

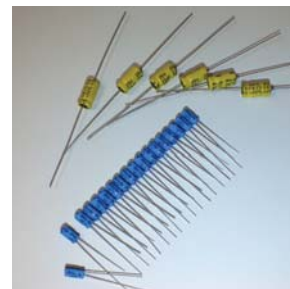
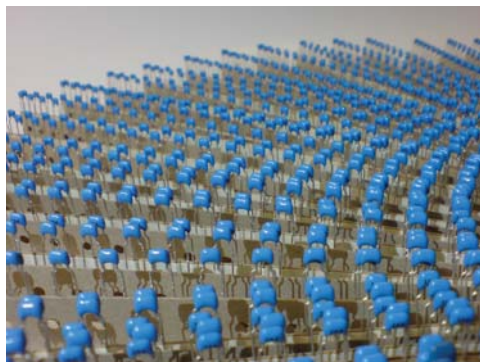
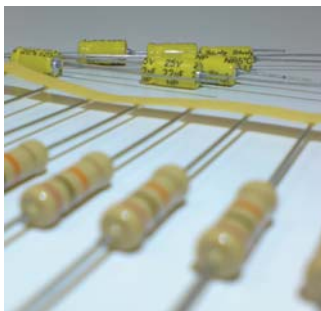
INTRO

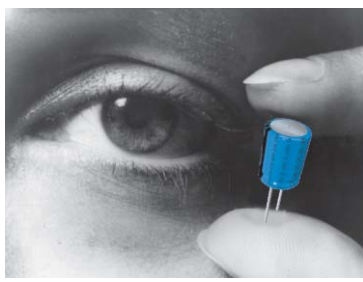
Liberty Components is a master distributor of Passive Components located in Southern California serving the continental United States. We pride ourselves with the best of quality and service. Our reseller and distributor network though out the United States sells to end-users in the Medical, Telecommunication, and various Manufacturing industries. All our components are manufactured under strict ISO 9002:94 certified facilities in Japan, Taiwan, and Korea. We invite you to look though this catalog and call us for samples or quotes of your passive component needs.

Liberty Components is a stocking master distributor with over 200 million components ready to ship at a moments notice. Our inventory includes resistors, capacitors and diodes of all values, tolerances and sizes in both traditional through hole and SMD (Surface Mount Device) packaging.

Liberty Components also specializes in custom OEM passive components. We are able to customize passive components to your specification under your private brand label. Please call us for your custom OEM components.

Please feel free to give us a call. Whether it's 1000pcs, 10 million pcs or customized components, Liberty is your source to all your passive component needs.





HISTORY

Liberty Components was established by Gary Lee in 1978. At inception, Liberty was known as "Liberty International Components, Inc." and was a sales office for Firstohm, Ltd., one of the largest resistor manufacturers in Taiwan at its time. Through the years, Liberty expanded its product line with partnership factories located in Taiwan, Korea and Japan to provide more than through-hole resistors to our customers. We offer quality passive electronic components at competitive prices.

In 2002, with the passing of our founder, the corporate name for Liberty changed to Liberty Bell Components, Inc. We are still the same company with many of the same employees. We at Liberty have continued the legacy of our founder to provide the best quality components with the best service in the industry at the most competitive pricing on the market.

QUALITY

The quality of Liberty components is second to none. While many of our competitors in the through-hole resistor business have moved on to "Copper Clad" leads and use thinner leads to reduce cost, Liberty refuses to use sub-standard raw materials and practices to build our components. Our through-hole resistors are still built on industry standard lead thicknesses for its wattage rating and we only use tinned 100% copper leads.



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Surface Mount
Diodes

Surface Mount
Resistors

Surface Mount
Capacitors

Fixed Component
Diodes

Fixed Component
Resistors

Fixed Component
Capacitors



Aluminum Electrolytic Capacitor Type EGA

Δ Features

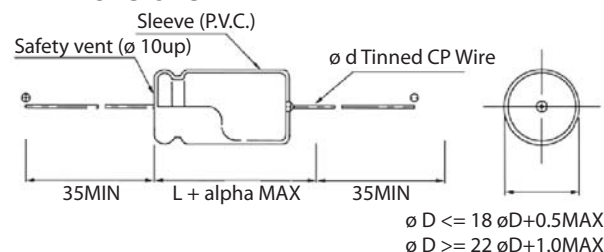
- Axial Leads, 85°C Standard Series
- Designed in high CV value with smaller size
- Guaranteed long life (2,000 hours at 85° C)

Δ Applications

- Suitable for consumer electronics equipment.



Δ Dimensions



DØ x L (mm)

øD	5	6	8	10	13	16	18	22	25
ød	0.6			0.8			0.8 / 1.0		
6.3 ~100V	1.5			2			2		
α 160V ~450	1.5			2			2		

Δ Specifications

Item		Performance Characteristics									
Operating Temperature Range		-40 + 85°C					-25 + 85°C				
Rated Voltage		6.3V ~100V					160V ~450V				
Capacitance Range		0.47 ~22,000 μF									
Capacitance Tolerance		±20% (120Hz, 20°C)									
Leakage Current		0.02CV or 4 μA, whichever is greater after 2 minutes application of rated voltage.					.03CV + 10 μA, whichever is greater after 2 minutes application of rated voltage.				
Dissipation Factor (120Hz, 20°C)	Rated voltage (V)	6.3	10	16	25	35	50	63	100	160~250	350~450
	Tan δ (max.)	0.28	0.24	0.20	0.16	0.14	0.12	0.10	0.10	0.20	0.25
For capacitance of more than 1,000μF, add 0.02 for every increase of 1,000μF.											
Temperature Characteristics (120Hz)	Impedance Ratio / Stability at Low Temperature										
	Rated voltage (V)	6.3	10	16	25	35	50	63~100	160~250	350~400	450
	Z (-25°C) / Z (20°C)	5	4	3	2	2	2	2	4	4	6
	Z (-40°C) / Z (20°C)	12	10	8	5	4	3	3	15	10	-
Load Life	After 2,000 hours application of WV at 85°C, capacitor shall meet the characteristics requirements mentioned below.										
	Capacitance change	Within ±20% of initial value									
	Tan δ	200% or less of initial specified value									
	Leakage current	Initial specified value or less									
Shelf Life	After leaving capacitors under no load at 85°C for 1,000 hours and applying voltage according to JIS C5102 and C5141, they shall meet the specified value as load life characteristics listed above										

NOTE: Part Numbering System

(1) (2) (3) (4)
EGA 106 M 1H

- 1 Series
- 2 Capacitance
- 3 Tolerance
- 4 Working Voltage



Δ Dimensions

Dφ x L (mm)

WV(SV) Cap (μF)	6.3 (8)	10 (13)	16 (20)	25 (32)	35 (44)	50 (63)	63 (75)	100 (125)
0.47						5 x 13	5	5 x 13
1						5 x 13	10	5 x 13
2.2						5 x 13	23	5 x 13
3.3						5 x 13	30	5 x 13
4.7						5 x 13	36	5 x 13
10				5 x 13	37	5 x 13	41	5 x 13
22			5 x 13	50	5 x 13	58	5 x 13	70
33			5 x 13	60	5 x 13	80	6.3 x 13	95
47		5 x 13	70	5 x 13	90	6.3 x 13	105	6.3 x 13
100	5 x 13	110	6.3 x 13	130	6.3 x 13	145	6.3 x 16	140
220	6.3 x 13	180	6.3 x 16	220	8 x 16	260	8 x 16	280
330	6.3 x 16	250	8 x 16	300	8 x 16	320	8 x 16	350
470	8 x 16	330	8 x 16	350	8 x 16	390	8 x 20	460
1000	8 x 20	530	8 x 20	570	10 x 21	700	10 x 26	830
2200	10 x 21	850	13 x 26	1100	13 x 26	1190	13 x 31	1330
3300	13 x 26	1210	13 x 26	1290	13 x 31	1460	16 x 31	1700
4700	13 x 26	1400	13 x 31	1550	16 x 31	1840	16 x 41	2190
6800	13 x 31	1650	16 x 31	1930	16 x 41	2310	18 x 41	2480
10000	16 x 31	1990	16 x 41	2350	18 x 41	2520	22 x 51	3240
15000	16 x 41	2480	18 x 41	2630	22 x 51	3310		
22000	18 x 41	2730	22 x 51	3390	25 x 51	3500		

WV(SV) Cap (μF)	160 (200)	200 (250)	250 (300)	350 (400)	400 (450)	450 (500)
1			6.3 x 13	16	6.3 x 16	20
2.2		6.3 x 13	24	6.3 x 16	30	8 x 16
3.3	6.3 x 16	37	6.3 x 16	37	8 x 16	40
4.7	8 x 16	50	8 x 16	50	8 x 20	55
10	8 x 20	80	8 x 20	80	10 x 21	60
22	10 x 21	130	10 x 26	145	13 x 26	110
33	10 x 26	180	13 x 26	195	13 x 31	170
47	13 x 26	230	13 x 31	230	13 x 31	200
100	16 x 31	400	16 x 31	400	16 x 41	270
220	16 x 41	670	18 x 41	690	22 x 41	764

Ripple current (mA) at 85°C 120 Hz

• Frequency coefficient of allowable ripple current

WV	Cap(μF) \ Frequency	50 Hz	120 Hz	300 Hz	1 KHz	10 KHz~
6.3~100	~ 47	0.75	1	1.35	1.57	2.00
	100 ~ 470	0.80	1	1.23	1.34	1.50
	1,000 ~ 22,000	0.85	1	1.10	1.13	1.15
160~450	1 ~ 220	0.80	1	1.25	1.40	1.60



Aluminum Electrolytic Capacitor Type EGR

Δ Features

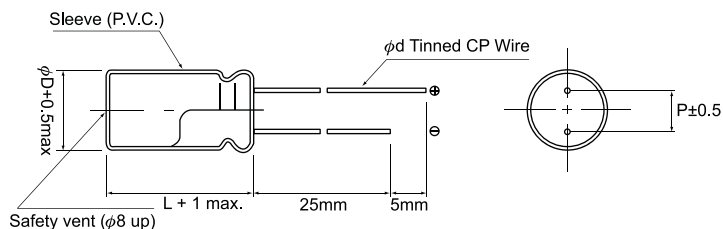
- Radial Leads, 85°C Standard Series
- Guaranteed long life (2,000 hours at 85° C)

Δ Applications

- Suitable for consumer electronics equipment.



Δ Dimensions



DØ x L (mm)

	5	6.3	8	10	13	16	18	20	22	25
φD	5	6.3	8	10	13	16	18	20	22	25
P	2	2.5	3.5	5	5	7.5	7.5	10	10	12.5
φd		0.5			0.6		0.8		1	
~100WV		1.0			1.5		1.5		2	
~160WV~		1.5			2		2		2	

Δ Specifications

Item	Performance Characteristics												
Operating Temperature Range	-40 + 85°C						-25 + 85°C						
Rated Voltage	6.3V ~100V						160V ~450V						
Capacitance Range	0.1 ~22,000 μF												
Capacitance Tolerance	±20% (120Hz, 20°C)												
Leakage Current	0.02CV or 4 μA, whichever is greater after 2 minutes application of rated voltage.						.03CV + 10 μA, whichever is greater after 2 minutes application of rated voltage.						
Dissipation Factor (120Hz, 20°C)	Rated voltage (V)	6.3	10	16	25	35	50	63	100	160~250	350~450		
	Tan δ (max.)	0.24	0.2	0.17	0.15	0.12	0.1	0.1	0.1	0.2	0.25		
For capacitance of more than 1,000μF, add 0.02 for every increase of 1,000μF.													
Temperature Characteristics (120Hz)	Impedance Ratio / Stability at Low Temperature												
	Rated voltage (V)	6.3	10	16	25	35	50	63	100	160~200	250~350	400	450
	Z (-25°C) / Z (20°C)	5	4	3	2	2	2	2	2	3	4	6	15
	Z (-40°C) / Z (20°C)	12	10	8	5	4	3	3	3	4	8	10	-
Load Life	After 2,000 hours application of WV at 85°C, capacitor shall meet the characteristics requirements mentioned below.												
	Capacitance change	Within ±20% of initial value											
	Tan δ	200% or less of initial specified value											
	Leakage current	Initial specified value or less											
Shelf Life	After leaving capacitors under no load at 85°C for 1,000 hours and applying voltage according to JIS C5102 and C5141, they shall meet the specified value as load life characteristics listed above.												

NOTE: Part Numbering System
(1) (2) (3) (4)
EGR 106 M 1H

- 1 Series
- 2 Capacitance
- 3 Tolerance
- 4 Working Voltage



Δ Dimensions

Dφ x L (mm)

Cap (μF) \ WV(SV)	6.3 (8)		10 (13)		16 (20)		25 (32)		35 (44)		50 (63)		63 (75)	
0.1											5 x 11	1.3		
0.22											5 x 11	2.9		
0.33											5 x 11	4.3		
0.47											5 x 11	6.2		
1											5 x 11	17		
2.2											5 x 11	28		
3.3											5 x 11	35		
4.7											5 x 11	40		
10					5 x 11	50	5 x 11	55	5 x 11	60	5 x 11	60	5 x 11	65
22	5 x 11	65	5 x 11	65	5 x 11	75	5 x 11	80	5 x 11	90	5 x 11	95	5 x 11	100
33	5 x 11	80	5 x 11	85	5 x 11	90	5 x 11	95	5 x 11	105	5 x 11	125	6.3 x 11	140
47	5 x 11	95	5 x 11	100	5 x 11	110	5 x 11	115	6.3 x 11	145	8 x 11	175	8 x 11	185
									5 x 11	130	6.3 x 11	155	6.3 x 11	170
100	5 x 11	135	5 x 11	145	6.3 x 11	170	6.3 x 11	190	6.3 x 11	210	8 x 11	260	10 x 12	300
					5 x 11	160	5 x 11	180					8 x 11	280
220	5 x 11	200	6.3 x 11	240	6.3 x 11	260	8 x 11	330	10 x 12	385	10 x 12	430	10 x 16	490
			5 x 11	220			6.3 x 11	280	8 x 11	350	10 x 16	450		
330	6.3 x 11	270	6.3 x 11	290	8 x 11	370	10 x 12	440	10 x 12	490	10 x 16	590	10 x 20	710
	5 x 11	230			6.3 x 11	320	8 x 11	390			10 x 20	620		
470	6.3 x 11	320	6.3 x 11	350	8 x 11	440	10 x 12	550	10 x 16	650	13 x 20	760	13 x 20	900
			8 x 11	400			10 x 16	580			10 x 20	760		
1000	8 x 11	540	10 x 12	650	10 x 16	790	10 x 20	960	13 x 20	1150	13 x 25	1350	16 x 32	1400
			8 x 14	660	10 x 12	700	10 x 16	860	10 x 25	1100	16 x 25	1450	16 x 25	1300
2200	10 x 20	1000	10 x 20	1100	13 x 20	1300	13 x 25	1550	16 x 25	1800	16 x 36	2100	18 x 36	2300
	10 x 16	890	10 x 16	990	10 x 20	1000	16 x 25	1700	16 x 32	1910	16 x 32	1980	22 x 36	2550
3300	10 x 20	1190	13 x 20	1450	13 x 25	1700	16 x 25	1980	16 x 36	2280	18 x 36	2500	20 x 40	2700
					13 x 20	1550	13 x 25	1800	16 x 32	2100	22 x 30	2450	25 x 30	2600
4700	13 x 20	1550	13 x 25	1800	16 x 25	2100	16 x 32	2450	18 x 36	2700	20 x 40	2900	22 x 50	3400
					13 x 25	1850	16 x 25	2200	16 x 36	2500	25 x 30	2900	25 x 40	3200
6800	13 x 25	1920	16 x 25	2250	16 x 36	2650	18 x 36	2900	20 x 40	3000	22 x 50	3500	25 x 50	3900
					16 x 25	2250	16 x 36	2600	18 x 40	2800	25 x 40	3300		
10000	16 x 25	2350	16 x 36	2700	18 x 36	2950	20 x 40	3000	22 x 50	3700	25 x 50	4000		
			16 x 32	2550	16 x 36	2710	18 x 40	2800	25 x 40	3600				
15000	16 x 36	2850	18 x 36	3100	20 x 40	3400	22 x 50	3800	25 x 50	4300				
	16 x 32	2550	16 x 36	2880	18 x 40	3100	25 x 40	3600						
22000	18 x 36	3200	18 x 40	3400	22 x 50	4200	25 x 50	4500						
	22 x 30	3200	25 x 30	3300	25 x 40	4000								
33000	22 x 50	3900	22 x 50	4500	25 x 50	4800								
	25 x 40	3800	25 x 40	4800										
47000	22 x 50	3900	25 x 50	5000										
													Case Size	ripple

Ripple current (mA) at 85°C 120 Hz



Δ Dimensions

Dφ x L (mm)

WV(SV) Cap (μF)	100 (125)		160 (200)		200 (250)		250 (300)		350 (400)		400 (450)		450 (500)	
0.1	5 x 11	2.1			6.3 x 11	2.1								
0.22	5 x 11	4.7			6.3 x 11	4.7								
0.33	5 x 11	7			6.3 x 11	7								
0.47	5 x 11	10	6.3 x 11	15	6.3 x 11	15	6.3 x 11	15			6.3 x 11	12		
1	5 x 11	21	6.3 x 11	22	6.3 x 11	22	6.3 x 11	22	6.3 x 11	22	8 x 11	25	8 x 11	23
											6.3 x 11	20		
2.2	5 x 11	30	6.3 x 11	33	6.3 x 11	33	6.3 x 11	33	8 x 11	38	10 x 12	45	10 x 12	35
									6.3 x 11	30	8 x 11	38	8 x 11	28
3.3	5 x 11	40	6.3 x 11	40	6.3 x 11	40	8 x 11	46	10 x 12	55	10 x 12	55	10 x 16	45
							6.3 x 11	40	8 x 11	43	8 x 11	48	10 x 12	40
4.7	5 x 11	45	6.3 x 11	50	8 x 11	55	8 x 11	55	10 x 12	65	10 x 16	70	10 x 20	55
					6.3 x 11	50	6.3 x 11	50	8 x 11	55	10 x 12	60	10 x 12	46
10	6.3 x 11	75	8 x 11	80	10 x 12	95	10 x 16	105	10 x 20	115	13 x 20	130	13 x 20	90
	5 x 11	70			8 x 11	80	10 x 12	100	10 x 12	90	10 x 16	90	10 x 20	80
22	6.3 x 11	130	10 x 16	155	10 x 20	170	13 x 20	190	13 x 25	200	16 x 25	240	16 x 25	165
			10 x 12	130	10 x 16	150	10 x 20	150	13 x 20	150	13 x 25	200	13 x 25	140
33	8 x 11	180	10 x 20	205	13 x 20	230	13 x 20	230	16 x 25	275	16 x 32	300	16 x 36	230
			10 x 16	180	10 x 20	200	10 x 20	200	13 x 25	240	16 x 25	240	16 x 25	180
47	10 x 12	230	13 x 20	270	13 x 20	270	13 x 25	300	16 x 36	380	16 x 36	370	18 x 40	300
	8 x 11	200	10 x 20	210			13 x 20	270	16 x 25	300	16 x 25	280	16 x 32	220
68	10 x 12	270	13 x 20	350	13 x 25	350	16 x 25	380	16 x 25	400	16 x 32	340	18 x 36	260
100	10 x 20	370	13 x 25	430	16 x 32	530	16 x 32	520	18 x 40	590	20 x 40	550	22 x 40	350
	10 x 16	340			16 x 25	450	16 x 25	440	18 x 36	520	18 x 36	440	18 x 40	280
220	13 x 25	620	16 x 36	800	18 x 36	810	20 x 40	740	22 x 50	850	25 x 50	750		
	13 x 20	550	16 x 32	580	16 x 36	700	18 x 36	680	22 x 50	760	22 x 50	650	25 x 50	350
330	13 x 25	760	18 x 40	940	20 x 40	1130	22 x 50	1170						
			18 x 36	800	18 x 40	950	20 x 40	1000	25 x 50	1000				
470	16 x 25	1000	22 x 40	1410	22 x 50	1490	25 x 50	1600						
			18 x 40	1200	22 x 40	1300	22 x 50	1400						
1000	18 x 40	1380	25 x 50	1900										
	18 x 36	1350												
2200	22 x 50	2400												
	22 x 50	2400												
3300	25 x 50	2900												
													Case Size	Ripple

Ripple current (mA) at 85°C 120 Hz

• Frequency coefficient of allowable ripple current

WV	Cap(μF)	Frequency	50 Hz	120 Hz	300 Hz	1 KHz	10 KHz~
6.3~100		~ 68	0.75	1	1.35	1.57	2.00
		100 ~ 470	0.80	1	1.23	1.34	1.50
		1,000 ~ 47,000	0.85	1	1.10	1.13	1.15
160~450		0.47 ~ 220	0.80	1	1.25	1.40	1.60
		330 ~ 1,000	0.95	1	1.10	1.13	1.15

• Allowable ripple vs. Ambient temperature

Ambient Temp. (°C)	~ +70	+85
Compensating Coefficient	1.27	1.0



Aluminum Electrolytic Capacitor Type EWA

Δ Features

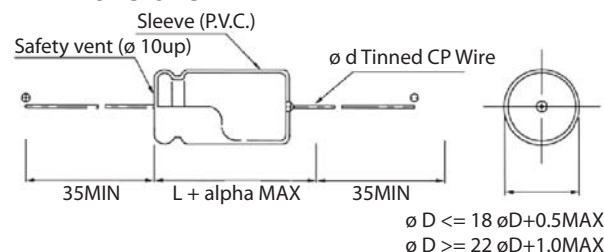
- Axial Leads, 105°C Standard Series
- Designed in high CV value with smaller size
- Guaranteed long life (2,000 hours at 105° C)

Δ Applications

- Suitable for high reliability equipment in the medical, telcom and industrial applications.



Δ Dimensions



DØ x L (mm)

øD	5	6	8	10	13	16	18	22	25
ød	0.6			0.8			0.8 / 1.0		
6.3 ~100V	1.5			2			2		
α 160V ~450	1.5			2			2		

Δ Specifications

Item		Performance Characteristics									
Operating Temperature Range		-40 + 105°C					-25 + 105°C				
Rated Voltage		6.3V ~100V					160V ~450V				
Capacitance Range		0.47 ~22,000 μF									
Capacitance Tolerance		±20% (120Hz, 20°C)									
Leakage Current		0.02CV or 4 μA, whichever is greater after 2 minutes application of rated voltage.					.03CV + 10 μA, whichever is greater after 2 minutes application of rated voltage.				
Dissipation Factor (120Hz, 20°C)	Rated voltage (V)	6.3	10	16	25	35	50	63	100	160~250	350~450
	Tan δ (max.)	0.28	0.24	0.20	0.16	0.14	0.12	0.10	0.10	0.20	0.25
For capacitance of more than 1,000μF, add 0.02 for every increase of 1,000μF.											
Temperature Characteristics (120Hz)	Impedance Ratio / Stability at Low Temperature										
	Rated voltage (V)	6.3	10	16	25	35	50	63~100	160~250	350~400	450
	Z (-25°C) / Z (20°C)	5	4	3	2	2	2	2	4	4	6
	Z (-40°C) / Z (20°C)	12	10	8	6	5	4	4	15	10	-
Load Life	After 2,000 hours application of WV at 105°C, capacitor shall meet the characteristics requirements mentioned below.										
	Capacitance change	Within ±20% of initial value									
	Tan δ	200% or less of initial specified value									
	Leakage current	Initial specified value or less									
Shelf Life	After leaving capacitors under no load at 105°C for 1,000 hours and applying voltage according to JIS C5102 and C5141, they shall meet the specified value as load life characteristics listed above										

NOTE: Part Numbering System

(1) (2) (3) (4)
EWA 106 M 1H

- 1 Series
- 2 Capacitance
- 3 Tolerance
- 4 Working Voltage



Δ Dimensions

Dφ x L (mm)

WV(SV) Cap (μF)	6.3 (8)	10 (13)	16 (20)	25 (32)	35 (44)	50 (63)	63 (75)	100 (125)
0.47						5 x 13	5	5 x 13
1						5 x 13	10	5 x 13
2.2						5 x 13	18	5 x 13
3.3						5 x 13	22	6.3 x 13
4.7						5 x 13	26	6.3 x 13
10				5 x 13	30	5 x 13	33	5 x 13
22			5 x 13	41	5 x 13	48	6.3 x 13	57
33			5 x 13	54	6.3 x 13	64	6.3 x 16	76
47		5 x 13	57	6.3 x 13	71	6.3 x 16	85	6.3 x 16
100	6.3 x 13	89	6.3 x 16	105	6.3 x 16	115	6.3 x 16	120
220	6.3 x 16	145	6.3 x 16	155	8 x 16	185	8 x 16	200
330	8 x 16	200	8 x 16	220	8 x 16	230	8 x 20	270
470	8 x 16	240	8 x 16	250	8 x 20	310	10 x 21	370
1000	10 x 21	430	10 x 21	460	10 x 26	550	13 x 26	640
2200	13 x 26	720	13 x 26	780	13 x 31	910	16 x 31	1040
3300	13 x 26	860	13 x 31	980	16 x 31	1140	16 x 41	1200
4700	13 x 31	1060	16 x 31	1220	16 x 31	1300	18 x 41	1540
6800	16 x 31	1300	16 x 31	1370	16 x 41	1620	22 x 41	1810
10000	16 x 41	1620	18 x 41	1690	22 x 41	1900	22 x 51	1980
15000	18 x 41	1740	22 x 41	1950	22 x 51	2050		
22000	22 x 41	2000	22 x 51	2080	25 x 51	2650		

WV(SV) Cap (μF)	160 (200)	200 (250)	250 (300)	350 (400)	400 (450)	450 (500)
1		6.3 x 13	10	6.3 x 16	11	6.3 x 16
2.2		6.3 x 16	17	8 x 16	20	8 x 16
3.3		8 x 16	24	8 x 16	24	8 x 20
4.7	8 x 16	28	8 x 16	28	8 x 20	32
10	8 x 20	43	10 x 21	50	10 x 21	50
22	10 x 26	85	13 x 26	100	13 x 26	100
33	13 x 26	120	13 x 26	120	13 x 31	135
47	13 x 31	155	13 x 31	155	16 x 31	175
100	16 x 31	270	16 x 41	300	16 x 41	300
220	22 x 41	510	22 x 41	510		

Ripple current (mA) at 105°C 120 Hz

• Frequency coefficient of allowable ripple current

WV	Cap(μF) \ Frequency	50 Hz	120 Hz	300 Hz	1 KHz	10 KHz~
6.3~100	~ 47	0.75	1	1.35	1.57	2.00
	100 ~ 470	0.80	1	1.23	1.34	1.50
	1,000 ~ 22,000	0.85	1	1.10	1.13	1.15
160~450	1 ~ 220	0.80	1	1.25	1.40	1.60



Aluminum Electrolytic Capacitor Type EWR

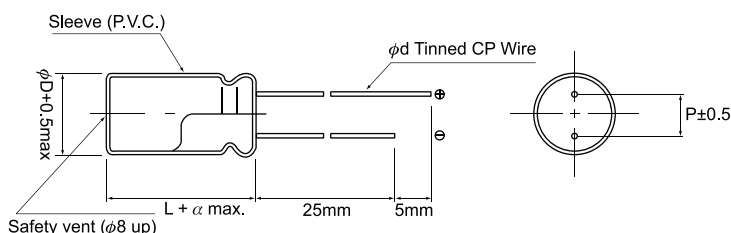
Δ Features

- Designed in high value CV with smaller size.
- Excellent reliability
- Guaranteed long life (2,000 hours at 105° C)



Δ Applications

- Suitable for use with high reliability equipment in the medical, telecom and consumer industry.



NOTE: Part Numbering System

(1) (2) (3) (4)

EWR 106 M 1H

- 1 Series
- 2 Capacitance
- 3 Tolerance
- 4 Working Voltage

DØ x L (mm)

DØ	5	6.3	8	10	13	16	18	20	22	25
P	2	2.5	3.5	5	5	7.5	7.5	10	10	12.5
φd	0.5			0.6		0.8		1		
α	~100WV			1.5		1.5		2		
	160WV~			2		2		2		

Δ Specifications

Item	Performance Characteristics												
Operating Temperature Range	-40 + 105°C						-25 + 105°C						
Rated Voltage	6.3V ~100V						160V ~450V						
Capacitance Range	0.1 ~47,000 μF												
Capacitance Tolerance	±20% (120Hz, 20°C)												
Leakage Current	0.02CV or 4 μA, whichever is greater after 2 minutes application of rated voltage.						0.03CV + 10 μA, whichever is greater after 2 minutes application of rated voltage.						
Dissipation Factor (120Hz, 20°C)	Rated voltage (V)	6.3	10	16	25	35	50	63	100	160~250	350~450		
	Tan d (max.)	0.28	0.24	0.2	0.16	0.14	0.12	0.1	0.08	0.2	0.25		
	For capacitance of more than 1,000μF, add 0.02 for every increase of 1,000μF.												
Temperature Characteristics (120Hz)	Impedance Ratio / Stability at Low Temperature												
	Rated voltage (V)	6.3	10	16	25	35	50	63	100	160~200	250~350	400	450
	Z (-25°C) / Z (20°C)	5	4	3	2	2	2	2	2	3	4	6	15
	Z (-40°C) / Z (20°C)	10	8	6	4	3	3	3	3	4	8	10	-
Load Life	After 2,000 hours application of WV at 105°C, capacitor shall meet the characteristics requirements mentioned below.												
	Capacitance change	Within ±20% of initial value											
	Tan d	200% or less of initial specified value											
	Leakage current	Initial specified value or less											
Shelf Life	After leaving capacitors under no load at 105°C for 1,000 hours and applying voltage according to JIS C5102 and C5141, they shall meet the specified value as load life characteristics listed above.												



Δ Dimensions

Dφ x L (mm)

Cap (μF) \ WV(SV)	6.3 (8)		10 (13)		16 (20)		25 (32)		35 (44)		50 (63)		63 (75)	
0.1											5 x 11	1.3		
0.22											5 x 11	2.9		
0.33											5 x 11	4.3		
0.47											5 x 11	7		
1											5 x 11	13		
2.2											5 x 11	20		
3.3											5 x 11	25		
4.7											5 x 11	30		
10					5 x 11	35	5 x 11	36	5 x 11	41	5 x 11	46	5 x 11	46
22	5 x 11	45	5 x 11	45	5 x 11	54	5 x 11	58	5 x 11	61	5 x 11	68	6.3 x 11	82
													5 x 11	71
33	5 x 11	55	5 x 11	58	5 x 11	65	5 x 11	68	5 x 11	75	6.3 x 11	95	6.3 x 11	100
											5 x 11	90		
47	5 x 11	65	5 x 11	68	5 x 11	79	5 x 11	83	6.3 x 11	100	6.3 x 11	115	8 x 11	135
									5 x 11	93	8 x 11	130	6.3 x 11	120
68	5 x 11	75	5 x 11	80	5 x 11	90	5 x 11	95	6.3 x 11	110	8 x 11	145	8 x 11	155
											6.3 x 11	130		
100	5 x 11	95	5 x 11	105	6.3 x 11	125	6.3 x 11	140	8 x 11	170	8 x 11	190	10 x 12	215
					5 x 11	115	5 x 11	125	6.3 x 11	150			8 x 11	200
220	5 x 11	145	6.3 x 11	175	6.3 x 11	190	8 x 11	240	10 x 12	275	10 x 16	440	10 x 20	400
			5 x 11	155					8 x 11	250	10 x 12	300	10 x 16	335
330	6.3 x 11	195	6.3 x 11	210	8 x 11	260	10 x 12	315	10 x 16	400	10 x 20	460	13 x 20	540
							8 x 11	275	10 x 12	350	10 x 16	410	10 x 20	510
470	6.3 x 11	230	8 x 11	290	10 x 12	370	10 x 16	440	10 x 20	520	13 x 20	610	13 x 20	640
			6.3 x 11	250	8 x 11	315	10 x 12	380	10 x 16	460	10 x 20	540		
1000	8 x 11	390	10 x 12	460	10 x 20	640	13 x 20	770	13 x 25	920	16 x 25	1080	16 x 32	1210
					10 x 16	560	10 x 20	680	13 x 20	810	13 x 25	950	16 x 25	930
2200	10 x 20	710	10 x 20	760	13 x 25	1000	16 x 25	1170	16 x 32	1340	16 x 36	1470	18 x 36	1650
	10 x 16	635			13 x 20	920	13 x 25	1090	16 x 25	1260	16 x 32	1410		
3300	10 x 20	840	13 x 25	1100	16 x 25	1300	16 x 32	1460	16 x 36	1610	18 x 36	1770	20 x 40	1950
			13 x 20	1000	13 x 25	1170	16 x 25	1400	16 x 32	1500				
4700	13 x 20	1090	16 x 25	1400	16 x 32	1600	16 x 32	1710	18 x 36	1910	20 x 40	2100	22 x 50	2450
			13 x 25	1260	16 x 25	1480	16 x 25	1570	16 x 36	1780				
6800	16 x 25	1500	16 x 32	1690	16 x 36	1780	18 x 36	2040	20 x 40	2150	22 x 50	2500	25 x 50	2800
	13 x 25	1350	16 x 25	1570	16 x 25	1600	16 x 36	1850	18 x 40	2000				
10000	16 x 32	1765	16 x 36	1890	18 x 36	2060	20 x 40	2150	22 x 50	2650	25 x 50	2850		
	16 x 25	1650	16 x 32	1820	16 x 36	1930	18 x 40	2000						
15000	16 x 36	2010	18 x 36	2180	20 x 40	2430	22 x 50	2750	25 x 50	3100				
	16 x 32	1820	16 x 36	2050	18 x 40	2210								
22000	18 x 40	2350	20 x 40	2650	22 x 50	3000	25 x 50	3250						
	18 x 36	2280	18 x 40	2420	22 x 40	2710								
33000	22 x 50	2800	22 x 50	3250	25 x 50	3450								
	20 x 40	2500	22 x 50	3210										
47000	22 x 50	2780	25 x 50	3570										
													Case Size	ripple

Ripple current (mA) at 105°C 120Hz



Δ Dimensions

Dφ x L (mm)

WV(SV) Cap(μF)	100 (125)		160 (200)		200 (250)		250 (300)		350 (400)		400 (450)		450 (500)	
0.1	5 x 11	1.5			6.3 x 11	1.5								
0.22	5 x 11	3.4			6.3 x 11	3.3								
0.33	5 x 11	5.0			6.3 x 11	5								
0.47	5 x 11	7.1	6.3 x 11	11	6.3 x 11	11	6.3 x 11	10			6.3 x 11	8.5		
1	5 x 11	15	6.3 x 11	16	6.3 x 11	16	6.3 x 11	15	6.3 x 11	15	8 x 11	17	8 x 11	13
											6.3 x 11	14		
2.2	5 x 11	21	6.3 x 11	25	6.3 x 11	25	6.3 x 11	23	8 x 11	26	10 x 12	30	10 x 12	23
									6.3 x 11	21	8 x 11	27	8 x 11	20
3.3	5 x 11	29	6.3 x 11	30	6.3 x 11	30	8 x 11	32	10 x 12	38	10 x 12	38	10 x 16	31
							6.3 x 11	28	8 x 11	30	8 x 11	34	10 x 12	28
4.7	5 x 11	32	6.3 x 11	34	8 x 11	39	8 x 11	39	10 x 12	45	10 x 16	50	10 x 20	40
					6.3 x 11	35	6.3 x 11	35	8 x 11	39	10 x 12	42	10 x 12	32
10	6.3 x 11	54	8 x 11	41	10 x 12	65	10 x 16	74	10 x 20	80	13 x 20	90	13 x 20	65
	5 x 11	50			8 x 11	57	10 x 12	71	10 x 12	64	10 x 16	64	10 x 20	27
22	6.3 x 11	93	10 x 16	100	10 x 20	120	13 x 20	130	13 x 25	115	16 x 25	165	16 x 25	115
			10 x 12	92	10 x 16	105	10 x 20	105	13 x 20	105	13 x 25	140	13 x 25	100
33	8 x 11	130	10 x 20	145	13 x 20	160	13 x 20	160	16 x 25	195	16 x 32	215	16 x 36	165
			10 x 16	125	10 x 20	140	10 x 20	140	13 x 25	170	16 x 25	170	16 x 25	125
47	10 x 12	165	13 x 20	195	13 x 20	195	13 x 25	210	16 x 36	270	16 x 36	270	18 x 40	185
	8 x 11	140	10 x 20	150			13 x 20	190	16 x 25	210	16 x 25	200	16 x 32	155
68	10 x 12	190	13 x 20	250	13 x 25	250	16 x 25	270	16 x 25	285	16 x 32	240	18 x 36	185
100	10 x 20	265	13 x 25	315	16 x 32	375	16 x 32	365	18 x 40	420	20 x 40	450	22 x 40	270
	10 x 16	240			16 x 25	320	16 x 25	310	18 x 36	370	18 x 36	310	18 x 40	200
220	13 x 25	440	16 x 36	570	18 x 36	575	20 x 40	600	22 x 50	620	25 x 50	660	25 x 50	250
	13 x 20	390	16 x 32	410	16 x 36	500	18 x 36	485			22 x 50	460		
330	13 x 25	540	18 x 40	750	20 x 40	705	22 x 50	730	25 x 50	710				
			18 x 36	570	18 x 40	675	20 x 40	710						
470	16 x 25	715	22 x 40	900	22 x 50	840	25 x 50	870						
			18 x 40	855	22 x 40	925	22 x 50	1000						
1000	18 x 40	985	25 x 50	1310										
	18 x 36	960												
2200	22 x 50	1750												
3300	25 x 50	2070												
													Case Size	Ripple

Ripple current (mA) at 105°C 120 Hz

• Frequency coefficient of allowable ripple current

WV	Cap(μF)	Frequency	50 Hz	120 Hz	300 Hz	1 KHz	10 KHz~
6.3~100		~ 68	0.75	1	1.35	1.57	2.00
		100 ~ 470	0.80	1	1.23	1.34	1.50
		1,000 ~ 47,000	0.85	1	1.10	1.13	1.15
160~450		0.47 ~ 220	0.80	1	1.25	1.40	1.60
		330 ~ 1,000	0.95	1	1.10	1.13	1.15

• Allowable ripple vs. Ambient temperature

Ambient Temp. (°C)	~ +70	+85	+105
Compensating Coefficient	1.78	1.4	1.0



Aluminum Electrolytic Capacitor Type ENA - Axial Non-Polar 85°C Series

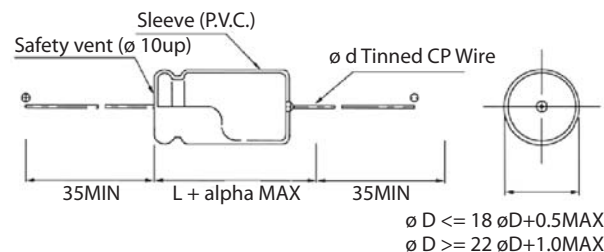
△ Features

- Exhibits reliable performance
- Guaranteed long life (2,000 hours at 85° C)

△ Applications

- In circuits where the polarity is reversed or not constant

△ Specifications



øD	6	8	10	13	16	18
ød	0.6	0.6	0.6	0.8		
α	1.0	1.5	2			

Item	Performance Characteristics								
Operating Temperature Range	-40 + 85°C								
Rated Voltage	6.3V ~ 100V								
Capacitance Range	0.1 ~ 2,200 µF								
Capacitance Tolerance	±20% (120Hz, 20°C)								
Leakage Current	0.03CV or 3 µA, whichever is greater after 5 minutes application of rated voltage.								
Dissipation Factor (120Hz, 20°C)	Rated voltage (V)	6.3	10	16	25	35	50	63	100
	Tan δ (max.)	0.26	0.24	0.22	0.20	0.16	0.14	0.12	0.10
	For capacitance of more than 1,000 µF, add 0.02 for every increase of 1,000 µF.								
Temperature Characteristics (120Hz)	Impedance / Stability at Low Temperature								
	Rated voltage (V)	6.3	10	16	25	35	50	63	100
	Z (-25°C) / Z (20°C)	4	3	2	2	2	2	2	2
	Z (-40°C) / Z (20°C)	10	8	6	5	4	4	3	3
	After 2,000 hours application of WV at 85°C, capacitor shall meet the characteristics requirements mentioned below.								
Load Life	Capacitance change	Within ±20% of initial value							
	Tan δ	200% or less of initial specified value							
	Leakage current	Initial specified value or less							
Shelf Life	After leaving capacitors under no load at 85°C for 1,000 hours and applying voltage according to JIS C5102 and C5141, they meet the specified value for load life characteristics listed above.								

△ Dimensions

Dφ x L (mm)

WV(SV) Cap (µF)	6.3 (10)		10 (13)		16 (20)		25 (32)		35 (44)		50 (63)		63 (75)		100 (125)	
0.1- 0.47											6.3 x 13	15	6.3 x 16	15	6.3 x 16	18
1											6.3 x 13	22	6.3 x 16	22	6.3 x 16	26
2.2											6.3 x 13	32	6.3 x 16	32	6.3 x 16	38
3.3											6.3 x 13	38	6.3 x 16	38	6.3 x 16	46
4.7											6.3 x 13	45	6.3 x 16	40	6.3 x 16	55
10									6.3 x 13	55	8 x 16	75	8 x 16	50	10 x 21	100
22					6.3 x 13	75	8 x 16	90	8 x 16	100	10 x 21	130	10 x 21	85	10 x 26	180
33			6.3 x 13	83	8 x 16	100	8 x 16	115	8 x 16	125	10 x 21	140	10 x 21	120	13 x 26	230
47	6.3 x 13	90	6.3 x 13	110	8 x 16	120	8 x 16	140	8 x 20	160	10 x 21	180	10 x 26	150	13 x 26	290
100	8 x 16	140	8 x 20	175	8 x 20	200	10 x 21	230	10 x 26	280	13 x 26	360	13 x 26	210	16 x 38	520
220	8 x 20	200	10 x 21	290	10 x 26	360	13 x 26	430	13 x 26	510	13 x 31	590	16 x 38	410		
330	10 x 21	320	10 x 26	405	13 x 26	480	13 x 26	520	13 x 31	600	16 x 31	720				
470	10 x 26	385	13 x 26	510	13 x 26	540	13 x 31	660	16 x 31	770						
1000	13 x 26	690	13 x 31	760	16 x 31	980										
2200	16 x 31	1240	16 x 38	1400											Case Size	Ripple

Ripple current (mA) at 85°C 120Hz

NOTE:

Part Numbering System

- | | | | | | |
|-----|-----|-----|-----|---|-----------------|
| (1) | (2) | (3) | (4) | 1 | Series |
| ENA | 106 | M | 1H | 2 | Capacitance |
| | | | | 3 | Tolerance |
| | | | | 4 | Working Voltage |



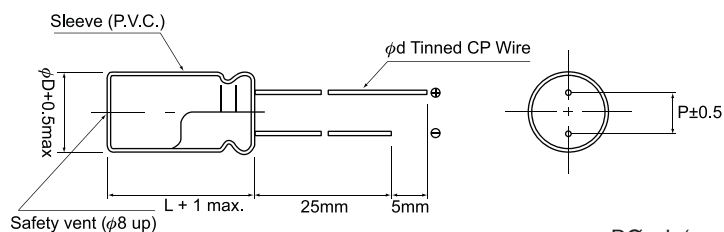
Aluminum Electrolytic Capacitor Type ENR - Radial Non Polar 85°C Series

△ Features

- Exhibits reliable performance
- Guaranteed long life (2,000 hours at 85° C)

△ Applications

- In circuits where the polarity is reversed or not constant



DØ x L (mm)

DØ	5	6.3	8	10	13	16	18
P	2	2.5	3.5	5	5	7.5	7.5
ød	0.5			0.6		0.8	
α		1			1.5		

△ Specifications

Item	Performance Characteristics								
Operating Temperature Range	-40 + 85°C								
Rated Voltage	6.3V ~ 100V								
Capacitance Range	0.1 ~ 4,700 μF								
Capacitance Tolerance	±20% (120Hz, 20°C)								
Leakage Current	0.03CV or 3 μA, whichever is greater after 5 minutes application of rated voltage.								
Dissipation Factor (120Hz, 20°C)	Rated voltage (V)	6.3	10	16	25	35	50	63	100
	Tan δ (max.)	0.26	0.24	0.22	0.20	0.16	0.14	0.12	0.10
Temperature Characteristics (120Hz)	For capacitance of more than 1,000μF, add 0.02 for every increase of 1,000μF.								
	Impedance Ratio / Stability at Low Temperature								
	Rated voltage (V)	6.3	10	16	25	35	50	63	100
	Z (-25°C) / Z (20°C)	4	3	2	2	2	2	2	2
	Z (-40°C) / Z (20°C)	10	8	6	5	4	4	3	3
Load Life	After 2,000 hours application of WV at 85°C with the polarity inverted every 250 hours, capacitor shall meet the characteristics requirements mentioned below.								
	Capacitance change	Within ±20% of initial value							
	Tan δ	200% or less of initial specified value							
	Leakage current	Initial specified value or less							
Shelf Life	After leaving capacitors under no load at 85°C for 1,000 hours and applying voltage according to JIS C5102 and C5141, they meet the specified value for load life characteristics listed above.								

NOTE: Part Numbering System

(1) (2) (3) (4)

ENR 106 M 1H

- 1 Series
- 2 Capacitance
- 3 Tolerance
- 4 Working Voltage



Δ Dimensions

Dφ x L (mm)

WV(SV) Cap (μF)	6.3 (10)		10 (13)		16 (20)		25 (32)		35 (44)		50 (63)		63 (75)		100 (125)	
0.1	0.47										5 x 11	11			5 x 11	14
1											5 x 11	17			5 x 11	21
2.2											5 x 11	25			6.3 x 11	34
3.3											5 x 11	27	5 x 11	28	6.3 x 11	39
4.7									5 x 11	34	5 x 11	34	6.3 x 11	34	6.3 x 11	47
10					5 x 11	42	5 x 11	42	5 x 11	43	6.3 x 11	52	6.3 x 11	57	8 x 11	71
22			5 x 11	57	5 x 11	57	6.3 x 11	65	6.3 x 11	73	8 x 11	89	8 x 11	95	10 x 16	135
33	5 x 11	64	5 x 11	64	5 x 11	70	6.3 x 11	80	8 x 11	100	8 x 11	105	10 x 12	135	13 x 20	220
47	5 x 11	76	5 x 11	76	6.3 x 11	95	6.3 x 11	95	8 x 11	120	10 x 12	150	10 x 16	180	13 x 20	240
100	6.3 x 11	125	6.3 x 11	125	8 x 11	160	8 x 11	160	10 x 16	230	10 x 20	265	13 x 20	320	16 x 25	425
220	8 x 11	215	8 x 11	215	10 x 12	275	10 x 16	305	13 x 20	410	13 x 25	480	16 x 25	575	18 x 36	720
330	8 x 11	265	10 x 16	345	10 x 16	375	13 x 20	450	13 x 20	505	16 x 25	650	16 x 32	655		
470	10 x 12	370	10 x 16	410	10 x 20	485	13 x 20	540	13 x 25	655	16 x 32	835	18 x 36	965		
1000	10 x 20	650	13 x 20	720	13 x 25	855	16 x 25	950	16 x 32	1140						
2200	13 x 25	1160	16 x 25	1280	16 x 32	1510	18 x 36	1620								
3300	16 x 25	1570	16 x 32	1690	18 x 36	1980										
4700	16 x 32	2020	18 x 36	2160											Case Size	Ripple

Ripple current (mA) at 85°C 120Hz



Aluminum Electrolytic Capacitor Type ESM - 7mm Height 85°C Standard Series

Δ Features

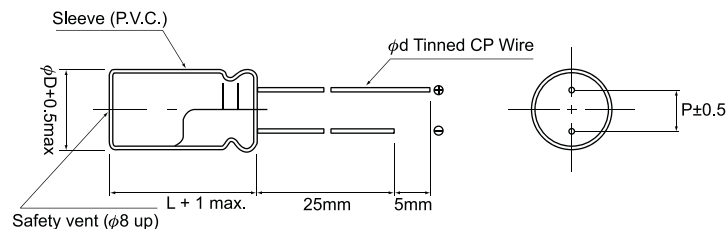
- 7m Height Subminiature Standard Series
- Highly reliable electrical performance
- Guaranteed long life (1,000 hours at 85° C)

Δ Applications

- Excellent spacing favor with 7mm height
- Expected life (1,000 hours at 85° C)



Δ Dimensions



DØ x L (mm)				
ØD	4	5	6	8
P	1.5	2.0	2.5	3.5
Ød	0.45	0.45	0.45	0.5

Δ Specifications

Item	Performance Characteristics							
Operating Temperature	-40 + 85°C							
Rated Voltage	4V ~ 50V							
Capacitance Range	0.1 ~ 470 μF							
Capacitance Tolerance	±20% (120Hz, 20°C)							
Leakage Current	I ≤ 0.01CV or 3 μA, whichever is greater after 2 minutes application of rated voltage.							
Dissipation Factor (120Hz, 20°C)	Rated voltage (V)	4	6.3	10	16	25	35	50
	Tan δ (max.)	0.35	0.24	0.20	0.16	0.14	0.12	0.10
Temperature Characteristics (120Hz)	Stability at Low Temperature							
	Rated voltage (V)	4	6.3	10	16	25	35	50
	Z (-25°C) / Z (20°C)	7	4	3	2	2	2	2
	Z (-40°C) / Z (20°C)	15	8	6	4	4	3	3
Load Life	After 1,000 hours application of WV at 85°C, capacitor shall meet the characteristics requirements.							
	Capacitance change	Within ±20% of initial value						
	Tan δ	200% or less of initial specified value						
	Leakage current	Initial specified value or less						
Shelf Life	After leaving capacitors under no load at 85°C for 1,000 hours and applying voltage according to							
	JIS C5102 and C5141, they meet the specified value for load life characteristics listed above.							

NOTE: Part Numbering System

(1) (2) (3) (4)
ESM 106 M 1H

- 1 Series
- 2 Capacitance
- 3 Tolerance
- 4 Working Voltage



Aluminum Electrolytic Capacitor

Type ESM

Fixed Component
Capacitors

Aluminum Electrolytic Capacitor Type ESM - 7mm Height 85°C Standard Series

Δ Dimensions

Dimensions

Dφ x L (mm)

WV(SV) Cap (μF)	4 (5)		6.3 (10)		10 (13)		16 (20)		25 (32)		35 (44)		50 (63)	
0.1													4 x 7	1
0.22													4 x 7	2.3
0.33													4 x 7	3.5
0.47													4 x 7	5
1													4 x 7	10
2.2													4 x 7	19
3.3													4 x 7	24
4.7													4 x 7	28
10							4 x 7	28	4 x 7	28	5 x 7	36	5 x 7	38
22			4 x 7	34	4 x 7	35	4 x 7	39	4 x 7	43	5 x 7	52	6.3 x 7	58
33	4 x 7	33	4 x 7	40	4 x 7	43	5 x 7	55	5 x 7	58	6.3 x 7	65	8 x 7	75
47	4 x 7	39	4 x 7	48	4 x 7	51	5 x 7	65	6.3 x 7	71	6.3 x 7	76	8 x 7	95
100	4 x 7	55	5 x 7	78	5 x 7	82	6.3 x 7	98	6.3 x 7	106	8 x 7	130		
220	6.3 x 7	110	6.3 x 7	120	6.3 x 7	126	6.3 x 7	132						
330	6.3 x 7	140	8 x 7	180	8 x 7	188	8 x 7	196						
470	8 x 7	240											Case Size	Ripple

Ripple current (mA) at 85°C 120Hz



Aluminum Electrolytic Capacitor Type ESH - 7mm Height 105°C Standard Series

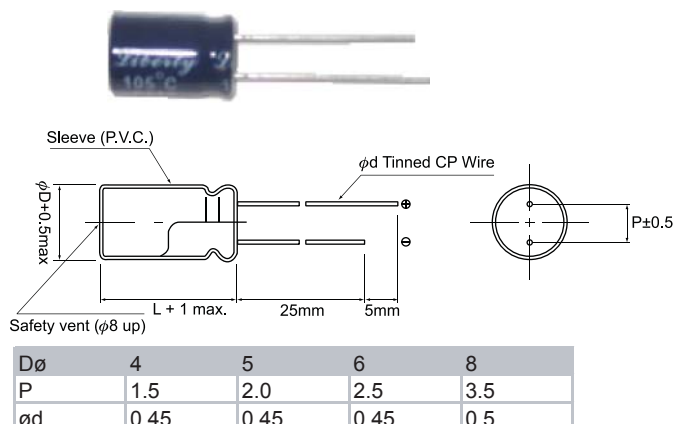
△ Features

- 7mm Height Standard Series
- Highly reliable electrical performance
- Expected life (1,000 hours at 105°C)

△ Applications

- For general purpose use with 7mm height
- Wide temperature range and miniature size

△ Specifications



Item		Performance Characteristics							
Operating Temperature Range		-40 + 105°C							
Rated Voltage		6.3V ~ 50V							
Capacitance Range		0.1 ~ 470 µF							
Capacitance Tolerance		±20% (120Hz, 20°C)							
Leakage Current		0.01CV or 3 µA, whichever is greater after 2 minutes application of rated voltage.							
Dissipation Factor (120Hz, 20°C)	Rated voltage (V)	4	6.3	10	16	25	35	50	
	Tan δ (max.)	0.35	0.24	0.21	0.18	0.15	0.13	0.12	
Temperature Characteristics (120Hz)	Impedance Ratio / Stability at Low Temperature								
	Rated voltage (V)	4	6.3	10	16	25	35	50	
	Z (-25°C) / Z (20°C)	6	3	2	2	2	2	2	
	Z (-40°C) / Z (20°C)	12	6	5	4	3	3	3	
Load Life	After 1,000 hours application of WV at 105°C, capacitor shall meet the characteristics requirements.								
	Capacitance change	Within ±20% of initial value							
	Tan δ	200% or less of initial specified value							
	Leakage current	Initial specified value or less							
Shelf Life		After leaving capacitors under no load at 105°C for 1,000 hours and applying voltage according to JIS C5102 and C5141, they meet the specified value for load life characteristics listed above.							

△ Dimensions

Dø x L (mm)

WV(SV) Cap (µF)	4 (5)	6.3 (10)	10 (13)	16 (20)	25 (32)	35 (44)	50 (63)		
0.1							4 x 7	1	
0.22							4 x 7	2.3	
0.33							4 x 7	3.5	
0.47							4 x 7	5	
1							4 x 7	10	
2.2							4 x 7	18	
3.3							4 x 7	23	
4.7						4 x 7	24	4 x 7	26
10				4 x 7	29	4 x 7	31	5 x 7	36
22		4 x 7	34	4 x 7	36	4 x 7	38	5 x 7	46
33		4 x 7	38	4 x 7	40	5 x 7	48	6.3 x 7	60
47	4 x 7	38	4 x 7	44	5 x 7	50	5 x 7	59	6.3 x 7
100	4 x 7	48	5 x 7	72	5 x 7	80	6.3 x 7	92	8 x 7
220	6.3 x 7	90	6.3 x 7	112	6.3 x 7	120	8 x 7	146	
330	8 x 7	142	8 x 7	150	8 x 7	162	8 x 7	180	
470	8 x 7	210	8 x 7	230					
								Case Size	Ripple

NOTE: Part Numbering System

(1)	(2)	(3)	(4)	1	Series	3	Tolerance
ESH	106	M	1H	2	Capacitance	4	Working Voltage

Ripple current (mA) at 105°C 120Hz



Aluminum Electrolytic Capacitor Type ELL

△ Features

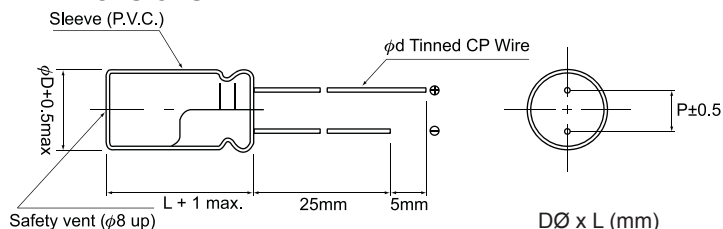
- Low Leakage current 85°C Series
- Low leakage current for timing
- Guaranteed long life (2,000 hours at 85° C)

△ Applications

- Suitable for use with high reliability equipment in the medical, telecom and consumer industry.



△ Dimensions



DØ	5	6.3	8	10	13	16	18
P	2	2.5	3.5	5	5	7.5	7.5
φd	0.5		0.6			0.8	
α	1				1.5		

△ Specifications

Item	Performance Characteristics									
Operating Temperature Range	-40 + 85°C									
Rated Voltage	6.3V ~ 100V									
Capacitance Range	0.1 ~ 10,000 μF									
Capacitance Tolerance	±20% (120Hz, 20°C)									
Leakage Current	0.02CV or 4 μA, whichever is greater after 2 minutes application of rated voltage.									
Dissipation Factor (120Hz, 20°C)	Rated voltage (V)	6.3	10	16	25	35	50	63	100	
	Tan δ (max.)	0.21	0.17	0.14	0.12	0.12	0.10	0.08	0.08	
Temperature Characteristics (120Hz)	Impedance Ratio / Stability at Low Temperature									
	Rated voltage (V)	6.3	10	16	25	35	50	63	100	
	Z (-25°C) / Z (20°C)	3	2	2	1.5	1.5	1.5	1.5	1.5	
	Z (-40°C) / Z (20°C)	5	4	3	2	2	2	2	2	
	After 2,000 hours application of WV at 85°C, capacitor shall meet the characteristics requirements.									
Load Life	Capacitance change	Within ±15% of initial value								
	Tan δ	150% or less of initial specified value								
	Leakage current	Initial specified value or less								
Shelf Life	After leaving capacitors under no load at 85°C for 1,000 hours and applying voltage according to JIS C5102 and C5141, they meet the specified value for load life characteristics listed above.									

NOTE: Part Numbering System

(1) (2) (3) (4)
ELL 106 M 1H

- 1 Series
- 2 Capacitance
- 3 Tolerance



Aluminum Electrolytic Capacitor

Type

ELL

Aluminum Electrolytic Capacitor Type ELL

Δ Dimensions

Dφ x L (mm)

WV(SV) Cap (μF)	6.3 (10)	10 (13)	16 (20)	25 (32)	35 (44)	50 (63)	63 (75)	100 (125)		
0.1-0.47						5 x 11		5 x 11		
1						5 x 11	10	5 x 11	19	
2.2						5 x 11	23	5 x 11	28	
3.3						5 x 11	40	5 x 11	45	
4.7				5 x 11	45	5 x 11	45	5 x 11	50	
10			5 x 11	55	5 x 11	70	5 x 11	70	6.3 x 11	75
22			5 x 11	85	5 x 11	100	6.3 x 11	110	6.3 x 11	110
33			5 x 11	100	6.3 x 11	140	6.3 x 11	140	8 x 11	165
47		5 x 11	110	6.3 x 11	140	6.3 x 11	170	8 x 11	190	8 x 11
100		6.3 x 11	180	8 x 11	230	8 x 11	280	10 x 12	300	10 x 16
220		8 x 11	310	10 x 12	370	10 x 16	400	10 x 20	440	13 x 20
330		10 x 12	400	10 x 16	420	10 x 20	490	13 x 20	550	13 x 25
470	10 x 12	390	10 x 16	530	10 x 20	550	13 x 20	660	13 x 25	680
1000	10 x 20	650	13 x 20	810	13 x 25	910	16 x 25	1010	16 x 25	1100
2200	13 x 25	1060	16 x 25	1200	16 x 25	1300	16 x 36	1440	18 x 36	1580
3300	16 x 25	1270	16 x 32	1420	16 x 36	1550	18 x 40	1720		
4700	16 x 32	1500	16 x 36	1650	18 x 36	1820				
6800	18 x 36	1760	18 x 36	1890						
10000	18 x 40	1900								
									Case size	Ripple

Ripple current (mA) at 85°C 120Hz



Aluminum Electrolytic Capacitor Type ESL - 7mm Height 85°C Low Leakage Series

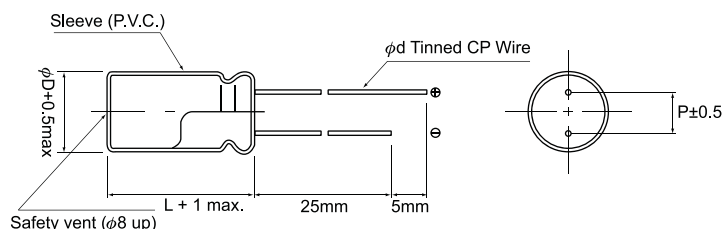
△ Features

- Low Leakage Current Series
- Highly reliable electrical performance
- Expected life (1,000 hours at 85°C)

△ Applications

- Excellent spacing with 7mm height

△ Specifications



Dφ	4	5	6	8
P	1.5	2.0	2.5	3.5
φd	0.45	0.45	0.45	0.5

Item		Performance Characteristics					
Operating Temperature Range		-40 + 85°C					
Rated Voltage		6.3V ~ 50V					
Capacitance Range		0.1 ~ 220 μF					
Capacitance Tolerance		±20% (120Hz, 20°C)					
Leakage Current		$I \leq 0.01CV$ or 3 μA, whichever is greater after 2 minutes application of rated voltage.					
Dissipation Factor (120Hz, 20°C)	Rated voltage (V)	6.3	10	16	25	35	50
	Tan δ (max.)	0.24	0.20	0.16	0.14	0.12	0.10
Temperature Characteristics (120Hz)	Stability at Low Temperature						
	Rated voltage (V)	6.3	10	16	25	35	50
	Z (-25°C) / Z (20°C)	4	3	2	2	2	2
	Z (-40°C) / Z (20°C)	8	6	4	4	3	3
Load Life	After 1,000 hours application of WV at 85°C, capacitor shall meet the characteristics requirements.						
	Capacitance change	Within ±20% of initial value					
	Tan δ	200% or less of initial specified value					
	Leakage current	Initial specified value or less					
Shelf Life		After leaving capacitors under no load at 85°C for 1,000 hours and applying voltage according to JIS C5102 and C5141, they meet the specified value for load life characteristics listed above.					

△ Dimensions

Dφ x L (mm)

WV(SV) Cap (μF)	6.3 (10)	10 (13)	16 (20)	25 (32)	35 (44)	50 (63)		
0.1							4 x 7	1
0.22							4 x 7	2.3
0.33							4 x 7	3.5
0.47							4 x 7	5
1							4 x 7	10
2.2							4 x 7	19
3.3							4 x 7	24
4.7					4 x 7	24	5 x 7	29
10	4 x 7	34	5 x 7	38	5 x 7	44	6.3 x 7	44
22	4 x 7	34	5 x 7	38	5 x 7	44	6.3 x 7	51
33	5 x 7	42	5 x 7	47	6.3 x 7	57	6.3 x 7	63
47	5 x 7	50	6.3 x 7	59	6.3 x 7	68	8 x 7	78
100	6.3 x 7	77	8 x 7	96	8 x 7	107		
220	8 x 7	130						
							Case Size	Ripple

Ripple current (mA) at 85°C 120Hz

NOTE:	Part Numbering System		1	Series
	(1)	(2) (3) (4)	2	Capacitance
	ESL	106 M 1H	3	Tolerance
			4	Working Voltage



Aluminum Electrolytic Capacitor Type GLZ

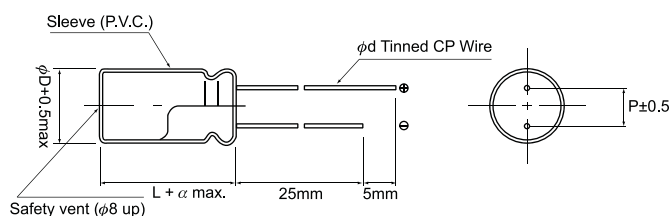
△ Features

- Designed to withstand high ripples
- Has low impedance characteristics
- Guaranteed long life (2,000 ~ 3,000 hours at 105° C)



△ Applications

- Suitable for use in high reliability switching power supply circuits.



DØ x L (mm)

DØ	5	6.3	8	10	13	16	18	22	25
P	2	2.5	3.5	5	5	7.5	7.5	10	12.5
φd		0.5			0.6		0.8		1
α	~100V	1			1.5		1.5		2
	160V~	1.5			2		2		2

△ Specifications

Item	Performance Characteristics											
Operating Temperature Range	-55 + 105°C (6.3 ~ 100V)				-40 + 105°C (160 ~ 400V)				-25 + 105°C (450V)			
Rated Voltage	6.3V ~100V											
Capacitance Range	0.47 ~ 15,000 μF											
Capacitance Tolerance	±20% (120Hz, 20°C)											
Leakage Current	6.3V ~ 100V						160V ~ 450V					
	0.03CV or 4 μA, whichever is greater after 2 minutes application of rated voltage.						CV 1000: I = 0.1CV + 40 μA max. (2 minutes) CV 1000: I = 0.4CV + 100 μA max. (2 minutes)					
Dissipation Factor	Rated voltage (V)	6.3	10	16	25	35	50	63	100	160~250	350	400~450
	Tan d (max.)	0.24	0.20	0.16	0.14	0.12	0.10	0.09	0.09	0.15	0.20	0.25
(120Hz, 20°C)	For capacitance of more than 1,000μF, add 0.02 for every increase of 1,000μF.											
Temperature Characteristics	Impedance Ratio / Stability at Low Temperature											
(120Hz)	Rated voltage (V)	6.3~10	16~25	35~50	63~100	160~200	250	350	400	450		
	Z (-55°C) / Z (20°C)	5	4	3	-	-	-	-	-	-	-	-
	Z (-40°C) / Z (20°C)	-	-	-	3	4	6	8	10	-	-	-
	Z (-25°C) / Z (20°C)	-	-	-	2	3	3	4	6	15	-	-
Load Life	After a certain hour application of rated voltage and ripple current at 105°C, capacitor shall meet the characteristics requirements mentioned below.											
	5 ~ 6 φ : 2,000 hours 8 ~ 10 φ : 2,000 hours ≥ 13 φ : 3,000 hours											
	Capacitance change	Within ±20% of initial value										
	Tan d	200% or less of initial specified value										
	Leakage current	Initial specified value or less										
Shelf Life	After leaving capacitors under no load at 105°C for 1,000 hours and applying voltage according to JIS C5102 4-3, capacitor shall meet the specified value as load life characteristics listed above.											

