

Thick Film Chip Resistors (Low Resistance Type)

ERJ type

ERJ 2LW, 3LW, 6LW series

ERJ 2BW, 3BW, 6BW, 8BW, 6CW, 8CW series

ERJ 2B, 3B, 6D, 6B, 8B, 14B series

ERJ 3R, 6R, 8R, 14R, 12R, 12Z, 1TR series

ERJ L03, L06, L08, L14, L12, L1D, L1W series

Features

- Current sensing resistor
- Small size and lightweight
- Realize both low-resistance & High-precision by original thick film resistive element & special electrode structure
- Suitable for both reflow and flow soldering
- Realize High-power by double-sided resistive elements structure that aimed to suppress temperature rising
: ERJ2LW, 3LW, 6LW, 2BW, 3BW, 6BW, 8BW, 6CW, 8CW
- Low TCR : $\pm 75 \times 10^{-6} / \text{K}$ (ERJ6CW, ERJ8CW)
- Low resistance value : Thick film resistors available from 5 mΩ (ERJ3LW, 6LW)
- Reference standard : IEC 60115-8, JIS C 5201-8, JEITA RC-2144
- AEC-Q200 compliant
- RoHS compliant

■ As for packaging methods, land pattern, soldering conditions and safety precautions, please see data files.

Explanation of part numbers

Note : Please check the "Ratings" for the presence/absence of part numbers for combinations of the symbols below.

- ERJ2LW, 3LW, 6LW, 2BW, 3BW, 6BW, 8BW, 6CW, 8CW series

<High power (double-sided resistive elements structure) type>

1	2	3	4	5	6	7	8	9	10	11	12	
E	R	J	2	B	W	G	R	0	4	7	X	
Product code			Code	inch size	Power rating	Resistance tolerance		Resistance value		Packaging methods		
Thick film chip resistors			2LW	0402	0.2 W	Code	Tolerance	Shown by 4 digits or letters. (Ex.) R005 : 0.005 Ω = 5 mΩ R047 : 0.047 Ω = 47 mΩ		Code	Packaging	Part No.
			3LW	0603	0.25 W	D	±0.5 %*			X	Pressed carrier taping 2 mm pitch, 10,000 pcs	ERJ2LW ERJ2BW
			6LW	0805	0.5 W	F	±1 %			V	Punched carrier taping 4 mm pitch, 5,000 pcs	ERJ3LW ERJ6LW ERJ3BW ERJ6BW ERJ8BW ERJ6CW ERJ8CW
			2BW	0402	0.25 W	G	±2 %					
			3BW	0603	0.33 W	J	±5 %					
			6BW	0805	0.5 W							
			8BW	1206	1 W							
			6CW	0805	0.5 W							
			8CW	1206	1 W							
						*Please refer to the rating table for the resistance tolerance.						

Thick Film Chip Resistors (Low Resistance Type)

Explanation of part numbers

Note : Please check the "Ratings" for the presence/absence of part numbers for combinations of the symbols below.

- ERJ2BS/2BQ, 3BS/3BQ, 6BS/6BQ, 8BS/8BQ, 14BS/14BQ, 6D, 3R, 6R, 8R, 14R, 12R, 12Z, 1TR series <High power type/Standard type>

1	2	3	4	5	6	7	8	9	10	11				
E	R	J	8	R	Q	F	R	2	2	V				
Product code		Size, Power rating			Resistance value region		Resistance tolerance		Resistance value		Packaging methods			
Thick film chip resistors		Code	inch size	Power rating	S	0.1Ω to 0.2Ω	Code	Tolerance	Shown by 3 digits or letters. Only when it is D (E24,E96) or F (E96), shown by 4 digits or letters. (Ex.) R22 : 0.22 Ω R102 : 0.102 Ω			Code	Packaging	Part No.
		2B	0402	0.166 W	Q	0.22Ω to 9.1Ω*	D	±0.5 %*				X	Punched carrier taping 2 mm pitch, 10,000 pcs	ERJ2B
		3B	0603	0.25 W	*2B:0.22 Ω to 1.0 Ω		F	±1 %	*Please refer to the rating table for the resistance tolerance.	V	Punched carrier taping 4 mm pitch, 5,000 pcs	ERJ3B/3R ERJ6D/6B/ ERJ6R ERJ8B/8R		
		3R	0603	0.1 W			G	±2 %						
		6D	0805	0.5 W	J	±5 %	U	Embossed carrier taping 4 mm pitch, 5,000 pcs					ERJ14B/14R ERJ12R ERJ12Z	
		6B	0805	0.33 W										
		6R	0805	0.125 W					Embossed carrier taping 4 mm pitch, 4,000 pcs	ERJ1TR				
		8B	1206	0.5 W										
		8R	1206	0.25 W										
		14B	1210	0.5 W										
		14R	1210	0.25 W										
		12R	1812	0.5 W										
		12Z	2010	0.5 W										
		1TR	2512	1 W										

