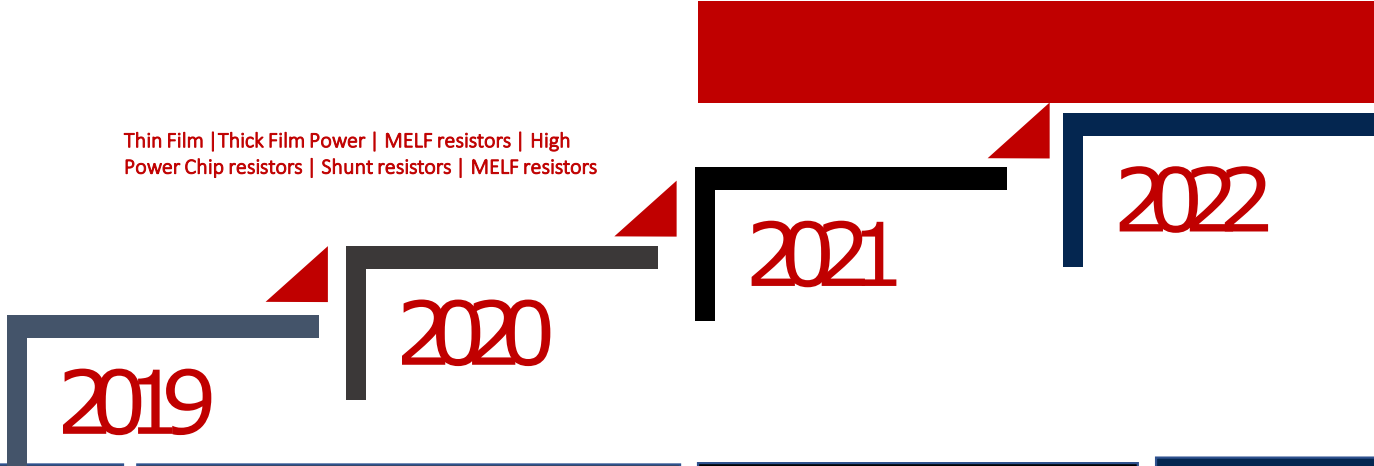


Thin Film | Thick Film Power | MELF resistors | High Power Chip resistors | Shunt resistors | MELF resistors



- TaN resistor layer material → TAR series
- ALN substrate apply to Thin and Thick Film → ARN and CRP series
- **Power and Resistance range Upgrade:** Current Sense(CS 1020-2W, CR 1225-3W) /Metal Foil(2010/2512) /4T 1206
- **High Power Metal Foil Resistor** (0402~1206) R<10mohm(CSM)
- **PWR Jumper Series** (0603 R<8mohm ; 0805/1206 R<5mohm)
- **Melf High Voltage resistance** range extended(CSRP- 10M)

- 5G market application
- **Microwave thin film chip resistors** (low noise)
- **Long side development:** 4-terminal(2010), current sensing chip(7520)
- **TaN thin film resistor (TAR Series)** 0402~1206 size, 10Ω~1MΩ、TCR ±10
- **MELF High Frequency Series**
- **High Voltage Low VCR series** (1206/1210/2512)
- **High Power thin film chip resistor** (0603 & 0805)

- Thin film chip Resistor upgrade Operating temperatura
- **Thin film chip Resistor Safety Automotive**
- Thin film High moisture resistance Chip Resistor
- High Precision Automotive grade

- TaN thin film resistor (TAR Series) upgrade **High reliability**
- Thin film chip Resistor **Safety Automotive**
- Thin flim chip Resistor **upgrade Operating temperatura (230°C)**


shortform

[Descargar](#)

Manufacturer for
Resistor, Capacitor, Inductor
& Customized Your Need

THINFILM


METALLOWHM

NEW Four Terminal High Precision	4T06		1206	1/2W	±0.5%~±5%	10mΩ-20mΩ	±50~±150
	4T10		2010	3/4W			


THICKFILMCURRENTSENSING


NEW Wide Terminal	CSW08		0518	1/2W	±0.5%, ±5%	10mΩ-100mΩ	±200~±300
	CSW62		0619	3/4W, 1.5W			
	CSW20		1020	1W, 2W			
	CSW25		1225	1.5W, 3W			

