FrelTec GmbH

Mathildenstr. 10A
82319 Starnberg
Germany

MELF Metal Film Resistors

MELF Metal Film Resistors

SPECIFICATION

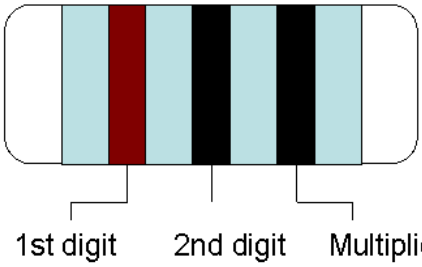
Part Number

057		24*		_ _ _ _		E*		J*		E03*		D*
Type		Size		Value		Power Rating		Tolerance		Packing Type		TCR
						Code : Watt						
057 : MELF Metal Film Resistors		12 : 0102 2,2x1,1		The last digit is the multiplier which denotes the number of zero following		D: 1/8W		B : ±0,1%		E03 : 3000pcs 0102 and 0204 size (7")		B : ±10ppm/°C
		24 : 0204 3,5x1,4		0000 = 0Ohm		S: 1/5W		C : ±0,25%		E02 : 2000pcs 0207 size (7")		C : ±15ppm/°C
		27 : 0207 5,9x2,2		R = Decimal		E: 1/4W		D : ±0,5%				D : ±25ppm/°C
				Example: R010 = 0,01Ohm		V: 0,3W		F : ±1%				E : ±50ppm/°C
				97R6= 97,6Ohm		F: 2/5W		J : ±5%				F : ±100ppm/°C
				9760 = 976Ohm		H: 1/2W						
				1001 = 1kOhm		J: 1W						* not all combination is possible

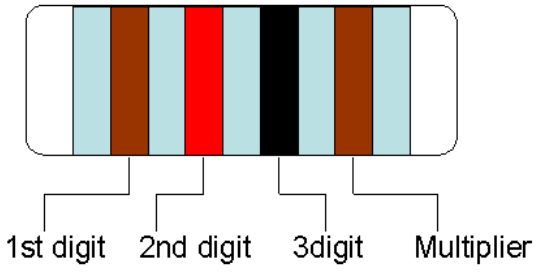
All products according to RoHS (2011/65/EU)

MELF Metal Film Resistors

Marking & Resistance Tolerance



±5%	E-24	1,0	1,1	1,2	1,3	1,5	1,6	1,8	2,0	2,2	2,4	2,7	3,0	3,3	3,6	3,9	4,3	4,7	5,1	5,6	6,2	6,8	7,5	8,2	9,1



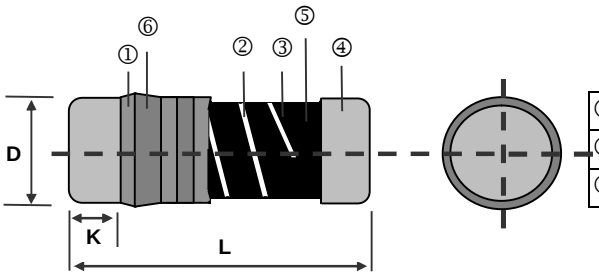
±1%	E-96	1,00	1,02	1,05	1,07	1,10	1,13	1,15	1,18	1,21	1,24	1,27	1,30	1,33	1,37	1,40	1,43	1,47	1,50	1,54	1,58	1,62	1,65	1,69	1,74
		1,78	1,82	1,87	1,91	1,96	2,00	2,05	2,10	2,15	2,21	2,26	2,32	2,37	2,43	2,49	2,55	2,61	2,67	2,74	2,80	2,87	2,94	3,01	3,09
		3,16	3,24	3,32	3,40	3,48	3,57	3,65	3,74	3,83	3,92	4,02	4,12	4,22	4,32	4,42	4,53	4,64	4,75	4,87	4,99	5,11	5,23	5,36	5,49
		5,62	5,76	5,90	6,04	6,19	6,34	6,49	6,65	6,81	6,98	7,15	7,32	7,50	7,68	7,87	8,06	8,25	8,45	8,66	8,87	9,09	9,31	9,53	9,76
±0,50% ±0,25% ±0,10%	E-192	10,0	10,1	10,2	10,4	10,5	10,6	10,7	10,9	11,0	11,1	11,3	11,4	11,5	11,7	11,8	12,0	12,1	12,3	12,4	12,6	12,7	12,9	13,0	13,2
		13,3	13,5	13,7	13,8	14,0	14,2	14,3	14,5	14,7	14,9	15,0	15,2	15,4	15,6	15,8	16,0	16,2	16,4	16,5	16,7	16,9	17,2	17,4	17,6
		17,8	18,0	18,2	18,4	18,7	18,9	19,1	19,3	19,6	19,8	20,0	20,3	20,5	20,8	21,0	21,3	21,5	21,8	22,1	22,3	22,6	22,9	23,2	23,4
		23,7	24,0	24,3	24,6	24,9	25,2	25,5	25,8	26,1	26,4	26,7	27,1	27,4	27,7	28,0	28,4	28,7	29,1	29,4	29,8	30,1	30,5	30,9	31,2
		31,6	32,0	32,4	32,8	33,2	33,6	34,0	34,4	34,8	35,2	35,7	36,1	36,5	37,0	37,4	37,9	38,3	38,8	39,2	39,7	40,2	40,7	41,2	41,7
		42,2	42,7	43,2	43,7	44,2	44,8	45,3	45,9	46,4	47,0	47,5	48,1	48,7	49,3	49,9	50,5	51,1	51,7	52,3	53,0	53,6	54,2	54,9	55,6
		56,2	56,9	57,6	58,3	59,0	59,7	60,4	61,2	61,9	62,6	63,4	64,2	64,9	65,7	66,5	67,3	68,1	69,0	69,8	70,6	71,5	72,3	73,2	74,1
		75,0	75,9	76,8	77,7	78,7	79,6	80,6	81,6	82,5	83,5	84,5	85,6	86,6	87,6	88,7	89,8	90,9	92,0	93,1	94,2	95,3	96,5	97,6	98,8

Color	Digit	Multiplier
Silver	-	10^{-2}
Gold	-	10^{-1}
Black	0	10^{0}
Brown	1	10^{1}
Red	2	10^{2}
Orange	3	10^{3}
Yellow	4	10^{4}
Green	5	10^{5}
Blue	6	10^{6}
Violet	7	10^{7}
Grey	8	10^{8}
White	9	10^{9}

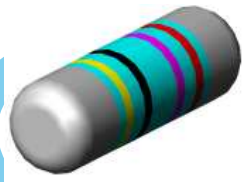
Resistance more than two significant figures (<1Ohm) or more than three significant figures (>1Ohm) will not provide color code

MELF Metal Film Resistors

Construction



①	Insulation Coating	④	Electrode Cap
②	Trimming Line	⑤	Resistor Layer
③	Ceramic Rod	⑥	Marking