- ERJL03, L06, L08, L14, L12, L1D, L1W series <Low TCR type>

1	2	3	4	5	6	7	8	9	10	11	12		
E	R	J	L	1	4	K	J	5	0	M	U		
Product Code		Size, Power rating			Resistance value		Resistance tolerance		Resistance value		Packaging methods		
Thick film chip resistors		Code	inch size	Power rating	Code	Standard *	Code	Tolerance	Shown by 3 digits or letters. (Ex.) 50M : 50 mΩ 10C : 100 mΩ		Code	Packaging	Part No.
		L03	0603	0.2 W	K	20 mΩ, 22 mΩ, 33 mΩ, 39 mΩ, 47 mΩ, 50 mΩ, 100mΩ	F	±1 %			V	Punched carrier taping 4 mm pitch, 5,000 pcs	ERJL03 ERJL06 ERJL08
		L06	0805	0.25 W			J	±5 %					
		L08	1206	0.33 W									
		L14	1210	0.33 W							U	Embossed carrier taping 4 mm pitch, 5,000 pcs	ERJL14 ERJL12 ERJL1D
		L12	1812	0.5 W									
		L1D	2010	0.5 W									
		L1W	2512	1 W	*L03, L06, L08 : 47 mΩ to 100 mΩ L1D, L1W : 40 mΩ to 100 mΩ						Embossed carrier taping 4 mm pitch, 3,000 pcs		ERJL1W
NRFND		Not recommended for new design											

NRFD Not recommended for new design

Ratings

<High power (double-sided resistive elements structure) type>

Part No. (inch size)	Power rating (70 °C) ^{*1} (W)	Resistance tolerance (%)	Resistance range ^{*2} (Ω)	T.C.R. (×10 ⁻⁶ /K)	Category temperature range(°C)	AEC-Q200 Grade
ERJ2LW (0402)	0.2	±1, ±2, ±5	10 m	0 to +500	-55 to +125	Grade 1
ERJ3LW (0603)	0.25	±1, ±2, ±5	5 m	0 to +700		
ERJ6LW (0805)	0.5	±1, ±2, ±5	10 m	0 to +300		
ERJ2BW (0402)	0.25	±1, ±2, ±5	47 m to 100 m (E24)	0 to +300	-55 to +155	Grade 0
ERJ3BW (0603)	0.33	±1, ±2, ±5	20 m to 100 m (E24)	20 mΩ ≤ R < 39 mΩ : 0 to +250 39 mΩ ≤ R ≤ 100 mΩ : 0 to +150		
ERJ6BW (0805)	0.5	±1, ±2, ±5	10 m to 100 m (E24)	10 mΩ ≤ R < 15 mΩ : 0 to +300 15 mΩ ≤ R ≤ 100 mΩ : 0 to +200		
ERJ8BW (1206)	1	±1, ±2, ±5	10 m to 100 m (E24)	10 mΩ ≤ R < 20 mΩ : 0 to +200 20 mΩ ≤ R < 47 mΩ : 0 to +150 47 mΩ ≤ R ≤ 100 mΩ : 0 to +100		
ERJ6CW (0805)	0.5	±0.5, ±1, ±2, ±5	10 m to 30 m (E24)	±75		
ERJ8CW (1206)	1	±1, ±2, ±5	10 m to 50 m (E24)	±75	-55 to +125	Grade 1

*1: Use it on the condition that the case temperature is below the upper category temperature.

*2: Please contact us when resistors of irregular series are needed.

- Rated Continuous Working Voltage (RCWV) shall be determined from $RCWV = \sqrt{\text{Power Rating} \times \text{Resistance Value}}$.
- Overload Test Voltage (OTV) shall be determined from $OTV = \text{Specified Magnification (refer to performance)} \times RCW$.