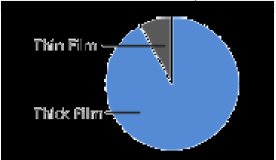
THICKFILM

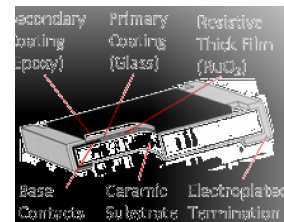
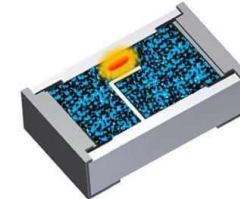
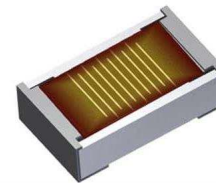
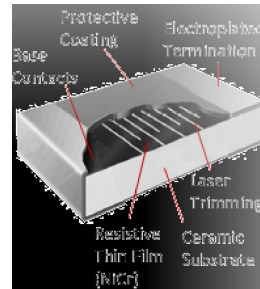
NEW Green Lead Hires	CRG01		0520	1/2W	±0.5%, ±5%	10mΩ-100mΩ	±100~±300
	CRG02		0621	1/2W			
	CRG03		0822	1/2W			
	CRG05		0923	1/2W			
	CRG06		1024	1/2W			
	CRG10		1225	1/2W			
	CRG0A		2026	3W			
CRG12	2527	3W					
NEW Aluminum Nitride	CRP06		1028	1/2W	±1%, ±5%	10mΩ-100mΩ	±100
	CRP12		2029	1W			
NEW Wide Terminal	CRW25		1030	3W	±0.5%, ±1%, ±5%	10mΩ-100mΩ	±1000~±3000
	CRW20		1031	3W			
	CRW62		2032	1.5W			
	CRW08		0533	3W			

METALLOWHM

NEW Ultra-Low Ohm Jumper	LRJ02		0402	20A	Jumper	0.5mΩMax	-
	LRJ03		0603	22.4A			-
	LRJ05		0805	31.6A			-
	LRJ06		1206	50A			-
	LRJ10		2010	71A			-
	LRJ12		2512	100A			-
					0.2mΩMax	-	

	Thin Film	Thick Film
Appearance	 <p>While the manufacturing process and properties are very different, the chip resistors for thin and thick film often have a similar appearance.</p>	
Construction		
Film thickness (µm)	±0.1	±100
Manufacturing process	Sputtering (Vacuum Deposition)	Screen and stencil printing
Trimming	Abrasive or Laser, for complex patterns photo etching	Abrasive or Laser
Resistive Material	Uniform metallic film, usually Nichrome	Paste of Ruthenium Oxide or other alloy.
Properties		
Resistance Values (Ω)	0.2 – 20M	1 – 100M
Tolerance (%)	±0.1 - ±2	±1 - ±5
Temperature Coefficient (ppm/K)	±5 - ±50	±50 - ±200
Maximum Operating Temperature (°C)	155	155
Maximum Operating Voltage Umax (V)	50 - 500	50 – 200
Non-linearity (dB)	>110	>50
Current Noise (µV/V)	<0.1	<10
Power Rating P70 (W)	1/16 – 1	1/16 – 1/4
Stability at P70 (1000h) ΔR/R %	±0.15 - ±0.5	±1 - ±3
Moisture resistance	Thick film is more resistant to moisture, since they are glass like.	
High frequency behavior	Thin film features lower parasitic inductance and capacitance. However, inductance may be high if thin film is executed with a cylindrical shape that is spiral cut.	

Applications		
Typical areas of use	High precision: Measuring or monitoring equipment, medical or audio applications, precision controls.	Very wide, almost any electrical device with battery or AC connection. The average PC contains well over 1000 thick film chip resistors.
Market share		
Cost	More expensive than thick film.	Lowest cost resistor type on the market. Preferred solution if performance requirements are low.
Estimated use in analogue circuits		



Thinfil resistor

Thickfil resistor

THIN FILM RESISTOR COMPARISON

ARF Series

High Frequency (up to 40GHz) Thin Film Precision Chip Resistors

Key Properties

- High Purity alumina substrate
- High Frequency (Up to 40GHz)
- 0402 | 0603 | 0805 | 1206 case sizes
- Ohmic range (50Ω~150Ω)
- Resistor tolerance to $\pm 0.1\%$
- TCR to ± 25 ppm/°C



