NIKKOHM RESISTORS

Power Resistors
Current Shunts
Precision Resistors
Microwave Resistors
Thermal Converters

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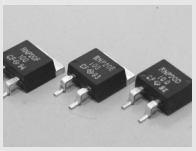
NIKKOHM-INDEX

RNP Series (SMD) — TO-style Power Film Resistors

Type	Style	Power (Watts)	Res. Range (ohms)	TCR (ppm)	Tol. (%)	W (mm)	H (mm)	L (mm)	P (mm)	page
RNF-25	(TO251)	25	0.02-51K	*1	5%	8.2	12.0	0.8	5.08	12
RNP-20D	TO263	35	0.02-51K	*1	1%, 5%	10.0	10.3	4.5	5.08	14
RNP-20E	TO263	35	0.02-51K	*1	1%, 5%	10.0	10.3	4.5	5.08	14
RNP-20F	TO263	35	0.02-51K	*1	1%, 5%	10.0	10.3	4.5	5.08	14

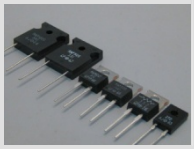
*1 Resistance 0.02-0.099: >250ppm/C, 0.1-9.9: 100ppm/C, 10-51K: 50ppm/C



RNP Series — TO-style Power Film Resistors

Type	Style	Power (Watts)	Res. Range (ohms)	TCR (ppm)	Tol. (%)	W (mm)	H (mm)	L (mm)	P (mm)	page
RNP-10S	TO126	20	0.02-51K	*1	1%, 5%	8.5	12.0	3.1	5.08	17
RNP-10	TO220	20	0.02-51K	*1	1%, 5%	10.1	15.0	4.5	5.08	19
RNP-20S	TO220	35	0.02-51K	*1	1%, 5%	10.1	15.0	4.5	5.08	21
RNP-50U	TO220	50	0.02-51K	*1	1%, 5%	10.1	15.0	4.5	5.08	23
RNP-50S	TO247	100	0.02-51K	*1	1%, 5%	16.0	20.0	4.8	10.9	25
RNP-80S	TO247	100	0.02-51K	*1	1%, 5%	16.0	20.0	4.8	10.9	---
RNP-100S	TO247	140	0.02-51K	*1	1%, 5%	16.0	20.0	4.8	10.9	27
RNP-140S	TO247	140	0.02-51K	*1	1%, 5%	16.0	20.0	4.8	10.9	---

*1 Resistance 0.02-0.099: >250ppm/C, 0.1-9.9: 100ppm/C, 10-51K: 50ppm/C



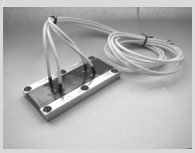
RPM Series — SOT-style Power Film Resistor

Type	Style	Power (Watts)	Res. Range (ohms)	TCR (ppm)	Tol. (%)	W (mm)	H (mm)	L (mm)	P (mm)	
RPM150	SOT227	150	0.02-100K	*1	5%	38.0	11.8	25.0	13.0	29
RPM200	SOT227	200	0.02-100K	*1	5%	38.0	11.8	25.0	13.0	29
RPM250	SOT227	250	0.02-100K	*1	5%	38.0	11.8	25.0	13.0	29
RPM300	SOT227	300	0.02-100K	*1	5%	38.0	11.8	25.0	13.0	29
RPM550	SOT227	550	50-1K	*1	5%	38.0	11.8	25.0	13.0	29
RPM600	SOT227	600	50-1K	*1	5%	38.0	11.8	25.0	13.0	29
RPK600	SOT227	600	50-1K	*1	5%	38.0	11.8	25.0	13.0	29
RPL320	----	300	0.1-51k	*1	5%	38.0	5.5	25.0	14.0	32

*1 Resistance 0.02-0.099: >250ppm/C, 0.1-100K: 100ppm/C

RPF, RPH Series — Screw Mount, Water Cooling, Power Film Resistor

Type	Style	Power (Watts)	Res. Range (ohms)	TCR (ppm)	Tol. (%)	W (mm)	H (mm)	L (mm)	P (mm)	
RPF50	Screw M	50	10-1K	250	10%	44.0	5.0	30.0	wire	---
RPF100	Screw M	100	10-1K	250	10%	50.0	10.0	50.0	wire	34
RPF250	Screw M	250	10-1K	250	10%	100.0	10.0	50.0	wire	34
RPH500	Water C	500	10-1K	250	10%	70.0	15.0	30.0	wire	34
RPH500S	Water C	500	0.22-1K	250	10%	102	81	70	---	38
RPH1000S	Water C	1000	0.22-1K	250	10%	204	81	70	---	38
RPH2000S	Water C	2000	0.22-1K	250	10%	204	---	70	---	38



RH, IRS Series — Metal Clad Wire Wound Resistors

Type	Style	Power (Watts)	Res. Range (ohms)	TCR (ppm)	Tol. (%)	W (mm)	H (mm)	L (mm)	P (mm)	
RH25C	Metal C	20	0.022-25K	250	5% *1	27.1	16.0	15.6	---	39
RH25CN	Metal C	20	0.1-10K	250	5% *1	27.1	16.0	15.6	---	39
RH50C	Metal C	30	0.048-50K	250	5% *1	70.6	16.0	15.6	---	39
RH50CN	Metal C	30	0.2-20K	250	5% *1	70.6	16.0	15.6	---	39
IRS30	Low P	30	1.0-420	250	5% *1	65.0	6.5	42.5	wire	---
IRS50	Low P	50	1.0-500	250	5% *1	90.0	6.5	42.5	wire	---

*1 Tolerance: 0.1%, 0.5%, 1.0%, 5.0% are optionally available

IRN, IRF Series — Flat Metal Clad Wire Wound Resistors

Type	Style	Power (Watts)	Res. Range (ohms)	TCR (ppm)	Tol. (%)	W (mm)	H (mm)	L (mm)	P (mm)	
IRN50	Metal C	50	1.0-0.42K	250	5.0 *2	60	10	70	wire	41
IRN100	Metal C	100	1.0-1.1K	250	5.0 *2	60	10	120	wire	41
IRN150	Metal C	150	1.0-1.75K	250	5.0 *2	60	10	170	wire	41
IRF100	Metal C	100	1.0-1.1K	250	5.0 *2	80	10	90	wire	41
IRF150	Metal C	150	1.0-1.75K	250	5.0 *2	80	10	120	wire	41
IRF200	Metal C	200	1.0-2.2K	250	5.0 *2	80	10	150	wire	41
IRF250	Metal C	250	1.0-2.97K	250	5.0 *2	80	10	180	wire	41
IRF300	Metal C	300	1.0-3.50K	250	5.0 *2	80	10	210	wire	41
IRF400	Metal C	400	1.0-4.45K	250	5.0 *2	80	10	270	wire	41
IRF500	Metal C	500	1.0-5.78K	250	5.0 *2	80	10	330	wire	41

*2 0.5, 1.0, 2.0 % are available

IRV, IRH Series — Metal Clad Wire Wound Resistors

Type	Style	Power (Watts)	Res. Range (ohms)	TCR (ppm)	Tol. (%)	W (mm)	H (mm)	L (mm)	P (mm)	page
IRV60	Metal C	60	0.1 – 270	250	5% *2	22	41	100	W& T	43
IRV80	Metal C	80	0.1 – 910	250	5% *2	22	41	150	W & T	43
IRV100	Metal C	100	0.1 – 1.1K	250	5% *2	22	41	165	W & T	43
IRV120	Metal C	120	0.1 – 1.3K	250	5% *2	22	41	182	W & T	43
IRV150	Metal C	150	0.1 – 1.6K	250	5% *2	22	41	210	W & T	43
IRV200	Metal C	200	0.1 – 2.2K	250	5% *2	30	60	165	W & T	43
IRV300	Metal C	300	0.1 – 2.7K	250	5% *2	30	60	215	W & T	43
IRV400	Metal C	400	0.1 – 4.3K	250	5% *2	30	60	265	W & T	43
IRV500	Metal C	500	0.1 – 6.8K	250	5% *2	30	60	335	W & T	43
IRH60	Metal C	60	0.1 – 270	250	5% *2	41	22	100	W & T	43
IRH80	Metal C	80	0.1 – 910	250	5% *2	41	22	150	W & T	43
IRH100	Metal C	100	0.1 – 1.1K	250	5% *2	41	22	165	W & T	43
IRH120	Metal C	120	0.1 – 1.3K	250	5% *2	41	22	182	W & T	43
IRH150	Metal C	150	0.1 – 1.6K	250	5% *2	41	22	210	W & T	43
IRH200	Metal C	200	0.1 – 2.2K	250	5% *2	60	30	165	W & T	43
IRH300	Metal C	300	0.1 – 2.7K	250	5% *2	60	30	215	W & T	43
IRH400	Metal C	400	0.1 – 4.3K	250	5% *2	60	30	265	W & T	43
IRH500	Metal C	500	0.1 – 6.8K	250	5% *2	60	30	335	W & T	43

*1 no-inductive is available add “N”. *2 Tolerance 0.5, 1.0, 2.0, are available. *3 “W & T”: wires and metal tabs

IRV, ULV Series — Metal Clad Wire Wound Resistors

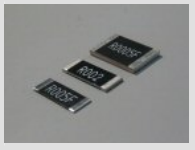
Type	Style	Power (Watts)	Res. Range (ohms)	TCR (ppm)	Tol. (%)	W (mm)	H (mm)	L (mm)	P (mm)	page
IRV600	Metal C	600	0.1- 94.0	250	5% *1	61	59	235	W & T	46
IRV800	Metal C	800	0.1-112.0	250	5% *1	61	59	285	W & T	46
IRV1000	Metal C	1000	0.1-140.0	250	5% *1	61	59	335	W & T	46
IRV1200	Metal C	1200	0.1-160.0	250	5% *1	61	59	405	W & T	46
ULV600	UL & MC	600	0.1- 94.0	250	5% *1	61	59	235	W & T	46
ULV800	UL & MC	800	0.1-112.0	250	5% *1	61	59	285	W & T	46
ULV1000	UL & MC	1000	0.1-140.0	250	5% *1	61	59	335	W & T	46
ULV1200	UL 6 MC	1200	0.1-160.0	250	5% *1	61	59	405	W & T	46

*1 0.5, 1.0, 2.0 % are available

WSL Series — Metal Plate Shunt Resistors

Type	Style	Power (Watts)	Res. Range (mohms)	TCR (ppm)	Tol. (%)	L (mm)	W (mm)	H (mm)	P (mm)	
WSL1	CHIP	1.0	0.5-10	100	1, 5	5.08	2.54 *1	2.0	---	49
WSL2	CHIP	2.0	0.5-10	100	1, 5	6.40	3.20 *1	2.0	---	49
WSL8	CHIP	8.0	0.5-10	100	1, 5,	12.8	6.40 *1	2.5	---	49

*1 Dimension W happen to be changed by it’s resistance



RAH10V, RAF30, NSPC Series — Metal Plate Shunt Resistors

Type	Style	Power (Watts)	Res. Range (mohms)	TCR (ppm)	Tol. (%)	W (mm)	H (mm)	L (mm)	P (mm)	
RAH10V	Radial	10	0.5-10	100	1, 5	22.0	18.5	4.5	17.80	53
RAF30	Bus	30	0.5-10	100	1, 5	50.0	39.0	2.7	---	55
NSPB	Screw	10	0.5-10	100	1, 5,	38.0	5.0	25.0	15.0	57
NSPC	Screw	10	0.5-10	100	1, 5	38.0	5.0	25.0	15.0	57

RCS Series — Metal Plate Shunt Resistors

Type	Style	Power (Watts)	Res. Range (mohms)	TCR (ppm)	Tol. (%)	W (mm)	H (mm)	L (mm)	P (mm)	
RCS2	Bus	1.0	0.5-10	100	1, 5	50.0	12.0	2.0	---	59
ECS3	Bus	2.0	0.5-10	100	1, 5	55.0	15.0	2.0	---	59
RCS4	Bus	8.0	0.5-10	100	1, 5,	50.0	15.5	1.5	---	59

NSLA, NSLB, NSLC Series — Metal Plate Shunt Resistors

Type	Style	Current (A)	Output Volt (mV)	TCR (ppm/K)	Tol. (%)	W (mm)	H (mm)	L (mm)	P (mm)	page
NSLA10	Screw	10	50, 60	5	0.25	50.8	42.9	31.8	25.4	62
NSLA15	Screw	15	50, 60	5	0.25	50.8	42.9	31.8	25.4	62
NSLA20	Screw	20	50, 60	5	0.25	50.8	42.9	31.8	25.4	62
NSLA30	Screw	30	50, 60	5	0.25	50.8	42.9	31.8	25.4	62
NSLA50	Screw	50	50, 60	5	0.25	50.8	42.9	31.8	25.4	62
NSLA75	Screw	75	50, 60	5	0.25	50.8	42.9	31.8	25.4	62
NSLA80	Screw	80	50, 60	5	0.25	50.8	42.9	31.8	25.4	62
NSLA85	Screw	85	50, 60	5	0.25	50.8	42.9	31.8	25.4	62
NSLA100	Screw	100	50, 60	5	0.25	50.8	42.9	31.8	25.4	62
NSLA150	Screw	150	50, 60	5	0.25	50.8	42.9	31.8	25.4	62
NSLB170	Screw	170	50	5	0.25	82.5	44.5	44.5	38.1	65
NSLB200	Screw	200	50	5	0.25	82.5	44.5	44.5	38.1	65
NSLB250	Screw	250	50	5	0.25	82.5	44.5	44.5	38.1	65
NSLB300	Screw	300	50	5	0.25	82.5	44.5	44.5	38.1	65
NSLB400	Screw	400	50	5	0.25	82.5	44.5	44.5	38.1	65
NSLB500	Screw	500	50	5	0.25	82.5	44.5	44.5	38.1	65
NSLB600	Screw	600	50	5	0.25	82.5	44.5	44.5	38.1	65
NSLC800	Screw	800	50	5	0.25	114	54.0	63.5	54.9	67
NSLC1000	Screw	800	50	5	0.25	114	54.0	63.5	54.9	67
NSLC1200	Screw	800	50	5	0.25	114	54.0	63.5	54.9	67

NSA Series — Metal Plate Shunt Resistors

Type	Style	Current (A)	Output Volt (mV)	TCR (ppm/K)	Tol. (%)	W (mm)	H (mm)	L (mm)	P (mm)	page
NSA50	1 screw	50	50, 60 *1	5	0.25	104.78	9.53	15.88	---	69
NSA100	1 screw	100	50, 60 *1	5	0.25	104.78	9.53	15.88	---	69
NSA150	1 screw	150	50, 60 *1	5	0.25	104.78	9.53	23.83	---	69
NSA200	1 screw	200	50, 60 *1	5	0.25	104.78	12.70	20.75	---	69
NSA250	1 screw	250	50, 60 *1	5	0.25	104.78	12.70	27.00	---	69
NSA300	1 screw	300	50, 60 *1	5	0.25	104.78	12.70	31.75	---	69
NSA400	1 screw	400	50, 60 *1	5	0.25	117.48	19.05	25.40	---	69
NSA500	1 screw	500	50, 60 *1	5	0.25	117.48	19.05	31.75	---	69
NSA600	1 screw	600	50, 60 *1	5	0.25	117.48	19.05	38.10	---	69

*1 100mV is available under different dimensions.

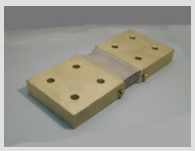
NSB Series — Metal Plate Shunt Resistors

Type	Style	Current (A)	Output Volt (mV)	TCR (ppm/K)	Tol. (%)	W (mm)	H (mm)	L (mm)	P (mm)	page
NSB300	2 screws	300	50, 60 *1	5	0.25	149.23	12.70	44.45	---	72
NSB400	2 screws	400	50, 60 *1	5	0.25	149.23	19.05	50.80	---	72
NSB500	2 screws	500	50, 60 *1	5	0.25	149.23	19.05	50.80	---	72
NSB600	2 screws	600	50, 60 *1	5	0.25	149.23	19.05	50.80	---	72
NSB700	2 screws	700	50, 60 *1	5	0.25	149.23	19.05	57.15	---	72
NSB800	2 screws	800	50, 60 *1	5	0.25	149.23	19.05	60.33	---	72
NSB1000	2 screws	1000	50, 60 *1	5	0.25	149.23	25.40	63.50	---	72
NSB1200	2 screws	1200	50, 60 *1	5	0.25	149.23	25.40	76.20	---	72

*1 100mV is available under different dimensions.

NSE Series — Metal Plate Shunt Resistors

Type	Style	Current (A)	Output Volt (mV)	TCR (ppm/K)	Tol. (%)	W (mm)	H (mm)	L (mm)	P (mm)	page
NSE1500	4 screws	1500	50, 60	5	0.25	244.45	25.40	76.20	---	74
NSE1500	4 screws	1500	100	5	0.25	285.75	25.40	76.20	---	74
NSE2000	4 screws	2000	50, 60	5	0.25	244.45	25.40	76.20	---	74
NSE2000	4 screws	2000	100	5	0.25	285.75	25.40	76.20	---	74



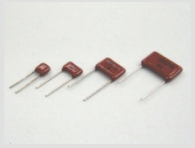
NSS Series — Metal Plate Shunt Resistors

Type	Style	Current (A)	Output Volt (mV)	TCR (ppm/K)	Tol. (%)	W (mm)	H (mm)	L (mm)	P (mm)	page
NSS100	1 screw	100	50, 60, 100	100	1.0	100	10	30	---	---
NSS200	1 screw	200	50, 60, 100	100	1.0	100	10	30	---	---
NSS400	1 screw	400	50, 60, 100	100	1.0	100	10	30	---	---
NSS600	1 screw	600	50, 60, 100	100	1.0	100	10	50	---	---
NSS1000	1 screw	1000	50, 60, 100	100	1.0	100	10	70	---	---

RP-44 Series — Thin Film Precision – Long Life Resistors

Type	Style	Power (W)	Res. Range (ohms)	TCR (ppm/K)	Tol. (%)	W (mm)	H (mm)	L (mm)	P (mm)	page
RP-84	Radial	1/8	10-47K	(25) 50	(0.1) 1.0	5.0	5.0	2.5	2.5	76
RP-44	Radial	1/4	10-180K	(25) 50	(0.1) 1.0	7.5	5.5	2.5	5.0	76
RP-24	Radial	1/2	10-1M	(25) 50	(0.1) 1.0	*1	7.5	2.5	7.5	76
RP-14	Radial	1.0	10-1M	(25) 50	(0.1) 1.0	14.0	8.5	2.5	*1	76

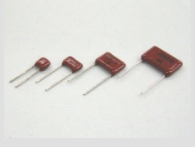
* 25ppm/K TCR and 0.1% tolerance are option. 0.1-10M resistance are available. Tape, color, forming available.



RP-46 Series — Thin Film Precision Resistors

Type	Style	Power (W)	Res. Range (ohms)	TCR (ppm/K)	Tol. (%)	W (mm)	H (mm)	L (mm)	P (mm)	page
RP-48	Radial	1/8	100-150K	2.5	0.02	5.6	8.2	2.54	2.54	79
RP-47	Radial	1/4	100-150K	2.5	0.02	6.8	8.6	2.54	3.18	79
RP-46	Radial	1/2	100-150K	2.5	0.02	8.0	9.0	2.54	5.08	79
RP-45	Radial	1.0	100-150K	2.5	0.02	10.2	9.0	2.54	8.62	79

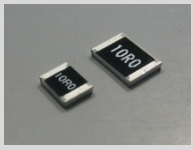
* 25ppm/K TCR and 0.1% tolerance are optional. 0.1-10M resistance are available.



NQA Series — Thin Film Precision Chip Resistors

Type	Style	Power (W)	Res. Range (ohms)	TCR (ppm/K)	Tol. (%)	L (mm)	W (mm)	H (mm)	P (mm)	page
NQA1/8	Chip	0.125	100-33K	2	0.05 *1	3.2	2.5	1.0	---	86
NQA1/4	Chip	0.250	100-62K	2	0.05 *1	4.5	3.2	1.0	---	86

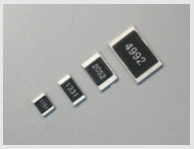
* 5ppm-0.1%, 5ppm-0.05% are available.



R Series — Thin Film Precision Chip Resistors

Type	Style	Power (W)	Res. Range (ohms)	TCR (ppm/K)	Tol. (%)	L (mm)	W (mm)	H (mm)	P (mm)	page
R1206	Chip	0.25	25-50K	5 *1	0.05 *1	3.05	1.53	0.7	---	83
R1210	Chip	0.25	25-50K	5 *1	0.05 *1	3.05	2.54	0.7	---	83
R2010	Chip	0.5	25-100K	5 *1	0.05 *1	5.08	2.54	0.7	---	83
R2512	Chip	1.0	25-100K	5 *1	0.05 *1	6.35	3.05	0.7	---	83
R3010	Chip	2.0	25-100K	5 *1	0.05 *1	7.62	5.08	0.7	---	83

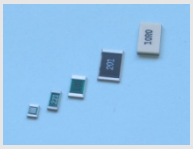
*1 25ppm/K TCR and 0.1% tolerance are optional. 0.1-10M resistance is optional.



RPC Series — Thin Film Power Chip Resistors

Type	Style	Power (W)	Res. Range (ohms)	TCR (ppm/K)	Tol. (%)	L (mm)	W (mm)	H (mm)	P (mm)	page
RPC14	Chip	0.25	10-200K	50	1.0	3.2	2.6	0.7	---	---
RPC12	Chip	0.5	10-200K	50	1.0	5.0	2.5	0.7	---	---
RPC11	Chip	1.0	10-1M	50	1.0	5.7	3.8	0.7	---	---
RPC21	Chip	2.0	10-1M	50	1.0	8.5	5.5	0.7	---	---

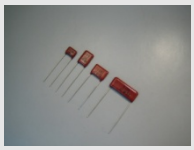
*



RP-42 Series — Thin Film Precision - Long Life Resistors

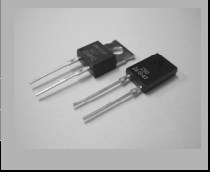
Type	Style	Power (W)	Res. Range (ohms)	TCR (ppm/K)	Tol. (%)	W (mm)	H (mm)	L (mm)	P (mm)	page
RP-102	Radial	0.125	10-22K	50	1%	5.0	4.05	1.8	3.5	81
RP-82	Radial	0.25	10-250K	50	1%	6.3	4.05	2.2	5.0	81
RP-41	Radial	0.50	10-510K	50	1%	6.3	9.0	2.2	5.0	81
RP-42	Radial	0.50	10-1M	50	1%	9.0	6.3	2.2	7.5	81
RP-22	Radial	1.0	10-1M	50	1%	15.0	8.0	2.8	12.5	81
RP-23	Radial	1.0	10-1M	50	1%	17.0	6.3	2.8	15.0	81
RP-12	Radial	2.0	10-1M	50	1%	22.5	9.0	2.8	20.0	81
RP-203	Radial	3.0	10-1M	50	1%	22.5	15.0	3.55	20.0	81
RP-303	Radial	3.0	10-1M	50	1%	22.5	15.0	4.25	20.0	81

*5ppmTCR and 0.1% tolerance is available.



TO126, TO220 Series — Thin Film Precision Power Resistors

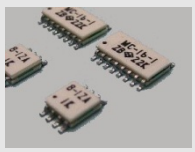
Type	Style	Power (W)	Res. Range (ohms)	TCR (ppm/K)	Tol. (%)	W (mm)	H (mm)	L (mm)	P (mm)	page
RNP-10P	TO220	10	1-51K	5	0.1	8.5	12.0	3.1	5.08	91
RNP-20P	TO220	10	1-51K	5	0.1	10.1	15.0	4.5	5.08	93



MC Series — Thin Film Precision Networks

Type	Style	Power (W)	Res. Range (ohms)	TCR (ppm/K)	Tol. (%)	W (mm)	L (mm)	H (mm)	P (mm)	page
MC4	SOP	0.05	100-22K	5	0.05, 0.1	5.3	3.5	2.3	1.27	97
MC8	SOP	0.05	100-22K	5	0.05, 0.1	5.3	5.5	2.3	1.27	97
MC16	SOP	0.05	100-22K	5	0.05, 0.1	5.3	10.5	2.3	1.27	97
MCL6	SOP	0.10	10K-20K *1	5	1/2 LSB	5.3	3.5	2.3	1.27	99
MCL8	SOP	0.10	10K-20K *1	5	1/2 LSB	5.3	5.5	2.3	1.27	99
MCL10	SOP	0.10	10K-20K *1	5	1/2 LSB	5.3	10.5	2.3	1.27	99

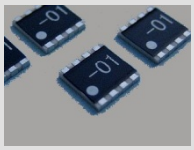
*1 R-2R ladder is available in 1K-2K.



MCM Series — Thin Film Precision Networks

Type	Style	Power (W)	Res. Range (ohms)	TCR (ppm/K)	Tol. (%)	W (mm)	L (mm)	H (mm)	P (mm)	page
MCM4	SOIC	0.05	100-22K	5-2	0.05-0.02	5.00	3.00	0.8	1.27	95
MCM8	SOIC	0.05	100-22K	5-2	0.05-0.02	5.00	5.00	0.8	1.27	95
MCM16	SOIC	0.05	100-22K	5-2	0.05-0.02	5.00	10.00	0.8	1.27	95

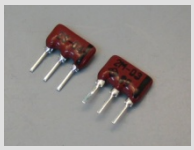
* TCR and tolerance show matching and trucking.



2M, 2S, 2T Series — Thin Film Precision Networks

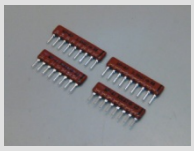
Type	Style	Power (W)	Res. Range (ohms)	TCR (ppm/K)	Tol. (%)	W (mm)	H (mm)	L (mm)	P (mm)	page
2M00	SIP	0.125	500-50K *1	5	0.1	8.0	7.0	2.54	2.54	101
2S00	SIP	0.125	500-50K *1	5	0.1	8.0	5.0	2.54	2.54	101
2T00	SIP	0.125	500-50K *1	5	0.1	8.0	5.0	2.54	2.54	101

*1 Resistance ratio is limited under 5 times.



MP Series — Thin Film Precision Networks

Type	Style	Power (W)	Res. Range (ohms)	TCR (ppm/K)	Tol. (%)	W (mm)	H (mm)	L (mm)	P (mm)	page
MP-3S	SIP	0.125	47-22K	5 / 1	0.1 / 0.05	10.2	7.0	3.0	2.54	103
MP-4S	SIP	0.125	47-22K	5 / 1	0.1 / 0.05	12.7	7.0	3.0	2.54	103
MP-5S	SIP	0.125	47-22K	5 / 1	0.1 / 0.05	15.2	7.0	3.0	2.54	103
MP-6S	SIP	0.125	47-22K	5 / 1	0.1 / 0.05	17.8	7.0	3.0	2.54	103
MP-4P	SIP	0.125	47-22K	5 / 1	0.1 / 0.05	12.7	7.0	3.0	2.54	103
MP-5P	SIP	0.125	47-22K	5 / 1	0.1 / 0.05	15.2	7.0	3.0	2.54	103
MP-6P	SIP	0.125	47-22K	5 / 1	0.1 / 0.05	17.8	7.0	3.0	2.54	103
MP-7P	SIP	0.125	47-22K	5 / 1	0.1 / 0.05	20.3	7.0	3.0	2.54	103
MP-8P	SIP	0.125	47-22K	5 / 1	0.1 / 0.05	22.9	7.0	3.0	2.54	103
MP-2I	SIP	0.125	47-22K	5 / 1	0.1 / 0.05	10.2	7.0	3.0	2.54	103
MP-3I	SIP	0.125	47-22K	5 / 1	0.1 / 0.05	15.2	7.0	3.0	2.54	103
MP-4I	SIP	0.125	47-22K	5 / 1	0.1 / 0.05	20.3	7.0	3.0	2.54	103



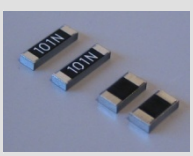
MD Series — Thin Film Precision Networks

Type	Style	Power (W)	Res. Range (ohms)	TCR (ppm/K)	Tol. (%)	W (mm)	H (mm)	L (mm)	P (mm)	page
MD-8	DIP	0.15	51-10K	25	0.5	22.0	4.6	7.6	2.54	105
MD-16	DIP	0.15	51-10K	25	0.5	22.0	4.6	7.6	2.54	105
MDL-8										107
*										

RFH Series — Microwave Resistors

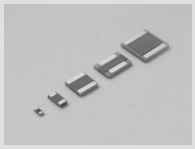
Type	Style	Power (W)	Res. Range (ohms)	TCR (ppm/K)	Tol. (%)	L (mm)	W (mm)	H (mm)	P (mm)	page
RFH52	Chip	10	* 1	50	1.0	5.0	2.5	1.2	---	109
RFH72	Chip	10	* 1	50	1.0	7.0	2.0	1.2	---	109
RFK52	Chip	20	* 1	50	1.0	5.0	2.5	1.2	---	109
RFK72	Chip	20	* 1	50	1.0	7.0	2.0	1.2	---	109

* 1: 50, 100, 150, 200, 250, 300, 400, 600, 800 ohms



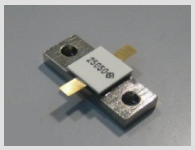
RFR Series — Microwave Chip Resistors

Type	Style	Power (W)	Res. Range (ohms)	TCR (ppm/K)	Tol. (%)	L (mm)	W (mm)	H (mm)	P (mm)	page
RFR010 010	Chip	10	*1	50	1.0	5.08	2.54	1.05	---	112
RFR010 020	Chip	10	*1	50	1.0	5.08	2.54	1.05	---	112
RFR050 010	Chip	50	*1	50	1.0	5.08	5.08	10.5	---	112
RFR050 020	Chip	50	*1	50	1.0	5.08	5.08	10.5	---	112
RFR100 010	Chip	100	*1	50	1.0	5.84	8.89	1.05	---	112
RFR100 020	Chip	100	*1	50	1.0	5.84	8.89	1.05	---	112
RFR250 010	Chip	250	*1	50	1.0	9.52	9.52	1.05	---	112
RFR250 020	Chip	250	*1	50	1.0	9.52	9.52	1.05	---	112
*1: 50, 100, 150, 200, 250, 300, 400, 500, 800 ohms										



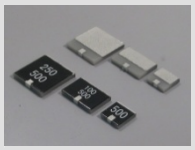
RFR Series — Microwave Flanged Resistors

Type	Style	Power (W)	Res. Range (ohms)	TCR (ppm/K)	Tol. (%)	L (mm)	W (mm)	H (mm)	P (mm)	page
RFR010 120	Flange	10	*1	50	1.0	7.10	5.10	3.10	---	115
RFR050 120	Flange	50	*1	50	1.0	13.80	6.35	3.10	---	115
RFR050 110	Flange	50	*1	50	1.0	20.30	5.70	3.10	---	115
RFR100 110	Flange	100	*1	50	1.0	20.30	6.35	3.10	---	115
RFR150 110	Flange	150	*1	50	1.0	22.10	9.52	4.00	---	115
RFR200 110	Flange	200	*1	50	1.0	24.77	9.52	5.08	---	115
RFR250 110	Flange	250	*1	50	1.0	22.10	9.52	4.00	---	115
RFR400 110	Flange	400	*1	50	1.0	31.80	12.70	5.33	---	115
RFR600 110	Flange	600	*1	50	1.0	48.26	26.42	5.59	---	115
*1: 50, 100, 150, 200, 250, 300, 400, 500, 800 ohms										



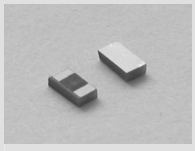
RFT Series — Microwave Chip Terminations

Type	Style	Power (W)	Impedance (ohms)	TCR (ppm/K)	Tol. (%)	L (mm)	W (mm)	H (mm)	P (mm)	page
RFT010 010	Chip	10	50	50	1.0	5.08	2.54	1.05	---	117
RFT010 020	Chip	10	50	50	1.0	5.08	2.54	1.05	---	117
RFT050 010	Chip	50	50	50	1.0	5.08	5.08	1.05	---	117
RFT050 020	Chip	50	50	50	1.0	5.08	5.08	1.05	---	117
RFT100 010	Chip	100	50	50	1.0	5.84	8.89	1.05	---	117
RFT100 020	Chip	100	50	50	1.0	5.84	8.89	1.05	---	117
RFT150 010	Chip	150	50	50	1.0	6.35	9.52	1.05	---	117
RFT150 020	Chip	150	50	50	1.0	6.35	9.52	1.05	---	117
RFT250 010	Chip	250	50	50	1.0	9.52	9.52	1.05	---	117
RFT250 020	Chip	250	50	50	1.0	9.52	9.52	1.05	---	117



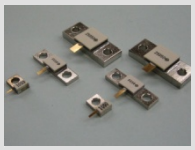
RFTS Series — Microwave Chip Terminations

Type	Style	Power (W)	Impedance (ohms)	TCR (ppm/K)	Tol. (%)	L (mm)	W (mm)	H (mm)	P (mm)	page
RFTS05 ZF0	Chip	5	50	50	1.0	2.54	1.27	0.63	---	120
RFTS05 ZE0	Chip	5	50	50	1.0	2.54	1.27	0.63	---	120
RFTS05 ZZ0	Chip	5	50	50	1.0	2.54	1.27	0.63	---	120
RFTS05 ZY0	Chip	5	50	50	1.0	2.54	1.27	0.63	---	120
RFTS10 ZF0	Chip	10	50	50	1.0	5.08	2.54	1.00	---	120
RFTS10 ZE0	Chip	10	50	50	1.0	5.08	2.54	1.00	---	120
RFTS10 ZZ0	Chip	10	50	50	1.0	5.08	2.54	1.00	---	120
RFTS10 ZY0	Chip	10	50	50	1.0	5.08	2.54	1.00	---	120
RFTS50 ZF0	Chip	50	50	50	1.0	5.08	5.08	1.00	---	120
RFTS50 ZE0	Chip	50	50	50	1.0	5.08	5.08	1.00	---	120
RFTS50 ZZ0	Chip	50	50	50	1.0	5.08	5.08	1.00	---	120
RFTS50 ZY0	Chip	50	50	50	1.0	5.08	5.08	1.00	---	120
*1: F, E, Z, Y show terminal configuration.										



RFT Series — Microwave Flange Terminations

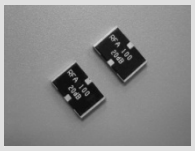
Type	Style	Power (W)	Impedance (ohms)	TCR (ppm/K)	Tol. (%)	L (mm)	W (mm)	H (mm)	P (mm)	page
RFT010 120	Flange	10	50	50	1.0	7.10	5.10	3.10	---	124
RFT050 120	Flange	50	50	50	1.0	13.08	6.35	3.10	---	124
RFT050 130	Flange	50	50	50	1.0	13.08	6.35	3.10	---	124
RFT050 140	Flange	50	50	50	1.0	13.08	6.35	3.10	---	124
RFT080 120	Flange	80	50	50	1.0	13.08	6.35	3.10	---	124
RFT080 130	Flange	80	50	50	1.0	13.08	6.35	3.10	---	124
RFT080 140	Flange	80	50	50	1.0	13.08	6.35	3.10	---	124
RFT050 110	Flange	50	50	50	1.0	20.30	5.70	3.10	---	124
RFT100 110	Flange	100	50	50	1.0	20.30	6.35	3.10	---	124
RFT150 110	Flange	150	50	50	1.0	22.10	9.52	3.10	---	124
RFT250 110	Flange	250	50	50	1.0	22.10	9.52	4.00	---	124
RFT400 110	Flange	400	50	50	1.0	31.80	12.70	5.33	---	124
RFT600 110	Flange	600	50	50	1.0	48.26	26.42	5.59	---	124



RFA Series — Microwave Chip Attenuators

Type	Style	Power (W)	Attenuation (dB)	Imp (ohms)	Tol. (%)	L (mm)	W (mm)	H (mm)	P (mm)	page
RFA001 010	Chip	1	*1	50	2.0	4.00	4.00	0.65	---	126
RFA010 020	Chip	10	10, 20, 30	50	2.0	5.08	2.54	1.1	---	128
RFA020 010	Chip	20	10, 20, 30	50	2.0	5.08	5.08	1.1	---	128
RFA020 020	Chip	20	10, 20, 30	50	2.0	5.08	5.08	1.1	---	128
RFA100 010	Chip	100	10, 20, 30	50	2.0	5.08	8.89	1.1	---	128
RFA150 010	Chip	150	10, 20, 30	50	2.0	6.35	9.52	1.1	---	128

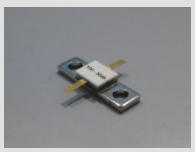
*1: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 20 dB



RFA Series — Microwave Flange Attenuators

Type	Style	Power (W)	Attenuation (dB)	Imp (ohms)	Tol. (%)	L (mm)	W (mm)	H (mm)	P (mm)	page
RFA010 110	Chip	10	*1	50	2.0					---
RFA020 110	Chip	20		50	2.0					---
RFA040 110	Chip	40		50	2.0					---
RFA100 110	Chip	100		50	2.0	20.30	5.90	2.70	---	---
RFA150 110	Chip	150		50	2.0	22.10	9.52	2.70	---	---

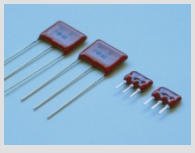
*1: 1, 3, 6, 10, 20, 30 dB



RFA50T Series — Microwave Radial Leaded Attenuators

Type	Style	Power (W)	Attenuation (dB)	Imp (ohms)	Tol. (%)	W (mm)	H (mm)	L (mm)	P (mm)	page
RFA50TF	Radial	---	*1	50	1.0	8.00	7.00	3.0	2.54	131
RFA75TF	Radial	---		75	1.0	8.00	7.00	3.0	2.54	131
RFA300TF	Radial	---		300	1.0	8.00	7.00	3.0	2.54	131
RFA600TF	Radial	---		600	1.0	8.00	7.00	3.0	2.54	131
RFA50T	Radial	---		50	1.0	13.00	11.50	2.5	5.0	131
RFA75T	Radial	---		75	1.0	13.00	11.50	2.5	5.0	131
RFA300T	Radial	---		300	1.0	13.00	11.50	2.5	5.0	131
RFA600T	Radial	---		600	1.0	13.00	11.50	2.5	5.0	131

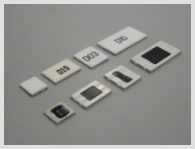
*1: 2,3,4,5,6,7,8,9,10,16, 20,30 dB



RFA Series — Microwave Coaxial Attenuators

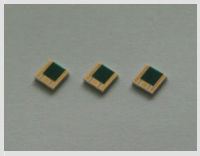
Type	Style	Power (W)	Attenuation (dB)	Imp (ohms)	Tol. (%)	L (mm)	W (mm)	H (mm)	P (mm)	page
RFA54DD	Coax	0.25	*1	50 *2	2.0	5.00	3.80	0.70	---	134
RFA55DD	Coax	0.25		50 *2	2.0	5.00	4.50	0.70	---	134
RFA85DD	Coax	0.50		50 *2	2.0	8.00	5.25	0.70	---	134
RFA67DD	Coax	1.00		50 *2	2.0	6.00	7.00	0.70	---	134
RFA37DD	Coax	1.00		50 *2	2.0	13.00	7.00	0.70	---	134

*1: 2,3,4,5,6,7,8,9,10,16, 20,30 dB, *2 75 ohm impedance is available by additional characters “DC”



RFD Series — Microwave Coaxial Terminations

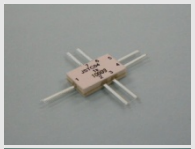
Type	Style	Power (W)	Impedance (ohms)	TCR (ppm/K)	Tol. (%)	L (mm)	W (mm)	H (mm)	P (mm)	page
RFD3350	Coax	0.25	50	50	2.0	3.80	2.70	0.70	---	138
RFD4450	Coax	0.25	50	50	2.0	3.80	2.70	0.70	---	138
RFD5450	Coax	0.50	50	50	2.0	5.40	4.20	0.70	---	138
RFD8750	Coax	1.00	50	50	2.0	8.00	7.00	0.70	---	138



JSTC Series — Multi-junction Thermal Converters

Type	Style	Power (W)	Input Resistance (ohms)	Output Resistance (ohms)	Sensitivity (V/W)	L (mm)	W (mm)	H (mm)	P (mm)	page
JSTC04	Device	0.10	*1	< 400	0.6	15.00	9.00	3.50	---	139
JSTC05	Device	0.10	*1	< 400	0.6	15.00	9.00	3.50	---	141
JSTC06	Device	0.10	*1	< 400	0.6	15.00	9.00	3.50	---	143
TVC04A	Unit	0.10	*1	< 400	0.6	73.5	28.0	37.6	---	145
TVC05B	Unit	0.10	*1	< 400	0.6	73.5	28.0	28.0	---	145
TVC06A	Unit	0.10	*1	< 400	0.6	73.5	28.0	37.6	---	145
TVC06B	Unit	0.10	*1	< 400	0.6	73.5	28.0	28.0	---	145
TVCC04AR	Case	---	---	---	---	35.0	28.0	28.0	---	147
TVCC04AP	Case	---	---	---	---	35.0	28.0	28.0	---	147
TVCC05BR	Case	---	---	---	---	35.0	28.0	28.0	---	147
TVCC05BP	Case	---	---	---	---	35.0	28.0	28.0	---	147
TVCC06AR	Case	---	---	---	---	35.0	28.0	28.0	---	147
TVCC06AP	Case	---	---	---	---	35.0	28.0	28.0	---	147
TVCC06BR	Case	---	---	---	---	35.0	28.0	28.0	---	147
TVCC06BP	Case	---	---	---	---	35.0	28.0	28.0	---	147

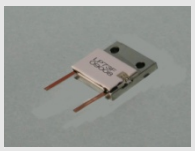
* 1: 100, 200, 500, 700, 1K, 2Kohm



LP Series — Multi-junction Thermal Converters

Type	Style	Power (W)	Input Resistance (ohms)	Output Resistance (ohms)	Sensitivity (V/W)	L (mm)	W (mm)	H (mm)	P (mm)	page
LP73F	---	0.01	50	2K +/- 1K	13 +/- 2	15.00	15.00	3.90	---	149
LP34B	---	0.01	50, 75	< 3K	> 2	25.00	12.50	4.50	---	151
LP34TW	---	0.01	50, 75	< 12K	> 1.4	32.00	22.00	5.50	---	151

*



LP Series — Thermopile Detector

Type	Style	Power (W)	Response (ms)	Output Resistance (ohms)	Sensitivity (V/W)	D (mm)	H (mm)	L (mm)	P (mm)	page
LP111S	TO5	0.01	45	2K	10.0	9.05	3.5	---	---	153
LP123S	---	0.01	45	1K	5.0	9.05	3.5	---	---	153
LP231	---	0.01	250	4K	4.5	15.24	4.4	---	---	153
LP31B	---	0.01	4,000	6.5K	0.45	38.00	10.0	---	---	153

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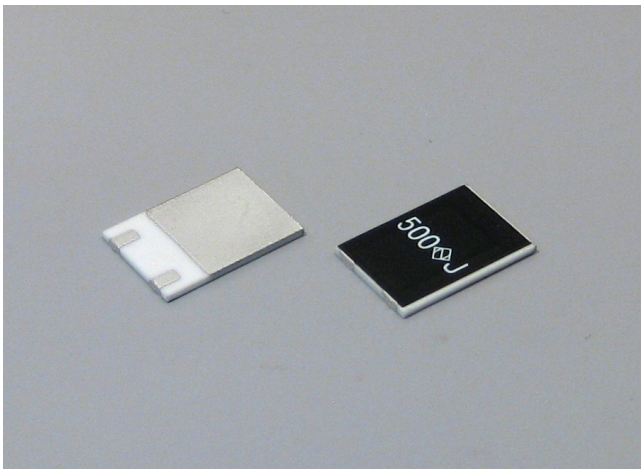
25W
SMD SURGE PROTECTION RESISTOR

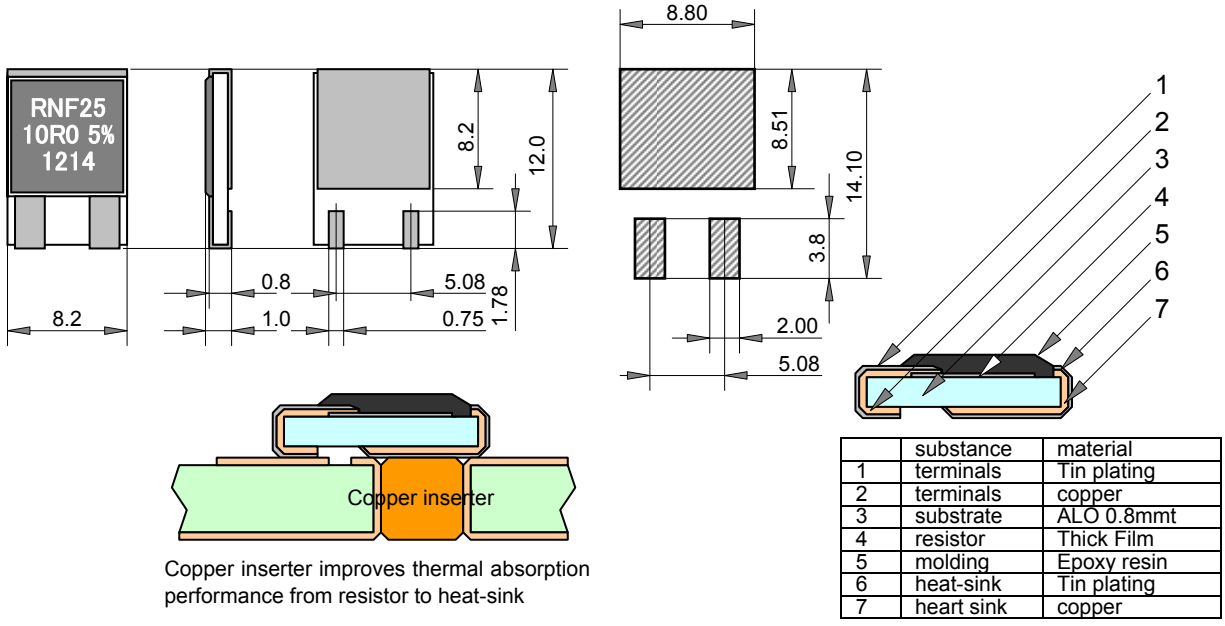
RNF25



Features and Applications

Very low profile, right weight SMD surge protection power film resistors of fitting to D-PAK foot pattern.
Excellent rf characteristics advantage to high speed pulse operation.
Applications include power electronics, power consumption meter, electronic load equipments, battery charger, automotive and etc.

Dimensions, Foot Pattern, Materials and Application



Copper inserter improves thermal absorption performance from resistor to heat-sink

	substance	material
1	terminals	Tin plating
2	terminals	copper
3	substrate	ALO 0.8mmt
4	resistor	Thick Film
5	molding	Epoxy resin
6	heat-sink	Tin plating
7	heart sink	copper

Ordering Information

Type	TCR	Resistance	Tolerance	Code	Packaging
RNF25	-	102	J	Z00	---
RNF25		1 ohm- 51kohm E24+	F (1.0%)	Z00 Z01	Bulk Tape reel

1.0	1.1	1.2	1.3	1.5	1.6	1.8	2.0	2.2	2.4	2.5	2.7	3.0	3.3
3.6	3.9	4.0	4.3	4.7	5.0	5.1	5.6	6.2	6.8	7.5	8.0	8.2	9.1

Note: RNF10 can operate 35W rating under cooling back metal, 25deg C.

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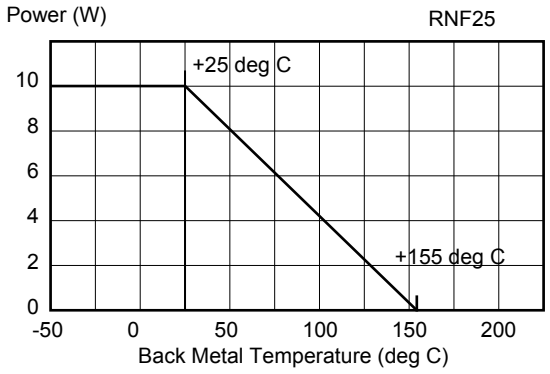
25W SMD POWER CHIP RESISTOR, RNF25

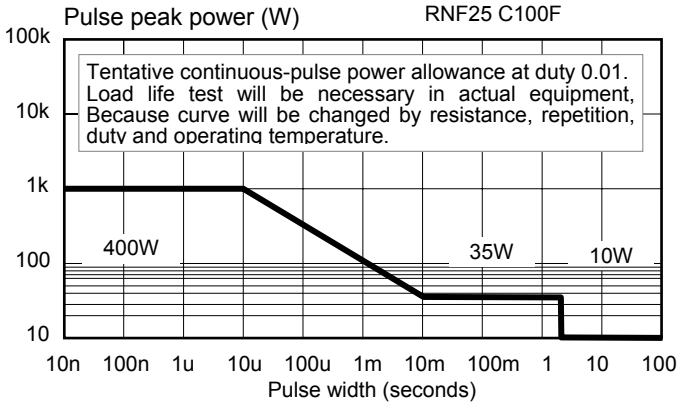
Specifications

	RNF25	Test Conditions
Rating Power	25 Watts	-55 deg C to 25 deg C backing temperature
Rating Power	2.5 Watts	Attached on simple foot print.
Short Time Overload	40 W	Continuous operating voltage for 5 second.
Heat Resistance	3.6 deg C/W	Resistor hot spot to flange
Resistance Range	1.0 - 51kΩ	Note 2
Nominal	E24+	Include 2.5, 4.0, 5.0, 8.0 and 16
TCR(ppm/deg C)	100 (A)	Note 3.
Tolerance	+/-1% (F)	5% tolerance at 0.01-0.091 Ω are available.
Capacitance	1.44pF	Equivalent parallel capacitance.
Inductance	8.38nH	Equivalent series inductance
Operation Temp.	-55 deg C to+155 deg C	
Operating Volt.	$\sqrt{P \cdot R}$	P is rating power and R resistance
Withstanding Volt.	1500 VAC	Terminal and flange, 60 seconds. 1mA
Load Life	+/- 1.0 %	25 deg C, 90 min.ON, 30 min. OFF, 1000h.
Humidity	+/- 1.0 %	40 deg C, 90-95%RH, DC 0.1W, 1000 hours.
Temp. Cycle	+/- 0.25 %	-55 deg C,30 min.,+155 deg C,30 min., 5cyc
Soldering Heat	+/- 0.1 %	350+/-5 deg C, 3seconds,
Lead Solder ability	Over 95% of surface	230+/-5 deg C, 3seconds.
Insulation Resistance	Over 1,000 Meg Ω	Between terminals and back metal.
Vibration	+/- 0.25 %	IEC60068-2-6, see note 4

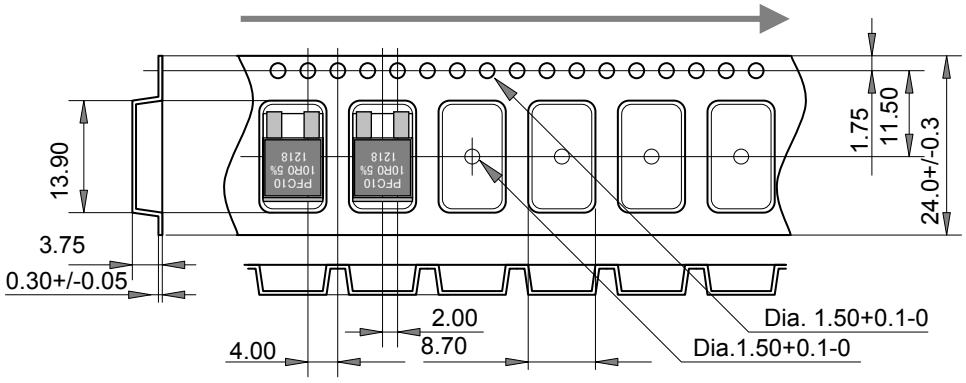
Power Derating



Pulse Energy Durability



Plastic Tape Specifications



Standard Package contains 2000pcs/reel, diameter 254mm reel in paper box.

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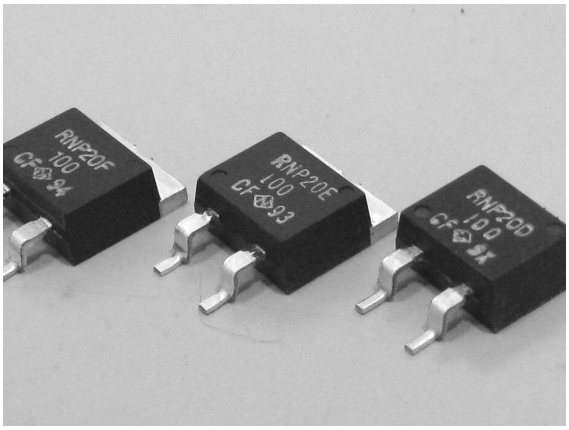


TO263 SURFACE MOUNT
35W HIGH POWER RESISTORS
RNP-20D, RNP-20E, RNP-20F

Features and Applications

35W high power resistors in TO263 (D2-PAK) style surface mount mold package with Nickel plated (RNP-20D), matte Tin plated (RNP-20E, RNP-20F) flange.

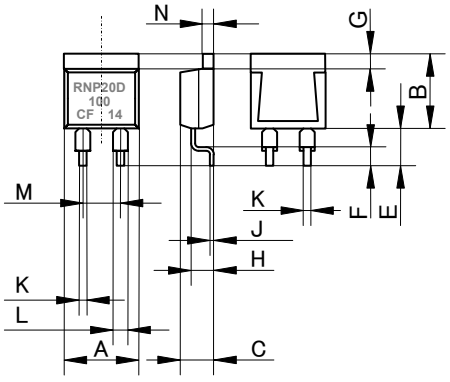
Non-inductive design suits high frequency applications and high-speed pulse circuits.

Low, 3.3 deg C/W heat resistance from resistor hot spot to flange and long life performance are presented with thin film metallization technology.

Wide, 10 mΩ to 51K Ω resistance range, non-inductive impedance characteristic and heat extracting through insulated metal flange aids circuit designers.

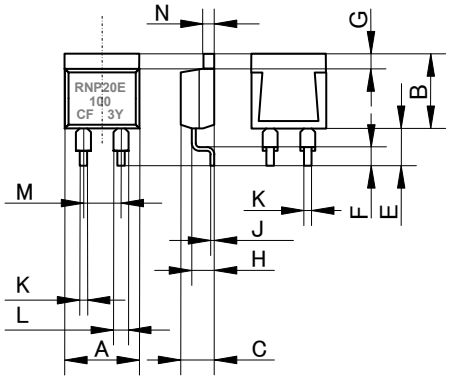
Applications for UPS, power unit of machines, motor control, drive circuits, automotive, measurements, industrial computers and high frequency electronics.

Dimensional Specifications (mm)



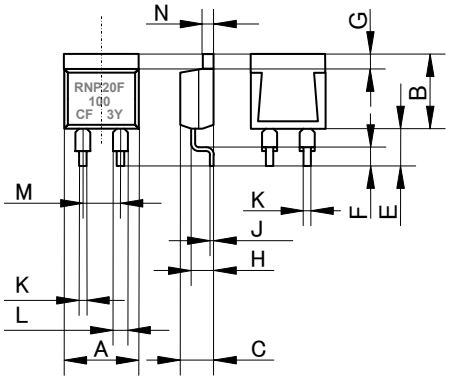
RNP-20D

RNP-20D		
	mm	+/-mm
A	10.1	+/-0.2
B	10.3	+/-0.2
C	4.5	+/-0.2
D	-	-
E	5.0	+/-1.0
F	2.5	+/-0.5
G	2.2	+/-0.2
H	2.75	+/-0.2
J	0.5	+/-0.05
K	0.75	+/-0.05
L	1.5	+/-0.05
M	5.08	+/-0.10
N	1.5	+/-0.05



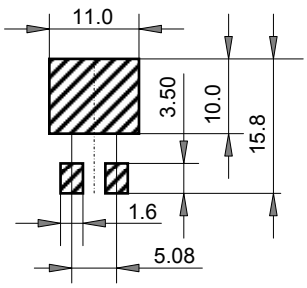
RNP-20E

RNP-20E		
	mm	+/-mm
A	10.1	+/-0.2
B	10.3	+/-0.2
C	4.5	+/-0.2
D	-	-
E	5.0	+/-1.0
F	2.5	+/-0.5
G	2.2	+/-0.2
H	2.75	+/-0.2
J	0.5	+/-0.05
K	0.75	+/-0.05
L	1.5	+/-0.05
M	5.08	+/-0.10
N	1.5	+/-0.05

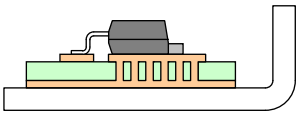


RNP-20F

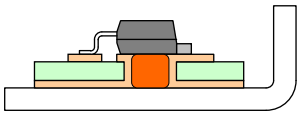
RNP-20F		
	mm	+/-mm
A	10.1	+/-0.2
B	10.3	+/-0.2
C	4.5	+/-0.2
D	-	-
E	5.0	+/-1.0
F	2.5	+/-0.5
G	2.2	+/-0.2
H	2.75	+/-0.2
J	0.5	+/-0.05
K	0.75	+/-0.05
L	1.5	+/-0.05
M	5.08	+/-0.10
N	1.5	+/-0.05



Recommended Foot Pattern. (in mm)
Additional heat cooling system will be necessary when applied power exceeds 1W.



Via hole thermal connection to heat-sink



Insertion cylinder thermal connection to heat-sink

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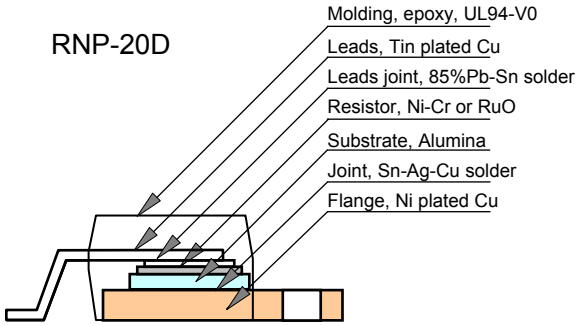
TO263 SURFACE MOUNT 35W HIGH POWER RESISTORS

RNP-20D, RNP-20E, RNP-20F

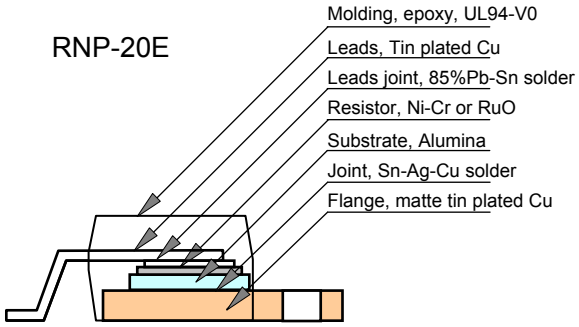
Materials and Reflow Temperature

RNP-20D



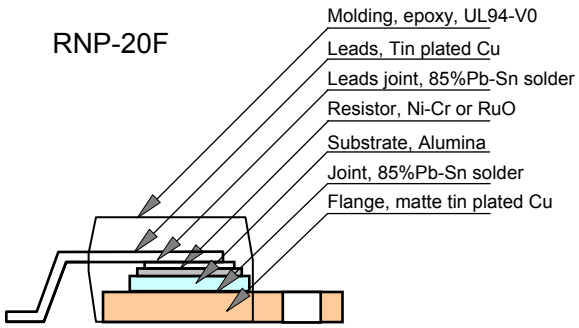
Between flange and resistor is insulated.

RNP-20E



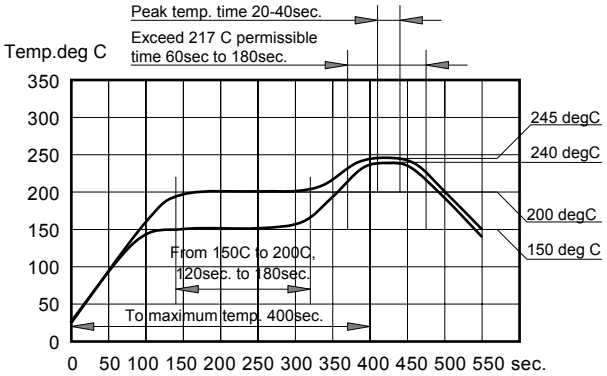
Between flange and resistor is insulated.

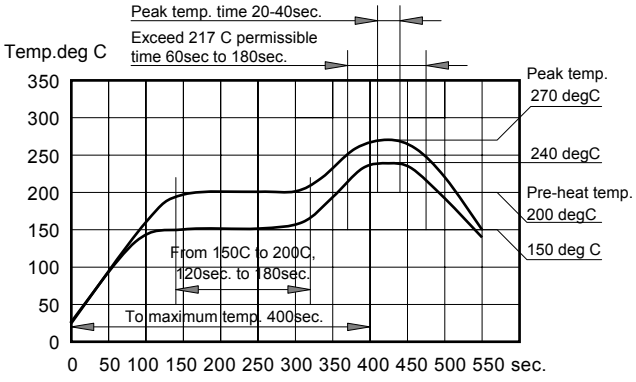
RNP-20F



Between flange and resistor is insulated.

When joint on printed circuit board, reflow soldering by furnace with another parts shall not be recommended. After mounting another parts and after pre-coating solder on to land pattern, dip flange and leads in to soldering resin, place RNP-20D resistor on the land pattern, and heat flange for 20-30 seconds by soldering iron which iron tip temperature is 300-350 deg C. Flange temperature shall be in 270+/-10 deg C for 30 seconds. A better result will be obtained if flange is pre-coating solder. Please note using soldering flux and large caloric capacity.





Ordering Information

Type	TCR	Resistance	Tolerance	Code	Note
RNP-20F	A	1R0 *(1)	F	Z01	Tape reel
RNP-20D	H(>250ppm)	R02 to 51K	J (5%)	Z01	Tape/500pcs
RNP-20E	A(100ppm)	E24+	F (1%)	Z03	Tube/50pcs
RNP-20F	C(50ppm)	R01-1% is option		Z05	Tray/100pcs

Resistance value (*) is available following modified E24 as E24+.

1.0	1.1	1.2	1.3	1.5	1.6	1.8	2.0	2.2	2.4	2.5	2.7	3.0	3.3
3.6	3.9	4.0	4.3	4.7	5.0	5.1	5.6	6.2	6.8	7.5	8.0	8.2	9.1

*1: E96 and any other resistances are available optionally, please call factory.

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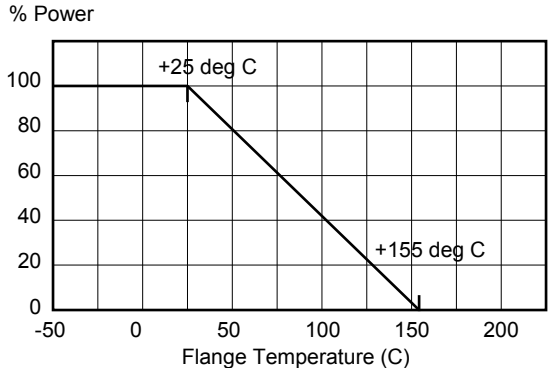
TO263 SURFACE MOUNT 35W HIGH POWER RESISTORS

RNP-20D, RNP-20E, RNP-20F

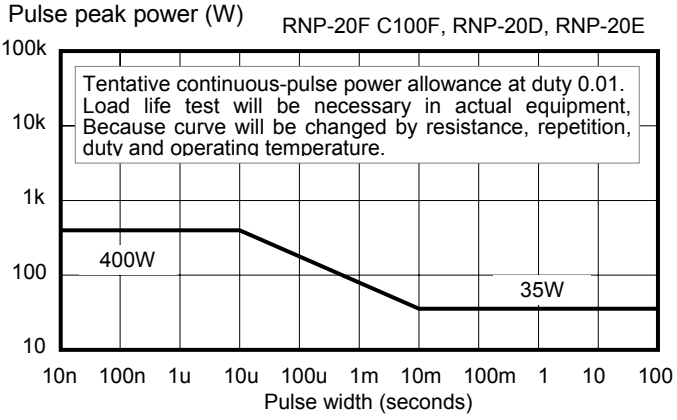
Specifications

Type	RNP-20D, RNP-20E, RNP-20F			Test Conditions
Rating Power	35 Watt			-55 deg C to 25 deg C flange temperature
Rating Power	1 Watt			Attached on simple foot print.
Heat Resistance	3.3 deg C/W			Resistor hot spot to flange
Resistance Range	0.02-0.091Ω	0.1-9.1Ω	10-51KΩ	Note 2
Nominal	E6	E24	E24	Include 2.5, 4.0, 5.0, 8.0 and 16
TCR (ppm/deg C)	250(H)	100 (A)	50 (C)	Note 3.
Tolerance	5%(J)	1% (F) 5% (J)	+/-1% (F)	1% tolerance at 0.01-0.091 Ω are available.
Capacitance	1.44pF			Equivalent parallel capacitance.
Inductance	8.38nH			Equivalent series inductance
Operation Temp.	-55 deg C to+155 deg C			
Operating Volt.	Either 500V or $\sqrt{P \cdot R}$			P is rating power and R resistance
Withstanding Volt.	2000 VAC			Terminal and flange, 60 seconds. 1mA
Load Life	+/- 1.0 %			25 deg C, 90 min.ON, 30 min. OFF, 1000h.
Humidity	+/- 1.0 %			40 deg C, 90-95%RH, DC 0.1W, 1000 hours.
Temp. Cycle	+/- 0.25 %			-55 deg C,30 min.,+155 deg C,30 min., 5cyc
Soldering Heat	+/- 0.1 %			350+/-5 deg C, 3seconds,
Lead Solder ability	Over 95% of surface			230+/-5 deg C, 3seconds.
Insulation Resistance	Over 1,000 Meg Ω			Between terminals and tab.
Vibration	+/- 0.25 %			IEC60068-2-6, see note 4
Flammability	UL94-V0			
Weight	1.5 grams			

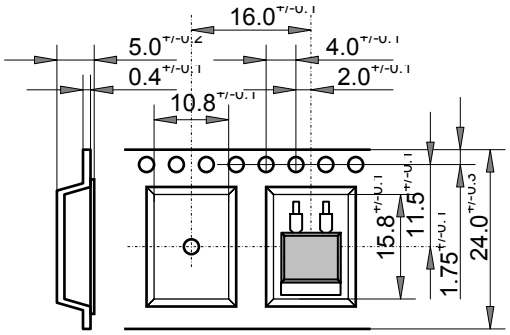
Power Derating



Pulse Energy Durability



Tape Dimension



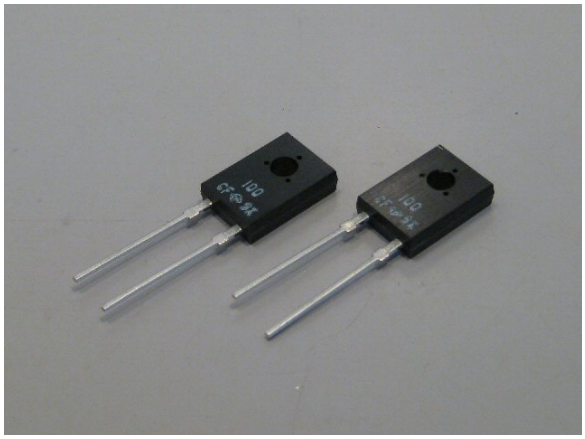
Reel Dimension
Outer diameter: 330 mm
Inner diameter: 100 mm
Width: 23.9 mm min. 27.4 mm max
Package quantity: 500pcs/13 inches reel

Note:
(1) Flange insulation is not necessary between flange and heat-sink, flange and resistor is separated by alumina substrate.
(2) Resistance measurement shall be made at terminal foot portion.
(3) TCR of low resistance will be increased as 300ppm/0.02Ω, 200ppm/0.05Ω, 140ppm/0.1Ω and 80ppm/0.2Ω typically. Testing point is at 5.27mm from bottom of molding of terminals.
(4) Test method is IEC60068-2-6, and specification is sine sweep wave form, 100Hz-2000Hz, 10 cycles, amplitude 0.75mm or 100m/s2, 90minutes. direction x-y z, Amplitude 0.75mm will be applied under break point Frequency (about 60Hz) and 100m/ s2 over break point
(5) Standard packaging is tape reel, a tape reel contains 500pcs. when small quantity, tube packaging will be used, the tube is made by RoHS PS/PE which contains 50pcs / tube.

20120401

TO126 20W HIGH POWER RESISTORS

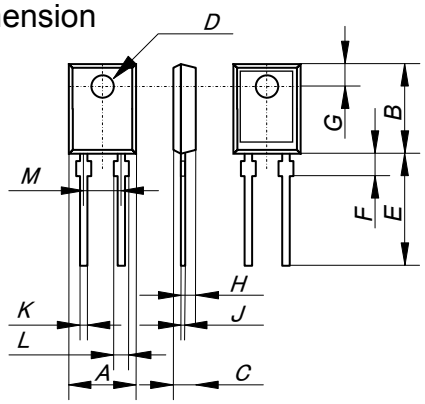
RNP-10S



Features and Applications

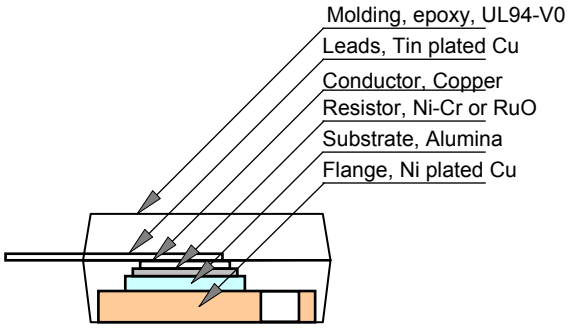
Small size 20W high power resistors in TO126 style molded package.
Non-inductive design suits high frequency applications and high-speed pulse circuits.
Low, 5.9 C/W heat resistance from resistor hot spot to flange and long life performance are presented by thin film metallization technology and rejection of plastic adhesive joint.
Wide 100 milliohm to 51KOhm resistance range, non-inductive impedance characteristic and heat conduction through the insulated metal flange aid circuit designers.
Small size and thin profile suit high-density compact installations.
Complete thermal conduction, heat dissipation design and vibration durable design also available.
Applications for UPS, power unit of machines, motor control, drive circuits, automotive, measurements, industrial computers and high frequency electronics.

Dimension



RNP-10S		
	mm	*+/-mm*
A	*8.5*	*+/-0.2*
B	*12.0*	*+/-0.2*
C	*3.1*	*+/-0.2*
D	*3.1*	*+/-0.1*
E	*17.0*	*+/-1.0*
F	*3.2*	*+/-0.5*
G	*3.8*	*+/-0.2*
H	*1.75*	*+/-0.1*
J	*0.5*	*+/-0.05*
K	*0.6*	*+/-0.05*
L	*1.4*	*+/-0.05*
M	*5.08*	*+/-0.1*

Materials



Between flange and resistor are insulated.

Specifications and Performances

Items	Specification-Performance			Test Conditions
Rating Power	20 Watts			At flange temperature of -55 C to +25 deg C
Rating Power	1 Watt			Free air (without heat sink).
Hear resistance	5.9 deg C/W			From hot spot to flange.
Resistance Range	0.01-0.09	0.1-9.1ohm	10-51Kohm	Note 2.
Nominal Resistance	E6	E24	E24	Includes 2.5, 4.0, 5.0, 8.0 and 16
TCR, ppm/deg C	+/-250 (H*)	+/-100 (A*)	+/-50 (C)	Note 3
Tolerance	+/-5%(J)	+/-1%(F), 5%(J)	+/-1%(F)	1% tolerance at 0.01-0.091 ohm are available optionally.
Capacitance	1.00 pF			Equivalent parallel capacitance.
Inductance	8.22 nH			Equivalent series inductance
Operation Temp. Range	-55 deg C to +155deg C			
Max. Operation Voltage	smaller value either 500V or $\sqrt{P \times R}$			P: rating power and R: resistance
Withstanding Voltage	2000 Volt AC			60 seconds, 1mA, between terminals and flange.
Load Life	+/-1.0 %			25 deg C, 90 min.ON, 30min.OFF, 1000hours.
Humidity	+/-1.0 %			40 deg C, 90 to 95%RH, DC0.1W, 1000hours.
Soldering Heat	+/-1.0 %			350+/-5 deg C, 3seconds,
Solder ability	Over 95 of surface			230+/-5 deg C, 3seconds.
Insulation Resistance	Over 1000 Meg ohm			Between terminals and flange.
Vibration	+/-0.25 %			IEC60068-2-6, see note 4
Weight	0.9 grams			

TO126 20W HIGH POWER RESISTORS RNP-10S

Ordering Information

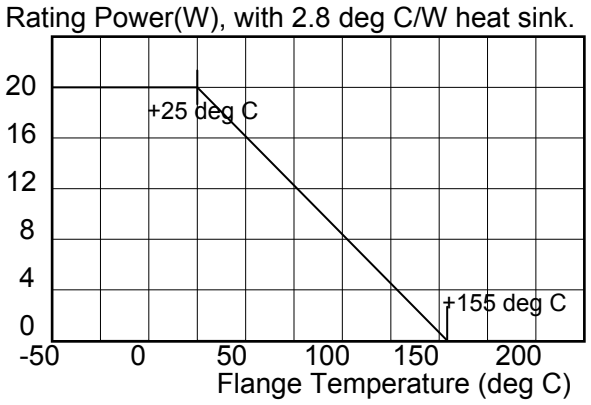
RNP-10S	C		10R0 (*)		F	Z00		Note
RNP-10S	H(250ppm)	>	R02-R09 (+E6)	>	J(5%)	Z03	>	Tube/60pcs
	A(100ppm)	>	R10-9R1 (+E24)	>	F(1%), J(5%)			
	C(50ppm)	>	10R-51K (+E24)	>	F(1%)			

Resistance value (*) is available following modified E24, +E24.

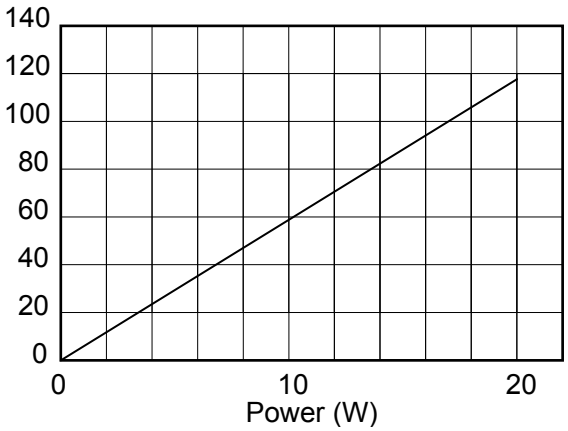
1.0	1.1	1.2	1.3	1.5	1.6	1.8	2.0	2.2	2.4	2.5	2.7	3.0	3.3
3.6	3.9	4.0	4.3	4.7	5.0	5.1	5.6	6.2	6.8	7.5	8.0	8.2	9.1

Note*: When ordering, additional ohm resistance notation is recommended for keeping out of misunderstanding.

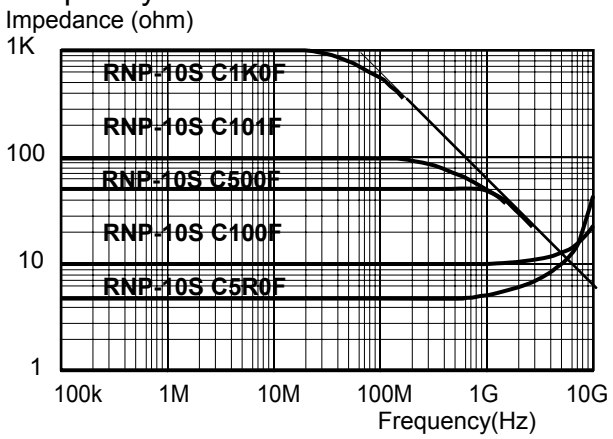
Derating Curve



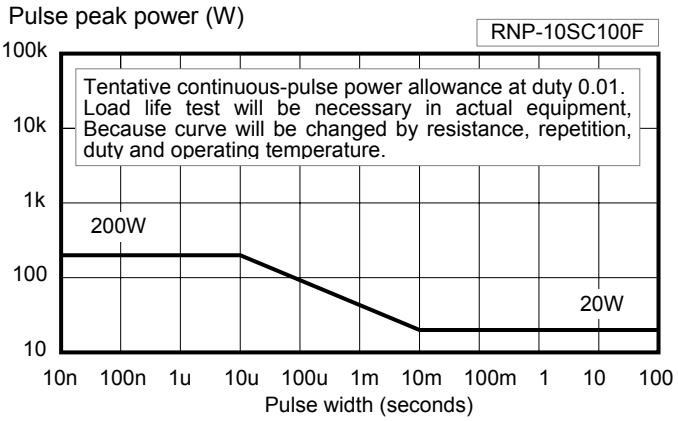
Temperature Rise at Flange Temperature (deg C)



Frequency Characteristics



Pulse Energy Durability



Notes

(1) Insulation material is unnecessary between flange and heat-sink, because flange and resistor are separated by alumina insulated substrate. When mounting resistor on heat-sink, screw, clip and pressure strip with using heat conduction grease on back side of resistor are recommended. Recommended screw torque is 0.5-0.6Nm.

(2) Resistance measurement shall be made at a point 5.27mm +/-0.6 mm from the resistor body.

(3) TCR of low resistance will be increased as 300ppm/0.02ohm, 200ppm/0.05ohm, 140ppm/0.1ohm and 80ppm/0.2ohm typically. Testing point is at 5.27mm from bottom of molding of terminals.

(4) Test method is IEC60068-2-6, and specification is sine sweep wave form, 100Hz-2000Hz, 10 cycles, amplitude 0.75mm or 100m/s^2, 90minutes. direction x-y z, Amplitude 0.75mm will be applied under break point Frequency (about 60Hz) and 100m/ s^2 over break point

(5) When mounting resistor on heat-sink by screw, clip and pressure strip with using heat conduction grease on back side of resistor are recommended. Recommended screw torque is 0.5-0.6Nm.

(6) 0.1% tolerance resistors is available, please see datasheet of RNP-10P.

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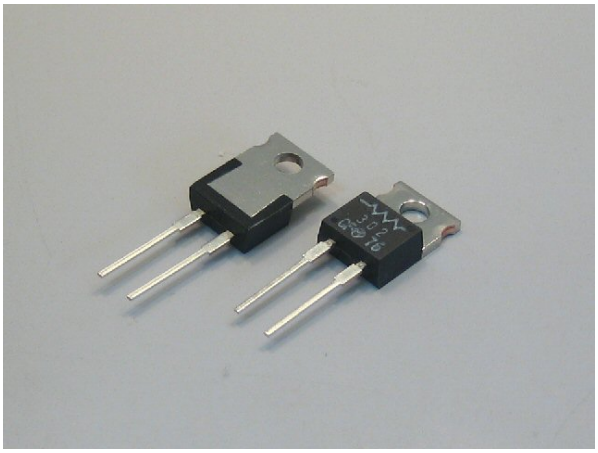
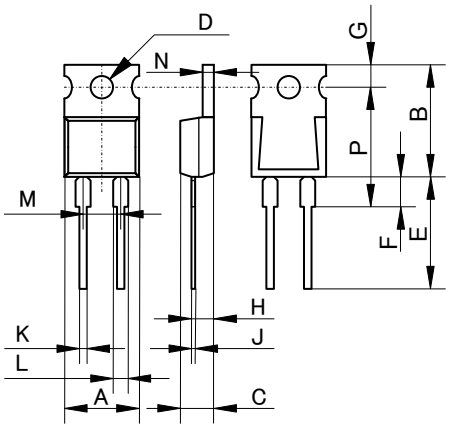
TO220 20W HIGH POWER RESISTORS
RNP-10



Features and Applications

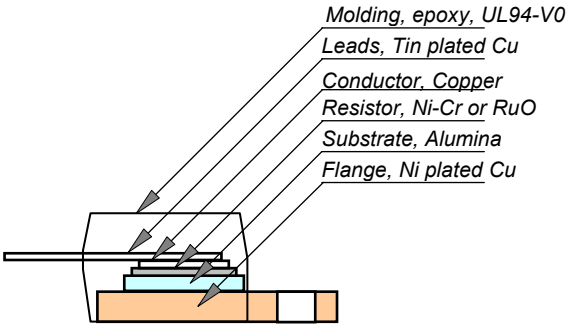
20W high power resistors in TO220 style molded package for through-hole (20W) and surface mount (10W).
Non-inductive design suits high frequency applications and high-speed pulse circuits.
Low, 5.9 deg C/W heat resistance from resistor hot spot to flange and long life performance are presented with thin film metallization technology and rejection of plastic adhesive joint.
Wide 100 milliohm to 51KOhm resistance range, non-inductive impedance characteristic and heat conduction through the insulated metal flange aid circuit designers.
Small size and thin profile suit high-density compact installations.
Complete thermal conduction, heat dissipation design and vibration durable design also available.
Applications for UPS, power unit of machines, motor control, drive circuits, automotive, measurements, industrial computers and high frequency electronics.

Dimensions (mm)



RNP10		
	mm	+/-mm
A	8.5	+/-0.2
B	12.0	+/-0.2
C	3.1	+/-0.2
D	3.1	+/-0.1
E	17.0	+/-1.0
F	3.2	+/-0.5
G	3.8	+/-0.2
H	1.75	+/-0.1
J	0.5	+/-0.05
K	0.6	+/-0.05
L	1.4	+/-0.05
M	5.08	+/-0.1

Structure and Material



Between flange and resistor is insulated.

Ordering Information

RNP-10	C		10R0 (*)		F	Z00		Note
RNP-10	H(250ppm)	>	R02-R09 (+E6)	>	J(5%)	Z03	>	Tube/50pcs
	A(100ppm)	>	R10-9R1 (+E24)	>	F(1%), J(5%)	Z05		Tray/100pcs
	C(50ppm)	>	10R-51K (+E24)	>	F(1%)			

Resistance value (*) is available following modified E24, +E24.

1.0	1.1	1.2	1.3	1.5	1.6	1.8	2.0	2.2	2.4	2.5	2.7	3.0	3.3
3.6	3.9	4.0	4.3	4.7	5.0	5.1	5.6	6.2	6.8	7.5	8.0	8.2	9.1

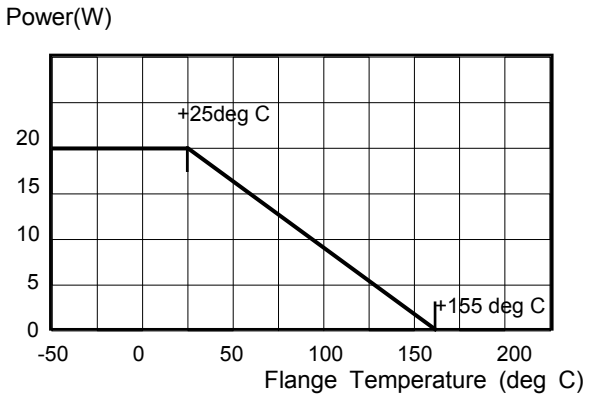
Note*: When ordering, additional ohm resistance notation is recommended for keeping out of misunderstanding.

