A S J

ASJ PTE LTD

LEAD FREE CHIP RESISTOR SPECIFICATION (LOW TCR)
Reference No. : SYS – ENG – 212
Revision No. : C

COPY FOR REFERENCE ONLY

1. SCOPE

1.1. This specification specifies fixed thick film chip resistor with low TCR (referred to as resistor hereinafter) for use in electronic equipment. In case there are discrepancies in specifications between this specification and the Customer's specifications, the latter shall precede.

2. PART NUMBERING SYSTEM

Part Numbering is made in accordance with the following system:

CRXX -	XXXX -	X	X-	X
Resistance	Resistance Value	Tolerance	Packaging	TCR(ppm/^{o}C)
CR10 - 0402		D - 0.5%	L - 5K reel	E - ± 50ppm
CR16 - 0603		F - 1%	K - 10K reel	
CR21 - 0805		J - 5%	E - 4K reel	
CR32 - 1206				
CR40 - 1210				
CR50 - 2010				
CR63 - 2512				

Eg: CR10-1001-DK-E

3. RATING

3.1. Rated Power

3.1.1 Resistor Rated Power

	Rated Power	Maximum Working Voltage	Maximum Overload Voltage	Maximum Intermittent Overload Voltage	Dielectric Withstanding Voltage
CR10	1/16W	50V	100V	50V	300V
CR16	1/10W	75V	150V	100V	300V
CR21	1/8W	150V	300V	300V	500V
CR32	1/4W	200V	400V	400V	500V
CR40	1/3W	200V	400V	400V	500V
CR50	3/4W	200V	400V	400V	500V
CR63	1W	200V	400V	400V	500V

3.2 Power Derating Characteristics

Rated Power shall be the load power corresponding to nominal wattage suitable for continuous use at 70°C ambient temperature. In case the ambient temperature exceeds 70°C, reduce the load power in accordance with Derating curve in Fig. 1.

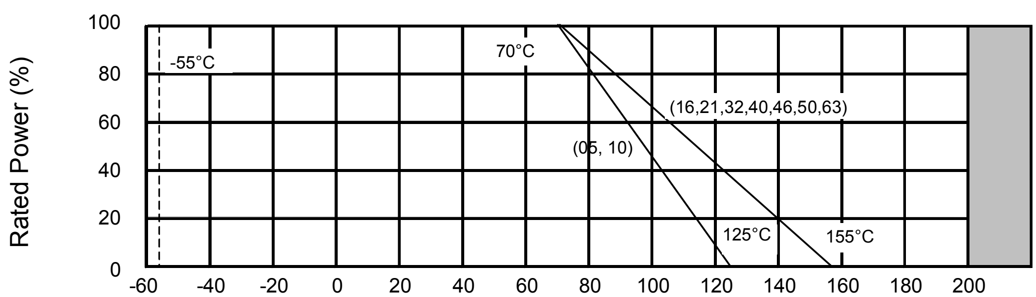


Fig.1 Power Derating Characteristics

3.3 Standard Atmospheric Condition

Unless otherwise specified, the standard range of atmospheric conditions for making measurements and tests is as follows :

Ambient Temperature = +5°C to +35°C

Relative Humidity = < 85% RH

Air Pressure = 86 to 106kPa

If there may be any doubt about the results, measurement shall be made within the following limits :

Ambient Temperature = 20± 2°C

Relative Humidity = 60 to 70% RH

Air Pressure = 86 to 106kPa

3.4 Operating Temperature Range -55°C to +155°C

3.5 Storage Temperature Range -5°C to +40°C

3.6 Flammability Rating Tested in accordance to UL-94, V-0

3.7 Moisture Sensitivity Level Rating : Level 1

3.8 Product Assurance

ASJ resistor shall warranty 12 months from the date of shipment.

3.9 ASJ resistors are RoHS compliance in accordance to RoHS Directive 2002/95/EC.

3.10 Resistance, Resistance Tolerance and Temperature Coefficient of Resistance.

	Resistance Range			
	D (+/- 0.5%) E - 96	F (+/- 1%) E – 96 E – 24	G (+/- 2%) E – 24	J (+/- 5%) E - 24
CR10 (0402)	-	10Ω to 1MΩ	10Ω to 1MΩ	10Ω to 1MΩ
CR16 (0603)	10Ω to 1MΩ	10Ω to 1MΩ	10Ω to 1MΩ	10Ω to 1MΩ
CR21 (0805)	10Ω to 1MΩ	10Ω to 1MΩ	10Ω to 1MΩ	10Ω to 1MΩ
CR32 (1206)	10Ω to 1MΩ	10Ω to 1MΩ	10Ω to 1MΩ	10Ω to 1MΩ
CR40 (1210)	10Ω to 1MΩ	10Ω to 1MΩ	10Ω to 1MΩ	10Ω to 1MΩ
CR50 (2010)	10Ω to 1MΩ	10Ω to 1MΩ	10Ω to 1MΩ	10Ω to 1MΩ
CR63 (2512)	10Ω to 1MΩ	10Ω to 1MΩ	10Ω to 1MΩ	10Ω to 1MΩ
Temperature Coefficient Resistance (TCR)	0.5%, 1% & 5% (For all product type)	10Ω≤ R< 1MΩ	±50ppm/°C	

3.11 Rated Voltage

The rated voltage is calculated from the rated power and nominal resistance by the following formula:

$$E = \sqrt{P.R}$$

Where E : Rated Voltage (V)
P : Rated Power (W)
R : Nominal Resistance (Ω)

In case the value calculated by the formula exceeds the maximum working voltage given in Section 3.1.2, the maximum working voltage in Section 3.1.2 shall be regarded as the rated voltage.

4. MARKING ON PRODUCT

The nominal resistance shall be marked on the surface of each resistor

Part Number	Color	Marking on Product
CR10 (0402)	-	No marking
CR16 (0603)	Light Brown	1) Tolerance : +/-1.0% (F) ° Four Numerals Marking (E96 Series) ° 0603 Three Characters Marking based on E-96 marking standard. 2) Tolerance; ±5.0% (J) Three Numerals Marking
CR21 (0805)	Light Brown	
CR32 (1206)	Light Brown	
CR40 (1210)	Light Brown	
CR50 (2010)	Light Brown	
CR63 (2512)	Light Brown	

4.1 Numeric Numbering

4.1.1 5% Tolerance : ***Three Numerals Marking***

First 2 digits are significant figures, third digit is number of zeros. Letter R is decimal point.

Example

Nominal Resistance	*Marking*	*Remarks*
10 Ω	100	10 X 10^0 = 1 0
100 Ω	101	10 X 10^1 = 1 00
4.7K Ω	472	47 X 10^2 = 47 00
47K Ω	473	47 X 10^3 = 47 000
470K Ω	474	47 X 10^4 = 47 0000
4.7M Ω	475	47 X 10^5 = 47 00000

4.1.2 1% Tolerance : ***Four Numerals Marking***

First 3 digits are significant figures, fourth digit is number of zeros.

Examples:

Nominal Resistance	***Marking***	***Remarks***
10 Ω	10R0	10 X 10^0 = 10
100 Ω	1000	100 X 10^0 = 100
4.7K Ω	4701	470 X 10^1 = 470 0
47K Ω	4702	470 X 10^2 = 470 00
470K Ω	4703	470 X 10^3 = 470 000
1M Ω	1004	100 X 10^4 = 100 0000

4.1.3 0603 1% Tolerance : ***Three Character E-96 Marking Standard.***

The first 2 digits for the 3 digits E-96 part marking standard (Refer Table 2 & 3). The third character is a letter multiplier :

Nominal resistance	***Marking***	***Remark***
33.2 Ω	51 R	332 X 10^{-1} Ω
150 Ω	18 A	150 X 10^0 Ω
4.99K Ω	68 B	499 X 10^1 Ω
1 0.2K Ω	02 C	102 X 10^2 Ω
100K Ω	01 D	100 X 10^3 Ω

4.1.3.1 EIA-96 Marking Scheme

Table 2 Significant figures

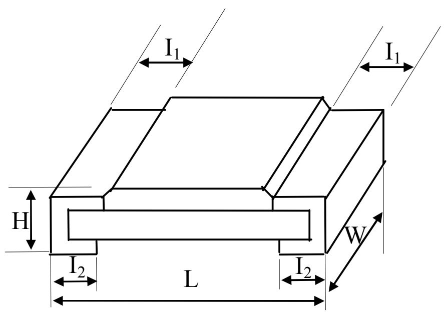
Significant Figures	Symbol	Significant Figures	Symbol	Significant Figures	Symbol	Significant Figures	Symbol
100	01	178	25	316	49	562	73
102	02	182	26	324	50	576	74
105	03	187	27	332	51	590	75
107	04	191	28	340	52	604	76
110	05	196	29	348	53	619	77
113	06	200	30	357	54	634	78
115	07	205	31	365	55	649	79
118	08	210	32	374	56	665	80
121	09	215	33	383	57	681	81
124	10	221	34	392	58	698	82
127	11	226	35	402	59	715	83
130	12	232	36	412	60	732	84
133	13	237	37	422	61	750	85
137	14	243	38	432	62	768	86
140	15	249	39	442	63	787	87
143	16	255	40	453	64	806	88
147	17	261	41	464	65	825	89
150	18	267	42	475	66	845	90
154	19	274	43	487	67	866	91
158	20	280	44	499	68	887	92
162	21	287	45	511	69	909	93
165	22	294	46	523	70	931	94
169	23	301	47	536	71	953	95
174	24	309	48	549	72	976	96

Table 3 Multiplier

Symbol	Multiplier	Symbol	Multiplier
A	10^0	G	10^6
B	10^1	H	10^7
C	10^2	X	10^{-1}
D	10^3	Y	10^{-2}
E	10^4		
F	10^5		

5. DIMENSIONS, CONSTRUCTIONS AND MATERIALS

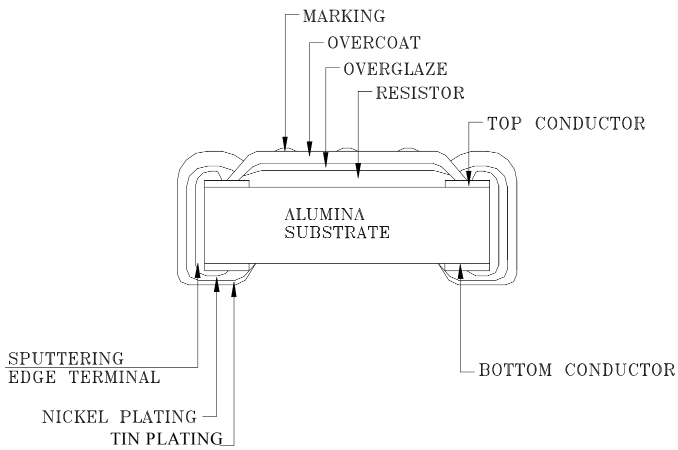
5.1. Dimensions



Unit : Inches (Millimeters)

