

LEADED RESISTORS 2009



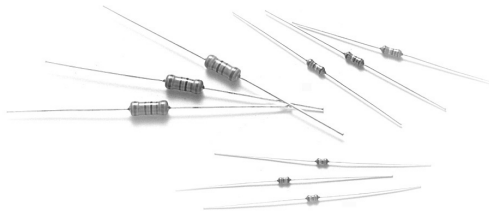


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Metal Film Resistors

MFR Type

Normal & Miniature Style [MFR Series]



INTRODUCTION

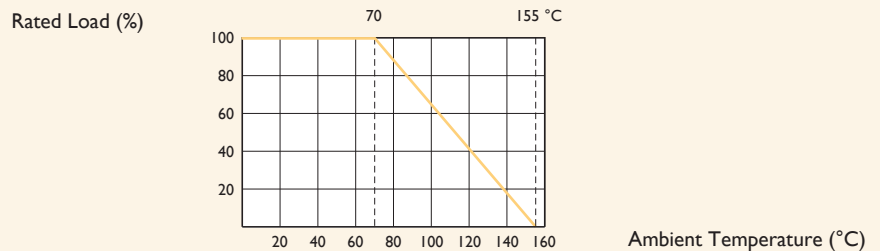
The MFR Series Metal Film Resistors are manufactured using vacuum sputtering system to deposit multiple layers of mixed metals alloy and passive materials onto a carefully treated high grade ceramic substrate. After a helical groove has been cut in the resistive layer, tinned connecting leads of electrolytic copper are welded to the end-caps. The resistors are coated with layers of blue color lacquer.

FEATURES

Power Rating	1/6W, 1/4W, 1/2W, 1W, 2W, 3W
Resistance Tolerance	$\pm 0.5\%$, $\pm 1\%$
T.C.R.	$\pm 15\text{ppm}/^{\circ}\text{C}$, $\pm 25\text{ppm}/^{\circ}\text{C}$, $\pm 50\text{ppm}/^{\circ}\text{C}$, $\pm 100\text{ppm}/^{\circ}\text{C}$

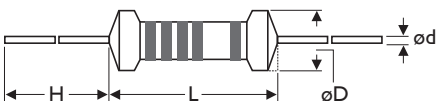
DERATING CURVE

For resistors operated in ambient temperatures above 70°C , power rating must be derated in accordance with the curve below.



DIMENSIONS

Unit: mm



STYLE		DIMENSION			
Normal	Miniature	L	øD	H	ød
MFR-12	MFR25S	3.4 ± 0.3	1.9 ± 0.2	28 ± 2.0	0.45 ± 0.05
MFR-25	MFR50S	6.3 ± 0.5	2.4 ± 0.2	28 ± 2.0	0.55 ± 0.05
MFR-50	MFR1WS	9.0 ± 0.5	3.3 ± 0.3	26 ± 2.0	0.55 ± 0.05
MFR100	MFR2WS	11.5 ± 1.0	4.5 ± 0.5	35 ± 2.0	0.8 ± 0.05
MFR200	MFR3WS	15.5 ± 1.0	5.0 ± 0.5	33 ± 2.0	0.8 ± 0.05

Note:

ELECTRICAL CHARACTERISTICS

STYLE	MFR-12	MFR25S	MFR-25	MFR50S	MFR-50	MFRIWS	MFRI00	MFR2WS	MFR200	MFR3WS
Power Rating at 70°C	1/6W	1/4W		1/2W		1W		2W		3W
Maximum Working Voltage	200V		250V	300V	350V	400V	500V			
Maximum Overload Voltage	400V		500V	600V	700V	800V	1,000V			
Dielectric Withstanding Voltage	300V	400V	500V			700V	1,000V			
Resistance Range	1 Ω - 10M Ω & 0 Ω for E24 & E96 series value									
Operating Temp. Range	-55°C to +155°C									
Temperature Coefficient	$\pm 15\text{ppm}/^\circ\text{C}$, $\pm 25\text{ppm}/^\circ\text{C}$, $\pm 50\text{ppm}/^\circ\text{C}$, $\pm 100\text{ppm}/^\circ\text{C}$									

Note: Special value is available on request

ENVIRONMENTAL CHARACTERISTICS

PERFORMANCE TEST	TEST METHOD		APPRAISE
Short Time Overload	JIS-C-5202 5.5	2.5 times RCWV for 5 Sec.	$\pm 0.25\% + 0.05 \Omega$
Dielectric Withstanding Voltage	JIS-C-5202 5.7	in V-Block for 60 Sec.	By type
Temperature Coefficient	JIS-C-5202 5.2	-55°C to +155°C	By type
Insulation Resistance	JIS-C-5202 5.6	in V-Block	>10,000M
Solderability	JIS-C-5202 6.5	260 $\pm 5^\circ\text{C}$ for 5 ± 0.5 Sec.	95% Min. coverage
Resistance to Solvent	JIS-C-5202 6.9	IPA for 1 Min. with ultrasonic	No deterioration of coatings and markings
Terminal Strength	JIS-C-5202 6.1	Direct load for 10 Sec. in the direction of the terminal leads	$\geq 2.5\text{kg}$ (24.5N)
Pulse Overload	JIS-C-5202 5.8	4 times RCWV 10,000 cycles (1 Sec. on, 25 Sec. off)	$\pm 1.0\% + 0.05 \Omega$
Load Life in Humidity	JIS-C-5202 7.9	40 $\pm 2^\circ\text{C}$, 90-95% RH at RCWV for 1,000 Hr. (1.5 Hr. on, 0.5 Hr. off)	$\pm 1.5\% + 0.05 \Omega$
Load Life	JIS-C-5202 7.10	70°C at RCWV for 1,000 Hr. (1.5 Hr. on, 0.5 Hr. off)	$\pm 1.5\% + 0.05 \Omega$
Temperature Cycling	JIS-C-5202 7.4	-55°C $\Rightarrow$ Room Temp. $\Rightarrow$ +155°C $\Rightarrow$ Room Temp. (5 cycles)	$\pm 0.75\% + 0.05 \Omega$
Resistance to Soldering Heat	JIS-C-5202 6.4	350 $\pm 10^\circ\text{C}$ for 3 ± 0.5 Sec.	$\pm 0.25\% + 0.05 \Omega$

Note: Rated Continuous Working Voltage (RCWV) = $\sqrt{\text{Power Rating} \times \text{Resistance Value}}$

Metal Film Resistors

Precision Type

Normal & Miniature Style [MFP Series]



INTRODUCTION

The MFP Series Metal Film Precision Resistors are manufactured using vacuum sputtering system to deposit multiple layers of mixed metals alloy and passivative materials onto a carefully treated high grade ceramic substrate. After a helical groove has been cut in the resistive layer, tinned connecting leads of electrolytic copper are welded to the end-caps. The resistors are coated with layers of blue color lacquer. Ultra high precision resistors, ultra high stability, ultra low temperature coefficient.

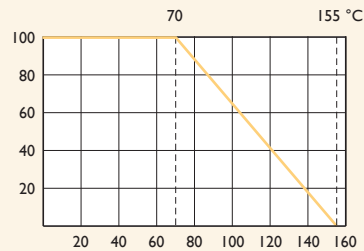
FEATURES

Power Rating	1/6W, 1/4W, 0.4W, 1/2W, 0.6W, 1W, 2W, 3W
Resistance Tolerance	0.1%, $\pm 0.25\%$
T.C.R.	$\pm 15\text{ppm}/^{\circ}\text{C}$, $\pm 25\text{ppm}/^{\circ}\text{C}$

DERATING CURVE

For resistors operated in ambient temperatures above 70°C , power rating must be derated in accordance with the curve below.

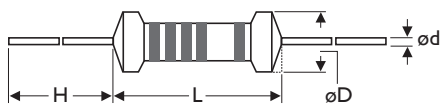
Rated Load (%)



Ambient Temperature ($^{\circ}\text{C}$)

DIMENSIONS

Unit: mm



STYLE

DIMENSION

Normal	Miniature	L	øD	H	ød
MFP-12	MFP25S	3.4 ± 0.3	1.9 ± 0.2	28 ± 2.0	0.45 ± 0.05
MFP204	-	3.4 ± 0.3	1.9 ± 0.2	28 ± 2.0	0.45 ± 0.05
MFP-25	MFP50S	6.3 ± 0.5	2.4 ± 0.2	28 ± 2.0	0.55 ± 0.05
MFP207	-	6.3 ± 0.5	2.4 ± 0.2	28 ± 2.0	0.55 ± 0.05
MFP-50	MFP1WS	9.0 ± 0.5	3.3 ± 0.3	26 ± 2.0	0.55 ± 0.05
MFP100	MFP2WS	11.5 ± 1.0	4.5 ± 0.5	35 ± 2.0	0.8 ± 0.05
MFP200	MFP3WS	15.5 ± 1.0	5.0 ± 0.5	33 ± 2.0	0.8 ± 0.05

Note:

ELECTRICAL CHARACTERISTICS

STYLE	MFP-12	MFP25S	MFP204	MFP-25	MFP50S	MFP207	MFP-50	MFPIWS	MFPI00	MFP2WS	MFP200	MFP3WS
Power Rating at 70°C	1/6W	1/4W	0.4W	1/4W	1/2W	0.6W	1/2W	1W		2W		3W
Maximum Working Voltage	150V	200V		250V			350V	400V	500V			
Maximum Overload Voltage	300V	400V		500V	600V		700V	800V	1,000V			
Dielectric Withstanding Vol.	300V			500V				700V	1,000V			
Resistance Range	10 Ω - 1 M Ω for E192 series value											
Operating Temp. Range	-55°C to +155°C											
Temperature Coefficient	$\pm 15\text{ppm}/^\circ\text{C}$, $\pm 25\text{ppm}/^\circ\text{C}$											

Note: Special value is available on request

ENVIRONMENTAL CHARACTERISTICS

PERFORMANCE TEST	TEST METHOD		APPRAISE
Short Time Overload	JIS-C-5202 5.5	2.5 times RCWV for 5 Sec.	$\pm 0.1\% + 0.05 \Omega$
Dielectric Withstanding Voltage	JIS-C-5202 5.7	in V-Block for 60 Sec.	By type
Temperature Coefficient	JIS-C-5202 5.2	-55°C to +155°C	By type
Insulation Resistance	JIS-C-5202 5.6	in V-Block	$> 10,000\text{M} \Omega$
Solderability	JIS-C-5202 6.5	260 $\pm 5^\circ\text{C}$ for 5 ± 0.5 Sec.	95% Min. coverage
Resistance to Solvent	JIS-C-5202 6.9	IPA for 1 Min. with ultrasonic	No deterioration of coatings and markings
Terminal Strength	JIS-C-5202 6.1	Direct load for 10 Sec. in the direction of the terminal leads	$\geq 2.5\text{kg}$ (24.5N)
Pulse Overload	JIS-C-5202 5.8	4 times RCWV 10,000 cycles (1 Sec. on, 25 Sec. off)	$\pm 1.0\% + 0.05 \Omega$
Load Life in Humidity	JIS-C-5202 7.9	40 $\pm 2^\circ\text{C}$, 90-95% RH at RCWV for 1,000 Hr. (1.5 Hr. on, 0.5 Hr. off)	$\pm 1.0\% + 0.05 \Omega$
Load Life	JIS-C-5202 7.10	70°C at RCWV for 1,000 Hr. (1.5 Hr. on, 0.5 Hr. off)	$\pm 1.0\% + 0.05 \Omega$
Temperature Cycling	JIS-C-5202 7.4	-55°C $\Rightarrow$ Room Temp. $\Rightarrow$ +155°C $\Rightarrow$ Room Temp. (5 cycles)	$\pm 0.25\% + 0.05 \Omega$
Resistance to Soldering Heat	JIS-C-5202 6.4	350 $\pm 10^\circ\text{C}$ for 3 ± 0.5 Sec.	$\pm 0.25\% + 0.05 \Omega$

Note: Rated Continuous Working Voltage (RCWV) = $\sqrt{\text{Power Rating} \times \text{Resistance Value}}$

Metal Film Resistors

High Precision Type

Normal Style [MHP Series]



INTRODUCTION

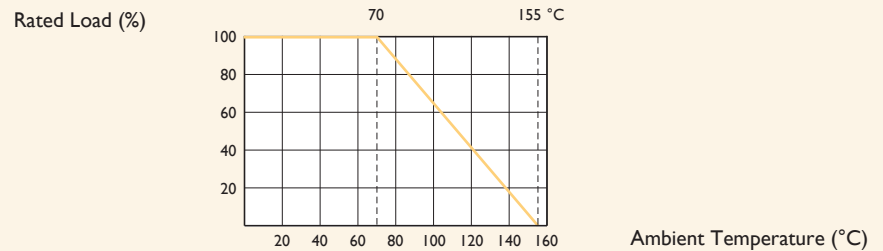
The MHP Series Metal Film High Precision Resistors are manufactured using vacuum sputtering system to deposit multiple layers of mixed metals alloy and passive materials onto a carefully treated high grade ceramic substrate. After a helical groove has been cut in the resistive layer; tinned connecting leads of electrolytic copper are welded to the end-caps. The resistors are coated with layers of blue color lacquer. Ultra high precision resistors, ultra high stability, ultra low temperature coefficient.

FEATURES

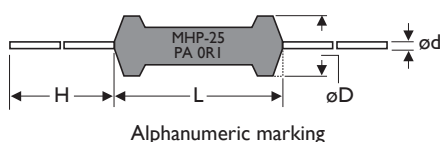
Power Rating	1/4W, 1/2W
Resistance Tolerance	$\pm 0.02\%$, $\pm 0.05\%$
T.C.R.	$\pm 5\text{ppm}/^{\circ}\text{C}$, $\pm 10\text{ppm}/^{\circ}\text{C}$

DERATING CURVE

For resistors operated in ambient temperatures above 70°C, power rating must be derated in accordance with the curve below.



DIMENSIONS



Unit: mm

STYEL	DIMENSION			
	L	øD	H	ød
Normal				
MHP-25	6.2 $\pm$ 0.3	1.8 $\pm$ 0.3	36 $\pm$ 2.0	0.63 $\pm$ 0.05
MHP-50	9.1 $\pm$ 0.3	2.1 $\pm$ 0.3	36 $\pm$ 3.0	0.63 $\pm$ 0.05

Note:

ELECTRICAL CHARACTERISTICS

STYLE	MHP-25	MHP-50
Power Rating at 70°C	1/4W	1/2W
Maximum Working Voltage	200V	250V
Maximum Overload Voltage	400V	500V
Dielectric Withstanding Voltage	300V	500V
Resistance Range	100 Ω - 500K Ω for E192 series value	
Operating Temp. Range	-55°C to +150°C	
Temperature Coefficient	$\pm 5\text{ppm}/^\circ\text{C}$, $\pm 10\text{ppm}/^\circ\text{C}$	

Note: Special value is available on request.

ENVIRONMENTAL CHARACTERISTIC

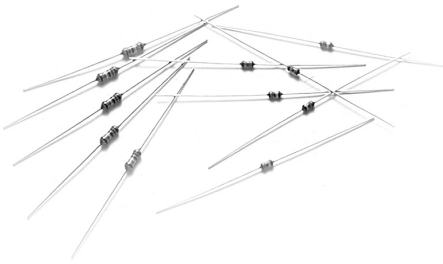
PERFORMANCE TEST	TEST METHOD		APPRAISE
Short Time Overload	JIS-C-5202 5.5	2.5 times RCWV for 5 Sec.	$\pm 0.25\% + 0.05 \Omega$
Dielectric Withstanding Voltage	JIS-C-5202 5.7	in V-Block for 60 Sec.	By type
Temperature Coefficient	JIS-C-5202 5.2	-55°C to +150°C	By type
Insulation Resistance	JIS-C-5202 5.6	in V-Block	> 10,000M Ω
Solderability	JIS-C-5202 6.5	260 $\pm 5^\circ\text{C}$ for 5 ± 0.5 Sec.	95% Min. coverage
Resistance to Solvent	JIS-C-5202 6.9	IPA for 1 Min. with ultrasonic	No deterioration of coatings and markings
Terminal Strength	JIS-C-5202 6.1	Direct load for 5 Sec. In the direction of the terminal leads	$\geq 2.5\text{kg}$ (24.5N)
Pulse Overload	JIS-C-5202 5.8	4 times RCWV for 10,000 cycles (1 Sec. on, 25 Sec. off)	$\pm 1.0\% + 0.05 \Omega$
Load Life in Humidity	JIS-C-5202 7.9	40 $\pm 2^\circ\text{C}$, 90 - 95% RH at RCWV for 1,000 Hr. (1.5 Hr. on, 0.5 Hr. off)	$\pm 0.5\% + 0.05 \Omega$
Load Life	JIS-C-5202 7.10	70°C at RCWV for 1,000 Hr. (1.5 Hr. on, 0.5 Hr. off)	$\pm 0.5\% + 0.05 \Omega$
Temperature Cycling	JIS-C-5202 7.4	-55°C $\Rightarrow$ Room Temp. $\Rightarrow$ +155°C $\Rightarrow$ Room Temp. (5 cycles)	$\pm 0.015\% + 0.05 \Omega$
Resistance to Soldering Heat	JIS-C-5202 6.4	350 $\pm 10^\circ\text{C}$ for 3 ± 0.5 Sec.	$\pm 0.1\% + 0.05 \Omega$

Note: Rated Continuous Working Voltage (RCWV) = $\sqrt{\text{Power Rating} \times \text{Resistance Value}}$

Metal Film Resistors

Professional Type

Miniature Style [MF0 Series]



INTRODUCTION

The MF0 Series Metal Film Professional Resistors are manufactured using vacuum sputtering system to deposit multiple layers of mixed metals alloy and passive materials onto a carefully treated high grade ceramic substrate. After a helical groove has been cut in the resistive layer, tinned connecting leads of electrolytic copper are welded to the end-caps. The resistors are coated with layers of blue color lacquer.

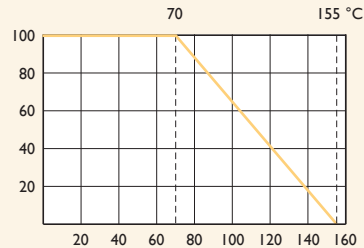
FEATURES

Power Rating	0.4W, 0.6W
Resistance Tolerance	$\pm 1\%$
T.C.R.	$\pm 50\text{ppm}/^{\circ}\text{C}$

DERATING CURVE

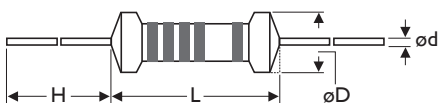
For resistors operated in ambient temperatures above 70°C , power rating must be derated in accordance with the curve below.

Rated Load (%)



Ambient Temperature ($^{\circ}\text{C}$)

DIMENSIONS



Unit: mm

STYLE	DIMENSION			
Miniature	L	øD	H	ød
MF0204	3.4 ± 0.3	1.9 ± 0.2	28 ± 2.0	0.45 ± 0.05
MF0207	6.3 ± 0.5	2.4 ± 0.2	28 ± 2.0	0.55 ± 0.05

Note:

ELECTRICAL CHARACTERISTICS

STYLE	MF0204	MF0207
Power Rating at 70°C	0.4W	0.6W
Maximum Working Voltage	250V	350V
Maximum Overload Voltage	500V	700V
Dielectric Withstanding Voltage	300V	500V
Resistance Range	1 Ω - 10M Ω & 0 Ω for E24 & E96 series value	
Operating Temp. Range	-55°C to +155°C	
Temperature Coefficient	$\pm 50\text{ppm}/^\circ\text{C}$	

Note: Special value is available on request

ENVIRONMENTAL CHARACTERISTICS

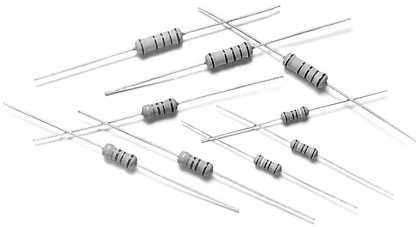
PERFORMANCE TEST	TEST METHOD		APPRAISE
Short Time Overload	JIS-C-5202 5.5	2.5 times RCWV for 5 Sec.	$\pm 0.25\% + 0.05 \Omega$
Dielectric Withstanding Voltage	JIS-C-5202 5.7	in V-Block for 60 Sec.	By type
Temperature Coefficient	JIS-C-5202 5.2	-55°C to +155°C	By type
Insulation Resistance	JIS-C-5202 5.6	in V-Block	> 10,000M
Solderability	JIS-C-5202 6.5	260 $\pm 5^\circ\text{C}$ for 5 ± 0.5 Sec.	95% Min. coverage
Resistance to Solvent	JIS-C-5202 6.9	IPA for 1 Min. with ultrasonic	No deterioration of coatings and markings
Terminal Strength	JIS-C-5202 6.1	Direct load for 10 Sec. in the direction of the terminal leads	$\geq 2.5\text{kg}$ (24.5N)
Pulse Overload	JIS-C-5202 5.8	4 times RCWV 10,000 cycles (1 Sec. on, 25 Sec. off)	$\pm 1.0\% + 0.05 \Omega$
Load Life in Humidity	JIS-C-5202 7.9	40 $\pm 2^\circ\text{C}$, 90-95% RH at RCWV for 1,000 Hr. (1.5 Hr. on, 0.5 Hr. off)	$\pm 1.5\% + 0.05 \Omega$
Load Life	JIS-C-5202 7.10	70°C at RCWV for 1,000 Hr. (1.5 Hr. on, 0.5 Hr. off)	$\pm 1.5\% + 0.05 \Omega$
Temperature Cycling	JIS-C-5202 7.4	-55°C $\Rightarrow$ Room Temp. $\Rightarrow$ +155°C $\Rightarrow$ Room Temp. (5 cycles)	$\pm 0.75\% + 0.05 \Omega$
Resistance to Soldering Heat	JIS-C-5202 6.4	350 $\pm 10^\circ\text{C}$ for 3 ± 0.5 Sec.	$\pm 0.25\% + 0.05 \Omega$

Note: Rated Continuous Working Voltage (RCWV) = $\sqrt{\text{Power Rating} \times \text{Resistance Value}}$

Metal Film Resistors

Flame-Proof Type

Normal & Miniature Style [FMF Series]



INTRODUCTION

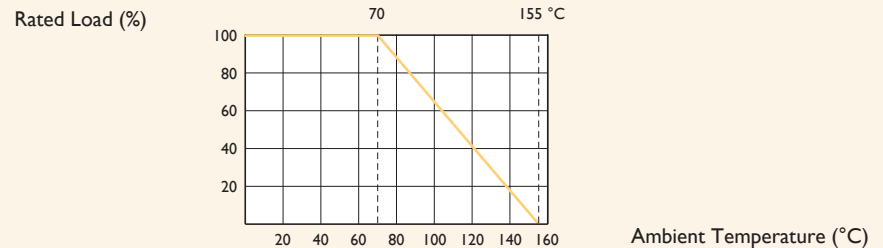
The FMF Series Flame Proof Resistors are manufactured using vacuum sputtering system to deposit multiple layers of mixed metals alloy and passivative materials onto a carefully treated high grade ceramic substrate. After a helical groove has been cut in the resistive layer, tinned connecting leads of electrolytic copper are welded to the end-caps. The resistors are coated with layers of gray color lacquer.

FEATURES

Power Rating	1/4W, 1/2W, 1W, 2W, 3W
Resistance Tolerance	±1%
T.C.R.	±50ppm/°C, ±100ppm/°C
Flameproof Multi-layer Coating Meets	UL-94V-0
Flameproof Feature Meets Overload Test	UL-1412

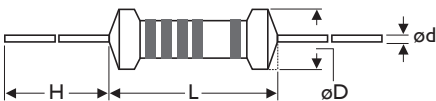
DERATING CURVE

For resistors operated in ambient temperatures above 70°C, power rating must be derated in accordance with the curve below.



DIMENSIONS

Unit: mm



STYLE		DIMENSION			
Normal	Miniature	L	øD	H	ød
FMF-25	FMF50S	6.3±0.5	2.4±0.2	28±2.0	0.55±0.05
FMF-50	FMF1WS	9.0±0.5	3.3±0.3	26±2.0	0.55±0.05
FMF100	FMF2WS	11.5±1.0	4.5±0.5	35±2.0	0.8±0.05
FMF200	FMF3WS	15.5±1.0	5.0±0.5	33±2.0	0.8±0.05

Note:

ELECTRICAL CHARACTERISTICS

STYLE	FMF-25	FMF50S	FMF-50	FMFIWS	FMFI00	FMF2WS	FMF200	FMF3WS
Power Rating at 70°C	1/4W	1/2W		1W		2W		3W
Maximum Working Voltage	250V	300V	350V	400V	500V			
Maximum Overload Voltage	500V	600V	700V	800V	1,000V			
Dielectric Withstanding Voltage	400V		500V	600V	750V			
Resistance Range	1 Ω - 10M Ω & 0 Ω for E24 & E96 series value							
Operating Temp. Range	-55°C to +155°C							
Temperature Coefficient	±50ppm/°C, ±100ppm/°C							

Note: Special value is available on request

ENVIRONMENTAL CHARACTERISTICS

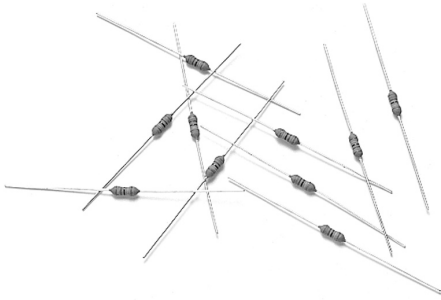
PERFORMANCE TEST	TEST METHOD		APPRAISE
Short Time Overload	JIS-C-5202 5.5	2.5 times RCWV for 5 Sec.	±0.25%+0.05 Ω
Dielectric Withstanding Voltage	JIS-C-5202 5.7	in V-Block for 60 Sec.	By type
Temperature Coefficient	JIS-C-5202 5.2	-55°C to +155°C	By type
Insulation Resistance	JIS-C-5202 5.6	in V-Block	> 1,000M Ω
Solderability	JIS-C-5202 6.5	260±5°C for 5±0.5 Sec.	95% Min. coverage
Resistance to Solvent	JIS-C-5202 6.9	IPA for 1 Min. with ultrasonic	No deterioration of coatings and markings
Terminal Strength	JIS-C-5202 6.1	Direct load for 10 Sec. in the direction of the terminal leads	≥2.5kg (24.5N)
Pulse Overload	JIS-C-5202 5.8	4 times RCWV 10,000 cycles (1 Sec. on, 25 Sec. off)	±1.0%+0.05 Ω
Load Life in Humidity	JIS-C-5202 7.9	40±2°C, 90-95% RH at RCWV for 1,000 Hr. (1.5 Hr. on, 0.5 Hr. off)	±1.5%+0.05 Ω
Load Life	JIS-C-5202 7.10	70°C at RCWV for 1,000 Hr. (1.5 Hr. on, 0.5 Hr. off)	±1.5%+0.05 Ω
Temperature Cycling	JIS-C-5202 7.4	-55°C ⇄ Room Temp. ⇄ +155°C ⇄ Room Temp. (5 cycles)	±0.75%+0.05 Ω
Resistance to Soldering Heat	JIS-C-5202 6.4	350±10°C for 3±0.5 Sec.	±0.25%+0.05 Ω
Overload Flame Retardant	JIS-C-5202 7.12	4 times RCWV for 1 Min.	No evidence of flaming or arcing

Note: Rated Continuous Working Voltage (RCWV) = $\sqrt{\text{Power Rating} \times \text{Resistance Value}}$

Metal Film Resistors

Professional & Flame-Proof Type

Miniature Style [FM0 Series]



INTRODUCTION

The FM0 Series Metal Film Professional & Flame Proof Resistors are manufactured using vacuum sputtering system to deposit multiple layers of mixed metals alloy and passive materials onto a carefully treated high grade ceramic substrate. After a helical groove has been cut in the resistive layer; tinned connecting leads of electrolytic copper are welded to the end-caps. The resistors are coated with layers of light green color lacquer.