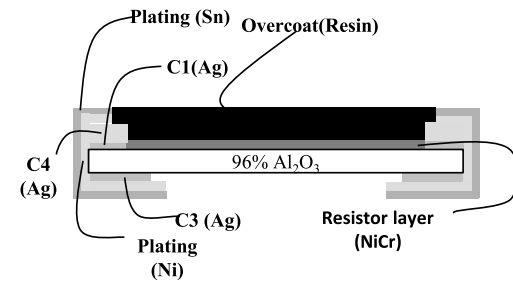
Competitor: Vishay FC

ARM Series

High Power Thin Film Chip Resistors

Key Properties

- High precision resistance tolerance $\pm 0.02\%$
- Low TCR down to ± 5 ppm/°C
- Resistance values 10Ω to 5.1MΩ
- 1206 case sizes
- Test proven immunity to humidity and sulfur
- AEC-Q200 Compliance



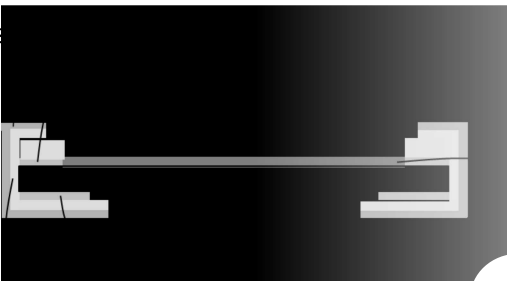
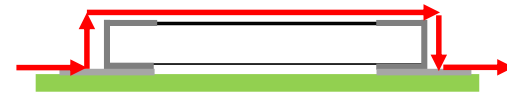
Competitor: Ssumu RG

ARN Series

Aluminum Nitride Thin Film Precision Chip Resistors

Key Properties

- High Thermal conductivity aluminum nitride substrate
- 0603 | 0805 | 1206 | 2512 case sizes
- Power rating up to 6.0 W
- Resistance 50 Ω~30.1 KΩ
- Resistor tolerance to $\pm 0.1\%$
- TCR to ± 25 ppm/°C



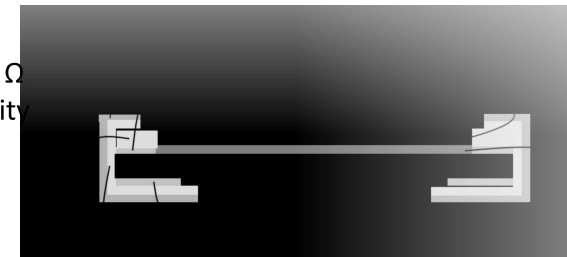
Competitor: Vishay PCAN

ARHV Series

High Voltage Thin Film Flat Chip Resistor

Key Properties

- High operating voltage to 1000 V
- Low voltage coefficient < 1 ppm/V
- Tolerance down to $\pm 0.1\%$
- TCR down to ± 25 ppm/°C
- 1206 to 1210 case sizes
- Resistance values 121KΩ to 1MΩ
- Test proven immunity to humidity and sulfur
- AEC-Q200 Compliance

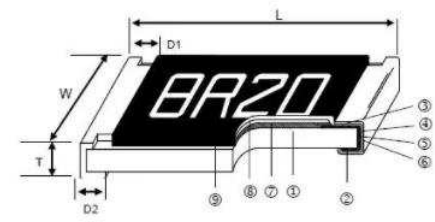


Competitor: Vishay TNPVe3

TANTALUM NITRIDE THIN FILM PRECISION CHIP RESISTOR TAR SERIES

0402 / 0603 / 0805 / 1206

AEC-Q Compliance



① Alumina Substrate	④ Edge Electrode	⑦ Resistor Layer
② Bottom Electrode	⑤ Barrier Layer	⑧ Overcoat
③ Top Electrode	⑥ External Electrode	⑨ Marking

The tantalum nitride resistive film forms a moisture impervious tantalum pentoxide barrier layer that can withstand thousands biased humidity testing at 85 °C /85% relative humidity, This precision robust performance is an ideal choice for a wide range of applications requiring precision resistance with long term stability, reliability, and critical environmental. TaN thin film resistor is for your high –level designs.