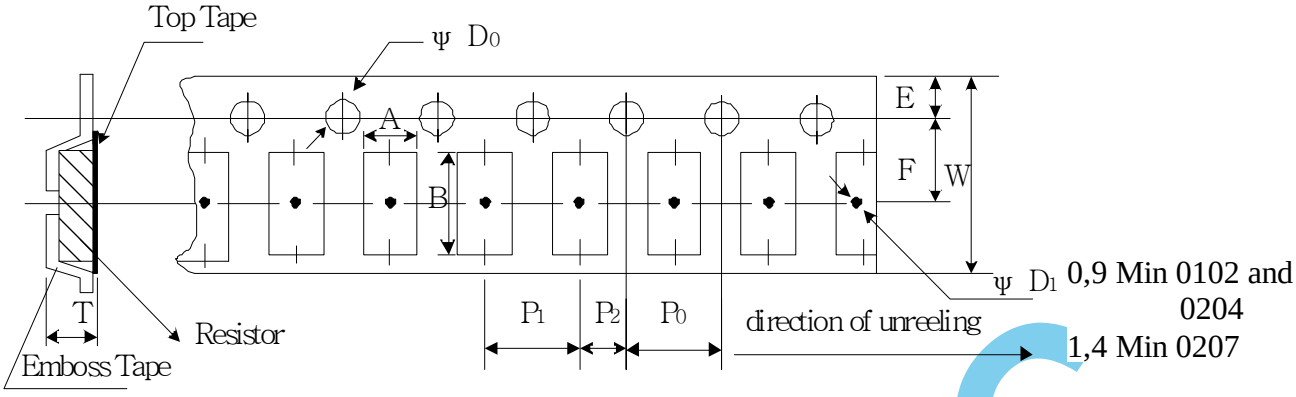
Dimensions

Type	L	ΦD	K min.
0102	2,20±0,10	1,10±0,10	0,450,05
0204	3,50±0,20	1,40±0,15	0,8±0,1
0207	5,90±0,20	2,20±0,20	1,3±0,1

Unit: mm

MELF Metal Film Resistors

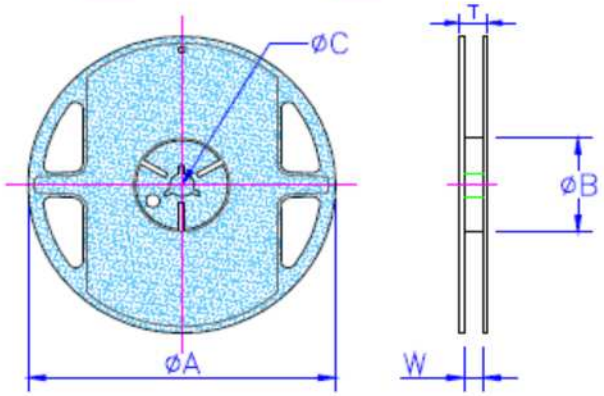
Packing



Type	A	B	W	E	F	P_0	P_1	P_2	ΦD_0	T
0102	1,30±0,10	2,40±0,10	8,0±0,10	1,75±0,10	3,50±0,05	4,00±0,10	4,00±0,10	2,00±0,05	1,50+0,10	1,50±0,10
0204	1,55±0,10	3,65±0,10	8,0±0,10	1,75±0,10	3,50±0,05	4,00±0,10	4,00±0,10	2,00±0,05	1,50+0,10	1,80±0,10
0207	2,40±0,10	6,15±0,10	12,0±0,10	1,75±0,10	5,50±0,05	4,00±0,10	4,00±0,10	2,00±0,05	1,50+0,10	2,70±0,10

Unit: mm

Tape in Reel packing:



Type	ΦA	ΦB	ΦC	W	T
0102	178,5±1,5	60,0+1,0	13,0±0,2	9,0±0,5	12,5±0,5
0204	178,5±1,5	60,0+1,0	13,0±0,2	9,0±0,5	12,5±0,5
0207	178,5±1,5	60,0+1,0	13,0±0,5	13,0±0,5	15,5±0,5

unit mm

Stock period

The performance of these products, including the solderability, is guaranteed for 12 month after production date code, provided that they remain packed as they were when delivered and stored at a temperature 15 to 28°C and a relative humidity less than 80%RH

MELF Metal Film Resistors

Specification

Item / Type	Power Rating at 70˚C	Operating Temp. Range	Max. Operating Voltage	Max. Overload Voltage	Resistance Range ±0,1% E24, E96 *	±0,25% E24, E96 *	±0,5% E24, E96 *	±1% E24, E96 *	±5% E24	TCR (PPM/˚C)
0102	1/8W	-55 ~ +155°C	150V	300V	100Ω-56kΩ					±15
					100Ω-82kΩ		49,9Ω-200kΩ	49,9Ω-390kΩ	-	±25
					-		8,2Ω-1MΩ			±50
					-			40Ω-1MΩ		±100
	Jumper 2A				-				0Ω (<15mΩ)	-
0204	1/4W	-55 ~ +155°C	200V	400V	49,9Ω-20kΩ					±10
					10Ω-300kΩ					±15
					10Ω-1MΩ		10Ω-3,4MΩ	1Ω-3,4MΩ		±25
					10Ω-1MΩ	1Ω-1MΩ	1Ω-3,4MΩ	0,2Ω-3,4MΩ		±50
					-			0,1Ω-1MΩ		±100
	Jumper 2A				-				0Ω (<15mΩ)	-
0207	1/2W	-55 ~ +155°C	300V	600V	49,9Ω-20KΩ					±10
					10Ω-300KΩ					±15
					10Ω-1MΩ		10Ω-3,4MΩ	1Ω-3,4MΩ		±25
					10Ω-1MΩ	1Ω-1MΩ	1Ω-3,4MΩ	0,2Ω-3,4MΩ		±50
					-			0,1Ω-1MΩ		±100
	Jumper 4A				-				0Ω (<15mΩ)	-

High Power Rating Electrical Specifications

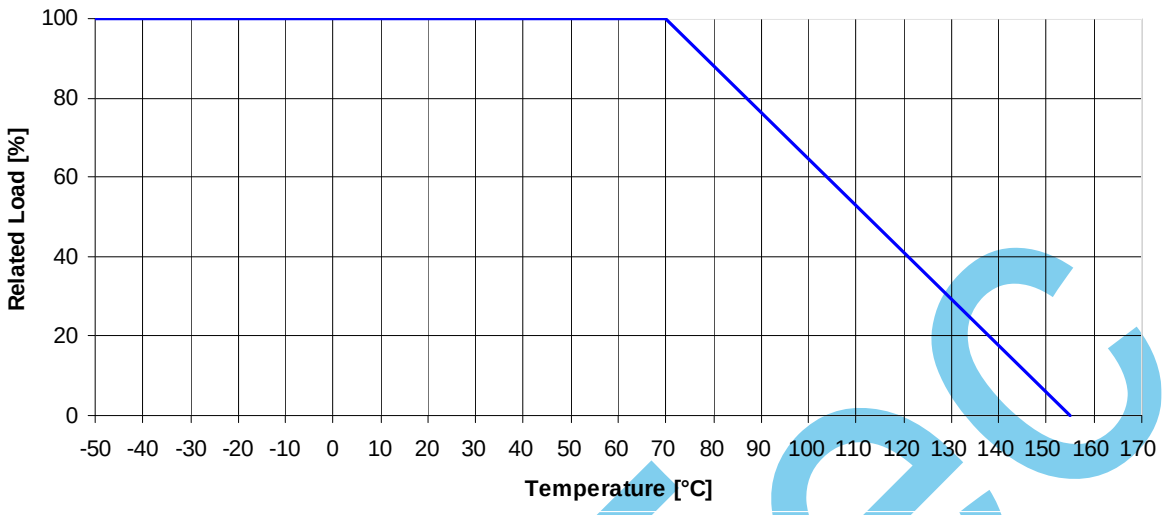
Item / Type	Power Rating at 70°C	Operating Temp. Range	Max. Operating Voltage	Max. Overload Voltage	Resistance Range ±0,1% E24, E96 *	±0,25% E24, E96 *	±0,5% E24, E96 *	±1% E24, E96 *	±5% E24	TCR (PPM/˚C)
0102	1/5W	-55 ~ +155°C	150V	300V	100Ω-56kΩ					±15
					-	100Ω – 82kΩ	49,9Ω – 200kΩ	49,9Ω – 390kΩ	-	±25
	0,3W				-		8,2Ω - 1MΩ			±50
					-			40Ω – 1MΩ		±100
0204	2/5W	-55 ~ +155°C	200V	400V	10Ω-300kΩ					±15
					10Ω - 1MΩ		10Ω – 3,4MΩ	1Ω – 3,4MΩ		±25
					10Ω-1MΩ	1Ω - 1MΩ	1Ω – 3,4MΩ	0,2Ω – 3,4MΩ		±50
					-			0,1Ω – 1MΩ		±100
0207	1W	-55 ~ +155°C	350V	700V	10Ω-300kΩ					±15
					10Ω - 1MΩ		10Ω – 3,4MΩ	1Ω – 3,4MΩ		±25
					10Ω-1MΩ	1Ω - 1MΩ	1Ω – 3,4MΩ	0,2Ω – 3,4MΩ		±50
					-			0,1Ω – 1MΩ		±100