CODE	L	W	H	1_1	1_2
CR10 (0402)	0.040±0.004 (1.00±0.10)	0.020±0.002 (0.50±0.05)	0.014±0.002 (0.35±0.05)	0.008±0.004 (0.20±0.10)	0.010±0.004 (0.25±0.10)
CR16 (0603)	0.063±0.004 (1.60±0.10)	0.031±0.004 (0.80±0.10)	0.018±0.004 (0.45±0.10)	0.012±0.004 (0.30±0.10)	0.012±0.004 (0.30±0.10)
CR21 (0805)	0.079±0.006 (2.00±0.15)	0.049±0.004 (1.25±0.10)	0.020±0.004 (0.50±0.10)	0.016±0.008 (0.40±0.20)	0.016±0.008 (0.40±0.20)
CR32 (1206)	0.122±0.004 (3.10±0.10)	0.063±0.006 (1.60±0.15)	0.022±0.002 (0.55±0.05)	0.020±0.010 (0.50±0.25)	0.020±0.010 (0.50±0.25)
CR40 (1210)	0.122±0.004 (3.10±0.10)	0.098±0.006 (2.50±0.15)	0.022±0.002 (0.55±0.05)	0.020±0.010 (0.50±0.25)	0.016±0.008 (0.40±0.20)
CR50 (2010)	0.200±0.006 (5.00±0.15)	0.098±0.006 (2.50±0.15)	0.022±0.002 (0.55±0.05)	0.024±0.010 (0.60±0.25)	0.016±0.008 (0.40±0.20)
CR63 (2512)	0.250±0.006 (6.30±0.15)	0.126±0.006 (3.20±0.15)	0.022±0.002 (0.55±0.05)	0.024±0.010 (0.60±0.25)	0.016±0.008 (0.40±0.20)

5.2 Resistor Construction

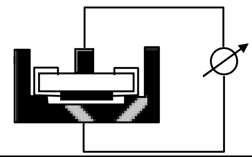
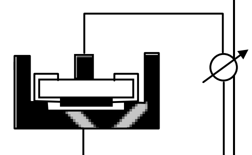


5.3 Materials

Construction		*Material Used*	*Thickness*
Substrate	Ceramic Substrate	Alumina substrate, 96% purity	-
Resistive body	Resistor	Ruthenium oxide	-
Protective Film	Overglaze	Borosilicate-glass	-
	Overcoat	Epoxy Polymer	-
Internal Electrode	Top/ Bottom Conductor	Silver palladium	30± 2µm (Wet)
Secondary Electrode	Nickel Plating	Nickel	2.5 ~ 12 µm
Tertiary Electrode	Tin Plating	Pure Tin, Sn	5.0µm ~ 20 µm
Edge Terminal	Sputtering 0201,0402,0603,0805, 1206,1210,2010,2512	Nickel Chromium	0.08 ~ 0.2 µm

6. ELECTRICAL CHARACTERISTICS AND TEST CONDITIONS

CHARACTERISTICS		TESTING CONDITIONS		
		Resistance		
1	Resistance Value	Resistance accuracy being fully relies with respect to tolerance of resistor.	***JIS C 5202 5.1*** Application time to be within 5 secs . Applied Voltage for resistance measurement :	
			<10Ω 10~99Ω 100~999 1K~ 9.9K 10K~ 99.9K 100K~999K 1M	0.1V 0.3V 1.0V 3.0 V 10.0 V 30.0 V 50.0 V
2	Resistance Temperature Coefficient	Refer Section 3.5 Table 1	***JIS C 5202 5.2*** Measure R at $t_o=25^0C$ and after 45 minutes measure R at $t=125^0C$. *Calculation :* $TCR(ppm/^0C)=\frac{R-R_0}{R_0}*\frac{1}{t-t_0}*10^6$	
3	Voltage Coefficient (Applicable for >1KΩ only)	Voltage coefficient ≤ 100ppm/V	***JIS C 5202 5.3 Method II*** Apply DC Voltage,E_2=1/10 rated voltage and E_1=100% rated voltage to Rx. Measure voltage V_1 & V_2 across Rs. Voltage applied shall be 3secs or less during 5secs of E_1 and not more than 10secs during E_2 *Calculation :* $V_c(\%/V)=\frac{(V_2*10)-V_1}{V_1}*\frac{1}{E_1-E_2}*100$	
4	Short Time Overload	±0.5% for 1% tolerance resistor ±1.0% for 5% tolerance resistor	***JIS C 5202 5.5*** Apply at 2.5 times rated voltage for 5 seconds. Applied voltage shall not exceed maximum overload voltage or current.	

5	Insulation Resistance	> 10G Ω		***JIS C 5202 5.6*** Apply 500V ± 15VDC for 1 minute for chip ≥ 0805. Apply 300V ± 15VDC for 1 minute for chip 0402 & 0603 
6	Dielectric Withstanding Voltage	No failure of resistor such as short-circuit, burning, breakdown. ±(1%+0.05Ω) for 1% & 5% tolerance resistor		***JIS C 5202 5.7*** Apply 500VAC for 1 minute ± 10secs. for chip ≥ 0805. Apply 300VAC for 1 minute ± 10secs. for chip 0402 & 0603  The variation in relation to the initial resistance shall be within ± 1%.
7	Intermittent Overload	±(5%+0.1Ω) for 1% & 5% tolerance resistor		***JIS C 5202 5.8*** Apply 4 times rated voltage for 1 secs ON and 25 secs OFF. Total 10 000 $^{+400}_{-0}$ cycles Applied voltage/current shall not exceed maximum intermittent overload voltage/ current.
8	Noise	1~9 10~99 100~999 1K~9.9K 10K~99.9K 100K~999.9K >1M	-10dB(0.32μv/v) - 5 dB(0.52μv/v) 0 dB(1.0μv/v) 10 dB(3.2μv/v) 18 dB(5.6μv/v) 20 dB(10μv/v) 30 dB(32μv/v)	***JIS C 5202 5.9*** V_n(dB) = T-*f*(T-S)-D

9	Terminal Strength	Tolerance resistor. With no evidence of mechanical damage after releasing the pressure.	***JIS C 5202 6.1***
	A) Bend Test (Applicable for chip size smaller than CR40)	±(0.5%+0.05Ω) for 1% & 5%	***JIS C 5202 6.1.4(1) Method 2*** Bend Test : Apply force till 3mm bend and hold for 5±1 secs. Measure resistance while applying pressure.
	B) Pull Test (Applicable for chip size bigger than CR21)	±(1.0%+0.05Ω) for 1% & 5%	Pull Test : Apply 0.5kgF for 30±5 secs
	C) Push Test	±(1.0%+0.05Ω) for 1% & 5%	***JIS C 5202 6.1.4(3) Method B*** Push Test : Apply 1.2kgF for 60±5secs
	D) Robushness test	After reading/initial reading >50-%	Component mounted on board precondition using steam aging for 4 hour. Initial reading = Force required to break away components mounted on board. After Reading = Force required to break away components mounted on board after preconditioned.
10	Resistance to soldering heat	±(0.5%+0.05Ω) for 1% & 5% tolerance resistor	***JIS C 5202 6.10*** A) Solder bath method Resistor dipped entirely in solder bath of 260±5°C for 10^{+1}_{0} sec. B) Flow soldering Preheat : 100°C to 105°C for 30±5 sec. Resistor dipped entirely in solder bath of 265±3°C for 5^{+1}_{0} C) Reflow soldering method Peak : 250^{+5}_{0} °C 230±5°C for 30 - 40secs. D) Soldering Iron method Bit temp.: 350±10°C Application time of soldering iron is 3^{+1}_{0} sec. After which the sample shall be left at ambient temperature for 1~ 2 hrs before measurement.

11	Solderability	≥ 95% Coverage	Precondition by baking 4 hours at 155°C. ***IEC 60068-2-58*** Solder bath method : Solder : Sn-3-Ag-0.5C Flux : 25% Colophony, 75% 2-Propanol by weight. 215±3°C for 2^{+1}_{-0} sec
12	Resistance to Solvent	±(1%+0.05Ω) for 1% & 5% tolerance resistor Marking shall be legible without mechanical damage in appearance.	***JIS C 5202 6.9*** Immerse in 20°C~25°C Isoproyl Alcohol solvent for 60±10secs.
13	Low Temperature	±(0.5%+0.05Ω) for 1% tolerance resistor ±(1%+0.05Ω) for 5% tolerance resistor	***JIS C 5202 7.1*** -55±3°C for 1000 $\pm^{48}_{0}$ hours Sample shall be left at ambient temperature for 1~ 2 hrs after test before measuring final resistance.
14	Low Temperature with Load	±(0.5%+0.05Ω) for 1% tolerance resistor ±(1%+0.05Ω) for 5% tolerance resistor	***JIS C 5202 7.1*** -55±3°C for 90 minutes, 0.1 rated continuous working voltage as per 3.5 shall be applied for 45 $\pm^{5}_{0}$ minutes. Voltage Sample shall be left at ambient temperature for ~ 8 hrs after the removal of the voltage for 15 $\pm^{5}_{0}$ before measuring final resistance.
15	High Temperature	±(1%+0.05Ω) for 1% tolerance resistor ±(2%+0.10Ω) for 5% tolerance resistor	***JIS C 5202 7.2*** 155±5°C for 1000 $\pm^{48}_{0}$ hours Sample shall be left at ambient temperature for 1~ 2 hrs after test before measuring final resistance.