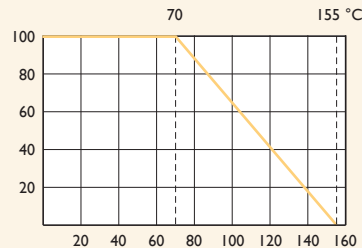
FEATURES

Power Rating	0.4W, 0.6W
Resistance Tolerance	±1%
T.C.R.	±50ppm/°C
Flameproof Multi-layer Coating Meets	UL-94V-0
Flameproof Feature Meets Overload Test	UL-1412

DERATING CURVE

For resistors operated in ambient temperatures above 70°C, power rating must be derated in accordance with the curve below.

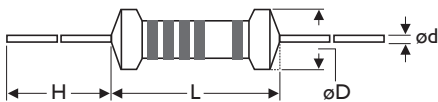
Rated Load (%)



Ambient Temperature (°C)

DIMENSIONS

Unit: mm



STYLE	DIMENSION			
Miniature	L	øD	H	ød
FM0204	3.4±0.3	1.9±0.2	28±2.0	0.45±0.05
FM0207	6.3±0.5	2.4±0.2	28±2.0	0.55±0.05

Note:

ELECTRICAL CHARACTERISTICS

STYLE	FM0204	FM0207
Power Rating at 70°C	0.4W	0.6W
Maximum Working Voltage	200V	300V
Maximum Overload Voltage	400V	600V
Dielectric Withstanding Voltage	300V	500V
Resistance Range	1 Ω - 10M Ω & 0 Ω for E24 & E96 series value	
Operating Temp. Range	-55°C to +155°C	
Temperature Coefficient	± 50 ppm/°C	

Note: Special value is available on request

ENVIRONMENTAL CHARACTERISTICS

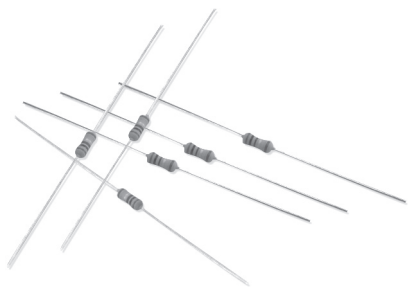
PERFORMANCE TEST	TEST METHOD		APPRAISE
Short Time Overload	JIS-C-5202 5.5	2.5 times RCWV for 5 Sec.	$\pm 0.25\% + 0.05 \Omega$
Dielectric Withstanding Voltage	JIS-C-5202 5.7	in V-Block for 60 Sec.	By type
Temperature Coefficient	JIS-C-5202 5.2	-55°C to +155°C	By type
Insulation Resistance	JIS-C-5202 5.6	in V-Block	> 1,000M Ω
Solderability	JIS-C-5202 6.5	260 ± 5 °C for 5 ± 0.5 Sec.	95% Min. coverage
Resistance to Solvent	JIS-C-5202 6.9	IPA for 1 Min. with ultrasonic	No deterioration of coatings and markings
Terminal Strength	JIS-C-5202 6.1	Direct load for 10 Sec. in the direction of the terminal leads	≥ 2.5 kg (24.5N)
Pulse Overload	JIS-C-5202 5.8	4 times RCWV 10,000 cycles (1 Sec. on, 25 Sec. off)	$\pm 1.0\% + 0.05 \Omega$
Load Life in Humidity	JIS-C-5202 7.9	40 ± 2 °C, 90-95% RH at RCWV for 1,000 Hr. (1.5 Hr. on, 0.5 Hr. off)	$\pm 1.5\% + 0.05 \Omega$
Load Life	JIS-C-5202 7.10	70°C at RCWV for 1,000 Hr. (1.5 Hr. on, 0.5 Hr. off)	$\pm 1.5\% + 0.05 \Omega$
Temperature Cycling	JIS-C-5202 7.4	-55°C $\Rightarrow$ Room Temp. $\Rightarrow$ +155°C $\Rightarrow$ Room Temp. (5 cycles)	$\pm 0.75\% + 0.05 \Omega$
Resistance to Soldering Heat	JIS-C-5202 6.4	350 ± 10 °C for 3 ± 0.5 Sec.	$\pm 0.25\% + 0.05 \Omega$
Overload Flame Retardant	JIS-C-5202 7.12	4 times RCWV for 1 Min.	No evidence of flaming or arcing

Note: Rated Continuous Working Voltage (RCWV) = $\sqrt{\text{Power Rating} \times \text{Resistance Value}}$

Metal Film Resistors

Flame-Proof Type

High Power Style [FMP Series]



INTRODUCTION

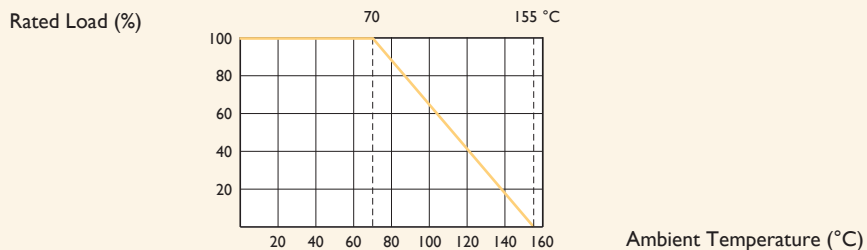
The FMP Series Metal Film Power Flame Proof Resistors are manufactured using vacuum sputtering system to deposit multiple layers of mixed metals alloy and passive materials onto a carefully treated high grade ceramic substrate. After a helical groove has been cut in the resistive layer; tinned connecting leads of electrolytic copper are welded to the end-caps. The resistors are coated with layers of pink color lacquer.

FEATURES

Power Rating	1/2W, 1W, 2W, 3W, 4W
Resistance Tolerance	$\pm 1\%$, $\pm 5\%$
T.C.R.	$\pm 100\text{ppm}/^{\circ}\text{C}$
Flameproof Multi-layer Coating Meets	UL-94V-0
Flameproof Feature Meets Overload Test	UL-1412

DERATING CURVE

For resistors operated in ambient temperatures above 70°C, power rating must be derated in accordance with the curve below.



DIMENSIONS

Unit: mm



STYLE	DIMENSION			
Normal	L	øD	H	ød
FMP-50	3.4 $\pm$ 0.3	1.9 $\pm$ 0.2	28 $\pm$ 2.0	0.45 $\pm$ 0.05
FMP100	6.3 $\pm$ 0.5	2.4 $\pm$ 0.2	28 $\pm$ 2.0	0.55 $\pm$ 0.05
FMP200	9.0 $\pm$ 0.5	3.9 $\pm$ 0.3	26 $\pm$ 2.0	0.55 $\pm$ 0.05
FMP3WS	11.5 $\pm$ 1.0	4.5 $\pm$ 0.5	35 $\pm$ 2.0	0.8 $\pm$ 0.05
FMP300	15.5 $\pm$ 1.0	5.0 $\pm$ 0.5	33 $\pm$ 2.0	0.8 $\pm$ 0.05
FMP4WV	17.0 $\pm$ 1.0	7.5 $\pm$ 0.5	32 $\pm$ 2.0	0.8 $\pm$ 0.05

Note:

ELECTRICAL CHARACTERISTICS

STYLE	FMP-50	FMP100	FMP200	FMP3WS	FMP300	FMP4WV
Power Rating at 70°C	1/2W	1W	2W	3W		
Maximum Working Voltage	200V	350V	500V		750V	
Maximum Overload Voltage	400V	600V	700V		1,000V	
Dielectric Withstanding Voltage	300V	500V			750V	
Resistance Range	1 Ω - 10M Ω & 0 Ω for E24 & E96 series value					
Operating Temp. Range	-55°C to +155°C					
Temperature Coefficient	± 100 ppm/°C					

Note: Special value is available on request.

ENVIRONMENTAL CHARACTERISTICS

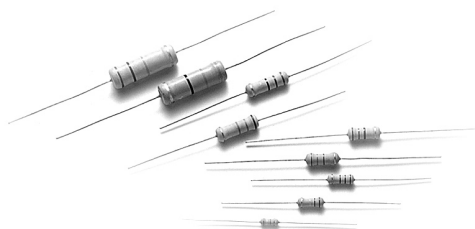
PERFORMANCE TEST	TEST METHOD		APPRAISE
Short Time Overload	JIS-C-5202 5.5	2.5 times RCWV for 5 Sec.	$\pm 0.5\% + 0.05 \Omega$
Dielectric Withstanding Voltage	JIS-C-5202 5.7	in V-Block for 60 Sec.	By type
Temperature Coefficient	JIS-C-5202 5.2	-55°C to +155°C	By type
Insulation Resistance	JIS-C-5202 5.6	in V-Block	$> 1,000M \Omega$
Solderability	JIS-C-5202 6.5	260 $\pm 5^\circ\text{C}$ for 5 ± 0.5 Sec.	95% Min. coverage
Resistance to Solvent	JIS-C-5202 6.9	IPA for 1 Min. with ultrasonic	No deterioration of coatings and markings
Terminal Strength	JIS-C-5202 6.1	Direct load for 10 Sec. in the direction of the terminal leads	$\geq 2.5\text{kg}$ (24.5N)
Pulse Overload	JIS-C-5202 5.8	4 times RCWV 10,000 cycles (1 Sec. on, 25 Sec. off)	$\pm 1.0\% + 0.05 \Omega$
Load Life in Humidity	JIS-C-5202 7.9	40 $\pm 2^\circ\text{C}$, 90-95% RH at RCWV for 1,000 Hr. (1.5 Hr. on, 0.5 Hr. off)	$\pm 2.0\% + 0.05 \Omega$
Load Life	JIS-C-5202 7.10	70°C at RCWV for 1,000 Hr. (1.5 Hr. on, 0.5 Hr. off)	$\pm 2.0\% + 0.05 \Omega$
Temperature Cycling	JIS-C-5202 7.4	-55°C $\Rightarrow$ Room Temp. $\Rightarrow$ +155°C $\Rightarrow$ Room Temp. (5 cycles)	$\pm 1.0\% + 0.05 \Omega$
Resistance to Soldering Heat	JIS-C-5202 6.4	350 $\pm 10^\circ\text{C}$ for 3 ± 0.5 Sec.	$\pm 0.25\% + 0.05 \Omega$
Overload Flame Retardant	JIS-C-5202 7.12	4 times RCWV for 1 Min.	No evidence of flaming or arcing

Note: Rated Continuous Working Voltage (RCWV) = $\sqrt{\text{Power Rating} \times \text{Resistance Value}}$

Metal Oxide Film Resistors

Flame-Proof Type

Normal & Miniature Style [RSF Series]



INTRODUCTION

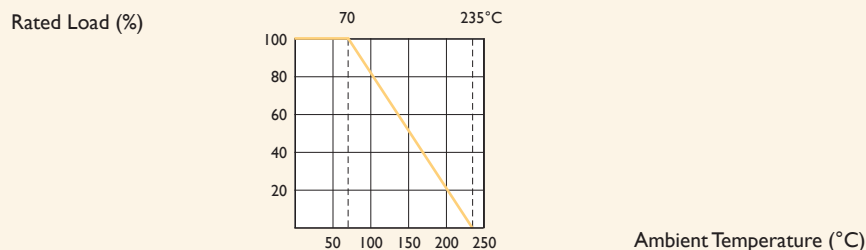
The RSF Series Metal Oxide Film Flame Proof Resistors offer excellent performance in applications where stability and uniformity of characteristics are desired. They provide lower cost alternatives to Carbon Composition Resistors and General Purpose Metal Films. Metal Oxides also can replace many low power General Purpose wirewound applications, saving both money and time, with shorter delivery cycles. The normal style & the miniature style of RSF series are coated with layers of gray and pink colors flame proof lacquer respectively.

FEATURES

Power Rating	1/4W, 1/2W, 1W, 2W, 3W, 5W
Resistance Tolerance	±2%, ±5%
T.C.R.	±300ppm/°C
Flameproof Multi-layer Coating Meets	UL-94V-0
Flameproof Feature Meets Overload Test	UL-1412

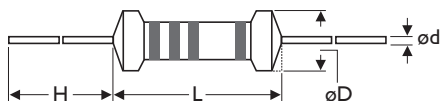
DERATING CURVE

For resistors operated in ambient temperatures above 70°C, power rating must be derated in accordance with the curve below.



DIMENSIONS

Unit: mm



STYLE		DIMENSION			
Normal	Miniature	L	øD	H	ød
RSF-25	RSF50S	6.3±0.5	2.4±0.2	28±2.0	0.55±0.05
RSF-50	RSF1WS	9.0±0.5	3.3±0.3	26±2.0	0.55±0.05
RSF100	RSF2WS	11.5±1.0	4.5±0.5	35±2.0	0.8±0.05
RSF200	RSF3WS	15.5±1.0	5.0±0.5	33±2.0	0.8±0.05
RSF3WM	RSF5SS	17.5±1.0	6.5±1.0	32±2.0	0.8±0.05
RSF300	RSF5WS	24.5±1.0	8.5±1.0	38±2.0	0.8±0.05
RSF500	-	24.5±1.0	8.5±1.0	38±2.0	0.8±0.05

Note: RSF1WS (for MB Type) ød = 0.8±0.05mm

ELECTRICAL CHARACTERISTICS

NORMAL STYLE

STYLE	RSF-25	RSF-50	RSF100	RSF200	RSF3WM	RSF300	RSF500
Power Rating at 70°C	1/4W	1/2W	1W	2W	3W		5W
Maximum Working Voltage	200V	250V	350V		450V	500V	750V
Maximum Overload Voltage	300V	400V	600V		700V	800V	1,000V
Dielectric Withstanding Voltage	250V	350V	500V		600V	700V	750V
Resistance Range	1 Ω - 1M Ω & 0 Ω for E24 series value						
Operating Temp. Range	-55°C to +235°C						
Temperature Coefficient	± 300 ppm/°C						

MINIATURE STYLE

STYLE	RSF50S	RSFIWS	RSF2WS	RSF3WS	RSF5SS	RSF5WS
Power Rating at 70°C	1/2W	1W	2W	3W	5W	
Maximum Working Voltage	250V	300V	350V		500V	700V
Maximum Overload Voltage	400V	500V	600V		800V	900V
Dielectric Withstanding Voltage	350V	400V	500V		700V	700V
Resistance Range	1 Ω - 1M Ω & 0 Ω for E24 series value					
Operating Temp. Range	-55°C to +235°C					
Temperature Coefficient	± 300 ppm/°C					

Note: Special value is available on request

ENVIRONMENTAL CHARACTERISTICS

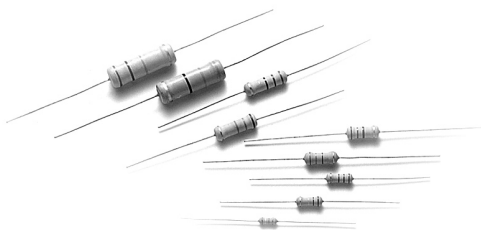
PERFORMANCE TEST	TEST METHOD		APPRAISE
Short Time Overload	JIS-C-5202 5.7	2.5 times RCWV for 5 Sec.	$\pm 1.0\% + 0.05 \Omega$ for normal style $\pm 2.0\% + 0.05 \Omega$ for miniature style
Dielectric Withstanding Voltage	JIS-C-5202 5.7	in V-Block for 60 Sec.	By type
Temperature Coefficient	JIS-C-5202 5.2	-55°C to +235°C	By type
Insulation Resistance	JIS-C-5202 5.6	in V-Block	>1,000M Ω
Solderability	JIS-C-5202 6.5	260 $\pm$ 5°C for 5 $\pm$ 0.5 Sec.	95% Min. coverage
Resistance to Solvent	JIS-C-5202 6.9	PA for 1 Min. with ultrasonic	No deterioration of coatings and markings
Terminal Strength	JIS-C-5202 6.1	Direct load for 10 Sec. in the direction of the terminal leads	≥ 2.5 kg (24.5N)
Pulse Overload	JIS-C-5202 5.8	4 times RCWV 10,000 cycles (1 Sec. on, 25 Sec. off)	$\pm 2.0\% + 0.05 \Omega$
Load Life in Humidity	JIS-C-5202 7.9	40 $\pm$ 2°C, 90-95% RH at RCWV for 1,000 Hr. (1.5 Hr. on, 0.5 Hr. off)	$\pm 5.0\% + 0.05 \Omega$
Load Life	JIS-C-5202 7.10	70°C at RCWV for 1,000 Hr. (1.5 Hr. on, 0.5 Hr. off)	$\pm 5.0\% + 0.05 \Omega$
Temperature Cycling	JIS-C-5202 7.4	-55°C $\Rightarrow$ Room Temp. $\Rightarrow$ +155°C $\Rightarrow$ Room Temp. (5 cycles)	$\pm 1.0\% + 0.05 \Omega$
Resistance to Soldering Heat	JIS-C-5202 6.4	350 $\pm$ 10°C for 3 $\pm$ 0.5 Sec.	$\pm 1.0\% + 0.05 \Omega$
Overload Flame Retardant	JIS-C-5202 7.12	4 times RCWV for 1 Min.	No evidence of flaming or arcing

Note: Rated Continuous Working Voltage (RCWV) = $\sqrt{\text{Power Rating} \times \text{Resistance Value}}$

Metal Oxide Film Resistors

Low Inductive & Flame-Proof Type

Normal & Miniature Style [LIR Series]



INTRODUCTION

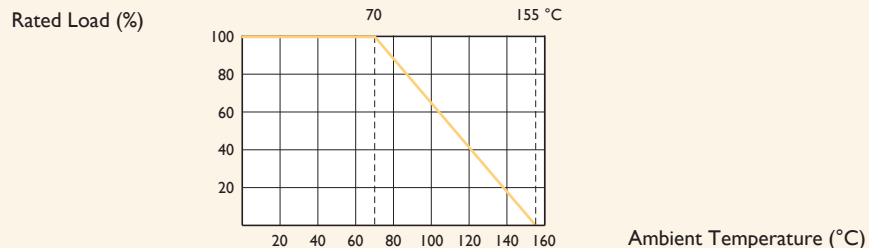
The LIR Series Metal Oxide Film Flame Proof Low Inductive Resistors offer excellent performance in applications where stability and uniformity of characteristics are desired. They provide lower cost alternatives to Carbon Composition Resistors and General Purpose Metal Films. Metal Oxides also can replace many low power General Purpose wirewound applications, saving both money and time, with shorter delivery cycles. The normal style & the miniature style of LIR series are coated with layers of gray and pink colors flame proof lacquer respectively.

FEATURES

Power Rating	1/4W, 1/2W, 1W, 2W
Resistance Tolerance	±5%, ±10%
T.C.R.	±300ppm/°C
Flameproof Multi-layer Coating Meets	UL-94V-0
Flameproof Feature Meets Overload Test	UL-1412

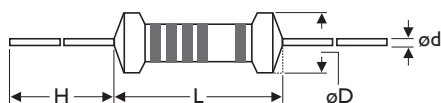
DERATING CURVE

For resistors operated in ambient temperatures above 70°C, power rating must be derated in accordance with the curve below.



DIMENSIONS

Unit: mm



5th color code: blue

STYLE		DIMENSION			
Normal	Miniature	L	øD	H	ød
LIR-25	LIR50S	6.3±0.5	2.4±0.2	28±2.0	0.55±0.05
LIR-50	LIR1WS	9.0±0.5	3.3±0.3	26±2.0	0.55±0.05
LIR100	LIR2WS	11.5±1.0	4.5±0.5	35±2.0	0.8±0.05
LIR200	LIR3WS	15.5±1.0	5.0±0.5	33±2.0	0.8±0.05

Note: LIR1WS (for MB Type) ød 0.8±0.0 mm

ELECTRICAL CHARACTERISTICS

NORMAL STYLE

STYLE	LIR-25	LIR-50	LIR100	LIR200
Power Rating at 70°C	1/4W	1/2W	1W	2W
Maximum Working Voltage	200V	250V	350V	
Maximum Overload Voltage	300V	400V	600V	
Dielectric Withstanding Voltage	250V	350V	500V	
Resistance Range	1 Ω - 100K Ω & 0 Ω for E24 resistance value			
Operating Temp. Range	-55°C to +155°C			
Temperature Coefficient	± 300 ppm/°C			

MINIATURE STYLE

STYLE	LIR50S	LIR1WS	LIR2WS	LIR3WS
Power Rating at 70°C	1/2W	1W	2W	3W
Maximum Working Voltage	250V	300V	350V	
Maximum Overload Voltage	400V	500V	600V	
Dielectric Withstanding Voltage	350V	400V	500V	
Resistance Range	1 Ω - 100K Ω & 0 Ω for E24 resistance value			
Operating Temp. Range	-55°C to +155°C			
Temperature Coefficient	± 300 ppm/°C			

Note: Special value is available on request

ENVIRONMENTAL CHARACTERISTICS

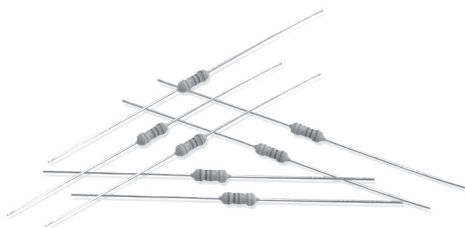
PERFORMANCE TEST	TEST METHOD		APPRAISE
Short Time Overload	JIS-C-5202 5.5	2.5 times RCWV for 5 Sec.	$\pm 1.0\% + 0.05 \Omega$ for normal style $\pm 2.0\% + 0.05 \Omega$ for miniature style
Dielectric Withstanding Voltage	JIS-C-5202 5.7	in V-Block for 60 Sec.	By type
Temperature Coefficient	JIS-C-5202 5.2	-55°C to +155°C	By type
Insulation Resistance	JIS-C-5202 5.6	in V-Block	$> 1,000M \Omega$
Solderability	JIS-C-5202 6.5	260 ± 5 °C for 5 ± 0.5 Sec.	95% Min. coverage
Resistance to Solvent	JIS-C-5202 6.9	IPA for 1 Min. with ultrasonic	No deterioration of coatings and markings
Terminal Strength	JIS-C-5202 6.1	Direct load for 10 Sec. in the direction of the terminal leads	≥ 2.5 kg (24.5N)
Pulse Overload	JIS-C-5202 5.8	4 times RCWV 10,000 cycles (1 Sec. on, 25 Sec. off)	$\pm 2.0\% + 0.05 \Omega$
Load Life in Humidity	JIS-C-5202 7.9	40 ± 2 °C, 90-95% RH at RCWV for 1,000 Hr. (1.5 Hr. on, 0.5 Hr. off)	$\pm 5\% + 0.05 \Omega$
Load Life	JIS-C-5202 7.10	70°C at RCWV for 1,000 Hr. (1.5 Hr. on, 0.5 Hr. off)	$\pm 5\% + 0.05 \Omega$
Temperature Cycling	JIS-C-5202 7.4	-55°C $\Rightarrow$ Room Temp. $\Rightarrow$ +155°C $\Rightarrow$ Room Temp. (5 cycles)	$\pm 1\% + 0.05 \Omega$
Resistance to Soldering Heat	JIS-C-5202 6.4	350 ± 10 °C for 3 ± 0.5 Sec.	$\pm 1\% + 0.05 \Omega$
Overload Flame Retardant	JIS-C-5202 7.12	4 times RCWV for 1 Min.	No evidence of flaming or arcing

Note: Rated Continuous Working Voltage (RCWV) = $\sqrt{\text{Power Rating} \times \text{Resistance Value}}$

Metal Film Resistors

Fusible & Flame-Proof Type

Normal & Miniature Style [FRM Series]



INTRODUCTION

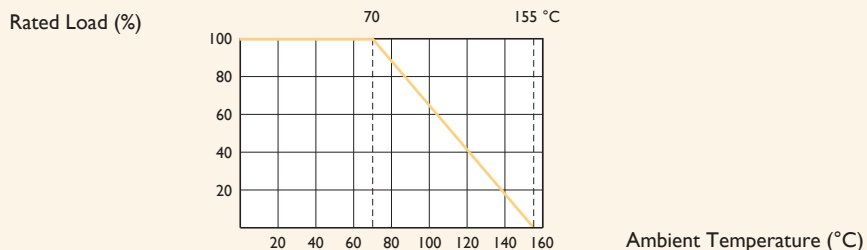
The FRM Series Metal Film Fusible Resistors are manufactured using vacuum sputtering system to deposit multiple layers of mixed metals alloy and passive materials onto a carefully treated high grade ceramic substrate. After a helical groove has been cut in the resistive layer, tinned connecting leads of electrolytic copper are welded to the end-caps. The resistors are coated with layers of gray color lacquer for normal size & pink color lacquer for miniature size. Overload protection without risk of fire. Wide range of overload currents.

FEATURES

Power Rating	1/4W, 1/2W, 1W, 2W, 3W
Resistance Tolerance	±2%, ±5%
T.C.R.	±200ppm/°C
Flameproof Multi-layer Coating Meets	UL-94V-0
Flameproof Feature Meets Overload Test	UL-1412

DERATING CURVE

For resistors operated in ambient temperatures above 70°C, power rating must be derated in accordance with the curve below.



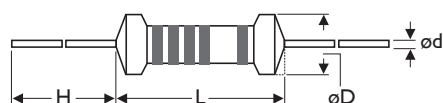
FUSING CHARACTERISTICS

$R < 2.0 \Omega$ Fusing time within 30 seconds at 25 times of rated power

$R > 2.2 \Omega$ Fusing time within 30 seconds at 16 times of rated power

Fusing residual resistive value at least 100 times rated resistance

DIMENSIONS



5th color code: white

Unit: mm

ST YLE		DIMENSION			
Normal	Miniature	L	øD	H	ød
FRM-25	FRM50S	6.3±0.5	2.4±0.2	28±2.0	0.55±0.05
FRM-50	FRM1WS	9.0±0.5	3.3±0.3	26±2.0	0.55±0.05
FRM100	FRM2WS	11.5±1.0	4.5±0.5	35±2.0	0.8±0.05
FRM200	FRM3WS	15.5±1.0	5.0±0.5	33±2.0	0.8±0.05

Note:

ELECTRICAL CHARACTERISTICS

STYLE	FRM-25	FRM50S	FRM-50	FRMIWS	FRM100	FRM2WS	FRM200	FRM3WS
Power Rating at 70°C	1/4W	1/2W		1W		2W		3W
Maximum Working Voltage	200V		250V		300V		350V	
Maximum Overload Voltage	400V		500V		600V		700V	
Dielectric Withstanding Voltage	250V				350V			
Resistance Range	4.7 Ω - 560 Ω ($\pm 2\%$) for E24 series value & 2.2 Ω - 560 Ω ($\pm 5\%$) for E24 series value							
Operating Temp. Range	-55°C to +155°C							
Temperature Coefficient	± 200 ppm/°C							

Note: Special value is available on request

ENVIRONMENTAL CHARACTERISTICS

PERFORMANCE TEST	TEST METHOD		APPRAISE
Short Time Overload	JIS-C-5202 5.5	2.5 times RCWV for 5 Sec.	$\pm 2.0\% + 0.05 \Omega$
Dielectric Withstanding Voltage	JIS-C-5202 5.7	in V-Block for 60 Sec.	By type
Temperature Coefficient	JIS-C-5202 5.2	-55°C to +155°C	by Type
Insulation Resistance	JIS-C-5202 5.6	in V-Block	> 100M Ω
Solderability	JIS-C-5202 6.5	260 $\pm$ 5°C for 5 $\pm$ 0.5 Sec.	95% Min. coverage
Resistance to Solvent	JIS-C-5202 6.9	IPA for 1 Min. with ultrasonic	No deterioration of coatings and markings
Terminal Strength	JIS-C-5202 6.1	Direct load for 10 Sec. In the direction of the terminal leads	≥ 2.5 kg (24.5N)
Pulse Overload	JIS-C-5202 5.8	4 times RCWV 10,000 cycles (1 Sec. on, 25 Sec. off)	$\pm 1.0\% + 0.05 \Omega$
Load Life in Humidity	JIS-C-5202 7.9	40 $\pm$ 2°C, 90-95% RH at RCWV for 1,000 Hr. (1.5 Hr. on, 0.5 Hr. off)	$\pm 5.0\% + 0.05 \Omega$
Load Life	JIS-C-5202 7.10	70°C at RCWV for 1,000 Hr. (1.5 Hr. on, 0.5 Hr. off)	$\pm 5.0\% + 0.05 \Omega$
Temperature Cycling	JIS-C-5202 7.4	-55°C $\Rightarrow$ Room Temp. $\Rightarrow$ +155°C $\Rightarrow$ Room Temp. (5 cycles)	$\pm 2.0\% + 0.05 \Omega$
Resistance to Soldering Heat	JIS-C-5202 6.4	350 $\pm$ 10°C for 3 $\pm$ 0.5 Sec.	$\pm 1.0\% + 0.05 \Omega$
Overload Flame Retardant	JIS-C-5202 7.12	4 times RCWV for 1 Min.	No evidence of flaming or arcing

Note: Rated Continuous Working Voltage (RCWV) = $\sqrt{\text{Power Rating} \times \text{Resistance Value}}$

Melf Metal Film Resistors

MMF Type

Normal & Miniature Style [MMF Series]



INTRODUCTION

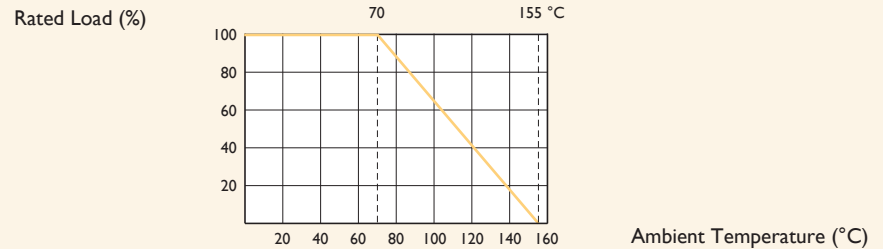
The MMF Series Melf Metal Film Resistors are manufactured using vacuum sputtering system to deposit multiple layers of mixed metals alloy and passivative materials onto a carefully treated high grade ceramic substrate. After a helical groove has been cut in the resistive layer, SMD enabled structure. The resistors are coated with layers of blue color lacquer.