***** E192 please check with sales

Operating Voltage $=\sqrt{P/R}$ or Max. Operating Voltage listed above, whichever is lower

Overload Voltage $=2{,}5\sqrt{P/R}$ or Max. Overload Voltage listed above, whichever is lower

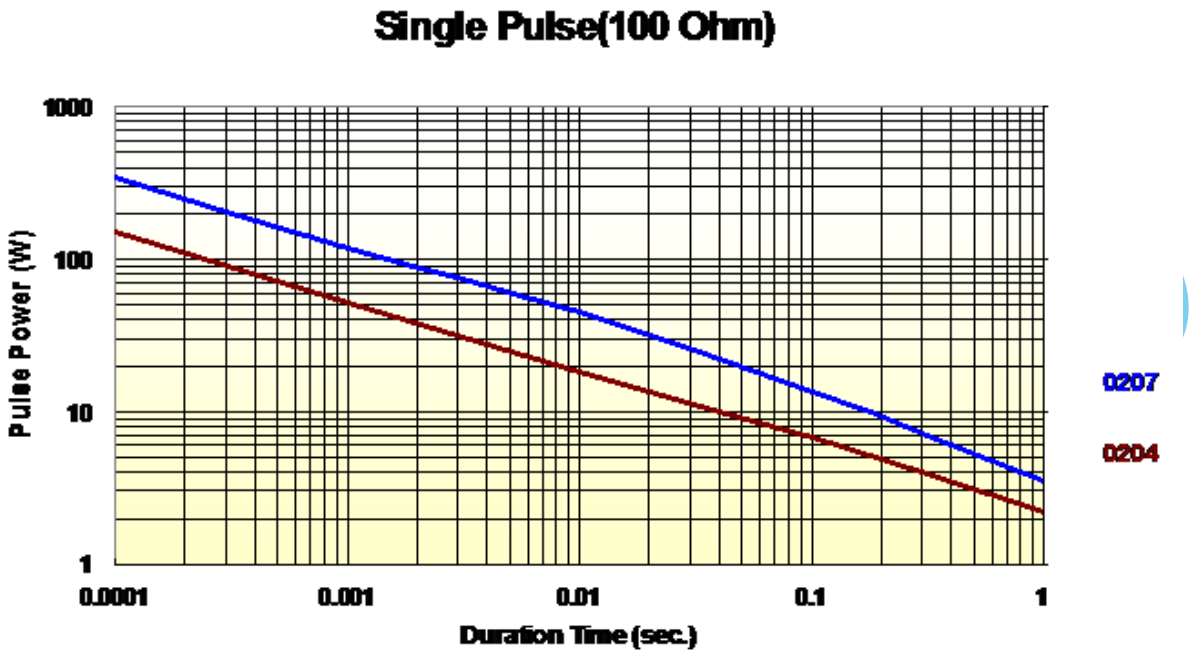
Power rating:

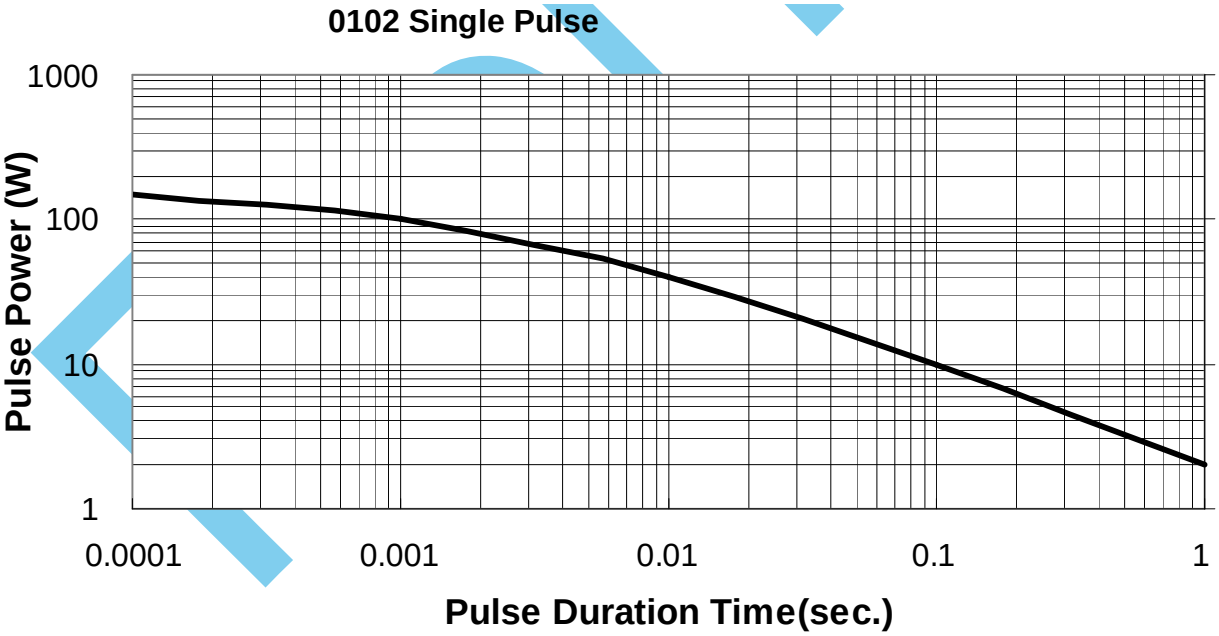


$$RCWV = \sqrt{R \bullet P}$$

Pulse withstanding capacity

The single impulse graph is the result of 50 impulses of rectangular shape applied at one-minute intervals. The limit of acceptance was a shift in resistance of less than 1% from the initial value. The power applied was subject to the restrictions of the maximum permissible impulse voltage graph shown.