Thick Film Chip Resistors (Low Resistance Type)

Ratings

<High power type>

Part No. (inch size)	Power rating (70 °C) ^{*1} (W)	Resistance tolerance (%)	Resistance range ^{*3} (Ω)	T.C.R. (×10 ⁻⁶ /K)	Category temperature range(°C)	AEC-Q200 Grade	
ERJ2BS (0402)	0.166	±1, ±2, ±5	0.10 to 0.20 (E24)	0.10 Ω ≤ R < 0.22 Ω : 0 to +300	-55 to +155	Grade 0	
ERJ2BQ (0402)			0.22 to 1.0 (E24)	0.22 Ω ≤ R ≤ 1.0 Ω : 0 to +250			
ERJ3BS (0603)	0.25	±1, ±2, ±5	0.10 to 0.20 (E24)	0.10 Ω ≤ R < 0.22 Ω : 0 to +300			
ERJ3BQ (0603)			0.22 to 0.91 (E24)	0.22 Ω ≤ R < 1.0 Ω : 0 to +300			
			1.0 to 9.1 (E24)	1.0 Ω ≤ R ≤ 9.1 Ω : ±200			
ERJ6DS (0805)	0.5	±0.5, ±1, ±2, ±5	0.10 to 0.20 (E24 ^{*2})	0.10 Ω ≤ R < 0.22 Ω : 0 to +150			
ERJ6DQ (0805)			0.22 to 9.1 (E24 ^{*2})	0.22 Ω ≤ R < 1.0 Ω : 0 to +100 1.0 Ω ≤ R ≤ 9.1 Ω : ±100			
ERJ6BS (0805)	0.33	±1, ±2, ±5	0.10 to 0.20 (E24)	0.10 Ω ≤ R < 0.22 Ω : 0 to +250			
ERJ6BQ (0805)			0.22 to 0.91 (E24)	0.22 Ω ≤ R < 1.0 Ω : 0 to +250			
			1.0 to 9.1 (E24)	1.0 Ω ≤ R ≤ 9.1 Ω : ±200			
ERJ8BS (1206)	0.5	±1, ±2, ±5	0.10 to 0.20 (E24)	0.10 Ω ≤ R < 0.22 Ω : 0 to +250			
ERJ8BQ (1206)			0.22 to 0.91 (E24)	0.22 Ω ≤ R < 1.0 Ω : 0 to +250			
			1.0 to 9.1 (E24)	1.0 Ω ≤ R ≤ 9.1 Ω : ±200			
ERJ14BS (1210)	0.5	±1, ±2, ±5	0.10 to 0.20 (E24)	0.10 Ω ≤ R < 0.22 Ω : 0 to +200			
ERJ14BQ (1210)			0.22 to 0.91 (E24)	0.22 Ω ≤ R < 1.0 Ω : 0 to +200			
			1.0 to 9.1 (E24)	1.0 Ω ≤ R ≤ 9.1 Ω : ±100			

*1: Use it on the condition that the case temperature is below the upper category temperature.

*2: E96 series resistance values are also available. Please contact us for details.

*3: Please contact us when resistors of irregular series are needed.

- Rated Continuous Working Voltage (RCWV) shall be determined from $RCWV = \sqrt{\text{Power Rating} \times \text{Resistance Value}}$.
- Overload Test Voltage (OTV) shall be determined from $OTV = \text{Specified Magnification (refer to performance)} \times RCW$.