FEATURES

Power Rating	1/6W, 1/4W, 0.4W, 1/2W, 0.6W, 1W
Resistance Tolerance	$\pm 0.1\%$, $\pm 0.25\%$, $\pm 0.5\%$, $\pm 1\%$, $\pm 2\%$, $\pm 5\%$
T.C.R.	$\pm 15\text{ppm}/^{\circ}\text{C}$, $\pm 25\text{ppm}/^{\circ}\text{C}$, $\pm 50\text{ppm}/^{\circ}\text{C}$, $\pm 100\text{ppm}/^{\circ}\text{C}$, $\pm 200\text{ppm}/^{\circ}\text{C}$

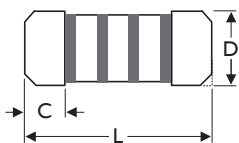
DERATING CURVE

For resistors operated in ambient temperatures above 70°C , power rating must be derated in accordance with the curve below.



DIMENSIONS

Unit: mm



STYLE		DIMENSION		
Normal	Miniature	L	D	C Min.
MMF-12	MMF25S / MMF204	3.50 ± 0.2	1.40 ± 0.15	0.5
MMF-25	MMF50S / MMF207	5.90 ± 0.2	2.20 ± 0.1	0.5
MMF-50	MMF1WS	8.50 ± 0.2	3.20 ± 0.2	0.5

Note:

ELECTRICAL CHARACTERISTICS

STYLE	MMF-12	MMF25S	MMF204	MMF-25	MMF50S	MMF207	MMF-50	MMFIWS
Power Rating at 70°C	1/6W	1/4W	0.4W	1/4W	1/2W	0.6W	1/2W	1W
Maximum Working Voltage	150V	200V		250V			350V	
Maximum Overload Voltage	300V	400V		500V			700V	
Dielectric Withstanding Voltage	300V			500V			700V	
Resistance Range	1 Ω - 1M Ω & 0 Ω for E24 & E96 series value, 100 Ω - 100K Ω for E192 series value							
Operating Temp. Range	-55°C to +155°C							
Temperature Coefficient	$\pm 15\text{ppm}/^\circ\text{C}$, $\pm 25\text{ppm}/^\circ\text{C}$, $\pm 50\text{ppm}/^\circ\text{C}$, $\pm 100\text{ppm}/^\circ\text{C}$, $\pm 200\text{ppm}/^\circ\text{C}$							

Note: Special value is available on request

ENVIRONMENTAL CHARACTERISTICS

PERFORMANCE TEST	TEST METHOD		APPRAISE
Short Time Overload	JIS-C-5202 5.5	2.5 times RCWV for 5 Sec.	$\pm 0.5\% + 0.05 \Omega$
Dielectric Withstanding Voltage	JIS-C-5202 5.7	in V-Block for 60 Sec.	By type
Temperature Coefficient	JIS-C-5202 5.2	-55°C to +155°C	By type
Insulation Resistance	JIS-C-5202 5.6	in V-Block	> 10,000M Ω
Solderability	JIS-C-5202 6.5	260 $\pm 5^\circ\text{C}$ for 5 ± 0.5 Sec.	95% Min. coverage
Resistance to Solvent	JIS-C-5202 6.9	IPA for 1 Min. with ultrasonic	No deterioration of coatings and markings
Pulse Overloads	JIS-C-5202 5.8	4 times RCWV 10,000 cycles (1 Sec. on, 25 Sec. off)	$\pm 1.0\% + 0.05 \Omega$
Load Life in Humidity	JIS-C-5202 7.9	40 $\pm 2^\circ\text{C}$, 90-95% RH at RCWV for 1,000 Hr. (1.5 Hr. on, 0.5 Hr. off)	$\pm 2\% + 0.1 \Omega$
Load Life	JIS-C-5202 7.10	70°C at RCWV for 1,000 Hr. (1.5 Hr. on, 0.5 Hr. off)	$\pm 2.0\% + 0.1 \Omega$
Temperature Cycling	JIS-C-5202 7.4	-55°C $\Rightarrow$ Room Temp. $\Rightarrow$ +155°C $\Rightarrow$ Room Temp. (5 cycles)	$\pm 0.75\% + 0.05 \Omega$
Resistance to Soldering Heat	JIS-C-5202 6.4	350 $\pm 10^\circ\text{C}$ for 3 ± 0.5 Sec.	$\pm 0.5\% + 0.05 \Omega$

Note: Rated Continuous Working Voltage (RCWV) = $\sqrt{\text{Power Rating} \times \text{Resistance Value}}$

Melf Metal Film Resistors

MMP Type

High Power Style [MMP Series]



INTRODUCTION

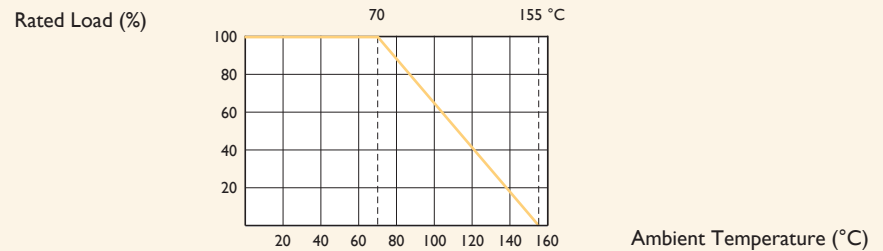
The MMP Series Melf Metal Film High Power Resistors are manufactured using vacuum sputtering system to deposit multiple layers of mixed metals alloy and passive materials onto a carefully treated high grade ceramic substrate. After a helical groove has been cut in the resistive layer; SMD enabled structure and high power in small packages. The resistors are coated with layers of blue color lacquer.

FEATURES

Power Rating	1W, 2W
Resistance Tolerance	$\pm 1\%$, $\pm 2\%$, $\pm 5\%$
T.C.R.	$\pm 50\text{ppm}/^{\circ}\text{C}$, $\pm 100\text{ppm}/^{\circ}\text{C}$, $\pm 200\text{ppm}/^{\circ}\text{C}$

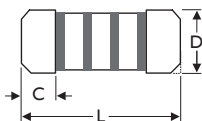
DERATING CURVE

For resistors operated in ambient temperatures above 70°C , power rating must be derated in accordance with the curve below.



DIMENSIONS

Unit: mm



STYLE	DIMENSION		
Ultra Miniature	L	D	C Min.
MMP100	5.9 ± 0.2	2.2 ± 0.1	0.5
MMP200	8.5 ± 0.2	3.0 ± 0.2	0.5

Note:

ELECTRICAL CHARACTERISTICS

STYLE	MMP100	MMP200
Power Rating at 70°C	1W	2W
Maximum Working Voltage	350V	
Maximum Overload Voltage	700V	
Dielectric Withstanding Voltage	500V	
Resistance Range	1 Ω - 1M Ω & 0 Ω for E24 & E96 series value	
Operating Temp. Range	-55°C to +155°C	
Temperature Coefficient	$\pm 50\text{ppm}/^\circ\text{C}$, $\pm 100\text{ppm}/^\circ\text{C}$, $\pm 200\text{ppm}/^\circ\text{C}$	

Note: Special value is available on request

ENVIRONMENTAL CHARACTERISTICS

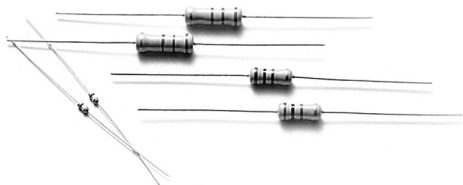
PERFORMANCE TEST	TEST METHOD		APPRAISE
Short Time Overload	JIS-C-5202 5.5	2.5 times RCWV for 5 Sec.	$\pm 0.5\% + 0.05 \Omega$
Dielectric Withstanding Voltage	JIS-C-5202 5.7	in V-Block for 60 Sec.	By type
Temperature Coefficient	JIS-C-5202 5.2	-55°C to +155°C	By type
Insulation Resistance	JIS-C-5202 5.6	in V-Block	$> 10,000\text{M} \Omega$
Solderability	JIS-C-5202 6.5	260 $\pm 5^\circ\text{C}$ for 5 ± 0.5 Sec.	95% Min. coverage
Resistance to Solvent	JIS-C-5202 6.9	IPA for 1 Min. with ultrasonic	No deterioration of coatings and markings
Pulse Overload	JIS-C-5202 5.8	4 times RCWV 10,000 cycles (1 Sec. on, 25 Sec. off)	$\pm 1.0\% + 0.05 \Omega$
Load Life in Humidity	JIS-C-5202 7.9	40 $\pm 2^\circ\text{C}$, 90-95% RH at RCWV for 1,000 Hr. (1.5 Hr. on, 0.5 Hr. off)	$\pm 2\% + 0.1 \Omega$
Load Life	JIS-C-5202 7.10	70°C at RCWV for 1,000 Hr. (1.5 Hr. on, 0.5 Hr. off)	$\pm 2\% + 0.1 \Omega$
Temperature Cycling	JIS-C-5202 7.4	-55°C $\Rightarrow$ Room Temp. $\Rightarrow$ +155°C $\Rightarrow$ Room Temp. (5 cycles)	$\pm 0.75\% + 0.05 \Omega$
Resistance to Soldering Heat	JIS-C-5202 6.4	350 $\pm 10^\circ\text{C}$ for 3 ± 0.5 Sec.	$\pm 0.5\% + 0.05 \Omega$

Note: Rated Continuous Working Voltage (RCWV) = $\sqrt{\text{Power Rating} \times \text{Resistance Value}}$

Carbon Film Resistors

CFR Type

Normal & Miniature Style [CFR Series]



INTRODUCTION

The CFR Series Carbon Film Resistors are manufactured by coating a homogeneous film of pure carbon on high grade ceramic rods. After a helical groove has been cut in the resistive layer, tinned connecting leads of electrolytic copper are welded to the end-caps. The resistors are coated with layers of tan color lacquer.

FEATURES

Power Rating	1/6W, 1/4W, 1/2W, 1W, 2W, 3W
Resistance Tolerance	±2%, ±5%
T.C.R.	see Table I

DERATING CURVE

For resistors operated in ambient temperatures above 70°C, power rating must be derated in accordance with the curve below.

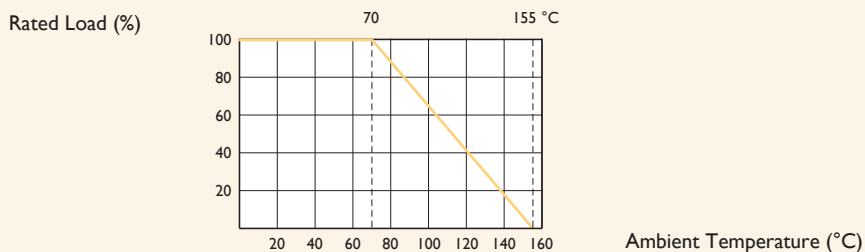
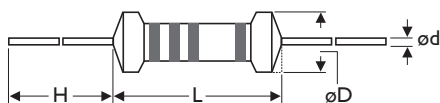


TABLE I TEMPERATURE COEFFICIENT

STYLE	MAX. VALUE OF TEMP. COEFFICIENT PPM/°C		
	under 100K Ω	100K Ω - 1M Ω	1M Ω - 10M Ω
CFR100, CFR200, CFR2WS, CFR3WS	±350	-500	-1,500
CFR-12, CFR-25, CFR-50, CFR25S, CFR50S, CFR1WS	+350 / -500	-700	-1,500

DIMENSIONS

Unit: mm



STYLE		DIMENSION			
Normal	Miniature	L	øD	H	ød
CFR-12	CFR25S	3.4±0.3	1.9±0.2	28±2.0	0.45±0.05
CFR-25	CFR50S	6.3±0.5	2.4±0.2	28±2.0	0.55±0.05
CFR-50	CFR1WS	9.0±0.5	3.3±0.3	26±2.0	0.55±0.05
CFR100	CFR2WS	11.5±1.0	4.5±0.5	35±2.0	0.8±0.05
CFR200	CFR3WS	15.5±1.0	5.0±0.5	33±2.0	0.8±0.05

Note:

ELECTRICAL CHARACTERISTICS

STYLE	CFR-12	CFR25S	CFR-25	CFR50S	CFR-50	CFRIWS	CFRI00	CFR2WS	CFR200	CFR3WS
Power Rating at 70°C	1/6W	1/4W		1/2W		1W		2W		3W
Maximum Working Voltage	150V	200V	250V	300V	350V	400V	500V			
Maximum Overload Voltage	300V	400V	500V	600V	700V	800V	1,000V			
Dielectric Withstanding Voltage	300V	400V	500V			700V	1,000V			
Resistance Range	1 Ω - 10M Ω & 0 Ω for E24 series value									
Operating Temp. Range	-55°C to +155°C									
Temperature Coefficient	see Table I									

Note: Special value is available on request

ENVIRONMENTAL CHARACTERISTICS

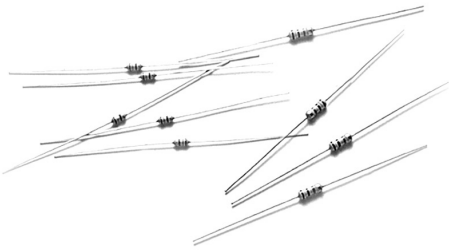
PERFORMANCE TEST	TEST METHOD		APPRAISE
Short Time Overload	JIS-C-5202 5.5	2.5 times RCWV for 5 Sec.	$\pm 0.75\% + 0.05 \Omega$
Dielectric Withstanding Voltage	JIS-C-5202 5.7	in V-Block for 60 Sec.	By type
Temperature Coefficient	JIS-C-5202 5.2	-55°C to +155°C	By type
Insulation Resistance	JIS-C-5202 5.6	in V-Block	$> 1,000M \Omega$
Solderability	JIS-C-5202 6.5	260 $\pm$ 5°C for 5 $\pm$ 0.5 Sec.	95% Min. coverage
Resistance to Solvent	JIS-C-5202 6.9	IPA for 1 Min. with ultrasonic	No deterioration of coatings and markings
Terminal Strength	JIS-C-5202 6.1	Direct load for 10 Sec. in the direction of the terminal leads	$\geq 2.5kg$ (24.5N)
Pulse Overload	JIS-C-5202 5.8	4 times RCWV 10,000 cycles (1 Sec. on, 25 Sec. off)	$\pm 1.0\% + 0.05 \Omega$
Load Life in Humidity	JIS-C-5202 7.9	40 $\pm$ 2°C, 90-95% RH at RCWV for 1,000 Hr. (1.5 Hr. on, 0.5 Hr. off)	$\pm 3\% + 0.05 \Omega$
Load Life	JIS-C-5202 7.10	70°C at RCWV for 1,000 Hr. (1.5 Hr. on, 0.5 Hr. off)	$\pm 3\% + 0.05 \Omega$
Temperature Cycling	JIS-C-5202 7.4	-55°C $\Rightarrow$ Room Temp. $\Rightarrow$ +155°C $\Rightarrow$ Room Temp. (5 cycles)	$\pm 1\% + 0.05 \Omega$
Resistance to Soldering Heat	JIS-C-5202 6.4	350 $\pm$ 10°C for 3 $\pm$ 0.5 Sec.	$\pm 1\% + 0.05 \Omega$

Note: Rated Continuous Working Voltage (RCWV) = $\sqrt{\text{Power Rating} \times \text{Resistance Value}}$

Carbon Film Resistors

Professional Type

Miniature Style [CF0 Series]



INTRODUCTION

The CF0 Series Carbon Film Professional Resistors are manufactured by coating a homogeneous film of pure carbon on high grade ceramic rods. After a helical groove has been cut in the resistive layer, tinned connecting leads of electrolytic copper are welded to the end-caps. The resistors are coated with layers of tan color lacquer.

FEATURES

Power Rating	0.4W, 0.6W
Resistance Tolerance	±2%, ±5%
T.C.R.	see Table I

DERATING CURVE

For resistors operated in ambient temperatures above 70°C, power rating must be derated in accordance with the curve below.

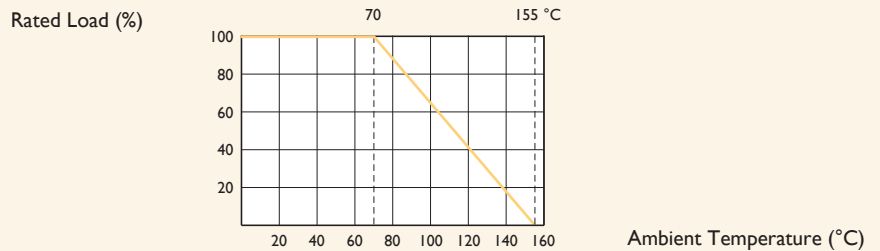
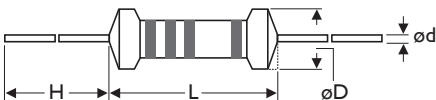


TABLE I TEMPERATURE COEFFICIENT

STYLE	MAX. VALUE OF TEMP. COEFFICIENT PPM/°C		
	under 100K Ω	100K Ω - 1M Ω	1M Ω - 10M Ω
CF0204, CF0207	+350 / -500	-700	-1,500

DIMENSIONS

Unit: mm



STYLE	DIMENSION			
Miniature	L	ϕD	H	ϕd
CF0204	3.4±0.3	1.9±0.2	28±2.0	0.45±0.05
CF0207	6.3±0.5	2.4±0.2	28±2.0	0.55±0.05

Note:

ELECTRICAL CHARACTERISTICS

STYLE	CF0204	CF0207
Power Rating at 70°C	0.4W	0.6W
Maximum Working Voltage	200V	300V
Maximum Overload Voltage	400V	600V
Dielectric Withstanding Voltage	300V	500V
Resistance Range	1 Ω - 10M Ω & 0 Ω for E24 series value	
Operating Temp. Range	-55°C to +155°C	
Temperature Coefficient	see Table I	

Note: Special value is available on request

ENVIRONMENTAL CHARACTERISTICS

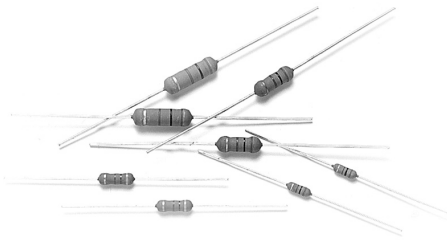
PERFORMANCE TEST	TEST METHOD		APPRAISE
Short Time Overload	JIS-C-5202 5.5	2.5 times RCWV for 5 Sec.	$\pm 0.75\% + 0.05 \Omega$
Dielectric Withstanding Voltage	JIS-C-5202 5.7	in V-Block for 60 Sec.	By type
Temperature Coefficient	JIS-C-5202 5.2	-55°C to +155°C	By type
Insulation Resistance	JIS-C-5202 5.6	in V-Block	> 1,000M Ω
Solderability	JIS-C-5202 6.5	260 $\pm$ 5°C for 5 $\pm$ 0.5 Sec.	95% Min. coverage
Resistance to Solvent	JIS-C-5202 6.9	IPA for 1 Min. with ultrasonic	No deterioration of coatings and markings
Terminal Strength	JIS-C-5202 6.1	Direct load for 10 Sec. In the direction of the terminal leads	$\geq 2.5\text{kg}$ (24.5N)
Pulse Overload	JIS-C-5202 5.8	4 times RCWV 10,000 cycles (1 Sec. on, 25 Sec. off)	$\pm 1.0\% + 0.05 \Omega$
Load Life in Humidity	JIS-C-5202 7.9	40 $\pm$ 2°C, 90-95% RH at RCWV for 1,000 Hr. (1.5 Hr. on, 0.5 Hr. off)	$\pm 3\% + 0.05 \Omega$
Load Life	JIS-C-5202 7.10	70°C at RCWV for 1,000 Hr. (1.5 Hr. on, 0.5 Hr. off)	$\pm 3\% + 0.05 \Omega$
Temperature Cycling	JIS-C-5202 7.4	-55°C $\Rightarrow$ Room Temp. $\Rightarrow$ +155°C $\Rightarrow$ Room Temp. (5 cycles)	$\pm 1\% + 0.05 \Omega$
Resistance to Soldering Heat	JIS-C-5202 6.4	350 $\pm$ 10°C for 3 $\pm$ 0.5 Sec.	$\pm 1\% + 0.05 \Omega$

Note: Rated Continuous Working Voltage (RCWV) = $\sqrt{\text{Power Rating} \times \text{Resistance Value}}$

Carbon Film Resistors

Flame-Proof Type

Normal & Miniature Style [FCR Series]



INTRODUCTION

The FCR Series Carbon Film Flame Proof Resistors are manufactured by coating a homogeneous film of pure carbon on high grade ceramic rods. After a helical groove has been cut in the resistive layer, tinned connecting leads of electrolytic copper are welded to the end-caps. The resistors are coated with layers of gray color lacquer.

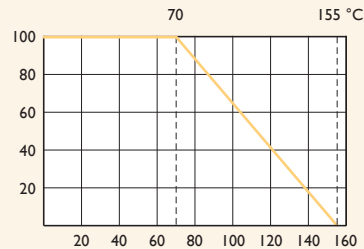
FEATURES

Power Rating	1/4W, 1/2W, 1W, 2W, 3W
Resistance Tolerance	±2%, ±5%
T.C.R.	see Table I
Flameproof Multi-layer Coating Meets	UL-94V-0
Flameproof Feature Meets Overload Test	UL-1412

DERATING CURVE

For resistors operated in ambient temperatures above 70°C, power rating must be derated in accordance with the curve below.

Rated Load (%)



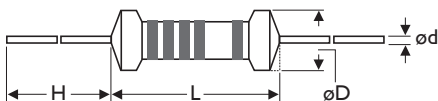
Ambient Temperature (°C)

TABLE I TEMPERATURE COEFFICIENT

STYLE	MAX. VALUE OF TEMP. COEFFICIENT PPM/°C		
	under 100K Ω	100K Ω - 1M Ω	1M Ω - 10M Ω
FCR100, FCR200, FCR2WS, FCR3WS	±350	-500	-1,500
FCR-25, FCR-50, FCR50S, FCR1WS	+350 / -500	-700	-1,500

DIMENSIONS

Unit: mm



5th color code: black

STYLE		DIMENSION			
Normal	Miniature	L	øD	H	ød
FCR-25	FCR50S	6.3±0.5	2.4±0.2	28±2.0	0.55±0.05
FCR-50	FCR1WS	9.0±0.5	3.3±0.3	26±2.0	0.55±0.05
FCR100	FCR2WS	11.5±1.0	4.5±0.5	35±2.0	0.8±0.05
FCR200	FCR3WS	15.5±1.0	5.0±0.5	33±2.0	0.8±0.05

Note:

ELECTRICAL CHARACTERISTICS

STYLE	FCR-25	FCR50S	FCR-50	FCRIWS	FCRI00	FCR2WS	FCR200	FCR3WS
Power Rating at 70°C	1/4W	1/2W		1W		2W		3W
Maximum Working Voltage	250V	300V	350V	400V	500V			
Maximum Overload Voltage	500V	600V	700V	800V	1,000V			
Dielectric Withstanding Voltage	400V		500V	600V	750V			
Resistance Range	1 Ω - 10M Ω & 0 Ω for E24 series value							
Operating Temp. Range	-55°C to +155°C							
Temperature Coefficient	see Table I							

Note: Special value is available on request

ENVIRONMENTAL CHARACTERISTICS

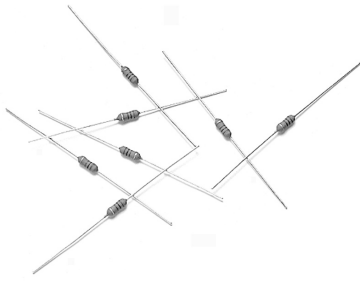
PERFORMANCE TEST	TEST METHOD		APPRAISE
Short Time Overload	JIS-C-5202 5.5	2.5 times RCWV for 5 Sec.	$\pm 0.75\% + 0.05 \Omega$
Dielectric Withstanding Voltage	JIS-C-5202 5.7	in V-Block for 60 Sec.	By type
Temperature Coefficient	JIS-C-5202 5.2	-55°C to +155°C	By type
Insulation Resistance	JIS-C-5202 5.6	in V-Block	$> 1,000M \Omega$
Solderability	JIS-C-5202 6.5	260 $\pm$ 5°C for 5 $\pm$ 0.5 Sec.	95% Min. coverage
Resistance to Solvent	JIS-C-5202 6.9	IPA for 1 Min. with ultrasonic	No deterioration of coatings and markings
Terminal Strength	JIS-C-5202 6.1	Direct load for 10 Sec. in the direction of the terminal leads	$\geq 2.5\text{kg}$ (24.5N)
Pulse Overload	JIS-C-5202 5.8	4 times RCWV 10,000 cycles (1 Sec. on, 25 Sec. off)	$\pm 1.0\% + 0.05 \Omega$
Load Life in Humidity	JIS-C-5202 7.9	40 $\pm$ 2°C, 90-95% RH at RCWV for 1,000 Hr. (1.5 Hr. on, 0.5 Hr. off)	$\pm 3\% + 0.05 \Omega$
Load Life	JIS-C-5202 7.10	70°C at RCWV for 1,000 Hr. (1.5 Hr. on, 0.5 Hr. off)	$\pm 3\% + 0.05 \Omega$
Temperature Cycling	JIS-C-5202 7.4	-55°C $\Rightarrow$ Room Temp. $\Rightarrow$ +155°C $\Rightarrow$ Room Temp. (5 cycles)	$\pm 1\% + 0.05 \Omega$
Resistance to Soldering Heat	JIS-C-5202 6.4	350 $\pm$ 10°C for 3 $\pm$ 0.5 Sec.	$\pm 1\% + 0.05 \Omega$
Overload Flame Retardant	JIS-C-5202 7.12	4 times RCWV for 1 Min.	No evidence of flaming or arcing

Note: Rated Continuous Working Voltage (RCWV) = $\sqrt{\text{Power Rating} \times \text{Resistance Value}}$

Carbon Film Resistors

Professional & Flame-Proof Type

Miniature Style [FC0 Series]



INTRODUCTION

The FC0 Series Carbon Film Professional & Flame Proof Resistors are manufactured by coating a homogeneous film of pure carbon on high grade ceramic rods. After a helical groove has been cut in the resistive layer, tinned connecting leads of electrolytic copper are welded to the end-caps. The resistors are coated with layers of green color lacquer.

FEATURES

Power Rating	0.4W, 0.6W
Resistance Tolerance	±2%, ±5%
T.C.R.	see Table I
Flameproof Multi-layer Coating Meets	UL-94V-0
Flameproof Feature Meets Overload Test	UL-1412

DERATING CURVE

For resistors operated in ambient temperatures above 70°C, power rating must be derated in accordance with the curve below.