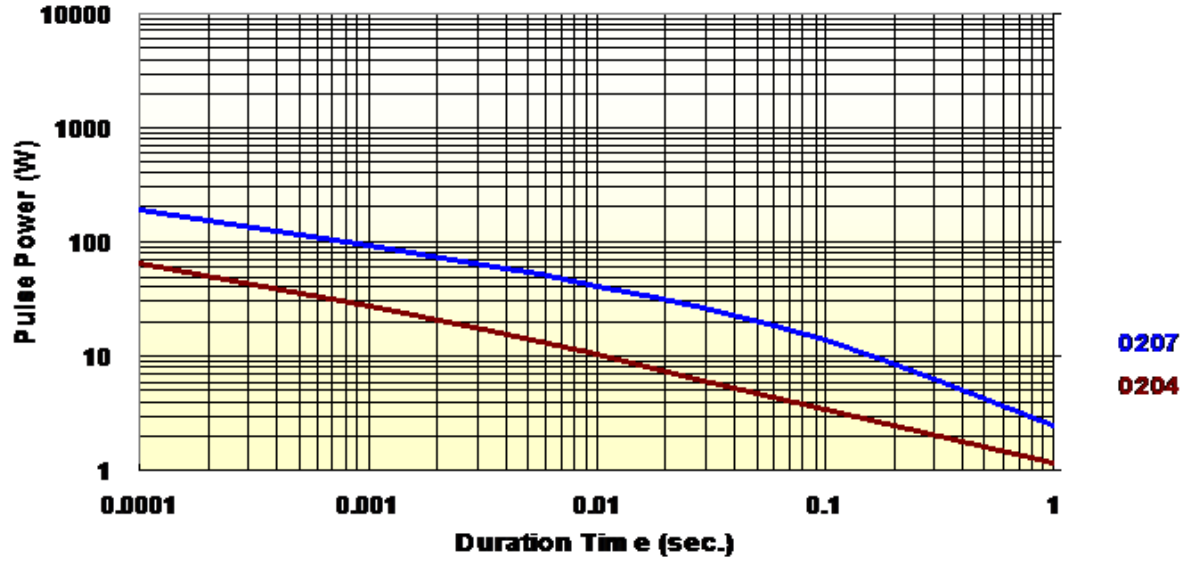




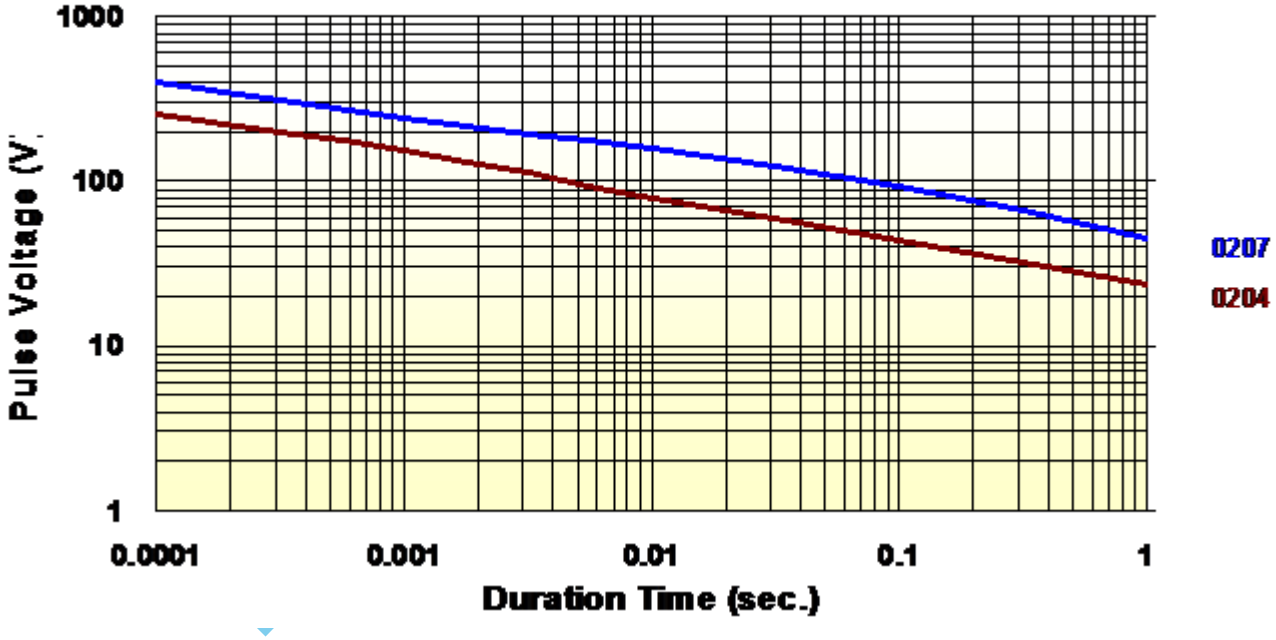
Continuous Pulse

The continuous load graph was obtained by applying repetitive rectangular pulses where the pulse period was adjusted so that the average power dissipated in the resistor was equal to its rated power at 70°C. Again the limit of acceptance was a shift in resistance of less than 1% from the initial value.

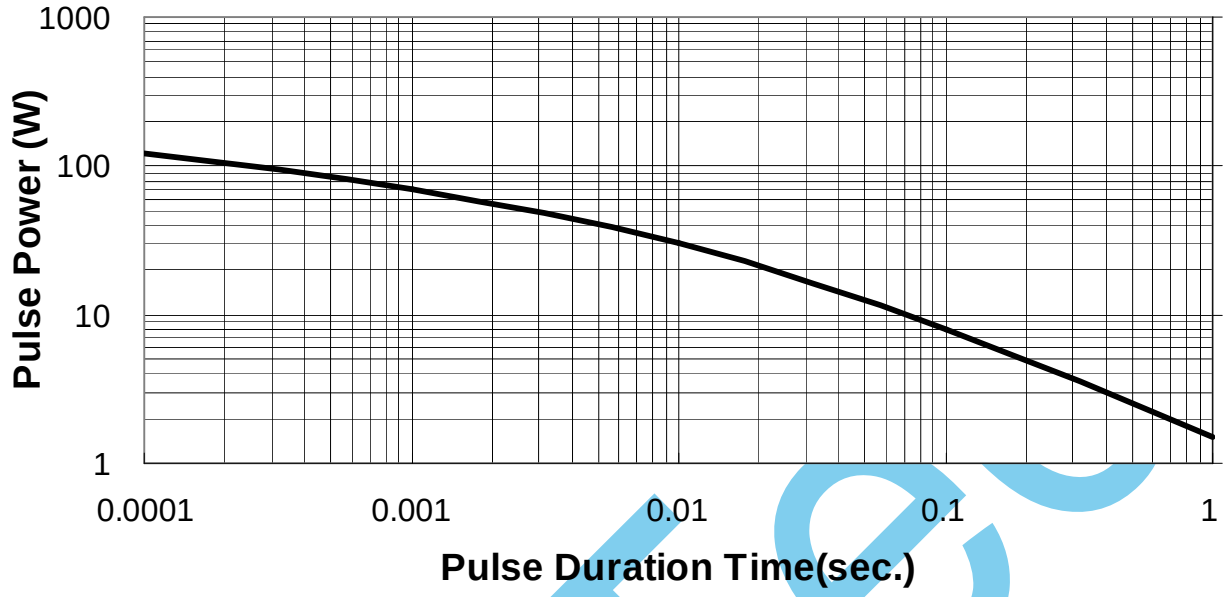
Continuous Pulse(100 Ohm)



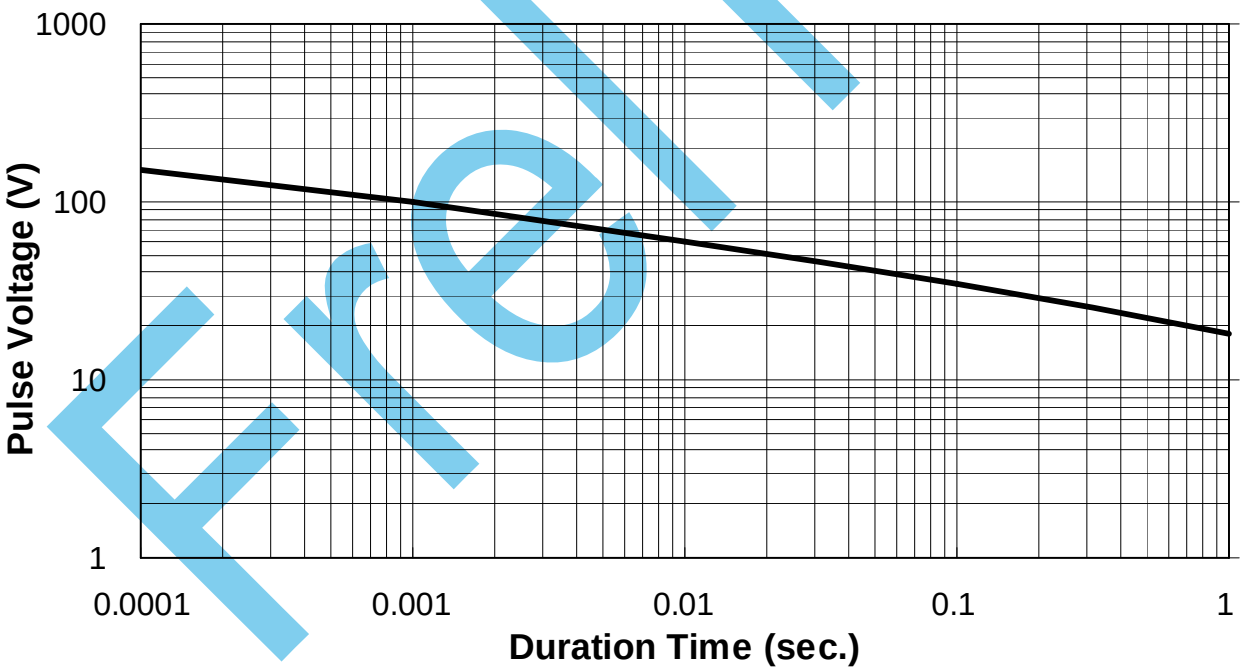
Pulse Voltage(100 Ohm)