Features

- Tantalum nitride thin film resistor
- High stability in humid environments
- High temperature exposure stability 0,1% at 1000h at 155°C.
- Tight tolerance down to ±0.05%
- Extremely low TCR down to ±10PPM/ C
- Resistance values from 10 ohm to 1M ohm
- Special materials, design, and processing for high sulfur applications
- Test proven immunity to humidity, moisture, and sulfur

Type	Power Rating at 70°C	Operating Temp. Range	Max. Operating Voltage	Max. Overload Voltage	Resistance Range					TCR (PPM/°C)
					±0.05%	±0.1%	±0.25%	±0.5%	±1%	
TAR02 (0402)	1/16W	-55 ~ +155°C	50V	100V	40Ω - 35KΩ					±10 ±15 ±25 ±50
TAR03 (0603)	1/6W	-55 ~ +155°C	75V	150V	40Ω - 130KΩ					±10 ±15 ±25 ±50
TAR05 (0805)	1/5W	-55 ~ +155°C	100V	200V	10Ω - 350KΩ					±10 ±15 ±25 ±50
TAR06 (1206)	1/2W	-55 ~ +155°C	200V	400V	1Ω - 1MΩ					±10 ±15 ±25 ±50

Long Termination thick film chip Resistor

CSWseries | CRWseries

0508 / 0612 / 1020 / 1225

AEC-Q Compliance

Propósito del desarrollo: Altos requerimientos para transmisión de datos; eficiencia en disipación de calor.

Las resistencias están **construidas a base de cerámica** (óxido de aluminio).

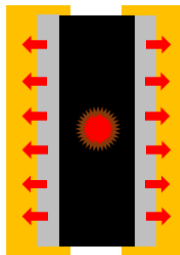
Resistencia de chip plano con terminación de lado ancho (geometría inversa), proporciona una ruta más corta para la **disipación de calor a la PCB**, mejora la clasificación de **alta potencia**, la construcción de electrodo ancho admite un **buen rendimiento de ciclo térmico**.

La composición de la pasta se ajusta para dar la resistencia aproximada requerida y se recorta al valor nominal mediante un cortador láser.

Ultra high power long side terminal resistor technology



Short Terminal resistor



Long Terminal resistor

Power rating/Size	Common part	Long Side Terminal
0805	0.125W	0.75W
1206	0.25W	1.5W
2010	0.75W	2W
2512	1W	3W

- 1) better **heat dissipation** and higher power rating
- 2) **High resistance** of welding crack · the construction design of electrode distance is short.

Current sensing Wide Termination-CSW Series

Series	PN	Size	Power	Tolerance	Resistance	TCR/PPM
Wide Terminal	CSW08	0518	1/2W	±1%, ±5%	10mΩ~100mΩ	±200/±600
	CSW62	0612	3/4W, 1.5W			
	CSW20	1020	1W, 2W			
	CSW25	1225	1.5W, 3W			

- *3 Watts power rating in 1 Watt size, 1225 package
- *Low TCR of ±200 PPM/°C
- *Resistance values from 1m to 1 ohm
- *High purity alumina substrate for high power dissipation
- *Long side terminations with higher power rating



Manuf	Series	Size	0508	0612	1020	1225
Viking	CSW	Power rating	1/2W	0.75W/1.5W	1W/2W	1.5W/3W
		Resistance range	10m -1R			
KOA	WK73S	Power rating	1W	0.75W/1W/1.5W	1W/2W	1.5W/2W/3W
		Resistance range	20m -10R	10m -10R		
Yageo	PE	Power rating	1.2W	1W/2W		
		Resistance range	5m-100m	1m-100m		
Vishay	RCWE	Power rating		1W	2W	
		Resistance range	10mR-1R			

Long Termination Thick Film Resistor -CRW

Series	PN	Size	Power	Tolerance	Resistance	TCR/PPM
Wide Terminal	CRW25	1225	3W	±0.5%, ±1%, ±5%	0Ω, 1Ω~1MΩ	±100/±150±200
	CRW20	1020	2W			
	CRW62	0612	1.5W			
	CRW08	0518	1W			

