

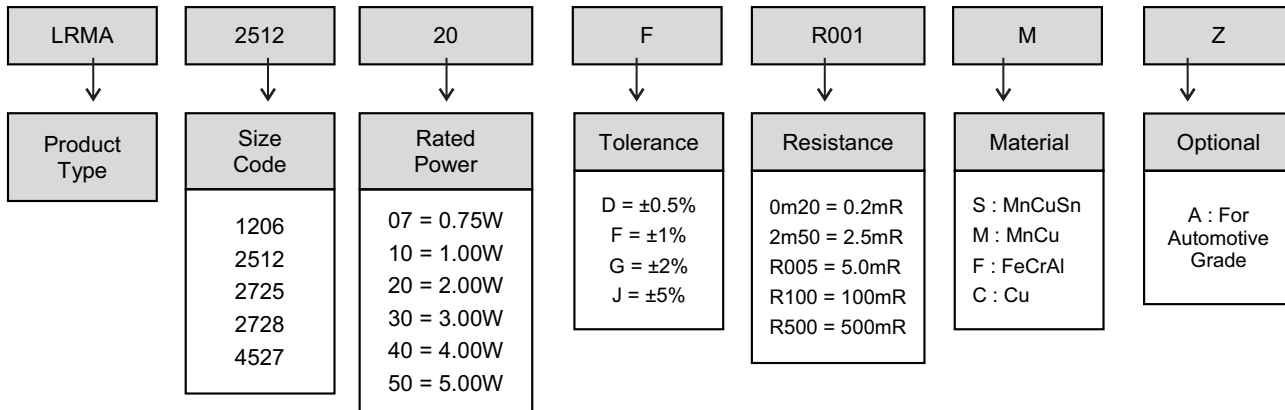
### FEATURES

- Low Resistance, Low TCR
- Precision current sensing
- Precision voltage division
- AEC - Q200 version available

### APPLICATION

- Battery Management systems
- Power supply
- Precision Measuring equipment
- Replaces RFE LR series

### PART NUMBER EXAMPLE



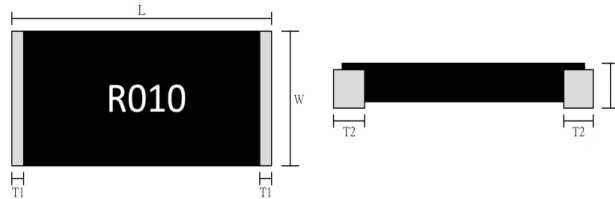
### ELECTRICAL CHARACTERISTICS & DIMENSION

Size Code	Rating Power at 70°C	T.C.R (ppm/°C)	Max. Rating Current	Max. Overload Current	Resistance Range (mΩ)		Material	Operate Temperature Range (°C)
					0.5% (D)	1.0% (F) 2.0% (G) 5.0% (J)		
1206	0.75W	≤ ±50	3.83A	7.66A	51~100	51~100	R051~R100 : FeCrAl	-55 ~ +170
	1W		31.62A	63.25A	7~50	1~50	R001 : MnCuSn R002~R007 : MnCu R008~R050 : FeCrAl	
2512	1W		44.72A	100.00A	7~450	0.5~500	R0005 : MnCuSn R001~R006 : MnCu R007~R500 : FeCrAl	
	2W		63.25A	141.42A	7~450	0.5~450		
	3W		77.46A	154.91A	7~100	0.5~100		
2725	4W		126.49A	252.98A	---	0.25~3	R00025 : MnCuSn R0005~R0025 : MnCu R003 : FeCrAl	
2728	4W		31.62A	54.77A	7~450	4~450	R004~R450 : FeCrAl	
4527	2W		63.25A	109.54A	7~100	0.5~100	R0005 : MnCuSn R001~R005 : MnCu R006~R500 : FeCrAl	
	3W		77.46A	134.16A	7~60	0.5~60		
	5W		100A	173.20A	7~500	0.5~500		

### JUMPER SPECIFICATION

Size Code	Rating Power at 70°C	Max. Rating Current	Resistance (mΩ)	Material	Operate Temperature Range (°C)
1206	1W	70.7A	≤ 0.2	Jumper : Cu	-55 ~ +170
2512	2W	100A			