<table>
<tr><td>16</td><td>Temperature Cycling</td><td>±(0.5%+0.05Ω) for 1% tolerance resistor ±(1%+0.05Ω) for 5% tolerance resistor</td><td>JIS C5202 7.4
<table><tr><td>Step</td><td>Temp. (°C)</td><td>Time (minute)</td></tr><tr><td>1</td><td>-55 ± 5</td><td>30 mins</td></tr><tr><td>2</td><td>25 ± 5</td><td>5 mins max</td></tr><tr><td>3</td><td>155 ± 5</td><td>30 mins</td></tr><tr><td>4</td><td>25 ± 5</td><td>5 mins max</td></tr></table>Repeat step 1 to 4 for 5 cycles</td></tr>
<tr><td>17</td><td>Resistance to damp Heat (Humidity)</td><td>±(1%+0.1Ω) for 1% & 5% tolerance resistor</td><td>JIS C 5202 7.5
40±2°C and 90~95%RH for $1000\pm_{0}^{48}$hours
Sample shall be left at ambient temperature for 1~ 2 hrs after test before measuring final resistance.</td></tr>
<tr><td>18</td><td>Loadlife</td><td>±(1.0%+0.05Ω) for 1% tolerance resistor ±(2.0%+0.1Ω) for 5% tolerance resistor</td><td>JIS C5202 7.10
At 70±3°C Apply DC rated voltage at 90minutes On, 30minutes Off for $1000\pm_{0}^{48}$hours
Sample shall be left at ambient temperature for 1~ 2 hrs after test before measuring final resistance.</td></tr>
<tr><td>19</td><td>Salt Spray</td><td>±(3%+0.1Ω) for 1% & 5% tolerance resistor</td><td>JIS C5202 7.7
Spray 5±1 Wt% salt water for 96±4 hours at 35±2°C</td></tr>
<tr><td>20</td><td>Mounting Quality Test</td><td>Visual check for solder joint wetting condition, resistor body damages</td><td>Solder Paste : Sn-3Ag-0.5Cu
Reflow soldering method
Peak : 250_{0}^{+5} °C
230±5°C for 60sec</td></tr>
</table>

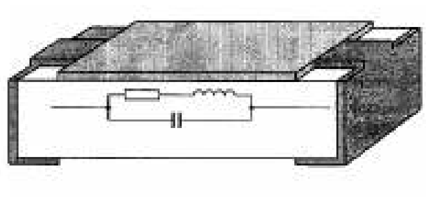
6.1 Frequency Response (To be tested upon customer's request)

Resistors are designed to function according to ohmic laws. This applied for rectangular chip resistors for frequencies up to 100K Hz.

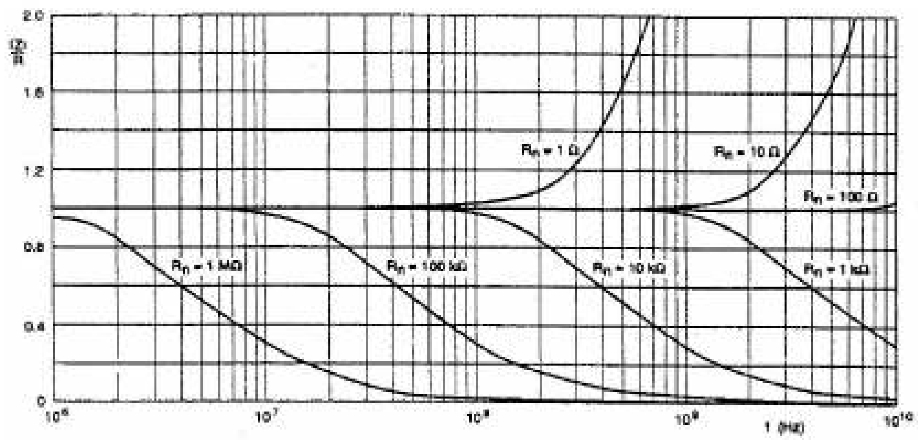
Chip resistors are represented by an ideal resistor switched in series with a coil and both switched parallels to a capacitor. The dimensions of the terminations and the conductive path length mainly determine the values of the capacitance and inductance. The trimming patterns has a negligible influence on the inductance as the path length is not influenced. Its influence on the capacitance is negligible as the total capacitance is largely determined by the terminations.The environment surrounding chips has a large influence on the behavior of the chip on the printed-circuit board.

Typical values of Capacitance and Inductance

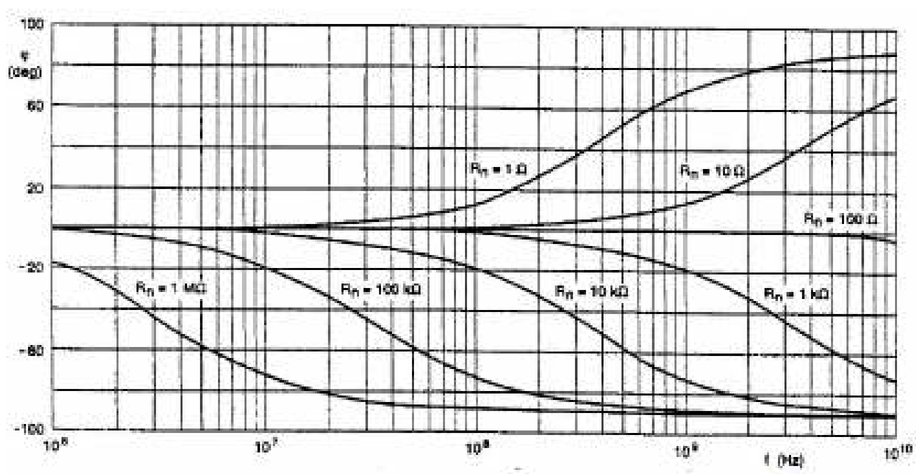
	1206	0805	0603
Capacitance	0.05 pF	0.09 pF	0.05 pH
Inductance	2 nH	1 nH	0.4 nH



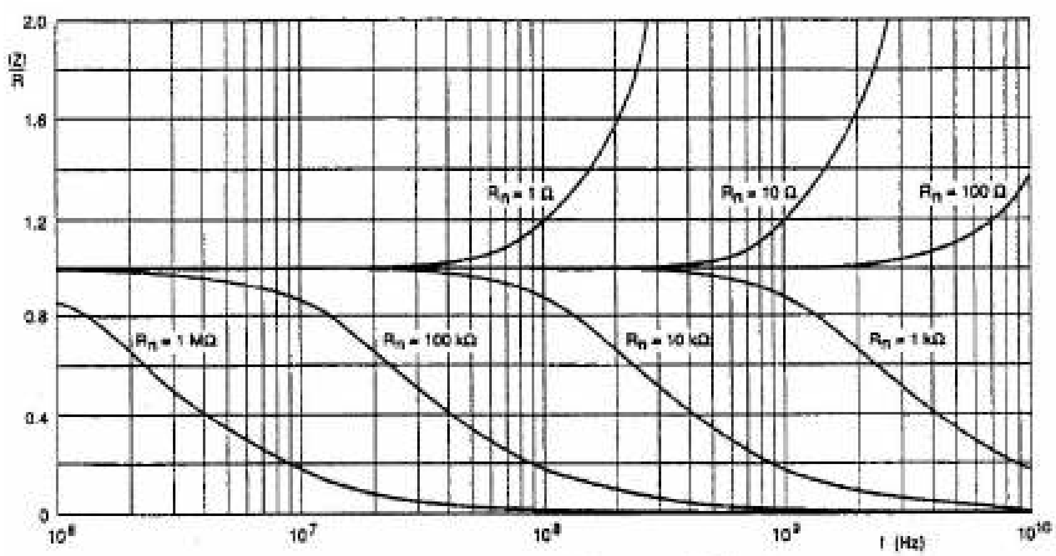
Equivalent circuit.



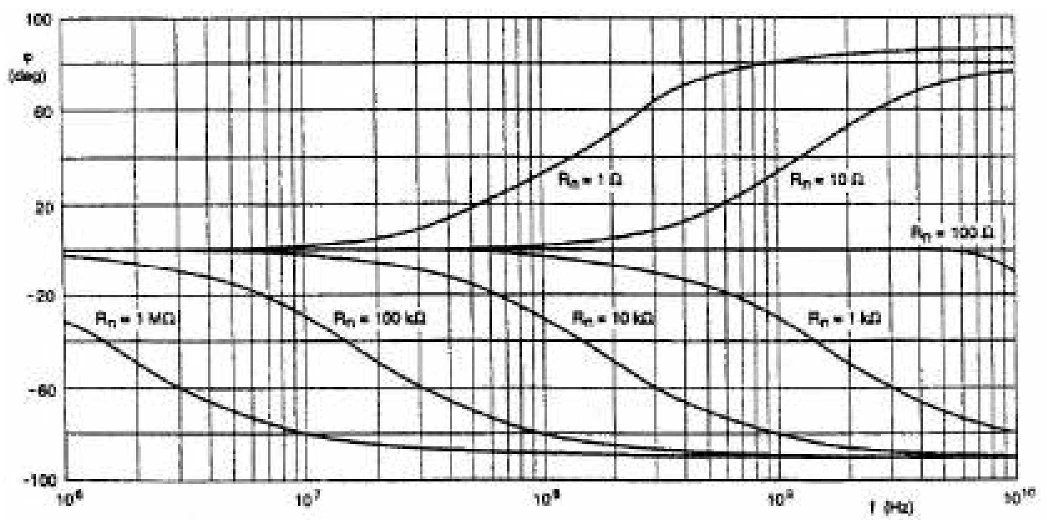
Size 0603 : Impedance as a function of frequency for a chip resistor



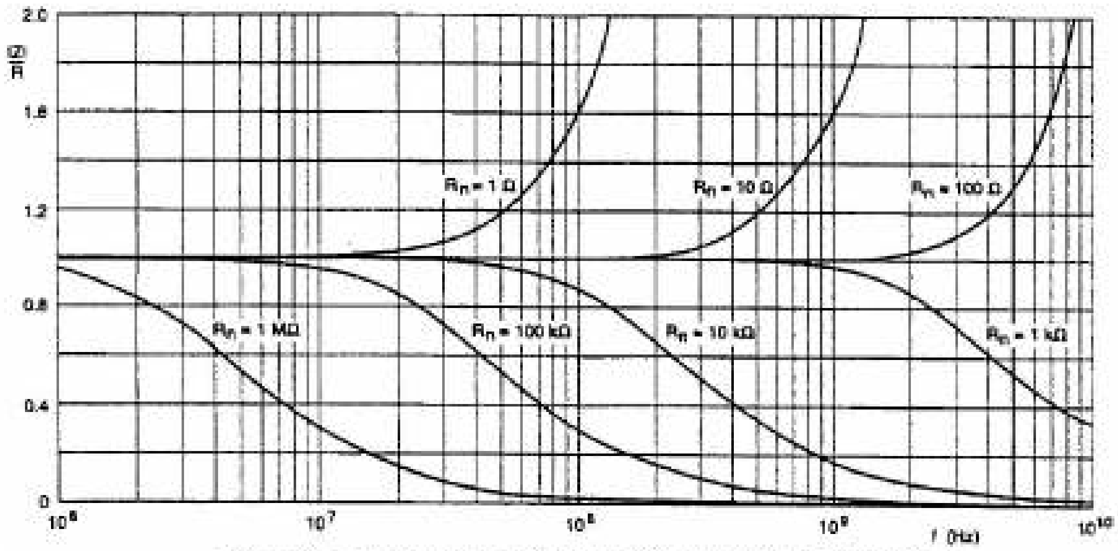
Size 0603: Phase shift as a function of frequency for a chip resistor