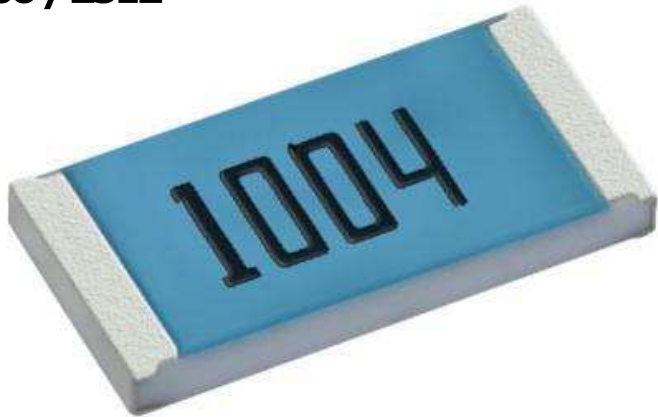
- * Long side terminations enhanced power rating in compact sizes
- * AEC-Q200 qualified, 100% CCD inspection
- * High reliable multilayer electrode construction
- * Compatible with all soldering process



Manuf	Series	Size	0508	0612	1020	1225
Viking	CRW	Power rating	1W	1.5W	2W	3W
		Resistance range	1R-1M			
KOA	WK73R	Power rating	0.75W/1W	0.75W/1W	1W	1.5W/2W
		Resistance range	1R-1M			
Vishay	RCL	Power rating		1W	1W	2W
		Resistance range	1R-1M			
Rohm	LTR	Power rating	0.25W	0.75W	1W	2W
		Resistance range	1R-1M			

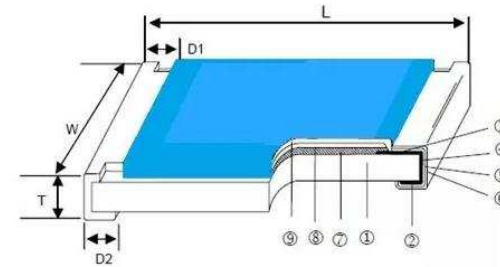
THICK FILM HIGH POWER CHIP RESISTOR ALUMINUM NITRIDE SUBSTRATE (ALN) – CRP SERIES

1206 / 2512



FEATURES

- Thick film resistive element on an aluminum nitride (AlN) substrates
- **Power ratings up to 22 W** with active temperature control
- Very high thermal conductivity in a small package size
- Tolerance down to $\pm 1\%$, TCR of ± 150 ppm/ $^{\circ}\text{C}$
- Lead (Pb)-free wraparound termination over nickel barrier.



① Aluminum Nitride Substrate	④ Edge Electrode	⑦ Resistor Layer
② Bottom Electrode	⑤ Barrier Layer	⑧ Primary Overcoat
③ Top Electrode	⑥ External Electrode	⑨ Secondary Overcoat

CRP series thick film resistor is designed on high thermal conductivity aluminum nitride substrate with enlarged backside terminations to reduce the thermal resistance between the topside resistor layer and the solder joint on the end users' circuit assembly.

It offers effectively heat dissipation to remove the heat to the overall performance of the devices. **Enhance over 3 times more power** in same size .

Excellent reliability and stability. It offers High Thermal Conductivity for Power to 22 W with temperature control in 2512 Case .

Item Type	Power Rating at 70°C	Operating Temp. Range	Max. Operating Voltage	Resistance Range (Ω)		TCR (PPM/ $^{\circ}\text{C}$)
				$\pm 1\%$ (E24、E96)	$\pm 5\%$ (E24)	
CRP06	2.4W	-55 ~ +155 $^{\circ}\text{C}$	200	10 Ω – 2K Ω		± 150
CRP12	3.5W	-55 ~ +155 $^{\circ}\text{C}$	200	3 Ω – 2K Ω		± 150

ULTRALOW RESISTANCE METAL ALLOY JUMPER LRJ SERIES

0402 / 0603 / 0805 / 1206 / 2010

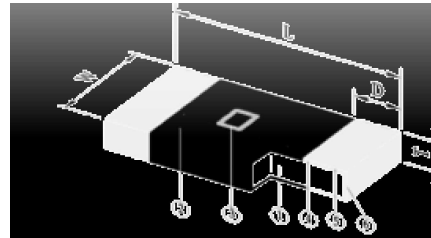


Metal alloy 0 ohm jumper resistor for ultra low resistance under 0.5mohm for sizes of 0402~0805, under 0.2mohm for sizes of 1206,2010 withstand high temperature for high current applications.