### DIMENSION (unit : mm)



Size Code	Power Rating	Resistance Range	L	W	H	T1	T2				
1206	0.75W	51~100 mΩ	3.20±0.254	1.65±0.254	0.35±0.254	0.40±0.254	0.51±0.254				
	1W	1~2mΩ			0.63±0.254						
		3~50mΩ			0.43±0.254						
2512	1W	0.5~1mΩ	6.35±0.254	3.05±0.254	0.65±0.254	1.05±0.254	2.20±0.254				
		1.5mΩ			0.51±0.254		2.00±0.254				
		2mΩ					1.40±0.254				
		2W					2.5~75mΩ	1.10±0.254			
							76~200mΩ	0.75±0.254	1.10±0.254		
							201~500mΩ	0.41±0.254	0.75±0.254	0.85±0.254	
	3W	0.5~1mΩ			0.65±0.254	1.05±0.254	2.20±0.254				
		1.5mΩ			0.54±0.254	0.75±0.254	2.00±0.254				
		2mΩ					1.40±0.254				
		2.5~100mΩ					1.10±0.254				
		2725			4W	0.2mΩ	6.80±0.254	6.35±0.254	0.77±0.254	0.20~1.50	2.30±0.254
						0.5mΩ			0.65±0.254		
1mΩ	0.55±0.254		1.80±0.254								
0.2~3mΩ											
2728	4W	4~450mΩ	6.60±0.254	6.70±0.254	0.62±0.254	0.20~1.00	1.10±0.254				
4527	2W	0.5mΩ	11.3±0.254	6.60±0.254	0.77±0.254	0.20~1.00	3.00±0.254				
		1.~1.5mΩ			0.65±0.254		2.00±0.254				
		2~5mΩ					0.55±0.254				
		6~100mΩ					0.77±0.254	3.00±0.254			
	3W	0.5mΩ			0.65±0.254		0.75±0.254	3.00±0.254			
		1~1.5mΩ						0.55±0.254	2.00±0.254		
		2~5mΩ							0.77±0.254		
		6~60mΩ									
	5W	0.5mΩ			0.62±0.254		0.72±0.254	3.00±0.254			
		1~1.5mΩ						0.62±0.254	2.00±0.254		
		2~5mΩ									
		6~500mΩ									

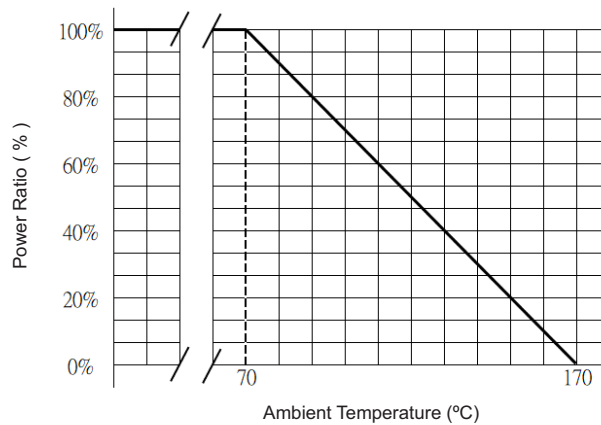
### ■ JUMPER DIMENSION (unit : mm)

Size Code	Power Rating	Resistance Range	L	W	H	T1	T2
1206	1W	< 0.2mΩ	3.20±0.254	1.65±0.254	0.67±0.254	0.40±0.254	0.51±0.254
2512	2W	< 0.2mΩ	6.35±0.254	3.05±0.254	0.67±0.254	1.05±0.254	1.10±0.254

### ■ POWER DERATING CURVE

The Operating Temperature Range : -50°C ~ +170°C

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



### ■ RATING CURRENT

The following equation may be used to determine the DC (Direct Current) or AC (Alternating Current) (RMS, root mean square value) of normal rated power. However, if the result value exceeds the highest current of regulated standards (paragraph 5), the highest normal rated power is to be used.

$$I = \sqrt{P/R}$$

I = Rating Current (A)  
P = Rating Power (W)  
R = Resistance (Ω)