20W HIGH POWER RESISTORS RNP-10

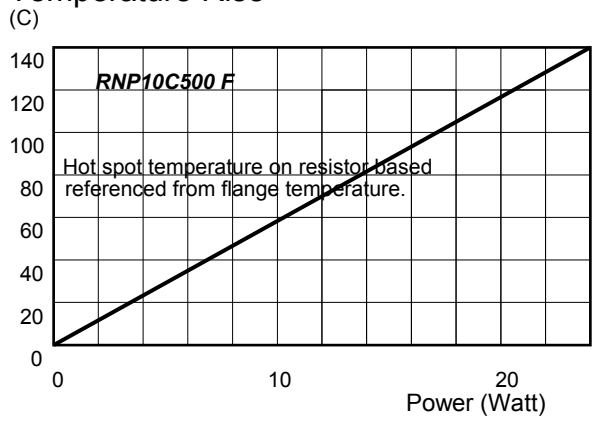
Specifications

Items	RNP-10		RMP-10	Test Conditions
Rating Power	20 W		10W	-55 to 25 deg C flange temperature
Rating Power	1 W		1W	Free air.
Heat Resistance	5.9 deg C/W		5.9 deg C/W	From resistor hot spot to flange
Resistance Range	0.01-0.091ohm	0.1-9.1ohm	10-51kohm	Note 2
Nominal Resistance	E6	E24	E24	Includes 2.5, 4.0 and 5.0
TCR (ppm / deg C)	250(H)	100 (A)	50 (C)	Note 3
Tolerance	5%(J)	1%(F) , 5% (J)	1% (F)	1% tolerance at 0.01-0.091 ohm are available optionally.
Capacitance	1.15pF			Equivalent parallel capacitance.
Inductance	8.38nH			Equivalent series inductance
Operation Temp. Range	-55 deg C to+155 deg C			
Max. Operating Volt.	smaller value either 500V or $\sqrt{P \cdot R}$			P: rating power and R: resistance
Withstanding Volt.	2000 VAC			60 seconds. 1mA
Load Life	+/- 1.0 %			25 deg C, 90 min .ON, 30 min .OFF, 1000 hours.
Humidity	+/- 1.0 %			40 deg C, 90-95%RH, DC 0.1W, 1000 hours.
Temp. Cycle	+/- 0.25 %			-55 deg C,30 min.,+155 deg C,30 min., 5cycles
Soldering Heat	+/- 0.1 %			350+/-5 deg C, 3seconds,
Solder ability	Over 95% of surface			230+/-5 deg C, 3seconds.
Insulation Resistance	Over 1,000 Meg ohm			Between terminals and flange.
Vibration	+/- 0.25 %			IEC60068-2-6, see note 4
Weight	2.1 grams			

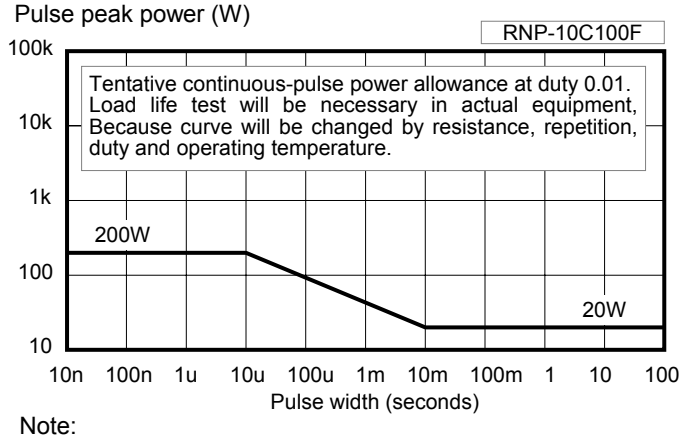
Derating



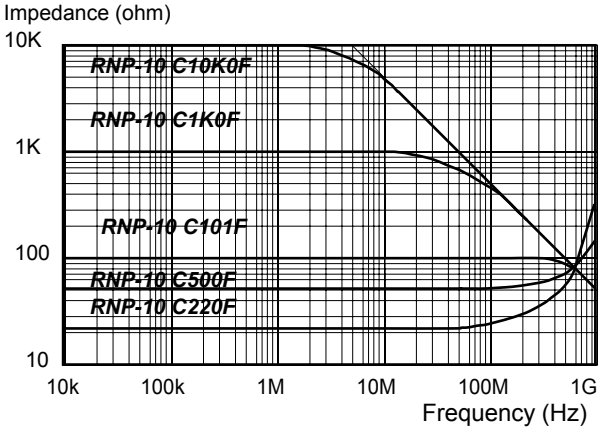
Temperature Rise



Pulse Energy Durability



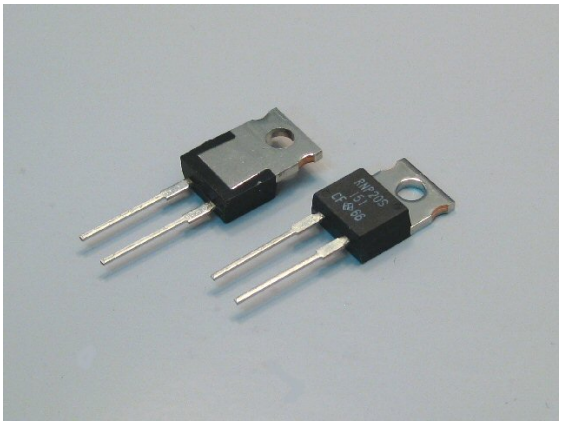
Frequency Characteristics



Note:

(1) Insulating material is unnecessary between flange and heat-sink, flange and resistor is separated by alumina substrate.
(2) Resistance measurement shall be made at a point 5.27mm +/-0.6 mm from the resistor body.
(3) TCR of low resistance will be increased as 300ppm/0.02ohm, 200ppm/0.05ohm, 140ppm/0.1ohm and 80ppm/0.2ohm typically. Testing point is at 5.27mm from bottom of molding of terminals.
(4) Test method is IEC60068-2-6, and specification is sine sweep wave form, 100Hz-2000Hz, 10 cycles, amplitude 0.75mm or $100m/s^2$, 90minutes. direction x-y z, Amplitude 0.75mm will be applied under break point Frequency (about 60Hz) and $100m/s^2$ over break point
(5) When mounting resistor on heat-sink by screw, clip and pressure strip with using heat conduction grease on back side of resistor are recommended. Recommended screw torque is 0.5-0.6Nm.
(6) 0.1% tolerance resistors is available, please see datasheet of RNP-20P.

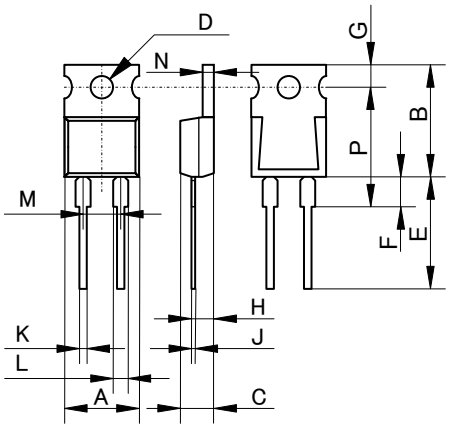
TO220 35W HIGH POWER RESISTORS
RNP-20S



Features and Applications

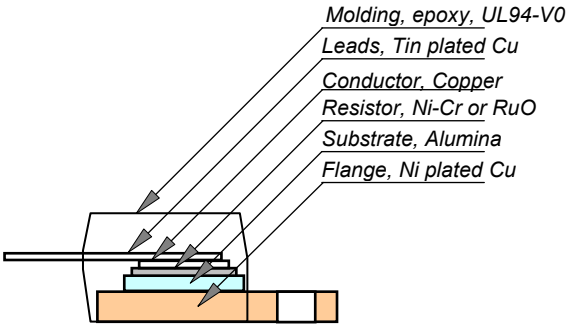
35W high power resistors in TO220 style mold package for through-hole and surface mount.
Non-inductive design suits high frequency applications and high-speed pulse circuits.
Low, 3.3 deg C/W heat resistance from resistor hot spot to flange and long life performance are presented with thin film metallization technology and rejection of plastic adhesive joint.
Wide 100 milliohm to 51kOhm resistance range, non-inductive impedance characteristic and heat conduction through the insulated metal flange aid circuit designers.
Small size and thin profile suit high-density compact installations.
Complete thermal conduction, heat dissipation design and vibration durable design also available.
Applications for UPS, power unit of machines, motor control, drive circuits, automotive, measurements, industrial computers and high frequency electronics.

Dimensional Specifications (mm)



RNP-20S		
	mm	+/-mm
A	10.1	+/-0.2
B	15.0	+/-0.2
C	4.5	+/-0.2
D	3.6	+/-0.1
E	15.5	+/-1.0
F	4.0	+/-0.5
G	3.0	+/-0.2
H	2.75	+/-0.2
J	0.5	+/-0.05
K	0.75	+/-0.05
L	1.5	+/-0.05
M	5.08	+/-0.10
N	1.5	+/-0.05
P	16.0	+/-0.50

Structure and Material



Between flange and resistor is insulated.

Ordering Information

RNP-20S	C		10R0 (*)		F		Z03		Note
RNP-20S	H(250ppm)	>	R02-R09 (+E6)	>	J(5%)		Z03	>	Tube
	A(100ppm)	>	R10-9R1 (+E24)	>	F(1%), J(5%)		Z05	>	Tray
	C(50ppm)	>	10R-51K (+E24)	>	F(1%)				

Resistance value (*) is available following modified E24, +E24.

1.0	1.1	1.2	1.3	1.5	1.6	1.8	2.0	2.2	2.4	2.5	2.7	3.0	3.3
3.6	3.9	4.0	4.3	4.7	5.0	5.1	5.6	6.2	6.8	7.5	8.0	8.2	9.1

Note*: When ordering, additional ohm resistance notation is recommended for keeping out of misunderstanding.

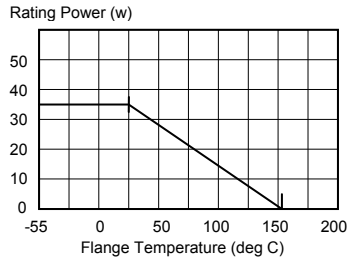
35W HIGH POWER RESISTORS

RNP-20S

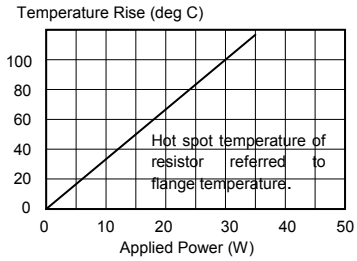
Specifications

Type	RNP-20S			Test Conditions
Rating Power	35 W			-55 deg C to 25 deg C flange temperature
Rating Power	1 Watt			Free air.
Heat Resistance	3.3 deg C/W			Heat resistance between hot spot and flange
Resistance Range	0.01-0.091ohm	0.1-9.1ohm	10-51kohm	Note 2
Nominal Resistance	E6	E24	E24	Include 2.5, 4.0, 5.0, 8.0 and 16
TCR(ppm/deg C)	250(H)*	100 (A)*	50 (C)	Note 3
Tolerance	5%(J)	1% (F) 5% (J)	+/-1% (F)	1% tolerance at 0.01-0.091 ohm is available optionally.
Capacitance	1.44pF			Equivalent parallel capacitance.
Inductance	8.38nH			Equivalent series inductance
Operation Temp.	-55 deg C to+155 deg C			
Max. Operating Volt.	smaller value either 500V or $\sqrt{P \cdot R}$			P is rating power and R resistance
Withstanding Volt.	2000 VAC			Terminal and flange, 60 seconds, 1mA
Load Life	+/- 1.0 %			25 deg C, 90 min. ON, 30 min. OFF, 1000 hours.
Humidity	+/- 1.0 %			40C, 90-95%RH, DC 0.1W, 1000 hours.
Temp. Cycle	+/- 0.25 %			-55 deg C,30 min.,+155 deg C,30 min., 5cycles
Soldering Heat	+/- 0.1 %			350+/-5 deg C, 3seconds,
Solder ability	Over 95% of surface			230+/-5 deg C, 3seconds.
Insulation Resistance	Over 1,000 Meg ohm			Between terminals and flange.
Vibration	+/- 0.25 %			IEC60068-2-6, see note 4
Weight	2.1 grams			

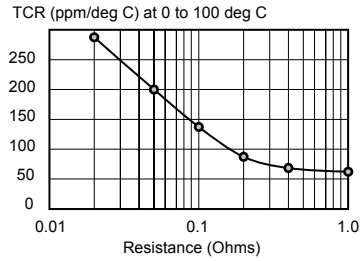
Derating



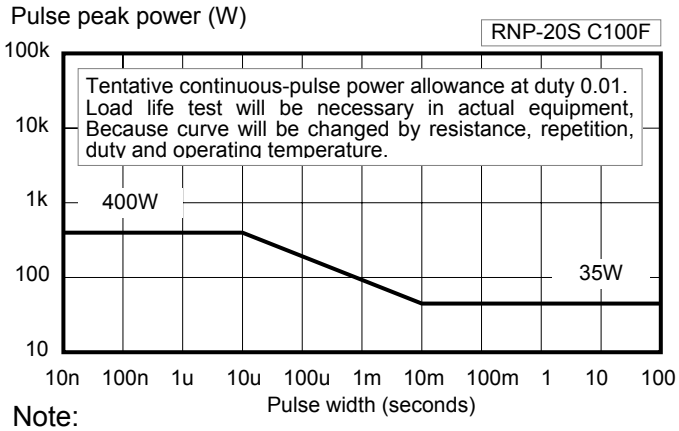
Temperature Rise



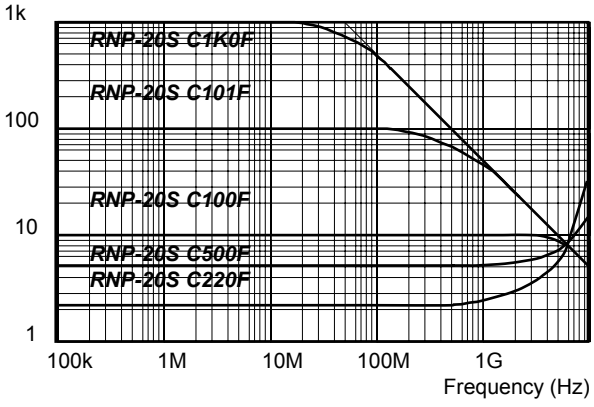
Typical TCR in Low Ohms



Pulse Energy Durability



Frequency Characteristics



Note:

(1) Insulating material is unnecessary between flange and heat-sink, flange and resistor is separated by alumina substrate.
(2) Resistance measurement shall be made at a point 5.27mm +/-0.6 mm from the resistor body.
(3) TCR of low resistance will be increased as 300ppm/0.02ohm, 200ppm/0.05ohm, 140ppm/0.1ohm and 80ppm/0.2ohm typically. Testing point is at 5.27mm from bottom of molding of terminals.
(4) Test method is IEC60068-2-6, and specification is sine sweep wave form, 100Hz-2000Hz, 10 cycles, amplitude 0.75mm or 100m/s^2, 90minutes. direction x-y z, Amplitude 0.75mm will be applied under break point Frequency (about 60Hz) and 100m/ s^2 over break point
(5) When mounting resistor on heat-sink by screw, clip and pressure strip with using heat conduction grease on back side of resistor are recommended. Recommended screw torque is 0.5-0.6Nm.
(6) 0.1% tolerance resistors is available, please see datasheet of RNP-20P.
(7) Standard packaging is RoHS PS/PE tube packaging, which contains 50pcs / tube.

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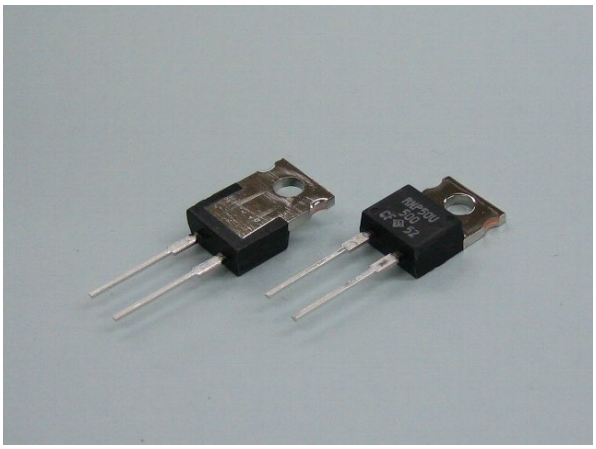
TO220 50W HIGH POWER RESISTORS

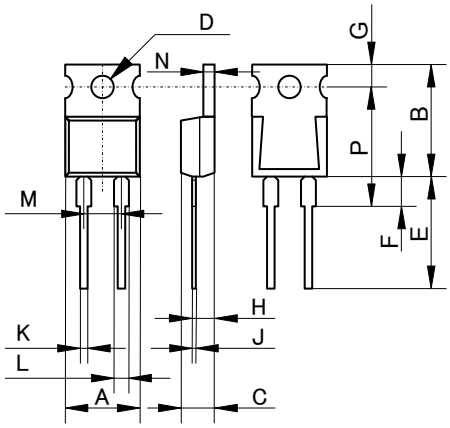
RNP-50U



Features and Applications

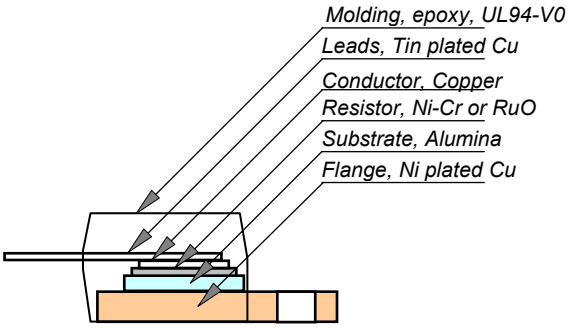
50W high power resistors in TO220 style mold package for through-hole and surface mount.
Non-inductive design suits high frequency applications and high-speed pulse circuits.
Low, 2.3 deg C/W heat resistance from resistor hot spot to flange and long life performance are presented with thin film metallization technology and rejection of plastic adhesive joint.
Wide 100 milliohm to 51kOhm resistance range, non-inductive impedance characteristic and heat conduction through the insulated metal flange aids circuit designers.
Small size and thin profile suit high-density compact installations.
Complete thermal conduction, heat dissipation design and vibration durable design also available.
Applications for UPS, power unit of machines, motor control, drive circuits, automotive, measurements, industrial computers and high frequency electronics.

Dimensional Specifications (mm)



RNP-50U		
	mm	+/-mm
A	8.5	+/-0.2
B	12.0	+/-0.2
C	3.1	+/-0.2
D	3.1	+/-0.1
E	17.0	+/-1.0
F	3.2	+/-0.5
G	3.8	+/-0.2
H	1.75	+/-0.1
J	0.5	+/-0.05
K	0.6	+/-0.05
L	1.4	+/-0.05
M	5.08	+/-0.1
N	1.5	+/-0.05
P	16	+/-0.05

Structure and Material



Between flange and resistor is insulated.

Ordering Information

RNP-50U	C		10R0 (*)		F	Z03		Note
RNP-50U	H(250ppm)	>	R02-R09 (+E6)	>	J(5%)	Z03	>	Tube
	A(100ppm)	>	R10-9R1 (+E24)	>	F(1%), J(5%)	Z05	>	Tray
	C(50ppm)	>	10R-51K (+E24)	>	F(1%)			

Resistance value (*) is available following modified E24, +E24.

1.0	1.1	1.2	1.3	1.5	1.6	1.8	2.0	2.2	2.4	2.5	2.7	3.0	3.3
3.6	3.9	4.0	4.3	4.7	5.0	5.1	5.6	6.2	6.8	7.5	8.0	8.2	9.1

Note*: When ordering, additional ohm resistance notation is recommended for keeping out of misunderstanding.

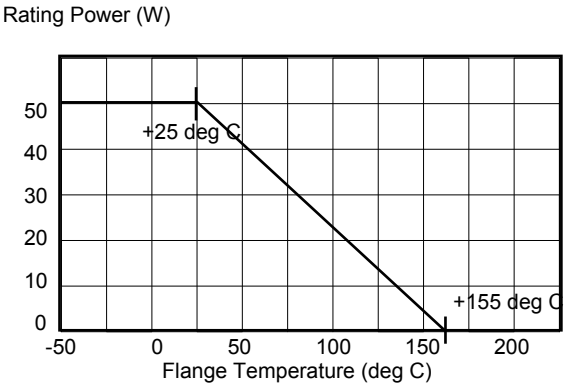
TO220 50W HIGH POWER RESISTORS

RNP-50U

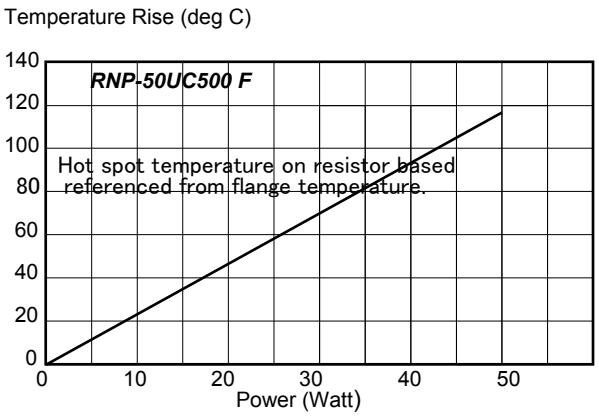
Specifications

	RNP-50U			Test Conditions
Rated Power	50 Watt			-55 deg C to 25 deg C flange temperature
Rating Power	1 Watt			Free air.
Heat Resistance	2.3 C/W			Hot spot to flange
Resistance Range	0.02-0.09ohm	0.1-9.1ohm	10-51Kohm	Note 2
Nominal Resistance	E6	E24	E24	Include 2.5, 4.0, 5.0, 8.0 and 16
TCR, ppm/deg C	250(H)	100 (A)	50 (C)	Note 3
Tolerance	5%(J)	1% (F), 5% (J)	+/-1% (F)	1% tolerance at 0.01-0.091 ohm is available optionally.
Capacitance	1.69pF			Equivalent parallel capacitance.
Inductance	9.65nH			Equivalent series inductance
Operation Temp.	-55 deg C to+155 deg C			
Max. Operating Volt.	smaller either 500V or $\sqrt{P \times R}$			P is rating power and R resistance
Withstanding Voltage	2000VAC			Terminal and flange, 60 seconds, 1mA
Load Life	+/- 1.0 %			25 deg C, 90 min. ON, 30 min. OFF, 1000 hours.
Humidity	+/- 1.0 %			40C, 90-95%RH, DC 0.1W, 1000 hours.
Temp. Cycle	+/- 0.25 %			-55 deg C,30 min.,+155 deg C,30 min., 5cycles
Soldering Heat	+/- 0.1 %			350+/-5 deg C, 3seconds,
Solder ability	Over 95% of surface			230+/-5 deg C, 3seconds.
Insulation Resistance	Over 1,000 Meg ohm			Between terminals and flange.
Vibration	+/- 0.25 %			IEC60068-2-6, see note 4
Weight	2.1 grams			

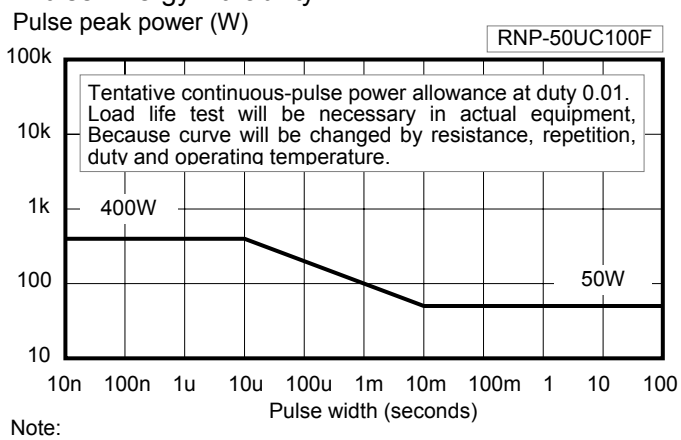
Derating



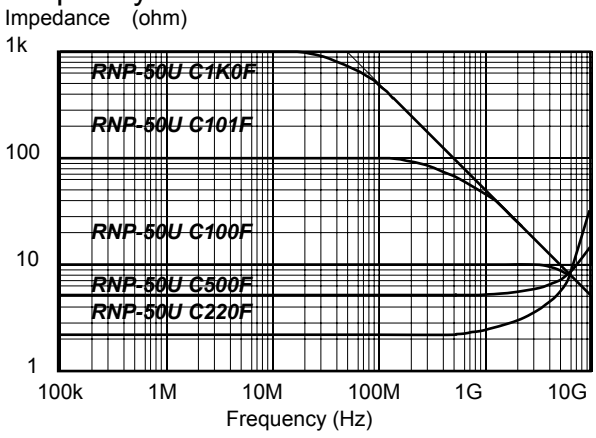
Temperature Rise



Pulse Energy Durability



Frequency Characteristics



Note:

(1) Insulation material is unnecessary between flange and heat-sink, flange and resistor is separated by alumina substrate.
(2) Resistance measurement shall be made at a point 5.27mm +/-0.6 mm from the resistor body.
(3) TCR of low resistance will be increased as 300ppm/0.02ohm, 200ppm/0.05ohm, 140ppm/0.1ohm and 80ppm/0.2ohm typically. Testing point is at 5.27mm from bottom of molding of terminals.
(4) Test method is IEC60068-2-6, and specification is sine sweep wave form, 100Hz-2000Hz, 10 cycles, amplitude 0.75mm or 100m/s^2, 90minutes. direction x-y z, Amplitude 0.75mm will be applied under break point Frequency (about 60Hz) and 100m/ s^2 over break point
(5) When mounting resistor on heat-sink by screw, clip and pressure strip with using heat conduction grease on back side of resistor are recommended. Recommended screw torque is 0.5-0.6Nm.
(6) Standard packaging is anti-static PE tray, which contains 100pcs / tray.

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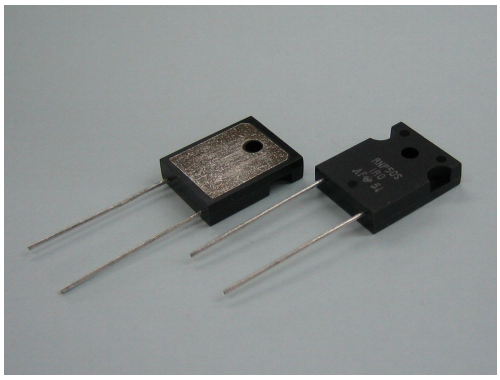
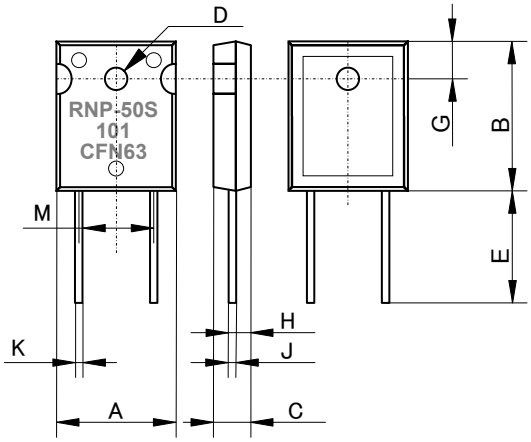


TO247 100W HIGH POWER RESISTORS

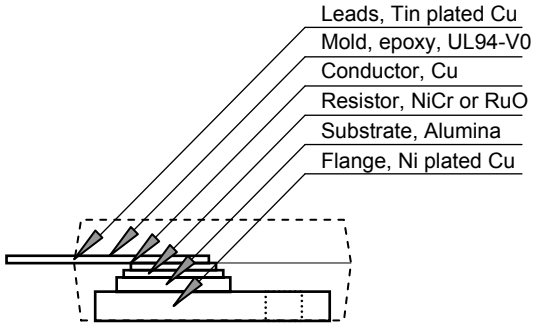
RNP-50S

Features and Applications

100W high power resistor in TO-247 molded package.
Non-inductive design suits high frequency applications and high-speed pulse circuits.
Low, 1.3 deg C/W heat resistance from resistor hot spot to flange and long life performance are presented with thin film metallization technology and rejection of plastic adhesive joint.
Wide 20 milliohm to 51kOhm resistance range, non-inductive impedance characteristic and heat conduction through the insulated metal flange aids circuit designers.
Small size and thin profile suit high-density compact installations.
Complete thermal conduction, heat dissipation design and vibration durable design also available.
Applications for UPS, power unit of machines, motor control, drive circuits, automotive, measurements, industrial computers and high frequency electronics.



RNP-50S		
	mm	+/-mm
A	16.0	+/-0.2
B	20.0	+/-0.5
C	4.8	+/-0.2
D	3.55*	+/-0.1
E	14.5	+/-0.5
F	-	-
G	5.1	+/-0.5
H	3.63	+/-0.2
J	-	-
K	0.8	+/-0.05
L	-	
M	10.9	+/-0.1
N		



Between flange and resistor are insulated

Note(*): Dimension D, 3.20 mm was changed to 3.55 mm from April 2009.

Specifications and Performances

	RNP-50S			Test Conditions
Rating Power	100 Watts			-55 deg C to +25 deg C flange temperature.
Rating Power	3.0 Watts			Free air.
Heat Resistance	1.3 deg C/W			Hot spot to flange.
Resistance Range	0.02-0.09ohm	0.1-9.1 ohm	10-51k ohm	Note 2
Nominal Resistance	+E6	+E12	+E24	Include 2.5, 4.0, 5.0, 8.0 and 16
TCR (ppm/deg C)	>250(H)	100(A)	50(C)	Note 3
Tolerance	+/-5%	+/-5%, +/-1%	+/-1%	1% tolerance at 0.01-0.091 ohm is available optionally.
Capacitance	2.35pF			Equivalent parallel capacitance.
Inductance	11.72nH			Equivalent series inductance
Operation Temp. Range	-55 deg C to+155 deg C			
Max. Applied Voltage	smaller value either 700V or $\sqrt{P \cdot R}$			P is rating power and R resistance
Withstanding Voltage	2500 VAC			Terminal and flange, 60 seconds, 1mA
Load Life	+/- 1.0 %			25 deg C, 90 min. ON, 30min.OFF, 1000hours.
Humidity	+/-1.0 %			40 deg C, 90 - 95%RH, DC0.1W, 1000hours.
Temperature Cycle	+/- 0.25 %			-55C, 30 min., +155C, 30min., 5cycles.
Soldering Heat	+/- 0.25 %			350+/-5 deg C, 3seconds,
Solder ability	Over 3/4 of round			230+/-5 deg C, 3seconds.
Insulation Resistance	Over 1000 Meg ohm			Between terminals and flange
Vibration	+/- 0.25 %			IEC60068-2-6, see note 4
Weight	6.4 grams			

TO247 100W HIGH POWER RESISTORS

RNP-50S

Ordering Information

RNP-50S	C		10R0 (*)		F		Z00		Note
RNP-50S	H(250ppm)	>	R02-R09 (+E6)	>	J(5%)	>	(Z03)	>	(Tube) *
	A(100ppm)	>	R10-9R1 (+E24)	>	F(1%), J(5%)	>	Z05	>	Tray/50pcs
	C(50ppm)	>	10R-51K (+E24)	>	F(1%)				

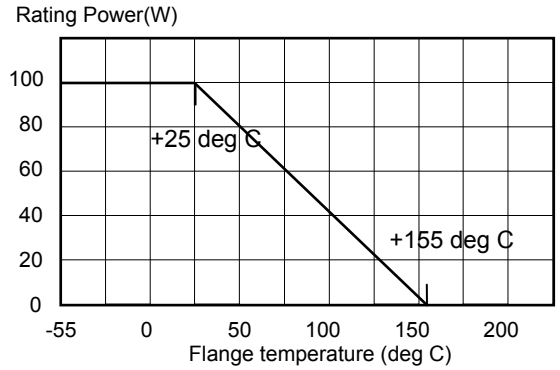
* Tube package will be available soon.

Resistance value (*) is available following modified E24, +E24.

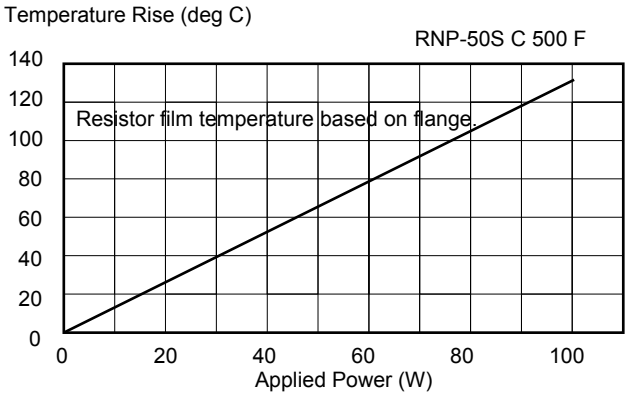
1.0	1.1	1.2	1.3	1.5	1.6	1.8	2.0	2.2	2.4	2.5	2.7	3.0	3.3
3.6	3.9	4.0	4.3	4.7	5.0	5.1	5.6	6.2	6.8	7.5	8.0	8.2	9.1

Note*: When ordering, additional ohm resistance notation is recommended.

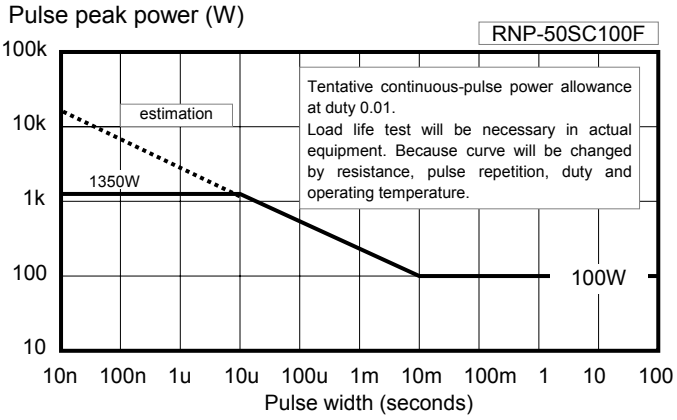
Derating Curve



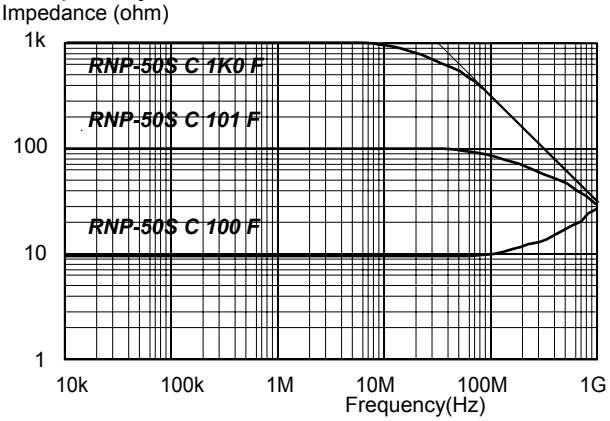
Temperature Rise



Pulse Energy Durability



Frequency Characteristics



Note:

(1) Insulation material is unnecessary between flange and heat-sink, flange and resistor is separated by alumina substrate.

(2) Resistance measurement shall be made at a point 2.54mm+/-1.0mm from the resistor body.

(3) TCR of low resistance will be increased as 300ppm/0.02ohm, 200ppm/0.05ohm, 140ppm/0.1ohm and 80ppm/0.2ohm typically. Testing point is at 2.54mm from bottom of molding of terminals.

(4) Test method is IEC60068-2-6, and specification is sine sweep wave form, 100Hz-2000Hz, 10 cycles, amplitude 0.75mm or 100m/s^2, 90minutes. direction x-y z, Amplitude 0.75mm will be applied under break point Frequency (about 60Hz) and 100m/ s^2 over break point

(5) When mounting resistor on heat-sink by screw, clip and pressure strip with using heat conduction grease on back side of resistor are recommended. Recommended screw torque is 0.5-0.6Nm. In case of screw mount, ISO M3 screw is necessary, 1/8" screw cannot be acceptable.

(6) Standard packaging is anti-static PE tray, which contains 50pcs / tray.

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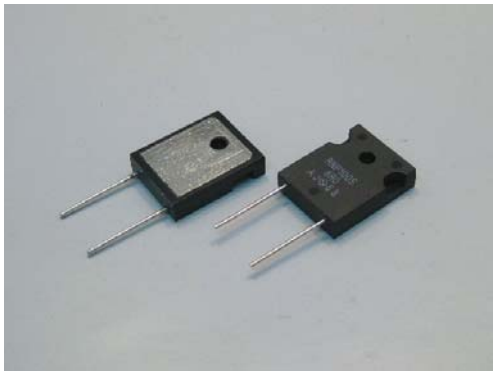
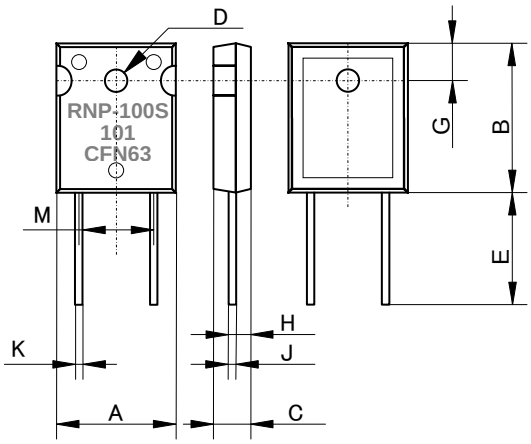


TO247 140W HIGH POWER RESISTORS

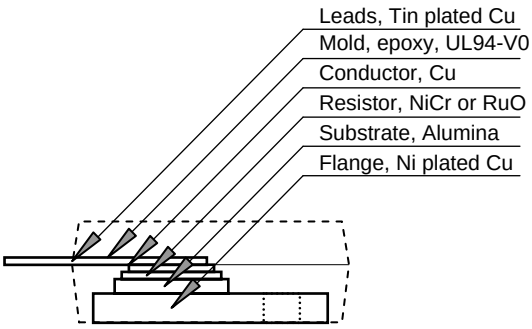
RNP-100S

Features and Applications

140W high power resistor in TO-247 molded package.
Non-inductive design suits high frequency applications and high-speed pulse circuits.
Low, 0.9 deg C/W heat resistance from resistor hot spot to flange and long life performance are presented with thin film metallization technology and rejection of plastic adhesive joint.
Wide 100 milliohm to 51kOhm resistance range, non-inductive impedance characteristic and heat conduction through the insulated metal flange aids circuit designers.
Small size and thin profile suit high-density compact installations.
Complete thermal conduction, heat dissipation design and vibration durable design also available.
Applications for UPS, power unit of machines, motor control, drive circuits, automotive, measurements, industrial computers and high frequency electronics.



RNP-100S		
	mm	+/-mm
A	16.0	+/-0.2
B	20.0	+/-0.5
C	4.8	+/-0.2
D	3.55*	+/-0.1
E	14.5	+/-0.5
F	-	-
G	5.1	+/-0.5
H	3.63	+/-0.2
J	-	-
K	0.8	+/-0.05
L	-	
M	10.9	+/-0.1
N		



Between flange and resistor are insulated

Specifications and Performances

	RNP-100S			Test Conditions
Rating Power	140 Watts			-55 deg C to +25 deg C flange temperature.
Rating Power	2.0 Watts			Free air.
Heat Resistance	0.9 deg C/W			Hot spot to flange
Resistance Range	0.02-0.09ohm	0.1-9.1 ohm	10-51k ohm	Note 2
Nominal Resistance	+E6	+E12	+E24	Include 2.5, 4.0, 5.0, 8.0 and 16
TCR (ppm/deg C)	>250(H)	100(A)	50(C)	Note 3
Tolerance	+/-5%	+/-5%, +/-1%	+/-1%	1% tolerance at 0.01-0.091 ohm is available optionally.
Capacitance	3.68pF			Equivalent parallel capacitance.
Inductance	12.25nH			Equivalent series inductance
Operation Temp. Range	-55 deg C to+155 deg C			
Max. Applied Voltage	smaller value either 700V or $\sqrt{P \cdot R}$			P is rating power and R resistance
Withstanding Voltage	2500 VAC			Terminal and flange, 60 seconds, 1mA
Load Life	+/- 1.0 %			25 deg C, 90 min. ON, 30min.OFF, 1000hours.
Humidity	+/-1.0 %			40 deg C, 90 - 95%RH, DC0.1W, 1000hours.
Temperature Cycle	+/- 0.25 %			-55 deg C, 30 min., +155 deg C, 30min., 5cycles.
Soldering Heat	+/- 0.25 %			350+/-5 deg C, 3seconds,
Solder ability	Over 3/4 of round			230+/-5 deg C, 3seconds.
Insulation Resistance	Over 1000 Meg ohm			Between terminals and flange
Vibration	+/- 0.25 %			IEC60068-2-6, see note 4
Weight	6.3 grams			

TO247 140W HIGH POWER RESISTORS

RNP-100S

Ordering Information

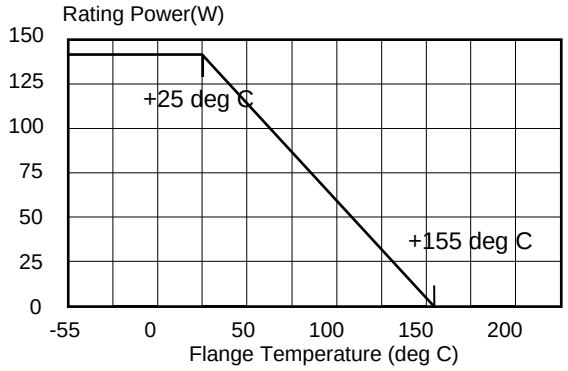
Model	TCR		Resistance		Tolerance		Code	Note
RNP-100S	C		101		F		Z00	|
|	|		|		|		|	|
RNP-100S	H (>=250ppm)	>	R02-R09 (+E6)	>	J(5%)		Z03	Tube*
	A (100ppm)	>	R10-9R1 (+E24)	>	F(1%), J(5%)		Z05	Tray/50pcs
	C (50ppm)	>	10R-51K (+E24)	>	F(1%)			

Resistance value (*) is available following modified E24, +E24.

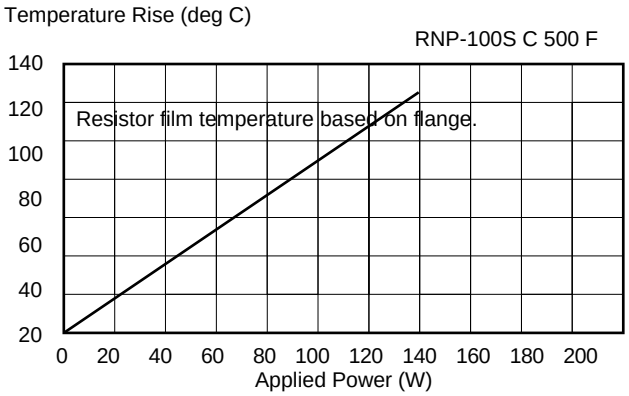
1.0	1.1	1.2	1.3	1.5	1.6	1.8	2.0	2.2	2.4	2.5	2.7	3.0	3.3
3.6	3.9	4.0	4.3	4.7	5.0	5.1	5.6	6.2	6.8	7.5	8.0	8.2	9.1

Note*: When ordering, additional ohm resistance notation is recommended for keeping out of misunderstanding.

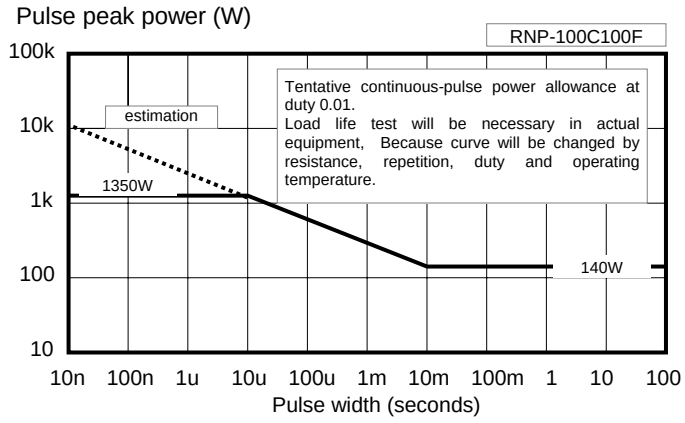
Derating Curve



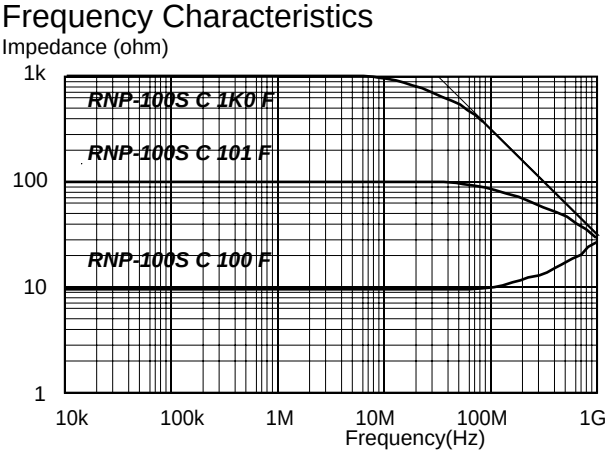
Temperature Rise



Pulse Energy Durability



Frequency Characteristics



Note:

(1) Insulation material is unnecessary between flange and heat-sink, flange and resistor is separated by alumina substrate.

(2) Resistance measurement shall be made at a point 2.54mm+/-1.0mm from the resistor body.

(3) TCR of low resistance will be increased as 300ppm/0.02ohm, 200ppm/0.05ohm, 140ppm/0.1ohm and 80ppm/0.2ohm typically. Testing point is at 2.54mm from bottom of molding of terminals.

(4) Test method is IEC60068-2-6, and specification is sine sweep wave form, 100Hz-2000Hz, 10 cycles, amplitude 0.75mm or 100m/s^2, 90minutes. Direction x-y-z, Amplitude 0.75mm will be applied under break point Frequency (about 60Hz) and 100m/ s^2 over break point

(5) When mounting resistor on heat-sink by screw, clip and pressure strip with using heat conduction grease on back side of resistor are recommended. Recommended screw torque is 0.5-0.6Nm. In case of screw mount, ISO M3 screw is necessary, also,1/8" screw can be acceptable.

(6) Standard packaging is anti-static PE tray, which contains 50pcs / tray.

20120401

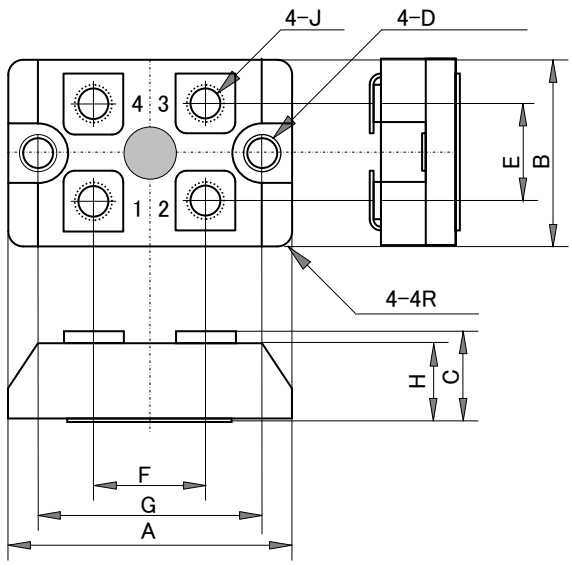
200W, 300W, 600W
CHASSIS MOUNTING NON-INDUCTIVE

HIGH POWER RESISTORS
RPM150, RPM200, RPM250, RPM300, RPM550, RPM600

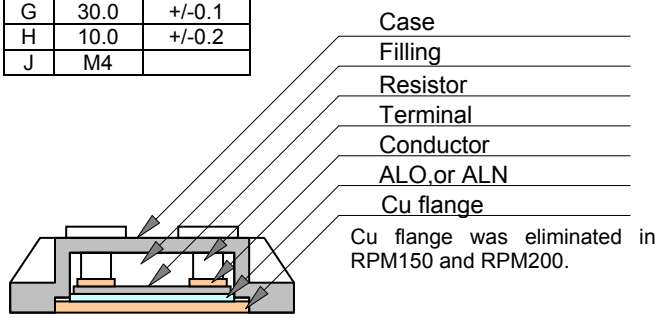
Features and Applications

Small size SOT227, 200W to 600W high power resistor.
Install on air-cooled heat sink or water-cooling will be necessary.
200W has light weight, 300W is powered by copper metal flange and 600W has well heat conduction ceramics, ALN substrate.
RPM series has 6 types of circuit configuration for each customer's applications.
M4 screw terminals, very low series inductance make small sized high performance power electronics.
Higher density packing, vibration-proof and perfect heat dissipation possible.
Applications include snubber resistors for power supplies, gate resistors, pulse generators, high frequency amplifiers, dumping resistance of theater audio equipment.

Dimensions



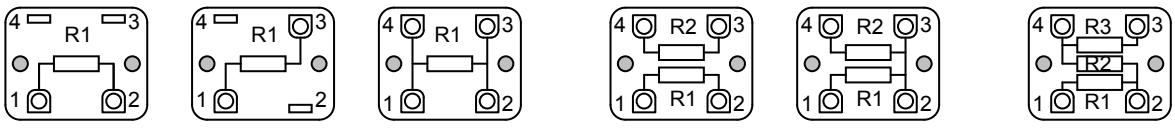
	mm	+/- mm
A	38.0	+/-0.2
B	25.0	+/-0.2
C	11.8	+/-0.5
D	4.2	+/-0.1
E	13.0	+/-0.3
F	15.0	+/-0.4
G	30.0	+/-0.1
H	10.0	+/-0.2
J	M4	



Cu flange was eliminated in RPM150 and RPM200.

Note: Depth of terminal screw is max 6mm-M4. Screw is not attached.

Schematics



RPM200X RPM300X RPM600X	RPM200Y RPM300Y RPM600Y	RPM200Z RPM300Z RPM600Z	RPM150X RPM250X RPM550X	RPM150Y RPM250Y RPM550Y	RPM150Z RPM550Z RPM550Z

RPM150, RPM200, RPM250, RPM300, RPM550, RPM600
CHASSIS MOUNTING NON-INDUCTIVE HIGH POWER RESISTORS

Ordering Information

RPM600	Z	A	101 (*)	J	Z00
RPM150	X	A (100ppm)	+E12	J (5%)	Z00
RPM200	Y		R1=R2=R3		(RoHS)
RPM250	Z				
RPM300					
RPM550					
RPM600					

Resistance value (*) is available following modified E12, +E12.

1.0	1.2	1.5	1.8	2.2	2.5	2.7	3.3	3.9	4.7	5.0	5.6	6.8	8.2

Specifications and Performances

	RPM150	RPM250	RPM200	RPM300	Conditions
Rating Power	150 W	250W	200W	300 W	per package
Configuration	XYZ	XYZ	XYZ	XYZ	
Weight	20.0gr	30.0gr	20.0gr	30.0gr	
Thermal Resist.	0. 5K/W	0.32 K/W	0.5 K/W	0.32 K/W	
Single or Dual	More than one		One resistor		same resistance, R1= R2= R3
Resistance Range	0.1ohm to 100kohm		0.1ohm to 100kohm		only single Z connection at 0.1-1.0Ω*
Resistance	E12+		E12+		additionally, 2.5 and 5.0.
TCR	+/-100 ppm/K(A)		+/-100 ppm/K(A)		for -55 to +120 C, typical >1ohm
Tolerance	+/-5%(J)		+/-5%(J)		1% optional
Operation Temp.	-55 - +155 deg C		-55 - +155 deg C		
Max. Voltage	$E=\sqrt{P\cdot R}$				
Withstanding	2500 VAC				60 seconds.
Load Life	+/-1.0 %				25degC, 90 min.ON, 30min.OFF, 1000h.
Humidity	+/-1.0 %				40degC, 90 to 95%RH, DC0.1W, 1000h.
Tem. Cycle	+/-1.0 %				Note 1
Short Time OL	---				Note 2
Insulation	Over 1000 Meg ohm				between terminals and flange.
Vibration	+/-0.25 %				Note 4
Flammability	UL94V-0				

* Option 0.05 ohms +/-5%

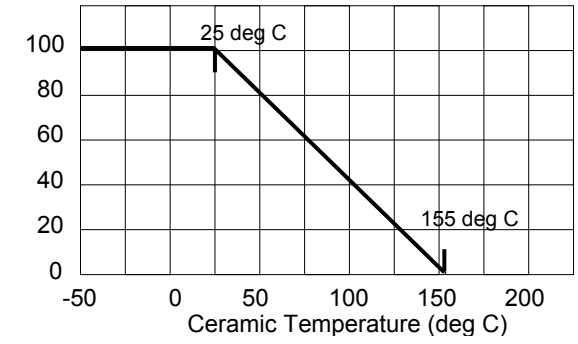
	RPM550	RPM600	Conditions
Rating Power	600 Watts	600 Watts	per package
Configuration	XYZ	XYZ	
Weight	30.0gr	30.0gr	
Thermal Resist.	0.11 K/W	0.11 K/W	
Single or Dual	More than one	One resistor	same resistance, R1= R2= R3
Resistance Range	50ohm to 500ohm	50ohm to 1kohm	
Resistance	E12+	E12+	additionally, 2.5 and 5.0.
TCR	+/-100 ppm/K(A)	+/-100 ppm/K(A)	for -55 to +120 C, typical
Tolerance	+/-5%(J)	+/-5%(J)	1% optional
Operation Temp.	-55 - +155 C	-55 - +155 C	
Max. Voltage	$E=\sqrt{P\cdot R}$		
Withstanding	2500 VAC		60 seconds.
Load Life	+/-1.0 %		25deg C, 90 min.ON, 30min.OFF, 1000h.
Humidity	+/-1.0 %		40deg C, 90 to 95%RH, DC0.1W, 1000h.
Temp Cycle	+/-1.0 %		Note 1
Short Time OL	---		Note 2
Insulation	Over 1000 Meg ohm		between terminals and flange.
Vibration	+/-0.25 %		Note 4
Flammability	UL94V-0		

Note1: -55C, 30 min.,+120 deg C 30min., 20cycles.
Note2: Several seconds overload can not be applied.
Note3: Torque: Terminal 1.0Nm max, 0.6Nm recommend. Mounting 1.6Nm max, 1.0Nm recommend.

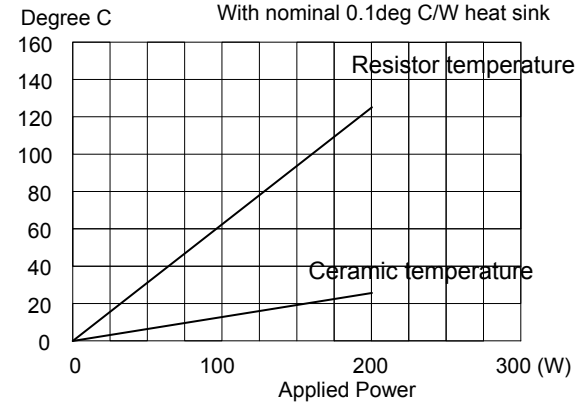
RPM150, RPM200, RPM250, RPM300, RPM550, RPM600
CHASSIS MOUNTING NON-INDUCTIVE HIGH POWER RESISTORS

Performances

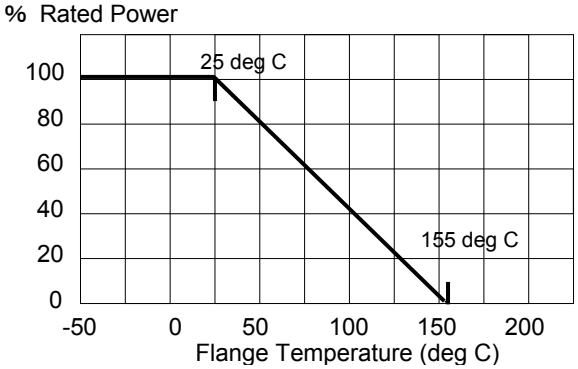
Derating Curve, RPM150, RPM200



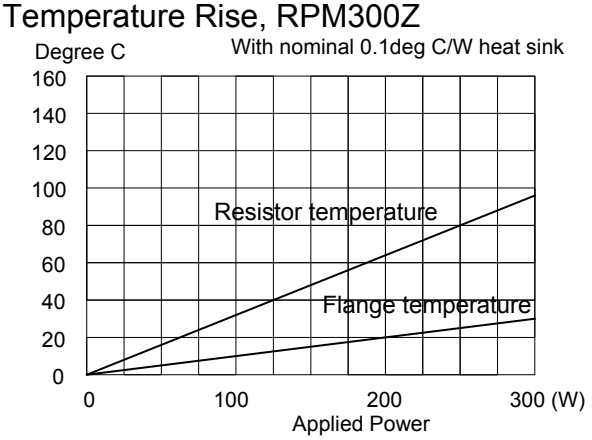
Temperature Rise, RPM200Z



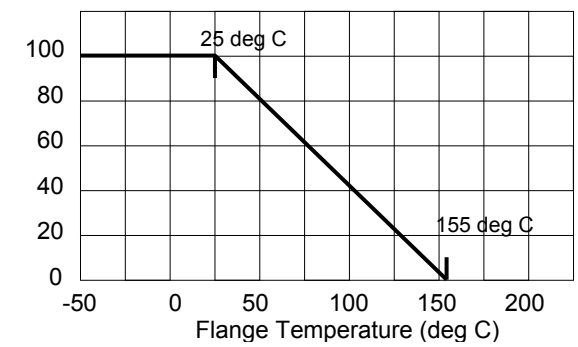
Derating Curve, RPM250, RPM300



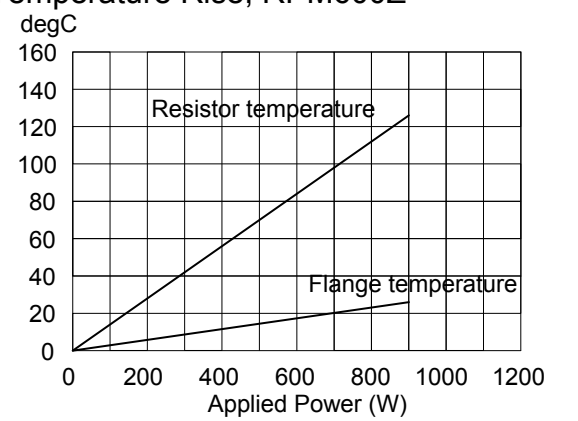
Temperature Rise, RPM300Z



Derating Curve, RPM550, RPM600

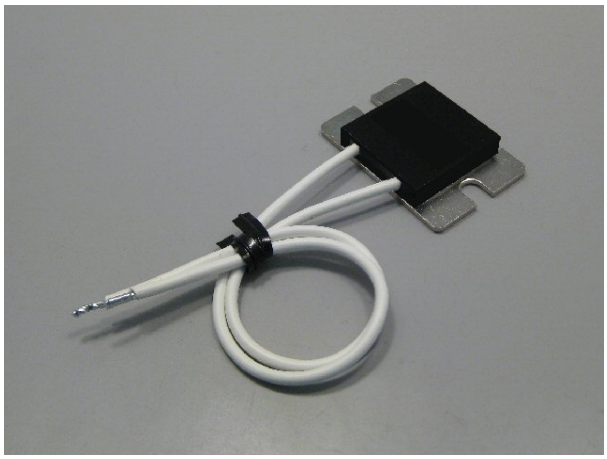


Temperature Rise, RPM600Z



300W
CHASSIS MOUNTING NON-INDUCTIVE FLAT TYPE HIGH POWER RESISTORS

RPL320



Features and Applications

Flat type, 300W high power resistor. Attaching an air-cooled heat sink or water-cooling necessary.
Rated power is 300W (one element).
Custom resistance and power resistor network available.
Higher density packing, vibration-proof, insulation withstand voltage and perfect heat dissipation possible.
Applications include snubber resistors, surge protection, breeder resistor, dummy load, gate resistor, dumping resistor for power supplies, pulse generators, high frequency amplifiers, theater audio equipment, etc.
Note: RPL310 was alternated by RPL320.

Dimensions

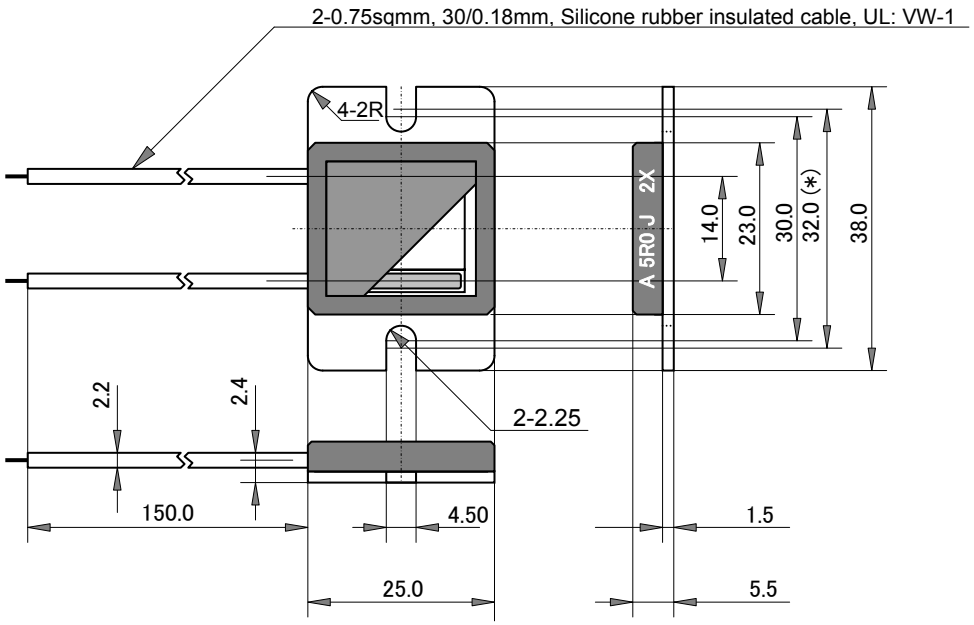


Figure 1. Dimension and Marking (mm)

* : for mounting screw.

300W RPL320

CHASSIS MOUNTING NON-INDUCTIVE FLAT TYPE HIGH POWER RESISTORS

Ordering Information

Type	TCR	Resistance	Tolerance	Code	Note
RPL320	A	10R	J	Z00	
RPL320	A (100ppm)	10R	J (5%)	Z00	RoHS, bulk package
		E12+ (*)			

(*) Recommend resistance value, when request for optional resistance please call factory.

1.0	1.2	1.5	1.8	2.2	2.5	2.7	3.3	3.9	4.7	5.0	5.6	6.8	8.2

Specifications and Performances

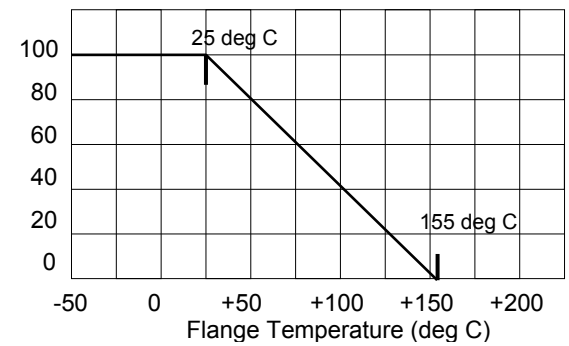
Items	Specifications	Conditions
Rating Power	300 Watts	At flange temperature -55 to +25 deg C
Heat Resistance	0.23 deg C/W	From resistor to flange
Resistance Range	0.1 ohm to 51K ohm	0.1ohm to 0.82 ohm, option
Nominal Resistance	E12+	Additionally, 2.0 and 5.0.
TCR	+/-100 ppm/K (A)	For -55 to +155 deg C, exclude wire leads
Tolerance	+/-5% (J)	
Operation Temp.	-55 to +155 deg C	
Max. Applied Voltage	$E=\sqrt{P\cdot R}$	
Withstanding Voltage	2000 VAC	60 seconds between terminals and flange. Leak current below 0.5mA
Load Life	⊿R+/-1.0 %	Continuous power 1000hours.
Humidity	⊿R+/-1.0 %	60 deg C, 90 to 95%RH, DC0.1W, 1000hours.
Temperature Cycle	⊿R+/-1.0 %	-55 deg C, 30 min.,+155 deg C 30min., 5 cycles.
Insulation Resistance	Over 1000 Meg ohm	Between terminals and flange.
Vibration	⊿R+/-0.5 %	Note 2
Flammability	UL94V-0	For resistor body
Weight	20 grams	May be changed by lead length.

Note 1: Torque: Terminal 1.0Nm max, 0.6Nm recommend. Mounting 1.6Nm max, 1.0Nm recommend.

Note 2: IEC60068-2-6, displacement 0.75mm or acceleration 100m/sec^2, 10Hz-54Hz sweep, 10 cycles X-Y-Z direction.

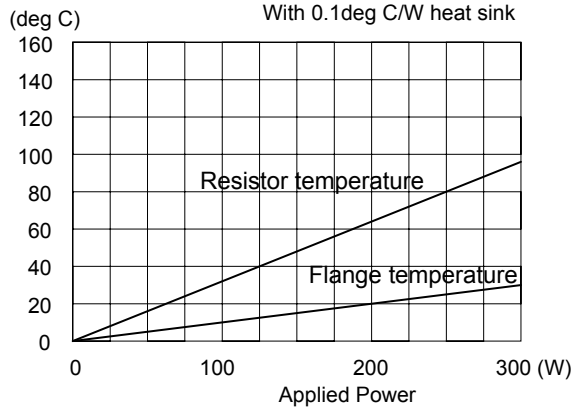
Derating Curve,

RPL320

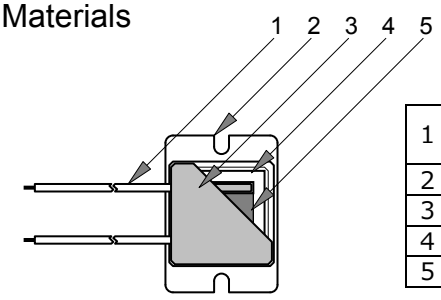


Temperature Rise, RPL320

With 0.1deg C/W heat sink



Materials



1	Terminals	Silicone insulated wires. 2-0.75sqmm, 30/0.18mm, Silicone rubber insulated cable, UL:VW-1
2	Flange	Ni plated copper plate.
3	Case	Epoxy insulator
4	Substrate	Al2O3 alumina substrate
5	Resistor	Metal film resistor

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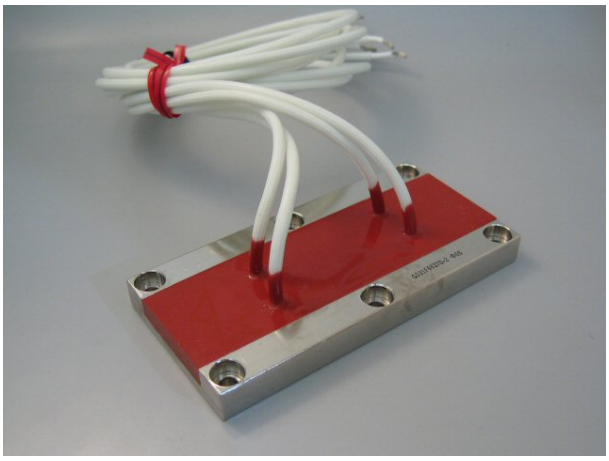


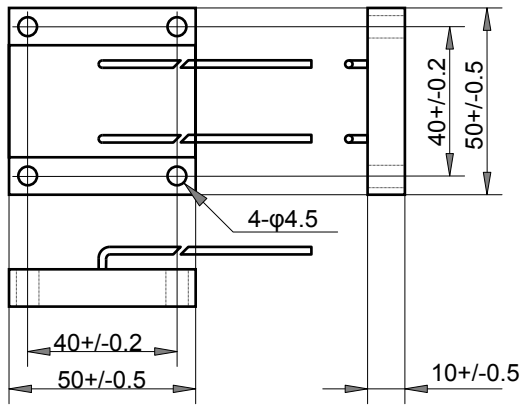
SCREW MOUNT NON-INDUCTIVE
HIGH POWER RESISTORS

RPF-100, RPF-250

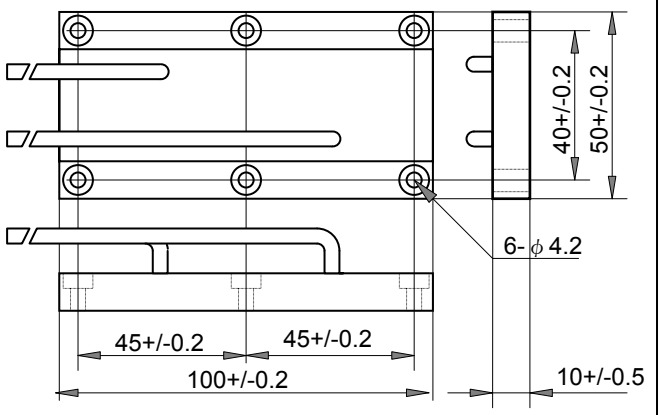
Features and Applications

Chassis mounting high power resistor of 100W to 250W rating power.
Small in regard to thickness and with vertical terminal wires so suitable for high density electronic design.
Also, a decrease in the inductive effect in power electronics circuits will be realized.
Complete thermal conduction and heat dissipation design will be available.
Gate resistor and snubber resistor in power supply.
Load resistor and dumping resistor in high end audio.
Precision terminal resistor in RF amplifiers.

RPF-100



RPF-250

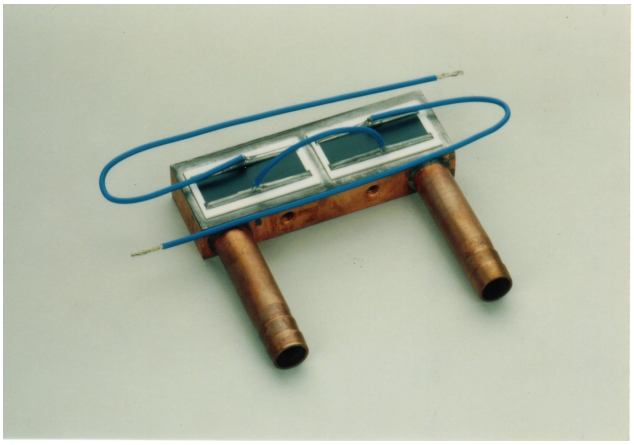


Specifications and Performances

	RPF-100	RPF-250	Test Conditions
Rated Power	100W	250W	
Resistance Range	10ohm～1Kohm	1ohm～1Kohm	
Resistance	E24	E24	Additionally, 2.0 and 5.0.
TCR	±250 ppm/℃	±250 ppm/℃	For -55 to +155 ℃
Tolerance	±10%	±10%	
Operation Temp.	-55 - +120 ℃	-55 - +120 ℃	
Applied Voltage	$E = \sqrt{P \cdot R}$	$E = \sqrt{P \cdot R}$	
Insulation Voltage	5KVAC	5KVAC	60 seconds, 1mA
Load Life	±(1.0 %)	±(1.0 %)	25℃, 90 min.ON, 30min.OFF, 1000hours.
Humidity	±(1.0 %)	±(1.0 %)	40℃, 90～95%RH, DC0.1W, 1000hours.
Temperature Cycles	±(1.0 %)	±(1.0 %)	-55℃, 30 min.,+155℃30min., 20cycles. (-55℃, 30 min.,+120℃30min., 20cycles. at RPF-100)
Short time OVL	±(0.25 %)	±(0.25 %)	Rating watt×2.5, 2.5seconds, with heat sink.
Insulation Resistance	> 1000 Mohm	> 1000 Mohm	Between terminals and tab.
Vibration	±(0.25 %)	±(0.25 %)	
Weight			

500W WATER COOLING NON-INDUCTIVE
HIGH POWER RESISTORS

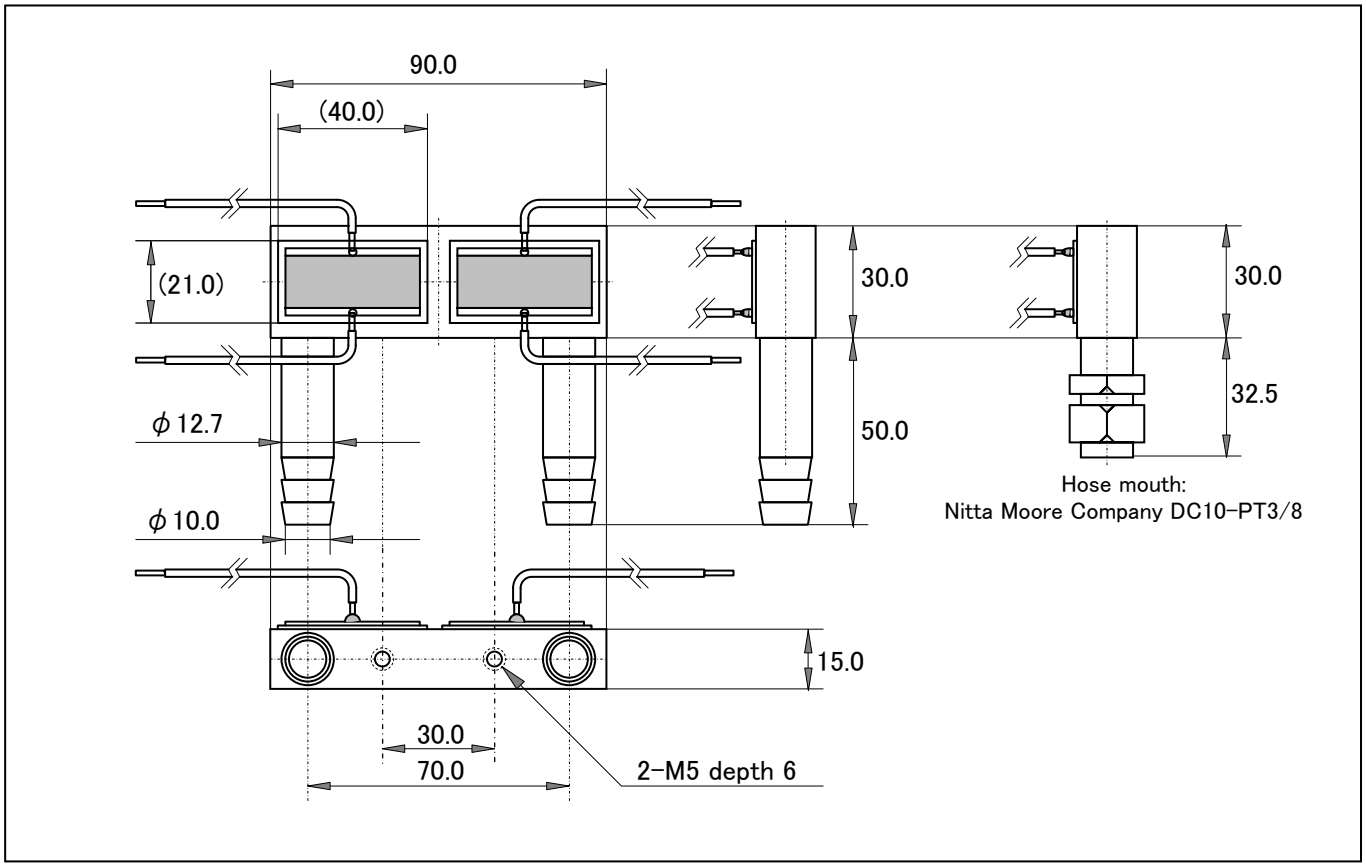
RPH500



Features and Applications

Small sized 500W water-cooled non-inductive resistor with a very low resistor temperature under operation.
Flat plate resistance and twisted pair leads and special terminal structure (patent) are shown excellent serge absorption performances.
Resistors are insulated from case by the high purity alumina substrate, and are guaranteed to voltage-proof of 5kV.
Leads type, length, terminal processing (patented), and hose connection can be accepted arbitrary demands.
Surge suppression resistors for power thyristor and IGBT, used in power supply of electric power conversion system and of industrial apparatus, high output AC motor controls.

Dimensions (mm)



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URL: http://www.nikkohm.co.jp & http://www.nikkohm.com / e-mail: info@nikkohm.co.jp

500W WATER COOLING NON-INDUCTIVE HIGH POWER RESISTORS RPH500

Specifications and Performances

	Specifications
Resistance	Any Value (odd value will be under MOQ 100pcs)
Resistance Range	0.1ohm-1Kohm
TCR	+/-250ppm/ degree C
Tolerance	+/-10%
Series Inductance	40nH/dual resistor, (Typical)
Parallel Capacitance	160pF/dual resistor, (Typical)
Hose Mouth	Standard: Nipple, any types are available.
Water Temperature	+41degreeC maximum at inlet, more than the dew point
Volume of Water Flow	2 litters/minutes minimum.
Water Pressure Loss	0.06Kg/(cm*cm)
Water Temperature Rise	1.4 degree C
Case Temperature Rise	14 degree C
Surface Temperature Rise	50 degree C
Surface Temperature Rise	Maximum 110 degree C
Rating Power	500W (250W/resistor element)
Max. Applied Power	700W (350W/resistor element)
Max. Continuous Impulse Load	Peak Power 37KW/10us/10KHz (Only for reference)
Damaged Impulse Load	100KW peak power/70us single and 37KW peak power/34us continuous.
Terminal Codes	Teflon Insulated Wire(0.18/30, outer diameter 2mm, Blue), 200mm length.
Dielectric Strength	AC2000V, 60 seconds. (Between terminals and case)
Max Operating Voltage	AC1000V
Insulation Resistance	1000Mohmminimum. (Between terminals and case)
Load Life	+/-2% (Rating 500W, 1000 hours)
Humidity	+/-2%(Rating*0.1, 1000hours, continuous load)
Weight	350 grams

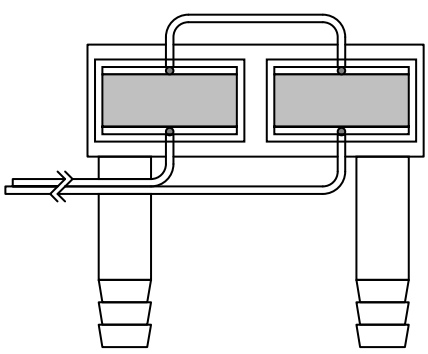
Ordering Information

Model	TCR	Resistance	Tolerance	Remarks
RPH500	H	20 Ohm	K	
|	|	|	|	
RPH500	H (250ppm/K)	0.1 Ohm-1k Ohm	K (+/-10%)	
RPH500-000				
RPH500-001				
RPH500-999				

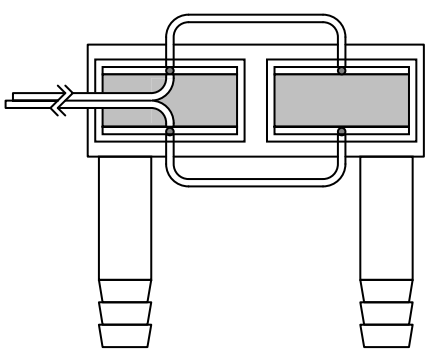
xxx: 3 digits specified code from specification draw, please call factory

Schematics & Wiring

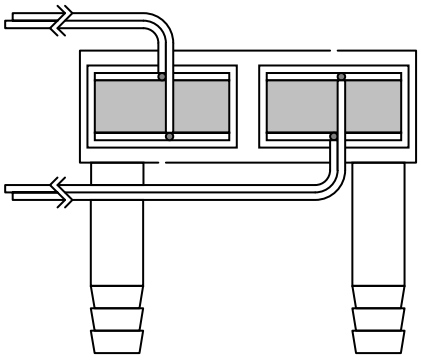
A resistor includes a couple of resistor elements and has following three ways connection. Series connection is standard, but if customer request specified connection and fly-lead length, please call our factory.



Series Connection



Parallel Connection



Separate Connection

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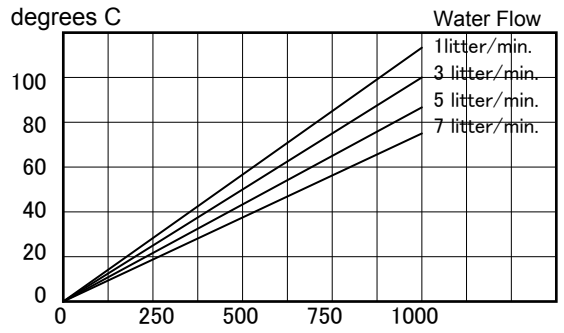
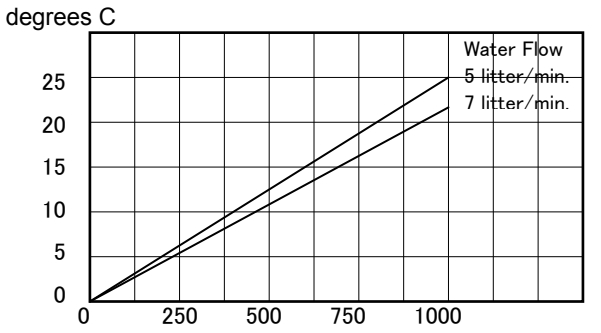
500W WATER COOL NON-INDUCTIVE HIGH POWER RESISTORS **RPH500**

Temperature Rise Characteristics

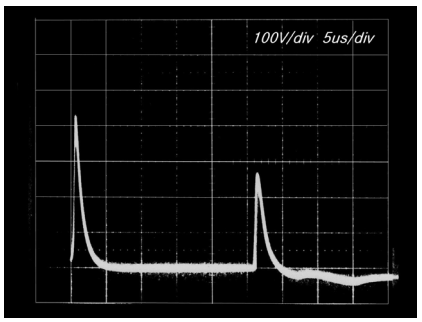
Resistor Surface Temperature Rise

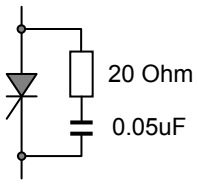


Case Temperature Rise

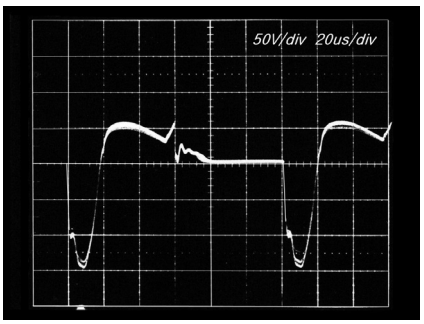


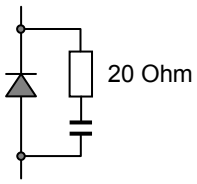
Recommended Long Life Actual Application of RPH500 snubber.