△ Frequency coefficient of allowable ripple current

WV	Cap(μF) \ Frequency	50Hz	120Hz	300Hz	1KHz	10KHz~
6.3 ~ 100	~ 47	-	0.17	0.4	0.65	1
	100 ~ 220	0.3	0.5	0.65	0.8	1
	330 ~ 680	0.57	0.71	0.82	0.9	1
	1000 ~ 15000	0.75	0.87	0.96	0.98	1
160 ~ 450	0.47 ~ 220	0.8	1	1.25	1.4	1.6
	330 ~ 470	0.9	1	1.1	1.13	1.15



Aluminum Electrolytic Capacitor

Type **GLZ**

Δ Dimensions

Dφ x L (mm)

Cap (μF)	WV	6.3V			10V			16V			25V		
		Size	Imp.	Ripple	Size	Imp.	Ripple	Size	Imp.	Ripple	Size	Imp.	Ripple
4.7											5 x 11	1.50	160
10											5 x 11	1.50	160
22		5 x 11	1.50	160	5 x 11	1.50	160	5 x 11	1.50	160	5 x 11	1.50	160
33		5 x 11	1.50	160	5 x 11	1.50	160	5 x 11	1.50	160	5 x 11	1.50	160
47		5 x 11	1.50	160	5 x 11	1.50	160	5 x 11	1.50	160	5 x 11	1.50	160
100		5 x 11	1.50	160	5 x 11	1.50	160	6 x 11	0.50	250	6 x 11	0.50	250
220		6 x 11	0.50	250	6 x 11	0.50	250	8 x 11	0.28	410	8 x 11	0.28	410
330		6 x 11	0.50	250	8 x 11	0.28	410	8 x 11	0.28	410	10 x 12	0.19	600
470		8 x 11	0.28	410	8 x 11	0.28	410	10 x 12	0.19	600	10 x 16	0.14	800
680		10 x 12	0.19	600	10 x 12	0.19	600	10 x 16	0.14	800	10 x 20	0.11	1000
1000		10 x 12	0.19	600	10 x 16	0.14	800	10 x 20	0.11	1000	13 x 20	0.075	1250
1500		10 x 20	0.11	1000	10 x 20	0.11	1000	13 x 20	0.075	1250	16 x 25	0.038	1900
2200		13 x 20	0.075	1250	13 x 20	0.075	1250	13 x 25	0.057	1550	16 x 25	0.038	1900
3300		13 x 20	0.075	1250	13 x 25	0.057	1550	16 x 25	0.038	1900	16 x 31	0.033	2350
4700		16 x 25	0.038	1900	16 x 25	0.038	1900	16 x 31	0.033	2350	18 x 35	0.030	2700
6800		16 x 25	0.038	1900	16 x 31	0.033	2350	18 x 35	0.030	2700	18 x 40	0.027	3300
10000		16 x 31	0.033	2350	18 x 35	0.030	2700	18 x 40	0.027	3300			
15000		18 x 35	0.030	2700	18 x 40	0.027	3300						

Cap (μF)	WV	35V			50V			63V			100V		
		Size	Imp.	Ripple	Size	Imp.	Ripple	Size	Imp.	Ripple	Size	Imp.	Ripple
0.47					5 x 11	7.50	25				5 x 11	43.0	20
1					5 x 11	5.30	40				5 x 11	20.0	30
2.2					5 x 11	4.50	55				5 x 11	9.80	44
3.3					5 x 11	3.90	65				5 x 11	6.60	58
4.7		5 x 11	1.50	160	5 x 11	3.50	90	5 x 11	4.70	68	5 x 11	4.60	74
10		5 x 11	1.50	160	5 x 11	2.10	120	5 x 11	2.10	110	6 x 11	1.80	130
22		5 x 11	1.50	160	5 x 11	1.80	150	6 x 11	0.98	180	8 x 11	0.68	230
33		5 x 11	1.50	160	6 x 11	0.65	250	6 x 11	0.71	220	10 x 12	0.46	320
47		6 x 11	0.50	250	6 x 11	0.65	250	8 x 11	0.65	310	10 x 16	0.37	420
100		8 x 11	0.28	410	8 x 11	0.36	340	10 x 12	0.31	390	13 x 20	0.18	580
150		8 x 11	0.28	410	10 x 12	0.26	490	10 x 16	0.25	440	13 x 25	0.13	710
220		10 x 12	0.19	600	10 x 16	0.18	650	10 x 20	0.20	700	16 x 25	0.10	890
330		10 x 16	0.14	800	10 x 20	0.15	810	13 x 20	0.12	980	16 x 25	0.090	1080
470		10 x 20	0.11	1000	13 x 20	0.13	1100	13 x 25	0.081	1200	16 x 31	0.076	1310
680		13 x 20	0.075	1250	13 x 25	0.10	1200	16 x 25	0.058	1300	16 x 35	0.064	1410
1000		13 x 25	0.057	1550	16 x 25	0.058	1600	16 x 31	0.049	1380	18 x 40	0.047	4520
1500		16 x 25	0.038	1900	16 x 31	0.040	2000	18 x 35	0.038	1750			
2200		16 x 31	0.033	2350	18 x 35	0.035	2300	18 x 40	0.032	2120			
3300		18 x 35	0.030	2700									
4700		18 x 40	0.027	3300									

• Impedance: (Ω) Max. 20°C 100KHz • Allowable ripple current: (mA) at 105°C 100KHz

Cap (μF)	WV	160V		200V		250V		350V		400V		450V	
		Size	Imp.	Size	Imp.	Size	Imp.	Size	Imp.	Size	Imp.	Size	Imp.
0.47		6 x 11	12	6 x 11	12	6 x 11	12	8 x 11	11				
1		6 x 11	17	6 x 11	17	6 x 11	17	10 x 12	17	10 x 12	16	10 x 12	18
2.2		6 x 11	25	6 x 11	25	8 x 11	29	10 x 16	31	10 x 16	27	10 x 20	29
3.3		8 x 11	36	8 x 11	36	10 x 12	42	10 x 16	38	10 x 20	36	13 x 20	41
4.7		8 x 11	43	10 x 12	50	10 x 12	50	10 x 20	49	10 x 20	43	13 x 20	49
10		10 x 12	70	10 x 16	80	10 x 20	88	13 x 20	82	13 x 25	72	16 x 25	75
22		10 x 20	130	10 x 20	140	13 x 25	155	16 x 25	130	16 x 25	110	16 x 31	115
33		13 x 20	180	13 x 25	190	13 x 25	190	16 x 31	160	16 x 31	140	18 x 35	145
47		13 x 25	220	13 x 25	220	16 x 25	230	18 x 35	200	18 x 35	170	20 x 40	175
100		16 x 25	330	16 x 31	335	18 x 35	340	20 x 40	290	22 x 50	350	25 x 50	350
220		18 x 35	500	18 x 40	515	20 x 40	525	25 x 50	550				
330		20 x 40	900	22 x 40	1100	22 x 50	1150						
470		22 x 50	1200	22x 50	1310	25 x 50	1350					Case Size	Ripple

• Allowable ripple current (mA) at 105°C 120Hz



Electric Double Layer Capacitor Type DB

Δ Features

- Small size, large capacity, excellent voltage holding
- Uniform 5mm Pitch of terminal spacing
- Wider temperature range (-25 ~ +70° C) than battery makes periodic changes unnecessary

Δ Applications

- Ideal for backing up of CMOS's, Microcomputers, RAM's and the like used in VCR's, tuners, TV sets, Telephone sets and others



Δ Specifications

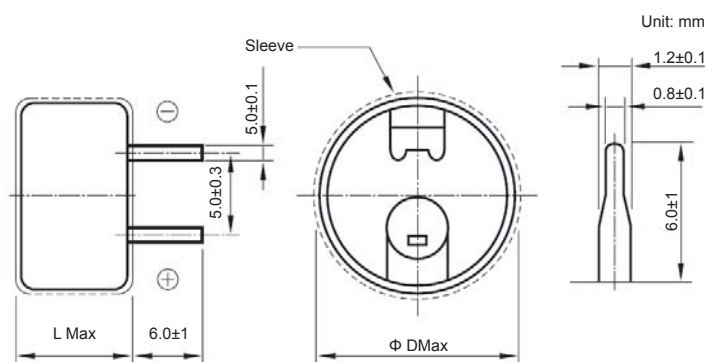
Item	Performance						
Category temperature range (°C)	-25 to +70						
Tolerance at rated capacitance (%)	-20 to +80						
Internal resistance at 1kHz	Rated Capacitance (F)	0.047	0.1	0.22	0.33	0.47	1.0
	Internal Resistance (Ω)	120	75	75	75	30	30
Characteristics at high and low temp	Percentage of Capacitance Change	Within ±30% of value at 20°C					
	Internal Resistance	Less than five times the value at 20°C					
Endurance	Test time	1000 hours					
	Percentage of capacitance change	Within ±30% of the initial measure value					
	Internal Resistance	Within four times the initial specified value					
Shelf Life (70°)	Test time: 1000 hours : same as endurance						

Δ Standard Ratings

Rated Voltage (V)	Rated Capacitance (F)	ΦDxL(mm)
5.5	0.047	13.5x7.5
5.5	0.1	13.5x7.5
5.5	0.22	13.5x7.5
5.5	0.33	13.5x7.5
5.5	0.47	21.5x8.0
5.5	1.0	21.5x8.0

NOTE: Part Numbering System
(1) (2) (3) (4)
DB 106 M 1H

- 1 Series
- 2 Capacitance
- 3 Tolerance
- 4 Working Voltage





Ceramic Disc Capacitors Type CDC

△ Features

- Linear temperature coefficient of capacitance.
- High stability of capacitance.
- Low loss at wide range of frequency.

△ Part Numbering

<u>CDC</u>	<u>101</u>	<u>CG</u>	<u>1H</u>	<u>K</u>	<u>□</u>	<u>□</u>
(1)	(2)	(3)	(4)	(5)	(6)	(7)

- (1) Type
- (2) Nominal Capacitance
- (3) Temperature Characteristics
- (4) Rated Voltage
- (5) Capacitance Tolerance
- (6) Lead type (Omitted in straight leads)
- (7) Suffix (Omitted in bulk package)

△ Applications

- Temperature compensation of resonant circuit and filters
- Where low losses and high stability of capacitance tolerance and high insulation resistance are required.

(2) Nominal Capacitance Designation

Stated in three digits and in units of pico farads (pF). The capacitance shall be expressed in a 3 digit code. The first and second digits identify the first and second significant figures of the capacitance, the third digit identifies the multiplier. However, when capacitance is below 10pF there are decimal digits included, they are stated as D. Please check examples below:

Symbol	Capacitance (pF)
D75	0.75
5D0	5.0
100	10
101	100

(3) Temperature Characteristics

Class I (Temperature Compensating Type)

Code	SL/GP
Temp. Range	-25°C to 105°C
Temp. Coeff.	+350ppm to -1000ppm/°C

Class II (High Dielectric Type)

Code	Y5F(YF)/Y5P(YP)	Y5V(YV)/Z5V(ZV)	Y5U(YU)/Z5U(ZU)
Temp. Range	-25°C to 85°C	-25°C to 85°C	-25°C to 85°C
Temp. Coeff.	±10%	+20% to -30%	+20% to -55%

(4) Rated Voltage

Symbol	Rated Voltage	VDC
1H	50	50V
2A	100	100V
2H	500	500V
3A	1000	1kV

(5) Capacitance Tolerance

Symbol	Tolerance	Capacitance Range
K	±10%	
M	±20%	

Other nonstandard values are available on special request.

(6) Lead Type

Use the letter "C" when crimped leads are needed.

(7) Suffix

Use the letter "T" when taped/box packages are needed.



Ceramic Disc Capacitors

Type CDC

Δ Electrical Specifications (Class I, T.C. Type)

Item	Test Method	Requirements
Operating Temp. Range		-25°C to +85°C
Rated Voltage		50VDC - 100VDC
Dielectric Withstanding Voltage	250% of the rated voltage for 1 to 5 seconds	No damage occurs when the test voltage is applied between terminals
Capacitance	Measured at 1MHz, 5Vrms Max. and 20°C	Within the specified tolerance Standard capacitance tolerance ±0.25pF (1 to 5pF) ±0.50pF (1 to 10pF) ±1pF (10pF) ±5% (Over 10pF E24 series) ±10% (Over 10pF E24 series)
Q-Factor		Cap. <30pF: Q≥400+20 X C (C:Rated capacitance in pF) Cap. ≥30pF: Q≥1000
Insulation Resistance	Measured at the rated voltage and 1 Minute Electrification	I.R. ≥ 10,000MΩ
Temperature Coefficient of Capacitance	Temperature Range: -25°C to +85°C Reference Temperature: 20°C $T.C. = \frac{\Delta C}{C_{20} \times \Delta T}$	Temperature coefficient tolerance
		Capacitance (pF) Rated temperature coefficient (ppm/°C)
		NPO SL
		1 to 2 ±250 +350
		3 ±120 to
		4 & Up ±60 -1000

Δ Electrical Specifications (Class II High-K Type)

Item	Test Method	Requirements
Operating Temp. Range		-25°C to +85°C
Rated Voltage		25VDC - 500VDC
Dielectric Withstanding Voltage	250% of the rated voltage for 1 to 5 seconds	No damage occurs when the test voltage is applied between terminals
Capacitance	Measured at 1MHz, 5Vrms Max. and 20°C	Within the specified tolerance Standard capacitance tolerance [Y5F/Y5P]: ±10% (In E-12 Series) [Y5T]: ±20% (In E-6 Series) [Y5U/Z5U]: ±20% (In E-6 Series) [Y5V/Z5V]: +80%, -20% (In E-3 Series)
Dissipation Factor (tan φ)		[Y5F/Y5P, Y5T, Y5U/Z5U]: tan φ ≤2.5% [Y5V/Z5V]: tan φ ≤5.0%
Insulation Resistance	Measured at the rated voltage and 1 Minute Electrification	Cap. ≤ 0.02μF: I.R. ≥ 10000MΩ Cap. > 0.02μF: CR products ≥200MΩ · μF
Temperature Coefficient of Capacitance	Capacitance Change = $\frac{\Delta C}{C_{20}} \times 100\%$ ΔC: Capacitance drifts in the pF from the capacitance value at 20°C over the specified temperature range C20: Capacitance Value in pF at the specified reference temperature of 20°C	Temp. Char.
		Max. Cap. Change
		Temp. Range
		Y5F/Y5P ±10% -25°C ~ +85°C
		Y5T +20% ~ -30% -25°C ~ +85°C
		Y5U/Z5U +20% ~ -55% -10°C ~ +85°C
		Y5V +30% ~ -80% -25°C ~ +85°C
		Z5V +30% ~ -80% +10°C ~ +85°C



Ceramic Disc Capacitors Type CDC

Δ Dimensions (Rated 50VDC - 100VDC)

Temperature Coefficient	"D" Max mm T.C. Code	5	6.5	8	9.5	10.5	12.5	Capacitance Change(ppm/°C)
NPO	CG	1 to 47	51 to 100	110 to 150	160 to 220	240 to 270	300 to 390	0±60
SL/gp*	SL	1 to 180	200 to 330	360 to 470	520 to 680	750 to 1000	NIL	+350~-1000

Note:

*SL/GP is for general purpose capacitor with temperature coefficient of +350 to -1000ppm/°C.

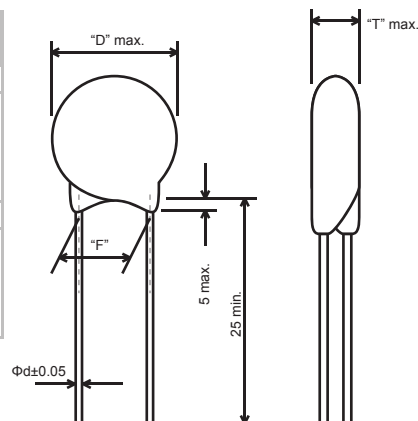
**Other sizes of lead spacing are available upon request.

Δ Features

W.V. (DC)	Temp.Char.Capacitance Range (PF)					
	NP0(CH)	SL	Y5F/Y5P	Z5U	Z5V	DIA(min)
50V/100V	0.5~47	33~150	100~2200	1000~5000	3000~10000	5±1
	60~68	180~220	3000	5600~6800	-	6±1
	75~100	250~330	3900	7500~10000	12000~22000	7±1
	120~150	390	4700~6800	-	-	8±1
	180~200	470~560	-	-	-	9±1
	220~270	680~820	7500~8200,10000	20000~22000	-	10±1
	300~330	-	-	-	-	12±1

Voltage	Capacitance (μF)		D.F.	Dimensions			
	(Y5U/Z5U)	(Y5V/Z5V)	(% MAX.)	D	T	F	d
50v		0.022	5.0	5.0	3.5	2.5±1.0	0.5
	0.047	0.047		6.0		5.0±1.0	0.6
		0.1		8.0		6.3±1.0	
	0.1			8.4		10.0±1.0	
100v		0.022	5.0	5.0	3.5	2.5±1.0	0.5
	0.047	0.047		6.0		5.0±1.0	0.6
		0.1		8.0		6.3±1.0	
	0.1			8.4		10.0±1.0	

Unit: mm





High Voltage Ceramic Disc Capacitor Type CKD

Δ Features

- Wide operating temperature range: -25°C to 125°C
- Two kinds of Capacitors for "DC circuit use" and Pulse Circuit Use" are available
- Low loss at wide range of frequency and stable against pulse voltage
- Miniaturized type applying new ceramic dielectrics
- Flame retardent insulating coating applied

Δ Part Numbering

CKD 101 YF 3A K □ □
(1) (2) (3) (4) (5) (6) (7)

- (1) Type
(2) Nominal Capacitance
(3) Temperature Characteristics
(4) Rated Voltage
(5) Capacitance Tolerance
(6) Lead type (Omitted in straight leads)
(7) Suffix (Omitted in bulk package)

Δ Applications

- DC and pulse high voltage circuit
- Resonance circuit in F.B.T. with inductor for TV set
- Snubber circuit of switching power supply

(2) Nominal Capacitance Designation

Stated in three digits and in units of pico farads (pF). The capacitance shall be expressed in a 3 digit code. The first and second digits identify the first and second significant figures of the capacitance, the third digit identifies the multiplier. However, when capacitance is below 10pF there are decimal digits included, they are stated as D. Please check examples below:

Symbol	Capacitance (pF)
D75	0.75
5D0	5.0
100	10
101	100

(3) Temperature Characteristics

Class I (Temperature Compensating Type)

Code	SL/GP
Temp. Range	-25°C to 105°C
Temp. Coeff.	+350ppm to -1000ppm/°C

Class II (High Dielectric Type)

Code	Y5F(YF)/Y5P(YP)	Y5V(YV)/Z5V(ZV)	Y5U(YU)/Z5U(ZU)
Temp. Range	-25°C to 85°C	-25°C to 85°C	-25°C to 85°C
Temp. Coeff.	±10%	+20% to -30%	+20% to -55%

(4) Rated Voltage

Symbol	Rated Voltage	VDC
2H	500	500V
3A	1000	1kV
3D	2000	2kV
3F	3000	3kV
3G	4000	4kV
3J	6000	6kV
3K	8000	8kV
4A	10000	10kV
4C	15000	15kV

(5) Capacitance Tolerance

Symbol	Tolerance	Capacitance Range
K	±10%	
M	±20%	

Other nonstandard values are available on special request.

(6) Lead Type

Use the letter "C" when crimped leads are needed.

(7) Suffix

Use the letter "T" when taped/box packages are needed.



Ceramic Disc Capacitor

Type

CKD

High Voltage Ceramic Disc Capacitor Type CKD

Δ Specifications

Item	Requirements			
	Class I	Class II		
Operating Temperature Range	-25°C to 105°C	[WV<4kVDC]: -25°C to 105°C [WV≥4kVDC]: -25°C to 85°C		
Rated Voltage	1kVDC to 3kVDC	500VDC to 15kVDC		
Dielectric Withstanding Voltage	150% of the rated voltage for 1 to 5 seconds	150% of the rated voltage for 1 to 5 seconds		
Capacitance	Within the specified tolerance, when measured at 1MHz, 1 to 5Vrms at 20°C	Within the specified tolerance, when measured at 1MHz, 1 to 5Vrms at 20°C		
Q or Dissipation Factor	Capacitance ≥ 30pF Q ≥1000	D.F. (tanθ)≤2.5%, when measured at 1kHz, 1 to 5 Vrms at 20°C		
	Capacitance , 30pF Q ≥400+20 X C			
	(C: Capacitance in pF)			
Insulation Resistance	10,000MΩ min. at 500V and 1 minute electrification.	10,000MΩ min. at 500V and 1 minute electrification.		
Temperature Characteristics	SL/GP: +350 to -1000ppm/°C over the temperature range of 20°C to 85°C	Temp. Char.	Cap. Change	Temp. Range
		Y5F/Y5P	±10% max.	-25°C to 85°C
		Y5V/Z5V	+20%, -30%	-25°C to 85°C
		Y5U/Z5U	+20%, -55%	-25°C to 85°C
		The Reference Temperature: 20°C		



Ceramic Disc Capacitor

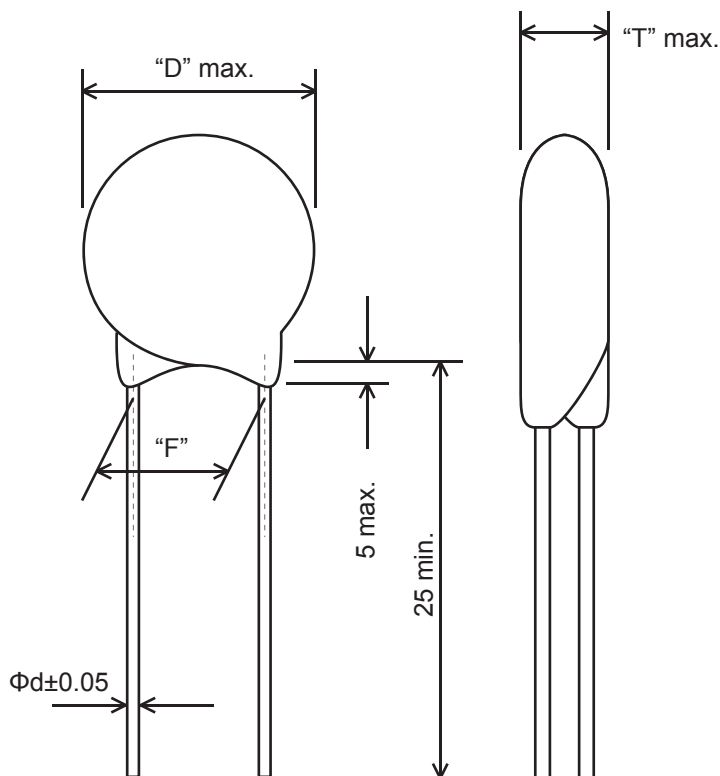
Type

CKD

High Voltage Ceramic Disc Capacitor Type CKD

Δ Capacitance Chart

Disc Dia. mm (in.)		Available Capacitance Range, pF										
D ± 2 (± 0.079)	T max.	Y5F (Y5P)			(Y5U/Z5U)					(Y5V/Z5V)		
		1000V	2000V	3000V	1000V	2000V	3000V	4000V	5000V	1000V	2000V	3000V
4.0 (0.157)	3.0 (0.118)	100-270	100-150	100-150	330-680	-	-	-	-	820-1200	-	-
5.0 (0.197)	4.0 (0.157)	330-470	180-270	100-150	820-1200	330-470	-	-	-	1500	-	-
6.0 (0.236)	4.0 (0.157)	560	330	180	1500	560-820	-	-	-	1800	1000-1200	-
7.0 (0.276)	4.0 (0.157)	680-1200	390-560	220-330	1800-2700	1000-1500	390-1000	-	-	2200-3900	1500-2200	1200-1500
8.0 (0.315)	4.0 (0.157)	1500	680-820	390-560	3300-3900	1800	1200	100-820	-	-	2700	1800
9.0 (0.354)	5.0 (0.197)	1800	1000-1200	680	4700	2200-2700	1500-1800	-	-	4700-5600	3300-3900	2200-2700
10.0 (.394)	5.0 (0.197)	-	1500	820-1000	5600	3300-3900	2200	1000	-	6800-8200	-	-
11.0 (0.433)	5.0 (0.197)	2200-2700	1800	1200	6800	4700	2700-3300	1200-2200	100-1000	-	4700-6800	3300-3900
13.0 (0.512)	6.0 (0.236)	3300	2200-2700	1500-1800	8200-12000	5600-8200	3900-5600	2700-3300	1200-2200	10000-15000	8200	4700-6800
15.0 (0.591)	6.0 (0.236)	3900	3300-3900	2200-2700	15000	10000	6800	3900-4700	2700-3300	22000	10000-15000	8200
19.0 (0.748)	7.0 (0.276)	-	-	3300-3900	-	-	8200-10000	5600-6800	3900-4700	-	-	10000





Ceramic Disc Capacitor

Type

CKD

High Voltage Ceramic Disc Capacitor Type CKD

Δ Capacitance Chart

W.V. (DC)	TEMP.CHAR./CAPACITANCE RANGE(PF)					DIA (mm)
	NPO(CH)	SL	B(Y5P)(Y5E)	E(Z5U)	F(Z5V)	
3KV	1~18	15~47	100~470	1000~1200	1800~2200	6±1
	20~30	50~68	680~820	1500	2700~3300	7±1
	33~39	82~100	1000	1800~2000	3900	8±1
	47~56	120	1200	2200~2700	4700~5600	9±1
	62~68	150~180	1500	3000~3300		10±1
	72~82	200~220	1800		6800~8200	11±1
	90~100	270	2000~2200	3900~4700	10000	12±1
	110~120	300~330				13±1
	150		2700~3300	5000~6800		14±1

W.V. (DC)	TEMP.CHAR./CAPACITANCE RANGE(PF)				DIA (mm)
		SL	Y5P	E(Z5U)	
6KV		5~22	100~330		6±1
		27~39	390~500		7±1
		47~56	560~680	1000	8±1
		68			9±1
		82	820	1500	10±1
				2200	11±1
		100~120	1000		12±1
			1500		13±1
		150			14±1
				3300	15±1

W.V. (DC)	TEMP.CHAR./CAPACITANCE RANGE(PF)			DIA (mm)
		B(Y5P)		
10KV		100~120		7±1
		150~180		8±1
		200~220		10±1
		270~330		12±1
		470~560		13±1
		680		14±1



Ceramic Disc Capacitor Temperature Characteristics

Fig. 1A (T. C. PPM/°C) NPO

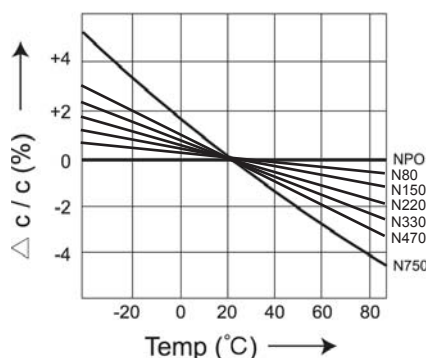
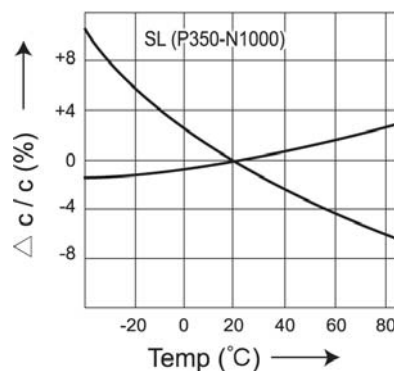
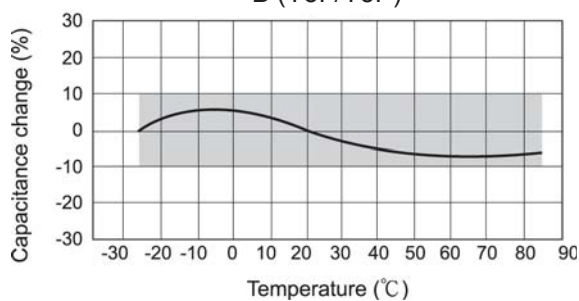


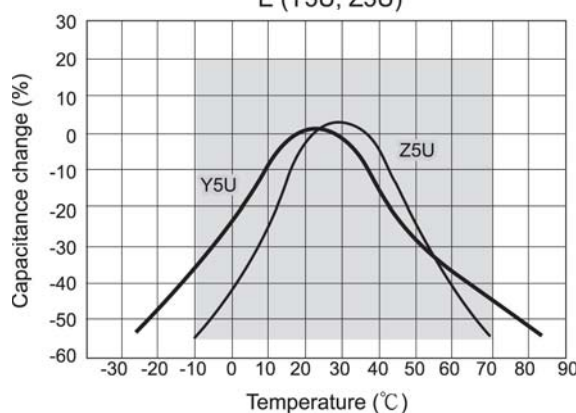
Fig. 1B SL (P350-N1000)



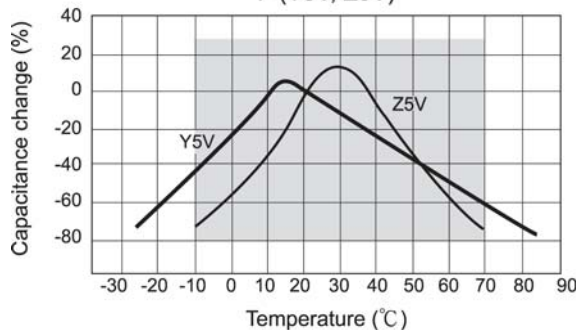
B (Y5F/Y5P)

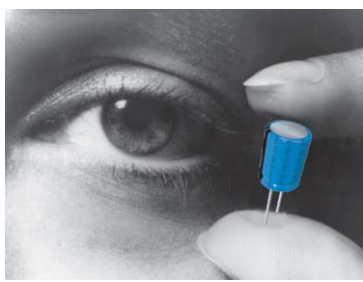


E (Y5U, Z5U)



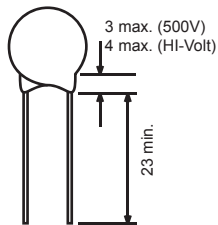
F (Y5V, Z5V)



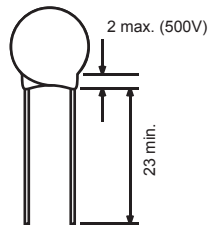


Δ Dimensions

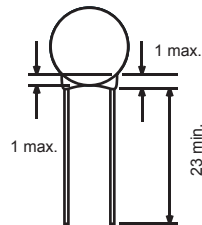
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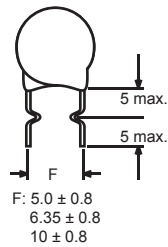
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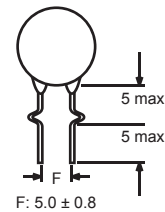
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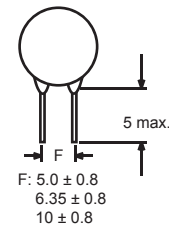
Style 4



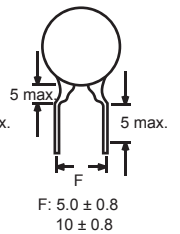
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Style 6

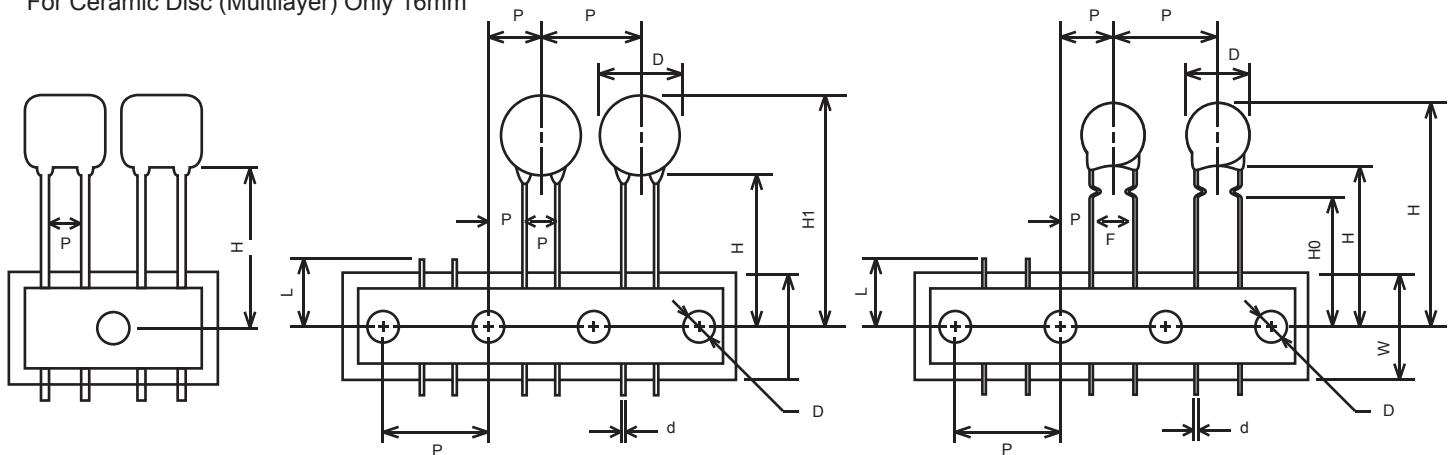


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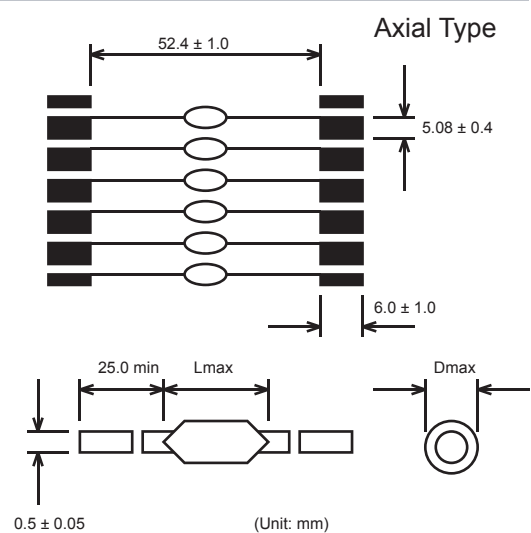
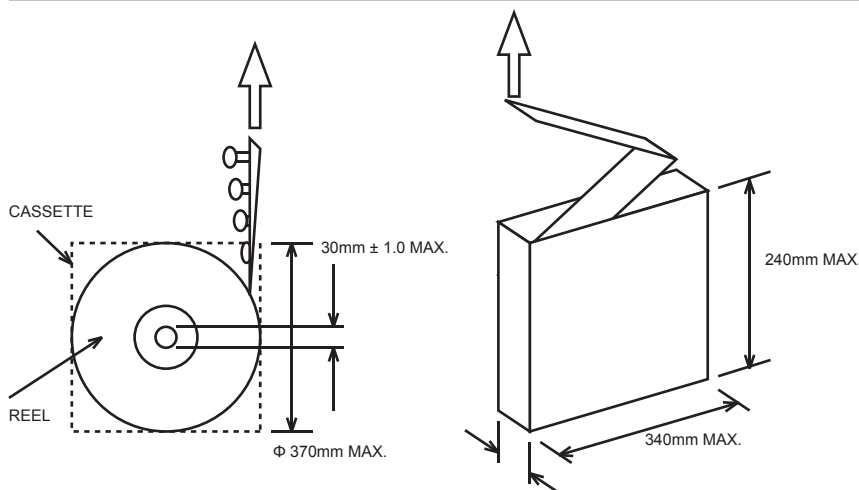


Taping Lead Taping Capacitors For Automatic Insertion

* For Ceramic Disc (Multilayer) Only 16mm



Symbol	D	d	P	P0	P1	P2	F	H	H0	H1	D0	W	L	t
Value	Max 11.0	0.6	12.7	12.7	3.85	6.35	5.0	16.0 20.0	16.0	Max 32.25	4.0	18.0	Max 11.0	0.7
Tolerance	-	0.06 - 0.05	±1	±0.2	±0.7	±1	+0.8 -0.2	+1.5 -1.0	±0.5	-	±0.2	±0.5	-	±0.2





Multilayer Ceramic Capacitor Type CMA

Δ Application

- Guaranteed long life (2,000 hours at 85° C)

Our Axial leaded, Epoxy Coated Multilayer Ceramic Capacitors are built by superior moisture and shock resistant epoxy coating. These capacitors are supplied in both bulk or taping and reel package for automatic insertion and sequencing with any leaded components.

Δ Ordering Code

<u>CMA</u>	<u>101</u>	<u>CG</u>	<u>1H</u>	<u>J</u>
1	2	3	4	5

1. TYPE

CMA	AXIAL MULTILAYER CERAMIC CAPACITOR
-----	------------------------------------

2. RATED CAPACITANCE

CODE	
1D5	1.5
102	1,000
223	22,000
104	100,000

3. TEMPERATURE CHARACTERISTICS

CODE	NPO	CODE	X7R	Z5U	Y5V
TEMP COEFF. (PPM/°C)	0±30	CAP CHANGE (%)	±15	+22, -56	+22, -82

4. RATED VOLTAGE

CODE	
1C	16V
1E	25V
1H	50V
1F	63V
2A	100V
2B	200V
2H	500V

5. TOLERANCE

CODE		CODE	
B	±0.1PF	J	±5%
C	±0.25PF	K	±10%
D	±0.5PF	M	±20%
F	±1PF	Z	+80% -20%
G	±2PF	P	+100% -0%



Multilayer Ceramic Capacitor

Type

CMA

Multilayer Ceramic Capacitor Type CMA

Δ Application

Spec. \ T.C.		NPO				X7R				Z5U		Y5V	
Size		R15		R18		R15		R18		R15	R18	R15	R18
CAP / WVDC		50	100	50	100	50	100	50	100	50		50	
1-100pF	1-100pF												
120	121												
150	151												
180	181												
220	221												
270	271												
330	331												
390	391												
470	471												
560	561												
680	681												
820	821												
1000	102												
1200	122												
1500	152												
1800	182												
2200	222												
2700	272												
3300	332												
3900	392												
4700	472												
5600	562												
6800	682												
8200	822												
0.01uF	103												
0.012	123												
0.015	153												
0.018	183												
0.022	223												
0.027	273												
0.033	333												
0.039	393												
0.047	473												
0.056	563												
0.068	683												
0.082	823												
0.10	104												
0.12	124												
0.15	154												
0.18	184												
0.22	224												
0.33	334												
0.47	474												
0.56	564												
0.68	684												
0.82	824												
1.0	105												
1.5	155												
2.2	225												

Available
Not Available



Multilayer Ceramic Capacitor

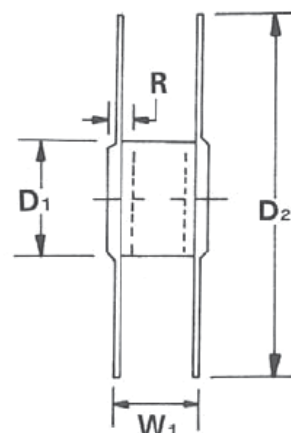
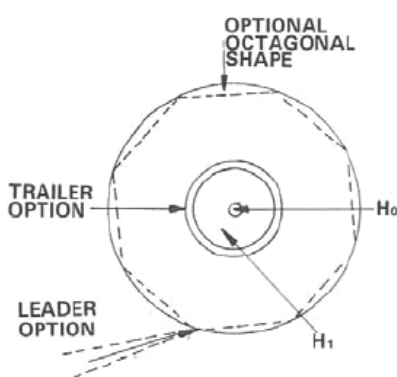
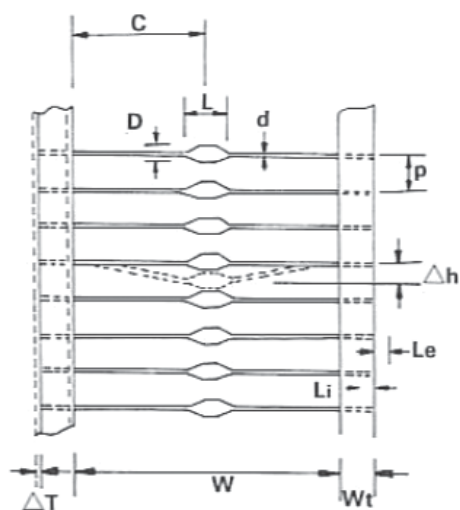
Type

CMA

Fixed Component
Capacitors

Multilayer Ceramic Capacitor Type CMA

Δ Dimensions



Description	Symbol	Dimensions in [mm]
Pitch of Component	P	0.200±0.020 [5.08±0.51]
Cumulative Tolerance of P over 5 consecutive units		±0.0059 [±0.15]
Tape Width	Wt	0.236±0.039 [6.0±1.0]
Lead Wire Protrusion	Le	0.236±0.039 [6.0±1.0]
Lead Extensions into Tape	Li	0.062 max [0.8]
Offset Between Tapes	ΔT	0.031 max [0.8]
Width Between Tapes	Wt	2.06±0.062 [52.37±1.57]
Pilot Hole DIA	H1	0.315 [8.0]
Centered	C	±0.030 [±0.76]
Core Diameter	D1	1.3756-3.260 [34.90-92.10]
Reel Diameter	D2	14 max [355.60]
Core Width	W1	2.750±0.060 [69.85±1.52]
Recess Width	R	0.374 min [9.5]
Arbor Hole	H0	0.510-0.608 [15.5-18.0]
Deflection From Nominal Position	ΔH	0.074 max [1.19]
Leader Option	L	12 min [304.8]

Δ Packaging Quantity

Size Code	Taping Type		Bulk Type Quantity/Bag
	Quantity/Reel	Quantity/Box	
R15	8,000	5,000	1,000
R20	8,000	5,000	1,000



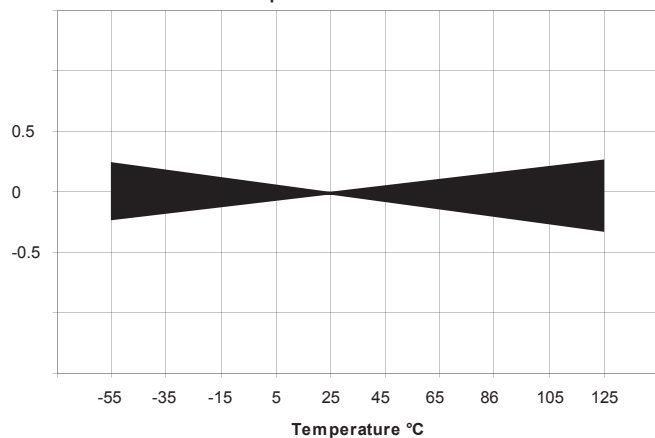
Multilayer Ceramic Capacitor

Type

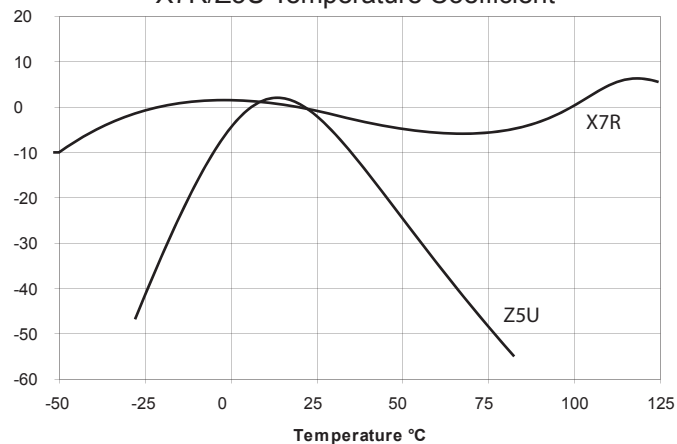
CMA

Fixed Component
Capacitors

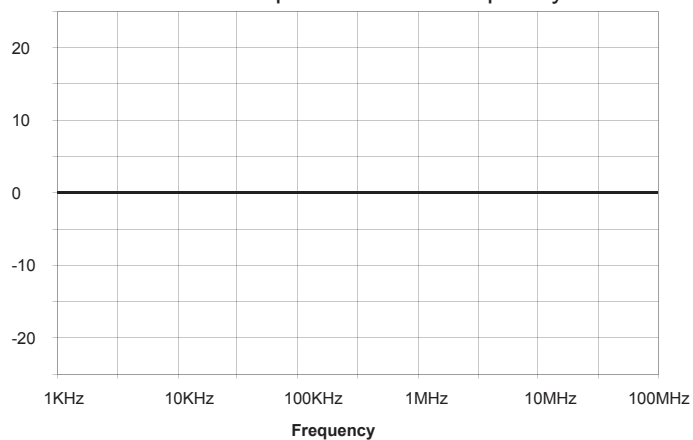
NPO Temperature Coefficient



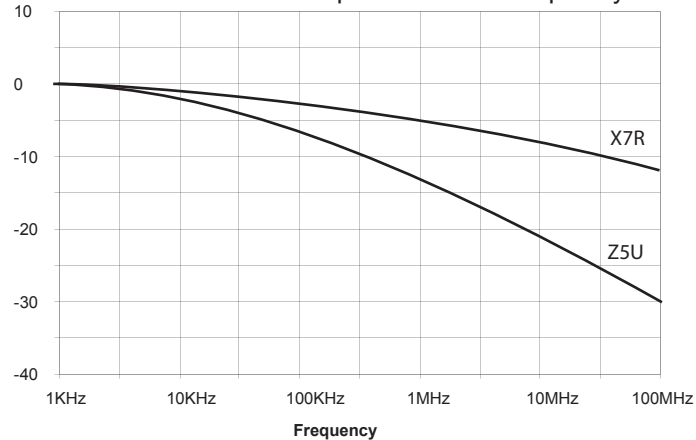
X7R/Z5U Temperature Coefficient



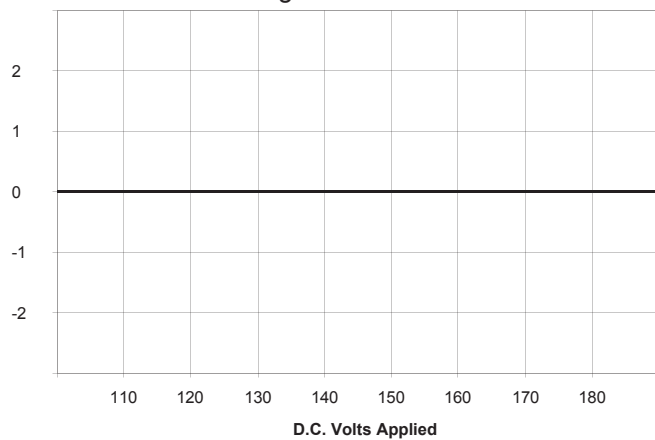
NPO Δ Capacitance vs. Frequency



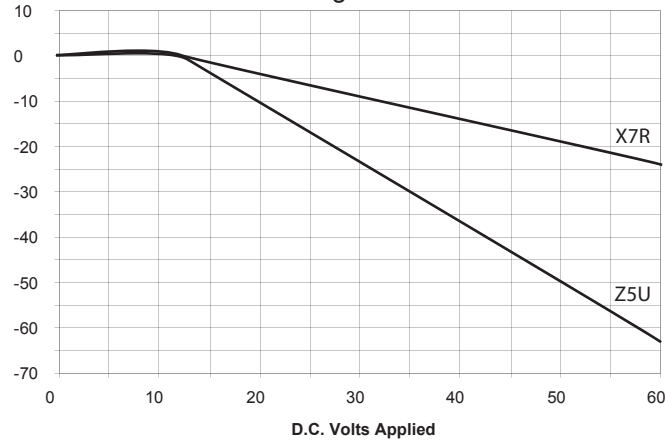
X7R/Z5U Δ Capacitance vs. Frequency



NPO Voltage Coefficient



X7R/Z5U Voltage Coefficient





Multilayer Ceramic Capacitor Type CMR

Δ Application

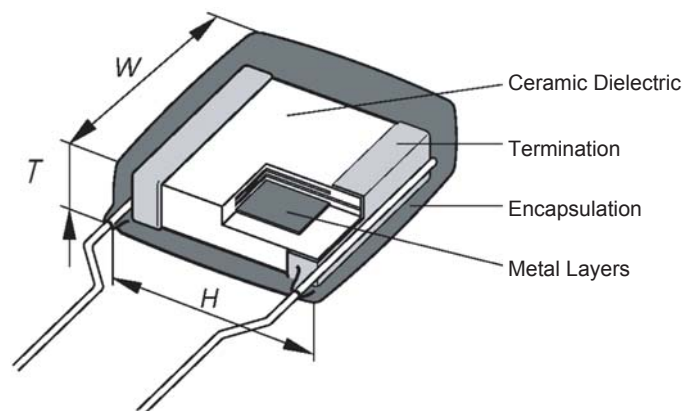
NPO: Temperature compensation type, have little or no change in capacitance with variation in temperature. Hence, they are used in radio frequency oscillators, precision timing circuits, ultra stable amplifiers, etc.

X7R: Temperature stable type for by-pass and decoupling in radio and television receivers, computer servo systems. Audio tone and coupling, etc. where moderate capacitance variations are permissible and dissipation factor is not critical.

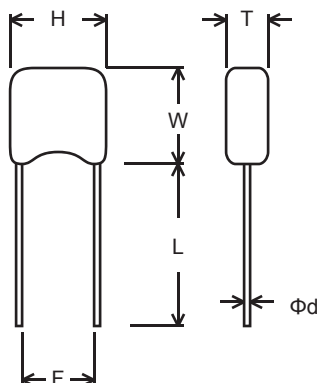
Z5U/ Y5V: General type for by-pass and filtering applications.

- Guaranteed long life (2,000 hours at 85° C)
- Suitable for medical, telecom and consumer electronic equipment use.

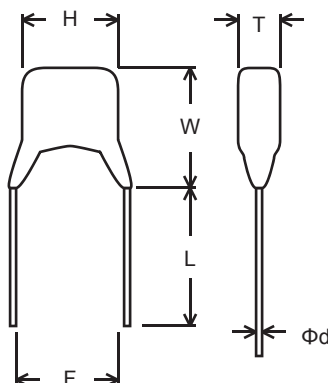
Δ Construction



1. Straight Long Lead



2. Straight Cut Lead

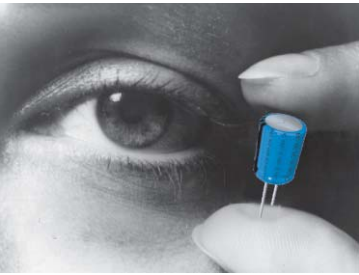


Size Code

R15	H 4.5mm	W 4.5mm	T 2.5mm
R18	H 5.5mm	W 5.5mm	T 3.0mm

Δ Ordering Terminology

CMR	100	ZU	1C	M	1	
Series Code	Capacitance Code in pF ID0=1pF 100=10pF 101=100pF 102=1000pF (.001μF) 103=10000pF (.01μF) 104=100000pF (.1μF) 105=1000000pF (1μF)	T.C. Code CG = NPO XR = X7R YV = Y5V ZU = Z5U	Voltage Code 1A = 10V 1C = 16V 1E = 25V 1H = 50V 1J = 63V 2A = 100V	Tolerance: C = ± .25pf D = ± .50pf J = ± 5% K = ± 10% M = ± 20%	Lead Spacing: 1 = .10" 2 = .20" 3 = .30" 4 = .40"	Omitted in bulk package T = Taped/Box K = Crimped leads



Multilayer Ceramic Capacitor Type CMR

Δ Specifications

Temperature coefficient

- NPO: $\pm 30\text{ppm}/^\circ\text{C}$, -55°C to $+125^\circ\text{C}$
- X7R: $\pm 15\%$, -55°C to $+125^\circ\text{C}$
- Z5U: $+22\%$, -56% , $+10^\circ\text{C}$ to $+85^\circ\text{C}$
- Y5V: $\pm 22\%$, -82% , -30°C to $+85^\circ\text{C}$

Capacitance test 25°C

- NPO: 1 VRMS max at 1KHz (1MHz for 100pF or less)
- X7R: 1 VRMS max at 1KHz
- Z5U: 1 VRMS max at 1KHz
- Y5V: 1 VRMS max at 1KHz

Dissipation Factor 25°C

NPO: 0.15% max a 1KHz, 1VRMS max (1MHz for 1000pF or less)

Z5U: 5% max (at 1KHz, 1VRMS max)

X7R: (at 1KHz, 1VRMS max)		Y5V: (at 1KHz, 1VRMS max)	
Max	Rated Voltage	Max	Rated Voltage
2.5%	$\geq 50\text{V}$	5%	$\geq 50\text{V}$
3.5%	25V & 16V	7%	25V & 16V
5.0%	10V & 6.3V	10%	10V & 6.3V

Dielectric strength 25°C (Flash Test)

- NPO and X7R: 300% rated voltage for 5 seconds with 50mA max charging current.
- Z5U and Y5V: 250% rated voltage for 5 seconds with 50mA max charging current.

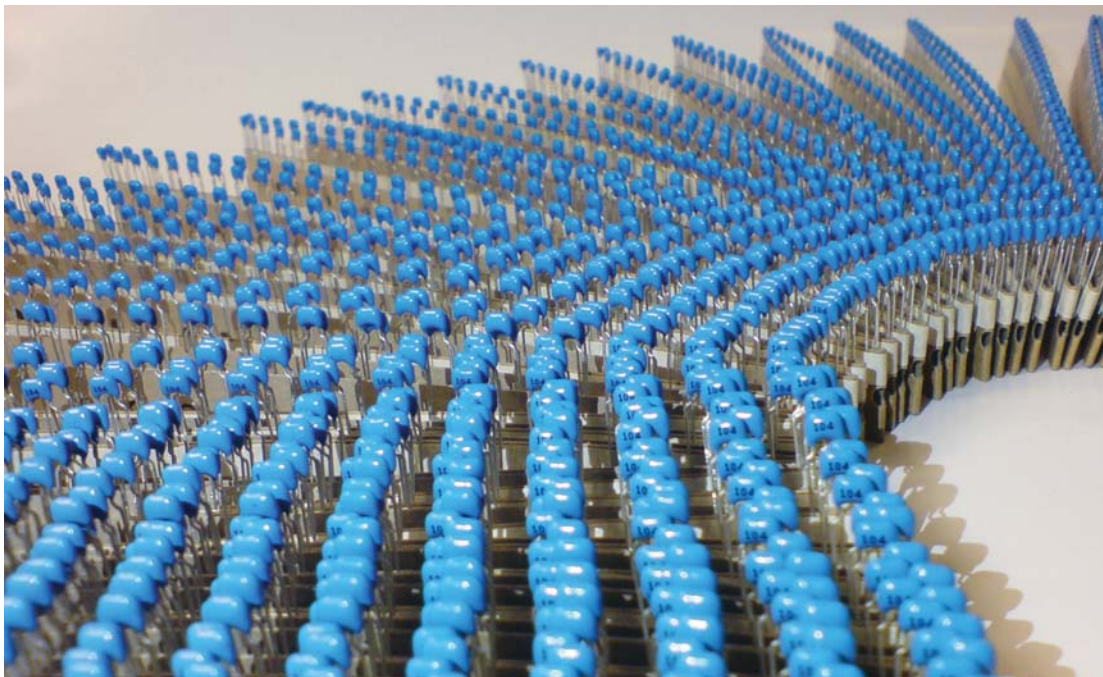
LifeTest:

(1000hrs at max temp. applied with Flash test voltage
Recovery: 6-24hrs for NPO and $24\pm 2\text{hrs}$ for X7R & Z5U)

- NPO: $\leq \pm 3\%$ at 200% rated voltage, 125°C
- X7R: $\leq \pm 3\%$ at 200% rated voltage, 125°C
- Z5U: $\leq \pm 3\%$ at 200% rated voltage, 85°C
- Y5V: $\leq \pm 3\%$ at 200% rated voltage, 85°C

Insulation Resistance after 60 sec., charging at rated voltage, 25°C , 55% R.H. max

- NPO: $100\text{G}\Omega$ or $1000\text{M}\Omega\text{-uF}$ whichever is less
- X7R: $10\text{G}\Omega$ or $100\text{M}\Omega\text{-uF}$ whichever is less
- Z5U: $10\text{G}\Omega$ or $100\text{M}\Omega\text{-uF}$ whichever is less
- Y5V: $10\text{G}\Omega$ or $1000\text{M}\Omega\text{-uF}$ whichever is less





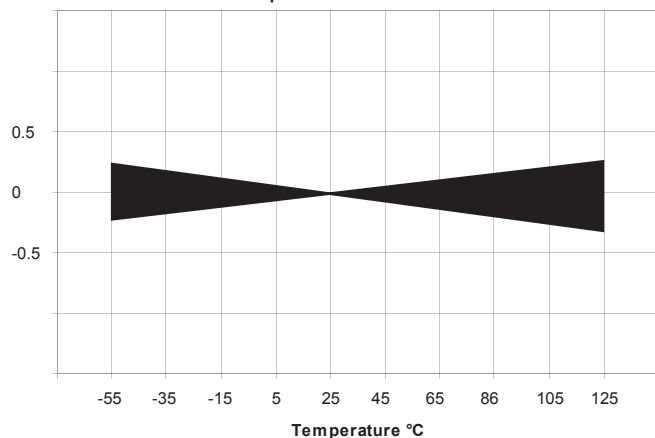
Multilayer Ceramic Capacitor

Type

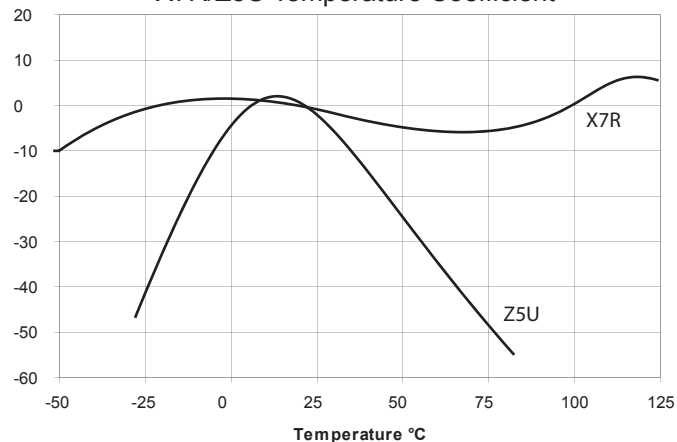
CMR

Fixed Component
Capacitors

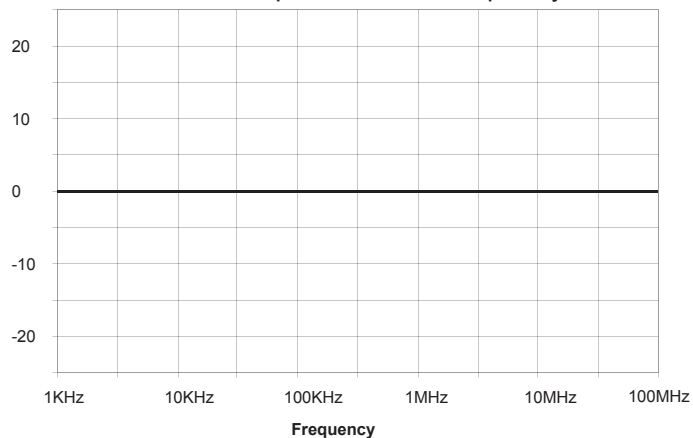
NPO Temperature Coefficient



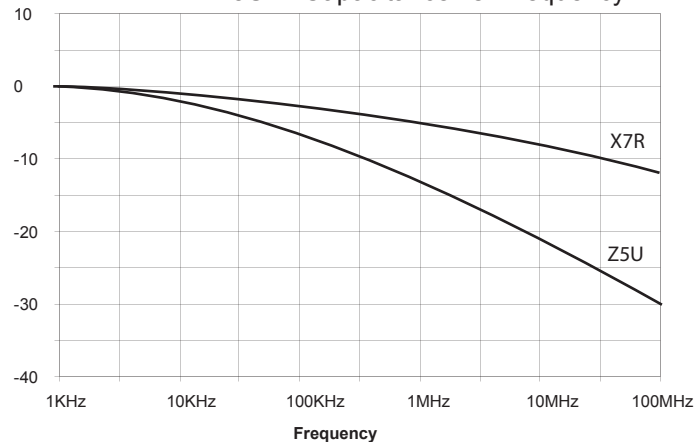
X7R/Z5U Temperature Coefficient



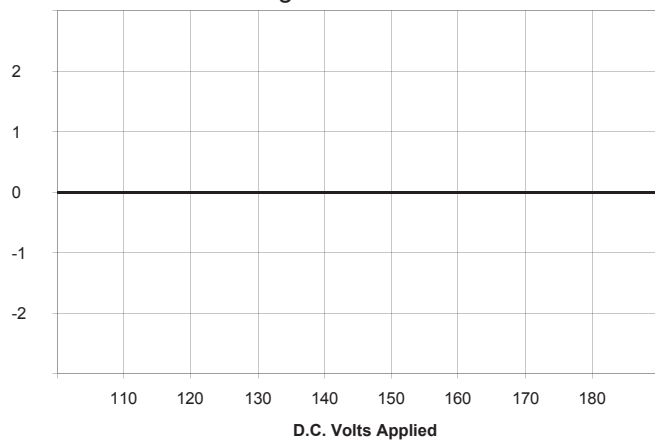
NPO Δ Capacitance vs. Frequency



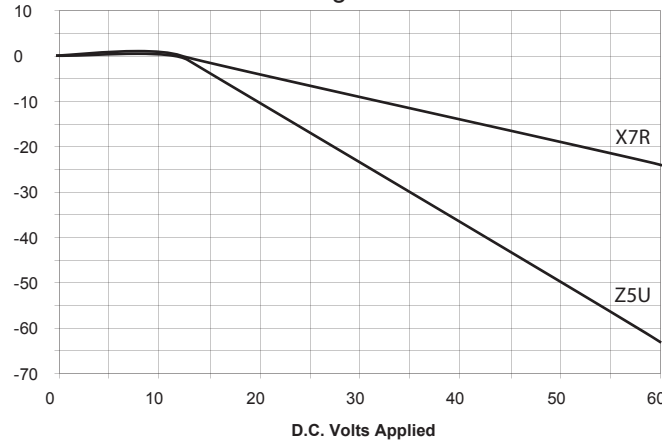
X7R/Z5U Δ Capacitance vs. Frequency



NPO Voltage Coefficient

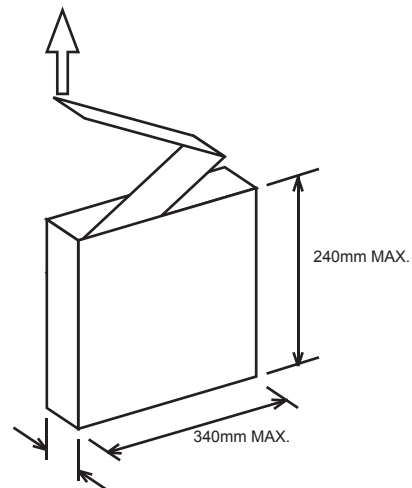
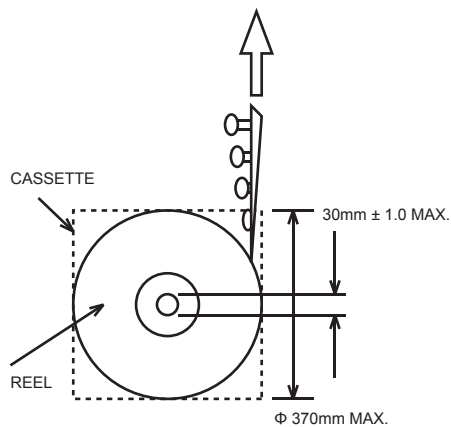
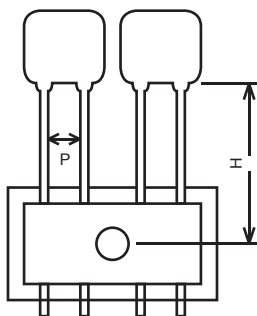


X7R/Z5U Voltage Coefficient





Δ Dimensions



Taping Lead Taping Capacitors For Automatic Insertion

* For Monolithic (Multilayer) Only 16mm

Symbol	D	d	P	P0	P1	P2	F	H	H0	H1	D0	W	L	t
Value	Max 11.0	0.6	12.7	12.7	3.85	6.35	5.0	16.0 20.0	16.0	Max 32.25	4.0	18.0	Max 11.0	0.7
Tolerance	-	0.06 - 0.05	±1	±0.2	±0.7	±1	+0.8 -0.2	+1.5 -1.0	±0.5	-	±0.2	±0.5	-	±0.2

units: mm



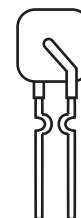
Poly Switch PPTC (Polymeric Positive Temperature Coefficient) Resettable Fuse Capacitor Type PS06

Δ Feature:

- Direct Fuse Replacement in DC Circuits
- Auto Reset (when power is cycled)
- Crossover with Raychem and Bourns

Δ Application:

- PCB, USB Port, Printer, Scanners and other PC Peripherals.