<Standard type>

Part No. (inch size)	Power rating (70 °C) ^{*1} (W)	Resistance tolerance (%)	Resistance range ^{*2} (Ω)	T.C.R. (×10 ⁻⁶ /K)	Category temperature range(°C)	AEC-Q200 Grade
ERJ3RS (0603)	0.1	±1, ±2, ±5	0.10 to 0.20 (E24)	0.10 Ω ≤ R < 0.22 Ω : 0 to +300	-55 to +155	Grade 0
ERJ3RQ (0603)			0.22 to 0.91 (E24)	0.22 Ω ≤ R < 1.0 Ω : 0 to +300		
			1.0 to 9.1 (E24)	1.0 Ω ≤ R ≤ 9.1 Ω : ±200		
ERJ6RS (0805)	0.125	±1, ±2, ±5	0.10 to 0.20 (E24)	0.10 Ω ≤ R < 0.22 Ω : 0 to +250		
ERJ6RQ (0805)			0.22 to 0.91 (E24)	0.22 Ω ≤ R < 1.0 Ω : 0 to +250		
			1.0 to 9.1 (E24)	1.0 Ω ≤ R ≤ 9.1 Ω : ±200		
ERJ8RS (1206)	0.25	±1, ±2, ±5	0.10 to 0.20 (E24)	0.10 Ω ≤ R < 0.22 Ω : 0 to +250		
ERJ8RQ (1206)			0.22 to 0.91 (E24)	0.22 Ω ≤ R < 1.0 Ω : 0 to +250		
			1.0 to 9.1 (E24)	1.0 Ω ≤ R ≤ 9.1 Ω : ±200		
ERJ14RS (1210)	0.25	±1, ±2, ±5	0.10 to 0.20 (E24)	0.10 Ω ≤ R < 0.22 Ω : 0 to +200		
ERJ14RQ (1210)			0.22 to 0.91 (E24)	0.22 Ω ≤ R < 1.0 Ω : 0~+200		
			1.0 to 9.1 (E24)	1.0 Ω ≤ R ≤ 9.1 Ω : ±100		
ERJ12RS (1812)	0.5	±1, ±2, ±5	0.10 to 0.20 (E24)	0.10 Ω ≤ R < 0.22 Ω : 0 to +200		
ERJ12RQ (1812)			0.22 to 0.91 (E24)	0.22 Ω ≤ R < 1.0 Ω : 0 to +200		
			1.0 to 9.1 (E24)	1.0 Ω ≤ R ≤ 9.1 Ω : ±100		
ERJ12ZS (2010)	0.5	±1, ±2, ±5	0.10 to 0.20 (E24)	0.10 Ω ≤ R < 0.22 Ω : 0 to +200		
ERJ12ZQ (2010)			0.22 to 0.91 (E24)	0.22 Ω ≤ R < 1.0 Ω : 0 to +200		
			1.0 to 9.1 (E24)	1.0 Ω ≤ R ≤ 9.1 Ω : ±100		
ERJ1TRS (2512)	1	±1, ±2, ±5	0.10 to 0.20 (E24)	0.10 Ω ≤ R < 0.22 Ω : 0 to +200		
ERJ1TRQ (2512)			0.22 to 0.91 (E24)	0.22 Ω ≤ R < 1.0 Ω : 0 to +200		
			1.0 to 9.1 (E24)	1.0 Ω ≤ R ≤ 9.1 Ω : ±100		

*1: Use it on the condition that the case temperature is below the upper category temperature.

*2: Please contact us when resistors of irregular series are needed.

- Rated Continuous Working Voltage (RCWV) shall be determined from $RCWV = \sqrt{\text{Power Rating} \times \text{Resistance Value}}$.
- Overload Test Voltage (OTV) shall be determined from $OTV = \text{Specified Magnification (refer to performance)} \times RCW$.

Thick Film Chip Resistors (Low Resistance Type)

Ratings

<Low TCR type>

Part No. (inch size)	Power rating (70 °C) ^{*1} (W)	Resistance tolerance (%)	Resistance range ^{*2} (Ω)	T.C.R. (×10 ⁻⁶ /K)	Category temperature range(°C)	AEC-Q200 Grade
ERJL03 (0603)	0.2	±1, ±5	47 m to 100 m	±200	-55 to +125	Grade 1
ERJL06 (0805)	0.25	±1, ±5	47 m to 100 m	±100		
ERJL08 (1206)	0.33	±1, ±5	47 m to 100 m	±100		
ERJL14 (1210)	0.33	±1, ±5	20 m to 100 m	R < 47 mΩ : ±300 R ≥ 47 mΩ : ±100		
ERJL12 (1812)	0.5	±1, ±5	20 m to 100 m			
ERJL1D (2010)	0.5	±1, ±5	40 m to 100 m			
NRFND ERJL1W (2512)	1	±1, ±5	40 m to 100 m			

*1: Use it on the condition that the case temperature is below the upper category temperature.

NRFND

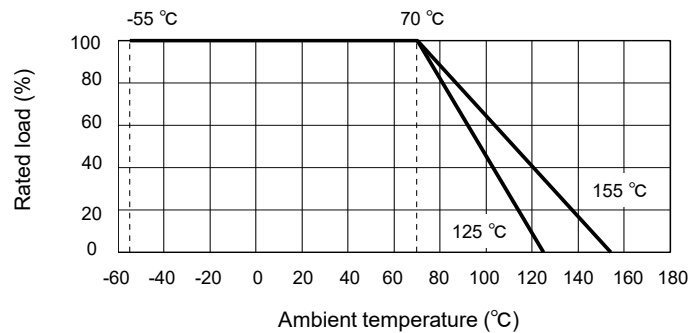
Not recommended for new design

*2: Standard R.V. : 20 mΩ, 22 mΩ, 33 mΩ, 39 mΩ, 47 mΩ, 50 mΩ, 100 mΩ, Custom R.V. : Each 1 mΩ within upper range.