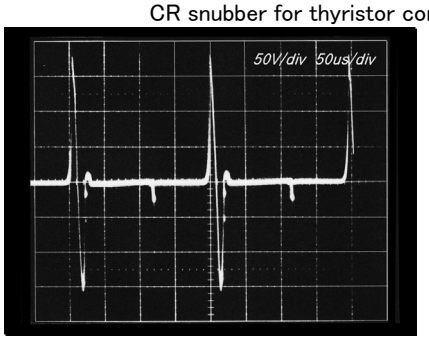


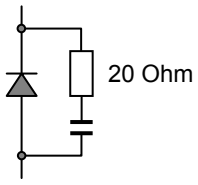
CR snubber for thyristor converter



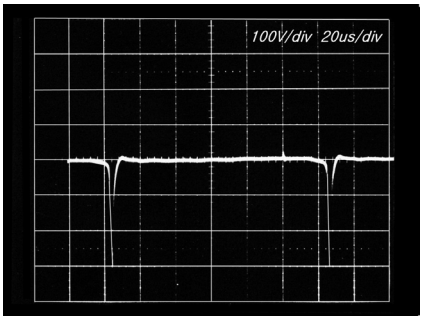


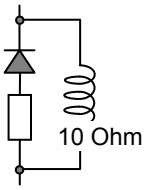
CRD snubber





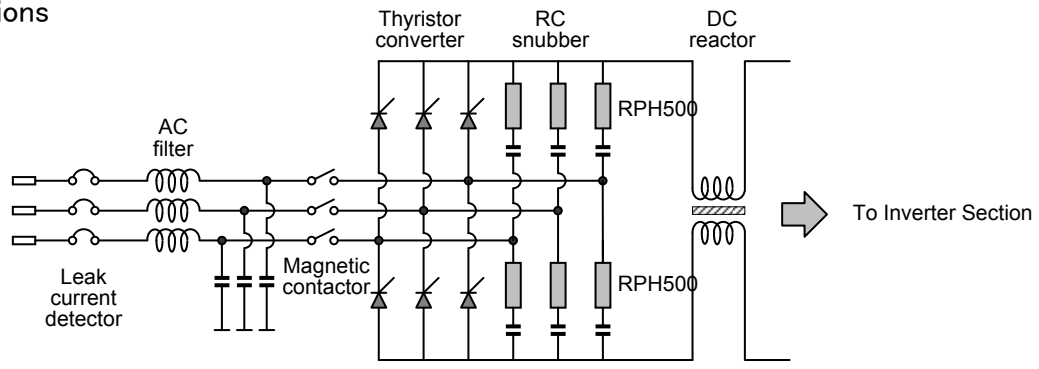
CRD snubber





LRD snubber

Applications



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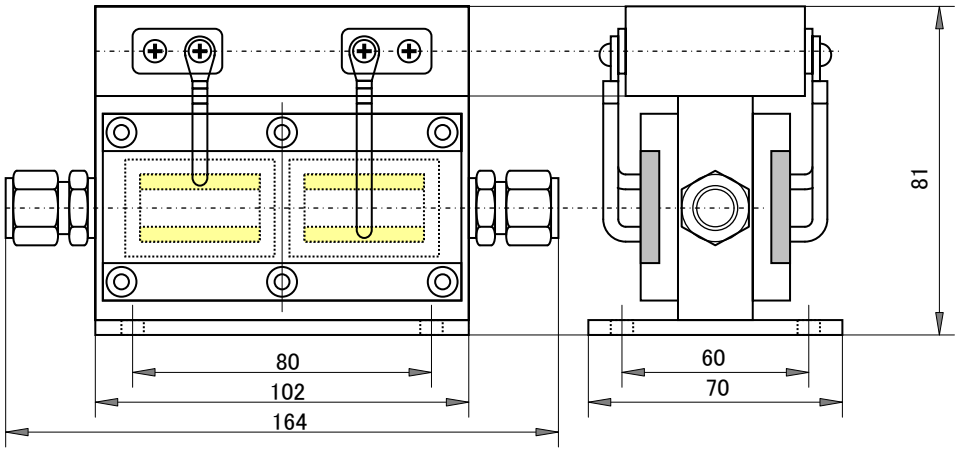
WATER COOLED HIGH POWER RESISTORS
RPH-500, SRPH-1000S, RPH-2000S

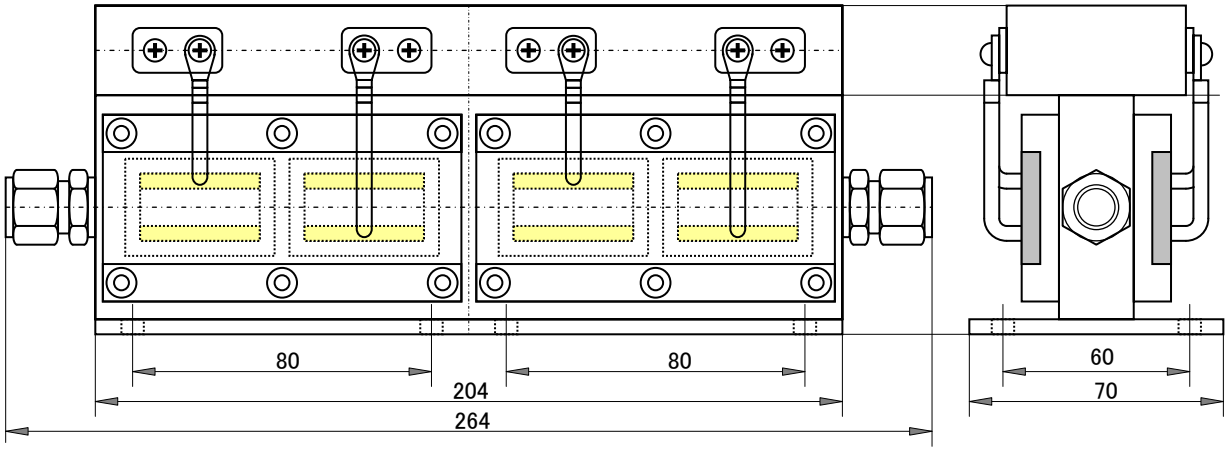
Dimensions

RPH-500S



Note:
RPH-2000S (2kW) are similar appearance to RPH500S or RPH1000S, and are manufactured in standard. Please require the specifications to factory.

RPH-1000S



Specifications and Performances

Specification Items	RPH-500S	RPH-1000S	RPH-2000S	Test Conditions
Rating Power	500 W	1KW	2KW	
Resistance Range	0.22ohm～1Kohm			
Nominal Resistance	Any Value			
TCR	±250 ppm/deg C (H)			For -55 to +155 deg C
Tolerance	±10% (K)			
Withstanding Voltage	2000 V AC			Terminals and case
Inductance	0.1μH			
Capacitance	300pF	600pF	1200pF	4.7pF at series connection
Maximum Water Pressure	10kg/cm^2			
Volume of Water Flow	6 litters/min			
Standard Water Temperature	41℃			At inlet
Minimum Water Temperature	Over Dew Point			
Water Temperature Rise	1.4℃	3.0℃	6.0℃	At outlet at rating power
Case Temperature Rise	14.0℃			
Resistor Surface Tem. Rise	50.0℃			At rating power
Maximum Surface Temperature	110℃			At rating power
Pressure Loss	0.1kgf/ cm^2			
Weight	3kg	5kg	10kg	

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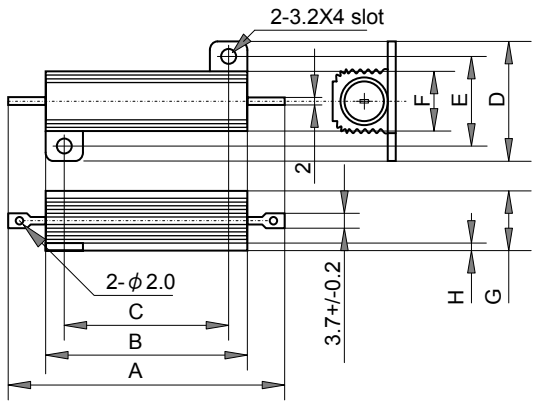
20W, 50W Wire Wound Resistors

RH25C, RH25CN, RH50C, RH50CN

Features and Applications

Inductive (RH25C, RH50C), non-inductive (RH25CN, RH50CN) aluminum clad housed wire-wound resistors.
Cement molded resistors construction gives complete environmental protection and 250 deg C high temperature operation.
Complete welding terminal construction.
Braking resistor and dumping resistor of the motor control, rush current protection, gate resistor, snubber resistor.

Dimensional Specifications (mm)



Symbol	RH25C, RH25CN	RH50C, RH50CN
A	49.4±0.2	70.6±0.2
B	27.1+0.15-0.10	49.3+0.15-0.10
C	18.3±0.2	39.7±0.2
D	29.6±0.2	29.6±0.2
E	20.6±0.2	20.6±0.2
F	15.6±0.2	15.6±0.2
G	16±0.2	16±0.2
H	2.2±0.2	2.2±0.2
Weight	16.5gr	35gr

	Specifications	Test Condition
Short time overload	±0.5%	
Heat shock	±0.5%	
Dielectric strength	±0.2%	2000VAC, 60sec.
Insulation resistance	10Gohm	
Load life	±1.0%	
Operating temp. range	-55 to +250 deg C	
Storage temp. range	-55 to +250 deg C	

Specifications

Type	Rated Watt Heat Sink (W)	Rated Watt Free Air (W)	Resistance (ohm)	TC Lower Limit (±ppm/K)				Tolerance (%)
				200ppm	100ppm	50ppm	30ppm	
RH25C	20	8	0.022-25K	0.022-0.09	0.1-0.976	1-19.6	20-25K	±0.1(B), ±0.5(D), ±1.0(F) ±5.0(J)
RH25CN	20	8	0.1-10K	-	0.1-0.976	1-19.6	20-10K	
RH50C	30, 50(1)	10	0.048-50K	0.048-0.09	0.1-0.976	1-19.6	20-50K	
RH50CN	30, 50(1)	10	0.2-20K	-	0.2-0.976	1-19.6	20-20K	

(1) Please see note (1) in next page.

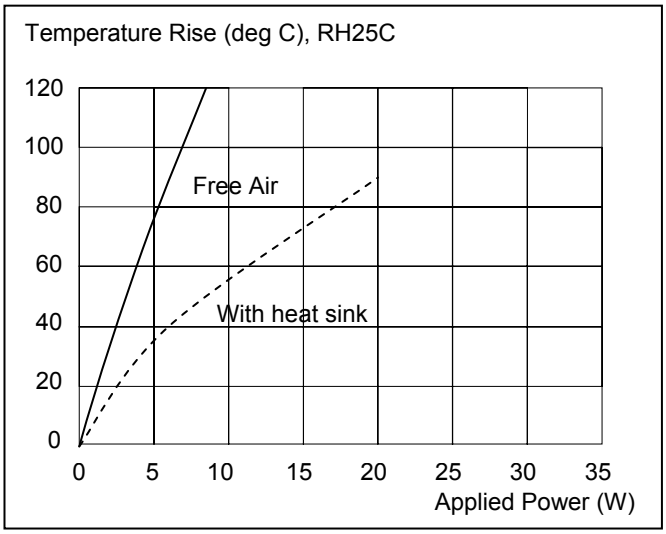
Ordering Information

Model	Filling	Inductive / not	Resistance	Tolerance	Note
RH25	C	N	50ohm	F	
RH25	C (high temp.)	- (inductive)	any value in above range	B (+/-0.1%)	
RH50		N (non inductive)		D (+/-0.5%)	
				F (+/-1.0%)	
				J (+/-5.0%)	

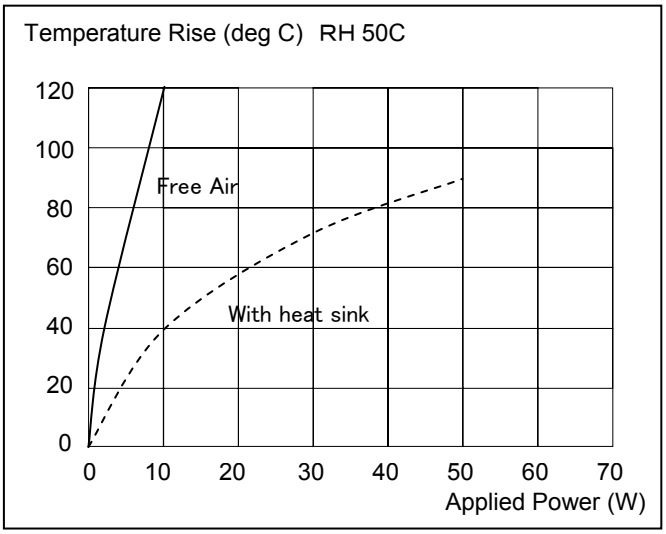
20W, 50W Wire Wound Resistors

RH25C, RH25CN, RH50C, RH50CN

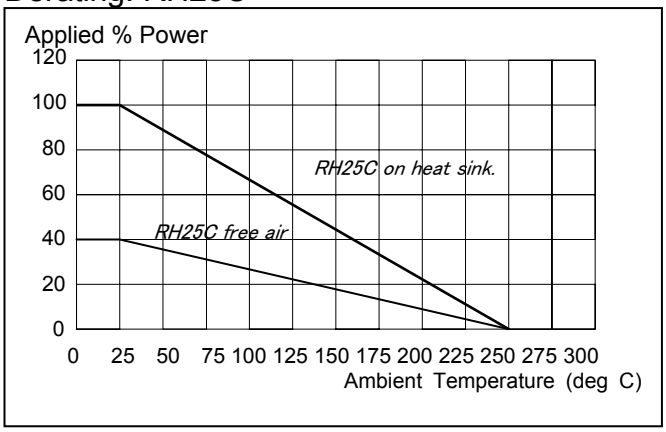
Temperature Rise, RH25C



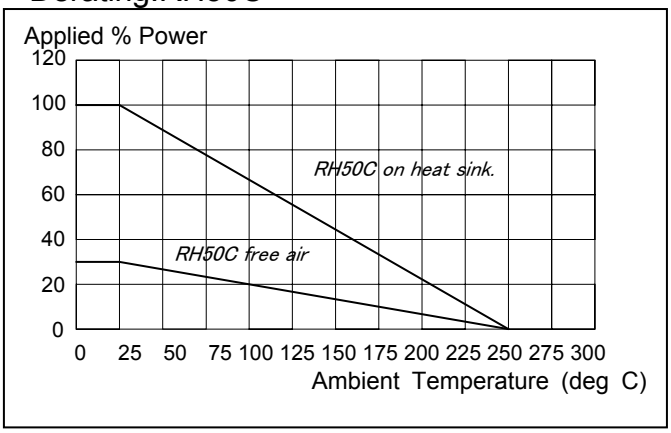
Temperature Rise, RH50C



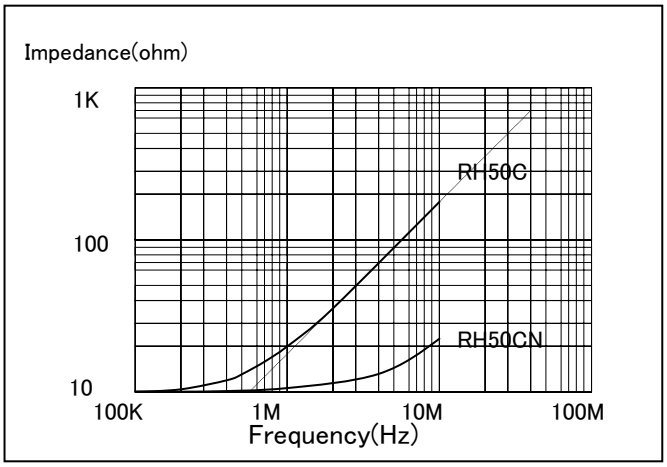
Derating. RH25C



Derating.RH50C



Frequency Characteristics. RH50C and RH50CN



Note:

(1) 30W rating power of RH50C is on heat sink (178x127x51x1mm), 50W power of RH50C is on heat sink (305x305x2mm)

(2) RH20 and RH50 were discontinued by reason of increasing high temperature performance, and replace to RH25C and RH50C.

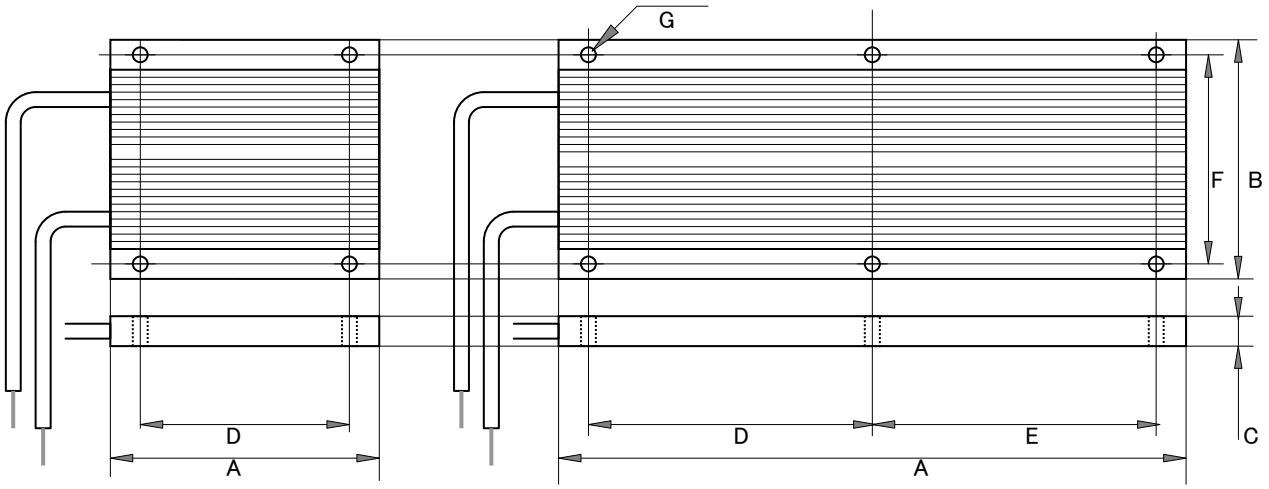
20110201

Metal-Clad Wire Wound Resistors
IRN, IRF

Features and Applications

Very thin, 10mm thickness, light weighted metal-clud wire wound power resistor.
50W to 500W rating power for chassis mounting.
Excellent space factor for installation.
Charging current protection in power source.
Braking resistor and dumping resistor of the motor control.

Dimensional Specifications (mm)



IRN50, IRN100, IRN150, IRF100, IRF150, IRF200, IRF250

IRF300, IRF400, IRF500

(mm)	IRN50	IRN100	IRN150	IRF100	IRF150	IRF200	IRF250	IRF300	IRF400	IRF500
A±1.0	70	120	170	90	120	150	180	210	270	330
B±0.3	60	60	60	80	80	80	80	80	80	80
C	10	10	10	10	10	10	10	10	10	10
D±0.3	50	100	150	70	100	130	160	95	125	155
E±0.3	-	-	-	-	-	-	-	95	125	155
F±0.3	50	50	50	70	70	70	70	70	70	70
G	4-φ5.3	4-φ5.3	4-φ5.3	4-φ5.3	4-φ5.3	4-φ5.3	4-φ5.3	6-φ5.3	6-φ5.3	4-φ5.3
Weight (gr)	100	160	220	155	200	245	290	335	430	525

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Metal-Clad Wire Wound Resistors

IRN, IRF

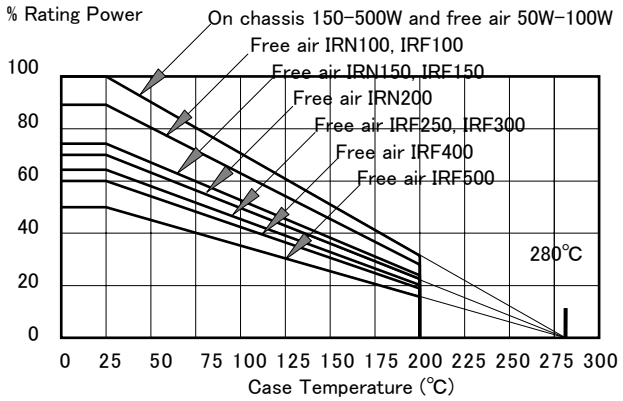
Ordering Information

Type	Rated Power	Filling	Resistance	Tolerance	Insulation Volt	Wire Length
IRF	500	S	1R0	5%	4500V	300mm
IRN IRF	50, 100, 150 100 150 200 250 300 400 500	S S(silicone) only	1 ohm See spec.	0.5% 1.0% 2.0% 5.0% 10.0%	1000V 1500V 2500V 3000V 4500V	Any value

Specifications and Performances

	IRN50	IRN100	IRN150	IRF100	IRF150	IRF200	IRF250	IRF300	IRF400	IRF500
Rating Power(W)	50	100	150	100	150	200	250	300	400	500
Free Rating Power(W)	50	90	112	90	112	140	162	195	240	250
Resistance(ohm)	1-420	1-1.1K	1-1.75K	1-1.1K	1-1.75K	1-2.2K	1-2.97K	1-3.5K	1-4.45K	1-5.78K
TCR	±260ppm/℃(H)									
Tolerance (%)	±0.5%(D), ±1.0%(F), ±2.0%(G), ±5.0%(J), ±10%(K)									
Dielectric Strength	AC1000V (AC1500V, AC2500V, AC3000V, AC4500V are available), at leakage current 2mA.									
Temperature Range	-55 ℃ to +200℃ at Cement filled. (-55 ℃ to +150℃ at Silicone filled)									
Insulation Resistance	< 20MOhms									
Short Time Over Load	±1%, (Rating power×10 in 5 seconds interval) (IRN50, Rating power×5 in 5 seconds interval)									
Humidity	±1%,									
Thermal Shock	±1%, (After power with rating for 30 minutes, -15℃, 15 minutes)									
Vibration	±1%, (10Hz-55Hz-10Hz, 1minute cycle, for 2 hours with x-y direction)									
Humidity	±1%, (40℃,95%-RH, 0.1*power rating , 1.5hours on 0.5hours off, 500hours)									
Load Life	±1%, (Power rating , 1.5hours on 0.5hours off, 500hours)									
Filling	Silicone only									
Terminals	1.25mm^2 (except below resistance) 2.0mm^2 (IRF200-1-4ohm, IRF250-1-5ohm, IRF300-1-6ohm, IRF400-1-8ohm, IRF500-1-10ohm)									

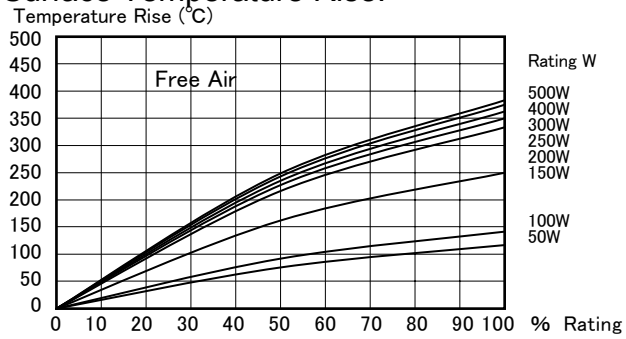
Derating.



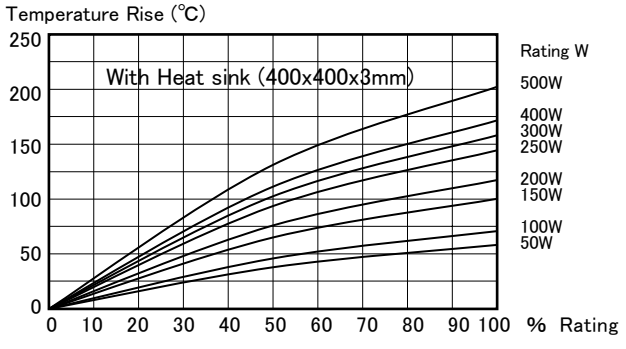
Chassis size 150-200W: 200*200*3mm

Chassis size 250-500W: 400*400*3mm

Surface Temperature Rise.

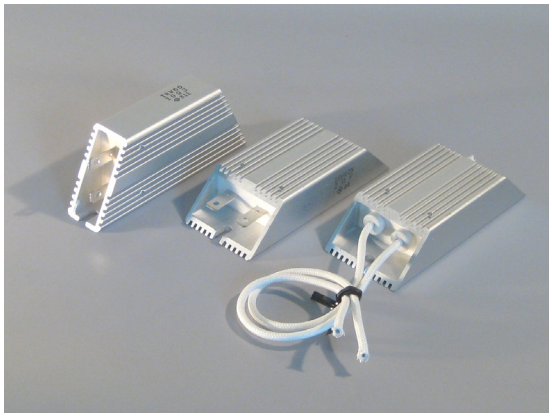


Surface Temperature Rise.



20111001

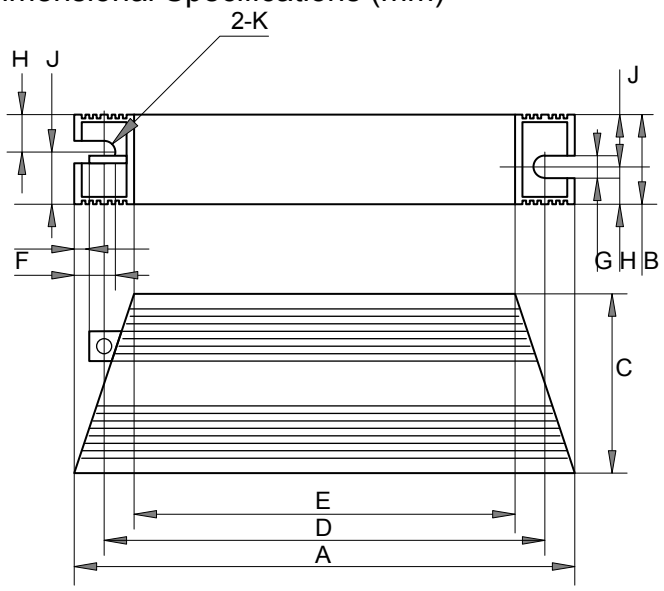
Metal Clad Wire Wound Resistors
IRV, IRH, ULV, ULH



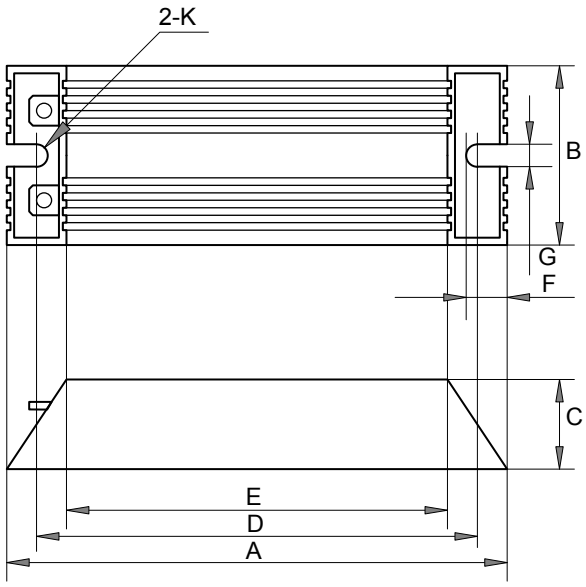
Features and Applications

Overload durable, metal clad wire wound power resistor.
60W to 500W rating power, heat conductive cement filled, aluminum housed resistors.
Flying leads, metal tab and L type metal tab terminals are available.
Dielectric strength of 1500V to 5400V available.
Surge protection resistors, recycling resistors, braking resistors for motor control, and current detection resistors for power electronics.

Dimensional Specifications (mm)



IRV



IRH

	IRV60	IRV80	IRV100	IRV120	IRV150	IRV200	IRV300	IRV400	IRV500
A±2	100	150	165	182	210	165	215	265	335
B±0.5	22	22	22	22	22	30	30	30	30
C±0.5	41	41	41	41	41	60	60	60	60
D±2	87	137	152	169	197	146	196	246	316
E±2	60	110	125	143	170	125	175	225	295
F±0.5	8.65	8.65	8.65	8.65	8.65	12	12	12	12
G±0.5	4.3	4.3	4.3	4.3	4.3	5.3	5.3	5.3	5.3
H	10	10	10	10	10	13	13	13	13
J	12	12	12	12	12	17	17	17	17
K	2.15R	2.15R	2.15R	2.15R	2.15R	2.65R	2.65R	2.65R	2.65R
Weight (gr)*	113	189	215	241	290	447	600	780	980

* Weight does not contains flying wire lead.

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Metal Clad Wire Wound Resistors

IRV, IRH, ULV, ULH

Dimensional Specifications (mm)

	IRH60	IRH80	IRH100	IRH120	IRH150	IRH200	IRH300	IRH400	IRH500
A±2	100	150	165	182	210	165	215	265	335
B±0.5	41	41	41	41	41	60	60	60	60
C±0.5	22	22	22	22	22	30	30	30	30
D±2	87	137	152	169	197	146	196	246	316
E±2	60	110	125	143	170	125	175	225	295
F±0.5	8.65	8.65	8.65	8.65	8.65	12	12	12	12
G±0.5	4.3	4.3	4.3	4.3	4.3	5.3	5.3	5.3	5.3
H	-	-	-	-	-	-	-	-	-
J	-	-	-	-	-	-	-	-	-
K	2.15R	2.15R	2.15R	2.15R	2.15R	2.65R	2.65R	2.65R	2.65R
Weight (g)	110	195	216	245	283	485	600	770	990

Power, Resistance, Terminals

	IRV60 IRH60	IRV80 IRH80	IRV100 IRH100	IRV120 IRH120	IRV150 IRH150	IRV200 IRH200	IRV300 IRH300	IRV400 IRH400	IRV500 IRH500
Rating Power(W)/Chassis	60	80	100	120	150	200	300	400	500
Rating Power(W)/Free Air	48	64	80	96	120	140	210	240	300
Resistance(ohm) inductive	0.1-400	0.1-910	0.1-1.1K	0.1-1.3K	0.1-1.6K	0.1-2.2K	0.1-2.7K	0.1-4.3K	0.1-6.8K
Resistance(ohm) no-induct.	0.1-180	0.1-110	0.1-240	0.1-300	0.1-390	0.1-1.0K	0.1-1.5K	0.1-2.2K	0.1-3.0K
Tolerance (%)	+/-0.5%(D), +/-1.0%(F), +/-2.0%(G), +/-5.0%(J), +/-10%(K)								
Terminal Wire of 1.25 mm^2	>1.0 ohms					NA	NA	NA	NA
Terminal Wire of 2 mm^2	0.1-0.99 ohms					> 5.0 ohms			
Terminal Wire of 5.5 mm^2	NA	NA	NA	NA	NA	1-4.99 ohms			
Terminal Wire of 8 mm^2	NA	NA	NA	NA	NA	0.1-0.99 ohms			
Tab Terminals #250*2	AB	AB	AB	AB	AB	NA	NA	NA	NA
Metal Terminals 2t-10w-4.3φ	NA	NA	NA	NA	NA	AB	AB	AB	AB
L-Type Metal Terminals	NA								

* AB: available, NA: not available

Power, Resistance, Terminals (UL)

	ULV60 ULH60	ULV80 ULH80	ULV100 ULH100	ULV120 ULH120	ULV150 ULH150	ULV200 ULH200	ULV300 ULH300	ULV400 ULH400	ULV500 ULH500
Rating Power(W)/Chassis	60	80	100	120	150	200	300	400	500
Rating Power(W)/Free Air	48	64	80	96	120	140	210	240	300
Resistance(tab) inductive	0.1-375	0.1-281	0.1-225	0.1-187	0.1-150	0.1-450	0.1-300	0.1-225	0.1-180
Resistance(tab) no-induct.	0.1-180	0.1-110	0.1-225	0.1-187	0.1-150	0.1-450	0.1-300	0.1-225	0.1-180
Resistance(fly) inductive	0.1-400	0.1-910	0.1-1.1K	0.1-1.3K	0.1-1.6K	0.1-2.2K	0.1-2.7K	0.1-4.3K	0.1-6.8K
Resistance(fly) no-induct.	0.1-180	0.1-110	0.1-240	0.1-300	0.1-390	0.1-1.0K	0.1-1.5K	0.1-2.2K	0.1-3.0K
Tolerance (%)	+/-2.0%(G), +/-5.0%(J), +/-10%(K)								

Specifications and Performance

TCR(ppm/K)	±260ppm/K(H)
Tolerance (%), not UL	±0.5%(D), ±1.0%(F), ±2.0%(G), ±5.0%(J), ±10%(K)
Dielectric Strength	AC1500V, AC2500V, AC3000V, AC4500V and AC5400V are available at leakage current 2mA.
Temperature Range	-55 C to +200 C
Insulation Resistance	< 20Mohms
Short Time Over Load	±2%, (Rating power×10 in 5 seconds interval) (IRH/V60, Rating power×5 in 5 seconds interval)
Moisture Resistance(%-ohms)	±3%, (40C,95%RH, DC100V case / terminal, 500hours)
Thermal Shock(%-ohms)	±2%, (After power with rating for 30 minutes, -15C, 15 minutes)
Vibration(%-ohms)	±1%, (10Hz-55Hz-10Hz, 1minute cycle, for 2 hours with x-y direction)
Humidity(%-ohms)	±3%, (40C,95%-RH, 0.1*power rating , 1.5hours on, 0.5hours off, 500hours)
Load Life(%-ohms)	±5%, (Power rating , 1.5hours on 0.5hours off, 500hours)
Filling	Cement

Metal Clad Wire Wound Resistors

IRV, IRH, ULV, ULH

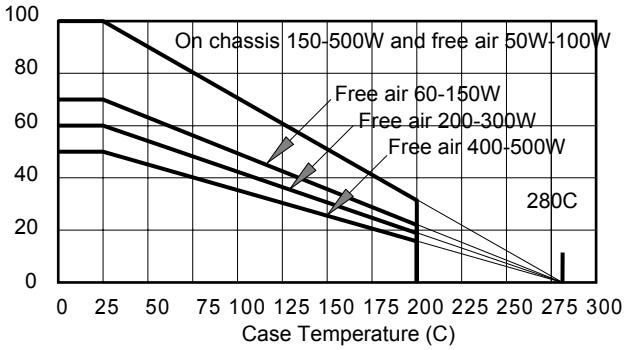
Ordering Information

Type	Power	Winding	Resistance	Tolerance	Terminals	Insulation
IRV	500	-	0.1 ohm	J	FL300mm	4500V
IRV	60	- (inductive)	See table	0.5% (D)	Flying Lead	1500Vac
IRH	80	N (non-ind)		1.0% (F)	TAB#250	2500Vac*
|	100			2.0% (G)	TAB4.3D	3000Vac
|	120			5.0% (J)	TAB-L (NA)	4500Vac
|	150			10% (K)		5400Vac
|	200			-UL-		
ULV	300			2.0% (G)		Standard
UHV	400			5.0% (J)		2500Vac
	500			10% (K)		

Type	8 mm^2	5.5 mm^2	2 mm^2	1.25mm^2	UL3512 AWG10	UL3512 AWG14
IRH/IRV 60-150	-	-	0.1-0.99 ohm	1 - ohm	-	-
IRV/IRH 200-500	0.1-0.99 ohm	1.0-4.99 ohm	5.0 - ohm	-	-	-
ULH/ULV 60-120	-	-	-	-	-	0.1 ohm-
ULH/ULV 150	-	-	-	-	-	0.11 ohm-
ULH/ULV 200	-	-	-	-	0.1-0.15 ohm	0.16 ohm-
ULH/ULV 300	-	-	-	-	0.1-0.22 ohm	0.23 ohm-
ULH/ULV 400	-	-	-	-	0.1-0.30 ohm	0.31 ohm-
ULH/ULV 500	-	-	-	-	0.1-0.37ohm	0.38 ohm-

Derating.

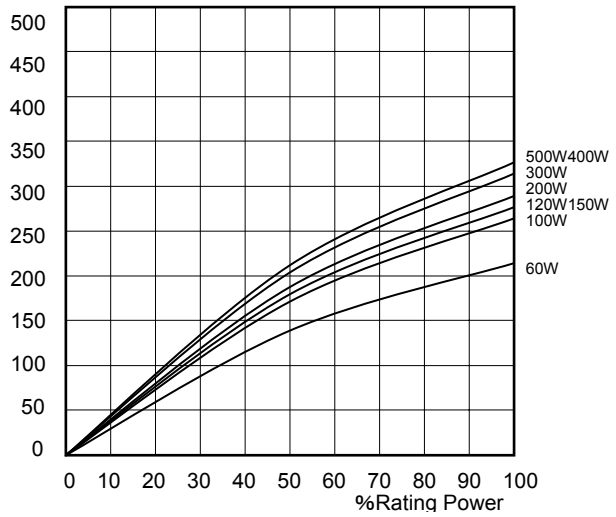
% Rating Power



Chassis size 150-200W: 200*200*3mm
Chassis size 250-500W: 400*400*3mm

Surface Temperature Rise, under Free Air

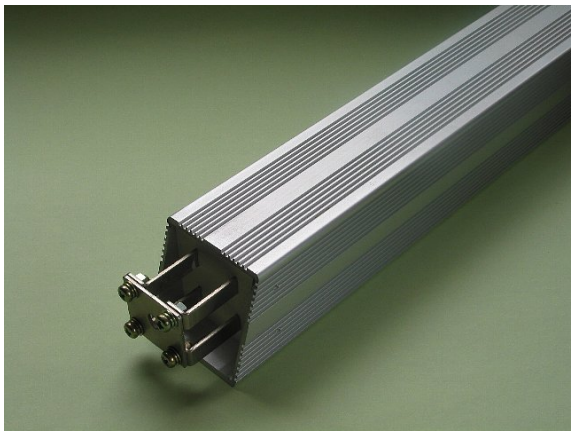
Temperature Rise (deg C)



Note
(1) Installation of a thermal protection switch is available. Please contact to info@nikkohm.com.
(2) Flying lead length is assigned by your requirement.
(3) Insulating voltage is assigned by your requirement.

20111001

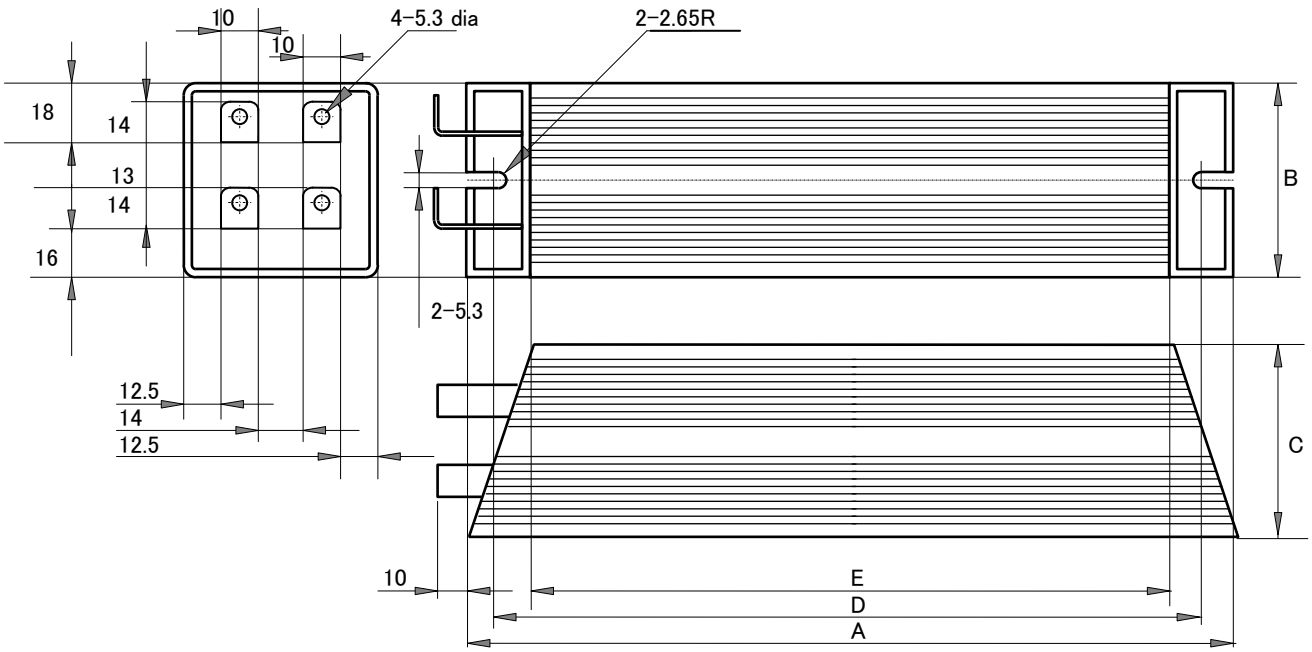
600, 800, 1000, 1200 W
Metal Clad Wire Wound Resistors
IRV600, IRV800, IRV1000, IRV1200



Features and Applications

600W to 1200W (on chassis) metal clad giant current durable wire wound resistors.
Minimum resistance value of 0.1 ohm inductive and non inductive are available.
Good heat conductive aluminum housed, full welding structure, no burn insulation and excellent space factor for installation.
Current detection, motor control, recycle braking resistor and dumping resistor of the power electronics..

Dimensions (mm)



	A ±2	B ±0.5	C ±0.5	D ±2	E ±2	Flying Lead 8mm^2	Flying Lead 5.5mm^2
IRV600	235	61	59	216	195	0.1Ω～0.99Ω	≧ 1Ω
IRV800	286	61	59	266	245		
IRV1000	335	61	59	316	295		
IRV1200	405	61	59	386	365		

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URL: http://www.nikkohm.co.jp & http://www.nikkohm.com / e-mail: info@nikkohm.co.jp

600,800,1000,1200 W Metal Clad Wire Wound Resistors
IRV600, IRV800, IRV1000, IRV1200

Ordering Information

Type & Power	Connection	Ind./non-ind.	Resistance	Tolerance	Terminals	Voltage
IRV1200	P	N	50 OHM	J	L	1500V
IRV600	P (parallel)	--- (inductive)	Any value	+/-0.5% (D)	L (metal)	3500V
IRV800	S (series)	N (non-ind.)		+/-1.0% (F)	FL (Fly wire)	4500V
IRV1000				+/-5.0% (J)		5400V
IRV1200				+/-10% (K)		

Note: Tolerance +/-5%(J) is standard.

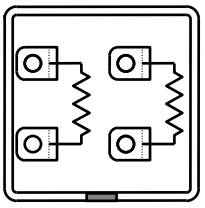
Rated Power and Resistance

Type	Rated Power, On chassis	Rated Power, Free	Instant Power	Connection	Inductive /Non-inductive	Resistance Range (ohms)
IRV600	600W	300W	6KW	Parallel	Inductive	0.1 – 9.0
					Non-inductive	0.1 – 5.3
				Series	Inductive	9.1 - 94
					Non-inductive	5.4 – 21.2
IRV800	800W	400W	8KW	Parallel	Inductive	0.1 – 11.0
					Non-inductive	0.1 – 7.2
				Series	Inductive	11.1 – 112
					Non-inductive	7.2 – 28.8
IRV1000	1000W	400W	10KW	Parallel	Inductive	0.1 – 18.0
					Non-inductive	0.1 – 9.0
				Series	Inductive	18.1 - 140
					Non-inductive	9.1 - 36
IRV1200	1200W	480W	12KW	Parallel	Inductive	0.1 – 25
					Non-inductive	0.1 – 12
				Series	Inductive	25.1 - 160
					Non-inductive	12.1 - 48.0

Terminal connections

The resistor has four terminals as shown in figure, which are connected one resistor element to a pair of terminal.

Two resistors are connected as either Parallel or Series. The total resistance are specified as IRV series Resistance.



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URL: http://www.nikkohm.co.jp & http://www.nikkohm.com / e-mail: info@nikkohm.co.jp

600,800,1000,1200 W Metal Clad Wire Wound Resistors

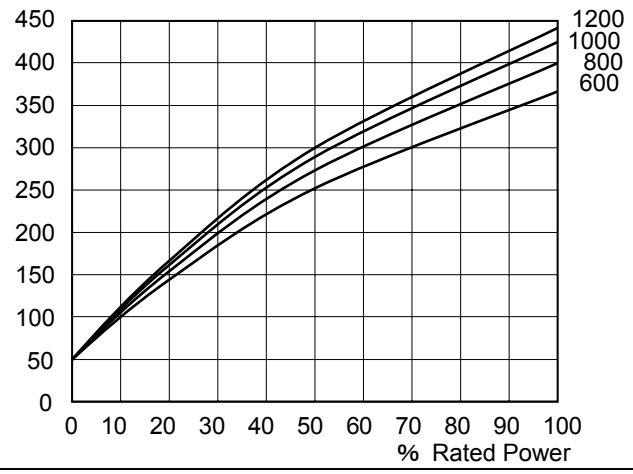
IRV600, IRV800, IRV1000, IRV1200

Specifications and Performances

	Specifications				Remarks
Model	IRV600	IRV800	IRV1000	IRV1200	
Weight	1165gr	1500gr	1835gr	2304gr	
Absolute Tolerance	±0.5%(D), ±1.0%(F), ±5.0%(J), ±10.0%(K)				Standard:±5.0%(J)
Withstanding Voltage	1500 VAC, Optional 3500 VAC, 4500 VAC, 5400 VAC are available.				2mA leakage current
Insulating Resistance	minimum 20 MΩ				at 1000 Volts
Operating Temperature Range	-55 to +200 deg C				
Storage Temperature Range	-55 to +200 deg C				

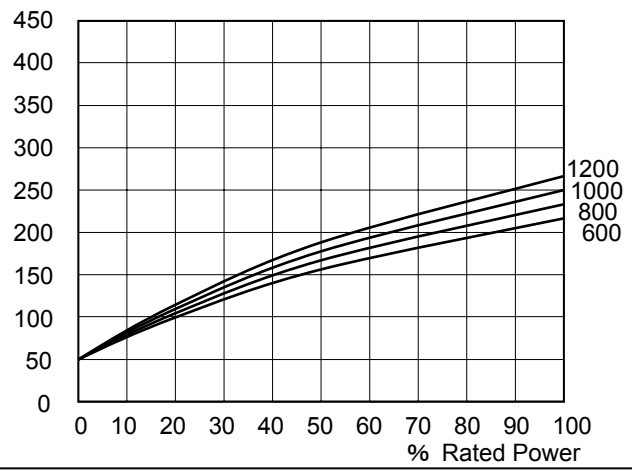
Temperature Rise

Temperature Rise (deg C) in free air.

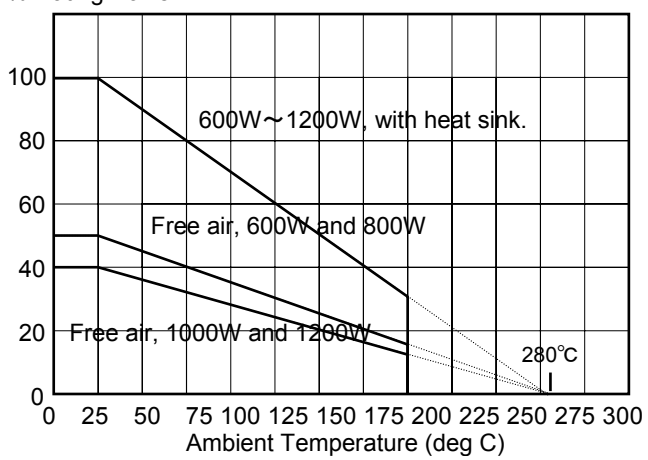


Temperature Rise

Temperature Rise (deg C) with heat sink of 600*600*5mm sized.



Derating
% Rating Power



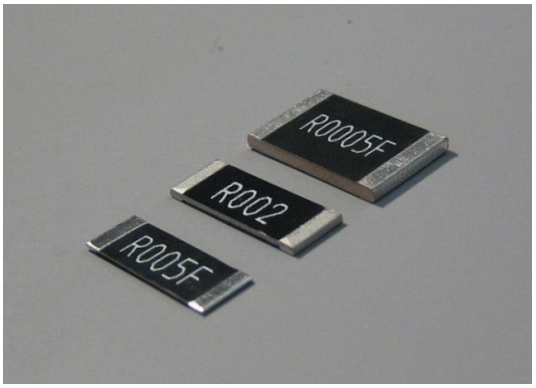
Note:

(1) Resistor terminal have not metal short bar that makes series or parallel connection.
(2) Flying lead terminals are available. Please call factory: info@nikkohm.co.jp.
(3) Please request specification sheet at ordering. The sheet will help not to misunderstanding about actual specifications.

20111001

CHIP SHUNT RESISTORS,

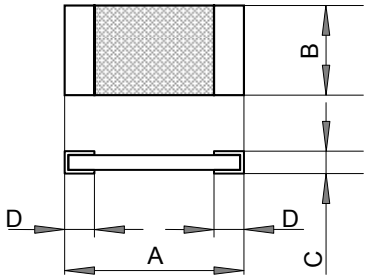
WSL1, WSL2, WSL8



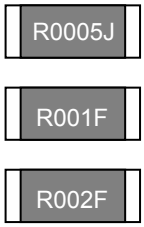
Features and Applications

Presenting surface mounted, low resistance value, low profile, low inductance and large impulse durable metal plate current detectors.
Rating 1/2W, 1W and 8W selectable for your applications.
Tolerance +/-5% and TC 0 ppm/degC to +100 ppm/degC in standard, 1% tolerance is available.
Current detection circuit for high speed CPU peripherals, battery charging current protections, DC-DC conversion modules, DC-AC conversion, servo-motor control electronics, intelligent power modules,

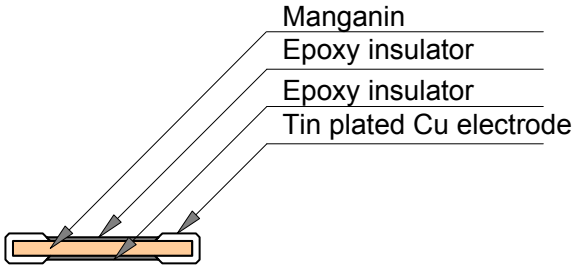
Dimension Specifications



Marking



Structure and Materials



P/N	A		B		C		D	
	(mm)	(inch)	(mm)	(inch)	(mm)	(inch)	(mm)	(inch)
WSL1A----------J(5%)/F(1%)	5.08+/-0.25	0.200+/-0.01	2.54+/-0.25	0.100+/-0.01	1.0 max	0.04 max	0.8	0.030
WSL2A0.5milliohmJ(5%)/F(1%)	6.4+/-0.3	0.250+/-0.01	8.2+/-0.3	0.320+/-0.01	2.0 max	0.08 max	0.8	0.030
WSL2A 1milliohmJ(5%)/F(1%)	6.4+/-0.3	0.250+/-0.01	4.1+/-0.3	0.161+/-0.01	1.0 max	0.04 max	0.8	0.030
WSL2A 2milliohmJ(5%)/F(1%)	6.4+/-0.3	0.250+/-0.01	3.4+/-0.3	0.133+/-0.01	1.0 max	0.04 max	0.8	0.030
WSL2A 3milliohmJ(5%)/F(1%)	6.4+/-0.3	0.250+/-0.01	3.4+/-0.3	0.133+/-0.01	1.0 max	0.04 max	0.8	0.030
WSL2A 4milliohmJ(5%)/F(1%)	6.4+/-0.3	0.250+/-0.01	2.6+/-0.3	0.102+/-0.01	1.0 max	0.04 max	0.8	0.030
WSL2A 5milliohmJ(5%)/F(1%)	6.4+/-0.3	0.250+/-0.01	4.0+/-0.3	0.157+/-0.01	1.0 max	0.04 max	0.8	0.030
WSL8A0.5milliohmJ(5%)/F(1%)	12.8+/-0.5	0.500+/-0.02	7.8+/-0.5	0.307+/-0.02	2.5 max	0.10 max	1.3	0.051
WSL8A 1milliohmJ(5%)/F(1%)	12.8+/-0.5	0.500+/-0.02	4.5+/-0.5	0.177+/-0.02	1.5 max	0.06 max	1.4	0.055
WSL8A 2milliohmJ(5%)/F(1%)	12.8+/-0.5	0.500+/-0.02	4.5+/-0.5	0.177+/-0.02	1.5 max	0.06 max	1.4	0.055
WSL8A 3milliohmJ(5%)/F(1%)	12.8+/-0.5	0.500+/-0.02	4.5+/-0.5	0.177+/-0.02	1.5 max	0.06 max	1.4	0.055
WSL8A 4milliohmJ(5%)/F(1%)	12.8+/-0.5	0.500+/-0.02	5.5+/-0.5	0.216+/-0.02	1.5 max	0.06 max	1.4	0.055
WSL8A 5milliohmJ(5%)/F(1%)	12.8+/-0.5	0.500+/-0.02	4.5+/-0.5	0.177+/-0.02	1.5 max	0.06 max	1.4	0.055
WSL8A 7milliohmJ(5%)/F(1%)	12.8+/-0.5	0.500+/-0.02	5.2+/-0.5	0.204+/-0.02	0.6 max	0.02 max	1.3	0.051
WSL8A 10milliohmJ(5%)/F(1%)	12.8+/-0.5	0.500+/-0.02	4.2+/-0.5	0.165+/-0.02	0.6 max	0.02 max	1.3	0.051

Specification and Performances

	WSL1	WSL2	WSL8	Remarks
Resistance	0.5, 1, 2, 3, 4, 5 milliohms		0.5, 1, 2, 3, 4, 5, 7,10 milliohms	0.5mohm is option
TCR	0 to +100 ppm/C (A)			-55 to +125 deg C range
Tolerance	+/-1.0% (F), +/-5.0% (J)			1% is option
Rating Power	1W	2W	8W	on metal insulated PWB.
Rating Current	30A	45A	90A	At 1 milliohm
Maximum Current	45A	65A	126A	2.5seconds one time
Series Inductance	1nH	2nH	5nH	
Operating Temp.	-55 to 175 deg C	-55 to +175 deg C	-55 to 175 deg C	
Storage Temp.	-55 to 175 deg C	-55 to 175 deg C	-55 to 175 deg C	

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CHIP SHUNT RESISTORS, WSL1, WSL2, WSL8

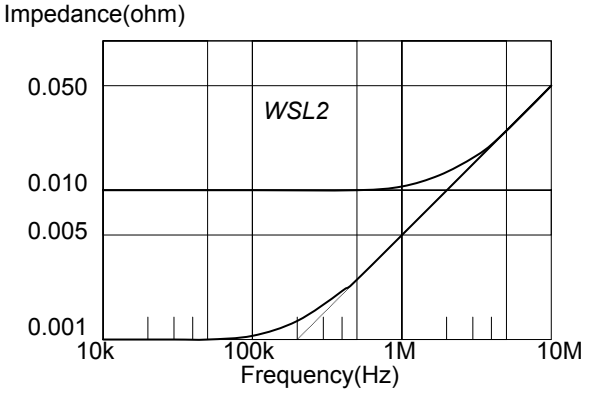
Ordering Information

Type	TCR	Resistance	Tolerance	Option Code	Remarks
WSL8	A	R001	J	Z01	
WSL1	A (100ppm)	R0005	J (5%)	Z00	Bulk
WSL2		R001	F (1%)	Z01	Tape Reel
WSL8		R002			
		R003			
		R004			
		R005			
		R007			
		R010			

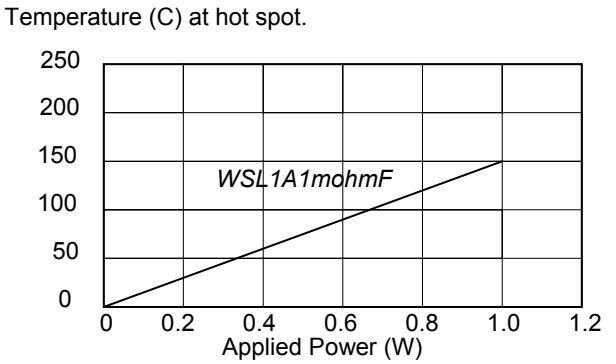
Specifications

	Specifications	Conditions
Short Time Overload	+/-0.5%	maximum current, 2.5seconds.
Low Temperature Storage	+/-0.5%	-55C, 24hours
High Temperature Storage	+/-1.0%	+175C, 1000hours
Heat Shock	+/-0.5%	-55C to +125C, 20min. interval, 5min. 5cycles
Vibration	+/-0.5%	10-2000Hz, 1.5mm/20gr, 2hours
Soldering Heat	+/-0.25%	260C+/-5C, 10+/-1seconds.
Solder ability	90%/terminal surface	
Humidity	+/-0.5%	85C, 85%RH, dc0.1W, 1000 hours
Load Life	+/-0.5%	25C, dc rated power, 90min ON, 30min OFF, 1000hours

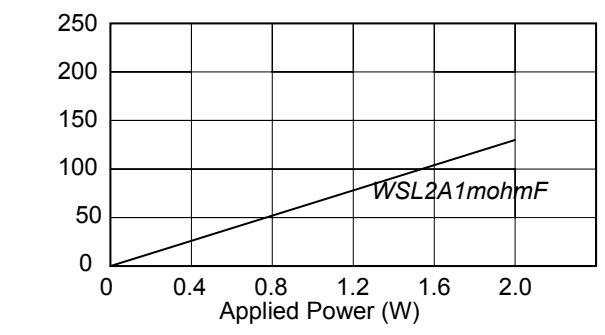
Frequency Characteristics



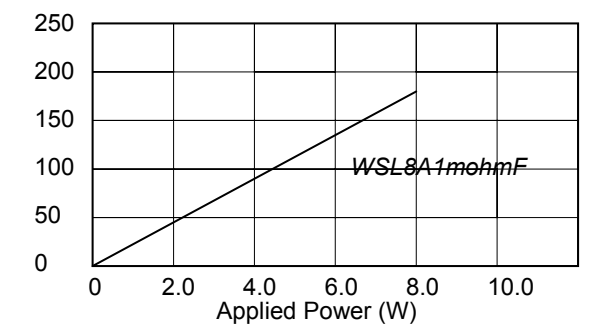
Temperature Rise, WSL1



Temperature Rise, WSL2



Temperature Rise, WSL8



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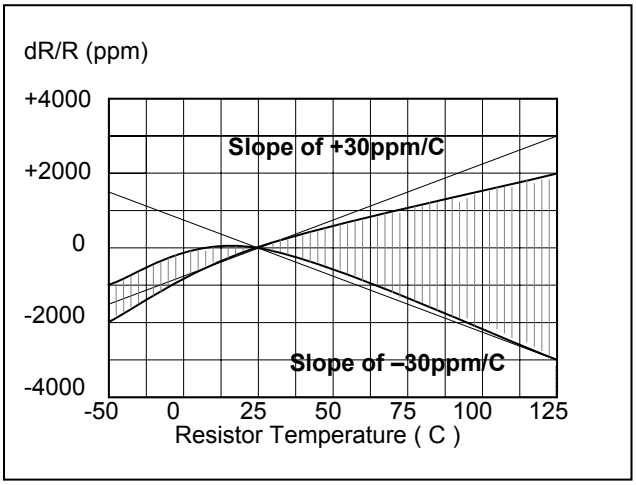
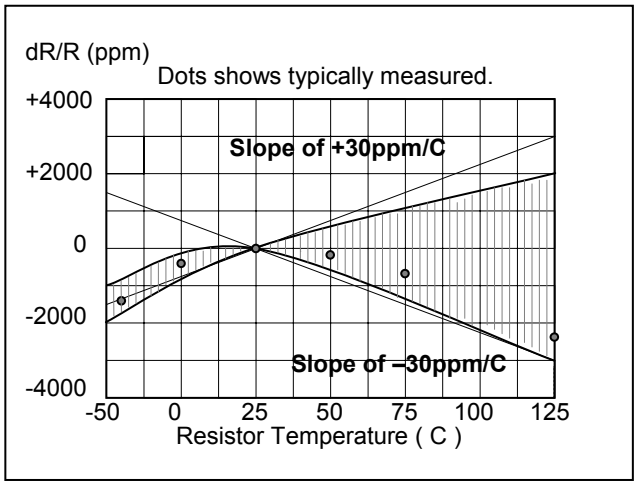
CHIP SHUNT RESISTORS,

WSL1, WSL2, WSL8

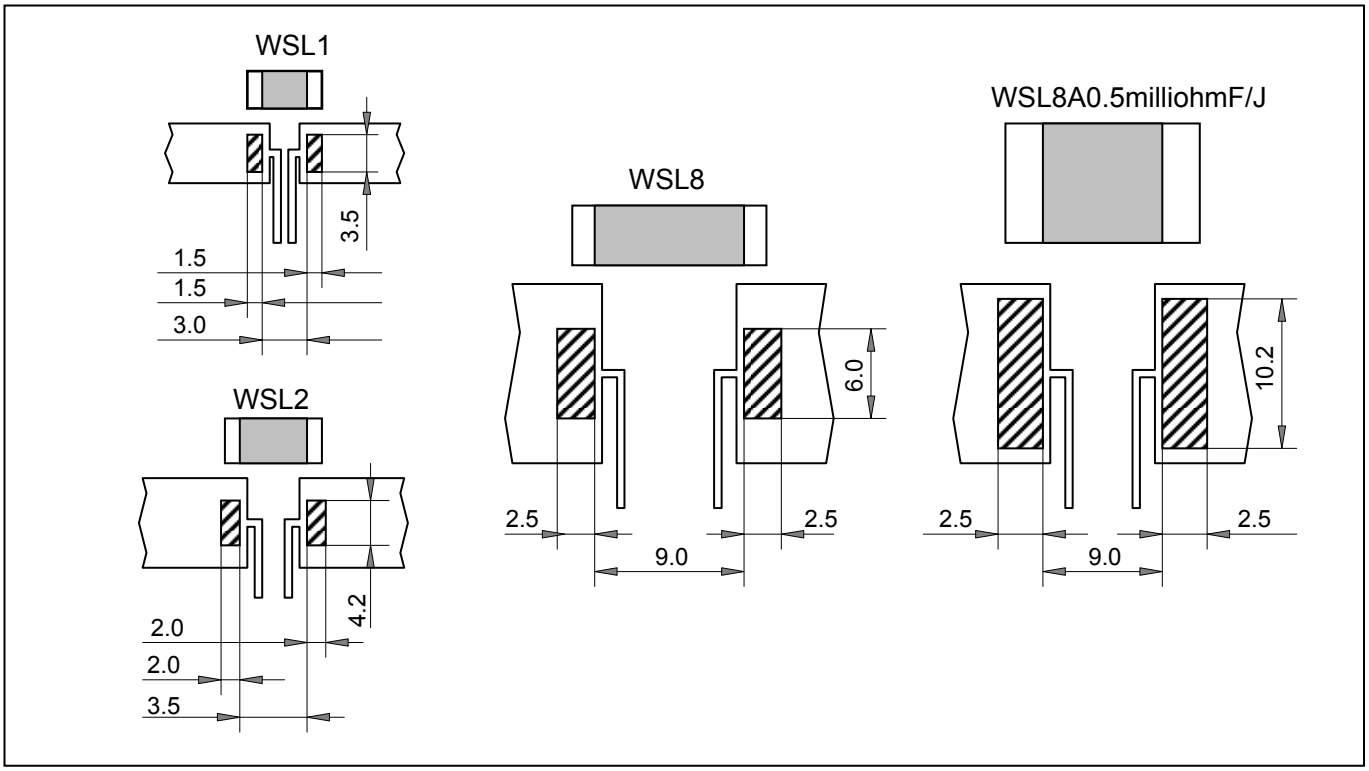
Temperature Characteristics, WSL2



Temperature Characteristics, WSL8



Recommended Foot Print (mm)



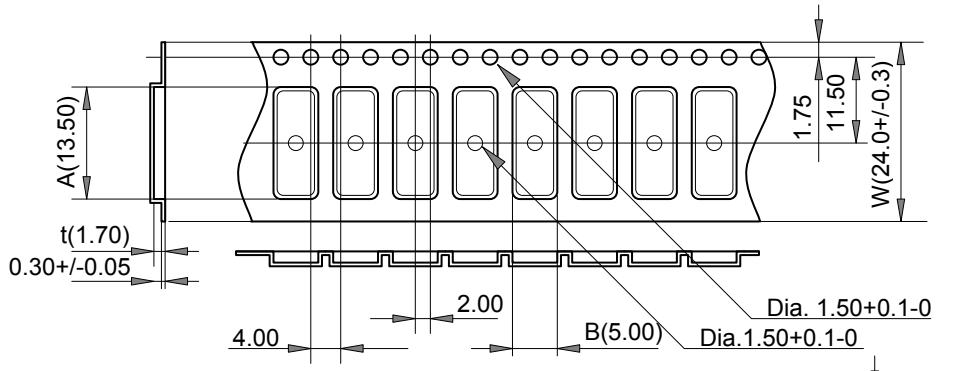
Note: Soldering recommendation
Because heat capacity of WSL8 is larger than another small chip components, when re-flow soldering process is taken in installing WSL8, temperature shall be increase by 10 deg C or 20 deg C.
Custom design: Making customer required length / width current shunt resistor is available, please call factory.
info@nikkohm.com
Note: Printed circuit board recommendation
Better heat distribution will be expected at WSL8 when Copper foil of 90 micro meter thickness and insulated metal (Iron or Aluminum) circuit board. Because, almost heat occurred at resistor flows through terminals.

CHIP SHUNT RESISTORS,

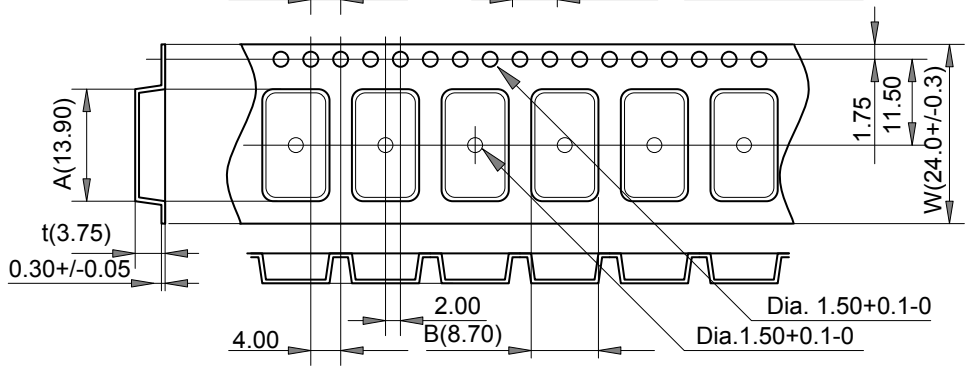
WSL1, WSL2, WSL8

Taping Specifications (WSL8)

WSL8-1mohm
WSL8-2mohm
WSL8-3mohm
WSL8-5mohm
WSL8-10mohm



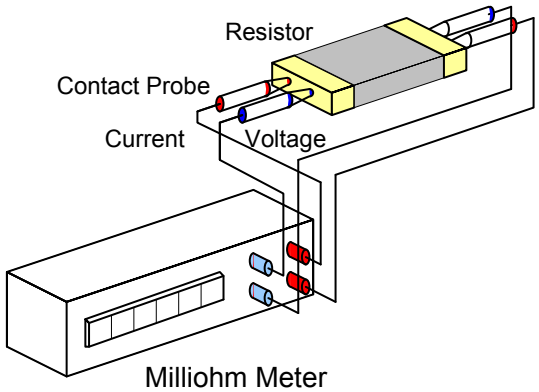
WSL8-0.5mohm
WSL8- 4mohm
WSL8- 7mohm



P/N	W(mm)	Pocket Size			Reel Diameter	Quantity per Reel	Note
		A(mm)	B(mm)	t(mm)	(mm)	(pieces)	--
WSL2	12.00	6.80	4.00	1.60	254	2000	---
WSL8-0.5milliohm	24.00	13.90	8.70	3.75	254	1000	---
WSL8- 1 milliohm	24.00	13.50	5.00	1.70	254	2000	---
WSL8- 2 milliohm	24.00	13.50	5.00	1.70	254	2000	---
WSL8- 3 milliohm	24.00	13.50	5.00	1.70	254	2000	---
WSL8- 4 milliohm	24.00	13.90	8.70	3.75	254	1000	---
WSL8- 5 milliohm	24.00	13.50	5.00	1.70	254	2000	---
WSL8- 7 milliohm	24.00	13.90	8.70	3.75	254	1000	---
WSL8-10 milliohm	24.00	13.90	5.00	1.70	254	2000	---

When tape dimensions of WSL1 and WSL2 request in detail, please call factory.

Resistance Measuring Position

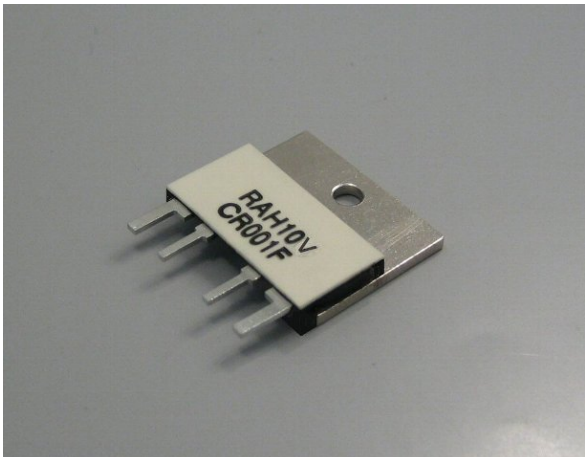


Resistance checking of the WSL resistors is done at side positions of resistor terminals as shown in left figure with 4-ports measuring system. Resistance tolerance of +/-1.0% shall be within +0.8% and –0.8% in factory inspection. When surface mount resistor is attached on circuit board, small resistance change will be occur, If small resistance change cannot be ignored, please call factory.

20120201

4-TERMINALS MILLIOHM RESISTORS

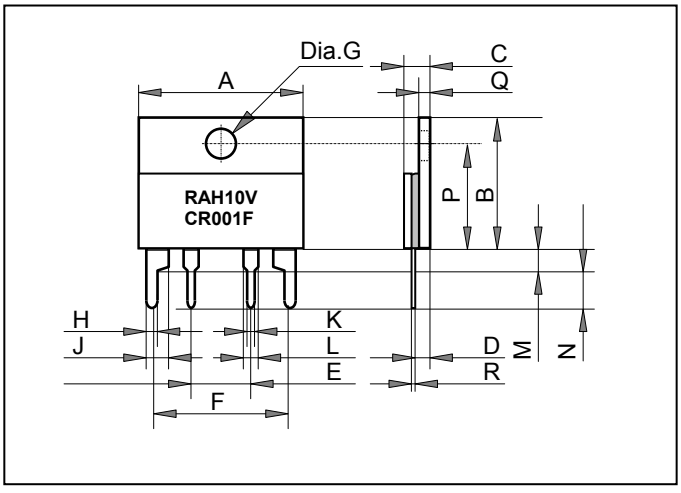
RAH10V



Features and Applications

Milliohm precision resistor with Kelvin four terminals in ceramic cover.
1mΩ to 10mΩ resistance range is available.
1% and 5% tolerance and stable +/-30ppm/C (typical) TCR and 30A operating current.
Small size and thin profile fit for high density design.
Complete heat conduction, heat dissipation design and vibration durable design will be available.
Applications for circuit board test, IC test, precision measurements, precision power supply, UPS, battery charging, power module, motor drive control, actuator drive circuit, automotive electronics and industrial computer.

Dimensions (mm)



R	R001	R002	R003	R005	R010
A	22+/-0.5				
B	18.5;/-0.5				
C	3.8+/-0.5	3.3+/-0.5	3.1+/-0.5	3.0+/-0.5	2.9+/-0.5
D	2.6+/-0.2	2.1+/-0.2	1.9+/-0.2	1.8+/-0.2	1.7+/-0.2
E	7.6+/-0.2				
F	17.8+/-0.2				
G	3.5+/-0.3				
H	1.4+/-0.2				
J	3.0+/-0.2				
K	1.0+/-0.2				
L	2.0+/-0.2				
M	3.0+/-0.2				
N	5.0+/-0.2				
P	14.0+/-0.3				
Q	1.5+/-0.2				
R	0.7+/-0.3				

Dimension C and D will be changed by nominal resistance value.

Ordering Information

Type	TCR	Resistance Value	Tolerance	Code	Package
RAH10V	C	R005	J	Z00	
RAH10V	C (50ppm/deg C)	R001 (1 milliohm)	J (5%)	Z00	BULK
		R002 (2 milliohm)	F (1%)		
		R003 (3 milliohm)			
		R004 (4 milliohm)			
		R005 (5 milliohm)			
		R006 (6 milliohm)			
		R008 (8 milliohm)			
		R010 (10 milliohm)			

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URL: http://www.nikkohm.co.jp and http://www.nikkohm.com / e-mail: info@nikkohm.co.jp

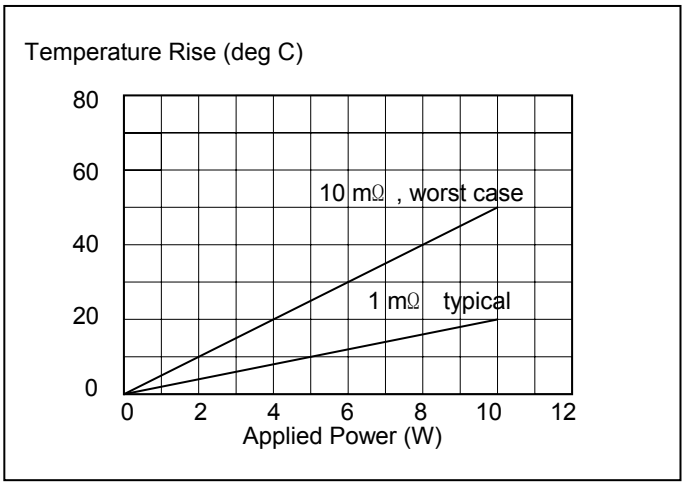
4-TERMINALS MILLIOHM METAL PLATE RESISTORS

RAH10V

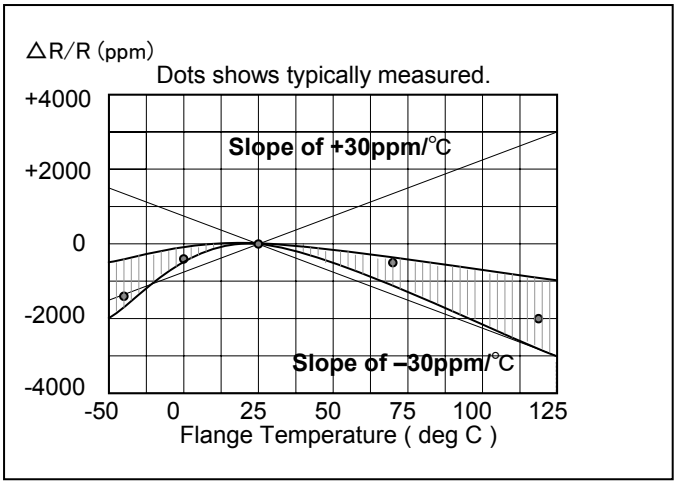
Specifications and Performances

	Specification	Test Conditions
Rating Power	10 Watt	Below 25 deg C flange temperature.
Rating Power	2 Watt	Free air.
Heat Resistance,	2.2 deg C/W	Resistor-Flange
Max. Operating Current	100 A at 1mΩ	Short time overload, 2.5 seconds.
Resistance Range	0.001-0.010 Ω	
Nominal Resistance	1-2-3-4-5-6-8-10 m Ω	
TCR	+/-50 ppm/deg C	-40 to +125 deg C
TCR	+/-30ppm/deg C	-20 to +100 deg C
Tolerance	+/-0.5%, +/-1% , +/-5%	
Operation Temp. Range	-55 to +125 deg C	
Storage Temp. Range	-55 to +125 deg C	
Withstanding Voltage	500 Volt	60 seconds.
Load Life	+/-1.0 %	25 deg C, 90 min. ON, 30min.OFF, 1000hours.
Humidity	+/-1.0 %	40 deg C, 90-95%RH, DC0.1W, 1000hours.
Weight	---	
Flammability	---	

Temperature Rise

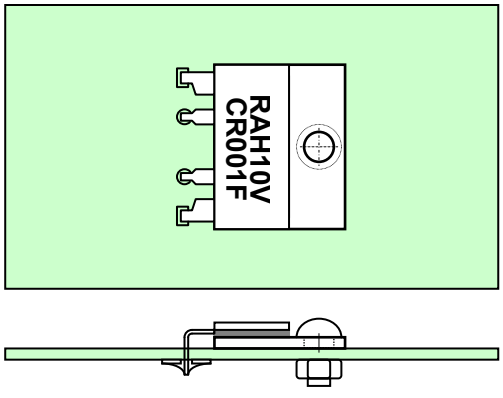


Temperature Coefficient



Note

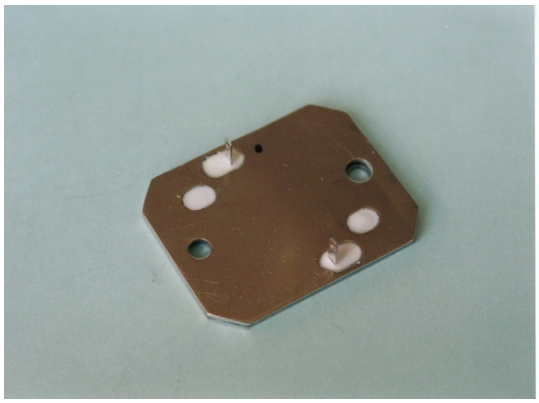
(1) Screw mounting shall be necessary to be increased vibration durability because terminals are strong to bending force.



20110701

RF CURRENT DETECT RESISTORS

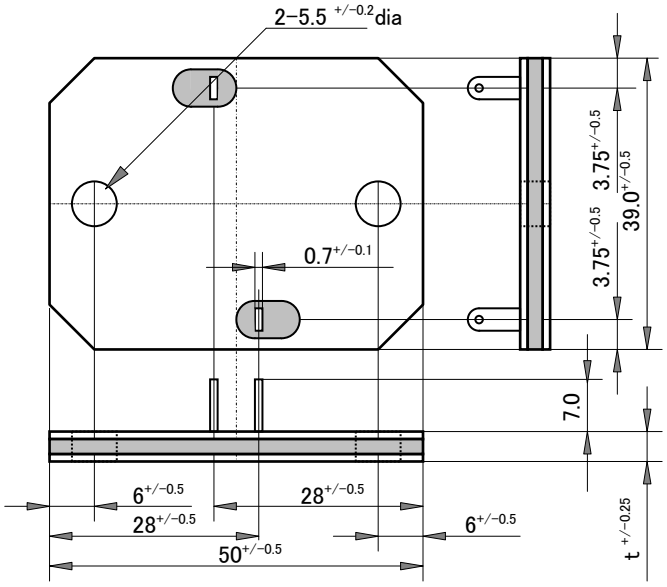
RAF30

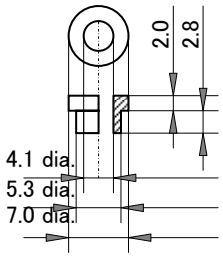


Features and Applications

1milliohm to 5milliohm, 30W rating power, Kelvin 4 terminal, bus-bar attachment type, precision current detector.
Inductance influence has been decreased through the small distance between current terminals.
Applications include industrial measurement, measuring instruments, precision power supply, precision equipment power supply, constant current power supply, IC test equipment, ac motor control, actuator control, inverters, IPM, rechargeable battery charge circuits, etc.

Dimensions（mm）





Attached Parts
2 pcs of Insulation Jackets.

Notes: Thickness, t=2.7mm (at 1milliohm), t=2.4mm (at 2milliohm), t=2.3mm (at 4milliohm)

Ordering Information

Type	TCR	Resistance	Tolerance	Code	Note
RAF30	C	0R001	F (1%)	000	
RAF30	C (50ppm/C)	0R001	F (1.0 %)	000	Not RoHS
	E (25ppm/C)	0R002	D (0.5 %)		
		0R003			
		0R004			
		0R005			

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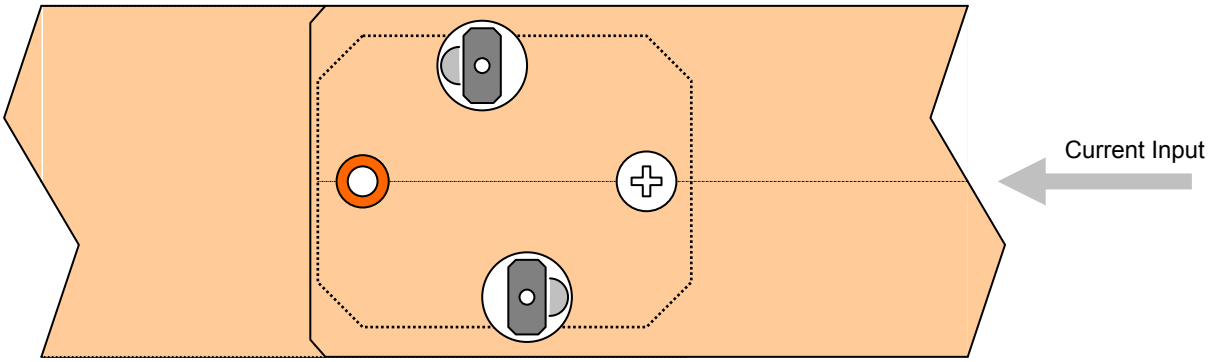
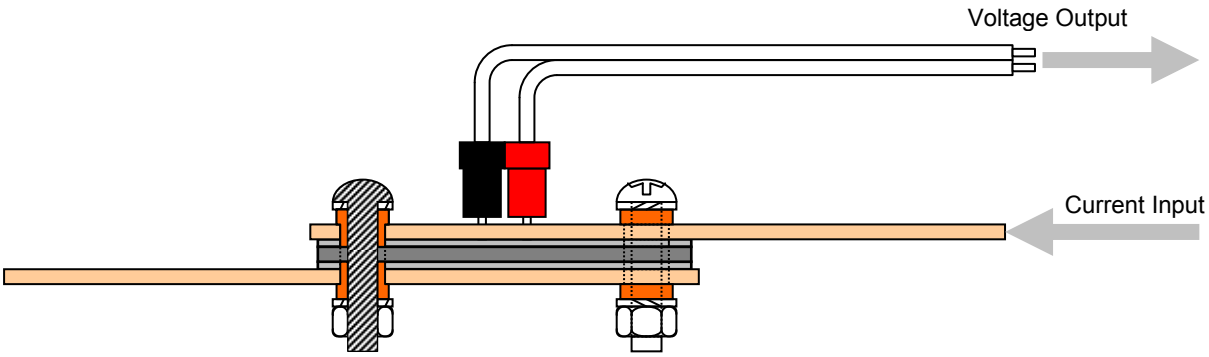
RF CURRENT DETECT RESISTORS RAF30

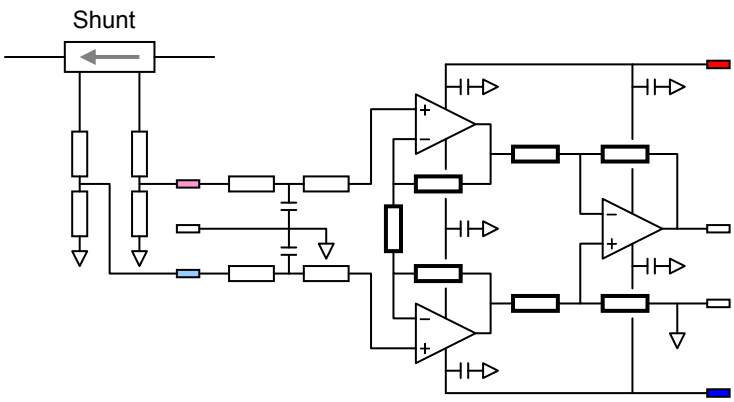
Specifications

	Specifications	Conditions
Power Rating	30W with heat sink (Bus Bar)	
Rating Temperature	-55 to +125 degree C	
Resistance	1milliohm to 5milliohms	
Tolerance	+/-0.5%(D), +/-1.0%(F),	
TCR	+/-50ppm/K (C), +/-25ppm/K (E)	
Thermal EMF	Less than 1micro Volts in 0 -100 degree C.	
Operating Temperature	-55 to +125 degree C	
Weight	38 grams	

Typical Installation and Circuit



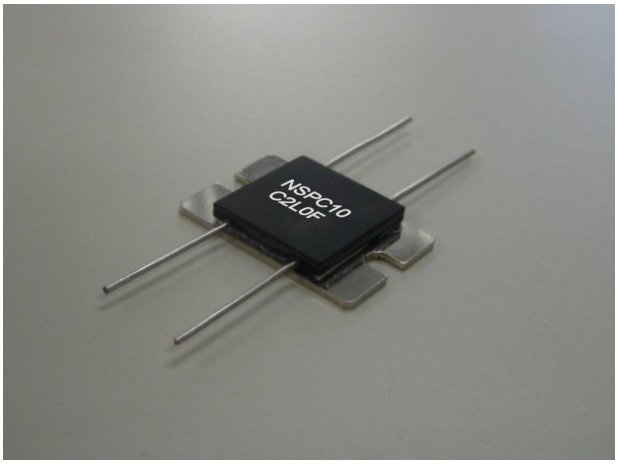




20110501

10W PRECISION SHUNT

NSPB10, NSPC10

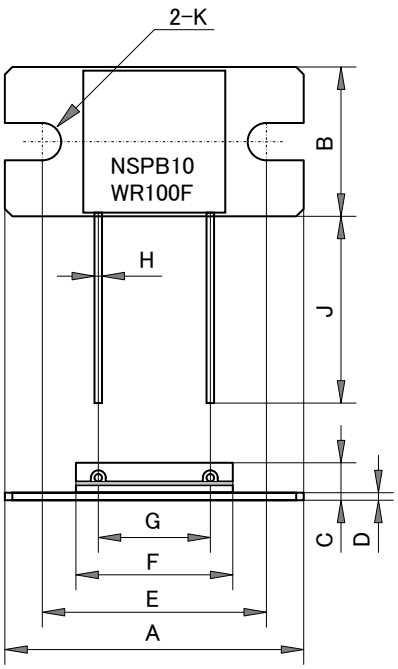


Features and Applications

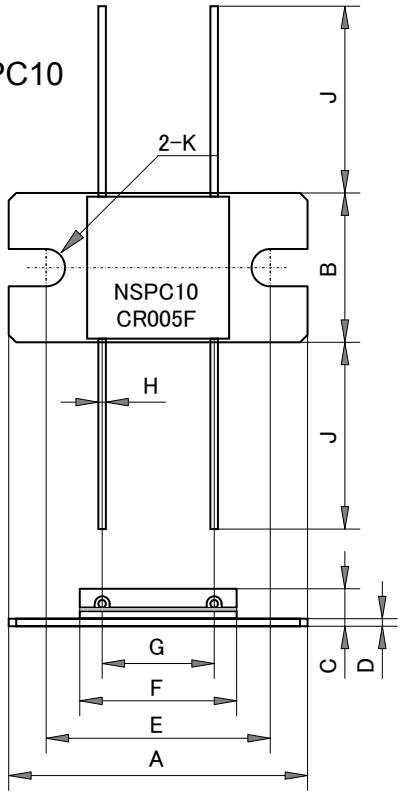
2 terminals and 4 terminals, low profile, precision shunt resistor.
M3 screw terminals is available in NSPD10.
Very low series inductance.
Higher density packing, vibration-proof and perfect heat dissipation are possible.
Applications include power measurement, power consumption meter, electronic load equipments, battery charger, etc.