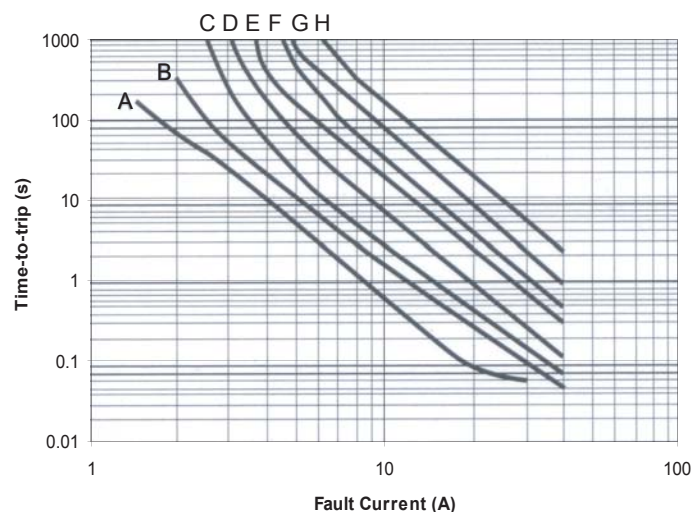


Δ Electrical Characteristics

Model	Vmax (V)	Ro (Ω)	IT (A)	Ttrip (S)	IH (A)	I _{max} (A)	Pd _{typ} (W)
PS06-075	6	0.140-0.230	1.30	0.40	0.75	40	0.30
PS06-090	6	0.100-0.180	1.80	1.20	0.90	40	0.60
PS06-110	6	0.080-0.140	2.20	2.30	1.10	40	0.70
PS06-120	6	0.080-0.140	2.00	3.50	1.20	40	0.60
PS06-135	6	0.060-0.120	2.70	4.50	1.35	40	0.81
PS06-160	6	0.050-0.110	3.20	9.00	1.60	40	0.90
PS06-185	6	0.050-0.090	3.70	10.00	1.85	40	1.00
PS06-250	6	0.030-0.060	5.00	10.00	2.50	40	1.21

Δ Typical T-I Derating Form

Model	Ambient Temperature (°C)								
	-40	-20	0	25	40	50	60	70	85
PS06-075	1.05	0.95	0.85	0.75	0.65	0.60	0.55	0.50	0.43
PS06-090	1.40	1.25	1.10	0.90	0.75	0.69	0.65	0.60	0.50
PS06-110	1.75	1.52	1.33	1.10	0.99	0.90	0.80	0.73	0.63
PS06-120	1.69	1.52	1.36	1.20	1.04	0.96	0.88	0.80	0.68
PS06-135	2.15	1.94	1.70	1.35	1.20	1.14	1.00	0.90	0.81
PS06-160	2.49	2.21	1.94	1.60	1.42	1.31	1.19	1.03	0.88
PS06-185	2.87	2.59	2.28	1.85	1.63	1.52	1.33	1.21	1.05
PS06-250	3.82	3.44	3.03	2.50	2.17	2.00	1.81	1.59	1.39



Legend

IH(A): Hold current: maximum current at which the device will not trip at 25°C still air

IT(A): Tripping current: minimum current at which the device will trip at 25°C under specified conditions.

Tt(S): Maximum time to trip at specified current. (generally at 5IH)

Vmax(V): Maximum device operating voltage.

I_{max}(A): Maximum fault current device can withstand without damage at rated voltage.

Pd_{typ}(W): Typical power dissipation: Typical amount of power dissipated by the device when in tripped state air environment.

Ro(Ω): Minimum-maximum device resistance at 25° prior to tripping.

A=PS06-075 E=PS06-135

B=PS06-090 F=PS06-160

C=PS06-110 G=PS06-185

D=PS06-120 H=PS06-250



Poly Switch PPTC (Polymeric Positive Temperature Coefficient) Resettable Fuse Capacitor Type PS06

Δ Dimensions

Model	Amax (mm)	Bmax (mm)	Cmax (mm)	Dtyp (mm)	Diameter of Lead (mm)	Fig.
PS06-075	6.9	11.4	5.1	3.1	Φ0.6	2
PS06-090	7.4	14.0	5.1	3.1	Φ0.6	1
PS06-110	7.9	14.2	5.1	3.1	Φ0.6	1
PS06-120	7.4	12.6	5.1	3.1	Φ0.6	2
PS06-135	8.9	14.5	5.1	3.1	Φ0.6	1
PS06-160	8.9	17.9	5.1	3.1	Φ0.6	1
PS06-185	10.7	16.7	5.1	3.1	Φ0.6	1
PS06-250	11.5	20.4	5.1	3.1	Φ0.6	1

Fig. 1

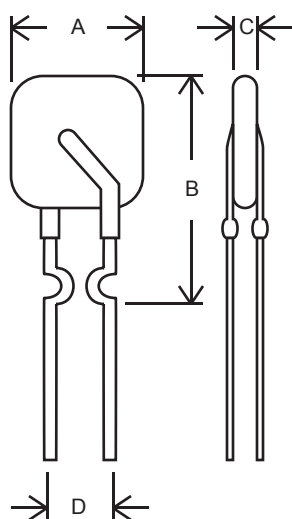
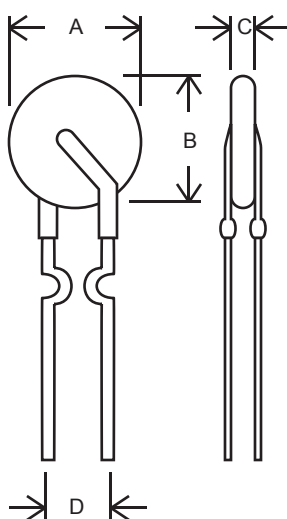


Fig. 2





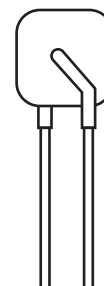
Poly Switch PPTC (Polymeric Positive Temperature Coefficient) Resettable Fuse Capacitor Type PS16

Δ Feature:

- Direct Fuse Replacement in DC Circuits
- Auto Reset (when power is cycled)
- Crossover with Raychem and Bourns

Δ Application:

- Energy-Saving Lamps, Ballast, Loudspeakers, Power Supply,
- Motor, Fans, Compressor and other power related applications.



Δ Electrical Characteristics

Model	V _{max} (V)	R _o (Ω)	I _T (A)	T _T (S)	I _H (A)	I _{max} (A)	τ _c (S)
PS16-300	16	0.034-0.105	5.1	≤2.0	3.0	100	≤60
PS16-400	16	0.020-0.063	6.8	≤3.5	4.0	100	≤60
PS16-500	16	0.014-0.044	8.5	≤0.4	5.0	100	≤60
PS16-600	16	0.009-0.030	10.2	≤5.8	6.0	100	≤60
PS16-700	16	0.006-0.021	11.9	≤8.0	7.0	100	≤60
PS16-800	16	0.005-0.018	13.6	≤9.0	8.0	100	≤60
PS16-900	16	0.004-0.015	15.3	≤12.0	9.0	100	≤60
PS16-1000	16	0.003-0.012	17.0	≤12.5	10.0	100	≤60
PS16-1100	16	0.003-0.010	18.7	≤13.5*	11.0	101	≤60
PS16-1200	16	0.002-0.009	20.4	≤16.0	12.0	100	≤60
PS16-1400	16	0.002-0.008	23.8	≤20.0	14.0	100	≤60

* Devices tested at 60A. The others tested at 5IH.

Legend

I_H(A): Hold current: maximum current at which the device will not trip at 25°C still air

I_T(A): Tripping current: minimum current at which the device will trip at 25°C under specified conditions.

T_T(S): Maximum time to trip at specified current. (generally at 5IH)

V_{max}(V): Maximum device operating voltage.

I_{max}(A): Maximum fault current device can withstand without damage at rated voltage.

P_{dtyp}(W): Typical power dissipation: Typical amount of power dissipated by the device when in tripped state air environment.

R_o(Ω): Minimum-maximum device resistance at 25° prior to tripping.

Δ Typical T-I Derating Form

Model	Ambient Temperature (°C)								
	-40	-20	0	25	40	50	60	70	85
PS16-300	4.4	4.0	3.6	3.0	2.6	2.4	2.1	1.9	1.4
PS16-400	5.9	5.3	4.8	4.0	3.5	3.2	2.8	2.5	1.9
PS16-500	7.3	6.6	6.0	5.0	4.4	4.0	3.6	3.1	2.4
PS16-600	8.8	8.0	7.2	6.0	5.2	4.8	4.2	3.8	2.8
PS16-700	10.3	9.3	8.4	7.0	6.2	5.6	5.0	4.4	3.3
PS16-800	11.7	10.7	9.6	8.0	6.9	6.4	5.6	5.1	3.7
PS16-900	13.2	11.9	10.7	9.0	7.9	7.2	6.4	5.6	4.2
PS16-1000	14.7	13.3	12.0	10.0	8.7	8.0	7.0	6.3	4.7
PS16-1100	16.1	14.6	13.1	11.0	9.7	8.8	7.8	6.9	5.2
PS16-1200	17.6	16.0	14.4	12.0	10.4	9.6	8.4	7.6	5.6
PS16-1400	20.5	18.7	16.8	14.0	12.1	11.2	9.8	8.9	6.5



PolySwitch PPTC Resettable Fuse Capacitor

Type

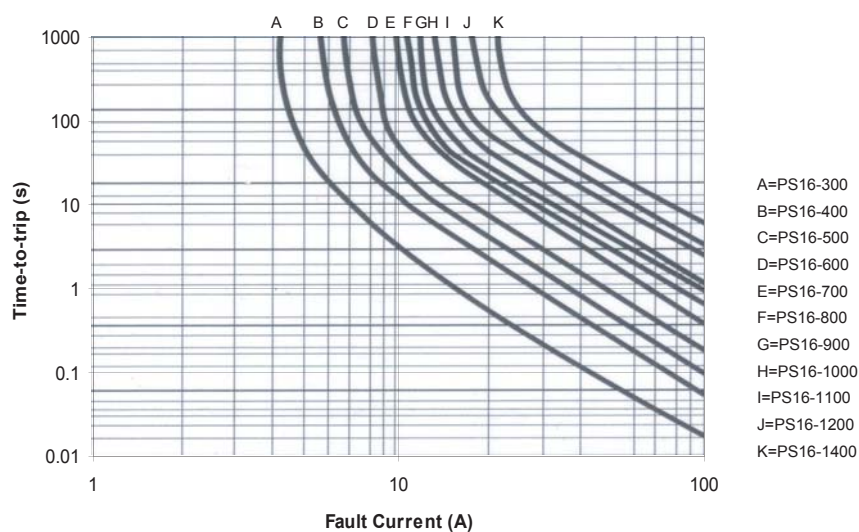
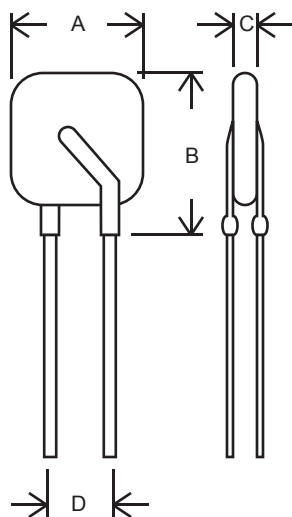
PS

PS16

Poly Switch PPTC (Polymeric Positive Temperature Coefficient) Resettable Fuse Capacitor
Type PS16

Δ Dimensions

Model	Amax (mm)	Bmax (mm)	Cmax (mm)	Dtyp (mm)	Diameter of Lead (mm)
PS16-300	8.0	12.0	3.1	5.1	Φ0.8
PS16-400	10.0	14.0	3.1	5.1	Φ0.8
PS16-500	11.5	14.0	3.1	5.1	Φ0.8
PS16-600	11.5	17.0	3.1	5.1	Φ0.8
PS16-700	12.0	20.0	3.1	5.1	Φ0.8
PS16-800	13.5	21.5	3.1	5.1	Φ0.8
PS16-900	15.0	21.5	3.1	5.1	Φ0.8
PS16-1000	17.5	25.0	3.1	5.1	Φ0.8
PS16-1100	18.5	27.0	3.1	5.1	Φ0.8
PS16-1200	18.5	29.0	3.6	10.2	Φ1.0
PS16-1400	29.0	29.0	3.6	10.2	Φ1.0





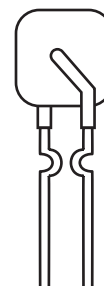
Poly Switch PPTC (Polymeric Positive Temperature Coefficient) Resettable Fuse Capacitor Type PS30

Δ Feature:

- Direct Fuse Replacement in DC Circuits
- Auto Reset (when power is cycled)
- Crossover with Raychem and Bourns

Δ Application:

- Energy-Saving Lamps, Ballast, Loudspeakers, Power Supply,
- Motor, Fans, Compressor and other power related applications.



Δ Electrical Characteristics

Model	V _{max} (V)	R _o (Ω)	I _T (A)	T _T (S)	I _H (A)	I _{max} (A)	τ _c (S)
PS30-090	30	0.07-0.12	1.80	≤7.1	0.90	40	≤60
PS30-110	30	0.05-0.10	2.20	≤6.6	1.10	40	≤60
PS30-135	30	0.04-0.08	2.70	≤7.3	1.35	40	≤60
PS30-160	30	0.03-0.07	3.20	≤8.0	1.60	40	≤60
PS30-185	30	0.03-0.06	3.70	≤8.7	1.85	40	≤60
PS30-250	30	0.02-0.04	5.00	≤10.3	2.50	40	≤60
PS30-300	30	0.02-0.05	6.00	≤10.8	3.00	40	≤60
PS30-400	30	0.01-0.03	8.00	≤12.7	4.00	40	≤60
PS30-500	30	0.01-0.03	10.00	≤14.5	5.00	40	≤60
PS30-600	30	0.005-0.02	12.00	≤16.0	6.00	40	≤60
PS30-700	30	0.005-0.02	14.00	≤17.5	7.00	40	≤60
PS30-800	30	0.005-0.02	16.00	≤18.8	8.00	40	≤60
PS30-900	30	0.005-0.01	18.00	≤20*	9.00	40	≤60

* Devices tested at 40A. The others tested at 5IH.

Legend

I_H(A): Hold current: maximum current at which the device will not trip at 25°C still air

I_T(A): Tripping current: minimum current at which the device will trip at 25°C under specified conditions.

T_T(S): Maximum time to trip at specified current. (generally at 5IH)

V_{max}(V): Maximum device operating voltage.

I_{max}(A): Maximum fault current device can withstand without damage at rated voltage.

P_{dtyp}(W): Typical power dissipation: Typical amount of power dissipated by the device when in tripped state air environment.

R_o(Ω): Minimum-maximum device resistance at 25° prior to tripping.

Δ Typical T-I Derating Form

Model	Ambient Temperature (°C)								
	-40	-20	0	25	40	50	60	70	85
PS30-090	1.40	1.25	1.10	0.90	0.75	0.69	0.65	0.60	0.50
PS30-110	1.75	1.52	1.33	1.10	0.99	0.90	0.80	0.73	0.63
PS30-135	2.15	1.94	1.70	1.35	1.20	1.14	1.00	0.90	0.81
PS30-160	2.49	2.21	1.94	1.60	1.42	1.31	1.19	1.03	0.88
PS30-185	2.87	2.59	2.28	1.85	1.63	1.52	1.33	1.21	1.05
PS30-250	3.82	3.44	3.03	2.50	2.17	2.00	1.81	1.60	1.39
PS30-300	4.55	4.10	3.60	3.00	2.65	2.51	2.24	2.01	1.74
PS30-400	6.00	5.40	4.74	4.00	3.47	3.28	2.82	2.63	2.26
PS30-500	7.44	6.68	5.80	5.00	4.30	4.03	3.58	3.22	2.77
PS30-600	8.90	7.99	7.08	6.00	5.13	4.82	4.27	3.84	3.30
PS30-700	10.35	9.30	8.21	7.00	5.95	5.58	4.96	4.46	3.84
PS30-800	11.60	10.60	9.35	8.00	6.79	6.36	5.64	5.07	4.36
PS30-900	13.25	11.90	10.49	9.00	7.53	7.12	6.32	5.69	4.88



PolySwitch PPTC Resettable Fuse Capacitor

Type

PS

PS30

Poly Switch PPTC (Polymeric Positive Temperature Coefficient) Resettable Fuse Capacitor
Type PS30

Δ Dimensions

Model	Amax (mm)	Bmax (mm)	Cmax (mm)	Dtyp (mm)	Diameter of Lead (mm)	Fig.
PS30-090	6.5	14.0	3.1	5.1	Φ0.6	1
PS30-110	8.0	14.0	3.1	5.1	Φ0.6	1
PS30-135	9.0	14.0	3.1	5.1	Φ0.6	1
PS30-160	10.0	17.0	3.1	5.1	Φ0.6	1
PS30-185	11.0	17.0	3.1	5.1	Φ0.6	1
PS30-250	12.0	19.0	3.1	5.1	Φ0.6	1
PS30-300	12.0	21.0	3.1	5.1	Φ0.8	2
PS30-400	14.5	23.0	3.1	5.1	Φ0.8	2
PS30-500	14.5	28.0	3.1	10.2	Φ0.8	2
PS30-600	17.0	28.0	3.1	10.2	Φ0.8	2
PS30-700	19.5	30.0	3.1	10.2	Φ0.8	2
PS30-800	22.0	32.0	3.1	10.2	Φ0.8	2
PS30-900	24.5	36.5	3.1	10.2	Φ0.8	2

Fig. 1

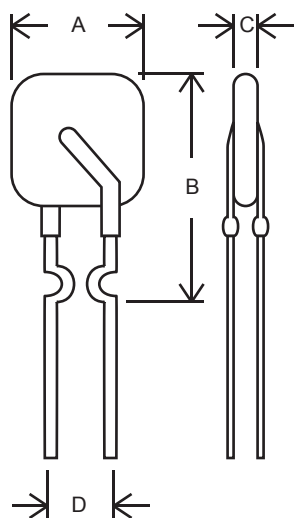
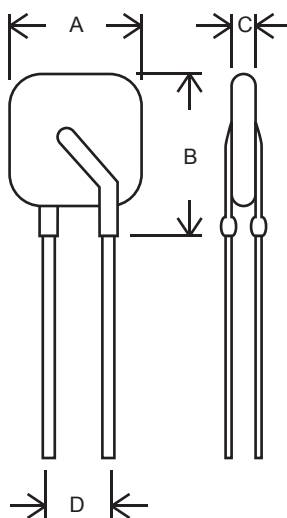


Fig. 2





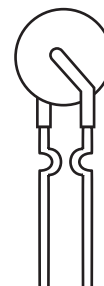
Poly Switch PPTC (Polymeric Positive Temperature Coefficient) Resettable Fuse Capacitor Type PS60

Δ Feature:

- Direct Fuse Replacement in DC Circuits
- Auto Reset (when power is cycled)
- Crossover with Raychem and Bourns

Δ Application:

- Energy-Saving Lamps, Ballast, Loudspeakers, Power Supply,
- Motor, Fans, Compressor and other power related applications.



Δ Electrical Characteristics

Model	Ro (Ω)	IT (A)	TT (S)	IH (A)
PS60-005	7.30-11.10	0.15	≤5.0	0.05
PS60-010	2.50-4.50	0.20	≤8.0	0.10
PS60-017	2.00-3.20	0.34	≤5.0	0.17
PS60-020	1.50-2.84	0.40	≤3.6	0.20
PS60-025	1.00-1.95	0.50	≤3.2	0.25
PS60-030	0.76-1.36	0.60	≤3.0	0.30
PS60-040	0.52-0.86	0.80	≤3.8	0.40
PS60-050	0.41-0.77	1.00	≤4.0	0.50
PS60-065	0.27-0.48	1.30	≤5.3	0.65
PS60-075	0.18-0.40	1.50	≤6.3	0.75
PS60-090	0.14-0.31	1.80	≤7.2	0.90
PS60-110	0.14-0.25	2.20	≤8.2	1.10
PS60-135	0.12-0.19	2.70	≤9.6	1.35
PS60-160	0.09-0.14	3.20	≤11.4	1.60
PS60-185	0.08-0.12	3.70	≤12.6	1.85
PS60-250	0.05-0.08	5.00	≤15.6	2.50
PS60-300	0.04-0.06	6.00	≤19.8	3.00
PS60-375	0.03-0.05	7.50	≤24.0	3.75

Note: All PS60-xxx listed on this page have

Vmax (V): 60

Imax (A): 40

tc (S): ≤60

Legend

IH(A): Hold current: maximum current at which the device will not trip at 25°C still air

IT(A): Tripping current: minimum current at which the device will trip at 25°C under specified conditions.

Tt(S): Maximum time to trip at specified current. (generally at 5IH)

Vmax(V): Maximum device operating voltage.

Imax(A): Maximum fault current device can withstand without damage at rated voltage.

Pdtyp(W): Typical power dissipation: Typical amount of power dissipated by the device when in tripped state air environment.

Ro(Ω): Minimum-maximum device resistance at 25° prior to tripping.

Δ Typical T-I Derating Form

Model	Ambient Temperature (°C)								
	-40	-20	0	25	40	50	60	70	85
PS60-005	0.077	0.069	0.061	0.050	0.044	0.040	0.036	0.032	0.025
PS60-010	0.18	0.15	0.13	0.10	0.08	0.07	0.06	0.05	0.03
PS60-017	0.28	0.24	0.20	0.17	0.14	0.12	0.10	0.09	0.06
PS60-020	0.34	0.29	0.25	0.20	0.16	0.14	0.13	0.10	0.07
PS60-025	0.42	0.36	0.31	0.25	0.20	0.18	0.16	0.12	0.09
PS60-030	0.52	0.44	0.38	0.30	0.24	0.22	0.18	0.14	0.10
PS60-040	0.66	0.57	0.50	0.40	0.32	0.29	0.24	0.20	0.14
PS60-050	0.83	0.74	0.63	0.50	0.41	0.36	0.30	0.25	0.18
PS60-065	1.10	0.95	0.82	0.65	0.53	0.47	0.40	0.33	0.24
PS60-075	1.26	1.11	0.95	0.75	0.61	0.54	0.45	0.39	0.28
PS60-090	1.52	1.30	1.15	0.90	0.73	0.65	0.55	0.47	0.33
PS60-110	1.82	1.60	1.35	1.10	0.89	0.79	0.65	0.55	0.40
PS60-135	2.20	1.91	1.65	1.35	1.09	0.96	0.80	0.68	0.50
PS60-160	2.60	1.95	1.95	1.60	1.30	1.13	1.00	0.80	0.60
PS60-185	3.00	2.30	2.30	1.85	1.50	1.33	1.12	0.92	0.67
PS60-250	4.05	3.02	3.02	2.50	2.02	1.80	1.55	1.30	0.90
PS60-300	4.82	3.62	3.62	3.00	2.43	2.16	1.85	1.50	1.09
PS60-375	6.02	4.50	4.50	3.75	3.02	2.68	2.30	1.95	1.39



PolySwitch PPTC Resettable Fuse Capacitor

Type

PS

PS60

Poly Switch PPTC (Polymeric Positive Temperature Coefficient) Resettable Fuse Capacitor Type PS60

Δ Dimensions

Model	Amax (mm)	Bmax (mm)	Cmax (mm)	Dtyp (mm)	Diameter of Lead (mm)	Fig.
PS60-005	6.0	11.0	3.1	5.1	Φ0.6	1
PS60-010	6.0	11.0	3.1	5.1	Φ0.6	1
PS60-017	6.0	11.5	3.1	5.1	Φ0.6	1
PS60-020	6.0	11.5	3.1	5.1	Φ0.6	1
PS60-025	6.5	11.5	3.1	5.1	Φ0.6	1
PS60-030	8.0	13.5	3.1	5.1	Φ0.6	1
PS60-040	8.0	14.0	3.1	5.1	Φ0.6	1
PS60-050	8.0	14.0	3.1	5.1	Φ0.6	1
PS60-065	10.0	14.5	3.1	5.1	Φ0.6	1
PS60-075	11.0	15.5	3.1	5.1	Φ0.6	1
PS60-090	12.0	16.5	3.1	5.1	Φ0.6	1
PS60-110	13.0	17.0	3.1	5.1	Φ0.6	1
PS60-135	16.0	18.0	3.1	5.1	Φ0.6	2
PS60-160	17.0	20.0	3.1	5.1	Φ0.8	2
PS60-185	18.0	23.0	3.1	5.1	Φ0.8	2
PS60-250	21.5	23.5	3.1	10.2	Φ0.8	2
PS60-300	25.0	27.5	3.1	10.2	Φ0.8	2
PS60-375	28.5	32.5	3.1	10.2	Φ0.8	2

Fig. 1

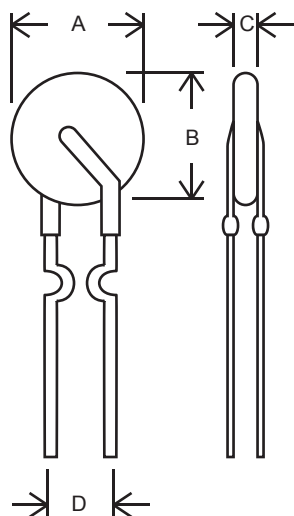
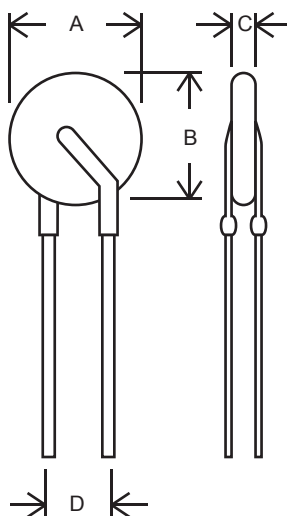


Fig. 2





PolySwitch PPTC Resettable Fuse Capacitor

Type

PS

PS90

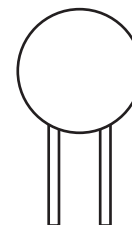
Poly Switch PPTC (Polymeric Positive Temperature Coefficient) Resettable Fuse Capacitor Type PS90

Δ Feature:

- Fuse Capacitor (use in place of traditional fuse)
- Auto Reset (when power is cycled)

Δ Application:

- Automotive Wiring Harness, Door Lock, Security Alarm,
- Rain Brush, Actuators and other Automotive applications.



Δ Electrical Characteristics

Model	IH (A)	IT (A)	Vmax (V)	Imax (A)	Ttrip (S)	Pdtype (W)	Ro (Ω)
PS90-020	0.20	0.40	90	20	10	1.70	1.00-2.5
PS90-025	0.25	0.50	90	20	10	1.75	0.80-2.0
PS90-035	0.35	0.75	90	20	10	1.80	0.60-1.2
PS90-055	0.55	1.10	90	20	10	2.00	0.35-0.9
PS90-075	0.75	1.50	90	20	10	2.50	0.20-0.6
PS90-090	0.90	1.80	90	20	10	3.00	0.10-0.5

Δ Dimensions

Model	Amax	Bmin	Cmax	Dtyp
PS90-020	5.5	7.6	3.1	5.1
PS90-025	7.5	7.6	3.1	5.1
PS90-035	7.5	7.6	3.1	5.1
PS90-055	11.0	7.6	3.1	5.1
PS90-075	11.0	7.6	3.1	5.1
PS90-090	13.0	7.6	3.1	5.1

Legend

IH(A): Hold current: maximum current at which the device will not trip at 25°C still air

IT(A): Tripping current: minimum current at which the device will trip at 25°C under specified conditions.

Tt(S): Maximum time to trip at specified current. (generally at 5IH)

Vmax(V): Maximum device operating voltage.

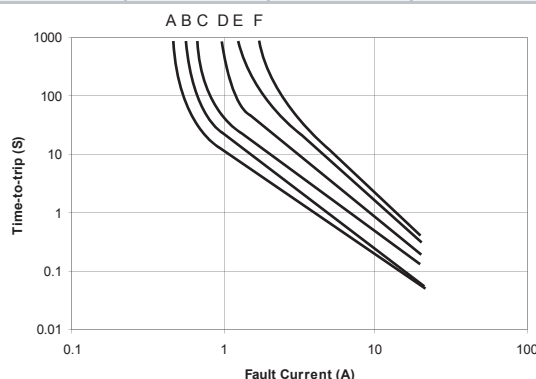
Imax(A): Maximum fault current device can withstand without damage at rated voltage.

Pdtype(W): Typical power dissipation: Typical amount of power dissipated by the device when in tripped state air environment.

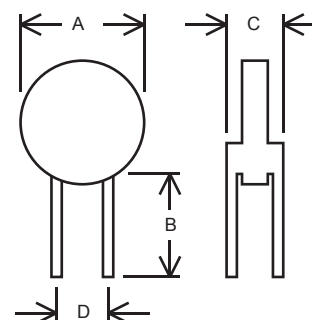
Ro(Ω): Minimum-maximum device resistance at 25° prior to tripping.

Δ Typical T-I Derating Form

Model	Ambient Temperature (°C)								
	-40	-20	0	25	40	50	60	70	85
PS90-020	0.30	0.26	0.24	0.20	0.16	0.15	0.13	0.10	0.08
PS90-025	0.38	0.33	0.28	0.25	0.21	0.18	0.16	0.14	0.10
PS90-035	0.54	0.46	0.42	0.35	0.28	0.26	0.23	0.20	0.14
PS90-055	0.86	0.76	0.66	0.55	0.46	0.42	0.36	0.31	0.24
PS90-075	1.16	1.00	0.92	0.75	0.62	0.56	0.50	0.42	0.30
PS90-090	1.42	1.24	1.08	0.90	0.74	0.66	0.58	0.50	0.36



A=PS90-020
B=PS90-025
C=PS90-035
D=PS90-055
E=PS90-075
F=PS90-090





Poly Switch PPTC (Polymeric Positive Temperature Coefficient) Resettable Fuse Capacitor Type PS250/600

Δ Feature:

- Fuse Capacitor (use in place of traditional fuse)
- Auto Reset (when power is cycled)

Δ Application:

- LAN Equipment, MDF Modules, Mobile Phones,
- DSL Modems and other Telcom & Network Equipment.



Δ Electrical Characteristics

Model	Vmax (V)	Ro (Ω)	IT (A)	TT(S)		IH (A)
				I (A)	(S)	
PS250-080F	60	14.00-22.00	0.16	1	≤0.5	0.08
PS250-080N	60	14.00-22.00	0.16	1	≤0.5	0.08
PS250-100F	60	12.00-18.00	0.2	1	≤0.5	0.1
PS250-100N	60	12.00-18.00	0.2	1	≤0.5	0.1
PS250-110F	60	6.00-12.00	0.22	1	≤1.0	0.11
PS250-110N	60	6.00-12.00	0.22	1	≤1.0	0.11
PS250-120F	60	4.00-12.00	0.24	1	≤2.0	0.12
PS250-120N	60	6.00-12.00	0.24	1	≤2.0	0.12
PS250-130F	60	4.00-10.00	0.26	1	≤2.0	0.13
PS250-145F/U	60	3.00-8.00	0.29	1	≤3.0	0.145
PS250-160F	60	2.00-6.00	0.32	3	≤3.0	0.16
PS250-180U	60	0.80-2.00	0.6	3	≤3.0	0.18
PS250-180F	60	0.80-2.00	0.6	3	≤3.0	0.18
PS600-150N	60	6.00-12.00	0.3	3	≤1.0	0.15
PS600-150F	60	6.00-12.00	0.3	3	≤1.0	0.15
PS600-160F	60	4.00-10.00	0.32	3	≤2.0	0.16

Legend

IH(A): Hold current: maximum current at which the device will not trip at 25°C still air

IT(A): Tripping current: minimum current at which the device will trip at 25°C under specified conditions.

Tt(S): Maximum time to trip at specified current. (generally at 5IH)

Vmax(V): Maximum device operating voltage.

I_{max}(A): Maximum fault current device can withstand without damage at rated voltage.

Pdtyp(W): Typical power dissipation: Typical amount of power dissipated by the device when in tripped state air environment.

Ro(Ω): Minimum-maximum device resistance at 25° prior to tripping.



PolySwitch PPTC Resettable Fuse Capacitor

Type

PS

PS250/600

Poly Switch PPTC (Polymeric Positive Temperature Coefficient) Resettable Fuse Capacitor Type PS250/600

Δ Typical T-I Derating Form

Model	Ambient Temperature (°C)								
	-40	-20	0	25	40	50	60	70	85
PS250-080F/N	0.124	0.110	0.095	0.800	0.066	0.059	0.051	0.044	0.033
PS250-100F/N	0.166	0.146	0.128	0.100	0.086	0.075	0.065	0.056	0.043
PS250-110F/N	0.171	0.151	0.131	0.110	0.091	0.081	0.071	0.061	0.046
PS250-120F/N	0.191	0.170	0.148	0.120	0.104	0.093	0.082	0.071	0.055
PS250-130F	0.204	0.185	0.160	0.130	0.116	0.105	0.091	0.080	0.060
PS250-145F/U	0.225	0.199	0.172	0.145	0.119	0.106	0.093	0.080	0.060
PS250-160F/U	0.250	0.220	0.195	0.160	0.137	0.123	0.110	0.095	0.074
PS250-180F	0.269	0.240	0.211	0.180	0.153	0.138	0.123	0.109	0.087
PS600-150F/N	0.238	0.211	0.183	0.150	0.128	0.115	0.101	0.088	0.067
PS600-160F	0.250	0.220	0.195	0.160	0.137	0.123	0.110	0.095	0.074

Δ Dimensions

Fig 1.

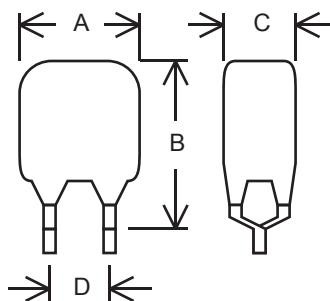
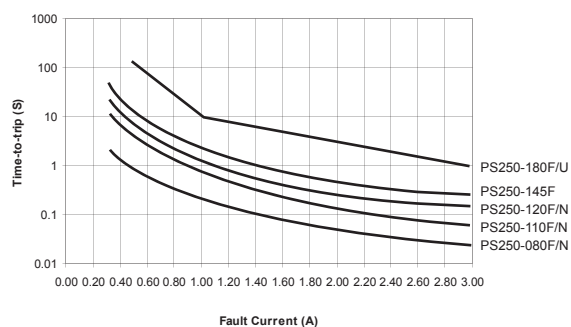
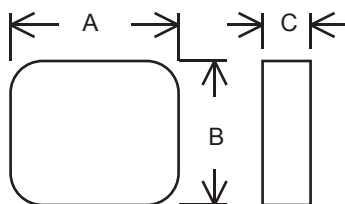


Fig 2.



Model	Amax (mm)	Bmax (mm)	Cmax (mm)	Dtyp (mm)	Diameter of Lead (mm)	Fig.
PS250-080F	7.0	10.0	4.6	5.1	Φ0.6	1
PS250-080N	6.0	6.0	2.5	-	-	2
PS250-100F	7.0	10.0	4.6	5.1	Φ0.6	1
PS250-100N	6.0	6.0	2.5	-	-	2
PS250-110F	7.0	10.0	4.6	5.1	Φ0.6	1
PS250-110N	6.0	6.0	2.5	-	-	2
PS250-120F	7.0	10.0	4.6	5.1	Φ0.6	1
PS250-120N	6.0	6.0	2.5	5.1	Φ0.6	2
PS250-130F	7.5	11.0	4.6	5.1	Φ0.6	1
PS250-145F/U	7.5	11.0	4.6	5.1	Φ0.6	1
PS250-160F	11.5	12.0	4.6	5.1	Φ0.6	1
PS250-180U	11.0	12.0	4.6	5.1	Φ0.6	1
PS250-180F	11.5	12.0	4.6	5.1	Φ0.6	1
PS600-150N	13.5	12.0	6.5	5.1	Φ0.6	2
PS600-150F	13.5	12.0	6.5	5.1	Φ0.6	1
PS600-160F	13.5	16.0	6.5	5.1	Φ0.6	1



Poly Switch (PPTC Resettable Fuse Capacitor) Compatibility Chart

Liberty	Raychem	Bourns
PS250-080N/F	TSL250-080	X
PS250-100N/F	X	X
PS250-110N	TGC250-120T	X
PS250-110F	TR250-120T	MF-R012/250
PS250-120N/F	TS250-130	MF-SM13/250-2
PS250-130F	X	X
PS250-145F	TR250-145	MF-R014/250
PS250-160F	X	X
PS250-180F	TRW250-180	MF-R018/250
PS250-180U	TR250-180U	MF-R018/250U
PS600-150F	TR600-150	X
PS600-160F	TR600-160	X
PS60-xxx	RXExxx	MF-Rxxx/MR-RXxxx
ex. PS60-010	RXE010	MF-R010
ex. PS60-110	RXE110	MF-RX110
PS30-xxx	RUExxx	MF-Rxxx
ex. PS30-090	RUE090	MF-R090-0-9
ex. PS30-185	RUE185	MF-R185
PS16-xxx	RGExxx	MF-RGxxx
ex. PS16-400	RGE400	MF-RG400
ex. PS15-500	RGE500	MF-RG500
PS-WSMAxxx/PS-WSMBxxx	MiniSMDCxxx	MF-MSMDxxx
ex. PS-WSMA020	MiniSMDC020	MF-MSMD020
ex. PS-WSMB110	MiniSMDC110	MF-MSMD110
PS070	LTP070	MF-LS070
PS100	LTP100	MF-LS100
PS120	SRP120	MF-S120
PS175	SRP175	MF-S175
PS180	LTP180	MF-LS180
PS190	LTP190	MF-LS190
PS200	SRP200	MF-S200
PS260	LTP260	MF-LS260
PS300	LTP300	MF-LS300
PS310	X	X
PS340	LTP340	MF-LS340
PS350	SRP350	MF-S350
PS420	SRP420	MF-S420



Polyester Film Capacitor Type PEI Series

△ Features

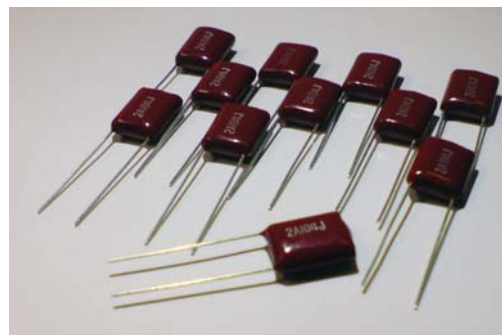
- Inductive construction
- High insulation resistance, moisture & wide temperature range

△ Applications

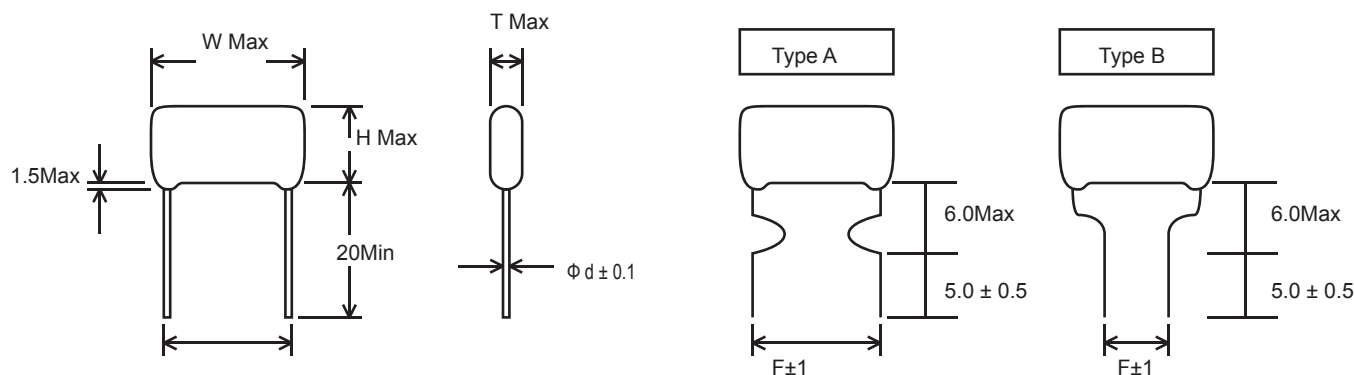
- Suitable for general use in various medical, telecom and industrial equipment

△ Specifications

Item	Characteristics
Operating Temperature Range	- 40 ~ +85°C
Capacitance Range	0.001μF ~ 0.47μF
Capacitance Tolerance	± 2%(G), ± 5%(J), ± 10%(K)
Standard Working Voltage	DC50V(1H), 100V(2A), 250V(2E), 400V(2G), 630V(2J)
Dissipation Factor	Max 0.8% at 1kHz, 20°C
Insulation Resistance	Min 30,000MΩ (C ≤ 0.33μF) Min 10,000MΩ (C > 0.33μF)
Withstanding Voltage	Rated voltage X 2.5 (5sec)



△ Dimensions





Polyester Film Capacitor Type PEI Series

Δ Dimensions

units: mm

WV		SCQ SEIES(SMALL) DC 50V = 1H					CQ SEIES(STANDARD) DC 100V(50V) = 2A					DC 250V = 2E				
Cap(μF)		W	H	T	P	ø	W	H	T	P	ø	W	H	T	P	ø
102	0.001	6.0	8.0	3.0	3.5	0.5	5.6	11.0	3.0	3.5	0.5	6.0	12.0	3.5	3.5	0.5
122	0.001	6.0	8.0	3.0	3.5	0.5	5.6	11.0	3.0	3.5	0.5	6.0	12.0	3.5	3.5	0.5
152	0.002	6.0	8.0	3.0	3.5	0.5	5.6	11.0	3.0	3.5	0.5	6.0	12.0	3.5	3.5	0.5
182	0.002	6.0	8.0	3.0	3.5	0.5	5.6	11.0	3.0	3.5	0.5	6.0	12.0	3.5	3.5	0.5
222	0.002	6.0	8.0	3.0	3.5	0.5	5.6	11.0	3.0	3.5	0.5	6.0	12.0	3.5	3.5	0.5
272	0.003	6.0	8.0	3.0	3.5	0.5	5.6	11.0	3.0	3.5	0.5	6.0	12.0	3.5	3.5	0.5
332	0.003	6.0	8.0	3.0	3.5	0.5	5.6	11.0	3.0	3.5	0.5	6.0	12.0	3.5	3.5	0.5
392	0.004	6.0	8.0	3.0	3.5	0.5	5.6	11.0	3.0	3.5	0.5	6.0	12.0	3.5	3.5	0.5
472	0.005	6.0	8.0	3.5	3.5	0.5	5.6	11.0	3.0	3.5	0.5	6.0	12.0	3.5	3.5	0.5
562	0.006	6.0	8.0	3.5	3.5	0.5	5.6	11.0	3.0	3.5	0.5	6.0	12.0	3.5	3.5	0.5
682	0.007	6.5	8.0	3.5	3.5	0.5	6.0	12.0	3.5	3.5	0.5	6.0	13.0	3.5	4.5	0.5
822	0.008	6.5	8.0	3.5	3.5	0.5	6.5	12.0	3.5	3.5	0.5	7.5	13.5	4.5	4.5	0.5
103	0.01	6.5	8.0	3.5	3.5	0.5	6.5	12.0	3.5	3.5	0.5	7.5	13.5	4.5	4.5	0.5
123	0.012	6.5	8.0	3.5	3.5	0.5	6.5	12.0	3.5	3.5	0.5	7.5	13.5	4.5	4.5	0.5
153	0.015	6.5	9.5	3.5	3.5	0.5	6.5	13.0	3.5	4.0	0.5	8.0	13.5	4.5	5.0	0.5
183	0.018	6.5	10.0	5.0	3.5	0.5	7.0	13.0	4.0	5.0	0.5	9.0	14.0	5.5	5.0	0.5
223	0.022	6.5	10.0	5.0	3.5	0.5	7.0	13.0	4.0	5.0	0.5	9.0	14.0	5.5	5.0	0.5
273	0.027	6.5	10.0	5.0	3.5	0.5	8.0	13.5	4.5	5.0	0.5	9.0	14.0	5.5	5.0	0.5
333	0.033	8.0	10.0	5.0	3.5	0.5	8.0	13.5	4.5	5.0	0.5	9.0	14.0	5.5	5.0	0.5
393	0.039	8.0	10.5	5.0	5.0	0.5	9.0	14.0	4.5	5.0	0.5	10.0	14.0	6.5	5.5	0.5
473	0.047	8.0	10.5	5.0	5.0	0.5	9.0	14.0	4.5	5.0	0.5	10.0	14.0	6.5	5.5	0.5
563	0.056	8.0	11.0	5.0	5.0	0.5	10.0	14.0	5.0	7.5	0.5	12.0	15.0	7.0	6.5	0.6
683	0.068	9.5	11.0	5.0	5.0	0.5	10.0	14.0	5.0	7.5	0.5	12.0	15.0	7.0	6.5	0.6
823	0.082	10.0	11.5	6.0	5.0	0.5	11.0	14.0	6.0	7.5	0.5	13.0	15.0	8.0	7.5	0.6
104	0.1	10.0	11.5	6.0	5.0	0.5	11.0	14.0	6.0	7.5	0.5	13.0	15.0	8.0	7.5	0.6
124	0.12	10.0	11.5	6.0	5.0	0.5	11.0	14.0	6.0	7.5	0.5					
154	0.15	11.0	12.5	6.5	5.0	0.5	12.0	17.0	7.0	7.5	0.6					
184	0.18	11.5	12.5	7.0	7.5	0.6	13.5	18.0	8.0	10.0	0.6					
224	0.22	11.5	14.5	7.0	7.5	0.6	13.5	18.0	8.0	10.0	0.6					
274	0.27	12.5	16.0	7.5	7.5	0.6	15.0	21.0	8.5	10.0	0.6					
334	0.33	12.5	16.0	7.5	7.5	0.6	15.0	21.0	8.5	10.0	0.6					
394	0.39	14.5	16.0	8.5	7.5	0.6	18.0	21.0	10.0	10.0	0.6					
474	0.47	14.5	16.0	8.5	7.5	0.6	18.0	21.0	10.0	10.0	0.6					

NOTE: Part Numbering System

(1) (2) (3) (4)

PEI 103 J 2A

- 1 Series
- 2 Capacitance
- 3 Tolerance
- 4 Working Voltage



Metallized Polyester Film Capacitor Series Type MER

△ Features

- Non-inductive constructions with flame-retardant epoxy powder coating
- Excellent electrical characteristic & self-healing characteristics

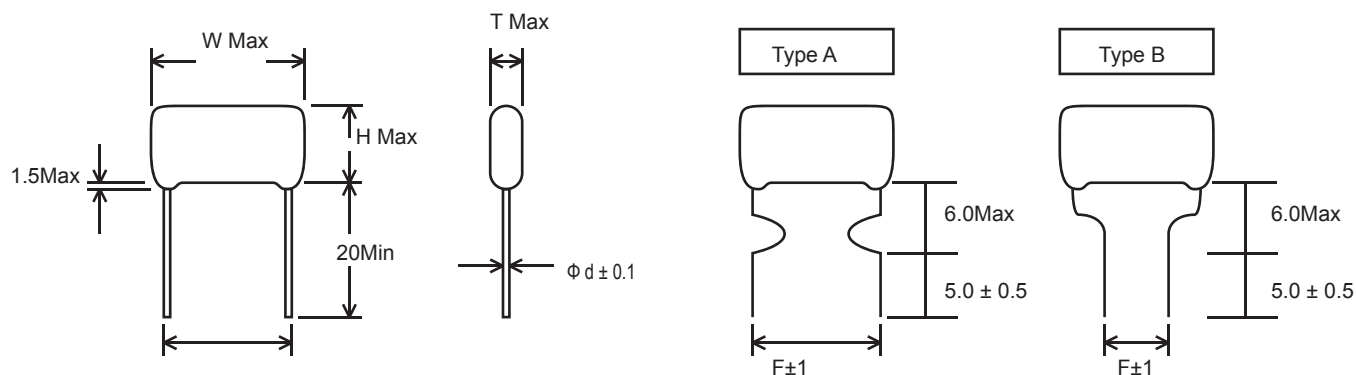
△ Applications

- Suitable for in filter, coupling and bypassing of the general communication, self-healing characteristics.

△ Specifications

Item	Characteristics
Operating Temperature Range	- 40 ~ +85°C
Capacitance Range	0.01μF ~ 6.8μF
Capacitance Tolerance	± 2%(G), ± 5%(J), ± 10%(K)
Standard Working Voltage	DC100V(2A), 250V(2E), 400V(2G), 630V(2J)
Dissipation Factor	Max 1.0% at 1kHz, 20°C
Insulation Resistance	Min 9,000MΩ (C ≤ 0.33μF) Min 3,000MΩ (C > 0.33μF)
Withstanding Voltage	Rated voltage X 1.75 (5sec)

△ Dimensions





Metallized Polyester Film Capacitor Series Type MER

Δ Dimensions

units: mm

WV		DC 250V (100V) = 2A					DC 400V = 2G					DC 630V = 2J				
Cap(μF)		W	H	T	P	ø	W	H	T	P	ø	W	H	T	P	ø
103	0.01	14.0	10.5	6.0	11.5	0.7	14.0	10.5	6.5	11.5	0.7	14.0	10.5	6.5	11.5	0.7
123	0.012	14.0	10.5	6.0	11.5	0.7	14.0	10.5	6.5	11.5	0.7	14.0	10.5	6.5	11.5	0.7
153	0.015	14.0	10.5	6.0	11.5	0.7	14.0	10.5	6.5	11.5	0.7	14.0	10.5	6.5	11.5	0.7
183	0.018	14.0	10.5	6.0	11.5	0.7	14.0	10.5	6.5	11.5	0.7	14.0	10.5	6.5	11.5	0.7
223	0.022	14.0	10.5	6.0	11.5	0.7	14.0	10.5	6.5	11.5	0.7	14.0	10.5	6.5	11.5	0.7
273	0.027	14.0	10.5	6.0	11.5	0.7	14.0	10.5	6.5	11.5	0.7	14.0	10.5	6.5	11.5	0.7
333	0.033	14.0	10.5	6.0	11.5	0.7	14.0	10.5	6.5	11.5	0.7	14.0	10.5	6.5	11.5	0.7
393	0.039	14.0	10.5	6.0	11.5	0.7	14.0	10.5	6.5	11.5	0.7	19.5	12.5	6.5	16.5	0.7
473	0.047	14.0	10.5	6.0	11.5	0.7	14.0	10.5	6.5	11.5	0.7	19.5	12.5	6.5	16.5	0.7
563	0.056	14.0	12.5	6.5	11.5	0.7	14.0	10.5	6.5	11.5	0.7	19.5	12.5	6.5	16.5	0.7
683	0.068	14.0	12.5	6.5	11.5	0.7	14.0	10.5	6.5	11.5	0.7	19.5	12.5	6.5	16.5	0.7
823	0.082	14.0	12.5	6.5	11.5	0.7	14.0	13.0	8.0	11.5	0.7	19.5	15.0	8.5	16.5	0.7
104	0.1	14.0	12.5	6.5	11.5	0.7	16.5	13.0	6.5	15.0	0.7	19.5	15.0	8.5	16.5	0.7
124	0.12	14.0	12.5	6.5	11.5	0.7	19.5	13.0	7.5	16.5	0.7	19.5	15.0	8.5	16.5	0.7
154	0.15	14.0	12.5	6.5	11.5	0.7	19.5	13.0	7.5	16.5	0.7	25.0	16.0	9.5	21.5	0.7
184	0.18	14.0	12.5	6.5	11.5	0.7	19.5	13.0	7.5	16.5	0.7	25.0	16.0	9.5	21.5	0.7
224	0.22	19.5	12.5	6.5	16.5	0.7	25.0	14.5	7.5	21.5	0.7	25.0	18.0	9.5	21.5	0.8
274	0.27	19.5	12.5	6.5	16.5	0.7	25.0	14.5	7.5	21.5	0.7	25.0	18.0	9.5	21.5	0.8
334	0.33	19.5	12.5	6.5	16.5	0.7	25.0	17.0	9.0	21.5	0.7	25.0	19.5	10.5	26.5	0.8
394	0.39	19.5	12.5	6.5	16.5	0.7	25.0	17.0	9.0	21.5	0.7	29.5	19.5	10.5	26.5	0.8
474	0.47	19.5	13.5	6.5	16.5	0.7	25.0	17.0	11.0	21.5	0.8	29.5	22.0	12.0	26.5	0.8
564	0.56	19.5	14.0	7.0	16.5	0.7	29.5	19.0	11.0	26.5	0.8	29.5	22.0	13.0	26.5	0.8
684	0.68	25.0	14.0	7.0	21.5	0.7	29.5	19.0	11.0	26.5	0.8	30.0	25.0	15.0	26.5	0.8
824	0.82	25.0	17.0	7.0	21.5	0.8	29.5	19.0	11.0	26.5	0.8	37.0	28.0	17.0	31.5	0.8
105	1.0	25.0	17.0	9.5	21.5	0.8	30.0	21.5	13.5	26.5	0.8	37.0	28.0	17.0	31.5	0.8
125	1.2	25.0	20.0	9.5	21.5	0.8	30.0	23.0	13.5	26.5	0.8	37.0	28.0	17.0	31.5	0.8
155	1.5	29.5	20.0	9.5	26.5	0.8	30.0	24.0	15.0	26.5	0.8					
185	1.8	29.5	20.0	9.5	26.5	0.8										
205	2.0	29.5	20.0	9.5	26.5	0.8										
225	2.2	29.5	20.0	9.5	26.5	0.8										
275	2.7	30	20.0	11.0	26.5	0.8										
335	3.3	30	20.0	11.0	26.5	0.8										
475	4.7	30	25.0	14.0	26.5	0.8										
685	6.8	30	25.0	16.0	26.5	0.8										

NOTE: Part Numbering System
(1) (2) (3) (4)
MER 103 M 2A

- 1 Series
- 2 Capacitance
- 3 Tolerance
- 4 Working Voltage



Metallized Polypropylene Film Capacitor Type MPR Series

△ Features

- Non-inductive constructions
- Low-loss & inherent temperature rise and excellent frequency characteristics

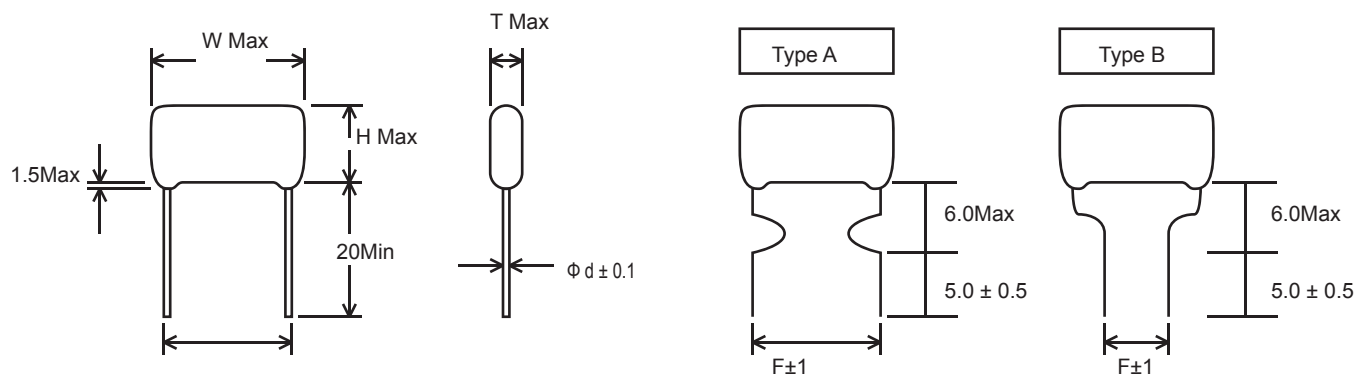
△ Applications

- Suitable for high frequency coupling and decoupling, sample and hold, and high fidelity circuitry

△ Specifications

Item	Characteristics
Operating Temperature Range	- 40 ~ +85°C
Capacitance Range	0.047μF ~ 1.0μF
Capacitance Tolerance	± 5%(J), ± 10%(K)
Standard Working Voltage	DC100V(2A), 250V(2E), 400V(2G), 630V(2J)
Dissipation Factor	Max 1.0% at 1kHz, 20°C
Insulation Resistance	Min 25,000MΩ (C ≤ 0.33μF) Min 7,000MΩ (C > 0.33μF)
Withstanding Voltage	Rated voltage X 1.75 (5sec)

△ Dimensions





Metallized Polypropylene Film Capacitor Type MPR Series

Δ Features

units: mm

WV		DC 250V (100V) = 2A					DC 400V = 2G					DC 630V = 2J				
Cap(μF)		W	H	T	P	ø	W	H	T	P	ø	W	H	T	P	ø
473	0.047	16.0	11.0	7.0	11.5	0.7	16.0	11.0	7.0	11.5	0.7	20.0	13.0	8.0	16.5	0.7
563	0.056	16.0	11.0	7.0	11.5	0.7	16.0	11.0	7.0	11.5	0.7	20.0	13.0	8.0	16.5	0.7
683	0.068	16.0	11.0	7.0	11.5	0.7	20.0	15.0	10.0	16.5	0.7	20.0	14.5	9.0	16.5	0.7
823	0.082	16.0	11.0	7.0	11.5	0.7	20.0	15.0	10.0	16.5	0.7	20.0	14.5	9.0	16.5	0.7
104	0.1	16.0	11.0	8.0	11.5	0.7	20.0	15.0	10.0	16.5	0.7	20.0	14.5	9.0	16.5	0.7
124	0.12	16.0	11.0	8.0	11.5	0.7	20.0	16.0	10.0	16.5	0.7	20.0	15.0	10.0	16.5	0.7
154	0.15	20.0	14.0	9.0	16.5	0.7	20.0	16.0	10.0	16.5	0.7	25.0	16.0	10.0	21.5	0.8
184	0.18	20.0	14.0	9.0	16.5	0.7	20.0	16.0	10.0	16.5	0.7	25.0	16.0	10.0	21.5	0.8
224	0.22	20.0	14.0	9.0	16.5	0.7	25.0	16.0	10.0	21.5	0.7	30.0	20.0	12.0	26.5	0.8
274	0.27	20.0	14.0	9.0	16.5	0.7	25.0	16.0	10.0	21.5	0.7	30.0	20.0	12.0	26.5	0.8
334	0.33	25.0	15.5	9.5	21.5	0.7	25.0	17.0	11.5	21.5	0.7	30.0	20.0	12.0	26.5	0.8
394	0.39	25.0	15.5	9.5	21.5	0.7	25.0	17.0	11.5	21.5	0.7	30.0	20.0	12.0	26.5	0.8
474	0.47	25.0	15.5	9.5	21.5	0.7	25.0	17.0	11.5	21.5	0.7	36.0	21.0	15.0	31.5	0.8
564	0.56	25.0	18.0	12.0	21.5	0.8	25.0	18.5	12.5	21.5	0.7	36.0	21.0	15.0	31.5	0.8
684	0.68	25.0	18.0	12.0	21.5	0.8	29.5	18.5	10.5	26.5	0.8	36.0	21.0	15.0	31.5	0.8
824	0.82	25.0	18.0	12.0	21.5	0.8	29.5	18.5	10.5	26.5	0.8	36.0	24.0	18.0	31.5	0.8
105	1.0	25.0	20.0	14.0	21.5	0.8	29.5	20.0	13.0	26.5	0.8	36.0	26.0	20.0	31.5	0.8
125	1.2	25.0	20.0	14.0	21.5	0.8	29.5	20.0	13.0	26.5	0.8	36.0	26.0	20.0	31.5	0.8

NOTE: Part Numbering System

(1) (2) (3) (4)

MPR 103 J 2A

- 1 Series
- 2 Capacitance
- 3 Tolerance
- 4 Working Voltage



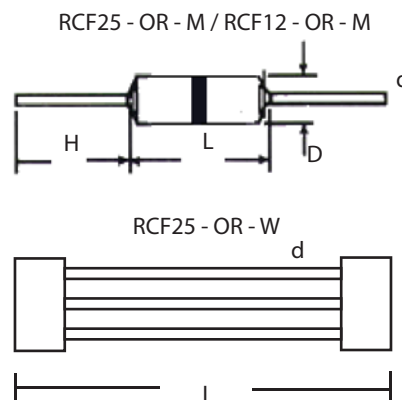
Zero Ohm and Jumper Wire Type RCF Series

Δ Applications

- Used when circuit path on a PC board needs to be crossed over.
- Used for circuit tuning by changing point connections.

All Liberty Resistors uses the highest quality tin coated copper leads. The leads are rated at the below MAXIMUM soldering temperature and soldering time.

MAXIMUM soldering temperature/time
350°C 3sec
235°C 2min



Δ Specifications

Construction	Part Number	L	D	H (Min)	d
Jumper Wire	RCF24 * - OR - W	61.5 ± 1			0.6 ± 0.5
Ceramic (Metal Body)	RCF16 * - OR - C(M)	3.8 ± 0.5	1.5 ± 0.2	27	0.45 ± 0.5
Ceramic (Metal Body)	RCF25 * - OR - C(M)	6.5 ± 0.3	2.5 ± 0.2	27	0.6 ± 0.5
Ceramic (Metal Body)	RCF - 51 - OR - C(M)	9 ± 0.5	3.2	25	0.6 ± 0.5
Ceramic (Metal Body)	RCF - 100 - OR - C(M)	11	4.5	30	0.8 ± 0.03
Ceramic (Metal Body)	RCF - 200 - OR - C(M)	16	6	30	0.8 ± 0.03

Test	Test Method	Limits
Resistance		0.01 ohm max.
Operating Temperature		-55 °C to +155 °C
Max Current		25amps @ +25 °C (ZR25)
Max Working Voltage		300Vdc
Max Overload Voltage		600Vdc
Temperature Coefficient		(PPM/ °C) 0 to -100 PPM
Short Time Overload	Apply 2.5 times the rated voltage for 5 sec.	No visible damage
Load	1000 hrs. at 70 °C a direct voltage applied, cycles of 1.5 hrs on and 0.5 hrs off throughout test.	Δ R = 0.5%
Temperature Cycling	5 cycles of 30 min. duration at the extremes of temp. range, max. and min., measurements of ohmic value 4 hrs. after completion of test.	Δ R = 0.5%
Dielectric Strength	Using a 90 °C "V" shaped conductive block, applying 100V min., increasing 100V/sec. for 5 seconds	Δ R = 0.5%
Humidity	350 hrs. at 40 °C, 90 to 95% Rh	R = 0.5%
Solderability	Dipped in Sn/Pb(60/40) at 235 °C, 5 sec. 1.5 mm from the body.	95% ø of tested surface covered
Vibration	By MIL STD.202, 201A	
Terminal Strength	Traction, applied 2.5kg for 10 sec. Bends, 2 bends 90 °C applying load to terminals of 0.5kg. Twist 2 successive turn 180 °C, 6mm from body.	No visible damage
Resistance to Solvents	Trichlorethylene, TMC as the most aggressive for 60 sec. at boiling point.	No visible damage



Carbon Film Fixed Resistors Type RCF Series

△ Features

- Resistance temperature coefficient is relatively high.
- Quick dissipation of heat and low temperature rise.
- Low price.
- Selected superior quality materials to ensure stability and reliability.
- Variety of packaging available: bulk, strip pack, tape and reel, etc.

△ Applications

- Easily used for various medical, telecom and consumer electronic equipment.

△ Specifications

Dimensions



All Liberty Resistors uses the highest quality tin coated copper leads. The leads are rated at the below MAXIMUM soldering temperature and soldering time.