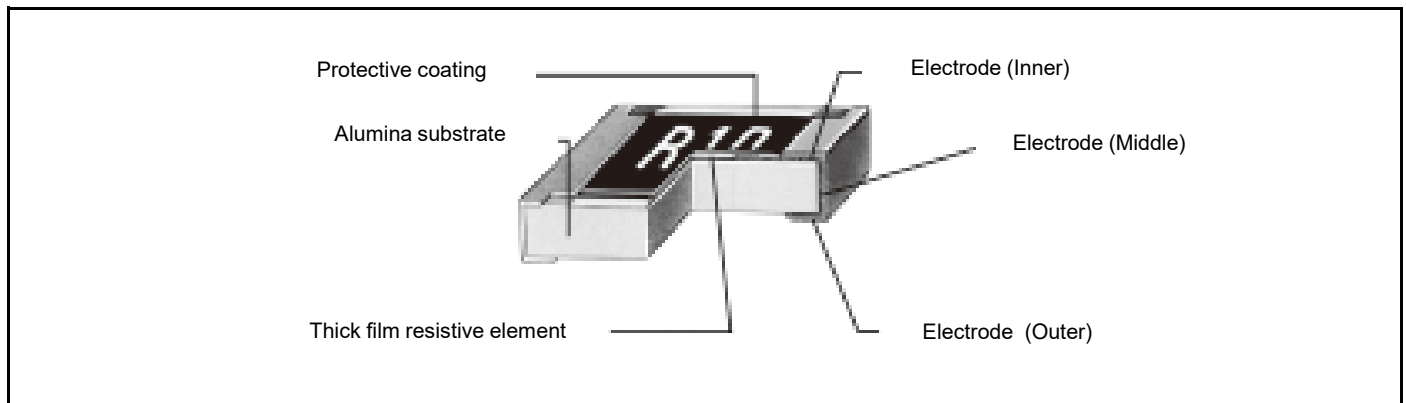
- Rated Continuous Working Voltage (RCWV) shall be determined from $RCWV = \sqrt{\text{Power Rating} \times \text{Resistance Value}}$.
- Overload Test Voltage (OTV) shall be determined from $OTV = \text{Specified Magnification (refer to performance)} \times RCW$.

Power derating curve

For resistors operated in ambient temperatures above 70 °C, power rating shall be derated in accordance with the figure on the right.

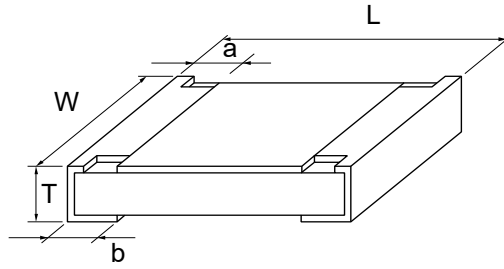


Construction



Thick Film Chip Resistors (Low Resistance Type)

Dimensions (not to scale)