Dimensions

NSPB10(preliminary)



NSPC10



	A	B	C	D	E	F	G	H	J	K
NSPB10	38.0	25.0	5.0	1.5	31.0	23.0	15.0	1.2	30	2-4.5
NSPC10	38.0	25.0	5.0	1.5	31.0	23.0	15.0	1.2	30	2-4.5
Tolerance	+/-0.2	+/-0.2	+/-0.2	+/-0.1	+/-0.5	+/-0.2	+/-0.5	+/-0.05	+/-10	---

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10W PRECISION SHUNT NSPB10, NSPC10

Ordering Information

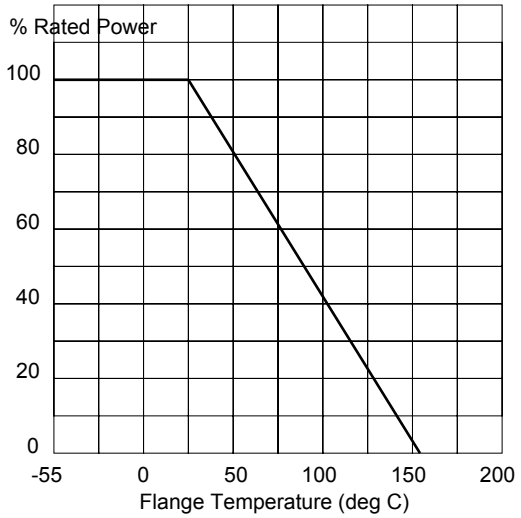
Type	TCR	Output Voltage	Tolerance	Code	Note
NSPC10	C	0R002	F	Z00	RoHS
NSPB10	C(50ppm)	0R33-1R00	D (0.5%)*	Z00	
NSPC10		0R001-0R01	F (1.0%)	(RoHS)	
			J (5.0%)		

* : Option

Performance and Specifications

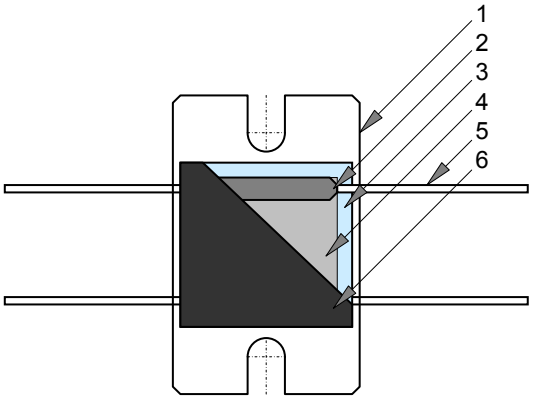
Type	NSPB10	NSPC10	Conditions
Resistance	0R020-1R00	R001-0R010	
TCR	50ppm/deg C (C)	50ppm/deg C (C)	-55 deg C - +125 deg C
Tolerance	+/-1% - +/-5%	+/-1.0%	
Rated Power	10W	10W	with heat sink
Rated Power	2W	2W	without heat sink
Rated Temp.	-55 - +25 deg C	-55 - +25 deg C	
Operating Temp.	-55 - +155 deg C	-55 - +155 deg C	
Max. Operating Volt.	750V	750V	
Max. Current	5A	70A	Short time current 100A at R001
Withstand Volt	+/- 0.2%	+/- 0.2%	DC1kV-1min.
Insulation Resistance	>10 G ohm	>10 G ohm	DC500V-2min.
Low temp. Disposure	+/-0.3%	+/-0.3%	-55 deg C 0W 24hours
Low Temp. Operation	+/-0.3%	+/-0.3%	-55 deg C Rated power
High Temp. Disposure	+/-1.0%	+/-1.0%	155deg C 0W 2000hours
Solder-ability	>95% cover	>95% cover	245 deg C 5 seconds
Overload	+/-0.3%	+/-0.3%	Rated voltage x 2.5, 5 sec.
Humidity	+/-0.5%	+/-0.5%	MIL-R-39009
Life	+/-1.0%	+/-1.0%	MIL-R-39009
Vibration	+/-0.2%	+/-0.2%	20G, 10Hz-2000Hz, 20min. xyz 4 hours
Weight	20 grams	20 grams	

Derating



Materials

1	Flange	Ni plated Cu plate
2	Junction	Solder
3	Insulator	Alumina Insulator
4	Resistor	Cu-Ni alloy / Mn-Cu alloy
5	Leads	1.2mm diameter Tin plated Cu
6	Cover	Epoxy resin, non flammable



20110801

2W 3W CURRENT SENSING RESISTORS

RCS2(100A),

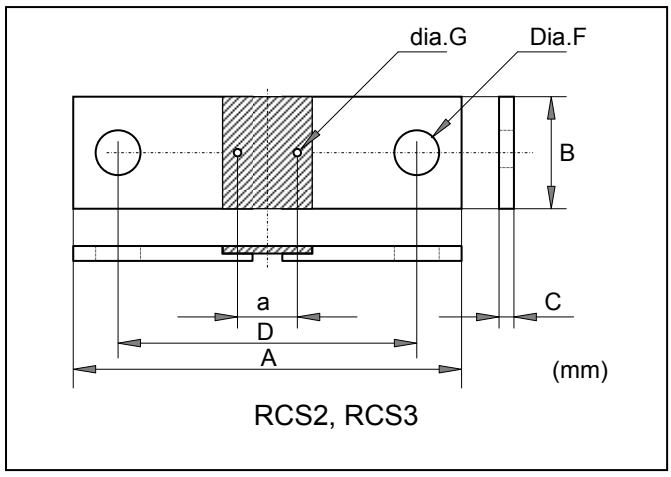
RCS3(170A)

RCS4(170A)

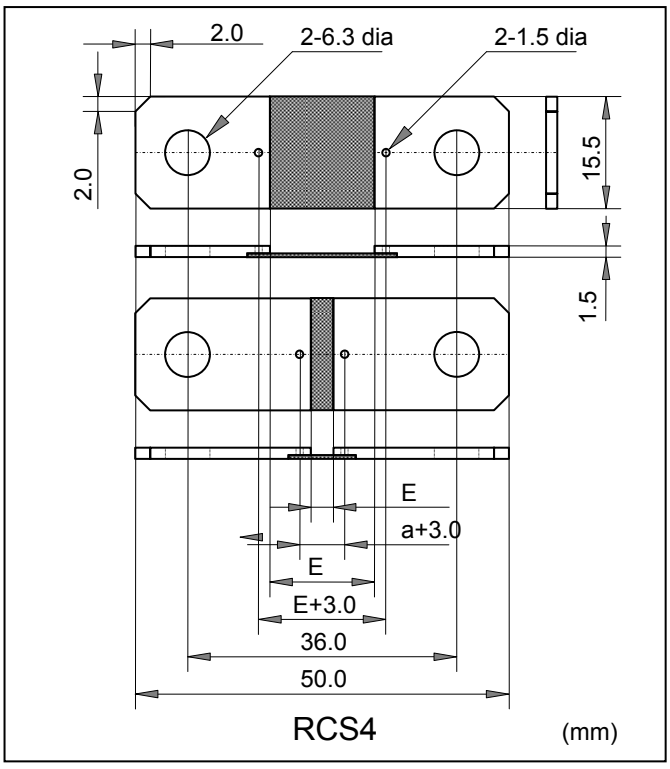
Features and Applications

Rating current 170A (0.1mohm-3W, RCS3 and RCS4) and 100A (0.1mohm-2W, RCS2) current detecting resistors for electric equipments.
RCS4 has same performance but is smaller and light weight than RCS3
Excellent long term stability and less than 80ppm/C TCR are realized by using Ni alloy and fully fine welding structure.
Simple 4-ports Kelvin structure is easy to install large current bus-bar.
Current detection in precision power source, constant current source, industrial power conversion circuit, HEV, of fuel cells, constant electronic load and etc.

Dimensions



RCS2, RCS3



RCS4

(mm)		RCS2	RCS3	RCS4
A		50.0	55.0	50.0
B		12.0	15.0	15.5
C		2.0	2.0	1.5
D		35.0	40.0	36.0
F		6.2	6.2	6.3
G		3.2	0.8	1.5
	milliohm	RCS2	RCS3	RCS4
E	0.1	5.6	7.0	3.0
E	0.2	7.7	9.6	6.0
E	0.3	9.6	12.0	9.0
E	0.4	11.6	14.5	12.0
E	0.5	14.0	17.5	7.5
E	0.6	---	---	9.0
E	0.7	---	---	10.5
E	0.8	---	---	12.0
E	0.9	---	---	13.5
E	1.0	---	---	15.0

Rating current and Maximum, RCS3-RCS4 (1).

milliohm	Rating Current(A)	Max Current (A)
0.1	173	200
0.2	122	141
0.3	100	115
0.4	86	100
0.5	77	89

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2W 3W CURRENT SENSING RESISTORS
RCS2(100A), RCS3(170A), RCS4(170A)

Ordering Information

Type	TCR	Resistance	Tolerance	Note
RCS4	A	0R0001	F	Z00
RCS2	A (0/+80ppm/C)	0R0001	F(+/-1%)	Z00
RCS3		0R0002	J(+/-5%)	
RCS4		0R0003		
		0R0004		
		0R0005		

Specification and Performance

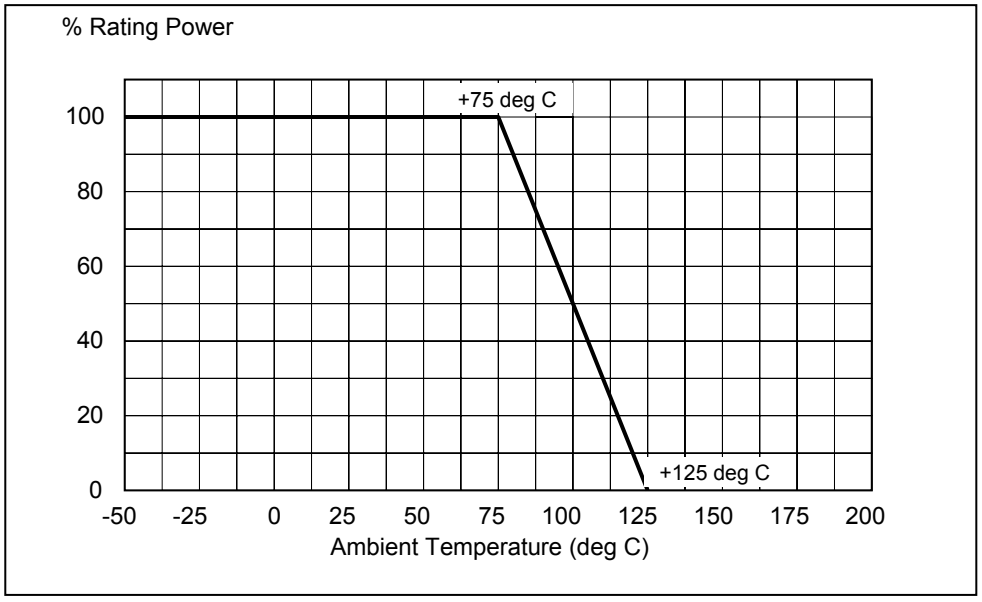
Items	Specification		
Type	RCS2	RCS3	RCS4
Resistance	0.1 to 0.5 milliohm	0.1 to 0.5 milliohm	0.1 to 1.0 milliohm
TCR	+0 to 80ppm/C (A)	+0 to 80ppm/C (A)	+0 to 60ppm/C (A)
Tolerance	+/-1% (F) and +/-5% (J)	+/-1% (F) and +/-5% (J)	+/-1% (F) and +/-5% (J)
Rating Power	2W	3W	3W
Maximum Power	2kW/0.1seconds	3kW/0.1seconds	3kW/0.1seconds
Rating Current	See below table	See upper table	See upper table
Operating Temperature	-55 - +175degC	-55 - +175degC	-55 - +175degC
Storage Temperature	-55 - +175degC	-55 - +175degC	-55 - +175degC

Rating Current and Max Current, RCS2 (1)

Resistance	0.1mohm	0.2mohm	0.3mohm	0.4mohm	0.5mohm
Rating Current	141.4A	100.0A	81.6A	70.7A	63.2A
Maximum Current	173.0A	122.0A	100.0A	86.0A	77.0A

Note (1): Rating and maximum current are specified in connecting to bus-bar, not at standing alone resistor in free air.

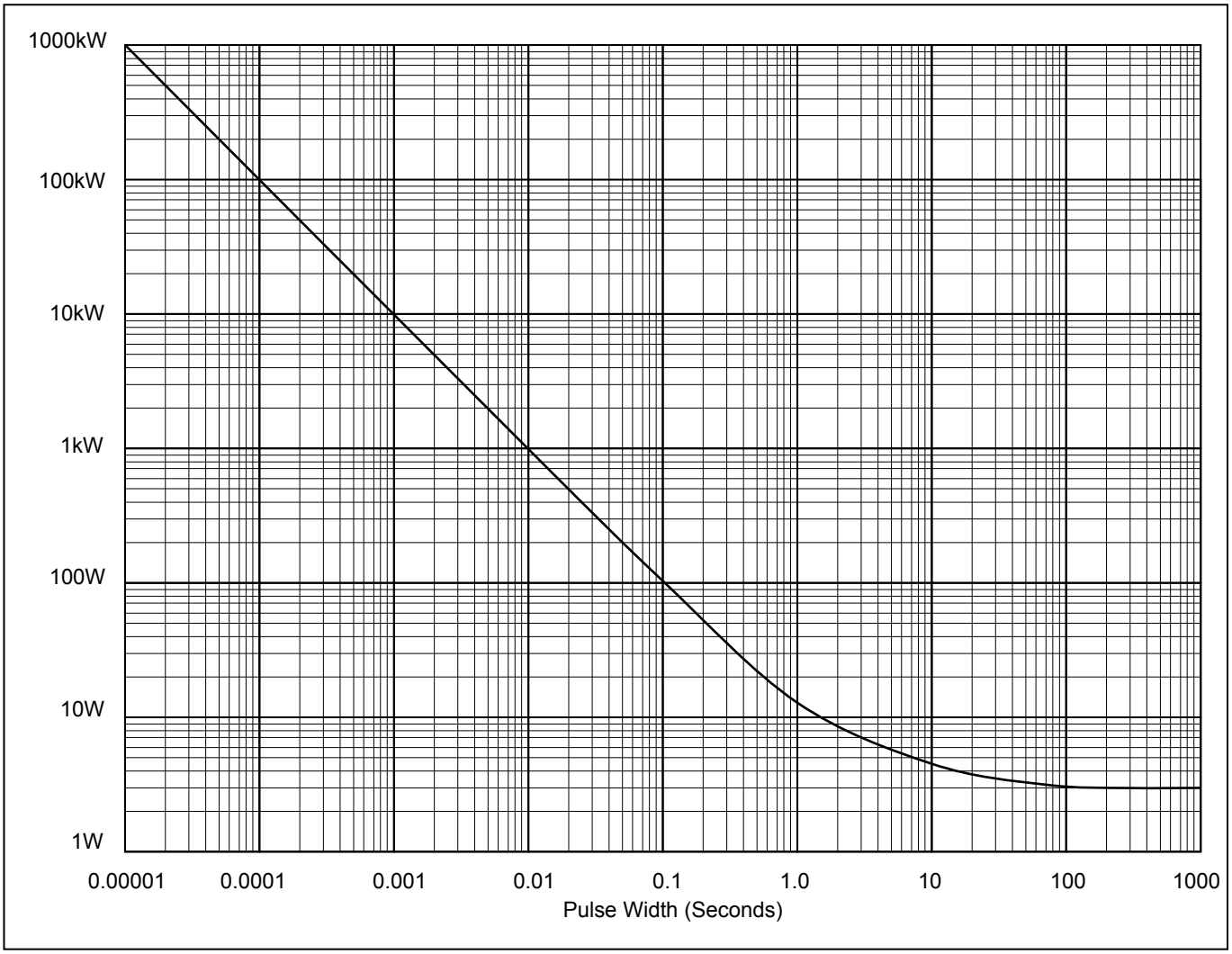
Power Derating



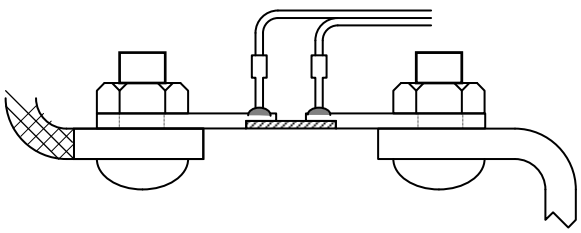
2W 3W CURRENT SENSING RESISTORS

RCS2(100A), RCS3(170A), RCS4(170A)

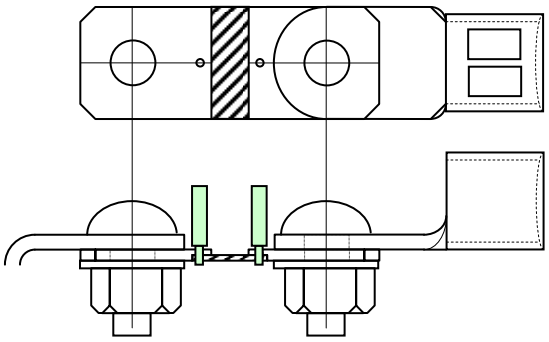
Pulse Energy (RCS4A0L100FZ00)



Applications



Note:
(1) When RCS current detector is attached to current bus, mechanical strain shall be rejected from the resistor as shown in above illustration.
(2) Resistance shall be made by calculating from DC voltage on detecting terminal at application of current through current terminals..
(3) Voltage output Copper pins shall be contacted to Copper terminals of resistor.



Recommended installation is shown in right hand drawing. Terminal shall be used R type (JST38-S5) with AWG#2. Bus bar shall be used Cu bar, 15.5mm width and 2mm thick. Cross area will be 31mm square. Screw is M5-M6.

20111201

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RoHS

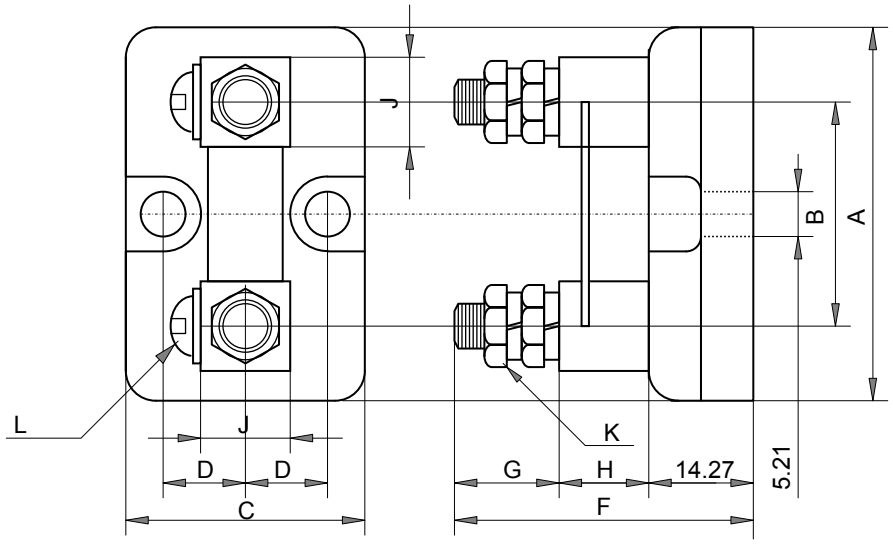
LIGHTWEIGHT PRECISION
CURRENT SHUNT RESISTORS

NSLA10, NSLA20, NSLA30
NSLA50, NSLA75, NSLA80
NSLA85, NSLA100, NSLA150

Features and Applications

Lightweight large current shunt resistors for ampere-meters, designed for power electric equipment.
Excellent long-term stability, low emf and low TCR.
Easy current measurement is performed by attaching to current bus or wires and connecting to ampere-meter through flexible wires.
All of shunts are calibrated on equipment with current certifications traceable to US-N.I.S.T
For high precision power supply, power converters, and current measurement instruments.

Dimension (mm)



mm	NSLA10 -50	NSLA15 -50	NSLA20 -50	NSLA30 -50	NSLA50 -50	NSLA75 -50	NSLA80 -50	NSLA85 -50	NSLA100 -50	NSLA150 -50
A	50.80 mm									
B	25.40 mm									
C	31.75 mm									
D	11.10 mm									
F	42.88 mm									
G	15.88 mm									
H	12.70 mm									
J	13.0mm x 13.0mm									
K (inch)	1/4-28 (6.0mm)									
L(inch)	0.36L-10-32 scr. (4.0mm-9mm)									

Tolerances +/-0.015 inch (+/-0.38 mm) for hole diameter, Other tolerances +/-0.030 inch (+/- 0.076 mm) unless otherwise noted.

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LIGHTWEIGHT PRECISION CURRENT SHUNT RESISTORS

NSLA10, NSLA20, NSLA30, NSLA50, NSLA75, NSLA80 NSLA85, NSLA100, NSLA150

Ordering Information

Style	Rating Current in A	Voltage in mV	Tolerance	Code
NSLA	10	-50mV	C	Z00
NSLA	15	-50mV	C(+/-0.25%)	Z00
	20	-60mV	(1)	
	30			
	50			
	75			
	80			
	85			
	100			
	150			

(1) Accuracy will be assure B (+/-0.1%) in option.
(2) Recommended operation current shall be 2/3 of their rated current.

Specification and Performance

	NSLA10	NSLA15	NSLA20	NSLA30	NSLA50	NSLA75	NSLA80	NSLA85	NSLA100	NSLA150
Rated Current (A)	10	15	20	30	50	75	80	85	100	150
Operating Current (A)	6.67	10.00	13.33	20.00	33.33	50.00	53.33	56.67	66.67	100.00
Net Weight (g)	90	90	90	90	90	90	90	90	90	90
Rated Output (mV)	50, 60									
Resistance (milliohms)	Resistance is based on the amperage and mV rating, nominal resistance is calculated using Ohms law.									
Voltage Tolerance (%)	+/-0.25%(C)									
Operating Temp.	+30 to +70 deg C measured at center of manganin strips									
Storage Temp.	-55 to +80 deg C									

The way to reduce the operating temperature, such as forced air, increasing physical size, adding heat sink to the blocks, designing for water cooling, and etc.

	50mV
NSLA10-50	5.00000 milliohm
NSLA15-50	3.33333 milliohm
NSLA20-50	2.50000 milliohm
NSLA30-50	1.66667 milliohm
NSLA50-50	1.00000 milliohm
NSLA75-50	0.66667 milliohm
NSLA80-50	0.62500 milliohm
NSLA85-50	0.58824 milliohm
NSLA100-50	0.50000 milliohm
NSLA150-50	0.33333 milliohm
	60mV
NSLA10-60	6.00000 milliohm
NSLA15-60	4.00000 milliohm
NSLA20-60	3.00000 milliohm
NSLA30-60	2.00000 milliohm
NSLA50-60	1.20000 milliohm
NSLA75-60	0.80000 milliohm
NSLA80-60	0.75000 milliohm
NSLA85-60	0.70588 milliohm
NSLA100-60	0.60000 milliohm
NSLA150-60	0.40000 milliohm

Equivalent resistance (milliohm) calculated from the I-V characteristic.

Thickness (mm)	Width (mm)	Current (A) at 30 deg C Temp. Rise	Current (A) at 65 deg C temp. Rise
3	25	230	362
4	25	290	456
4	50	510	802
5	25	340	535
5	50	610	960
6	25	380	598
6	30	430	675
6	40	550	865
6	50	680	1070
6	75	940	1479
6	100	1200	1888
6	125	1440	2265
6	150	1680	2643
8	50	800	1258
8	75	1100	1730
8	100	1400	2202
8	125	1650	2595
8	150	1930	3036
10	50	880	1384
10	75	1220	1919
10	100	1540	2422

Current capacity of copper bus bar, JSIA

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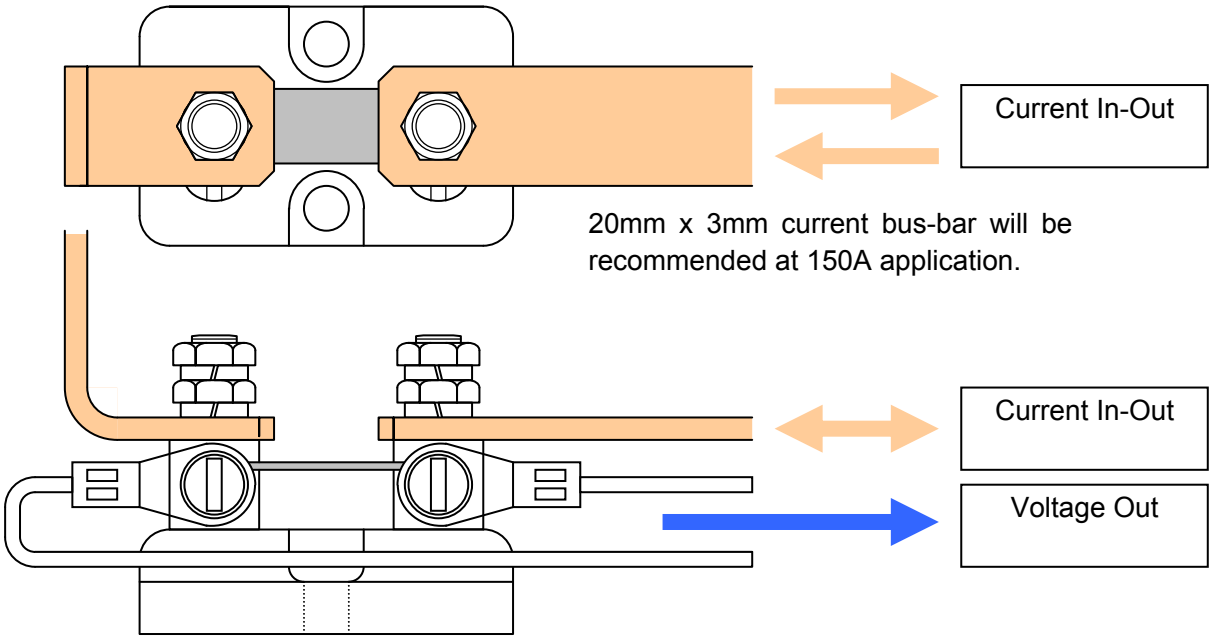
RoHS

LIGHTWEIGHT PRECISION CURRENT SHUNT RESISTORS

NSLA10, NSLA20, NSLA30, NSLA50, NSLA75, NSLA80 NSLA85, NSLA100, NSLA150

Applications



NSLA10-60mV

NSLA50-60mV

NSLA100-60mV

NSLA150-60mV

Note
The resistance will remain within 0.25% if the shunt is operated between 20 and 90 degrees C. If the temperature of the shunt exceeds 90 degrees C the resistance may drift. The temperature of the shunt is measured on the resistance strips.

20120101

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RoHS

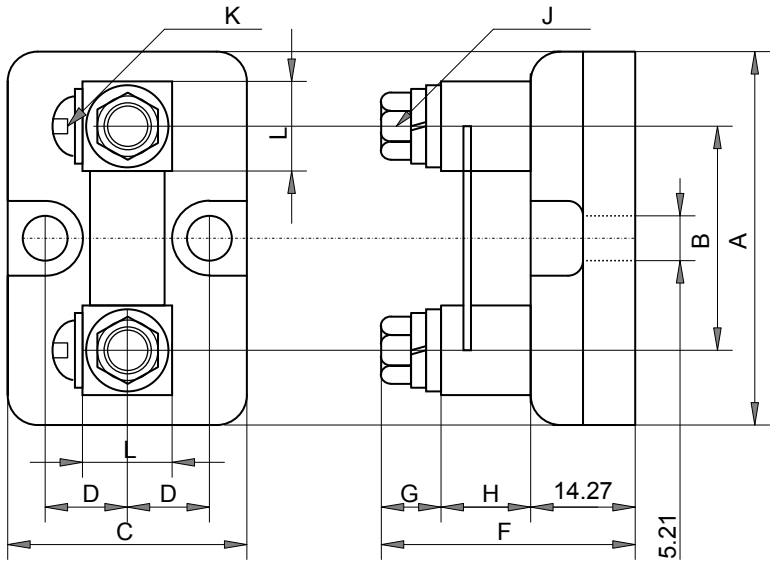
LIGHTWEIGHT PRECISION
CURRENT SHUNT RESISTORS

NSLB170, NSLB200, NSLB250
NSLB300, NSLB400, NSLB450
NSLB500, NSLB600

Features and Applications

Lightweight large current shunt resistors for ampere-meters, designed for power electric equipment.
Excellent long-term stability, low emf and low TCR.
Easy current measurement is performed by attaching to current bus or wires and connecting to ampere-meter through flexible wires.
All of shunts are calibrated on equipment with current certifications traceable to US-N.I.S.T
For high precision power supply, power converters, and current measurement instruments.

Dimension (mm)



p/n	A	B	C	D	F	G	H	J (inch)	K (inch)
NSLB170-50	82.55	38.10	44.45	15.88	44.45	11.13	19.05	1/8-16x5/8	#10-32 SCR.
NSLB200-50	82.55	38.10	44.45	15.88	44.45	11.13	19.05	1/8-16x5/8	#10-32 SCR.
NSLB250-50	82.55	38.10	44.45	15.88	44.45	11.13	19.05	1/8-16x5/8	#10-32 SCR.
NSLB300-50	82.55	38.10	44.45	15.88	44.45	11.13	19.05	1/8-16x5/8	#10-32 SCR.
NSLB400-50	82.55	38.10	44.45	15.88	44.45	11.13	19.05	1/8-16x5/8	#10-32 SCR.
NSLB450-50	82.55	38.10	44.45	15.88	44.45	11.13	19.05	1/8-16x5/8	#10-32 SCR.
NSLB500-50	82.55	38.10	44.45	15.88	44.45	11.13	19.05	1/8-16x5/8	#10-32 SCR.
NSLB600-50	82.55	38.10	44.45	15.88	44.45	11.13	19.05	1/8-16x5/8	#10-32 SCR.

Tolerances +/-0.015 inch (+/-0.38 mm) for hole diameter, Other tolerances +/-0.030 inch (+/- 0.076 mm) unless otherwise noted.

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LIGHTWEIGHT PRECISION CURRENT SHUNT RESISTORS

NSLB170, NSLB200, NSLB250, NSLB300, NSLB400, NSLB450 NSLB500, NSLB600

Ordering Information

Style		Rating Current in A	Voltage in mV	Tolerance	Code
NSLB		200	-50mV	C	Z00
NSLB	>	170	-50mV	C (+/-0.25%)	Z00
		200			
		250		(1)	
		300			
		400			
		450			
		500			
		600			

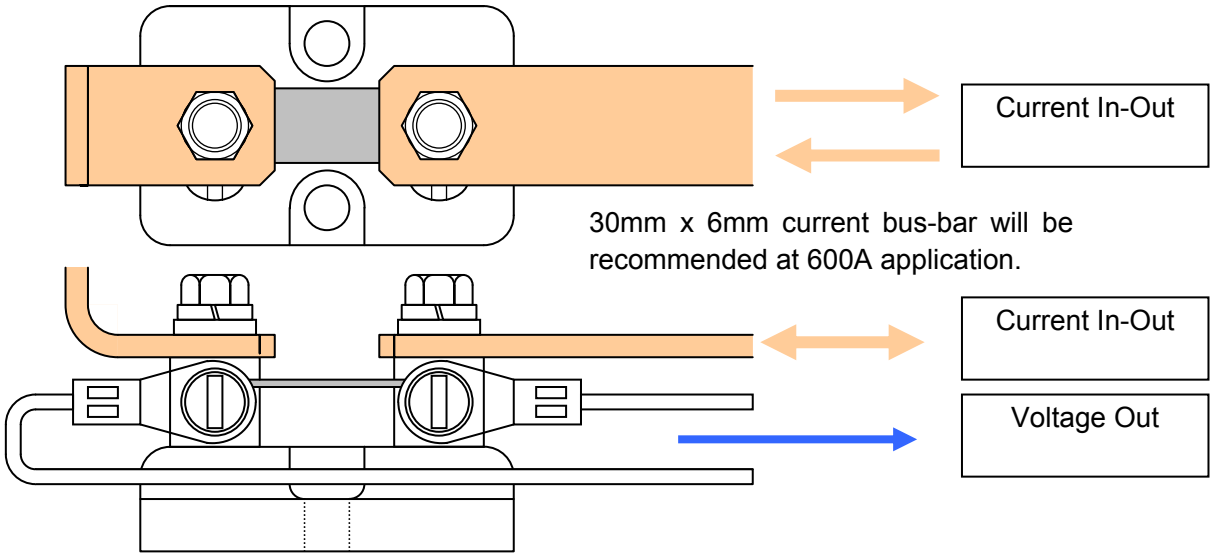
(1) Accuracy will be assure B (+/-0.1%) in option.
(2) Recommended operation current shall be 2/3 of their rated current.

Specification and Performance

	NSLB170	NSLB200	NSLB250	NSLB300	NSLB400	NSLB450	NSLB500	NSLB600
Rated Current (A)	170	200	250	300	400	450	500	600
Operating Current (A)	113	133	166	200	267	300	333	400
Net Weight (g)	---	---	---	---	---	---	---	---
Rated Output	50mV or 60mV							
Resistance (milliohms)	Resistance is based on the amperage and mV rating, nominal resistance is calculated using Ohms law.							
Voltage Tolerance (%)	+/-0.25%(C)							
Operating Temp.	+30 to +70 deg C measured at center of manganin strips							
Storage Temp.	-55 to +80 deg C							

The way to reduce the operating temperature, such as forced air, increasing physical size, adding heat sink to the blocks, designing for water cooling, and etc.

Applications



20120101

RoHS

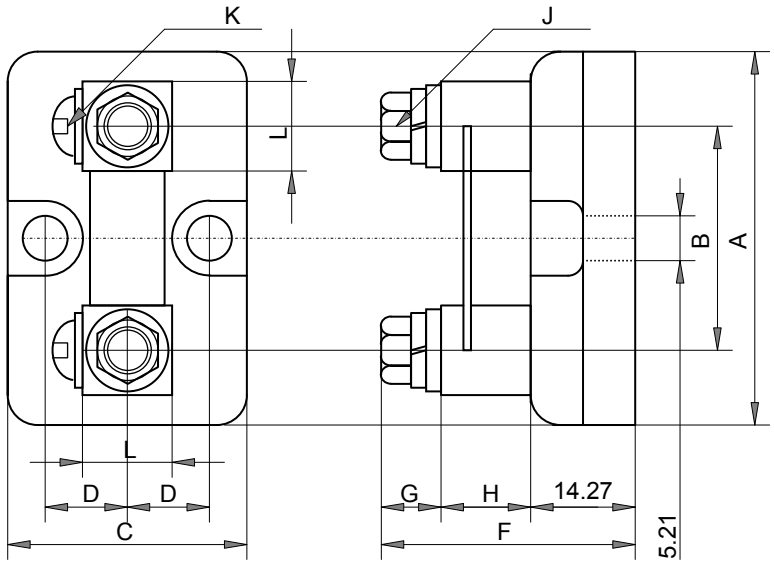
LIGHTWEIGHT PRECISION
CURRENT SHUNT RESISTORS

NSLC800, NSLC1000, NSLC1200

Features and Applications

Lightweight large current shunt resistors for ampere-meters, designed for power electric equipment.
Excellent long-term stability, low emf and low TCR.
Easy current measurement is performed by attaching to current bus or wires and connecting to ampere-meter through flexible wires.
All of shunts are calibrated on equipment with current certifications traceable to US-N.I.S.T
For high precision power supply, power converters, and current measurement instruments.

Dimension (mm)



p/n	A	B	C	D	F	G	H	J	K
NSLC800-50	114.30	54.86	63.50	25.40	53.98	14.27	25.40	1/2-13x7/8	#10-32 SCR.
NSLC1000-50	114.30	54.86	63.50	25.40	53.98	14.27	25.40	1/2-13x7/8	#10-32 SCR.
NSLC1200-50	114.30	54.86	63.50	25.40	53.98	14.27	25.40	1/2-13x7/8	#10-32 SCR.

Tolerances +/-0.015 inch (+/-0.38 mm) for hole diameter, Other tolerances +/-0.030 inch (+/- 0.076 mm) unless otherwise noted.

Ordering Information

Style		Rating Current in A	Voltage in mV	Tolerance	Code
NSLC		1000	-50mV	C	Z00
NSLC	>	800	-50mV	C(0.25%)	Z00
		1000			
		1200			

(1) Accuracy will be assure B (+/-0.1%) in option.
(2) Recommended operation current shall be 2/3 of their rated current.

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RoHS

LIGHTWEIGHT PRECISION CURRENT SHUNT RESISTORS

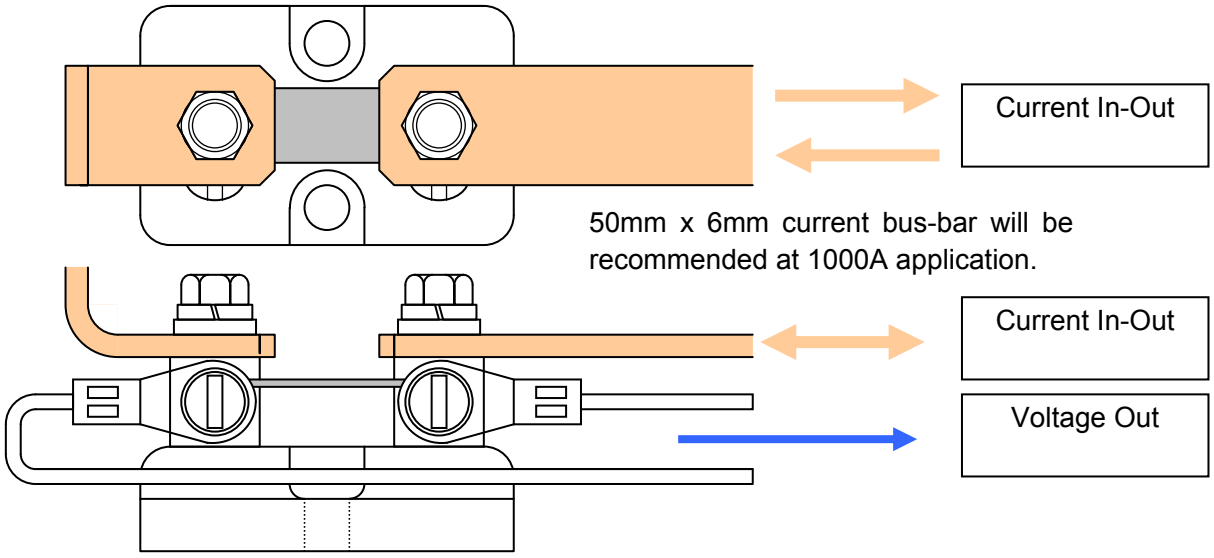
NSLC800, NSLC1000, NSLC1200

Specification and Performance

	NSLC800	NSLC1000	NSLC1200
Rated Current (A)	800	1000	1200
Operating Current (A)	533	667	800
Net Weight (g)	900	900	900
Rated Output	50mV or 60mV		
Resistance (milliohms)	Resistance is based on the amperage and mV rating, nominal resistance is calculated using Ohms law.		
Voltage Tolerance (%)	+/-0.25%(C)		
Operating Temp.	+30 to +70 deg C measured at center of manganin strips		
Storage Temp.	-55 to +80 deg C		

The way to reduce the operating temperature, such as forced air, increasing physical size, adding heat sink to the blocks, designing for water cooling, and etc.

Applications



Allowable Current of Cu Bus-Bar (Temperature Rise - A)

Cross Section (mm X mm) and Allowable Current (A) in Power Distribution System

Temp rise	3X25	4X25	4X50	5X25	5X50	6X25	6X30	6X40	6X50	6X75	6X100	6X125	6X150	---
30deg C	230	290	510	340	610	380	430	550	680	940	1,200	1,440	1,680	---
65deg C	362	456	802	535	960	598	676	865	1,070	1,479	1,888	2,265	2,643	---

Cross Section (mm X mm) and Allowable Current (A) in Power Distribution System

Temp rise	8X50	8X75	8X100	8X125	8X150	10X50	10X75	10X100	10X125	10X150	12X75	12X100	12X125	12X150
30deg C	800	1,100	1,440	1,650	1,930	880	1,220	1,540	1,820	2,120	1,320	1,660	1,950	2,280
65deg C	1,258	1,730	2,202	2,595	3,036	1,384	1,919	2,422	2,863	3,335	2,076	2,611	3,067	3,586

Allowable Current of Cu Twisted Wire (ambient temperature - A)

sq mm	2	4	6	8	14	22	38	60	100	150	200	250	325	400	500
30 deg C	32	45	59	74	107	140	197	264	363	481	572	678	793	908	1,027
40 deg C	29	39	52	65	95	124	174	234	321	426	506	600	702	804	909
50 deg C	24	33	44	55	80	104	147	198	272	360	428	507	593	680	768

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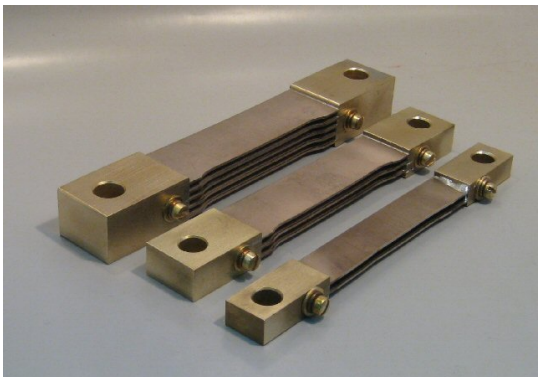
RoHS

PRECISION CURRENT SHUNT RESISTORS

NSA50, NSA100, NSA150
NSA200, NSA250, NSA300
NSA400, NSA500, NSA600



Features and Applications

Large current shunt resistors for ampere-meters, designed for standard current measurement of electric equipment.

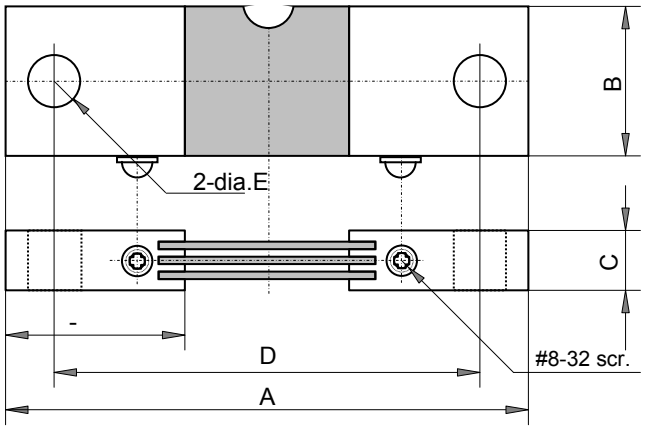
Excellent long-term stability, low emf and low TCR.

Easy current measurement is performed by attaching to current bus directory and connecting to ampere-meter through flexible wires.

All of shunts are calibrated on equipment with current certifications traceable to US-N.I.S.T

For high precision power supply, power converters, and current measurement instruments.

Dimension (mm)



mm	NSA50 -50	NSA100 -50	NSA150 -50	NSA200 -50	NSA250 -50	NSA300 -50	NSA400 -50	NSA500 -50	NSA600 -50
A	104.78	104.78	104.78	104.78	104.78	104.78	117.48	117.48	117.48
B	15.88	15.88	23.83	20.65	27.00	31.75	25.40	31.75	38.10
C	9.53	9.53	9.53	12.70	12.70	12.70	19.05	19.05	19.05
D	84.15	84.15	84.15	84.15	84.15	84.15	92.08	92.08	92.08
E	8.74	8.74	8.74	8.74	8.74	8.74	10.31	10.31	10.31
Ohm	1.000	0.500	0.333	0.250	0.200	0.167	0.125	0.100	0.083

Ohm Resistance (milliohm) calculated from the V-I characteristic

mm	NSA50 -100	NSA100 -100	NSA150 -100	NSA200 -100	NSA250 -100	NSA300 -100	NSA400 -100	NSA500 -100	NSA600 -100
A	146.05	146.05	146.05	146.05	146.05	146.05	158.75	158.75	158.75
B	15.88	15.88	23.83	20.65	27.00	31.75	25.40	31.75	38.10
C	9.53	9.53	9.53	12.70	12.70	12.70	19.05	19.05	19.05
D	125.43	125.43	125.43	125.43	125.43	125.43	134.95	134.95	134.95
E	8.74	8.74	8.74	8.74	8.74	8.74	10.31	10.31	10.31
Ohm	2.000	1.000	0.667	0.500	0.400	0.333	0.250	0.200	0.167

Ohm Resistance (milliohm) calculated from the V-I characteristic.

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PRECISION CURRENT SHUNT RESISTORS

NSA50, NSA100, NSA150, NSA200, NSA250, NSA300 NSA400, NSA500, NSA600

Ordering Information

Style	Rated Current in A	Voltage in mV	Tolerance	Code
NSA	300	-50	C	Z00
NSA	50	-50	C(+/-0.25%)	Z00
	100	-60	(1)	
	150	-100		
	200			
	250			
	300			
	400			
	500			
	600			

(1) Accuracy will be assure B(+/-0.1%) in option.

(2) Recommended operation current shall be 2/3 of their rated current.

Specification and Performance

	NSA50	NSA100	NSA150	NSA200	NSA250	NSA300	NSA400	NSA500	NSA600
Rated Current (A)	50	100	150	200	250	300	400	500	600
Operating Current (A)	33.3	66.7	100	133	167	200	267	333	400
Rated Output (mV)	50, 60 or 100								
Eq. Resistance(milliohms)	Resistance is based on the amperage and millivolt rating, nominal resistance is calculated using Ohms law.								
Voltage Tolerance (%)	+/-0.25%(C)								
Operating Temp. (deg C)	+30 to +70 deg C measured at center of manganin strips								
Strage Temp. (deg C)	-55 to +80 deg C								
Weight (Kg)									

The way to reduce the operating temperature, such as forced air, increasing physical size, adding heat sink to the blocks, designing for water cooling, and etc.

Thickness (mm)	Width (mm)	Current (A) at 30 deg C Temp. Rise	Current (A) at 65 deg C temp. Rise
3	25	230	362
4	25	290	456
4	50	510	802
5	25	340	535
5	50	610	960
6	25	380	598
6	30	430	675
6	40	550	865
6	50	680	1070
6	75	940	1479
6	100	1200	1888
6	125	1440	2265
6	150	1680	2643
8	50	800	1258
8	75	1100	1730
8	100	1400	2202
8	125	1650	2595
8	150	1930	3036
10	50	880	1384
10	75	1220	1919
10	100	1540	2422

Current capacity of copper bus bar, JSIA

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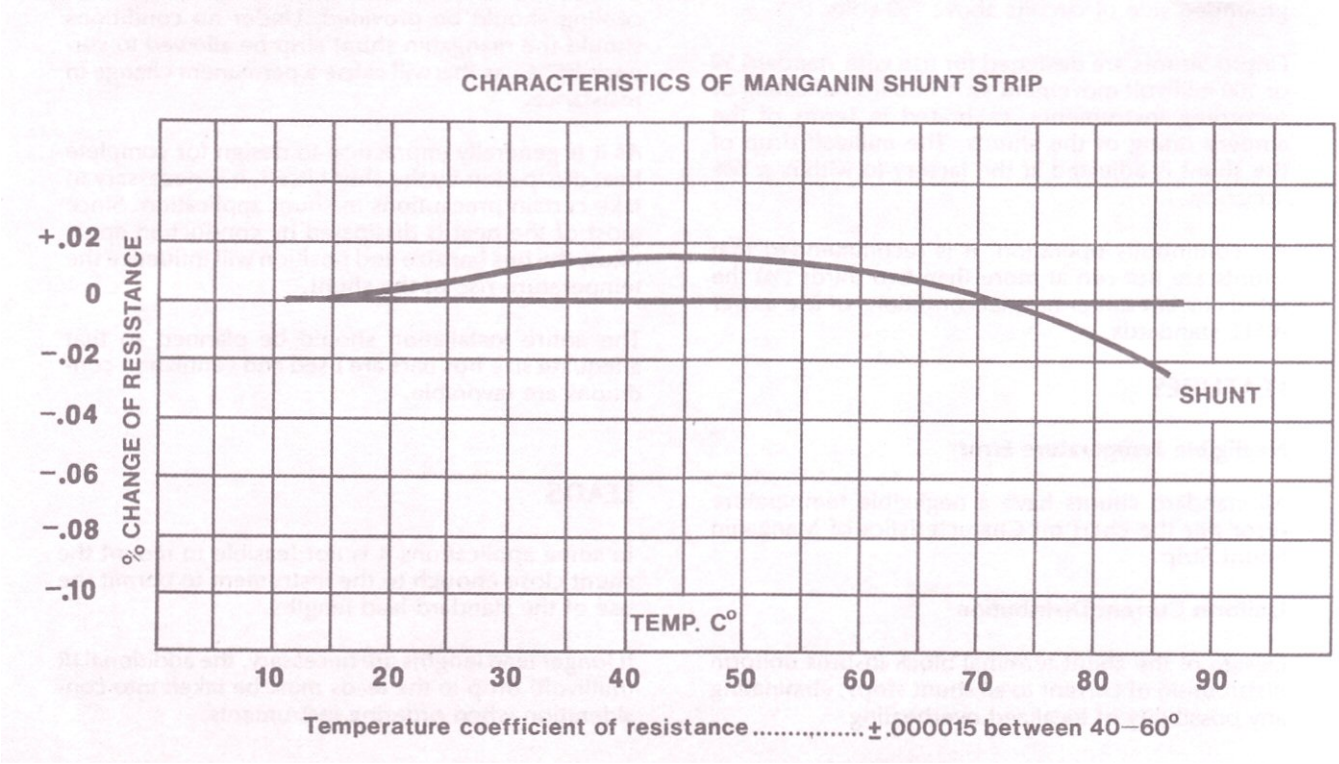
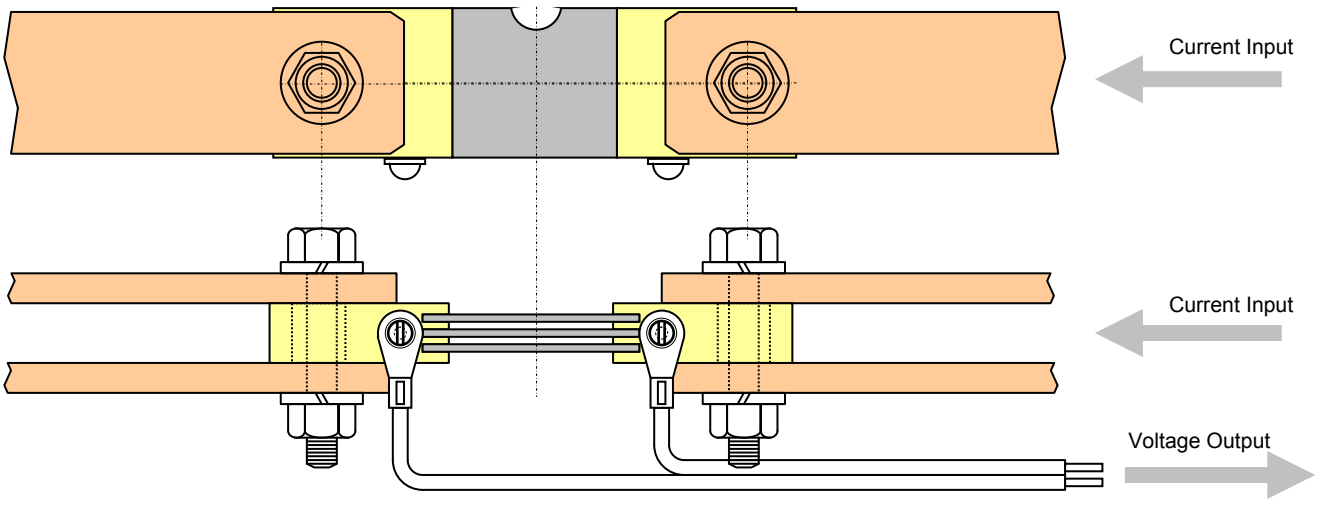
PRECISION CURRENT SHUNT RESISTORS

NSA50, NSA100, NSA150, NSA200, NSA250, NSA300 NSA400, NSA500, NSA600

TCR Characteristics, Typical



Applications



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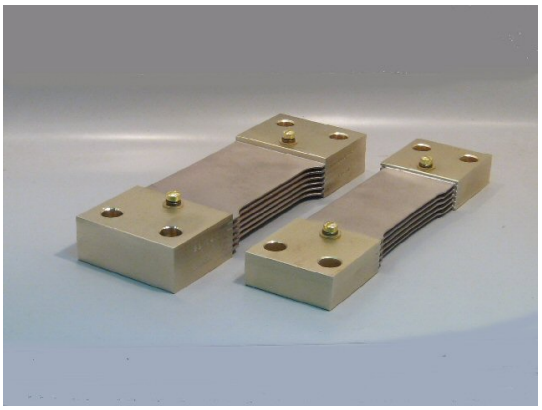
RoHS

PRECISION CURRENT SHUNT RESISTORS

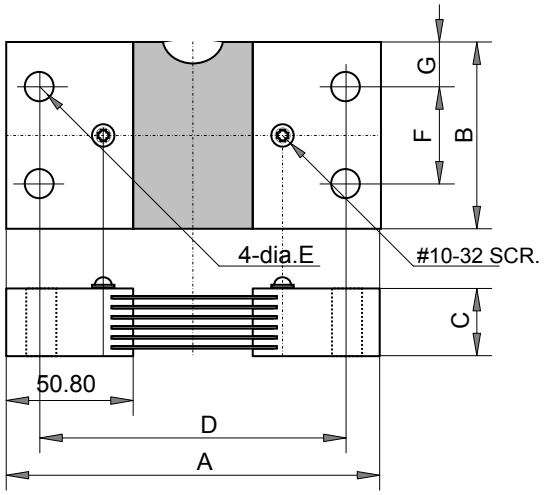
NSB300, NSB400, NSB500
NSB600, NSB700, NSB800
NSB1000, NSB1200



Features and Applications

Large current shunt resistors for ampere-meters, designed for power electric equipment.
Excellent long-term stability, low emf and low TCR.
Easy current measurement is performed by attaching to current bus directory and connecting to ampere-meter through flexible wires.
All of shunts are calibrated on equipment with current certifications traceable to US-N.I.S.T
For high precision power supply, power converters, and current measurement instruments.

Dimension (mm)



mm	NSB300-50	NSB400-50	NSB500-50	NSB600-50	NSB750-50	NSB800-50	NSB1000-50	NSB1200-50
A	149.23	149.23	149.23	149.23	149.23	149.23	149.23	149.23
B	44.45	50.80	50.80	50.80	57.15	60.33	63.50	76.20
C	12.70	19.05	19.05	19.05	19.05	19.05	25.40	25.40
D	120.65	120.65	120.65	120.65	120.65	120.65	120.65	120.65
E	11.13	11.13	11.13	11.13	11.13	11.13	11.13	11.13
F	25.40	31.75	31.75	31.75	38.10	38.10	38.10	38.10
G	9.53	9.53	9.53	9.53	9.53	9.53	12.70	19.05

mm	NSB300 -100	NSB400 -100	NSB500 -100	NSB600 -100	NSB750 -100	NSB800 -100	NSB1000 -100	NSB1200 -100
A	196.85	196.85	196.85	196.85	196.85	196.85	196.85	196.85
B	44.45	50.80	50.80	50.80	57.15	60.33	63.50	76.20
C	12.70	19.05	19.05	19.05	19.05	19.05	25.40	25.40
D	168.28	168.28	168.28	168.28	168.28	168.28	168.28	168.28
E	11.13	11.13	11.13	11.13	11.13	11.13	11.13	11.13
F	25.40	31.75	31.75	31.75	38.10	38.10	38.10	38.10
G	9.53	9.53	9.53	9.53	9.53	11.13	11.13	19.05

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PRECISION CURRENT SHUNT RESISTORS

NSB300, NSB400, NSB500, NSB600, NSB700, NSB800 NSB1000, NSB1200

Ordering Information

Style	Rated Current in A	Voltage in mV	Tolerance	Code
NSB	300	-50	C	Z00
NSB	300	-50	C(+/-0.25%)	Z00
	400	-60	(1)	
	500	-100		
	600			
	750			
	800			
	1000			
	1200			

(1) Accuracy will be assure B(+/-0.1%) in option.

(2) Recommended operation current shall be 2/3 of their rated current.

Specification and Performance

	NSB300	NSB400	NSB500	NSB600	NSB750	NSB800	NSB1000	NSB1200
Rated Current (A)	300	400	500	600	750	800	1000	1200
Operating Current (A)	200	267	333	400	500	533	667	800
Rated Output (mV)	50, 60 or 100							
Eq. Resistance(milliohms)	Resistance is based on the amperage and millivolt rating, nominal resistance is calculated using Ohms law.							
Voltage Tolerance (%)	+/-0.25%(C)							
Operating Temp. (deg C)	+30 to +70 deg C measured at center of manganin strips							
Strage Temp. (deg C)	-55 to +80 deg C							
Weight (Kg)								

The way to reduce the operating temperature, such as forced air, increasing physical size, adding heat sink to the blocks, designing for water cooling, and etc.

	50mV
NSB300-50	0.16666
NSB400-50	0.12500
NSB500-50	0.10000
NSB600-50	0.08333
NSB750-50	0.06666
NSB800-50	0.06250
NSB1000-50	0.05000
NSB1200-50	0.04166
	100mV
NSB300-100	0.33333
NSB400-100	0.25000
NSB500-100	0.20000
NSB600-100	0.16666
NSB750-100	0.13333
NSB800-100	0.12500
NSB1000-100	0.10000
NSB1200-100	0.08333

Resistance (milliohm) calculated from the V-I characteristic.

Thickness (mm)	Width (mm)	Current (A) at 30 deg C Temp. Rise	Current (A) at 65 deg C temp. Rise
3	25	230	362
4	25	290	456
4	50	510	802
5	25	340	535
5	50	610	960
6	25	380	598
6	30	430	675
6	40	550	865
6	50	680	1070
6	75	940	1479
6	100	1200	1888
6	125	1440	2265
6	150	1680	2643
8	50	800	1258
8	75	1100	1730
8	100	1400	2202
8	125	1650	2595
8	150	1930	3036
10	50	880	1384
10	75	1220	1919
10	100	1540	2422

Current capacity of copper bus bar, JSIA

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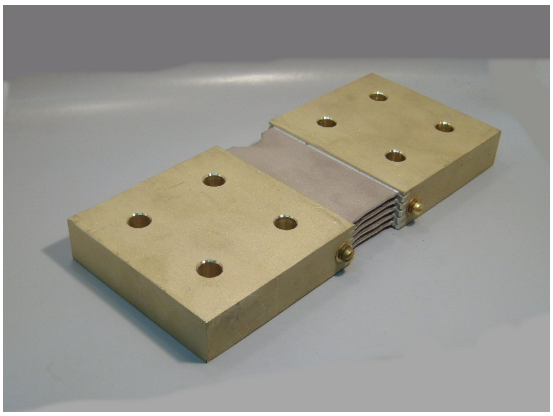
RoHS

PRECISION CURRENT SHUNT

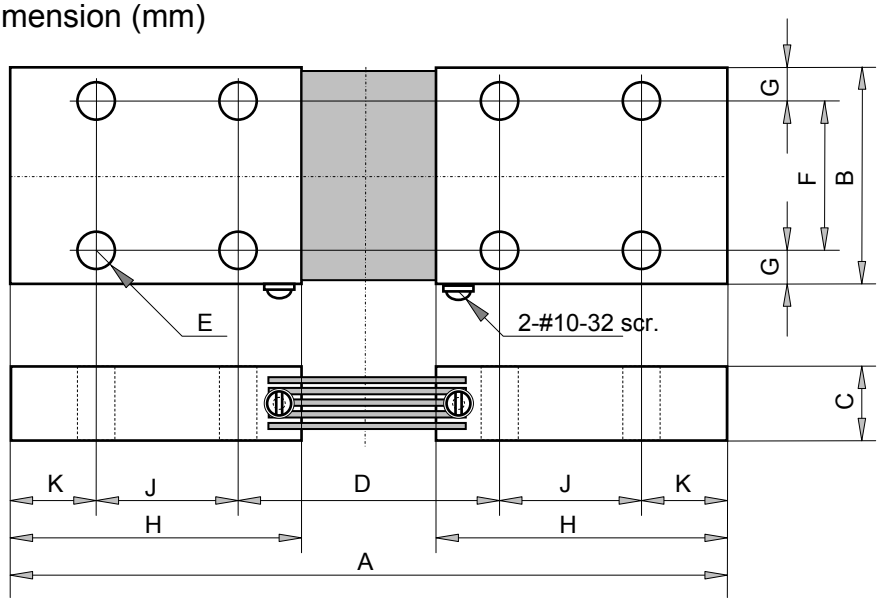
NSE1500, NSE2000



Features and Applications

Large current shunt for ampere-meters, designed for power electric equipment.
Excellent long-term stability, low emf and low TCR.
Easy current measurement is performed by attaching to current bus directory and connecting to ampere-meter through flexible wires.
All of shunts are calibrated on equipment with current certifications traceable to US-N.I.S.T
For high precision power supply, EV charger, power converters, and current measurement instruments.

Dimension (mm)



mm	NSE1500-50	NSE1500-100
A	244.45	285.75
B	76.20	76.20
C	25.40	25.40
D	92.08	133.35
E	11.11 dia.	11.11 dia.
F	50.80	50.80
G	12.70	25.40
H	101.60	101.60
J	50.80	50.80
K	25.40	25.40

mm	NSE2000-50	NSE2000-100
A	244.45	285.75
B	76.20	76.20
C	25.40	25.40
D	92.08	133.35
E	11.11 dia.	11.11 dia.
F	50.80	50.80
G	12.70	25.40
H	101.60	101.60
J	50.80	50.80
K	25.40	25.40

Tolerance +/-0.38mm, Other tolerances +/-0.78mm unless otherwise noted.

Ordering Information

Style	Rated Current in A	Voltage in mV	Tolerance	Code
NSE	1500	-50mV	C	Z00
NSE	1500	-50mV	C(+/-0.25%)	Z00
	2000	(-60) option	(1)	
		-100mV		

(1) Accuracy will be assure B(+/-0.1%) in option.
(2) Recommended operation current shall be decreased 2/3 of their rated current.

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PRECISION CURRENT SHUNT

NSE1500, NSE2000

Specification and Performance

	NSE1500-50mV	NSE1500-100mV	NSE2000-50mV	NSE2000-100mV
Rated Current (A)	1500A	1500A	2000A	2000A
Operating Current (A)	1000A	1000A	1330A	1330A
Rated Output (mV)	50mV (60mV option)	100mV	50mV (60mV option)	100mV
Eq. Resistance(milliohms)	---	---	---	---
Voltage Tolerance (%)	Resistance is based on the amperage and millivolt rating, nominal resistance is calculated using Ohms law.			
Operating Temp. (deg C)	+/-0.25%(C)			
Strage Temp. (deg C)	+30 to +70 deg C measured at center of Manganin strips			
Weight (Kg)	-55 to +80 deg C			

The way to reduce the operating temperature, such as forced air, increasing physical size, adding heat sink to the blocks, designing for water cooling, and etc.

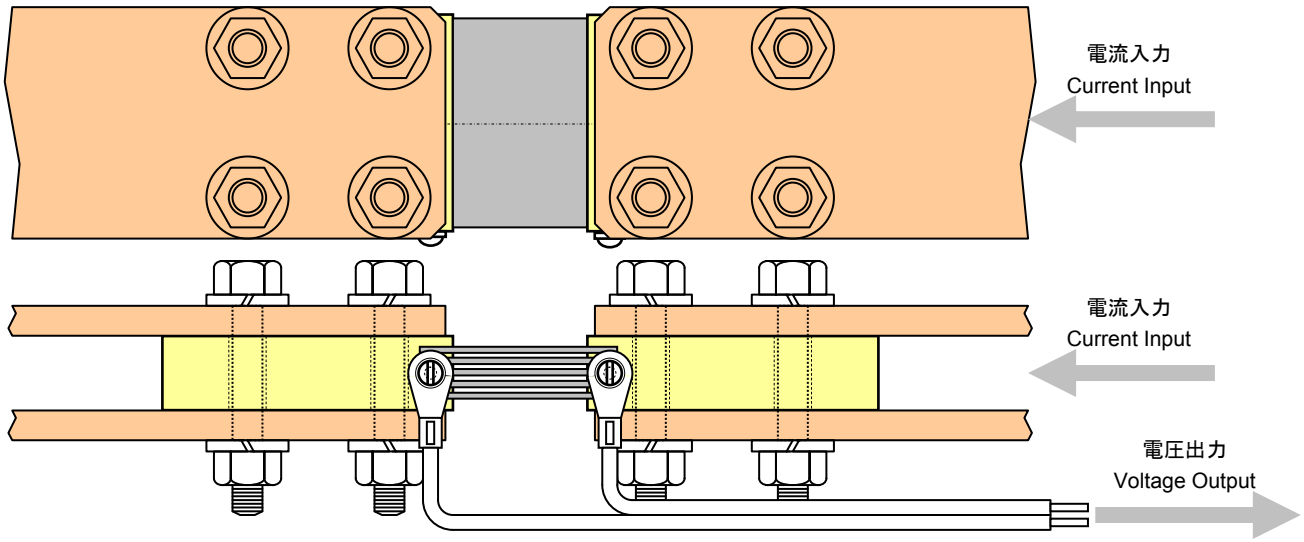
	milliohms
NSE1500-50mV	0.03333
NSE1500-100mV	0.06667
	milliohms
NSE2000-50mV	0.02500
NSE2000-100mV	0.05000

Resistance (milliohm) calculated from the V-I characteristic.

Thickness (mm)	Width (mm)	Current (A) at 30 deg C Temp. Rise	Current (A) at 65 deg C temp. Rise
3	25	230	362
4	25	290	456
4	50	510	802
5	25	340	535
5	50	610	960
6	25	380	598
6	30	430	675
6	40	550	865
6	50	680	1070
6	75	940	1479
6	100	1200	1888
6	125	1440	2265
6	150	1680	2643
8	50	800	1258
8	75	1100	1730
8	100	1400	2202
8	125	1650	2595
8	150	1930	3036
10	50	880	1384
10	75	1220	1919
10	100	1540	2422

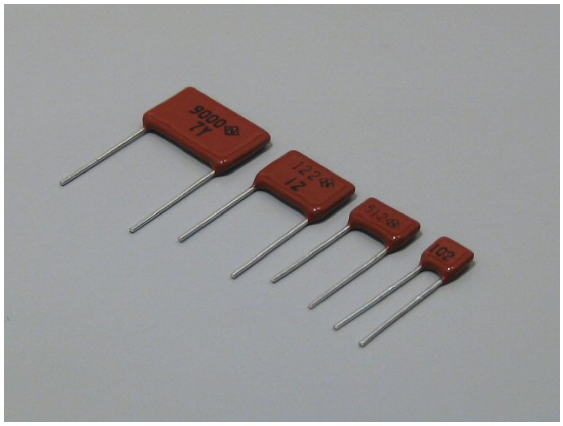
Current capacity of copper bus bar, JSIA

Applications



20111201

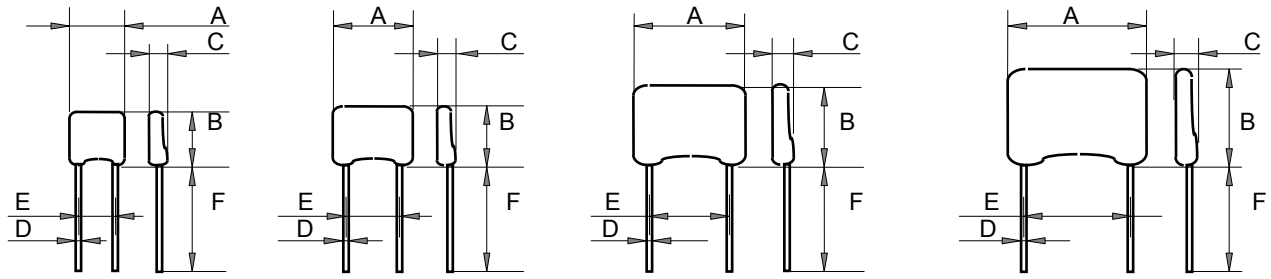
RADIAL LEADS METAL FILM RESISTORS
RP-84, RP-44, RP-24, RP-14



Features and Applications

Radial leaded 1/8W-1/4W-1/2W-1W rating and up to 25ppm/K, 0.1% absolute in series.
Precision Ni-Cr thin film resistors, applicable in general use.
Color coded, lead forming and taping to be available in 1/4W and 1/2W.
Featuring long-term stability, low noise, wide operating temperature range, and low failure rate.
Communications, power control, Industrial measurements, automatic testing, medical, and high-ended audio systems.

Dimensions (mm)



RP−84　　RP−44　　RP−24　　RP−14

Type	A	B	C	D	E	F
RP-84	5.0max	5.0max	2.5max	0.5 dia.	2.5±0.5	10±2
RP-44	7.5max	5.5max	2.5max	0.5 dia.	5.0±0.5	10±2
RP-24	10.0max	7.5max	2.5max	0.5 dia.	7.5±0.5	10±2
RP-14	14.0max	8.5max	2.5max	0.5 dia.	10.0±0.5	10±2

Specifications and Performances

Type	RL84	RP-84		RT-84	RL44	RP-44		RT-44
Lead Pitch	2.5mm				5.0mm			
Rating	1/8W				1/4W			
Resistance	0.1-9.1	47-33K	10-47K	47K-10M	0.1-9.1	47-180K	10-250K	270K-10M
Nominal Value	E12	E24, E96	E24	E24	E12,	E24, E96	E24	E24
TCR(+/-ppm/K)	250 (H)	25 (E)	50 (C)	100 (A)	2 5 0 (H)	25 (E)	50 (C)	100 (A)
Tolerance(+/-%)	5.0 (J)	0.1(B)	1.0(F)	2.0(G)	5.0(J)	0.1(B)	1.0(F)	2.0(G)
Lead-free	Z00				Z00	Z00	Z00	Z00
Color Coded	Not available, Z00 only				NA	NA	A00	A00
Lead Formed	Not available, Z00 only				010	NA	Z10	Z10
Taping	Not available, Z00 only				Z02	Z02	Z02	Z02
Working Voltages	√(PR)				√(PR)			
Rated Amb. Temp.	70 deg C				70 deg C			
Operating Temp.	-55 to +155 deg C				-55 to +155 deg C			

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RADIAL LEADS METAL FILM RESISTORS

RP-84, RP-44, RP-24, RP-14

Specifications and Performances

P/N	RL24	RP-24		RT-24	RL14	RP-14		RT-14
Lead Pitch	7.5mm				10.0mm			
Rating	1/2W	1/4W	1/2W		1W	1/2W	1W	
Resistance	0.1-9.1	47-750K	10-1M	1M-10M	0.1-9.1	47-750K	10-1M	1M-10M
Nominal Value	E12	E24, E96	E24	E24	E12	E24, E96	E24	E24
TCR (ppm/deg C)	250(H)	25(E)	50(C)	100(A)	250(H)	25(E)	50(C)	100(A)
Tolerance (%)	5.0 (J)	0.1 (B)	1.0 (F)	2.0 (G)	5.0 (J)	0.1 (B)	1.0 (F)	2.0 (G)
Lead-free	Z00	Z00	Z00	Z00	Z00			
Color Coded	NA	NA	A00	A00	Not available, Z00 only			
Lead Formed	010	NA	Z10	Z10	Not available, Z00 only			
Taping	Z02	Z02	Z02	Z02	Not available, Z00 only			
Working Voltages	√(PR)				√(PR)			
Rated Amb. Temp.	70 deg C				70 deg C			
Operating Temp.	-55 to +155 deg C				-55 to +155 deg C			

Performance

	EB (25ppm, 0.1%)	CF (50ppm, 1.0%)	Test Condition
Short Time Overload	±0.10%	±0.25%	2.5 times rated power, 5 seconds.
Load Life	±0.10%	±0.5%	70 deg C, 90min., ON, 30min., OFF, 1000hours
Humidity	±0.25%	±0.5%	40degC,90-95%RH,90min.,ON,30min.,OFF, 1000hours.
Temperature Cycle	±0.10%	±0.25%	-55C, 30min., +155C, 30 min., 20 cycles.
Soldering Heat	±0.10%	±0.10%	4mm portion, 350C, 3 seconds, dipping.
Withstanding Volt.	±0.10%	±0.25%	
Terminal Strength	±0.10%	±0.25%	
Insulation Resistance	>10,000MΩ	>10,000MΩ	

Ordering Information

Type		TCR		Resistance		Tolerance
RP-24		C		10kohm		F
RP-84		E	>	E96+	>	B
RP-44		C	>	E24+	>	F
RP-24						
RP-14						

Code	Note
A10	Color-Forming-Bulk
Z00	No color, no forming, bulk
A00	Color*, no forming, bulk
Z10	No color, forming**, bulk
A10	Color*, forming**, bulk
Z02	No color, no forming, tape***
A02	Color*, no forming, tape***
Z12	No color, forming**, tape***
A12	Color*, forming**, tape***

* Color code printing is available only RP-44 and RP-24.
** Lead forming is available only RP-44 and RP-24.
*** Taping is available only RP-44 and RP-24.

Marking Stamp on Resistors

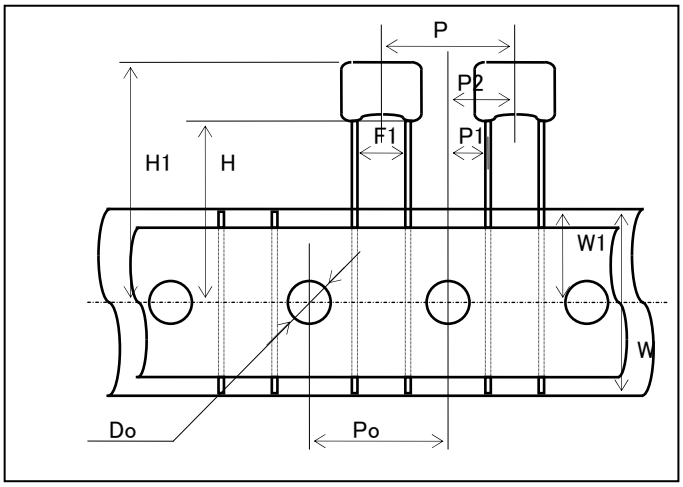
Type	RP-84EB	RP-84CF	RP-44EB	RP-44CF	RP-24EB	RP-24CF	RP-14EB	RP-14EB
Resistance	E24,E96	E24	E24,E96	E24	E24,E96	E24	E24,E96	E24
TCR	±25ppm	±50ppm	±25ppm	±50ppm	±25ppm	±50ppm	±25ppm	±50ppm
Tolerance	±0.1%	±1%	±0.1%	±1%	±0.1%	±1%	±0.1%	±1%
Marking	9092	103	9292N	103N	9092N 96	103N 96	9092N 96	103N 96
Tape Reel	NA	NA	3000pcs	3000pcs	2000pcs	2000pcs	NA	NA
Tape Box	NA	NA	2000pcs	2000pcs	2000pcs	2000pcs	NA	NA

RADIAL LEADS METAL FILM RESISTORS

RP-84, RP-44, RP-24, RP-14

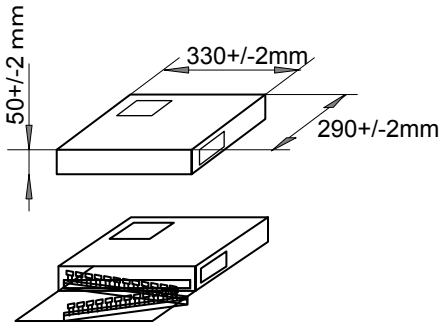
Taping Dimensions

	Sym	RP-44	RP-24
Pitch, resistors	P	12.7±1.0	12.7±1.0
Pitch, send holes	Po	12.7±0.3	12.7±0.3
Gap tolerance, holes	P1,P2	3.85±0.5 6.35±1.3	2.6±0.5 6.35±1.3
Pitch, lead wires	F1,F2	5.0±0.3	7.5±0.3
Fall resistor	Δh	0±2.0	0±2.0
Tape width	W	18.0±0.5	18.0±0.5
Tolerance, tape width	W1	9.0±0.75	9.0±0.75
Bottom of resistor	H	19.0±1.0	19.0±1.0
Top of resistor	H1	25.0 以下	26.0 以下
Hole diameter	Do	4.0φ±0.2	4.0φ±0.2
Thickness of tape	t	0.5±0.2	0.5±0.2



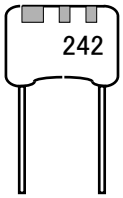
Taping Specification

Tape Folded, Type (- -2)

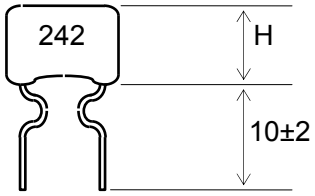


Color code (A- -)

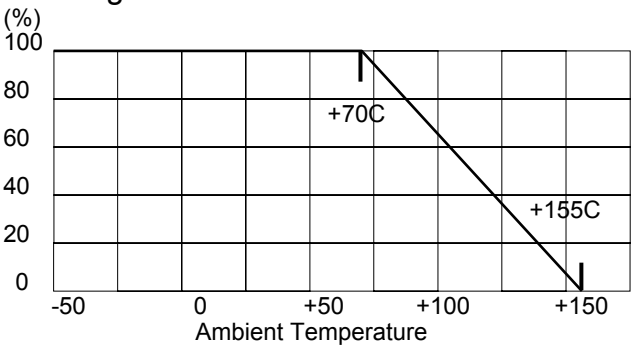
Color	1st	2nd	Multiplier
BLACK	0	0	1
BROWN	1	1	10
RED	2	2	100
ORANGE	3	3	1000
YELLOW	4	4	10000
GREEN	5	5	100000
BLUE	6	6	1000000
PURPLE	7	7	10000000
GRAY	8	8	
WHITE	9	9	



Lead Forming (-1-)



Derating



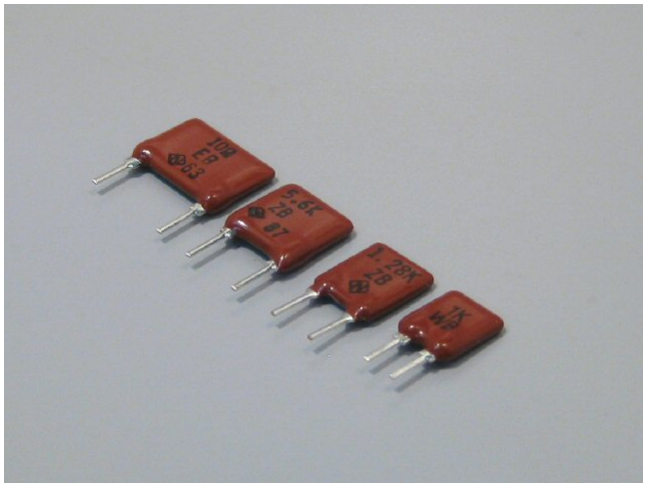
Note(1): As for marking specifications of RL type and RT type, call factory.
Note(2): Zero Ohm resistor that are used for jumper are available.