MAXIMUM soldering temperature/time

350°C 3sec

235°C 2min

Requirements		Performance				Test Method	
Operating Temp. Range		-55°C ~ +155°C				JIS C 5202	MIL-STD-202
Temp Coefficient (ppm/°C)	Type	T.C.R.				-	-
		± 150	-150 -700	-150 -1,000	-150 -1,300	5.2	Method 304
	0.125W	Under 1K Ω	1.1K Ω - 47K Ω	51K Ω - 510K Ω	560 Ω - 1M Ω		
	0.25W	Under 1K Ω	1.1K Ω - 150K Ω	160K Ω - 2.2M Ω	2.4M Ω - 5.1M Ω		
	0.5W & Over	Under 1K Ω	24K Ω - 470K Ω	510K Ω - 2.2K Ω	2.4M Ω - 10M Ω		
Noise (µV/V)	Type	Noise					
		0.1	0.3	0.6	1.0	5.9-11	Method 308
	0.125W	-	Under 10K Ω	11K Ω - 100K Ω	Over 110K Ω		
	0.25W & Over	Under 100K Ω	110K Ω - 510K Ω	560K Ω - 2.2M Ω	Over 110K Ω		
Dielectric Withstanding		No evidence of flashover or breakdown				5.7-A	Method 301
Resistance to Solvents		Permanent marking no physical or electrical damage or				-	Method 215
Short Time Overload		ΔRmax ≤ ± (1% ± 0.05Ω)				5.5-A	
Resistance to Soldering Heat		ΔRmax ≤ ± (1% ± 0.05Ω)				6.4, 350°C 3 Sec.	Method 210
Temperature Cycling		ΔRmax ≤ ± (0.5% ± 0.05Ω)				7.4, 55°C / 85°C	Method 107
Vibration		ΔRmax ≤ ± (0.5% ± 0.05Ω)				6.3.3-A	Method 204
Moisture Resistance	R>100KΩ	ΔRmax ≤ ± 5%				7.9,40°C 90-95% RH 1000Hrs	Method 106
	R≤100KΩ	ΔRmax ≤ ± (3% ± 0.05Ω)					
Load Life	R>100KΩ	ΔRmax ≤ ± 3%				7.10, 70°C 1000Hrs	Method 108
	R≤100KΩ	ΔRmax ≤ ± (2% ± 0.05Ω)					

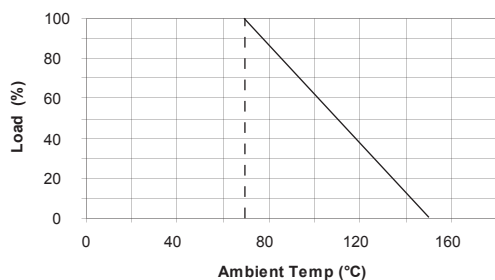


Carbon Film Fixed Resistors Type RCF Series

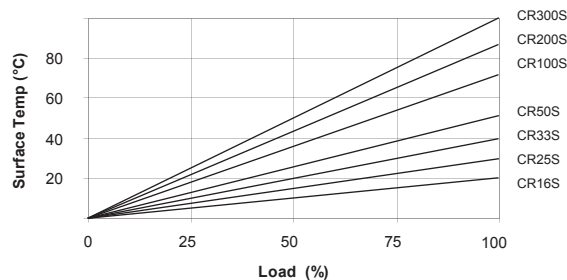
Δ Dimensions

Type	POWER RATING (W)	L±0.5	D±0.5	H (Min)	D±0.03	Max. Working V.	Max. Overload V.	Resistance Range ±2 % (G)	±5% (J)
RCF-16	1/8W	3.7	1.6	27	0.46	200V	400V	10Ω - 470K	0.1Ω - 47M
RCF-20	1/4WS	3.7	1.6	27	0.46	200V	400V	10Ω - 470K	0.1Ω - 47M
RCF-25	1/4W	6.5	2.5	27	0.58	250V	500V	10Ω - 1M	0.1Ω - 47M
RCF-33	1/3W	8.5	2.8	25	0.58	300V	600V	10Ω - 1M	0.1Ω - 47M
RCF-52	1/2WS	6.5	2.5	27	0.58	250V	500V	10Ω - 1M	0.1Ω - 47M
RCF-50	1/2W	9.0	3.2	25	0.58	350V	700V	10Ω - 1M	0.1Ω - 47M
RCF-100	1W	11.0	4.5	30	0.80	500V	1000V	10Ω - 1M	0.1Ω - 47M
RCF-200	2W	16.0	5.0	30	0.80	500V	1000V	10Ω - 1M	0.1Ω - 47M
RCF-300	3W	17.0	6.0	30	0.80	650V	1200V	10Ω - 470K	0.1Ω - 47M

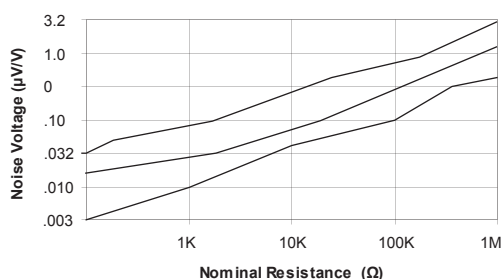
Derating Curve



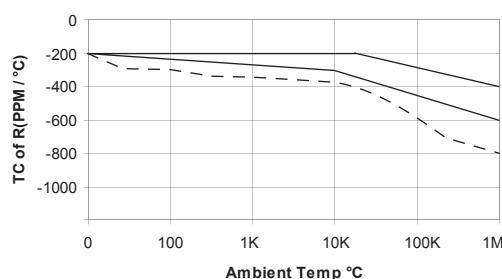
Surface Temp Rise



Current Noise



Temperature Coefficient



Δ Part Numbering

RCF	25	TR	100	J
Series Code	Power Rating 16=1/8W 20=1/4WS 25=1/4W 51=1/2W 52=1/2WS 100=1W 200=2W	Packaging TR=Tape Reel	Resistance Code D50=0.50Ω 1D0=1.0Ω 100=10Ω 101=100Ω 102=1000Ω 103=10000Ω 104=100000Ω 105=1000000Ω	Tolerance: J = ± 5%



Carbon Flameproof Resistors

Type RFP Series

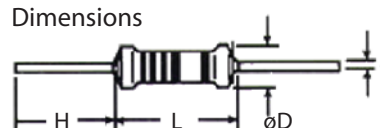
△ Features

- Complete nonflamable insulated coating
- Does not burn in outside flaming or inside overloading
- Ensures safety

△ Specifications

Style	Power Rating (W)	Dimensions (mm)				Max. Working V.	Max. Overload V.	Resistance Range	
		L	D	d	H (Min)			±2 % (G)	±5% (J)
RFP	1/4 W (0.25 W)	6.5 ± 0.5	2.3 ± 0.2	0.58 ± 0.02	27	250 V	500 V	10Ω - 1M	1Ω - 10M
RFP	1/2 W (0.5 W)	9 ± 1	3.5 ± 0.5	0.58 ± 0.02	27	350 V	700 V	10Ω - 1M	1Ω - 10M

Dimensions



△ Characteristics

Requirements	Characteristics	Test Method
Non-Combustibility	Flame Resistance: Will not burn continuously for more than 5 seconds. Overload Burning: will not fume under the overload of less than 5 times of rated power. The volume of fumes emitted under the overload of more than 5 times of rated power is less than that of stilled fumes emitted by one cigarette. During the test the height of fumes does not go over 3 mm and the burning does not continue for more than 3 seconds.	MIL-STD-202 Method 111 JIS C 5202 7. 12 EIAJ-RC 2658 5. 1

△ Part Numbering

RFP	25	TR	100	J
Series Code	Power Rating 12=1/8W 16=1/6W 25=1/4W 51=1/2W 100=1W 200=2W	Packaging TR=Tape Reel	Resistance Code D50=0.50Ω 1D0=1.0Ω 100=10Ω 101=100Ω 102=1000Ω 103=10000Ω 104=100000Ω 105=1000000Ω	Tolerance: J = ± 5%

All Liberty Resistors uses the highest quality tin coated copper leads. The leads are rated at the below MAXIMUM soldering temperature and soldering time.

MAXIMUM soldering temperature/time

350°C 3sec

235°C 2min



Metal Film Fixed Resistors Type RMF Series

△ Features

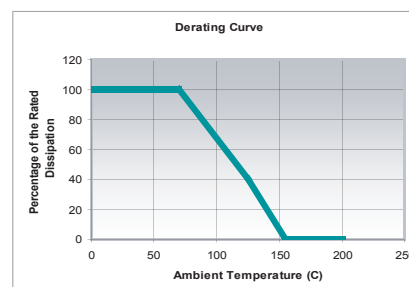
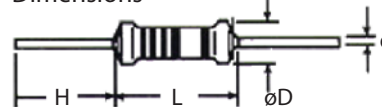
- High aluminum content base material
- Vacuum sputtered by Ni-Cr alloy
- Excellent heat and wet proof special resin for protective coating
- Stable and uniform properties, excellent performance in open air

△ Applications

- Suitable for products for high reliability.
- High-precision medical, telecom and consumer electronic equipment

△ Resistance Range

Dimensions



STYLE	POWER RATING (W)	TOLERANCE	TC±25PPM/°C	TC±100PPM/°C TC±50PPM/°C
MF-16	1/8 W	±1%	10Ω ~ 1MΩ	0.1Ω ~ 10MΩ
		±0.5%	100Ω ~ 1MΩ	1Ω ~ 10MΩ
		±0.25%	51.1Ω ~ 470KΩ	51.1Ω ~ 470KΩ
		±0.1%	51.1Ω ~ 470KΩ	51.1Ω ~ 470KΩ
MF-25	1/4 W	±1%	10Ω ~ 10MΩ	0.1Ω ~ 10MΩ
		±0.5%	0.1Ω ~ 10MΩ	0.1Ω ~ 10MΩ
		±0.25%	10Ω ~ 470KΩ	10Ω ~ 470KΩ
		±0.1%	10Ω ~ 470KΩ	10Ω ~ 470KΩ
MF-50	1/2 W	±1%	0.1Ω ~ 10MΩ	0.1Ω ~ 10MΩ
		±0.5%	0.1Ω ~ 10MΩ	0.1Ω ~ 10MΩ
		±0.25%	10Ω ~ 470KΩ	10Ω ~ 470KΩ
		±0.1%	10Ω ~ 470KΩ	10Ω ~ 470KΩ
MF-100	1 W	±1%	0.1Ω ~ 10MΩ	0.1Ω ~ 10MΩ
		±0.5%	0.1Ω ~ 10MΩ	0.1Ω ~ 10MΩ
		±0.25%	1Ω ~ 1MΩ	10Ω ~ 470KΩ
		±0.1%	1Ω ~ 1MΩ	10Ω ~ 470KΩ
MF-200	2 W	±1%	0.1Ω ~ 10MΩ	0.1Ω ~ 10MΩ
		±0.5%	0.1Ω ~ 10MΩ	0.1Ω ~ 10MΩ
		±0.25%	1Ω ~ 1MΩ	10Ω ~ 470KΩ
		±0.1%	1Ω ~ 1MΩ	10Ω ~ 470KΩ
MF-300	3 W	±1%	0.1Ω ~ 10MΩ	0.1Ω ~ 10MΩ
		±0.5%	0.1Ω ~ 10MΩ	0.1Ω ~ 10MΩ
		±0.25%	1Ω ~ 1MΩ	1Ω ~ 470KΩ
		±0.1%	1Ω ~ 1MΩ	1Ω ~ 470KΩ

△ Dimensions (mm)

Type	Power Rating (W)	L±0.5	D±0.5	H (Min)	D±0.03	Max. Working V.	Max. Overload V.
RMF-16	1/8W	3.7	1.8	27	0.46	200V	300V
RMF-25	1/4W	6.5	2.5	27	0.58	250V	500V
RMF-50	1/2W	9	3.7	25	0.68	400V	700V
RMF-100	1W	11	4.5	33	0.8	500V	1000V
RMF-200	2W	16	5	33	0.8	750V	1000V
RMF-300	3W	17	6	30	0.8	750V	1000V



Miniature Size Metal Film Fixed Resistors Type RMF Series

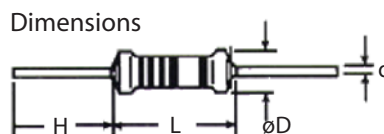
△ Features

- Miniature size for saving PCB assembly
- Vacuum sputtering metal film on high aluminum ceramic rods
- Superior electrical performance, cost comparable to conventional sizes
- Standard tolerance $\pm 1\%$ (2%, 5% Available)

△ Applications

- Suitable for products for high reliability.
- High-precision medical, telecom and consumer electronic equipment

△ Dimensions (mm)



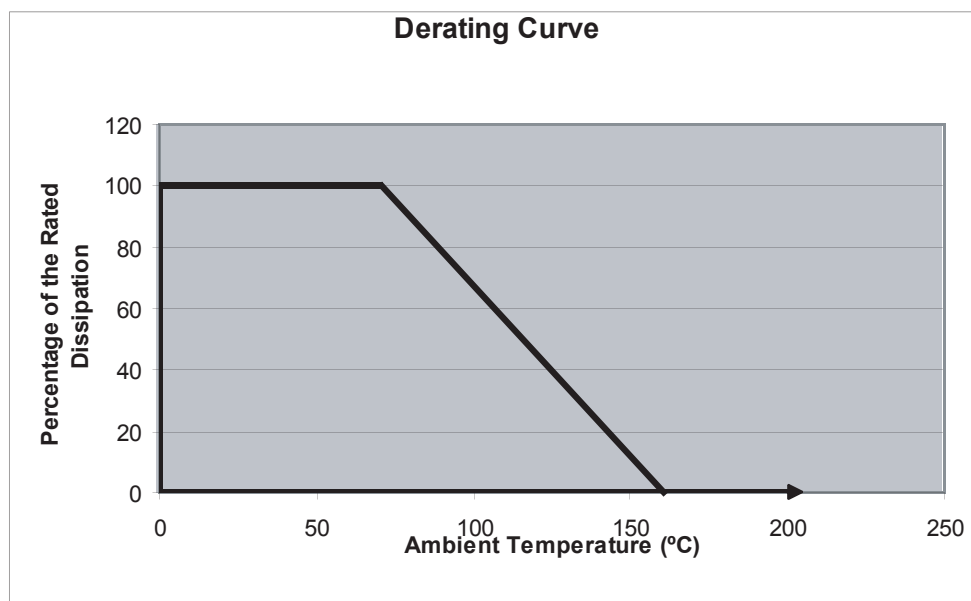
All Liberty Resistors uses the highest quality tin coated copper leads. The leads are rated at the below **MAXIMUM** soldering temperature and soldering time.

MAXIMUM soldering temperature/time
350°C 3sec
235°C 2min

Type	Power Rating (W)	Small Type	L ± 0.5	D ± 0.5	H(Min)	D ± 0.3	Max. Working V.	Max. Overload V.
RMF-20	1/4W	1/4WS	3.7	1.8	27	0.46	200V	300V
RMF-52	1/2W	1/2WS	6.5	2.5	25	0.58	250V	500V
RMF-101	1W	1WS	9.0	3.7	25	0.68	400V	700V
RMF-201	2W	2WS	11.0	4.5	30	0.80	500V	1000V
RMF-301	3W	3WS	16.0	5.0	30	0.80	750V	1000V
RMF-501	5W	5WS	17.0	6.0	30	0.80	750V	1000V

- Max working voltage determined by $E = PR$, E should not exceed value listed in column above.

△ Derating Curve





Metal Film Fixed Resistors Type RMF Series

Δ Characteristics

Requirements	Characteristics	Remarks
Temperature Coefficient	±50ppm	10 -6/K
		MIL-STD-202
		Method 304
Thermal Resistance	140 K/W	
Life Stability at 70°C at 1000Hr Max Resistance Change	0.5%	K Most Umax 1.5 Hr On
		0.5 Hr Off
Dielectric Withstanding Voltage	300 Vrms for MF25S	
	500 Vrms for MF50S	
Insulation Resistance	>1000 MΩ	100VDC
Damp Heat Steady State	±0.5%	56 days at 40°C and 93% Relative Humidity at a Voltage of 0.1 Times Rated Voltage, Max 16 volts
Short Time Overload	ΔR ±0.25%	2.5 Times Rated Voltage at Most 2 Times Limiting Element Voltage (UMax)
Moisture Resistance	± 0.5%	
Resistance to Soldering Heat	± 0.25%	350 ± 5°C to 6mm Distance from the resistance body in 3 secs.
Temperature Cycling	± 0.5%	-65°C to +155°C
Low Temperature Operation	± 0.25%	High Frequency 10-500Hz
Vibration	± 0.25%	-65°C
Current Noise	Up to 1MΩ ≤0.5 μV/V	-5dB
Solderability	>95% Coverage	Dipping in 235-5dBC Solder Bath for 2.5 secs.
Resistance to Solvents	No Failure to Top Coating and Color Code	

Δ Part Numbering

RMF	25	TR	1000	F
Series Code	Power Rating 16 = 1/8W 25 = 1/4W 51 = 1/2W 100 = 1W 200 = 2W 300 = 3W 500 = 5W	Packaging TR = Tape Reel	Resistance Code D500 = 0.500Ω 1D00 = 1.00Ω 10D0 = 10.0Ω 1000 = 100Ω 1001 = 1000Ω 1002 = 10000Ω 1003 = 100000Ω 1004 = 1000000Ω	Tolerance: F = ±1% D = ±0.5% CC = ±0.25% BB = ±0.1%



Miniature Metal Film Fixed Resistors Type RMF Series

Δ Characteristics

Requirements	Characteristics	Remarks
Temperature Coefficient	±50ppm	10 -6/K
		MIL-STD-202
		Method 304
Thermal Resistance	140 K/W	
Life Stability at 70°C at 1000Hr Max Resistance Change	0.5%	K Most Umax 1.5 Hr On
		0.5 Hr Off
Dielectric Withstanding Voltage	300 Vrms for MF25S	
	500 Vrms for MF50S	
Insulation Resistance	>1000 MΩ	100VDC
Damp Heat Steady State	±0.5%	56 days at 40°C and 93% Relative Humidity at a Voltage of 0.1 Times Rated Voltage, Max 16 volts
Short Time Overload	ΔR ±0.25%	2.5 Times Rated Voltage at Most 2 Times Limiting Element Voltage (UMax)
Moisture Resistance	± 0.5%	
Resistance to Soldering Heat	± 0.25%	350 ± 5°C to 6mm Distance from the resistance body in 3 secs.
Temperature Cycling	± 0.5%	-65°C to +155°C
Low Temperature Operation	± 0.25%	High Frequency 10-500Hz
Vibration	± 0.25%	-65°C
Current Noise	Up to 1MΩ ≤0.5 μV/V	-5dB
Solderability	>95% Coverage	Dipping in 235-5dBC Solder Bath for 2.5 secs.
Resistance to Solvents	No Failure to Top Coating and Color Code	

Δ Part Numbering

RMF	20	TR	1000	F
Series Code	Power Rating 20 = 1/4WS 52 = 1/2WS 101 = 1WS 201 = 2WS 301 = 3WS 501 = 5WS	Packaging TR = Tape Reel	Resistance Code D500 = 0.500Ω 1D00 = 1.00Ω 10D0 = 10.0Ω 1000 = 100Ω 1001 = 1000Ω 1002 = 10000Ω 1003 = 100000Ω 1004 = 1000000Ω	Tolerance: F = ±1% D = ±0.5% CC = ±0.25% BB = ±0.1%



Metal Flameproof Resistors Type RFM Series

△ Features

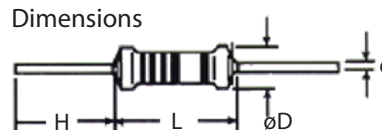
- Nonflammable, high performance metal film fixed resistors
- Flame-overload burning-resisting resin
- Excellent electronic performance

△ Applications

- Suitable for products for high reliability.
- High-precision medical, telecom and consumer electronic equipment

△ Dimensions

Dimensions



All Liberty Resistors uses the highest quality tin coated copper leads. The leads are rated at the below MAXIMUM soldering temperature and soldering time.

MAXIMUM soldering temperature/time

350°C 3sec

235°C 2min

Style	Power Rating (W)		Dimensions (mm)				Max Working Voltage		Max Overload Voltage	
	70°C	125 °C	L	D	H (min)	d	70 °C	125 °C	70 °C	125 °C
RFM 25	0.25W	0.1W	6.5±0.5	2.3±0.2	27	0.58±0.2	250	200	500	400
RFM 50	0.5W	0.125W	9.0±1	3.5±0.5	27	0.65±0.2	350	250	700	500

△ Characteristics

Requirements	Characteristics	Test Method
Non-Combustibility	Flame Resistance: Will not burn continuously for more than 5 seconds. Overload Burning: will not fume under the overload of less than 5 times of rated power. The volume of fumes emitted under the overload of more than 5 times of rated power is less than that of stilled fumes emitted by one cigarette. During the test the height of fumes does not go over 3 mm and the burning does not continue for more than 3 seconds.	MIL-STD-202 Method 111 JIS C 5202 7. 12 EIAJ-RC 2658 5. 1

△ Part Numbering

RFM	25	TR	1000	F
Series Code	Power Rating 12=1/8W 16=1/6W 25=1/4W 51=1/2W 100=1W 200=2W 300=3W 500=5W	Packaging TR=Tape Reel	Resistance Code D500=0.500Ω 1D00=1.00Ω 10D0=10.0Ω 1000=100Ω 1001=1000Ω 1002=10000Ω 1003=100000Ω 1004=1000000Ω	Tolerance: F = ± 1%

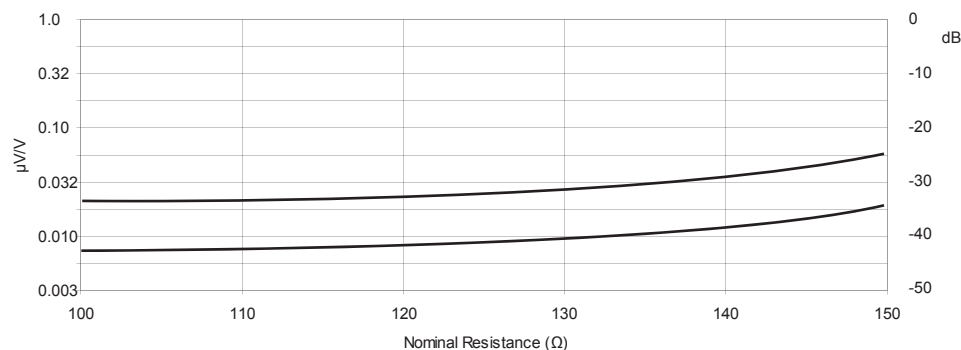


Metal Flameproof Resistors Type RFM Series

Δ Characteristics

Characteristic	Specification	Test Method
		All resistance measurements should be performed after stabilization or conditioning periods.
DC Resistance	Within Specified Tolerance	MIL-STD-202 Method 303
Temperature Coefficient	As Buyer Requested $\pm 25\text{ppm}/^{\circ}\text{C}$ $\pm 100\text{ppm}/^{\circ}\text{C}$ $\pm 50\text{ppm}/^{\circ}\text{C}$ $\pm 200\text{ppm}/^{\circ}\text{C}$	MIL-STD-202 Method 304
Dielectric Strength	No Flashover or Damage	MIL-STD-202 Method 301 1/8W 300V 1 Minute, 1/4 500V 1 Minute 1/8W 300V 1 Minute, 1/4 500V 1 Minute
Insulation Resistance	At Least 1,000M Ω	MIL-STD-202 Method 302 100V 1 Minute
Current Noise Test	Below 10K Ω Below 0.05 $\mu\text{V}/\text{V}$ 10K Ω - Below 0.1 $\mu\text{V}/\text{V}$ Below 1M7 Below 0.2 $\mu\text{V}/\text{V}$	MIL-STD-202 Method 308
Vibration	ΔR Within $\pm$ (0.25% 0.05 Ω)	MIL-STD-202 Method 201 10Hz X.Y.Z. 3 Directions 2 Hours each
Torminal Strength	Lead does not break or loosen	MIL-STD-202 Method 211
Resistance to Soldering Heat	ΔR Within $\pm$ (0.25% 0.05 Ω)	MIL-STD-202 Method 210 350 $^{\circ}\text{C}$, 3 $\pm$ 0.05Sec.
Solderability	At Least 95% Coverage	MIL-STD-202 Method 208 230 $^{\circ}\text{C}$, 0.05Sec.
Thermal Shock	ΔR Within $\pm$ (0.5% 0.05 Ω)	MIL-STD-202 Method 107 -55 $^{\circ}\text{C}$ +155 $^{\circ}\text{C}$ 5 Cycles
Short Time Overload	ΔR Within $\pm$ (0.5% 0.05 Ω)	MIL-R-10509 PARA, 4,6,6, 2.5 Times Rated Working Voltage, 5 Secs
Humidity	ΔR Within $\pm$ (1% 0.05 Ω) No Mechanical Damage	MIL-STD-202 Method 103 40 $^{\circ}\text{C}$, RH95% 500
Low Temperature Operation	ΔR Within $\pm$ (0.5% 0.05 Ω)	MIL-R-10509 PARA, 4,6,5, Rated Working Voltage, at -65 $^{\circ}\text{C}$ 45 Minutes
Load Life	ΔR Within $\pm$ (1% 0.05 Ω)	MIL-STD-202 Method 108 Rated Working Voltage 1 1/2 Hours on 1/2 Hours Off For Total 1000Hours
Resistance To Solvent	Color Bands Legible No Mechanical Damage	MIL-STD-202 Method 215

Δ Current Noise





Metal Oxide Film Resistors Type RMO Series

△ Features

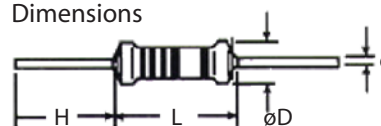
- Special metal oxide film thermochemically burned on
- High heat conductive base material
- Electrical and mechanical stability and high reliability
- Coating and marking resist trichlorethylene freon and clearing agents
- 1/2-3W apply color code

△ Applications

- Easily used for various kinds of medical, telecom and electronic devices and instruments.

△ Specifications

Dimensions

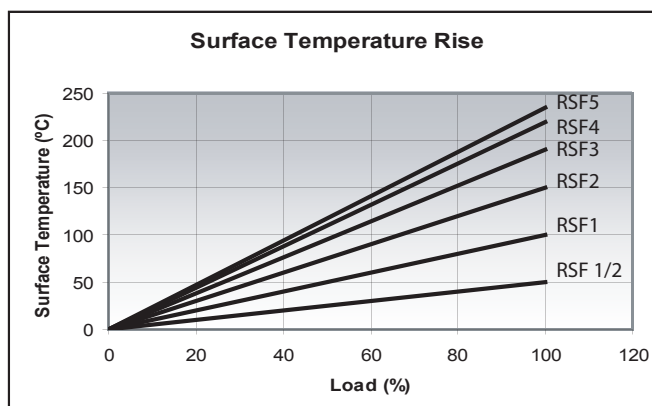
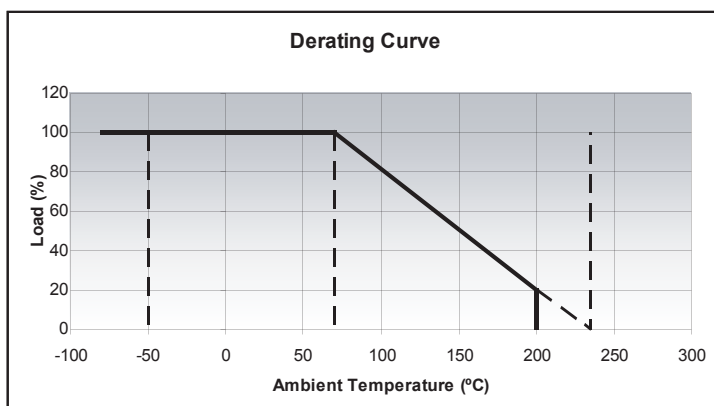


All Liberty Resistors uses the highest quality tin coated copper leads. The leads are rated at the below **MAXIMUM** soldering temperature and soldering time.

MAXIMUM soldering temperature/time
350°C 3sec
235°C 2min

Part	Type	DIMENSION(mm)				Max Working Voltage	Max Overload Voltage	Resistance Range $\pm 5\%$ (J)
		L	D	d	H(MIN)			
RMO-12	1/8W	3.7 $\pm$ 0.4	1.8 $\pm$ 0.2	0.46 $\pm$ 0.02	27	200V	400V	0.1 Ω -1M Ω
RMO-25	1/4W	6.8 $\pm$ 0.5	2.5 $\pm$ 0.2	0.58 $\pm$ 0.02	27	250V	500V	0.1 Ω -1M Ω
RMO-51	1/2W	9 $\pm$ 1	3.0 $\pm$ 0.5	0.68 $\pm$ 0.02	25	300V	600V	0.1 Ω -1M Ω
RMO-100	1W	12 $\pm$ 1	4.5 $\pm$ 0.5	0.8 $\pm$ 0.03	30	350V	700V	0.1 Ω -1M Ω
RMO-200	2W	16 $\pm$ 1	5 $\pm$ 0.5	0.8 $\pm$ 0.03	30	350V	700V	0.1 Ω -1M Ω
RMO-300	3W	18 $\pm$ 1	6 $\pm$ 0.5	0.8 $\pm$ 0.03	30	500V	1000V	0.1 Ω -1M Ω
RMO-500	5W	25 $\pm$ 1	8.5 $\pm$ 0.5	0.8 $\pm$ 0.03	30	750V	1000V	0.1 Ω -1M Ω

Part	Small Type	DIMENSION(mm)				Max Working Voltage	Max Overload Voltage	Resistance Range $\pm 5\%$ (J)
		L	D	d	H(MIN)			
RMO-20	1/4WS	3.7 $\pm$ 0.4	1.8 $\pm$ 0.2	0.46 $\pm$ 0.02	27	250V	500V	0.1 Ω -1M Ω
RMO-52	1/2WS	6.8 $\pm$ 0.5	2.5 $\pm$ 0.2	0.58 $\pm$ 0.02	27	300V	600V	0.1 Ω -1M Ω
RMO-101	1WS	9 $\pm$ 1	3.0 $\pm$ 0.5	0.68 $\pm$ 0.02	25	350V	700V	0.1 Ω -1M Ω
RMO-201	2WS	12 $\pm$ 1	4.5 $\pm$ 0.5	0.8 $\pm$ 0.03	30	350V	700V	0.1 Ω -1M Ω
RMO-301	3WS	16 $\pm$ 1	5 $\pm$ 0.5	0.8 $\pm$ 0.03	30	500V	1000V	0.1 Ω -1M Ω
RMO-501	5WS	18 $\pm$ 1	6 $\pm$ 0.5	0.8 $\pm$ 0.03	30	750V	1200V	0.1 Ω -1M Ω
RMO-701	7WS	25 $\pm$ 1	8.5 $\pm$ 0.5	0.8 $\pm$ 0.03	30	800V	1500V	0.1 Ω -1M Ω





Metal Oxide Film Resistors Type RMO Series

Δ Characteristics

Requirements	Performance	Test Method	
		JIS-C-5202	MIL-STD-202
Operating Temp. Range	$\pm 55^{\circ}\text{C} \sim +155^{\circ}\text{C}$	-	-
Temp. Coefficient (ppm/ $^{\circ}\text{C}$)	$\pm 350^*$	5.2	Method 304
Short Time Overload	$\Delta R_{\text{max}} \leq \pm (1\% 0.05\Omega)$	5.5-A	-
Resistance to Soldering Heat	$\Delta R_{\text{max}} \leq \pm (1\% 0.05\Omega)$	6.4. 350°C 3 Secs.	Method 210
Temp. Cycling	$\Delta R_{\text{max}} \leq \pm (1\% 0.05\Omega)$	7.4 $-55^{\circ}\text{C} / 85^{\circ}\text{C}$, 5 Cycles	Method 107
Moisture Resistance	$\Delta R_{\text{max}} \leq \pm 5\%$	7.9 95%RH On-Off 1,000Hr	Method 106
Load Life	$\Delta R_{\text{max}} \leq \pm 5\%$	7.10 70°C On-Off 1,000Hr	Method 108
Dielectric Withstanding Voltage	$\Delta R_{\text{max}} \leq \pm (0.05\% 0.05\Omega)$	5.7-A	Method 301
Insulation Resistance	$>10000\text{M}\Omega$	5.6-A	-
Non-Combustibility	The resistor shall withstand overload test in accordance with article UL492.2.13 without producing a fire hazard.		

Δ Part Numbering

RMO	25	TR	100	J
Series Code	Power Rating 12=1/8W 16=1/6W 25=1/4W 51=1/2W 100=1W 200=2W 300=3W 500=5W	Packaging TR=Tape Reel	Resistance Code D50=0.50 Ω 1D0=1.0 Ω 100=10 Ω 101=100 Ω 102=1000 Ω 103=10000 Ω 104=100000 Ω 105=1000000 Ω	Tolerance: J = $\pm 5\%$



Metal Flameproof Fusible Resistors Type RFU Series

Δ Features

- Small in size, low cost
- Resistor provides circuit protection for overload or component failure
- Noncombustible insulating coat, solvent proof
- Uniform in fusing time
- Good TCR ± 200 PPM / $^{\circ}\text{C}$

Δ Applications

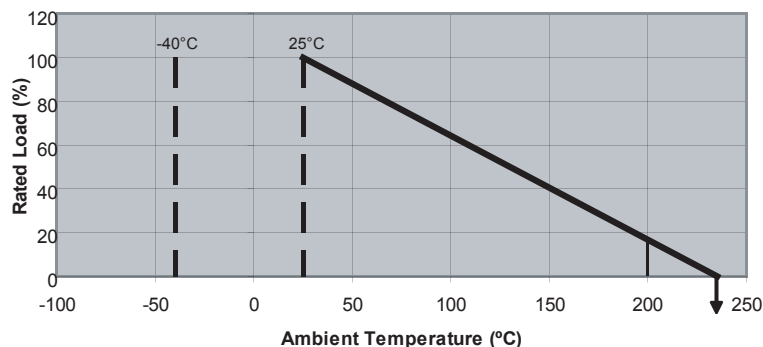
- Excellent application for high temperatures
- Suitable for use in transistor protection circuits
- Excellent for medical, telecom and consumer electronic equipment use.

Δ Dimensions

Type		Dimensions (mm)				Resistance Range	Max. Working Voltage	Dielectric Withstanding Voltage
		L	D	d	H(MIN)			
	1/4W	6.5±0.5	2.3±0.2	0.58±0.02	27	0.1Ω-100KΩ	250V	300V
	1/2WS	6.5±0.5	2.3±0.2	0.58±0.02	27	0.1Ω-100KΩ	250V	300V
1/2W	1WS	9±0.5	4.0±0.2	0.65±0.02	25	0.1Ω-100KΩ	300V	500V
1W	2WS	11±0.5	4.5±0.2	0.78±0.02	27	0.1Ω-100KΩ	350V	500V
2W	3WS	15±0.5	5.5±0.2	0.78±0.02	27	0.1Ω-100KΩ	500V	500V

- Max overload voltage is 2 times of max working voltage.
- Tolerance will be $\pm 10\%$ for values lower than 0.5 OHM.

Derating Curve



Δ Fusing Characteristics

Power	Fusing Time		
	Minimum	Nominal	Maximum
16xWattage	3 Sec.	30 Sec.	1 Min.
20	2 Sec.	15 Sec.	30 Sec.
24	1 Sec.	5 Sec.	10 Sec.
28	0.8 Sec.	3 Sec.	7 Sec.
32	0.8 Sec.	2 Sec.	4 Sec.

- Same fusing chart for FMF, FKN, and FSQ series.

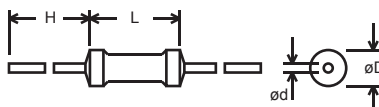


Fusible Wirewound Resistors Type RFU Series

Δ Characteristics

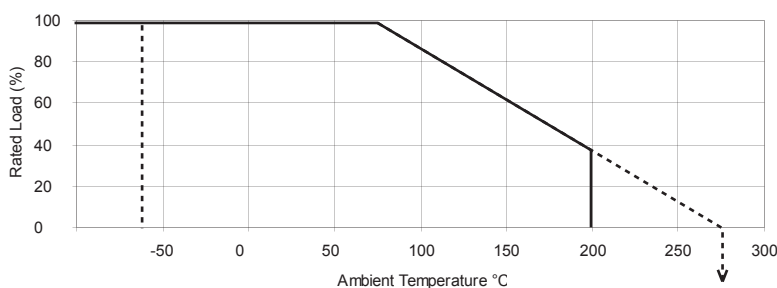
Characteristics	Condition	Spec.
Operating Temp	-40°C ~ 240°C	
Resistance Temp. Coefficient	-30°C ~ 150°C	±200ppm/°C
Shot Time Overload	4 Times of Rated Wattage for 5 Secs.	±2%
Insulation Resistance	500V Megger	1,000MΩ
Temp. Cycle	-30°C ~ 85°C for 5 Cycles	±1%
Load Life	25°C On-Off Cycle, 1000hrs	±5%
Moisture-Proof Load Life	40°C 95% RH On-Off Cycle, 1000hrs	±5%
Solder Pot	270°C for 3 Secs	±1%
Incombustibility	16 Times of Rated Wattage for 5 Min.	Not Flamed

*Total Resistance Change / ($\Delta R\%$ + 0.05Ω)



Δ Dimensions

Style	Power Rating	Dimension (mm)				Resistance Range	Dielectric Withstanding Voltage
		L ± 1.5	D ± 1	H(Min)	d ± 0.05		
RFU	1W	9	4.5	25	0.65	0.1Ω - 72Ω	500V
	2W	11	5.0	27	0.8	0.1Ω - 60Ω	500V
	3W	13	5.5	27	0.8	0.1Ω - 100Ω	500V
	4W	17	6.5	27	0.8	0.2Ω - 200Ω	500V
	5W	19	6.5	27	0.8	0.3Ω - 250Ω	500V

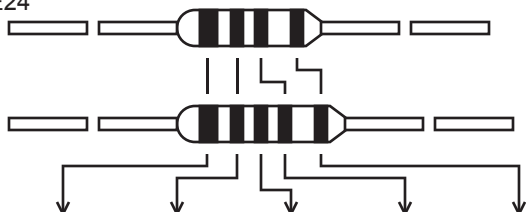


Test Items	Condition	Spec.
Operating Temp	-55°C ~ 275°C	
Resistance Temp. Coefficient	-30°C ~ 150°C	±300ppm/°C
Shot Time Overload	2.5 Times of Rated Wattage for 5 Secs.	±2%
Insulation Resistance	500V Megger	1,000MΩ
Temp. Cycle	-30°C ~ 85°C for 5 Cycles	±1%
Load Life	70°C On-Off Cycle, 1000hrs	±5%
Moisture-Proof Load Life	40°C 95% RH On-Off Cycle, 1000hrs	±5%
Solder Pot	270°C for 3 Secs	±1%
Incombustibility	16 Times of Rated Wattage for 5 Min.	Not Flamed



General Specification of Resistors

E6, E12, E24
E24, E96



Color	1st Band	2nd Band	3rd Band	Multiplier	Tolerance
Black	0	0	0	100	
Brown	1	1	1	101	F(±1%)
Red	2	2	2	102	G(±2%)
Orange	3	3	3	103	
Yellow	4	4	4	104	
Green	5	5	5	105	D(±0.5%)
Blue	6	6	6	106	C(±0.25%)
Violet	7	7	7	107	B(±0.1%)
Gray	8	8	8		
White	9	9	9	10-3	
Gold				10-1	J(±5%)
Silver				10-2	K(±10%)
Plain					M(±20%)

Symbol	T	E	C	K	J	L	D
T.C.R.	±10	±25	±50	±100	±150	±200	+200 -500

Symbol	A	B	C	D	F	G	J	K	M
Resistance Tolerance	±0.05	±0.1	±0.25	±0.5	±1	±2	±5	±10	±20

Δ How to Apply Resistors Correctly

- The characteristics of resistor have relations to temperature moisture and voltage.
- The rating of resistor is specified on the basis of temperature.
- The power rating of resistor is all specified with a direct-current. (D.C.) continuous working voltage or sine-wave root-mean-square (RMS) continuous working voltage at commercial-line frequency.
- The tests regarding characteristics of resistor is principally specified on the basis of moisture.
- Maximum rated voltage and maximum overload voltage are limited for each style of resistor, (1) Generally, rated voltage $E = \sqrt{PR}$ where E=volt, P=watt, R=ohm. (2) Generally, overload voltage $ET = \sqrt{PR} \times 2.5$, application time=5secs.
- NOTE: Max Rated and Max Overload Voltage are specified in each specification, so if the voltage valued computed, is over than specified voltage value, the specified value should be applied to resistor.
- In the complicated or high density circuit, it is recommended that the wattage or OHMIC values or resistor should have a large redundancy from a view point of reliability.
- It is necessary that the handling or wiring of resistor to the circuit is careful and please do not apply any stress to the resistor by over heating.
- To rise the reliability of resistor, it is better to prefer resistor with uniform quality than taking resistor met with severe specification.
- To rise the stability of resistor, it is very important to take resistor met with circuit conditions and is also economical not to have unreasonable design from a point of pricing resistor.
- Generally, failure of resistor takes a concentrated trend in the impulse circuit with complicated pulse wave form or LC circuit generated high voltage with transient phenomena, therefore, it is very important for designers to consider these conditions in the circuit design, if the resistor is applied in these circuits.

±2% E24	±5% E48	±1% E96	±0.5% E192	±2% E24	±5% E48	±1% E96	±0.5% E192
100	100	100	100	330			
		102	101		332	332	332
		105	102			340	336
		107	104			348	340
		110	106		348	348	344
		113	107			357	348
		115	109				352
		118	110				357
		121	111				361
		124	113		365	365	365
		127	114			374	370
		130	115			383	374
		133	117				379
		137	118				383
		140	120				388
		143	121				392
		147	122				397
		150	124				402
		154	126				407
		158	127				412
		162	129				417
		165	130				422
		169	133				427
		174	135				432
		178	137				437
		182	138				442
		187	140				448
		191	142				453
		196	143				459
		200	145				464
		205	147				470
		210	149				475
		215	150				481
		218	152				487
		221	154				493
		223	155				499
		226	158				505
		229	160				511
		232	162				517
		237	164				523
		240	165				530
		243	167				536
		246	169				542
		249	172				549
		252	174				556
		255	176				562
		258	178				569
		261	180				576
		264	182				583
		267	184				590
		271	187				597
		274	189				604
		277	191				612
		280	193				619
		283	196				626
		287	198				634
		291	200				642
		294	203				649
		298	205				657
		301	208				665
		305	210				673
		309	213				681
		312	215				690
		316	218				698
		320	221				706
		324	223				715
		328	226				723
			229				732
			232				741
			234				750
			237				759
			240				768
			243				777
			246				787
			249				796
			252				806
			255				816
			258				825
			261				835
			264				845
			267				856
			271				866
			274				876
			277				887
			280				898
			283				909
			287				920
			291				931
			294				942
			298				953
			301				965
			305				976
			309				988
			312				
			316				
			320				
			324				
			328				

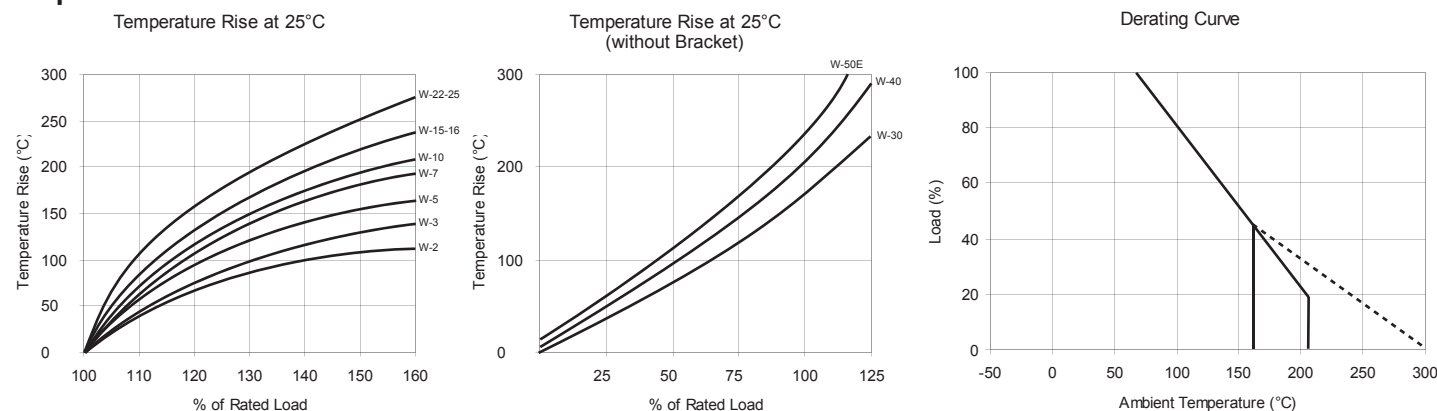


Wirewound Rectangular Resistor

△ Features

- No self-ignition even if current overflows
- Superior heat dissipation; small linear temperature coefficient
- Instant overload capability; low noise, no annual shift on resistance

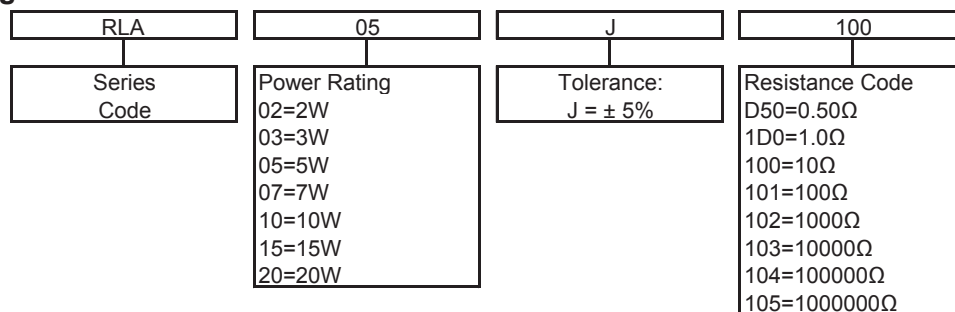
△ Specifications



△ Characteristics

Test Items	Condition	Spec.
Operating Temp	-55°C ~ 275°C	
Resistance Temp. Coefficient	-30°C ~ 150°C	±300ppm/°C
Shot Time Overload	2.5 Times of Rated Wattage for 5 Secs.	±2%
Insulation Resistance	500V Megger	1,000MΩ
Temp. Cycle	-30°C ~ 85°C for 5 Cycles	±1%
Load Life	70°C On-Off Cycle, 1000hrs	±5%
Moisture-Proof Load Life	40°C 95% RH On-Off Cycle, 1000hrs	±5%
Solder Pot	270°C for 3 Secs	±1%
Incombustibility	16 Times of Rated Wattage for 5 Min.	Not Flamed

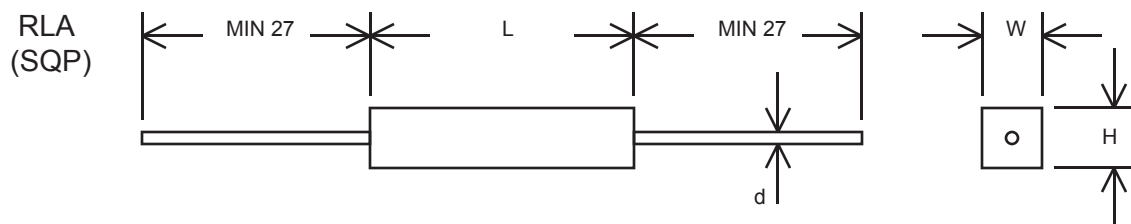
△ Part Numbering





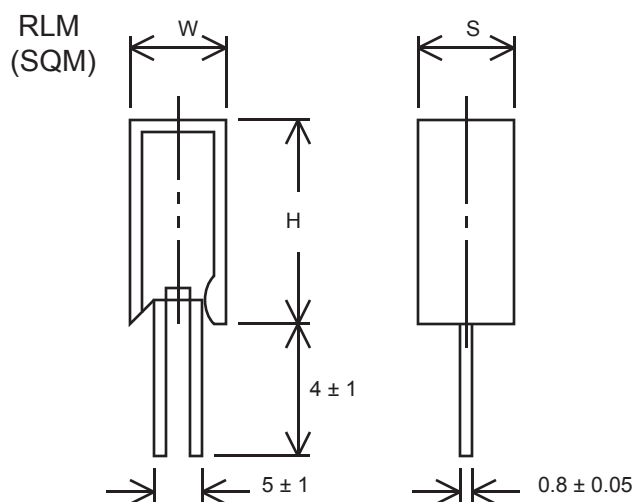
Wirewound Rectangular Resistor

Δ Dimensions

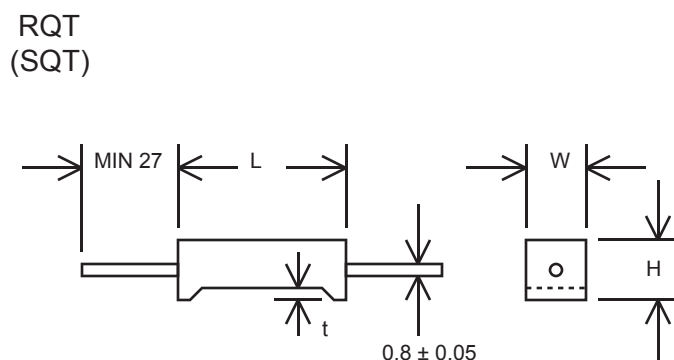


RLA	Dimensions (mm)				Resistance Range (Ω)		Max Working Voltage
	$L \pm 0.5$	$W \pm 0.5$	$H \pm 0.5$	$d \pm 0.03$	RLA	RS+RLA	
2W	18.0	7.0	7.0	0.65	0.1 Ω ~ 120 Ω	120~20K Ω	15V
3W	22.0	8.0	8.0	0.8	0.1 Ω ~ 150 Ω	150~33K Ω	350V
5W	22.0	9.5	9.0	0.8	0.1 Ω ~ 200 Ω	200~50K Ω	350V
7W	35.0	9.5	9.0	0.8	0.1 Ω ~ 500 Ω	500~50K Ω	500V
10W	48.0	9.5	9.0	0.8	0.1 Ω ~ 1K Ω	1K~50K Ω	750V
15W	48.0	12.5	12.0	0.8	0.5 Ω ~ 1K Ω	1K~150K Ω	1000V
20W	60.0	14.0	13.5	0.8	0.5 Ω ~ 1K Ω	1K~150K Ω	1000V

• Note: Non-inductive type up to 15.



TYPE	DIMENSION (mm)			RESISTANCE RANGE (Ω)	
	$H \pm 1.5$	$W \pm 1$	$S \pm 1$	RLM	RS + RLM
2W	20	11	1.7	0.1 - 20 Ω	20 - 47K Ω
3W	25	12	9	0.1 - 50 Ω	50 - 47K Ω
5W	25	13	9	0.1 - 100 Ω	100 - 47K Ω
7W	39	13	9	0.1 - 500 Ω	500 - 47K Ω
10W	51	13	9	0.1 - 1K Ω	1K - 47K Ω

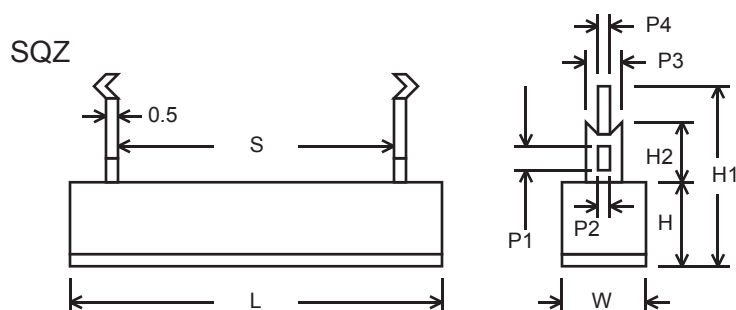


TYPE	DIMENSION (mm)				RESISTANCE RANGE (Ω)	
	$W \pm 1$	$H \pm 1.5$	$L \pm 1$	$t \pm 1$	RQT	RS + RQT
5W	10	9	22	1.5	0.1 - 200 Ω	200 - 47K Ω
7W	10	9	35	3.0	0.1 - 500 Ω	500 - 47K Ω
10W	10	9	48	3.0	0.1 - 1K Ω	1K - 47K Ω



Wirewound Rectangular Resistor

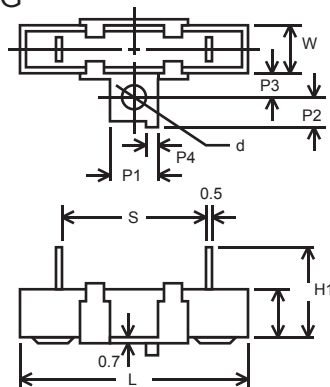
Δ Specifications



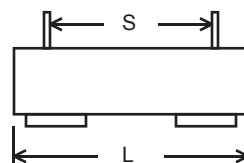
Description	Power Rating (W)	Resistance Range (Ω)		Dimensions (mm)									
		SQZ	RS + SQZ	L	H	W	S	H1	H2	P1	P2	P3	P4
SQZ - 5	5	0.1 Ω - 150 Ω	151 Ω - 5K Ω	27.0	9.5	9.5	15.0	24.0	9.5	4.0	2.0	5.0	1.4
SQZ - 7	7	0.1 Ω - 450 Ω	451 Ω - 50K Ω	35.0	9.5	9.5	22.5	24.0	9.5	4.0	2.0	5.0	1.4
SQZ - 10	10	0.1 Ω - 470 Ω	471 Ω - 50K Ω	48.0	9.5	9.5	35.0	24.0	9.5	4.0	2.0	5.0	1.4
SQZ - 15	15	0.1 Ω - 600 Ω	601 Ω - 150K Ω	48.0	12.5	12.5	32.5	34.5	15.0	7.0	6.0	10.0	2.7
SQZ - 20	20	0.1 Ω - 1K Ω	1.1 K Ω - 150K Ω	63.5	12.5	12.5	50.0	34.5	15.0	7.0	6.0	10.0	2.7
SQZ - 3	3			22.0	8.0	8.0	12.0	23.0	12.0	4.0	2.0	5.0	1.4
SQZ - 5	5			22.0	9.5	9.5	12.0	24.0	12.0	4.0	2.0	5.0	1.4

• Note: Resistance up to 50 Ω Maximum for Non-Inductive Type

SQHG



SQH



Description	Power Rating (W)	Resistance Range (Ω)		Dimensions (mm)									
		SQH	RS + SQH	L $\pm$ 2	H $\pm$ 1	W $\pm$ 1	S $\pm$ 1	H1 $\pm$ 1	P1 $\pm$ 1	P2 $\pm$ 1	P3 $\pm$ 1	P4 $\pm$ 1	d
SQH - 10	10	0.1 Ω - 600 Ω	601 Ω - 50K Ω	48.0	10.0	10.0	33	21	12	6	8.0	3.0	4
SQH - 15	15	0.1 Ω - 600 Ω	601 Ω - 150K Ω	48.0	12.0	12.0	33	21	12	6	8.0	3.0	4
SQH - 20	20	0.1 Ω - 1K Ω	1.1K Ω - 150K Ω	63.7			42	24	12	6	8.0	3.0	4
SQH - 30	30	0.1 Ω - 2K Ω		75.0	19.0	18.0	56	30	17	8	10.0	3.0	4
SQH - 40	40	0.1 Ω - 2K Ω		90.0	19.0	18.0	68	30	17	8	10.0	3.0	4



Wirewound Resistors Flame-Proof Coating

Type - RLE Series

△ Features

- Resistance wire wound on a alkaliess ceramic
- Ceramic coated with a non-corrosive, high insulating heat proof material
- Super heat dissipation
- Small linear temperature coefficient, instant overload capability, low noise

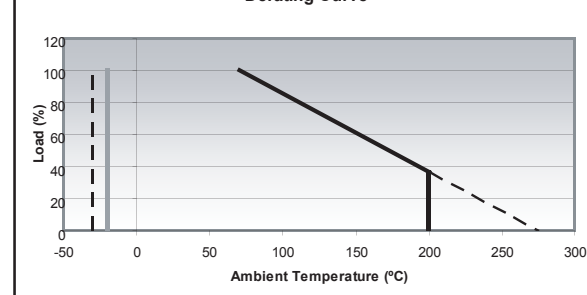
△ Applications

- Suitable for printed circuit board mounting.
- High Temperature application in medical, telecom and consumer electronic equipment.

Dimensions



Derating Curve

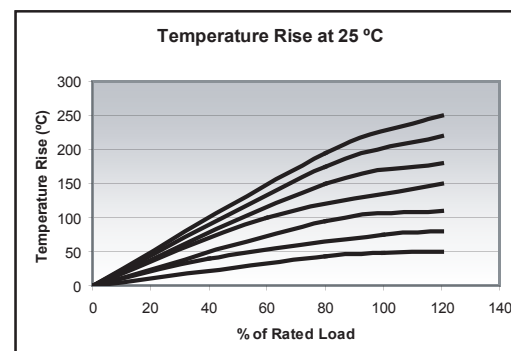


△ Specifications

Characteristics	Condition	Spec.
Resistance Temp. Coeff.	- 30°C~ 200°C	±300 PPM/°C
Short Time Overload	5 times of rated wattage for 5 sec.	±2%
Rate Load	Rate Watt 30 min.	±1%
Voltage Durability	500V AC 1 Min.	NOT CHANGED
Insulation Resistance	500V MEGGER	500 MΩ
Temp. Cycle	- 30°C~ 85°C 5 Cycles	±1%
Load Life	70°C On-Off Cycle 1000 Hrs.	±5%
Moisture-proof Load Life	40°C 95% Rh On-Off Cycle 500 Hrs.	±3%
Incombustibility	6 times of rated wattage for 5 min.	Not Flamed

△ Dimensions

Part number RLE	Dimension(mm)				Resistance Range(Ω)	Dielectric Voltage(V)
	D±1.5	L±1.5	H±3	d±0.05		
RLE 1/2 W	3.5	9	27	0.6	0.1~300	500
RLE 1 W	4	12	28	0.65	0.1~499	500
RLE 2 W	5	15.5	28	0.8	0.1~1.5K	500
RLE 3 WS	5.5	16	28	0.8	0.1~1.5K	500
RLE 3 W	6	17.5	28	0.8	0.1~1.5K	500
RLE 5 WS	6.5	18	28	0.8	0.5~1.5K	500
RLE 5 W	8.5	25	38	0.8	0.5~1.5K	500
RLE 7 W	8.5	30	38	0.8	0.5~3K	500
RLE 8 W	8.5	40	38	0.8	1~3K	800
RLE 10 W	8.5	53	38	0.8	1~3K	1000



- Note/Resistance up to 15Ω maximum for non-inductive type higher resistance values other than the list are also available.



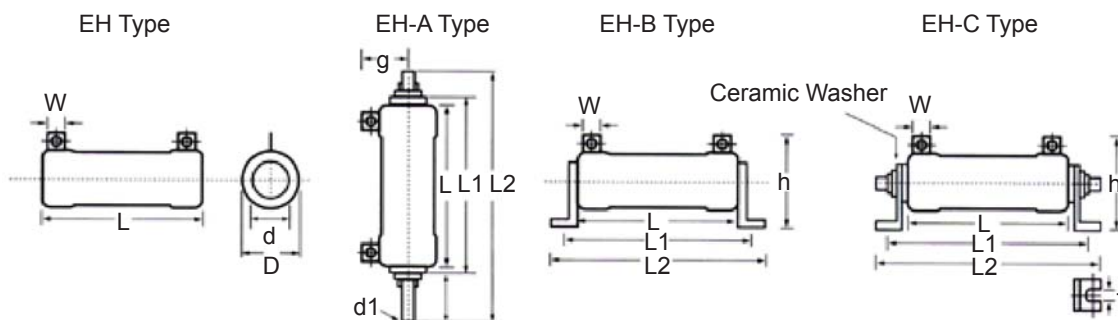
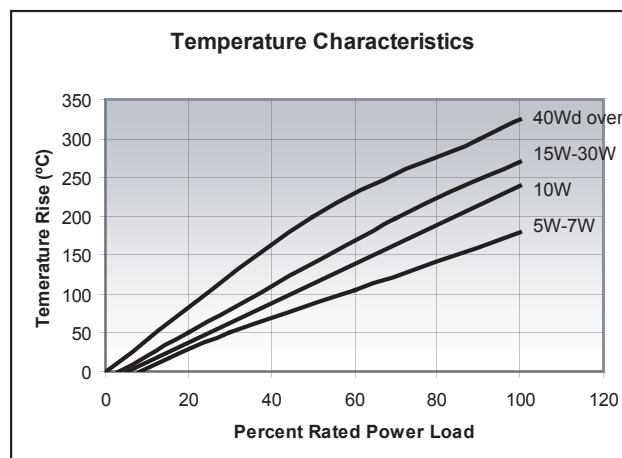
Power Type Fixed Wirewound Resistors Type - REH Series

△ Features

- High resistivity to heat, small resistance temp coefficient
- Change in resistance with temp is linear
- Resistance value unchanged after long use
- Good resistivity until short time overload
- Insulation: $\geq 500V$, $20M\Omega$
- Load: 1000V 1 Min.

△ Application

- High Power
- Power Supplies
- Telecom Equipment



△ Specifications

Silicone Coating Type			Resist Range: Adjustable Type	Dimension (mm)							A Type		B Type			C Type			Special Type With Ceramic Coating	
				L	D	d	g	W	d1	f	L1	L2	L1	L2	h	L1	L2	h		
EH	5W		0.1Ω ~ 5K(650)	30	12	6	17	5			40	52	45							
EH	10W		0.1Ω ~ 10K(1.2K)	45	12	6	17	5			55	67	60							
EH	15W		0.1Ω ~ 15K(1.5K)	45	15	8	19	5		4.1	55	67	60							
EH	20W		0.1Ω ~ 20K(2.2K)	50	19	10	20	5		4.1	60	77	68	76	38	76	86	38		
EH	30W		0.1Ω ~ 30K(3.3K)	75	19	10	20	5		4.1	85	105	93	101	38	101	111	38		
EH	40W		0.1Ω ~ 40K(4.9K)	90	19	10	20	5		4.1	100	115	108	116	38	116	126	38		
EH	50W		0.1Ω ~ 50K(5.6K)	75	30	16	32	8	5	5.2	89	110	100	117	58	115	131	58	CHT 75W	
EH	60W		0.1Ω ~ 60K(7K)	90	30	16	32	8	5	5.2	104	120	115	132	58	130	146	58	CHT 90W	
EH	80W		0.1Ω ~ 80K(10K)	115	30	16	32	8	5	5.2	129	150	140	157	58	155	171	58	CHT 120W	
EH	100W		0.1Ω~100K(12K)	140	30	16	32	8	5	5.2	154	173	165	182	58	180	196	58	CHT 150W	
EH	120W		0.1Ω~120K(15K)	163	30	16	32	8	5	5.2	179	200	188	207	58	203	221	58	CHT 180W	
EH	150W		0.1Ω~150K(16K)	195	30	16	32	8	5	5.2	209	230	220	237	58	235	251	58	CHT 225W	
EH	200W		0.1Ω~200K(24K)	254	30	16	32	8	5	5.2	268	288	279	296	58	294	310	58	CHT 300W	
EH	250W		0.1Ω~250K(30K)	303	30	16	32	8	5	5.2	319	340	328	347	58	343	361	58	CHT 375W	
EH	300W		0.1Ω~300K(50K)	254	45	28	47	15		9.15	270		294	314	90	309	330	90	CHT 450W	
EH	400W		0.1Ω~400K(60K)	330	45	28	47	15		9.15	345		379	390	90	385	406	90	CHT 600W	
EH	500W		0.1Ω~500K(80K)	303	55	35	52	15		9.15	318		343	363	95	358	378	95	CHT 750W	
EH	600W		0.1Ω~600K(90K)	330	55	35	52	15		9.15						385	405	95	CHT 850W	
EH	750W		0.1Ω~750K(100K)	390	55	35	52	15		9.15						445	465	95	CHT1000W	
EH	1000W		0.1Ω~ 1M(120K)	500	55	35	52	15		9.15						555	575	95	CHT1500W	
EH	1500W		0.1Ω~ 1.5M(150K)	500	69	40	60	15		9.15						584	608	130	CHT2250W	
EH	2000W		0.1Ω~ 2M(200K)	650	69	40	60	15		9.15						734	758	130	CHT3000W	



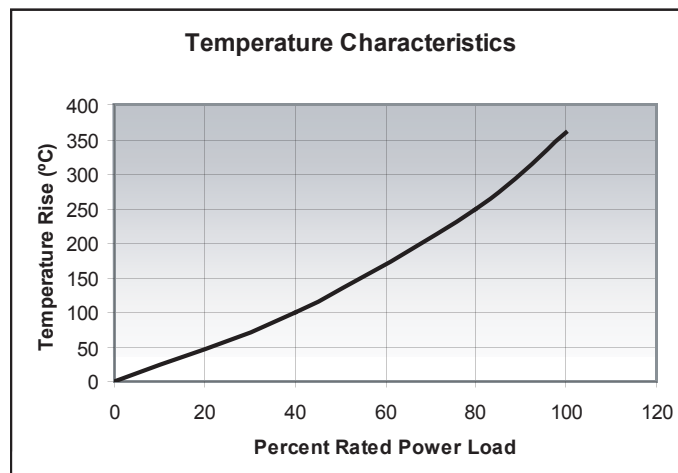
High-Power Ribbon Wirewound Resistors Type - RER Series

△ Features

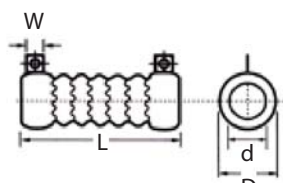
- High resistivity to heat, small resistance temp coefficient
- Change in resistance with temp is linear
- Resistance value unchanged after long use
- Good resistivity until short time overload
- Insulation: $\geq 500V$, $20M\Omega$
- Load: $1000V$ 1 Min.