Part No.	Dimensions					Unit : mm
	L	W	a	b	T	Mass (Weight) (Reference) (g/1000 pcs)
ERJ2LW	1.00±0.10	0.50+0.10/-0.05	0.25±0.10	0.25±0.10	0.40±0.05	0.8
ERJ2BW	1.00±0.10	0.50+0.10/-0.05	0.24±0.10	0.24±0.10	0.35±0.05	0.8
ERJ2B	1.00±0.10	0.50+0.10/-0.05	0.20±0.10	0.27±0.10	0.35±0.05	0.8
ERJ3LW (5 mΩ)	1.60±0.15	0.80±0.15	0.50±0.20	0.50±0.20	0.55±0.10	3
ERJ3LW (10 mΩ) ERJ3BW	1.60±0.15	0.80±0.15	0.40±0.20	0.40±0.20	0.55±0.10	3
ERJ3R ERJ3B ERJL03	1.60±0.15	0.80+0.15/-0.05	0.30±0.20	0.30±0.15	0.45±0.10	2
ERJ6LW	2.00±0.20	1.25±0.20	0.63±0.20	0.63±0.20	0.70±0.10	6
ERJ6BW	2.00±0.20	1.25±0.20	0.55±0.20	0.55±0.20	0.65±0.10	6
ERJ6CW (10 to 13 mΩ)	2.05±0.20	1.30±0.20	0.60±0.20	0.60±0.20	0.65±0.10	6
ERJ6CW (15 to 30 mΩ)			0.45±0.20	0.45±0.20		
ERJ6D	2.00±0.20	1.25±0.10	0.40±0.20	0.55±0.25	0.60±0.10	5
ERJ6R ERJ6B ERJL06	2.00±0.20	1.25±0.10	0.40±0.20	0.40±0.20	0.60±0.10	5
ERJ8BW	3.20±0.20	1.60±0.20	1.00±0.20	1.00±0.20	0.65±0.10	13
ERJ8CW (10 to 16 mΩ)	3.20±0.20	1.60±0.20	1.10±0.20	1.10±0.20	0.65±0.10	13
ERJ8CW (18 to 50 mΩ)	3.20±0.20	1.60±0.20	0.60±0.20	0.60±0.20	0.65±0.10	13
ERJ8R ERJ8B ERJL08	3.20+0.05/-0.20	1.60+0.05/-0.15	0.50±0.20	0.50±0.20	0.60±0.10	10
ERJ14R ERJ14B ERJL14	3.20±0.20	2.50±0.20	0.50±0.20	0.50±0.20	0.60±0.10	16
ERJ12R ERJL12	4.50±0.20	3.20±0.20	0.50±0.20	0.50±0.20	0.60±0.10	27
ERJ12Z ERJL1D	5.00±0.20	2.50±0.20	0.60±0.20	0.60±0.20	0.60±0.10	27
ERJ1TR	6.40±0.20	3.20±0.20	0.65±0.20	0.60±0.20	0.60±0.10	45
NRFD ERJL1W	6.40±0.20	3.20±0.20	0.65±0.20	1.30±0.20	1.10±0.10	79

NRFD Not recommended for new design

Thick Film Chip Resistors (Low Resistance Type)

Performance

- ERJ2LW, 3LW, 6LW, 2BW, 3BW, 6BW, 8BW, 6CW, 8CW series
<High power (double-sided resistive elements structure) type>

Test item	Performance requirements ΔR	Test conditions
Resistance	Within specified tolerance	20 °C
T. C. R.	Within specified T. C. R.	+25 °C / +125 °C
Overload	± 2 %	ERJ6LW : Rated voltage $\times$ 1.77, 5 s ERJ8BW (R > 0.05 Ω) : Rated voltage $\times$ 1.77, 5 s Other : Rated voltage $\times$ 2.0, 5 s
Resistance to soldering heat	± 1 %	270 °C, 10 s
Rapid change of temperature	± 1 % ERJ2LW : ± 2 %	-55 °C (30min.) / +155 °C (ERJ□LW, ERJ□CW : +125 °C) (30 min.), 100 cycles
High temperature exposure	± 1 %	+155 °C (ERJ□LW, ERJ□CW : +125 °C), 1000 h
Damp Heat, Steady state	± 1 %	60 °C, 90 % to 95 %RH, 1000 h
Load life in humidity	± 3 %	60 °C, 90 % to 95 %RH, Rated voltage, 1.5 h ON / 0.5 h OFF cycle, 1000 h
Endurance at 70 °C	± 3 %	70 °C, Rated voltage, 1.5 h ON / 0.5 h OFF cycle, 1000 h

- ERJ2BS/2BQ, 3BS/3BQ, 6BS/6BQ, 8BS/8BQ, 14BS/14BQ, 6D, 3R, 6R, 8R, 14R, 12R, 12Z, 1TR series <High power type/Standard type>

Test item	Performance requirements ΔR	Test conditions
Resistance	Within specified tolerance	20 °C
T. C. R.	Within specified T. C. R.	+25 °C / +125 °C
Overload	± 2 %	Rated voltage $\times$ 2.5 (ERJ6D : $\times 1.77$), 5 s
Resistance to soldering heat	± 1 %	270 °C, 10 s
Rapid change of temperature	± 1 %	-55 °C (30 min.) / +155 °C (30 min.), 100 cycles
High temperature exposure	± 1 %	+155 °C, 1000 h
Damp Heat, Steady state	± 1 %	60 °C, 90 % to 95 %RH, 1000 h
Load life in humidity	± 3 %	60 °C, 90 % to 95 %RH, Rated voltage, 1.5 h ON / 0.5 h OFF cycle, 1000 h
Endurance at 70 °C	± 3 %	70 °C, Rated voltage, 1.5 h ON / 0.5 h OFF cycle, 1000 h