20120401

1/4W, PRECISION THIN FILM RESISTORS

RP48, RP47, RP46, RP45

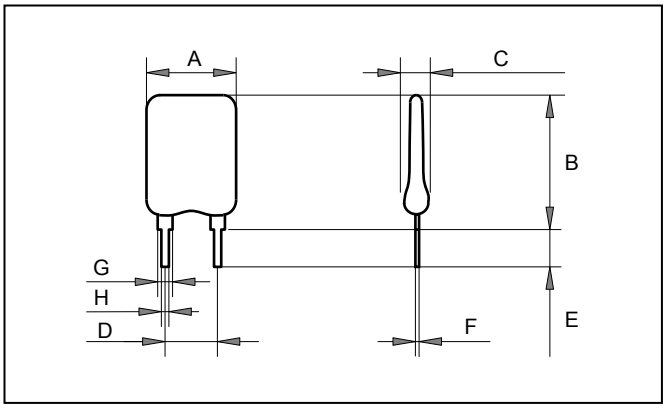
100mil-150mil-200mil-300mil pitch
Through-hole Precision Resistors, 2ppm-0.01%



Features and Applications

High precision thin film resistors, typically 2ppm/C TC made by Ni-Cr alloy spattered on alumina substrate, also 5ppm/K and 0.05% as standard.
Wide operating temperature range covered from -55 to 125C and absolutely linear (not bent) proportional dR vs. dT characteristics within the temperature range.
Sufficient rating power, long-term stability, low current noise, low voltage coefficient and low thermal EMF provided.
Easy to install on precision electronics by leaded style, shorter delivery than other type precision resistors, free from matching and tracking calculations, and economical.
Fit for discrete voltage dividers and common analog circuits of professional audio, sensor pre-amplifiers, industrial measurement, control, medical electronics, ATE, aerospace, and reliable power electronics.

Dimensions (mm)



(mm)	RP48	RP47	RP46	RP45
A	5.6max	6.8max	8.0max	10.16max
B	8.2max	8.6max	9.0max	9.0max
C	2.54max	2.54max	2.54max	2.54max
D	2.54+/-0.25	3.81+/-0.25	5.08+/-0.25	7.62+/-0.25
E	3.3+/-0.5	3.3+/-0.5	3.3+/-0.5	3.3+/-0.5
F	0.25	0.25	0.25	0.25
G	1.2	1.2	1.2	1.2
H	0.5+/-0.05	0.5+/-0.05	0.5+/-0.05	0.5+/-0.05

Ordering Information

Type	TCR	Resistance	Tolerance	Option Code	Note
RP46	W	2.61Kohm	A	Z00	
RP45	Y (2.0ppm/K)	See table	T(0.01%)	Z00 bulk	7.62mm
RP46	W (2.5ppm/K)		Q(0.02%)		5.08mm
RP47	Z (5.0ppm/K)		A(0.05%)		3.81mm
RP48	N (10ppm/K)		B(0.10%)		2.54mm
	E (25ppm/K)		D(0.25%)		

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1/4W, PRECISION THIN FILM RESISTORS RP48, RP47, RP46, RP45

Specifications

P/N	RP48, RP47					Notes
Resistance Range (ohm)	100-20K	100-150K	100-150 K	50-150K	10-150K	
Absolute TCR (+/-ppm/K)	1(X)(*1)	2(Y), 2.5(W)	5(Z)	10(N)	25(E)	-55 to +125 deg C
Absolute Tolerance (+/-%)	0.01(T)(*1)	0.02(Q)	0.05(A)	0.1(B)	0.1(B)	-55 to +125 deg C
Standard Resistance	E96** and E24**, include 2.5 and 5.0 / any resistance value*					
Rating Power (Watts)	0.25W					-55 to+70 degC
Max Working Voltages (V)	$\sqrt{P \cdot R}$					

P/N	RP46, RP45					Notes
Resistance Range (ohm)	100-20K	100-150K	100-150 K	50-510K	10-820K	
Absolute TCR (+/-ppm/K)	1(X) (*1)	2(Y), 2.5(W)	5(Z)	10(N)	25(E)	-55 to +125 degC
Absolute Tolerance (+/-%)	0.01(T) (*1)	0.02(Q)	0.05(A)	0.1(B)	0.1(B)	-55 to +125 degC
Standard Resistance	E96** and E24**, include 2.5 and 5.0 / any resistance value*					
Rating Power (Watts)	0.25W					-55 to+70 degC
Max Working Voltages (V)	$\sqrt{P \cdot R}$					

Note* 4 or more significant resistance and odd resistance, please call factory about printing method.
Note* Precision, 1ppm/degC and 0.01% is optional, resistor will be supplied with data one by one.
Note: When another combination of Resistance-TCR-Tolerance is required, please call factory.

Performances

	Specification	Conditions and Note
Noise	< -43dB	
Voltage Coefficient	< 0.1ppm/V	THD at rating power < -120dB
Thermal EMF	0.05 uV/C	
Temperature Cycle	+/-0.05%	-55C30min, +120C30min, 20cycles.
Short Time Over Load	+/-0.05%	Rating Power×2.5, 5seconds
Solder ability	Covered 95%	235C, 2seconds
Solvent	No damage	IPA test
Terminal Strength	+/-0.05%	
Withstanding Voltage	+/-0.03%	
Soldering Heat	+/-0.03%	350C, 3seconds.
Vibration	Not specified	
Load Life	+/-0.05%	1000 hours
Humidity	+/-0.05%	1000 hours
Shelf Life Stability	+/-0.03%	One year at 25C
Operating Temp.	-55 to +125C	
Storage Temp.	-55 to +125C	

TCR and Tolerance Identifications

TCR and Symbols		Tolerance and Symbols	
X	+/-1ppm/C	T	+/-0.01%
Y	+/-2ppm/C	Q	+/-0.02%
W	+/-2.5ppm/C	A	+/-0.05%
Z	+/-5ppm/C	B	+/-0.10%
N	+/-10ppm/C	D	+/-0.50%
E	+/-25ppm/C	F	+/-1.0%
C	+/-50ppm/C		

Resistance, E24+

1.0	1.5	2.2	3.0	4.3	5.6	8.2
1.1	1.6	2.4	3.3	4.7	6.2	9.1
1.2	1.8	(2.5)	3.6	(5.0)	6.8	
1.3	2.0	2.7	3.9	5.1	7.5	

E96 Resistance, E96

1.00	1.21	1.47	1.78	2.15	2.61	3.16	3.83	4.64	5.62	6.81	8.25
1.02	1.24	1.50	1.82	2.21	2.67	3.24	3.92	4.75	5.76	6.98	8.45
1.05	1.27	1.54	1.87	2.26	2.74	3.32	4.02	4.87	5.90	7.15	8.66
1.07	1.30	1.58	1.91	2.32	2.80	3.40	4.12	4.99	6.04	7.32	8.87
1.10	1.33	1.62	1.96	2.37	2.87	3.48	4.22	5.11	6.19	7.50	9.09
1.13	1.37	1.65	2.00	2.43	2.94	3.57	4.32	5.23	6.34	7.68	9.31
1.15	1.40	1.69	2.05	2.49	3.01	3.65	4.42	5.36	6.49	7.87	9.53
1.18	1.43	1.74	2.10	2.55	3.09	3.74	4.53	5.49	6.65	8.06	9.76

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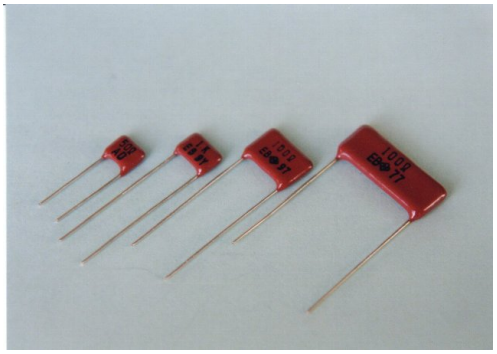
PRECISION
RADIAL LEADED THIN FILM RESISTORS

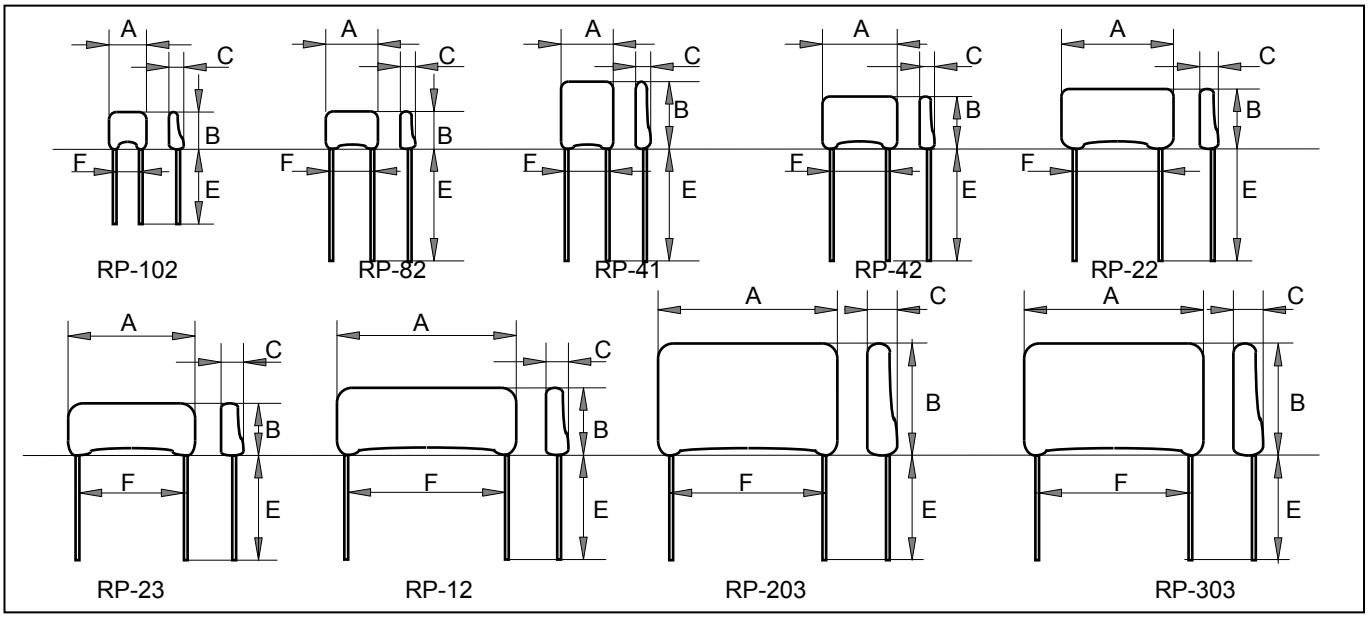


RP-102, RP-82, RP-41, RP-42, RP-22, RP-23, RP-12, RP-203, RP-303

Features and Applications

Radial leaded, through-hole 1/10W, 1/8W, 1/4W, 1/2W, 1W, 2W, 3W rating and up to 5ppm/C, 0.1% absolute in series. Any resistance value available.
Long life, precision Ni-Cr thin film resistors, applicable in general use for industrial circuits with sufficient power derating.
Date code printing on resistor surface helpful in realizing traceability
Featuring long-term stability, low noise, wide operating temperature range and low failure rate.
Suitable for industrial electronics applications of 5-15-24-48V circuits such as data transmission, train control, electric power control, industrial machines, industrial measurements, automatic testing, medical and low noise high-ended audio systems.

Dimensions (mm)



Type	Rating	A	B	C	D (Leads)	E	F
(RP84)	1/8W	5.0max	5.0max	2.5max	0.5 dia	10+/-2	2.5+/-0.5
RP-102	1/8W	5.0+/-1	4.05+/-0.5	1.8+/-0.5	0.5 dia	10+/-2	3.5+/-0.5
RP-82	1/4W	6.3+/-1	4.05+/-0.5	2.2+/-0.5	0.5 dia	25+/5	5.0+/-0.5
RP-41	1/2W	6.3+/-1	9.0+/-1.0	2.2+/-0.5	0.5 dia	25+/5	5.0+/-0.5
RP-42	1/2W	9.0+/-1	6.3+/-1.0	2.2+/-0.5	0.5 dia	25+/5	7.5+/-0.5
(RP-14)	1W	14.0max	8.5max	2.5max	0.5 dia	10+/-2	10.0+/-0.5
RP-22	1W	15.0+/-1	8.0+/-1.0	2.8+/-0.8	0.5 dia	25+/5	12.5+/-0.5
RP-23	1W	17.0+/-1.5	6.3+/-1.0	2.8+/-0.8	0.5 dia	25+/5	15.0+/-0.5
RP-12	2W	22.5+/-1.5	9.0+/-1.0	2.8+/-0.8	0.8 dia	25+/5	20.0+/-0.5
RP-203	3W	22.5+/-1.5	15.0+/-1.0	3.55+/-1.0	0.8 dia	25+/5	20.0+/-0.5
RP-303	4W	22.5+/-1.5	15.0+/-1.0	4.25+/-1.0	0.8 dia	25+/5	20.0+/-0.5

Note 1: (RP-84) and (RP-14) in dimensional was shown only to select from leads pitch variety.

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PRECISION-NIKKOHM

RoHS

PRECISION RADIAL LEADED THIN FILM RESISTORS

RP-102, RP-82, RP-41, RP-42, RP-22, RP-23, RP-12, RP-203, RP-303

Specifications (Resistance Range in ohm)

Type	Power	Z---B	E---B	C---F	A---J	H---J
		5ppm/C, 0.1%	25ppm/C, 0.1%	50ppm/C, 1%	100ppm/C, 5%	250ppm/C, 5%
RP-102	1/8W	NA	51-10K	10-22K	5-51K	NA
RP-82	1/4W	100-100K	51-180K	10-250K	5-250K	1-250K
RP-41	1/2W	100-100K	10-402K	10-510K	5-510K	1-1M
RP-42	1/2W	100-100K	47-750K	10-1M	5-1M	1-1M
RP-22	1W	100-100K	51-1M	10-1M	5-1M	1-5.1M
RP-23	1W	100-100K	51-1M	10-1M	5-1M	1-5.1M
RP-12	2W	NA	51-1M	10-1M	5-3M	1-10M
RP-203	3W	NA	51-1M	10-1M	5-5M	1-15M
RP-303	4W	NA	51-1M	10-1M	5-5M	1-15M

Note 1: Power rating notations had been changed from previous specifications by results of long term test.
Note 2: Any combination of TCR and tolerance are available, as such as A---F(100ppm-1%), Z---D(5ppm-0.5%) or C---B.

Performances

	E-B(25ppm, 0.1%)	C-F(50ppm, 1.0%)	Conditions
Resistance Value	47-1Mohm	19-1Mohm	Any Value
TCR	25ppm/C	50ppm/C	
Tolerance	0.1%	1.0%	
Rated Ambient Temp.	-55-+70C	-55-+70C	
Operating Temp. Range	-55-+155C	-55-+155C	
Storage Temp. Range	-55-+155C	-55-+155C	
Max Applied Voltage	350V	500V	
Short Time Overload	+/-(0.10%+0.01ohm)	+/- (0.25%+0.01 ohm)	2.5 times rated power, 5 seconds.
Load Life	+/- (0.10%+0.01 ohm)	+/- (0.5%+0.01 ohm)	70C, 90min., on, 30min., off, 1000hours
Humidity	+/- (0.25%+0.01 ohm)	+/- (0.5%+0.01 ohm)	40C,90-95%RH,90min.,on,30min.,off, 1000h.
Temperature Cycle	+/- (0.10%+0.01 ohm)	+/- (0.25%+0.01 ohm)	-55C, 30min., +155C, 30 min., 20 cycles.
Soldering Heat	+/- (0.10%+0.01 ohm)	+/- (0.10%+0.01 ohm)	4mm portion, 350C, 3 seconds, dipping.
Withstanding Volt.	+/- (0.10%+0.01 ohm)	+/- (0.25%+0.01 ohm)	
Terminal Strength	+/- (0.10%+0.01 ohm)	+/- (0.25%+0.01 ohm)	
Insulation Resistance	>10,000Megohm	>10,000Megohm	

Ordering Information

P/N	Type	TCR	Resistance	Tolerance	RoHS Code	Notes
RP82Z90R2BZ00	RP82	Z(5ppm/C)	90.2ohm	B(0.1%)	Z00	
RP41E5K49BZ00	RP41	E(25ppm/C)	5.49Kohm	B(0.1%)	Z00	
RP42C103FZ00	RP42	C(50ppm/C)	10Kohm	F(1.0%)	Z00	
RP23E251BZ00	RP23	E(25ppm/C)	250ohm	B(0.1%)	Z00	

TCR and Tolerance

TCR	
X	+/-1ppm/K
Z	+/-5 ppm/K
N	+/-10 ppm/K
E	+/-25 ppm/K
C	+/-50 ppm/K
A	+/-100 ppm/K
H	+/-250 ppm/K

Tolerance	
T	+/-0.01
B	+/-0.1 %
C	+/-0.25 %
D	+/-0.5 %
F	+/-1 %
G	+/-2 %
J	+/-5 %

Note 3： Up to TCR±1ppm/K、tolerance+/-0.01% are available. Please call factory. 20090101

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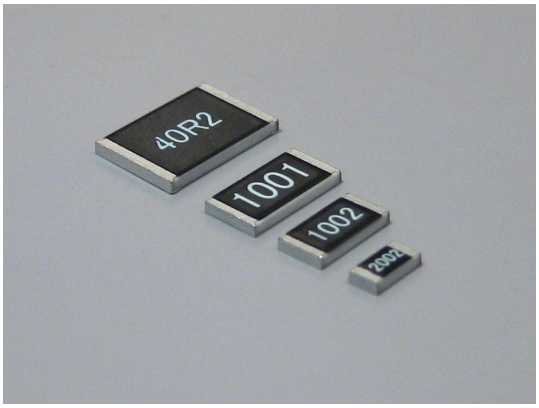


1/4W, 1/2W, 1W, 2W Thin Film Precision Chip

R1206, R1210, R2010, R2512, R3020

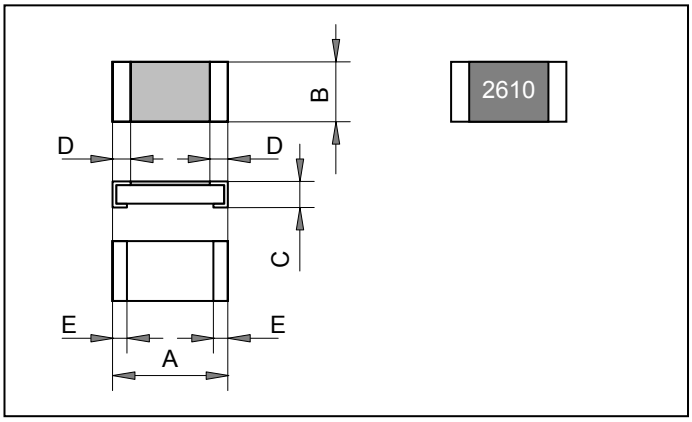
Features and Applications

Thin film precision chip resistor, 2.5ppm/deg C TC and 0.05% tolerance is standard.

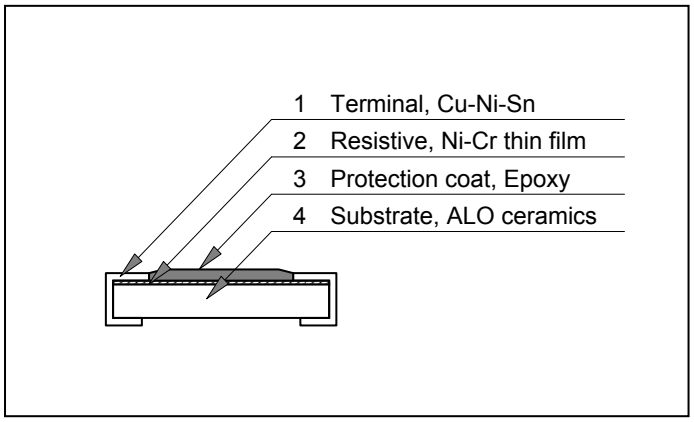
Ni-Cr alloy thin film resistor, which is made by the advanced Nikkohm process deposited on alumina ceramic substrate and offer the features of long term stability and very low TC.

Applications: Industrial measurement, control electronics and automatic test equipment.

Dimensional Specifications (mm)



Materials



	R1206-0.25W	R1210-0.25W	R2010-0.5W	R2512-1W	R3020-2W
A	3.05+/-0.2	3.05+/-0.2	5.08+/-0.2	6.35+/-0.2	7.62+/-0.2
B	1.53+/-0.2	2.54+/-0.2	2.54+/-0.2	3.05+/-0.2	5.08+/-0.2
C	0.70+/-0.1	0.70+/-0.1	0.70+/-0.1	0.70+/-0.1	0.70+/-0.1
D	0.41+/-0.3	0.41+/-0.3	0.58+/-0.3	0.58+/-0.3	0.58+/-0.3
E	0.36+/-0.2	0.36+/-0.2	0.51+/-0.2	0.51+/-0.25	0.51+/-0.25

Ordering Information

Type	TCR	Resistance	Tolerance	Packaging
R1206	Z	1002	A	Z01
R1206	Z (5ppm/degC)	1022	A (0.05%)	Z00 (Bulk)
R1210		E96		Z01 (Tape)
R2010				
R2512				
R3010				

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1/4W, 1/2W, 1W, 2W Precision Chip

R1206, R1210, R2010, R2512, R3020

Resistance Value, E24+ & E96+

1.00	1.02	1.05	1.07	1.10	1.13	1.15	1.18	1.20	1.21	1.24	1.27	1.30	1.33	1.37	1.40	1.43	1.47	1.50	1.54
1.58	1.60	1.62	1.65	1.69	1.74	1.78	1.80	1.82	1.87	1.91	1.96	2.00	2.05	2.10	2.15	2.20	2.21	2.26	2.32
2.37	2.40	2.43	2.49	2.50	2.55	2.61	2.67	2.70	2.74	2.80	2.87	2.94	3.00	3.01	3.09	3.16	3.24	3.30	3.32
3.40	3.48	3.57	3.60	3.65	3.74	3.83	3.90	3.92	4.02	4.12	4.22	4.30	4.32	4.42	4.53	4.64	4.70	4.75	4.87
4.99	5.00	5.10	5.11	5.23	5.36	5.49	5.60	5.62	5.76	5.90	6.04	6.19	6.20	6.34	6.49	6.65	6.80	6.81	6.98
7.15	7.32	7.50	7.68	7.87	8.06	8.20	8.25	8.45	8.66	8.87	9.09	9.10	9.31	9.53	9.76				

TCR and Tolerance Identifications

TCR	
TCR	Symbols
+/- 5ppm/C	Z

Tolerance	
Tolerance	Symbols
+/- 0.05%	A

Specifications

	R1206	R1210	R2010	R2512	R3020
Resistance	25-50Kohm	25-50Kohm	1-100kohm	1-100Kohm	1-100Kohm
TCR	+/-5ppm(Z)	+/-5ppm(Z)	+/-5ppm(Z)	+/-5ppm(Z)	+/-5ppm(Z)
Tolerance	+/-0.05%(A)	+/-0.05%(A)	+/-0.05%(A)	+/-0.05%(A)	+/-0.05%(A)
Resistance Value	E96, E24	E96, E24	E96, E24	E96, E24	E96, E24
Rating Powers	0.25W	0.25W	0.5W	1.0W	2W
Working Voltages	50VDC または $E = \sqrt{P \cdot R}$				
Operating Temp.	-25 deg C to +125 deg C				
Storage Temp.	-25 deg C to +125 deg C				

Performances

	R1206, R1210, R2010, R2512, R3020	条件 Conditions
Short Time Overload	+/- 0.05%	2.5 times rated power, 5seconds.
Insulating Voltage	+/- 0.01%	
Withstanding Voltage	+/- 0.01%	
Heat Shock	+/- 0.05%	
Vibration	+/- 0.01%	
Soldering Heat	+/- 0.05%	260 degree deg C, 10+/-1seconds.
Solder ability	90%	
Solvent	None	
Terminal Strength	+/- 0.05%	
Humidity	+/- 0.05%	40C, 90-95RH, DC0.1W, 1000hours
Load Life	+/- 0.05%	70 deg C, Rated Power, 90min ON, 30min OFF, 1000hours
Thermal EMF	---	
PCT	+/-0.05%	100H, Typical
Long Term Stability	+/-50ppm/year	Room Temperature, Typical

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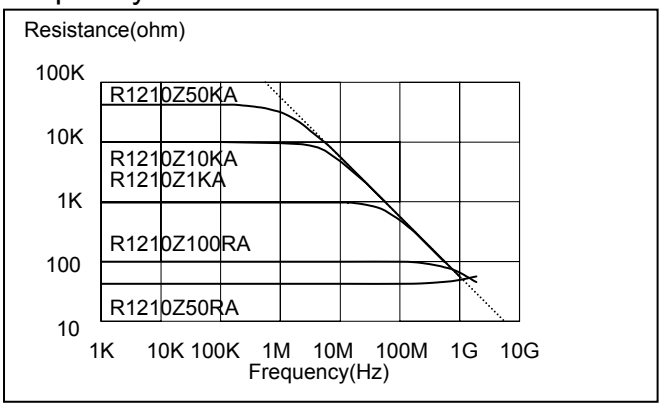
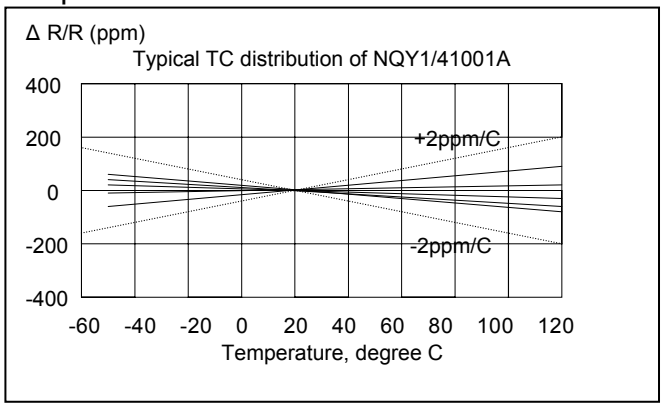
1/4W, 1/2W, 1W, 2W Precision Chip
R1206, R1210, R2010, R2512, R3020

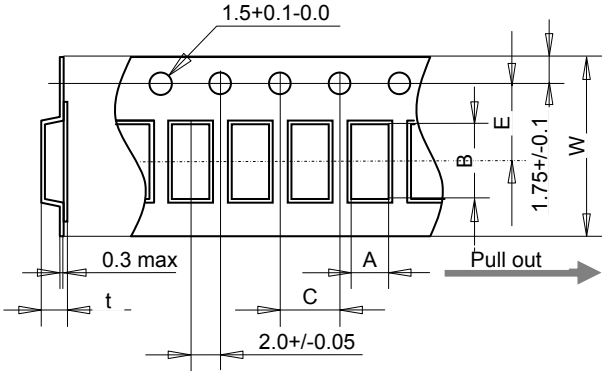
Frequency Characteristics

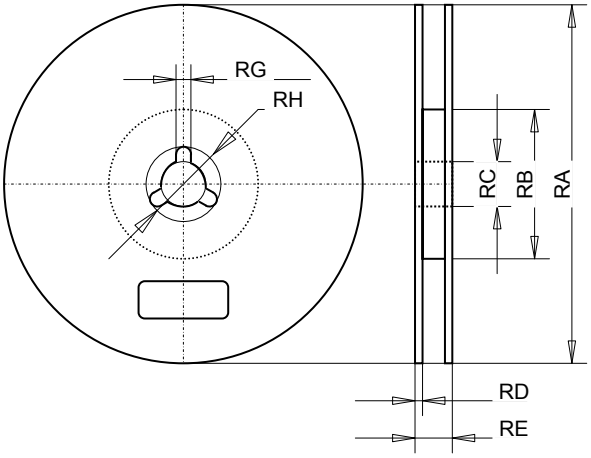


Temperature Characteristics



Packaging (please call factory)





Tape Dimensions

	A	B	C	W	E	t	Note
R1206	2.00+/-0.15	3.60+/-0.15	4.0+/-0.1	8.0+/-0.2	3.50+/-0.05	1.0 max.	
R1210	2.85+/-0.15	3.50+/-0.15		8.0+/-0.2	3.50+/-0.05	1.0+/-0.20	
R2010	3.10+/-0.15	5.50+/-0.15		12.30+/-0.2	5.50+/-0.05	1.1+/-0.15	
R2512	3.60+/-0.15	6.90+/-0.15		12.30+/-0.2	5.50+/-0.05	1.1+/-0.15	
R3020							

Reel Dimensions

	RA	RB	RC	RD	RE	RG	RH
R1206	φ 180+0/-1.5	φ 60+1/-0	φ 13+/-0.2	9.0+1.0/-0.0	11.4+/-1.0	2.0+/-0.5	21+/-0.8
R1210							
R2010							
R2512					13.0+/-1.0		
R3020							

Quantity per Reel

	Quantity
R1206	500pcs, 1000pcs, 2000cs
R1210	500pcs, 1000pcs, 2000pcs
R2010	500pcs, 1000pcs, 2000pcs
R2512	500pcs, 1000pcs
R3020	500pcs, 1000pcs

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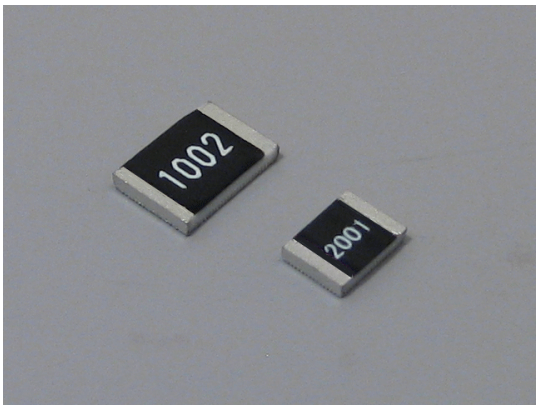


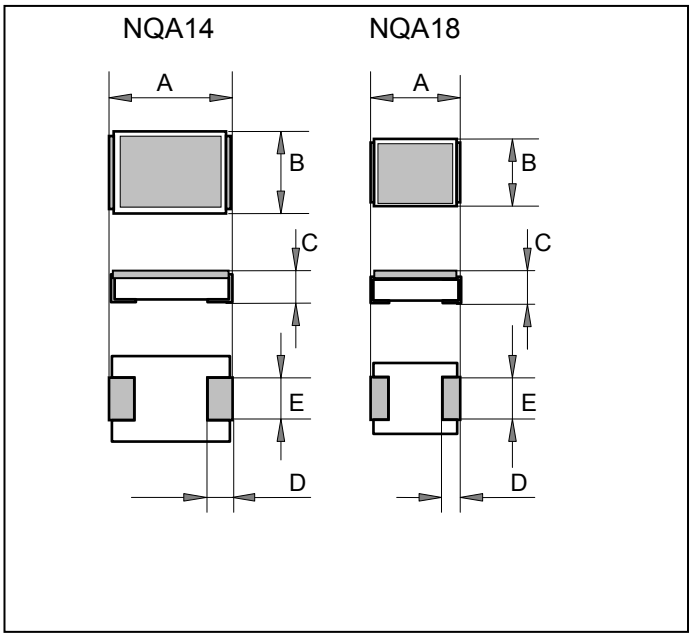
1/8W, 1/4W Precision Chip Resistors

NQA18, NQA14

Features and Applications

Thin film precision chip resistor, 5ppm/deg C TCR and 0.05% tolerance is in standard.
2.5ppm/C, 0.05% is available.
Ni-Cr alloy thin film resistor, which is made by the advanced Nikkohm process deposited on alumina ceramic substrate and offer the features of long term stability and very low TCR.
Application includes Industrial measurement, control electronics and automatic test equipment.

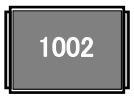
Dimensional Specifications (mm)



	NQA18	NQA14
A	3.2+/-0.2	4.5+/-0.2
B	2.5+/-0.2	3.2+/-0.2
C	1.0max.	1.0max.
D	0.8+/-0.3	1.0+/-0.3
E	1.4+/-0.3	1.4+/-0.3

Marking

(1) Marking shall be done with a method of IEC 4digits notation on each resistors.
(2) Type, TCR, resistance, tolerance, date-code manufacturer marking are print on surface of packaging.



Ordering Information

Type	TCR	Resistance	Tolerance	Code	Note
NQA14	Z	1131	A	Z01	
NQA18	Z (5ppm/K)	E24+ & E96	A (0.05%)	Z00	Bulk (1)
NQA14		10-33kohm (2)		Z01	Tape reel

Note: (1) Bulk packing (100pcs) and tape reel packing are available.
(2) TCR and tolerance will be 5ppm-0.1% in resistance 10ohm-99ohm

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1/8W, 1/4W Precision Chip Resistors. NQA18, NQA14

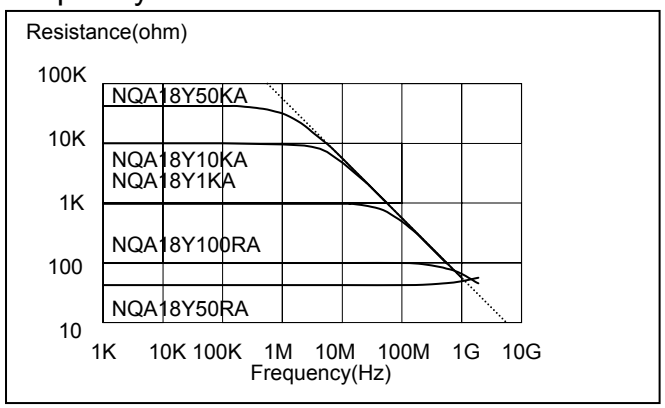
Specifications

Type	NQA18(1)(2)		NQA14(1)(2)	
Resistance	10-33K	100-33K	10-62K	100-62K
TCR	5ppm(Z)	5ppm(Z)	5ppm(Z)	5ppm(Z)
Tolerance	0.1%(B)	0.05%(A)	0.1%(B)	0.05%(A)
Resistance Value	E24+, E96	E24+, E96	E24+, E96	E24+, E96
Rating Powers	0.125W		0.25W	
Working Voltages	50VDC or $E = \sqrt{P \cdot R}$		100VDC or $E = \sqrt{P \cdot R}$	
Operating Temp.	-55 to +125 deg C		-55 to +125 deg C	
Storage Temp.	-55 to +125 deg C		-55 to +125 deg C	

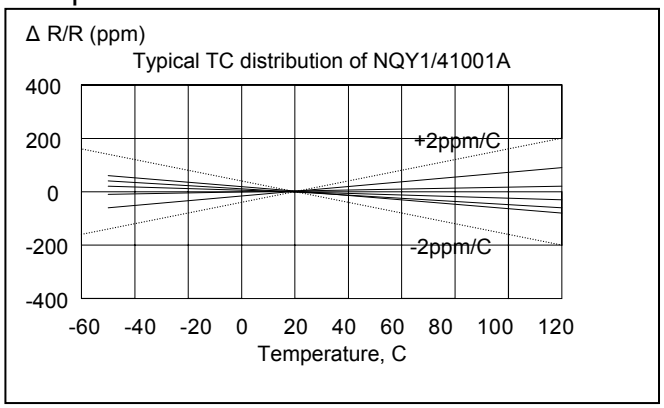
Performances

Term	NQA18	NQA14	Conditions
Short Time Overload	+/- 0.05%	+/- 0.05%	2.5 times rated power, 5seconds.
Insulating Voltage	+/- 0.01%	+/- 0.01%	
Withstanding Voltage	+/- 0.01%	+/- 0.01%	
Heat Shock	+/- 0.05%	+/- 0.05%	
Vibration	+/- 0.01%	+/- 0.01%	
Soldering Heat	+/- 0.05%	+/- 0.05%	260C, 10+/-1seconds.
Solder ability	---	---	
Solvent	---	---	
Terminal Strength	+/- 0.05%	+/- 0.05%	
Humidity	+/- 0.05%	+/- 0.05%	40C, 90-95RH, DC0.1W, 1000hours
Load Life	+/- 0.05%	+/- 0.05%	70C,Rated Power, 90min ON, 30min OFF, 1000hours
Thermal EMF	---	---	
PCT	+/-0.05%	+/-0.05%	100H, Typical
Long Term Stability	+/-50ppm/year	+/-50ppm/year	Room Temperature, Typical

Frequency Characteristics



Temperature Characteristics



1/8W, 1/4W Precision Chip Resistors NQA18, NQA14

TCR and Tolerance Notation (for reference only)

TCR	
TCR	Symbols
+/- 1.0 ppm/C	X
+/- 2.0 ppm/C	Y
+/-2.5 ppm/C	W
+/- 5.0 ppm/C	Z
+/-10 ppm/C	N

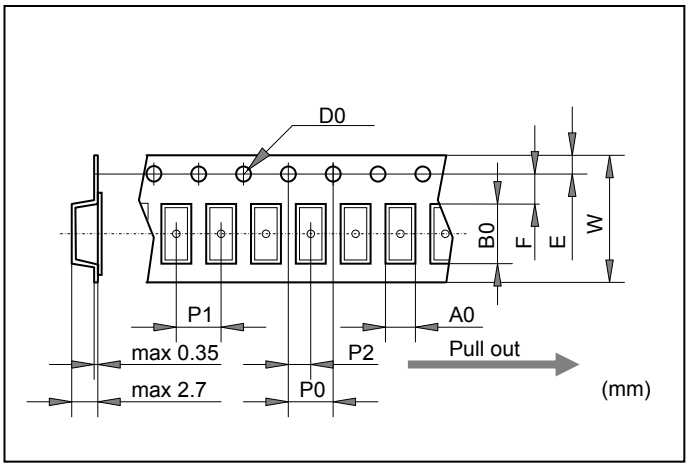
Tolerance	
Tolerance	Symbols
+/- 0.01 %	T
+/- 0.02 %	Q
+/- 0.025 %	---
+/- 0.05 %	A
+/-0.10 %	B

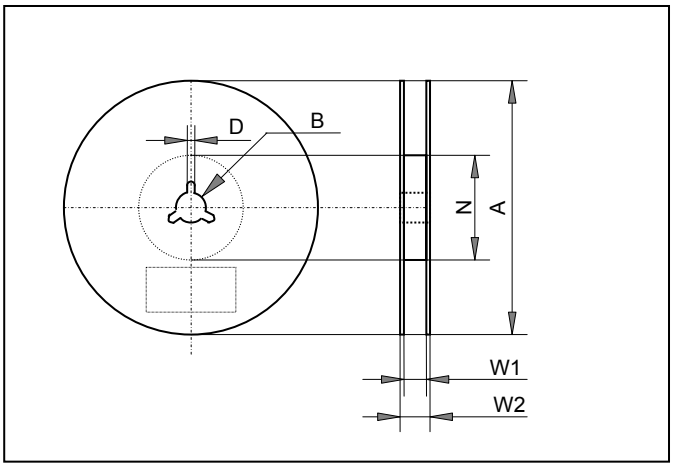
Resistance Value, Standard

E24+ (includes 2.5 and 5.0)												
1.0	1.1	1.2	1.3	1.5	1.6	1.8	2.0	2.2	2.4	(2.5)	2.7	3.0
3.3	3.6	3.9	4.3	4.7	(5.0)	5.1	5.6	6.2	6.8	7.5	8.2	9.1

E96												
1.00	1.02	1.05	1.07	1.10	1.13	1.15	1.18	1.21	1.24	1.27	1.30	1.33
1.37	1.40	1.43	1.47	1.50	1.54	1.58	1.62	1.65	1.69	1.74	1.78	1.82
1.87	1.91	1.96	2.00	2.05	2.10	2.15	2.21	2.26	2.32	2.37	2.43	2.49
2.55	2.61	2.67	2.74	2.80	2.87	2.94	3.01	3.09	3.16	3.24	3.32	3.40
3.48	3.57	3.65	3.74	3.83	3.92	4.02	4.12	4.22	4.32	4.42	4.53	4.64
4.75	4.87	4.99	5.11	5.23	5.36	5.49	5.62	5.76	5.90	6.04	6.19	6.34
6.49	6.65	6.81	6.98	7.15	7.32	7.50	7.68	7.87	8.06	8.25	8.45	8.66
8.87	9.09	9.31	9.53	9.76								

Tape Dimensions (mm)





Tape (mm)

Type	A0	B0	W	F	E	P1	P2	P0	D0
NQA18	2.8+/-0.2	3.9+/-0.2	8.0+/-0.3	5.5+/- 005	1.75+/- 0.1	4.0+/- 0.1	2.0+/- 0.05	4.0+/- 0.1	D 1.5+/- 0.1
NQA14	3.45+/- 0.2	5.1+/- 0.2	8.0+/- 0.3	5.5+/- 005	1.75+/- 0.1	8.0+/- 0.1	2.0+/- 0.05	4.0+/- 0.1	D 1.5+/-0.1

Reel (mm)

Type	A	N	B	D	W1	W2	Qty/reel
NQA18	D 178+/- 0.2	Min .D 60	dia13+/- 0.5	2+/- 05	12.4+/- 2.0	Max.18.4	2000pcs
NQA14	D 254+/-0.2	Min. D 80	dia13+/- 0.5	2+/- 05	12.4+/- 2.0	Max.18.4	2000pcs

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1/4W, 1/2W, 1W, 2W Power Chip Resistors
RPC14 (1/4W), RPC12 (1/2W), RPC11 (1W), RPC21 (2W)

Ordering Information

RPC12	E		100Kohm		B	Z01	Note
RPC14	E (25ppm/K)	>	E96+	>	B (0.1%)	Z00	Bulk/100pcs
RPC12	C (50ppm/K)	>	E24+	>	F (1.0%)	Z01	Tape/2000pcs
RPC11							
RPC21							

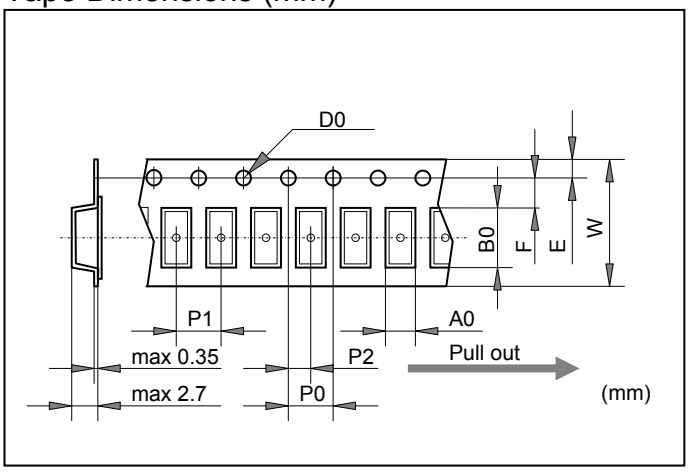
Specifications

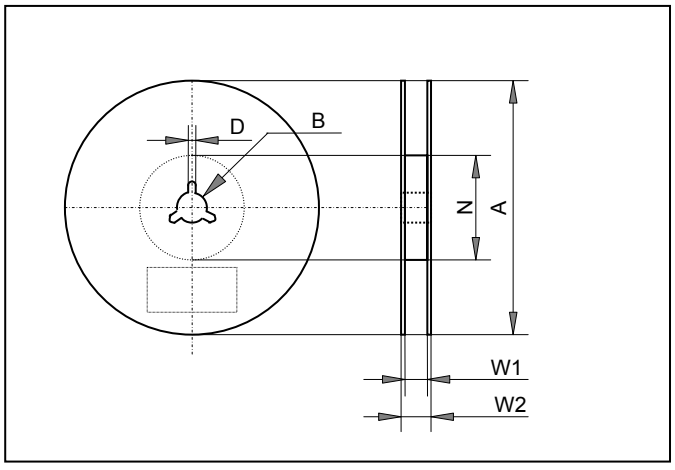
Power Rating	RPC14, 1/4W	RPC12, 1/2W	RPC11, 1W	RPC21, 2W
TCR	25ppm(E)	25ppm(E)	25ppm(E)	25ppm(E)
Tolerance	1%(B)	1%(B)	1%(B)	1%(B)
Resistance	100-51K	100-51K	100-100K	100-100K
Resistance	E96, E24+	E96, E24+	E96, E24+	E96, E24+
Working Voltages	100VDC or $E = \sqrt{P \cdot R}$			
Operating Temp.	-55 to +155 degC			
Storage Temp.	-55 to +155 degC			

Power Rating	RPC14, 1/4W	RPC12, 1/2W	RPC11, 1W	RPC21, 2W
TCR	50ppm(C)	50ppm(C)	50ppm(C)	50ppm(C)
Tolerance	1%(F)	1%(F)	1%(F)	1%(F)
Resistance	10-200K	10-200K	10-1M	10-1M
Resistance	E24+	E24+	E24+	E24+
Working Voltages	100VDC or $E = \sqrt{P \cdot R}$			
Operating Temp.	-55 to +155 degC			
Storage Temp.	-55 to +155 degC			

Note: Please request reliability specifications for RPC to factory.

Tape Dimensions (mm)





Tape (mm)

Type	A0	B0	W	F	E	P1	P2	P0	D0
RPC14	2.8+/-0.2	3.9+/-0.2	8.0+/-0.3	5.5+/- 005	1.75+/- 0.1	4.0+/- 0.1	2.0+/- 0.05	4.0+/- 0.1	D 1.5+/- 0.1
RPC12	3.45+/- 0.2	5.1+/- 0.2	8.0+/- 0.3	5.5+/- 005	1.75+/- 0.1	8.0+/- 0.1	2.0+/- 0.05	4.0+/- 0.1	D 1.5+/-0.1

Reel (mm)

Type	A	N	B	D	W1	W2	Qty/reel
RPC14	D 178+/- 0.2	Min .D 60	dia13+/- 0.5	2+/- 05	12.4+/- 2.0	Max.18.4	2000pcs
RPC12	D 254+/-0.2	Min. D 80	dia13+/- 0.5	2+/- 05	12.4+/- 2.0	Max.18.4	2000pcs

Note: Please request taping dimensional specification of RPC11 and RPC21 to factory.

20120601

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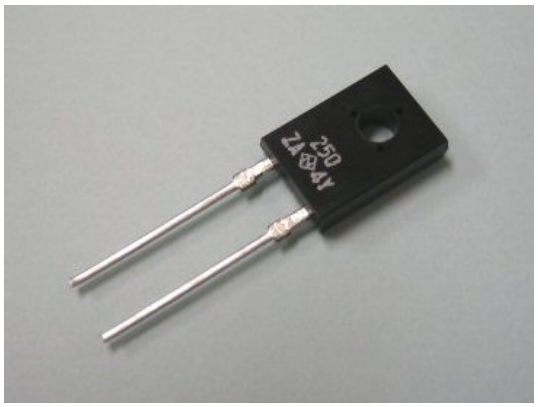


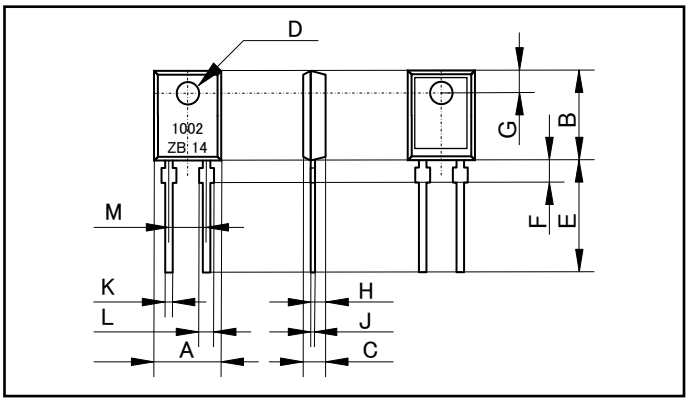
TO126 10W PRECISION POWER RESISTORS

RNP-10P

Features and Applications

0.1% accuracy, 5ppm/C TCR, TO126 style high precision high power resistors.
Now the precision series has been released. 10W rating power when attaching to metal case or heat-sink. RNP20P has proportional temperature vs. small resistance change between –55 to +120 deg C because of use of thin film, and no use of bulk metal resistance.
Non inductive and non capacitive impedance characteristic realized in range of DC to 100MHz.
2KV withstanding voltage between circuit and flange. Program-able precision voltage power supply, program precision current power supply, program high frequency power supply, program low distortion AC power supply, testing inspection equipment for power semiconductors and the other inverters, UPS, motor control, electronic load, high frequency power supply, high frequency amplifiers, 50ohm termination, adjustment resistor for high frequency, Wilkinson amplifier, etc.

Dimensions (mm)



	mm	mm
A	8.5	+/-0.2
B	12.0	+/-0.2
C	3.1	+/-0.2
D	3.1	+/-0.1
E	17.0	+/-1.0
F	3.2	+/-0.5
G	3.8	+/-0.2
H	1.75	+/-0.1
J	0.5	+/-0.05
K	0.6	+/-0.05
L	1.4	+/-0.05
M	5.08	+/-0.1

Ordering Information

Type	TCR	Resistance	Tolerance	Code	
RNP-10P	Z	1R25	B	Z00	PE Tube
RNP-10P	Z (5ppm/K)	E24+, E96	B (0.1%)	Z00	

Resistance Value, E24+ & E96

1.00	1.02	1.05	1.07	1.10	1.13	1.15	1.18	1.20	1.21	1.24	1.27	1.30	1.33	1.37	1.40	1.43	1.47	1.50	1.54
1.58	1.60	1.62	1.65	1.69	1.74	1.78	1.80	1.82	1.87	1.91	1.96	2.00	2.05	2.10	2.15	2.20	2.21	2.26	2.32
2.37	2.40	2.43	2.49	2.50	2.55	2.61	2.67	2.70	2.74	2.80	2.87	2.94	3.00	3.01	3.09	3.16	3.24	3.30	3.32
3.40	3.48	3.57	3.60	3.65	3.74	3.83	3.90	3.92	4.02	4.12	4.22	4.30	4.32	4.42	4.53	4.64	4.70	4.75	4.87
4.99	5.00	5.10	5.11	5.23	5.36	5.49	5.60	5.62	5.76	5.90	6.04	6.19	6.20	6.34	6.49	6.65	6.80	6.81	6.98
7.15	7.32	7.50	7.68	7.87	8.06	8.20	8.25	8.45	8.66	8.87	9.09	9.10	9.31	9.53	9.76				

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TO126 10W PRECISION POWER RESISTORS

RNP-10P

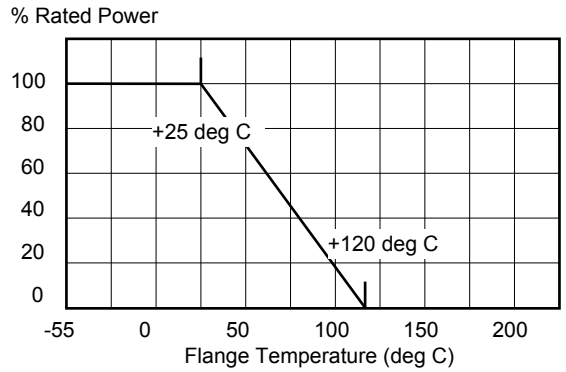
Specifications

Items	Specifications	Notes
Resistance Range	1 ohm – 51 k ohm	
TCR	+/-5 ppm/degree C (Z)	
Tolerance	+/-0.1% (B),	
Nominal Resistance	E24+、E96	
Operation Temp. Range	-55C to +120 degree C	
Rating Power Temp	+25 degree C	
Rating Power	10 Watt	At -55 to 25 deg C flange temperature
Derating Rating Power	5 Watt	At -55 to 25 C flange temperature
Heat Resistance	5.9 degree C/W	Hot spot to flange
Max. Operating Volt.	500V or $\sqrt{P \cdot R}$	
Inductance	10nH	At stand-off
Capacitance	1pF	At stand-off

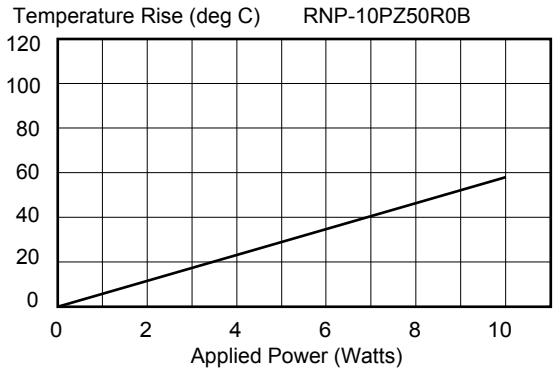
Performances

	Performances	Conditions
Withstanding Volt.	AC2000 Volt	60 seconds.
Insulation Resistance	Over 1,000 Meg ohm	Between terminals and flange.
Short Time Overload	+/- (0.25 %)	Rating power*2.5, 5 seconds, with heat sink
Temp. Cycle	+/- (0.25 %)	-55 C,30 min.,+120 C,30 min., 5cycles
Humidity	+/- (1.0 %)	40C, 90-95%RH, DC 0.1W, 1000 hours.
Load Life	+/-(1.0 %)	25 C, 90 min. ON, 30 min. OFF, 1000 hours.
Soldering Heat	+/- (0.1 %)	350+/-5 C, 3seconds,
Solder ability	Over 3/4 of surface	230+/-5 C, 3seconds.
Vibration	+/- (0.25 %)	JISC5202
Terminal Strength	+/- (0.25 %)	Tension 4.9N, 1-5 sec. Bend 2.45N, 90degree, 2 times.

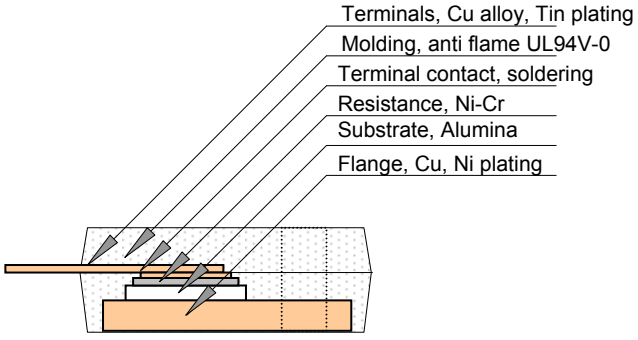
Derating



Temperature Rise



Materials



Notes

(1) Flange and resistor has insulated inside, when you attach flange to electric device metal case, please attach directly with screw stop.

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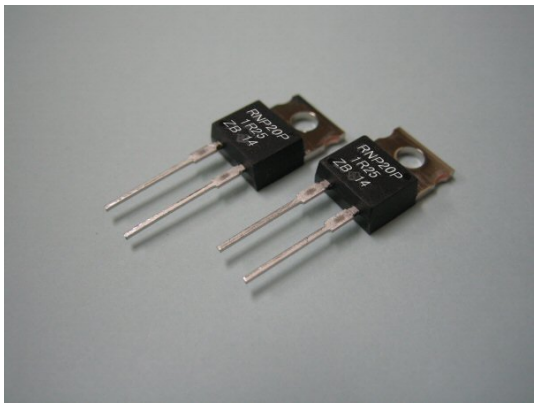


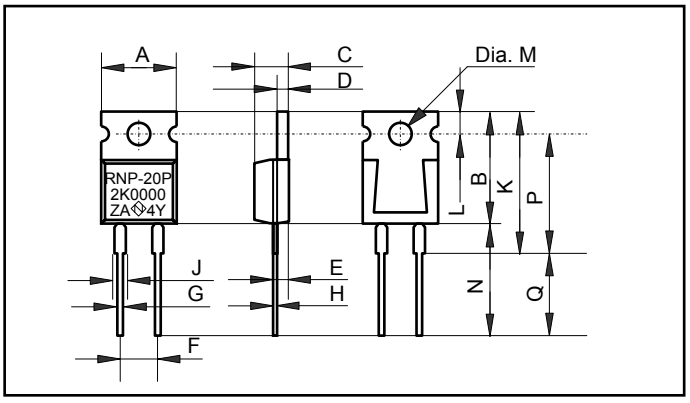
TO220 10W PRECISION POWER RESISTORS

RNP-20P

Features and Applications

0.1% accuracy, 5ppm/C TCR, TO220 style high precision high power resistors. The famously advanced TO220 resistors were produced by Nikkohm and were the worlds fastest in 1985.
Now the precision series has been released. 10W rating power when attaching to metal case or heat-sink. RNP-20P has proportional temperature vs. small resistance change between –55 to +120 deg C because of use of thin film, and no use of bulk metal resistance.
Non inductive and non capacitive impedance characteristic realized in range of DC to 100MHz.
2KV withstanding voltage between circuit and flange. Program-able precision voltage power supply, program precision current power supply, program high frequency power supply, program low distortion AC power supply, testing inspection equipment for power semiconductors and the other inverters, UPS, motor control, electronic load, high frequency power supply, high frequency amplifiers, 50ohm termination, adjustment resistor for high frequency, Wilkinson amplifier, etc.

Dimensions (mm)



Symbol	(mm)
A	10.1+/-0.2
B	15.0+/-0.2
C	4.5+/-0.2
D	1.5+/-0.1
E	2.45+/-0.2
F	5.08+/-0.5
G	0.75
H	0.50
J	1.5
K	19.0
L	2.7+/-0.5
M	3.6 dia.
N	15.0 min.
P	16.0+/-0.5
Q	11.0 min.

Ordering Information

Type	TCR	Resistance	Tolerance	Code	Note
RNP-20P	Z	1R25	B	Z00	PE Tube
RNP-20P	Z (5ppm/K)	E24+, E96	B (0.1%)	Z00	

Resistance Value, E24+ & E96

1.00	1.02	1.05	1.07	1.10	1.13	1.15	1.18	1.20	1.21	1.24	1.27	1.30	1.33	1.37	1.40	1.43	1.47	1.50	1.54
1.58	1.60	1.62	1.65	1.69	1.74	1.78	1.80	1.82	1.87	1.91	1.96	2.00	2.05	2.10	2.15	2.20	2.21	2.26	2.32
2.37	2.40	2.43	2.49	2.50	2.55	2.61	2.67	2.70	2.74	2.80	2.87	2.94	3.00	3.01	3.09	3.16	3.24	3.30	3.32
3.40	3.48	3.57	3.60	3.65	3.74	3.83	3.90	3.92	4.02	4.12	4.22	4.30	4.32	4.42	4.53	4.64	4.70	4.75	4.87
4.99	5.00	5.10	5.11	5.23	5.36	5.49	5.60	5.62	5.76	5.90	6.04	6.19	6.20	6.34	6.49	6.65	6.80	6.81	6.98
7.15	7.32	7.50	7.68	7.87	8.06	8.20	8.25	8.45	8.66	8.87	9.09	9.10	9.31	9.53	9.76				

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TO220 10W PRECISION POWER RESISTORS

RNP-20P

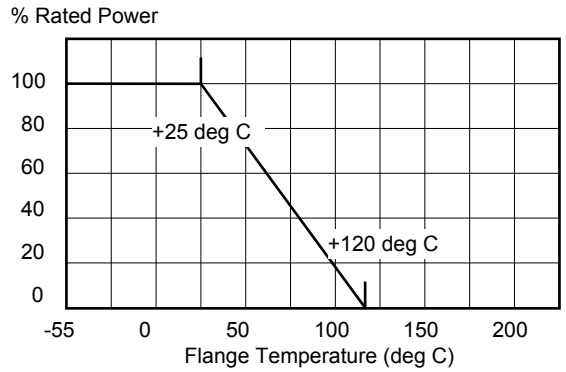
Specifications

Items	Specifications	Notes
Resistance Range	1 ohm – 51 k ohm	
TCR	+/-5 ppm/degree C (Z)	
Tolerance	+/-0.1 % (B),	
Nominal Resistance	E24+, E96	
Operation Temp. Range	-55C to +120 degree C	
Rating Power Temp	+25 degree C	
Rating Power	10 Watts	At -55 to 25 C flange temperature
Derated Rating Power	5 Watts	At -55 to 25 C flange temperature
Heat Resistance	3.3 degree C/W	Hot spot to flange
Max. Operating Volt.	500V or $\sqrt{P \cdot R}$	
Inductance	10nH	At stand-off
Capacitance	1pF	At stand-off

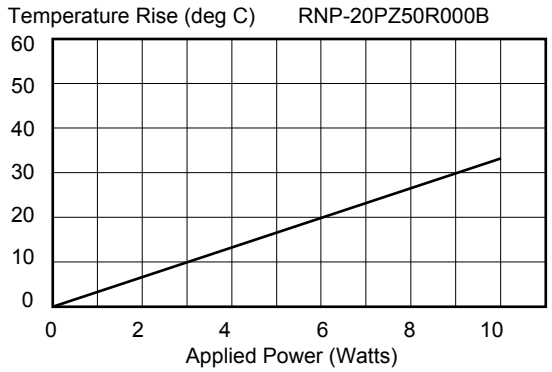
Performances

	Performances	Conditions
Withstanding Volt.	AC2000 Volt	60 seconds.
Insulation Resistance	Over 1,000 Meg ohm	Between terminals and flange.
Short Time Overload	+/- (0.25 %)	Rating power*2.5, 5 seconds, with heat sink
Temp. Cycle	+/- (0.25 %)	-55 C,30 min.,+120 C,30 min., 5cycles
Humidity	+/- (1.0 %)	40C, 90-95%RH, DC 0.1W, 1000 hours.
Load Life	+/-(1.0 %)	25 C, 90 min. ON, 30 min. OFF, 1000 hours.
Soldering Heat	+/- (0.1 %)	350+/-5 C, 3seconds,
Solder ability	Over 3/4 of surface	230+/-5 C, 3seconds.
Vibration	+/- (0.25 %)	JISC5202
Terminal Strength	+/- (0.25 %)	Tension 4.9N, 1-5 sec. Bend 2.45N, 90degree, 2 times.

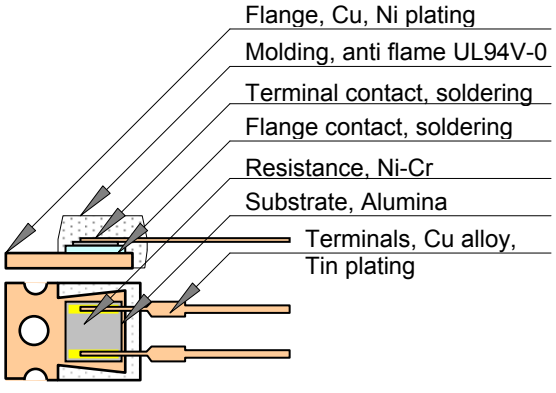
Derating



Temperature Rise



Materials



Notes

(1) Flange and resistor has insulated inside, when you attach flange to electric device metal case, please attach directly with screw stop.

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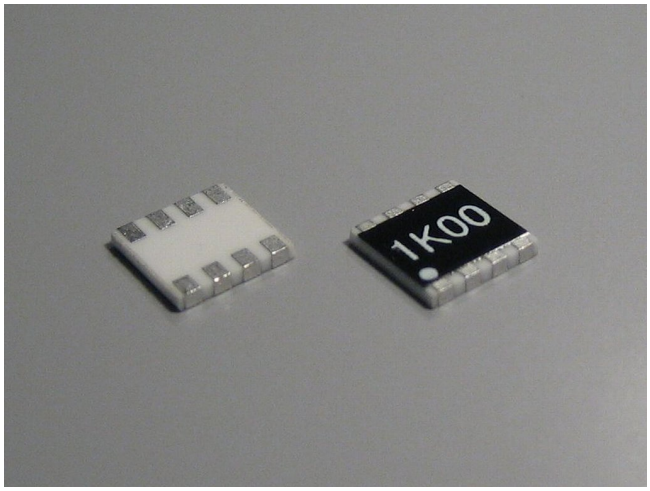
CHIP RESISTOR NETWORKS

SOIC TYPE

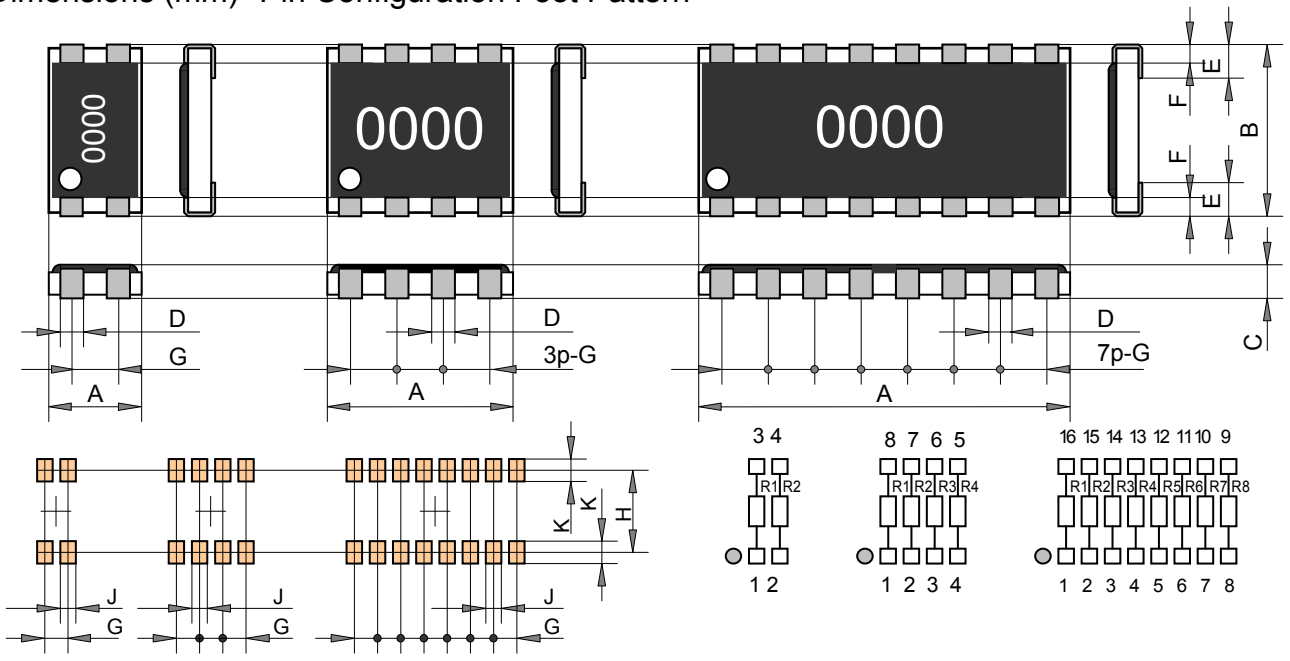
MCM4, MCM8, MCM16



Features and Applications

1ppm/C tracking and 0.01% ratio precision NiCr thin film resistor networks.
50mW/resistor rating sufficient power derating for 5 volt analog circuits.
Simple standard circuits for 8pin available to satisfy flexible circuit design requirements.
Supplied in plastic tape reel for automated assembling.
Custom designed circuits also available in 8pin configuration. Customer service will be advised.
Measurement, industrial electronics, industrial instruments, automatic testing, high-speed digital data transmission, intelligent hubs and routers, and data switching.

Dimensions (mm) Pin Configuration Foot Pattern



	A	B	C	D	E	F	G	H	J	K
MCM4	3.00	5.00	0.80	0.635	1.00	(0.5)	1.27	4.00	0.635	1.00
	+/-0.2	+/-0.1	+/-0.2	+/-0.1	+/-0.2		+/-0.1	-	+/-0.1	-
MCM8	5.00	5.00	0.80	0.635	1.00	(0.5)	1.27	4.00	0.635	1.00
	+/-0.2	+/-0.1	+/-0.2	+/-0.1	+/-0.2		+/-0.1	-	+/-0.1	-
MCM16	10.00	5.00	0.80	0.635	1.00	(0.5)	1.27	4.00	0.635	1.00
	+/-0.2	+/-0.1	+/-0.2	+/-0.1	+/-0.2		+/-0.1	-	+/-0.1	-

MCM4, MCM8, MCM16

Ordering Information

Type	TCR	Resistance	Tol.	Package
MCM8	T(5ppm-2ppm)	10kohm	Q(0.1%-0.01%)	Z00
MCM4	Z (5 ppm/C)	E24 & E96	A (0.05%)	Z00(Bulk)
MCM8	P (10ppm/C)			Z01(Tape)
MCM16	Q (5 ppm/C)		Q (0.01%)	
MCM4-00	R (1 ppm/C)		R (0.02%)	
MCM8-00	S (5 ppm/C)		S (0.05%)	
MCM16-00	T (2 ppm/C)		T (0.10%)	

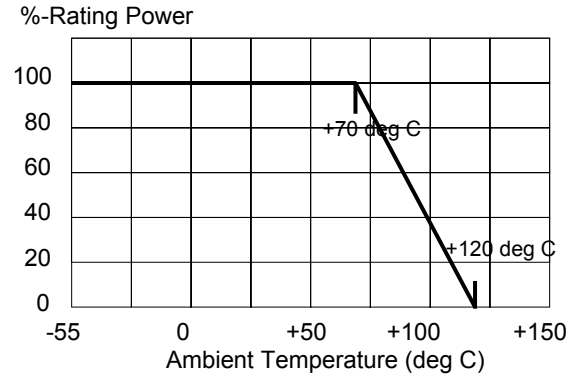
Note: When MCM8 T 10kohm Q Z00, R1=R2=R3=R4=10kohm Tracking 2ppm/deg C, matching: 0.01% at -20 deg C to +120 deg C

Matching Tracking Notation

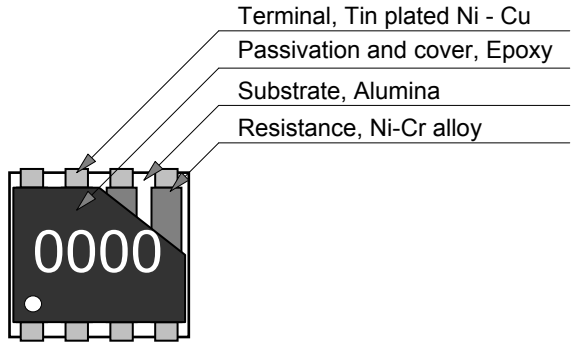
	TCR	Tracking
P	+/-50 ppm/deg C	10 ppm/deg C
Q	+/-10 ppm/deg C	5 ppm/deg C
R	+/-5 ppm/deg C	1 ppm/deg C
S	+/-25 ppm/deg C	5 ppm/deg C
T	+/-5 ppm/deg C	2 ppm/deg C

	Tolerance	Ratio
P	+/-0.05%	0.01%
Q	+/-0.1%	0.01%
R	+/-0.1%	0.02%
S	+/-0.1%	0.05%
T	+/-0.1%	0.10%

Derating



Material



Performances

Type	MCM	Note
Resistance Range (ohm)	100 ohm - 22Kohm	E24+ and E96
Standard Resistance	100ohm 1Kohm 10Kohm	Same resistance
TC-Absolute	+/-5ppm/deg C	-20 deg C to +120 deg C
TC-Tracking	+/-1ppm/deg C	-20 deg C to +120 deg C
Tolerance-Absolute	+/-0.05%	-20 deg C to +120 deg C
Tolerance-Matching	+/-0.01%	-20 deg C to +120 deg C
Rating Power/Resistor	50 mW	
Rating Power/Package	0.2 W	
Max. Operating Volt.	$\sqrt{P \cdot R}$ or 80 V	
Rating Temp.	+70℃	
Operating Temp. Range	-55 to +120 deg C	
Storage Temp. Range	-55 to +120 deg C	

Electrical Specifications

Items	Specifications	Conditions
Short Time Overload	+/-(0.05%) absolute	2.5 times rating power, 5 seconds
Insulation Resistance	>10,000Mohm	
Withstand Voltage	+/-(0.05%) absolute	100V, 60 seconds
Heat Shock	+/-(0.1%) absolute	5 cycles for temp. -65, +25, +125, +25 degC
Soldering Heat	+/-(0.05%) absolute	350 deg C, 3 seconds
Solder ability	Covered 95% area	230 deg C, 3 seconds
Solvent	No mechanical damage	
Humidity	+/-(0.1%) absolute	40 deg C, 90-95RH, DC 0.1W, 1000hours
Load Life	+/-(0.1%) absolute	70 deg C, 90min.ON, 30minOFF, 1000hours

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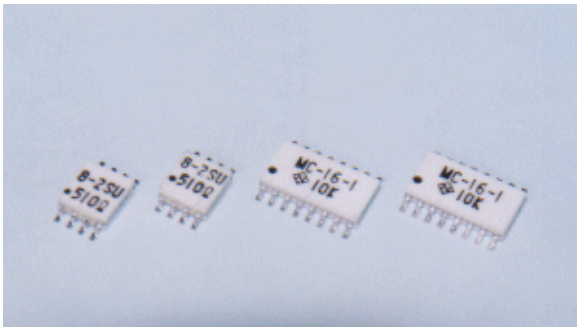
SOP SOIC RESISTOR NETWORKS

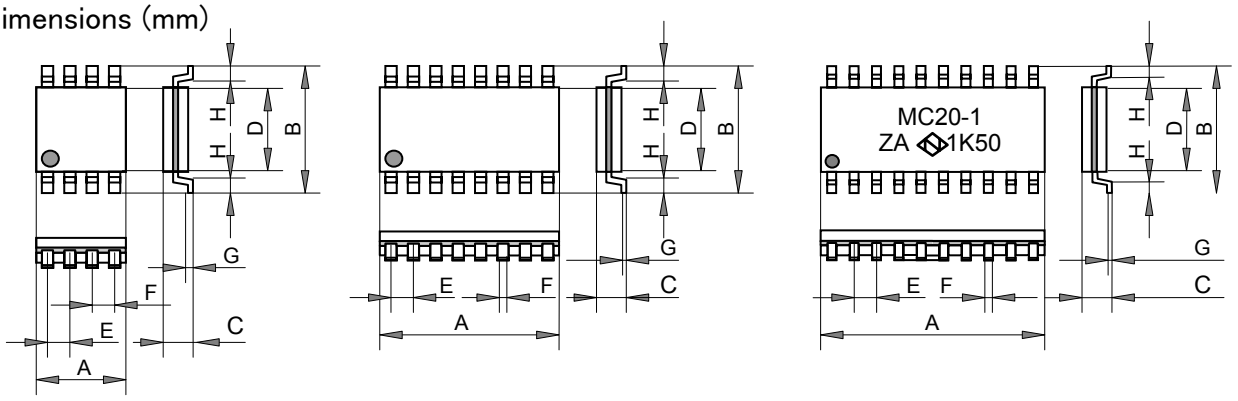
MC8, MC16, MC20
MCN8, MCN16, MCN20



Features and Applications

5ppm/C TCR and 0.05% tolerance standard super precision Ni-Cr thin film resistor networks.
50mW/resistor rating sufficient power derating for 5-15 volt swinging circuits.
Simple standard circuits for 8 pins, 16 pins and 20 pins available to satisfy flexible circuit design requirements.
Both narrow SOIC and SOP available.
Supplied in plastic stick or tape reel for automated assembling.
Custom designed circuits also available in 8, 14, 16, 18, and 20pins ceramic packages. Customer service will be advised.
Industrial electronics, industrial instruments, measurement, automatic test, high-speed digital data transmission, intelligent hubs and routers and data switching.

Dimensions (mm)



MC8, MCN8 MC16, MCN16 MC20, MCN20

	A	B	C	D	E	F	G	H
MC8	5.5+/-0.2	8.0+/-0.2	2.3max	5.3+/-0.2	1.27+/-0.2	0.4+/-0.05	0.2+/-0.1	0.3min
MCN8	5.5+/-0.2	5.99+/-0.2	2.3max	3.81+/-0.2	1.27+/-0.2	0.4+/-0.05	0.2+/-0.1	0.3min
MC16	10.5+/-0.2	8.0+/-0.2	2.3max	5.3+/-0.2	1.27+/-0.2	0.4+/-0.05	0.2+/-0.1	0.3min
MCN16	10.5+/-0.2	5.99+/-0.2	2.3max	3.81+/-0.2	1.27+/-0.2	0.4+/-0.05	0.2+/-0.1	0.3min
MC20	13.0+/-0.5	8.0+/-0.2	2.3max	5.3+/-0.2	1.27+/-0.2	0.4+/-0.05	0.2+/-0.1	0.3min
MCN20	13.0+/-0.5	5.99+/-0.2	2.3max	3.81+/-0.2	1.27+/-0.2	0.4+/-0.05	0.2+/-0.1	0.3min

Ordering Information

Type	Schematic	TCR	Resistance	Tolerance	Packaging	Note
MCN8	-1	Z	102	A	000	Bulk
MC8	-1	Z (5ppm)	101-223	A (0.05%)	000	Bulk
MC16				B (0.10%)	001	Tape
MC20					003	Tube
MCN8						
MCN16						
MCN20						

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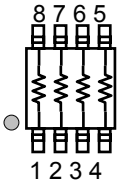
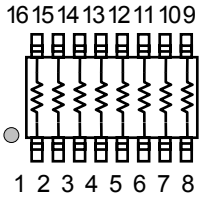
SOP RESISTOR NETWORKS

MC8, MC16

Schematics and Pin Configuration

MC8-1	MC16-1
	

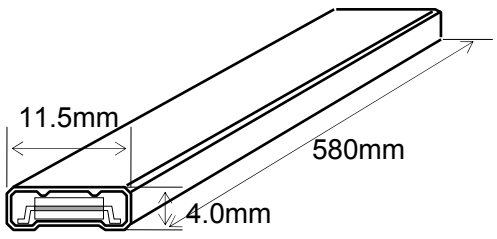
Performances

Type	MC8-1	MC16-1
Resistance Range (ohm)	100-22K	100-22K
TC Tracking	1ppm/K	1ppm/K
Ratio	0.01%	0.01%
TC-Absolute	+/-5ppm/K(Z)	+/-5ppm/K(Z)
Tolerance-Absolute	+/-0.05% (A), +/-0.1% (B)	+/-0.05% (A), +/-0.1% (B)
Rating Power/Resistor	100mW	100mW
Rating Power/Package	0.4W	1W
Max. Operating Volt.	$\sqrt{P \cdot R}$ or 100V	
Rating Temp.	+75 deg C	
Operating Temp. Range	-55 deg C to +120 deg C	
Storage Temp. Range	-55 deg C to +120 deg C	

Electrical Specifications

Items	Specifications	Conditions
Short Time Overload	+/-(0.05%) absolute	2.5 times rating power, 5 seconds
Insulation Resistance	>10,000Mohm	
Withstand Voltage	+/-(0.05%) absolute	100V, 60 seconds
Heat Shock	+/-(0.1%) absolute	5 cycles for temp. -65, +25, +125, +25 C
Soldering Heat	+/-(0.05%) absolute	350 C, 3 seconds
Solder ability	Covered 95% area	230 C, 3 seconds
Solvent	No mechanical damage	
Humidity	+/-(0.1%) absolute	40 C, 90-95RH, 90min.ON, 30minOFF, 1000hours
Load Life	+/-(0.1%) absolute	70 C, 90min.ON, 30minOFF, 1000hours

Stick (Symbol:003)



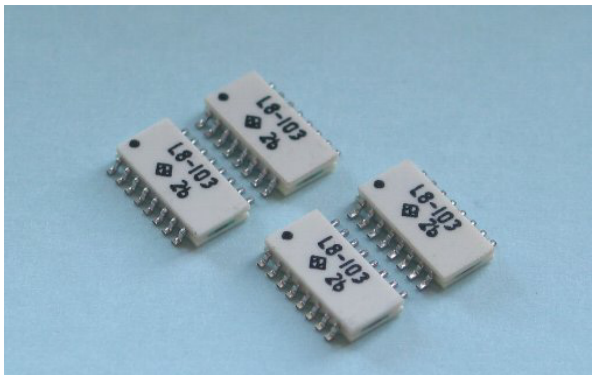
Note:

In P/N definition, additional 3 digits code shows packaging method. Third digit “0” shows bulk and “3” shows stick packaging.

MC8 and MC16 are not RoHS compliance parts. When you have any question, please mail to: sales@nikkohm.com.

SURFACE-MOUNT LADDER NETWORKS

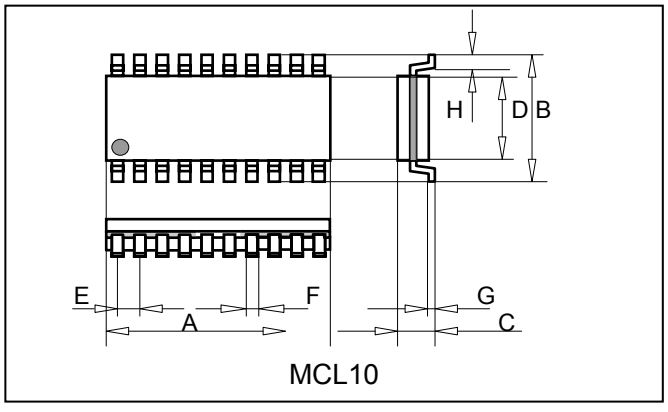
MCL6, MCL8, MCL10



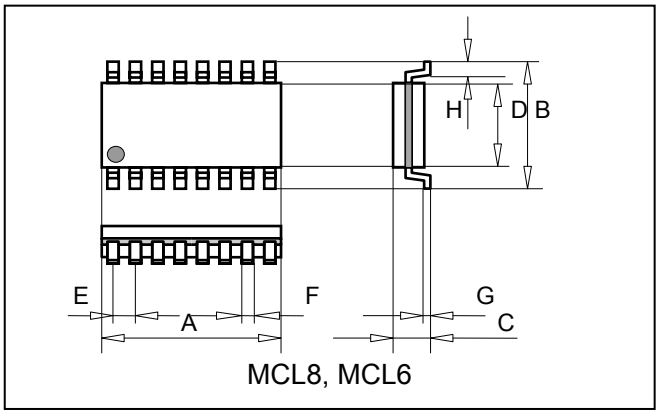
Features and Applications

10bit, 8bit and 6bit R-2R ladder resistor networks for voltage output DA conversion circuits.
Tight ratio and tracking performance realized through high precision thin film technologies that allow for absolute 5ppm/C TC and 0.05% tolerance.
Standard 16 and 20pins ceramic SOP packages and PE plastic stick.
Realizes long life stability and wide operating temperatures.
Industrial power supplies, standard voltage supplies, precision AD converter, digital signal processing, direct digital waveform synthesizer, measurements, industrial instruments, high speed digital data transmission, intelligent hubs and data switching.