△ Application

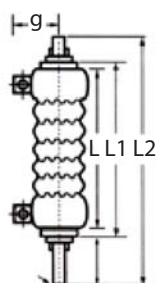
- High Power
- Power Supplies
- Telecom Equipment



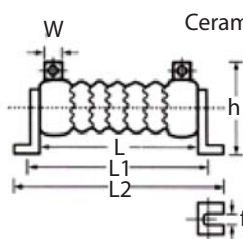
ER Type



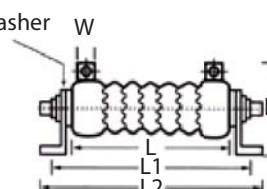
ER-A Type



ER-B Type



ER-C Type



△ Specifications

Type	Resistant Range	Dimension (mm)								A Type		B Type			C Type		
		L	D	d	g	W	d1	f		L1	L2	L1	L2	h	L1	L2	h
ER 120W	0.02Ω ~ 4Ω	115	33	16	32	8	5	5.2		129	150	133	157	58	145	171	58
ER 150W	0.03Ω ~ 5Ω	140	33	16	32	8	5	5.2		154	173	158	182	58	170	196	58
ER 180W	0.03Ω ~ 6Ω	165	33	16	32	8	5	5.2		179	200	183	207	58	195	221	58
ER 225W	0.04Ω ~ 8Ω	195	33	16	32	8	5	5.2		209	230	213	237	58	225	251	58
ER 300W	0.05Ω ~ 10Ω	254	33	16	32	8	5	5.2		268	288	272	296	58	285	310	58
ER 450W	0.06Ω ~ 12Ω	254	48	28	47	15		9.15		270		274	314	90	290	330	90
ER 600W	0.08Ω ~ 15Ω	330	48	28	47	15		9.15		345		349	390	90	365	406	90
ER 750W	0.1 Ω ~ 20Ω	303	58	35	52	15		9.15							358	378	95
ER 850W	0.2 Ω ~ 25Ω	330	58	35	52	15		9.15							385	405	95
ER 1000W	0.3 Ω ~ 30Ω	390	58	35	52	15		9.15							445	465	95
ER 1500W	0.4 Ω ~ 35Ω	500	58	35	52	15		9.15							555	575	95
ER 2250W	0.5 Ω ~ 40Ω	500	72	40	52	15		9.15							584	608	130
ER 3000W	0.7 Ω ~ 50Ω	650	72	40	52	15		9.15							734	758	130

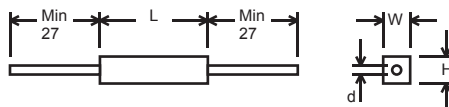


Fusible Wirewound Resistors Type FSQ Series

Δ Characteristics

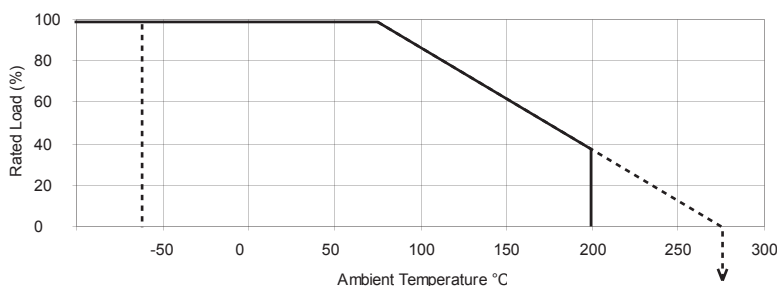
Characteristics	Condition	Spec.
Operating Temp	-40°C ~ 240°C	
Resistance Temp. Coefficient	-30°C ~ 150°C	±200ppm/°C
Shot Time Overload	4 Times of Rated Wattage for 5 Secs.	±2%
Insulation Resistance	500V Megger	1,000MΩ
Temp. Cycle	-30°C ~ 85°C for 5 Cycles	±1%
Load Life	25°C On-Off Cycle, 1000hrs	±5%
Moisture-Proof Load Life	40°C 95% RH On-Off Cycle, 1000hrs	±5%
Solder Pot	270°C for 3 Secs	±1%
Incombustibility	16 Times of Rated Wattage for 5 Min.	Not Flamed

*Total Resistance Change / (ΔR% + 0.05Ω)



Δ Dimensions

Style	Power Rating	Dimension (mm)				Resistance Range	Dielectric Withstanding Voltage
		L ± 1.5	h ± 0.5	W ± 0.5	H(Min)	d ± 0.05	
FSQ	2W	18	7	7	27	0.65	0.1Ω - 22Ω
	3W	22	8	8	27	0.8	0.1Ω - 12Ω
	5W	22	9	10	27	0.8	0.2Ω - 12Ω
	7W	35	9	10	27	0.8	0.3Ω - 250Ω
	10W	48	9	10	27	0.8	0.3Ω - 500Ω



Test Items	Condition	Spec.
Operating Temp	-55°C ~ 275°C	
Resistance Temp. Coefficient	-30°C ~ 150°C	±300ppm/°C
Shot Time Overload	2.5 Times of Rated Wattage for 5 Secs.	±2%
Insulation Resistance	500V Megger	1,000MΩ
Temp. Cycle	-30°C ~ 85°C for 5 Cycles	±1%
Load Life	70°C On-Off Cycle, 1000hrs	±5%
Moisture-Proof Load Life	40°C 95% RH On-Off Cycle, 1000hrs	±5%
Solder Pot	270°C for 3 Secs	±1%
Incombustibility	16 Times of Rated Wattage for 5 Min.	Not Flamed



SIP Resistor Networks

Type RNL Series

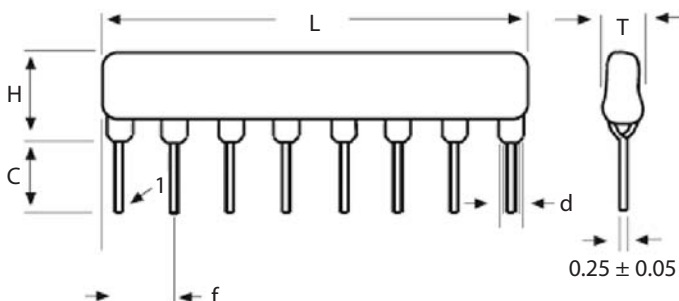
Δ Features

- Thick film resistor network with metal glaze on ceramic substrates
- Miniature, High Density Packaging
- Combinations of Different Ohmic value are available
- High reliability with RUO2 Paste

Δ Applications

- Control circuits of V.T.R. Computer, Air Conditioners, TVs, medical and telecom equipment

Dimensions (mm)



Δ Type of Circuits

A Circuit-Parallel Circuit		B Circuit-Isolated Circuit	
n=4 through 14pins		n=4 through 14pins	
Number of Elements, $R=n-1$		Number of Elements, $R=n/2$	

Δ Dimensions (mm)

Type	L (Max)	H (Max)		T (Max)	C + 0.3 - 0.2	d ± 0.05	f ± 0.2
		A Circuit	B Circuit				
4 pin	10.2	5.08	7.5	2.5	2.8	0.5	2.54
5 pin	12.7						
6 pin	15.3						
7 pin	17.8						
8 pin	20.4						
9 pin	22.9						
10 pin	25.4						
11 pin	28.0						
12 pin	30.5						
13 pin	33.1						
14 pin	35.6						

Δ Specifications

Operating Temp. Range	-55 °C ~ + 125 °C		Wattage/Element	RA		RB
T.C.R.	±100PPM 50 ohm ~ 2.2M ohm			B Style	Others	All Styles
	±250PPM < 50 ohm or 2.2M ohm			0.2W	0.125W	0.25W
Rating Ambient Temp.	+ 70 °C		Max. Working Voltage	100V		200V
Resistance Range	R style	Others	Resistance Tolerance	F=±1%, G=±2%, J=±5%		
(E-12 Series)	100Ω - 10K	10Ω - 4.7MΩ				



SIP Resistor Networks Type RNL Series

Δ Characteristics

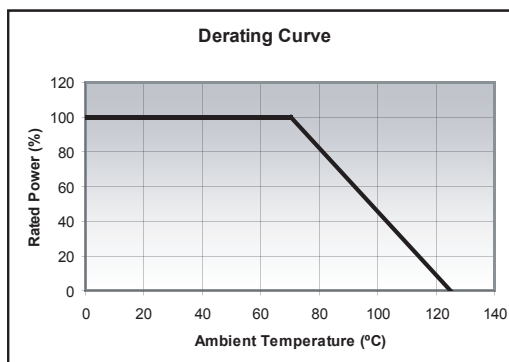
Item	Test Methods	Specifications
Resistance Temperature Characteristic	-55 °C ~ + 125 °C	± 100ppm/ °C for 50ohm ~ 2.2M ± 250ppm/ °C for < 50 ohm 2.2M
Temperature Cycling	-55 °C ~ + 125 °C, for 5 cycle	Δ R ±(0.5 % + 0.05Ω)
Short-Time Overload	Rated Voltage x 2.5 for 5 sec.	Δ R ±(0.5 % + 0.05Ω)
Resistance to Solering Heat	350 °C for 3 sec.	Δ R ±(0.5 % + 0.05Ω)
Insulation Resistance	100V for 1 minute	Δ 10,000 Megohm Min.
Terminal Strength	Tensile: 1Kg, 30 sec. Bending: 400g, 2 Times	Δ R ±(0.25 % + 0.05Ω)
Thermal Shock	Load V, Room Temp. 30 min. Unload, -55 °C, 15 min. Over 2 hrs in room temp.	Δ R ±(0.5 % + 0.05Ω)
Solderbility	230 °C ±5 °C, 3 sec.	Covering 95%
Moisture Load Life	40 °C, 90-95% RH rated Voltage for 1000 hours	Δ R ±(2% + 0.05Ω)
Load Life	70 °C at Rated Voltage for 1000 hours	Δ R ±(2% + 0.05Ω)

Δ Standard Resistance (ohm) E-12 Series

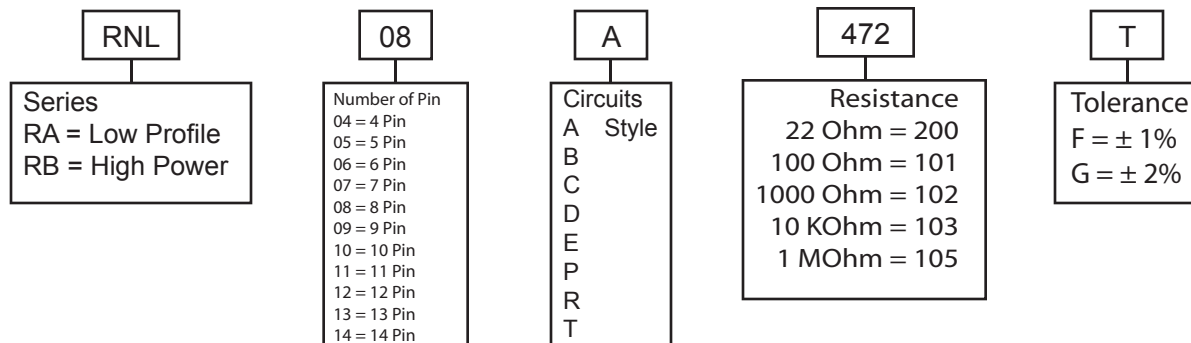
10	12	15	18	22	27	33	39	47	56	68	82
100	120	150	180	220	270	330	390	470	560	680	820
1K	1.2K	1.5K	1.8K	2.2K	2.7K	3.3K	3.9K	4.7K	5.6K	6.8K	8.2K
10K	12K	15K	18K	22K	27K	33K	39K	47K	56K	68K	82K
100K	120K	150K	180K	220K	270K	330K	390K	470K	560K	680K	820K
1M	1.2M	1.5M	1.8M	2.2M							

Δ Dual Terminitors (R1/R2) (ohm)

160/240	330/390
180/390	330/470
220/270	1.5K/3.3K
220/330	3.0K/6.2K



Δ How to Order





General Glass/Silicon Rectifiers

Type PR

Δ Specifications

Operating and Storage Temperature -55°C to +150°C

TYPE	Maximum Peak Reverse Voltage	Maximum Rectified Current @ Half-Wave Resistive Load 60Hz		Maximum Forward Peak Surge Current @ 8.3mS Superimposed	Maximum Reverse Current @ PRV @25°C T _A	Maximum Forward Voltage @25°C T _A	
	PRV	I _O @T _A		I _{FM} (Surge)	I _R	I _{FM}	V _{FM}
	V _{PK}	A _{AV}	°C	A _{PK}	μA _{dc}	A _{PK}	V _{PK}

1.0 AMPERES/DO-41

1N4001G	50	1	75	30	5.0	1	1.1
1N4002G	100	1	75	30	5.0	1	1.1
1N4003G	200	1	75	30	5.0	1	1.1
1N4004G	400	1	75	30	5.0	1	1.1
1N4005G	600	1	75	30	5.0	1	1.1
1N4006G	800	1	75	30	5.0	1	1.1
1N4007G	1000	1	75	30	5.0	1	1.1

1.5AMPERES/2.0AMPERES/DO-15

1N5391G	50	1.5	70	50	5.0	1.5	1.1
1N5392G	100	1.5	70	50	5.0	1.5	1.1
1N5393G	200	1.5	70	50	5.0	1.5	1.1
1N5394G	300	1.5	70	50	5.0	1.5	1.1
1N5395G	400	1.5	70	50	5.0	1.5	1.1
1N5396G	500	1.5	70	50	5.0	1.5	1.1
1N5397G	600	1.5	70	50	5.0	1.5	1.1
1N5398G	800	1.5	70	50	5.0	1.5	1.1
1N5399G	1000	1.5	70	50	5.0	1.5	1.1
RL201G	50	2.0	50	70	5.0	2.0	1
RL202G	100	2.0	50	70	5.0	2.0	1
RL203G	200	2.0	50	70	5.0	2.0	1
RL204G	400	2.0	50	70	5.0	2.0	1
RL205G	600	2.0	50	70	5.0	2.0	1
RL206G	800	2.0	50	70	5.0	2.0	1
RL207G	1000	2.0	50	70	5.0	2.0	1



General Glass/Silicon Rectifiers

Type PR

Δ Specifications

Operating and Storage Temperature -55°C to +150°C

TYPE	Maximum Peak Reverse Voltage	Maximum Rectified Current @ Half-Wave Resistive Load 60Hz		Maximum Forward Peak Surge Current @ 8.3mS Superimposed	Maximum Reverse Current @ PRV @25°C T _A	Maximum Forward Voltage @25°C T _A	
	PRV	I _O @T _A		I _{FM} (Surge)	I _R	I _{FM}	V _{FM}
	V _{PK}	A _{AV}	°C	A _{PK}	μA _{dc}	A _{PK}	V _{PK}

2.5 AMPERES/R-3

RL251G	50	2.5	70	70	5.0	2.5	1.0
RL252G	100	2.5	70	70	5.0	2.5	1.0
RL253G	200	2.5	70	70	5.0	2.5	1.0
RL254G	400	2.5	70	70	5.0	2.5	1.0
RL255G	600	2.5	70	70	5.0	2.5	1.0
RL256G	800	2.5	70	70	5.0	2.5	1.0
RL257G	1000	2.5	70	70	5.0	2.5	1.0

3.0AMPERES/DO-27

1N5400G	50	3.0	50	200	5.0	3.0	1.2
1N5401G	100	3.0	50	200	5.0	3.0	1.2
1N5402G	200	3.0	50	200	5.0	3.0	1.2
1N5403G	300	3.0	50	200	5.0	3.0	1.2
1N5404G	400	3.0	50	200	5.0	3.0	1.2
1N5405G	500	3.0	50	200	5.0	3.0	1.2
1N5406G	600	3.0	50	200	5.0	3.0	1.2
1N5407G	800	3.0	50	200	5.0	3.0	1.2
1N5408G	1000	3.0	50	200	5.0	3.0	1.2

6.0AMPERES/R-6

P600AG	50	6	60	400	10	6	0.95
P600BG	100	6	60	400	10	6	0.95
P600DG	200	6	60	400	10	6	0.95
P600GG	400	6	60	400	10	6	0.95
P600JG	600	6	60	400	10	6	0.95
P600KG	800	6	60	400	10	6	0.95
P600MG	1000	6	60	400	10	6	0.95



Glass/Silicon Passivated Rectifiers
Type PR - 1N5391(G/S) Thru 1N5399(G/S)
Reverse Voltage - 50 to 1000 Volts
Forward Current - 1.5 Amperes

Δ Features

- Low cost
- Diffused junction
- Low forward voltage drop
- Low reverse leakage current
- High current capability
- The plastic material carries UL recognition 94V-0

Δ Mechanical Data

- Case: JEDEC DO-41 molded plastic
- Polarity: Color band denotes cathode
- Weight: 0.012 ounces, 0.34 grams
- Mounting position: Any

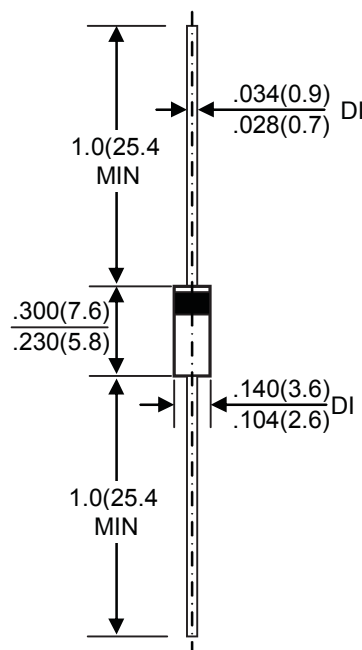
Δ Maximum Ratings and Electrical Characteristics

Ratings at 25°C ambient temperature unless otherwise specified.

Single phase, half wave, 60Hz, resistive or inductive load.

For capacitance load, derate current by 20%

DO-15



Dimensions in inches and (millimeters)

CHARACTERISTICS	SYMBOL	1N 5391	1N 5392	1N 5393	1N 5394	1N 5395	1N 5396	1N 5397	1N 5398	1N 5399	UNIT
Maximum Recurrent Peak Reverse Voltage	VRRM	50	100	200	300	400	500	600	800	1000	V
Maximum RMS Voltage	VRMS	35	70	140	210	280	350	420	560	700	V
Maximum DC Blocking Voltage	VDC	50	100	200	300	400	500	600	800	1000	V
Maximum Average Forward Rectified Current @TA =70 °C	l(AV)	1.5									A
Peak Forward Surge Current 8.3ms Single Half Sine-Wave Super Imposed on Rated Load(JEDEC Method)	lFSM	50									A
Maximum Forward Voltage at 1.5A DC	VF	1.1									V
Maximum DC Reverse Current @TJ=25°C	IR	5.0									uA
at Rated DC Blocking Voltage @TJ=100°C		50									
Typical Junction Capacitance (Note1)	CJ	20									pF
Typical Thermal Resistance (Note2)	RθJA	26									°C/W
Operating Temperature Range	TJ	-55 to +150									°C
Storage Temperature Range	TSTG	-55 to +150									°C

NOTES:1.Measured at 1.0 MHz and applied reverse voltage of 4.0V DC

2.Thermal resistance junction of lead.



Glass/Silicon Passivated Rectifiers Type PR - 1N5391(G/S) Thru 1N5399(G/S)

Δ Rating and Characteristics Curves

FIG. 1 – FORWARD CURRENT DERATING CURVE

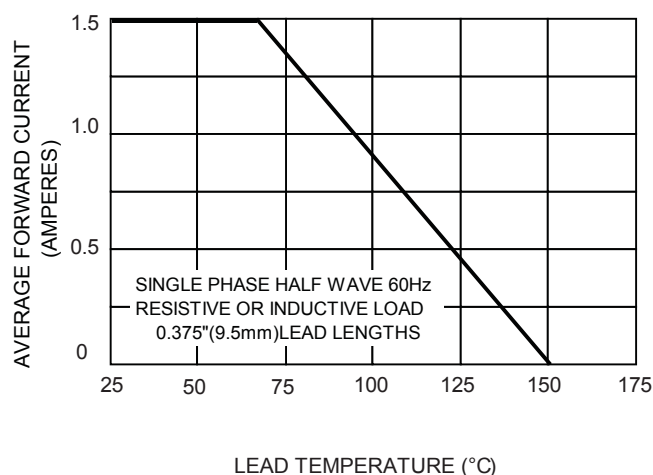


FIG. 2 – MAXIMUM NON-REPETITIVE SURGE CURRENT

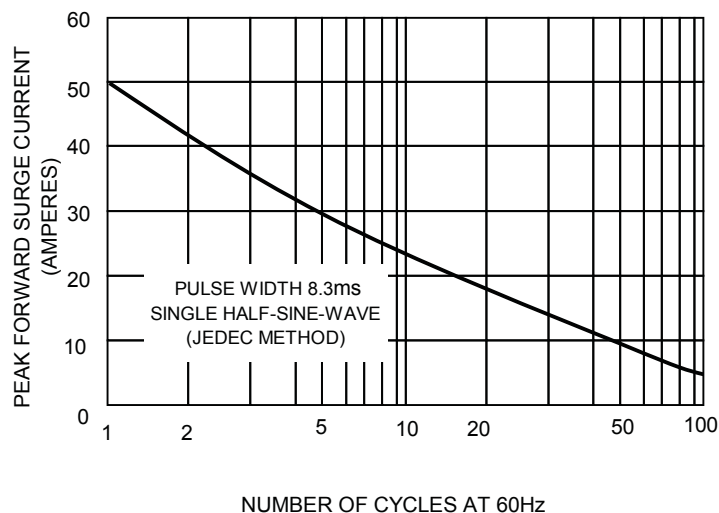


FIG.3 – TYPICAL JUNCTION CAPACITANCE

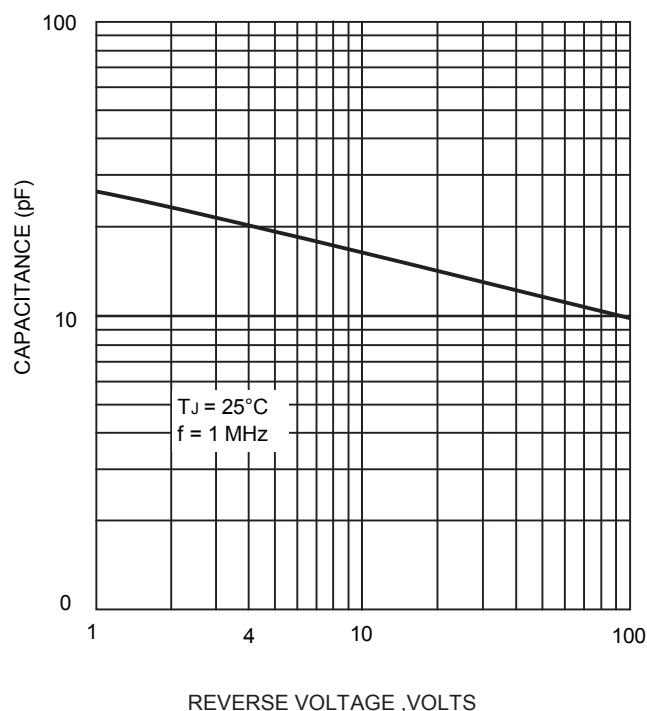
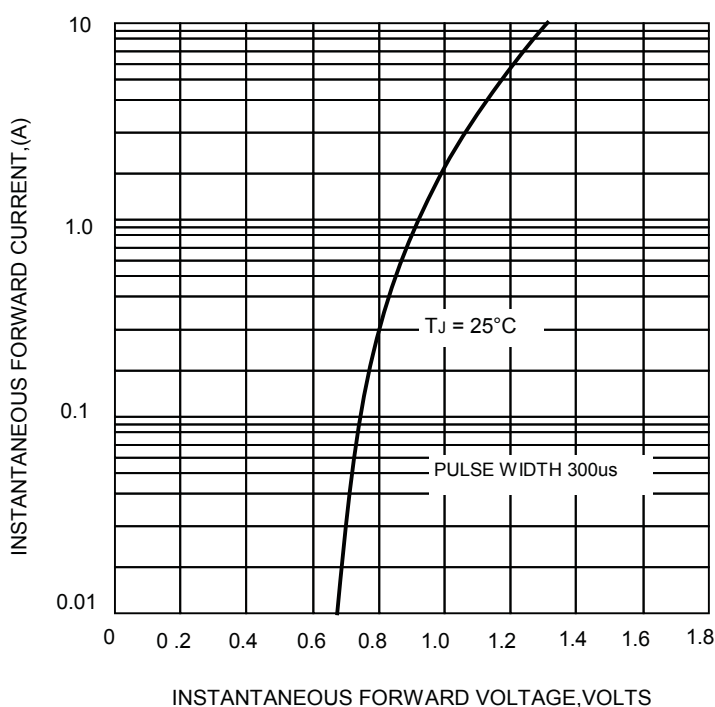


FIG.4-TYPICAL FORWARD CHARACTERISTICS





Glass/Silicon Passivated Rectifiers

Type PR - RL201(G/S) Thru RL207(G/S)

Reverse Voltage - 50 to 1000 Volts

Forward Current - 2.0 Amperes

△ Features

- Low cost
- Diffused junction
- Low forward voltage drop
- Low reverse leakage current
- High current capability
- The plastic material carries UL recognition 94V-0

△ Mechanical Data

- Case: JEDEC DO-41 molded plastic
- Polarity: Color band denotes cathode
- Weight: 0.012 ounces, 0.34 grams
- Mounting position: Any

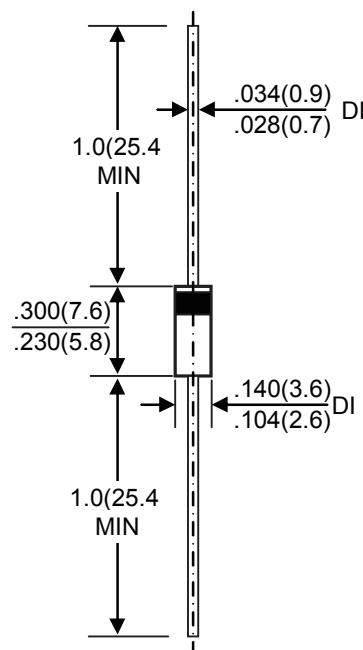
△ Maximum Ratings and Electrical Characteristics

Ratings at 25°C ambient temperature unless otherwise specified.

Single phase, half wave, 60Hz, resistive or inductive load.

For capacitance load, derate current by 20%

DO-15



Dimensions in inches and (millimeters)

CHARACTERISTICS	SYMBOL	RL201	RL202	RL203	RL204	RL205	RL206	RL207	UNIT
Maximum Recurrent Peak Reverse Voltage	V _{RRM}	50	100	200	400	600	800	1000	V
Maximum RMS Voltage	V _{RMS}	35	70	140	280	420	560	700	V
Maximum DC Blocking Voltage	V _{DC}	50	100	200	400	600	800	1000	V
Maximum Average Forward Rectified Current @T _A =50 °C	I _(AV)	2.0							A
Peak Forward Surge Current 8.3ms Single Half Sine-Wave Super Imposed on Rated Load(JEDEC Method)	I _{FSM}	70							A
Maximum Forward Voltage at 2.0A DC	V _F	1.0							V
Maximum DC Reverse Current @T _J =25°C at Rated DC Blocking Voltage @T _J =100°C	I _R	5.0 50							uA
Typical Junction Capacitance (Note1)	C _J	20							pF
Typical Thermal Resistance (Note2)	R _{θJA}	40							°C/W
Operating Temperature Range	T _J	-55 to +150							°C
Storage Temperature Range	T _{STG}	-55 to +150							°C

NOTES:1.Measured at 1.0 MHz and applied reverse voltage of 4.0V DC

2.Thermal resistance junction of lead.



Glass/Silicon Passivated Rectifiers Type PR - RL201(G/S) Thru RL207(G/S)

Δ Rating and Characteristics Curves

FIG. 1 – FORWARD CURRENT DERATING

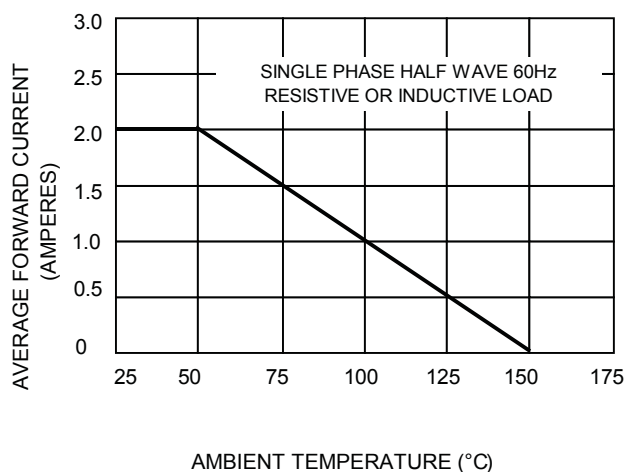


FIG. 2 – MAXIMUM NON-REPETITIVE SURGE CURRENT

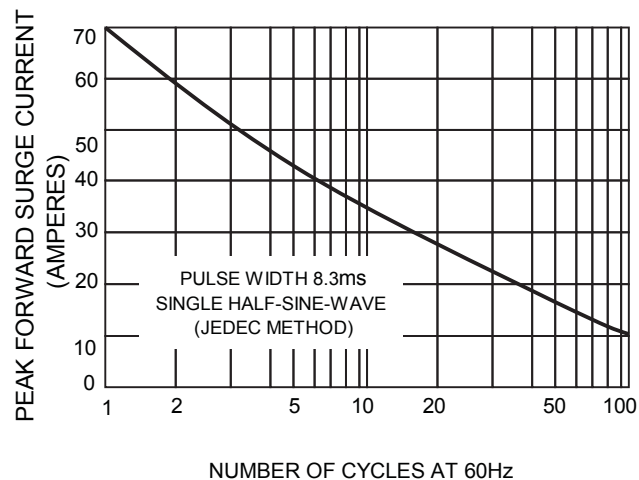


FIG.3 – TYPICAL JUNCTION CAPACITANCE

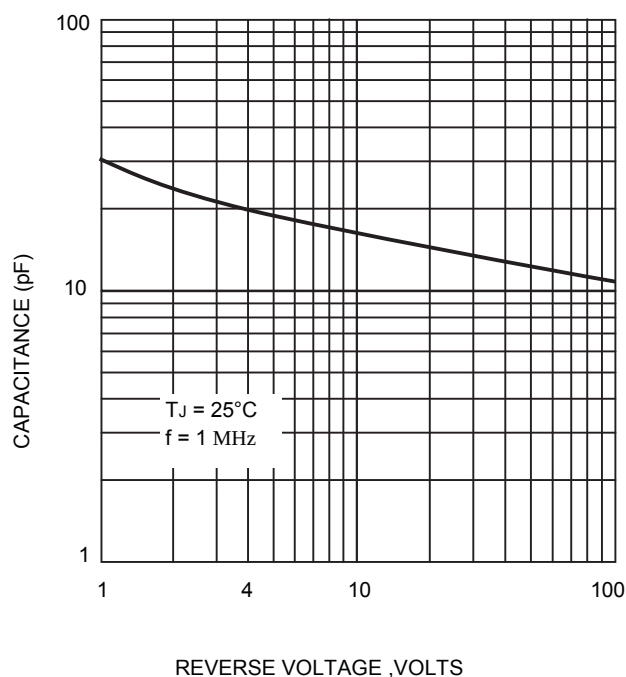
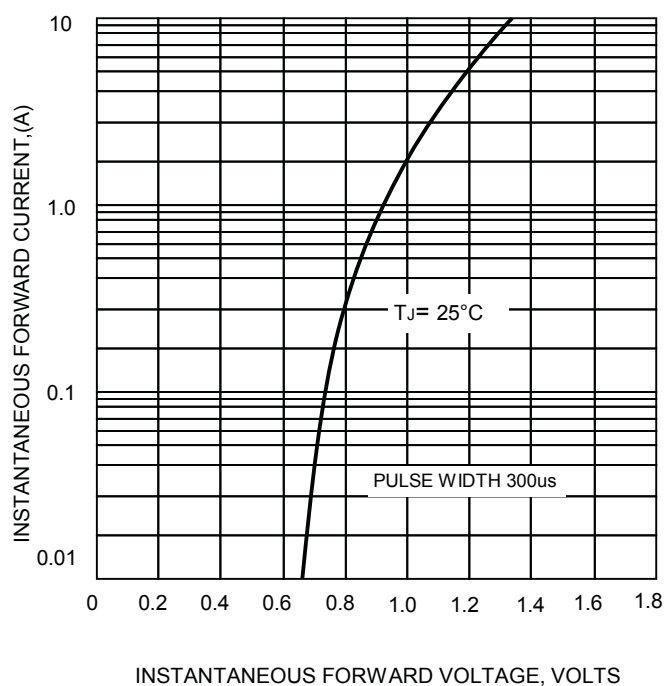


FIG.4-TYPICAL FORWARD CHARACTERISTICS





Glass/Silicon Passivated Rectifiers

Type PR - 1N5400(G/S) Thru 1N5408(G/S)

Reverse Voltage - 50 to 1000 Volts

Forward Current - 3.0 Amperes

Δ Features

- Low cost
- Diffused junction
- Low forward voltage drop
- Low reverse leakage current
- High current capability
- The plastic material carries UL recognition 94V-0

Δ Mechanical Data

- Case: JEDEC DO-27 molded plastic
- Polarity: Color band denotes cathode
- Weight: 0.04 ounces, 1.1 grams
- Mounting position: Any

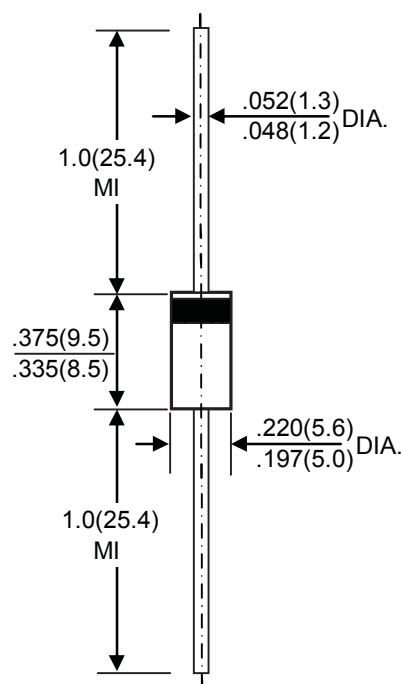
Δ Maximum Ratings and Electrical Characteristics

Ratings at 25°C ambient temperature unless otherwise specified.

Single phase, half wave, 60Hz, resistive or inductive load.

For capacitance load, derate current by 20%

DO-27

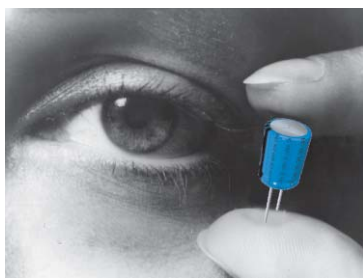


Dimensions in inches and (millimeters)

CHARACTERISTICS	SYMBOL	1N 5400	1N 5401	1N 5402	1N 5403	1N 5404	1N 5405	1N 5406	1N 5407	1N 5408	UNIT
Maximum Recurrent Peak Reverse Voltage	V _{RRM}	50	100	200	300	400	500	600	800	1000	V
Maximum RMS Voltage	V _{RMS}	35	70	140	210	280	350	420	560	700	V
Maximum DC Blocking Voltage	V _{DC}	50	100	200	300	400	500	600	800	1000	V
Maximum Average Forward Rectified Current @T _A =55°C	I _(AV)	3.0									A
Peak Forward Surge Current 8.3ms Single Half Sine-Wave Supe Imposed on Rated Load(JEDEC Method)	I _{FSM}	200									A
Maximum Forward Voltage at 3.0A DC	V _F	1.2									V
Maximum DC Reverse Current @T _J =25 °C	I _R	5.0									uA
at Rated DC Blocking Voltage @T _J =100 °C		50									
Typical Junction Capacitance (Note1)	C _J	50						35			pF
Typical Thermal Resistance (Note2)	RθJA	15									°C /W
Operating Temperature Range	T _J	-55 to +150									°C
Storage Temperature Range	T _{STG}	-55 to +150									°C

NOTES:1.Measured at 1.0 MHz and applied reverse voltage of 4.0V DC

2.Thermal resistance junction of ambient.



Glass/Silicon Passivated Rectifiers Type PR - 1N5400(G/S) Thru 1N5408(G/S)

Δ Rating and Characteristics Curves

FIG. 1 – FORWARD CURRENT DERATING CURVE

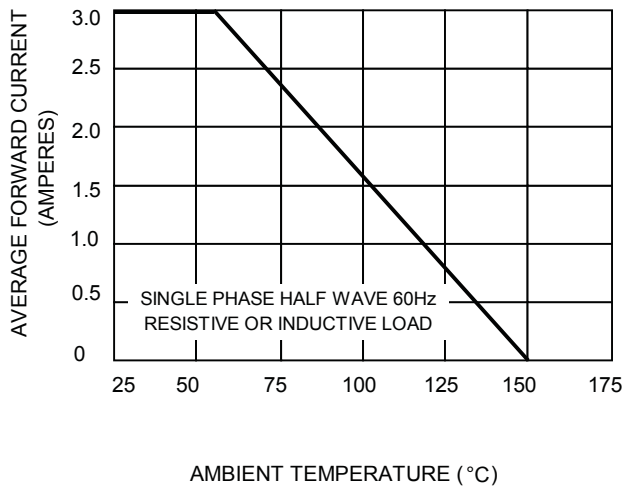


FIG. 2 – MAXIMUM NON-REPETITIVE SURGE CURRENT

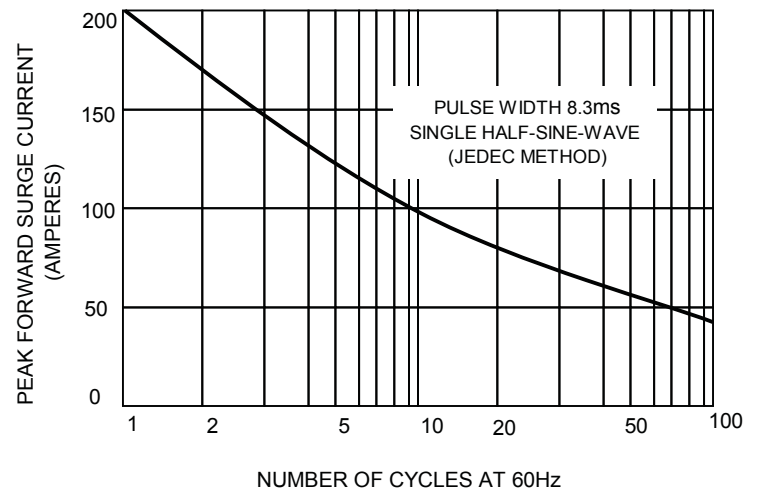


FIG.3 – TYPICAL JUNCTION CAPACITANCE

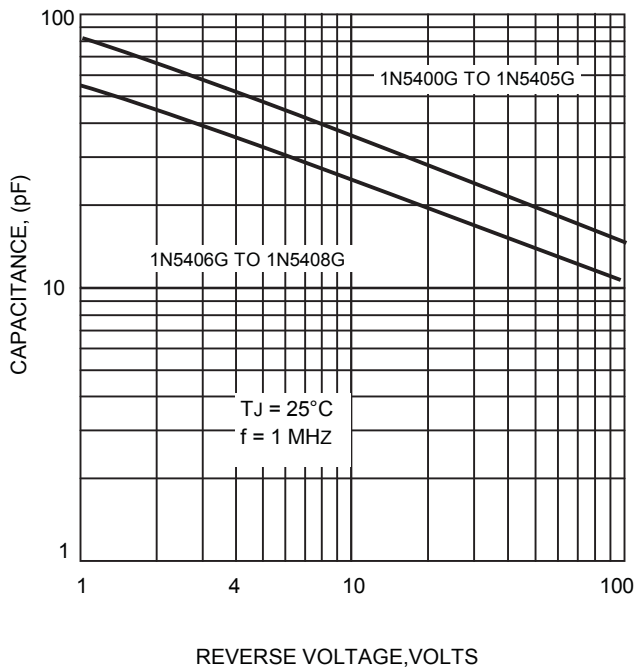
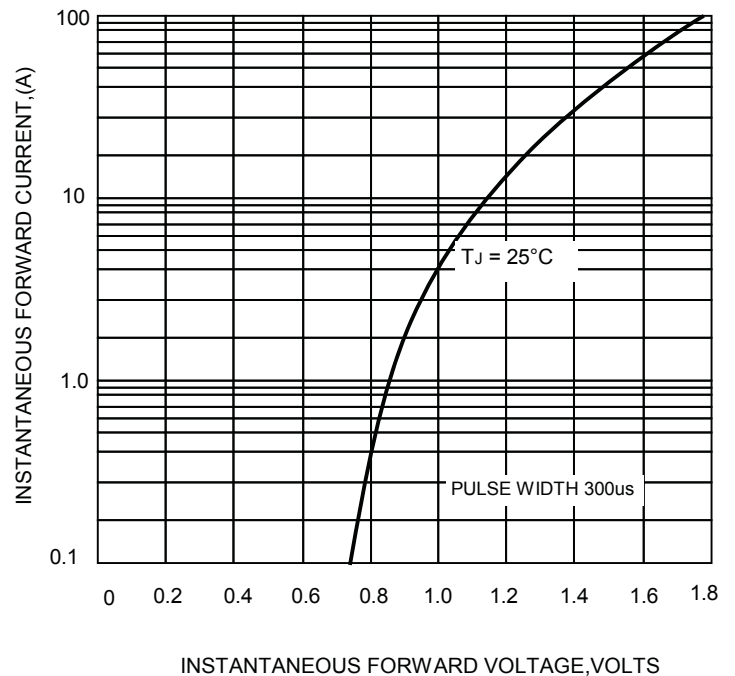


FIG.4-TYPICAL FORWARD CHARACTERISTICS





Glass/Silicon Passivated Rectifiers

Type PR - 1N4001(G/S) Thru 1N4007(G/S)
Reverse Voltage - 50 to 1000 Volts
Forward Current - 1.0 Amperes

△ Features

- Low cost
- Diffused junction
- Low forward voltage drop
- Low reverse leakage current
- High current capability
- The plastic material carries UL recognition 94V-0

△ Mechanical Data

- Case: JEDEC DO-41 molded plastic
- Polarity: Color band denotes cathode
- Weight: 0.012 ounces, 0.34 grams
- Mounting position: Any

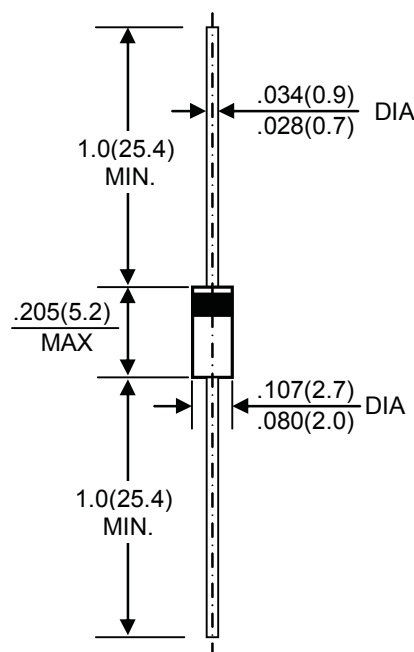
△ Maximum Ratings and Electrical Characteristics

Ratings at 25°C ambient temperature unless otherwise specified.

Single phase, half wave, 60Hz, resistive or inductive load.

For capacitance load, derate current by 20%

DO- 41



Dimensions in inches and (millimeters)

CHARACTERISTICS	SYMBOL	1N4001	1N4002	1N4003	1N4004	1N4005	1N4006	1N4007	UNIT
Maximum Recurrent Peak Reverse Voltage	V _{RRM}	50	100	200	400	600	800	1000	V
Maximum RMS Voltage	V _{RMS}	35	70	140	280	420	560	700	V
Maximum DC Blocking Voltage	V _{DC}	50	100	200	400	600	800	1000	V
Maximum Average Forward Rectified Current @T _A =75 °C	I _(AV)	1.0							A
Peak Forward Surge Current 8.3ms Single Half Sine-Wave Super Imposed On Rated Load (JEDEC Method)	I _{FSM}	30							A
Maximum Forward Voltage at 1.0A DC	V _F	1.1							V
Maximum DC Reverse Current @T _J =25°C	I _R	5.0							uA
at Rated DC Blocking Voltage @T _J =100°C		50							
Typical Junction Capacitance (Note1)	C _J	15							pF
Typical Thermal Resistance (Note2)	RθJC	50							°C/W
Operating Temperature Range	T _J	-55 to +150							°C
Storage Temperature Range	T _{STG}	-65 to +175							°C

NOTES: 1. Measured at 1.0 MHz and applied reverse voltage of 4.0V DC

2. Thermal resistance junction of ambient .375"(9.5mm) lead length



Glass/Silicon Passivated Rectifiers Type PR - 1N4001(G/S) Thru 1N4007(G/S)

Δ Rating and Characteristics Curves

FIG. 1 - FORWARD CURRENT DERATING CURVE

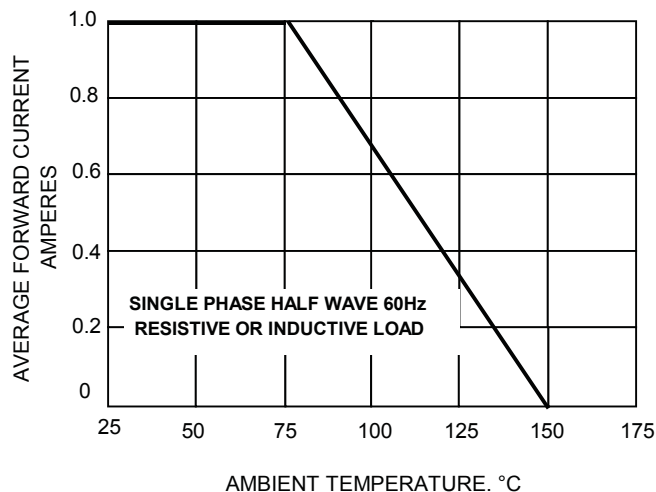


FIG. 2 - MAXIMUM NON-REPETITIVE SURGE CURRENT

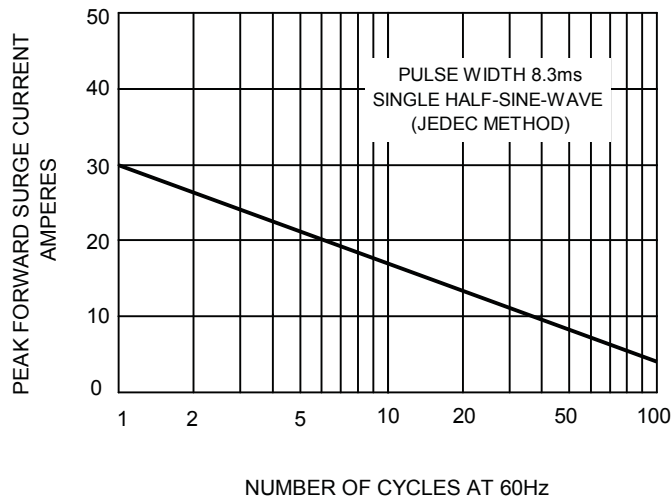


FIG. 3 - TYPICAL JUNCTION CAPACITANCE

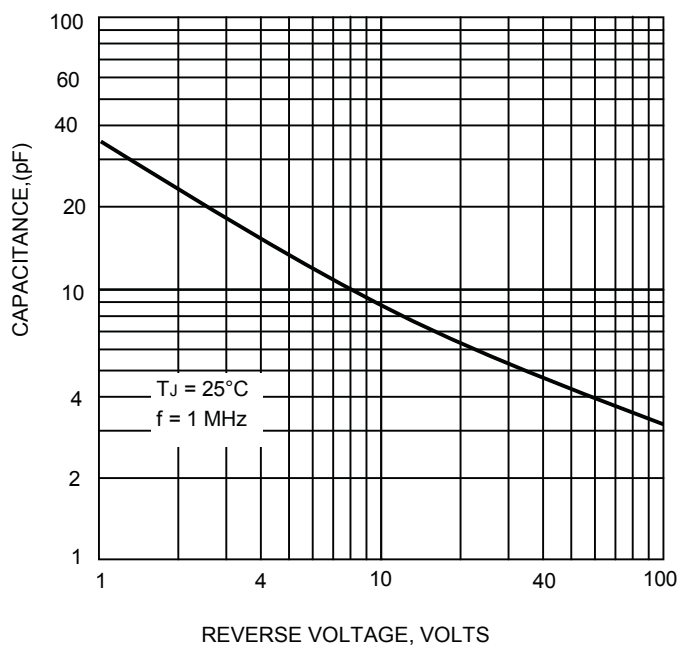
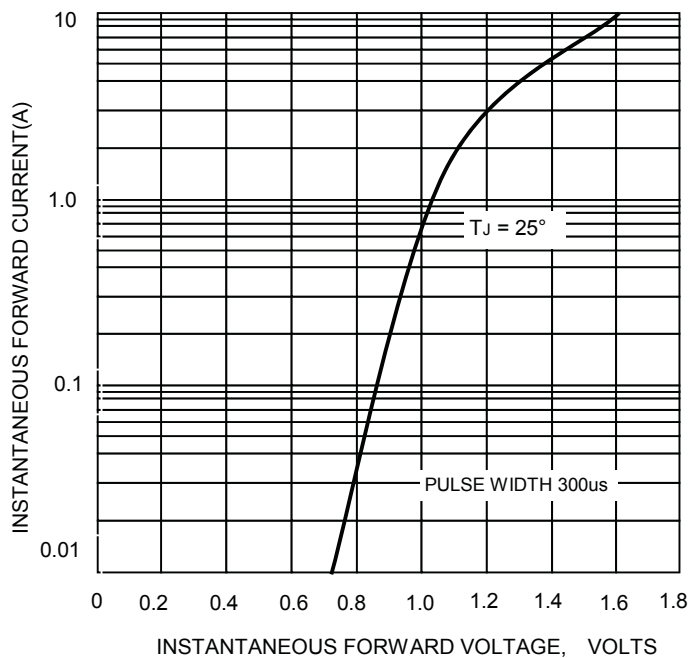


FIG. 4 - TYPICAL FORWARD CHARACTERISTICS





Glass/Silicon Passivated Rectifiers

Type PR - RL251(G/S) Thru RL257(G/S)

Reverse Voltage - 50 to 1000 Volts

Forward Current - 2.5 Amperes

Δ Features

- Low cost
- Diffused junction
- Low forward voltage drop
- Low reverse leakage current
- High current capability
- The plastic material carries UL recognition 94V-0

Δ Mechanical Data

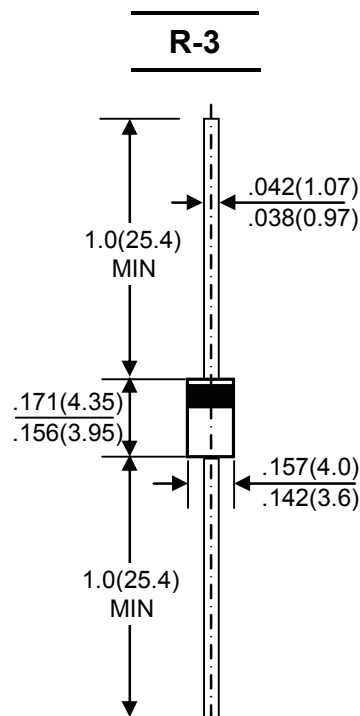
- Case: JEDEC R-3 molded plastic
- Polarity: Color band denotes cathode
- Weight: 0.021 ounces, 0.58 grams
- Mounting position: Any

Δ Maximum Ratings and Electrical Characteristics

Ratings at 25°C ambient temperature unless otherwise specified.

Single phase, half wave, 60Hz, resistive or inductive load.

For capacitance load, derate current by 20%



Dimensions in inches and (millimeters)

CHARACTERISTICS	SYMBOL	RL251	RL252	RL253	RL254	RL255	RL256	RL257	UNIT
Maximum Recurrent Peak Reverse Voltage	V _{RRM}	50	100	200	400	600	800	1000	V
Maximum RMS Voltage	V _{RMS}	35	70	140	280	420	560	700	V
Maximum DC Blocking Voltage	V _{DC}	50	100	200	400	600	800	1000	V
Maximum Average Forward Rectified Current @ T _A = 70°C	I _(AV)	2.5							A
Peak Forward Surge Current 8.3ms Single Half Sine-Wave Super Imposed on Rated Load(JEDEC Method)	I _{FSM}	150							A
Maximum Peak Forward Voltage at 2.5A DC	V _F	1.0							V
Maximum DC Reverse Current @ T _J = 25°C at Rated DC Blocking Voltage @ T _J = 100°C	I _R	5.0 50							uA
Typical Junction Capacitance (Note1)	C _J	25							pF
Typical Thermal Resistance (Note2)	R _{θJA}	30							°C/W
Operating Temperature Range	T _J	-55 to +150							°C
Storage Temperature Range	T _{STG}	-55 to +150							°C

NOTES:1.Measured at 1.0 MHz and applied reverse voltage of 4.0V DC

2.Thermal resistance junction of ambient.



Glass/Silicon Passivated Rectifiers

Type PR - RL251(G/S) Thru RL257(G/S)

Δ Rating and Characteristics Curves

FIG. 1 – FORWARD CURRENT DERATING

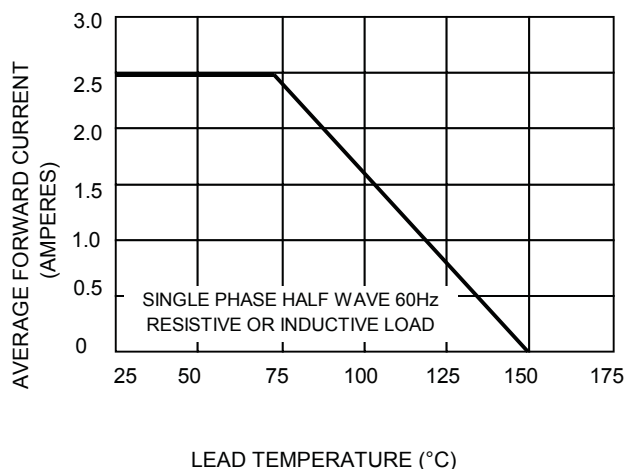


FIG. 2 – MAXIMUM NON-REPETITIVE SURGE CURRENT

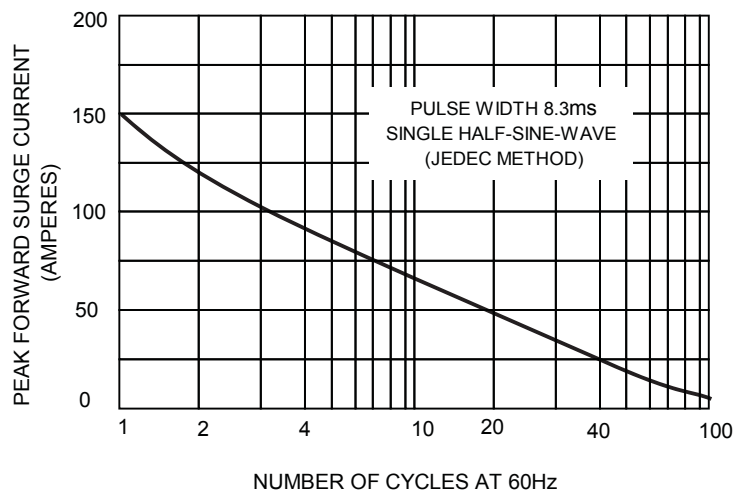


FIG.3 – TYPICAL JUNCTION CAPACITANCE

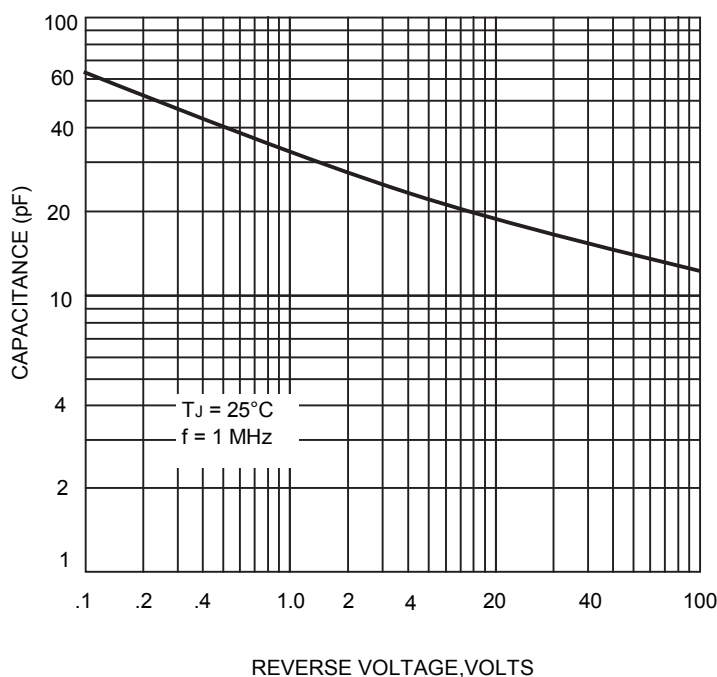
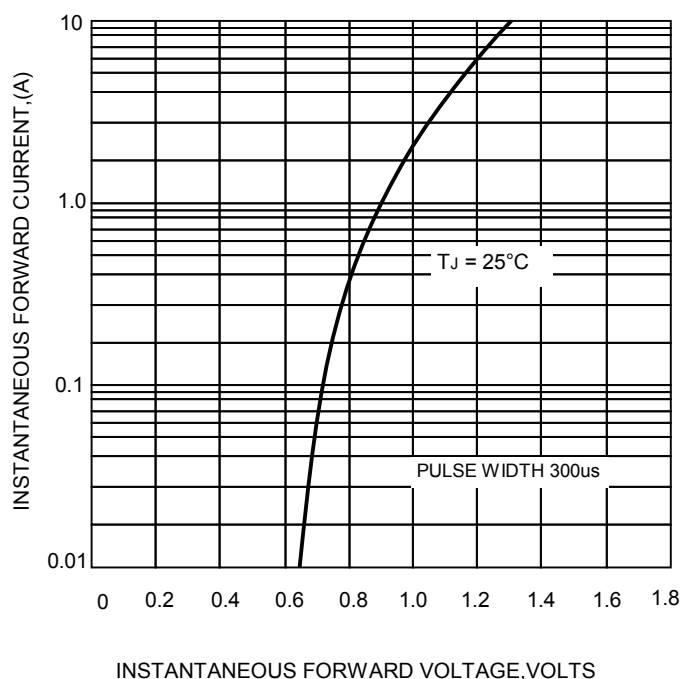


FIG.4-TYPICAL FORWARD CHARACTERISTICS





Glass/Silicon Passivated Rectifiers

Type PR - P600A(G/S) Thru P600M(G/S)

Reverse Voltage - 50 to 1000 Volts

Forward Current - 6.0 Amperes

△ Features

- Low cost
- Diffused junction
- Low forward voltage drop
- Low reverse leakage current
- High current capability
- The plastic material carries UL recognition 94V-0

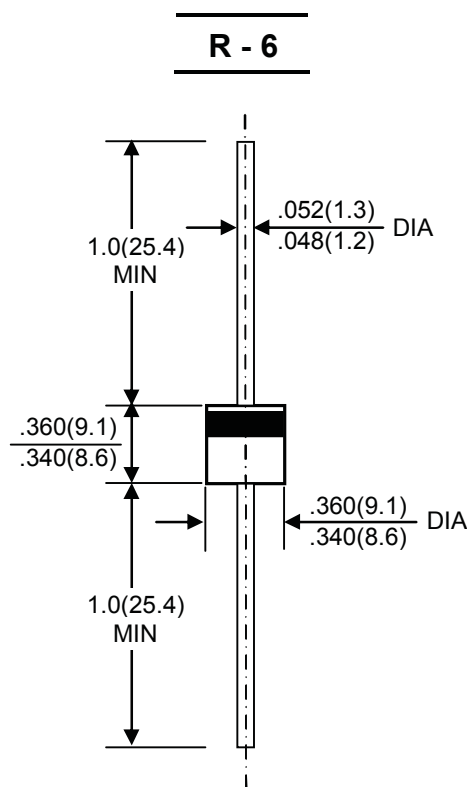
△ Mechanical Data

- Case: JEDEC R-6 molded plastic
- Polarity: Color band denotes cathode
- Weight: 0.07 ounces, 2.1 grams
- Mounting position: Any

△ Maximum Ratings and Electrical Characteristics

Ratings at 25°C ambient temperature unless otherwise specified.

Single phase, half wave, 60Hz, resistive or inductive load.



Dimensions in inches and (millimeters)

CHARACTERISTICS	SYMBOL	P600A	P600B	P600D	P600G	P600J	P600K	P600M	UNIT
Maximum Recurrent Peak Reverse Voltage	V_{RRM}	50	100	200	400	600	800	1000	V
Maximum RMS Voltage	V_{RMS}	35	70	140	280	420	560	700	V
Maximum DC Blocking Voltage	V_{DC}	50	100	200	400	600	800	1000	V
Maximum Average Forward Rectified Current @ $T_A = 60^\circ\text{C}$	$I_{(AV)}$	6.0							A
Peak Forward Surge Current 8.3ms Single Half Sine-Wave Super Imposed on Rated Load(JEDEC Method)	I_{FSM}	400							A
Maximum Forward Voltage at 6.0A DC	V_F	0.95							V
Maximum DC Reverse Current @ $T_J = 25^\circ\text{C}$ at Rated DC Blocking Voltage @ $T_J = 100^\circ\text{C}$	I_R	10 100							μA
Typical Junction Capacitance (Note1)	C_J	100							pF
Typical Thermal Resistance (Note2)	$R_{\theta JA}$	10							$^\circ\text{C/W}$
Operating Temperature Range	T_J	-55 to +150							$^\circ\text{C}$
Storage Temperature Range	T_{STG}	-55 to +150							$^\circ\text{C}$

NOTES: 1. Measured at 1.0 MHz and applied reverse voltage of 4.0V DC
2. Thermal resistance junction of lead.



Glass/Silicon Passivated Rectifiers Type PR - P600A(G/S) Thru P600M(G/S)

Δ Rating and Characteristics Curves

FIG. 1 – FORWARD CURRENT DERATING CURVE

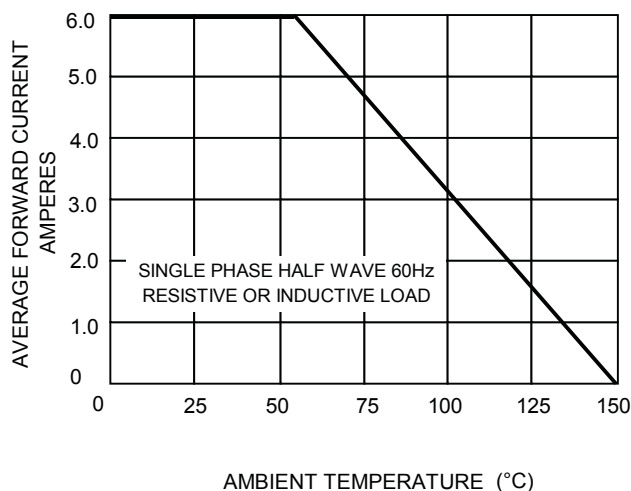


FIG. 2 – MAXIMUM NON-REPETITIVE SURGE CURRENT

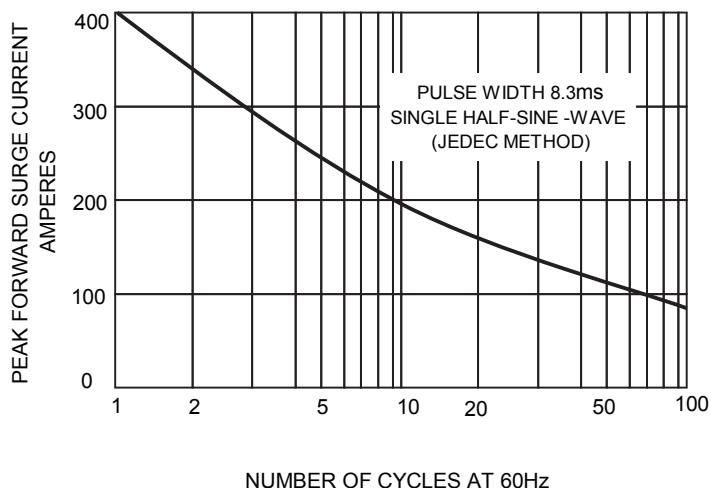


FIG.3 – TYPICAL JUNCTION CAPACITANCE

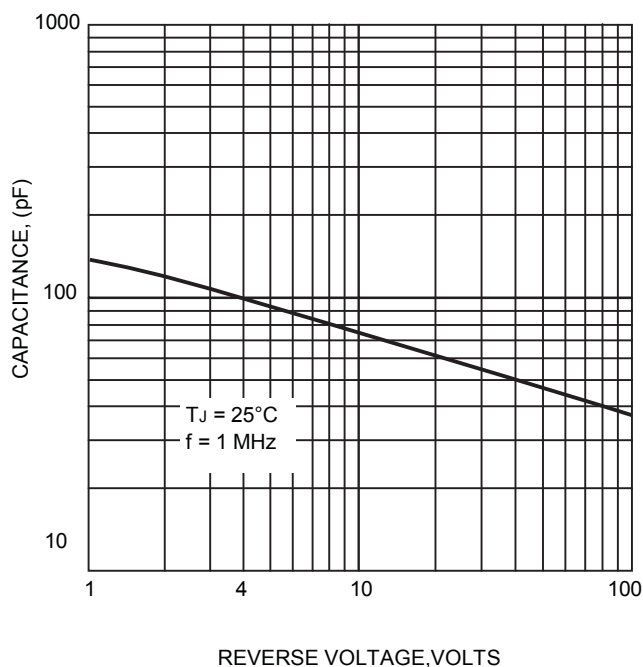
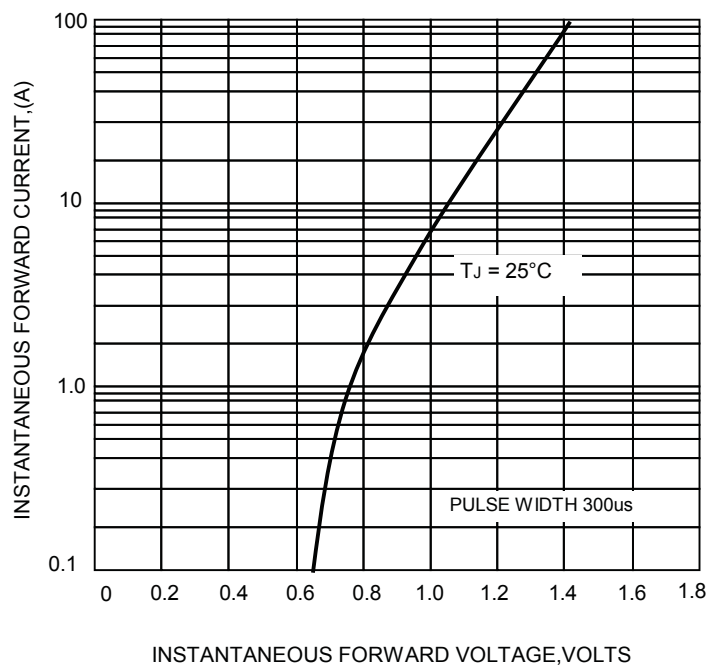


FIG.4-TYPICAL FORWARD CHARACTERISTICS





Nickel Barrier Termination Type

△ Features

- Small in size and wide capacitance range.
- Superior humidity characteristic and long life thanks to the monolithic construction.
- Three layer terminals are made of metal, excellent solderability and high resistance to migration.
- Low inductance and excellent frequency characteristics enable a circuit with parameters nearly to the designed theoretical values.

△ Part Numbering

CMC 0805 CG 102 J 1H

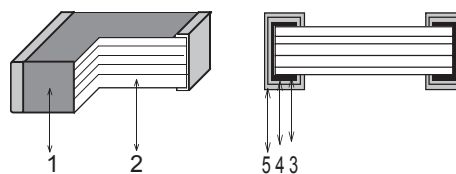
(1) (2) (3) (4) (5)(6)

- (1) Type
- (2) EIA size code
- (3) Temperature characteristics
- (4) Nominal capacitance
- (5) Capacitance tolerance
- (6) Rated voltage

△ Applications

- General electronic equipment.
- Class I (T.C. Type) Temperature compensation.
- Class I (T.C. Type) Tuned Circuits and Filters.
- Class II (Hi-K type) By pass and coupling.

