



## ■ Tolerance

(%)

Symbol	A	B	C	D	F	G	J	K	M
Tolerance	±0.05	±0.1	±0.25	±0.5	±1.0	±2.0	±5.0	±10	±20

## ■ T.C.R.

(ppm/°C)

Symbol	C1	C2	C3	C4	C5	C6
T.C.R.	±25	±50	±100	±200	±350	±500

## ■ Basic Value of Resistance (E series)

E-6	10	1.5	2.2	3.3	4.7	6.8						
E-12	1.0	1.2	1.5	1.8	2.2	2.7	3.3	3.9	4.7	5.6	6.8	8.2
E-24	1.0	1.1	1.2	1.3	1.5	1.6	1.8	2.0	2.2	2.4	2.7	3.0
	3.3	3.6	3.9	4.3	4.7	5.1	5.6	6.2	6.8	7.5	8.2	9.1
E-48	1.00	1.05	1.10	1.15	1.21	1.27	1.33	1.40	1.47	1.54	1.62	1.69
	1.78	1.87	1.96	2.05	2.15	2.26	2.37	2.49	2.61	2.74	2.87	3.01
	3.16	3.32	3.48	3.65	3.83	4.02	4.22	4.42	4.64	4.87	5.11	5.36
	5.62	5.90	6.19	6.49	6.81	7.15	7.50	7.87	8.25	8.66	9.09	9.53
E-96	1.00	1.02	1.05	1.07	1.10	1.13	1.15	1.18	1.21	1.24	1.27	1.30
	1.33	1.37	1.40	1.43	1.47	1.50	1.54	1.58	1.62	1.65	1.69	1.74
	1.78	1.82	1.87	1.91	1.96	2.00	2.05	2.10	2.15	2.21	2.26	2.32
	2.37	2.43	2.49	2.55	2.61	2.67	2.74	2.80	2.87	2.94	3.01	3.09
	3.16	3.24	3.32	3.40	3.48	3.57	3.65	3.74	3.83	3.92	4.02	4.12
	4.22	4.32	4.42	4.53	4.64	4.75	4.87	4.99	5.11	5.23	5.36	5.49
	5.62	5.76	5.90	6.04	6.19	6.34	6.49	6.65	6.81	6.98	7.15	7.32
	7.50	7.68	7.87	8.06	8.25	8.45	8.66	8.87	9.09	9.31	9.53	9.76
E-192	1.00	1.01	1.02	1.04	1.05	1.06	1.07	1.09	1.10	1.11	1.13	1.14
	1.15	1.17	1.18	1.20	1.21	1.23	1.24	1.26	1.27	1.29	1.30	1.32
	1.33	1.35	1.37	1.38	1.40	1.42	1.43	1.45	1.47	1.49	1.50	1.52
	1.54	1.56	1.58	1.60	1.62	1.64	1.65	1.67	1.69	1.72	1.71	1.76
	1.78	1.80	1.82	1.84	1.87	1.89	1.91	1.93	1.96	1.98	2.00	2.03
	2.05	2.08	2.10	2.13	2.15	2.18	2.21	2.23	2.26	2.29	2.32	2.34
	2.37	2.40	2.43	2.46	2.49	2.52	2.55	2.58	2.61	2.64	2.67	2.71
	2.74	2.77	2.80	2.84	2.87	2.91	2.94	2.98	3.01	3.05	3.09	3.12
	3.16	3.20	3.24	3.28	3.32	3.36	3.40	3.44	3.48	3.52	3.57	3.61
	3.65	3.70	3.74	3.79	3.83	3.88	3.92	3.97	4.02	4.07	4.12	4.17
	4.22	4.27	4.32	4.37	4.42	4.48	4.53	4.59	4.64	4.70	4.75	4.81
	4.87	4.93	4.99	5.05	5.11	5.17	5.23	5.30	5.36	5.42	5.49	5.56
	5.62	5.69	5.76	5.83	5.90	5.97	6.04	6.12	6.19	6.26	6.34	6.42
	6.49	6.57	6.65	6.73	6.81	6.90	6.98	7.06	7.15	7.23	7.32	7.41
	7.50	7.59	7.68	7.77	7.87	7.96	8.06	8.16	8.25	8.35	8.45	8.56
	8.66	8.76	8.87	8.98	9.09	9.20	9.31	9.42	9.53	9.65	9.76	9.88