0102 Continuous Pulse



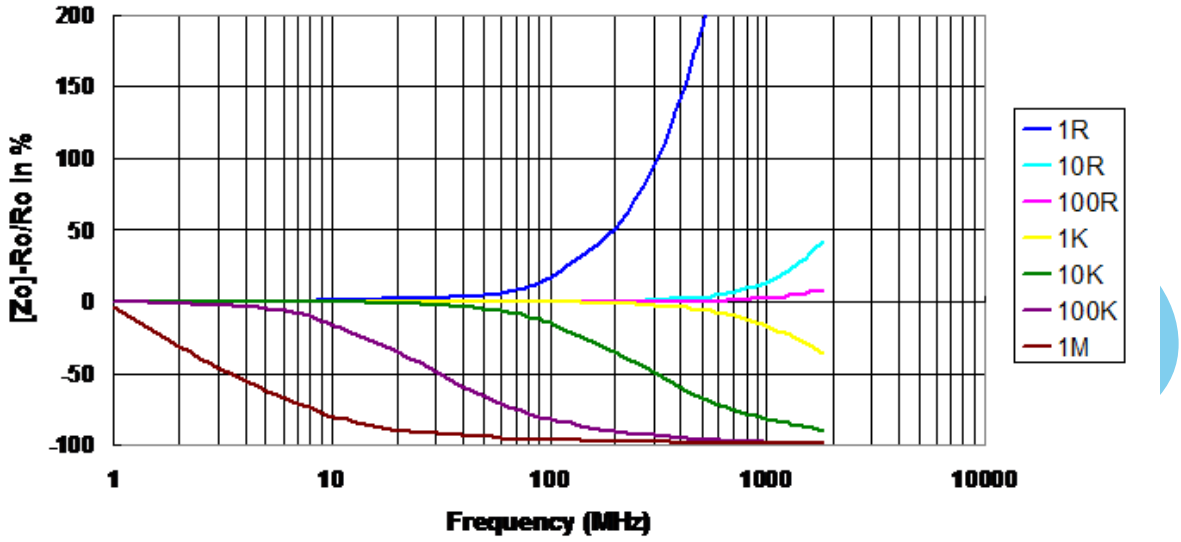
0102 Pulse Voltage (100 Ohm)



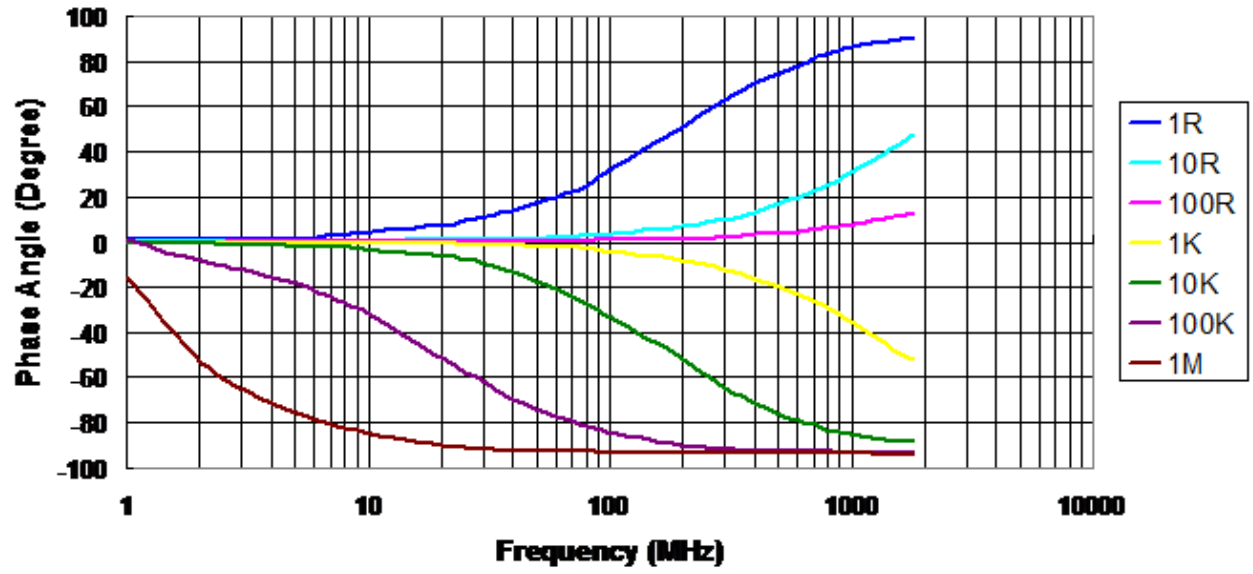
Frequency behavior

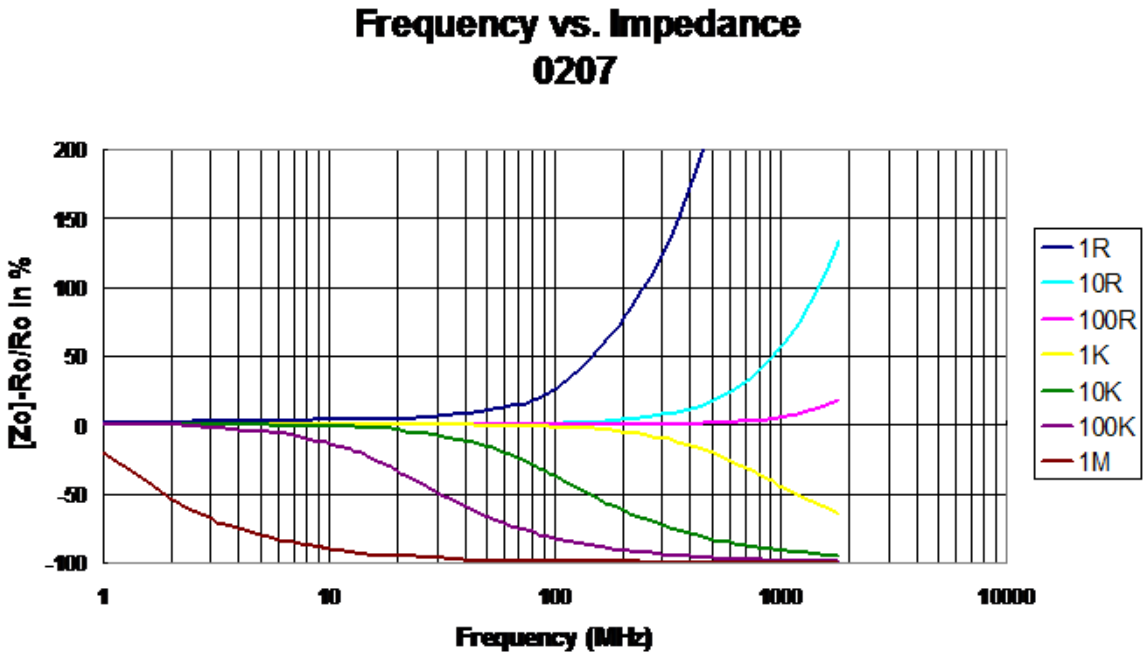
Resistors are designed to function according to ohmic laws. This is basically true of resistors for frequencies up to 100kHz. At higher frequencies, there is an additional contribution to the impedance by an ideal resistor switched in series with a coil and both switched parallel to a capacitor. The values of the capacitance and inductance are mainly determined by the dimensions of the terminations and the conductive path length.
The environment surrounding components has a large influence on the behavior of the component on the printed-circuit board.