△ Construction



NO.	Name	Material
1.	Ceramic Dielectric	Ceramics
2.	Inner Electrode	Palladium
3.	Substrate Electrode	Silver
4.	Intermediate Electrode	Nickel
5.	External Electrode	Solder

(3) Temperature characteristics

Class I (Temperature compensating type)

Code	C0G(CG)
Temp. range	-55 to 125°C
Temp. Coeff.	0 ± 30ppm/°C

Class II (High dielectric constant type)

Code	X7R(XR)	Z5U(ZU)	Y5V(YV)
Temp. range	-55 to 125°C	+10 to 85°C	-30 to 85°C
Cap. change	±15%	+22 to -56%	+22 to -82%

(4) Nominal Capacitance Designation

Stated in three digits and in units of pico farads (pF). The capacitance shall be expressed in a 3 digits code. The first and second digits identify the first and second significant figures of the capacitance, the third digit identifies the multiplier. However, when capacitance is below 10pF there are decimal digits included, they are stated as D. Please check examples below:

Symbol	Capacitance (pF)
D50	0.5
D75	0.75
1D5	1.5
100	10
101	100

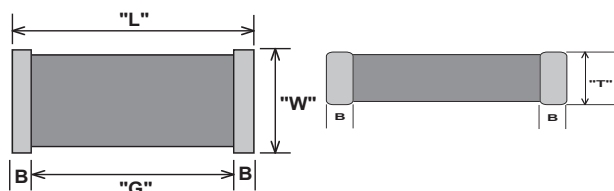
(5) Capacitance Tolerance

J = ±5% K = ±10%

(6) Rated Voltage

1H = 50V

(2) Size and Dimensions



Size	Dimensions in (mm) [Brackets indicate in inches]				
	L	W	T max.	B min.	G min.
0402	1±0.05 [0.39±.002]	0.5±0.05 [0.20±.002]	0.5 [0.20]	0.15 [.006]	0.3 [0.12]
0603	1.6±0.1 [.063±.004]	0.8±0.1 [.031±.004]	0.9 [.035]	0.2 [.008]	0.3 [.012]
0805	2.0±0.2 [.079±.008]	1.25±0.2 [.049±.008]	1.45 [.057]	0.2 [.008]	0.5 [.020]
1206	3.2±0.2 [.126±.008]	1.6±0.2 [.063±.008]	1.30 [.051]	0.2 [.008]	1.0 [.039]
1210	3.2±0.4 [.126±.016]	2.5±0.3 [.098±.012]	1.90 [.075]	0.3 [.012]	1.0 [.039]
1812	4.5±0.5 [.177±.020]	3.2±0.4 [.126±.016]	1.90 [.075]	0.4 [.016]	2.0 [.079]
2220	5.6±0.5 [.220±.020]	5.0±0.5 [.197±.020]	1.90 [.075]	0.4 [.016]	2.0 [.079]



Multilayer Ceramic Chip Capacitors Performance Specifications

1. Electrical

Dielectric Code	DIA IEC	COG 1BCG	X7R 2R1		
Temperature Characteristics	*1	0±30ppm/°C, C>20pF +120 ~ -40ppm/°C, C ≤ 20pF	ΔC±15% maximum over -55°C to +125°C		
Operating Temperature Range		-55°C to +125°C	-55°C to +125°C		
Measuring Conditions for Capacitance and D.F.	*2	1 MHz, 1 Crms, C ≤ 1000pF 1 MHz, 1 Crms, C > 1000pF	1KHz, 1 Vrms		
Dissipation Factor (D.F.) and Tangent of Loss Angle (tan δ)		0.1% for C ≤ 30 pF	rated voltage		
		100%/(400+20C) for C < 30pF	2.5%		50V
			3.5%	25V	16V
			5.0%	10V	6.3V
Insulation Resistance (I.R.) after 60 secs. Charging at rated voltage, 25°C, 55% RH max.		100 GΩ or 1000 MΩ x μF whichever is less	10 GΩ or 100 MΩ x μF whichever is less		
Voltage Proof, 25°C, 1-5 secs.		2.5 x Rated Voltage	2.5 x Rated Voltage		
Capacitance Aging		0	approx. = 1.5% per decade hour		

Dielectric Code	DIA IEC	Z5U 2E6	Y5V 2F4		
Temperature Characteristics	*1	ΔC+22%,-56% maximum over +10°C to +85°C	ΔC+22%,-82% maximum over -30°C to +85°C		
Operating Temperature Range		+10°C to +85°C	-30°C to +85°C		
Measuring Conditions for Capacitance and D.F.	*2	1KHz, 0.5Vrms	1KHz, 10 Vrms		
Dissipation Factor (D.F.) and Tangent of Loss Angle (tan δ)		4.0% 50V	rated voltage		
		6.0% 25V	5.0%	50V	50V
			7.0%	25V	16V
			10.0%	10V	6.3V
Insulation Resistance (I.R.) after 60 secs. Charging at rated voltage, 25°C, 55% RH max.		10 GΩ or 100 MΩ x μF whichever is less	10 GΩ or 100 MΩ x μF whichever is less		
Voltage Proof, 25°C, 1-5 secs.		2.5 x Rated Voltage	2.5 x Rated Voltage		
Capacitance Aging		approx. = 5% per decade hour	approx. = 3% per decade hour		



Multilayer Ceramic Chip Capacitors Performance Specifications

2. Environmental

Test	Test Conditions	Post-Test Inspection Requirements				
Solderability	IEC 384-10 4.11/JIS C 5102 8.13 Solder 60 Sn/40 Pb, 235±1 secs. Immersed for 5 secs.	At least 75% of termination area should be well tinned. No visible damage.				
Resistance to Soldering Heat	IEC 384-10 4.10/JIS C 5102 8.14 Immersed in solder bath at 260±5°C for 10±1 secs. Recovery: 6~24 hrs. (COG) 24±2 hrs. (X7R, Z5U, Y5V)	At least 75% of termination area should be covered by solder. No visible damage.				
			COG(1BCG)	X7R(2R1)	Z5U(2E6)	Y5U(2F4)
		ΔC/C	±0.5%, or ±0.5pF whichever is greater	+ 10% -5%	+20% -10%	+20% -10%
Rapid Change of Temperature	IEC 384-10 4.12/JIS C 5102 9.3 -55°C to + 125°C, 5 cycles(COG,X7R) Duration: 30 mins. Recovery: 6~24 hrs. (COG) 24±2hrs. (X7R)	No visible damage.				
			COG(1BCG)		X7R(2R1)	
		ΔC/C	±1%, or ±1pF whichever is greater		±10%	
		D.F.	1.5 x initial requirement			
		I.R.	0.25 x initial requirement			
Endurance (Life Test)	IEC 384-10 4.15 1000 hrs. at max. temperature with 1.5 x rated voltage applied Recovery: 6~24 hrs. (COG) 24±2 hrs. (X7R, Z5U, Y5V)	No visible damage.				
			COG(1BCG)	X7R(2R1)	Z5U(2E6)	Y5U(2F4)
		ΔC/C	±2%, or ±1pF whichever is greater	±20%	±20%	±30%
		D.F.	2.0 x initial req.	1.5 x initial requirement		
		I.R.	0.25 x initial requirement			
Humidity Test (Damp heat, steady state)	IEC 384-10 4.14/JIS C 5102 9.5 500 hrs. at 40±2°C, 90-95% RH Recovery: 6~24 hrs. (COG) 24±2 hrs. (X7R, Z5U, Y5V)	No visible damage.				
			COG(1BCG)	X7R(2R1)	Z5U(2E6)	Y5U(2F4)
		ΔC/C	±2%, or ±1pF whichever is greater	±10%	±20%	±30%
		D.F.	2.0 x initial req.	1.5 x initial requirement		
		I.R.	0.25 x initial requirement			
Adhesion	IEC 384-10 4.8/JIS C 5102 8.11.2 Capacitors mounted on a substrate. A force of 5N applied perpendicular to the plane of substrate and parallel the line joining the center of terminations for 10±1 secs	No visible damage.				

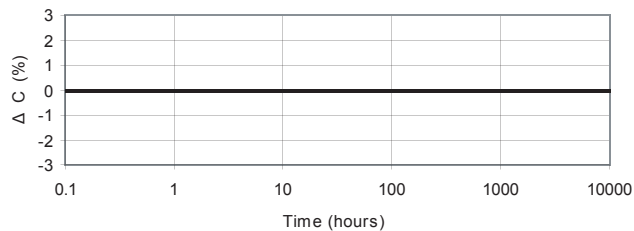
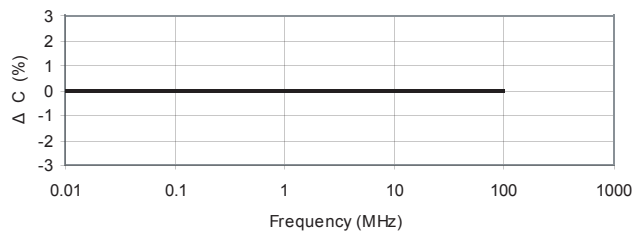
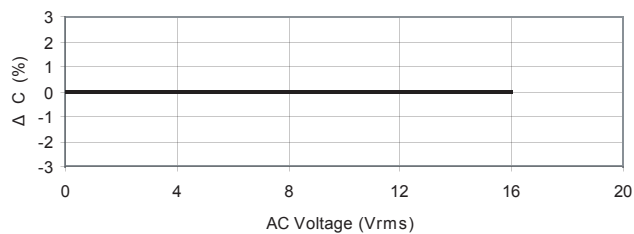
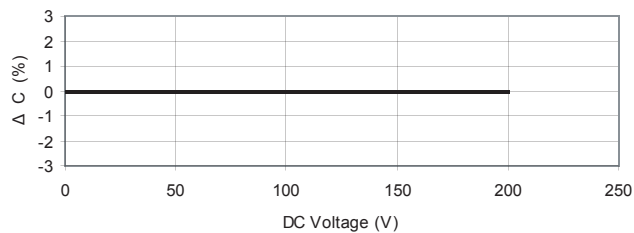
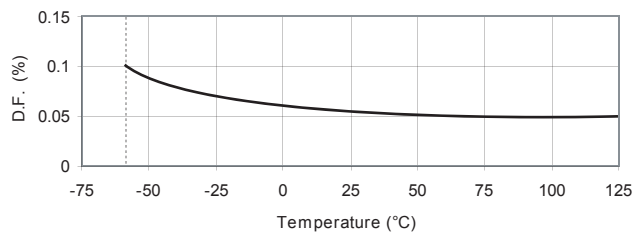
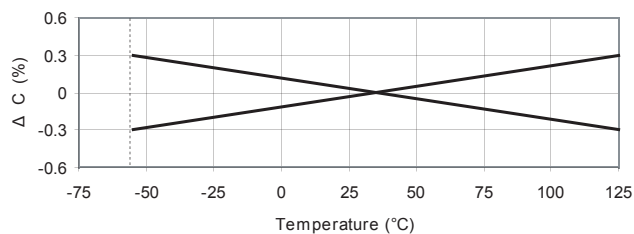


Multilayer Ceramic Chip Capacitors

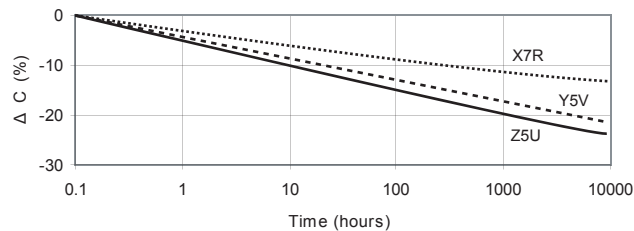
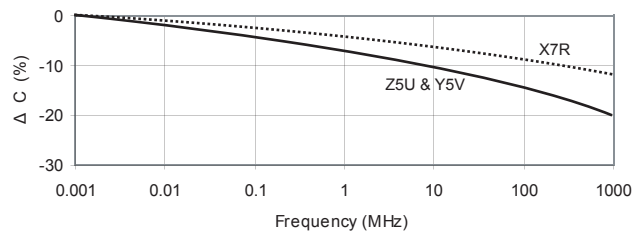
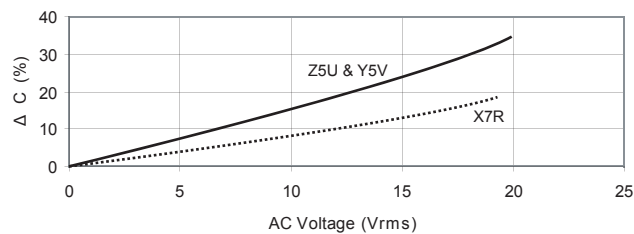
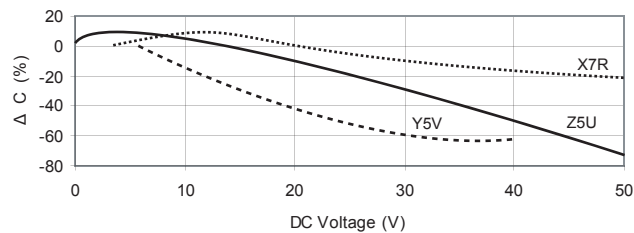
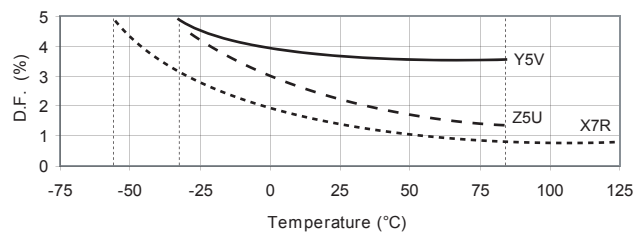
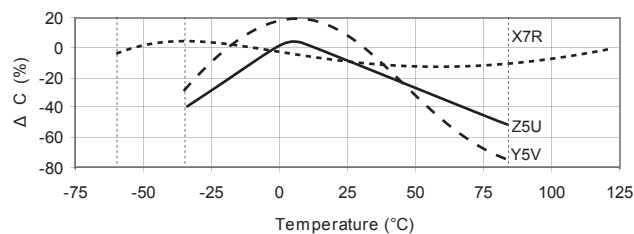
Type

CMC

COG(1B)



X7R (2R1), Z5U (2E6), Y5V(2F4)





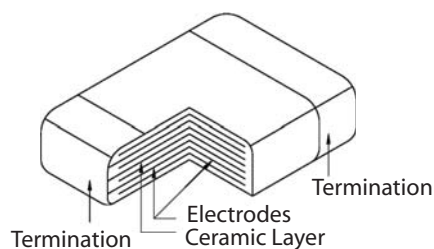
Multilayer Ceramic Chip Capacitors Type CMC Series

Δ Features

- Nickel-barrier terminations are finished by electroplated solder
- Nickel barrier layer in terminations prevents dissolution of termination

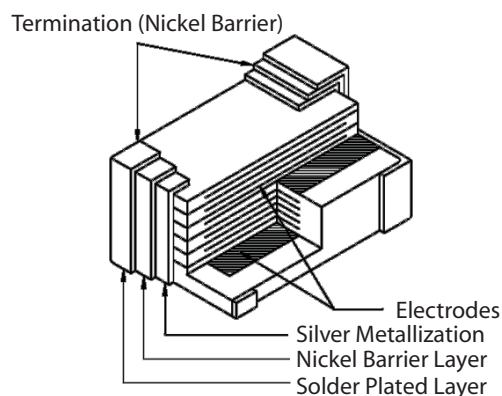
Δ Applications

- Suitable for thick-film hybrid circuits and automatic surface mounting



Δ Resistance to Soldering

Termination Material	Test Conditions
Nickel-barrier, Solder plated	260 °C, 60 Sn/40 Pb, 10 secs



Δ Tolerances Available

Dielectric		Available Tolerance	Capacitance
EIA	IEC		
COG	1BCG	± 0.25 pF	5 pF
		± 0.5 pF	5pF < CAP < 10 pF
		± 1%, ±2%, ±5%, ±10%	10 pF
X7R	2R1	± 5%, ±10%, ±20%	All values
Z5U	2E6	± 20%, +80% ~ -20%	All values
Y5V	2F4	± 20%, +80% ~ -20%	All values



Multilayer Ceramic Chip Capacitors Application Notes

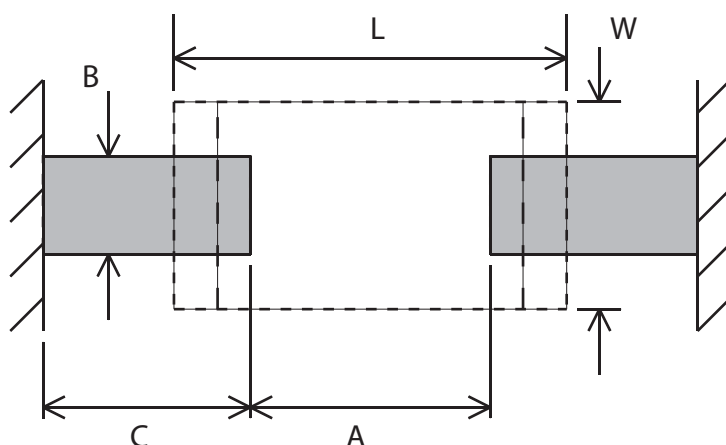
COOLING

After soldering, cool the chips and the substrate gradually to room temperature. Natural cooling in air is recommended to minimize stress in the solder joint. A cooling rate not exceeding 4° C/sec should be used when forced cooling is necessary.

CLEANING

All flux residues must be removed by using suitable electronics-grade vapor-cleaning solvents to eliminate contamination that could cause electrolytic-surface corrosion. Good results can be obtained by using ultrasonic cleaning of the solvent. The choice of the proper system is dependent upon many factors such as component mix, flux, and solder paste and assembly method. The ability of the cleaning system to remove flux residues and contamination from under the chips is very important.

RECOMMENDED PAD DIMENSIONS (for reflow soldering)



Unit: mm (inch)

Chip Size	L	W	A	B	C
0603	1.6 (0.063)	0.8 (0.032)	0.6~0.8 (0.024~0.032)	0.6~0.8 (0.024~0.032)	0.6~0.7 (0.024~0.028)
0805	2.0 (0.080)	1.2 (0.050)	1.0~1.2 (0.039~0.047)	0.8~1.1 (0.032~0.043)	0.6~0.7 (0.024~0.028)
1206	3.2 (0.126)	1.6 (0.063)	2.2~2.4 (0.087~0.094)	1.0~1.4 (0.039~0.055)	0.8~0.9 (0.032~0.035)
1210	3.2 (0.126)	2.5 (0.100)	2.0~2.4 (0.080~0.094)	1.8~2.3 (0.071~0.091)	1.0~1.2 (0.039~0.047)
1808	4.5 (0.177)	2.0 (0.080)	2.8~3.4 (0.110~0.134)	1.4~1.8 (0.055~0.071)	1.2~1.4 (0.047~0.055)
1812	4.5 (0.177)	3.2 (0.126)	3.0~3.5 (0.118~0.138)	2.3~3.0 (0.091~0.118)	1.2~1.4 (0.047~0.055)



Multilayer Ceramic Chip Capacitors Performance Specifications

2. Environmental

Test	Test Conditions	Post-Test Inspection Requirements	
Solderability	IEC 384-10 4.11/JIS C 5102 8.13 Solder 60 Sn/40 Pb, 235±5°C Immersed for 5 secs.	At least 75% of termination area should be well tinned. No visible damage.	
Resistance to Soldering Heat	IEC 384-10 4.10/JIS C 5102 8.14 Immersed in solder bath at 260±5°C for 10±1 secs. Recovery: 6~24 hrs. (COG) 24±2 hrs. (X7R)	At least 75% of termination area should be covered by solder. No visible damage.	
		COG(1BCG)	X7R(2R1)
		$\Delta C/C$	±1%, or ±1pF whichever is greater ≤ ±7%
Rapid Change of Temperature	IEC 384-10 4.12/JIS C 5102 9.3 -55°C to + 125°C, 5 cycles(COG,X7R) Duration: 30 mins. Recovery: 6~24 hrs. (COG) 24±2hrs. (X7R)	No visible damage.	
		COG(1BCG)	X7R(2R1)
		$\Delta C/C$	±1%, or ±1pF whichever is greater ≤ ±15%
		D.F.	≤ 2.0 x initial requirement ≤ 1.5 x initial requirement
Endurance (Life Test)	IEC 384-10 4.15 1000 hrs. at max. temperature with 1.5 x rated voltage applied Recovery: 6~24 hrs. (COG) 24±2hrs. (X7R)	No visible damage.	
		COG(1BCG)	X7R(2R1)
		$\Delta C/C$	±2%, or ±1pF whichever is greater ≤ ±20%
		D.F.	≤ 2.0 x initial requirement ≤ 7%
Humidity Test (Damp heat, steady state)	IEC 384-10 4.14/JIS C 5102 9.5 500 hrs. at 40±2°C, 90-95% RH Recovery: 6~24 hrs. (COG) 24±2hrs. (X7R)	No visible damage.	
		COG(1BCG)	X7R(2R1)
		$\Delta C/C$	±2%, or ±1pF whichever is greater ±10%
		D.F.	≤ 2.0 x initial requirement ≤ 7%
Adhesion	IEC 384-10 4.8/JIS C 5102 8.11.2 Capacitors mounted on a substrate. A force of 5N applied perpendicular to the lane of substrate and parallel the line joining the center of terminations for 10±1 secs.	No visible damage.	
		I.R.	≥ 0.25 x initial requirement



Multilayer Ceramic Chip Capacitors

Type

CMC

COG(NP0)

Multilayer Ceramic Chip Capacitors

Type CMC Series

COG (NPO)

EIA/IEC Dielectric Code: COG/1BCG

EIA/IEC Dielectric Code		COG/1BCG					
Size		0603	0805	1206	1210	1812	
(L) Length mm(in)		1.60±0.15(0.063±0.006)	2.00±0.20(0.080±0.008)	3.20±0.20(0.126±0.008)	3.20±0.30(0.126±0.012)	4.50±0.30(0.177±0.012)	
(W) Width mm(in)		0.08±0.15(0.032±0.06)	1.20±0.20(0.050±0.008)	1.60±0.20(0.063±0.008)	2.50±0.30(0.100±0.012)	3.20±0.30(0.126±0.012)	
(E) Termination mm(in)		0.40±0.20(0.16±0.008)	0.50±0.20(0.020±0.008)	0.50±0.20(0.020±0.008)	0.50±0.20(0.020±0.008)	0.64±0.38(0.025±0.015)	
W.V.D.C.		25	50	50	50	50	
Cap	0.47						
(pf)	1.0						
	1.2						
	1.5						
	1.8						
	2.2						
	2.7						
	3.3						
	3.9						
	4.7						
	5.6						
	6.8						
	8.2						
	10						
	12						
	15						
	18						
	22						
	27						
	33						
	39						
	47						
	56						
	68						
	82						
	100						
	120						
	150						
	180						
	220						
	270						
	330						
	390						
	470						
	560						
	680						
	820						
	1000						
	1200						
	1500						
	1800						
	2200						
	2700						
	3300						
	3900						
	4700						
	5600						
	6800						
	8200						
Cap.	.010						
(μF)	.012						
	.015						
	.018						
	.022						

Surface Mount
Capacitors



Multilayer Ceramic Chip Capacitors

Type

CMC

COG(NP0)

Multilayer Ceramic Chip Capacitors

Type CMC - High Voltage Series

COG (NPO)

EIA/IEC Dielectric Code: COG/1BCG

EIA/IEC Dielectric Code W.V.D.C.		COG / 1BCG													
		100V				250V				500V					
Cap. (pF)	Size	0603	0805	1206	1210	1812	0805	1206	1210	1812	0805	1206	1210	1808	1812
	10														
	12														
	15														
	18														
	22														
	27														
	33														
	39														
	47														
	56														
	68														
	82														
	100														
	120														
	150														
	180														
	220														
	270														
	330														
	390														
	470														
	560														
	680														
	820														
	1000														
	1200														
	1500														
	1800														
	2200														
	2700														
	3300														
	3900														
	4700														
	5600														
	6800														
	8200														
Cap. (pF)	.010														
	.012														
	.015														

Surface Mount
Capacitors



Multilayer Ceramic Chip Capacitors

Type

CMC

X7R

Multilayer Ceramic Chip Capacitors

Type CMC Series

X7R

EIA/IEC Dielectric Code: X7R/2R1

EIA/IEC Dielectric Code		X7R / 2R1									
Size		0603			0805			1206		1210	1812
(L) Length mm(in)		1.60±0.15(0.063±0.006)			2.00±0.20(0.080±0.008)			3.20±0.20(0.126±0.008)		3.20±0.30(0.126±0.012)	4.50±0.30(0.177±0.012)
(W) Width mm(in)		0.08±0.15(0.032±0.06)			1.20±0.20(0.050±0.008)			1.60±0.20(0.063±0.008)		2.50±0.30(0.100±0.012)	3.20±0.30(0.126±0.012)
(E) Termination mm(in)		0.40±0.20(0.16±0.008)			0.50±0.20(0.020±0.008)			0.50±0.20(0.020±0.008)		0.50±0.20(0.020±0.008)	0.64±0.38(0.025±0.015)
W.V.D.C.		16	25	50	16	25	50	16	25	50 50	50
Cap (pf)	100										
	120										
	150										
	180										
	220										
	270										
	330										
	390										
	470										
	560										
	680										
	820										
	1000										
	1200										
	1500										
	1800										
	2200										
	2700										
	3300										
	3900										
	4700										
	5600										
	6800										
	8200										
Cap. (µF)	0.01										
	0.012										
	0.015										
	0.018										
	0.022										
	0.027										
	0.033										
	0.039										
	0.047										
	0.056										
	0.068										
	0.082										
	0.1										
	0.12										
	0.15										
	0.18										
	0.22										
	0.27										
	0.33										
	0.39										
	0.47										
	0.68										
	0.68										

Surface Mount
Capacitors



Multilayer Ceramic Chip Capacitors

Type

CMC

X7R

Multilayer Ceramic Chip Capacitors

Type CMC - High Voltage Series

X7R

EIA/IEC Dielectric Code: X7R/2R1

EIA/IEC Dielectric Code		X7R / 2R1													
W.V.D.C.		100V				250V				500V					
Cap. (pF)	Size	0603	0805	1206	1210	1812	0805	1206	1210	1812	0805	1206	1210	1808	1812
100															
120															
150															
180															
220															
270															
330															
390															
470															
560															
680															
820															
1000															
1200															
1500															
1800															
2200															
2700															
3300															
3900															
4700															
5600															
6800															
8200															
.010															
.012															
.015															
.018															
.022															
.027															
.033															
.039															
.047															
.056															
.068															
.082															
.10															
.12															
.15															
.18															
.22															
.27															
.33															
.47															
.56															
.68															

Surface Mount
Capacitors



Multilayer Ceramic Chip Capacitors

Type

CMC

Y5V

Multilayer Ceramic Chip Capacitors

Type CMC Series

Y5V

EIA/IEC Dielectric Code: Y5V/2F4

EIA/IEC Dielectric Code		X7R / 2R1											
Size		0603				0805				1206			
(L) Length mm(in)		1.60±0.15(0.063±0.006)				2.00±0.20(0.080±0.008)				3.20±0.20(0.126±0.008)			
(W) Width mm(in)		0.08±0.15(0.032±0.06)				1.20±0.20(0.050±0.008)				2.50±0.30(0.100±0.012)			
(E) Termination mm(in)		0.40±0.20(0.16±0.008)				0.50±0.20(0.020±0.008)				0.50±0.20(0.020±0.008)			
W.V.D.C.		10	16	25	50	16	25	50	16	25	50	25	50
Cap.	0.01												
(µF)	0.012												
	0.015												
	0.018												
	0.022												
	0.027												
	0.033												
	0.039												
	0.047												
	0.056												
	0.068												
	0.082												
	0.1												
	0.12												
	0.15												
	0.18												
	0.22												
	0.27												
	0.33												
	0.39												
	0.47												
	0.56												
	0.68												
	0.82												
	1												
	1.2												
	1.5												
	1.8												
	2.2												
	2.7												
	3.3												

Surface Mount
Capacitors



Multilayer Ceramic Chip Capacitors

Type CMC Series

Z5U

EIA/IEC Dielectric Code: Z5U/2E6

EIA/IEC Dielectric Code											
Size		0603		0805		X7R / 2R1 1206		1210		1812	
(L) Length mm(in)		1.60±0.15(0.063±0.006)		2.00±0.20(0.080±0.008)		3.20±0.20(0.126±0.008)		3.20±0.30(0.126±0.012)		4.50±0.30(0.177±0.012)	
(W) Width mm(in)		0.08±0.15(0.032±0.06)		1.20±0.20(0.050±0.008)		1.60±0.20(0.063±0.008)		2.50±0.30(0.100±0.012)		3.20±0.30(0.126±0.012)	
(E) Termination mm(in)		0.40±0.20(0.16±0.008)		0.50±0.20(0.020±0.008)		0.50±0.20(0.020±0.008)		0.50±0.20(0.020±0.008)		0.64±0.38(0.025±0.015)	
W.V.D.C.		25 50		25 50		25 50		25 50		25 50	
Cap.	2700										
(pF)	3300										
	3900										
	4700										
	5600										
	6800										
	8200										
Cap.	0.01										
(µF)	0.012										
	0.015										
	0.018										
	0.022										
	0.027										
	0.033										
	0.039										
	0.047										
	0.056										
	0.068										
	0.082										
	0.1										
	0.12										
	0.15										
	0.18										
	0.22										
	0.27										
	0.33										
	0.39										
	0.47										
	0.56										
	0.68										
	0.82										
	1										
	1.2										
	1.5										
	1.8										



Multilayer Ceramic Chip Capacitors

Type

CMC

Z5U

Multilayer Ceramic Chip Capacitors
Type CMC - High Voltage Series
Z5U
EIA/IEC Dielectric Code: Z5U/2E6

EIA/IEC Dielectric Code		Z5U / 2E6				
W.V.D.C.		100V			250V	
Cap.	Size	0805	1206	1210	1812	1812
(pF)						
	.033					
	.039					
	.047					
	.056					
	.068					
	.082					
	.10					
	.12					
	.15					
	.18					
	.22					
	.27					
	.33					
	.39					
	.47					
	.56					
	.68					
	.82					
	1.0					
	1.2					
	.15					

Surface Mount
Capacitors



High Voltage Ceramic Chip Capacitors Type CFK

△ Features

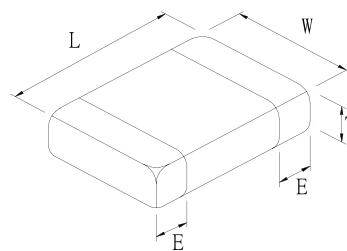
- Surface Mount
- Rated Voltage: 250 VAC, 5000VDC
- Chip Size: 1808, 1812, 2211

△ Applications

- Suitable for wave and reflow soldering
- Use in mobile, facsimile, telephone and other telecom electronic equipment where lightning surges occur.

△ Dimensions

Size		1808	1812	2211
(L) Length	mm	4.60±0.30	0.30± 4.60	4.60±0.30
	(in)	(0.181±0.12)	(0.12±0.181)	(0.181±0.12)
(W) Width	mm	2.00±0.20	0.20±3.20	3.20±0.30
	(in)	(0.080±0.008)	(0.008±0.126)	(0.126±0.012)
(E) Termination	mm	0.64±0.38	0.38±0.64	0.64±0.38
	(in)	(0.025±0.015)	(0.015±0.025)	(0.025±0.015)
(T) Thickness	mm	2.20	2.70	2.70
	(in)	(0.087)	(0.106)	(0.106)



△ Specifications

	Size	Length / Width	Volt	Capacitance
X7R	2211	L: 5.70±0.040mm (0.224±0.016) W: 2.80±0.030mm (0.110±0.012)	250	130pF-2200pF X1Y1 - TUV/UL
	1812	L: 4.60±0.030mm (0.181±0.012) W: 3.20±0.030mm (0.126±0.012)	250	150pF-1000pF X1Y2 - TUV/UL
	1808	L: 4.60±0.030mm (0.181±0.012) W: 2.00±0.020mm (0.080±0.008)	250	100pF-1000pF X1Y2 - TUV/UL
NPO	1808	L: 4.60±0.030mm (0.181±0.012) W: 2.00±0.020mm (0.080±0.008)	250	5.0pF-100pF X1Y2 - SEMKO
			250	3pF-150pF X1Y2 - TUV/UL



High Voltage Ceramic Chip Capacitors Type CFK

Δ Electrical

Test	Test Conditions	Post-Test Inspection Requirements
Temperature Coefficients	Operating temp. range: -55 to +125°C	Class I:
		ΔC: 0±30ppm/°C
		Class II:
		ΔC: ≤ ±15%
Capacitance	Class I:	Capacitance is within specified tolerance
	1MHz, 1Vrms	
	Class II:	
	1KHz, 1Vrms	
Dissipation Factor (D.F.) and Tangent of Loss Angle (tanδ)	Class I:	Class I:
	1MHz, 1Vrms	≤ 0.1%
	Class II:	Class II:
	1KHz, 1Vrms	≤ 2.5%
Insulation Resistance (I.R.)	Class I:	Class I:
	After 60 sec charging at 500V (DC) 25°C, 55% RH max.	≥100GΩ or ≥1000MΩ.μF Whichever is smaller
	Class II:	Class II:
	After 60 sec charging at 500V (DC) 25°C, 55% RH max.	≥10GΩ or ≥100MΩ.μF Whichever is smaller
Impulse Voltage	Each Individual Capacitor shall be subjected to a 5.0KV(X1Y2) impulse	No breakdown or failure
Withstanding Voltage	Test 1.5KV AC for 60 sec	No breakdown or failure



High Voltage Ceramic Chip Capacitors Type CFK

Δ Environmental

Test	Test Conditions	Post-Test Inspection Requirements
Solderability	Immersed in Solder bath at $245 \pm 5^{\circ}\text{C}$ for 5 ± 0.5 sec.	No Visible Damage At least 75% of termination area should be well tinned
Resistance to Soldering Heat	Immersed in Solder bath at $245 \pm 5^{\circ}\text{C}$ for 5 ± 0.5 sec. Recovery: 12 ± 1 hr.	No Visible Damage Class I: $\Delta C/C$: $\leq \pm 2.5\%$ or 0.25pF whichever is larger I.R.: More than $10\text{G}\Omega$ D.F.: $\leq 2.5\%$ Class II: $\Delta C/C$: $\leq 10\%$ I.R.: More than $1\text{G}\Omega$ D.F.: $\leq 2.5\%$
Endurance (Life Test)	Preconditioning 1000^{+48}_{-0} hr. at upper category temperature applied at: $1.25U_R$ (X1,X2) or $1.7U_R$ (Y2,Y3) Once every hour the voltage shall be increased to 1000Vrms for 0.1 sec. Recovery: 12 ± 1 hr.	No Visible Damage Class I: $\Delta C/C$: $\leq \pm 5\%$ I.R.: More than $1\text{G}\Omega$ D.F.: $\leq 0.25\%$ Class II: $\Delta C/C$: $\leq 10\%$ I.R.: $\geq 1\text{G}\Omega$ or $50\text{M}\Omega \cdot \mu\text{F}$ whichever is smaller D.F.: $\leq 2.5\%$
Humidity Test (Damp heat, steady state)	Preconditioning 500^{+24}_{-0} hr. at $40 \pm 2^{\circ}\text{C}$, $90\sim 95\%$ relative humidity. The capacitor with rated voltage (250VAC) applied. Recovery: 12 ± 1 hr.	No Visible Damage Class I: $\Delta C/C$: $\leq \pm 5\%$ or 0.5pF whichever is larger I.R.: More than $10\text{G}\Omega$ D.F.: $\leq 2.5\%$ Class II: $\Delta C/C$: $\leq 10\%$ I.R.: $\geq 1\text{G}\Omega$ or $50\text{M}\Omega \cdot \mu\text{F}$ whichever is smaller D.F.: $\leq 5\%$
Adhesion Strength of Termination	Capacitors mounted on a substrate. A force of 5N applied perpendicular to the place of substrate and parallel the line joining the center of terminations for 10 ± 1 sec.	No Visible Damage
Resistance to Flexure Stress	Capacitors mounted on a substrate. The board shall then be bent by 1mm at a rate of 1mm/sec .	No Visible Damage Change in capacitance is less than 10%
Active Flammability	The capacitor is applied $U_R(250\text{VAC})$. Then each sample shall be subjected to 20 discharges from a tank capacitor, charge to a voltage that, when discharged, places $U_i 2500\text{V}$ for X_2Y_3 , $U_i 5000\text{V}$ for X_1Y_2 across the capacitor under test. The interval between successive discharges shall be 5 sec.	The cheese cloth shall not burn with a flame.



High Voltage Ceramic Chip Capacitors Type CFK

Δ Ordering

CFK 1808 N - 100 J - 302 E D G
(1) (2) (3) (4) (5) (6) (7) (8) (9)

(1)	Series	CFK: X1Y2	
(2)	Size Code	1808	
		1812	
		2211	
(3)	Dielectric Code	N: COG (1BCG)	
		X: X7R (2R1)	
(4)	Capacitance Code	Capacitance expressed in pF. First two digits are significant figures. The third Digit denotes number of zeros. Use R for decimal point for values less than 10pF. (eg. R47: 0.47pF)	
(5)	Tolerance Code	Code	Tolerance
		C	±0.25pF
		D	±0.5pF
		F	±1%
		G	±2%
		J	±5%
		K	±10%
		M	±20%
		Z	+80% -20%
(6)	Rated Voltage Code	Other Tolerances Available Upon Request	
		502: 5000V	
		TR: Tape and Reel, Cardboard Tape	
(7)	Packaging Code	ER: Tape and Reel, Embossed Tape	
		No Code: Bulk	
		Code	Tolerance (mm)
(8)	Thickness Code	B	0.71-0.90
		C	0.91-1.30
		D	1.31-1.50
		E	1.51-1.80
		F	1.81-2.20
		G	2.21-2.70
(9)	Special Code	G: Cd/Pb Free	



High Voltage Ceramic Chip Capacitors Type CFH

△ Features

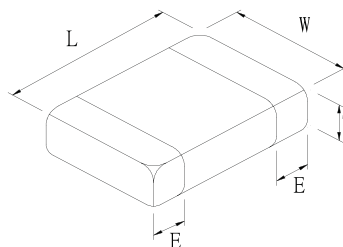
- Surface Mount
- Rated Voltage: 250 VAC, 3000VDC
- Chip Size: 1808, 1812

△ Applications

- Suitable for wave and reflow soldering
- Use in mobile, facsimile, telephone and other telecom electronic equipment where lightning surges occur.

△ Dimensions

Size		1808	1812
(L) Length	mm	4.60±0.30	0.30± 4.60
	(in)	(0.181±0.12)	(0.12±0.181)
(W) Width	mm	2.00±0.20	0.20±3.20
	(in)	(0.080±0.008)	(0.008±0.126)
(E) Termination	mm	0.64±0.38	0.64±0.38
	(in)	(0.025±0.015)	(0.015±0.025)
(T) Thickness	mm	2.20	2.70
	(in)	(0.087)	(0.106)



△ Specifications

	Size	Length / Width	Volt	Capacitance
X7R	1812	L: 4.60±0.030mm (0.181±0.012) W: 3.20±0.030mm (0.126±0.012)	250	300pF-2700pF X2Y3 - TUV/UL
			250	150pF-1000pF X2Y3 - SEMKO
	1808	L: 4.60±0.030mm (0.181±0.012) W: 2.00±0.020mm (0.080±0.008)	250	150pF-1800pF X2Y3 - TUV/UL
			250	5.0pF-220pF X2Y3 - SEMKO
NPO	1808	L: 4.60±0.030mm (0.181±0.012) W: 2.00±0.020mm (0.080±0.008)	250	3pF-1000pF X2Y3 - TUV/UL
			250	3pF-1000pF X2Y3 - TUV/UL



High Voltage Ceramic Chip Capacitors Type CFH

Δ Electrical

Test	Test Conditions	Post-Test Inspection Requirements
Temperature Coefficients	Operating temp. range: -55 to +125°C	Class I: $\Delta C: 0 \pm 30 \text{ ppm/}^\circ\text{C}$ Class II: $\Delta C: \leq \pm 15\%$
Capacitance	Class I: 1MHz, 1Vrms Class II: 1KHz, 1Vrms	Capacitance is within specified tolerance
Dissipation Factor (D.F.) and Tangent of Loss Angle ($\tan\delta$)	Class I: 1MHz, 1Vrms Class II: 1KHz, 1Vrms	Class I: $\leq 0.1\%$ Class II: $\leq 2.5\%$
Insulation Resistance (I.R.)	Class I: After 60 sec charging at 500V (DC) 25°C, 55% RH max. Class II: After 60 sec charging at 500V (DC) 25°C, 55% RH max.	Class I: $\geq 100 \text{ G}\Omega$ or $\geq 1000 \text{ M}\Omega \cdot \mu\text{F}$ Whichever is smaller Class II: $\geq 10 \text{ G}\Omega$ or $\geq 100 \text{ M}\Omega \cdot \mu\text{F}$ Whichever is smaller
Impulse Voltage	Each Individual Capacitor shall be subjected to a 2.5KV(X2/Y3) impulse	No breakdown or failure
Withstanding Voltage	Test 1.5KV AC for 60 sec	No breakdown or failure



High Voltage Ceramic Chip Capacitors Type CFH

Δ Environmental

Test	Test Conditions	Post-Test Inspection Requirements
Solderability	Immersed in Solder bath at $245 \pm 5^{\circ}\text{C}$ for 5 ± 0.5 sec.	No Visible Damage At least 75% of termination area should be well tinned
Resistance to Soldering Heat	Immersed in Solder bath at $245 \pm 5^{\circ}\text{C}$ for 5 ± 0.5 sec. Recovery: 12 ± 1 hr.	No Visible Damage Class I: $\Delta C/C: \leq \pm 2.5\%$ or 0.25pF whichever is larger I.R.: More than $10\text{G}\Omega$ D.F.: $\leq 2.5\%$ Class II: $\Delta C/C: \leq 10\%$ I.R.: More than $1\text{G}\Omega$ D.F.: $\leq 2.5\%$
Endurance (Life Test)	Preconditioning 1000^{+48}_{-0} hr. at upper category temperature applied at: $1.25U_R$ (X1,X2) or $1.7U_R$ (Y2,Y3) Once every hour the voltage shall be increased to 1000Vrms for 0.1 sec. Recovery: 12 ± 1 hr.	No Visible Damage Class I: $\Delta C/C: \leq \pm 5\%$ I.R.: More than $1\text{G}\Omega$ D.F.: $\leq 0.25\%$ Class II: $\Delta C/C: \leq 10\%$ I.R.: $\geq 1\text{G}\Omega$ or $50\text{M}\Omega \cdot \mu\text{F}$ whichever is smaller D.F.: $\leq 2.5\%$
Humidity Test (Damp heat, steady state)	Preconditioning 500^{+24}_{-0} hr. at $40 \pm 2^{\circ}\text{C}$, 90~95% relative humidity. The capacitor with rated voltage (250VAC) applied. Recovery: 12 ± 1 hr.	No Visible Damage Class I: $\Delta C/C: \leq \pm 5\%$ or 0.5pF whichever is larger I.R.: More than $10\text{G}\Omega$ D.F.: $\leq 2.5\%$ Class II: $\Delta C/C: \leq 10\%$ I.R.: $\geq 1\text{G}\Omega$ or $50\text{M}\Omega \cdot \mu\text{F}$ whichever is smaller D.F.: $\leq 5\%$
Adhesion Strength of Termination	Capacitors mounted on a substrate. A force of 5N applied perpendicular to the place of substrate and parallel the line joining the center of terminations for 10 ± 1 sec.	No Visible Damage
Resistance to Flexure Stress	Capacitors mounted on a substrate. The board shall then be bent by 1mm at a rate of 1mm/sec.	No Visible Damage Change in capacitance is less than 10%
Active Flammability	The capacitor is applied $U_R(250\text{VAC})$. Then each sample shall be subjected to 20 discharges from a tank capacitor, charge to a voltage that, when discharged, places $U_i 2500\text{V}$ for X_2Y_3 , $U_i 5000\text{V}$ for X_1Y_2 across the capacitor under test. The interval between successive discharges shall be 5 sec.	The cheese cloth shall not burn with a flame.



High Voltage Ceramic Chip Capacitors Type CFH

Δ Ordering

CFH 1808 N - 100 J - 302 E D G
(1) (2) (3) (4) (5) (6) (7) (8) (9)

(1)	Series	CFH: X2Y3	
(2)	Size Code	1808	
		1812	
(3)	Dielectric Code	N:	COG (1BCG)
		X:	X7R (2R1)
(4)	Capacitance Code	Capacitance expressed in pF. First two digits are significant figures. The third Digit denotes number of zeros. Use R for decimal point for values less than 10pF. (eg. R47: 0.47pF)	
(5)	Tolerance Code	Code	Tolerance
		C	±0.25pF
		D	±0.5pF
		F	±1%
		G	±2%
		J	±5%
		K	±10%
		M	±20%
		Z	+80% -20%
(6)	Rated Voltage Code	Other Tolerances Available Upon Request	
		302:	3000V
(7)	Packaging Code	TR:	Tape and Reel, Cardboard Tape
		ER:	Tape and Reel, Embossed Tape
		No Code:	Bulk
(8)	Thickness Code	Code	Tolerance (mm)
		B	0.71-0.90
		C	0.91-1.30
		D	1.31-1.50
		E	1.51-1.80
		F	1.81-2.20
(9)	Special Code	G:	2.21-2.70
		G:	Cd/Pb Free



High Voltage Ceramic Chip Capacitors Type CFV

Δ Features

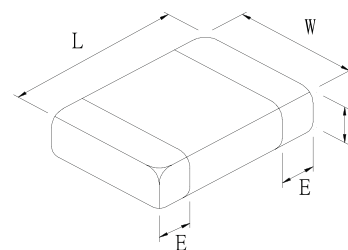
- Rated Voltage: 6000VDC
- Chip Size: 2211

Δ Applications

- Modems
- LAN / WAN Interface
- Industrial Controls
- Power Supply
- Back-Lighting Inverter
- Telecom Devices

Δ Dimensions

Size		1808	1812	2211
(L) Length	mm	4.60±0.30	4.60±0.30	5.70±0.40
	(in)	(.181±.012)	(0.181±.012)	(0.224±0.016)
(W) Width	mm	2.00±0.25	3.20±0.30	2.80±0.30
	(in)	(.080±.008)	(.126±.012)	(0.112±0.012)
(E) Termination	mm	0.64±0.38	0.64±0.38	0.85±0.55
	(in)	(.025±.015)	(.025±.015)	(0.033±0.022)
(T) Thickness	mm	2.20	2.70	2.75
	(in)	(0.087)	(0.106)	(0.108)



Δ Specifications

	Size	Length / Width	Volt	Capacitance
NPO	1808	L: 4.60±0.30mm (0.181±0.012) W: 2.00±0.20mm (0.080±0.012)	4000	3pF±100μF
	1812	L: 4.60±0.30mm (0.181±0.012) W: 3.20±0.30mm (0.126±0.012)	5000	1.5pF±100μF
	2211	L: 5.70±0.040mm (0.224±0.016) W: 2.80±0.030mm (0.112±0.012)	6000	2pF±100μF
X7R	1808	L: 4.60±0.30mm (0.181±0.012) W: 2.00±0.20mm (0.080±0.012)	4000	120pF±1000μF
	1812	L: 4.60±0.30mm (0.181±0.012) W: 3.20±0.30mm (0.126±0.012)	4000	150pF±1000μF
	2211	L: 5.70±0.040mm (0.224±0.016) W: 2.80±0.030mm (0.112±0.012)	4000	120pF±2200μF



High Voltage Ceramic Chip Capacitors Type CFV

Δ Electrical

Dielectric Code	EIA IEC	COG 1BCG	X7R 2R1
Temperature Characteristics		0±30ppm/°C, C>20pF 0-40+120ppm/°C, C>20pF	ΔC ± 15% maximum over -55°C tp +125°C
Operating Temperature Range		-55°C to +125°C	-55°C to +125°C
Measuring Conditions for Capacitance and D.F.		1MHz, 1Vrms, C≤1000pF 1KHz, 1Vrms, C>1000pF	1KHz, 1Vrms
Dissipation Factor (D.F.) and Tangent of Loss Angle (tan δ)		≤0.1% for C≥30pF ≤100% / (400+20C) for C≥30pF	≤2.5%
Insulation Resistance (I.R.) UR<500V: I.R. after 60secs. Charging at UR (DC) UR≥500V: I.R. after 60 secs. Charging at 500V (DC) 25°C, 55% RH max.		≥100GΩ or ≥1000MΩ·μF whichever is less	≥10GΩ or ≥100MΩ·μF whichever is less
Withstanding Voltage, 25°C, 1-5sec.		Rated Voltage ≤100V 2.5xUR 200V/250V 2.0xUR 500V 1.5xUR 1KV≤UR≤3KV 1.2xUR >3KV 1.1xUR	Rated Voltage ≤100V 2.5xUR 200V/250V 2.0xUR 500V 1.5xUR ≥1KV 1.2xUR
Capacitance Aging		Not Applicable	≈1.5% per decade hour



High Voltage Ceramic Chip Capacitors Type CFV

Δ Environmental

Test	Test Conditions	Post-Test Inspection Requirements		
Solderability	Immersed in Solder bath at $245 \pm 5^{\circ}\text{C}$ for 5 ± 0.5 sec.	No Visible Damage At least 75% of termination area should be well tinned		
Resistance to Soldering Heat	Immersed in Solder bath at $260 \pm 5^{\circ}\text{C}$ for 10 ± 1 sec. Recovery: 6 ~ 24hr. (COG) 24 ± 2 hr. (X7R, Z5U)	No Visible Damage At least 75% of termination area should be well tinned		
		COG(1BCG)	X7R(2R1)	Z5U(2E6)
		$\Delta\text{C/C}$	$\leq \pm 1\%$ or $\pm 1\text{pF}$ whichever is larger	$\leq \pm 1\%$ $\leq -10\% + 20\%$
Rapid Change of Temperature	-55°C to $+125^{\circ}\text{C}$, 5 cycles (COG, X7R) Duration: 30 Min. Recovery: 6 ~ 24hr. (COG) 24 ± 2 hr. (X7R, Z5U)	No Visible Damage		
		COG(1BCG)	X7R(2R1)	
		$\Delta\text{C/C}$	$\leq \pm 1\%$ or $\pm 1\text{pF}$ whichever is larger	$\leq \pm 15\%$
		D.F.	$\leq 2.0\text{x}$ initial requirement	$\leq 1.5\text{x}$ initial requirement
Endurance (Life Test)	1000+48-0 hr. at maximum temperature with $\leq 3\text{KV}$: 1.2 x rated voltage applied $> 3\text{KV}$: 1.2 x rated voltage applied Recovery: 6 ~ 24hr. (COG) 24 ± 2 hr. (X7R, Z5U)	No Visible Damage		
		COG(1BCG)	X7R(2R1)	
		$\Delta\text{C/C}$	$\leq \pm 1\%$ or $\pm 1\text{pF}$ whichever is larger	$\leq \pm 15\%$
		D.F.	$\leq 2.0\text{x}$ initial requirement	$\leq 1.5\text{x}$ initial requirement
Humidity Test (Damp heat, steady state)	500+24-0 hr. at $40 \pm 2^{\circ}\text{C}$, 90~95% RH Recovery: 6 ~ 24hr. (COG) 24 ± 2 hr. (X7R, Z5U)	No Visible Damage		
		COG(1BCG)	X7R(2R1)	
		$\Delta\text{C/C}$	$\leq \pm 2\%$ or $\pm 2\text{pF}$ whichever is larger	$\leq \pm 15\%$
		D.F.	$\leq 2.0\text{x}$ initial requirement	$\leq 7\text{x}$ initial requirement
Adhesion Strength of Termination	Capacitors mounted on a substrate. A force of 5N applied perpendicular to the place of substrate and parallel the line joining the center of terminations for 10 ± 1 sec.	No Visible Damage		
Resistance to Flexure Stress	Capacitors mounted on a substrate. The board shall then be bent by 1mm at a rate of 1mm/sec.	No Visible Damage Change in capacitance is less than 10%		



High Voltage Ceramic Chip Capacitors Type CFV

Δ Ordering

CFV 2211 N - 100 J - 602 E F G
(1) (2) (3) (4) (5) (6) (7) (8) (9)

(1)	Series	CFV:	
(2)	Size Code	1808	
		1812	
		2211	
(3)	Dielectric Code	N: COG (1BCG)	
		X: X7R (2R1)	
(4)	Capacitance Code	Capacitance expressed in pF. First two digits are significant figures. The third Digit denotes number of zeros. Use R for decimal point for values less than 10pF. (eg. R47: 0.47pF)	
(5)	Tolerance Code	Code	Tolerance
		C	±0.25pF
		D	±0.5pF
		F	±1%
		G	±2%
		J	±5%
		K	±10%
		M	±20%
		Z	+80% -20%
		Other Tolerances Available Upon Request	
(6)	Rated Voltage Code	402	4000V
		502	5000V
		602	6000V
(7)	Packaging Code	TR:	Tape and Reel, Cardboard Tape
		ER:	Tape and Reel, Embossed Tape
		No Code:	Bulk
(8)	Thickness Code	Code	Tolerance (mm)
		E	1.51-1.80
		F	1.81-2.20
		G	2.21-2.70
(9)	Special Code	G:	Cd/Pb Free



High Voltage Ceramic Chip Capacitors Type CMH

△ Features

- Rated Voltage: 100 VAC, 4000VDC
- Chip Size: 0805, 1206, 1210, 1808, 1812, 2220, 2225

△ Applications

- Modems
- LAN / WAN Interface
- Industrial Controls
- Power Supply
- Back-Lighting Inverter
- Telecom Devices

△ Electrical

Dielectric Code	EIA IEC	COG 1BCG	X7R 2R1	Z5U 2E6
Temperature Characteristics		0±30ppm/°C, C>20pF 0-40+120ppm/°C, C>20pF	ΔC ± 15% maximum over -55°C tp +125°C	ΔC +22%, -56% maximum over -55°C tp +125°C
Operating Temperature Range		-55°C to +125°C	-55°C to +125°C	-10°C to +85°C
Measuring Conifions for Capacitance and D.F.		1MHz, 1Vrms, C≤1000pF 1KHz, 1Vrms, C>1000pF	1KHz, 1Vrms	1KHz, 0.5Vrms
Dissipation Factor (D.F.) and Tangent of Loss Angle (tan δ)		≤0.1% for C≥30pF ≤100% / (400+20C) for C≥30pF	≤2.5%	≤4.0%
Insulation Resistance (I.R.) UR<500V:I.R. after 60secs. Charging at UR (DC) UR≥500V: I.R. after 60 secs. Charging at 500V (DC) 25°C, 55% RH max.		≥100GΩ or ≥1000MΩ·μF whichever is less	≥10GΩ or ≥100MΩ·μF whichever is less	≥10GΩ or ≥100MΩ·μF whichever is less
Withstanding Voltage, 25°C, 1-5sec.		Rated Voltage ≤100V 2.5xUR 200V/250V 2.0xUR 500V 1.5xUR 1KV≤UR≤3KV 1.2xUR >3KV 1.1xUR	Rated Voltage ≤100V 2.5xUR 200V/250V 2.0xUR 500V 1.5xUR ≥1KV 1.2xUR	Rated Voltage ≤100V 2.5xUR 200V/250V 1.5xUR
Capacitance Aging		Not Applicable	≈1.5% per decade hour	≈5% per decade hour



High Voltage Ceramic Chip Capacitors Type CMH

Δ Environmental

Test	Test Conditions	Post-Test Inspection Requirements		
Solderability	Immersed in Solder bath at $245 \pm 5^{\circ}\text{C}$ for 5 ± 0.5 sec.	No Visible Damage At least 75% of termination area should be well tinned		
Resistance to Soldering Heat	Immersed in Solder bath at $260 \pm 5^{\circ}\text{C}$ for 10 ± 1 sec. Recovery: 6 ~ 24hr. (COG) 24 ± 2 hr. (X7R, Z5U)	No Visible Damage At least 75% of termination area should be well tinned		
		COG(1BCG)	X7R(2R1)	Z5U(2E6)
		$\Delta\text{C/C}$	$\leq \pm 1\%$ or $\pm 1\text{pF}$ whichever is larger	$\leq \pm 1\%$ $\leq -10\% + 20\%$
Rapid Change of Temperature	-55°C to $+125^{\circ}\text{C}$, 5 cycles (COG, X7R) Duration: 30 Min. Recovery: 6 ~ 24hr. (COG) 24 ± 2 hr. (X7R, Z5U)	No Visible Damage		
		COG(1BCG)	X7R(2R1)	
		$\Delta\text{C/C}$	$\leq \pm 1\%$ or $\pm 1\text{pF}$ whichever is larger	$\leq \pm 15\%$
		D.F.	$\leq 2.0\text{x}$ initial requirement	$\leq 1.5\text{x}$ initial requirement
Edurance (Life Test)	1000+48-0 hr. at maximum temperature with $\leq 3\text{KV}$: 1.2 x rated voltage applied $> 3\text{KV}$: 1.2 x rated voltage applied Recovery: 6 ~ 24hr. (COG) 24 ± 2 hr. (X7R, Z5U)	No Visible Damage		
		COG(1BCG)	X7R(2R1)	
		$\Delta\text{C/C}$	$\leq \pm 1\%$ or $\pm 1\text{pF}$ whichever is larger	$\leq \pm 15\%$
		D.F.	$\leq 2.0\text{x}$ initial requirement	$\leq 1.5\text{x}$ initial requirement
Humidity Test (Damp heat, steady state)	500+24-0 hr. at $40 \pm 2^{\circ}\text{C}$, 90~95% RH Recovery: 6 ~ 24hr. (COG) 24 ± 2 hr. (X7R, Z5U)	No Visible Damage		
		COG(1BCG)	X7R(2R1)	
		$\Delta\text{C/C}$	$\leq \pm 2\%$ or $\pm 2\text{pF}$ whichever is larger	$\leq \pm 15\%$
		D.F.	$\leq 2.0\text{x}$ initial requirement	$\leq 7\text{x}$ initial requirement
Adhesion Strength of Termination	Capacitors mounted on a substrate. A force of 5N applied perpendicular to the place of substrate and parallel the line joining the center of terminations for 10 ± 1 sec.	No Visible Damage		
Resistance to Flexure Stress	Capacitors mounted on a substrate. The board shall then be bent by 1mm at a rate of 1mm/sec.	No Visible Damage Change in capacitance is less than 10%		



High Voltage Ceramic Chip Capacitors Type CMH

Δ Dimensions

Size	Length / Width	Volt	Capacitance
NPO	1812 L: 5.70±0.040mm (0.224±0.016) W: 2.80±0.030mm (0.112±0.012)	100	10pF±0.015μF
		250	10pF±0.012μF
		500	10pF±6800pF
		1000	10pF±4700μF
		2000	10pF±1200μF
		3000	10pF±470μF
	1808 L: 4.50±0.030mm (0.177±0.012) W: 3.20±0.030mm (0.126±0.012)	100	10pF±3300pF
		250	10pF±3300pF
		500	10pF±3300pF
		1000	3pF±2200pF
		2000	3pF±560pF
		3000	3pF±470pF
	1210 L: 3.20±0.030mm (0.126±0.012) W: 2.50±0.030mm (0.100±0.012)	4000	3pF±100pF
		100	10pF±0.010μF
		250	10pF±6800pF
		500	10pF±4700pF
		1000	10pF±2200pF
		2000	10pF±560pF
	1206 L: 3.20±0.020mm (0.126±0.008) W: 1.60±0.020mm (0.063±0.008)	3000	10pF±220pF
		100	10pF±4700pF
		250	10pF±3900pF
		500	10pF±2200pF
		1000	10pF±1500pF
		2000	10pF±270pF
	0805 L: 2.00±0.020mm (0.080±0.008) W: 1.20±0.020mm (0.050±0.008)	3000	10pF±68pF
		100	10pF±1800pF
		250	10pF±1200pF
	0603 L: 1.60±0.015mm (0.063±0.006) W: 0.80±0.015mm (0.032±0.006)	500	10pF±470pF
		100	10pF±1000pF
Z5U	1210 L: 3.20±0.030mm (0.126±0.012) W: 2.50±0.030mm (0.100±0.012)	100	0.22pF±0.56μF
	1206 L: 3.20±0.020mm (0.126±0.008) W: 1.60±0.020mm (0.063±0.008)	100	0.10pF±0.47μF
	0805 L: 1.60±0.015mm (0.063±0.006) W: 0.80±0.015mm (0.032±0.006)	100	0.047pF±0.1μF

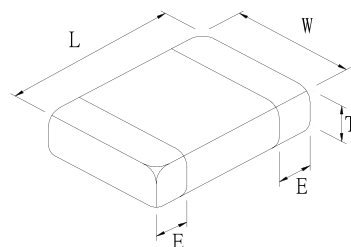


High Voltage Ceramic Chip Capacitors

Type CMH

High Voltage Ceramic Chip Capacitors Type CMH

Δ Dimensions



Size		0805	1206	1210	1808	1812	2211	2220	2225
(L) Length	mm	2.00±0.30	3.20±0.20	3.20±0.30	4.50±0.30	4.50±0.30	5.70±0.40	5.70±0.40	5.70±0.40
	(in)	(0.080±0.008)	(0.126±0.008)	(0.126±0.012)	(0.177±0.012)	(0.177±0.012)	(0.224±0.016)	(0.224±0.016)	(0.224±0.016)
(W) Width	mm	1.20±0.25	1.60±0.25	2.50±0.30	2.00±0.25	3.20±0.30	2.80±0.30	5.00±0.40	6.30±0.40
	(in)	(0.050±0.008)	(0.063±0.008)	(0.100±0.012)	(0.080±0.008)	(0.126±0.012)	(0.112±0.012)	(0.200±0.016)	(0.248±0.016)
(E) Termination	mm	0.50±0.20	0.50±0.20	0.50±0.20	0.64±0.38	0.64±0.38	0.85±0.55	0.85±0.55	0.85±0.55
	(in)	(0.020±0.008)	(0.020±0.008)	(0.020±0.008)	(0.025±0.015)	(0.025±0.015)	(0.033±0.022)	(0.033±0.022)	(0.033±0.022)
(T) Thickness	mm	1.40	1.80	2.20	2.20	2.70	2.70	3.00	3.00
	(in)	(0.055)	(0.071)	(0.087)	(0.087)	(0.106)	(0.106)	(0.118)	(0.118)

	Size	Length / Width	Volt	Capacitance
X7R	2225	L: 5.70±0.040mm (0.224±0.016) W: 6.30±0.040mm (0.248±0.016)	100	1000pF±1.5μF
			250	1000pF±0.82μF
			500	1000pF±0.33μF
			1000	1000pF±0.056μF
			2000	1000pF±0.022μF
			3000	1000pF±4700pF
	2220	L: 5.70±0.040mm (0.224±0.016) W: 5.00±0.040mm (0.200±0.016)	100	1000pF±1.5μF
			250	1000pF±0.68μF
			500	1000pF±0.27μF
			1000	1000pF±0.1μF
			2000	1000pF±0.01μF
			3000	1000pF±5600pF
	1812	L: 5.70±0.040mm (0.224±0.016) W: 2.80±0.030mm (0.112±0.012)	100	470pF±1.0μF
			250	470pF±0.47μF
			500	470pF±0.15μF
			1000	470pF±0.056μF
			2000	470pF±4700pF
			3000	470pF±2700μF
	1808	L: 4.50±0.030mm (0.177±0.012) W: 3.20±0.030mm (0.126±0.012)	100	150pF±0.047μF
			250	150pF±0.047μF
			500	150pF±0.068μF
			1000	150pF±0.01μF
			2000	150pF±2200pF
			3000	150pF±1800pF
	1210	L: 3.20±0.030mm (0.126±0.012) W: 2.50±0.030mm (0.100±0.012)	4000	470pF±1000pF
			100	100pF±0.33μF
			250	100pF±0.22μF
			500	100pF±0.056μF
			1000	220pF±0.01μF
			2000	220pF±1800pF
	1206	L: 3.20±0.020mm (0.126±0.008) W: 1.60±0.020mm (0.063±0.008)	100	100pF±0.18μF
			250	100pF±0.1μF
			500	100pF±0.047μF
			1000	220pF±0.01μF
			2000	220pF±1500pF
			100	100pF±0.1μF
	0805	L: 2.00±0.020mm (0.080±0.008) W: 1.20±0.020mm (0.050±0.008)	250	100pF±0.022μF
			500	100pF±0.022μF
			100	100pF±0.022μF
	0603	L: 1.60±0.015mm (0.063±0.006) W: 0.80±0.015mm (0.032±0.006)	100	100pF±0.022μF

Surface Mount
Capacitors



High Voltage Ceramic Chip Capacitors Type CMH

Δ Ordering

CMH 1808 CG - 101 J - 302 ER
(1) (2) (3) (4) (5) (6) (7)

(1)	Series	CMH:	
		0805	
(2)	Size Code	1206	
		1210	
		1808	
		1812	
		2220	
		2225	
(3)	Dielectric Code	CG: COG (1BCG)	
		XR: X7R (2R1)	
(4)	Capacitance Code	Capacitance expressed in pF. First two digits are significant figures. The third Digit denotes number of zeros. Use R for decimal point for values less than 10pF. (eg. R47: 0.47pF)	
(5)	Tolerance Code	Code	Tolerance
		C	±0.25pF
		D	±0.5pF
		F	±1%
		G	±2%
		J	±5%
		K	±10%
		M	±20%
		Z	+80% -20%
		Other Tolerances Available Upon Request	
(6)	Rated Voltage Code	302:	3000V
(7)	Packaging Code	PR:	Tape and Reel, Cardboard Tape
		ER:	Tape and Reel, Embossed Tape
		No Code:	Bulk

Surface Mount
Capacitors



PPTC

Type

PS

PS-SM

PPTC Type PSSM

Δ Feature

- Fuse Capacitor (Replaces traditional fuses in DC applications)
- Auto Reset (when power is cycled)

Δ Application

- Medical, telecom and consumer electronic equipment.
- Miniature PCB.