·three digit

1st and 2nd digit shows basic value of resistance, 3rd digit shows number of 0 follows basic value.

ex. 100=10 Ω

102=1000 Ω (=1k Ω)

·four digit

1st, 2nd and 3rd digit shows basic value of resistance, 4th digit shows number of 0 follows basic value.

ex. 1000=100 Ω

1001=1000 Ω (=1k Ω)

In case of three digit under 10 Ω or four digit under 100 Ω, a decimal point shows English letter "R".

ex. R10=0.10 Ω, 1R0=1.0 Ω

R100=0.100 Ω

1R00=1.00 Ω

## ■ Color band

	1st digit	2nd digit	3rd digit	Multiplier	Tolerance
BLACK	-	0	0	10 <sup>0</sup>	-
BROWN	1	1	1	10 <sup>1</sup>	F(±1.0%)
RED	2	2	2	10 <sup>2</sup>	G(±2.0%)
ORANGE	3	3	3	10 <sup>3</sup>	A(±0.05%)
YELLOW	4	4	4	10 <sup>4</sup>	-
GREEN	5	5	5	10 <sup>5</sup>	D(±0.5%)
BLUE	6	6	6	10 <sup>6</sup>	C(±0.25%)
PURPLE	7	7	7	10 <sup>7</sup>	B(±0.10%)
GREY	8	8	8	10 <sup>8</sup>	-
WHITE	9	9	9	10 <sup>9</sup>	-
GOLD	-	-	-	10 <sup>-1</sup>	J(±5.0%)
SILVER	-	-	-	10 <sup>-2</sup>	K(±10%)
-	-	-	-	-	M(±20%)

In case of tolerance class A, B, C, D and F

Five color bands



1st band = 1st digit

ex. brown-red-blue-red-brown

2nd band = 2nd digit

126 × 10<sup>2</sup> = 12600

3rd band = 3rd digit

= 12.6k Ω

4th band = multiplier

5th band = tolerance

brown = F(±1.0%)

In case of tolerance class G, J, K and M

Four color bands



1st band = 1st digit

ex. purple-green-gold-gold

2nd band = 2nd digit

75 × 10<sup>-4</sup> = 7.5 Ω

3rd band = multiplier

4th band = tolerance

gold = J(±5.0%)

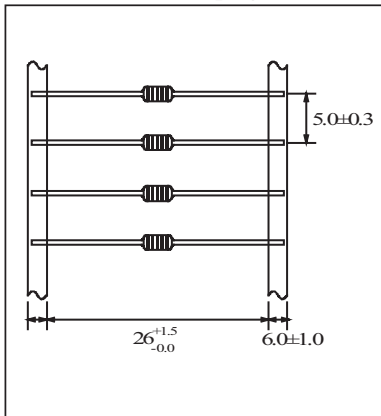
## ■ Terms

Rated voltage	Rated voltage is the D.C. or rms. AC maximum voltage at ambient temperature from -25 °C to 70 °C. Rated voltage shall be determined from following formula. If rated voltage is over Max. operational voltage, then rated voltage is equal to Max. operational voltage. Rated voltage [V] = √ rated wattage [W] × nominal resistance [Ω]
Max. operational voltage	Max. operational voltage is the D.C. or rms. AC maximum voltages that fixed by each resistor size. If calculated rated voltage is over Max. operational voltage, this Max. operational voltage is rated voltage.
Max. overload voltage	Max. overload voltage is the maximum voltages on the short time overload test (5 second). Generally, the short time overload test voltage is 2.5 times rated voltage, and if this voltage is over Max. overload voltage, this Max. overload voltage is test voltage on the short time overload test.