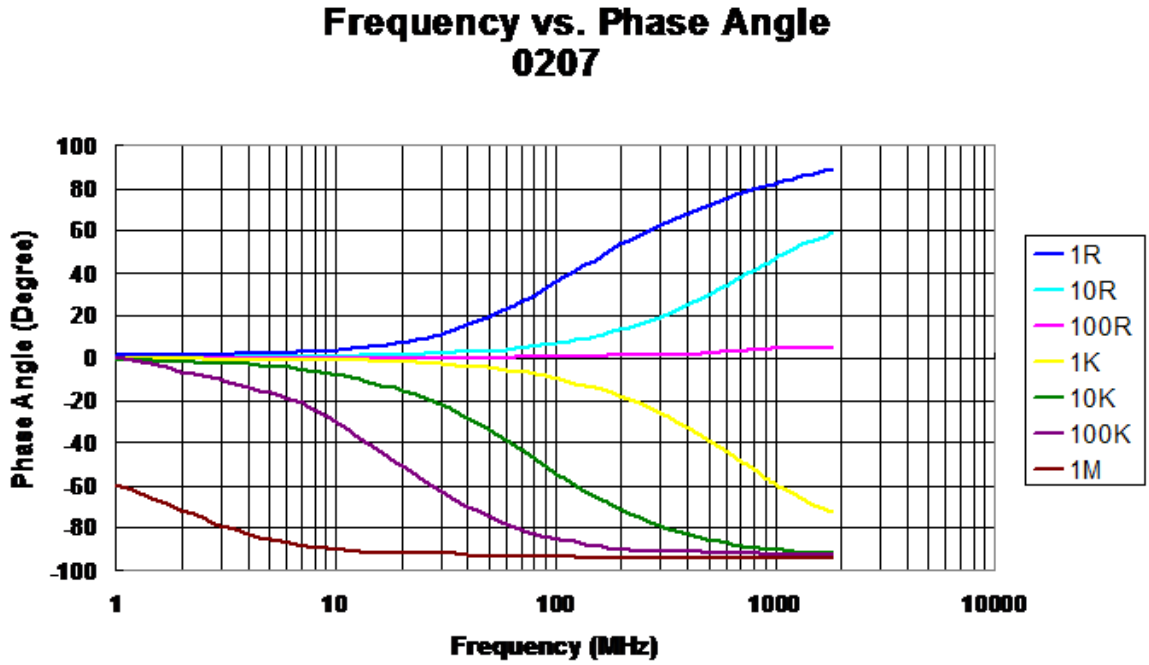
Frequency vs. Impedance
0204



Frequency vs. Phase Angle
0204

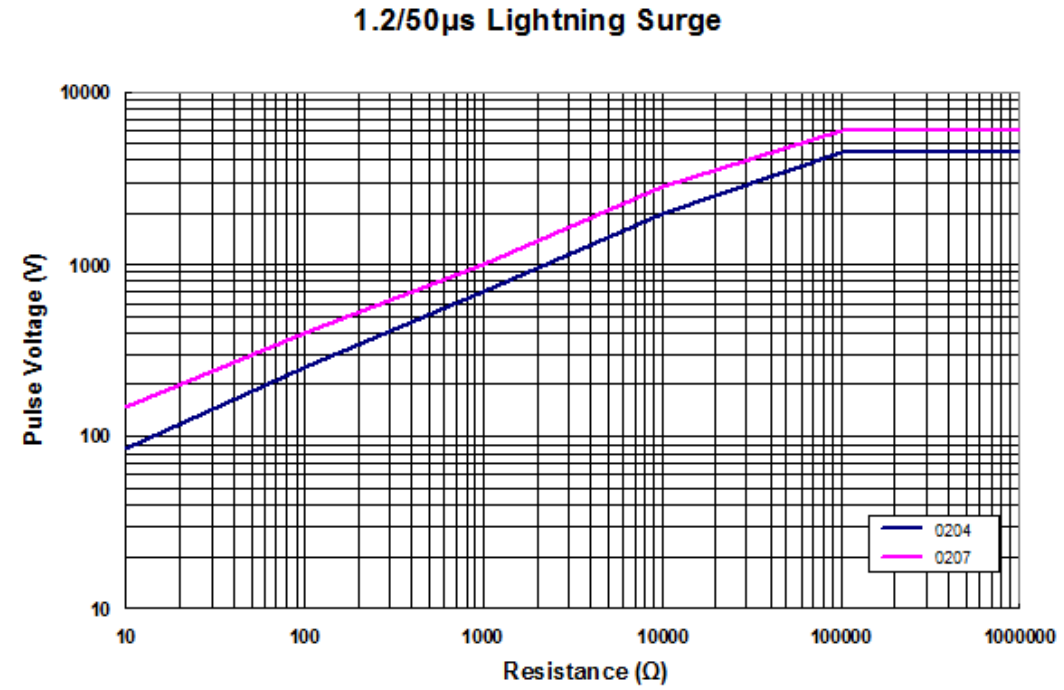


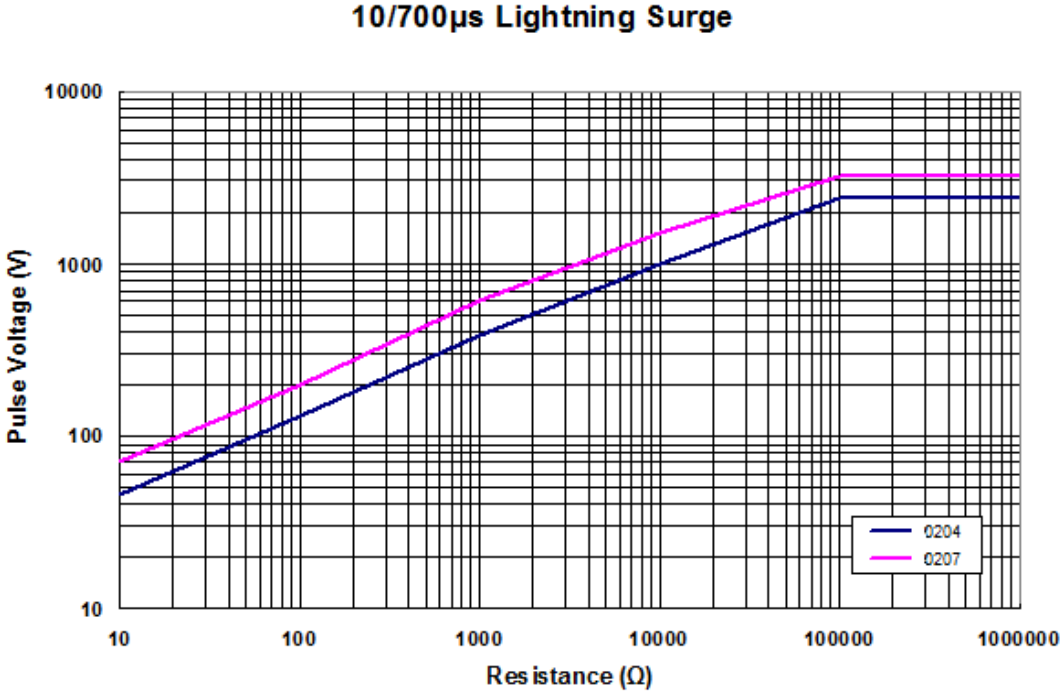




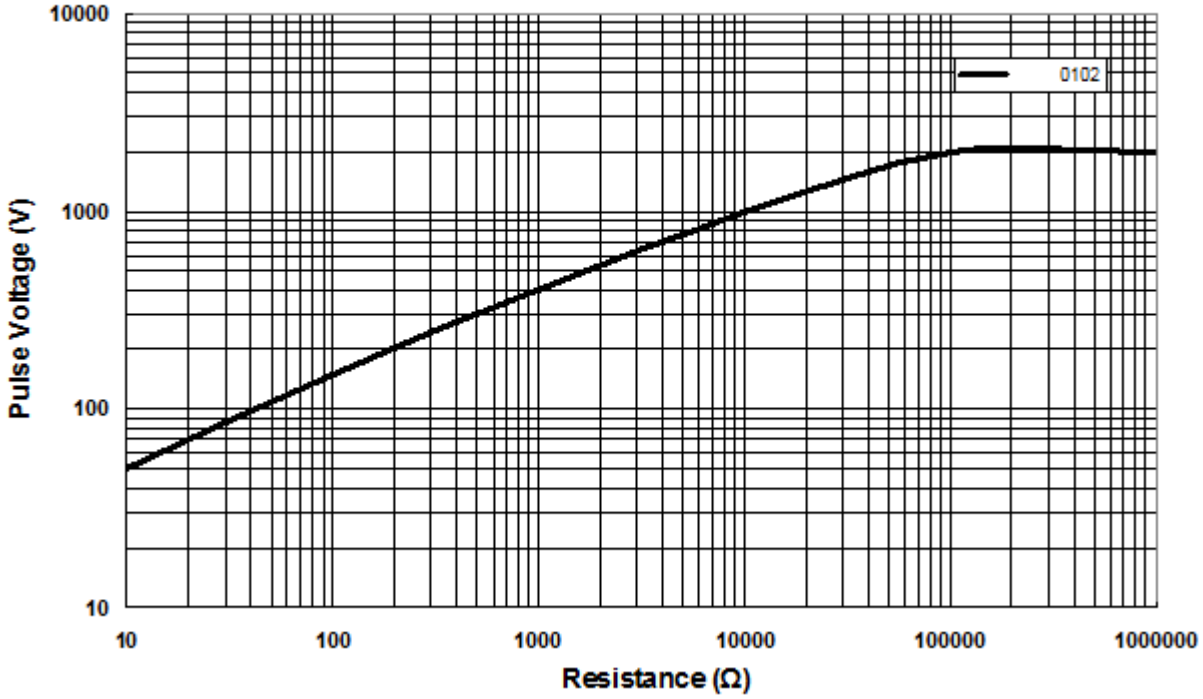
Lightning Surge

Resistors are tested in accordance with IEC 60 115-1 using both 1.2/50us and 10/700us pulse shapes. The limit of acceptance is a shift in resistance of less than 0,5% from the initial value.