Our LRJ series is true metal alloy plate zero ohm resistor, a good choice of less space and low cost than DIP jumper headers. This Metal jumper is designed to extremely low impedance and profile circuit linkage as a zero ohm resistor.

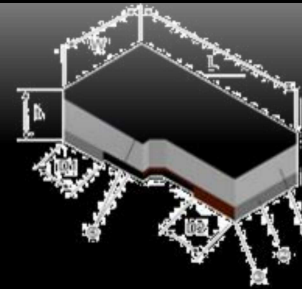
FEATURES

- High current application with Low profile.
- Ultra-Low resistance values, 0.2 mΩ /0.5mΩ Max.
- Operating temperature range -55°C~+150°C with stable resistance
- Wide range package sizes 0402-2010



LRJ06/LRJ10/LRJ12

① Alloy Plate	④ Internal Electrode
② Overcoat	⑤ Barrier Layer
③ Marking	⑥ Solder Plating



LRJ02/LRJ03/LRJ05

① Alumina Substrate	④ Overcoat
② External Electrode	⑤ No Marking
③ Resistor Layer	

Type	Item	Operating Temp. Range	Resistance Range (mΩ)	Rated Current (A)
LRJ02 (0402)		-55 ~ +155°C	0.5 mΩ Max.	20
LRJ03(0603)		-55 ~ +155°C		22.4
LRJ05(0805)		-55 ~ +155°C		31.6
LRJ06 (1206)		-55 ~ +155°C	0.2 mΩ Max.	50
LRJ10 (2010)		-55 ~ +155°C		71
LRJ12 (2512)		-55 ~ +155°C		100



Professional hightemp. Thin Film Chip Resistor ART Series

0603

AEC-Q Compliance

Features

- Operating temperature **up to 175°C** for 1000 hr
- Superior temperature cycling robustness
- Advanced sulfur resistance verified according to ASTM B 809

Type	Item	Power Rating at 85°C	Operating Temp. Range	Max. Operating Voltage	Max. Overload Voltage	Resistance Range		TCR (PPM/°C)
						±0.5%	±1%	
ART03		3/20W	-55 ~ +175°C	75V	150V	10Ω – 511KΩ		±25
						1Ω – 511KΩ		±50

High Power / temp. Thin Film Chip Resistor ARTP Series

0805

AEC-Q Compliance

Features

- Operating temperature **up to 175°C** for 1000 hr
- Rated dissipation up to **0.4 W for size 0805**
- Superior temperature cycling robustness
- Advanced sulfur resistance verified according to ASTM B 809

Type	Power Rating at 85°C	Operating Temp. Range	Max. Operating Voltage	Max. Overload Voltage	Resistance Range			TCR (PPM/°C)
					±0.1%	±0.5%	±1%	
ARTP05 (0805)	2/5W	-55 ~ +175°C	150V	300V	47Ω – 100KΩ	10Ω – 100KΩ		±25
					-	1Ω – 100KΩ		±50

HIGH POWER THIN FILM CHIP RESISTOR ARPSERIES

1206

AEC-Q Compliance

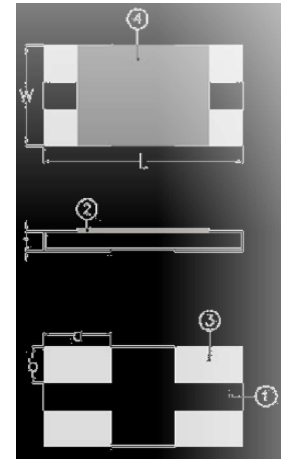
Type	Item	Power Rating at 70°C	Operating Temp. Range	Max. Operating Voltage	Max. Overload Voltage	Resistance Range			TCR (PPM/°C)
						±0.1%	±0.5%	±1%	
1206		1W	-55 ~ +155°C	200V	400V	47Ω – 100KΩ			±25
						47Ω – 100KΩ	10Ω – 100KΩ		±50