## ■ Notes

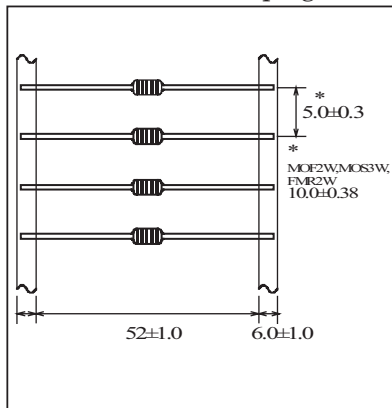
Storing	It is desirable that the Resistor are stored the room temperature at 0 °C to 30 °C and relative humidity under 65 %, are not stored for a long time and at high-temperature, High-humidity, because it is deteriorated.
Power derating	For stable use for a long period time, power rating shall be derated sufficiently under the power derating curve.
Pulse	In the case of pulse current or impact current circuit, please confer our engineer. And please confirm on the actual application circuit.
Mounting	When mounting on the board, please not take a damage on the body and lead wire. And don't force heavily on lead wire and welding point. In soldering, soldering heat is not too hot and soldering time is not too long.

### ★ Axial Panasert Taping (TP)



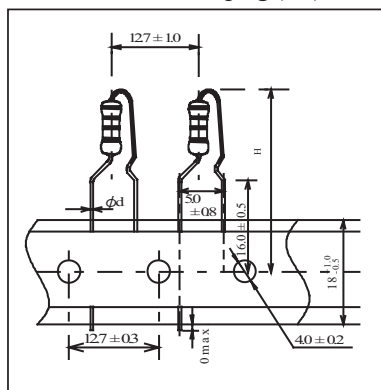
Model No.	Package Quantity
MOS1/2W	2000
FMR1/4W	2000
RTL1/4	2000
RNM1/4	2000
RNM1/2	2000
HMGL1/4	2000
HVL1/4	2000
NAT1/4	2000
NAT1/2	2000

### ★ Axial Universal Taping (TU)



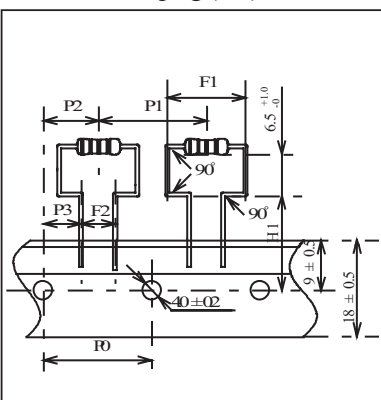
Model No.	Package Quantity	Model No.	Package Quantity
MOF1/2W	2000	RTL1/4	2000
MOF1W	2000	RTL1/2	2000
MOF2W	1000	RNM1/4	2000
MOS1/2W	2000	RNM1/2	2000
MOS1W	2000	HVL1/4	2000
MOS2W	2000	HVL1/2	2000
MOS3W	1000	HMGL1/4	2000
FMR1/4W	2000	HMGL1/2	2000
FMR1/2W	2000	NAT1/4	2000
FMR1W	2000	NAT1/2	2000
FMR2W	1000		2000

### ★ Panasert Radial Taping (RP)



Model No.	Package Quantity	Taping Dimensions (mm)	
		H	φd
MOS1/2W	2000	32max.	0.60±0.10
MOS1W	2000	32max.	0.65±0.10
MOS2W	2000	38max.	0.65±0.10
RNM1/2	2000	32max.	0.60±0.10
HMGL1/4	2000	32max.	0.60±0.10
HVL1/4	2000	32max.	0.60±0.10
NAT1/2	2000	32max.	0.60±0.05

### ★ Y Radial Taping (RY)



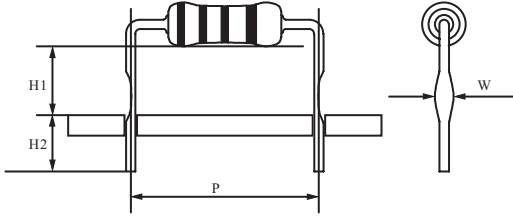
Model No.	Package Quantity	Taping Dimensions (mm)			
		P0	P1	P2	P3
MOS1/2W	2000	12.7±0.3	12.7±1.0	6.35±1.0	3.85±0.7
MOS1W	1000	15.0±0.3	30.0±1.0	7.5±1.0	3.75±0.5
MOS2W	500				
MOS3W	500				

Taping Dimensions(mm)		
F1	F2	H1
11.2max.	5.0±0.5	16.0±0.5
14.0max.	7.5±0.8	18.0±1.0
17.0max.		19.0±1.0
21.0max.		