Dimensional Specifications (mm)



MCL10



MCL8, MCL6

Type	Unit	A	B	C	D	E	F	G	H
MCL10	mm	13.8+/-0.2	5.3+/-0.2	2.3max	8.0+/-0.2	1.27+/-0.2	0.4+/-0.05	0.2+/-0.2	0.3min
MCL8, MCL6	mm	11.3+/-0.2	5.3+/-0.2	2.3max	8.0+/-0.2	1.27+/-0.2	0.4+/-0.05	0.2+/-0.2	0.3min

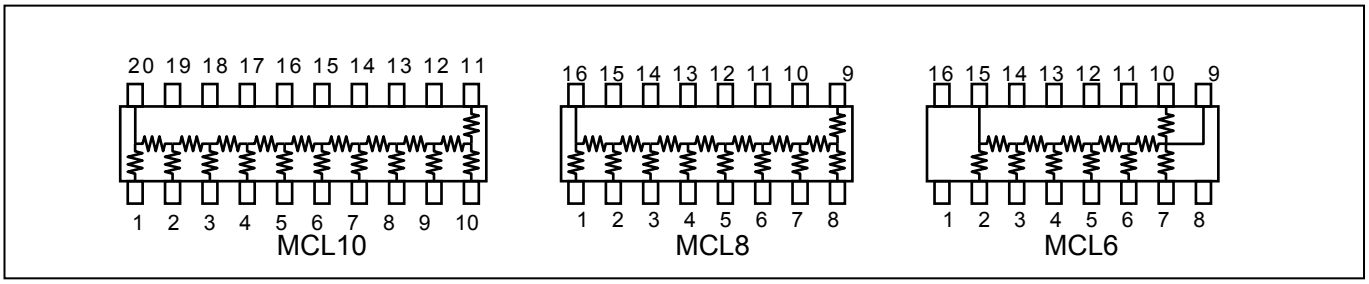
形名呼称 Ordering Information

P/N	Type	R1	R2	Packaging
MCL10-102-003	MCL10-	1kohm	2kohm	Stick
MCL10-103-001	MCL10-	10kohm	20kohm	Tape
MCL8-103-003	MCL8-	10kohm	20kohm	Stick
MCL6-102-000	MCL6-	1kohm	2kohm	Bulk

SURFACE-MOUNT LADDER NETWORKS

MCL6, MCL8, MCL10

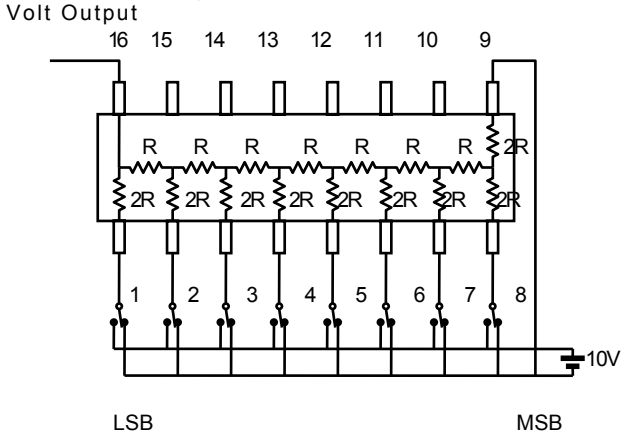
Schematics



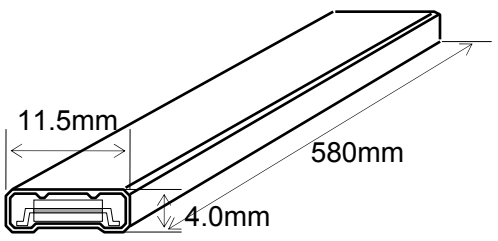
Specifications and Performances

Items	Specifications			Conditions
Type	MCL10	MCL8	MCL6	
Conversion Type	Volt. Output	Volt. Output	Volt. Output	
Resolution	10bits	8bits	6bits	
Resistance Range (ohm)	1k-2k or 10k-20k			R-2R
Linearity	+/-1/2LSB	+/-1/2LSB	+/-1/2LSB	-55C – 155C
Rating Voltage, Max.	10V	10V	10V	
TC-Absolute	+/-5ppm/C	+/-5ppm/C	+/-5ppm/C	
Tolerance-Absolute	+/-0.1%	+/-0.1%	+/-0.1%	
Rating Power	0.1 Watts/resistor			0C - 70C
Applied Volt.	100V or sqrt(PR)			
Humidity	+/-(0.25%+0.05ohm)			
Load Life	+/-(0.25%+0.05ohm)			
Temp. Cycle	+/-(0.25%+0.05ohm)			
Soldering Heat	+/-(0.10%+0.05ohm)			350C+/-5C, 3 seconds
Operating Temp. Range	-55 - +120C			
Storage Temp. Range	-55 - +120C			

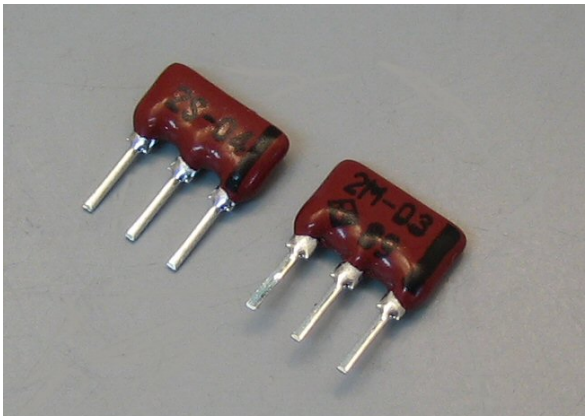
Typical Circuit.(MCL8)



Stick (Symbol:003)



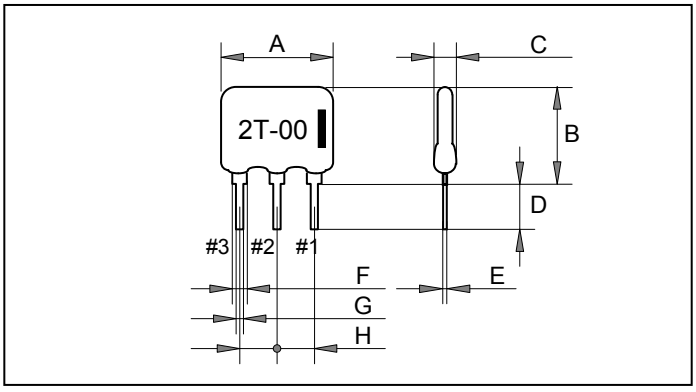
THROUGH-HOLE MATCHED PAIR SIP RESISTOR NETWORKS 2S, 2M, 2T



Features and Applications

High precision matched pair SIP resistor networks made by Ni-Cr thin film sputter on alumina substrates with high density patterning technologies.
1ppm-0.05% tight ratio tolerance and TC tracking are realized at 2T series.
2S and 2M show good performance and economical.
A lot of combination of resistance value is standardized for quick delivery.
2.5mm width slim body and 5.0mm high from PC board fit for high density layout design. (2S)
Wide applications such as voltage dividers, feed back resistors, voltage reference circuit in data processing, data transmission, precision power sources of industrial controls, medical, measurements, ATE.

Dimensions (mm)



	2T	2S	2M
A	8.0max	8.0max	8.0max
B	5.0max	5.0max	7.0max
C	2.54max	2.54max	2.54max
D	3.3	3.3	3.3
E	0.25	0.25	0.25
F	1.2	1.2	1.2
G	0.5	0.5	0.5
H	2.54	2.54	2.54

Ordering Information

p/n	Code	Note
2T-01	Z00	
↓	↓	
2T-01, 2T-02, 2T-03, 2T-04, 2T-05, 2T-06, 2T-07, 2T-08, 2T-09, 2T-10, 2T-11, 2T-12, 2T-13, 2T-14, 2T-15, 2T-16, 2T-17, 2T-18	Z00	Bulk
2S-01, 2S-02, 2S-03, 2S-04, 2S-05, 2S-06, 2S-07, 2S-08, 2S-09, 2S-10, 2S-11, 2S-12, 2S-13, 2S-14, 2S-15, 2S-16, 2S-17, 2S-18		
2M-01, 2M-02, 2M-03, 2M-04, 2M-05, 2M-06, 2M-07, 2M-08, 2M-09, 2M-10, 2M-11, 2M-12, 2M-13, 2M-14, 2M-15, 2M-16, 2M-17, 2M-18		

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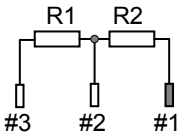
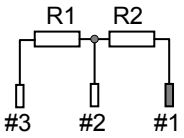
THROUGH-HOLE MATCHED PAIR SIP RESISTOR NETWORKS 2T, 2S, 2M

Electrical specifications

Type		Resistance		Tolerance		TCR		Pin configurations
		R1,#2-#3	R2,#1-#2	Absolute	Ratio	Absolute	Tracking	
2M-01	2S-01	1Kohm	1Kohm	+/-1%	0.1%	+/-25ppm	5ppm	
2M-02	2S-02	1Kohm	10Kohm	+/-1%	0.1%	+/-25ppm	5ppm	
2M-03	2S-03	10Kohm	10Kohm	+/-1%	0.1%	+/-25ppm	5ppm	
2M-04	2S-04	10Kohm	20Kohm	+/-1%	0.1%	+/-25ppm	5ppm	
2M-05	2S-05	20Kohm	20Kohm	+/-1%	0.1%	+/-25ppm	5ppm	
2M-06	2S-06	15Kohm	15Kohm	+/-1%	0.1%	+/-25ppm	5ppm	
2M-07	2S-07	30Kohm	30Kohm	+/-1%	0.1%	+/-25ppm	5ppm	
2M-08	2S-08	3Kohm	680ohm	+/-1%	0.1%	+/-25ppm	5ppm	
2M-09	2S-09	2.2Kohm	10Kohm	+/-1%	0.1%	+/-25ppm	5ppm	
2M-10	2S-10	50Kohm	50Kohm	+/-1%	0.1%	+/-25ppm	5ppm	
2M-11	2S-11	30Kohm	10Kohm	+/-1%	0.1%	+/-25ppm	5ppm	
2M-12	2S-12	60Kohm	20Kohm	+/-1%	0.1%	+/-25ppm	5ppm	
2M-13	2S-13	18Kohm	2Kohm	+/-1%	0.1%	+/-25ppm	5ppm	
2M-14	2S-14	1Kohm	3Kohm	+/-1%	0.1%	+/-25ppm	5ppm	
2M-15	2S-15	1Kohm	9Kohm	+/-1%	0.1%	+/-25ppm	5ppm	
2M-17	2S-17	3Kohm	6Kohm	+/-1%	0.1%	+/-25ppm	5ppm	
2M-18	2S-18	2Kohm	10Kohm	+/-1%	0.1%	+/-25ppm	5ppm	



Type	Resistance		Tolerance		TCR		Pin configurations
	R1,#2-#3	R2,#1-#2	Absolute	Ratio	Absolute	Tracking	
2T-01	1Kohm	1Kohm	+/-0.1%	0.05%	+/-5ppm	1ppm	
2T-02	1Kohm	10Kohm	+/-0.1%	0.05%	+/-5ppm	1ppm	
2T-03	10Kohm	10Kohm	+/-0.1%	0.05%	+/-5ppm	1ppm	
2T-04	10Kohm	20Kohm	+/-0.1%	0.05%	+/-5ppm	1ppm	
2T-05	20Kohm	20Kohm	+/-0.1%	0.05%	+/-5ppm	1ppm	
2T-06	15Kohm	15Kohm	+/-0.1%	0.05%	+/-5ppm	1ppm	
2T-07	30Kohm	30Kohm	+/-0.1%	0.05%	+/-5ppm	1ppm	
2T-08	3Kohm	680ohm	+/-0.1%	0.05%	+/-5ppm	1ppm	
2T-09	2.2Kohm	10Kohm	+/-0.1%	0.05%	+/-5ppm	1ppm	
2T-10	50Kohm	50Kohm	+/-0.1%	0.05%	+/-5ppm	1ppm	
2T-11	30Kohm	10Kohm	+/-0.1%	0.05%	+/-5ppm	1ppm	
2T-12	60Kohm	20Kohm	+/-0.1%	0.05%	+/-5ppm	1ppm	
2T-13	18Kohm	2Kohm	+/-0.1%	0.05%	+/-5ppm	1ppm	
2T-14	1Kohm	3Kohm	+/-0.1%	0.05%	+/-5ppm	1ppm	
2T-15	1Kohm	9Kohm	+/-0.1%	0.05%	+/-5ppm	1ppm	
2T-17	3Kohm	6Kohm	+/-0.1%	0.05%	+/-5ppm	1ppm	
2T-18	2Kohm	10Kohm	+/-0.1%	0.05%	+/-5ppm	1ppm	



Specifications and Performances

Type	2T	2S	2M	Test Conditions
Rating Power/element	125mW	125mW	125mW	250mW/Package
Rated Ambient Temp.	70 deg C	70 deg C	70 deg C	
Operating Temp. Range	-55 to +125 degC			
Tax. Applied Voltage	Less than 100V			Accordance with $E = \sqrt{P \cdot R}$
Short Time Overload	+/-0.1 % Abs			2.5 times rated power, 5seconds
Load Life	+/-0.1 % Abs			70C, 90min ON, 30min OFF, 1000hours
Humidity	+/-0.25 % Abs			40C, 90-95RH, DC 0.1W, 1,000hours
Soldering Heat	+/-0.1 % Abs			350C, 3seconds
Withstanding Voltage	+/-0.1 % Abs			1000VAC, 60seconds
Insulation Resistance	10,000Mohm			

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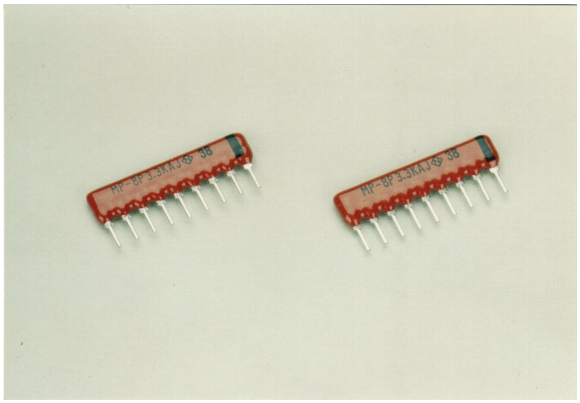
THROUGH-HOLE SIP RESISTOR NETWORKS

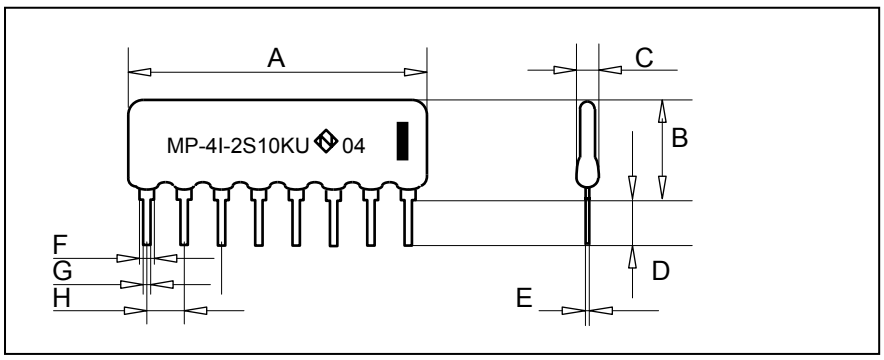
MP



Features and Applications

High precision through-hole SIP resistor networks made by NiCr thin film sputter on alumina substrates with high density patterning technologies.
5ppm-0.05% tight ratio tolerance and TC tracking are realized.
Individual (type I), series (type S) and parallel (P) circuit schematics are available.
2.5 mm width slim body and 7.5 mm height from PC board fit for high-density layout design.
Wide applications such as voltage dividers, feed back resistors for op amp, gain control circuit, termination of data transmission and voltage reference circuit, in data processing, data transmission, precision power sources of industrial controls, measurements, medical, measurements and automatic test systems.

Dimensions (mm) and Marking



▌: No.1 pin identification
MP-4I-2: Type
S: TCR and tracking
10K: Resistance
U: Tolerance and ratio
◈: Manufacturer's ID
34: Date code
Note: When A is too small to print full characters, marking will be omitted style.

(mm)	4 pins	5 pins	6 pins	7 pins	8 pins	9 pins	10 pins
A	10.2+/-1.5	12.7+/-1.5	15.2+/-1.5	17.8+/-1.5	20.3+/-1.5	22.9+/-1.5	25.4+/-1.5
B	7.0 mm max.						
C	3.0 mm max.						
D	3.3 mm						
E	0.25 mm						
F	1.2 mm						
G	0.5 mm						
H	2.54 mm						

THROUGH-HOLE SIP RESISTOR NETWORKS MP

Ordering Information

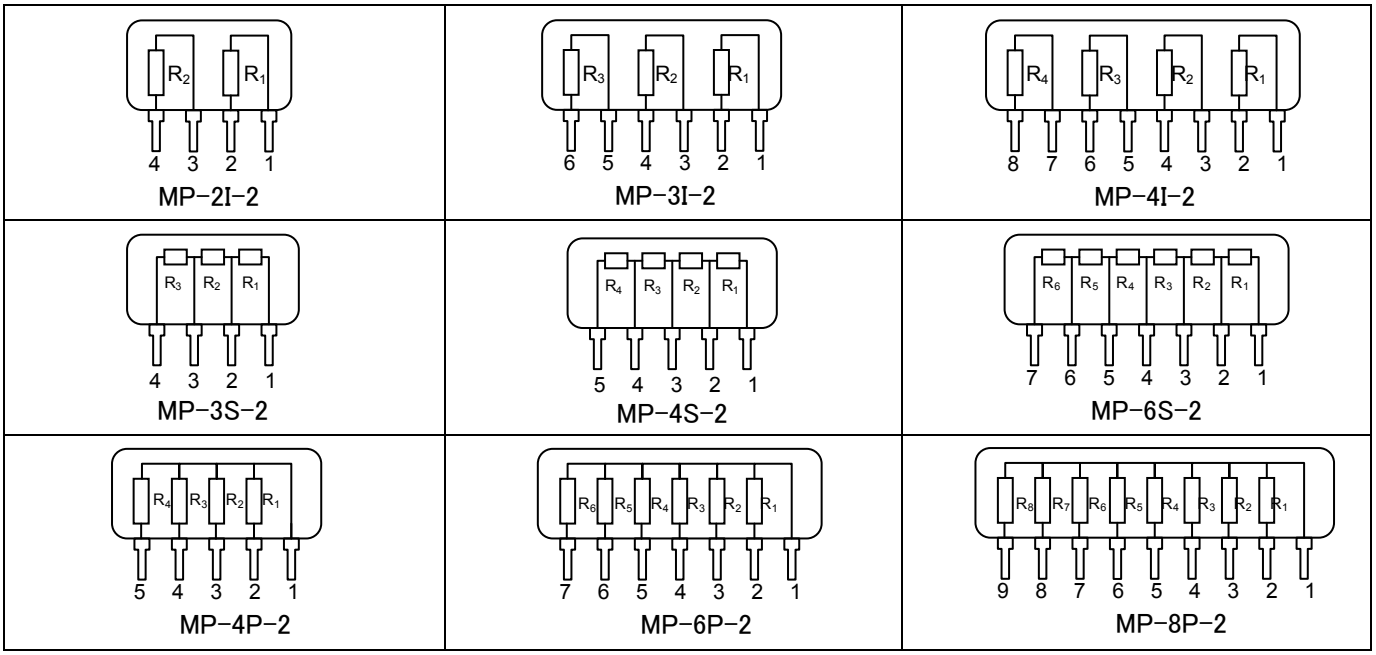
Model	TCR (abs-track)	Resistance	Tolerance (abs-ratio)	RoHS
MP-2I-2	A (100ppm-abs)	47R0-22K0	J (5.0%-abs)	Z00
MP-3I-2	C (50ppm-abs)		F (1.0%-abs)	
MP-4I-2	Z (5ppm-abs)		B (0.1%-abs)	
	R(5ppm-1ppm)		S(0.1%-0.05%)	
MP-3S-2	Q(10ppm-5ppm)		T(0.1%-0.1%)	
MP-4S-2	S(25ppm-5ppm)		U(0.5%-0.1%)	
MP-6S-2	L(50ppm-5ppm)		V(1.0%-0.1%)	
	P(50ppm-10ppm)		Y(1.0%-0.5%)	
MP-4P-2				
MP-6P-2				
MP-8P-2				

Resistance, TCR, Tolerance, Tracking and Ratio

Resistance	TCR Symbol	TCR			Tolerance Symbol	Tolerance	
		Absolute	Tracking			Absolute	Ratio
47 ohm – 22Kohm	R	+/- 5ppm	1ppm		S	+/-0.1%	+/-0.05
	Q	+/-10ppm	5ppm		T	+/-0.1%	0.1%
	S	+/-25ppm	5ppm		U	+/-0.1%	0.1%
	L	+/-50ppm	5ppm		V	+/-0.1%	0.1%
	P	+/-50ppm	10ppm		Y	+/-0.1%	0.1%

Note1: Table shows a case of tracking and ratio, specify only absolute available.

Schematics



Specifications and Performance

	Specifications	Conditions
Rating Power	125mW	
Rated Ambient Temp.	70 deg C	
Operating temp. Range	-55 to +125 deg C	
Max. Applied Voltage	100V or Accordance with E=sqrt(PR)	
Short Time Overload	+/-0.1 % Abs	2.5 times rated power, 5seconds
Load Life	+/-0.1 % Abs	70C, 90min ON, 30min OFF, 1000hours
Humidity	+/-0.25 % Abs	60C, 90-95RH, DC 0.1W, 1,000hours
Soldering Heat	+/-0.1 % Abs	350C, 3seconds
Withstanding Voltage	+/-0.1 % Abs	1000VAC, 60seconds
Insulation Resistance	10,000Mohm	

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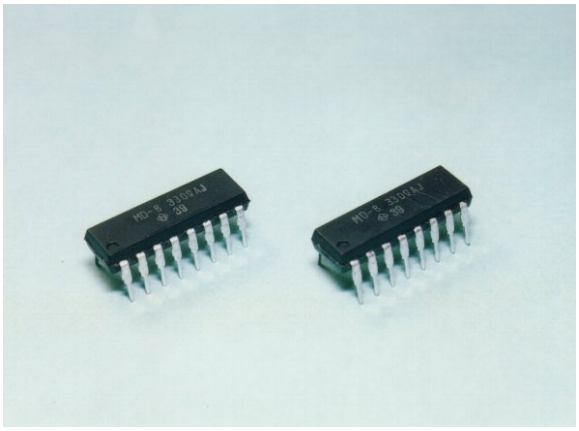
DIP THROUGH HOLE NETWORKS

MD8, MD15



Features and Applications

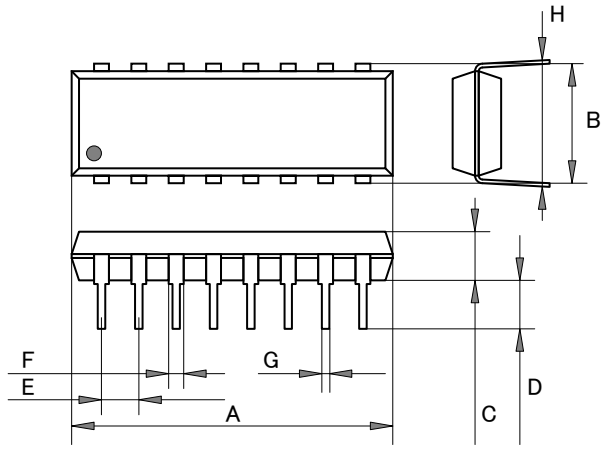
16pins plastic packaged DIP high precision thin film resistor networks with tight ratio and tracking performance.

Supplied in PE tray (standard) and ESD tube (optional) for automated assembly.

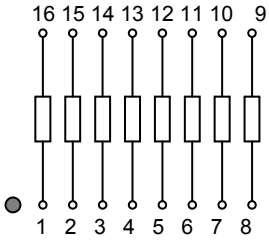
8 independent resistor circuits and 15 pull up resistor are standard.

Electronic measurements, power supply of industrial electronics, high speed digital communication systems, radio and wireless communication

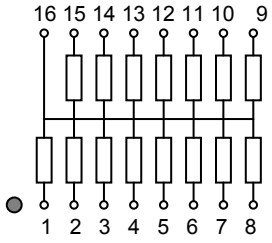
Dimension (mm)



	(mm)
A	22.0 Max.
B	7.6±0.6
C	4.6±0.5
D	3.2±o.2
E	2.54
F	1.1
G	0.5
H	8.3±0.3



MD8



MD16

Ordering Information

Model	resistors	TCR	Resistance	Tolerance	Package
MD	8	S	10Kohm	U	Z00
MD	8	E (25ppm)	51 to 10k	D (0.5%)	Z00
	15	C (50ppm)	To 20k /MD8	F (1%)	100pcs/Tray
		A (100ppm)		J(5%)	
		S (25ppm-5ppm))		U(0.5%-0.1%)	

Note: TCR-Tolerance combination are available such combination as A-J, C-F, E-D, S-U only.

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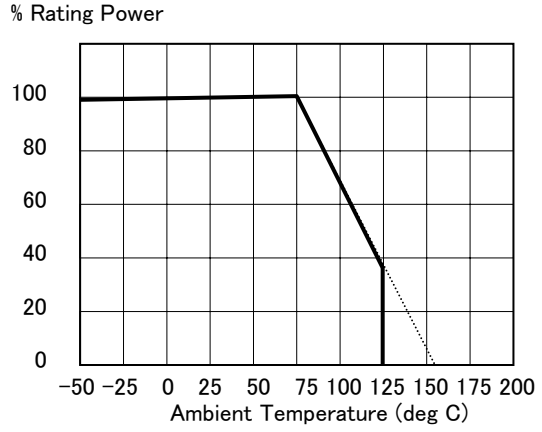
DIP THROUGH HOLE NETWORKS

MD8, MD15

Specifications and Performances

Model	MD8		MD8 & MD15		Conditions
Class	S-U	E-D	C-F	A-J	
Resistance Range(ohm)	51-10k	51-10k	51-10k	51-10k	
TCR-Absolute (ppm/K)	+/-25(S)	+/-25(E)	+/-50(C)	+/-100(A)	
TCR Tracking (ppm/K)	5	---	---	---	
Tolerance-Absolute (%)	+/-0.5(U)	±0.5 (D),	±1.0 (F),	±5 (J)	
Tolerance Match (%)	0.1	---	---	---	
Rating Power	0.1 Watt/resistor		0.1 Watt/resistor		-55 deg C to 70 deg C
Rating Power	1.5 W/package		1.5 W/package		-55 deg C to 70 deg C
Max. Applied Voltage	100V or $E = \sqrt{P \cdot R}$		100V or $E = \sqrt{P \cdot R}$		
Insulating Resistance	>1Gohm		>1Gohm		Independent pin to pin
Insulating Voltage	+/-0.5%		+/-0.5%		After application of 500V-1min.
Terminal strength	+/-0.25%		+/-0.25%		4.9N (0.5kgf), 5second, tension
Operating Temp. Range	-55 to +125 deg C		-55 to +125 deg C		
Storage Temp. Range	-55 to +125 deg C		-55 to +125 deg C		
Soldering Heat	±0.1%		±0.5%		350 deg C±5 deg C, 3 seconds
Temperature Cycle	±0.1%		±0.5%		-55 deg C 30mins. +125 deg C 30mins, 20 cycles
Humidity	±0.1%		±0.5%		Rating Power, 40 C, 90-95%RH, 90mins ON, 30mins. OFF, 1000hours
Load Life	±0.1%		±0.5%		Rating Power, 70 C, 90mins ON, 30mins. OFF, 1000hours

Derating Curve



Note:

MD series compliance to RoHS Directive 2002-95-EC, and contains Pb-Sn solder of high melt temp. for lead connections.

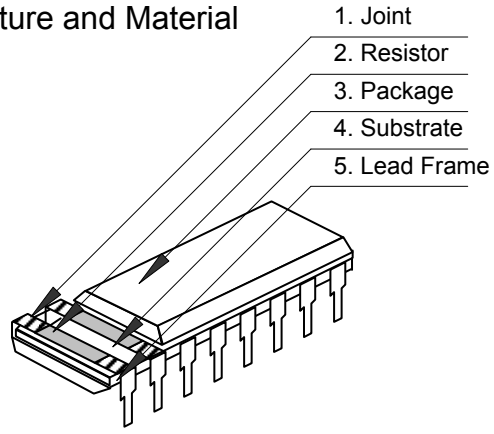
Molding material is certified to UL 94-V-0.

Molding material contains anti-flammable material of Br, and will be changed to Halogen free from June 2010.

When looking for DIP R-2R ladder network, refer to MDL datasheet.

Country of origin is Japan.

Structure and Material

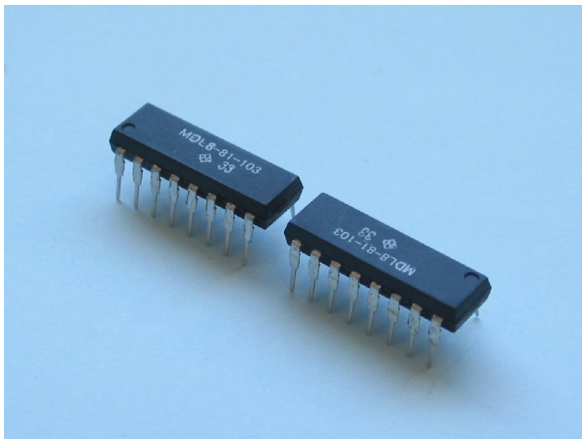


No.	Substance	Material
1	Terminal joint	Solder
2	Resistor	Ni-Cr alloy
3	Package	Epoxy resin
4	Substrate	Alumina
5	Lead frame	Matte tin plated phosphor Cu

20100201

R/2R LADDER DIP NETWORKS

MDL8



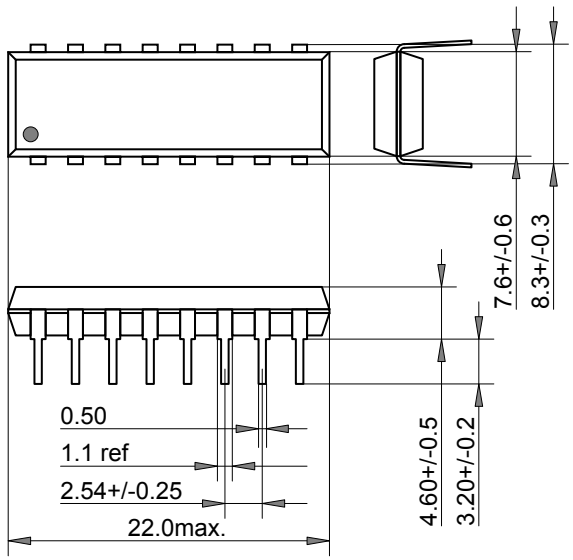
Features and Applications

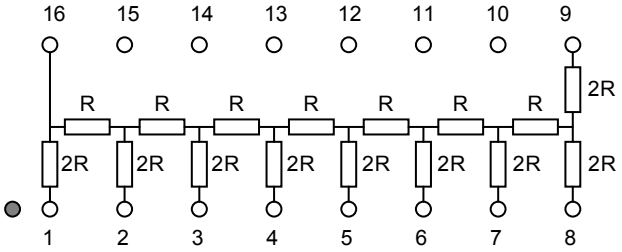
16pin plastic packaged DIP R/2R Ladder resistor networks for voltage output D/A converter.

Precision thin-film technology assures accuracy of +/-1/2LSB at -40 deg C to +125 deg C and long life stability.

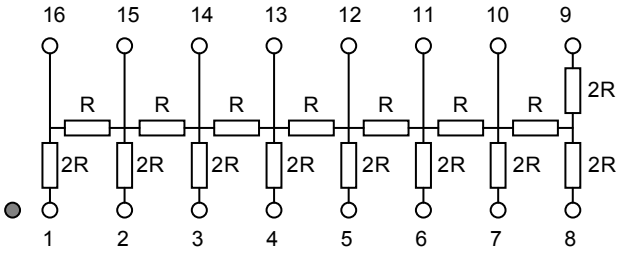
Industrial power supplies, standard voltage supplies, precision AD converter, digital signal processing, direct digital waveform synthesizer, measurements, industrial instruments, high speed digital data transmission, intelligent hubs and data switching.

Dimension (mm)





MDL8-81



MDL8-82

Ordering Information

Model	Bits	Schematics	Resistance	Package
MDL	8	-81	103	Z00
MDL	8	-81	102 (1k/2k)	Z00
		-82	103 (10k/20k)	100pcs/Tray

Note: Custom configurations and resistances are available. Consult factory.

Nikkohm Co., Ltd. 3-31-2640 Minamicho, Misawa, Aomori 033-0036 Japan TEL: +81-176-53-2105, FAX: +81-176-53-2106

URL: http://www.nikkohm.co.jp & http://www.nikkohm.com / e-mail: info@nikkohm.co.jp

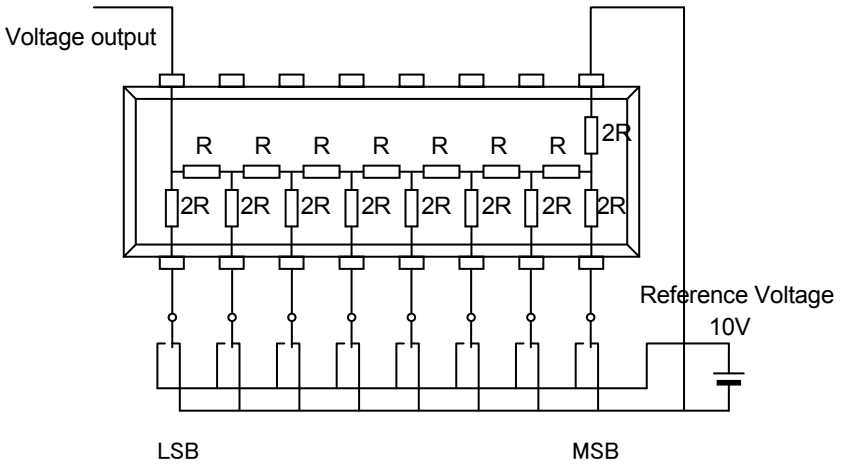
R/2R LADDER DIP NETWORKS

MDL8

Specifications and Performances

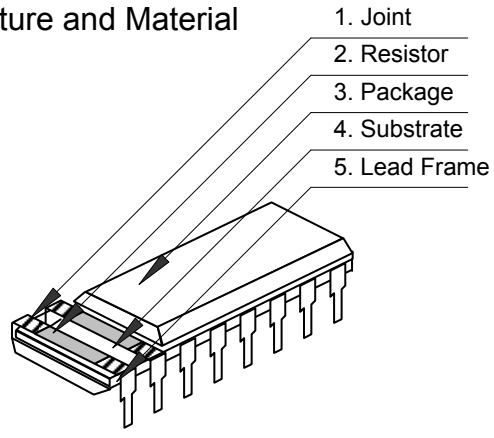
Model	MDL8-81, MDL8-82	Conditions
Resistance Range	51-20kohm	R value
Ladder Network Accuracy	+/-1/2 LSB	-55 deg C to 70 deg C
TCR-Absolute	+/-25 ppm/deg C	Each resistor
Tolerance-Absolute	±0.5 %	Each resistor
Rating Power per resistor	0.05 Watt / resistor	-55 deg C to 70 deg C
Rating Power per package	1.0 W/package	-55 deg C to 70 deg C
Max. Operating Voltage	100V or $E = \sqrt{P \cdot R}$	
Insulating Resistance	>1Gohm	Independent pin to pin
Insulating Voltage	+/-0.5%+/-0.5%	After application of 500V-1min.
Terminal strength	+/-0.25%+/-0.25%	4.9N (0.5kgf), 5second, tension
Operating Temp. Range	-55 to +125 deg C	
Storage Temp. Range	-55 to +125 deg C	

Voltage Output Configuration



Binary	Decimal	Note
00000000	0	
00000001	1	LSB=1
00000010	2	
00000100	4	
00001000	8	
00010000	16	
00100000	32	
01000000	64	
10000000	128	MSB=1
11111111	255	

Structure and Material

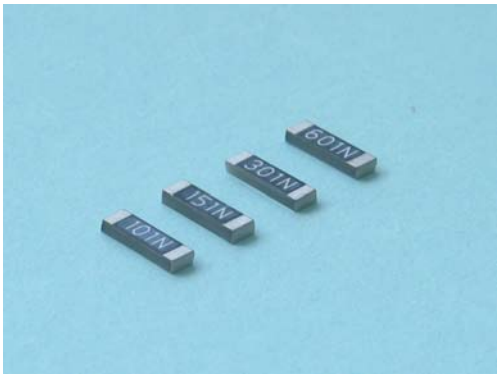


No.	Substance	Material
1	Terminal joint	Solder
2	Resistor	Ni-Cr alloy
3	Package	Epoxy resin
4	Substrate	Alumina
5	Lead frame	Matte tin plated phosphor Cu

20100201

RF POWER CHIP RESISTORS

RFH, RFJ, RFK



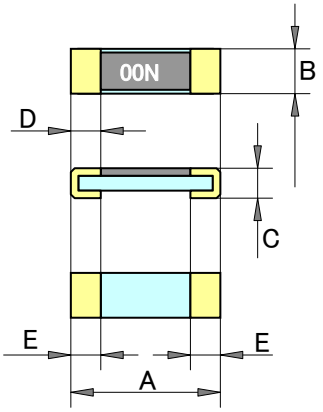
Features and Applications

5mm*2mm and 7mm*2mm small size 10W power chip resistors for RF applications. RFH and RFK are lead-less, RFJ have two beam leads. Strong terminals of RFH are prepared to extract heat from resistor chip to circuit board. RFJ and RFK have back metal for heart extraction. 10W (RFH72, RFH52) and 20W (RFK52, RFK72) power rating are available with beryllium free design.

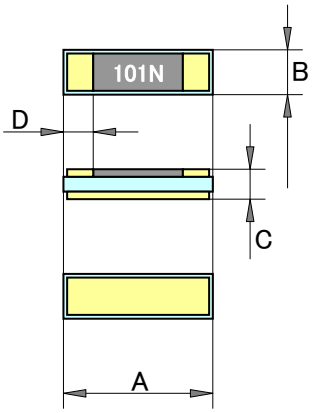
1% tolerance and 50ppm/degree tight resistances enable stable application circuits.

RF power amplifiers, RF power source, fixed station of cell phones, RF measurement and termination of circulators/isolators.

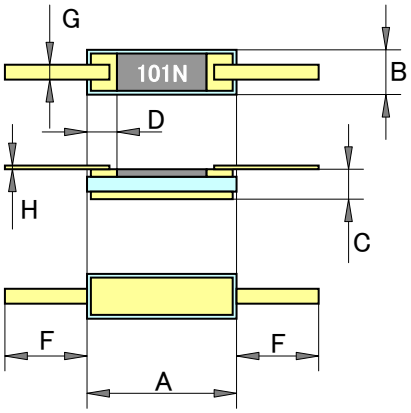
Dimensions



RFH72 and RFH52
RFH are attached on micro strip line of circuit board. Resistance heat will be transferred through terminals.



RFK72 and RFK52
RFK are attached on micro strip line of circuit board. Resistance heat will be transferred through back metallization.



RFJ72 and RFJ52
RFJ are installed in rectangular hole on circuit board. Back metallization is prepared for heat extraction.

	A	B	C	D	E	F	G	H
RFH52	5.0	2.5	1.2max	0.8	0.8	-	-	-
RFH72	7.0	2.0	1.2max	0.8	0.8	-	-	-
RFK52	5.0	2.5	1.2max	0.8	-	-	-	-
RFK72	7.0	2.0	1.2max	0.8	-	-	-	-
RFJ52	5.0	2.5	1.2max	-	-	5.0	1.0	0.1
RFJ72	7.0	2.0	1.2max	-	-	5.0	1.0	0.1

Note: Gap of “J” shall be sufficient height as RF characteristics.

RF POWER CHIP RESISTORS

RFH, RFJ, RFK

Ordering Information

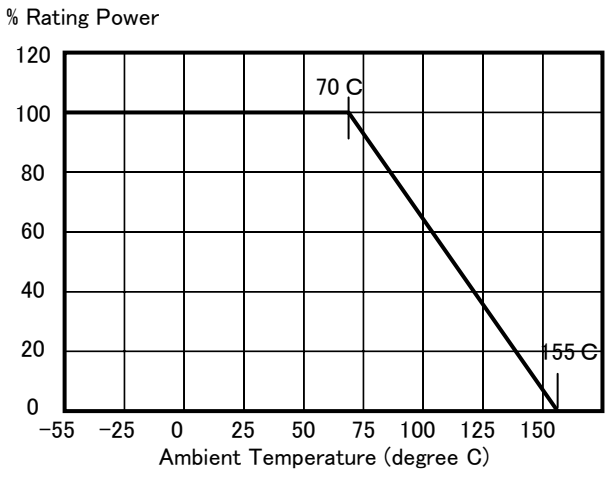
P/N	TYPE	TCR	Resistance	Tolerance	Package	Remarks
RFH72C50ohmF001	RFH72	C(50ppm)	50ohm	F (1%)	Z01 (100pcs/Bulk)	Leadless
RFK72C100ohmF000	RFK72	C(50ppm)	100ohm	F (1%)	Z00 (100pcs/Bulk)	Leadless
RFJ72C150ohmF003	RFJ72	C(50ppm)	100ohm	F (1%)	003 (100pcs/Tray)	Beam Leaded
RFJ52C100ohmF003	RFJ52	C(50ppm)	100ohm	F (1%)	003 (100pcs/Tray)	Beam Leaded

Note: Only, RFH and RFK are lead-free structure.

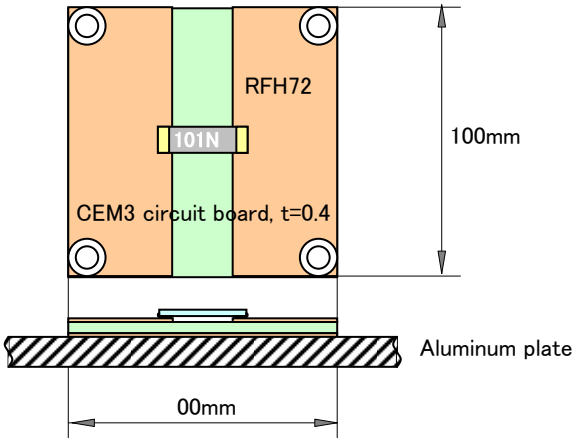
Specifications and Performances

Type	RFH52	RFH72	RFJ52	RFJ72	RFK	RFK
Rating Power with Heatsink	10W	10W	10W	20W	20W	20W
Resistance	50, 100, 150, 200, 250, 300, 400, 600, 800 Ω					
TC	+/-50ppm/K (C)					
Tolerance	+/-1.0% (F)					
Rated Ambient Temperature	70C					
Operating Temp Range	-55C to +155C					
Load Life	+/-0.5%					
Humidity	+/-0.5%					
Series Inductance	3.2 nH					
Parallel Capacitance	< 0.05 pF					

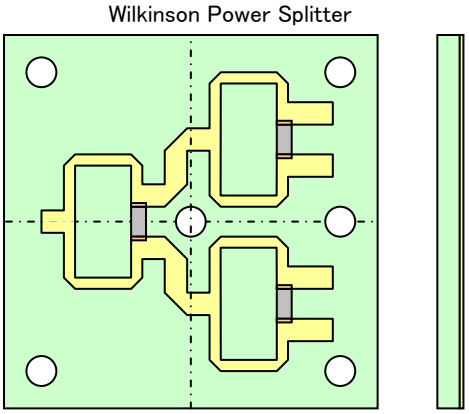
Note: Soldering temperature shall be under 350 C degree.



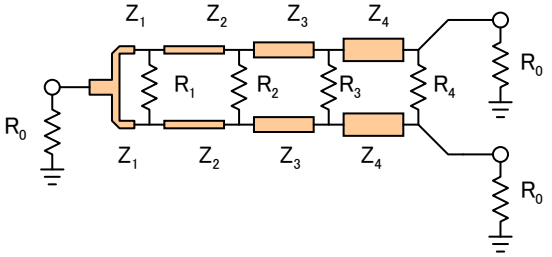
Derating



Heat-extraction system



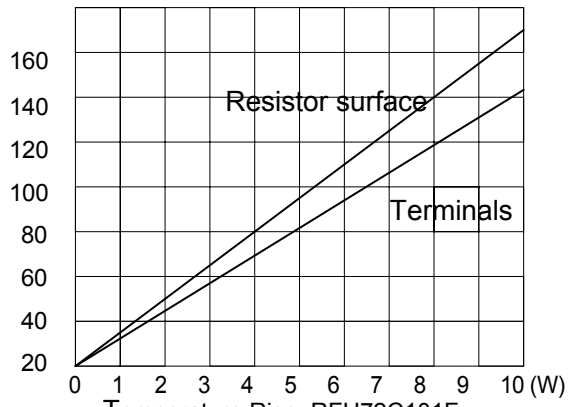
Applications of RFH72



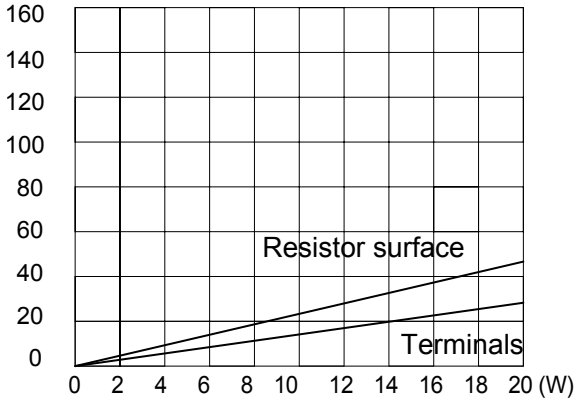
Application:
Absorption resistor in Willkinson circuit.

RF POWER CHIP RESISTORS

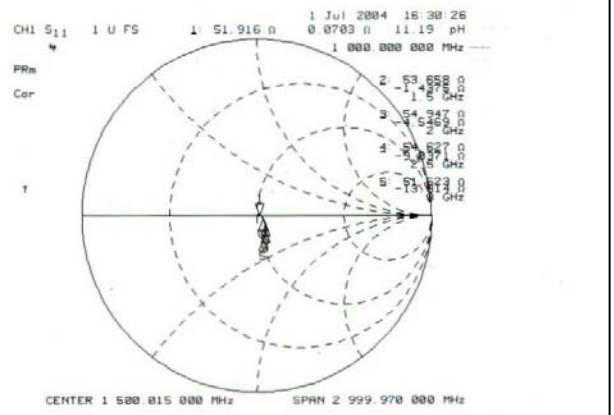
RFH, RFJ, RFK



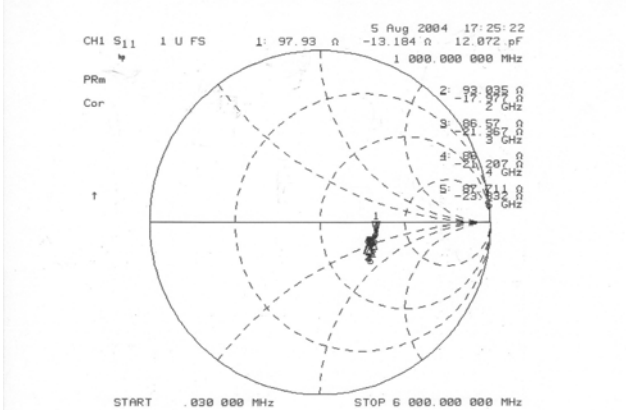
Temperature Rise, RFH72C101F
on 0.8mm Glass Teflon PWB



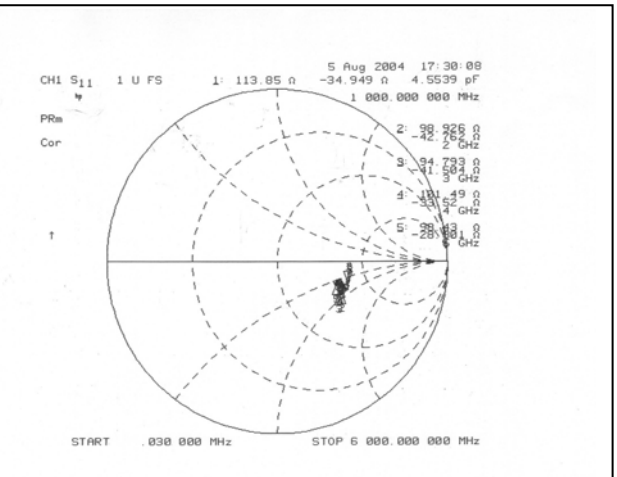
Temperature Rise, RFK72C101F
attached on heat sink



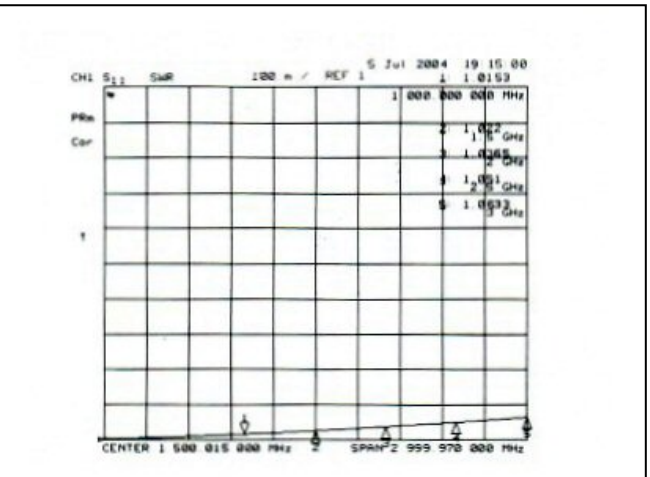
S11, RFH72C500F



S11, RFH72C101F

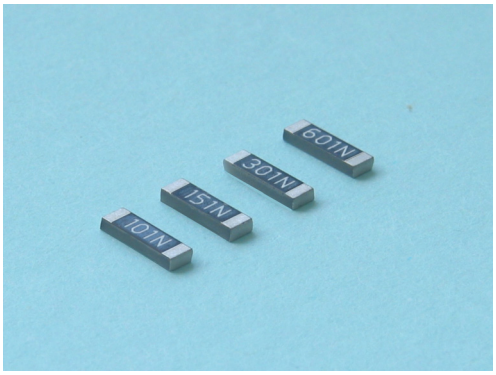


S11, RFH72C151F



VSWR, RFH72C500F

RF POWER RESISTORS
RFH, RFK,
RFR010-0, RFR050-0,
RFR100-0, RFR250-0



Features and Applications

RFR000-000, RFH and RFK are specified rating power of 10W to 250W, resistance of 50ohm to 800ohm for microwave applications. Heat from the resistors can be extracted through back metal or flange to PCB or case heat sink. RF application.

Small sized large power handling feature shows excellent RF characteristics in equipment with RoHS compliance and Beryllium free design.

1% tolerance and 50ppm/degree tight resistances are made application circuit stable.

RF power amplifiers, RF power source, fixed station of cell phone, RF measurement and terminations of circulators / isolators.

Ordering Information

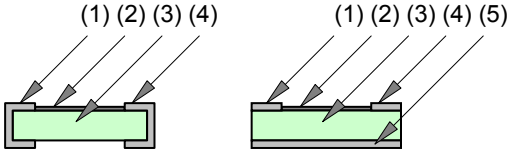
Ordering P/N	Type	Outlook	TC	Resistance	Tolerance	Bulk/Tape	Remarks
RFH52 C200 OhmFZ00	RFH52		C	200 Ohm	F	Z00-Z01	Bulk-Tape
RFH72 C200 OhmFZ00	RFH72		C	200 Ohm	F	Z00-Z01	Bulk-Tape
RFK52 C200 OhmFZ00	RFK52		C	200 Ohm	F	Z00-Z01	Bulk-Tape
RFK72 C200 OhmFZ00	RFK72		C	200 Ohm	F	Z00-Z01	Bulk-Tape
RFR010 010 C50 OhmFZ00	RFR010	010	C	50 Ohm	F	Z00-Z01	Bulk-Tape
RFR010 020 C50 OhmFZ00	RFR010	020	C	50 Ohm	F	Z00-Z01	Bulk-Tape
RFR050 010 C50 OhmFZ00	RFR050	010	C	50 Ohm	F	Z00-Z01	Bulk-Tape
RFR050 020 C50 OhmFZ00	RFR050	020	C	50 Ohm	F	Z00-Z01	Bulk-Tape
RFR100 010 C50 OhmFZ00	RFR100	010	C	50 Ohm	F	Z00-Z01	Bulk-Tape
RFR100 020 C50 OhmFZ00	RFR100	020	C	50 Ohm	F	Z00-Z01	Bulk-Tape
RFR250 010 C50 OhmFZ00	RFR250	010	C	50 Ohm	F	Z00-Z01	Bulk-Tape
RFR250 020 C50 OhmFZ00	RFR250	020	C	50 Ohm	F	Z00-Z01	Bulk-Tape

Specifications and Performances

Type	RFH52 RFH72	RFK52 RFK72	RFR010-0	RFR050-0	RFR100-0	RFR250-0
Rating Power with Heatsink	10W	10W	10W	50W	100W	250W
Resistance	50, 100, 150, 200, 250, 300, 400, 600, 800 ohm					
TC	+/-50ppm/K (C)					
Tolerance	+/-1.0% (F)					
Rated Ambient Temp.	100 deg C					
Operating Temp Range	-55C to +155C					
Load Life	+/-0.5%					
Humidity	+/-0.5%					
Series Inductance	0.32 nH	0.32 nH	-			
Parallel Capacitance	< 0.05 pF	< 0.05 pF	-			

(Note 1) Old RFJ, leaded, was discontinued, please attach beam lead on RFK at customers.

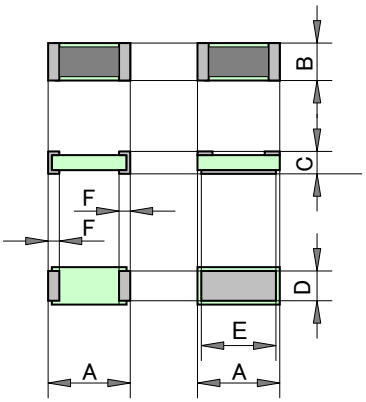
Materials



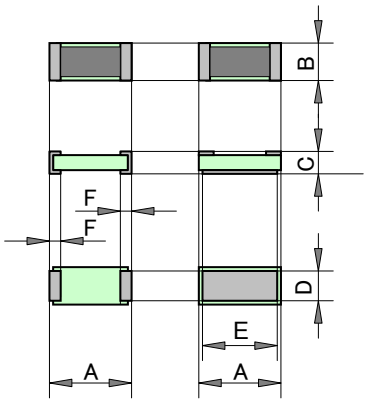
	Substance	Material
(1)	Cold End Terminal	Tin plated Ni-Cu
(2)	Resistive	Ni-Cr
(3)	Substrate	ALN
(4)	Hot End Terminal	Tin plated Ni-Cu
(5)	Back Metal	Tin plated Ni-Cu

RF POWER RESISTOR
RFH, RFK, RFR010-0, RFR050-0, RFR100-0, RFR250-0

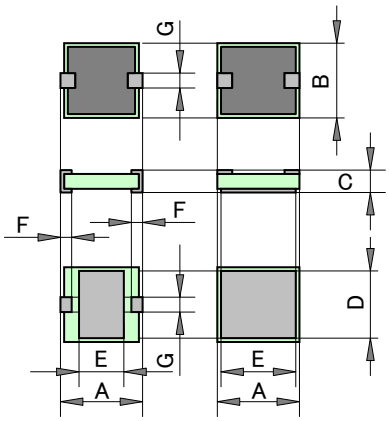
Dimension



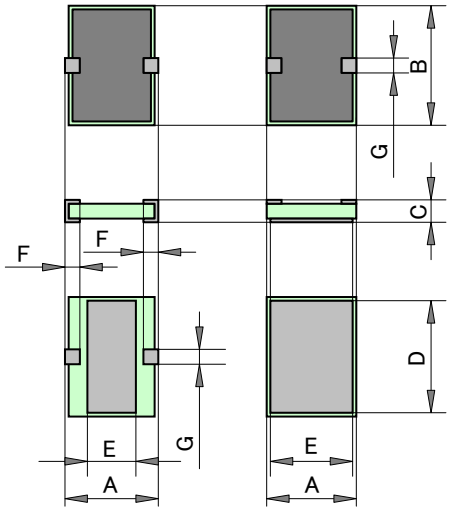
RFH52 RFH72 RFK52 RFK72



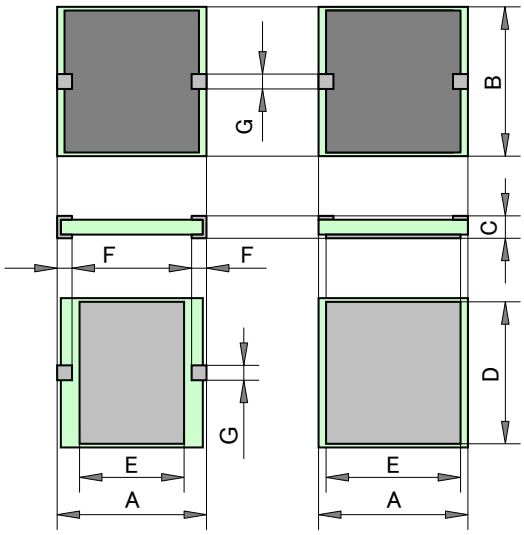
RFR010 010 RFR010 020



RFR050 010 RFR050 020



RFR100 010 RFR100 020



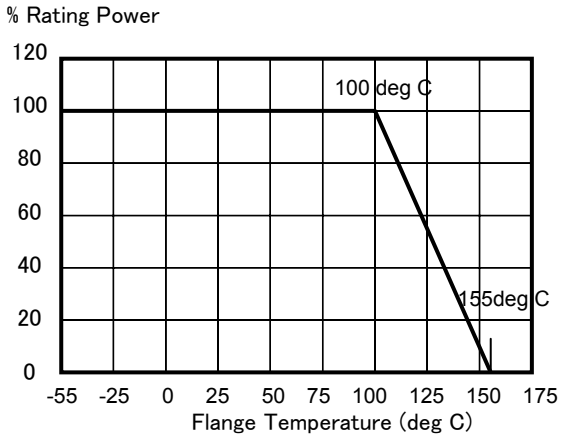
RFR250010 RFR250020

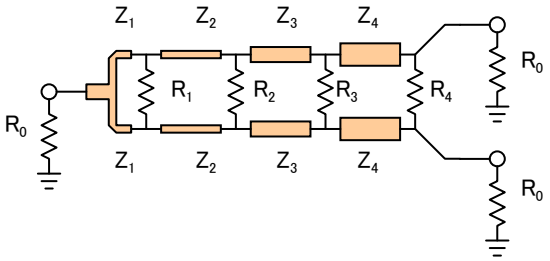
Type	Power	A	B	C	D	E	F	G
RFH52	10W	5.0	2.5	1.2max	–	–	0.8	–
RFH72	10W	7.0	2.0	1.2max	–	–	0.8	–
RFK52	10W	5.0	2.5	1.2max	2.3	4.8	0.8	–
RFK72	10W	7.0	2.0	1.2max	1.8	6.8	0.8	–

Type	Power	A	B	C	D	E	F	G
RFR010 010	10W	5.08	2.54	1.05	–	–	1.27	–
RFR010 020		5.08	2.54	1.05	2.34	4.88	1.27	–
RFR050 010	50W	5.08	5.08	1.05	4.84	2.00	1.27	1.27
RFR050 020		5.08	5.08	1.05	4.84	4.68	1.27	1.27
RFR100 010	100W	5.84	8.89	1.05	8.49	2.54	1.27	1.27
RFR100 020		5.84	8.89	1.05	8.49	5.45	1.27	1.27
RFR250 010	250W	9.52	9.52	1.05	9.12	6.00	1.27	1.27
RFR250 020		9.52	9.52	1.05	9.12	9.12	1.27	1.27

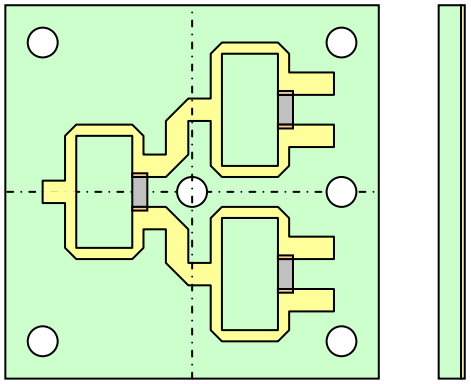
Note1: Gap of “J” shall be sufficient height as RF characteristics.

RF POWER RESISTOR
RFH, RFK, RFR010-0, RFR050-0, RFR100-0, RFR250-0

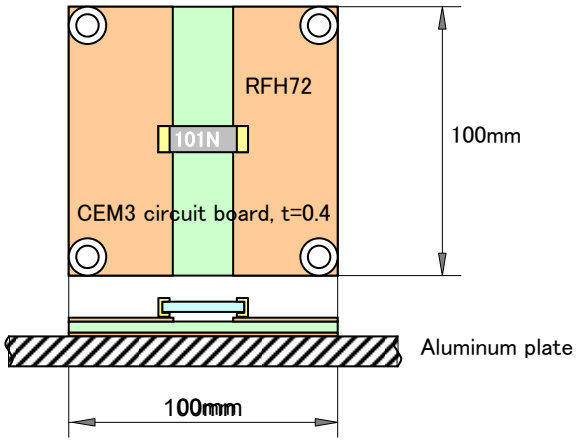




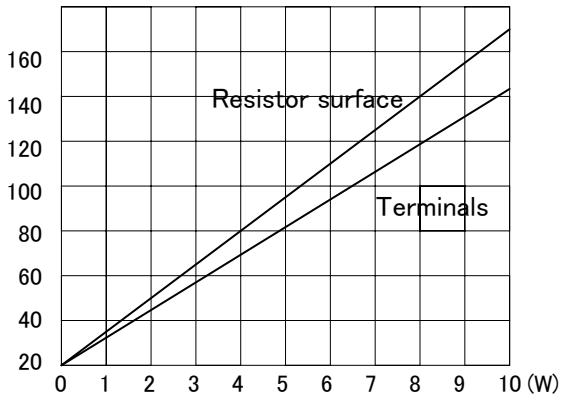
応用　ウイルキンソン電力2分岐の広帯域化と吸収抵抗



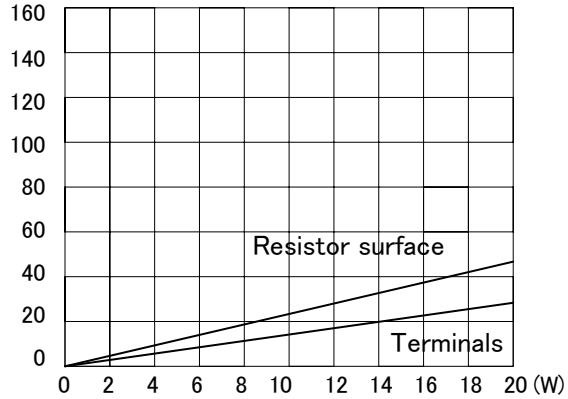
A application of RFH72



Heat-extraction system

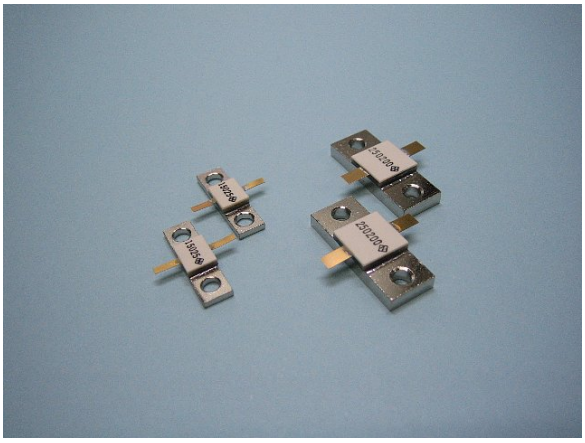


on 0.8mm Glass Tefron PWB



attached on heat sink

10W, 50W, 80W, 100W, 150W, 200W 250W, 400W, 600W FLANGED POWER RESISTORS, RFR



Features:

- ●High power flanged resistors for all DC up to 4GHz applications.
- ●Small size and wide frequency range specifications realized with through large heat conducting AIN substrate.
- ●Sufficient mechanical strength metallization from spattered thin film technology.
- ●50ohm resistance with tolerance 1%, and terminations include chips and many style flange provided as standard, and other resistance and power available.
- ●Long life and temperature stability are shown by a result of Ni-Cr thin film technology.

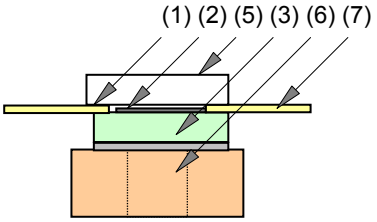
Applications: Termination for isolator/circulators, Fixed station of mobile communication electronics, High power microwave amplifiers

Ordering Information

Type	Style	TCR	Resistance	Tolerance	RoHS/Package
RFR050	120	C	201	F	Z00
RFR010	110	C (50ppm)	50 Ohm	F (1.0%)	Z00
RFR050	120		100 Ohm		
RFR080			150 Ohm		
RFR100			200 Ohm		
RFR150			250 Ohm		
RFR200			300 Ohm		
RFR250			400 Ohm		
RFR400			600 Ohm		
RFR600			800 Ohm		

Performance Specifications

Type	Rated Power (W)	Heat Resistance (deg C/W)	VSWR 500MHz	VSWR 1GHz	VSWR 2GHz
RFR010	10	6.5		1.15	
RFR050	50	2.5		1.15	
RFR080	80			1.20	
RFR100	100	1.3		1.20	
RFR150	150			1.30	
RFR200	200				
RFR250	250	0.5		1.30	
RFR400	400				
RFR600	800				



	Substance	Material
(1)	Cold end Terminal	Tin plated Ni-Cu
(2)	Resistive	Ni-Cr
(3)	Substrate	ALN
(4)	Hot end Terminal	Tin plated Ni-Cu
(5)	Cover	ALO
(6)	Flange	Ni plated Cu
(7)	Beam Lead	Au plated Cu

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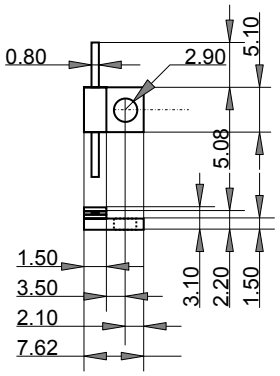
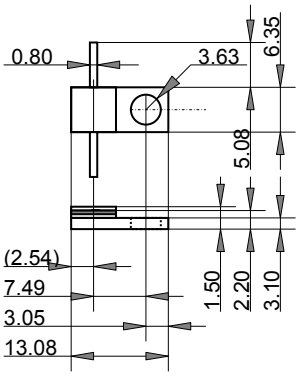
10W, 50W, 80W, 100W, 150W, 200W、250W, 400W, 600W, RESISTORS

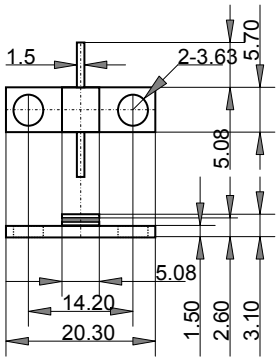
Style and Dimension (mm)



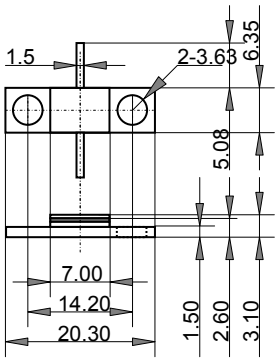
RFR010 120



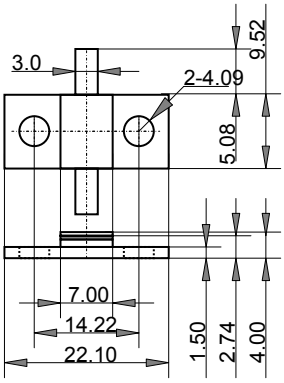
RFR050 120 RFR080 120



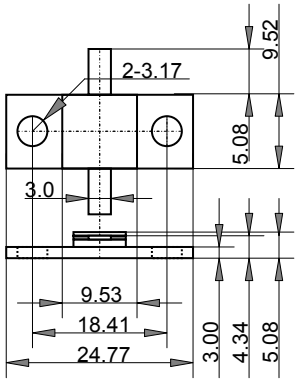
RFR050 110



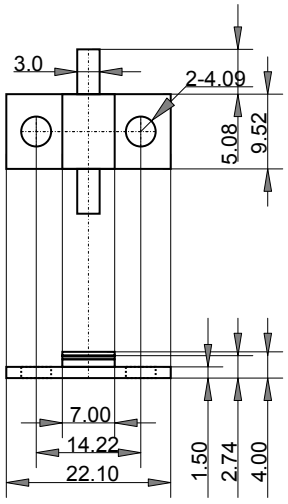
RFR100 110



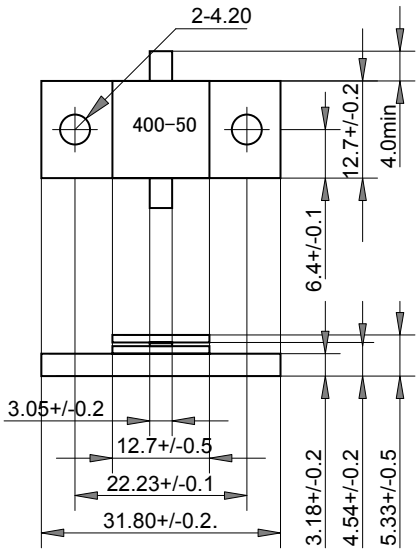
RFR150 110



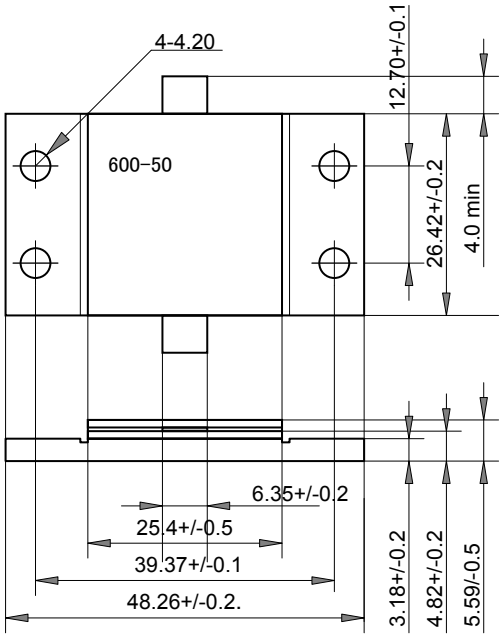
RFR200 110



RFR250 110



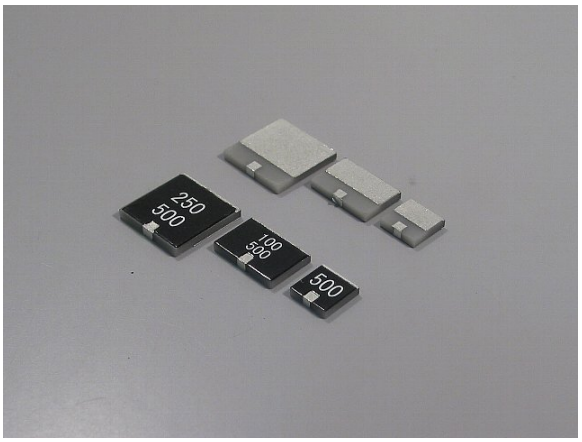
RFR400 110



RFR600 110

20111201

5W, 10W, 50W, 100W, 250W HIGH POWER SMD TERMINATIONS RFT005, RFT010, RFT050, RFT100, RFT150, RFT250



Features and Applications

High power surface mount termination for all DC up to 5GHz applications.

Small size and wide frequency range specifications realized with through large heat conducting AlN substrate.

Sufficient mechanical strength metallization from spattered thin film technology.

50ohm resistance with tolerance 1% and 10W, 50W, 100W, 150W and 250W provided as standard, and other resistance and power available.

Long life and temperature stability a result of Ni-Cr thin film technology.

Termination for isolator/circulators, fixed station of mobile communication electronics, and high power microwave amplifiers.

Ordering Information

Type	Structure	TCR	Resistance	Tolerance	Packaging	Note
RFT100	010	C	500	F	Z01	
|	|	|	|	|	|	
RFT010	010	C	500	F	Z00	Bulk
RFT050	020	(50ppm/C)	(50 Ohm)	(1%)	Z01	Tape reel
RFT100						
RFT150						
RFT250						

Specifications and Performances

Type	RFT010	RFT050	RFT100	RFT150	RFT250	Conditions
Rated Power (W)	10	30	100	150	250	-55 - +100 deg C
Maximum Power (W)	20	50	200	300	500	Pulse < 1 second
Resistance (Std) Ohm	50 Ohms					
TC (ppm/deg C)	50					
Tolerance (%)	1.0					
Heat Resistance (deg C/W)	5.5	1.1	0.5	0.3	0.2	
VSWR at 1GHz	1.15	1.15	1.20	1.20	1.20	
Max Operating Temperature	-55-155 deg C					
Storage Temperature	-55-155 deg C					

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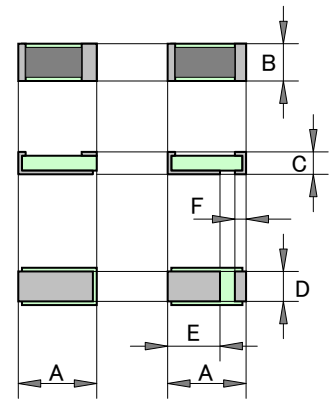
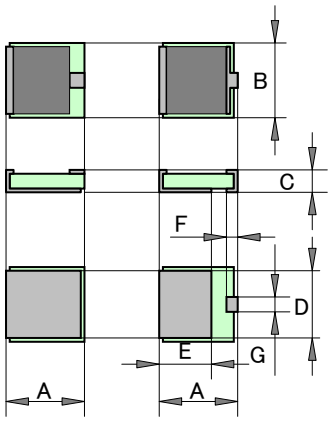
5W, 10W, 50W, 100W, 250W

HIGH POWER TERMINATIONS RFT050, RFT010, RFT050, RFT100, RFT250

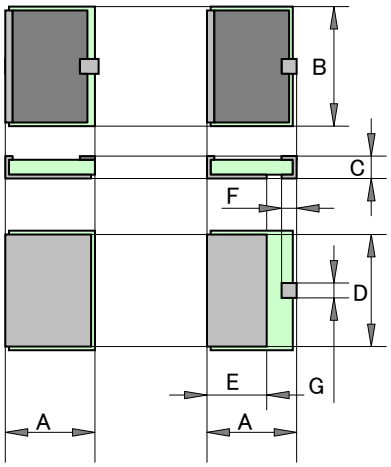
Style and Dimension



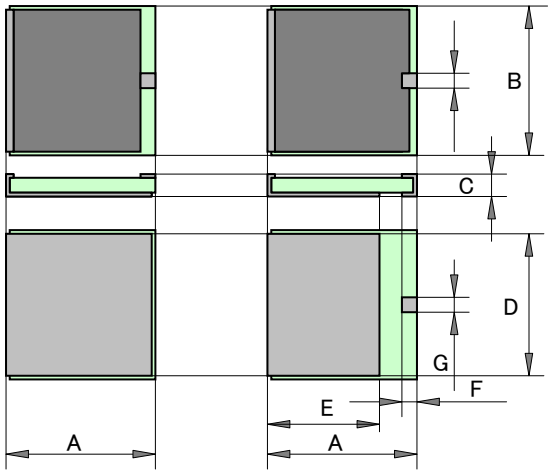
RFT005010 RFT005020
RFT010010 RFT010020



RFT050010 RFT050020



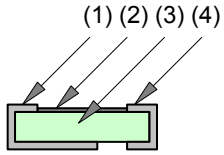
RFT100010 RFT100020



RFT250010 RFT250020

Type	Power	A	B	C	D	E	F	G
RFT010 010	10W	5.08	2.54	1.05	2.34	–	1.27	1.27
RFT010 020		5.08	2.54	1.05	2.30	2.54	1.27	1.27
RFT050 010	50W	5.08	5.08	1.05	4.84	–	1.27	1.27
RFT050 020		5.08	5.08	1.05	4.84	2.54	1.27	1.27
RFT100 010	100W	5.84	8.89	1.05	8.49	–	1.27	1.27
RFT100 020		5.84	8.89	1.05	8.49	3.05	1.27	1.27
RFT150 010	150W	6.35	9.52	1.05	9.12	–	1.27	1.27
RFT150 020		6.35	9.52	1.05	9.12	4.05	1.27	1.27
RFT250 010	250W	9.52	9.52	1.05	9.12	–	1.27	1.27
RFT250 020		9.52	9.52	1.05	9.12	6.98	1.27	1.27

Materials



	Substance	Material
(1)	Cold end Terminal	Tin plated Ni + Cu
(2)	Resistive	Ni-Cr
(3)	Substrate	ALN
(4)	Hot end Terminal	Tin plated Ni + Cu

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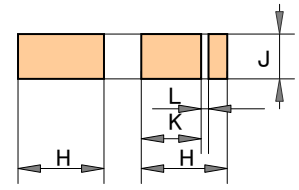
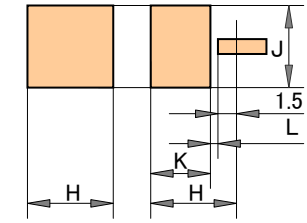
5W, 10W, 50W, 100W, 250W

HIGH POWER TERMINATIONS RFT050, RFT010, RFT050, RFT100, RFT250

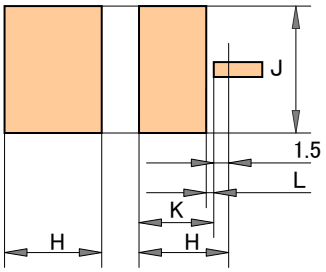
Foot Pattern Design



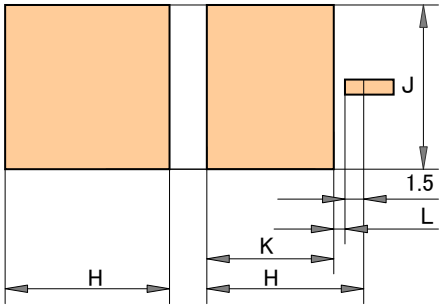
RFT010010 RFT010020



RFT050010 RFT050020

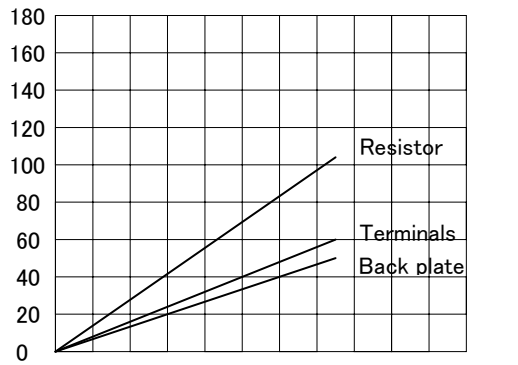


RFT100010 RFT100020

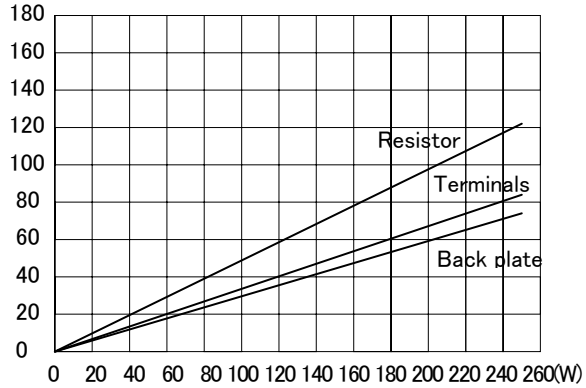


RFT250010 RFT250020

	H	J	K	L
RFT010 010	5.48	2.94	-	-
RFT010 020	5.48	2.94	(2.98)	0.5
RFT050 010	5.48	5.48	-	-
RFT050 020	5.48	5.48	(2.98)	0.5
RFT100 010	6.24	9.29	-	-
RFT100 020	6.24	9.29	(3.24)	0.5
RFT150 010	6.75	9.92	--	---
RFT150 020	6.75	9.92	(4.48)	0.5
RFT250 010	9.92	9.92	--	-
RFT250 020	9.92	9.92	(6.92)	0.5



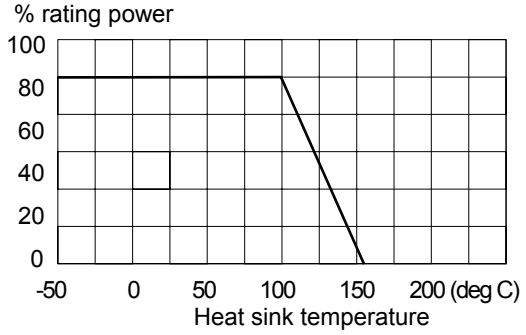
Temperature Rise, RFT100 010C50ohmF



Temperature Rise, RFT250 010C50ohmF

Note:
(1) Other resistance value and substrate thickness are available. Please consult Nikkohm factory.
(2) Power rating assumes that chip attached on metal plate.
(3) Solder joint design should assure a solder thickness within 50 micron meters.

Derating Curve



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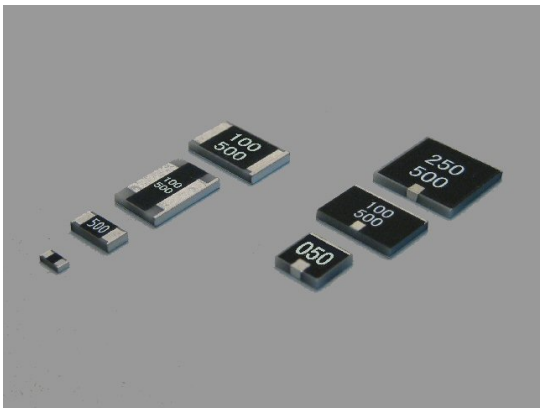
SURFACE MOUNT
HIGH POWER TERMINATIONS

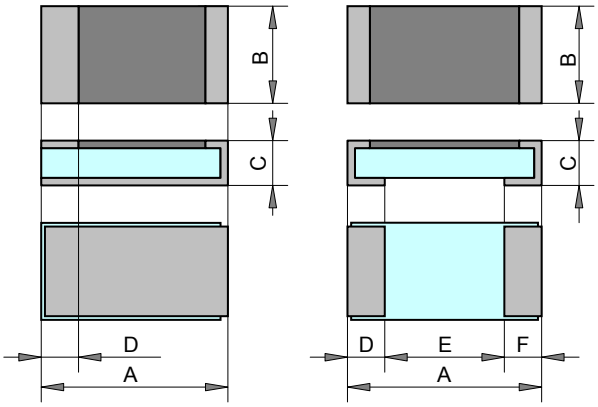
RFTS, RFTSA, RFTSB



Features and Applications

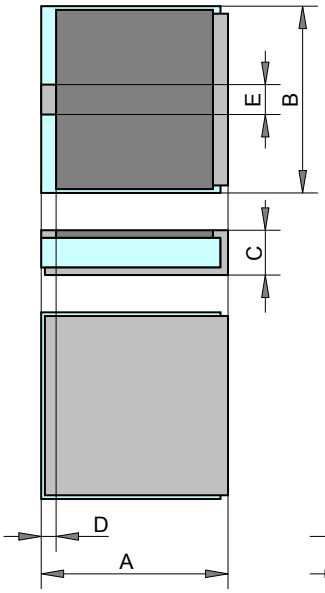
High power surface mount terminations for DC up to 6GHz applications.
Small size and wide frequency range specifications realized with large heat conducting AIN substrate.
Sufficient mechanical strength metallization from spattered thin film technology.
50ohm characteristic impedance with tolerance 1% in dc and 5W to 250W provided as standard, and other resistance and power available.
Long life and temperature stability a result of Ni-Cr thin film technology.
Terminations for isolator/circulators, fixed station of mobile communication electronics, and high power microwave amplifiers.