Features

- Wider bottom terminal enabling higher power capability (short side terminal)
- Significantly larger power handling capability than existing same size resistors
- Size: 1206, **Power rating: 1.0W**, Resistance range: 10 ~ 100KΩ
- Advanced sulfur resistance verified according to ASTM B 809

FOUR TERMINAL HIGH PRECISION CURRENT SENSE RESISTOR 4T SERIES

1206 / 2010



① Aluminum termination	④ Protection cover
② Resistor Layer	
③ Electrode	

Diagrama Esquemático

- V = Voltage terminal
- -I Current terminal

Features

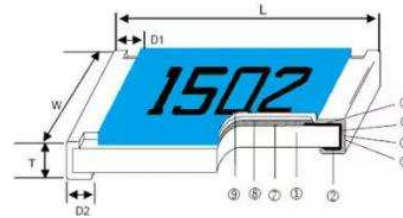
- SMD Type designed for automatic insertion
- **High power rating in small size**
- Metal foil construction ensures high reliability and performance with **very low and stable TCR**
- Design for current sense circuits in power electronic systems
- Industry standard sizes

Metal Foil is special designed for **4 terminations**. 1206/2010 , **high power, resistance 10m-20mohm**. Support 0.5%, 1% **tight tolerance**. Low TC 50/75/100ppm , Kelvin termination resistor design , surface-mount ,**High power current sensing for critical current sensing design**. This resistor covers the most widely used resistance range from 10m~20m. This technology offers an **excellent Temperature Coefficient of Resistance (TCR)** and **high reliable, accurate current detection**.

Type	Power Rating at 70°C	Operating Temp. Range	Resistance Range				TCR (PPM/°C)
			±0.5%	±1%	±2%	±5%	
4T06 (1206)	1/2W	-55 ~ +155°C	10mΩ - 20mΩ				±50 ±75 ±100
4T10 (2010)	3/4W	-55 ~ +155°C	10mΩ - 20mΩ				±50 ±75 ±100

GREEN THICK FILM CHIP RESISTOR CRG SERIES

0402 / 0603 / 0805 / 1206 / 1210 / 2010 / 2512



① Alumina Substrate	④ Edge Electrode	⑦ Resistor Layer
② Bottom Electrode	⑤ Barrier Layer	⑧ Primary Overcoat
③ Top Electrode	⑥ External Electrode	⑨ Secondary Overcoat



Features

- Green Resistor **without RoHS exemptions**.
- Highly reliable multilayer electrode construction.
- Compatible with all soldering process.

Green thick film resistor for environment protection that **meet RoHS compliant** without exemptions. Resistance 1ohm to10Mohm, sizes from 0201~2512, Completely free of Pb in its compounds. These rectangular resistors are high stability for any electronic applications.

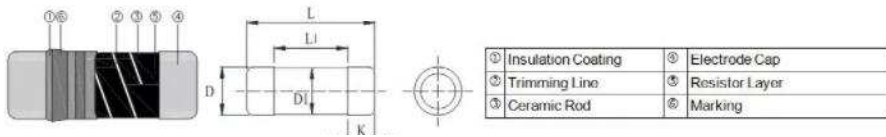
Item Type	Power Rating at 70°C Jumper Rated Current	Operating Temp. Range	Max. Operating Voltage	Max. Overload Voltage	Resistance Range		TCR (PPM/ °C)
					±1% (E24、 E96)	±5% (E24)	
CRG02 (0402)	1/16W	-55 ~ +155°C	50V	100V	1Ω - 9.76Ω	±200	
	Jumper: 1A				10Ω - 1MΩ	±100	
CRG03 (0603)	1/10W	-55 ~ +155°C	75V	150V	1.02MΩ - 10MΩ	±200	
	Jumper: 1A				0Ω (<50mΩ)	±100	
CRG05 (0805)	1/8W	-55 ~ +155°C	150V	300V	1.02MΩ - 10MΩ	±200	
	Jumper: 2A				0Ω (<50mΩ)	±100	
CRG06 (1206)	1/4W	-55 ~ +155°C	200V	400V	1Ω - 9.76Ω	±200	
	Jumper: 2A				10Ω - 1MΩ	±100	
CRG10 (1210)	1/3W	-55 ~ +155°C	200V	400V	1.02MΩ - 10MΩ	±200	
	Jumper: 2.5A				0Ω (<50mΩ)	±100	
CRG0A (2010)	3/4W	-55 ~ +155°C	200V	400V	1.02MΩ - 10MΩ	±200	
	Jumper: 3.5A				0Ω (<50mΩ)	±100	
CRG12 (2512)	1W	-55 ~ +155°C	250V	500V	1Ω - 9.76Ω	±200	
	Jumper: 4A				10Ω - 1MΩ	±100	
					1.02MΩ - 10MΩ	±200	
					0Ω (<50mΩ)		