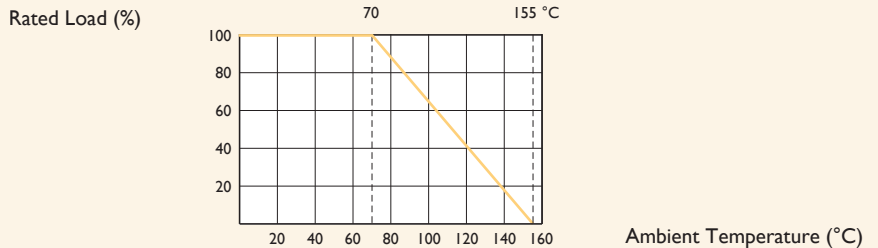
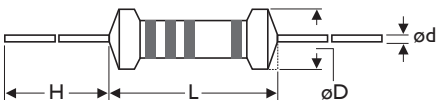


TABLE I TEMPERATURE COEFFICIENT

STYLE	MAX. VALUE OF TEMP. COEFFICIENT PPM/°C		
	under 100K Ω	100K Ω - 1M Ω	1M Ω - 10M Ω
FC0204, FC0207	+300 / -500	-700	-1,500

DIMENSIONS

Unit: mm



STYLE	DIMENSION			
Miniature	L	øD	H	ød
FC0204	3.4±0.3	1.9±0.2	28±2.0	0.45±0.05
FC0207	6.3±0.5	2.4±0.2	28±2.0	0.55±0.05

Note:

ELECTRICAL CHARACTERISTICS

STYLE	FC0204	FC0207
Power Rating at 70°C	0.4W	0.6W
Maximum Working Voltage	200V	300V
Maximum Overload Voltage	400V	600V
Dielectric Withstanding Voltage	300V	500V
Resistance Range	1 Ω - 10M Ω & 0 Ω for E24 series value	
Operating Temp. Range	-55°C to +155°C	
Temperature Coefficient	see Table I	

Note: Special value is available on request

ENVIRONMENTAL CHARACTERISTICS

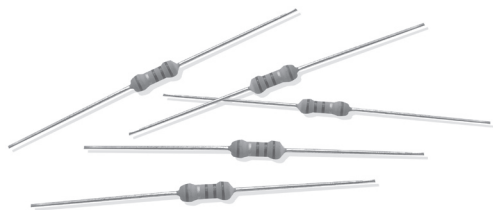
PERFORMANCE TEST	TEST METHOD		APPRAISE
Short Time Overload	JIS-C-5202 5.5	2.5 times RCWV for 5 Sec.	$\pm 0.75\% + 0.05 \Omega$
Dielectric Withstanding Voltage	JIS-C-5202 5.7	in V-Block for 60 Sec.	By type
Temperature Coefficient	JIS-C-5202 5.2	-55°C to +155°C	By type
Insulation Resistance	JIS-C-5202 5.6	in V-Block	> 1,000M Ω
Solderability	JIS-C-5202 6.5	260 $\pm$ 5°C for 5 $\pm$ 0.5 Sec.	95% Min. coverage
Resistance to Solvent	JIS-C-5202 6.9	IPA for 1 Min. with ultrasonic	No deterioration of coatings and markings
Terminal Strength	JIS-C-5202 6.1	Direct load for 10 Sec. in the direction of the terminal leads	$\geq 2.5\text{kg}$ (24.5N)
Pulse Overload	JIS-C-5202 5.8	4 times RCWV 10,000 cycles (1 Sec. on, 25 Sec. off)	$\pm 1.0\% + 0.05 \Omega$
Load Life in Humidity	JIS-C-5202 7.9	40 $\pm$ 2°C, 90-95% RH at RCWV for 1,000 Hr. (1.5 Hr. on, 0.5 Hr. off)	$\pm 3.0\% + 0.05 \Omega$
Load Life	JIS-C-5202 7.10	70°C at RCWV for 1,000 Hr. (1.5 Hr. on, 0.5 Hr. off)	$\pm 3.0\% + 0.05 \Omega$
Temperature Cycling	JIS-C-5202 7.4	-55°C $\Rightarrow$ Room Temp. $\Rightarrow$ +155°C $\Rightarrow$ Room Temp. (5 cycles)	$\pm 1.0\% + 0.05 \Omega$
Resistance to Soldering Heat	JIS-C-5202 6.4	350 $\pm$ 10°C for 3 $\pm$ 0.5 Sec.	$\pm 1.0\% + 0.05 \Omega$
Overload Flame Retardant	JIS-C-5202 7.12	4 times RCWV for 1 Min.	No evidence of flaming or arcing

Note: Rated Continuous Working Voltage (RCWV) = $\sqrt{\text{Power Rating} \times \text{Resistance Value}}$

Carbon Film Resistors

Non Inductive &
Flame-Proof Type

Normal & Miniature Style [NCR Series]



INTRODUCTION

The NCR Series Carbon Film Non Inductive Flame Proof Resistors are manufactured by coating a homogeneous film of pure carbon on high grade ceramic rods. Tinned connecting leads of electrolytic copper are welded to the end-caps. The Inductance is $< 1 \mu\text{H}$.

The resistors are coated with layers of gray color lacquer for normal size & pink color lacquer for miniature size.

FEATURES

Power Rating	1/4W, 1/2W, 1W, 2W, 3W
Resistance Tolerance	$\pm 5\%$, $\pm 10\%$
T.C.R.	see Table I
Flameproof Multi-layer Coating Meets	UL-94V-0
Flameproof Feature Meets Overload Test	UL-1412

DERATING CURVE

For resistors operated in ambient temperatures above 70°C , power rating must be derated in accordance with the curve below.

Rated Load (%)

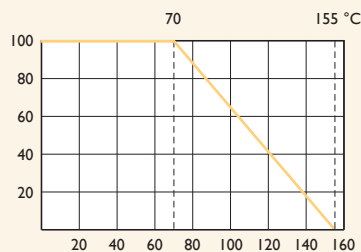
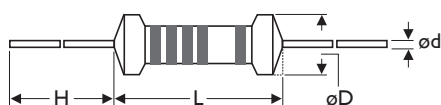
Ambient Temperature ($^\circ\text{C}$)

TABLE I TEMPERATURE COEFFICIENT

VALUE RANGE	MAX. VALUE OF TEMP. COEFFICIENT PPM/ $^\circ\text{C}$
Under $5\text{K } \Omega$	-500
$5\text{K} - 10\text{K } \Omega$	-800

DIMENSIONS

Unit: mm



5th color code: green

STYLE		DIMENSION			
Normal	Miniature	L	ϕD	H	ϕd
NCR-25	NCR50S	6.3 ± 0.5	2.4 ± 0.2	28 ± 2.0	0.55 ± 0.05
NCR-50	NCR1WS	9.0 ± 0.5	3.3 ± 0.3	26 ± 2.0	0.55 ± 0.05
NCR100	NCR2WS	11.5 ± 1.0	4.5 ± 0.5	35 ± 2.0	0.8 ± 0.05
NCR200	NCR3WS	15.5 ± 1.0	5.0 ± 0.5	33 ± 2.0	0.8 ± 0.05

Note:

ELECTRICAL CHARACTERISTICS

STYLE	NCR-25	NCR50S	NCR-50	NCRIWS	NCRI00	NCR2WS	NCR200	NCR3WS
Power Rating at 70°C	1/4W	1/2W		1W		2W		3W
Maximum Working Voltage	250V	300V	350V	400V	500V			
Maximum Overload Voltage	500V	600V	700V	800V	1,000V			
Dielectric Withstanding Voltage	500V		700V		1,000V			
Resistance Range	2.2 Ω - 10K Ω for E24 series value							
Operating Temp. Range	-55°C to +155°C							
Temperature Coefficient	see Table I							

Note: Special value is available on request

ENVIRONMENTAL CHARACTERISTICS

PERFORMANCE TEST	TEST METHOD		APPRAISE
Short Time Overload	JIS-C-5202 5.5	2.5 times RCWV for 5 Sec.	$\pm 0.75\% + 0.05 \Omega$ for normal style $\pm 2.0\% + 0.05 \Omega$ for miniature style
Dielectric Withstanding Voltage	JIS-C-5202 5.7	in V-Block for 60 Sec.	By type
Temperature Coefficient	JIS-C-5202 5.2	-55°C to +155°C	By type
Insulation Resistance	JIS-C-5202 5.6	in V-Block	>1,000M Ω
Solderability	JIS-C-5202 6.5	260 $\pm$ 5°C for 5 $\pm$ 0.5 Sec.	95% Min. coverage
Resistance to Solvent	JIS-C-5202 6.9	IPA for 1 Min. with ultrasonic	No deterioration of coatings and markings
Terminal Strength	JIS-C-5202 6.1	Direct load for 10 Sec. in the direction of the terminal leads	$\geq 2.5\text{kg}$ (24.5N)
Pulse Overload	JIS-C-5202 5.8	4 times RCWV 10,000 cycles(1 Sec. on, 25 Sec. off)	$\pm 1.0\% + 0.05 \Omega$
Load Life in Humidity	JIS-C-5202 7.9	40 $\pm$ 2°C, 90-95% RH at RCWV for 1,000 Hr. (1.5 Hr. on, 0.5 Hr. off)	$\pm 3.0\% + 0.05 \Omega$
Load Life	JIS-C-5202 7.10	70°C at RCWV for 1,000 Hr. (1.5 Hr. on, 0.5 Hr. off)	$\pm 3.0\% + 0.05 \Omega$
Temperature Cycling	JIS-C-5202 7.4	-55°C $\Rightarrow$ Room Temp. $\Rightarrow$ +155°C $\Rightarrow$ Room Temp. (5 cycles)	$\pm 1.0\% + 0.05 \Omega$
Resistance to Soldering Heat	JIS-C-5202 6.4	350 $\pm$ 10°C for 3 $\pm$ 0.5 Sec.	$\pm 1.0\% + 0.05 \Omega$
Overload Flame Retardant	JIS-C-5202 7.12	4 times RCWV for 1 Min.	No evidence of flaming or arcing

Note: Rated Continuous Working Voltage (RCWV) = $\sqrt{\text{Power Rating} \times \text{Resistance Value}}$

Melf Carbon Film Resistors

MCF Type

Normal & Miniature Style [MCF Series]



INTRODUCTION

The MCF Series Melf Carbon Film Resistors are manufactured by coating a homogeneous film of pure carbon on high grade ceramic rods. After a helical groove has been cut in the resistive layer, tinned connecting leads of electrolytic copper are welded to the end-caps. SMD enabled structure. The resistors are coated with layers of tan color lacquer.

FEATURES

Power Rating	1/6W, 1/4W, 0.4W, 1/2W, 0.6W, 1W
Resistance Tolerance	±2%, ±5%
T.C.R.	see Table I

DERATING CURVE

For resistors operated in ambient temperatures above 70°C, power rating must be derated in accordance with the curve below.

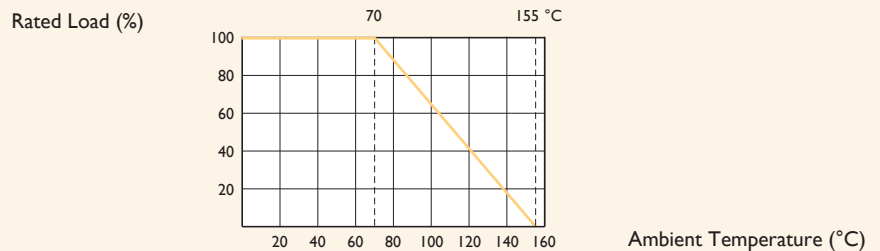
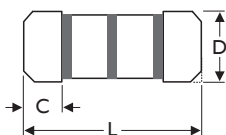


TABLE I TEMPERATURE COEFFICIENT

STYLE	MAX. VALUE OF TEMP. COEFFICIENT PPM/°C			
	under 1K Ω	1K1 Ω -47K Ω	51K Ω -470K Ω	510K Ω -1M Ω
MCF-12, MCF25S, MCF204	0 to -350	0 to -600	0 to -1,000	0 to -1,500
MCF-25, MCF50S, MCF207, MCF-50, MCF1WS	under 10K Ω	11K1 Ω -150K Ω	160K Ω -2M2 Ω	
	0 to -350	0 to -600	0 to -1,000	

DIMENSIONS

Unit: mm



STYLE		DIMENSION		
Normal	Miniature	L	D	C Min.
MCF-12	MCF25S / MCF204	3.50±0.2	1.40±0.15	0.5
MCF-25	MCF50S / MCF207	5.90±0.2	2.20±0.1	0.5
MCF-50	MCF1WS	8.50±0.2	3.20±0.2	0.5

Note:

ELECTRICAL CHARACTERISTICS

STYLE	MCF-12	MCF25S	MCF204	MCF-25	MCF50S	MCF207	MCF-50	MCFIWS
Power Rating at 70°C	1/6W	1/4W	0.4W	1/4W	1/2W	0.6W	1/2W	1W
Maximum Working Voltage	200V	250V		300V			350V	
Maximum Overload Voltage	400V	500V		600V			700V	
Dielectric Withstanding Voltage	200V			500V			700V	
Resistance Range	10 Ω - 1M Ω & 0 Ω for E24 series value							
Operating Temp. Range	-55°C to +155°C							
Temperature Coefficient	see Table I							

Note: Special value is available on request

ENVIRONMENTAL CHARACTERISTICS

PERFORMANCE TEST	TEST METHOD		APPRAISE
Short Time Overload	JIS-C-5202 5.5	2.5 times RCWV for 5 Sec.	±1.0%+0.05 Ω
Dielectric Withstanding Voltage	JIS-C-5202 5.7	in V-Block for 60 Sec.	By type
Temperature Coefficient	JIS-C-5202 5.2	-55°C to +155°C	By type
Insulation Resistance	JIS-C-5202 5.6	in V-Block	>10,000M Ω
Solderability	JIS-C-5202 6.5	260±5°C for 5±0.5 Sec.	95% Min. coverage
Resistance to Solvent	JIS-C-5202 6.9	IPA for 1 Min. with ultrasonic	No deterioration of coatings and markings
Pulse Overload	JIS-C-5202 5.8	4 times RCWV 10,000 cycles (1 Sec. on, 25 Sec. off)	±1.0%+0.05 Ω
Load Life in Humidity	JIS-C-5202 7.9	40±2°C, 90-95% RH at RCWV for 1,000 Hr. (1.5 Hr. on, 0.5 Hr. off)	±5.0%+0.1 Ω
Load Life	JIS-C-5202 7.10	70°C at RCWV for 1,000 Hr. (1.5 Hr. on, 0.5 Hr. off)	±3.0%+0.1 Ω
Temperature Cycling	JIS-C-5202 7.4	-55°C ⇄ Room Temp. ⇄ +155°C ⇄ Room Temp. (5 cycles)	±0.75%+0.05 Ω
Resistance to Soldering Heat	JIS-C-5202 6.4	350±10°C for 3±0.5 Sec.	±1.0%+0.05 Ω

Note: Rated Continuous Working Voltage (RCWV) = $\sqrt{\text{Power Rating} \times \text{Resistance Value}}$

Melf Carbon Film Resistors

MCP Type

High Power Style [MCP Series]



INTRODUCTION

The MCP Series Melf Carbon Film Resistors are manufactured by coating a homogeneous film of pure carbon on high grade ceramic rods. After a helical groove has been cut in the resistive layer, tinned connecting leads of electrolytic copper are welded to the end-caps. SMD enabled structure and high power in small packages. The resistors are coated with layers of tan color lacquer.

FEATURES

Power Rating	1W, 2W
Resistance Tolerance	±2%, ±5%
T.C.R.	see Table I

DERATING CURVE

For resistors operated in ambient temperatures above 70°C, power rating must be derated in accordance with the curve below.

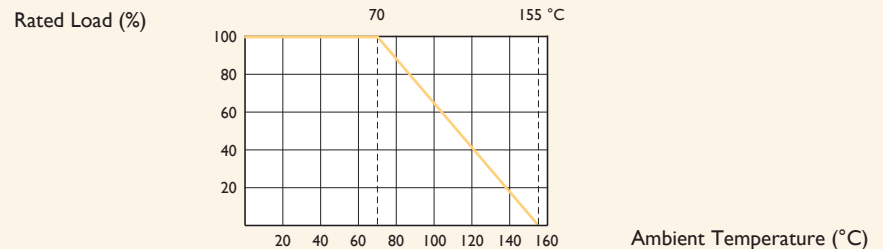
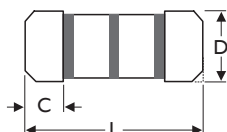


TABLE I TEMPERATURE COEFFICIENT

STYLE	MAX. VALUE OF TEMP. COEFFICIENT PPM/°C		
	under 10K Ω	11K Ω - 150K Ω	160K Ω - 2M2 Ω
MCP100, MCP200	0 to -350	0 to -600	0 to -1,000

DIMENSIONS

Unit: mm



STYLE	DIMENSION		
Ultra Miniature	L	D	C Min.
MCP100	5.9±0.2	2.2±0.1	0.5
MCP200	8.5±0.2	3.0±0.2	0.5

Note:

ELECTRICAL CHARACTERISTICS

STYLE	MCP100	MCP200
Power Rating at 70°C	1W	2W
Maximum Working Voltage	350V	
Maximum Overload Voltage	700V	
Dielectric Withstanding Voltage	500V	
Resistance Range	1 Ω - 1M Ω & 0 Ω for E24 & E96 series value	
Operating Temp. Range	-55°C to +155°C	
Temperature Coefficient	See Table I	

Note: Special value is available on request

ENVIRONMENTAL CHARACTERISTICS

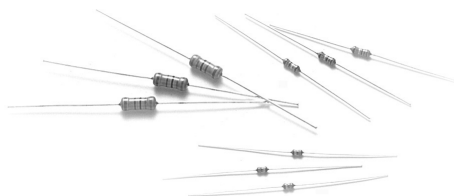
PERFORMANCE TEST	TEST METHOD		APPRAISE
Short Time Overload	JIS-C-5202 5.5	2.5 times RCWV for 5 Sec.	$\pm 1.0\% + 0.05 \Omega$
Dielectric Withstanding Voltage	JIS-C-5202 5.7	in V-Block for 60 Sec.	By type
Temperature Coefficient	JIS-C-5202 5.2	-55°C to +155°C	By type
Insulation Resistance	JIS-C-5202 5.6	in V-Block	> 10,000M Ω
Solderability	JIS-C-5202 6.5	260 $\pm$ 5°C for 5 $\pm$ 0.5 Sec.	95% Min. coverage
Resistance to Solvent	JIS-C-5202 6.9	IPA for 1 Min. with ultrasonic	No deterioration of coatings and markings
Pulse Overload	JIS-C-5202 5.8	4 times RCWV 10,000 cycles (1 Sec. on, 25 Sec. off)	$\pm 1.0\% + 0.05 \Omega$
Load Life in Humidity	JIS-C-5202 7.9	40 $\pm$ 2°C, 90-95% RH at RCWV for 1,000 Hr. (1.5 Hr. on, 0.5 Hr. off)	$\pm 5.0\% + 0.1 \Omega$
Load Life	JIS-C-5202 7.10	70°C at RCWV for 1,000 Hr. (1.5 Hr. on, 0.5 Hr. off)	$\pm 3.0\% + 0.1 \Omega$
Temperature Cycling	JIS-C-5202 7.4	-55°C $\Rightarrow$ Room Temp. $\Rightarrow$ +155°C $\Rightarrow$ Room Temp. (5 cycles)	$\pm 0.75\% + 0.05 \Omega$
Resistance to Soldering Heat	JIS-C-5202 6.4	350 $\pm$ 10°C for 3 $\pm$ 0.5 Sec.	$\pm 1.0\% + 0.05 \Omega$

Note: Rated Continuous Working Voltage (RCWV) = $\sqrt{\text{Power Rating} \times \text{Resistance Value}}$

High Voltage & High Ohmic Resistors

Flame-Proof Type

Normal Style [HHV Series]



INTRODUCTION

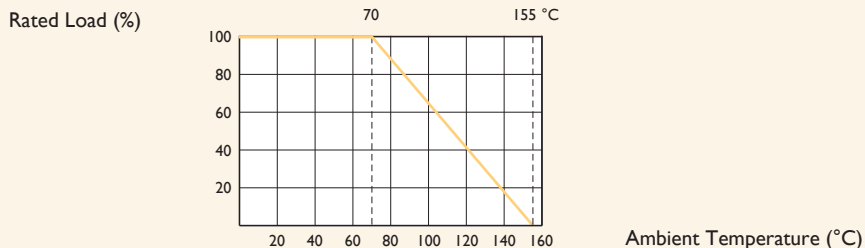
The HHV Series High Voltage & High Ohmic Resistors are metal glazed film, tinned connecting leads of electrolytic copper are welded to the end of caps. The resistors are coated with layers of pink color lacquer.

FEATURES

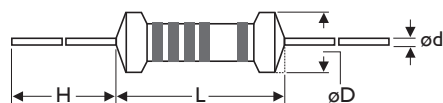
Power Rating	1/4W, 1/2W, 1W
Resistance Tolerance	$\pm 1\%$, $\pm 5\%$
T.C.R.	$\pm 300\text{ppm}/^{\circ}\text{C}$
Flameproof Multi-layer Coating Meets	UL-94V-0
Flameproof Feature Meets Overload Test	UL-1412

DERATING CURVE

For resistors operated in ambient temperatures above 70°C, power rating must be derated in accordance with the curve below.



DIMENSIONS



5th color code: yellow

Unit: mm

STYLE	DIMENSION			
Normal	L	ϕD	H	ϕd
HHV-25	6.3 ± 0.5	2.4 ± 0.2	28 ± 2.0	0.55 ± 0.05
HHV-50	9.0 ± 0.5	3.3 ± 0.3	26 ± 2.0	0.55 ± 0.05
HHV1WS	11.5 ± 1.0	4.5 ± 0.2	35 ± 2.0	0.80 ± 0.05
HHV100	15.5 ± 1.0	5.0 ± 0.5	33 ± 2.0	0.80 ± 0.05

Note:

ELECTRICAL CHARACTERISTICS

STYLE	HHV-25	HHV-50	HHVIWS	HHVI100
Power Rating at 70°C	1/4W	1/2W	1W	
Maximum Working Voltage (DC)	1,600V	3,500V	5,000V	10,000V
Maximum Overload Voltage (DC)	3,000V	7,000V	10,000V	20,000V
Dielectric Withstanding Voltage	500V	700V		
Resistance Range	100K Ω - 68M Ω for E24 & E96 series value			
Operating Temp. Range	-55°C to +155°C			
Temperature Coefficient	$\pm 300\text{ppm}/^\circ\text{C}$			

Note: Special value is available on request.

ENVIRONMENTAL CHARACTERISTICS

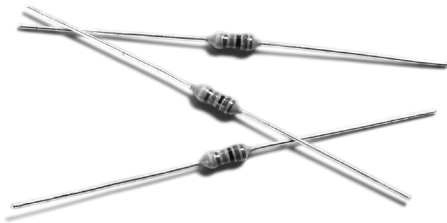
PERFORMANCE TEST	TEST METHOD		APPRAISE
Short Time Overload	JIS-C-5202 5.5	2.5 times RCWV for 5 Sec.	$\pm 2.0\% + 0.05 \Omega$
Dielectric Withstanding Voltage	JIS-C-5202 5.7	in V-Block for 60 Sec.	By type
Temperature Coefficient	JIS-C-5202 5.2	-55°C to +155°C	By type
Insulation Resistance	JIS-C-5202 5.6	in V-Block	$> 10,000\text{M} \Omega$
Solderability	JIS-C-5202 6.5	260 $\pm 5^\circ\text{C}$ for 5 ± 0.5 Sec.	95% Min. coverage
Resistance to Solvent	JIS-C-5202 6.9a	IPA for 1 Min. with ultrasonic	No deterioration of coatings and markings
Terminal Strength	JIS-C-5202 6.1	Direct load for 10 Sec. in the direction of the terminal leads	$\geq 2.5\text{kg}$ (24.5N)
Pulse Overload	JIS-C-5202 5.8	4 times RCWV 10,000 cycles (1 Sec. on, 25 Sec. off)	$\pm 1\% + 0.05 \Omega$
Load Life in Humidity	JIS-C-5202 7.9	40 $\pm 2^\circ\text{C}$, 90-95% RH at RCWV for 1,000 Hr. (1.5 Hr. on, 0.5 Hr. off)	$\pm 5.0\% + 0.05 \Omega$
Load Life	JIS-C-5202 7.10	70°C at RCWV for 1,000 Hr. (1.5 Hr. on, 0.5 Hr. off)	$\pm 5.0\% + 0.05 \Omega$
Temperature Cycling	JIS-C-5202 7.4	-55°C $\Rightarrow$ Room Temp. $\Rightarrow$ +155°C $\Rightarrow$ Room Temp. (5 cycles)	$\pm 1.0\% + 0.05 \Omega$
Resistance to Soldering Heat	JIS-C-5202 6.4	350 $\pm 10^\circ\text{C}$ for 3 ± 0.5 Sec.	$\pm 1.0\% + 0.05 \Omega$
Overload Flame Retardant	JIS-C-5202 7.12	4 times RCWV for 1 Min.	No evidence of flaming or arcing

Note: Rated Continuous Working Voltage (RCWV) = $\sqrt{\text{Power Rating} \times \text{Resistance Value}}$

Pulse-Loading Resistors

APR Type

Normal & Miniature Style [APR Series]



INTRODUCTION

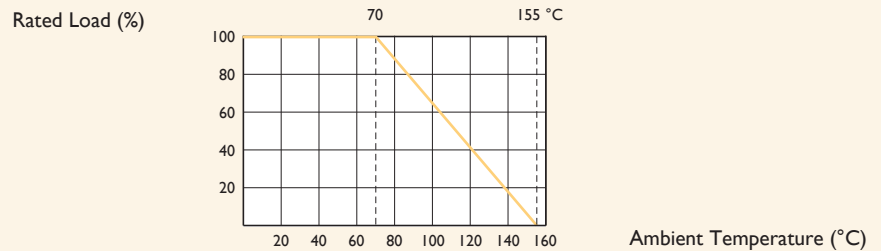
The APR Series Pulse-Loading Resistors are metal glazed film, tinned connecting leads of electrolytic copper are welded to the end-caps. The resistors are coated with layers of blue color lacquer. The 5th color band is yellow to represent APR series.

FEATURES

Power Rating	1/4W, 1/2W, 1W, 2W
Resistance tolerance	±5%
T.C.R.	±300ppm/°C

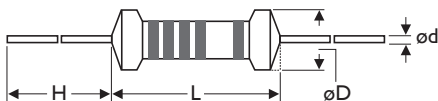
DERATING CURVE

For resistors operated in ambient temperatures above 70°C, power rating must be derated in accordance with the curve below.



DIMENSIONS

Unit: mm



5th color code: yellow

STYEL		DIMENSION			
Normal	Minuature	L	øD	H	ød
APR-25	APR50S	6.3±0.5	2.4±0.2	28±2.0	0.55±0.05
APR-50	-	9.0±0.5	3.3±0.3	26±3.0	0.55±0.05
APR100	-	11.5±1.0	4.5±0.5	35±2.0	0.80±0.05
APR200	-	15.5±1.0	5.0±0.5	33±2.0	0.80±0.05

Note:

ELECTRICAL CHARACTERISTICS

STYLE	APR-25	APR50S	APR-50	APR100	APR200
Power Rating at 70°C	1/4W	1/2W		1W	2W
Maximum Working Voltage (DC)	$\sqrt{P} \times \sqrt{R}$				
Dielectric Withstanding Voltage	500V		700V		
Resistance Range	100K Ω - 10M Ω				
Operating Temp. Range	-55°C to +155°C				
Temperature Coefficient	$\pm 300\text{ppm}/^{\circ}\text{C}$				

Note: Special value is available on request.