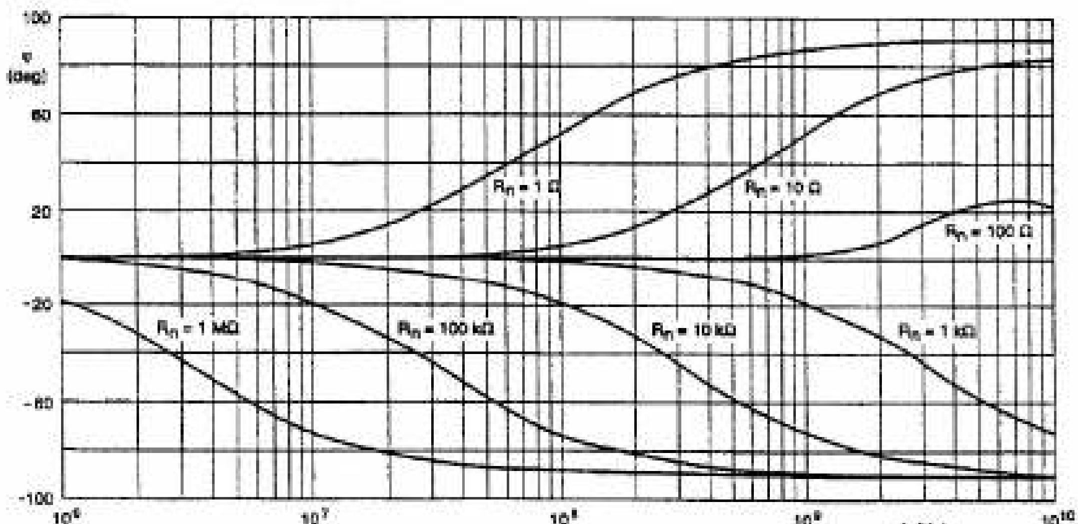
Size 0805 : Impedance as a function of frequency for a chip resistor



Size 0805: Phase shift as a function of frequency for a chip resistor



Size 1206 : Impedance as a function of frequency for a chip resistor



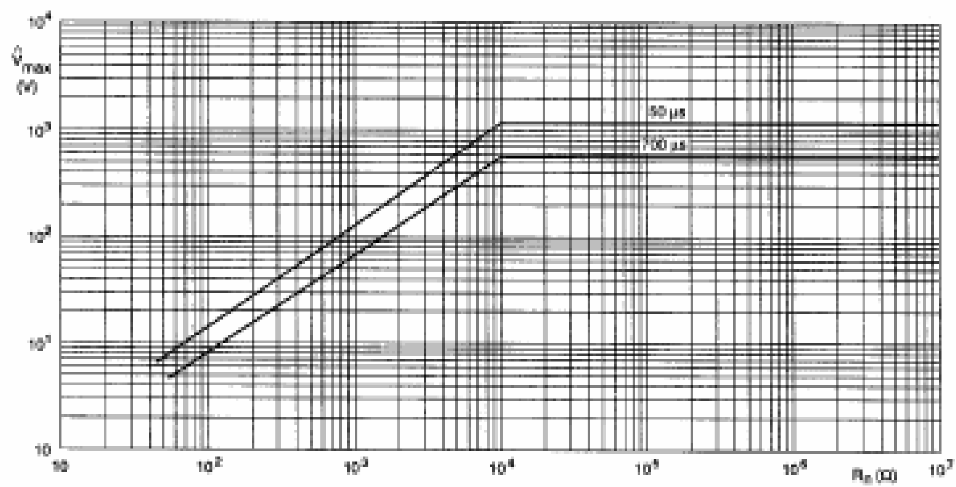
Size 1206: Phase shift as a function of frequency for a chip resistor

Pulse load Behavior (To be tested upon customer's request)

The load that cause chip resistor to open circuit is determined by the shape and time of a single pulse.

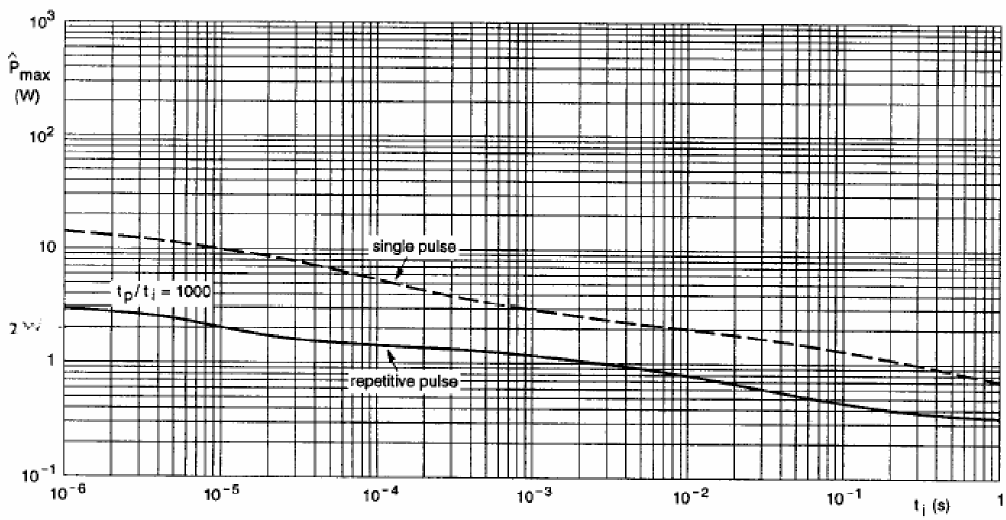
Parameter	Value
Exponential time constant (us)	50 to 700
Repetition time (s)	12 to 25
Amount of pulses	5 to 10

.
With this test, it can be determined at which applied voltage the resistive value changes about 0.5% of its nominal value under the above mentioned pulse conditions.



Maximum permissible peak pulse voltage ($\hat{V}_{max}$) without failing to 'open circuit'

Figure A

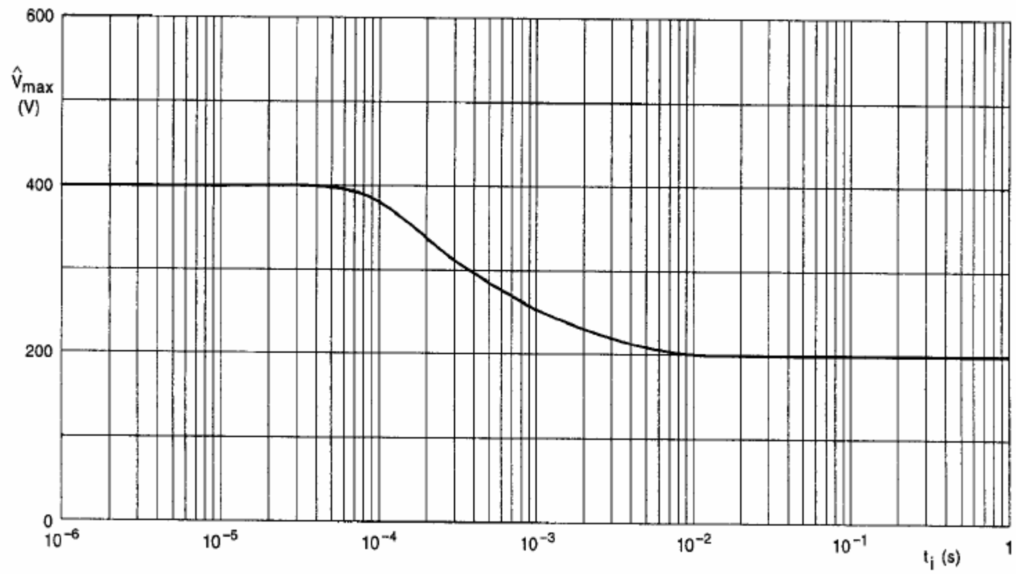


Pulse on a regular basis; maximum permissible peak pulse power ($\hat{P}_{max}$) as a function of pulse duration for R ≤ 10 kΩ, single pulse and repetitive pulse t_p/t_i = 1000.

Figure B

<u>Single pulse</u>
The resistor is considered to be operating under single pulse conditions if, it is loaded with a limited number (approx. 1500) of pulses over long time intervals (> 1 hours).

<u>Repetitive Pulse</u>
The resistor is operating under repetitive pulse conditions if, it is loaded by a continuous train of pulses of similar power.
The resistor must withstand a continuous train of pulses of repetition time t_p during which only a small resistance change is acceptable. The resistance change is equal to change permissible under continuous load conditions. The continuous pulse train and small permissible resistance change reduces the maximum handling capability.
Measurements of experiment have shown that the handling capability of chip resistor varies with the resistive value applied. Maximum peak pulse voltages as indicated below should not be exceeded.



Pulse on a regular basis; maximum permissible peak pulse voltage ($\hat{V}_{max}$) as a function of pulse duration (t_i).

Figure C

<u>Determination of Pulse load</u>

Fig B & C may be used to determine the maximum pulse load for a resistor.

Repetitive rectangular pulses	$(V_i^2/R) < P_{max}$ given by the solid lines of Fig. B for the applicable value of t_i and duty cycle t_p/t_I $V_i < V_{max}$ given in Fig C for the applicable value of t_i
Repetitive exponential pulses	As for rectangular pulses, except that t_i=0.5_T
Single rectangular pulses	$(V_i^2/R) < P_{max}$ given by dashed lines of Fig B for the applicable value of t_i $V_i < V_{max}$ given in Fig C for the applicable value of t_i