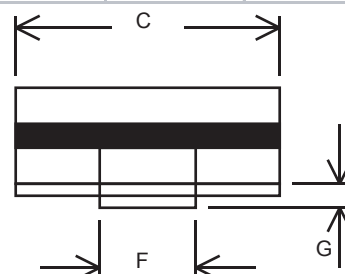
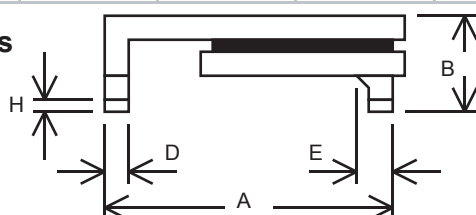
Δ Electrical Characteristics

Model	IH (A)	IT (A)	Ttrip		Vmax (V)	I _{max} (A) (A)	Rmin (Ω)	Rmax (Ω)	R1max (Ω)
PSSM-030	0.30	0.60	11.5	4.0	60	10	0.700	1.300	4.800
PSSM-050	0.50	1.00	2.5	4.0	30	10	0.350	0.600	1.400
PSSM-075	0.75	1.50	8.0	3.0	30	40	0.290	0.400	1.000
PSSM-110	1.10	2.20	8.0	2.0	15	40	0.100	0.190	0.480
PSSM-125	1.25	2.50	8.0	2.0	15	40	0.070	0.120	0.250
PSSM-130	1.30	2.60	8.0	4.0	15	40	0.080	0.130	0.280
PSSM-150	1.50	3.00	8.0	5.0	15	40	0.060	0.110	0.250
PSSM-185	1.85	3.70	8.0	5.0	15	40	0.450	0.080	0.165
PSSM-200	2.00	4.00	8.0	12.0	15	40	0.450	0.065	0.125
PSSM-250	2.50	5.00	8.0	25.0	15	40	0.250	0.052	0.085
PSSM-260	2.60	5.20	8.0	20.0	6	40	0.250	0.052	0.075
PSSM-300	3.00	6.00	8.0	35.0	6	40	0.150	0.330	0.048

Δ Typical T-I Derating Form

Model	Ambient Temperature (°C)								
	-40	-20	0	25	40	50	60	70	85
PSSM-030	0.45	0.40	0.35	0.30	0.25	0.23	0.20	0.17	0.14
PSSM-050	0.76	0.67	0.59	0.50	0.42	0.38	0.33	0.29	0.23
PSSM-075	1.13	1.01	0.88	0.75	0.62	0.56	0.50	0.44	0.34
PSSM-110	1.66	1.47	1.29	1.10	0.91	0.83	0.73	0.64	0.50
PSSM-125	1.89	1.68	1.46	1.25	1.04	0.94	0.83	0.73	0.56
PSSM-150	2.27	2.01	1.76	1.50	1.25	1.31	1.00	0.87	0.68
PSSM-185	2.20	2.08	1.96	1.85	1.70	1.66	1.50	1.48	1.40
PSSM-200	3.02	2.68	2.34	2.00	1.66	1.50	1.32	1.16	0.90
PSSM-250	3.78	3.35	2.93	2.50	2.08	1.88	1.65	1.45	1.13
PSSM-260	3.64	3.25	2.91	2.60	2.26	2.08	1.95	1.74	1.48
PSSM-300	4.01	3.67	3.32	3.00	2.60	2.40	2.25	2.10	1.80

Δ Dimensions



Legend

I_H(A): Hold current: maximum current at which the device will not trip at 25°C still air

I_T(A): Tripping current: minimum current at which the device will trip at 25°C under specified conditions.

T_T(S): Maximum time to trip at specified current. (generally at 5I_H)

V_{max}(V): Maximum device operating voltage.

I_{max}(A): Maximum fault current device can withstand without damage at rated voltage.

P_{dtyp}(W): Typical power dissipation: Typical amount of power dissipated by the device when in tripped state air environment.

R_o(Ω): Minimum-maximum device resistance at 25° prior to tripping.

Surface Mount
Capacitors



PPTC

Type

PS

PS-SM

PPTC Type PS-SM

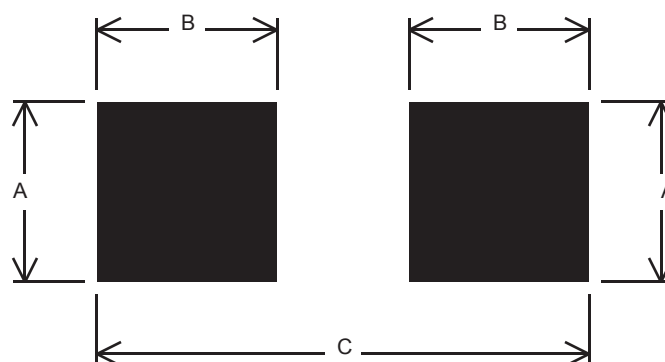
Δ Dimensions

units: mm

Model	A		B	C	D	
	Min	Max	Max	Max	Max	Min
PSSM-030	6.73	7.98	3.18	5.44	0.56	0.71
PSSM-050	6.73	7.98	3.18	5.44	0.56	0.71
PSSM-075	6.73	7.98	3.18	5.44	0.56	0.71
PSSM-110	6.73	7.98	3.00	5.00	0.56	0.71
PSSM-125	6.73	7.98	3.00	6.71	0.56	0.71
PSSM-130	8.00	9.50	3.00	6.71	0.56	0.71
PSSM-150	8.00	9.50	3.00	6.71	0.56	0.71
PSSM-185	8.00	9.50	3.00	6.71	0.56	0.71
PSSM-200	8.00	9.50	3.00	6.71	0.56	0.71
PSSM-250	8.00	9.50	3.00	6.71	0.56	0.71
PSSM-260	6.73	7.98	3.18	5.44	0.56	0.71
PSSM-300	6.73	7.98	3.18	5.00	0.56	0.71

Model	E		F		G		H
	Min	Max	Min	Max	Min	Max	Max
PSSM-030	0.56	0.71	2.16	2.41	0.66	1.37	0.43
PSSM-050	0.56	0.71	2.16	2.41	0.66	1.37	0.43
PSSM-075	0.56	0.71	2.16	2.41	0.66	1.37	0.43
PSSM-110	0.56	0.71	2.16	2.41	0.66	1.37	0.43
PSSM-125	0.56	0.71	2.16	2.41	0.66	1.37	0.43
PSSM-130	0.56	0.71	2.16	2.41	0.66	1.37	0.43
PSSM-150	0.56	0.71	3.68	3.94	0.66	1.37	0.43
PSSM-185	0.56	0.71	3.68	3.94	0.66	1.37	0.43
PSSM-200	0.56	0.71	3.68	3.94	0.66	1.37	0.43
PSSM-250	0.56	0.71	3.68	3.94	0.66	1.37	0.43
PSSM-260	0.56	0.71	2.16	2.41	0.66	1.37	0.43
PSSM-300	0.56	0.71	2.16	2.41	0.66	1.37	0.43

Model	A Nom	B Nom	C Nom
PSSM-030	3.1	2.3	9.7
PSSM-050	3.1	2.3	9.7
PSSM-075	3.1	2.3	9.7
PSSM-110	3.1	2.3	9.7
PSSM-125	3.1	2.3	9.7
PSSM-130	3.1	2.3	9.7
PSSM-150	4.6	2.3	10.7
PSSM-185	4.6	2.3	10.7
PSSM-200	4.6	2.3	10.7
PSSM-250	4.6	2.3	10.7
PSSM-260	3.1	2.3	9.7
PSSM-300	3.1	2.3	9.7





PPTC

Type

PS

PS-WSM

PPTC Type PS-WSM

△ Feature

- Fuse Capacitor (Replaces traditional fuses in DC applications)
- Auto Reset (when power is cycled)

△ Application

- Medical, telecom and consumer electronic equipment.
- Miniature PCB.

△ Electrical Characteristics

Model	IH (A)	IT (A)	(A)	Ttrip (S)	Vmax (V)	I _{max} (A) (A)	Rmin (Ω)	R1max (Ω)
PSWSM-010	0.10	0.20	1.5	0.15	60.0	10	0.700	6.000
PSWSM-014	0.14	0.28	1.5	0.15	60.0	10	0.700	6.000
PSWSM-020	0.20	0.40	6.0	0.06	30.0	10	0.600	5.000
PSWSM-035	0.35	0.70	8.0	0.20	6.0	40	-	1.300
PSWSM-050	0.50	1.00	8.0	0.15	15.0	40	0.150	1.000
PSWSM-075	0.75	1.50	8.0	0.20	13.2	40	0.100	0.480
PSWSM-110	1.10	2.20	8.0	0.30	6.0	40	0.040	0.260
PSWSM-125	1.25	2.50	8.0	0.40	6.0	40	0.070	0.250
PSWSM-150	1.50	3.00	8.0	0.50	6.0	40	0.040	0.110
PSWSM-160	1.60	3.20	8.0	1.00	6.0	40	0.030	0.100
PSWSM-190	1.90	3.80	10.0	2.00	16.0	100	0.024	0.080
PSWSM-200	2.00	4.00	8.0	2.00	6.0	40	0.020	0.060
PSWSM-260	2.60	5.20	8.0	2.00	6.0	40	0.015	0.047

Legend

IH(A): Hold current: maximum current at which the device will not trip at 25°C still air

IT(A): Tripping current: minimum current at which the device will trip at 25°C under specified conditions.

Tt(S): Maximum time to trip at specified current. (generally at 5IH)

Vmax(V): Maximum device operating voltage.

I_{max}(A): Maximum fault current device can withstand without damage at rated voltage.

Pdtyp(W): Typical power dissipation: Typical amount of power dissipated by the device when in tripped state air environment.

Ro(Ω): Minimum-maximum device resistance at 25° prior to tripping.

△ Typical T-I Derating Form

Model	Ambient Temperature (°C)								
	-40	-20	0	25	40	50	60	70	85
PSWSM-014	0.23	0.19	0.17	0.14	0.12	0.10	0.09	0.08	0.06
PSWSM-020	0.29	0.26	0.23	0.20	0.17	0.15	0.14	0.12	0.10
PSWSM-035	0.47	0.45	0.40	0.35	0.30	0.28	0.24	0.21	0.18
PSWSM-050	0.77	0.68	0.59	0.50	0.44	0.40	0.37	0.33	0.29
PSWSM-075	1.15	1.01	0.88	0.75	0.65	0.60	0.55	0.49	0.43
PSWSM-110	1.59	1.43	1.26	1.10	0.95	0.87	0.80	0.71	0.60
PSWSM-190	3.04	2.70	2.20	1.90	1.44	1.23	1.00	0.78	0.49



PPTC

Type

PS

PS-WSM

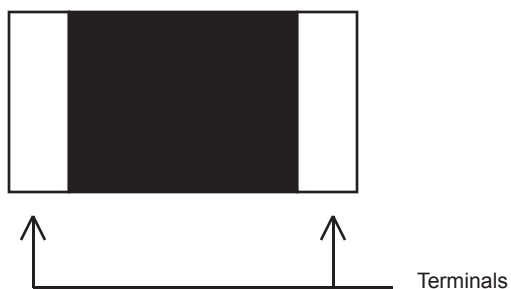
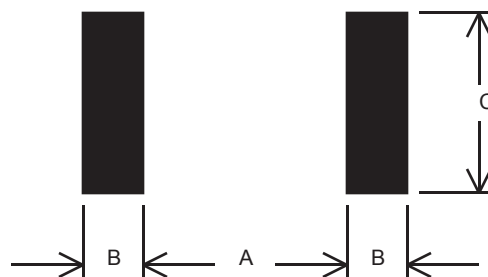
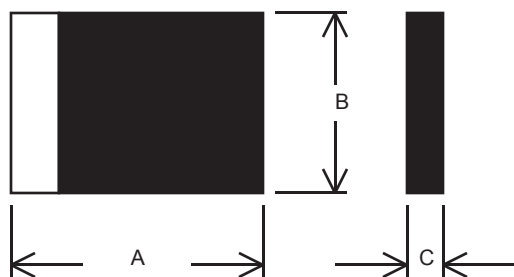
PPTC Type PSWSM

Δ Dimensions

Model	Amax	Bmax	Cmax	A Nom	B Nom	C Nom
PSWSM-010	4.73	3.41	0.81	3.45	1.78	3.15
PSWSM-014	4.73	3.41	0.81	3.45	1.78	3.15
PSWSM-020	4.73	3.41	0.62	3.45	1.78	3.15
PSWSM-035	3.43	2.80	0.62	2.00	1.00	2.50
PSWSM-050	4.73	3.41	0.62	3.45	1.78	3.15
PSWSM-075	4.73	3.41	0.62	3.45	1.78	3.15
PSWSM-110	4.73	3.41	1.25	3.45	1.78	3.15
PSWSM-125	4.73	3.41	1.25	3.45	1.78	3.15
PSWSM-150	4.73	3.41	1.25	3.45	1.78	3.15
PSWSM-160	4.73	3.41	1.25	3.45	1.78	3.15
PSWSM-190	11.51	5.33	0.55	9.57	1.45	4.75
PSWSM-200	4.73	3.41	1.25	3.45	1.78	3.15
PSWSM-260	4.73	3.41	2.25	3.45	1.78	3.15

units: mm

Surface Mount
Capacitors





PPTC

Type

PS

PS-xxx

PPTC Type PSxxx

Δ Feature

- Fuse Capacitor (Replaces traditional fuses in DC applications)
- Auto Reset (when power is cycled)

Δ Electrical Characteristics

Model	V _{max} (V)	R _o (Ω)	I _T (A)	T _T (S)	I _H (A)
PS070	15	0.100-0.200	1.45	≤5.0	0.70
PS100	24	0.070-0.130	2.50	≤7.0	1.00
PS120	15	0.085-0.160	2.70	≤5.0	1.20
PS-CW120	15	0.085-0.160	2.70	≤3.0	1.20
PS-CW170	15	0.030-0.052	3.40	≤3.0	1.70
PS175	15	0.050-0.090	3.80	≤5.0	1.75
PS-CW175	15	0.029-0.051	3.80	≤5.0	1.75
PS180	24	0.040-0.068	3.80	≤2.9	1.80
PS190	24	0.030-0.057	4.20	≤3.0	1.90
PS200	24	0.030-0.060	4.40	≤4.0	2.00
PS-CW200	15	0.022-0.039	4.50	≤5.0	2.00
PS-CW210	15	0.018-0.030	4.70	≤5.0	2.10
PS-CW240	15	0.014-0.026	5.40	≤4.0	2.40
PS-CW250	15	0.017-0.046	5.20	≤10.0*	2.50
PS260	24	0.025-0.042	5.20	≤5.0	2.60
PS300	24	0.015-0.031	6.30	≤4.0	3.00
PS310	24	0.018-0.030	6.00	≤5.0	3.10
PS340	24	0.016-0.027	6.80	≤5.0	3.40
PS350	24	0.017-0.031	6.30	≤3.0**	3.50
PS420	24	0.012-0.024	7.60	≤6.0	4.20

Note: All PS listed on this page have
I_{max} (A): 100
t_c (S): ≤60

Legend

I_H(A): Hold current: maximum current at which the device will not trip at 25°C still air

I_T(A): Tripping current: minimum current at which the device will trip at 25°C under specified conditions.

T_T(S): Maximum time to trip at specified current. (generally at 5I_H)

V_{max}(V): Maximum device operating voltage.

I_{max}(A): Maximum fault current device can withstand without damage at rated voltage.

P_{dtyp}(W): Typical power dissipation: Typical amount of power dissipated by the device when in tripped state air environment.

R_o(Ω): Minimum-maximum device resistance at 25° prior to tripping.

Δ Typical T-I Derating Form

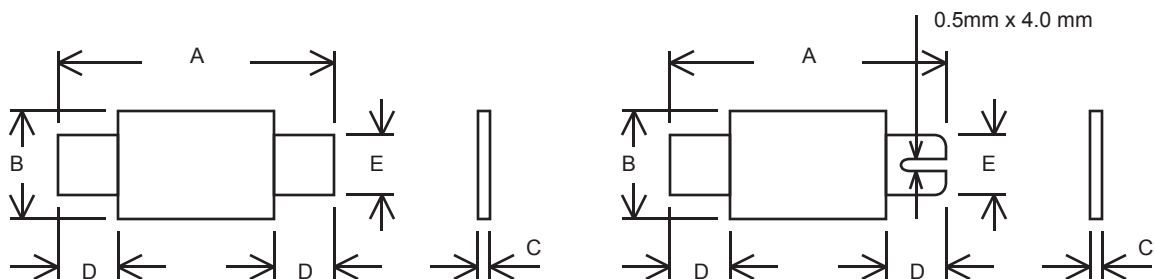
Model	Ambient Temperature (°C)								
	-40	-20	0	25	40	50	60	70	85
PS070	1.32	1.21	0.99	0.70	0.63	0.60	0.50	0.39	0.26
PS100	2.00	1.73	1.52	1.00	0.99	0.85	0.75	0.61	0.40
PS120	1.95	1.74	1.54	1.20	1.07	0.98	0.87	0.76	0.58
PS-CW170	3.20	2.70	2.20	1.70	1.30	1.10	0.80	0.60	-
PS175	2.57	2.36	2.07	1.75	1.59	1.39	1.27	1.18	0.99
PS-CW175	3.20	2.70	2.20	1.75	1.30	1.00	0.80	0.50	-
PS180	3.23	2.88	2.35	1.80	1.48	1.20	1.10	0.75	0.45
PS190	3.50	3.00	2.51	1.90	1.60	1.35	1.20	0.88	0.52
PS200	3.28	2.88	2.59	2.00	1.81	1.70	1.52	1.31	1.02
PS-CW200	3.70	3.20	2.60	2.00	1.50	1.20	0.90	0.50	-
PS-CW210	4.10	3.50	2.90	2.10	1.60	1.30	1.00	0.70	-
PS-CW240	4.40	3.70	3.10	2.40	1.80	1.50	1.20	0.90	-
PS-CW250	4.60	3.90	3.30	2.50	1.90	1.60	1.40	1.20	-
PS260	4.40	3.80	3.19	2.60	2.10	1.80	1.49	1.19	0.70
PS300	5.20	4.49	3.78	3.00	2.39	2.04	1.70	1.35	0.78
PS310	5.46	4.68	3.80	3.10	2.45	2.11	1.80	1.40	0.80
PS340	5.60	4.88	4.10	3.40	2.70	2.33	2.00	1.60	0.89
PS350	5.51	4.89	4.42	3.50	3.00	2.89	2.62	2.28	1.79
PS420	6.53	5.81	5.20	4.20	3.69	3.38	3.10	2.75	2.24



Type

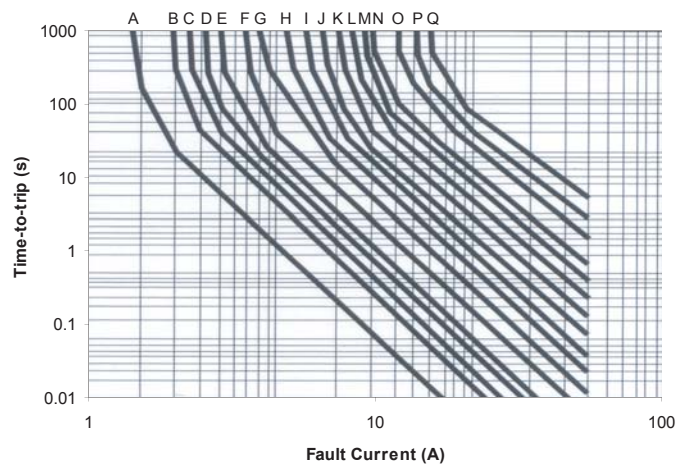
PS

PS-xxx

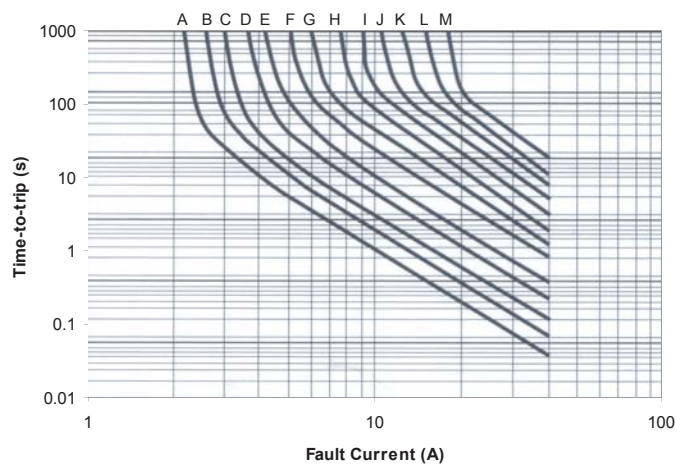


units: mm

Model	Atyp (mm)	Btyp (mm)	Ctyp (mm)	Dtyp (mm)	Etyp (mm)
PS070	20.0	5.2	0.9	6.0	4.0
PS100	20.0	5.2	0.8	6.0	4.0
PS120	20.0	5.2	0.8	6.0	4.0
PS-CW120	22.0	7.3	1.0	5.0	4.0
PS-CW170	17.5	5.2	1.0	5.0	4.0
PS175	22.0	3.8	0.8	5.0	3.2
PS-CW175	22.0	5.2	1.0	5.0	4.0
PS180	22.0	8.2	0.8	5.0	5.0
PS190	22.0	8.2	0.8	6.2	5.0
PS200	22.0	3.8	0.8	6.2	3.2
PS-CW200	25.0	5.3	1.0	5.0	4.0
PS-CW210	23.1	5.3	1.0	5.0	4.0
PS-CW240	33.0	5.3	1.0	5.0	4.0
PS-CW250	43.0	5.3	1.0	13.0	5.0
PS260	22.0	8.2	0.8	6.2	5.0
PS300	27.0	13.3	0.8	6.0	5.0
PS310	27.0	13.3	0.8	6.0	5.0
PS340	27.0	13.3	0.8	6.0	5.0
PS350	27.0	13.3	0.8	6.0	5.0
PS420	31.0	13.3	0.8	6.3	5.0



- | | | | |
|------------|------------|------------|------------|
| A=PS60-010 | E=PS60-030 | I=PS60-075 | M=PS60-160 |
| B=PS60-017 | F=PS60-040 | J=PS60-090 | N=PS60-185 |
| C=PS60-020 | G=PS60-050 | K=PS60-110 | O=PS60-250 |
| D=PS60-025 | H=PS60-065 | L=PS60-135 | P=PS60-300 |
| | | | Q=PS60-375 |



- A=PS30-090 D=PS30-160 G=PS30-300 J=PS30-600
B=PS30-110 E=PS30-185 H=PS30-400 K=PS30-700
C=PS30-135 F=PS30-250 I=PS30-500 L=PS30-800
M=PS30-900



Thick Film Chip Resistors Type MCR Series

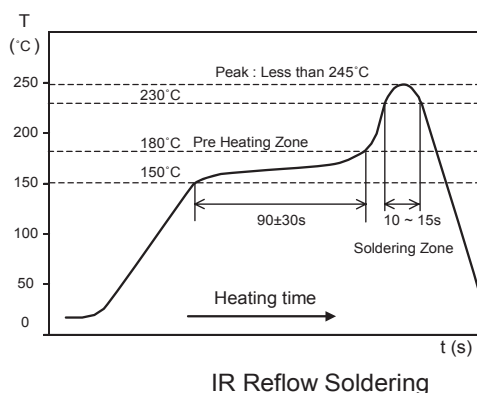
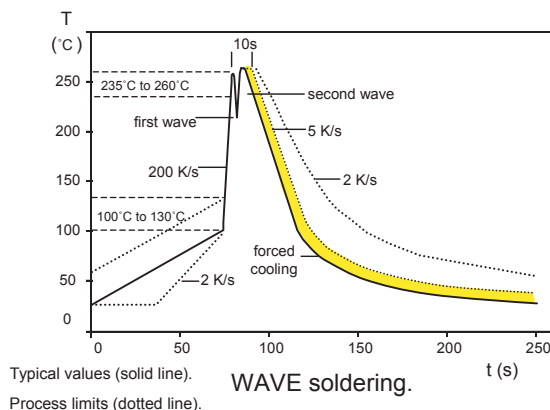
△ Features

- Small size and lightweight with size range per int'l standard.
- Highly stable in auto-placement surface mounting application.
- Compatible with flow and reflow soldering.
- Suitable for lead free soldering.

△ Applications

- Consumer electronics
- Medical equipment
- Telecom equipment
- Automotive, industry
- Computer

△ Soldering Temperature Curve



△ How to Order

Part Number

Example	MCR	0603	T	J	123	LF
	Type	Size	Packing	Tolerance	Resistance Value	
	MCR	0201	T: Tape	B: ±0.1%	123 = 12×10^3	LF = Lead Free
		0402		C: ±0.25%	= 12k Ω	
		0603		D: ±0.5%		
		0805		F: ±1%		
		1206		G: ±2%		
		1210		J: ±5%		
		2010				
		2512				

△ Resistance Marking

E-24 Series

473

3 digit marking for E24

ex. 473: $47 \times 10^3 = 47K\Omega$
 105: $10 \times 10^5 = 1M\Omega$
 1R5: $15 \times 10^{-1} = 1.5\Omega$
 0: 0Ω

1R00

4 digit marking for E241: $\Omega \sim 10m\Omega$

ex. 1R00: 1Ω
 R470 $470m\Omega$
 R010 $10m\Omega$

E-96 Series

1542

4 digit marking for E96

ex. 1542: $154 \times 10^2 = 15K4\Omega$

0C2

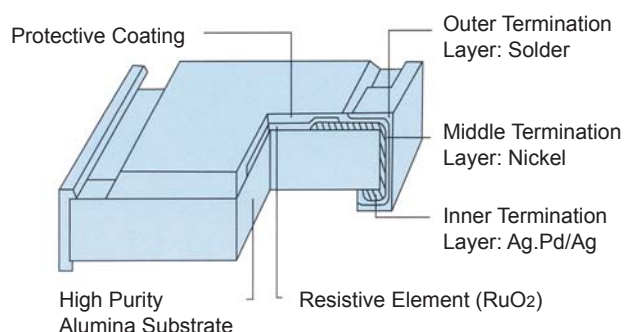
3 digit marking for E96 - 0603

ex. 0C2 (see table)
 $102 \times 10^2 = 10K2\Omega$

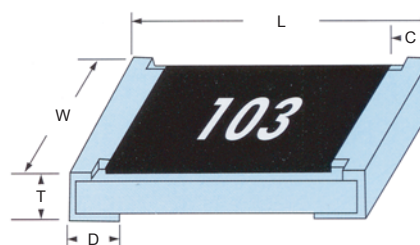


Thick Film Chip Resistors Type MCR Series

Δ Configuration



Δ Dimensions

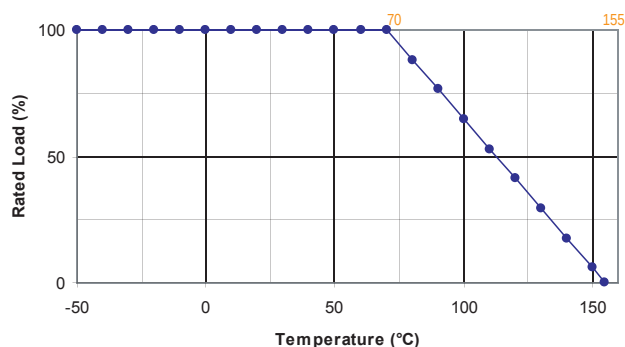


Size	L	W	C	D	T
0201	0.60 ± 0.05	0.30 ± 0.05	0.25 ± 0.05	0.15 ± 0.05	0.25 ± 0.05
0402	1.00 ± 0.05	0.50 ± 0.05	0.20 ± 0.10	0.25 ± 0.10	0.35 ± 0.05
0603	1.60 ± 0.10	0.80 ± 0.10	0.30 ± 0.20	0.30 ± 0.20	0.45 ± 0.10
0805	2.00 ± 0.15	1.20 ± 0.15	0.40 ± 0.20	0.40 ± 0.20	0.50 ± 0.10
1206	3.10 ± 0.15	1.60 ± 0.15	0.50 ± 0.25	0.50 ± 0.25	0.55 ± 0.10
1210	3.10 ± 0.15	2.65 ± 0.15	0.50 ± 0.20	0.50 ± 0.25	0.55 ± 0.10
2010	5.00 ± 0.20	2.50 ± 0.20	0.60 ± 0.25	0.60 ± 0.25	0.60 ± 0.10
2512	6.30 ± 0.20	3.10 ± 0.20	0.60 ± 0.25	0.60 ± 0.25	0.60 ± 0.15
1225	3.10 ± 0.20	6.30 ± 0.20	0.60 ± 0.25	0.90 ± 0.25	0.60 ± 0.15

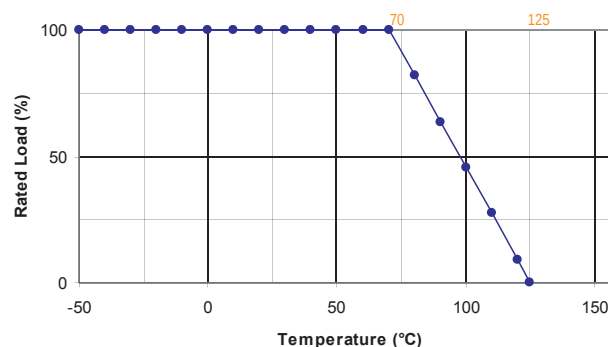
units: mm

Δ Power Derating Curve

For All Except 0201



For 0201 Only



*Maximum dissipation in percentage of rated power as a function of the ambient temperature.



Thick Film Chip Resistors Type MCR Series

Δ Rating

Type	Size	Power Rating at 70 °C	Max. RCWV	Max. Overload Voltage	Resistance Tolerance (%)	Temperature Coefficient (TCR; ppm/ °C)	Resistance Range		Standard Resistance Values
							Min.	Max.	
	0201	1/20W	15V	30V	± 1%(F)	± 300	10Ω	1M Ω	E-24
					± 5%(J)		0Ω & 1Ω	1M Ω	
	0402	1/16W	50V	100V	± 1%(F)	± 200	10Ω	1M Ω	E-96
					± 5%(J)		0Ω & 1Ω	10M Ω	E-24
	0603	1/10W	50V	100V	±0. 1%(B)	± 50	20Ω	510K Ω	E-96
					±0.2 5%(C)	± 50	20Ω	510K Ω	E-96
	0805	1/8W	150V	300V	± 0.5%(D)	± 50	20Ω	510K Ω	E-96
					± 1%(F)	± 100 ± 50	10Ω	1M Ω	E-96
	1206	1/4W	200V	400V	± 2%(G)	± 200	1Ω	10M Ω	E-24
					± 5%(J)	± 200	0Ω & 1Ω	10M Ω	E-24
	2010	1/2W	200V	400V	± 1%(F)	± 100	1Ω	10M Ω	E-96
					± 5%(J)	± 200	0Ω & 1Ω	10M Ω	E-24
	2512	1W	200V	400V	± 1%(F)	± 100	1Ω	10M Ω	E-96
					± 5%(J)	± 200	0Ω & 1Ω	10M Ω	E-24

Jumper : • 0201,0402,0603 size maximum resistance $R_{max} \leq 50m \Omega$ and rated current $I_R \leq 1A$

• 0805,1206,2010,2512 size maximum resistance $R_{max} \leq 50m \Omega$ and rated current $I_R \leq 2A$

1Ω ~10 Ω : • Temperature Coefficient of Resistance for 0402,0603,0805,1206 = -300~+500

• Temperature Coefficient of Resistance for 0201,2010,2512 = ± 300

Δ Low Resistance

Type	Size	Power Rating at 70 °C	Max. RCWV	Max. Overload Voltage	Resistance Tolerance (%)	Temperature Coefficient (TCR; ppm/ °C)	Resistance Range	
							Min.	Max.
	0603	1/10W	302mV	754mV	± 1%(F) ± 5%(J)	± 300	100m Ω	910m Ω
	0805	1/8W	337mV	843mV		± 400	50m Ω	91m Ω
	1206	1/4W	477mV	1192mV	± 1%(F) ± 5%(J)	± 200	50m Ω	910m Ω
	2010	1/2W	675mV	1686mV		± 400 ± 600	40m Ω 22m Ω	47m Ω 39m Ω
	2512	1W	954mV	2385mV		± 1000	10m Ω	20m Ω
	1225	2W	1349mV	3373mV	± 1%(F) ± 5%(J)	± 100 ± 150	20m Ω 10m Ω	910m Ω 19m Ω



Thick Film Chip Resistors Type MCR Series

Δ Specifications and Test Methods

ITEM	SPECIFICATION	TEST METHOD
DC Resistance	J: ± 5% G: ± 2% F: ± 1% D: ± 0.5% C: ± 0.25% B: ± 0.1% Zero ohm Jumper < 50mΩ	IEC 60115-1 4.5 / JIS C 5202 5.1 Measure the resistance value.
Short time Overload	J, G: Δ R ≤ ± (2% + 0.1 Ω) F, D: Δ R ≤ ± (1% + 0.05 Ω) C, B: Δ R ≤ ± (0.5% + 0.05 Ω)	IEC 60115-1 4.13 / JIS C 5202 5.5 2.5X Rated voltage or Max. Overload Voltage for 5 sec. measure resistance after 30 minutes
Solderability	Over 95% of termination must be covered with solder	IEC 60115-1 4.17 / JIS C 5202 6.5 After immersing flux, dip in the 245 ± 2°C molten solder bath for 3 ± 0.5 sec.
Resistance to Solder Heat	J, G: Δ R ≤ ± (1% + 0.1 Ω) F, D, C, B: Δ R ≤ ± (0.5% + 0.05 Ω) No mechanical damage	IEC 60115-1 4.18 / JIS C 5202 6.4 With 260 ± 5°C for 10 ± 1 sec.
Temperature Coefficient of Resistance (TCR)	J, G: ± 200ppm/°C F: ± 100 ± 50ppm/°C D, C, B: ± 50ppm/°C	IEC 60115-1 4.8.4.2 / JIS C 5202 5.2 Test temperature : 25 °C(T1) → -55°C(T2) 25°C(T1) → 125°C(T2) $TCR (ppm/°C) = \frac{R2-R1}{R1} \times \frac{1}{T2-T1} \times 10^6$ T1: 25°C T2: Test temperature R1: Resistance at reference temperature (T1) R2: Resistance at test temperature (T2)
Load Life Humidity	J, G: Δ R ≤ ± (3% + 0.1 Ω) F, D: Δ R ≤ ± (1% + 0.05 Ω) C, B: Δ R ≤ ± (0.5% + 0.05 Ω)	IEC 60115-1 4.24.2 / JIS C 5202 7.9 Maintain the temperature of the resistor at 40 ± 2°C and 90~95% R.H. with the rated voltage applied. Cycle ON for 1.5 hours and OFF for 0.5 hour for 1000+48/-0 hours. After 1~4 hour, measure the resistance value.
Load Life	J, G: Δ R ≤ ± (3% + 0.1 Ω) F, D: Δ R ≤ ± (1% + 0.05 Ω) C, B: Δ R ≤ ± (0.5% + 0.05 Ω)	IEC 60115-1 4.25.1 / JIS C 5202 7.10 Permanent resistance change after 1000+48/-0 hours (1.5 hours ON, 0.5 hour OFF) at RCWV or Max. Keep the resistor at 70 ± 2°C ambient
Intermittent Overload	Δ R ≤ ± (5% + 0.1 Ω) No mechanical damage	JIS C 5202 5.8 4.0xRated voltage (Max. Overload Voltage) 1 sec ON, 25 sec OFF, test 10,000 cycles
Temperature Cycle	J, G: Δ R ≤ ± (1% + 0.1 Ω) F, D, C, B: Δ R ≤ ± (0.5% + 0.05 Ω) No mechanical damage	IEC 60115-1 4.19 / JIS C 5202 7.4 Repeat 5 cycles as follows -55°C(30 min.) ~ + 25 °C(2~3 min.) +125°C(30 min.) ~ + 25 °C(2~3 min.) for 0201 -55°C(30 min.) ~ + 25 °C(2~3 min.) +155°C(30 min.) ~ + 25 °C(2~3 min.) for others
Insulation Resistance	Between termination and coating must be over 1000M Ω	IEC 60115-1 4.6.1.1 / JIS C 5202 5.6 Test voltage: 100 ± 15V
Bending Strength	J, G: Δ R ≤ ± (1% + 0.1 Ω) F, D, C, B: Δ R ≤ ± (0.5% + 0.05 Ω) No mechanical damage	IEC 60115-1 4.33 Resistance change after bended on the 90mm PCB. Bend: 3mm for 0201, 0402, 0603, 0805 2mm for 1206, 2010, 1225, 2512



Thick Film Chip Resistors Type MCR Series - Low Resistance

△ Specifications and Test Methods

ITEM	SPECIFICATION	TEST METHOD
DC Resistance	J: $\pm 5\%$, F: $\pm 1\%$	IEC 60115-1 4.5 / JIS C 5202 5.1 Measure the resistance value.
Short time Overload	J: $\Delta R \leq \pm (2\% + 0.5m\Omega)$ F: $\Delta R \leq \pm (1\% + 0.5m\Omega)$	IEC 60115-1 4.13 / JIS C 5202 5.5 2.5X Rated voltage or Max. Overload Voltage for 5 sec. measure resistance after 30 minutes
Solderability	Over 95% of termination must be covered with solder	IEC 60115-1 4.17 / JIS C 5202 6.5 After immersing flux, dip in the $245 \pm 2^\circ\text{C}$ molten solder bath for 3 ± 0.5 sec.
Resistance to Solder Heat	J: $\Delta R \leq \pm (1\% + 0.5m\Omega)$ F: $\Delta R \leq \pm (0.5\% + 0.5m\Omega)$ No mechanical damage	IEC 60115-1 4.18 / JIS C 5202 6.4 With $260 \pm 5^\circ\text{C}$ for 10 ± 1 sec.
Temperature Coefficient of Resistance (TCR)	Size : 0603 , 0805 100m Ω ~ 910m Ω : $\pm 300\text{ppm}/^\circ\text{C}$ Size : 1206 , 2010 , 2512 50m Ω ~ 910m Ω : $\pm 200\text{ppm}/^\circ\text{C}$ Size : 1225 20m Ω ~ 910m Ω : $\pm 100\text{ppm}/^\circ\text{C}$ reference for other resistance range in page 4	IEC 60115-1 4.8.4.2 / JIS C 5202 5.2 Test temperature : $25^\circ\text{C}(T_1) \rightarrow -55^\circ\text{C}(T_2)$ $25^\circ\text{C}(T_1) \rightarrow -125^\circ\text{C}(T_2)$ $\text{TCR (ppm}/^\circ\text{C}) = \frac{R_2 - R_1}{R_1} \times \frac{1}{T_2 - T_1} \times 10^6$ T1: 25°C T2: Test temperature R1: Resistance at reference temperature (T1) R2: Resistance at test temperature (T2)
Load Life Humidity	J: $\Delta R \leq \pm (3\% + 0.5m\Omega)$ F: $\Delta R \leq \pm (1\% + 0.5m\Omega)$	IEC 60115-1 4.24.2 / JIS C 5202 7.9 Maintain the temperature of the resistor at $40 \pm 2^\circ\text{C}$ and 90~95% R.H. with the rated voltage applied. Cycle ON for 1.5 hours and OFF for 0.5 hour for 1000+48/-0 hours. After 1~4 hour, measure the resistance value.
Load Life	J: $\Delta R \leq \pm (3\% + 0.5m\Omega)$ F: $\Delta R \leq \pm (1\% + 0.5m\Omega)$	IEC 60115-1 4.25.1 / JIS C 5202 7.10 Permanent resistance change after 1000+48/-0 hours (1.5 hours ON, 0.5 hour OFF) at RCWV or Max. Keep the resistor at $70 \pm 2^\circ\text{C}$ ambient
Temperature Cycle	J: $\Delta R \leq \pm (1\% + 1m\Omega)$ F: $\Delta R \leq \pm (0.5\% + 1m\Omega)$ No mechanical damage	IEC 60115-1 4.19 / JIS C 5202 7.4 Repeat 5 cycles as follows -55 $^\circ\text{C}$ (30 min.) ~ +25 $^\circ\text{C}$ (2~3 min.) +125 $^\circ\text{C}$ (30 min.) ~ +25 $^\circ\text{C}$ (2~3 min.) for 0201 -55 $^\circ\text{C}$ (30 min.) ~ +25 $^\circ\text{C}$ (2~3 min.) +155 $^\circ\text{C}$ (30 min.) ~ +25 $^\circ\text{C}$ (2~3 min.) for others
Insulation Resistance	Between termination and coating must be over 1000M Ω	IEC 60115-1 4.6.1.1 / JIS C 5202 5.6 Test voltage: $100 \pm 15\text{V}$
Bending Strength	J: $\Delta R \leq \pm (1\% + 1m\Omega)$ F: $\Delta R \leq \pm (0.5\% + 1m\Omega)$ No mechanical damage	IEC 60115-1 4.33 Resistance change after bended on the 90mm PCB. Bend: 3mm for 0201 , 0402 , 0603 , 0805 2mm for 1206 , 2010 , 1225 , 2512



Thick Film Chip Resistor - High Power Type HPR Series

Δ Features

- Rated Power up to 2W
- Suitable for lead free soldering.
- Compatible with flow and reflow soldering.

Δ Applications

- Consumer electronics
- Medical equipment
- Telecom equipment
- ie. Power Supply
Motherboards

Δ Rating - High Power Chip Resistor

Type	Size	Power Rating at 70 °C	Max. RCWV	Max. Overload Voltage	Resistance Tolerance (%)	Temperature Coefficient (TCR; ppm/°C)	Resistance Range		Standard Resistance Values
							Min.	Max.	
	0603	1/8W	50V	100V	± 1%(F)	± 100	10Ω	1MΩ	E-96
	0805	1/4W	150V	300V					
	1206	1/2W	200V	400V					
	2010	1W	200V	400V	± 5%(J)	± 200	1Ω	1MΩ	E-24
	2512	2W	300V	600V					

Jumper : 0603 maximum resistance $R_{max} \leq 20m\Omega$ and rated current $I_R = 2A$

0805,1206 maximum resistance $R_{max} \leq 20m\Omega$ and rated current $I_R = 4A$

2010,2512 maximum resistance $R_{max} \leq 20m\Omega$ and rated current $I_R = 6A$

Δ Rating - Low Resistance

Type	Size	Power Rating at 70 °C	Max. RCWV	Max. Overload Voltage	Resistance Tolerance (%)	Temperature Coefficient (TCR; ppm/°C)	Resistance Range	
							Min.	Max.
	0603	1/8W	337mV	754mV	± 1%(F) ± 5%(J)	± 100	100mΩ	910mΩ
	0805	1/4W	477mV	1067mV				
	1206	1/2W	675mV	1508mV				
	2010	1W	954mV	2133mV	± 150	± 150	47mΩ	91mΩ
	2512	2W	1349mV	3017mV				



Thick Film Chip Resistor - High Power

Type	HPR
------	-----

Thick Film Chip Resistor - High Power Type HPR Series

△ How to Order

Part Number

example	HPR	0603	T	J	123	LF
	Type	Size	Packing	Tolerance	Resistance Value	
	HPR	0603	T: Tape	F: $\pm 1\%$	123 = 12×10^3	LF = Lead Free
		0805		J: $\pm 5\%$	= 12k Ω	
		1206				
		2010				
		2512				

△ Resistance Marking

E-24 Series

473

3 digit marking for E24

ex. 473: $47 \times 10^3 = 47K\Omega$
 105: $10 \times 10^5 = 1M\Omega$
 1R5: $15 \times 10^{-1} = 1.5\Omega$
 0: 0Ω

1R00

4 digit marking for E241: $\Omega \sim 10m\Omega$

ex. 1R00: 1Ω
 R470 $470m\Omega$
 R010 $10m\Omega$

E-96 Series

1542

4 digit marking for E96

ex. 1542: $154 \times 10^2 = 15K4\Omega$

0C2

3 digit marking for E96 - 0603

ex. 0C2 (see table)
 $102 \times 10^2 = 10K2\Omega$



Thick Film Chip Resistor - High Power Type HPR Series

△ Specifications and Test Methods

ITEM	SPECIFICATION	TEST METHOD
DC Resistance	J: $\pm 5\%$, F: $\pm 1\%$	IEC 60115-1 4.5 / JIS C 5202 5.1 Measure the resistance value.
Short time Overload	J: $\Delta R \leq \pm (2\% + 0.1\Omega)$ F: $\Delta R \leq \pm (1\% + 0.05\Omega)$	IEC 60115-1 4.13 / JIS C 5202 5.5 5 X Rated voltage or Max. Overload Voltage for 5 sec. measure resistance after 30 minutes
Solderability	Over 95% of termination must be covered with solder	IEC 60115-1 4.17 / JIS C 5202 6.5 After immersing flux, dip in the $245 \pm 2^\circ\text{C}$ molten solder bath for 3 ± 0.5 sec.
Resistance to Solder Heat	J: $\Delta R \leq \pm (1\% + 0.1\Omega)$ F: $\Delta R \leq \pm (0.5\% + 0.05\Omega)$ No mechanical damage	IEC 60115-1 4.18 / JIS C 5202 6.4 With $260 \pm 5^\circ\text{C}$ for 10 ± 1 sec.
Temperature Coefficient of Resistance (TCR)	J: ± 150 ppm/ $^\circ\text{C}$ F: ± 100 ppm/ $^\circ\text{C}$	IEC 60115-1 4.8.4.2 / JIS C 5202 5.2 Test temperature : $25^\circ\text{C}(T1) \rightarrow -55^\circ\text{C}(T2)$ $25^\circ\text{C}(T1) \rightarrow 125^\circ\text{C}(T2)$ $\text{TCR (ppm/}^\circ\text{C)} = \frac{R2-R1}{R1} \times \frac{1}{T2-T1} \times 10^6$ T1: 25°C T2: Test temperature R1: Resistance at reference temperature (T1) R2: Resistance at test temperature (T2)
Load Life Humidity	J: $\Delta R \leq \pm (3\% + 0.1\Omega)$ F: $\Delta R \leq \pm (1\% + 0.05\Omega)$	IEC 60115-1 4.24.2 / JIS C 5202 7.9 Maintain the temperature of the resistor at $40 \pm 2^\circ\text{C}$ and 90~95% R.H. with the rated voltage applied. Cycle ON for 1.5 hours and OFF for 0.5 hour for 1000+48/-0 hours. After 1~4 hour, measure the resistance value.
Load Life	J: $\Delta R \leq \pm (3\% + 0.1\Omega)$ F: $\Delta R \leq \pm (1\% + 0.05\Omega)$	IEC 60115-1 4.25.1 / JIS C 5202 7.10 Permanent resistance change after 1000+48/-0 hours (1.5 hours ON , 0.5 hour OFF) at RCWV or Max. Keep the resistor at $70 \pm 2^\circ\text{C}$ ambient
Temperature Cycle	J: $\Delta R \leq \pm (1\% + 0.1\Omega)$ F: $\Delta R \leq \pm (0.5\% + 0.05\Omega)$ No mechanical damage	IEC 60115-1 4.19 / JIS C 5202 7.4 Repeat 5 cycles as follows $-55^\circ\text{C}(30 \text{ min.}) \sim +25^\circ\text{C}(2\sim3 \text{ min.})$ $+125^\circ\text{C}(30 \text{ min.}) \sim +25^\circ\text{C}(2\sim3 \text{ min.})$
Insulation Resistance	Between termination and coating must be over 1000M Ω	IEC 60115-1 4.6.1.1 / JIS C 5202 5.6 Test voltage: $100 \pm 15\text{V}$
Bending Strength	J: $\Delta R \leq \pm (1\% + 0.1\Omega)$ F: $\Delta R \leq \pm (0.5\% + 0.05\Omega)$ No mechanical damage	IEC 60115-1 4.33 Resistance change after bended on the 90mm PCB. Bend: 3mm for 0603 , 0805 2mm for 1206 , 2010 , 2512



Thick Film Chip Resistor - High Power Type HPR Series - Low Resistance

Δ Specifications and Test Methods

ITEM	SPECIFICATION	TEST METHOD
DC Resistance	J: ± 5% , F: ± 1%	IEC 60115-1 4.5 / JIS C 5202 5.1 Measure the resistance value.
Short time Overload	J: Δ R ≤ ± (2% + 0.1m Ω) F: Δ R ≤ ± (1% + 0.05m Ω)	IEC 60115-1 4.13 / JIS C 5202 5.5 5 X Rated voltage or Max. Overload Voltage for 5 sec. measure resistance after 30 minutes
Solderability	Over 95% of termination must be covered with solder	IEC 60115-1 4.17 / JIS C 5202 6.5 After immersing flux, dip in the 245 ± 2°C molten solder bath for 3 ± 0.5 sec.
Resistance to Solder Heat	J: Δ R ≤ ± (1% + 0.1m Ω) F: Δ R ≤ ± (0.5% + 0.05m Ω) No mechanical damage	IEC 60115-1 4.18 / JIS C 5202 6.4 With 260 ± 5°C for 10 ± 1 sec.
Temperature Coefficient of Resistance (TCR)	100mΩ ~ 910mΩ : ± 100ppm/°C 47mΩ ~ 91mΩ : ± 150ppm/°C	IEC 60115-1 4.8.4.2 / JIS C 5202 5.2 Test temperature : 25 °C(T1) → -55°C(T2) 25°C(T1) → 125°C(T2) $TCR (ppm/°C) = \frac{R2-R1}{R1} \times \frac{1}{T2-T1} \times 10^6$ T1: 25°C T2: Test temperature R1: Resistance at reference temperature (T1) R2: Resistance at test temperature (T2)
Load Life Humidity	J: Δ R ≤ ± (3% + 0.1m Ω) F: Δ R ≤ ± (1% + 0.05m Ω)	IEC 60115-1 4.24.2 / JIS C 5202 7.9 Maintain the temperature of the resistor at 40 ± 2°C and 90~95% R.H. with the rated voltage applied. Cycle ON for 1.5 hours and OFF for 0.5 hour for 1000+48/-0 hours. After 1~4 hour, measure the resistance value.
Load Life	J: Δ R ≤ ± (3% + 0.1m Ω) F: Δ R ≤ ± (1% + 0.05m Ω)	IEC 60115-1 4.25.1 / JIS C 5202 7.10 Permanent resistance change after 1000+48/-0 hours (1.5 hours ON , 0.5 hour OFF) at RCWV or Max. Keep the resistor at 70 ± 2°C ambient
Temperature Cycle	J: Δ R ≤ ± (1% + 0.1m Ω) F: Δ R ≤ ± (0.5% + 0.05m Ω) No mechanical damage	IEC 60115-1 4.19 / JIS C 5202 7.4 Repeat 5 cycles as follows -55°C(30 min.) ~ +25 °C(2~3 min.) +125°C(30 min.) ~ +25 °C(2~3 min.)
Insulation Resistance	Between termination and coating must be over 1000M Ω	IEC 60115-1 4.6.1.1 / JIS C 5202 5.6 Test voltage: 100 ± 15V
Bending Strength	J: Δ R ≤ ± (1% + 0.1m Ω) F: Δ R ≤ ± (0.5% + 0.05m Ω) No mechanical damage	IEC 60115-1 4.33 Resistance change after bended on the 90mm PCB. Bend: 3mm for 0603 , 0805 2mm for 1206 , 2010 , 2512



Thick Film Chip Resistor - Trimmable Type TCR Series

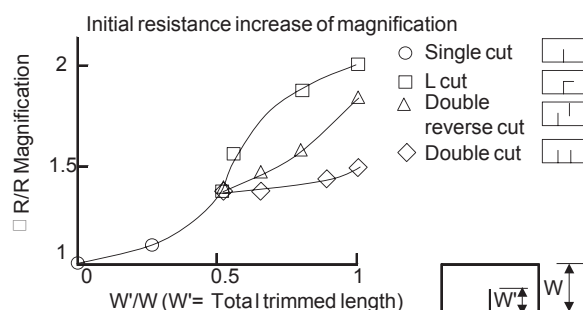
△ Features

- Resistance and protection film designed for YAG Laser Trimming
- Available for fine tuning of the resistance value to obtain optimal circuit signals.
- Suitable for lead free soldering.
- Compatible with flow and reflow soldering.

△ Applications

- Tuner
- Mobile Phone
- Smoke Detector
- Portable Measuring Equipment
- Photo Sensor

△ Resistance Rising Rate



Trimming shall be performed by laser. The maximum rising resistance equals to two times of the initial and the differences will depend on trimming type as shown at the left.

△ Rating

Type	Size	Power Rating at 70 °C	Max. RCWV	Max. Overload Voltage	Resistance Tolerance (%)	Temperature Coefficient (TCR; ppm/ °C)	Resistance Range		Standard Resistance Values
							Min.	Max.	
	0603	1/10W	50V	100V	0~-30%(X) 0~-20%(Y)	± 100	100 Ω	1M Ω	E-24
	0805	1/8W	150V	300V					
	1206	1/4W	200V	400V					
	2010	1/2W	200V	400V					
	2512	1W	200V	400V					

△ How to Order

Part Number

example

TCR	0603	T	X	123	LF
Type	Size	Packing	Tolerance	Resistance Value	
TCR	0603	T: Tape	X: 0%~-30%	123 = 12x10 ³	LF = Lead Free
	0805		Y: 0%~-20%	= 12k Ω	
	1206				
	2010				
	2512				



Thick Film Chip Resistor - Trimmable Type TCR Series

Δ Specifications and Test Methods

ITEM	SPECIFICATION	TEST METHOD
DC Resistance	X : 0 ~ -30% , Y : 0 ~ -20%	IEC 60115-1 4.5 / JIS C 5202 5.1 Measure the resistance value.
Short time Overload	$\Delta R \leq \pm (2\% + 0.1 \Omega)$	IEC 60115-1 4.13 / JIS C 5202 5.5 2.5X Rated voltage or Max. Overload Voltage for 5 sec. measure resistance after 30 minutes
Solderability	Over 95% of termination must be covered with solder	IEC 60115-1 4.17 / JIS C 5202 6.5 After immersing flux, dip in the 245 ± 2 °C molten solder bath for 3 ± 0.5 sec.
Resistance to Solder Heat	$\Delta R \leq \pm (1\% + 0.1 \Omega)$ No mechanical damage	IEC 60115-1 4.18 / JIS C 5202 6.4 With 260 ± 5 °C for 10 ± 1 sec.
Temperature Coefficient of Resistance (TCR)	$\pm 100 \text{ ppm/}^\circ\text{C}$	IEC 60115-1 4.8.4.2 / JIS C 5202 5.2 Test temperature : 25 °C(T1) $\rightarrow$ -55 °C(T2) 25 °C(T1) $\rightarrow$ 125 °C(T2) $\text{TCR (ppm/}^\circ\text{C)} = \frac{R_2 - R_1}{R_1} \times \frac{1}{T_2 - T_1} \times 10^6$ T1: 25 °C T2: Test temperature R1: Resistance at reference temperature (T1) R2: Resistance at test temperature (T2)
Load Life Humidity	$\Delta R \leq \pm (3\% + 0.1 \Omega)$	IEC 60115-1 4.24.2 / JIS C 5202 7.9 Maintain the temperature of the resistor at 40 ± 2 °C and 90~95% R.H. with the rated voltage applied. Cycle ON for 1.5 hours and OFF for 0.5 hour for 1000+48/-0 hours. After 1~4 hour, measure the resistance value.
Load Life	$\Delta R \leq \pm (3\% + 0.1 \Omega)$	IEC 60115-1 4.25.1 / JIS C 5202 7.10 Permanent resistance change after 1000+48/-0 hours (1.5 hours ON , 0.5 hour OFF) at RCWV or Max. Keep the resistor at 70 ± 2 °C ambient
Intermittent Overload	$\Delta R \leq \pm (5\% + 0.1 \Omega)$ No mechanical damage	JIS C 5202 5.8 4.0 x Rated voltage (Max. Overload Voltage) 1 sec ON, 25 sec OFF, test 10,000 cycles
Temperature Cycle	$\Delta R \leq \pm (1\% + 0.1 \Omega)$ No mechanical damage	IEC 60115-1 4.19 / JIS C 5202 7.4 Repeat 5 cycles as follows -55 °C(30 min.) $\sim$ +25 °C(2~3 min.) +125 °C(30 min.) $\sim$ +25 °C(2~3 min.)
Insulation Resistance	Between termination and coating must be over 1000M Ω	IEC 60115-1 4.6.1.1 / JIS C 5202 5.6 Test voltage: 100 ± 15 V
Bending Strength	$\Delta R \leq \pm (1\% + 0.1 \Omega)$ No mechanical damage	IEC 60115-1 4.33 Resistance change after bended on the 90mm PCB. Bend: 3mm for 0603 , 0805 2mm for 1206 , 2010 , 2512



Thick Film Chip Resistor - Surge Type SCR Series

Δ Features

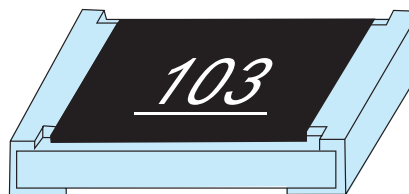
- Suitable for withstanding circuit for surge voltage
- Suitable for lead free soldering.
- Compatible with flow and reflow soldering.

Δ Applications

- Measurement Instrument
- Power Supply
- Automotive Industry
- Medical Equipment
- Telecom Equipment
- Consumer Electronics

Δ Rating

Type	Size	Power Rating at 70 °C	Max. RCWV	Max. Overload Voltage	Resistance Tolerance (%)	Temperature Coefficient (TCR; ppm/ °C)	Resistance Range		Standard Resistance Values
							Min.	Max.	
	0603	1/10W	50V	100V					
	0805	1/8W	150V	300V	± 5%(J)				
	1206	1/4W	200V	400V	± 10%(K)				
	2010	1/2W	200V	400V	±1 5%(L)	± 100	10 Ω	1M Ω	E-24
	2512	1W	200V	400V	± 20%(M)				



Δ How to Order

Part Number

example	SCR	0603	T	J	123	LF
	Type	Size	Packing	Tolerance	Resistance Value	
	SCR	0603	T: Tape	J: ±5%	123 = 12x10 ³	LF = Lead Free
		0805		K: ±10%	= 12k Ω	
		1206		L: ±15%		
		2010		M: ±20%		
		2512				

Δ Resistance Marking

E-24 Series



3 digit marking for E24

- ex. 473: 47x10³ = 47KΩ
 105: 10x10⁵ = 1MΩ
 1R5: 15x10⁻¹ = 1.5Ω
 0: 0Ω



4 digit marking for E241: Ω~10mΩ

- ex. 1R00: 1Ω
 R470 470mΩ
 R010 10mΩ



Thick Film Chip Resistor - Surge Type SCR Series

△ Specifications and Test Methods

ITEM	SPECIFICATION	TEST METHOD
DC Resistance	J ± 5% K : ± 10% L : ± 5% M : ± 20%	IEC 60115-1 4.5 / JIS C 5202 5.1 Measure the resistance value.
Short time Overload	$\Delta R \leq \pm (2\% + 0.1 \Omega)$	IEC 60115-1 4.13 / JIS C 5202 5.5 2.5X Rated voltage or Max. Overload Voltage for 5 sec. measure resistance after 30 minutes
High Voltage Pulses	$\Delta R \leq \pm (1\% + 0.1 \Omega)$	IEC 801-5 1.2/50μ s 2kV 100 Pulses (Sequence 25 P / min)
Solderability	Over 95% of termination must be covered with solder	IEC 60115-1 4.17 / JIS C 5202 6.5 After immersing flux, dip in the 245 ± 2 °C molten solder bath for 3 ± 0.5 sec.
Resistance to Solder Heat	$\Delta R \leq \pm (1\% + 0.1 \Omega)$ No mechanical damage	IEC 60115-1 4.18 / JIS C 5202 6.4 With 260 ± 5 °C for 10 ± 1 sec.
Temperature Coefficient of Resistance (TCR)	± 100 ppm/ °C	IEC 60115-1 4.8.4.2 / JIS C 5202 5.2 Test temperature : 25 °C(T1) → -55 °C(T2) 25 °C(T1) → 125 °C(T2) $TCR (ppm/^{\circ}C) = \frac{R2-R1}{R1} \times \frac{1}{T2-T1} \times 10^6$ T1: 25 °C T2: Test temperature R1: Resistance at reference temperature (T1) R2: Resistance at test temperature (T2)
Load Life Humidity	$\Delta R \leq \pm (3\% + 0.1 \Omega)$	IEC 60115-1 4.24.2 / JIS C 5202 7.9 Maintain the temperature of the resistor at 40 ± 2 °C and 90~95% R.H. with the rated voltage applied. Cycle ON for 1.5 hours and OFF for 0.5 hour for 1000+48/-0 hours. After 1~4 hour, measure the resistance value.
Load Life	$\Delta R \leq \pm (3\% + 0.1 \Omega)$	IEC 60115-1 4.25.1 / JIS C 5202 7.10 Permanent resistance change after 1000+48/-0 hours (1.5 hours ON , 0.5 hour OFF) at RCWV or Max. Keep the resistor at 70 ± 2 °C ambient
Intermittent Overload	$\Delta R \leq \pm (5\% + 0.1 \Omega)$ No mechanical damage	JIS C 5202 5.8 4.0 x Rated voltage (Max. Overload Voltage) 1 sec ON, 25 sec OFF, test 10,000 cycles
Temperature Cycle	$\Delta R \leq \pm (1\% + 0.1 \Omega)$ No mechanical damage	IEC 60115-1 4.19 / JIS C 5202 7.4 Repeat 5 cycles as follows -55 °C(30 min.) ~ +25 °C(2~3 min.) +125 °C(30 min.) ~ +25 °C(2~3 min.)
Insulation Resistance	Between termination and coating must be over 1000M Ω	IEC 60115-1 4.6.1.1 / JIS C 5202 5.6 Test voltage: 100 ± 15V
Bending Strength	$\Delta R \leq \pm (1\% + 0.1 \Omega)$ No mechanical damage	IEC 60115-1 4.33 Resistance change after bended on the 90mm PCB. Bend: 3mm for 0603 , 0805 2mm for 1206 , 2010 , 2512



Thick Film Chip Resistor - High Voltage Type HVR Series

△ Features

- Special material and design for high working voltage requirement
- Suitable for lead free soldering.
- Compatible with flow and reflow soldering.

△ Applications

- Medical Equipment
- Telecom Equipment
- Consumer Electronics
- Power Supply
- Automotive Industry

△ Rating

Type	Size	Power Rating at 70°C	Max. RCWV	Max. Overload Voltage	Resistance Tolerance (%)	Temperature Coefficient (TCR; ppm/°C)	Resistance Range		Standard Resistance Values
							Min.	Max.	
	1206	1/4W	800V	1600V					
	2010	1/2W	1500V	3000V	± 5%(J)	± 200	100KΩ	1MΩ	E-24
	2512	1W	2000V	4000V					

△ How to Order

Part Number

example	HVR	1206	T	J	123	LF
	Type	Size	Packing	Tolerance	Resistance Value	
	HVR	1206	T: Tape	J: ±5%	123 = 12×10^3 = 12k Ω	LF = Lead Free
		2010				
		2512				

△ Resistance Marking

E-24 Series



3 digit marking for E24

- ex. 473: $47 \times 10^3 = 47K\Omega$
 105: $10 \times 10^5 = 1M\Omega$
 1R5: $15 \times 10^{-1} = 1.5\Omega$
 0: 0Ω



4 digit marking for E241: $\Omega \sim 10m\Omega$

- ex. 1R00: 1Ω
 R470 $470m\Omega$
 R010 $10m\Omega$



Thick Film Chip Resistor - High Voltage Type HVR Series

Δ Features

ITEM	SPECIFICATION	TEST METHOD
DC Resistance	$J \pm 5\%$	IEC 60115-1 4.5 / JIS C 5202 5.1 Measure the resistance value.
Short time Overload	$\Delta R \leq \pm (1\% + 0.1 \Omega)$	IEC 60115-1 4.13 / JIS C 5202 5.5 2 X Rated voltage or Max. Overload Voltage for 5 sec. measure resistance after 30 minutes
Solderability	Over 95% of termination must be covered with solder	IEC 60115-1 4.17 / JIS C 5202 6.5 After immersing flux, dip in the $245 \pm 2^\circ\text{C}$ molten solder bath for 3 ± 0.5 sec.
Resistance to Solder Heat	$\Delta R \leq \pm (1\% + 0.1 \Omega)$ No mechanical damage	IEC 60115-1 4.18 / JIS C 5202 6.4 With $260 \pm 5^\circ\text{C}$ for 10 ± 1 sec.
Temperature Coefficient of Resistance (TCR)	$\pm 200 \text{ ppm}/^\circ\text{C}$	IEC 60115-1 4.8.4.2 / JIS C 5202 5.2 Test temperature : $25^\circ\text{C}(T1) \rightarrow -55^\circ\text{C}(T2)$ $25^\circ\text{C}(T1) \rightarrow 125^\circ\text{C}(T2)$ $\text{TCR (ppm}/^\circ\text{C)} = \frac{R2-R1}{R1} \times \frac{1}{T2-T1} \times 10^6$ T1: 25°C T2: Test temperature R1: Resistance at reference temperature (T1) R2: Resistance at test temperature (T2)
Load Life Humidity	$\Delta R \leq \pm (5\% + 0.1 \Omega)$	IEC 60115-1 4.24.2 / JIS C 5202 7.9 Maintain the temperature of the resistor at $40 \pm 2^\circ\text{C}$ and 90~95% R.H. with the rated voltage applied. Cycle ON for 1.5 hours and OFF for 0.5 hour for 1000+48/-0 hours. After 1~4 hour, measure the resistance value.
Load Life	$\Delta R \leq \pm (5\% + 0.1 \Omega)$	IEC 60115-1 4.25.1 / JIS C 5202 7.10 Permanent resistance change after 1000+48/-0 hours (1.5 hours ON , 0.5 hour OFF) at RCWV or Max. Keep the resistor at $70 \pm 2^\circ\text{C}$ ambient
Temperature Cycle	$\Delta R \leq \pm (1\% + 0.1 \Omega)$ No mechanical damage	IEC 60115-1 4.19 / JIS C 5202 7.4 Repeat 5 cycles as follows $-55^\circ\text{C}(30 \text{ min.}) \sim +25^\circ\text{C}(2\sim3 \text{ min.})$ $+125^\circ\text{C}(30 \text{ min.}) \sim +25^\circ\text{C}(2\sim3 \text{ min.})$
Insulation Resistance	Between termination and coating must be over 1000M Ω	IEC 60115-1 4.6.1.1 / JIS C 5202 5.6 Test voltage: $100 \pm 15\text{V}$
Voltage Coefficient of Resistance (VCR)	$\leq \pm 300 \text{ ppm/Volt}$	JIS C 5202 5.3.1 Measuring Voltage 10V/100V
Bending Strength	$\Delta R \leq \pm (1\% + 0.05 \Omega)$ No mechanical damage	IEC 60115-1 4.33 Resistance change after bended on the 90mm PCB. Bend: 2mm for 1206 , 2010 , 2512



Thick Film Chip Resistor - High Resistance

Type

HRR

Thick Film Chip Resistor - High Resistance Type HRR Series

△ Features

- Small size and lightweight with size range per International standard.
- Highly stable in auto-replacement surface mounting application.
- Compatible with flow and reflow soldering.