ENVIRONMENTAL CHARACTERISTIC

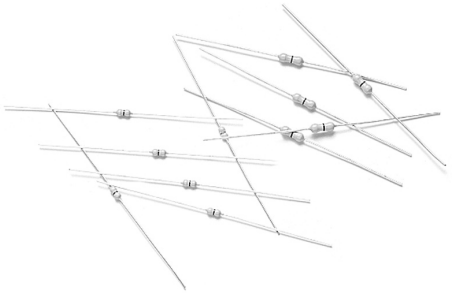
PERFORMANCE TEST	TEST METHOD		APPRAISE
Short Time Overload	JIS-C-5202 5.5	2.5 times RCWV for 5 Sec.	$\pm 1.0\% + 0.05 \Omega$
Dielectric Withstanding Voltage	JIS-C-5202 5.7	in V-Block for 60 Sec.	By type
Temperature Coefficient	JIS-C-5202 5.2	-55°C to +155°C	By type
Insulation Resistance	JIS-C-5202 5.6	in V-Block	$> 10,000\text{M} \Omega$
Solderability	JIS-C-5202 6.5	$260 \pm 5^\circ\text{C}$ for 5 ± 0.5 Sec.	95% Min. coverage
Resistance to Solvent	JIS-C-5202 6.9	IPA for 1 Min. with ultrasonic	No deterioration of coatings and markings
Terminal Strength	JIS-C-5202 6.1	Direct load for 10 Sec. In the direction of the terminal leads	$\geq 2.5\text{kg}$ (24.5N)
Pulse Overload	JIS-C-5202 5.8	4 times RCWV for 10,000 cycles (1 Sec. on, 25 Sec. off)	$\pm 1.0\% + 0.05 \Omega$
Load Life in Humidity	JIS-C-5202 7.9	$40 \pm 2^\circ\text{C}$, 90 - 95% RH at RCWV for 1,000 Hr. (1.5 Hr. on, 0.5 Hr. off)	$\pm 5.0\% + 0.05 \Omega$
Load Life	JIS-C-5202 7.10	70°C at RCWV for 1,000 Hr. (1.5 Hr. on, 0.5 Hr. off)	$\pm 5.0\% + 0.05 \Omega$
Temperature Cycling	JIS-C-5202 7.4	$-55^\circ\text{C} \Rightarrow \text{Room Temp.} \Rightarrow +155^\circ\text{C} \Rightarrow \text{Room Temp.}$ (5 cycles)	$\pm 1.0\% + 0.05 \Omega$
Resistance to Soldering Heat	JIS-C-5202 6.4	$350 \pm 10^\circ\text{C}$ for 3 ± 0.5 Sec.	$\pm 1.0\% + 0.05 \Omega$

Note: Rated Continuous Working Voltage (RCWV) = $\sqrt{\text{Power Rating} \times \text{Resistance Value}}$

Zero Ohm Resistors

ZOR Type

Normal Style [ZOR Series]



INTRODUCTION

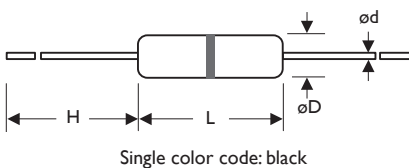
- Similar to a 1/4W resistor (1/6W size also available, typical resistance 0.004 Ω)
- Ideal for automatic insertion or Cut and Form
- Available in Tape/Reel, Tape/Box and Bulk
- Film type Zero Ohm also available in 1/4W (ZOR-25) and 1/6W (ZOR-12) size

SPECIFICATIONS

Power Rating	1/6W, 1/4W	
Maximum Resistance	0.005 Ω	
T.C.R.	$\pm 100\text{ppm}/^\circ\text{C}$	
Min. Insulation Resistance	Dry	10,000M Ω
	Wet	100M Ω
Min. Dielectric Withstanding Voltage	Atmospheric	500V RMS
	Reduced	325V RMS
Insulation Flammability	Resistor insulation is self extinguishing within 10 Sec. after externally applied flame is removed	
Current Rating	15 AMPS at 70°C for 1/4W	
	10 AMPS at 70°C for 1/6W	

DIMENSIONS

Unit: mm



STYLE	DIMENSION			
Normal	L	øD	H	ød
ZOR-12	3.3±0.4	1.8±0.3	28±2.0	0.45±0.05
ZOR-25	6.3±0.5	2.3±0.3	28±2.0	0.55±0.05

JPW Type

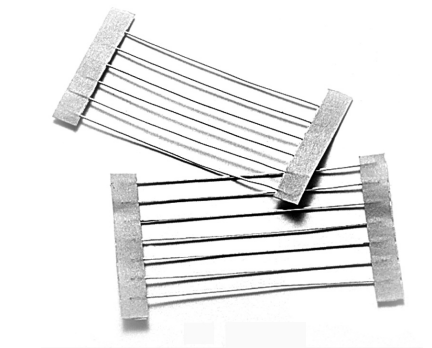
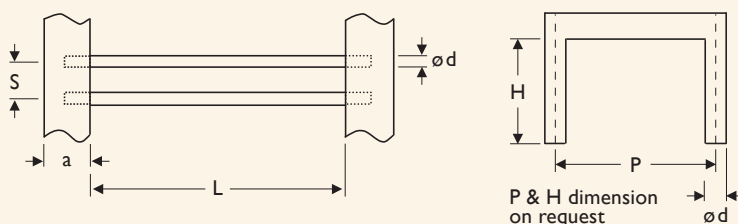
Normal Style [JPW Series]

Jumper Wires

SPECIFICATIONS

Material of Jumper Wire	Soft copper wire with tin plating		
Conductor Resistance	0.54m Ω /cm		
Wire Diameter	$\varnothing$ 0.5, $\varnothing$ 0.6, $\varnothing$ 0.7, $\varnothing$ 0.8, $\varnothing$ 1.0 ($\pm$ 0.05mm)		
Tension Strength	CNS 8938 within 28kg/mm ²		
Extension Rate	CNS 8938 $\varnothing$ 0.5 to $\varnothing$ 0.6mm	over 24%	
	CNS 8938 $\varnothing$ 0.7 to $\varnothing$ 1.0mm	over 26%	
Conductivity	$\varnothing$ 0.5mm	Minmum 94%	
	$\varnothing$ 0.6 to $\varnothing$ 1.0mm	Minmum 96%	
Twisting Strength	CNS 8938 $\varnothing$ 0.5mm	Load 250g	3 cycles
	CNS 8938 $\varnothing$ 0.6 to $\varnothing$ 0.8mm	Load 500g	3 cycles
	CNS 8938 $\varnothing$ 1.0mm	Load 1.0kg	3 cycles
Solderability	JIS-5012-C5033 260 $\pm$ 5°C, 5 $\pm$ 0.5 Sec. coverage 95%		
Element of Plating	JIS-H3101 Tin Minimum 99.9%		
Thickness of Plating	4 μ m $\pm$ 1 μ m		
Current Rating	$\varnothing$ 0.5mm	6 AMPS at 70°C	
	$\varnothing$ 0.6mm	7.5 AMPS at 70°C	
	$\varnothing$ 0.7mm	8.5 AMPS at 70°C	
	$\varnothing$ 0.8mm	10 AMPS at 70°C	
	$\varnothing$ 1.0mm	15 AMPS at 70°C	
Appearance	Smooth and shining		

DIMENSIONS



INTRODUCTION

Jumper wires or crossovers, as they are sometimes called, are basically interconnection devices between points on a P.C.Board. Generally they are used for the following reasons:

- Inability to connect two points on a P.C. Board due to other circuit paths which must be crossed over
- An After-the-Fact design change that requires new point connections
- Circuit tuning by changing point connections

Jumper wires offers a quick simple solution to these problems. They are especially suited for automatic machine insertion on lead tape or available in all packaging styles including pre-cut and formed leads for manual insertion.

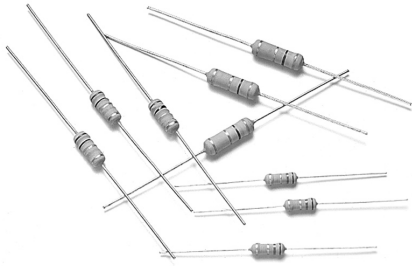
Unit: mm

STYLE	DIMENSION			
	Normal	ϕ d	L	S a
JPW-05		0.5 $\pm$ 0.05		
JPW-06		0.6 $\pm$ 0.05	26.0 $\pm$ 1.0	
JPW-07		0.7 $\pm$ 0.05	52.4 $\pm$ 1.0	5.0 $\pm$ 0.1 6.0 $\pm$ 0.5
JPW-08		0.8 $\pm$ 0.05	73.0 $\pm$ 1.5	
JPW-10		1.0 $\pm$ 0.05		

Wirewound Resistors

Flame-Proof Type

Normal & Miniature Style [KNP Series]



INTRODUCTION

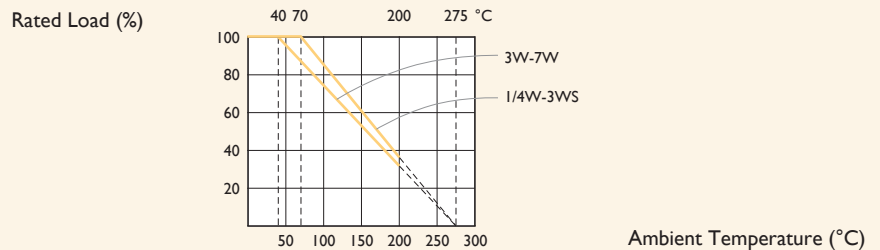
The resistor element is a resistive wire which is wound in a single layer on a ceramic rod, tinned connecting wires of electrolytic copper are welded to the end-caps. The ends of the resistance wire and the leads are connected to the caps by welding. The resistors are coated with layers of green color flame proof lacquer.

FEATURES

Power Rating	1/4W, 1/2W, 1W, 2W, 3W, 4W, 5W, 7W
Resistance Tolerance	$\pm 1\%$, $\pm 5\%$
T.C.R.	$\pm 300\text{ppm}/^\circ\text{C}$
Flameproof Multi-layer Coating Meets	UL-94V-0
Flameproof Feature Meets Overload Test	UL-1412

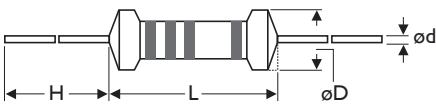
DERATING CURVE

For resistors operated in ambient temperatures above 40°C , power rating must be derated in accordance with the curve below.



DIMENSIONS

Unit: mm



STYLE		DIMENSION			
Normal	Miniature	L	ϕD	H	ϕd
KNP-25	KNP50S	6.3 ± 0.5	2.4 ± 0.2	28 ± 2.0	0.55 ± 0.05
KNP-50	KNP1WS	9.0 ± 0.5	3.3 ± 0.3	26 ± 2.0	0.55 ± 0.05
KNP100	KNP2WS	11.5 ± 1.0	4.5 ± 0.5	35 ± 2.0	0.8 ± 0.05
KNP200	KNP3WS	15.5 ± 1.0	5.0 ± 0.5	33 ± 2.0	0.8 ± 0.05
KNP300	KNP5WS	17.5 ± 1.0	6.5 ± 0.5	32 ± 2.0	0.8 ± 0.05
KNP400					
KNP500	KNP7WS	24.5 ± 1.0	8.0 ± 0.5	38 ± 2.0	0.8 ± 0.05
KNP700	-	24.5 ± 1.0	8.0 ± 0.5	38 ± 2.0	0.8 ± 0.05

Note: KNP1WS (for MB Type) $\phi d = 0.8 \pm 0.05$ mm

ELECTRICAL CHARACTERISTICS

NORMAL STYLE

STYLE	KNP-25	KNP-50	KNP100	KNP200	KNP300	KNP400	KNP500	KNP700
Power Rating at 70°C	1/4W	1/2W	1W	2W	3W	4W	5W	7W
Dielectric Withstanding Voltage	250V	300V	400V					
Resistance Range	0.1 Ω - 47 Ω		0.1 Ω - 100 Ω	0.1 Ω - 330 Ω	0.1 Ω - 560 Ω	0.1 Ω - 1K Ω		
Operating Temp. Range	-40°C to +200°C							
Temperature Coefficient	±300ppm/°C							

MINIATURE STYLE

STYLE	KNP50S	KNPIWS	KNP2WS	KNP3WS	KNP5WS	KNP7WS
Power Rating at 70°C	1/2W	1W	2W	3W	5W	7W
Dielectric Withstanding Voltage	200V	300V	400V			
Resistance Range	0.1 Ω - 47 Ω		0.1 Ω - 100 Ω	0.1 Ω - 330 Ω	0.1 Ω - 560 Ω	0.1 Ω - 1K Ω
Operating Temp. Range	-40°C to +200°C					
Temperature Coefficient	±300ppm/°C					

Note: Special value is available on request

ENVIRONMENTAL CHARACTERISTICS

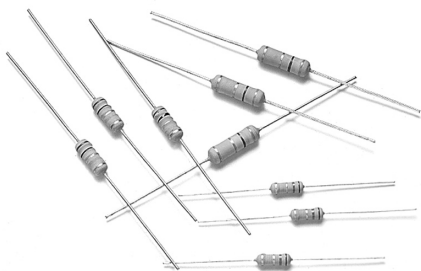
PERFORMANCE TEST	TEST METHOD		APPRAISE
Short Time Overload	JIS-C-5202 5.5	2.5 times RCWV for 5 Sec.	±2.0%+0.05 Ω
Dielectric Withstanding Voltage	JIS-C-5202 5.7	in V-Block for 60 Sec.	By type
Temperature Coefficient	JIS-C-5202 5.2	-40°C to +200°C	By type
Insulation Resistance	JIS-C-5202 5.6	in V-Block	>100M Ω
Solderability	JIS-C-5202 6.5	260±5°C for 5±0.5 Sec.	95% Min. coverage
Resistance to Solvent	JIS-C-5202 6.9	IPA for 1 Min. with ultrasonic	No deterioration of coatings and markings
Terminal Strength	JIS-C-5202 6.1	Direct load for 10 Sec. in the direction of the terminal leads	≥2.5kg (24.5N)
Load Life in Humidity	JIS-C-5202 7.9	40±2°C, 90-95% RH at RCWV for 1,000 Hr. (1.5 Hr. on, 0.5 Hr. off)	±5.0%+0.05 Ω
Load Life	JIS-C-5202 7.10	70°C at RCWV for 1,000 Hr. (1.5 Hr. on, 0.5 Hr. off)	±5.0%+0.05 Ω
Temperature Cycling	JIS-C-5202 7.4	-55°C ⇒ Room Temp. ⇒ +155°C ⇒ Room Temp. (5 cycles)	±1.0%+0.05 Ω
Resistance to Soldering Heat	JIS-C-5202 6.4	350±10°C for 3±0.5 Sec.	±1.0%+0.05 Ω
Overload Flame Retardant	JIS-C-5202 7.12	4 times RCWV for 1 Min.	No evidence of flaming or arcing

Note: Rated Continuous Working Voltage (RCWV) = $\sqrt{\text{Power Rating} \times \text{Resistance Value}}$

Wirewound Resistors

Flame-Proof & Non Inductive Type

Normal & Miniature Style [NKN Series]



INTRODUCTION

The resistor element is a resistive wire which is wound in a single layer on a ceramic rod, tinned connecting wires of electrolytic copper are welded to the end-caps. The ends of the resistance wire and the leads are connected to the caps by welding. The resistors are coated with layers of green color flame proof lacquer. The 5th color band is black to represent NKN series.

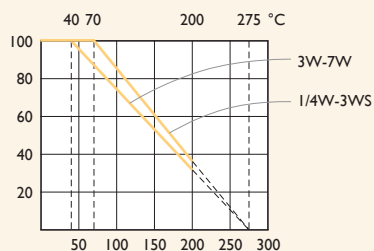
FEATURES

Power Rating	1/2W, 1W, 2W, 3W, 4W, 5W, 7W
Resistance Tolerance	±1%, ±5%
T.C.R.	±300ppm/°C
Flameproof Multi-layer Coating Meets	UL-94V-0
Flameproof Feature Meets Overload Test	UL-1412

DERATING CURVE

For resistors operated in ambient temperatures above 40°C, power rating must be derated in accordance with the curve below.

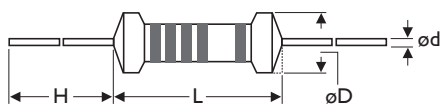
Rated Load (%)



Ambient Temperature (°C)

DIMENSIONS

Unit: mm



5th color code: black

STYLE		DIMENSION			
Normal	Miniature	L	øD	H	ød
NKN-50	NKN1WS	9.0±0.5	3.3±0.3	26±2.0	0.55±0.05
NKN100	NKN2WS	11.5±1.0	4.5±0.5	35±2.0	0.8±0.05
NKN200	NKN3WS	15.5±1.0	5.0±0.5	33±2.0	0.8±0.05
NKN300					
NKN400	NKN5WS	17.5±1.0	6.5±0.5	32±2.0	0.8±0.05
NKN500	NKN7WS	24.5±1.0	8.0±0.5	38±2.0	0.8±0.05

ELECTRICAL CHARACTERISTICS

NORMAL STYLE

STYLE	NKN-50	NKN100	NKN200	NKN300	NKN400	NKN500
Power Rating at 70°C	1/2W	1W	2W	3W	4W	5W
Dielectric Withstanding Voltage	250V	400V				
Resistance Range	0.1 Ω - 5 Ω	0.1 Ω - 10 Ω	0.1 Ω - 22 Ω	0.1 Ω - 27 Ω		0.1 Ω - 33 Ω
Operating Temp. Range	-40°C to +200°C					
Temperature Coefficient	± 300 ppm/°C					

MINIATURE STYLE

STYLE	NKNIWS	NKN2WS	NKN3WS	NKN5WS	NKN7WS
Power Rating at 70°C	1W	2W	3W	5W	7W
Dielectric Withstanding Voltage	250V	400V			
Resistance Range	0.1 Ω - 5 Ω	0.1 Ω - 10 Ω	0.1 Ω - 22 Ω	0.1 Ω - 27 Ω	0.1 Ω - 33 Ω
Operating Temp. Range	- 40°C to +200°C				
Temperature Coefficient	± 300 ppm/°C				

Note: Special value is available on request

ENVIRONMENTAL CHARACTERISTICS

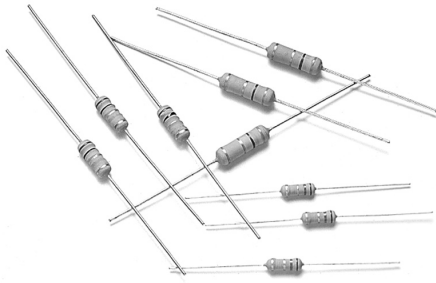
PERFORMANCE TEST	TEST METHOD		APPRAISE
Short Time Overload	JIS-C-5202 5.5	2.5 times RCWV for 5 Sec.	$\pm 2.0\% + 0.05 \Omega$
Dielectric Withstanding Voltage	JIS-C-5202 5.7	in V-Block for 60 Sec.	By type
Temperature Coefficient	JIS-C-5202 5.2	-40°C to +200°C	By type
Insulation Resistance	JIS-C-5202 5.6	in V-Block	$> 100M \Omega$
Solderability	JIS-C-5202 6.5	260 ± 5 °C for 5 ± 0.5 Sec.	95% Min. coverage
Resistance to Solvent	JIS-C-5202 6.9	IPA for 1 Min. with ultrasonic	No deterioration of coatings and markings
Terminal Strength	JIS-C-5202 6.1	Direct load for 10 Sec. in the direction of the terminal leads	≥ 2.5 kg (24.5N)
Load Life in Humidity	JIS-C-5202 7.9	40 ± 2 °C, 90-95% RH at RCWV for 1,000 Hr. (1.5 Hr. on, 0.5 Hr. off)	$\pm 5.0\% + 0.05 \Omega$
Load Life	JIS-C-5202 7.10	20°C at RCWV for 1,000 Hr. (1.5 Hr. on, 0.5 Hr. off)	$\pm 5.0\% + 0.05 \Omega$
Temperature Cycling	JIS-C-5202 7.4	-55°C $\Rightarrow$ Room Temp. $\Rightarrow$ +155°C $\Rightarrow$ Room Temp. (5 cycles)	$\pm 1.0\% + 0.05 \Omega$
Resistance to Soldering Heat	JIS-C-5202 6.4	350 ± 10 °C for 3 ± 0.5 Sec.	$\pm 1.0\% + 0.05 \Omega$
Overload Flame Retardant	JIS-C-5202 7.12	4 times RCWV for 1 Min.	No evidence of flaming or arcing

Note: Rated Continuous Working Voltage (RCWV) = $\sqrt{\text{Power Rating} \times \text{Resistance Value}}$

Fusible Wirewound Resistors

Flame-Proof Type

Normal & Miniature Style [FKN Series]



INTRODUCTION

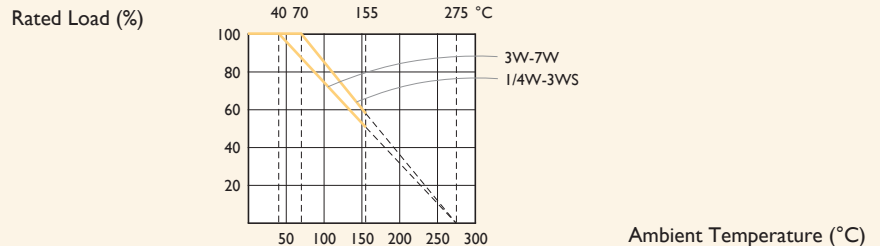
The resistor element is a resistive wire which is wound in a single layer on a ceramic rod, tinned connecting wires of electrolytic copper are welded to the end-caps. The ends of the resistance wire and the leads are connected to the caps by welding. The resistors are coated with layers of green color flame proof lacquer. Overload protection without risk of fire. Wide range of overload currents.

FEATURES

Power Rating	1/4W, 1/2W, 1W, 2W, 3W, 4W, 5W, 7W
Resistance Tolerance	±1%, ±5%
T.C.R.	±350ppm/°C
Flameproof Multi-layer Coating Meets	UL-94V-0
Flameproof Feature Meets Overload Test	UL-1412

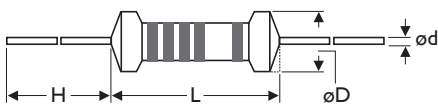
DERATING CURVE

For resistors operated in ambient temperatures above 40°C, power rating must be derated in accordance with the curve below.



DIMENSIONS

Unit: mm



5th color code: white

STYLE	DIMENSION				
Normal	Miniature	L	øD	H	ød
FKN-25	FKN50S	6.3±0.5	2.4±0.2	28±2.0	0.55±0.05
FKN-50	FKN1WS	9.0±0.5	3.3±0.3	26±2.0	0.55±0.05
FKN100	FKN2WS	11.5±1.0	4.5±0.5	35±2.0	0.8±0.05
FKN200	FKN3WS	15.5±1.0	5.0±0.5	33±2.0	0.8±0.05
FKN300	FKN5WS	17.5±1.0	6.5±0.5	32±2.0	0.8±0.05
FKN400					
FKN500					
	FKN7WS	24.5±1.0	8.0±0.5	38±2.0	0.8±0.05

Note: FKN1WS (for MB Type) ød = 0.8±0.05 mm

ELECTRICAL CHARACTERISTICS

NORMAL STYLE

STYLE	FKN-25	FKN-50	FKN100	FKN200	FKN300	FKN400	FKN500
Power Rating at 70°C	1/4W	1/2W	1W	2W	3W	4W	5W
Dielectric Withstanding Voltage	200V	300V					
Resistance Range	2.5 Ω - 22 Ω	0.8 Ω - 47 Ω	0.5 Ω - 100 Ω	0.1 Ω - 150 Ω	0.1 Ω - 330 Ω		0.1 Ω - 390 Ω
Operating Temp. Range	-40°C to +155°C						
Temperature Coefficient	±350ppm/°C						

MINIATURE STYLE

STYLE	FKN50S	FKNIWS	FKN2WS	FKN3WS	FKN5WS	FKN7WS
Power Rating at 70°C	1/2W	1W	2W	3W	5W	7W
Dielectric Withstanding Voltage	200V	300V				
Resistance Range	2.5 Ω - 22 Ω	0.8 Ω - 47 Ω	0.5 Ω - 100 Ω	0.1 Ω - 150 Ω	0.1 Ω - 330 Ω	0.1 Ω - 390 Ω
Operating Temp. Range	-40°C to +155°C					
Temperature Coefficient	±350ppm/°C					

Note: Special value is available on request

ENVIRONMENTAL CHARACTERISTICS

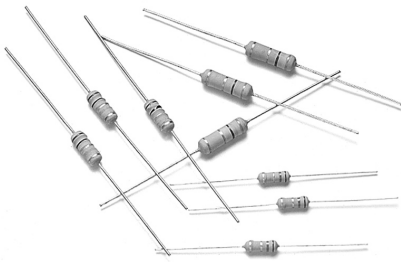
PERFORMANCE TEST	TEST METHOD		APPRAISE
Short Time Overload	JIS-C-5202 5.5	2.5 times RCWV for 5 Sec.	±2.0%+0.05 Ω
Dielectric Withstanding Voltage	JIS-C-5202 5.7	in V-Block for 60 Sec.	By type
Temperature Coefficient	JIS-C-5202 5.2	-40°C to +155°C	By type
Insulation Resistance	JIS-C-5202 5.6	in V-Block	> 100M Ω
Solderability	JIS-C-5202 6.5	260±5°C for 5±0.5 Sec.	95% Min. coverage
Resistance to Solvent	JIS-C-5202 6.9	IPA for 1 Min. with ultrasonic	No deterioration of coatings and markings
Terminal Strength	JIS-C-5202 6.1	Direct load for 10 Sec. In the direction of the terminal leads	≥ 2.5kg (24.5N)
Load Life in Humidity	JIS-C-5202 7.9	40±2°C, 90 - 95% RH at RCWV for 1,000 Hr. (1.5 Hr. on, 0.5 Hr. off)	±5.0%+0.05 Ω
Load Life	JIS-C-5202 7.10	70°C at RCWV for 1,000 Hr. (1.5 Hr. on, 0.5 Hr. off)	±5.0%+0.05 Ω
Temperature Cycling	JIS-C-5202 7.4	-55°C ⇄ Room Temp. ⇄ +155°C ⇄ Room Temp. (5 cycles)	±1.0%+0.05 Ω
Resistance to Soldering Heat	JIS-C-5202 6.4	350±10°C for 3±0.5 Sec.	±1.0%+0.05 Ω
Overload Flame Retardant	JIS-C-5202 7.12	4 times RCWV for 1 Min.	No evidence of flaming or arcing

Note: Rated Continuous Working Voltage (RCWV) = $\sqrt{\text{Power Rating} \times \text{Resistance Value}}$

Power Wirewound Resistors

Flame-Proof Type

High Power Style [PNP Series]



INTRODUCTION

The resistor element is a resistive wire which is wound in a single layer on a ceramic rod, tinned connecting wires of electrolytic copper are welded to the end-caps. The ends of the resistance wire and the leads are connected to the caps by welding. The resistors are coated with layers of green color flame proof lacquer. High power in small packages.

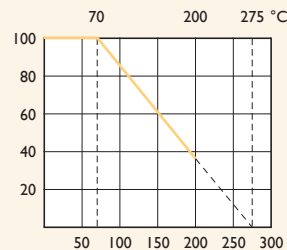
FEATURES

Power Rating	1W, 2W, 3W, 4W
Resistance Tolerance	$\pm 1\%$, $\pm 5\%$
T.C.R.	$\pm 300\text{ppm}/^{\circ}\text{C}$
Flameproof Multi-layer Coating Meets	UL-94V-0
Flameproof Feature Meets Overload Test	UL-1412

DERATING CURVE

For resistors operated in ambient temperatures above 70°C , power rating must be derated in accordance with the curve below.