Pulses may not be applied on a regular basis

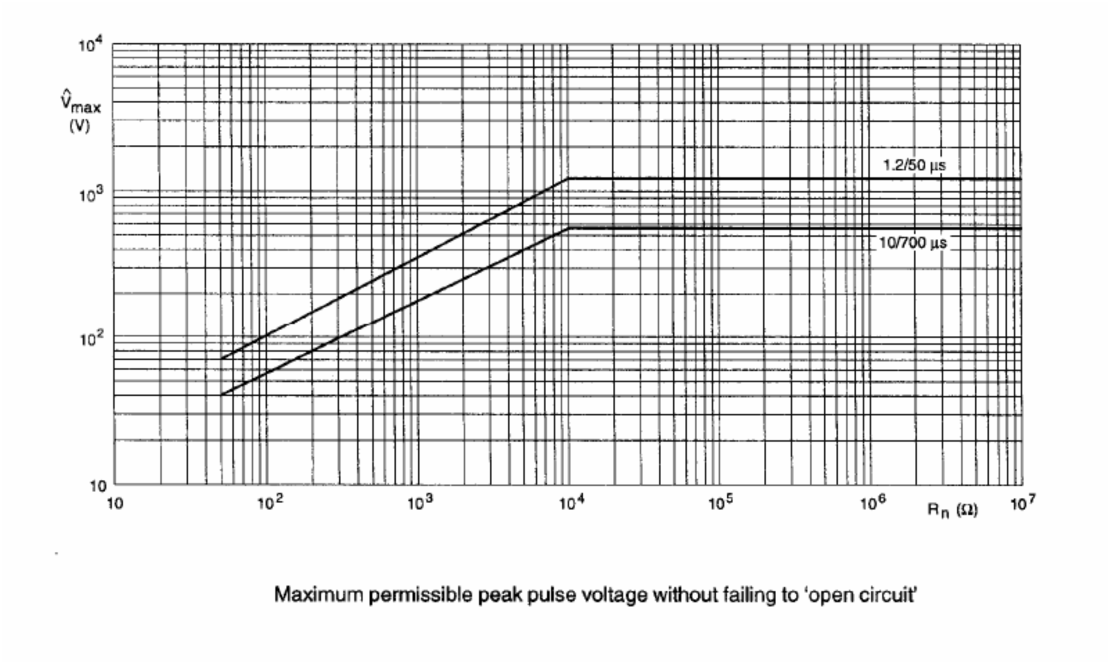


Figure D: 1206

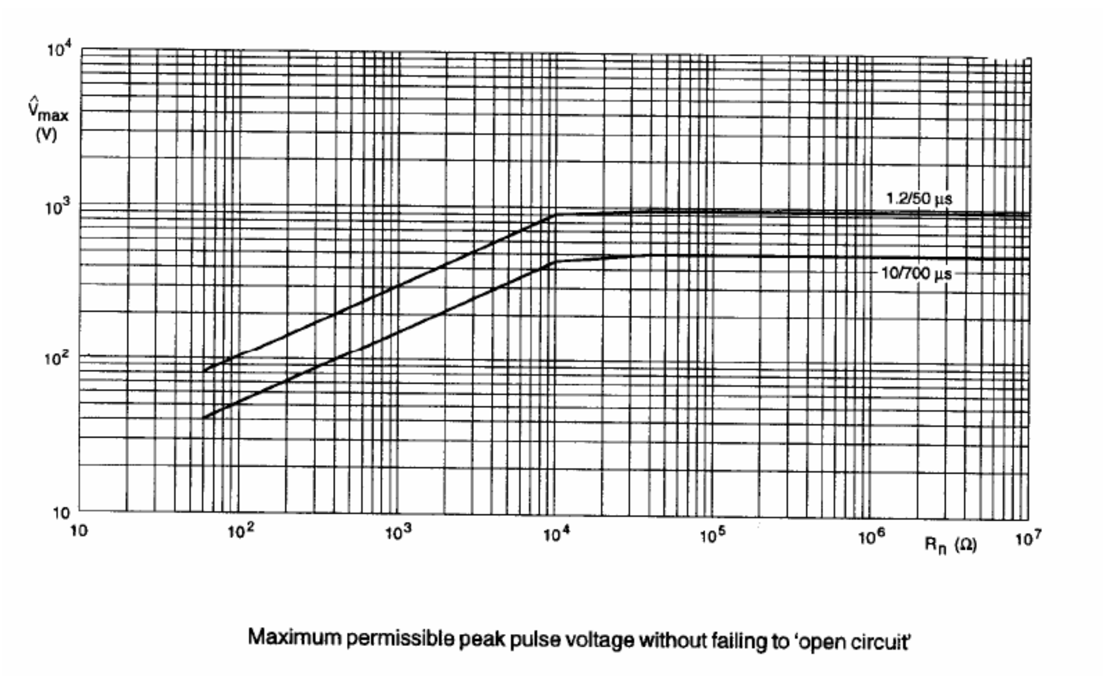
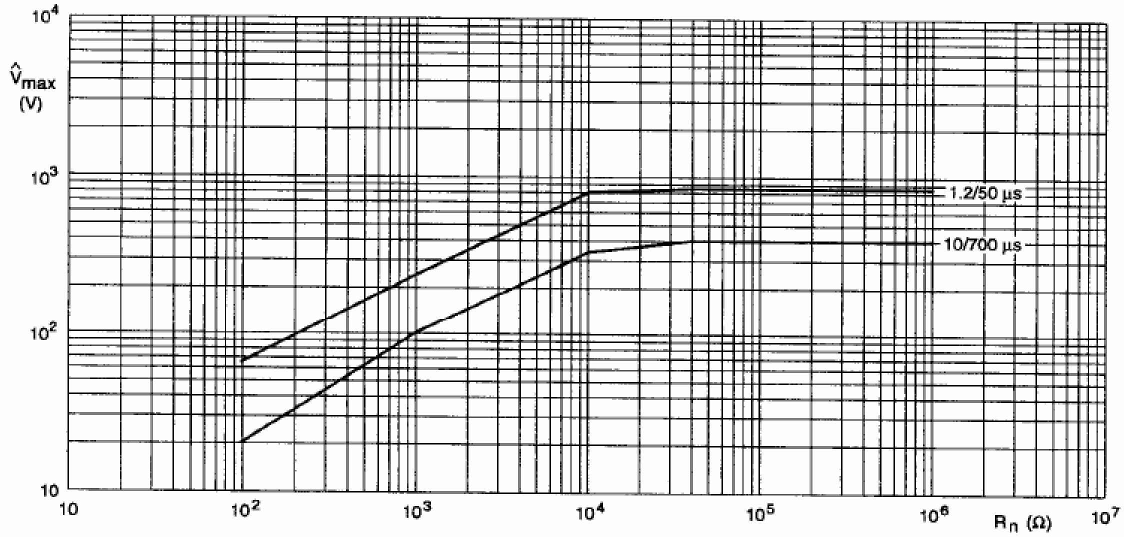


Figure E: 0805



Maximum permissible peak pulse voltage without failing to 'open circuit'

Figure F: 0603

Pulses applied on a regular basis

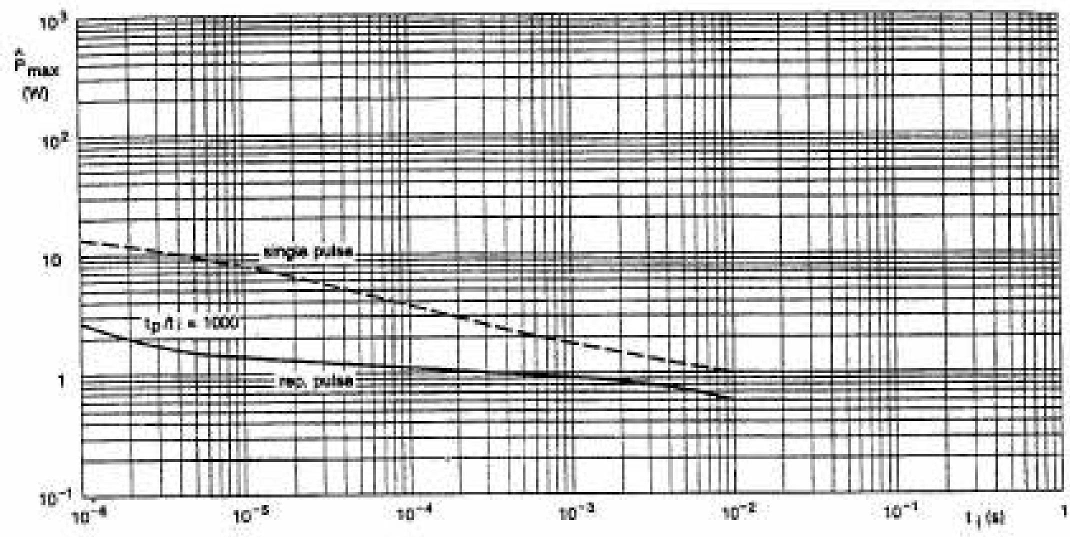


Figure G, 1206 : Maximum permissible peak pulse power (P max) as a function of pulse duration for $R \leq 10k\Omega$, single pulse and repetitive pulse t_p/t_i = 1000

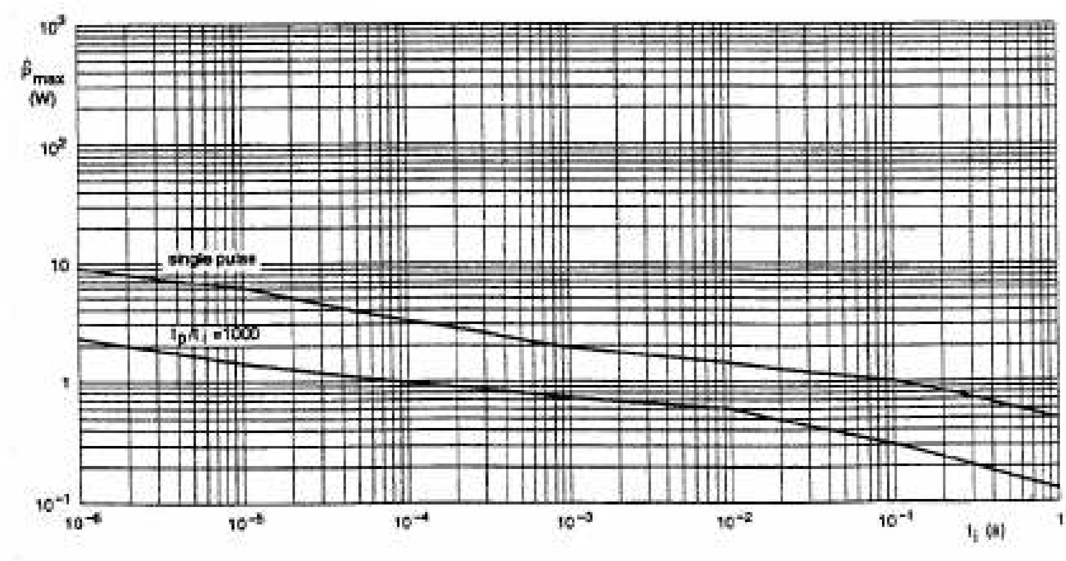


Figure H, 0805 : Maximum permissible peak pulse power (P max) as a function of pulse duration for $R \leq 10k\Omega$, single pulse and repetitive pulse t_p/t_i = 1000.