- ERJL03, L06, L08, L14, L12, L1D, L1W series < Low TCR type >

Test item	Performance requirements ΔR	Test conditions
Resistance	Within specified tolerance	20 °C
T. C. R.	Within specified T. C. R.	+25 °C / +125 °C
Overload	± 2 %	Rated voltage $\times$ 2.5, 5 s
Resistance to soldering heat	± 1 %	270 °C, 10 s
Rapid change of temperature	± 1 %	-55 °C (30 min.) / +125 °C (30 min.), 100 cycles
High temperature exposure	± 1 %	+125 °C, 1000 h
Damp Heat, Steady state	± 1 %	60 °C, 90 % to 95 %RH, 1000 h
Load life in humidity	± 3 %	60 °C, 90 % to 95 %RH, Rated voltage, 1.5 h ON / 0.5 h OFF cycle, 1000 h
Endurance at 70 °C	± 3 %	70 °C, Rated voltage, 1.5 h ON / 0.5 h OFF cycle, 1000 h

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- If any of our products, product specifications and/or technical information in this catalog is to be exported, the laws and regulations of the exporting country, especially with regard to security and export control, shall be observed.

<Regarding the Certificate of Compliance with the EU RoHS Directive/REACH Regulations>

- The switchover date for compliance with the RoHS Directive/REACH Regulations varies depending on the part number or series of our products.
- When you use the inventory of our products for which it is unclear whether those products are compliant with the RoHS Directive/REACH Regulation, please select "Sales Inquiry" in the website inquiry form and contact us.

Please note that we do not owe any liability and responsibility if our products are used beyond the description of this catalog or without complying with precautions in this catalog.



Application Guidelines (Fixed Resistors)

1. Safety precautions

- Make sure to exchange product specifications before using this product, regardless of the intended use.
The design and specifications in this catalog are subject to change without prior notice.
- Do not use the products beyond the specifications described in this catalog.
- This catalog explains the quality and performance of the products as individual components. Before use, check and evaluate their operations when installed in your products under the actual conditions for use.
- If a malfunction of this product may result in the loss of human life or other serious damage in transportation equipment (trains, automobiles, ships, etc.), signaling equipment, medical equipment, aerospace equipment, electric heating equipment, combustion and gas equipment, rotating equipment, disaster prevention and security equipment, and other equipment, ensure safety by implementing a fail-safe design with the following system.
 - * Systems equipped with a protection circuit and a protection device.
 - * Systems equipped with a redundant circuit or other system to prevent an unsafe status in the event of a single fault.
 - * Systems equipped with an arresting the spread of fire or preventing glitch.

2. Precautions for use

- These products are designed and manufactured for general and standard use in general electronic equipment (e.g. AV equipment, home electric appliances, office equipment, information and communication equipment).
If the product is to be used in an application that requires special quality and reliability and where failure or malfunction of the product may directly threaten human life or cause bodily harm (e.g., aerospace equipment, transportation equipment, combustion equipment, medical equipment, disaster prevention and security equipment, safety devices, etc.), be sure to consult with our sales office in advance and exchange product specifications appropriate for the application.
- These products are not intended for use in the following special conditions. Before using the products, carefully check the effects on their quality and performance, and determine whether or not they can be used.
 1. In liquid, such as water, oil, chemicals, or organic solvent.
 2. In direct sunlight, outdoors, or in dust.
 3. In salty air or air with a high concentration of corrosive gas, such as Cl_2 , H_2S , NH_3 , SO_2 , or NO_x .
 4. Electric Static Discharge (ESD) Environment.
These components are sensitive to static electricity and can be damaged under static shock (ESD).
Please take measures to avoid any of these environments.
Smaller components are more sensitive to ESD environment.
 5. Electromagnetic and Radioactive Environment.
Avoid any environment where strong electromagnetic waves and radiation exist.
 6. In an environment where these products cause dew condensation.
 7. Sealing or coating of these products or a printed circuit board on which these products are mounted, with resin or other materials.
- These products generate Joule heat when energized. Carefully position these products so that their heat will not affect the other components.
- Carefully position these products so that their temperatures will not exceed the category temperature range due to the effects of neighboring heat-generating components. Do not mount or place heat-generating components or inflammables, such as vinyl-coated wires, near these products.
- Note that non-cleaning solder, halogen-based highly active flux, or water-soluble flux may deteriorate the performance or reliability of the products.
- Carefully select a flux cleaning agent for use after soldering. An unsuitable agent may deteriorate the performance or reliability. In particular, when using water or a water-soluble cleaning agent, be careful not to leave water residues. Otherwise, the insulation performance may be deteriorated.
- Do not apply flux to these products after soldering. The activity of flux may be a cause of failures in these products.
- Refer to the recommended soldering conditions and set the soldering condition. High peak temperature or long heating time may impair the performance or the reliability of these products.
- Recommended soldering condition is for the guideline for ensuring the basic characteristics of the products, not for the stable soldering conditions. Conditions for proper soldering should be set up according to individual conditions.
- Do not reuse any products after removal from mounting boards.
- Do not drop these products. If these products are dropped, do not use them. Such products may have received mechanical or electrical damage.
- If any doubt or concern to the safety on these products arise, make sure to inform us immediately and conduct technical examinations at your side.