### ■ Forming

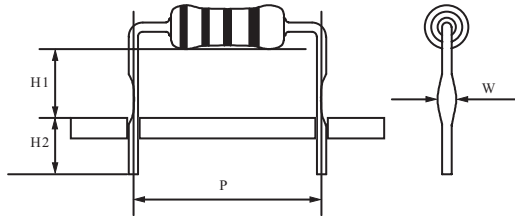
### ■ Forming Dimensions

#### ★ L, LS Forming



Forming Symbol	Forming Dimensions (mm)				Applicable Model No.	Package Quantity
	P	H1	H2	W		
L	10.0±1.0	6.0±1.0	5.0±1.0	1.2±0.2	MOS1/2	100/Pack
	15.0±1.0	6.0±1.0	5.0±1.0	1.4±0.2	MOS1	100/Pack
LS	15.0±1.0	6.0±1.0	5.5±1.0	1.4±0.2	MOS2	100/Pack
	20.0±1.0	6.5±1.0	5.5±1.0	1.4±0.2	MOS3	100/Pack

#### ★ L Forming



Forming Symbol	Forming Dimensions (mm)				Applicable Model No.	Package Quantity
	P	H1	H2	W		
L	15.0±1.0	6.5±1.0	5.5±1.0	1.4±0.2	MOF1/2 FMR1/2	100/Pack
	20.0±1.0	6.5±1.0	5.5±1.0	1.4±0.2	MOF1 FMR1	100/Pack
	25.0±1.0	9.5±1.0	5.5±1.0	1.4±0.2	MOF2 FMR2	100/Pack
	35.0±1.0	9.5±1.0	5.5±1.0	1.4±0.2	MOF3	100/Pack

### 1) Storage

Recommended storage condition is room temperature 0 °C-30 °C and humidity 65% or less. Please avoid using or storing in the environment of high temperature, high humidity, high dust, high density of harmful gas such as chlorine system, sulfuric acid system gas and so on, Please also avoid long-term storage and use it within one year after delivery.

### 2) Load condition

Even if used within load-derating curve, please consider self-heating of the resistor, ambient temperature and heat influence from other parts. In order to use in stable condition for long period of time, please take load-derating sufficiently.

### 3) Mounting position

When placing other electronic parts around this resistor, please position the other parts at least 5mm or more apart from this resistor.

### 4) Soldering

When soldering, please minimize heat influence of the soldering. Please finish soldering within 7 seconds at temperature 260°C or less. In case of manual work by soldering iron, please finish within 3 seconds at iron tip temperature of 380°C or less.

### 5) Shock against resistor

Please keep in mind that there is fear of breakage if strong shock applied against this resistor. Especially when automatic insertion machine used, breakage by the shock at the time of mounting may be feared against the resistor. Please perform adjustments to equipment and so on, not to apply strong shock against resistor. Moreover, please avoid drop from high position.

### 6) Forming of lead wire

When bending lead wire, please do not apply strong force to the resistor and the welding section of the lead-wire. Please be careful for bending form of the lead wire, not to become unnatural curvature.

### 7) Environment influencing substance

The resistor does not use class 1 ozone-depleting substance and specific bromine system flame-resisting agent (PBBO's, PBB's etc.). This includes direct content and use at process.

### 8) Others

- This specification expresses quality, performance of the electronic part alone in single. For use at your company, please be sure to carry out evaluation and check in the state where it is mounted in your product.
- These parts have the intention of being used by the general electric devices. In case that possibility of serious influence by the fault of these parts may be feared by the use to other devices requiring high reliability (traffic transport machine, medical apparatus, electric heat, combustion, gas apparatus, rotation apparatus, disaster prevention apparatus, etc.), please give extra consideration in design such as protection circuit, protection equipment, redundant circuit, etc. and secure safety of equipment.