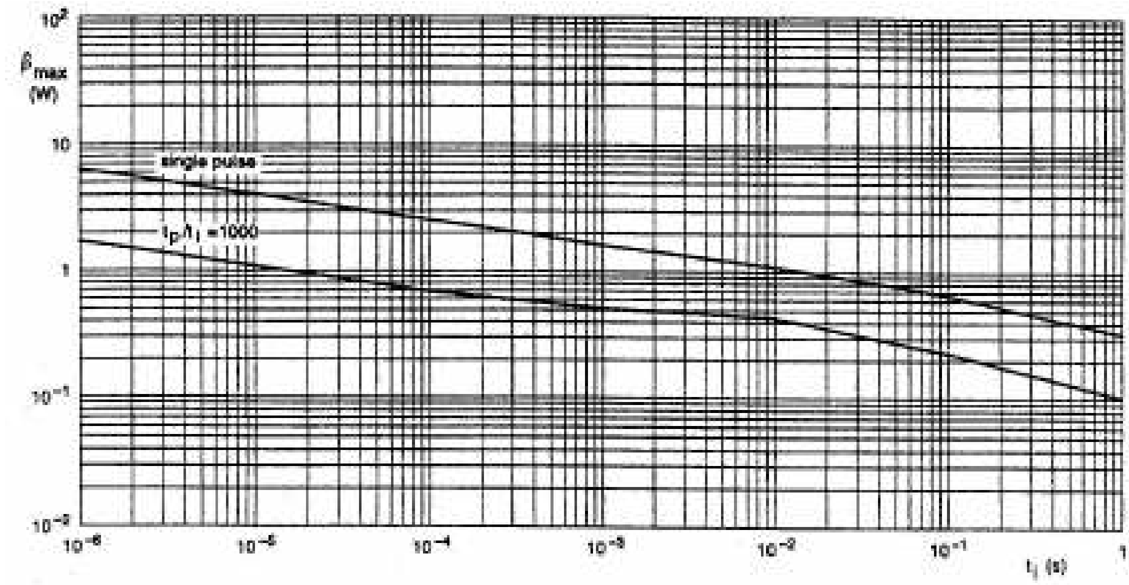


Figure 1, 0603 : Maximum permissible peak pulse power (P max) as a function of pulse duration for R≤10kΩ, single pulse and repetitive pulse t_p/t_i = 1000.

Pulses applied on a regular basis

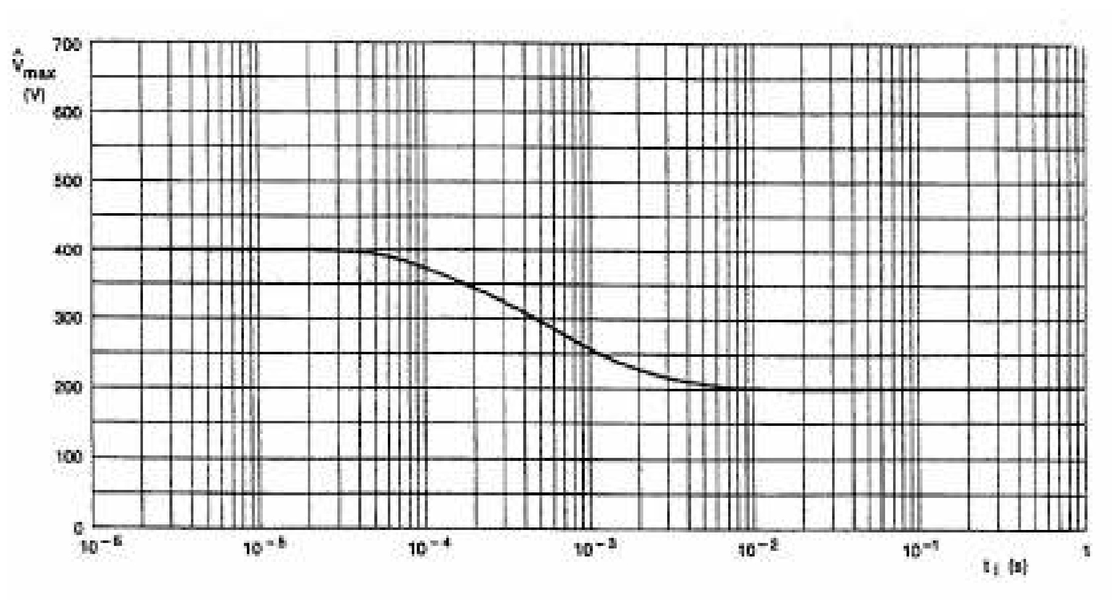


Figure J, 1206 : Maximum permissible peak pulse voltage (V max) as a function of pulse duration

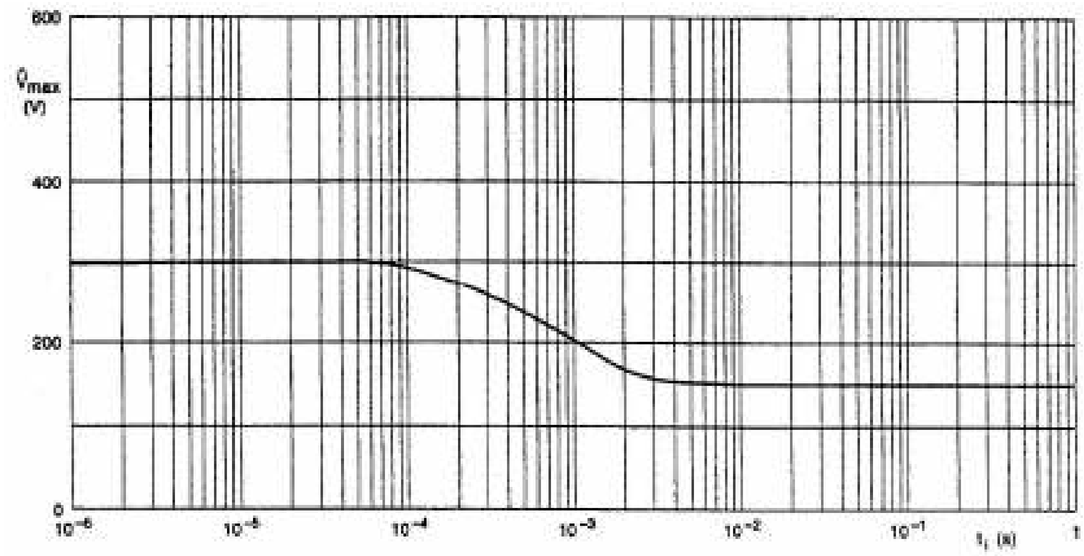


Figure K. 0805 : Maximum permissible peak pulse voltage (V max) as a function of pulse duration

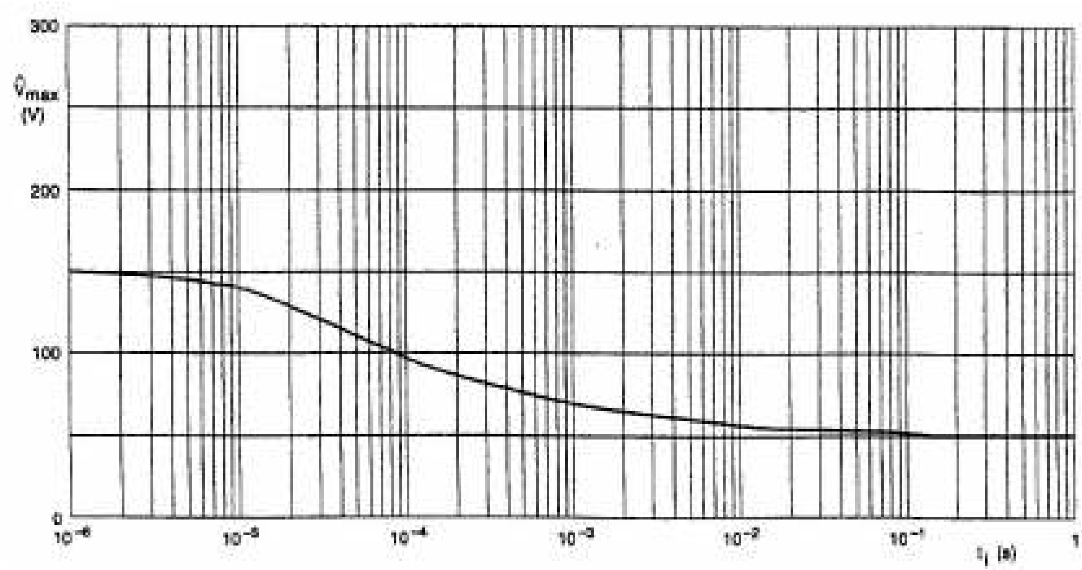
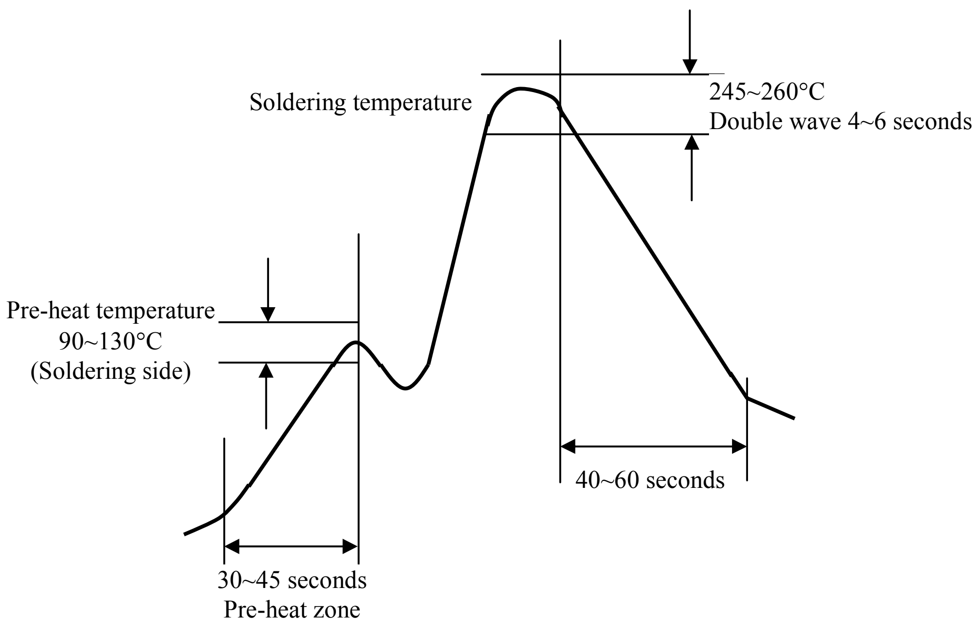


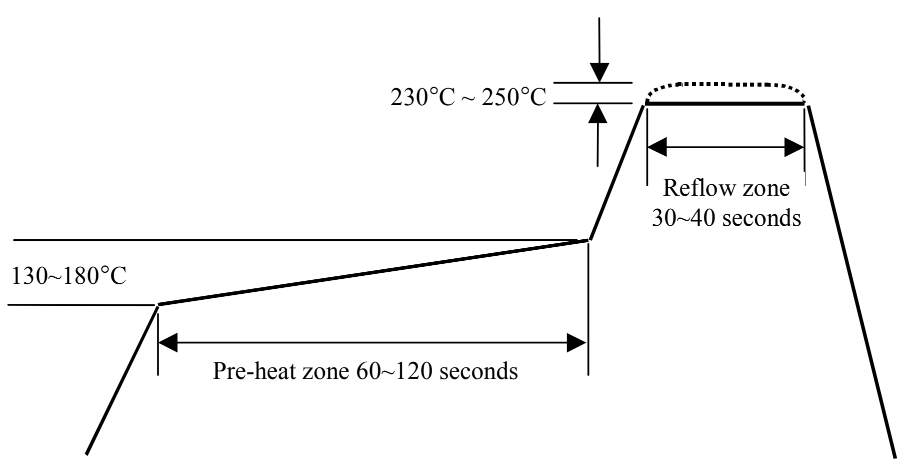
Figure L. 0603 : Maximum permissible peak pulse voltage (V max) as a function of pulse duration.