3. Precautions for storage

The performance of these products, including the solderability, is guaranteed for a year from the date of arrival at your company, provided that they remain packed as they were when delivered and stored at a temperature of 5 °C to 35 °C and a relative humidity of 45 % to 85 %.

Even within the above guarantee periods, do not store these products in the following conditions. Otherwise, their electrical performance and/or solderability may be deteriorated, and the packaging materials (e.g. taping materials) may be deformed or deteriorated, resulting in mounting failures.

1. In salty air or in air with a high concentration of corrosive gas, such as Cl₂, H₂S, NH₃, SO₂, or NO_x.
2. In direct sunlight.

<Package markings>

Package markings include the product number, quantity, and country of origin.

In principle, the country of origin should be indicated in English.

4. AEC-Q200 compliant

The products are tested based on all or part of the test conditions and methods defined in AEC-Q200. Please consult with Panasonic for the details of the product specification and specific evaluation test results, etc., make sure to exchange product specifications for each product when placing an order.



Application Guidelines (Surface Mount Resistors)

The following are precautions for individual products. Please also refer to the common precautions for Fixed Resistors in this catalog.

1. Take measures against mechanical stress during and after mounting of Surface Mount Resistors (hereafter called the resistors) so as not to damage their electrodes and protective coatings.
Be careful not to misplace the resistors on the land patterns. Otherwise, solder bridging may occur.
2. Keep the rated power and ambient temperature within the specified derating curve.
Some circuit boards, wiring patterns, temperatures of heat generated by adjacent components, or ambient temperatures can become factors in the rise of the temperature of the resistors, regardless of the level of power applied. Therefore, check the conditions before use and optimize them so as not to damage the boards and peripheral components.
Make sure to contact us before using the resistors under special conditions.
3. If a transient load (heavy load in a short time) like a pulse is expected to be applied, check and evaluate the operations of the resistors when installed in your products before use. Never exceed the rated power. Otherwise, the performance and/or reliability of the resistors may be impaired.
4. Transient voltage
If there is a possibility that the transient phenomenon (significantly high voltage applied in a short time) may occur or that a high voltage pulse may be applied, make sure to evaluate and check the characteristics of resistors mounted on your product rather than only depending on the calculated power limit or steady-state conditions.
5. The electrical characteristics may change when used in high-frequency circuits, so check thoroughly before use.
Such circuits change the electrical characteristics of the resistors.
6. Before using halogen-based or other high-activity flux, check the possible effects of the flux residues on the performance and reliability of the resistors.
7. When soldering with a soldering iron, never touch the resistors' bodies with the tip of the soldering iron.
When using a soldering iron with a high temperature tip, finish soldering as quickly as possible (within three seconds at 350 °C max.).
8. The connection reliability and performance may be affected if the amount of solder is too much or too little.
Check the performance and reliability of the product and use an appropriate amount of solder.
9. When the resistors' protective coatings are chipped, flawed, or removed, the characteristics of the resistors may be impaired. Take special care not to apply mechanical shock during automatic mounting or cause damage during handling of the boards with the resistors mounted.
10. Do not apply shock to the resistors or pinch them with a hard tool (e.g. pliers and tweezers). Otherwise, the resistors' protective coatings and bodies may be chipped, affecting their performance.
11. Avoid excessive bending of printed circuit boards in order to protect the resistors from abnormal stress.
12. Do not immerse the resistors in solvent for a long time.
Before using solvent, carefully check the effects of immersion.
13. Do not apply excessive tension to the terminals.