△ Applications

- Power Supply in small size
- Battery Charger
- Automotive Industry
- Medical Equipment
- Telecom Equipment
- Consumer Electronics

△ Rating

Type	Size	Power Rating at 70°C	Max. RCWV	Max. Overload Voltage	Resistance Tolerance (%)	Temperature Coefficient (TCR; ppm/°C)	Resistance Range		Standard Resistance Values
							Min.	Max.	
	0603	1/10W	50V	100V	± 5%(J)	± 200	11MΩ	100MΩ	E-12
	0805	1/8W	150V	300V					
	1206	1/4W	200V	400V					

△ How to Order

Part Number

example	HRR	0603	T	J	506	LF
	Type	Size	Packing	Tolerance	Resistance Value	
	Hrr	0603	T: Tape	J: ±5%	506 = 50x10 ⁶ = 50M Ω	LF = Lead Free
		0805				
		1206				



Thick Film Chip Resistor - High Resistance Type HRR Series

△ Features

ITEM	SPECIFICATION	TEST METHOD
DC Resistance	$J \pm 5\%$	IEC 60115-1 4.5 / JIS C 5202 5.1 Measure the resistance value.
Short time Overload	$J \Delta R \leq \pm 2\%$	IEC 60115-1 4.13 / JIS C 5202 5.5 2.5 X Rated voltage or Max. Overload Voltage for 5 sec. measure resistance after 30 minutes
Solderability	Over 95% of termination must be covered with solder	IEC 60115-1 4.17 / JIS C 5202 6.5 After immersing flux, dip in the $245 \pm 2^\circ\text{C}$ molten solder bath for 3 ± 0.5 sec.
Resistance to Solder Heat	$J \Delta R \leq \pm 2\%$	IEC 60115-1 4.18 / JIS C 5202 6.4 With $260 \pm 5^\circ\text{C}$ for 10 ± 1 sec.
Temperature Coefficient of Resistance (TCR)	$J : \pm 200 \text{ ppm}/^\circ\text{C}$	IEC 60115-1 4.8.4.2 / JIS C 5202 5.2 Test temperature : $25^\circ\text{C}(T1) \rightarrow -55^\circ\text{C}(T2)$ $25^\circ\text{C}(T1) \rightarrow 125^\circ\text{C}(T2)$ $\text{TCR (ppm}/^\circ\text{C}) = \frac{R2-R1}{R1} \times \frac{1}{T2-T1} \times 10^6$ T1: 25°C T2: Test temperature R1: Resistance at reference temperature (T1) R2: Resistance at test temperature (T2)
Load Life Humidity	$J \Delta R \leq \pm 5\%$	IEC 60115-1 4.24.2 / JIS C 5202 7.9 Maintain the temperature of the resistor at $40 \pm 2^\circ\text{C}$ and 90~95% R.H. with the rated voltage applied. Cycle ON for 1.5 hours and OFF for 0.5 hour for $1000+48/-0$ hours. After 1~4 hour, measure the resistance value.
Load Life	$J \Delta R \leq \pm 5\%$	IEC 60115-1 4.25.1 / JIS C 5202 7.10 Permanent resistance change after $1000+48/-0$ hours (1.5 hours ON, 0.5 hour OFF) at RCWV or Max. Keep the resistor at $70 \pm 2^\circ\text{C}$ ambient
Voltage Coefficient of Resistance (VCR)	$\leq \pm 300 \text{ ppm/Volt}$	JIS C 5202 5.3.1 Measuring Voltage 10V/100V
Temperature Cycle	$J \Delta R \leq \pm 5\%$	IEC 60115-1 4.19 / JIS C 5202 7.4 Repeat 5 cycles as follows $-55^\circ\text{C}(30 \text{ min.}) \sim +25^\circ\text{C}(2 \sim 3 \text{ min.})$ $+125^\circ\text{C}(30 \text{ min.}) \sim +25^\circ\text{C}(2 \sim 3 \text{ min.})$
Insulation Resistance	Between termination and coating must be over $1000\text{M } \Omega$	IEC 60115-1 4.6.1.1 / JIS C 5202 5.6 Test voltage: $100 \pm 15\text{V}$
Bending Strength	$J \Delta R \leq \pm 2\%$	IEC 60115-1 4.33 Resistance change after bended on the 90mm PCB. Bend: 3mm for 0603, 0805, 2mm for 1206



Thick Film Chip Resistor - Metal Strip Type MSR Series

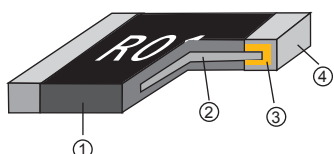
Δ Features

- High power rating and low TCR.
- Inductance less than 1.0nH.
- Low resistance and high precision (1%).
- Excellent reliability and reasonable cost.
- Suitable for lead free soldering.

Δ Applications

- Switching Power Supply
- Power Amplifier
- Medical Equipment
- Telecom Equipment
- Consumer Electronics

Δ Dimension and Construction

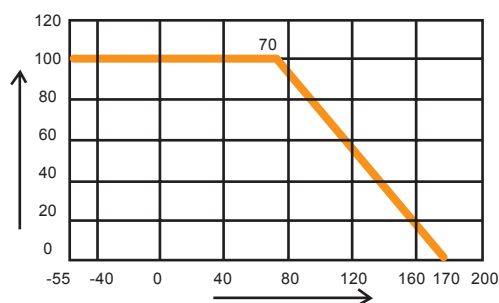


Type	1.Protective Coating	2.Resistive Element	3.Terminal	4.Outer Terminal
	Resin	Alloy Metal	Copper	Tin Plating

Type	L	W	T	a
1m,2m	6.20+/-0.25	3.20+/-0.25	0.70+/-0.20	2.0+/-0.30
3m~25m	6.20+/-0.20	3.20+/-0.20	0.60+/-0.20	0.80+/-0.20

Δ Power Derating Curve

Operating Temperature Range: -55 to +170 deg.C



Ambient Temperature (deg.C)



Thick Film Chip Resistor - Metal Strip Type MSR Series

Δ Rating

Type	Power Rating at 70 °C	Max. RCWV	Max. Overload Voltage	Resistance Tolerance (%)	Temperature Coefficient (TCR; ppm/°C)	Resistance Range (mΩ)
FMF25	1W	158mV	316mV	± 1%(F)	± 100	1,2,3,4,5
				± 5%(J)	± 70	7,10,12,15,18,20,25
	2W	224mV	418mV	± 1%(F)	± 100	1,2,3,4,5
				± 5%(J)	± 70	7,10,12,15,18,20,25

Δ How to Order

Part Number

example	MSR	2512	T	J	D001	H	LF
	Type	Size	Packing	Tolerance	Resistance Value	Wattage	
	MSR	2512	T: Tape	F: ±1% J: ±5%	506 = 50x10 ⁶ = 50M Ω	H: 1W J: 2W	LF = Lead Free

Δ Resistance Marking



For 1~2mΩ



For 3~25mΩ

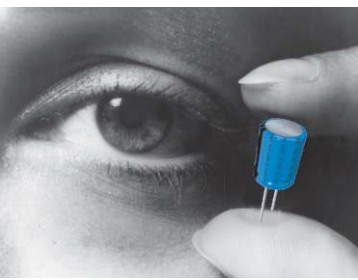
R001 = 1mΩ
R020 = 20mΩ



Thick Film Chip Resistor - Metal Strip Type MSR Series

Δ Rating

ITEM	SPECIFICATION	TEST METHOD
DC Resistance	$F \pm 1\%$, $J : \pm 5\%$	IEC 60115-1 4.5 / JIS C 5202 5.1 Measure the resistance value.
Short time Overload	$R \square \pm (1\% + 0.5m\Omega)$	IEC 60115-1 4.13 / JIS C 5202 5.5 5 X Rated voltage for 5 sec. measure resistance after 30 minutes
Solderability	Over 95% of termination must be covered with solder	IEC 60115-1 4.17 / JIS C 5202 6.5 After immersing flux, dip in the $245 \pm 2^\circ\text{C}$ molten solder bath for 3 ± 0.5 sec.
Resistance to Solder Heat	$R \square \pm (1\% + 0.5m\Omega)$ No mechanical damage	IEC 60115-1 4.18 / JIS C 5202 6.4 With $260 \pm 5^\circ\text{C}$ for 10 ± 1 sec.
Temperature Coefficient of Resistance (TCR)	$1m\Omega \sim 5m\Omega : \pm 100 \text{ ppm}/^\circ\text{C}$ $7m\Omega \sim 2.5m\Omega : \pm 70 \text{ ppm}/^\circ\text{C}$	IEC 60115-1 4.8.4.2 / JIS C 5202 5.2 Test temperature : $25^\circ\text{C}(T1) \rightarrow -55^\circ\text{C}(T2)$ $25^\circ\text{C}(T1) \rightarrow 125^\circ\text{C}(T2)$ $\text{TCR (ppm}/^\circ\text{C}) = \frac{R2-R1}{R1} \times \frac{1}{T2-T1} \times 10^6$ T1: 25°C T2: Test temperature R1: Resistance at reference temperature (T1) R2: Resistance at test temperature (T2)
Load Life Humidity	$R \square \pm (1\% + 0.5m\Omega)$	IEC 60115-1 4.24.2 / JIS C 5202 7.9 Maintain the temperature of the resistor at $40 \pm 2^\circ\text{C}$ and 90~95% R.H. with the rated voltage applied. Cycle ON for 1.5 hours and OFF for 0.5 hour for 1000+48/-0 hours. After 1~4 hour, measure the resistance value.
Load Life	$R \square \pm (1\% + 0.5m\Omega)$	IEC 60115-1 4.25.1 / JIS C 5202 7.10 Permanent resistance change after 1000+48/-0 hours (1.5 hours ON , 0.5 hour OFF) at RCWV or Max. Keep the resistor at $70 \pm 2^\circ\text{C}$ ambient
Temperature Cycle	$R \square \pm (1\% + 0.5m\Omega)$ No mechanical damage	IEC 60115-1 4.19 / JIS C 5202 7.4 Repeat 5 cycles as follows $-55^\circ\text{C}(30 \text{ min.}) \sim +25^\circ\text{C}(2 \sim 3 \text{ min.})$ $+125^\circ\text{C}(30 \text{ min.}) \sim +25^\circ\text{C}(2 \sim 3 \text{ min.})$
Insulation Resistance	Between termination and coating must be over 1000M Ω	IEC 60115-1 4.6.1.1 / JIS C 5202 5.6 Test voltage: $100 \pm 15\text{V}$
Bending Strength	$R \square \pm (1\% + 0.5m\Omega)$ No mechanical damage	IEC 60115-1 4.33 Resistance change after bended on the 90mm PCB. Bend: 2mm



Chip Resistor Array Type RCA

Δ Features

- Suitable for lead free soldering
- compatible with flow and reflow soldering

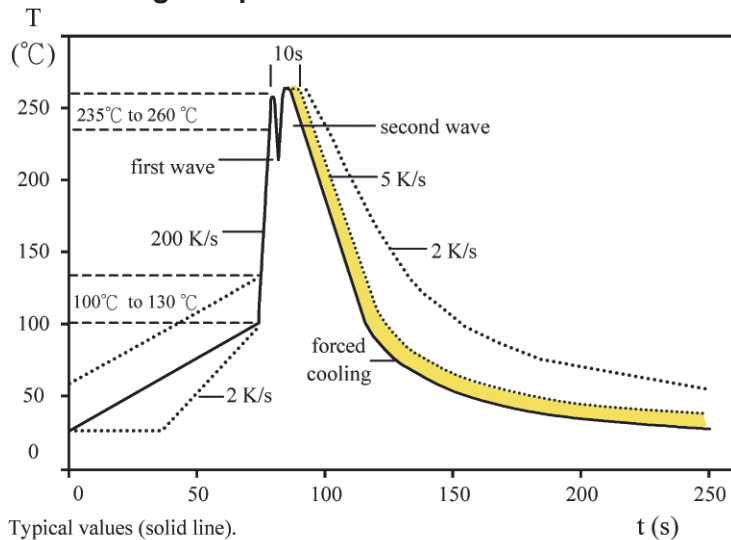
Δ Applications

- Automotive, Medical, and Telecom Industries

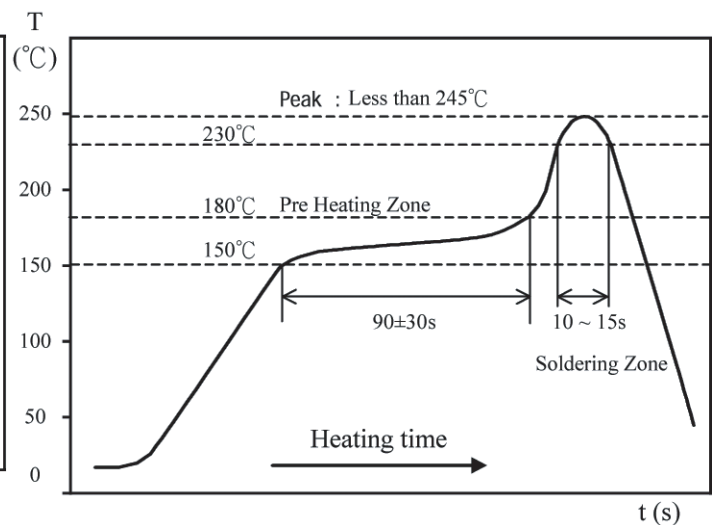
Δ Part Number

Type	Size	Isolated	Circuit Configuration	Packaging	Tolerance	Resistor Value
RCA	1206	B	8	T	J	103
	Chip Size	Isolated	Circuit 8P/4R	Taping	Example	Example
					J=5%	102=1KΩ
					F=1%	103=10KΩ

Δ Soldering Temperature Curve



WAVE soldering.



IR Reflow Soldering

Δ Rating

•Lead Free Chip Resistor Array

Type	Size	Power Rating at 70°C	Max. RCWV	Max. Overload Voltage	Resistance Tolerance (%)	Temperature Coefficient (TCR: ppm/°C)	Resistance Range (Ω)		Standard Resistance Values
							Min.	Max.	
RCA 1206	8P4R	1/16W (Element)	50V	100V	±5%(J) ±1%(F)	±200	0Ω, 10Ω	1MΩ	E-24

Jumper: 8P4R size maximum resistance $R_{max} = 50m\Omega$ and rated current $I_R = 1A$



Chip Resistor Array

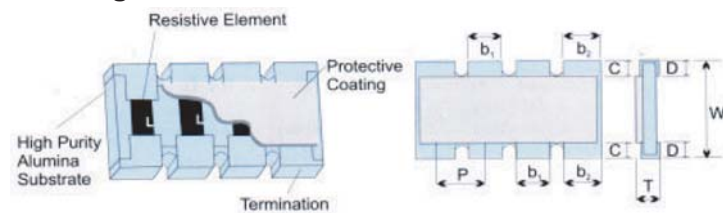
Type

RCA

△ Product Category

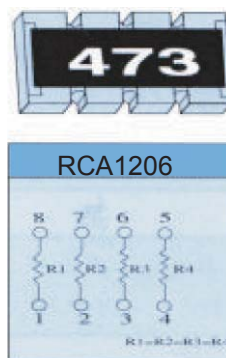
- Lead Free Chip Resistor Array (RCA1206) Convex

△ Configuration



Inner Termination Layer: Ag, Pd/Ag
Middle Termination Layer: Nickel
Outer Termination Layer: Solder

△ Circuit

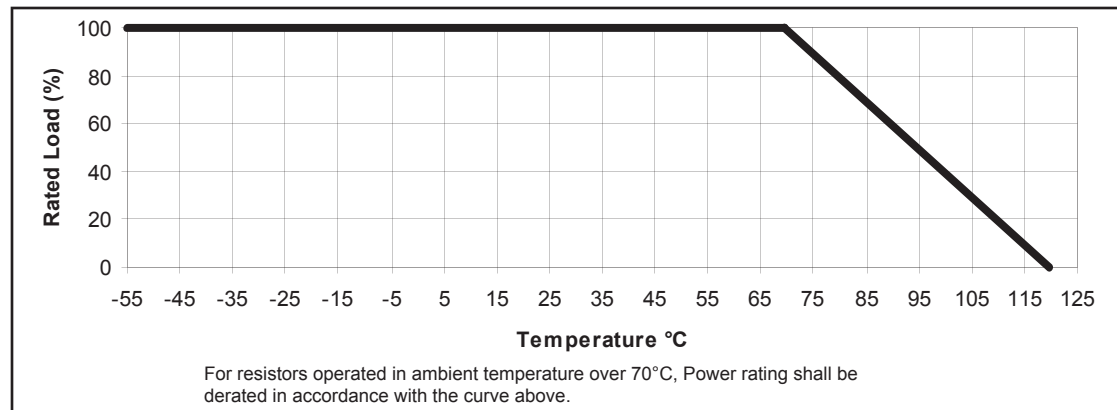


△ Dimensions

Size	L	W	T	C	D	P	b1	b2
8P4R	3.20±0.20	1.60±0.10	0.50±0.10	0.30±0.20	0.30±0.20	0.80±0.05	0.45±0.10	0.70±0.20

(unit: mm)

△ Power Derating Curve





△ Product Category

- Specification and Test Method

ITEM	SPECIFICATION	TEST METHOD
DC Resistance	J: $\pm 5\%$, F: $\pm 1\%$ Zero Ohm Jumper $< 50m\Omega$	IEC 115-1 4.5 / JIS C 5202 5.1 Measure the resistance value.
Short Time Overload	J: $\Delta R \leq \pm (2\% + 0.1\Omega)$ F: $\Delta R \leq \pm (1\% + 0.05\Omega)$	IEC 115-1 4.13 / JIS C 5202 5.5 2.5xRated voltage or Max. Overload Voltage for 5 sec. measure resistance after 30 minutes.
Solderability	Over 95% of termination must be covered with solder	IEC 115-1 4.17 / JIS C 5202 6.5 After immersing flux, dip in the $245\pm 2^{\circ}\text{C}$ molten solder bath for 3 ± 0.5 sec.
Resistance to Solder Heat	J: $\Delta R \leq \pm (1\% + 0.1\Omega)$ F: $\Delta R \leq \pm (0.5\% + 0.05\Omega)$ No mechanical damage	IEC 115-1 4.18 / JIS C 5202 6.4 with $260\pm 5^{\circ}\text{C}$ for 10 ± 1 sec.
Temperature Coefficient of Resistance (TCR)	$\pm 200\text{ppm}/^{\circ}\text{C}$	IEC 115-1 4.8.4.2 / JIS C 5202 5.2 Test Temperature: $25^{\circ}\text{C}(\text{T1}) \rightarrow -55^{\circ}\text{C}(\text{T2})$ $25^{\circ}\text{C}(\text{T1}) \rightarrow 125^{\circ}\text{C}(\text{T2})$ $\text{TCR (ppm}/^{\circ}\text{C}) = (\text{R2}-\text{R1})/\text{R1}(\text{T2}-\text{T1}) \times 10^6$ R1: Resistance at reference temperature (T1) R2: Resistance at test temperature (T2)
Load Life Humidity	J: $\Delta R \leq \pm (3\% + 0.1\Omega)$ F: $\Delta R \leq \pm (1\% + 0.05\Omega)$	IEC 115-1 4.24.2 / JIS C 5202 7.9 Maintain the temperature of the resistor at $40\pm 2^{\circ}\text{C}$ and 90~95% R.H. with the rated voltage applied. Cycle ON for 1.5 hours. After 1~4 hour, measure the resistance value.
Load Life	J: $\Delta R \leq \pm (3\% + 0.1\Omega)$ F: $\Delta R \leq \pm (1\% + 0.05\Omega)$	IEC 115-1 4.25.1 / JIS C 5202 7.10 Permanent resistance change after 1000+48/-0 hours (1.5 hours ON, 0.5 hour OFF) at RCWV or MAX. Keep the resistor at $70\pm 2^{\circ}\text{C}$ ambient
Intermittent Overload	$\Delta R \leq \pm (3\% + 0.1\Omega)$ No mechanical damage	JIS C 5202 5.8 4.0xRated voltage (Max. Overload Voltage) 1 sec ON, 25 sec OFF, test 10,000 cycles
Temperature Cycle	J: $\Delta R \leq \pm (1\% + 0.1\Omega)$ F: $\Delta R \leq \pm (0.5\% + 0.05\Omega)$ No mechanical damage	IEC 115-1 4.19 / JIS C 5202 7.4 Repeat 5 cycles as follows -55°C (30min) $+25^{\circ}\text{C}$ (2~3min) $+125^{\circ}\text{C}$ (30min) $+25^{\circ}\text{C}$ (2~3min)
Insulation Resistance	Between termination and coating must be over 1000M Ω	IEC 115-1 4.6.1.1 / JIS C 5202 5.6 Test voltage: $100\pm 15\text{V}$
Bending Strength	J: $\Delta R \leq \pm (1\% + 0.1\Omega)$ F: $\Delta R \leq \pm (0.5\% + 0.05\Omega)$ No mechanical damage	IEC 115-1 4.33 Resistance change after bended on the 90mm PCB. Bend: 3min

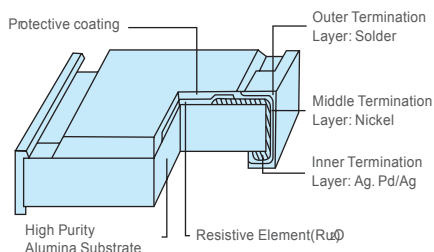


Thick Film Chip Resistor

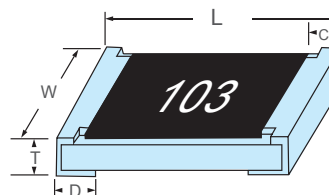
△ Product Category

- MCR - Chip Resistor: General Purpose, Low Resistance
- HPR - High Power Chip Resistor
- TCR - Trimmable Chip Resistor
- SCR - Surge Chip Resistor
- HVR - High Voltage Chip Resistor
- HRR - High Resistance Chip Resistor

△ Configuration

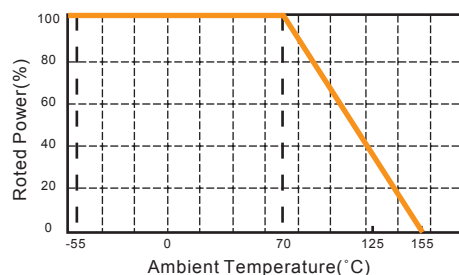


△ Dimensions

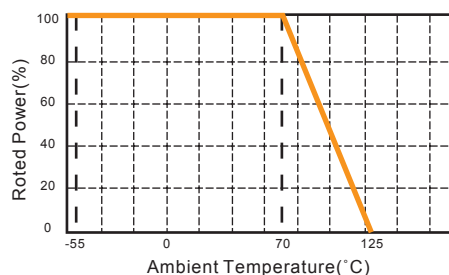


Size	L	W	C	D	T
0201	0.60± 0.10	0.30± 0.10	0.25± 0.20	0.15± 0.20	0.15± 0.10
0402	1.00± 0.10	0.50± 0.10	0.20± 0.20	0.20± 0.20	0.35± 0.10
0603	1.60± 0.10	0.80± 0.10	0.30± 0.20	0.30± 0.20	0.45± 0.10
0805	2.00± 0.15	1.20± 0.15	0.40± 0.20	0.40± 0.20	0.50± 0.10
1206	3.10± 0.15	1.60± 0.15	0.50± 0.25	0.50± 0.25	0.55± 0.10
2010	5.00± 0.20	2.50± 0.20	0.60± 0.25	0.65± 0.25	0.60± 0.10
2512	6.30± 0.20	3.10± 0.20	0.60± 0.25	0.65± 0.25	0.60± 0.15
2512 (HPR)	6.30± 0.20	3.10± 0.20	0.60± 0.25	1.80± 0.25	0.60± 0.15
1225	3.10± 0.20	6.30± 0.20	0.65± 0.25	0.90± 0.25	0.60± 0.15

△ Power Derating Curve



Maximum dissipation in percentage of rated power as a function of the ambient temperature for all sizes except 0201.



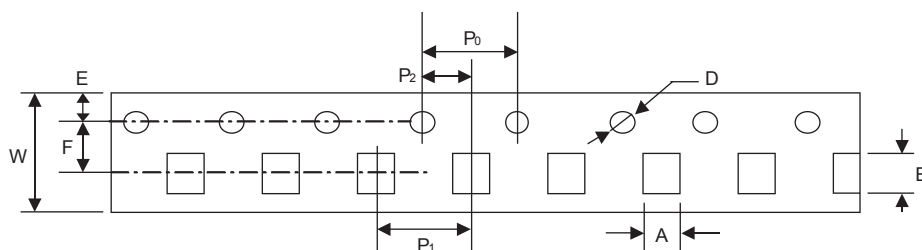
Maximum dissipation in percentage of rated power as a function of the ambient temperature for 0201.



Thick Film Chip Resistor

△ Tape and Reel Packaging

- Taping specs are according to EIA RS-481



Accumulated dimensional tolerance $40 \pm 0.2\text{mm}$

(unit: mm)

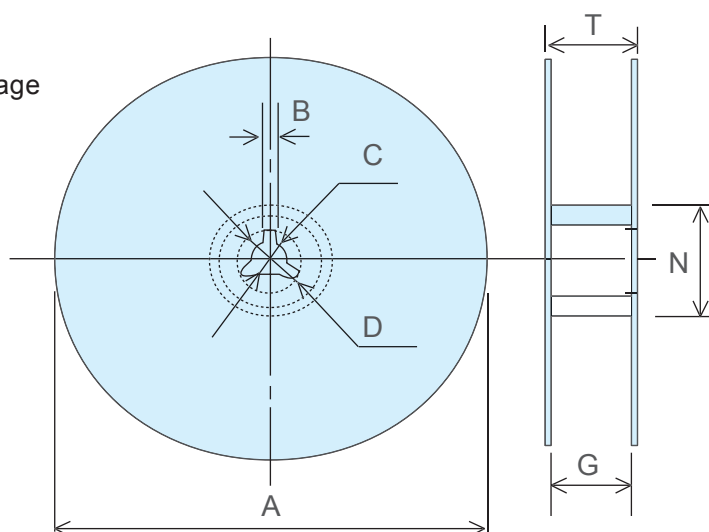
Size	A	B	W	F	E	P1	P2	P0	D
0201	0.40 ± 0.10	0.70 ± 0.10	8.00 ± 0.30	3.50 ± 0.05	1.75 ± 0.10	2.00 ± 0.10	2.00 ± 0.05	4.00 ± 0.10	$1.50 + 0.10 / -0$
0402	0.65 ± 0.10	1.15 ± 0.10	8.00 ± 0.30	3.50 ± 0.05	1.75 ± 0.10	2.00 ± 0.10	2.00 ± 0.05	4.00 ± 0.10	$1.50 + 0.10 / -0$
0603	1.10 ± 0.20	1.90 ± 0.20	8.00 ± 0.30	3.50 ± 0.05	1.75 ± 0.10	4.00 ± 0.10	2.00 ± 0.05	4.00 ± 0.10	$1.50 + 0.10 / -0$
0805	1.65 ± 0.20	2.40 ± 0.20	8.00 ± 0.30	3.50 ± 0.05	1.75 ± 0.10	4.00 ± 0.10	2.00 ± 0.05	4.00 ± 0.10	$1.50 + 0.10 / -0$
1206	2.00 ± 0.20	3.57 ± 0.20	8.00 ± 0.30	3.50 ± 0.05	1.75 ± 0.10	4.00 ± 0.10	2.00 ± 0.05	4.00 ± 0.10	$1.50 + 0.10 / -0$
2010	2.80 ± 0.20	5.50 ± 0.20	12.00 ± 0.30	5.50 ± 0.05	1.75 ± 0.10	4.00 ± 0.10	2.00 ± 0.05	4.00 ± 0.10	$1.50 + 0.10 / -0$
2512	3.50 ± 0.20	6.70 ± 0.20	12.00 ± 0.30	5.50 ± 0.05	1.75 ± 0.10	4.00 ± 0.10	2.00 ± 0.05	4.00 ± 0.10	$1.50 + 0.10 / -0$
1225	3.50 ± 0.20	6.70 ± 0.20	12.00 ± 0.30	5.50 ± 0.05	1.75 ± 0.10	4.00 ± 0.10	2.00 ± 0.05	4.00 ± 0.10	$1.50 + 0.10 / -0$



Thick Film Chip Resistor

△ Specifications

• Reel package



Size	Packaging Q'ty	A	N	C	D	B	G	T
0201, 0402	10Kpcs / Reel	178.0±2.0	60.0±0.5	13.0±0.5	20min	2.0±0.5	10.0±1.5	14.9 max.
	1Kpcs / Reel	100.0±0.5	52.0±0.5	13.0±0.5	20min	2.0±0.5	9.0±0.5	12.5 max.
0630 / 0805 1206	5Kpcs / Reel	178.0±2.0	60.0±0.5	13.0±0.5	20min	2.0±0.5	10.0±1.5	14.9 max.
	10Kpcs / Reel	254.0±2.0	100.0±1.0	13.5±0.5	20min	2.0±0.5	10.0±1.5	14.9 max.
	20Kpcs / Reel	330.0±2.0	100.0±1.0	13.5±0.5	20min	2.0±0.5	10.0±1.5	14.9 max.
2010 / 2512 1225	4Kpcs / Reel	178.0±2.0	60.0±0.5	13.0±0.5	20min	2.0±0.5	13.8±1.5	16.7 max.
	8Kpcs / Reel	250.0±2.0	60.0±0.5	13.5±0.5	20min	2.0±0.5	13.8±1.5	20.0 max.
	16Kpcs / Reel	330.0±2.0	60.0±0.5	13.5±0.5	20min	2.0±0.5	13.8±1.5	20.0 max.
(unit: mm)								



Thick Film Chip Resistor

△ Marking Table of 0603 ± 1% (Table 1)

Code	E48	E96	Code	E48	E96	Code	E48	E96	Code	E48	E96
01	100	100	25	178	178	49	316	316	73	562	562
02		102	26		182	50		324	74		576
03	105	105	27	187	187	51	332	332	75	590	590
04		107	28		191	52		340	76		604
05	110	110	29	196	196	53	348	348	77	619	619
06		113	30		200	54		357	78		634
07	115	115	31	205	205	55	365	365	79	649	649
08		118	32		210	56		374	80		665
09	121	121	33	215	215	57	383	383	81	681	681
10		124	34		221	58		392	82		698
11	127	127	35	226	226	59	402	402	83	715	715
12		130	36		232	60		412	84		732
13	133	133	37	237	237	61	422	422	85	750	750
14		137	38		243	62		432	86		768
15	140	140	39	249	249	63	442	442	87	787	787
16		143	40		255	64		453	88		806
17	147	147	41	261	261	65	464	464	89	825	825
18		150	42		267	66		475	90		845
19	154	154	43	274	274	67	487	487	91	866	866
20		158	44		280	68		499	92		887
21	162	162	45	287	287	69	511	511	93	909	909
22		165	46		294	70		523	94		931
24	169	169	47	301	301	71	536	536	95	953	953
		174	48		309	72		549	96		976

Code	A	B	C	D	E	F	G	H	X	Y	Z
Multiplier	10 ⁰	10 ¹	10 ²	10 ³	10 ⁴	10 ⁵	10 ⁶	10 ⁷	10 ⁻¹	10 ⁻²	10 ⁻³

△ Standard Resistance Value

E3	10				22				47								
E6	10		15		22		33		47		68						
E12	10	12	15	18	22	27	33	39	47	56	68	82					
E24	10	11	12	13	15	16	18	20	22	24	27	30	33	36	39	43	47
	51	56	62	68	75	82	91										
E96	100	102	105	107	110	113	115	118	121	124	127	130	133	137	140	143	147
	150	154	158	162	165	169	174	178	182	187	191	196	200	205	210	215	221
	226	232	237	243	249	255	261	267	274	280	287	294	301	309	316	324	332
	340	348	357	365	374	383	392	402	412	422	432	442	453	464	475	487	499
	511	523	536	549	562	576	590	604	619	634	649	665	681	698	715	732	750
	768	787	806	825	845	866	887	909	931	953	976						



General Glass/Silicon Rectifiers Type PR - Surface Mount

Δ Specifications

Operating and Storage Temperature -55°C to +150°C

TYPE	Maximum Peak Reverse Voltage	Maximum Rectified Current @ Half-Wave Resistive Load 60Hz		Maximum Forward Peak Surge Current @ 8.3mS Superimposed	Maximum Reverse Current @ PRV @25°C T _A	Maximum Forward Voltage @25°C T _A	
	PRV	I _O @T _A		I _{FM} (Surge)	I _R	I _{FM}	V _{FM}
	V _{PK}	A _{AV}	°C	A _{PK}	μA _{dc}	A _{PK}	V _{PK}

1.0 AMPERES/SMA

S1A	50	1.0	75	30	5.0	1.0	1.1
S1B	100	1.0	75	30	5.0	1.0	1.1
S1D	200	1.0	75	30	5.0	1.0	1.1
S1G	400	1.0	75	30	5.0	1.0	1.1
S1J	600	1.0	75	30	5.0	1.0	1.1
S1K	800	1.0	75	30	5.0	1.0	1.1
S1M	1000	1.0	75	30	5.0	1.0	1.1

2.0AMPERES/SMB

S2A	50	2.0	70	70	5.0	2.0	1.0
S2B	100	2.0	70	70	5.0	2.0	1.0
S2D	200	2.0	70	70	5.0	2.0	1.0
S2G	400	2.0	70	70	5.0	2.0	1.0
S2J	600	2.0	70	70	5.0	2.0	1.0
S2K	800	2.0	70	70	5.0	2.0	1.0
S2M	1000	2.0	70	70	5.0	2.0	1.0



General Glass/Silicon Rectifiers
Type PR - Surface Mount

Δ Specifications

Operating and Storage Temperature -55°C to +150°C

TYPE	Maximum Peak Reverse Voltage	Maximum Rectified Current @ Half-Wave Resistive Load 60Hz		Maximum Forward Peak Surge Current @ 8.3mS Superimposed	Maximum Reverse Current @ PRV @25°C T _A	Maximum Forward Voltage @25°C T _A	
	PRV	I _O @T _A		I _{FM} (Surge)	I _R	I _{FM}	V _{FM}
	V _{PK}	A _{AV}	°C	A _{PK}	μA _{dc}	A _{PK}	V _{PK}

3.0 AMPERES/SMC

S3AB	50	3.0	50	200	5.0	3.0	1.2
S3BB	100	3.0	50	200	5.0	3.0	1.2
S3DB	200	3.0	50	200	5.0	3.0	1.2
S3GB	400	3.0	50	200	5.0	3.0	1.2
S3JB	600	3.0	50	200	5.0	3.0	1.2
S3KB	800	3.0	50	200	5.0	3.0	1.2
S3MB	1000	3.0	50	200	5.0	3.0	1.2

3.0AMPERES/SMD

S3A	50	3.0	50	200	5.0	3.0	1.2
S3B	100	3.0	50	200	5.0	3.0	1.2
S3D	200	3.0	50	200	5.0	3.0	1.2
S3G	400	3.0	50	200	5.0	3.0	1.2
S3J	600	3.0	50	200	5.0	3.0	1.2
S3K	800	3.0	50	200	5.0	3.0	1.2
S3M	1000	3.0	50	200	5.0	3.0	1.2



Glass/Silicon Passivated Rectifiers

Type PR - Series S1

Reverse Voltage - 50 to 1000 Volts

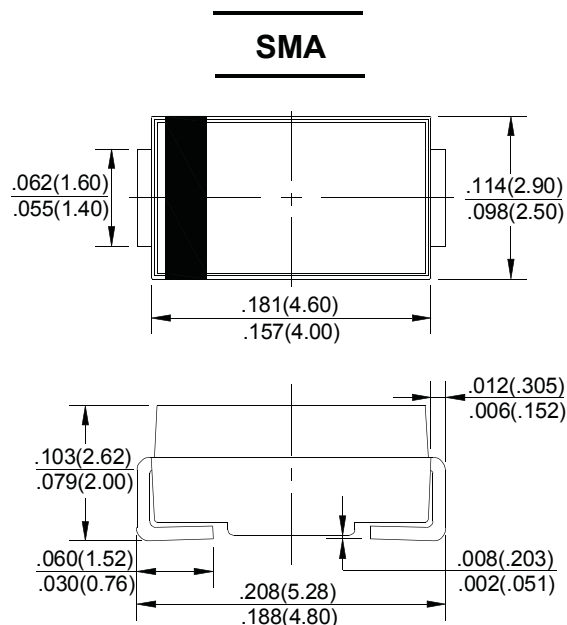
Forward Current - 1.0 Amperes

△ Features

- Glass/Silicon Passivated Chip
- For surface mounted applications
- Low forward voltage drop
- Low reverse leakage current
- High current capability
- The plastic material carries UL flammability classification 94V-0

△ Mechanical Data

- Case: Molded plastic
- Polarity: Indicated by cathode band
- Weight: 0.002 ounces , 0.064 grams
- Mounting position: Any



△ Maximum Ratings and Electrical Characteristics

Ratings at 25°C ambient temperature unless otherwise specified.

Single phase, half wave, 60Hz, resistive or inductive load.

For capacitance load, derate current by 20%

Dimensions in inches and (millimeters)

CHARACTERISTICS	SYMBOL	S1A	S1B	S1D	S1G	S1J	S1K	S1M	UNIT
Maximum Recurrent Peak Reverse Voltage	V _{RRM}	50	100	200	400	600	800	1000	V
Maximum RMS Voltage	V _{RMS}	35	70	140	280	420	560	700	V
Maximum DC Blocking Voltage	V _{DC}	50	100	200	400	600	800	1000	V
Maximum Average Forward Rectified Current @T _L =100 °C	I _(AV)	1.0							A
Peak Forward Surge Current 8.3ms Single Half Sine-Wave Super Imposed On Rated Load (JEDEC Method)	I _{FSM}	30							A
Maximum Forward Voltage at 1.0A DC	V _F	1.1							V
Maximum DC Reverse Current @T _J =25°C	I _R	5.0							uA
at Rated DC Blocking Voltage @T _J =100°C		100							
Typical Junction Capacitance (Note1)	C _J	10							pF
Typical Thermal Resistance (Note2)	R _{θJC}	30							°C/W
Operating Temperature Range	T _J	-55 to +150							°C
Storage Temperature Range	T _{STG}	-55 to +150							°C

NOTES:1.Measured at 1.0 MHz and applied reverse voltage of 4.0V DC.

2.Thermal resistance junction to lead.



Glass/Silicon Passivated Rectifiers Type PR - Series S1

Δ Rating and Characteristics Curves

FIG. 1 - FORWARD CURRENT DERATING CURVE

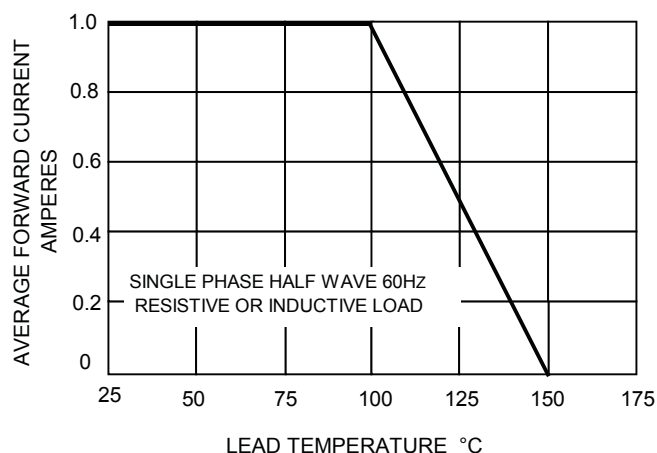


FIG.2 - MAXIMUM NON-REPETITIVE
SURGE CURRENT

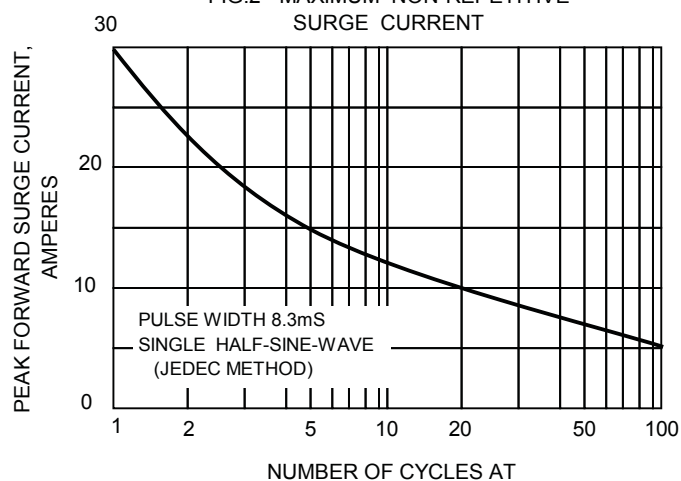


FIG.3-TYPICAL FORWARD CHARACTERISTICS

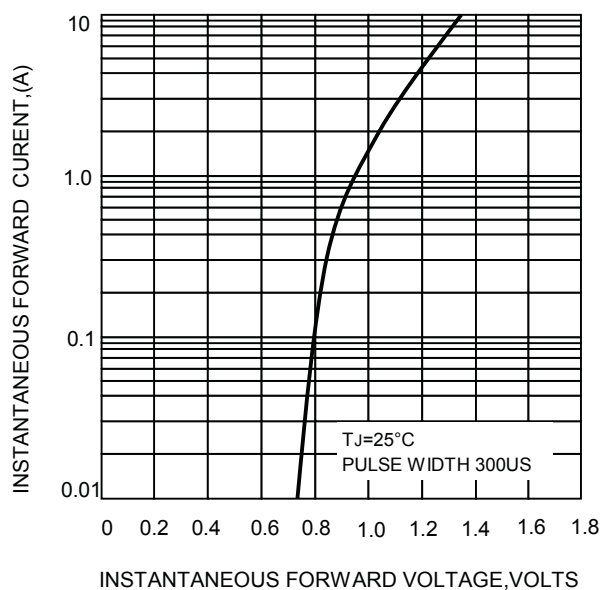
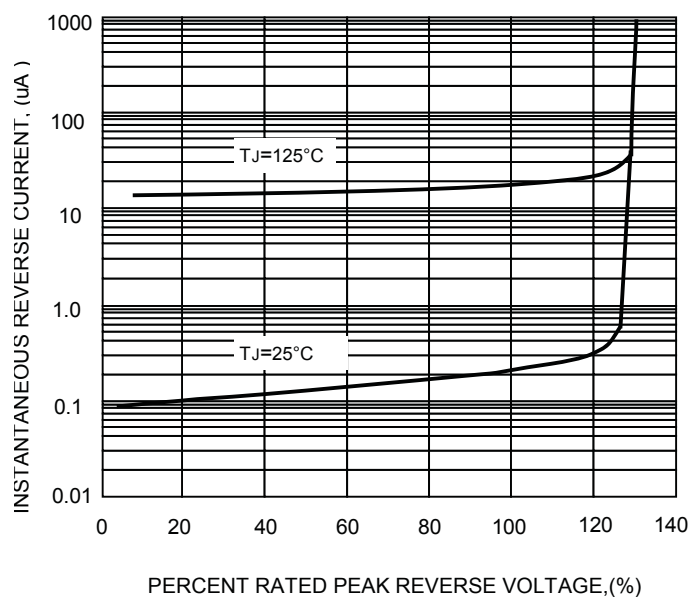


FIG.4-TYPICAL REVERSE CHARACTERISTICS





Glass/Silicon Passivated Rectifiers

Type PR - S2A Thru S2M

Reverse Voltage - 50 to 1000 Volts

Forward Current - 2.0 Amperes

Δ Features

- Glass/Silicon Passivated Chip
- For surface mounted applications
- Low forward voltage drop
- Low reverse leakage current
- High current capability
- The plastic material carries UL flammability classification 94V-0

Δ Mechanical Data

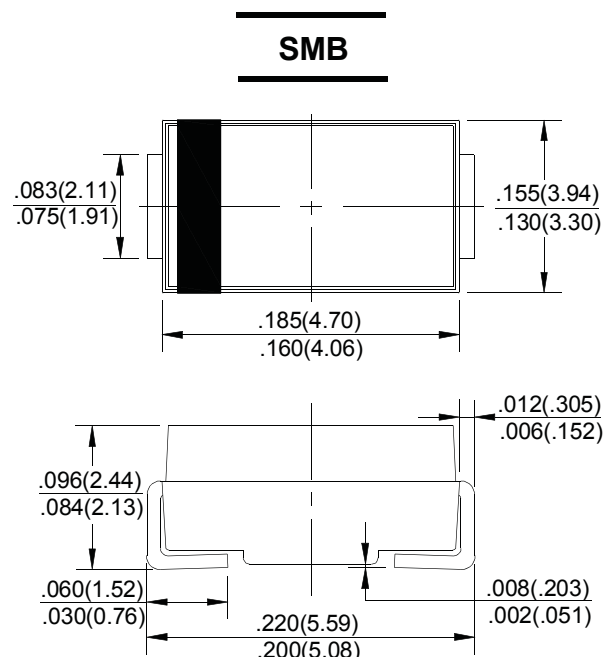
- Case: Molded plastic
- Polarity: Indicated by cathode band
- Weight: 0.002 ounces , 0.064 grams
- Mounting position: Any

Δ Maximum Ratings and Electrical Characteristics

Ratings at 25°C ambient temperature unless otherwise specified.

Single phase, half wave, 60Hz, resistive or inductive load.

For capacitance load, derate current by 20%



Dimensions in inches and (millimeters)

CHARACTERISTICS	SYMBOL	S2A	S2B	S2D	S2G	S2J	S2K	S2M	UNIT
Maximum Recurrent Peak Reverse Voltage	VRRM	50	100	200	400	600	800	1000	V
Maximum RMS Voltage	VRMS	35	70	140	280	420	560	700	V
Maximum DC Blocking Voltage	VDC	50	100	200	400	600	800	1000	V
Maximum Average Forward Rectified Current @TL=100°C	l(AV)	2.0							A
Peak Forward Surge Current 8.3ms Single Half Sine-Wave Super Imposed On Rated Load (JEDEC Method)	lFSM	70							A
Maximum Forward Voltage at 2.0A DC	VF	1.0							V
Maximum DC Reverse Current @TJ=25°C	IR	5.0							uA
at Rated DC Blocking Voltage @TJ=100°C		125							
Typical Junction Capacitance (Note1)	CJ	20							pF
Typical Thermal Resistance (Note2)	RθJL	20							°C /W
Operating Temperature Range	TJ	-55 to +150							°C
Storage Temperature Range	TSTG	-55 to +150							°C

NOTES:1.Measured at 1.0 MHz and applied reverse voltage of 4.0V DC.

2.Thermal resistance junction to lead.



Glass/Silicon Passivated Rectifiers

Type PR - S2A Thru S2M

Δ Rating and Characteristics Curves

FIG. 1 – FORWARD CURRENT DERATING

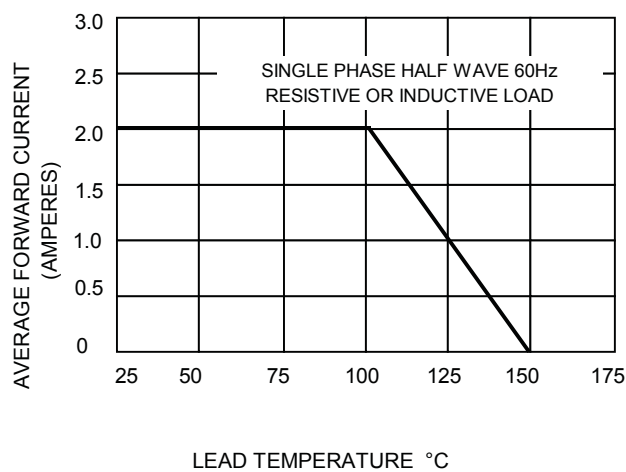


FIG. 2 – MAXIMUM NON-REPETITIVE SURGE CURRENT

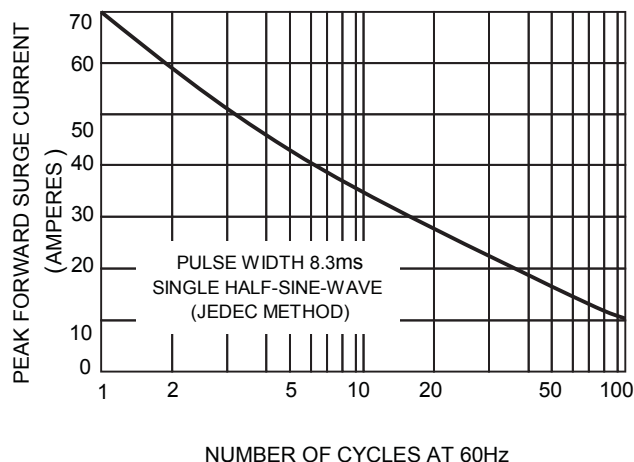


FIG.3-TYPICAL FORWARD CHARACTERISTICS

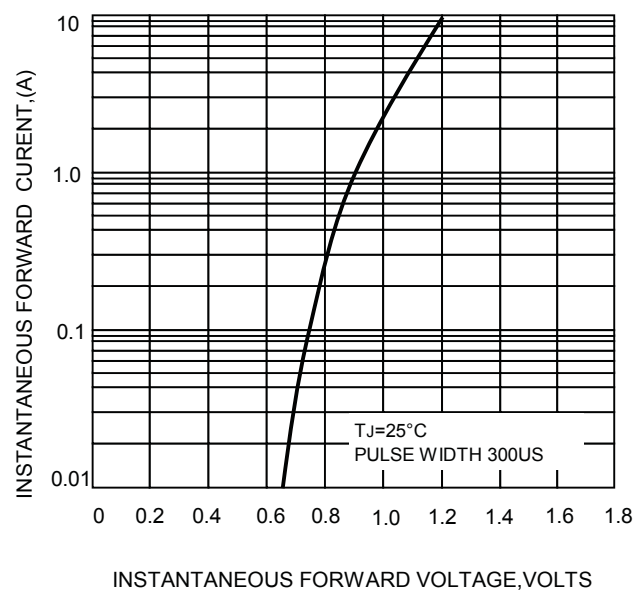
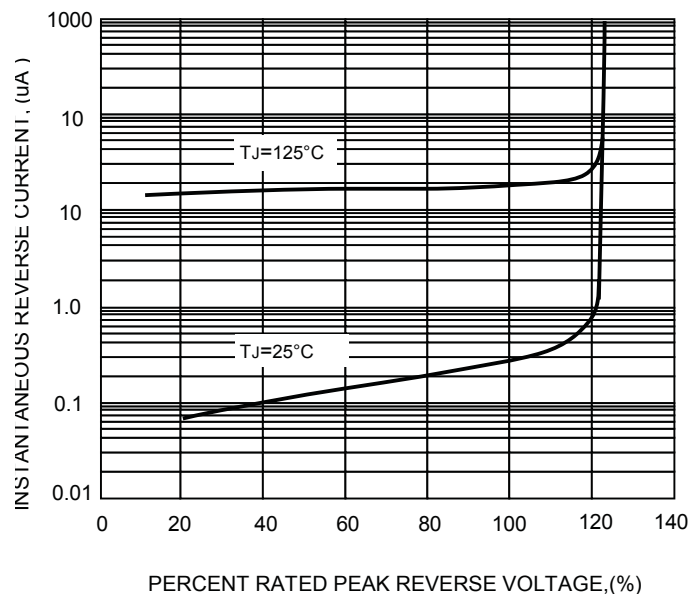


FIG.4-TYPICAL REVERSE CHARACTERISTICS





Glass/Silicon Passivated Rectifiers
Type PR - SM3AB Thru SM3MB
Reverse Voltage - 50 to 1000 Volts
Forward Current - 3.0 Amperes

Δ Features

- Glass/Silicon Passivated Chip
- For surface mounted applications
- Low forward voltage drop
- Low reverse leakage current
- High current capability
- The plastic material carries UL flammability classification 94V-0

Δ Mechanical Data

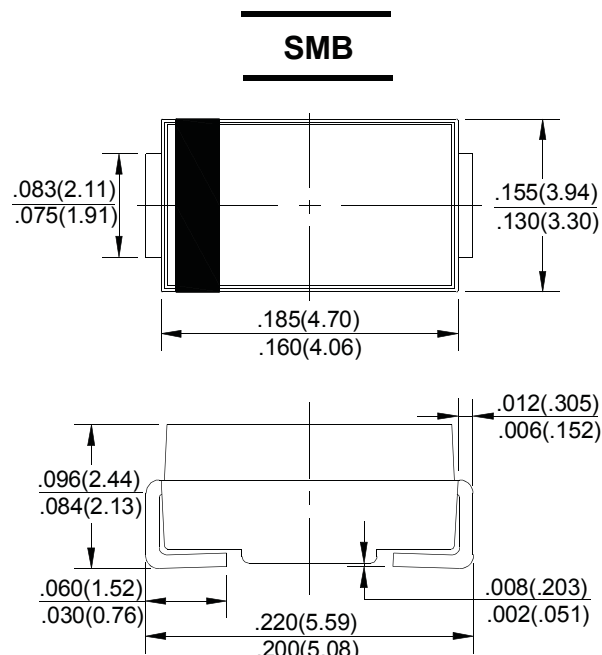
- Case: Molded plastic
- Polarity: Indicated by cathode band
- Weight: 0.002 ounces , 0.064 grams
- Mounting position: Any

Δ Maximum Ratings and Electrical Characteristics

Ratings at 25°C ambient temperature unless otherwise specified.

Single phase, half wave, 60Hz, resistive or inductive load.

For capacitance load, derate current by 20%



Dimensions in inches and (millimeters)

CHARACTERISTICS	SYMBOL	S3AB	S3BB	S3DB	S3GB	S3JB	S3KB	S3MB	UNIT
Maximum Recurrent Peak Reverse Voltage	V _{RRM}	50	100	200	400	600	800	1000	V
Maximum RMS Voltage	V _{RMS}	35	70	140	280	420	560	700	V
Maximum DC Blocking Voltage	V _{DC}	50	100	200	400	600	800	1000	V
Maximum Average Forward Rectified Current @T _L =75°C	I _(AV)	3.0							A
Peak Forward Surge Current 8.3ms Single Half Sine-Wave Super Imposed On Rated Load (JEDEC Method)	I _{FSM}	200							A
Maximum Forward Voltage at 3.0A DC	V _F	1.2							V
Maximum DC Reverse Current @T _J =25°C at Rated DC Blocking Voltage @T _J =100°C	I _R	5.0 250							uA
Typical Junction Capacitance (Note1)	C _J	40							pF
Typical Thermal Resistance (Note2)	R _{θJL}	10							°C /W
Typical Thermal Resistance (Note3)	R _{θJA}	50							°C /W
Operating Temperature Range	T _J	-55 to +150							°C
Storage Temperature Range	T _{STG}	-55 to +150							°C

NOTES:1.Measured at 1.0 MHz and applied reverse voltage of 4.0V DC.

2.Thermal resistance junction to lead.

3.Thermal resistance junction to ambient.



Glass/Silicon Passivated Rectifiers

Type

PR

SM3AB Thru SM3MB

Glass/Silicon Passivated Rectifiers

Type PR - SM3AB Thru SM3MB

Δ Rating and Characteristics Curves

FIG. 1 - FORWARD CURRENT DERATING CURVE

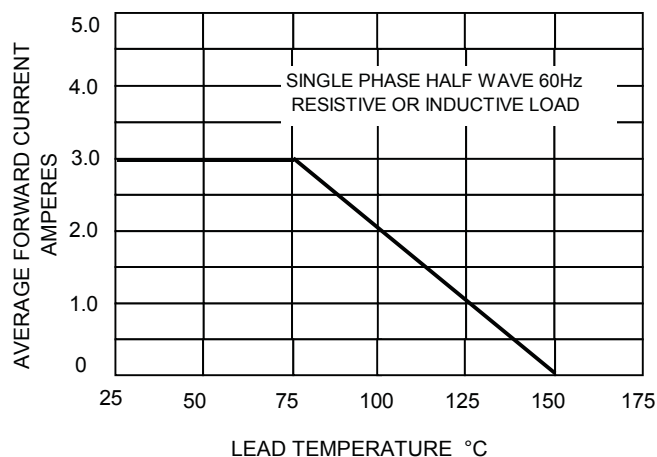


FIG.2 - MAXIMUM NON-REPETITIVE SURGE CURRENT

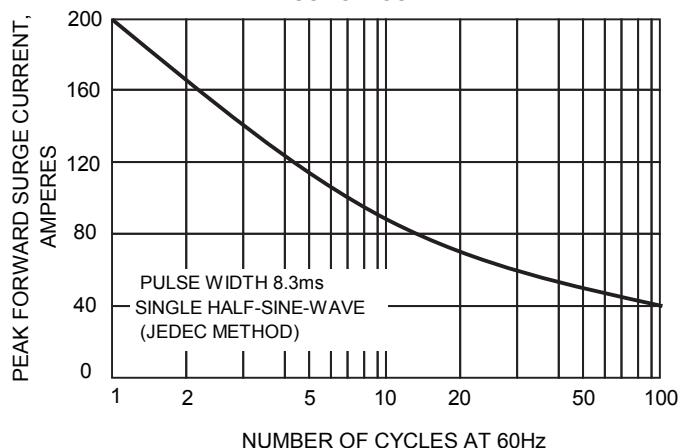


FIG.3-TYPICAL FORWARD CHARACTERISTICS

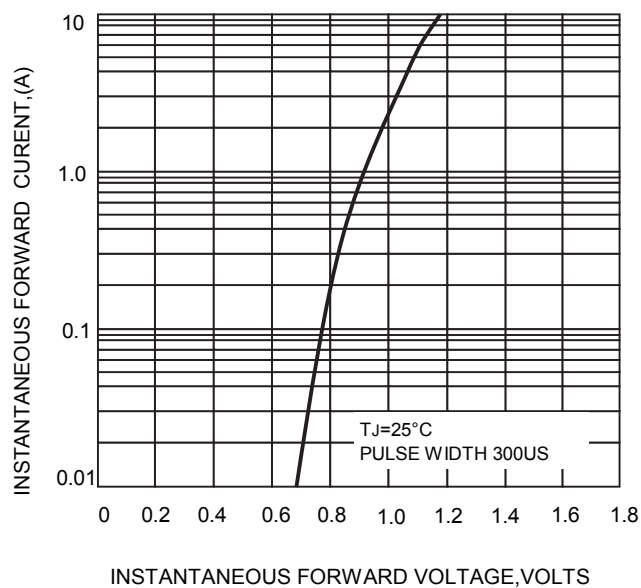
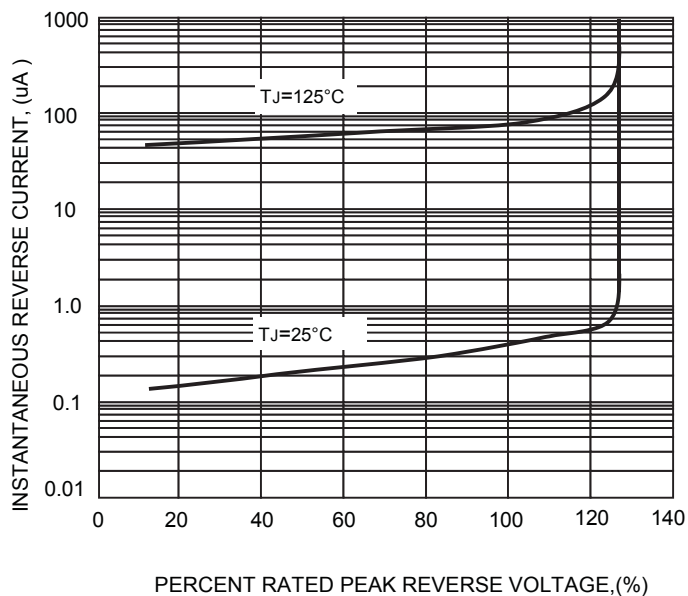


FIG.4-TYPICAL REVERSE CHARACTERISTICS





Glass/Silicon Passivated Rectifiers

Type PR - S3A Thru S3M

Reverse Voltage - 50 to 1000 Volts

Forward Current - 3.0 Amperes

Δ Features

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- For surface mounted applications
- Low forward voltage drop
- Low reverse leakage current
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- The plastic material carries UL flammability classification 94V-0

Δ Mechanical Data

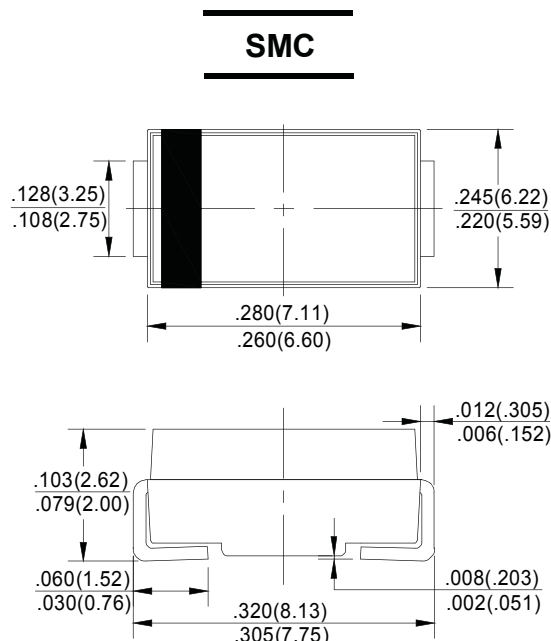
- Case: Molded plastic
- Polarity: Indicated by cathode band
- Weight: 0.002 ounces , 0.064 grams
- Mounting position: Any

Δ Maximum Ratings and Electrical Characteristics

Ratings at 25°C ambient temperature unless otherwise specified.

Single phase, half wave, 60Hz, resistive or inductive load.

For capacitance load, derate current by 20%



Dimensions in inches and (millimeters)

CHARACTERISTICS	SYMBOL	S3A	S3B	S3D	S3G	S3J	S3K	S3M	UNIT
Maximum Recurrent Peak Reverse Voltage	V _{RRM}	50	100	200	400	600	800	1000	V
Maximum RMS Voltage	V _{RMS}	35	70	140	280	420	560	700	V
Maximum DC Blocking Voltage	V _{DC}	50	100	200	400	600	800	1000	V
Maximum Average Forward Rectified Current @T _L =75°C	I _(AV)	3.0							A
Peak Forward Surge Current 8.3ms Single Half Sine-Wave Super Imposed On Rated Load (JEDEC Method)	I _{FSM}	200							A
Maximum Forward Voltage at 3.0A DC	V _F	1.2							V
Maximum DC Reverse Current @T _J =25°C at Rated DC Blocking Voltage @T _J =100°C	I _R	5.0 250							uA
Typical Junction Capacitance (Note1)	C _J	40							pF
Typical Thermal Resistance (Note2)	R _{θJL}	10							°C/W
Typical Thermal Resistance (Note3)	R _{θJA}	50							°C/W
Operating Temperature Range	T _J	-55 to +150							°C
Storage Temperature Range	T _{STG}	-55 to +150							°C

NOTES:1.Measured at 1.0 MHz and applied reverse voltage of 4.0V DC.

2.Thermal resistance junction to lead.

3.Thermal resistance junction to ambient.



Glass/Silicon Passivated Rectifiers

Type PR - S3A Thru S3M

Δ Rating and Characteristics Curves

FIG. 1 - FORWARD CURRENT DERATING CURVE

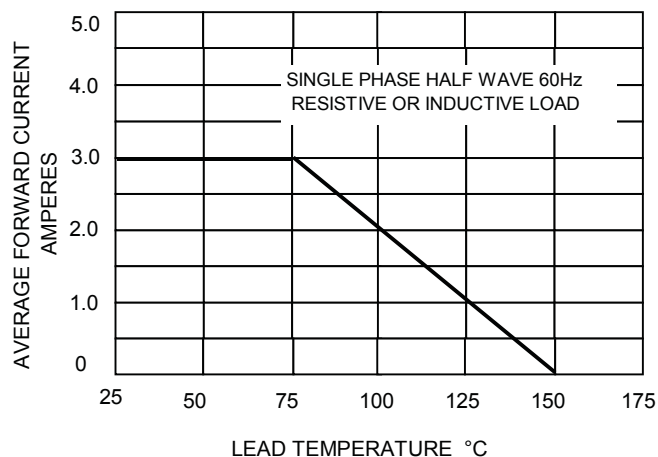


FIG. 2 - MAXIMUM NON-REPETITIVE SURGE CURRENT

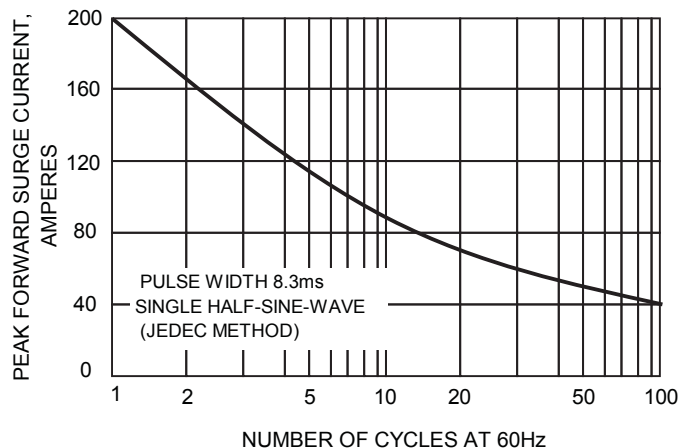


FIG. 3 - TYPICAL FORWARD CHARACTERISTICS

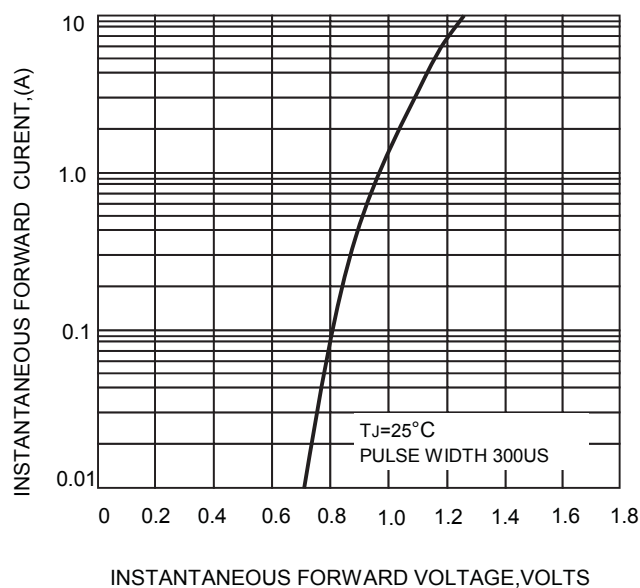


FIG. 4 - TYPICAL REVERSE CHARACTERISTICS