6.2 Soldering Profile

6.2.1 Flow Soldering

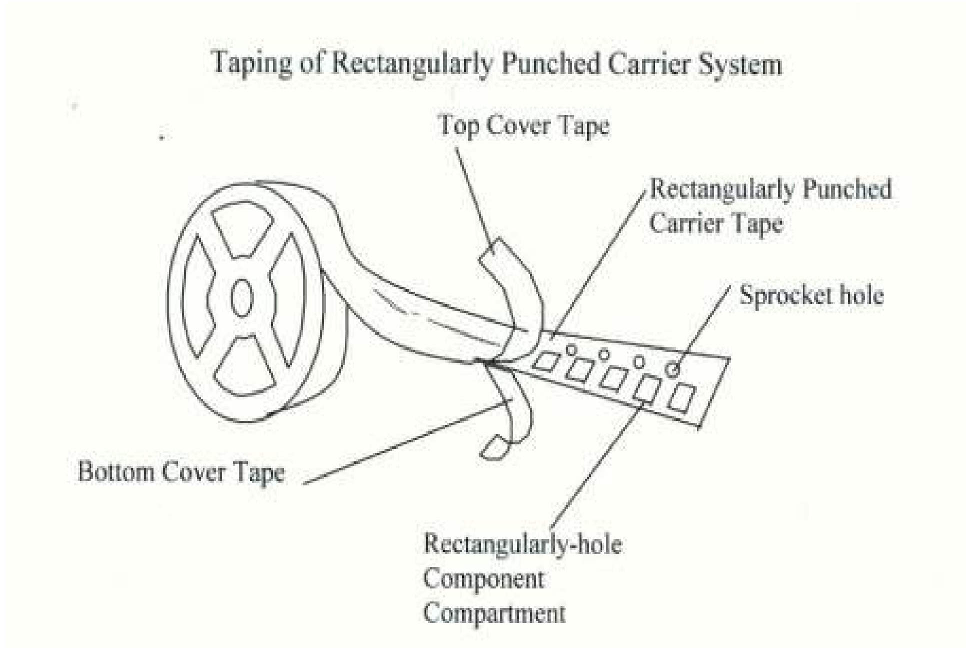


6.2.2 Reflow Soldering



7. TAPING

7.1 Structure of Taping



7.2 Materials

(1) Every taping shall consist of materials as shown in Table – 4
(2) Every taping shall not adversely affect the mechanical, electrical and solderability performances.
(3) Materials of taping shall generate no static.
(4) The taped products are stored at a temperature -5 to +40°C and a relative humidity 40 to 50% without exposing to direct sunlight and, after such conditioning, the tape shall show no deterioration in performances such as change in adhesion force or peel forces.

Tables 4 Materials of Taping

	Carrier Tape	Top Cover Tape	Bottom Cover Tape
Taping of Rectangularly Punched Carrier System	Paper	thermal adhesion polyester	thermal adhesion paper

7.3 Leader and Trailer Tape

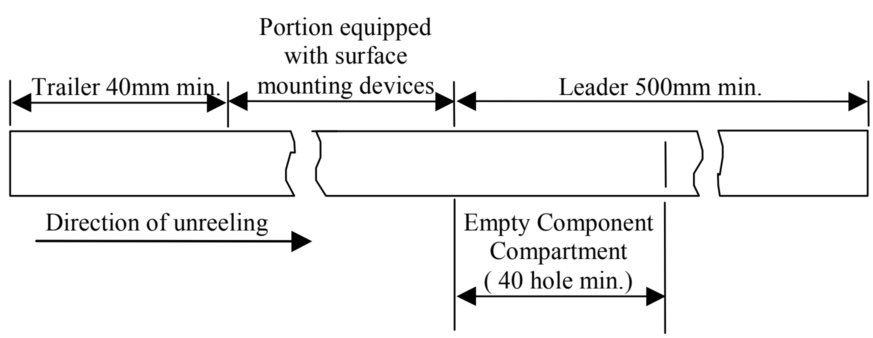
1) Leader Tape The length of leader tape shall be at least 500 mm including 40 or more or rectangular holes (component compartments) in which no component is placed.

The said 40 or more empty component compartments shall be sealed with the top cover tape (see Fig. 2).

2) Trailer Tape The trailer tape at the hub of reel shall be least 40 mm in length including carrier tape with empty component compartments. The empty component compartments shall be sealed with the top cover tape.

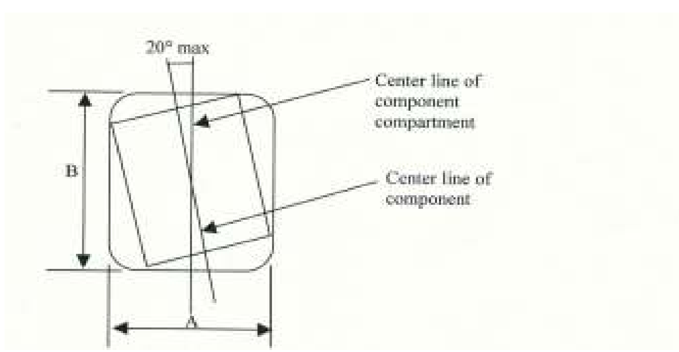
The last portion of the carrier tape shall release from the reel hub.

Fig. 2 Explanation of Leader and Trailer Tape

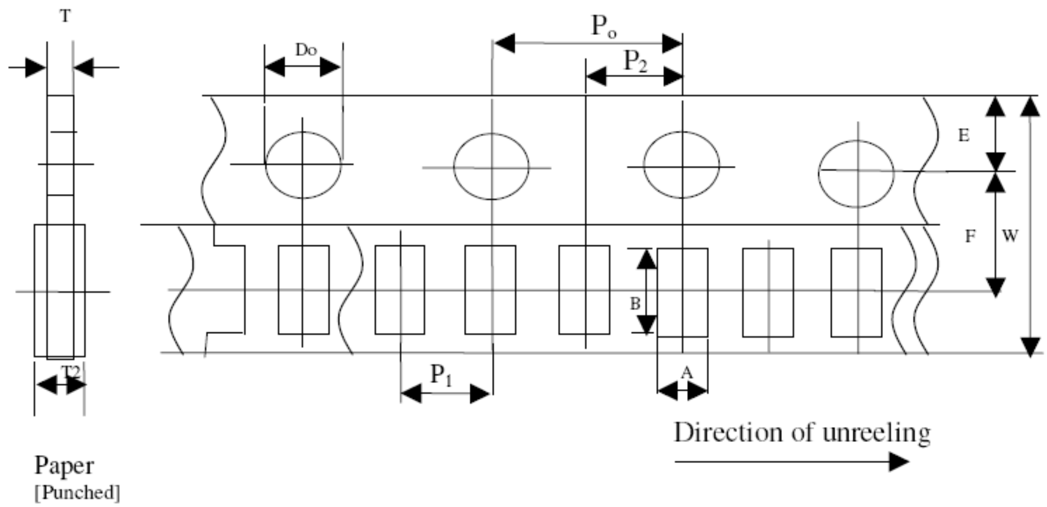


7.4 Position of Taped component The angle made by the center line of taped component and the center line of component compartment shall not exceed 20 degrees (see Fig. 3).

Fig. 3 Angle between Center Line of Component and Center Line of Component compartment



7.5 Dimension



Remark : Pitch tolerance over any 10 pitches of Po is ± 0.2 mm

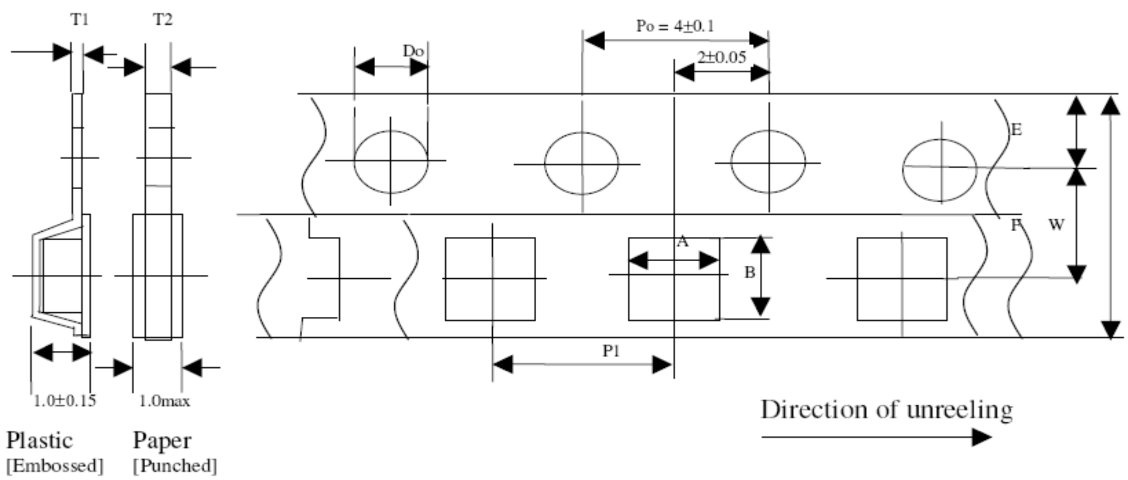
Dimension of Punched Paper Tape Carrier System (CR- 10)

(unit : mm)

Code	A	B	W	E	F	P_1
CR10	0.65 ± 0.1	1.15 ± 0.1	8.0 ± 0.2	1.75 ± 0.1	3.5 ± 0.05	2.0 ± 0.5

Code	P_2	P_0	D_0	T_2	T	
CR10	2.0 ± 0.05	4.0 ± 0.1	1.5	0.35±0.1	--	

7.5.2 Dimension of Punched Paper Tape Carrier System (CR16, 21, 32, 40, 50, 63)



Remark : Pitch tolerance over any 10 pitches of Po is ± 0.2 mm

Dimension of Punched Paper Tape Carrier System (CR - 16, 21, 32, 40)

Code	A	B	W	E	F	P1	Do	T2
CR16	1.1 ± 0.1	1.9 ± 0.1	8.0 ± 0.2	1.75 ± 0.1	3.5 ± 0.05	4.0 ± 0.1	$1.5 \pm_{0}^{0.1}$	0.60 ± 0.1
CR21	1.65 ± 0.1	2.4 ± 0.1						0.75 ± 0.1
CR32	1.9 ± 0.1	3.5 ± 0.1						0.75 ± 0.1
CR40	2.8 ± 0.1	3.5 ± 0.1						0.75 ± 0.1

Dimension of Plastic Embossed Carrier System (CR -50, 63)

Code	A	B	W	E	F	P1	Do	T1
CR50	2.9 ± 0.2	5.4 ± 0.2	12 ± 0.2	1.75 ± 0.1	5.5 ± 0.05	4.0 ± 0.1	$1.5 \pm_{0}^{0.1}$	0.2± 0.10
CR63	3.6 ± 0.2	6.6 ± 0.1						

7.6 Performance of Taping

7.6.1 Strength of carrier tape and top cover tape
When a tensile force of 10N (1.02 kgf) is applied in the direction of unreeling the tape, the carrier tape and top cover tape shall withstand this force.