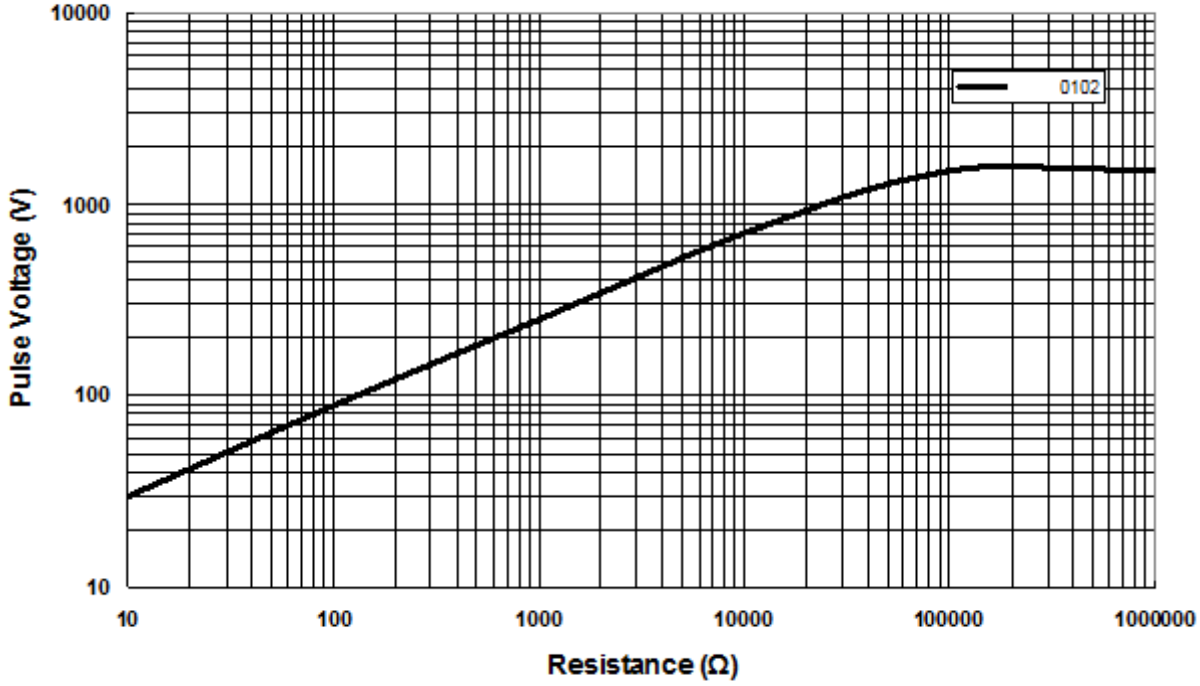




1.2/50µs Lightning Surge



10/700µs Lightning Surge

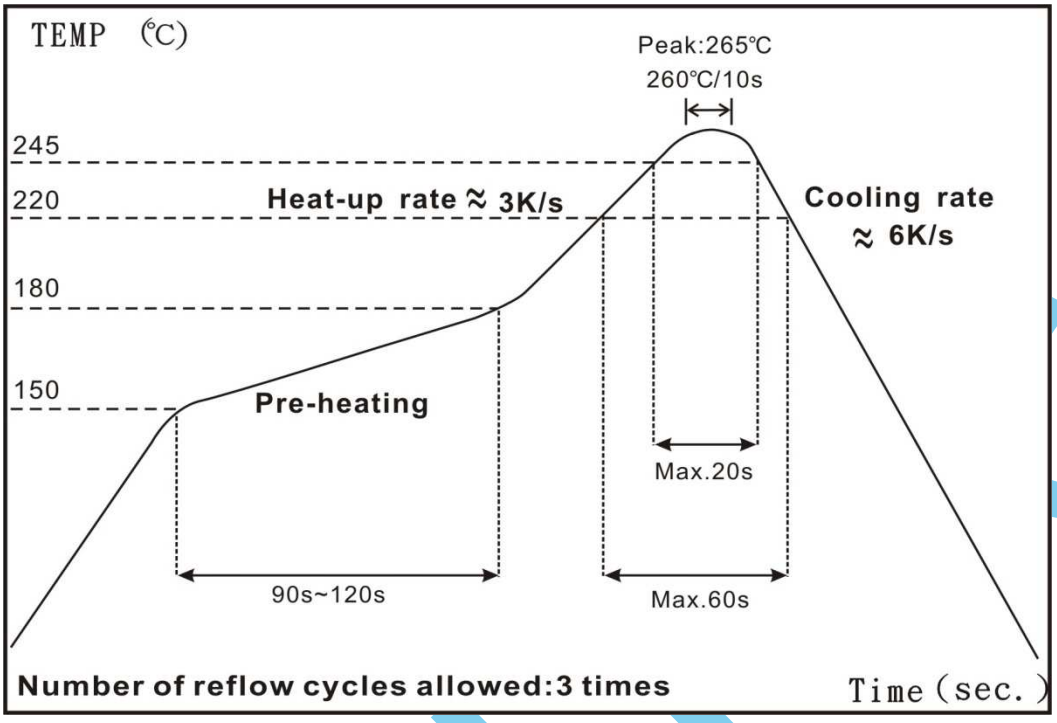


Environmental Characteristics

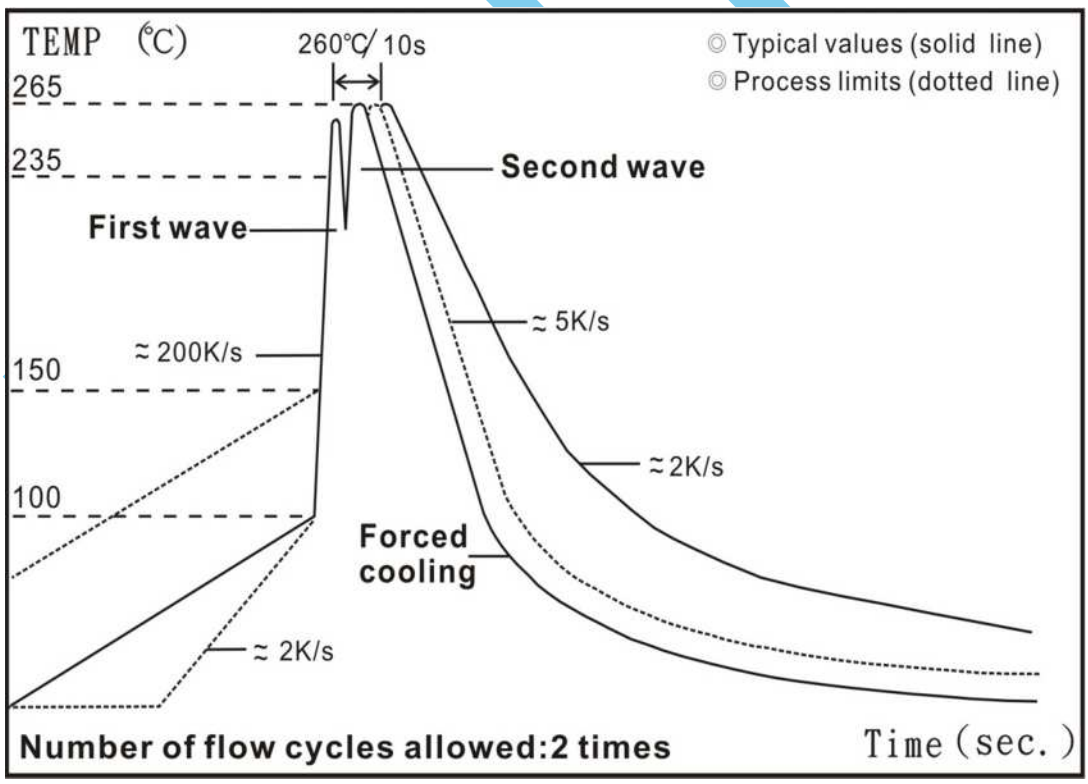
Item	Requirement		Test Method
	5% and Below	Jumper	
Temperature Coefficient of Resistance (T.C.R.)	As Spec		**JIS-C-5201-1 4.8** **IEC-60115-1 4.8** -55°C~+125°C, 25°C is the reference temperature
Short Time Overload	10Ω-270KΩ: ±(0,1%+0,05Ω) <10Ω & >270KΩ: ±(0,15%+0,05Ω) 0102: ±(0,15%+0,05Ω)	<15mΩ	**JIS-C-5201-1 4.13** **IEC-60115-1 4.13** RCWV*2,5 or Max. Overload Voltage whichever is lower for 5 seconds
Insulation Resistance	≥10G		**JIS-C-5201-1 4.6** **IEC-60115-1 4.6** Max. Overload Voltage for 1 minute
Operational Life	10Ω-270KΩ: ±(0,25%+0,05Ω) <10Ω & >270KΩ: ±(0,5%+0,05Ω) 0102: ±(0,5%+0,05Ω)	<15mΩ	**MIL-STD-202 Method 108** Condition D Steady State TA=125°C at derated power. Measurement at 24±4 hours after test conclusion.
Biased Humidity	10Ω-270KΩ: ±(0,5%+0,05Ω) <10Ω & >270KΩ: ±(1%+0,05Ω) 0102: ±(2%+0,05Ω)	<15mΩ	**MIL-STD-202 Method 103** 1000 hrs 85°C/85%RH 10% of operating power.
High Temperature Exposure	10Ω-270KΩ: ±(0,25%+0,05Ω) <10Ω & >270KΩ: ±(1%+0,05Ω) 0102: ±(1%+0,05Ω)	<15mΩ	**MIL-STD-202 Method 108** at +155°C for 1000 hrs
Board Flex	10Ω-270KΩ: ±(0,1%+0,05Ω) <10Ω & >270KΩ: ±(0,5%+0,05Ω) 0102: ±(0,5%+0,05Ω)	<15mΩ	**AEC-Q200-005** Bending once for 60 seconds with 2mm
Solderability	95% min. coverage		**JIS-C-5201-1 4.17** **IEC-60115-1 4.17** **J-STD-002** 245±5°C for 3 seconds