MELF METAL FILM PRECISION RESISTOR

CSR/SERIES

0102 / 0204 / 0207

AEC-Q Compliance



DESCRIPTION	CSR0102			CSR0204		CSR0207	
Resistance range	10Ω - 1MΩ; 0Ω			0.1Ω - 3.4MΩ; 0Ω		0.1Ω - 3.4MΩ; 0Ω	
Resistance tolerance	± 5%; ± 1%; ± 0.5%; ± 0.25%; ± 0.1%						
Temperature coefficient	± 100ppm/°C; ± 50ppm/°C; ± 25ppm/°C; ± 15ppm/°C			± 100ppm/°C; ± 50ppm/°C; ± 25ppm/°C; ± 15ppm/°C; ± 10ppm/°C			
Operation mode	Standard	High power		Standard	High power	Standard	High power
Power rating P70	1/8W	1/5W	0.3W	1/4W	2/5W	1/2W	1W
Operating voltage Umax.	150V	200V	200V	200V	200V	300V	350V
Operating temperature range	-55°C ~ 155°C						
Max. resistance change at P70 for resistance range, ΔR/R max., after 1000 h	≤ 0.5%			≤ 0.5%		≤ 0.5%	

Features

- AEC-Q200 Compliance.
- Thin film technology.
- Excellent overall stability.
- Sn termination on Ni barrier layer.
- Tight tolerance down to ± 0.1%.
- Extremely low TCR down to **± 10 PPM/°C**.
- High power rating up to 1 Watts.
- SMD enabled structure.
- Lead-free and RoHS compliant.

High level of MELF metal film precision resistor, ready for the size of 0102/0204/0207. **Tight tolerance of 0.1%**, TC5/10/15/25/50/100ppm.

Resistance range 0.1ohm~3.4Mohm.

The MELF is cylindrical in shape and with metal electrode Leadless face resistor. Land pattern sizes are the same as SMD chip resistors.

It is manufactured by **depositing a homogeneous film of NiCr onto a high-grade ceramic body**. High quality of MELF resistors offer excellent electrical and Environmental Stability, exceptional stability demonstrated over life, **biased humidity**, and **short time overload testing**.

AUTOMOTIVE GRADE METAL FILM PRECISION MELF RESISTOR

CSRA/SERIES

0102 / 0204 / 0207

AEC-Q Compliance



DESCRIPTION	CSRA0102		CSRA0204		CSRA0207	
Resistance range	1Ω - 1MΩ; 0Ω		0.1Ω - 3.4MΩ; 0Ω		0.1Ω - 3.4MΩ; 0Ω	
Resistance tolerance	± 5%; ± 1%; ± 0.5%; ± 0.25%; ± 0.1%					
Temperature coefficient	± 100ppm/°C; ± 50ppm/°C; ± 25ppm/°C; ± 15ppm/°C		± 100ppm/°C; ± 50ppm/°C; ± 25ppm/°C; ± 15ppm/°C; ± 5ppm/°C			
Operation mode	Standard	High power	Standard	High power	Standard	High power
Power rating P70	1/5W	0.3W	1/4W	2/5W	1/2W	1W
Operating voltage Umax.	200V	200V	200V	200V	300V	350V
Operating temperature range	-55°C ~ 155°C					
Max. resistance change at P70 for resistance range, ΔR/R max., after 1000 h	≤ 0.5%		≤ 0.5%		≤ 0.5%	

- Extremely low TCR down to **± 5 PPM/°C**.
- CSRA's **Biased Humidity** performance **is better**