7.6.2 Peel force of top cover tape
a) Ensure that the peel force meter is reset to ϕ initially.
b) A minimum of 4 holes is required when the top cover tape is pulled.
c) Do not reset the peel force meter.
d) The peel force of top cover tape shall be 0.1N to 0.7N (10 to 70 gf) when the top cover tape is pulled at a speed of 300 mm/min with the angle between the tape during peel and the direction of unreeling maintained at 165 to 180 degree as illustrated in Fig 4.

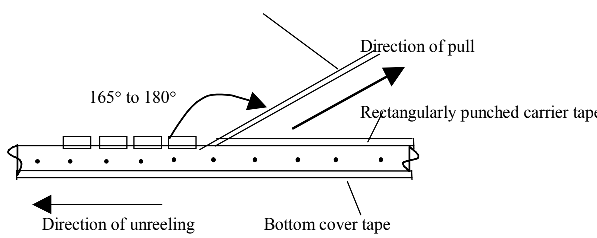


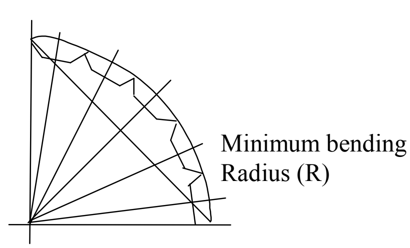
Fig. 4 Peeling Test

7.6.3 Minimum Bending Radius
When the tape is bent with the minimum bending radius specified in Fig 5 and Table 5, components shall maintain their position and shall be free from abnormalities such as damage.

Table

Width of Tape	Minimum Bending Radius
8 mm	30 mm
12 mm	30 mm

Fig. 5 Explanation of Minimum Bending Radius



7.6.4 Numbering of missing components and mistake in taping

a) The number of missing components shall not exceed 0.1% of the total number of components (marked number) or one whichever is the larger, and no consecutive missing chip exceeding two is allowed.

b) No mistake is allowed on the position of polarity or termination or front and rear of component at the time of taping.

7.7 Packaging

7.7.1 Taping

7.7.1.1 Quantity – Tape and Reels

Code	Quantity	Remarks
CR10	10000 pcs	
CR16	5000 pcs	10 000 or 20 000 pcs on request
CR21		
CR32		
CR40	5000 pcs	-
CR50	4000 pcs	-
CR63	4000 pcs	-

7.7.1.2 Quantity - Bulk Cassette

Code	Quantity	Remarks
CR10	50 000pcs	100 000 pcs on request
CR16	25 000pcs	-
CR21	10 000pcs	-
CR32	5 000pcs	-

7.7.2 Identification

Production label that indicates the 8 digits lot number, datecode,product type, resistance value and tolerance shall be pasted on the surface of each reel.

Lot Number : 8 digit running numbers

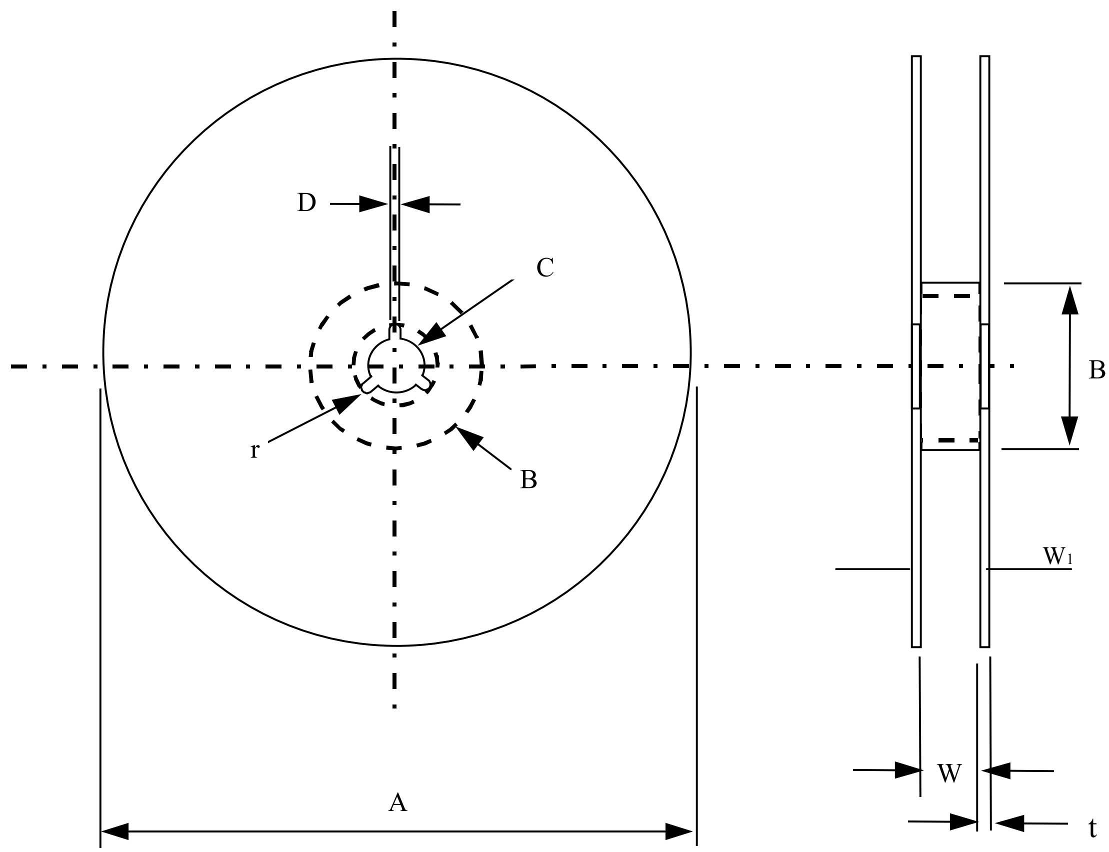
Date Code : YYYYMMDD

YYYY - Year
MM - Month
DD - Day

7.7.3 Packaging Reel Box

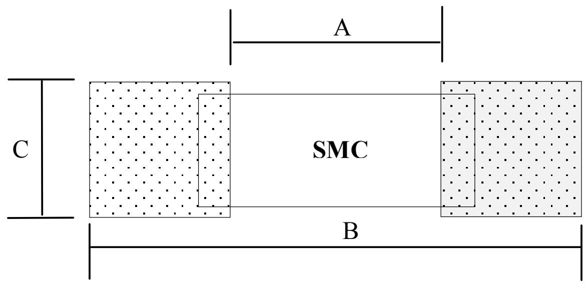
Dimension	Reel Box	Number of Reels
185 × 60 × 186 mm	25K Box	5
185 × 120 × 186 mm	50K Box	10

7.7.4 Reel Dimensions



Model	A	B	C	D	W	W_1	t	r
7"Reel (5K)	ϕ178±2.0	ϕ80min	13± 0.2	ϕ2.0± 0.5	11± 0.1	14.4 max	1.0± 0.1	1.0
7"Reel (4K)	ϕ178±2.0	ϕ60min	13± 0.2	ϕ2.0± 0.5	13±1.0	14.4 max	1.2± 0.1	1.0
10"Reel (10K)	ϕ254±2.0	ϕ60min	13± 0.2	ϕ2.0± 0.5	11± 1.0	14.4 max	1.5± 0.1	1.0
13"Reel (20K)	ϕ330±2.0	ϕ60min	13± 0.2	ϕ2.0± 0.5	11± 1.0	14.4 max	2.1± 0.1	-

8 Surface Mount Land Patterns



Product (Type)	Land Dimension		
	A	B	C
CR10 (0402)	0.020 [0.5]	0.059 [1.5]	0.020 ~ 0.024 [0.5 ~ 0.6]
CR16 (0603)	0.039 [1.0]	0.106 [2.7]	0.020 ~ 0.035 [0.5 ~ 0.9]
CR21 (0805)	0.047 [1.2]	0.138 [3.5]	0.043 ~ 0.051 [1.1 ~ 1.3]
CR32 (1206)	0.087 [2.2]	0.197 [5.0]	0.055 ~ 0.071 [1.4 ~ 1.8]
CR40 (1210)	0.087 [2.2]	0.197 [5.0]	0.083 ~ 0.118 [2.1 ~ 3.0]
CR50 (2010)	0.15 [3.9]	0.331 [8.4]	0.083 ~ 0.118 [2.1 ~ 3.0]
CR63 (2512)	0.205 [5.2]	0.413 [10.5]	0.098 ~ 0.189 [2.5 ~ 4.8]

9 APPLICABLE STANDARDS

JIS C 5202	Test Methods of Fixed Resistors for Electronic Equipment.
JIS C 5223	Fixed Thick Film Chip Resistors, Rectangular Type for Use in Electronic Equipment.
JIS C 0806	Packaging of Electronic Components on continuous tapes (surface mount devices).
MIL-R-55342	Resistors, Fixed, Film, Chip, Established Reliability, General Specifications for.
MIL-STD-202	Test Methods for Electronic and Electrical Parts.
IPC/JEDEC J STD 020	Moisture / Reflow sensitivity classification for non hermetic solid state surface mount devices.
2002/95/EC	RoHS Directive
IEC 60068-2-58	Solderability