Resistance to Soldering Heat	10Ω-270KΩ: ±(0,1%+0,05Ω) <10Ω & >270KΩ: ±(0,25%+0,05Ω) 0102: ±(0,25%+0,05Ω)	<15mΩ	**MIL-STD-202 Method 210** 260±5°C for 10 seconds
Voltage Proof	No breakdown or flashover		**JIS-C-5201-1 4.7** **IEC-60115-1 4.7** 1,42 times Max. Operating Voltage for 1 minute
Leaching	Individual leaching area ≦5% Total leaching area ≦ 10%		**JIS-C-5201-1 4.18** **IEC-60068-2-58 8.2.1** 260±5°C for 30 seconds
Temperature Cycling	10Ω-270KΩ: ±(0,25%+0,05Ω) <10Ω & >270KΩ: ±(0,5%+0,05Ω) 0102: ±(1%+0,05Ω)	<15mΩ	**JESD22 Method JA-104** -55°C to +125°C, 1000 cycles
Mechanical Shock	±(0,25%+0,05Ω)	<15mΩ	**MIL-STD-202 Method 213** Wave Form: Tolerance for half sine shock pulse. Peak value is 100g's. Normal duration (D) is 6.
Vibration	±(0,5%+0,05Ω)	<15mΩ	**MIL-STD-202 Method 204** 5 g's for 20 min., 12 cycles each of 3 orientations, 10-2000 Hz
ESD	±(0,5%+0,05Ω)	<15mΩ	**AEC-Q200-002** Human body, 2KV
Resistance to Solvents	No visible damage on appearance and marking.		**MIL-STD-202 Method 215** Add Aqueous wash chemical - OKEM Clean or equivalent. Do not use banned solvents.
Terminal Strength	No broken		**AEC-Q200-006** Force of 1,8kg for 60 seconds.
Flammability	No ignition of the tissue paper or scorching or the pinewood board		**UL-94** V-0 or V-1 are acceptable. Electrical test not required.

Soldering Conditions

IR Reflow Soldering



Wave Soldering (Flow Soldering)



(1) Time of IR reflow soldering at maximum temperature point 260°C：10s
(2) Time of wave soldering at maximum temperature point 260°C：10s
(3) Time of soldering iron at maximum temperature point 410°C：5s

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