Style and Dimension

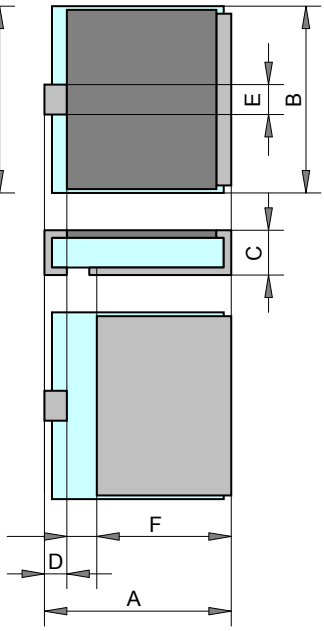


RFTSxxZF0

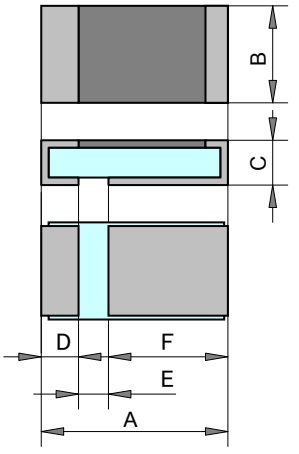
RFTSxxZE0



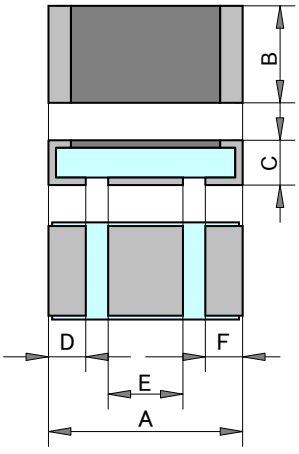
RFTSA100
RFTSA150
RFTSA250



RFTSB100
RFTSB150
RFTSB250



RFTSxxZZ0



RFTSxxZY0

SURFACE MOUNT HIGH POWER TERMINATIONS RFTS, RFTSA, RFTSB

Dimensions (mm)

Rated Power (W)	Type	Terminal	A (mm)	B (mm)	C (mm)	D (mm)	E (mm)	F (mm)
5	RFTS05	ZF0	2.54	1.27	0.63	0.70+/-0.2	-	-
5	RFTS05	ZE0	2.54	1.27	0.63	0.70+/-0.2	(1.14)	0.70+/-0.2
10	RFTS10	ZF0	5.08	2.54	1.00	1.00		-
10	RFTS10	ZE0	5.08	2.54	1.00	1.00	3.00	1.00
50	RFTS50	ZF0	5.08	5.08	1.20	1.00	-	-
50	RFTS50	ZE0	5.08	5.08	1.20	1.00	3.00	1.00
50	RFTS50	ZZ0	5.08	5.08	1.20	3.00	1.08	1.00
50	RFTS50	ZY0	5.08	5.08	1.20	100	2.00	1.00
100	RFTS100	ZF0	5.84	8.89	1.20	1.20	-	-
100	RFTS100	ZE0	5.84	8.89	1.20	1.20	2.40	1.20
100	RFTS100	ZZ0	5.84	8.89	1.20	3.40	1.20	1.20
100	RFTS100	ZY0	5.84	8.89	1.20	1.20	2.40	1.20
100	RFTSA100	---	5.84	8.89	1.20	1.20	1.20	---
100	RFTSB100	---	5.84	8.89	1.20	1.20	1.20	1.20
150	RFTSA150	---	8.89	8.89	1.20	1.20	1.20	---
150	RFTSB150	---	8.89	8.89	1.20	1.20	1.20	1.20
250	RFTSA250	---	9.52	9.52	1.20	1.20	1.20	---
250	RFTSB250	---	9.52	9.52	1.20	1.20	1.20	1.20

Ordering Information

Type	TCR	Impedance	Tolerance	Terminals & T/R	Note
RFTS50	C	500	F	ZF0	---
RFTS05	C (50ppm/K)	500 (50ohm)	F (1%)	ZF0	Bulk
RFTS10				ZE0	Bulk
RFTS50				ZZ0	Bulk
RFTS100				ZY0	Bulk
				ZF1	Tape reel
				ZE1	Tape reel
				ZZ1	Tape reel
				ZY1	Tape reel

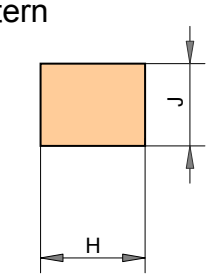
Type	TCR	Impedance	Tolerance	Terminals & T/R	Note
RFTSA100	C	500	F	Z00	---
RFTSA100	C (50ppm/K)	500 (50ohm)	F (1%)	Z00	Bulk
RFTSB100				Z01	Tape reel
RFTSA150					
RFTSB150					
RFTSA250					
RFTSB250					

Specifications and Performances

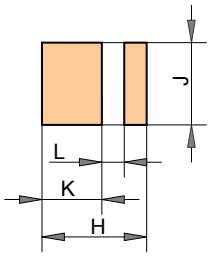
Type	RFTS 05	RFTS 10	RFTS 50	RFTS 100	RFTS 150	RFTS 250	Conditions
Rated Power (W)	5	30	50	100	150	250	
Maximum Power (W)	10	60	100	200	300	500	Pulse<1 second
Impedance (Ohms)	50 Ohms						
TCR (ppm/C)	50						
Tolerance (%)	1.0						
Heat Resistance (C/W)	12.5	6.5	2.5	1.3	1.0	0.5	
VSWR at 1GHz	1.15	1.15	1.2	1.2	1.2	1.2	
Max Operating Temperature	-55 - 155 deg C						
Storage Temperature	-55 - 155 deg C						

SURFACE MOUNT HIGH POWER TERMINATIONS RFTS, RFTSA, RFTSB

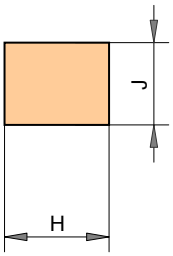
Foot Pattern



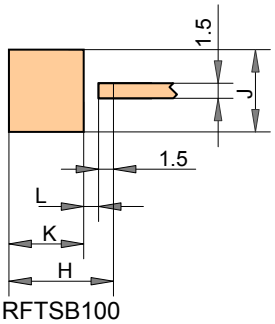
RFTS05 ZF0
RFTS10 ZF0
RFTS50 ZF0
RFTS100 ZF0



RFTS05 ZZ0
RFTS10 ZZ0
RFTS50 ZZ0
RFTS100 ZZ0

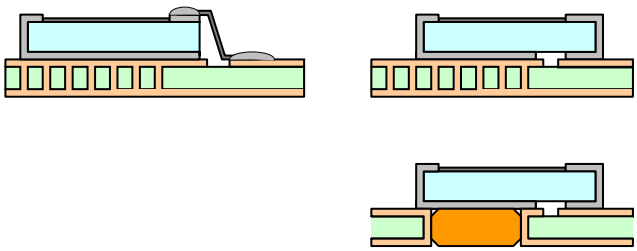


RFTSA100
RFTSA150
RFTSA250



RFTSB100
RFTSB150
RFTSB250

Installation



(mm)	H	J	K	L
RFTS05 ZF0	2.94	1.50	-	-
RFTS05 ZZ0	2.94	1.50		
RFTS10 ZF0	5.48	2.94	-	-
RFTS10 ZZ0	5.48	2.94	(2.98)	0.5
RFTS50 ZF0	5.48	5.48	-	-
RFTS50 ZZ0	5.48	5.48	(2.98)	0.5
RFTS100 ZF0	6.24	9.29	-	-
RFTS100 ZZ0	6.24	9.29	(3.24)	0.5
RFTS150 010	6.75	9.92	--	---
RFTS150 020	6.75	9.92	(4.48)	0.5
RFTS250 010	9.92	9.92	--	-
RFTS250 020	9.92	9.92	(6.92)	0.5

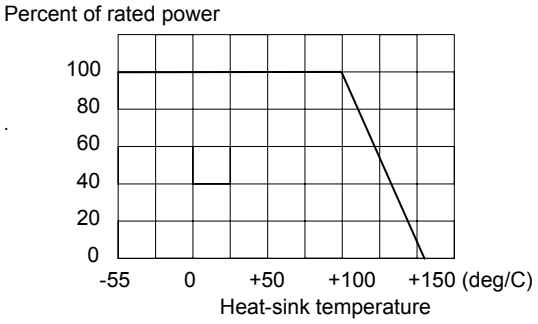
Remarks

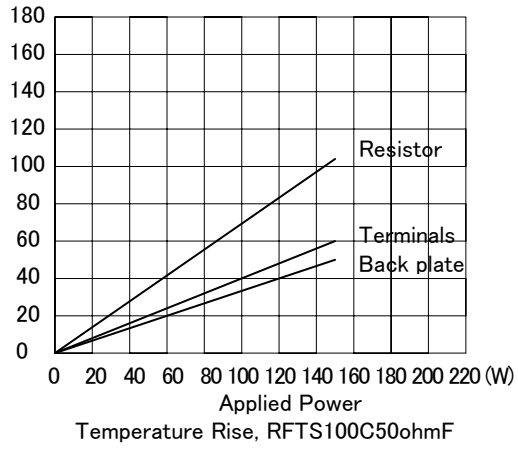
(1) Power rating assumes that chip attached on metal insulated PC board.

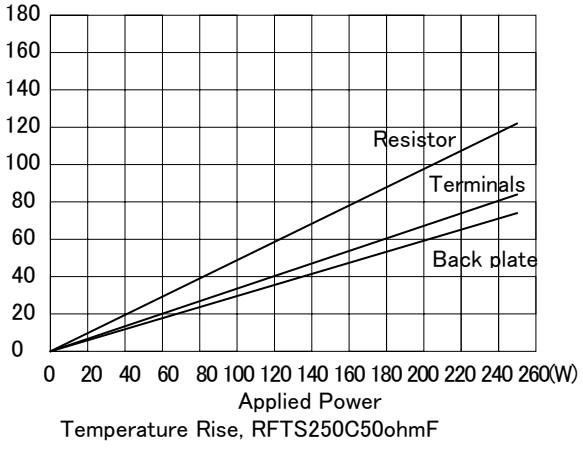
(2) Solder joint design should assure a solder thickness within 50 micron meters.

(3) Cu inlet inserted in to circuit board will help effective heat conduction.

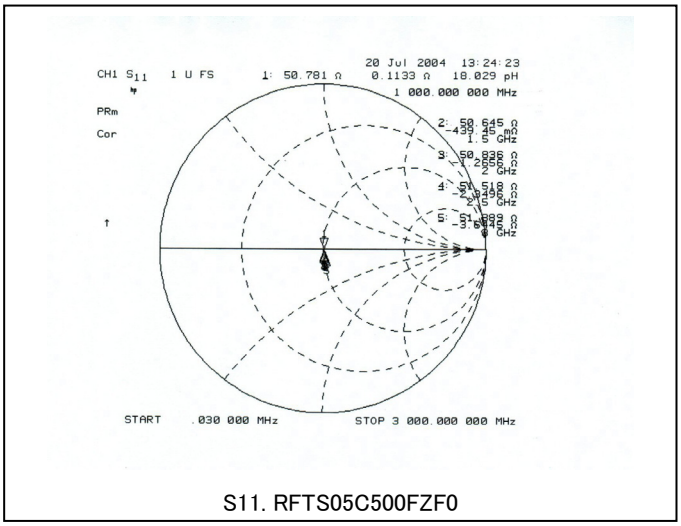
負荷軽減曲線 Derating Curve



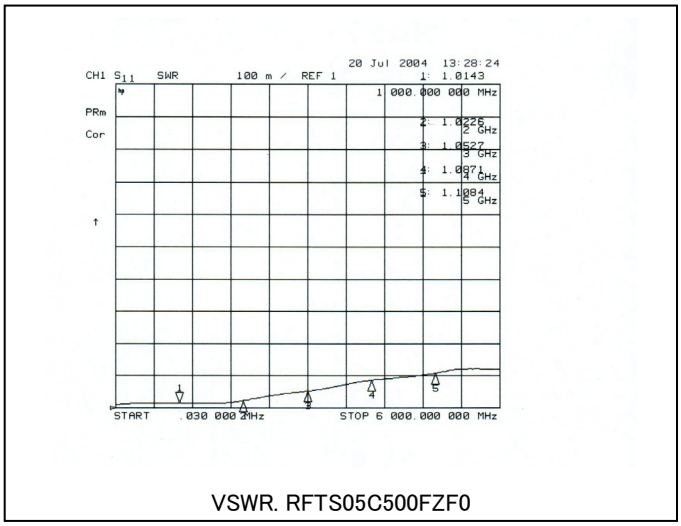




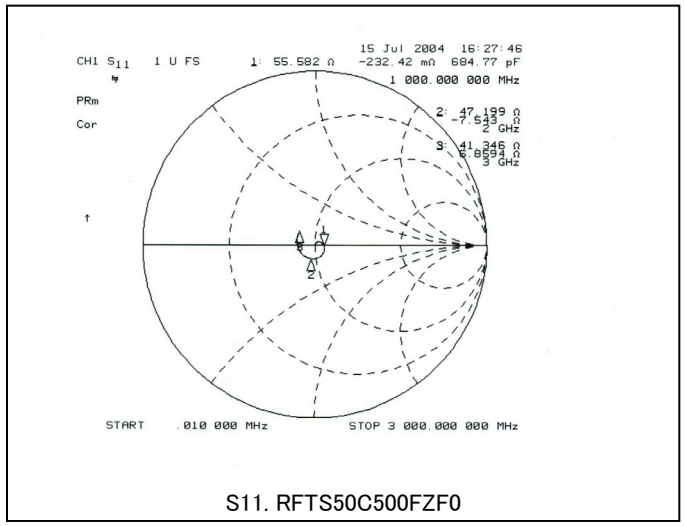
SURFACE MOUNT HIGH POWER TERMINATIONS RFTS, RFTSA, RFTSB



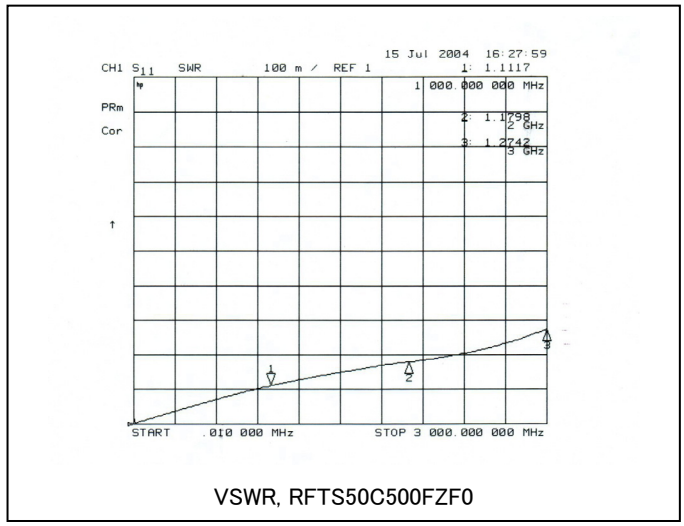
S11. RFTS05C500FZF0



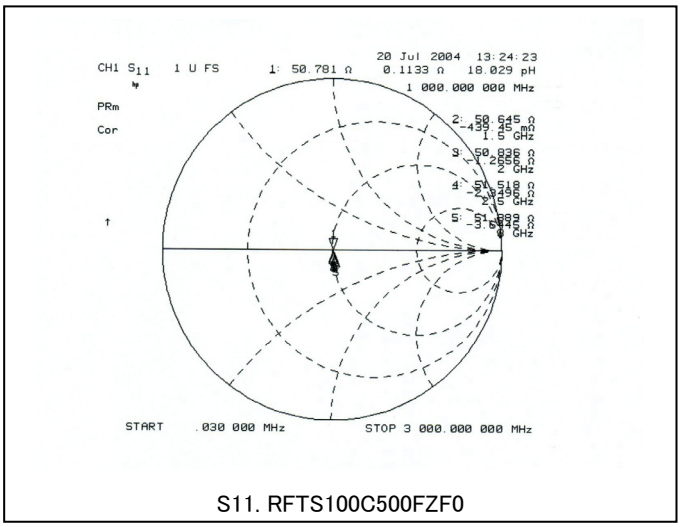
VSWR. RFTS05C500FZF0



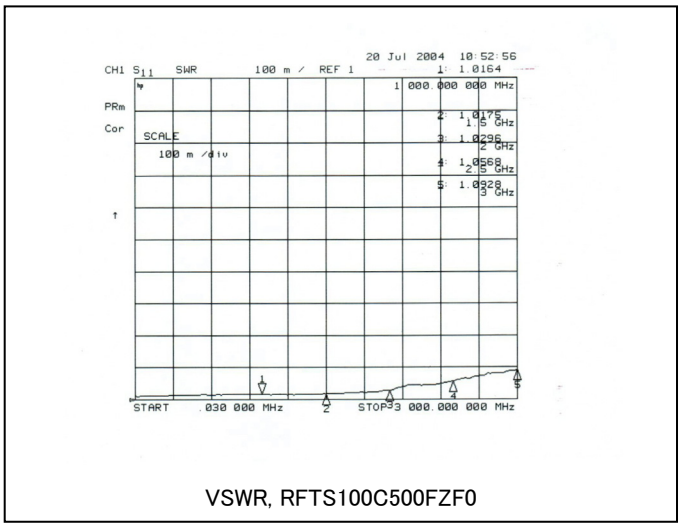
S11. RFTS50C500FZF0



VSWR, RFTS50C500FZF0

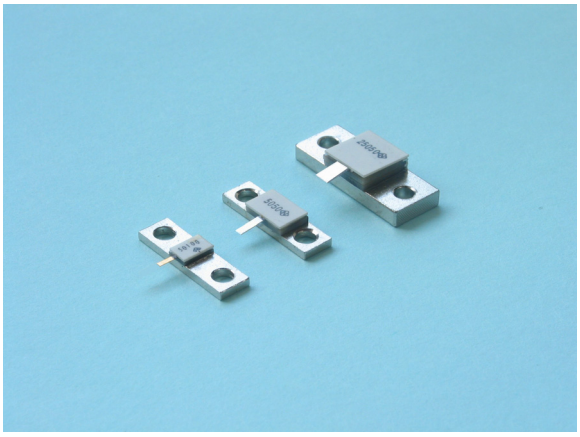


S11. RFTS100C500FZF0



VSWR, RFTS100C500FZF0

10W, 50W, 80W, 100W, 150W, 200W 250W, 400W, 600W FLANGED POWER TERMINATIONS, RFT



Features:

- ●High power flanged termination for all DC up to 4GHz applications.
- ●Small size and wide frequency range specifications realized with through large heat conducting AIN substrate.
- ●Sufficient mechanical strength metallization from spattered thin film technology.
- ●50ohm resistance with tolerance 1%, and terminations include chips and many style flange provided as standard, and other resistance and power available.
- ●Long life and temperature stability are shown by a result of Ni-Cr thin film technology.

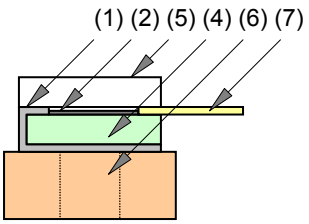
Applications: Termination for isolator/circulators, Fixed station of mobile communication electronics, High power microwave amplifiers

Ordering Information

Type	Style	TCR	Resistance	Tolerance	RoHS/Package
RFT050	120	C	500	F	Z00
RFT010	100	C (50ppm)	50 Ohm	F (1.0%)	Z00
RFT050	110				
RFT080	120				
RFT100	130				
RFT150	140				
RFT200					
RFT250					
RFT400					
RFT600					

Performance Specifications

Type	Rated Power (W)	Heat Resistance (deg C/W)	VSWR 500MHz	VSWR 1GHz	VSWR 2GHz
RFT010	10	6.5	---	1.15	---
RFT050	50	2.5	---	1.15	---
RFT080	80		---	1.20	---
RFT100	100	1.3	---	1.20	---
RFT150	150		---	1.30	---
RFT200	200		---		---
RFT250	250	0.5	---	1.30	---
RFT400	400		---		---
RFT600	800		---		---



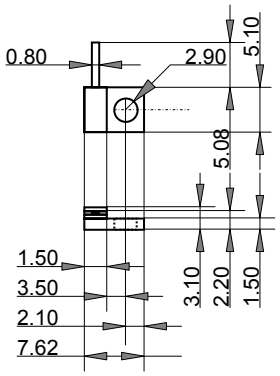
	Substance	Material
(1)	Cold end Terminal	Tin plated Ni-Cu
(2)	Resistive	Ni-Cr
(3)	Substrate	ALN
(4)	Hot end Terminal	Tin plated Ni-Cu
(5)	Cover	ALO
(6)	Flange	Ni plated Cu
(7)	Beam Lead	Au plated Cu

Nikkohm Co., Ltd. 3-31-2640 Minamicho, Misawa, Aomori 033-0036 Japan TEL: +81-176-53-2105, FAX: +81-176-53-2106

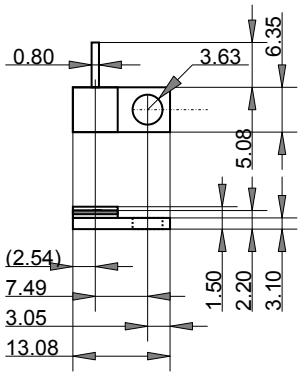
URL: http://www.nikkohm.co.jp & http://www.nikkohm.com / e-mail: info@nikkohm.co.jp

10W, 50W, 80W, 100W, 150W, 200W、250W, 400W, 600W, TERMINATIONS

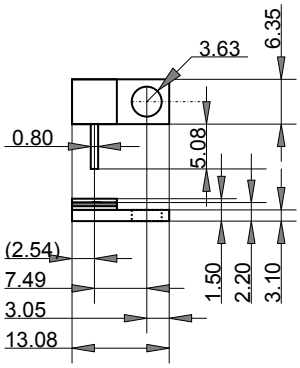
Style and Dimension (mm)



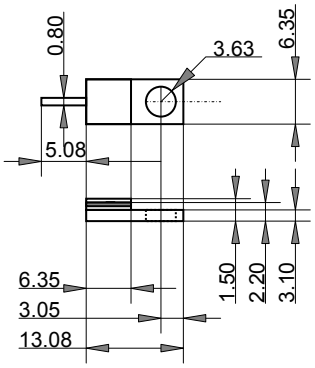
RFT010 120



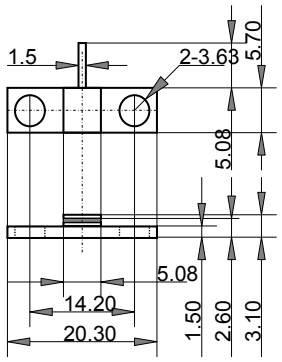
RFT050 120
RFT080 120



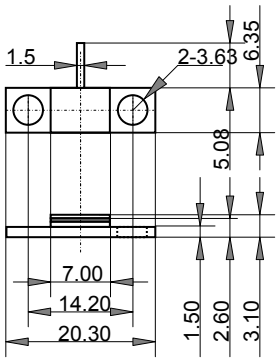
RFT050 130
RFT080 130



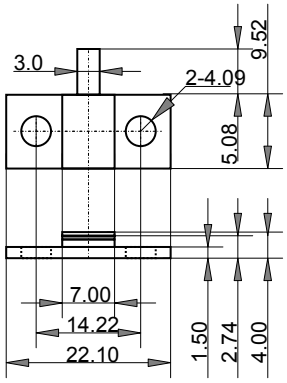
RFT050 140
RFT080 140



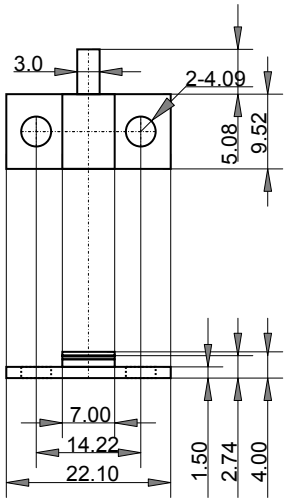
RFT050 110



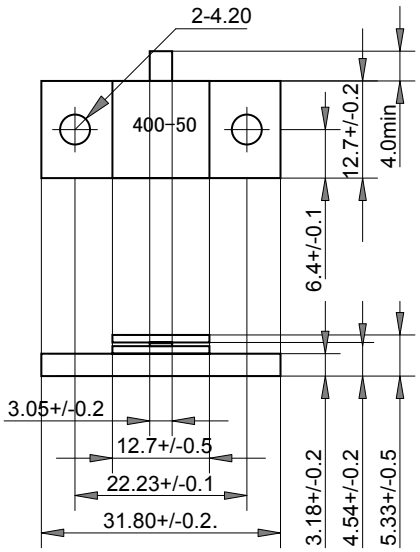
RFT100 110



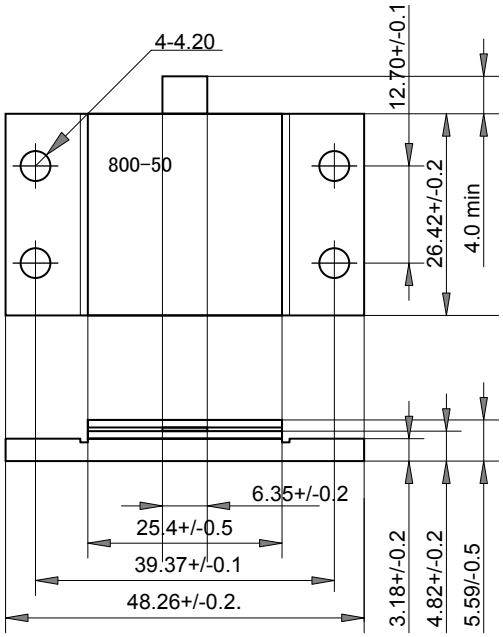
RFT150 110



RFT250 110



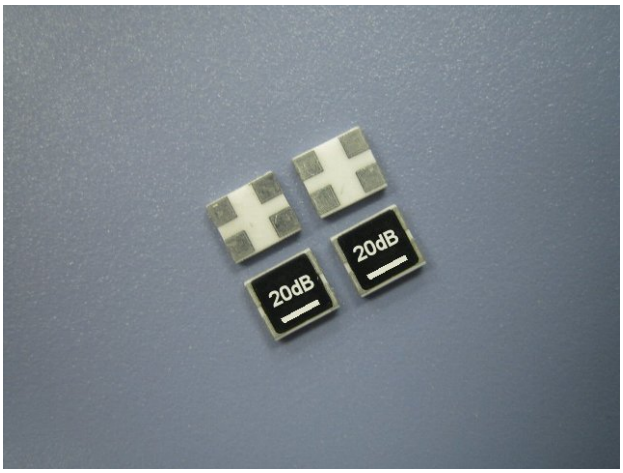
RFT400 110



RFT 600 110

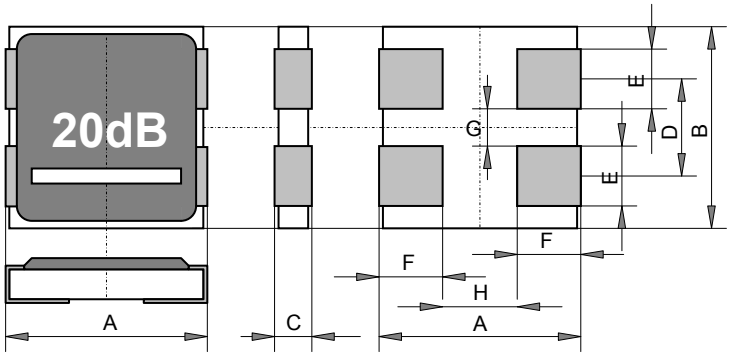
20111201

RF CHIP ATTENUATOR,
RFA001 010



Features and Applications

2.5GHz-1W surface mount small 4mmx4mm size, attenuators of 50ohm characteristic impedance.
RFA001 has 2.5GHz-1W power rating and high durability against pulse / EMI accidents in small signal applications.
Long life and temperature stability of thin film technology realize better performance at a temperature range from –55C to +155C.
Applications include impedance matching, gain control circuits, isolation circuits of power boost amplifiers at GHz, loss compensation of transmission line of data communication systems, detecting signal control of ATE-LSI test system-circuit board functional test systems, industrial measurement electronics, medical scientific electronics and miscellaneous communication systems.



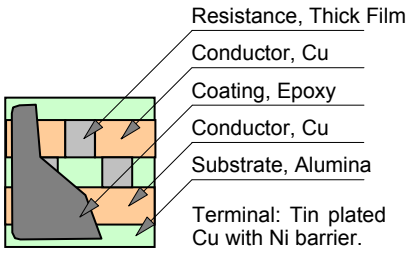
Symbol	mm	inch
A	4.0 /-0.2	0.157+/-0.008
B	4.0+/-0.2	0.157+/-0.008
C	(0.65)	(0.026)
D	2.0+/-0.1	0.079+/-0.004
E	(1.2)	(0.047)
F	1.2+/-0.1	0.047+/-0.004
G	0.8+/-0.1	0.032+/-0.004
H	1.6+/-0.1	0.063+/-0.004

Specifications and Performances

Attenuation	0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 20, 40* dB
Tolerance of Attenuation (at DC)	1-9dB:±0.3dB, 10dB:±0.5dB, 20dB:±1dB
Frequency Range	0-10dB: DC- 2,5GHz, 20dB: DC-600MHz
Volt Standing Wave Ratio	<1.2(0-10dB, DC-2.5GHz), (20dB, 0.6GHz)
Rating Power	1W
Characteristic Impedance	50 ohm
Tolerance of Impedance (at DC)	±2 ohm

(*) Attenuation 40dB is optional, please mail to info@nikkohm.co.jp

Structure and Material

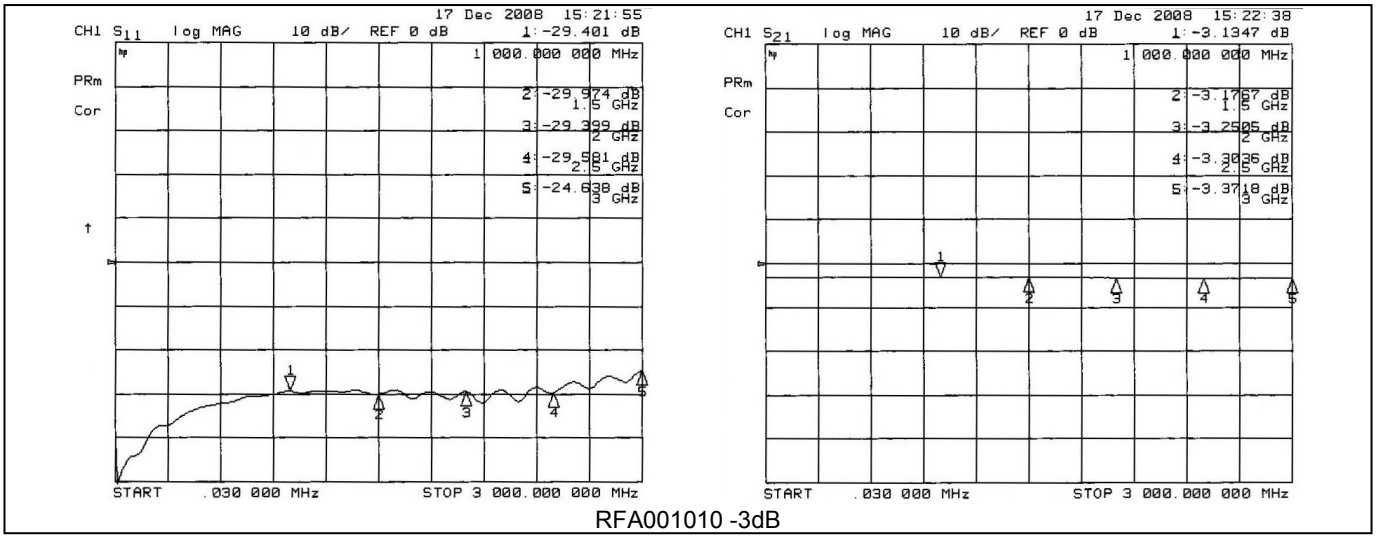


Ordering Information

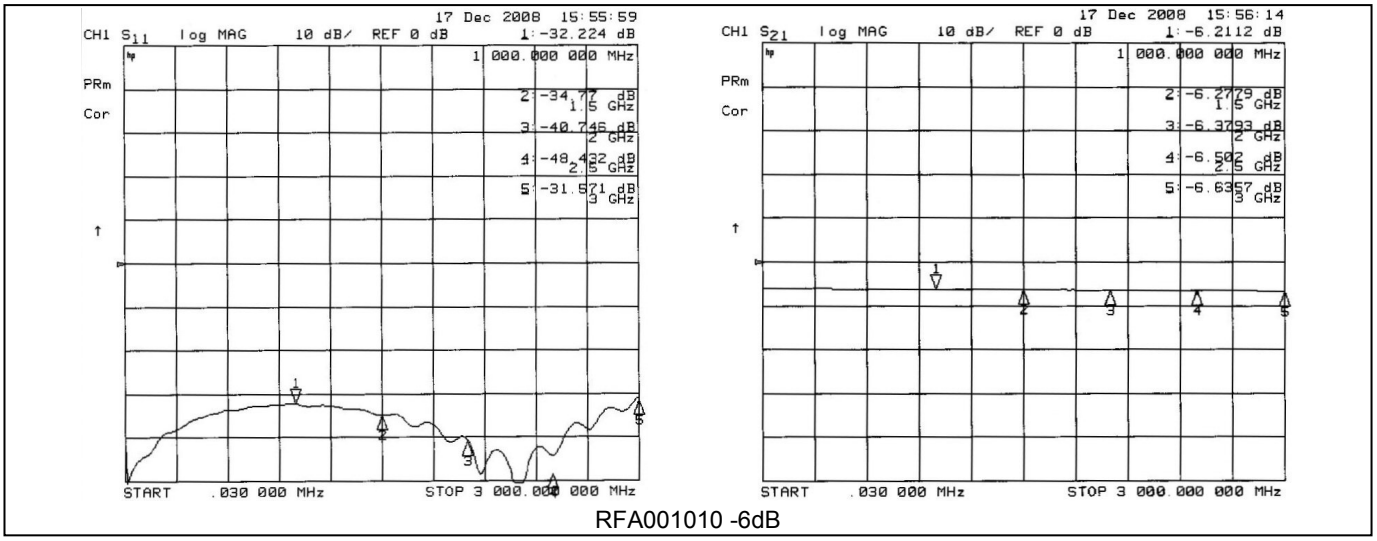
Type	Attenuation	Rating Power	
RFA001010	6dB	Z00	
RFA001010	0, 1, 2, 3, 4dB	Z00	Bulk
	5, 6, 7, 8, 9 dB	Z01	Tape reel
	10, 20, 40 dB		

RF CHIP ATTENUATOR RFA001 010

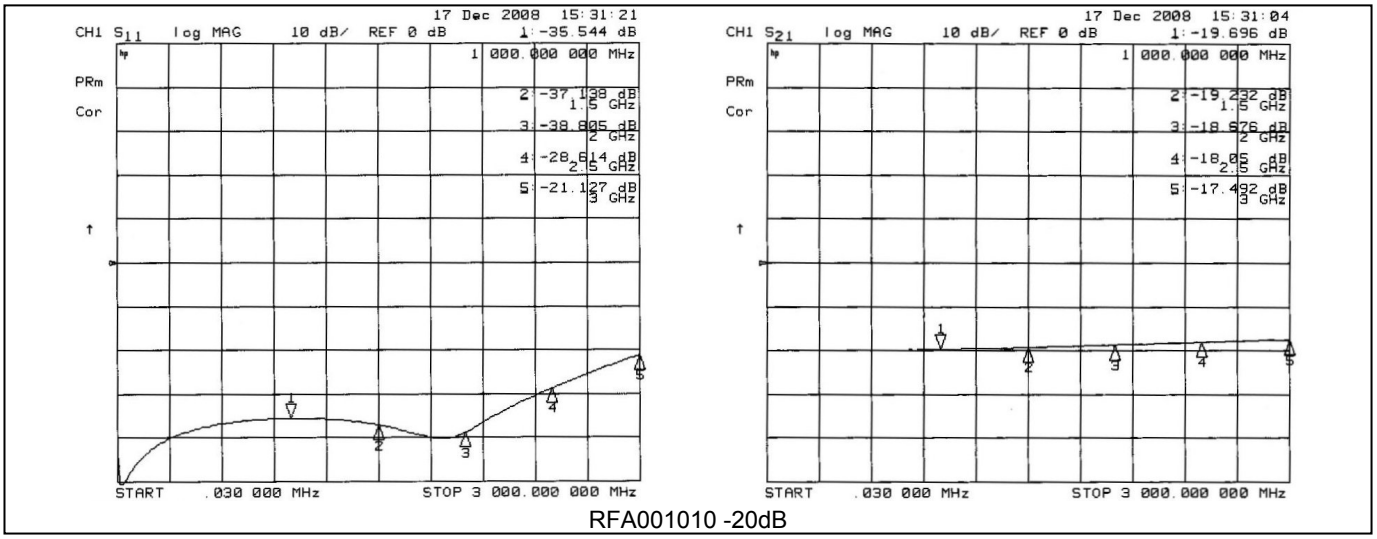
Typical S11-S21



RFA001010 -3dB



RFA001010 -6dB



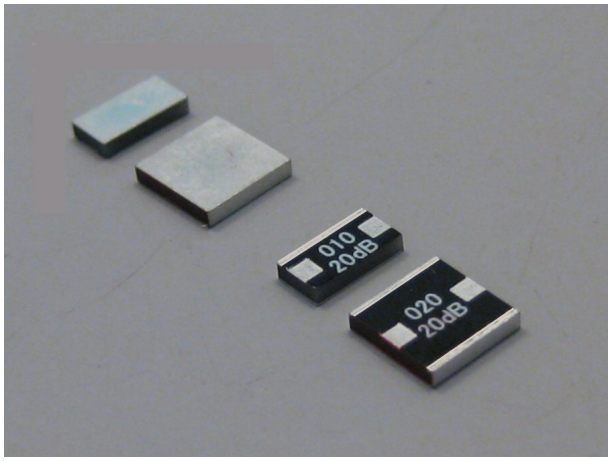
RFA001010 -20dB

Transformation: $VSWR = \frac{1+|\Gamma|}{1-|\Gamma|} \ldots\ldots |\Gamma| = 10^{\frac{S11}{20}}$ $\qquad |\Gamma| = \frac{VSWR-1}{VSWR+1} \ldots\ldots S11 = -(-20\log|\Gamma|)$

20091201

10W-150W

SURFACE MOUNT 50 ohm RF POWER ATTENUATORS RFA010, RFA020, RFA040, RFA100, RFA150



Features and Applications

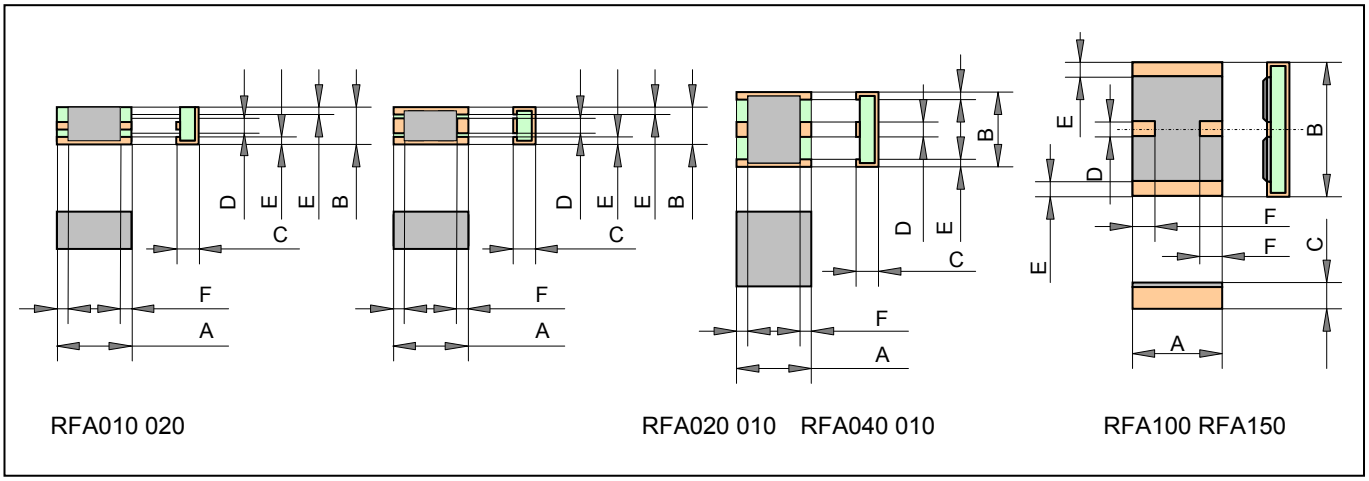
RFA010 to RFA150, 10W to 150W, surface mount small size attenuators of 10dB, 20dB and 30dB attenuation, 50ohm characteristic impedance for DC to 3GHz.

Pb free and BeO free configuration.

Long life and temperature stability of thin film technology realize better performance at a temperature range from –55C to +155C.

Applications include power detect circuit of isolator, gain control circuits, isolation circuits of power boost amplifiers at GHz, loss compensation of transmission line of data communication systems, detecting signal control of ATE-LSI test system-circuit board functional test systems, industrial measurement electronics, medical scientific electronics and many communication systems.

Dimensions (mm)



P/N	A	B	C	D	E	F	old p/n
RFA010 020	5.08+/-0.25	2.54+/-0.25	1.1 max.	1.0+/-0.3	0.2+/-0.1	(1.0)	Tee
RFA020 010	5.08+/-0.25	5.08+/-0.25	1.1 max.	1.0+/-0.3	0.2+/-0.1	(1.0)	PAI
RFA020 020	5.08+/-0.25	5.08+/-0.25	1.1 max.	1.0+/-0.3	0.2+/-0.1	(1.0)	Tee
RFA040 010	5.08+/-0.25	5.08+/-0.25	1.1 max.	1.0+/-0.3	0.2+/-0.1	(1.0)	PAI
RFA100 030	5.72+/-0.25	8.90+/-0.25	1.1 max.	1.1+/-0.3	0.3+/-0.1	(1.1)	RFAS100-1
RFA150 030	6.35+/-0.25	9.52+/-0.25	1.1 max.	1.1+/-0.3	0.3+/-0.1	(1.1)	RFAS150-1

SURFACE MOUNT RF POWER ATTENUATORS, 10W-150W

RFA010, RFA020, RFA040, RFA100, RFA150

Ordering Information

Type	Style	---	Attenuation	Code		Note
RFA100	030	---	20dB	Z01		
RFA010	010	---	10dB	Z00	>	Bulk
RFA020	020		20dB	Z01	>	Tape Reel
RFA040	030		30dB			
RFA100						
RFA150						

Specifications and Performances

Model	Rated Power	Schematic	Impedance*2	Attenuations*1	Frequency	Note
RFA010 010	10 W	Balanced PAI	50 ohm	3, 4, 5, 6, 7, 8, 9, 10, 20, 30 dB	DC-6.0GHz	
RFA010 020	10 W	Unbalanced Tee	50 ohm	10dB, 20dB, 30dB	DC-3.0GHz	
RFA020 010	20 W	Balanced PAI	50 ohm	10dB, 20dB, 30dB	DC-3.0GHz	
RFA020 020	20 W	Balanced Tee	50 ohm	10dB, 20dB, 30dB	DC-3.0GHz	
RFA040 010	40 W	Balanced PAI	50 ohm	10dB, 20dB, 30dB	DC-3.0GHz	
RFA100 030	100 W	Balanced PAI	50 ohm	10dB, 20dB, 30dB	DC-3.0GHz	
RFA150 030	150 W	Balanced PAI	50 ohm	10dB, 20dB, 30dB	DC-3.0GHz	

(*1) Attenuation Tolerance at DC are 20, 30dB: +/-0.4dB.

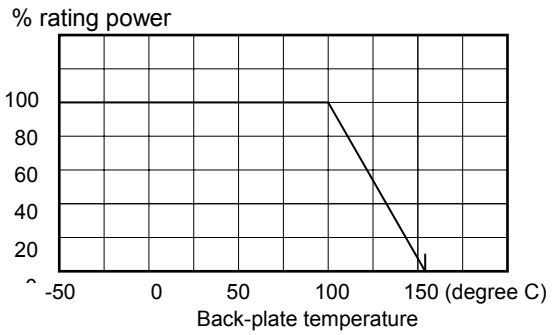
(*2) Impedance tolerance at DC are 50 ohm +/- 2%.

Note 1: Rating wattage of RFA100 and RFA150 assume that the chip attached on proper heat-sink by solder.

Specifications

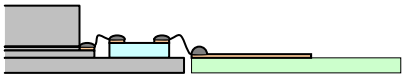
Items	Specifications	Conditions
Tolerance of Impedance	+/- 2%	Input DC resistance in terminating output with resistor.
Tolerance of Attenuation	See above note *1.	Output DC volt in terminating out put with resistor when stable 1V DC volt source connect to input.
TC of Impedance	+/- 50ppm/C	TC of input DC resistance in terminating output with resistor.
TC of Attenuation	+/- 50ppm/C	TC of output DC volt in terminating out put with resistor when stable 1V DC volt source connect to input.
Rating Temperature	-55-100 C	
Soldering Heat	+/- 1%	350C, 3 seconds dipping.
Soldering capability	95% covered	
Humidity	+/- 1% impedance	Input DC resistance change Under condition of 40C temp and 90-95%RH, rating power ON-90min, OFF-30min, 1000h
Load Life	+/- 1% impedance	Input DC resistance change. Under condition of 70C temp, rating power ON-90min, OFF-30min, 1000h
Operating Temperature	-55 deg C - +155 deg C	
Storage Temperature	-55 deg C - +155 deg C	

Derating

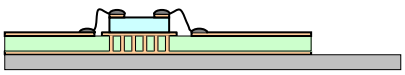


Note

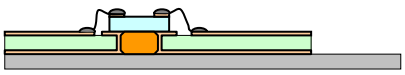
Heat conduction methods



Direct joint on metal surface.



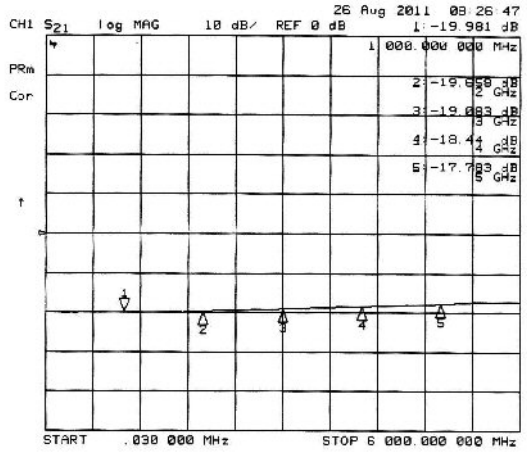
Heat transfer through via hole of PCB.



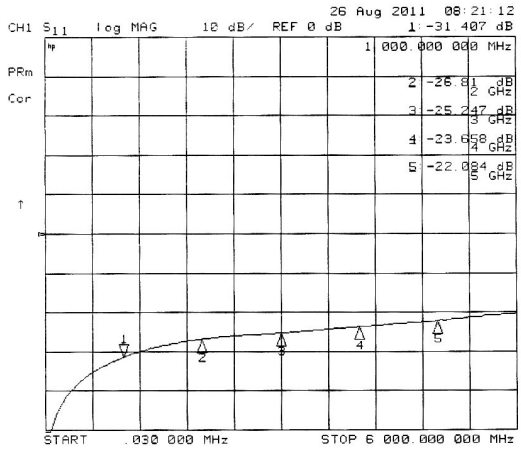
Heat transfer through Copper cylinder fitting.

SURFACE MOUNT RF POWER ATTENUATORS, 10W-150W

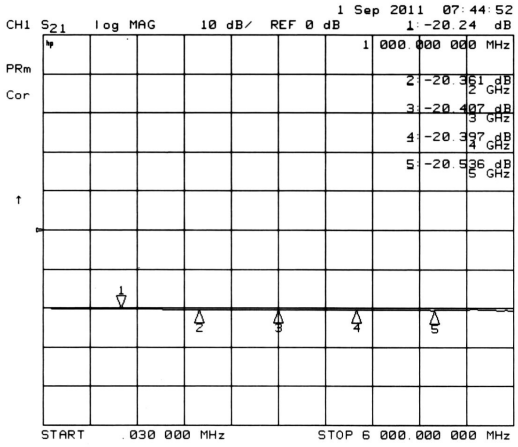
RFA010, RFA020, RFA040, RFA100, RFA150



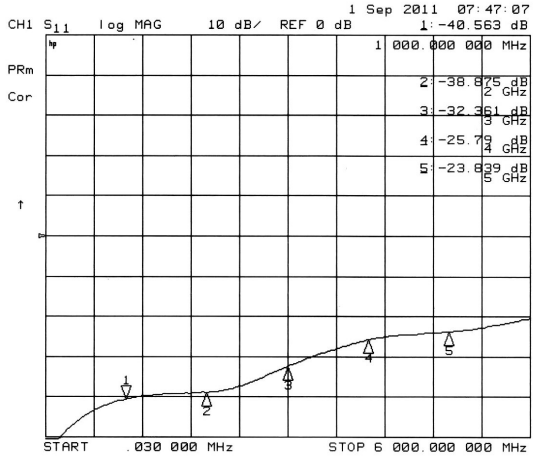
Attenuation, 10W RFA010 020



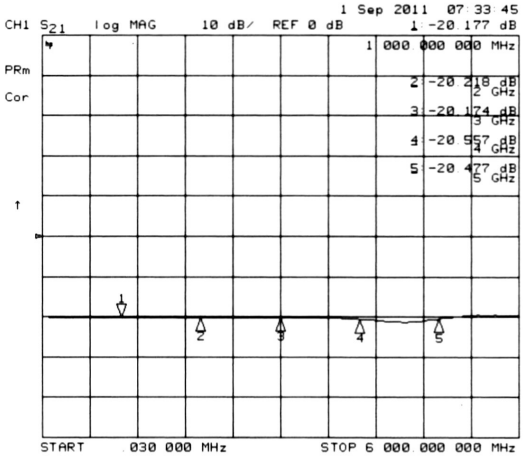
Return Loss, 10W RFA010 020



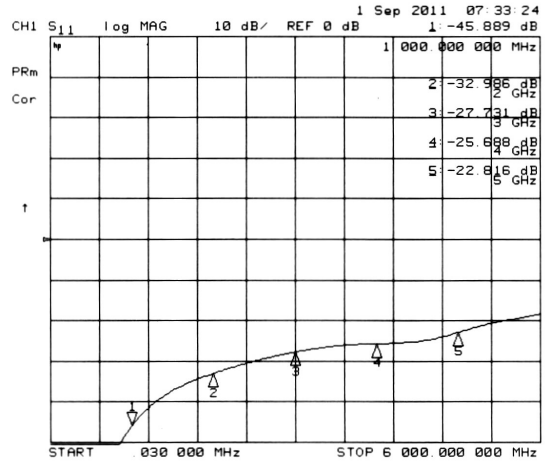
Attenuation, 20W RFA020 010



Return Loss、20W RFA020010



Attenuation, 20W RFA020 020



Return Loss, 20W RFA020 020

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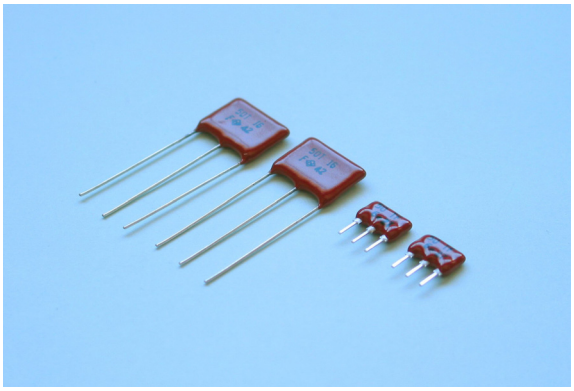
VHF/UHF THROUGH-HOLE ATTENUATOR

RFA-50T, RFA-75T, RFA-300T, RFA-600T



Features and Applications

RF attenuators with 50ohm, 75ohm, 300ohm and 600ohm characteristic impedance and T- schematic. For through hole applications of SIP.

Long life and temperature stability a result of Ni-Cr thin film and alumina substrates. RFA series useful in isolation circuits, data transmission, mobile, RF applications and measurements

Specifications and Performances

Model	Type	Characteristic Impedance	Attenuation	Frequency	Rate Power
RFA-50TF	T-SIP 2.54pitch leads	50 ohm	2,3,4,5,6,7,8,9,10,16, 20,30,32 dB	DC-100MHz	0.25W
RFA-75TF	T-SIP 2.54pitch leads	75 ohm	2,3,4,5,6,7,8,9,10,16, 20,30 dB	DC-100MHz	0.25W
RFA-300TF	T-SIP 2.54pitch leads	300 ohm	2,3,4,5,6,7,8,9,10,16, 20,30 dB	DC-100MHz	0.25W
RFA-600TF	T-SIP 2.54pitch leads	600 ohm	2,3,4,5,6,7,8,9,10,16, 20,30 dB	DC-100MHz	0.25W
RFA-50T	T-SIP 5.0pitch leads	50 ohm	2,3,4,5,6,7,8,9,10,16, 20,30,32 dB	DC-100MHz	0.50W
RFA-75T	T-SIP 5.0pitch leads	75 ohm	2,3,4,5,6,7,8,9,10,16, 20,30 dB	DC-100MHz	0.50W
RFA-300T	T-SIP 5.0pitch leads	300 ohm	2,3,4,5,6,7,8,9,10,16, 20,30 dB	DC-100MHz	0.50W
RFA-600T	T-SIP 5.0pitch leads	600 ohm	2,3,4,5,6,7,8,9,10,16, 20,30 dB	DC-100MHz	0.50W

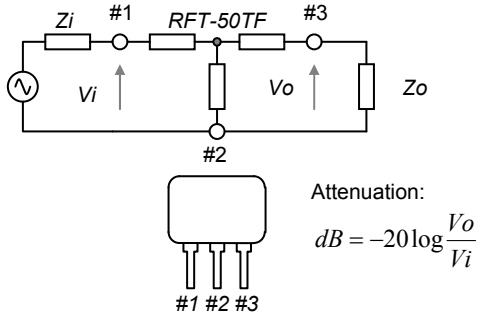
Note: 1db and 40dB are optional, consult factory.

Ordering Information

Model	Attenuation	Imp. Tolerance	RoHS	Note
RFA-50TF	6dB	F (1%)	Z00	---
RFA-50TF	2dB	F (+/-1%)	Z00	---
RFA-75TF	3dB			
RFA-300TF	4dB			
RFA-600TF	5dB, 6dB, 7dB			
	8dB, 9dB			
RFA-50T	10dB			
RFA-75T	16dB			
RFA-300T	20dB			
RFA-600T	30dB			
	32dB(*)			

(*): Attenuation 32dB is optional only for RFA50TF and RFA50T.

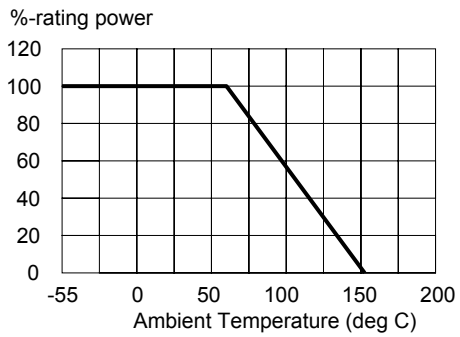
Pin Assignment



Attenuation:

$$dB = -20\log\frac{Vo}{Vi}$$

Power Derating



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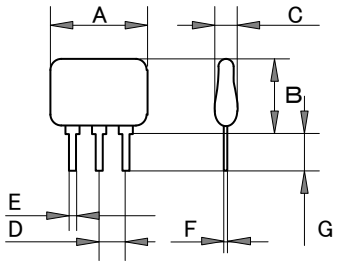
VHF/UHF THROUGH-HOLE ATTENUATORS
RFA-50T, RFA-75T, RFA-300T, RFA-600T

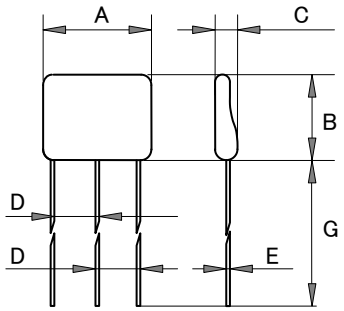
Dimensions

RFA-50TF, RFA-75TF, RFA-300TF, RFA-600TF



Symbol	mm
A	8.0max
B	7.0max
C	3.0max
D	2.54
E	0.5
F	0.25
G	3.3

RFA-50T, RFA-75T, RFA-300T, RFA-600T



Symbol	mm
A	13.0max
B	11.5max
C	2.5max
D	5.0
E	0.5φ
F	-
G	20

Perforemance

Items	Specifications	Test Methods
Tolerance of Impedance	+/-1% (F)	Input dc resistance in terminating output port with precision resistor.
Tolerance of Attenuation	+/-1%	Output dc volt in terminating output port with precision resistor when 1V stable dc source connect to input port.
TCR of Impedance	+/-50ppm/deg C	TC of input DC resistance in terminating output port with precision resistor
TCR of Attenuation	+/-50ppm/deg C	Output dc volt TC in terminating output port with precision resistor when 1V stable dc source connect to input port.
Rating Temperature	+70 deg C	-55 deg C to +70 deg C at rating power (Operating: +155deg C)
Soldering Heat	+/-1%	350℃, 3 seconds, dipping
Solder-ability	75% Covered	350℃, 3 seconds, dipping
Humidity	+/-1%	40℃,-95%RH, DC0.1W, 1000H
Load Life	+/-1%	70℃, 90minON, 30minOFF, 100H
Vibration	+/-1%	
Operating Temperature	-55 - +155 deg C	
Storage Temperature	-55 - +155 deg C	

Remarks:
Attenuators, RFA-50TS, RFA-300B, RFA-600B, RFA-85FD, RFA-85FC were discontinued, when request please call our factory.

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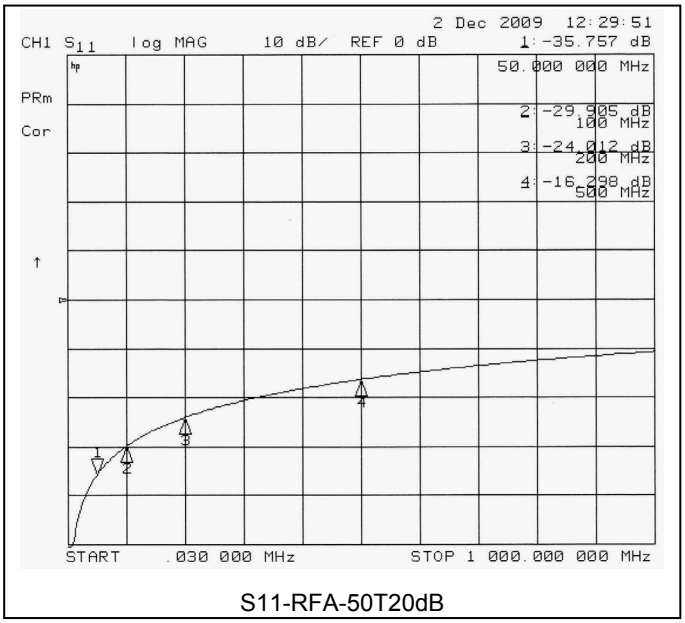
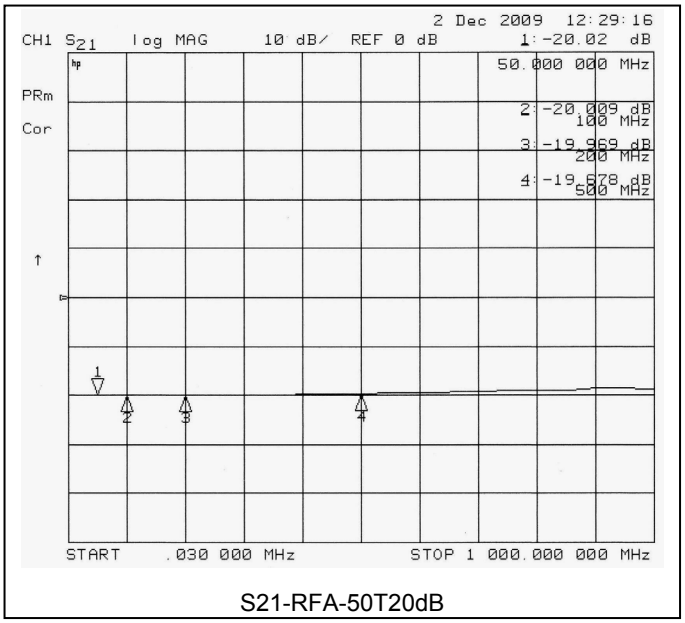
VHF/UHF THROUGH-HOLE ATTENUATORS
RFA-50T, RFA-75T, RFA-300T, RFA-600T

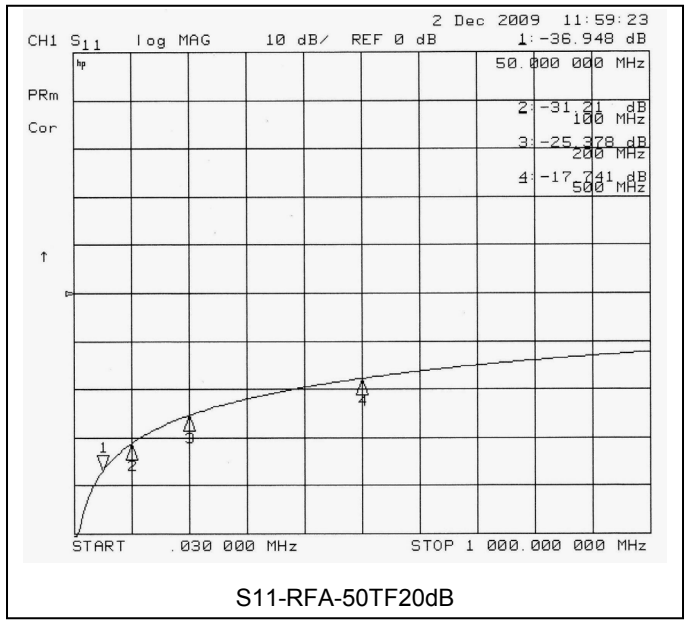
RF Characteristics, Typical



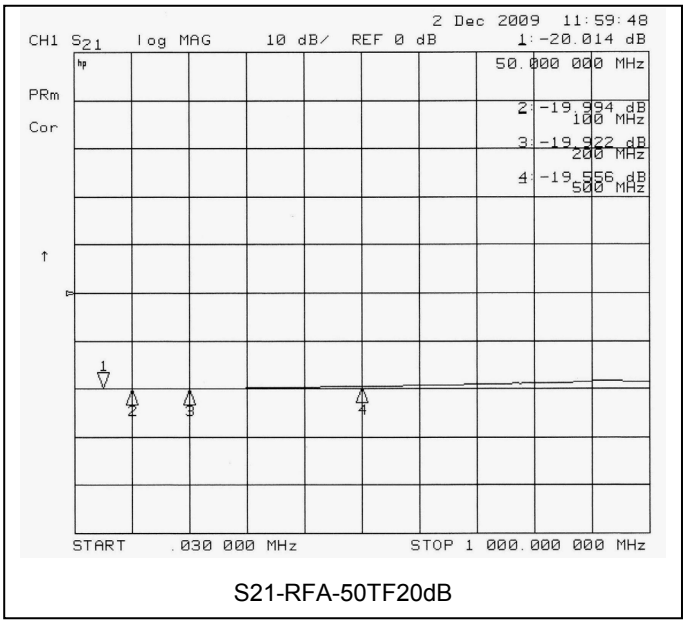
S11-RFA-50T20dB



S21-RFA-50T20dB



S11-RFA-50TF20dB



S21-RFA-50TF20dB

Note: Transformation between VSWR and S11:

$$VSWR = \frac{1+|\Gamma|}{1-|\Gamma|} \quad \ldots\ldots |\Gamma| = 10^{\frac{S11}{20}}$$

$$|\Gamma| = \frac{VSWR-1}{VSWR+1} \quad \ldots\ldots S11 = -(-20\log|\Gamma|)$$

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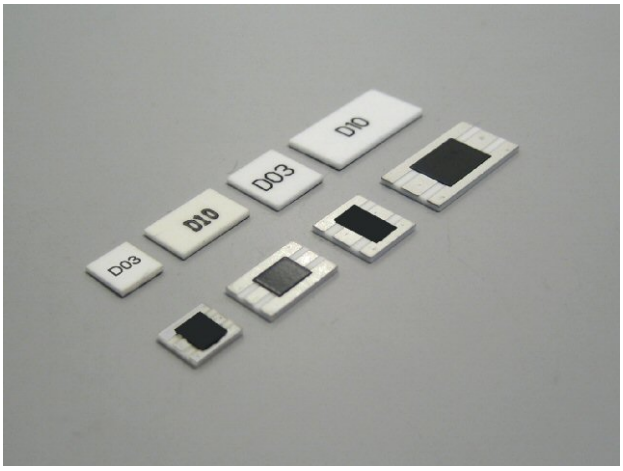
COAXIAL
RF POWER ATTENUATORS
RFA-54, RFA-55
RFA-85, RFA-67, RFA-37



Features and Applications

RFA-54D, RFA-84D, RFA-67D, RFA-37D are used for balanced coaxial attenuators, and are durable with large rated power.

In RFA-55DD, face down configuration on co-planer line show better return loss characteristics.

RFA-68D, 1.5GHz-30W, by attached to the heart sink direct, small size power attenuator.

Long life and temperature stability of thin film technology realize better performance at a temperature range from –55C to +155C.

Applications include gain control circuits, isolation circuits of power boost amplifiers at GHz, loss compensation of transmission line of data communication systems, detecting signal control of ATE-LSI test system-circuit board functional test systems, industrial measurement electronics, medical scientific electronics and miscellaneous communication systems.

Specifications and Performances

P/N	Type	Impedance	Attenuation (*1)	Frequency(*2)	Input Power(*3)
RFA-54DD	Coaxial	50 ohm	2, 3, 4, 5, 6, 7, 8, 9, 10, 20 dB	DC- 4GHz	0.25W
RFA-55DD	SMD	50 ohm	2, 3, 4, 5, 6, 7, 8, 9, 10, 20 dB	DC- 4GHz	0.25W
RFA-85DD	Coaxial	50 ohm	2, 3, 4, 5, 6, 7, 8, 9, 10, 20 dB	DC- 3GHz	0.50W
RFA-67DD	Coaxial	50 ohm	2, 3, 4, 5, 6, 7, 8, 9, 10, 20 dB	DC- 3GHz	1.00W
RFA-37DD	Coaxial	50 ohm	2, 3, 4, 5, 6, 7, 8, 9, 10, 20 dB	DC- 3GHz	1.00W
RFA-54DC	Coaxial	75 ohm	2, 3, 4, 5, 6, 7, 8, 9, 10, 20 dB	DC- 4GHz	0.25W
RFA-55DC	SMD	75 ohm	2, 3, 4, 5, 6, 7, 8, 9, 10, 20 dB	DC- 4GHz	0.25W
RFA-85DC	Coaxial	75 ohm	2, 3, 4, 5, 6, 7, 8, 9, 10, 20 dB	DC- 3GHz	0.50W
RFA-67DC	Coaxial	75 ohm	2, 3, 4, 5, 6, 7, 8, 9, 10, 20 dB	DC- 3GHz	1.00W
RFA-37DC	Coaxial	75 ohm	2, 3, 4, 5, 6, 7, 8, 9, 10, 20 dB	DC- 3GHz	1.00W

(*1) Attenuation tolerance at DC are 2,3,4,5,6db: +/-0.2dB, 7,8,9,10dB: +/-0.3dB, 20dB: +/-0.4dB

(*2) Frequency range are typical at S11<20dB, please note it will be influenced by the structure.

(*3) Input power are typical values under condition of assembling into metal housing.

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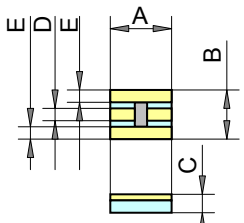
COAXIAL RF POWER ATTENUATORS
RFA−54, RFA−55, RFA−85, RFA−67, RFA−37

Ordering Information

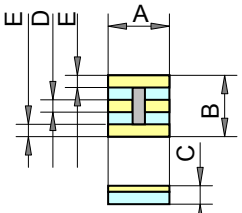
Type	Configuration (*1)	Attenuation	Packaging	Note
RFA-67	DD	10dB	Z00	
RFA-54	DD(50ohm)	2dB	Z00	> Bulk in PE box
RFA-55	DC(75ohm)	3dB	(Z01)	> (Taping option)
RFA-85		4dB		
RFA-67		5dB		
RFA-37		6dB		
		7dB		
		8dB		
		9dB		
		10dB		
		20dB		
		16dB option		

(*1) DD shows balanced 50ohm and DC shows balanced 75ohm characteristic impedance.

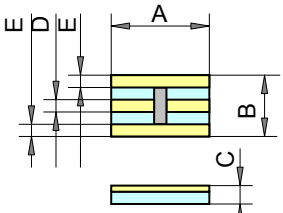
Dimensions (mm)



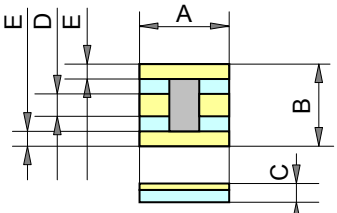
RFA54DD



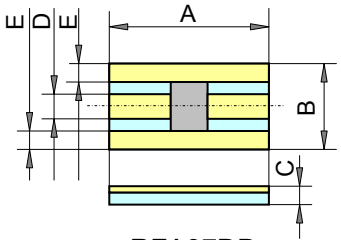
RFA55DD



RFA85DD



RFA67DD



RFA37DD

Type	A (mm)	B (mm)	C (mm)	D (mm)	E (mm)
RFA-54D	5.00	3.80	0.70	1.20	0.80
RFA-55D	5.00	4.50	0.70	1.20	1.00
RFA-85D	8.00	5.25	0.70	1.40	1.10
RFA-67D	6.00	7.00	0.70	2.00	1.40
RFA-37D	13.00	7.00	0.70	2.00	1.40

(*1) In case of 'DC', conductor width happen to change.

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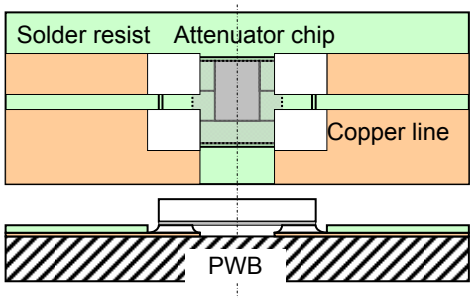
COAXIAL RF POWER ATTENUATORS
RFA-54, RFA-55, RFA-85, RFA-67, RFA-37

Specifications

Items	Specifications	Test Conditions
Characteristic Impedance	50Ω / 75Ω	
Tolerance of Impedance	+/- 2% (G)	Input DC resistance in terminating output with resistor.
Tolerance of Attenuation	See Bottom of first page.	Output DC volt in terminating out put with resistor when stable 1V DC volt source connect to input.
TC of Impedance	+/- 50ppm/deg C	TC of input DC resistance in terminating output with resistor.
TC of Attenuation	+/- 50ppm/deg C	TC of output DC volt in terminating out put with resistor when stable 1V DC volt source connect to input.
Rating Temperature	-55-70 deg C	
Soldering Heat	+/- 1%	DC resistance, 350C, 3 seconds dipping.
Soldering capability	95% covered	
Humidity	+/- 1%	Input DC resistance change Under condition of 40C temp and 90-95%RH, rating power ON-90min, OFF-30min, 1000h
Load Life	+/- 1%	Input DC resistance change. Under condition of 70C temp, rating power ON-90min, OFF-30min, 1000h
Operating Temperature	-55deg C - +155deg C	At hot spot of resistive material
Storage Temperature	-55deg C - +155deg C	1000 hours in excluding solder-ability and conductor damage

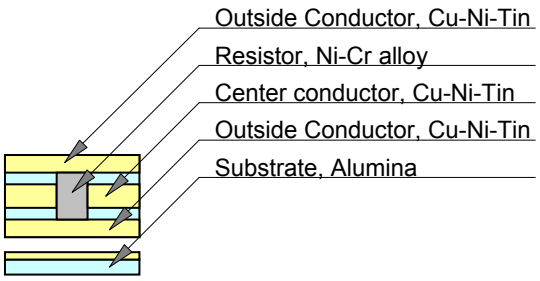
Note: Above specifications are applied to RFA-54D, RFA-55D, RFA-85D, RFA-67D and RFA-37D.

Face down installation, RFA-55DD

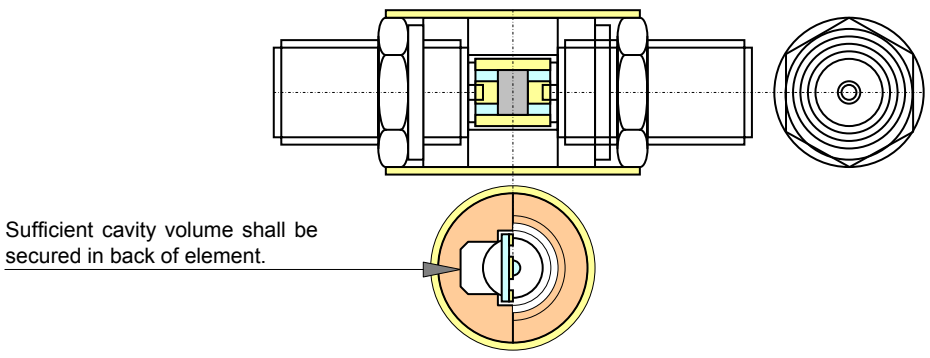


RF signal will be propagated straightly with out reflection.

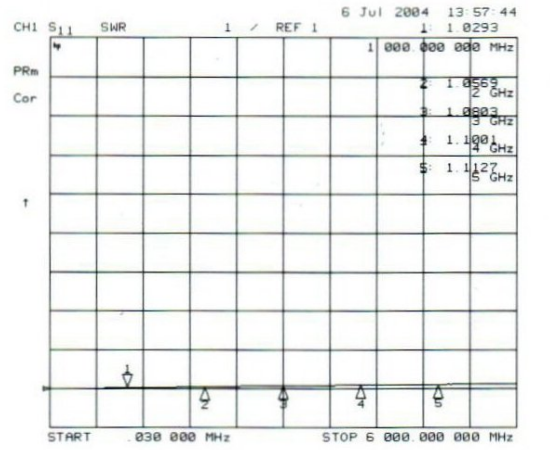
Materials



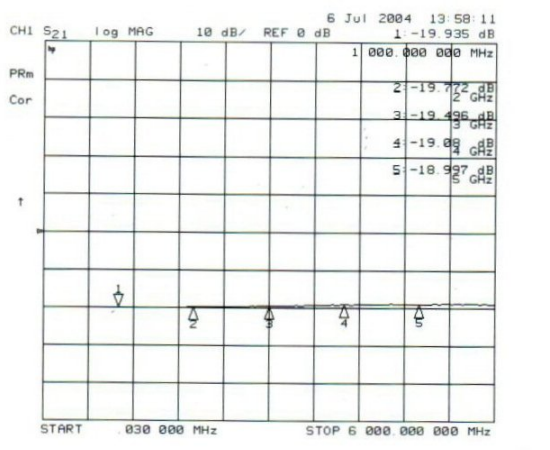
Coaxial Installation, RFA-85D, RFA-67D



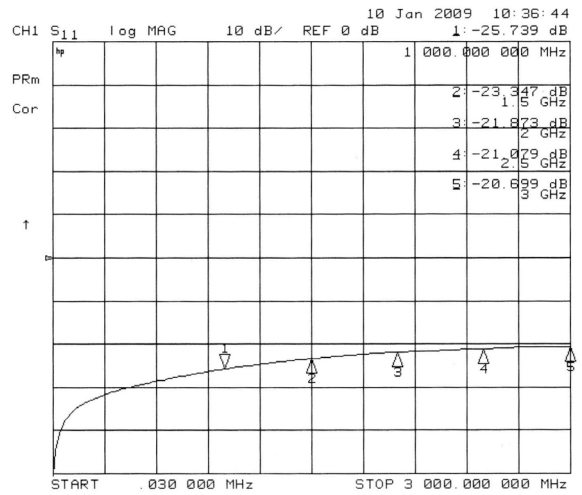
COAXIAL RF POWER ATTENUATORS
RFA-54, RFA-55, RFA-85, RFA-67, RFA-37



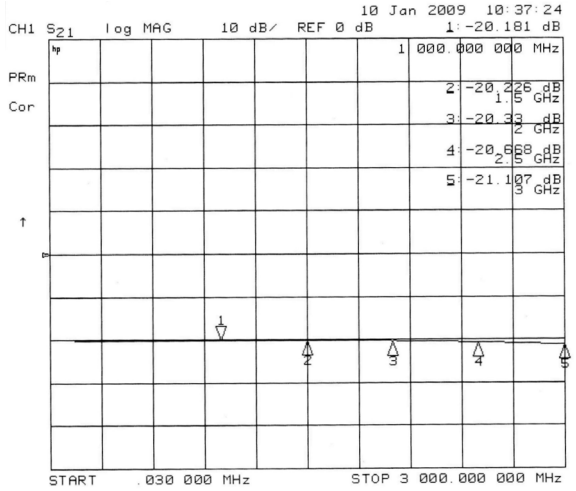
S11 RFA-55DD20dB



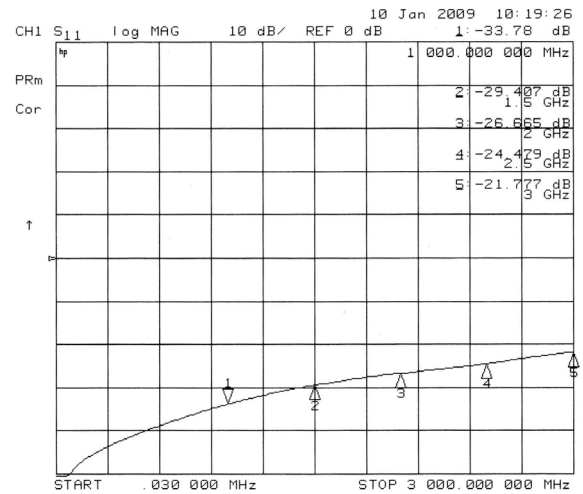
S21 RFA-55DD20dB



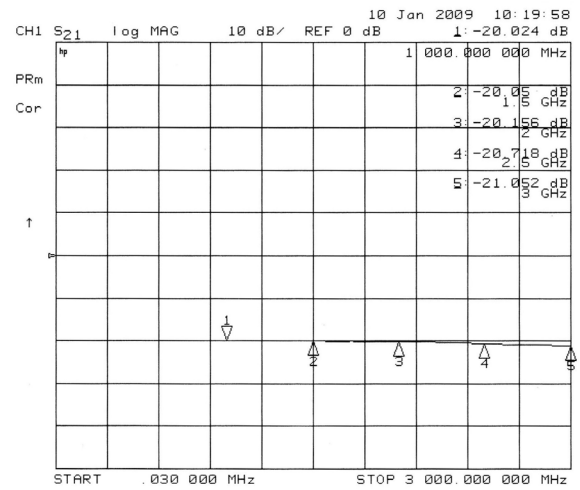
S11 RFA-67DD20dB



S21 RFA-67DD20dB



S11 RFA-68DD20dB*

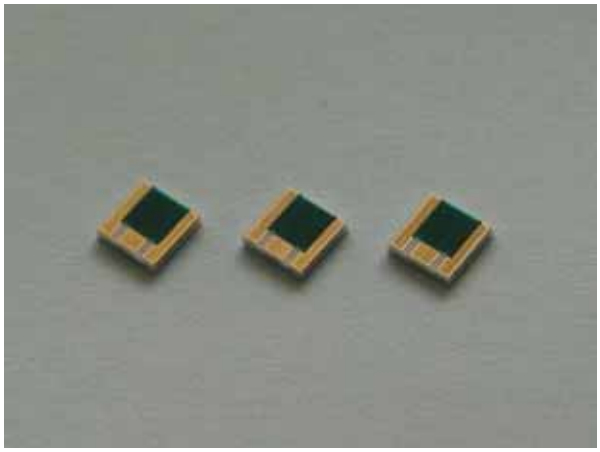


S21 RFA-68DD20dB*

* Please call factory for a specification of RFA-68DD

20120501

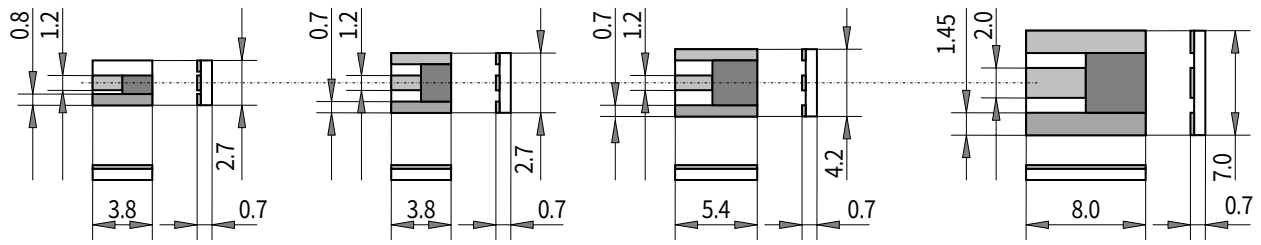
COAXIAL MICROWAVE TERMINATION
RFD33, RFD44, RFD54, RFD87



Feature and Applications

RF and microwave termination with 50ohm and 75 ohm characteristic impedance.
RFD is for termination of coaxial applications.
Ni-Cr thin film and alumina substrates realize long life and temperature stability.
Applications include RF amplifiers, radio transmitters, RF power sources, mobile communication systems and measurements.

Dimensions (mm)



Specifications and Performances

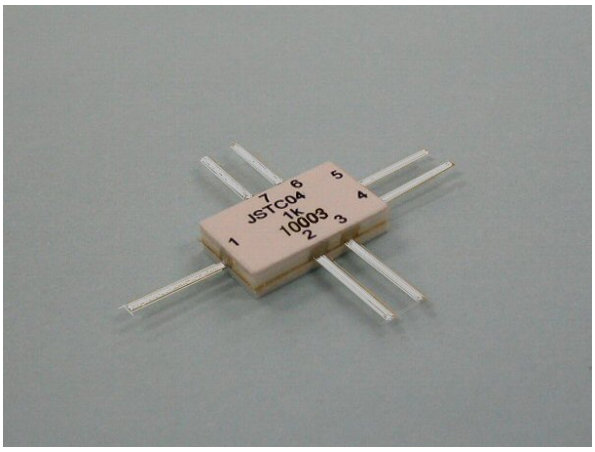
Model	Type	Impedance	Rated Power (*2)	Frequency Range	Remarks
RFD3350	Coaxial, Unbalanced Chip	50Ω	0.25W	DC- 4GHz	RoHS
RFD4450	Coaxial, Balanced Chip	50Ω	0.25W	DC- 4GHz	RoHS
RFD4475	Coaxial, Balanced Chip	50Ω	0.50W	DC- 4GHz	RoHS
RFD5450	Coaxial, Balanced Chip	50Ω	0.50W	DC- 3GHz	RoHS
RFD5475	Coaxial, Balanced Chip	75Ω	0.50W	DC- 3GHz	RoHS
RFD8750	Coaxial, Balanced Chip	50Ω	1.00W	DC- 3GHz	RoHS
RFD8775	Coaxial, Balanced Chip	75Ω	1.00W	DC- 3GHz	RoHS

Ordering Information

P/N	Type	Resistance	Terminal	Remarks
RFD-4450 Z00	RFD-44	50 ohms	Z00	Bulk packaging
RFD-8750 Z00	RFD-44	50 ohms	Z00	Bulk packaging

(*1) The chip is designed as 50 Ohms coplanar transmission line. When you make termination in coaxial parts, please make both side slot in coaxial outer conductor and joint chip side conductor to case slot by soldering directly.
The chip element conducts heat through the conductor of both sides to metal casing at the atmosphere. The side and the back of a termination chip have not metal conductor film.
(*2) Rated power is decided depending on the size of the surface area of the metal casing which attaches an element. Please refer to the above shown rated electric power.