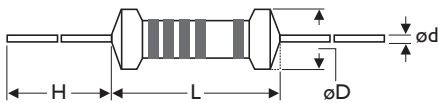
Rated Load (%)



Ambient Temperature ($^{\circ}\text{C}$)

DIMENSIONS

Unit: mm



5th color code: violet

STYLE	DIMENSION			
Ultra Miniature	L	ϕD	H	ϕd
PNP100	6.3 ± 0.5	2.4 ± 0.2	28 ± 2.0	0.55 ± 0.05
PNP200	9.0 ± 0.5	3.3 ± 0.3	26 ± 2.0	0.55 ± 0.05
PNP300	11.5 ± 1.0	4.5 ± 0.5	35 ± 2.0	0.8 ± 0.05
PNP400	15.5 ± 1.0	5.0 ± 0.5	33 ± 2.0	0.8 ± 0.05

Note:

ELECTRICAL CHARACTERISTICS

STYLE	PNP100	PNP200	PNP300	PNP400
Power Rating at 70°C	1W	2W	3W	4W
Dielectric Withstanding Voltage	300V			
Resistance Range	0.1 Ω - 33 Ω	0.1 Ω - 100 Ω	0.1 Ω - 150 Ω	0.1 Ω - 330 Ω
Operating Temp. Range	-40°C to +200°C			
Temperature Coefficient	± 300 ppm/°C			

Note: Special value is available on request

ENVIRONMENTAL CHARACTERISTICS

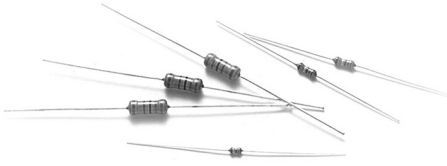
PERFORMANCE TEST	TEST METHOD		APPRAISE
Short Time Overload	JIS-C-5202 5.5	2.5 times RCWV for 5 Sec.	$\pm 2.0\% + 0.05 \Omega$
Dielectric Withstanding Voltage	JIS-C-5202 5.7	in V-Block for 60 Sec.	By type
Temperature Coefficient	JIS-C-5202 5.2	-40°C to +200°C	By type
Insulation Resistance	JIS-C-5202 5.6	in V-Block	> 100M Ω
Solderability	JIS-C-5202 6.5	260 $\pm$ 5°C for 5 $\pm$ 0.5 Sec.	95% Min. coverage
Resistance to Solvent	JIS-C-5202 6.9	IPA for 1 Min. with ultrasonic	No deterioration of coatings and markings
Terminal Strength	JIS-C-5202 6.1	Direct load for 10 Sec. in the direction of the terminal leads	≥ 2.5 kg (24.5N)
Load Life in Humidity	JIS-C-5202 7.9	40 $\pm$ 2°C, 90-95% RH at RCWV for 1,000 Hr. (1.5 Hr. on, 0.5 Hr. off)	$\pm 5.0\% + 0.05 \Omega$
Load Life	JIS-C-5202 7.10	20°C at RCWV for 1,000 Hr. (1.5 Hr. on, 0.5 Hr. off)	$\pm 5.0\% + 0.05 \Omega$
Temperature Cycling	JIS-C-5202 7.4	-55°C $\Rightarrow$ Room Temp. $\Rightarrow$ 155°C $\Rightarrow$ Room Temp. (5 cycles)	$\pm 1.0\% + 0.05 \Omega$
Resistance to Soldering Heat	JIS-C-5202 6.4	350 $\pm$ 10°C for 3 $\pm$ 0.5 Sec.	$\pm 1.0\% + 0.05 \Omega$
Overload Flame Retardant	JIS-C-5202 7.12	4 times RCWV for 1 Min.	No evidence of flaming or arcing

Note: Rated Continuous Working Voltage (RCWV) = $\sqrt{\text{Power Rating} \times \text{Resistance Value}}$

Power Wirewound Resistors

Flame-Proof Type

High Power Style [PNP V Series]



INTRODUCTION

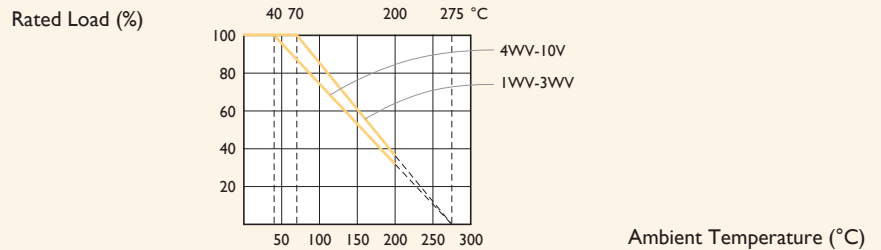
The resistor element is a resistive wire which is wound in a single layer on a ceramic rod, tinned connecting wires of electrolytic copper are welded to the end-caps. The ends of the resistance wire and the leads are connected to the caps by welding. The resistors are coated with layers of green color flame proof lacquer. High power in small package. The 5th color band is violet to represent PNPV series.

FEATURES

Power Rating	1W, 3W, 4W, 5W, 7W, 10W
Resistance Tolerance	$\pm 1\%$, $\pm 5\%$
T.C.R.	$\pm 300\text{ppm}/^{\circ}\text{C}$
Flameproof Multi-layer Coating Meets	UL-94V-0
Flameproof Feature Meets Overload Test	UL-1412

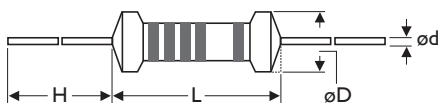
DERATING CURVE

For resistors operated in ambient temperatures above 40°C, power rating must be derated in accordance with the curve below.



DIMENSIONS

Unit: mm



5th color code: violet

STYEL	DIMENSION			
Normal	L	øD	H	ød
PNP1WV	10 $\pm$ 1.0	4.3 $\pm$ 0.5	26 $\pm$ 2.0	0.8 $\pm$ 0.05
PNP3WV	13 $\pm$ 1.0	5.5 $\pm$ 0.5	34 $\pm$ 2.0	0.8 $\pm$ 0.05
PNP4WV	17 $\pm$ 1.0	5.5 $\pm$ 0.5	32 $\pm$ 2.0	0.8 $\pm$ 0.05
PNP5WV	17 $\pm$ 1.0	7.5 $\pm$ 0.5	32 $\pm$ 2.0	0.8 $\pm$ 0.05
PNP7WV	25 $\pm$ 1.0	7.5 $\pm$ 0.5	38 $\pm$ 2.0	0.8 $\pm$ 0.05
PNP10V	44 $\pm$ 1.0	8.0 $\pm$ 0.5	28 $\pm$ 2.0	0.8 $\pm$ 0.05

Note:

ELECTRICAL CHARACTERISTICS

STYLE	PNPIWV	PNP3WV	PNP4WV	PNP5WV	PNP7WV	PNPI0V
Power Rating at 70°C	1W	3W	4W	5W	7W	10W
Dielectric Withstanding Voltage	300V					
Resistance Range	0.1 Ω - 620 Ω	0.15 Ω - 1.2K Ω	0.22 Ω - 1.8K Ω	0.27 Ω - 2.4K Ω	0.47 Ω - 4.3K Ω	1 Ω - 8.2K Ω
Operating Temp. Range	-40°C to +200°C					
Temperature Coefficient	± 300 ppm/°C					

Note: Special value is available on request.

ENVIRONMENTAL CHARACTERISTICS

PERFORMANCE TEST	TEST METHOD		APPRAISE
Short Time Overload	JIS-C-5202 5.5	2.5 times RCWV for 5 Sec.	$\pm 2.0\% + 0.05 \Omega$
Dielectric Withstanding Voltage	JIS-C-5202 5.7	in V-Block for 60 Sec.	By type
Temperature Coefficient	JIS-C-5202 5.2	- 40°C to + 200°C	By type
Insulation Resistance	JIS-C-5202 5.6	in V-Block	$> 100M \Omega$
Solderability	JIS-C-5202 6.5	260 $\pm 5^\circ\text{C}$ for 5 ± 0.5 Sec.	95% Min. coverage
Resistance to Solvent	JIS-C-5202 6.9	IPA for 1 Min. with ultrasonic	No deterioration of coatings and markings
Terminal Strength	JIS-C-5202 6.1	Direct load for 10 Sec. In the direction of the terminal leads	$\geq 2.5\text{kg}$ (24.5N)
Load Life in Humidity	JIS-C-5202 7.9	40 $\pm 2^\circ\text{C}$, 90 - 95% RH at RCWV for 1,000 Hr. (1.5 Hr. on, 0.5 Hr. off)	$\pm 5.0\% + 0.05 \Omega$
Load Life	JIS-C-5202 7.10	20°C at RCWV for 1,000 Hr. (1.5 Hr. on, 0.5 Hr. off)	$\pm 5.0\% + 0.05 \Omega$
Temperature Cycling	JIS-C-5202 7.4	-55°C $\Rightarrow$ Room Temp. $\Rightarrow$ +155°C $\Rightarrow$ Room Temp. (5 cycles)	$\pm 1.0\% + 0.05 \Omega$
Resistance to Soldering Heat	JIS-C-5202 6.4	350 $\pm 10^\circ\text{C}$ for 3 ± 0.5 Sec.	$\pm 1.0\% + 0.05 \Omega$
Overload Flame Retardant	JIS-C-5202 7.12	4 Times RCWV for 1 Min.	No evidence of flaming or arcing

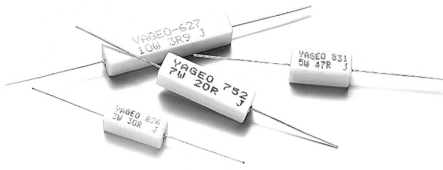
Note: Rated Continuous Working Voltage (RCWV) = $\sqrt{\text{Power Rating} \times \text{Resistance Value}}$

Cement Resistors

Axial Lead Type

Normal Style [SQP Series]

Non-Inductive Style [NSP Series]



INTRODUCTION

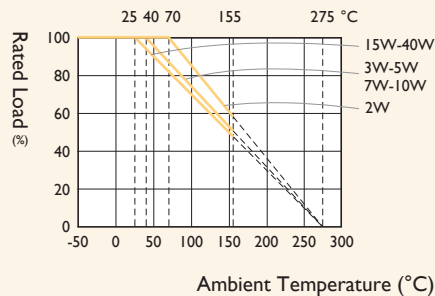
The materials used and the construction techniques ensure excellent flame resistance, arc resistance and moisture resistances as well as self-extinguishing capabilities. They will withstand the most rigorous loading test.

As resistors in radio and television receivers, the hazardous conditions of smoking and redheat can be completely prevented by the proper choice of power resistors.

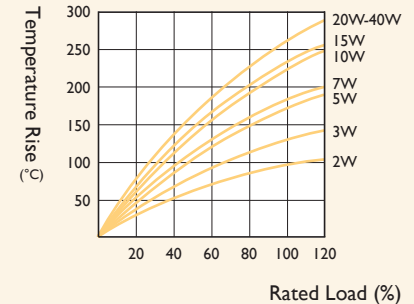
FEATURES

Power Rating	2W, 3W, 5W, 7W, 10W, 15W, 20W, 25W, 30W, 40W
Resistance Tolerance	±5%
T.C.R.	±300ppm/°C

DERATING CURVE

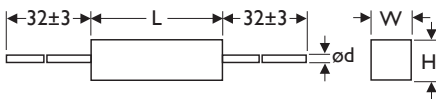


TEMPERATURE RISE



DIMENSIONS

Unit: mm



STYLE		DIMENSION			
Normal	Non-Inductive	L	W	H	ød
SQP200	NSP200	18±1.0	7.0±1.0	7.0±1.0	0.65±0.05
SQP300	NSP300	22±1.5	8.0±1.0	8.0±1.0	0.8±0.05
SQP500	NSP500	22±1.5	9.5±1.0	9.0±1.0	0.8±0.05
SQP700	NSP700	35±1.5	9.5±1.0	9.0±1.0	0.8±0.05
SQP10A	NSP10A	48±1.5	9.5±1.0	9.0±1.0	0.8±0.05
SQP15A	NSP15A	48±1.5	12.5±1.0	12.5±1.0	0.8±0.05
SQP20A	NSP20A	60±5.0	12.5±1.0	12.5±1.0	0.8±0.05
SQP25A	NSP25A	60±5.0	14.0±1.5	13.0±1.5	0.8±0.05
SQP30A	NSP30A	77±5.0	18.0±1.5	17.0±1.5	0.8±0.05
SQP40A	NSP40A	90±5.0	19.0±1.5	18.0±1.5	0.8±0.05

ELECTRICAL CHARACTERISTICS

NORMAL STYLE

STYLE	SQP200	SQP300	SQP500	SQP700	SQP10A	SQP15A	SQP20A	SQP25A	SQP30A	SQP40A
Power Rating at 70°C	2W	3W	5W	7W	10W	15W	20W	25W	30W	40W
Maximum Working Voltage	250V	350V		500V				1,000V		
Maximum Overload Voltage	500V	700V		1,000V				2,000V		
Dielectric Withstanding Voltage	500V	700V		1,000V				2,000V		
Resistance Range (Wirewound)	0.1 Ω - 36 Ω	0.1 Ω - 100 Ω								
Resistance Range (Metal Oxide Film)	39 Ω - 47K Ω	110 Ω - 100K Ω	110 Ω - 200K Ω			110 Ω - 100K Ω			110 Ω - 150K Ω	
Operating Temp. Range	-55°C to +155°C									
Temperature Coefficient	±300ppm/°C									

NON-INDUCTIVE STYLE

STYLE	NSP200	NSP300	NSP500	NSP700	NSPI0A	NSPI5A	NSP20A	NSP25A	NSP30A	NSP40A
Power Rating at 70°C	2W	3W	5W	7W	10W	15W	20W	25W	30W	40W
Maximum Working Voltage	250V	350V		500V				1,000V		
Maximum Overload Voltage	500V	700V		1,000V				2,000V		
Dielectric Withstanding Voltage	500V	700V		1,000V				2,000V		
Resistance Range (Wirewound)	0.1 Ω - 10 Ω	0.1 Ω - 20 Ω		0.1 Ω - 30 Ω	0.1 Ω - 40 Ω	0.1 Ω - 47 Ω	0.1 Ω - 56 Ω			
Operating Temp. Range	-55°C to +155°C									
Temperature Coefficient	±300ppm/°C									

Note: Special value is available on request.

ENVIRONMENTAL CHARACTERISTICS

PERFORMANCE TEST	TEST METHOD		APPRAISE
Short Time Overload	JIS-C-5202 5.5	2.5 times RCWV for 5 Sec.	±2.0%+0.05 Ω
Dielectric Withstanding Voltage	JIS-C-5202 5.7	in V-Block for 60 Sec.	By type
Temperature Coefficient	JIS-C-5202 5.2	-55°C to +155°C	By type
Insulation Resistance	JIS-C-5202 5.6	in V-Block	>1,000M Ω
Solderability	JIS-C-5202 6.5	260±5°C for 5±0.5 Sec.	95% Min. coverage
Resistance to Solvent	JIS-C-5202 6.9	IPA for 1 Min. with ultrasonic	No deterioration of coatings and markings
Terminal Strength	JIS-C-5202 6.1	Direct load for 10 Sec. in the direction of the terminal leads	≥2.5kg (24.5N)
Pulse Overload	JIS-C-5202 5.8	4 times RCWV 10,000 cycles (1 Sec. on, 25 Sec. off)	±2.0%+0.05 Ω
Load Life in Humidity	JIS-C-5202 7.9	40±2°C, 90-95% RH at RCWV for 1,000 Hr. (1.5 Hr. on, 0.5 Hr. off)	±5.0%+0.05 Ω
Load Life	JIS-C-5202 7.10	70°C at RCWV for 1,000 Hr. (1.5 Hr. on, 0.5 Hr. off)	±5.0%+0.05 Ω
Temperature Cycling	JIS-C-5202 7.4	-55°C ⇄ Room Temp. ⇄ +155°C ⇄ Room Temp. (5 cycles)	±2.0%+0.05 Ω
Resistance to Soldering Heat	JIS-C-5202 6.4	350±10°C for 3±0.5 Sec.	±1.0%+0.05 Ω

Note: Rated Continuous Working Voltage (RCWV) = $\sqrt{\text{Power Rating} \times \text{Resistance Value}}$

Cement Resistors

Vertical Lead Type

Normal Style [SQM Series]

Non-Inductive Style [NSM Series]



INTRODUCTION

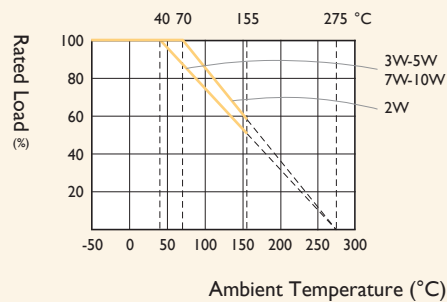
The materials used and the construction techniques ensure excellent flame resistance, arc resistance and moisture resistances as well as self-extinguishing capabilities. They will withstand the most rigorous loading test.

As resistors in radio and television receivers, the hazardous conditions of smoking and redheat can be completely prevented by the proper choice of power resistors.

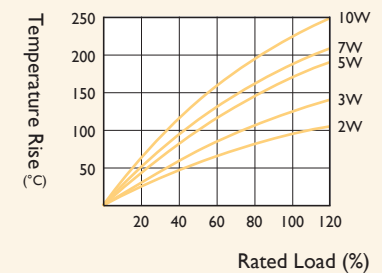
FEATURES

Power Rating	2W, 3W, 5W, 7W, 10W
Resistance Tolerance	±5%
T.C.R.	±300ppm/°C

DERATING CURVE

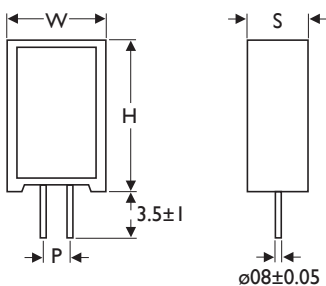


TEMPERATURE RISE



DIMENSIONS

Unit: mm



STYLE		DIMENSION			
Normal	Non-Ind.	H	W	S	P
SQM200	NSM200	20±1.5	11.0±1.0	7.0±1.0	5 ⁺²⁻¹
SQM300	NSM300	25±1.5	12.0±1.0	8.0±1.0	5 ⁺²⁻¹
SQM500	NSM500	25±1.5	13.0±1.0	9.0±1.0	5 ⁺²⁻¹
SQM700	NSM700	39±1.5	13.0±1.0	9.0±1.0	5 ⁺²⁻¹
SQM10A	NSM10A	51±1.5	13.0±1.0	9.0±1.0	5 ⁺²⁻¹
SQM10S	NSM10S	35±1.5	16.0±1.0	12.0±1.0	7 ⁺²⁻¹

ELECTRICAL CHARACTERISTICS

NORMAL STYLE

STYLE	SQM200	SQM300	SQM500	SQM700	SQM10A	SQM10S
Power Rating at 70°C	2W	3W	5W	7W	10W	
Maximum Working Voltage	250V	350V		500V		
Maximum Overload Voltage	500V	700V		1,000V		
Dielectric Withstanding Voltage	500V	700V		1,000V		
Resistance Range (Wirewound)	0.1 Ω - 36 Ω	0.1 Ω - 100 Ω				0.1 Ω - 47 Ω
Resistance Range (Metal Oxide Film)	39 Ω - 47K Ω	110 Ω - 100K Ω	110 Ω - 200K Ω			51 Ω - 100K Ω
Operating Temp. Range	-55°C to +155°C					
Temperature Coefficient	±300ppm/°C					

NON-INDUCTIVE STYLE

STYLE	NSM200	NSM300	NSM500	NSM700	NSM10A	NSM10S
Power Rating at 70°C	2W	3W	5W	7W	10W	
Maximum Working Voltage	250V	350V		500V		
Maximum Overload Voltage	500V	700V		1,000V		
Dielectric Withstanding Voltage	500V	700V		1,000V		
Resistance Range (Wirewound)	0.1 Ω - 10 Ω	0.1 Ω - 20 Ω		0.1 Ω - 30 Ω	0.1 Ω - 40 Ω	
Operating Temp. Range	-55°C to +155°C					
Temperature Coefficient	±300ppm/°C					

Note: Special value is available on request.

ENVIRONMENTAL CHARACTERISTICS

PERFORMANCE TEST	TEST METHOD		APPRAISE
Short Time Overload	JIS-C-5202 5.5	2.5 times RCWV for 5 Sec.	±2.0%+0.05 Ω
Dielectric Withstanding Voltage	JIS-C-5202 5.7	in V-Block for 60 Sec.	By type
Temperature Coefficient	JIS-C-5202 5.2	-55°C to +155°C	By type
Insulation Resistance	JIS-C-5202 5.6	in V-Block	>1,000M Ω
Solderability	JIS-C-5202 6.5	260±5°C for 5±0.5 Sec.	95% Min. coverage
Resistance to Solvent	JIS-C-5202 6.9	IPA for 1 Min. with ultrasonic	No deterioration of coatings and markings
Terminal Strength	JIS-C-5202 6.1	Direct load for 10 Sec. in the direction of the terminal leads	≥2.5kg (24.5N)
Pulse Overload	JIS-C-5202 5.8	4 times RCWV 10,000 cycles (1 Sec. on, 25 Sec. off)	±2.0%+0.05 Ω
Load Life in Humidity	JIS-C-5202 7.9	40±2°C, 90-95% RH at RCWV for 1,000 Hr. (1.5 Hr. on, 0.5 Hr. off)	±5.0%+0.05 Ω
Load Life	JIS-C-5202 7.10	70°C at RCWV for 1,000 Hr. (1.5 Hr. on, 0.5 Hr. off)	±5.0%+0.05 Ω
Temperature Cycling	JIS-C-5202 7.4	-55°C ⇄ Room Temp. ⇄ +155°C ⇄ Room Temp. (5 cycles)	±2.0%+0.05 Ω
Resistance to Soldering Heat	JIS-C-5202 6.4	350±10°C for 3±0.5 Sec.	±1.0%+0.05 Ω

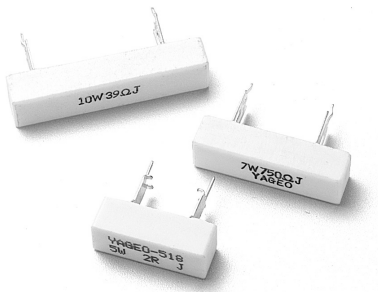
Note: Rated Continuous Working Voltage (RCWV) = $\sqrt{\text{Power Rating} \times \text{Resistance Value}}$

Cement Resistors

Radial Terminals Type

Normal Style [SQZ Series]

Non-Inductive Style [NSZ Series]



INTRODUCTION

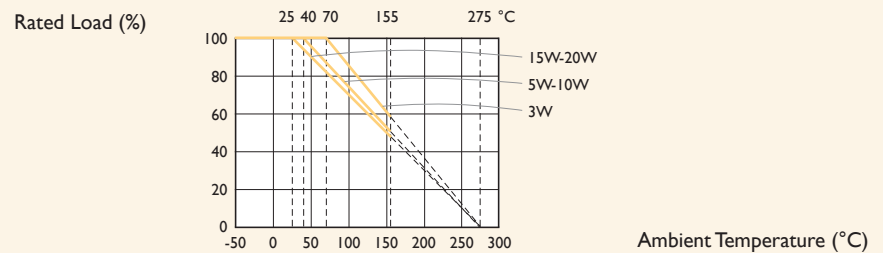
The materials used and the construction techniques ensure excellent flame resistance, arc resistance and moisture resistances as well as self-extinguishing capabilities. They will withstand the most rigorous loading test.

As resistors in radio and television receivers, the hazardous conditions of smoking and redheat can be completely prevented by the proper choice of power resistors.

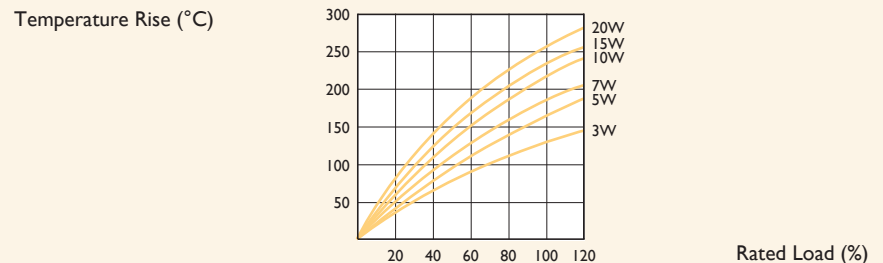
FEATURES

Power Rating	3W, 5W, 7W, 10W, 15W, 20W
Resistance Tolerance	±5%
T.C.R.	±300ppm/°C

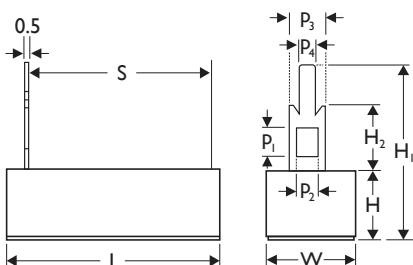
DERATING CURVE



TEMPERATURE RISE



DIMENSIONS



STYLE

DIMENSION

Normal	Non-Ind.	L	H	W	S	H ₁	H ₂	P ₁	P ₂	P ₃	P ₄
SQZ300	NSZ300	24.0±1.5	9.0±1	9.0±1	10.0±1	24.0±1	9.5±1.0	4.0±0.2	2.0±0.2	5.0±0.2	1.4±0.1
SQZ500	NSZ500	27.0±1.5	9.5±1	9.5±1	15.0±1	24.0±1	9.5±1.0	4.0±0.2	2.0±0.2	5.0±0.2	1.4±0.1
SQZ700	NSZ700	35.0±1.5	9.5±1	9.5±1	22.5±1	24.0±1	9.5±1.0	4.0±0.2	2.0±0.2	5.0±0.2	1.4±0.1
SQZ10A	NSZ10A	48.0±1.5	9.5±1	9.5±1	32.5±1	24.0±1	9.5±1.0	4.0±0.2	2.0±0.2	5.0±0.2	1.4±0.1
SQZ15A	NSZ15A	48.0±1.5	12.5±1	12.5±1	32.5±1	34.5±1	15.0±1.5	7.0±0.2	6.0±0.2	10.0±0.2	2.7±0.1
SQZ20A	NSZ20A	63.5±2.0	12.5±1	12.5±1	42.5±1	34.5±1	15.0±1.5	7.0±0.2	6.0±0.2	10.0±0.2	2.7±0.1

Unit: mm

ELECTRICAL CHARACTERISTICS

NORMAL STYLE

STYLE	SQZ300	SQZ500	SQZ700	SQZ10A	SQZ15A	SQZ20A
Power Rating at 70°C	3W	5W	7W	10W	15W	20W
Maximum Working Voltage	250V	350V	500V			
Maximum Overload Voltage	500V	700V	1,000V			
Dielectric Withstanding Voltage	500V	700V	1,000V			
Resistance Rang (Wirewound)	0.1 Ω - 47 Ω	0.1 Ω - 47 Ω	0.1 Ω - 100 Ω			
Resistance Range (Metal Oxide Film)	51 Ω - 33K Ω	51 Ω - 200K Ω	110 Ω - 200K Ω		110 Ω - 100K Ω	
Operating Temp. Range	-55°C to +155°C					
Temperature Coefficient	± 300 ppm/°C					

NON-INDUCTIVE STYLE

STYLE	NSZ300	NSZ500	NSZ700	NSZ10A	NSZ15A	NSZ20A
Power Rating at 70°C	3W	5W	7W	10W	15W	20W
Maximum Working Voltage	250V	350V	500V			
Maximum Overload Voltage	500V	700V	1,000V			
Dielectric Withstanding Voltage	500V	700V	1,000V			
Resistance Range (Wirewound)	0.1 Ω - 10 Ω			0.1 Ω - 20 Ω		0.1 Ω - 30 Ω
Operating Temp. Range	-55°C to +155°C					
Temperature Coefficient	± 300 ppm/°C					

Note: Special value is available on request.

ENVIRONMENTAL CHARACTERISTICS

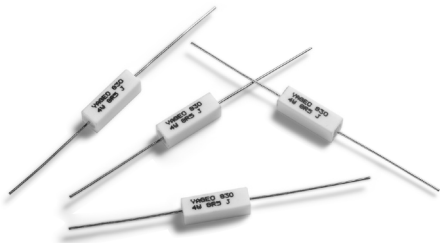
PERFORMANCE TEST	TEST METHOD		APPRAISE
Short Time Overload	JIS-C-5202 5.5	2.5 times RCWV for 5 Sec.	$\pm 2.0\% + 0.05 \Omega$
Dielectric Withstanding Voltage	JIS-C-5202 5.7	in V-Block for 60 Sec.	By type
Temperature Coefficient	JIS-C-5202 5.2	-55°C to +155°C	By type
Insulation Resistance	JIS-C-5202 5.6	in V-Block	$> 1,000M \Omega$
Solderability	JIS-C-5202 6.5	260 ± 5 °C for 5 ± 0.5 Sec.	95% Min. coverage
Resistance to Solvent	JIS-C-5202 6.9	IPA for 1 Min. with ultrasonic	No deterioration of coatings and markings
Terminal Strength	JIS-C-5202 6.1	Direct load for 10 Sec. in the direction of the terminal leads	≥ 2.5 kg (24.5N)
Pulse Overload	JIS-C-5202 5.8	4 times RCWV 10,000 cycles (1 Sec. on, 25 Sec. off)	$\pm 2.0\% + 0.05 \Omega$
Load Life in Humidity	JIS-C-5202 7.9	40 ± 2 °C, 90-95% RH at RCWV for 1,000 Hr. (1.5 Hr. on, 0.5 Hr. off)	$\pm 5.0\% + 0.05 \Omega$
Load Life	JIS-C-5202 7.10	70°C at RCWV for 1,000 Hr. (1.5 Hr. on, 0.5 Hr. off)	$\pm 5.0\% + 0.05 \Omega$
Temperature Cycling	JIS-C-5202 7.4	-55°C $\Rightarrow$ Room Temp. $\Rightarrow$ +155°C $\Rightarrow$ Room Temp. (5 cycles)	$\pm 2.0\% + 0.05 \Omega$
Resistance to Soldering Heat	JIS-C-5202 6.4	350 ± 10 °C for 3 ± 0.5 Sec.	$\pm 1.0\% + 0.05 \Omega$

Note: Rated Continuous Working Voltage (RCWV) = $\sqrt{\text{Power Rating} \times \text{Resistance Value}}$

Cement Resistors

Axial Lead Type

Power Wirewound Style [PSP Series]



INTRODUCTION

The materials used and the construction techniques ensure excellent flame resistance, arc resistance and moisture resistances as well as self-extinguishing capabilities. They will withstand the most rigorous loading test.

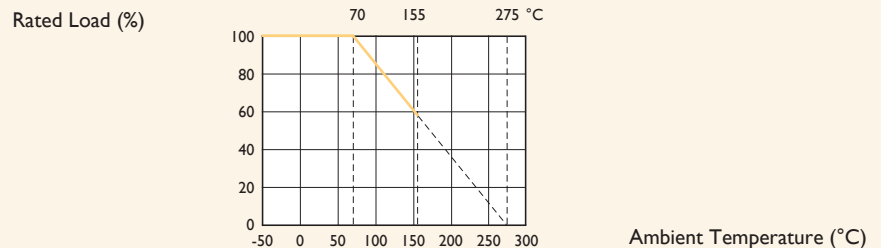
As resistors in radio and television receivers, the hazardous conditions of smoking and redheat can be completely prevented by the proper choice of power resistors.

FEATURES

Power Rating	4W, 5W, 7W, 9W
Resistance Tolerance	±5%, ±10%
T.C.R	±400ppm/°C

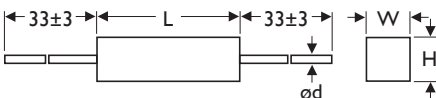
DERATING CURVE

For resistors operated in ambient temperatures above 70°C, power rating must be derated in accordance with the curve below.



DIMENSIONS

Unit: mm



STYEL		DIMENSION			
Normal	Miniature	L	W	H	ød
PSP400	-	20±1.0	6.4±0.3	6.4±0.3	0.8±0.02
PSP500	-	25±1.0	6.4±0.3	6.4±0.3	0.8±0.02
-	PSP7WS	25±1.0	9.0±0.3	9.0±0.3	0.8±0.02
PSP700	-	38±1.0	6.4±0.3	6.4±0.3	0.8±0.02
PSP900	-	38±1.0	9.0±0.3	9.0±0.3	0.8±0.02

Note:

ELECTRICAL CHARACTERISTICS

STYLE	PSP400	PSP500	PSP7WS	PSP700	PSP900
Power Rating at 70°C	4W	5W	7W		9W
Resistance Range	0.1 Ω - 2.5K Ω	0.1 Ω - 2.7K Ω		0.3 Ω - 3.9K Ω	
Operating Temp. Range	-55°C to +155°C				
Temperature Coefficient	± 400 ppm/°C				

Note: Special value is available on request.

ENVIRONMENTAL CHARACTERISTIC

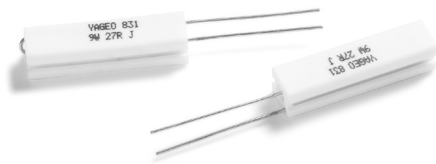
PERFORMANCE TEST	TEST METHOD		APPRAISE
Short Time Overload	JIS-C-5202 5.5	2.5 times RCWV for 5 Sec.	$\pm 2.0\% + 0.05 \Omega$
Dielectric Withstanding Voltage	JIS-C-5202 5.7	in V-Block for 60 Sec.	By type
Temperature Coefficient	JIS-C-5202 5.2	-55°C to +155°C	By type
Insulation Resistance	JIS-C-5202 5.6	in V-Block	$\geq 1,000M \Omega$
Solderability	JIS-C-5202 6.5	260 ± 5 °C for 5 ± 0.5 Sec.	95% Min. coverage
Resistance to Solvent	JIS-C-5202 6.9	IPA for 1 Min. with ultrasonic	No deterioration of coatings and markings
Terminal Strength	JIS-C-5202 6.1	Direct load for 10 Sec. In the direction of the terminal leads	≥ 2.5 kg (24.5N)
Pulse Overload	JIS-C-5202 5.8	4 times RCWV 10,000 cycles (1 Sec.on, 25 Sec.off)	$\pm 2.0\% + 0.05 \Omega$
Load Life in Humidity	JIS-C-5202 7.9	40 ± 2 °C, 90 - 95% RH at RCWV for 1,000 Hr. (1.5 Hr. on, 0.5 Hr. off)	$\pm 5.0\% + 0.1 \Omega$
Load Life	JIS-C-5202 7.10	70°C at RCWV for 1,000 Hr. (1.5 Hr. on, 0.5 Hr. off)	$\pm 5.0\% + 0.1 \Omega$
Temperature Cycling	JIS-C-5202 7.4	-55°C $\Rightarrow$ Room Temp. $\Rightarrow$ +155°C $\Rightarrow$ Room Temp. (5 cycles)	$\pm 2.0\% + 0.05 \Omega$
Resistance to Soldering Heat	JIS-C-5202 6.4	350 ± 10 °C for 3 ± 0.5 Sec.	$\pm 1.0\% + 0.05 \Omega$

Note: Rated Continuous Working Voltage (RCWV) = $\sqrt{\text{Power Rating} \times \text{Resistance Value}}$

Cement Resistors

Vertical Lead Type

Power Wirewound Style [PSM Series]



INTRODUCTION

The materials used and the construction techniques ensure excellent flame resistance, arc resistance and moisture resistances as well as self-extinguishing capabilities. They will withstand the most rigorous loading test.

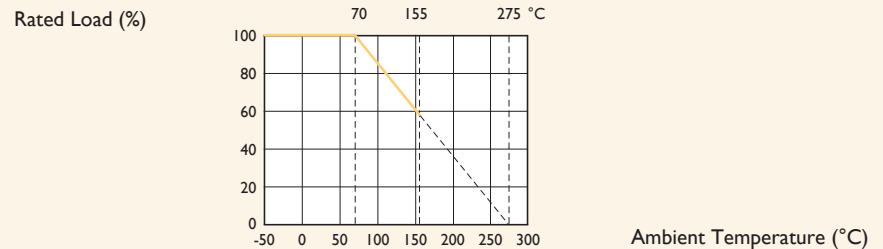
As resistors in radio and television receivers, the hazardous conditions of smoking and redheat can be completely prevented by the proper choice of power resistors.

FEATURES

Power Rating	4W, 5W, 7W, 9W
Resistance Tolerance	±5%, ±10%
T.C.R	±400ppm/°C

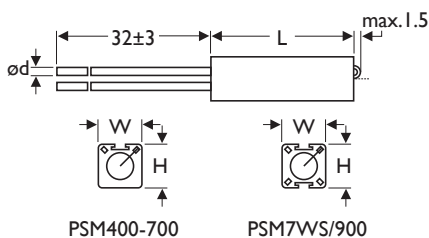
DERATING CURVE

For resistors operated in ambient temperatures above 70°C, power rating must be derated in accordance with the curve below.



DIMENSIONS

Unit: mm



STYEL		DIMENSION			
Normal	Miniature	L	W	H	Ød
PSM400	-	20±1.0	7.0±0.5	8.0±0.4	0.8±0.02
PSM500	-	25±1.0	7.0±0.5	8.0±0.4	0.8±0.02
-	PSM7WS	25±1.0	9.0±0.4	10.0±0.4	0.8±0.02
PSM700	-	38±1.0	7.0±0.5	8.0±0.4	0.8±0.02
PSM900	-	38±1.0	10.0±0.4	10.0±0.4	0.8±0.02

Note:

ELECTRICAL CHARACTERISTICS

STYLE	PSM400	PSM500	PSM7WS	PSM700	PSM900
Power Rating at 70°C	4W	5W	7W		9W
Resistance Range	0.1 Ω - 2.5K Ω	0.1 Ω - 2.7K Ω		0.3 Ω - 3.9K Ω	
Operating Temp. Range	-55°C to +155°C				
Temperature Coefficient	± 400 ppm/°C				

Note: Special value is available on request.

ENVIRONMENTAL CHARACTERISTIC

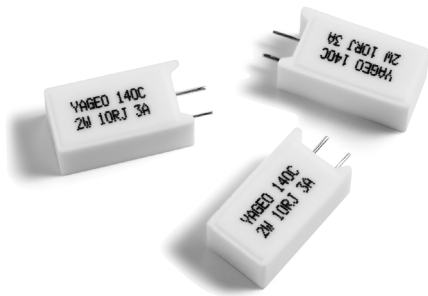
PERFORMANCE TEST	TEST METHOD		APPRAISE
Short Time Overload	JIS-C-5202 5.5	2.5 times RCWV for 5 Sec.	$\pm 2.0\% + 0.05 \Omega$
Dielectric Withstanding Voltage	JIS-C-5202 5.7	in V-Block for 60 Sec.	By type
Temperature Coefficient	JIS-C-5202 5.2	-55°C to +155°C	By type
Insulation Resistance	JIS-C-5202 5.6	in V-Block	$\geq 1,000M \Omega$
Solderability	JIS-C-5202 6.5	260 $\pm 5^\circ\text{C}$ for 5 ± 0.5 Sec.	95% Min. coverage
Resistance to Solvent	JIS-C-5202 6.9	IPA for 1 Min. with ultrasonic	No deterioration of coatings and markings
Terminal Strength	JIS-C-5202 6.1	Direct load for 10 Sec. In the direction of the terminal leads	$\geq 2.5\text{kg}$ (24.5N)
Pulse Overload	JIS-C-5202 5.8	4 times RCWV 10,000 cycles (1 Sec.on, 25 Sec.off)	$\pm 2.0\% + 0.05 \Omega$
Load Life in Humidity	JIS-C-5202 7.9	40 $\pm 2^\circ\text{C}$, 90 - 95% RH at RCWV for 1,000 Hr. (1.5 Hr. on, 0.5 Hr. off)	$\pm 5.0\% + 0.1 \Omega$
Load Life	JIS-C-5202 7.10	70°C at RCWV for 1,000 Hr. (1.5 Hr. on, 0.5 Hr. off)	$\pm 5.0\% + 0.1 \Omega$
Temperature Cycling	JIS-C-5202 7.4	-55°C $\Rightarrow$ Room Temp. $\Rightarrow$ +155°C $\Rightarrow$ Room Temp. (5 cycles)	$\pm 2.0\% + 0.05 \Omega$
Resistance to Soldering Heat	JIS-C-5202 6.4	350 $\pm 10^\circ\text{C}$ for 3 ± 0.5 Sec.	$\pm 1.0\% + 0.05 \Omega$

Note: Rated Continuous Working Voltage (RCWV) = $\sqrt{\text{Power Rating} \times \text{Resistance Value}}$

Cement Resistors

Vertical Lead Type

Fusible Thermal Style [FTR Series]



INTRODUCTION

The material used and the construction techniques ensure excellent flame resistance, arc resistance and moisture resistances as well as self-extinguishing capabilities. They will withstand the most rigorous loading test.

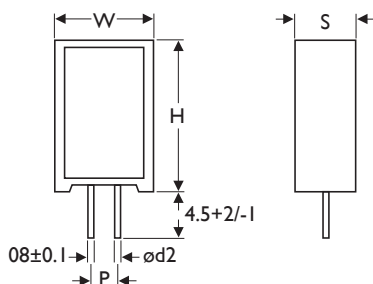
Apply fusible thermal resistors, respond quickly to overloading as external overheating. These resistors also provide outstanding feature against surges, suitable for the prevention of inrush current for switching regulators.

FEATURES

Rated Current	2A, 3A, 5A, 10A
Resistance Tolerance	±5%, ±10%
T.C.R	±250ppm/°C

DIMENSIONS

Unit: mm



STYEL	DIMENSION				
Normal	H	W	S	P	ød2
FTR100	25±1.5	13±1.0	9.0±1.0	5.0±1.0	2A: 0.6±0.1
FTR200	38±1.5	13±1.0	9.0±1.0	5.0±1.0	3A: 0.6±0.1
FTR300	35±1.5	16±1.0	12±1.0	7.5±1.0	5A: 1.0±0.1
					10A: 1.0±0.1

Note:

ELECTRICAL CHARACTERISTICS

FTR100 / 200 / 300					FTR100	FTR200	FTR300
Standard Current(A)	Fusing Temperature (°C)	Standard Voltage (V)	Resistance Range	Operating Temperature Range	Power Rating at 70°C		
10A	109+1/-3	250	1 Ω - 10K Ω	-25°C to +125°C	1.2	1.4	2.0
	129±4				1.6	2.0	2.5
	152±4				1.6	2.0	2.5
	188+3/-1				2.0	2.4	3.5
	226+1/-3				2.0	2.4	3.5
5A	129±3	250	1 Ω - 10K Ω	-25°C to +125°C	1.6	2.2	-
	187+1/-3				2.1	2.4	-
3A	145±4	250	1 Ω - 10K Ω	-25°C to +125°C	1.6	2.2	-
2A	95+3/0				0.8	1.2	-
	110±4				1.2	1.4	-
	126±4				1.4	1.6	-
	130±4				1.6	2.1	-
	145±4				2.1	2.4	-

Note: Special value is available on request.

ENVIRONMENTAL CHARACTERISTIC

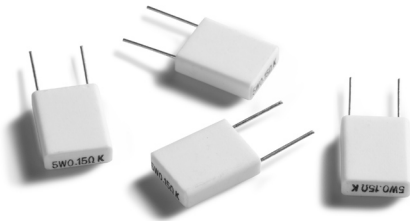
PERFORMANCE TEST	TEST METHOD		APPRAISE
Short Time Overload	JIS-C-5202 5.5	2.5 times RCWV for 5 Sec.	±2.0%+0.05 Ω
Temperature Coefficient	JIS-C-5202 5.2	-25°C to +125°C	By type
Terminal Strength	JIS-C-5202 6.1	Direct load for 10 Sec. In the direction of the terminal leads	≥25N
Load Life	JIS-C-5202 7.10	25°C at RCWV for 1,000 Hr: (1.5 Hr: on, 0.5 Hr: off)	±5.0%+0.1 Ω

Note: Rated Continuous Working Voltage (RCWV) = $\sqrt{\text{Power Rating} \times \text{Resistance Value}}$

Ceramic Metal Plate Resistors

Radial Lead Type

Normal Style [SLR]



INTRODUCTION

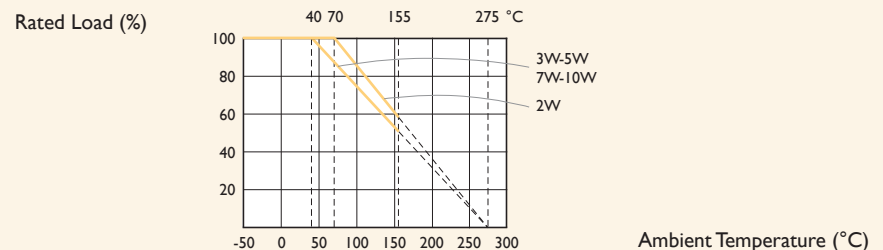
The materials used and the construction techniques ensure excellent flame resistance, arc resistance and moisture resistances as well as self-extinguishing capabilities. They will withstand the most rigorous loading test.

As resistors in radio and television receivers, the hazardous conditions of smoking and redheat can be completely prevented by the proper choice of power resistors.

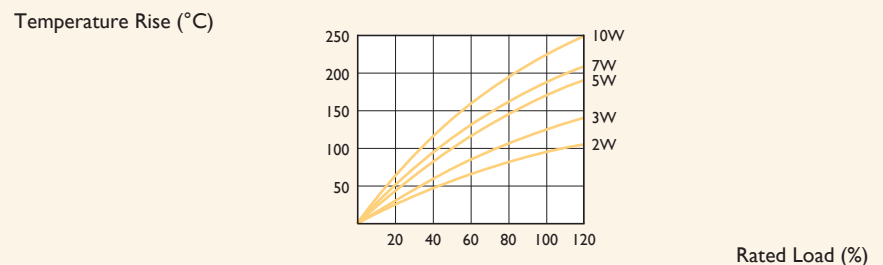
FEATURES

Power Rating	2W, 3W, 5W, 7W, 10W
Resistance Tolerance	$\pm 5\%$, $\pm 10\%$
T.C.R.	$\pm 250\text{ppm}/^{\circ}\text{C}$

DERATING CURVE

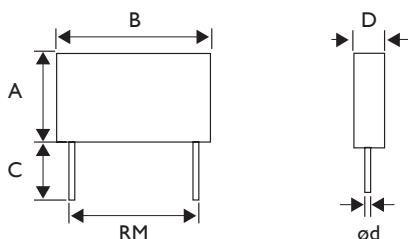


TEMPERATURE RISE



DIMENSIONS

Unit: mm



STYLE	DIMENSION					
NORMAL	A	B	C	D	ØD	RM
SLR200	8±1	13±1	3.5±1	5±1	0.6±0.05	9±1
SLR300	13±1	13±1	3.5±1	5±1	0.6±0.05	8±1
SLR500	18±1	14±1	3.5±1	5±1	0.6±0.05	10±1
SLR700	18±1	26±1	3.5±1	5±1	0.8±0.05	20±1
SLR10A	20±1	26±1	3.5±1	5±1	0.8±0.05	20±1

Note:

ELECTRICAL CHARACTERISTICS

STYLE	SLR200	SLR300	SLR500	SLR700	SLR10A
Power Rating at 70°C	2W	3W	5W	7W	10W
Maximum Working Voltage	250V	350V		500V	
Maximum Overload Voltage	500V	700V		1,000V	
Dielectric Withstanding Voltage	500V	700V		1,000V	
Resistance range	0.10 Ω - 0.68 Ω	0.05 Ω - 1 Ω	0.05 Ω - 3.3 Ω		
Operating Temp. Range	-55°C to +155°C				
Temperature Coefficient	± 250 ppm/°C				

Note: Special value is available on request

ENVIRONMENTAL CHARACTERISTICS

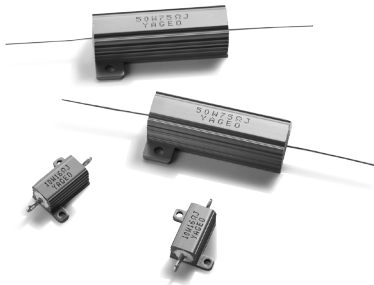
PERFORMANCE TEST	TEST METHOD		APPRAISE
Short Time Overload	JIS-C-5202 5.5	2.5 times RCWV for 5 Sec.	$\pm 2.0\% + 0.05 \Omega$
Dielectric Withstanding Voltage	JIS-C-5202 5.7	in V-Block for 60 Sec.	By type
Temperature Coefficient	JIS-C-5202 5.2	-55°C to +155°C	By type
Insulation Resistance	JIS-C-5202 5.6	in V-Block	$> 1,000M \Omega$
Solderability	JIS-C-5202 6.5	260 ± 5 °C for 5 ± 0.5 Sec.	95% Min. coverage
Resistance to Solvent	JIS-C-5202 6.9	IPA for 1 Min. with ultrasonic	No deterioration of coatings and markings
Terminal Strength	JIS-C-5202 6.1	Direct load for 10 Sec. in the direction of the terminal leads	≥ 2.5 kg (24.5N)
Pulse Overload	JIS-C-5202 5.8	4 times RCWV 10,000 cycles (1 Sec. on, 25 Sec. off)	$\pm 2.0\% + 0.05 \Omega$
Load Life in Humidity	JIS-C-5202 7.9	40 ± 2 °C, 90-95% RH at RCWV for 1,000 Hr. (1.5 Hr. on, 0.5 Hr. off)	$\pm 5.0\% + 0.05 \Omega$
Load Life	JIS-C-5202 7.10	70°C at RCWV for 1,000 Hr. (1.5 Hr. on, 0.5 Hr. off)	$\pm 5.0\% + 0.05 \Omega$
Temperature Cycling	JIS-C-5202 7.4	-55°C $\Rightarrow$ Room Temp. $\Rightarrow$ +155°C $\Rightarrow$ Room Temp. (5 cycles)	$\pm 2.0\% + 0.05 \Omega$
Resistance to Soldering Heat	JIS-C-5202 6.4	350 ± 10 °C for 3 ± 0.5 Sec.	$\pm 1.0\% + 0.05 \Omega$

Note: Rated Continuous Working Voltage (RCWV) = $\sqrt{\text{Power Rating} \times \text{Resistance Value}}$

Aluminum Housed Resistors

Power Wirewound Type

Lug / Threaded Style [AHA Series] Straight Leadwire Style [AHP Series]

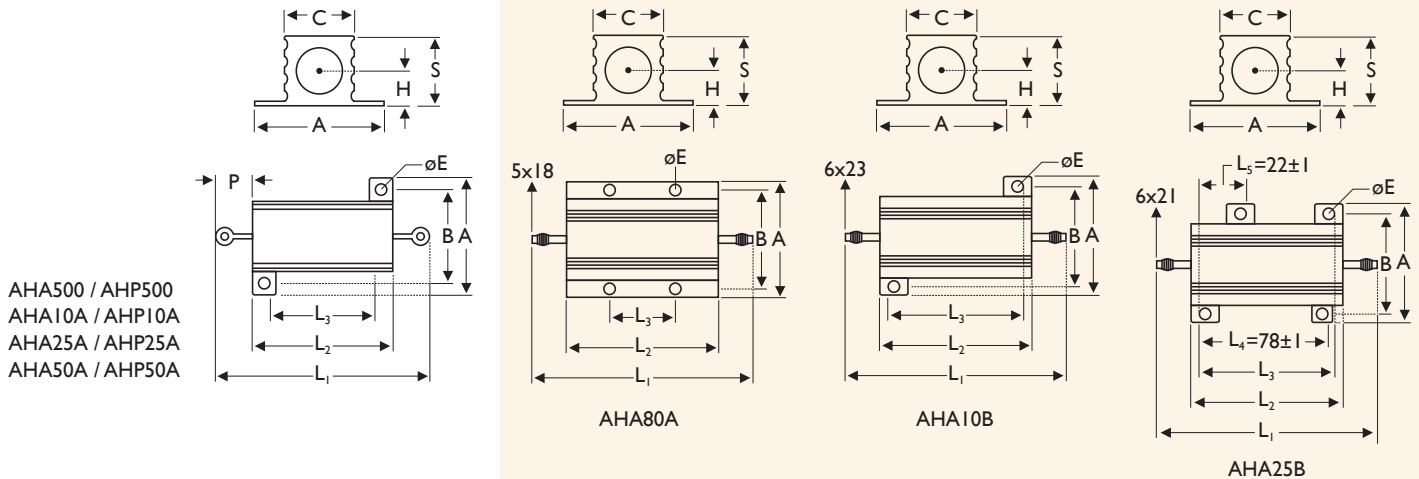


FEATURES

Power Rating	5W, 10W, 25W, 50W, 80W, 100W, 250W
Resistance tolerance	$\pm 0.25\%$, $\pm 0.5\%$, $\pm 1\%$, $\pm 5\%$, $\pm 10\%$
T.C.R.	$\pm 200\text{ppm}/^{\circ}\text{C}$

DIMENSIONS

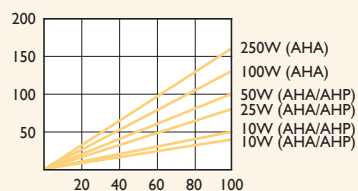
Unit: mm



STYEL	DIMENSION									
Normal	L ₁	L ₂	L ₃	A	B	C	øE	S	H	P
AHA500 / AHP500	25±2	15±1	10±1	16.5±1	12.5±1	8.5±1	2±0.3	8±1	4±0.5	5±2
AHA10A / AHP10A	32±2	19±1	14±1	20±1	15.5±1	10.5±1	2±0.3	10±1	5±0.5	6±2
AHA25A / AHP25A	47±2	27±1	18±1	27±1	19±1	15±1	3.2±0.3	15.5±1	7±0.5	10±2
AHA50A / AHP50A	70±2	50±1	39±1	29±1	21±1	15±1	3.2±0.3	15.5±1	7±0.5	10±2
AHA80A	102±2	66±1	35±1	47±1	37±1	28±1	4.5±0.3	25±1	12±0.5	-
AHA10B	135±2	89±1	69±1	70±1	48±1	46±1	5±0.3	44.5±1	19.5±0.5	-
AHA25B	155±2	114±1	98±1	77±1	64±1	53±1	5±0.3	55.5±1	25±0.5	-

TEMPERATURE RISE

Temperature (°C)



Rated Load (%)

ELECTRICAL CHARACTERISTICS

STYLE	AHA500 AHP500	AHA10A AHP10A	AHA25A AHP25A	AHA50A AHP50A	AHA80A	AHA10B	AHA25B
Power Rating at 70°C	5W	10W	25W	50W	80W	100W	250W
Dielectric Withstanding Voltage	1,000V			2,000V		4,500V	
Resistance Range	0.1 Ω - 100 Ω				0.1 Ω - 3K Ω		
Operating Temp. Range	-55°C to +275°C						
Temperature Coefficient	±200ppm/°C						

Note: Special value is available on request.

ENVIRONMENTAL CHARACTERISTIC

PERFORMANCE TEST	TEST METHOD		APPRAISE
Short Time Overload	JIS-C-5202 5.5	2.5 times RCWV for 5 Sec.	±0.5%+0.05 Ω
Dielectric Withstanding Voltage	JIS-C-5202 5.7	in V-Block for 60 Sec.	By type
Temperature Coefficient	JIS-C-5202 5.2	-55°C to +275°C	By type
Insulation Resistance	JIS-C-5202 5.6	in V-Block	> 100M Ω
Solderability	JIS-C-5202 6.5	260±5°C for 5±0.5 Sec.	95% Min. coverage
Resistance to Solvent	JIS-C-5202 6.9	IPA for 1 Min. with ultrasonic	No deterioration of coatings and markings
Terminal Strength	JIS-C-5202 6.1.2	Pull test (30 Sec. Min.): 5W: 1kg, 10W: 2.3kg, 25 - 50W: 4.5kg Torque test (5 - 15 Sec.): 100W: 2.7N, 250W: 3.7N	±0.2%+0.05 Ω
Load Life in Humidity	JIS-C-5202 7.9	40±2°C, 90 - 95% RH at 1/10 × Power Rating for 1,000 Hr. (1.5 Hr. on, 0.5 Hr. off)	±0.5%+0.05 Ω
Load Life	JIS-C-5202 7.10	25°C at RCWV for 1,000 Hr. (1.5 Hr. on, 0.5 Hr. off)	±1.5%+0.05 Ω
Temperature Cycling	JIS-C-5202 7.4	-55°C ⇄ Room Temp. ⇄ +155°C ⇄ Room Temp. (5 cycles)	±1.0%+0.05 Ω
Resistance to Soldering Heat	JIS-C-5202 6.4	350±10°C for 3±0.5 Sec.	±1.0%+0.05 Ω

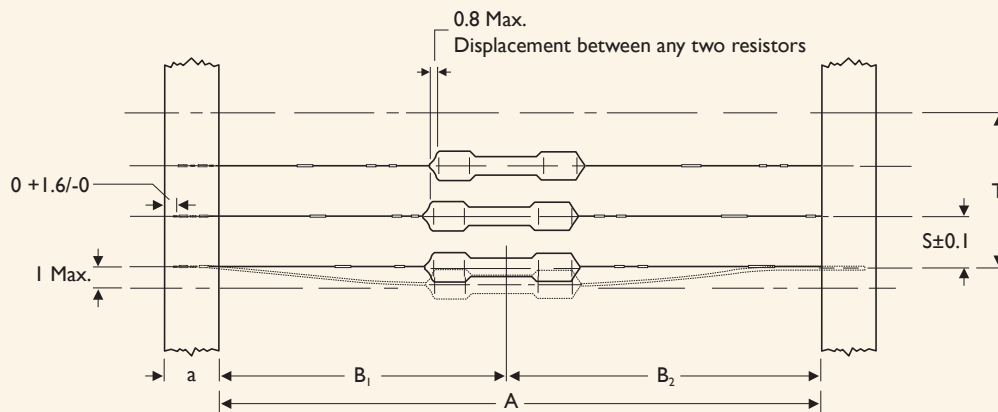
Note: Rated Continuous Working Voltage (RCWV) = $\sqrt{\text{Power Rating} \times \text{Resistance Value}}$



GENERAL INFORMATION

PACKING METHODS

The resistors are supplied on bandolier; either 1,000 resistors in ammpack or 5,000 resistors on reel.