THERMAL CONVERTER ELEMENT
JSTC04



Features and Applications

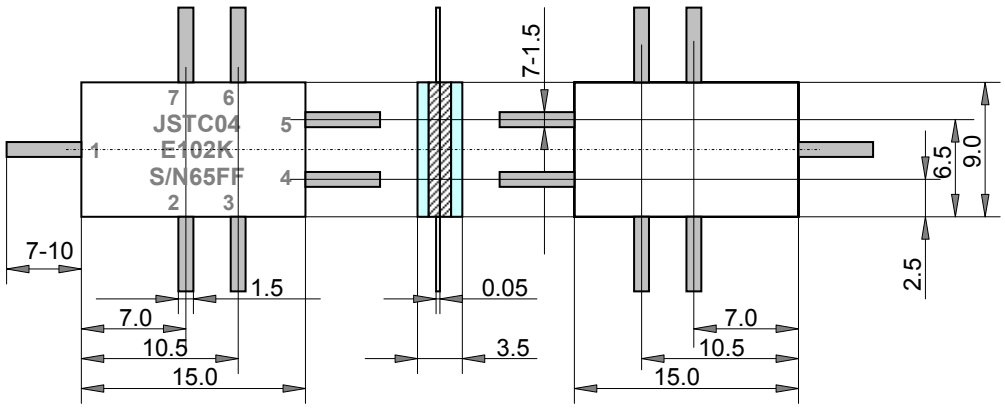
The JSTC04 is a high-frequency multi-junction thermal converter device for high-precision AC-DC transfer standards. Using NIKKOHM's unique thin-film thermopile technology, this device realizes sensitivity of 10-6 to 10-7 for comparing rms power between ac and dc input voltages.

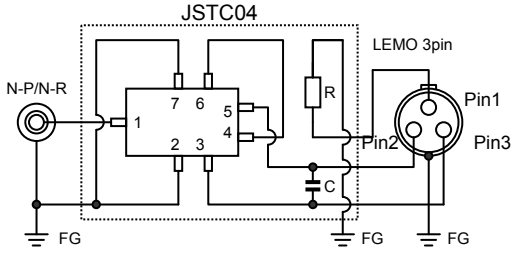
The JSTC04 thermal converter is designed to minimize effects from stray inductances and capacitances in the input circuit. The frequency characteristic of the AC-DC transfer difference is self-calculable, and has been evaluated to be better than 0.001% in the frequency range between 10kHz to 100 kHz, and better than 0.01% up to 1 MHz.

All the JSTC04 devices are identified by serial production numbers, and are individually inspected and guaranteed for the specifications. The inspection data include input resistance, output resistance, sensitivity (output voltage), and reversal error.

The JSTC04 thermal converter has been developed through the collaboration with AIST (National Institute of Advanced Industrial Science and Technology, Japan).

Dimensions, Pin Configuration and Connection





pin	Descriptions
1	Input Hi
2	Input Lo., internal connect to 7
3	DC output A +
4	DC output A -
5	DC output B -
6	DC output B +
7	Input Lo., internal connect to 2

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THERMAL CONVERTER ELEMENT JSTC04

Ordering Information

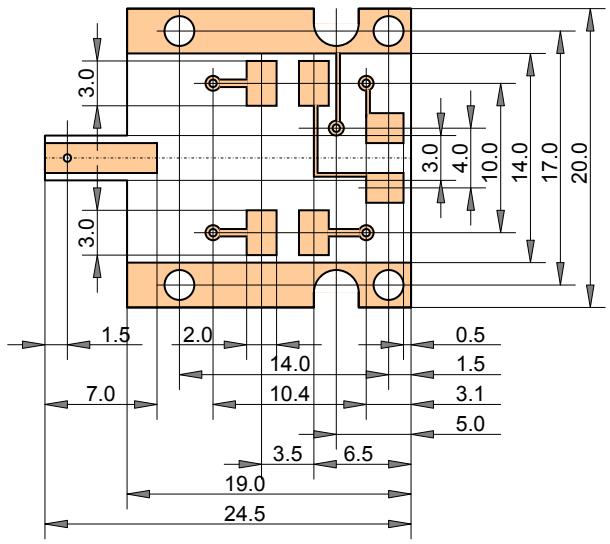
Model	TCR, input resistance	Input resistance (*)	Tolerance, Input resistance	Additional Code
JSTC04	E	500 Ohm	K	Z00
JSTC04	E (+/-25ppm/K)(*)	100 Ohm	K(+/-10%)	Z00 (RoHS)
		200 Ohm		
		500 Ohm		
		1k Ohm		
		2k Ohm		

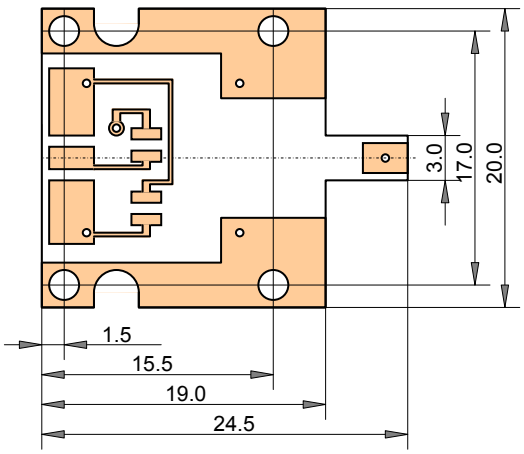
(*) Other input resistances, TCs, and tolerances are available on request.

Specifications and Performances

	JSTC04	Conditions
INPUT		
Rated Power	0.1 W	
Max Applied Power	0.5 W	
Resistance	100, 200, 500, 1K, 2K Ohms	.
TCR	+/−25ppm/K (E)	
Tolerance	+/−10% (K)	
Frequency Range	DC,10kHz−1MHz	
OUTPUT		
Rating output voltage	More than 60mV	
Output resistance	Less than 400 Ohm	
TC of Output resistance	+/− 300ppm/K	
INPUT/OUTPUT		
Sensitivity	More than 0.6 V/W	
TC of Sensitivity	−0.001mV/mW/K	Typical
Response Time	2.5 +/−0.6 seconds	63% response
Reversal Error	Less than 100ppm	Typical
AC−DC Difference, 10k−100kHz	Less than 10ppm	Typical
AC−DC Difference, 100K−1MHz	Less than 100ppm	Typical
ENVIRONMENTAL		
Operating Temp.	25 +/− 5 degree C	
Storage Temp.	−20 to 80 degree C	

Recommended Foots patterns





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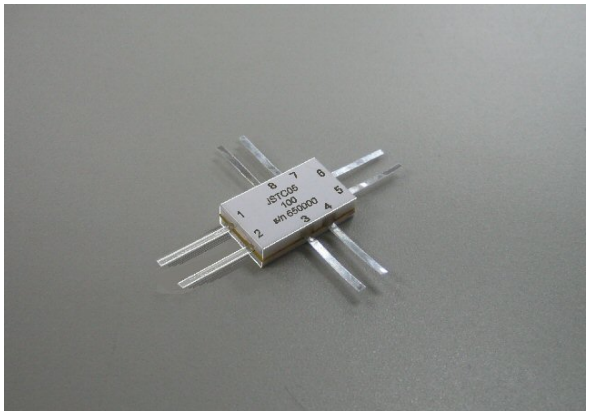
THERMAL CONVERTER ELEMENT
JSTC05



Features and Applications

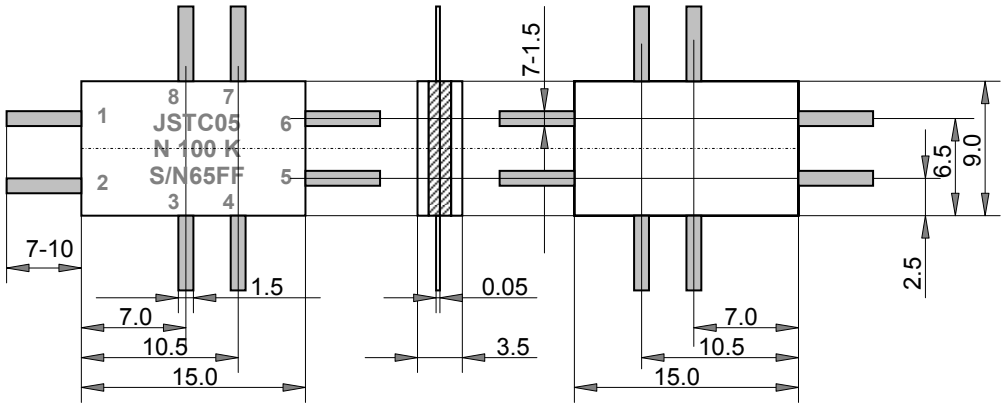
The JSTC05 is a low-frequency multi-junction thermal converter device for high-precision AC-DC transfer standards. Using NIKKOHM's unique thin-film thermopile technology, this device realizes sensitivity of 10-6 to 10-7 for comparing rms power between ac and dc input voltages.

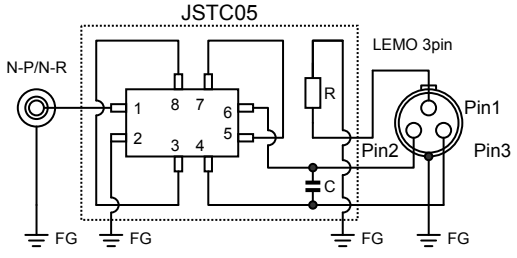
The JSTC05 thermal converter has special dual-heater structure to adopt the 90-degree-addition method for the evaluation of low-frequency effect due to insufficient thermal averaging. By increasing thermal mass and reducing temperature coefficient of the input circuit, frequency characteristic better than 0.001% has been realized in the frequency range between 10 Hz to 10 kHz.

All the JSTC05 devices are identified by serial production numbers, and are individually inspected and guaranteed for the specifications. The inspection data include input resistance, output resistance, sensitivity (output voltage), and reversal error.

The JSTC05 thermal converter has been developed through the collaboration with AIST (National Institute of Advanced Industrial Science and Technology, Japan).

Dimensions, Pin Configuration and Connection





pin	Descriptions
1	Input A + to N connector.
2	Input B + to FG
3	Input B - to pin 8
4	DC output A +
5	DC output A -
6	DC output B -
7	DC output B+-
8	Input A -

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THERMAL CONVERTER ELEMENT JSTC05

Ordering Information

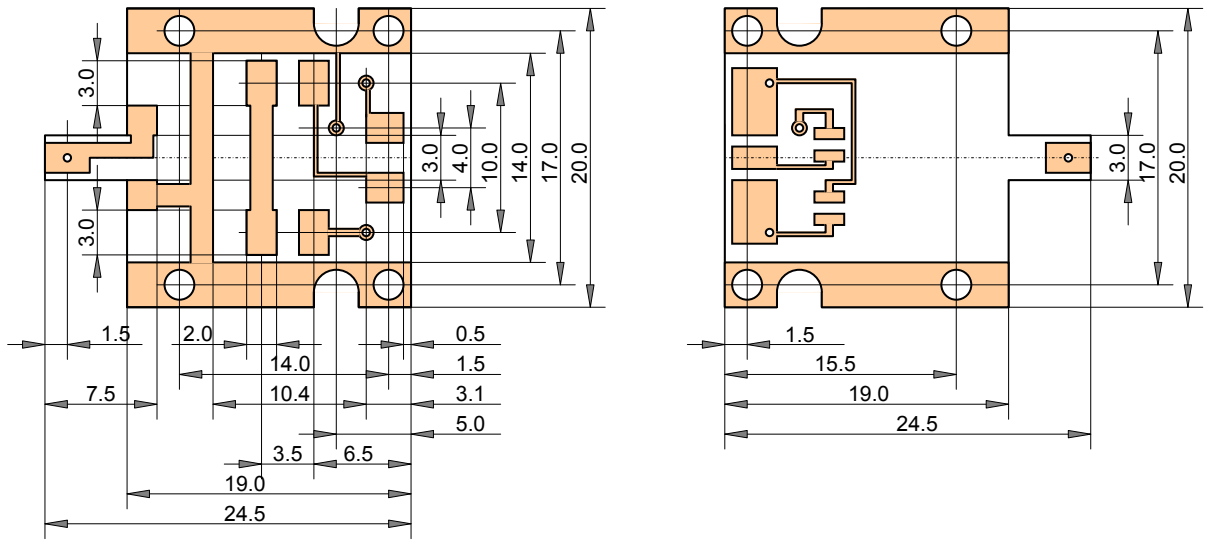
Model	TCR, input resistance	Input resistance (*)	Tolerance, Input resistance	Additional Code
JSTC05	N	100 Ohm	K	Z00
JSTC05	N (+/-10ppm/K) (*)	100 Ohm (x2)	K(+/-10%)(*)	Z00 (RoHS)

(*) Other input resistances, TCs, and tolerances are available on request.

Specifications and Performances

	JSTC05	Conditions
INPUT		
Rated Power	0.1 W	Total
Max Applied Power	0.5 W	Total
Resistance	100 Ohm (x2)	Another resistance available, please call factory
TCR	+/-10ppm/K (N)	
Tolerance	+/-10% (K)	
Resistance Matching	+/-1%	
Frequency Range	DC, 5Hz-10kHz	
OUTPUT		
Rating output voltage	More than 60mV	
Output resistance	Less than 400 Ohm	
TC of Output resistance	+/- 300ppm/K	
INPUT/OUTPUT		
Sensitivity	More than 0.6 V/W	
TC of Sensitivity	-0.001mV/mW/K	Typical
Response Time	6.0 +/-1.0 seconds	63% response
Reversal Error	Less than 100ppm	Typical
AC-DC Difference, 10Hz-10kHz	Less than 10ppm	Typical
ENVIRONMENTAL		
Operating Temp.	25 +/- 5 degree C	
Storage Temp.	-20 to 80 degree C	

Recommended Foots patterns (mm)



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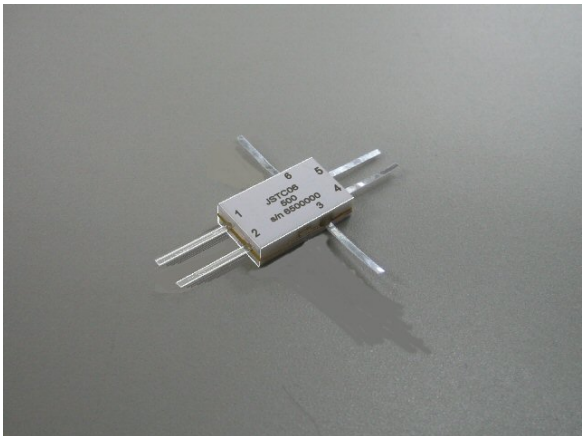
THERMAL CONVERTER ELEMENT
JSTC06



Features and Applications

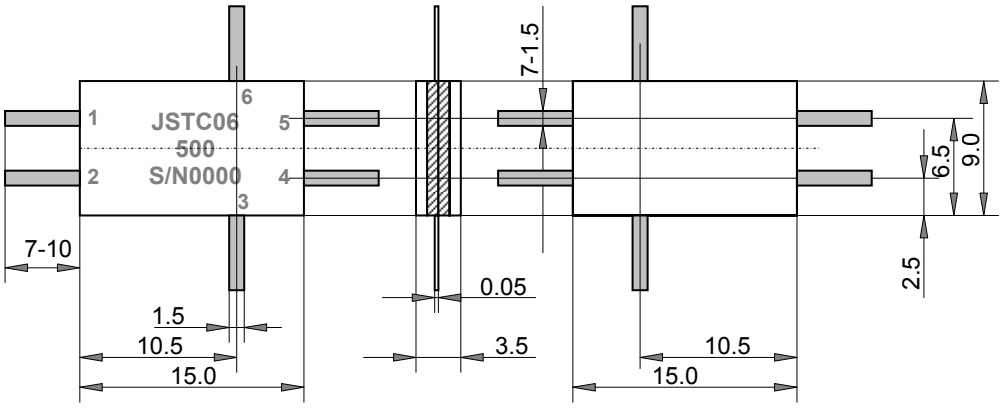
The JSTC06 is a general-purpose multi-junction thermal converter device for high-precision AC-DC transfer standards. Using NIKKOHM's unique thin-film thermopile technology, this device realizes sensitivity of 10-6 to 10-7 for comparing rms power between ac and dc input voltages.

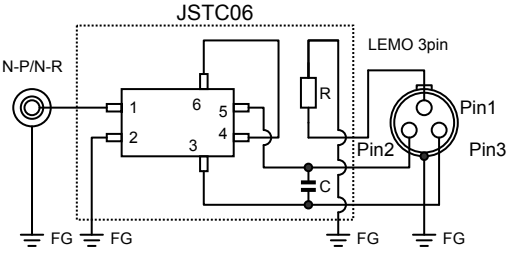
The JSTC06 thermal converter is designed for the operation at wide frequency range between 10Hz to 1MHz. By the use of U-shape heater pattern, the reversal error of the JSTC06 is reduced to be smaller than 0.001%. AC-DC transfer difference of the JSTC06 is better than 0.001% in the frequency range between 10 Hz to 100 kHz, and better than 0.01% up to 1 MHz.

All the JSTC06 devices are identified by serial production numbers, and are individually inspected and guaranteed for the specifications. The inspection data include input resistance, output resistance, sensitivity (output voltage), and reversal error.

The JSTC06 thermal converter has been developed through the collaboration with AIST (National Institute of Advanced Industrial Science and Technology, Japan).

Dimensions, Pin Configuration and Connection





pin	Descriptions
1	Input + to N connector
2	Input – to FG
3	DC output A +
4	DC output A -
5	DC output B -
6	DC output B +

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THERMAL CONVERTER ELEMENT JSTC06

Ordering Information

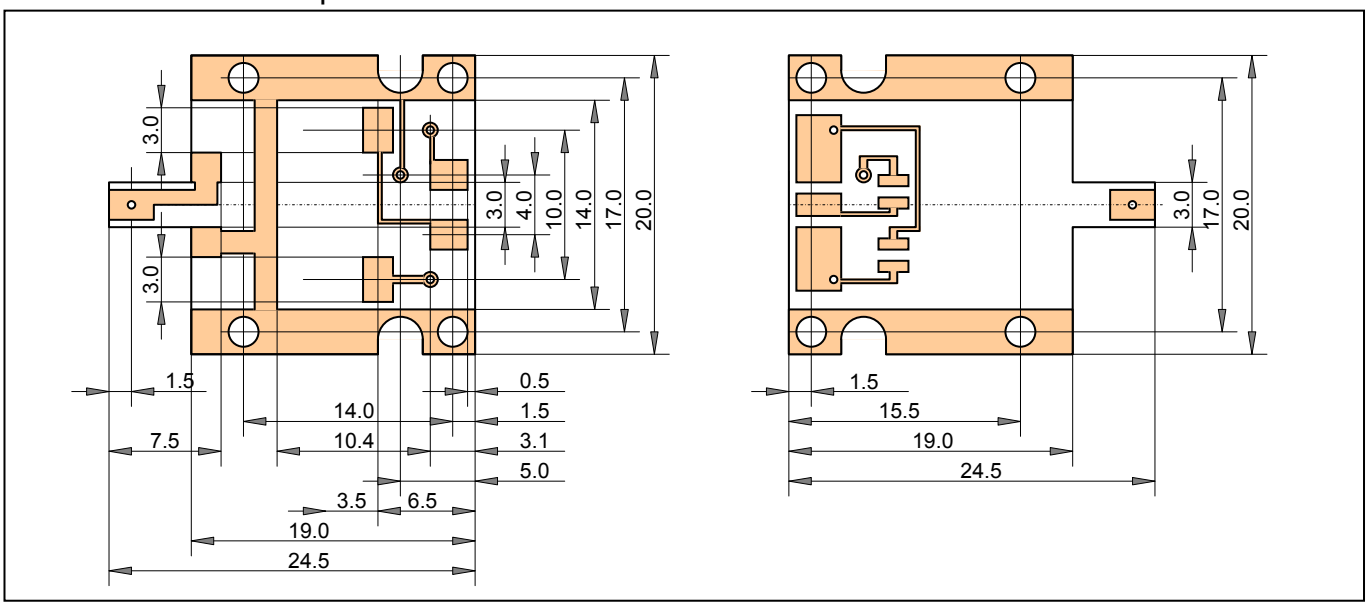
Model	TCR, input resistance	Input resistance (*)	Tolerance, Input resistance	Additional Code
JSTC06	E	500 Ohm	K	Z00
JSTC06	E (+/-25ppm/K) (*)	100 Ohm	K(+/-10%)	Z00 (RoHS)
		200 Ohm		
		500 Ohm		
		1k Ohm		
		2k Ohm		

(*) Other input resistances, TCs, and tolerances are available on request.

Specifications and Performances

	JSTC06	Conditions
INPUT		
Rated Power	0.1 W	
Max Applied Power	0.5 W	
Resistance	100, 200, 500, 1K, 2K Ohms	.
TCR	+/−25ppm/K (E)	
Tolerance	+/−10% (K)	
Frequency Range	DC,10Hz−1MHz	
OUTPUT		
Rating output voltage	More than 60mV	
Output resistance	Less than 400 Ohm	
TC of Output resistance	+/− 300ppm/K	
INPUT/OUTPUT		
Sensitivity	More than 0.6 V/W	
TC of Sensitivity	−0.001mV/mW/K	Typical
Response Time	2.5 +/−0.6 seconds	63% response
Reversal Error	Less than 10ppm	Typical
AC−DC Difference, 10Hz−100kHz	Less than 10ppm	Typical
AC−DC Difference, 100K−1MHz	Less than 100ppm	Typical
ENVIRONMENTAL		
Operating Temp.	25 +/− 5 degree C	
Storage Temp.	−20 to 80 degree C	

Recommended Foots patterns



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THERMAL VOLTAGE CONVERTER
TVC04A, TVC05B
TVC06A, TVC06B

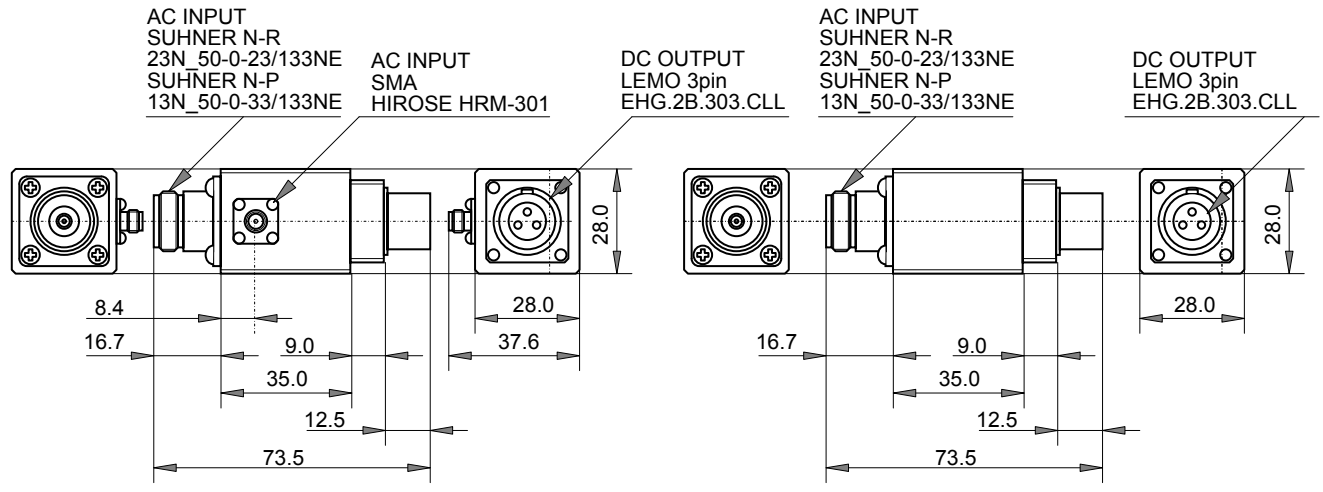
Features and Applications

The Thermal Voltage Converters TVC04/05/06(A/B) are fully assembled version of the JSTC04/05/06 series thermal converter elements, and may readily be used as the AC-DC transfer standard with input and output connectors. The TVC0xA thermal voltage converter employs the virtual-TEE configuration ("internal" or "built-in" TEE). Combined with the JSTC04 element, precise evaluation of frequency characteristic of the ac-dc transfer difference is possible at 10-6 level up to 1MHz. While the TVC0xB has similar configuration as the TVC0xA, except that the second input connector for the virtual-TEE configuration is not installed. The TVC0xA is best suited for the use with JSTC05 or JSTC06 elements.

All the HF-TVC modules are identified by serial production numbers, and are individually inspected and guaranteed for the specifications. The inspection data include input resistance, output resistance, sensitivity (output voltage), reversal error. The ac-dc transfer difference data with respect to the NIKKOHM's reference standard will also be attached to the TVC.

The HF-TVC has been developed through the collaboration with AIST (National Institute of Advanced Industrial Science and Technology, Japan).

Dimensions



TVC04A, TVC06A

TVC05B, TVC06B

Note: Both TVC0xA-R/P, TVC0xB-R/P have the same dimensions, except that the SMA connector is not mounted in the case of TVC0xB-R/P. The suffices "R" or "P" indicates the selection of the input connector, i.e., an N-R(receptacle) or an N-P(plug) connector.

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THERMAL VOLTAGE CONVERTER
TVC04A, TVC05B, TVC06A, TVC06B

Ordering Information

Type	Input Connector	Input resistance TCR	Input resistance	Input resistance Tolerance	Remarks
TVC04A	R	E	500 Ohm	K	---
TVC04A	R (Receptacle)	N (+/-10ppm/deg C)	100 Ohm	K (+/-10%)	---
TVC05B	P (Plug)	E(+/-25ppm/deg C)	200 Ohm		
TVC06A			500 Ohm		
TVC06B			1k Ohm		
			2k Ohm		

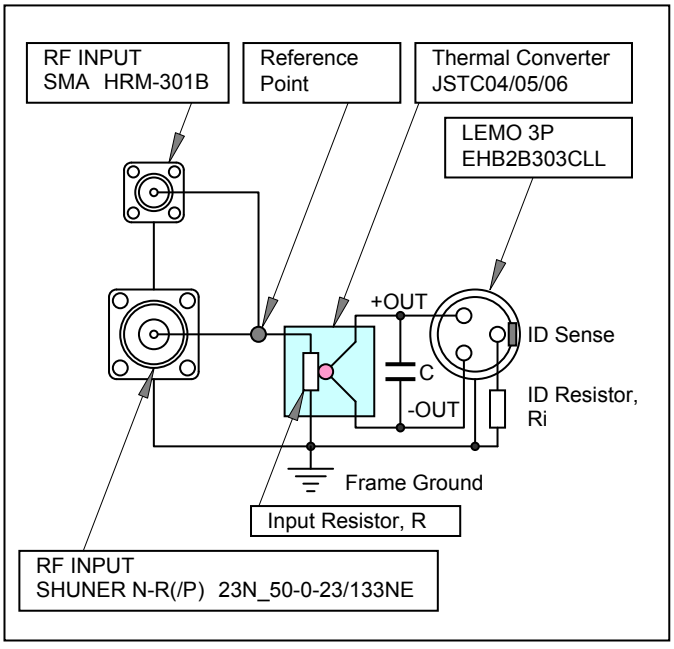
*N applies to TVC05

Specifications and Performances (for type TVC04/05 refer to JSTC04/05 datasheet)

	TVC04A	TVC05B	TVC06A, TVC06B	Conditions
INPUT				
Rated Power	0.1 W	0.1 W	0.1 W	
Max Applied Power	0.5 W	0.5 W	0.5 W	
Resistance (Ohm)	100, 200, 500, 1k, 2k	100 Ohms	100, 200, 500, 1k, 2k	.
TCR	+/-25ppm/K (E)	+/-10ppm/K (N)	+/-25ppm/K (E)	
Tolerance	+/-10% (K)	+/-10% (K)	+/-10% (K)	
Frequency Range	DC, 10kHz-1MHz	DC, 5Hz-10kHz	DC, 10Hz-1MHz	
OUTPUT				
Rating output voltage	More than 60mV	More than 60mV	More than 60mV	
Output resistance	Less than 400Ohm	Less than 400Ohm	Less than 400Ohm	
TC of Output resistance	+/- 300ppm/K	+/- 300ppm/K	+/- 300ppm/K	
INPUT/OUTPUT				
Sensitivity	More than 0.6 V/W	More than 0.6 V/W	More than 0.6 V/W	
TC of Sensitivity	-0.001mV/mW/K	-0.001mV/mW/K	-0.001mV/mW/K	Typical
Response Time	2.5 +/-0.6 seconds	6.0 +/-1.0 seconds	2.5 +/-0.6 seconds	63% response
Reversal Error	Less than 100ppm	Less than 100ppm	Less than 10ppm	Typical
AC-DC Difference, 10Hz-100kHz	*Less than 10ppm	**Less than 10ppm	Less than 10ppm	Typical
AC-DC Difference, 100K-1MHz	Less than 100ppm		Less than 100ppm	Typical
Environmental				
Operating Temp.	25 +/- 5 degree C	25 +/- 5 degree C	25 +/- 5 degree C	
Storage Temp.	-20 to 80 degree C	-20 to 80 degree C	-20 to 60 degree C	
Mechanical				
Weight (Net)	275 gram	275 gram	275 gram	

(*) 10kHz-100kHz, (**) 10Hz-10kHz

Internal schematic



Values of the ID Resistor (Ri)

Input Resistance, R	ID Sense Resistors, Ri
50 Ohm	50 - (56) - 82 Ohms
100 Ohm	100 - (120) -180 Ohms
200 Ohm	200 - (220) - 470 Ohms
500 Ohm	500 - (560) - 820 Ohms
1K Ohm	1k - (1.2K) - 1.8k Ohms
2K Ohm	2k - (2.2K) - 4.7k Ohms

Note: The values in parenthesis are nominal values. Other values are available on request..

Note: Output Capacitance
The shunting capacitance between the output pins is 10 nF. Other values are available on request.

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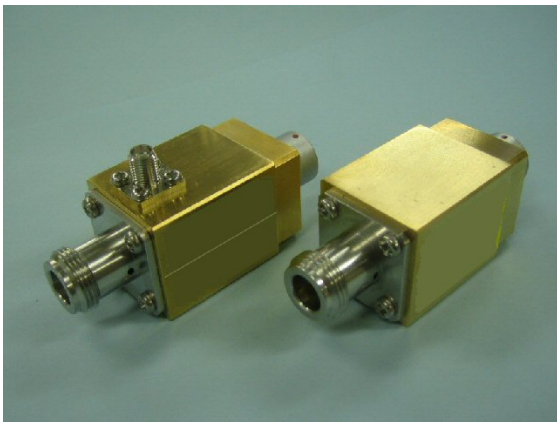


AC-DC THERMAL VOLTAGE CONVERTER
CASE KIT

TVCC

Features and Applications

A kit of containing metal chassis, N-connectors (P or R), SMA connector, LEMO-3 pins connector, circuit boards and screws for assembling TVC04, TVC05 or TVC06.
The Kit does not contain JSTC, wires and name plate.
Material of metal case is Au plated brass.

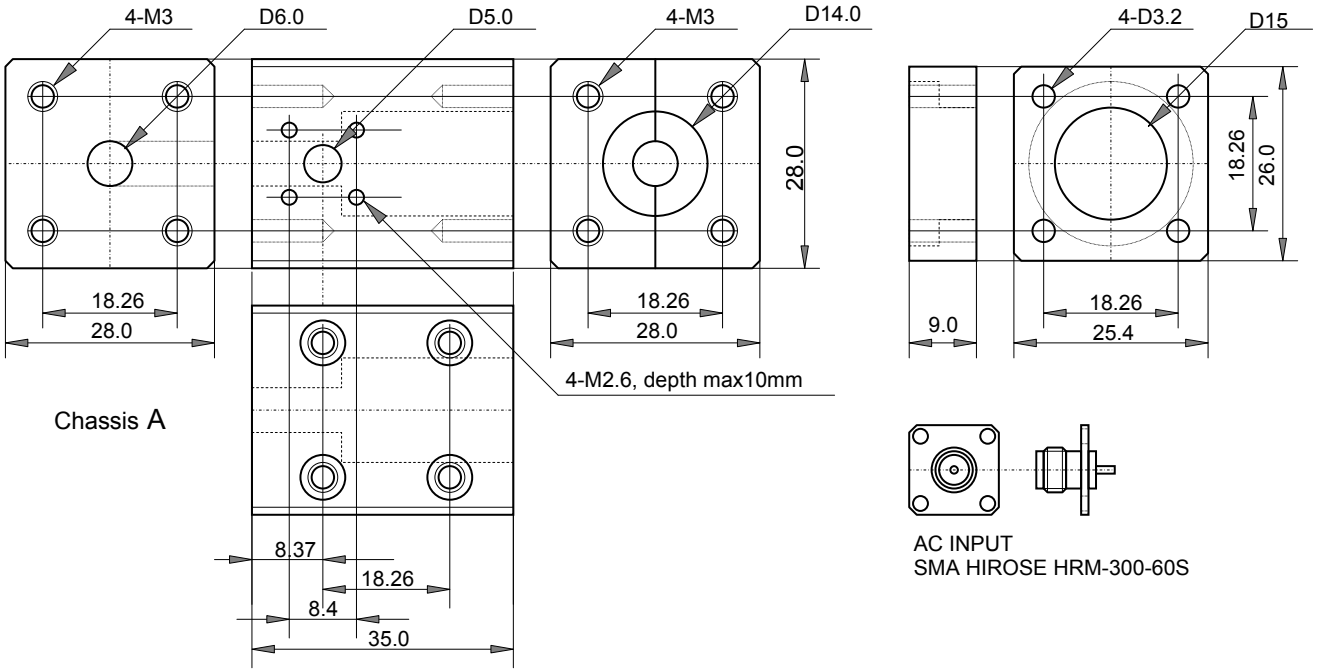
Ordering Information and Parts

Ordering P/N	TVCC04AR	TVCC05BR	TVCC06AR	TVCC06BR
Input Connector, N	SUHNER N-R	SUHNER N-R	SUHNER N-R	SUHNER N-R
Input Connector, SMA	SMA HIROSE HRM-300-60S	---	SMA HIROSE HRM-300-60S	---
Output Connector	LEMO 3pin	LEMO 3pin	LEMO 3pin	LEMO 3pin
Circuit Board	PCB04	PCB05	PCB06	PCB06
Chassis	Chassis A	Chassis B	Chassis A	Chassis B
Screws, M2.6-6mm	4	---	4	---
Screws, M3-16mm	4	4	4	4
Screws, M3-8mm	4	4	4	4
Screws, M3-12mm	4	4	4	4
Screws, M2-4mm	4	4	4	4
Wires	---	---	---	---
T-C Element	---	---	---	---
Capacitor	10pF	10pF	10pF	10pF
Resistor	[1608]-560Ohm-J	[1608]-560Ohm-J	[1608]-560Ohm-J	[1608]-560Ohm-J
Remarks				

Ordering P/N	TVCC04AP	TVCC05BP	TVCC06AP	TVCC06BP
Input Connector, N	SUHNER N-P	SUHNER N-P	SUHNER N-P	SUHNER N-P
Input Connector, SMA	SMA HIROSE HRM-300-60S	---	SMA HIROSE HRM-300-60S	---
Output Connector	LEMO 3pin	LEMO 3pin	LEMO 3pin	LEMO 3pin
Circuit Board	PCB04	PCB05	PCB06	PCB06
Chassis	Chassis A	Chassis B	Chassis A	Chassis B
Screws, M2.6-6mm	4	---	4	---
Screws, M3-16mm	4	4	4	4
Screws, M3-8mm	4	4	4	4
Screws, M3-12mm	4	4	4	4
Screws, M2-4mm	4	4	4	4
Wires	---	---	---	---
T-C Element	---	---	---	---
Capacitor	10pF	10pF	10pF	10pF
Resistor	[1608]-560Ohm-J	[1608]-560Ohm-J	[1608]-560Ohm-J	[1608]-560Ohm-J
Remarks				

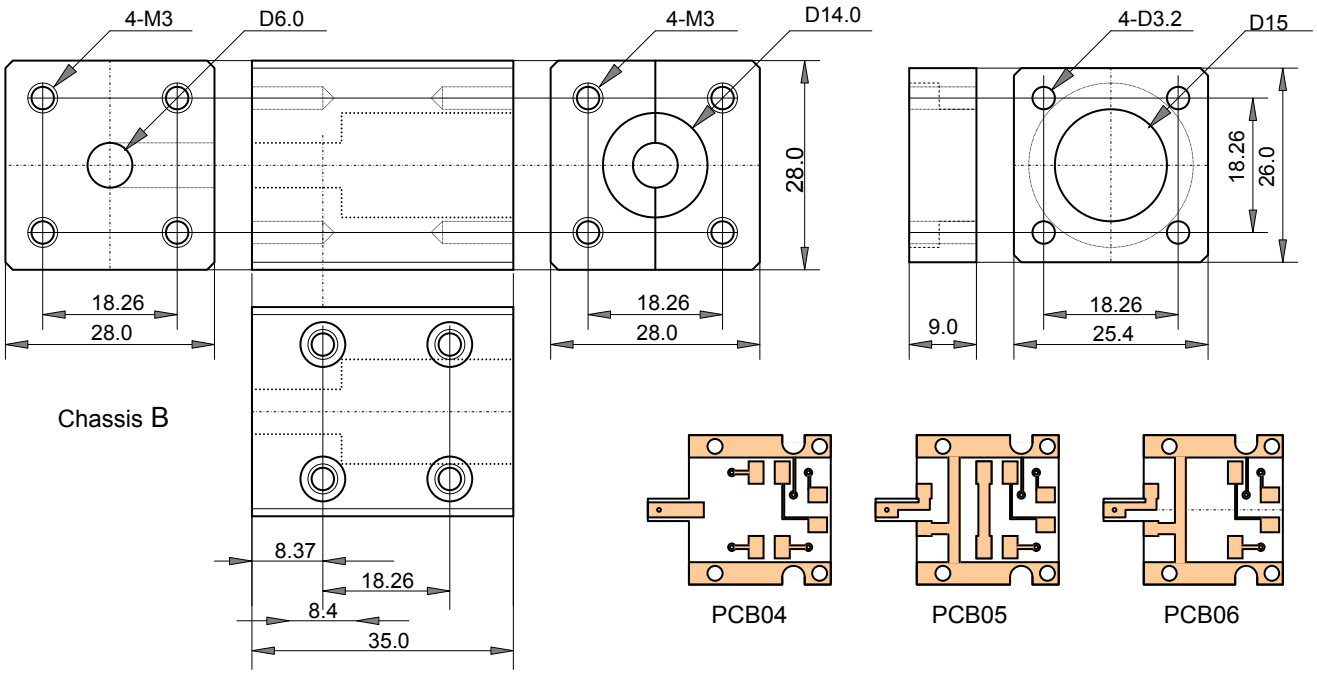
Note: "---" shows not included.

AC-DC THERMAL VOLTAGE CONVERTER CASE KIT TVCC



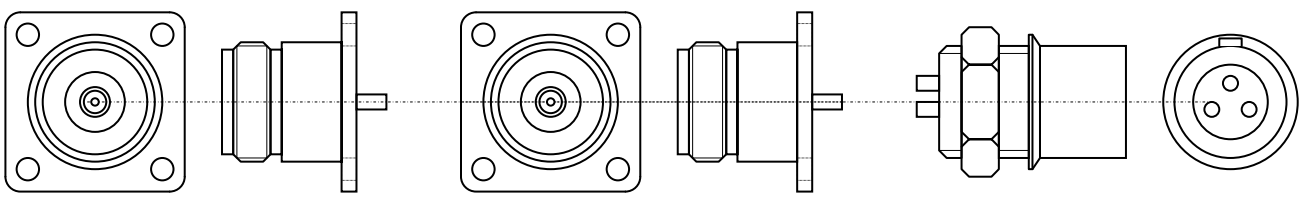
Chassis A

AC INPUT
SMA HIROSE HRM-300-60S



Chassis B

PCB04 PCB05 PCB06



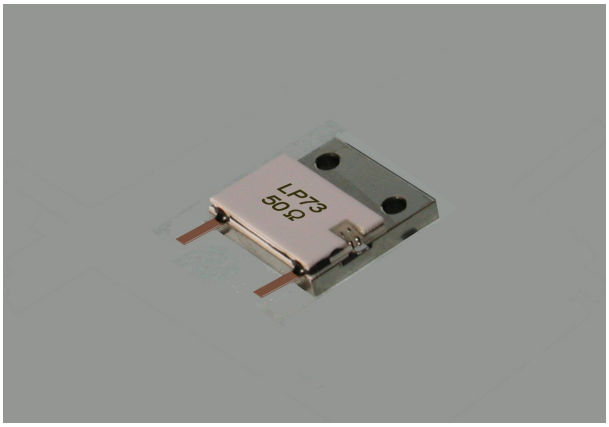
AC INPUT
SUHNER N-R_23N_50-0-23/133NE

AC INPUT
SUHNER N-P_13N_50-0-33/133NE

DC OUTPUT
LEMO 3pin EHG.2B.303.CLL

20100601

RMS-DC THERMAL CONVERTER
LP73F



Features and Applications

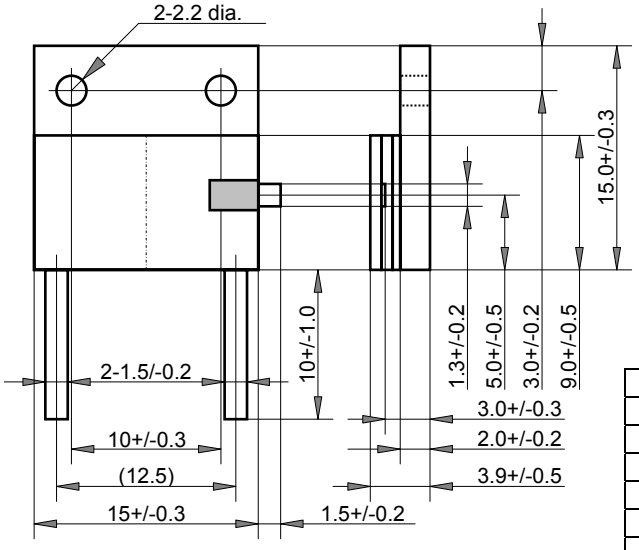
True RMS-DC converter.

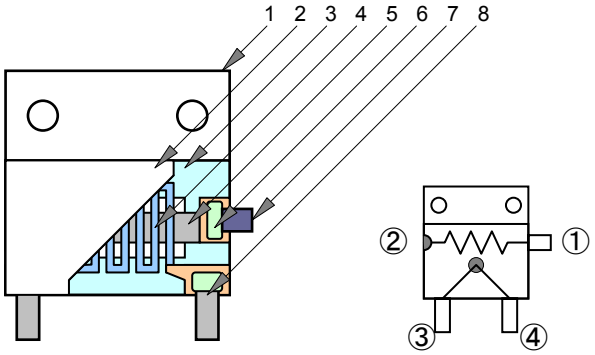
LP73F converts AC/RF input voltage to DC output volt.

Output voltage shows rms power of modulated wave form, waveform with distortion and noise waveform. Wide frequency range operation and long-life operation are available.

For RF power measurements, RMS-DC conversion, thermal converter applications.

Dimensions (mm), Pin configuration and Materials





No.	Substances	Materials	Remarks
1	Flange, input common	Ni plated Cu	
2	Ceramic cover	ALO	
3	Ceramic frame	ALO	
4	Thermocouples	Bi & Sb	
5	Input resistance	Ni-Cr	
6	Internal junction	In alloy	
7	Input terminal	Bronze phosphor	
8	Output terminals	Cu foil	

Ordering Information

Model	TCR	Input Resistance	Tolerance	Additional	Remarks
LP73F	A	50ohm	K	Z00	

LP73F	A(100ppm/C)	50ohm 75ohm	K(10%)	Z00

RMS-DC CONVERTER LP73F

Specifications and Performances

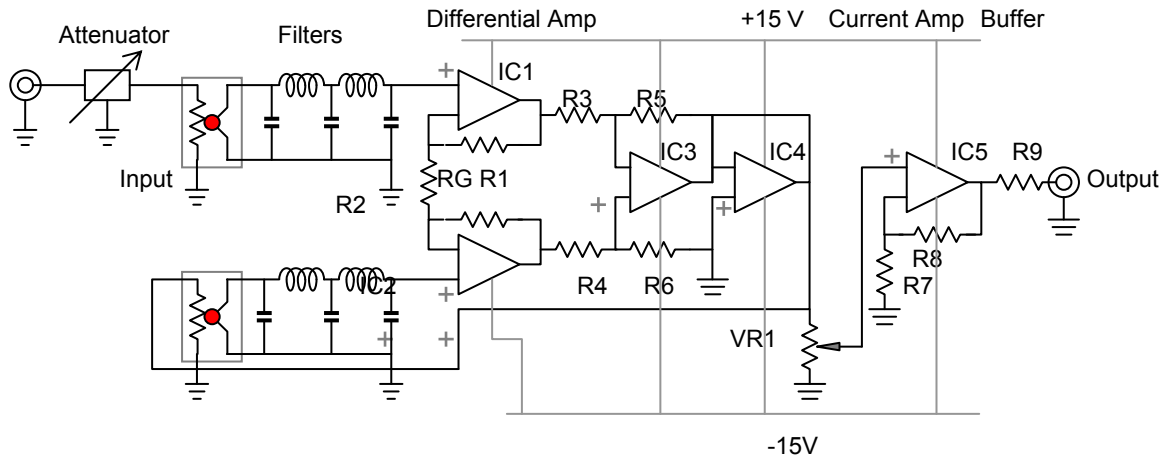
INPUT		
Rating Power	10mW	
Max Applied Power	30mW	For 10 seconds
Resistance	50ohm or 75ohm +/-10%	.
TCR	+/-100ppm/deg C	
Tolerance		
Frequency Range	DC-120MHz	
OUTPUT		
Sensitivity	13mV+/-2mV/10mW	
TC of Sensitivity	(-0.2% +/- 0.1%)/deg C	
Linearity	< 98%	At output voltage 1-13mV
Internal Resistance	2kohm+/-1kohm	
Response Time	<1 seconds	63% response
Terminal strength	> 9.8N	Pull
Insulation Resistance	> 20Mohm	Base plate to terminals
Operating Temp.	-10 – 60 deg C	
Storage Temp.	-20 – 80 deg C	
Weight	4.3g	

Note

Recommended soldering temperature is 220-230 deg C soldering iron with heat-insulating clip.

Mechanical shock in transportation and handling shall be kept away.

Electric static discharge shall be escaped.



An application of LP73F, RMS-DC conversion.

Nikkohm Co., Ltd. 3-31-2640 Minamicho, Misawa, Aomori 033-0036 Japan TEL: +81-176-53-2105, FAX: +81-176-53-2106
URL: http://www.nikkohm.co.jp and http://www.nikkohm.com

RMS-DC CONVERTER
LP-34B, LP34TW

Features and Applications

True RMS-DC converter.

RMS of AC input, those are RF, AC distortion or noise signals at the input terminal change at the output terminal to stable DC voltage. Input voltage warms thin film resistor, small temperature rises of the resistor convert to DC voltage through thin film thermocouples.

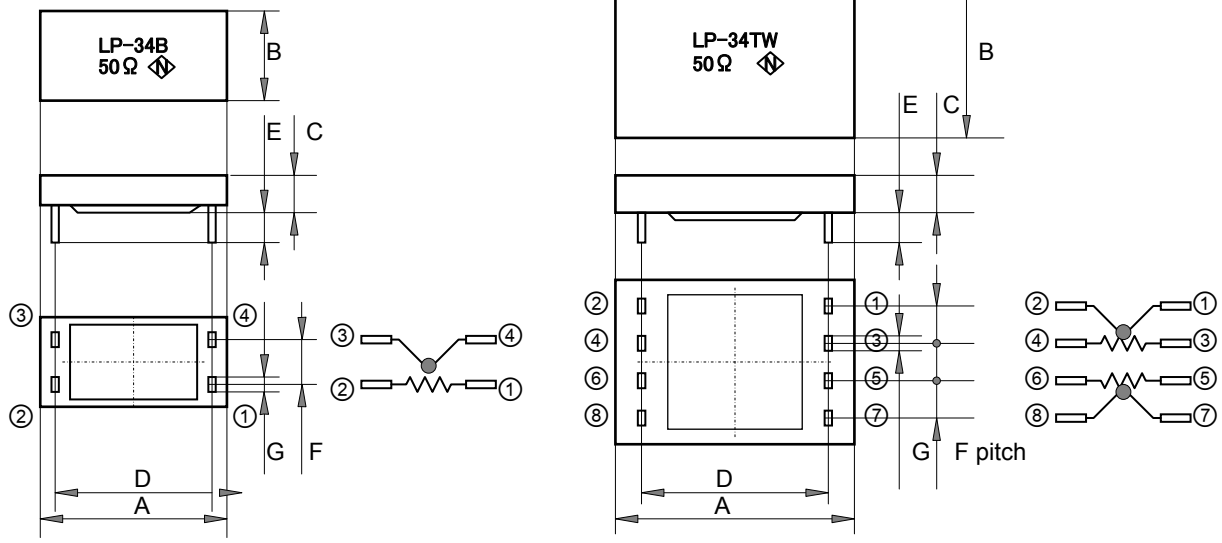
Realizes fast response time and stable conversion sensitivity.

LP34TW houses dual resistor-thermocouple pair and the dual balanced type has more stable characteristics in ambient temperature changes.

Tiny smd detector for DC to a few GHz applications also available. Please contact the factory.

For RF power measurements, RMS-DC conversion, and thermal converter applications.

Dimensions and Pin Configuration



Type	A	B	C	D	E	F	G
LP34B	25.0	12.5	4.5	20.5	5.0	5.08	0.4
LP34TW	32.0	22.0	5.5	25.5	3.5	5.08	0.4

Nikkohm Co., Ltd. 3-31-2640 Minamicho, Misawa, Aomori 033-0036 Japan TEL: +81-176-53-2105, FAX: +81-176-53-2106

URL: http://www.nikkohm.co.jp & http://www.nikkohm.com / e-mail: info@nikkohm.co.jp

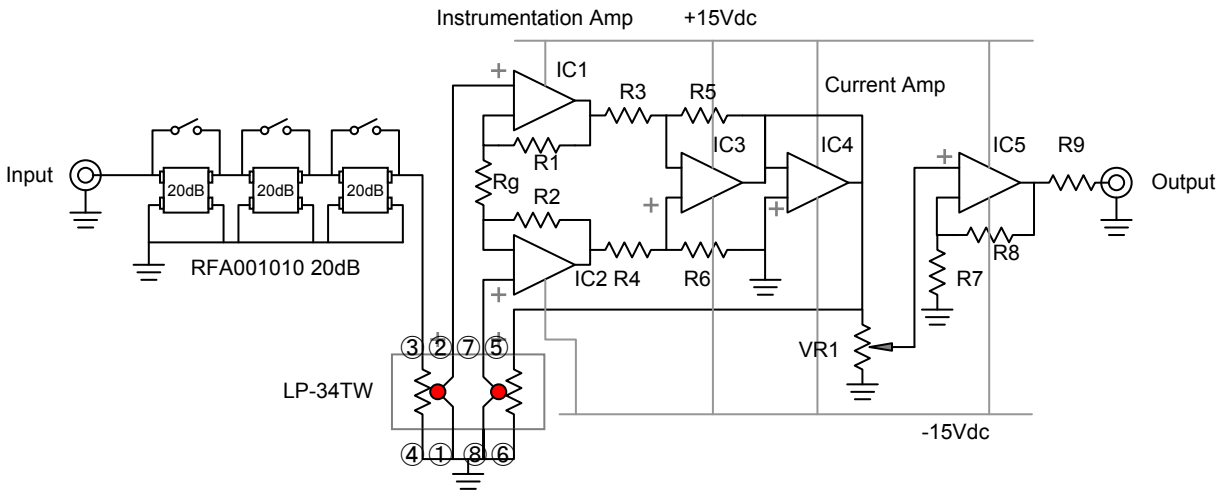
RMS-DC CONVERTER LP-34B, LP34TW

Ordering Information

Type	TCR	Input Resistance	Tolerance	Code
LP34TW	----	50R0	K	000
LP34B LP34TW	----	50R0 75R0	K (+/-10%)	000 (not RoHS)

Specifications and Performances

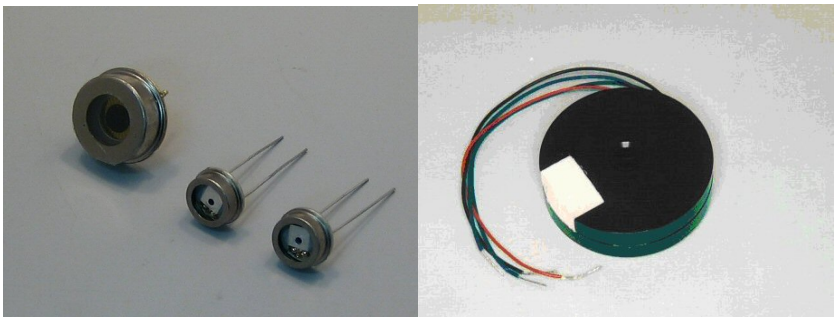
Type	LP-34B, Single	LP-34TW, Dual	Conditions
INPUT			
Rated Power	10mW	10mW	
Max Applied Power	20mW	20mW	
Resistance	50Ω or 75Ω	50Ω or 75Ω	.
TCR	+/-100ppm/K	+/-100ppm/K	
Tolerance	+5% , - 30%	+5%, - 30%	
Ratio	-	5%	
Frequency Range	DC-120MHz	DC-20MHz	
OUTPUT			
Sensitivity	> 2.0mV/mW	> 1.4mV/mW	
TC of Sensitivity	(-0.2% +/- 0.1%)/C	(-0.2% +/- 0.1%)/C	
Linearity Error	< 1.5% / 1mV-13mV	-	
Diff. of Linearity	-	< +/- 2.0%	
Diff. of Sensitivities	-	< +/- 8.0%	
Internal Resistance	< 3KΩ	< 12KΩ	
Response Time	< 0.3 seconds	< 0.3 seconds	63% response
Operating Temp.	-10C – 60C	-10C – 60C	
Storage Temp.	-20C – 80C	-20C – 80C	
Weight			



Application of LP34TW, RMS-DC conversion.

20111001

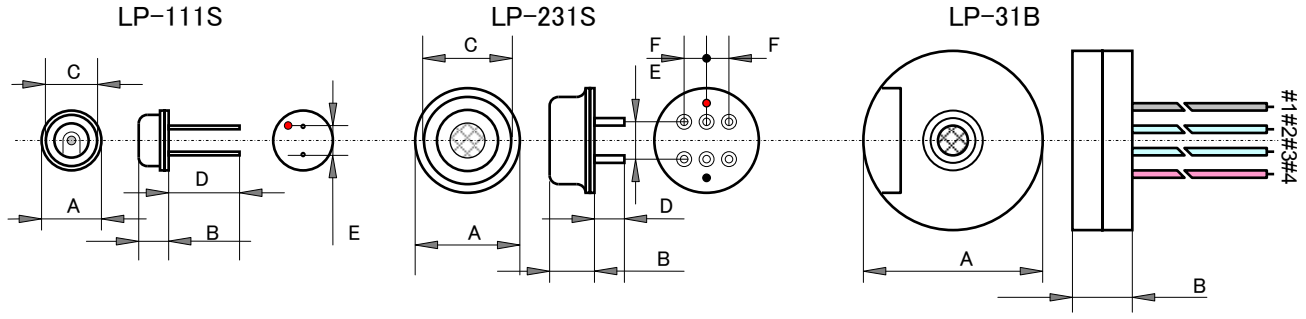
THERMOPILE, RADIATION POWER SENSING DEVICES
LP111S, LP231S, LP31B



Features and Applications

Thin film thermopiles for such radiation power sensing as CO_2 laser and infra-red optical power.
Fast response (LP111S), high stability (LP231S) and including incident power calibration system (LP31B) are distinctive feature.
Optical chopper that is always prepared in pyro-electricity sensor is unnecessary.
Stable +/-DC output voltage is observed without influence from ambient temperature change.
Wide and flat sensitivity characteristics at 0.2 to 20 micro-meter wave length are available.
Low output impedance less than 10 K ohm gives easy amplifier circuit construction.
None-contact temperature measurement, laser power measurement, power stabilization of laser generator and radiation optical power measurements.

Dimension and Pin Configurations (mm)



(mm)	A	B	C	D	E	F
LP-111S	9.05 dia.	3.5	8.1 dia.	17+/-2	5.0	-
LP-123	9.05 dia.	3.5	8.1 dia.	17+/-2	5.0	-
LP-231S	15.24 dia	4.4	14.0 dia.	-	7.62	2.54
LP-31B	38.0 dia.	10.0	-	-	-	-

Ordering Information

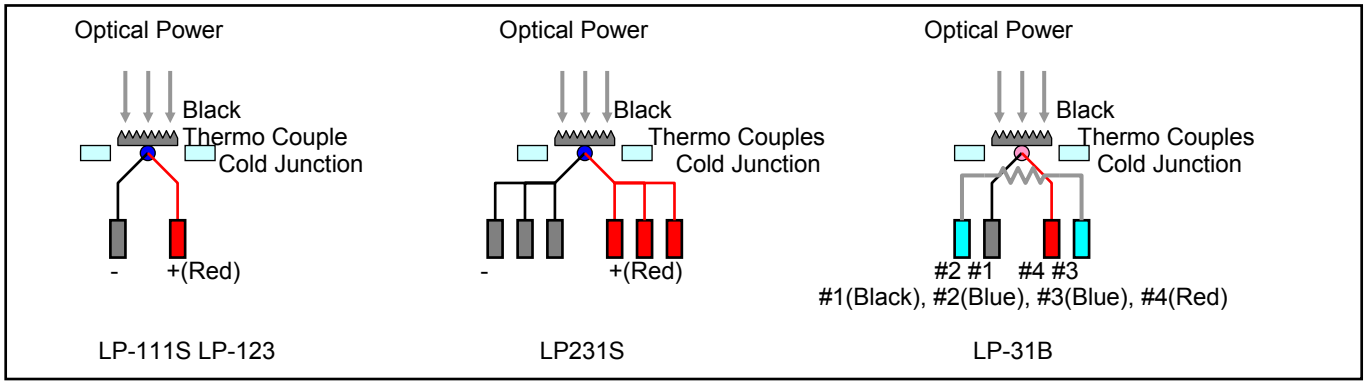
Type	TCR	Resistance	Tolerance	Code	Note
LP-111S	---	---	---	000	Not RoHS
LP-123					
LP-231					
LP-31B					

THERMOPILE, RADIATION POWER SENSING DEVICES
LP111S, LP231S, LP31B

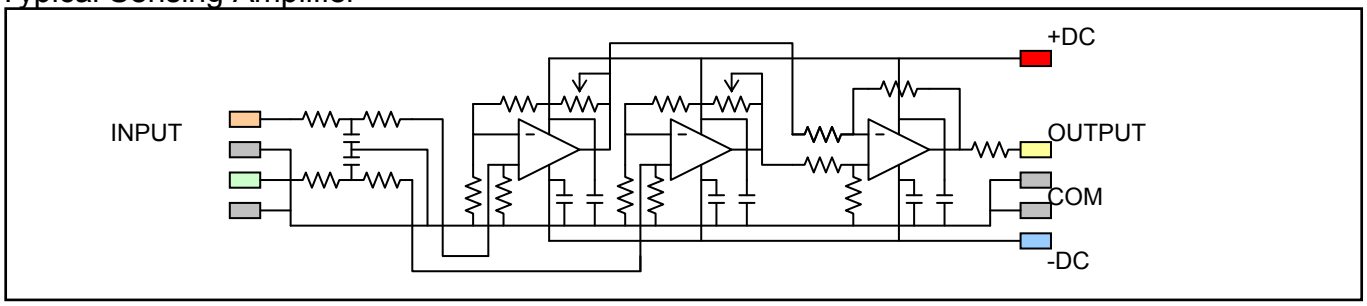
Specifications

	p/n	LP-111S	LP-123	LP-231S	LP-31B
INPUT	Range of Detecting Wave Length (um)	0.4-20.0	0.4-20.0	0.4-20.0	0.4-20.0
	Material of Absorption Black	Metal Black	Metal Black	Metal Black	Metal Black
	Continuous Max. Input Power(mW)	10	10	10	10
	Warning Input Power(mW)	20	20	50	200
	Diameter of Detecting Aperture, (mm dia.)	1.0	1.0	4.5.	5.0
OUTPUT	Sensitivity (mV/mW)	10.0	5.0	4.5	0.45
	Error from Linearity	-	-	-	-
	Internal Resistance (kohms)	2.0+/-1.0	2.0+/-1.0	4.0+/-2.0	6.5+/-3.5
	63% Response Time (ms)	45	45	250	4,000
	Number of Thermo Couple (pairs)	22	11	30	36
CALIBRATION	Resistance of Calibration Resistor (ohms)	---	---	---	250-500
MECHANICAL	Storage Temperature (deg C)	0-40	0-40	0-40	0-40
	Operation Temperature (deg C)	0-40	0-40	0-40	0-40

Schematics and Pin Connections



Typical Sensing Amplifier



20110501

Standard Significant Resistance Value, TCR code and Tolerance code, '+' shows modified

E6+
1.0
1.5
2.2
3.3
4.7
(5.0)
6.8

E12+
1.0
1.2
1.5
1.8
2.2
2.7
3.3
3.9
4.7
(5.0)
5.6
6.8
8.2

E24+	
1.0	3.3
1.1	3.6
1.2	3.9
1.3	4.3
1.5	4.7
1.6	(5.0)
1.8	5.1
2.0	5.6
2.2	6.2
2.4	6.8
(2.5)	7.5
2.7	8.2
3.0	9.1

E96+						
1.00	1.43	2.05	2.94	4.22	6.04	8.66
1.02	1.47	2.10	3.01	4.32	6.19	8.87
1.05	1.50	2.15	3.09	4.42	6.34	9.09
1.07	1.54	2.21	3.16	4.53	6.49	9.31
1.10	1.58	2.26	3.24	4.64	6.65	9.53
1.13	1.62	2.32	3.32	4.75	6.81	9.76
1.15	1.65	2.37	3.40	4.87	6.98	
1.18	1.69	2.43	3.48	4.99	7.15	
1.21	1.74	2.49	3.57	5.11	7.32	
1.24	1.78	2.55	3.65	5.23	7.50	
1.27	1.82	2.61	3.74	5.36	7.68	
1.30	1.87	2.67	3.83	5.49	7.87	
1.33	1.91	2.74	3.92	5.62	8.06	
1.37	1.96	2.80	4.02	5.76	8.25	
1.40	2.00	2.87	4.12	5.90	8.45	

Table 1. Resistance value, E6+, E12+, E24+ and E96+

TCR	
X	+/- 1ppm/C
Y	+/- 2ppm/C
W	+/- 2.5ppm/C
Z	+/- 5ppm/C
N	+/- 10ppm/C
L	+/- 15ppm/C
E	+/- 25ppm/C
C	+/- 50ppm/C
A	+/-100ppm/C
H	+/-250ppm/C

Tolerance	
T	+/-0.01%
Q	+/0.02%
A	+/0.05%
B	+/0.10%
C	+/0.25%
D	+/0.50%
F	+/1.00%
G	+/2.00%
J	+/5.00%
K	+/-10.0%
M	+/-20.0%

Table 2. TCR and Tolerance

Year	Month	Marking Date code
2011	JAN	11
2011	FEB	12
2011	MAR	13
2011	APR	14
2011	MAY	15
2011	JUN	16
2011	JUL	17
2011	AUG	18
2011	SEP	19
2011	OCT	1X
2011	NOV	1Y
2011	DEC	1Z

Table 3. Date code

Linear Resistance Change (ppm) of Ni-Cr Thin-film

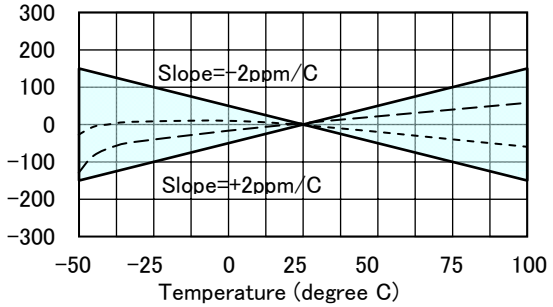
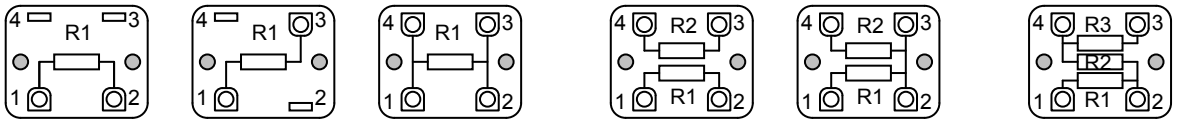


Figure 1. Resistance change of Precision.

Type	90% Failure Rate (Fit)
RP-24/RP-44	0.00003925
RNP-20S	0.00002058
RPM300	0.00620000
WSL8	0.00015000

Table 4. Failure Rate, Long Life Resistor



RPM200X RPM300X RPM600X | RPM200Y RPM300Y RPM600Y | RPM200Z RPM300Z RPM600Z | RPM150X RPM150X RPM150X | RPM150Y RPM150Y RPM150Y | RPM150Z RPM150Z RPM150Z

Figure 2. Schematics for SOT227 Power Resistors

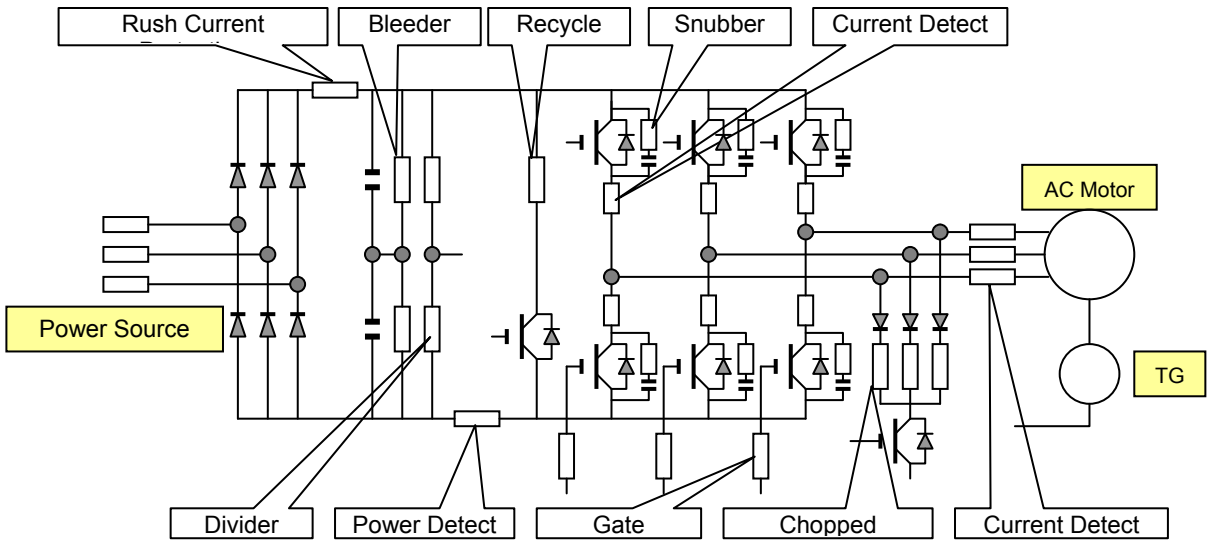


Figure 3. Power Resistor Applications in Typical Power Electronics, Motor Control

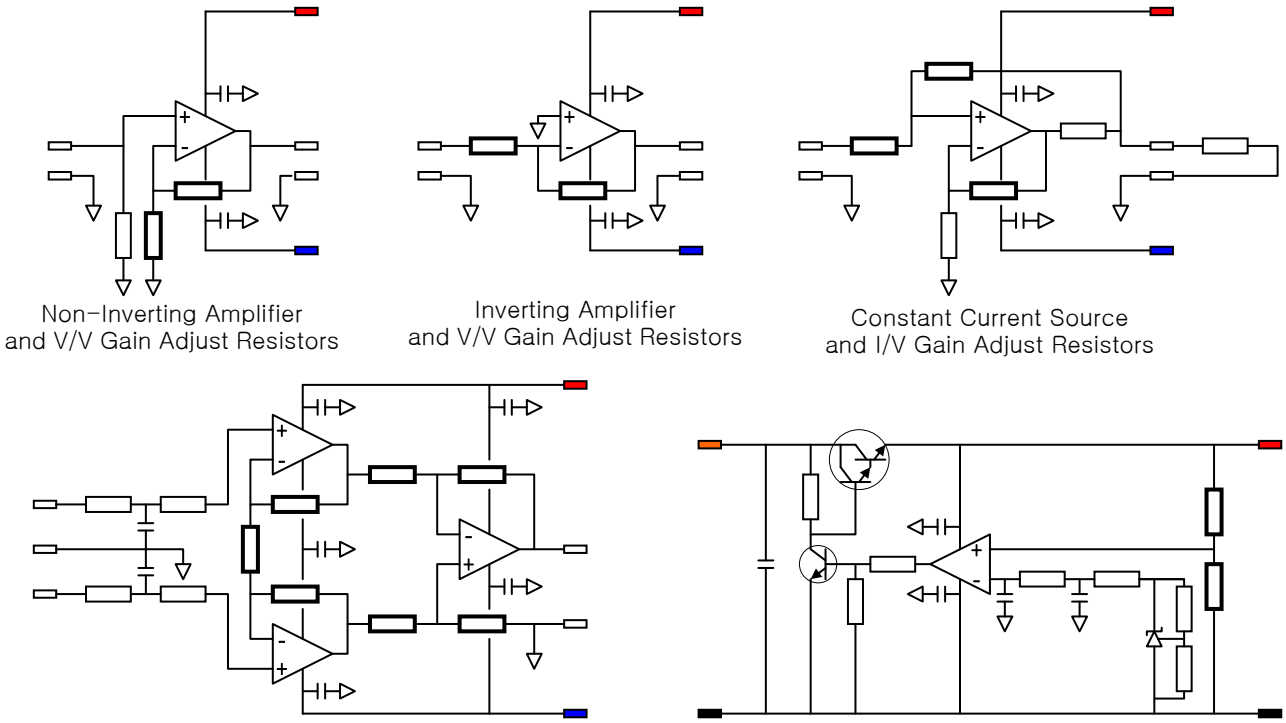


Figure 4. Low Noise Precision Resistor Applications

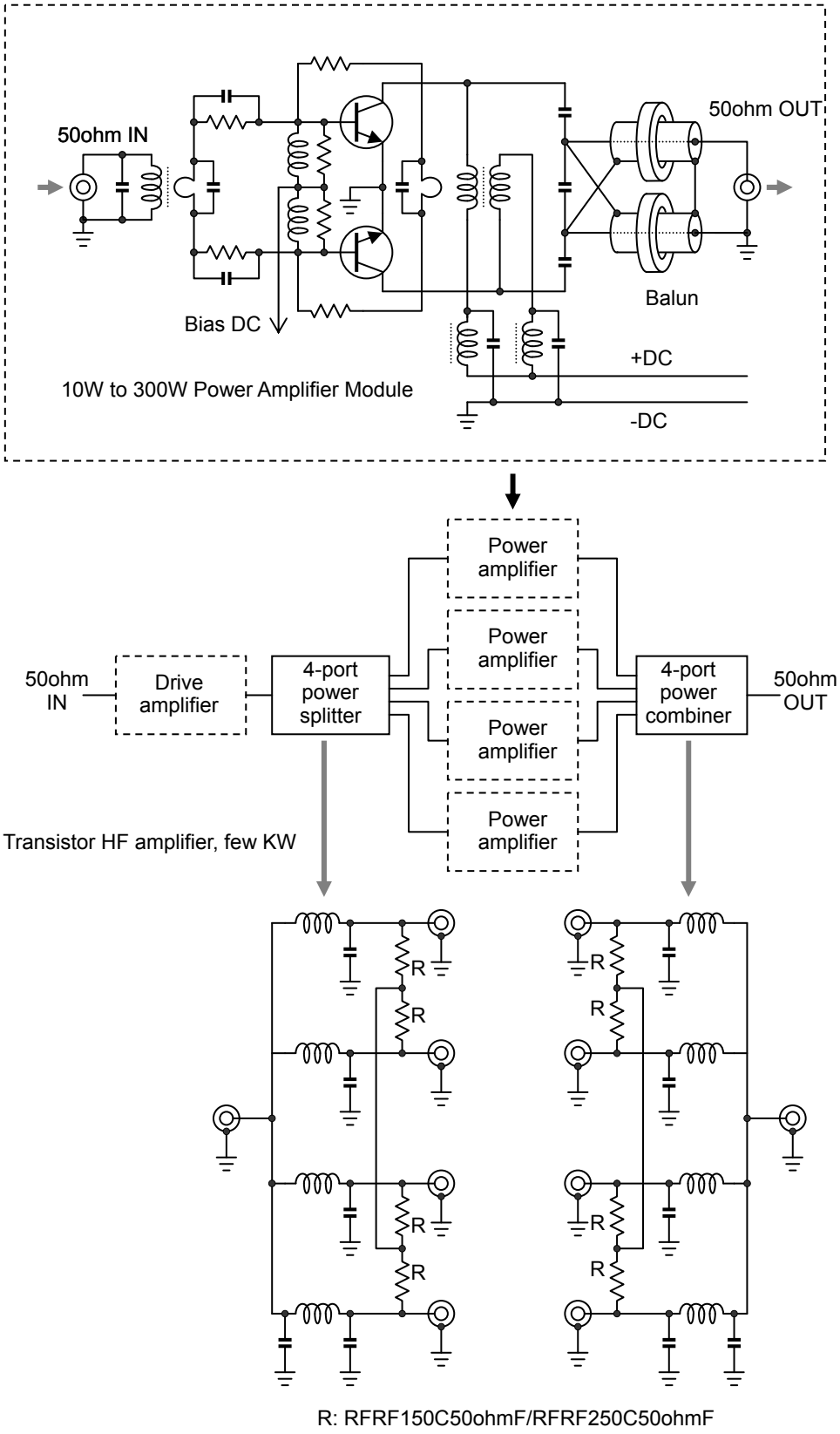


Figure 5. Lumped constant power splitter and power combiner

Return Loss, Reflection, VSWR

S11(dB)	Γ	VSWR
1	1.122018	17.3910
2	1.258925	8.7242
3	1.412538	5.8480
4	1.584893	4.4194
5	1.778279	3.5698
6	1.995262	3.0095
7	2.238721	2.6146
8	2.511886	2.3229
9	2.818383	2.0999
10	3.162278	1.9250
11	3.548134	1.7849
12	3.981072	1.6709
13	4.466836	1.5769
14	5.011872	1.4985
15	5.623413	1.4326
16	6.309573	1.3767
17	7.079458	1.3290
18	7.943282	1.2880
19	8.912509	1.2528
20	10.000000	1.2222
21	11.220185	1.1957
22	12.589254	1.1726
23	14.125375	1.1524
24	15.848932	1.1347
25	17.782794	1.1192
26	19.952623	1.1055
27	22.387211	1.0935
28	25.118864	1.0829
29	28.183829	1.0736
30	31.622777	1.0653
31	35.481339	1.0580
32	39.810717	1.0515
33	44.668359	1.0458
34	50.118723	1.0407
35	56.234133	1.0362
36	63.095734	1.0322
37	70.794578	1.0287
38	79.432823	1.0255
39	89.125094	1.0227
40	100.000000	1.0202
41	112.201845	1.0180
42	125.892541	1.0160
43	141.253754	1.0143
44	158.489319	1.0127
45	177.827941	1.0113
46	199.526231	1.0101
47	223.872114	1.0090
48	251.188643	1.0080
49	281.838293	1.0071
50	316.227766	1.0063
51	354.813389	1.0057
52	398.107171	1.0050
53	446.683592	1.0045
54	501.187234	1.0040
55	562.341325	1.0036
56	630.957344	1.0032
57	707.945784	1.0028
58	794.328235	1.0025
59	891.250938	1.0022
60	1000.000000	1.0020

Attenuation / Gain, Vout/Vin Ratio (dB)

+/- dB	Vout/Vin	Vin/Vout
0.0	1.000000	1.000000
0.1	1.011579	0.988553
0.2	1.023293	0.977237
0.3	1.035142	0.966051
0.4	1.047129	0.954993
0.5	1.059254	0.944061
0.6	1.071519	0.933254
0.7	1.083927	0.922571
0.8	1.096478	0.912011
0.9	1.109175	0.901571
1.0	1.122018	0.891251
2.0	1.258925	0.794328
3.0	1.412538	0.707946
4.0	1.584893	0.630957
5.0	1.778279	0.562341
6.0	1.995262	0.501187
7.0	2.238721	0.446684
8.0	2.511886	0.398107
9.0	2.818383	0.354813
10	3.162278	0.316228
11	3.548134	0.281838
12	3.981072	0.251189
13	4.466836	0.223872
14	5.011872	0.199526
15	5.623413	0.177828
16	6.309573	0.158489
17	7.079458	0.141254
18	7.943282	0.125893
19	8.912509	0.112202
20	10.000000	0.100000
21	11.220185	0.089125
22	12.589254	0.079433
23	14.125375	0.070795
24	15.848932	0.063096
25	17.782794	0.056234
26	19.952623	0.050119
27	22.387211	0.044668
28	25.118864	0.039811
29	28.183829	0.035481
30	31.622777	0.031623
31	35.481339	0.028184
32	39.810717	0.025119
33	44.668359	0.022387
34	50.118723	0.019953
35	56.234133	0.017783
36	63.095734	0.015849
37	70.794578	0.014125
38	79.432823	0.012589
39	89.125094	0.011220
40	100.000000	0.010000
41	112.201845	0.008913
42	125.892541	0.007943
43	141.253754	0.007079
44	158.489319	0.006310
45	177.827941	0.005623
46	199.526231	0.005012
47	223.872114	0.004467
48	251.188643	0.003981
49	281.838293	0.003548
50	316.227766	0.003162

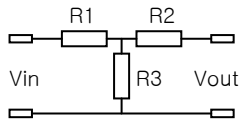
Transformation between VSWR and S11:

$$VSWR = \frac{1+|\Gamma|}{1-|\Gamma|} \quad \ldots\ldots\ldots |\Gamma| = 10^{\frac{S11}{20}}$$

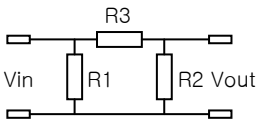
$$|\Gamma| = \frac{VSWR-1}{VSWR+1} \quad \ldots\ldots\ldots S11 = -(-20\log|\Gamma|)$$

Resistive Attenuator and Resistance Values

Circuit T Attenuator, Impedance 50 OHMS



Circuit PAI Attenuator, Impedance 50 OHMS



Attenuation (dB)	Vin/Vout (k)	R1 (OHMS)	R2 (OHMS)	R3 (OHMS)	Attenuation (dB)	Vin/Vout (k)	R1 (OHMS)	R2 (OHMS)	R3 (OHMS)
0	1.000				0	1.000			
1	1.122	2.875	2.875	433.337	1	1.122	869.548	869.548	5.769
2	1.259	5.731	5.731	215.240	2	1.259	436.212	436.212	11.615
3	1.413	8.550	8.550	141.926	3	1.413	292.402	292.402	17.615
4	1.585	11.314	11.314	104.829	4	1.585	220.971	220.971	23.848
5	1.778	14.006	14.006	82.241	5	1.778	178.489	178.489	30.398
6	1.995	16.614	16.614	66.931	6	1.995	150.476	150.476	37.352
7	2.239	19.124	19.124	55.802	7	2.239	130.728	130.728	44.801
8	2.512	21.525	21.525	47.309	8	2.512	116.143	116.143	52.844
9	2.818	23.811	23.811	40.592	9	2.818	104.994	104.994	61.589
10	3.162	25.975	25.975	35.136	10	3.162	96.248	96.248	71.151
11	3.548	28.013	28.013	30.616	11	3.548	89.244	89.244	81.657
12	3.981	29.924	29.924	26.810	12	3.981	83.545	83.545	93.247
13	4.467	31.708	31.708	23.568	13	4.467	78.845	78.845	106.074
14	5.012	33.366	33.366	20.780	14	5.012	74.926	74.926	120.309
15	5.623	34.902	34.902	18.363	15	5.623	71.629	71.629	136.140
16	6.310	36.319	36.319	16.257	16	6.310	68.834	68.834	153.777
17	7.079	37.623	37.623	14.413	17	7.079	66.449	66.449	173.455
18	7.943	38.818	38.818	12.792	18	7.943	64.402	64.402	195.435
19	8.913	39.912	39.912	11.363	19	8.913	62.638	62.638	220.008
20	10.000	40.909	40.909	10.101	20	10.000	61.111	61.111	247.500
21	11.220	41.817	41.817	8.984	21	11.220	59.785	59.785	278.276
22	12.589	42.641	42.641	7.994	22	12.589	58.629	58.629	312.746
23	14.125	43.389	43.389	7.115	23	14.125	57.619	57.619	351.365
24	15.849	44.065	44.065	6.335	24	15.849	56.734	56.734	394.646
25	17.783	44.676	44.676	5.641	25	17.783	55.958	55.958	443.164
26	19.953	45.227	45.227	5.024	26	19.953	55.276	55.276	497.563
27	22.387	45.724	45.724	4.476	27	22.387	54.676	54.676	558.564
28	25.119	46.171	46.171	3.987	28	25.119	54.146	54.146	626.976
29	28.184	46.573	46.573	3.553	29	28.184	53.679	53.679	703.709
30	31.623	46.935	46.935	3.165	30	31.623	53.266	53.266	789.779
31	35.481	47.259	47.259	2.821	31	35.481	52.900	52.900	886.329
32	39.811	47.550	47.550	2.513	32	39.811	52.577	52.577	994.640
33	44.668	47.810	47.810	2.240	33	44.668	52.290	52.290	1,116.149
34	50.119	48.044	48.044	1.996	34	50.119	52.036	52.036	1,252.469
35	56.234	48.253	48.253	1.779	35	56.234	51.810	51.810	1,405.409
36	63.096	48.440	48.440	1.585	36	63.096	51.610	51.610	1,576.997
37	70.795	48.607	48.607	1.413	37	70.795	51.433	51.433	1,769.511
38	79.433	48.757	48.757	1.259	38	79.433	51.275	51.275	1,985.506
39	89.125	48.890	48.890	1.122	39	89.125	51.135	51.135	2,227.847
40	100.000	49.010	49.010	1.000	40	100.000	51.010	51.010	2,499.750

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