Bandolier for Axial Leads

STYLE		DIMENSIONS					Unit: mm
Normal	Miniature	a	A ⁽¹⁾	B ₁ - B ₂	S (Spacing)	T (Max. Deviation of Spacing)	
TYPE-12	TYPE25S / 204	6±0.5	52.4±1.5	1.2	5	1mm Per 10 Spacings, 0.5mm Per 5 Spacings	
			26.0±1.5	1			
TYPE-25	TYPE50S / 207	6±0.5	52.4±1.5	1.2	5		
			26.0±1.5	1			
TYPE-50	TYPE1WS	6±0.5	52.4±1.5	1.2	5		
TYPE100	TYPE2WS	6±0.5	73.0±1.5	1.5	5		
			52.4±1.5	1.2			
TYPE200	TYPE3WS	6±0.5	73.0±1.5	1.5	10		
KNP300	KNP5WS		52.4±1.5	1.2			
RSF300	RSF5WS		91.0±1.5	1.5			
RSF500 / KNP500	KNP7WS	6±0.5	73.0±1.5	1.5	10		

Note: 1. Optional please refer to table "Exception"

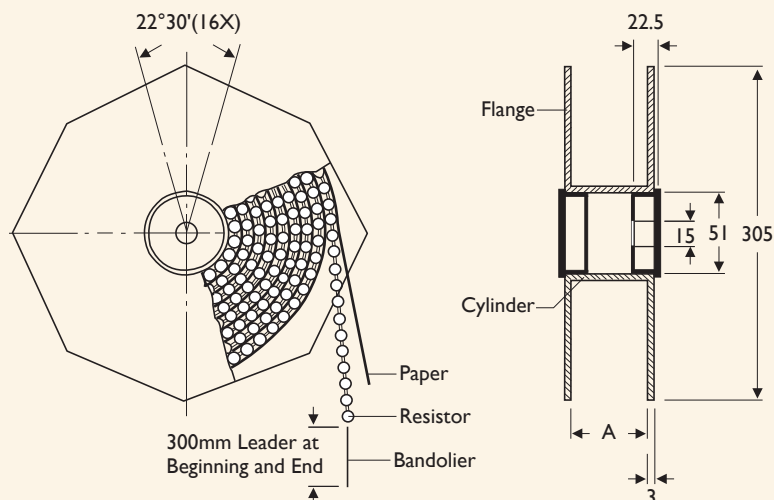
EXCEPTION

Unit: mm

SERIES	POWER RATING	STANDARD LEAD LENGTH	MINIATURE LEAD LENGTH
RSF	3WM, 5SS	73	52.4
KNP / NKN / FKN	3W, 4W, 5WS	73	52.4
RSF / KNP / NKN / FKN	5W, 7W on T/R	73	

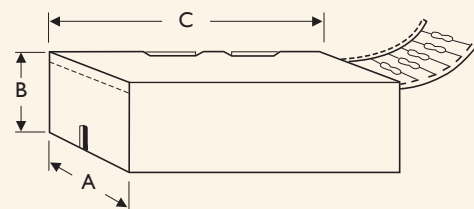
TAPE ON REEL PACKING

Bandoliers can be reeled; dimension a differ with type.



TAPE ON BOX PACKING

Bandoliers may also be supplied in a cardboard box ("ammopack").



"Ammopack" is an abbreviation of "ammunition packing"
The dimensions of A-B-C vary with type and quantity.

STYLE		TAPE ON REEL		TAPE ON BOX			Unit: mm/pcs
Normal	Miniature	Across Flange (A)	Q'TY Per Reel	W (A)	H (B)	L (C)	Q'TY Per Box
TYPE-12	TYPE25S / 204	72	5,000	78/81	24/70	260	2,000/5,000
TYPE-25	TYPE50S / 207	48/72	5,000	78/81	24/104	260	1,000/5,000
TYPE-50	TYPE1WS	72	2,500	73	45	258	1,000
TYPE100	TYPE2WS	95	2,000	103	78	260	1,000
TYPE200	TYPE3WS	95	1,000	103	94	260	1,000
KNP300	KNP5WS	95	1,000	103	78	260	500
RSF300	RSF5WS	95	250	116	79	255	250
RSF500 / KNP500	KNP7WS						

BULK PACKAGING

POWER RATING	PCS/PER INNER BOX	BAG/PER INNER BOX	PCS/PER BAG
1/6W, 1/4WS, 0.4W	2,000	10	200
1/4W, 1/2WS, 0.6W	1,000	5	200
1/2W, 1WS	1,000	5	200
1W, 2WS	1,000	10	100
2W, 3WS	1,000	10	100
3W	500	10	50
5W	500	10	50
7W	500	10	50

PACKING QUANTITIES (STANDARD TYPE)

WATT	PACKAGE	Q'TY	WEIGHT	CARTON Q'TY	NW/GW	CARTON	CARTON SIZE	CUBIC FIT
		(Pcs)	(Kg)	(Pcs)	(Kg)	(No.)	(cm)	(Cu.ft.)
1/6W	Tape / Reel	5,000	1.1	50,000	11/13	E1	60×30.5×43.5	3
1/4WS	Tape / Box	5,000	0.74	100,000	15/16	E3	42.5×28×35	1.5
0.4W	Bulk	10,000	1.18	160,000	19/20	E3	42.5×28×35	1.5
1/4W	Tape / Reel	5,000	1.5	50,000	16/18	E1	60×30.5×43.5	3
1/2WS	Tape / Box	5,000	1.1	75,000	18/19	E3	42.5×28×35	1.5
0.6W	Bulk	10,000	1.6	100,000	15/16	E3	42.5×28×35	1.5
1/2W	Tape / Reel	3,000	1.3	25,000	13/15	E1	60×30.5×43.5	3
1WS	Tape / Box	1,000	0.43	30,000	13/14	E2	40.5×28×33	1.4
	Tape / Box	2,000	0.86	30,000	13/14	E3	42.5×28×35	1.5
	Bulk	5,000	1.86	50,000	17/18	E3	42.5×28×35	1.5
1W	Tape / Reel	2,000	2.2	20,000	22/24	E1	60×30.5×43.5	3
2WS	Tape / Box	1,000	0.9	16,000	14/15	E3	42.5×28×35	1.5
	Bulk	2,000	1.5	24,000	21/22	E3	42.5×28×35	1.5
2W	Tape / Reel	1,000	1.6	8,000	11/12	E3	42.5×28×35	1.5
3WS	Tape / Box	1,000	1.12	12,000	14/15	E3	42.5×28×35	1.5
	Bulk	1,000	1.02	16,000	22/24	E3	42.5×28×35	1.5
3W, 5W	Tape / Box	500	0.94	8,000	14/15	E3	42.5×28×35	1.5
5WS	Bulk	1,000	1.75	8,000	14/15	E3	42.5×28×35	1.5
5SS	Tape / Reel	1,000	2.5	8,000	21/23	E1	60×30.5×43.5	3
	Tape / Box	500	0.93	8,000	15/16	E3	42.5×28×35	1.5
JPW-05	Tape / Reel	10,000	1.4	100,000	15/17	E1	60×30.5×43.5	3
	Tape / Box	10,000	1.06	150,000	16/17	E3	42.5×28×35	1.5
JPW-06	Tape / Reel	10,000	1.9	100,000	22/24	E1	60×30.5×43.5	3
	Tape / Box	10,000	1.5	150,000	24/25	E3	42.5×28×35	1.5
JPW-08	Tape / Reel	10,000	3	100,000	32/34	E1	60×30.5×43.5	3
	Tape / Box	10,000	2.7	100,000	27/28	E3	42.5×28×35	1.5
JPW-10	Tape / Reel	10,000	5	100,000	50/52	E1	60×30.5×43.5	3
	Tape / Box	5,000	2.33	75,000	35/36	E3	42.5×28×35	1.5

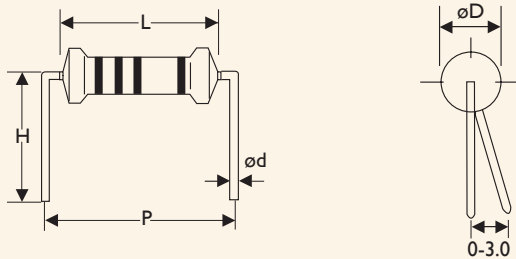
PACKING QUANTITIES (CEMENT TYPE)

TYPE	POWER	BOX	CARTON	NW	GW
(Unit)	(Watt)	(Pcs)	(Pcs)	(Kg)	(Kg)
SQP	2W	500	4,000	15	16
	3W	500	4,000	18	19
	5W	500	4,000	21	22
	7W	250	2,000	18	19
	10W	250	2,000	23	24
	15W	150	900	18	19
	20W	100	600	16	17
	25W	100	600	16	17
	30W	50	250	16	17
	40W	50	250	19	20
SQM	2W	1,000	2,000	11	12
	3W	1,000	2,000	12	13
	5W	1,000	2,000	13	14
	7W	1,000	2,000	20	21
	10W	500	1,000	17	18
SQZ	3W	100	2,000	12	13
	5W	100	2,000	13	14
	7W	100	2,000	20	21
	10W	60	1,200	12	13
	15W	30	600	13	14
	20W	30	600	16	17
SLR	3W	1,000	8,000	17	18.3
	5W	1,000	8,000	27.2	28.5



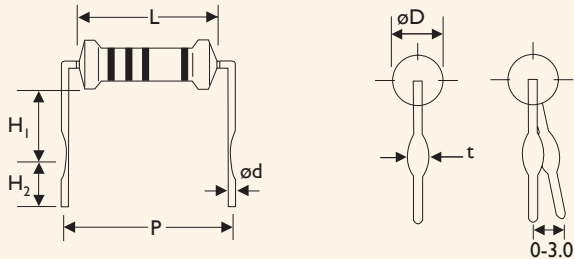
FORMING DIMENSION (SPECIAL TYPE)

M TYPE



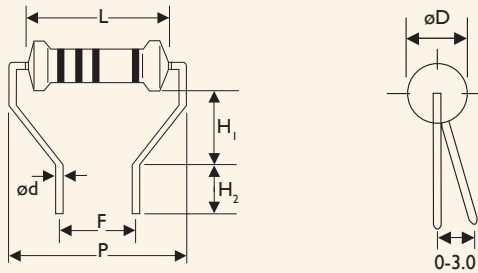
STYLE		DIMENSIONS					Unit: mm	
Normal	Miniature	L	P	øD	ød	H		
TYPE-12	TYPE25S	3.4±0.3	6.0±1	1.9±0.2	0.45±0.05	10.0±1		
TYPE-25	TYPE50S	6.3±0.5	10.0±1	2.4±0.2	0.55±0.05	10.0±1		
TYPE-50	TYPE1WS	9.0±0.5	12.5±1	3.3±0.3	0.55±0.05	10.0±1		
TYPE100	TYPE2WS	11.5±1.0	15.0±1	4.5±0.5	0.8±0.05	12.5±1		
TYPE200	TYPE3WS	15.5±1.0	20.0±1	5.0±0.5	0.8±0.05	15.0±1		

MB TYPE

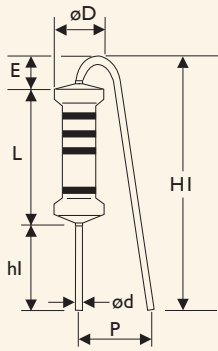
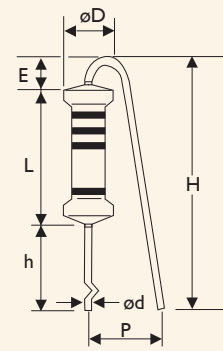
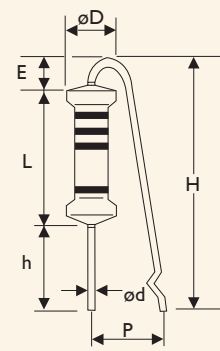
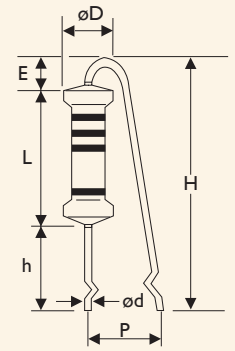


STYLE		DIMENSIONS							Unit: mm	
Normal	Miniature	L	P	øD	ød	H ₁	H ₂	t		
TYPE-25	TYPE50S	6.3±0.5	10.0±1	2.4±0.2	0.55±0.05	6.0±1	5.0±1	1.2±0.2		
TYPE-50	-	9.0±0.5	12.5±1	3.3±0.3	0.55±0.05	6.0±1	5.0±1	1.2±0.2		
-	TYPE1WS	9.0±0.5	12.5±1	3.3±0.3	0.8±0.05	6.0±1	5.0±1	1.4±0.2		
TYPE100	TYPE2WS	11.5±1.0	15.0±1	4.5±0.5	0.8±0.05	6.0±1	5.0±1	1.4±0.2		
TYPE200	TYPE3WS	15.5±1.0	20.0±1	5.0±0.5	0.8±0.05	10.0±1	5.0±1	1.4±0.2		
TYPE300	TYPE5WS	24.5±1.0	30.0±1	8.0±0.5	0.8±0.05	15.0±1	5.0±1	1.4±0.2		
TYPE500	-	24.5±1.0	30.0±1	8.0±0.5	0.8±0.05	15.0±1	5.0±1	1.4±0.2		

MR TYPE



STYLE		DIMENSIONS							Unit: mm	
Normal	Miniature	L	P	F	øD	ød	H ₁	H ₂		
TYPE-50	TYPE1WS	9.0±0.5	14.5±1	7.0±0.5	3.3±0.3	0.55±0.05	7.0±1	5.0±1		
TYPE100	TYPE2WS	11.5±1.0	17.5±1	7.0±0.5	4.5±0.5	0.8±0.05	8.0±1	5.0±1		
TYPE200	TYPE3WS	15.5±1.0	21.5±1	7.0±0.5	5.0±0.5	0.8±0.05	9.0±1	5.0±1		

F TYPE**FK TYPE****FFK TYPE****FKK TYPE****STYLE****DIMENSIONS**

Unit: mm

Normal	Miniature	L	P	øD	ød	h	H Max.	hl	HI Max.	E Max.
TYPE100	TYPE2WS	11.5±1	6±1	4.5±0.5	0.8±0.05	10.0±1	25	5.0±1	20	3.5
TYPE200	TYPE3WS	15.5±1	6±1	5.0±0.5	0.8±0.05	10.0±1	30	5.0±1	25	3.5

Note: TYPE-25/50S is available.

FT Type Forming for Taping

Rated Watts 1/4W, 1/2WS & 0.6W

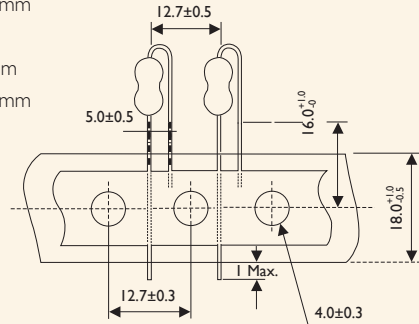
Body Dimension : L = 6.3±0.5mm

øD = 2.4±0.2mm

Rated Watts : 1/2W & 1WS

Body Dimension : L = 9±0.5mm

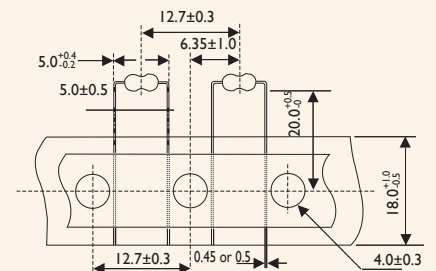
øD = 3.3±0.3mm

**MT Type Forming for Taping**

Rated Watts 1/6W, 1/4WS & 0.4W

Body Dimension : L = 3.4±0.3mm

øD = 1.9±0.2mm

**PN Type Forming for Taping**

Rated Watts 1/4W, 1/2WS & 0.6W

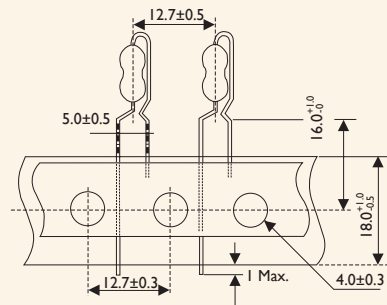
Body Dimension : L = 6.3±0.5mm

øD = 2.4±0.2mm

Rated Watts : 1/2W & 1WS

Body Dimension : L = 9±0.5mm

øD = 3.3±0.3mm

**AV Type Forming for Taping**

Rated Watts 1/4W, 1/2WS & 0.6W

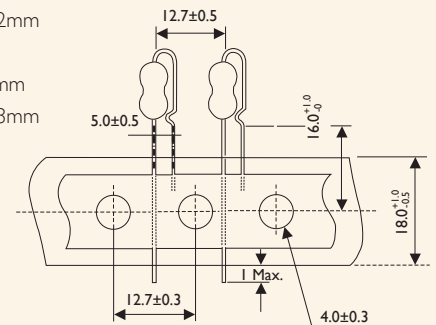
Body Dimension : L = 6.3±0.5mm

øD = 2.4±0.2mm

Rated Watts : 1/2W & 1WS

Body Dimension : L = 9±0.5mm

øD = 3.3±0.3mm





EXPLANATIONS OF ORDERING CODE

MFR	-12	F	T	F	52-	100R
Code 1 - 3 Series Name See Index	Code 4 - 6 Power Rating -05 = $\varnothing$ d0.5mm -06 = $\varnothing$ d0.6mm -07 = $\varnothing$ d0.7mm -08 = $\varnothing$ d0.8mm -10 = $\varnothing$ d1.0mm -14 = $\varnothing$ d1.4mm -12 = 1/6W -25 = 1/4W 25S = 1/4WS -50 = 1/2W 50S = 1/2WS 100 = 1W 1WS = 1WS 200 = 2W 2WS = 2WS 204 = 0.4W 207 = 0.6W 300 = 3W 3WS = 3WS 3WM = 3WM 400 = 4W 500 = 5W 5WS = 5WS 5SS = 5WSS 700 = 7W 7WS = 7WS 10A = 10W 20A = 20W 30A = 30W 40A = 40W 50A = 50W 10S = 10WS 15A = 15W 25A = 25W 10B = 100W 25B = 250W	Code 7 Tolerance P = ± 0.02 % A = ± 0.05 % B = ± 0.1 % C = ± 0.25 % D = ± 0.5 % F = ± 1 % G = ± 2 % J = ± 5 % K = ± 10 % - = Base on Spec.	Code 8 Packing Style T = Tape/Box R = Tape/Reel B = Bulk	Code 9 Temperature Coef- ficient of Resistance - = Base on Spec. A = ± 5 ppm/ $^{\circ}$ C B = ± 10 ppm/ $^{\circ}$ C C = ± 15 ppm/ $^{\circ}$ C D = ± 25 ppm/ $^{\circ}$ C E = ± 50 ppm/ $^{\circ}$ C F = ± 100 ppm/ $^{\circ}$ C G = ± 200 ppm/ $^{\circ}$ C H = ± 250 ppm/ $^{\circ}$ C I = ± 300 ppm/ $^{\circ}$ C J = ± 350 ppm/ $^{\circ}$ C	Code 10 - 12 Forming Type 26- = 26mm 52- = 52.4mm 73- = 73mm 81- = 81mm 91- = 91mm F = F Type FK = FK Type FKK = FKK Type FFK = F-form Kink M = M-Type Forming MB = M-form W/flat MT = MT Type Forming MR = MR Type AV = AVIsert PN = PANAsert	Code 13 - 17 Resistance Value 0R1 = 0.1 100R = 100 10K = 10,000 10M = 10,000,000

EXCEPTION:

• Cement series:

<Code 8>: Special packing style code

B: Bulk with wirewound or metal oxide sub-assembly for resistance value

W: Bulk with wirewound sub-assembly for resistance value

M: Bulk with metal oxide sub-assembly for resistance value

<Code 10-12>: Without forming code

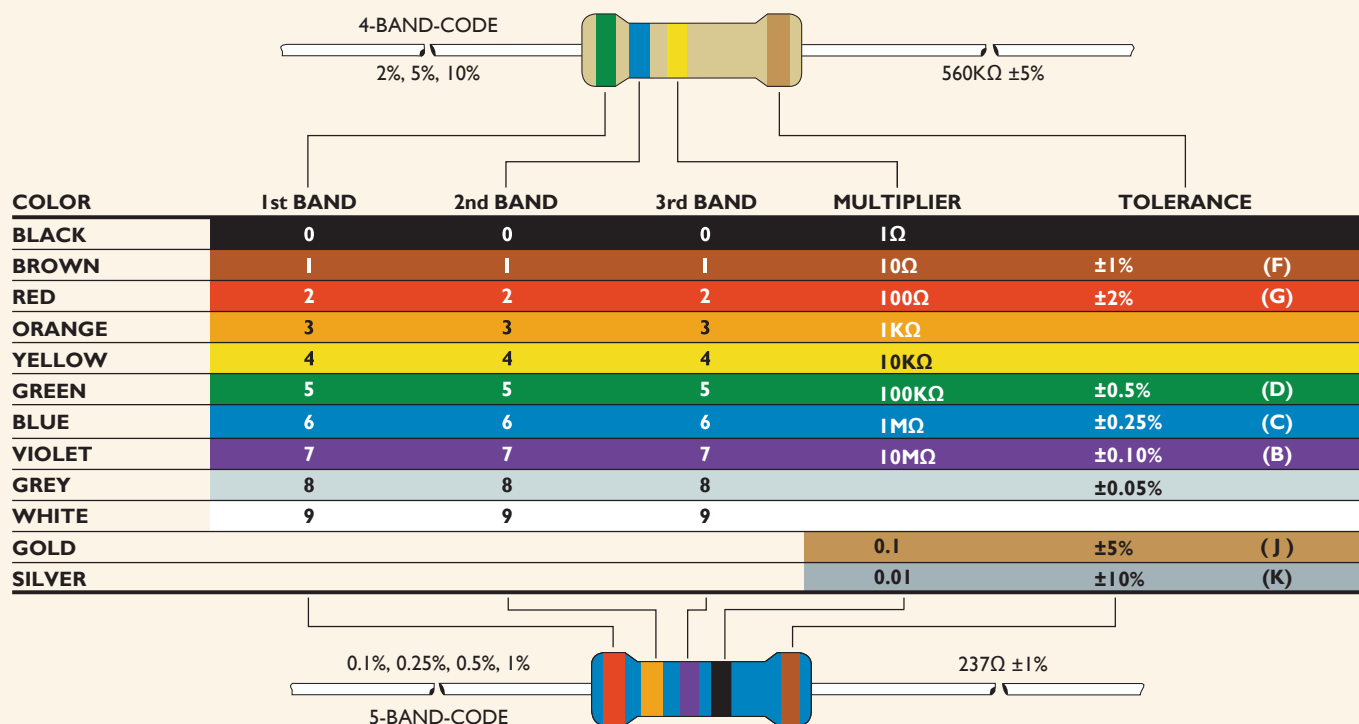
Example: **SQP500JB-10R**

• JPW series:

<Code 13-17>: without resistance value code

Example: **JPW-06-T-52-**

MARKING AND STANDARD RESISTANCE VALUE FOR THE 10-TO-100 DECADE



STANDARD RESISTANCE VALUES FOR THE 10-TO-100 DECADE

(Also Usable in Decade Multiples or Sub-Multiples)

RESISTANCE TOLERANCE (±%)																	
0.10%	0.25%	1%	2%	0.10%	0.25%	1%	2%	0.10%	0.25%	1%	2%	0.10%	0.25%	1%	2%	0.10%	0.25%
0.50%	10%	0.50%	10%	0.50%	10%	0.50%	10%	0.50%	10%	0.50%	10%	0.50%	10%	0.50%	10%	0.50%	10%
10	10	10		14.7	14.7	-		21.5	21.5	-		31.6	31.6	-		46.4	46.4
10.1	-	-		14.9	-	-		21.8	-	-		32	-	-		47	-
10.2	10.2	-		15	15	15		22.1	22.1	22		32.4	32.4	-		47.5	47.5
10.4	-	-		15.2	-	-		22.3	-	-		32.8	-	-		48.1	-
10.5	10.5	-		15.4	15.4	-		22.6	22.6	-		33.2	33.2	33		48.7	48.7
10.6	-	-		15.6	-	-		22.9	-	-		33.6	-	-		49.3	-
10.7	10.7	-		15.8	15.8	-		23.2	23.2	-		34	34	-		49.9	49.9
10.9	-	-		16	-	16		23.4	-	-		34.4	-	-		50.5	-
11	11	11		16.2	16.2	-		23.7	23.7	-		34.8	34.8	-		51.1	51.1
11.1	-	-		16.4	-	-		24	-	24		35.2	-	-		51.7	-
11.3	11.3	-		16.5	16.5	-		24.3	24.3	-		35.7	35.7	-		52.3	52.3
11.4	-	-		16.7	-	-		24.6	-	-		36.1	-	36		53	-
11.5	11.5	-		16.9	16.9	-		24.9	24.9	-		36.5	36.5	-		53.6	53.6
11.7	-	-		17.2	-	-		25.2	-	-		37	-	-		54.2	-
11.8	11.8	-		17.4	17.4	-		25.5	25.5	-		37.4	37.4	-		54.9	54.9
12	-	12		17.6	-	-		25.8	-	-		37.9	-	-		55.6	-
12.1	12.1	-		17.8	17.8	-		26.1	26.1	-		38.3	38.3	-		56.2	56.2
12.3	-	-		18	-	18		26.4	-	-		38.8	-	-		56.9	-
12.4	12.4	-		18.2	18.2	-		26.7	26.7	-		39.2	39.2	39		57.6	57.6
12.6	-	-		18.4	-	-		27.1	-	27		39.7	-	-		58.3	-
12.7	12.7	-		18.7	18.7	-		27.4	27.4	-		40.2	40.2	-		59	59
12.9	-	-		18.9	-	-		27.7	-	-		40.7	-	-		59.7	-
13	13	13		19.1	19.1	-		28	28	-		41.2	41.2	-		60.4	60.4
13.2	-	-		19.3	-	-		28.4	-	-		41.7	-	-		61.2	-
13.3	13.3	-		19.6	19.6	-		28.7	28.7	-		42.2	42.2	-		61.9	61.9
13.5	-	-		19.8	-	-		29.1	-	-		42.7	-	-		62.6	-
13.7	13.7	-		20	20	20		29.4	29.4	-		43.2	43.2	43		63.4	63.4
13.8	-	-		20.3	-	-		29.8	-	-		43.7	-	-		64.2	-
14	14	-		20.5	20.5	-		30.1	30.1	30		44.2	44.2	-		64.9	64.9
14.2	-	-		20.8	-	-		30.5	-	-		44.8	-	-		65.7	-
14.3	14.3	-		21	21	-		30.9	30.9	-		45.3	45.3	-		66.5	66.5
14.5	-	-		21.3	-	-		31.2	-	-		45.9	-	-		67.3	-
E-192	E-96	E-24		E-192	E-96	E-24		E-192	E-96	E-24		E-192	E-96	E-24		E-192	E-96

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