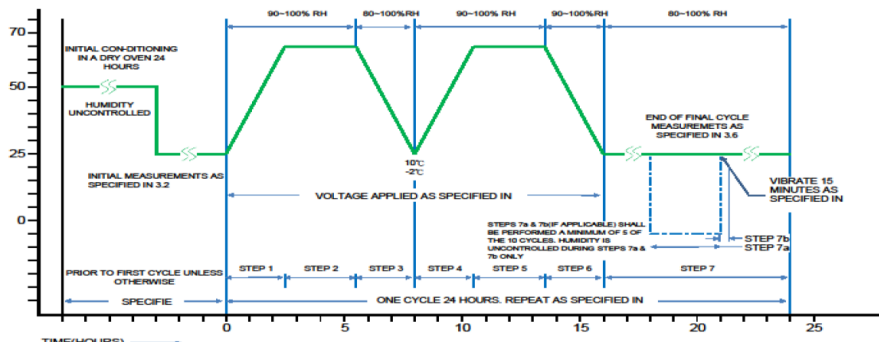
### ■ MARKING FORMAT

- All the other products marking are 4 digits
- “R” designates the decimal location in ohms  
e.g. 1mΩ=R001, 25mΩ=R025, 100mΩ=R100
- “m” designates the decimal location in milli-ohms  
e.g. 0.25mΩ=0m25, 0.5mΩ=0m50, 25.5mΩ=25m5
- 0Ω marking as 0R

### TEST PROCEDURES : except Jumper

Test Item	Test Method	Procedure	Requirement
Temperature Coefficient of Resistance (T.C.R.)	JIS C 5201-1 clause 4.8	$T.C.R (ppm/^{\circ}C) = \frac{R2 - R1}{R1 (T2 - T1)} \times 10^6$ R1: resistance at room temperature (T1) R2: resistance at 150°C (T2)	Refer to standard Electrical Specification
Short Time Overload	JIS C 5201-1 clause 4.13	The number of rated power are as follows: 1206 : 4 times of rated power 2512 - 1W & 2W : 5 times of rated power 2512 - 3W : 4 times of rated power 2725 - 4W : 4 times of rated power 2728 - 4W : 3 times of rated power 4527 - 2W & 3W : 5 times of rated power 4527 - 5W : 3 times of rated power  Rating power duration : 5 seconds	Size 4527 : $\Delta R/R1 \leq \pm 2.0\%$ The others : $\Delta R/R1 \leq \pm 0.5\%$
High Temperature Exposure	JIS C 5201-1 clause 4.23.2	1,000hrs at +170°C	Size 4527 : $\Delta R/R1 \leq \pm 2.0\%$ The others : $\Delta R/R1 \leq \pm 1.0\%$
Soldering Heat	JIS C 5201-1 clause 4.18	260 ± 5 °C for 10 seconds	$\Delta R/R1 \leq \pm 0.5\%$
Temperature Cycling	JIS C 5201-1 clause 4.19	-55°C to +150°C, 1000 cycles, 15 minutes at each extreme	$\Delta R/R1 \leq \pm 0.5\%$
Bias Humidity	JIS C 5201-1 clause 4.24	1,000hrs @ +85°C / 85%RH, 10% Bias 1.5hrs "ON", 0.5hrs "OFF"	$\Delta R/R1 \leq \pm 0.5\%$
Load at Rated Power	JIS C 5201-1 clause 4.25	1,000hrs @ 70°C, 1.5hrs "ON", 0.5hrs "OFF"	Size 4527 : $\Delta R/R1 \leq \pm 2.0\%$ The others : $\Delta R/R1 \leq \pm 1.0\%$
Solderability	JIS C 5201-1 clause 4.17	245 ± 5 °C for 2±0.5 seconds	> 95% coverage
Dielectric Withstanding Voltage	JIS C 5201-1 clause 4.7	Applied 500VAC for 1 minute, and limit surge Current 50mA (max.)	No short or burned on the appearance
Core Body Strength	JIS C 5201-1 clause 4.15	Central part pressurizing force : 5N, 10 seconds	No broken
Terminal Strength	JIS C 5201-1 clause 4.32	Pressurizing force : 17.7N, 10 seconds	No broken
Terminal Bending Strength	JIS C 5201-1 clause 4.33	Bending once for 2mm, 10 seconds	$\Delta R/R1 \leq \pm 0.5\%$ , No broken
Moisture Resistance (Climatic Sequence)	MIL-STD 202 Method 106	T= 24 hours / Cycle, 10 cycles Steps 7a & 7b not required. Unpowered (Figure 1)	$\Delta R/R1 \leq \pm 0.5\%$

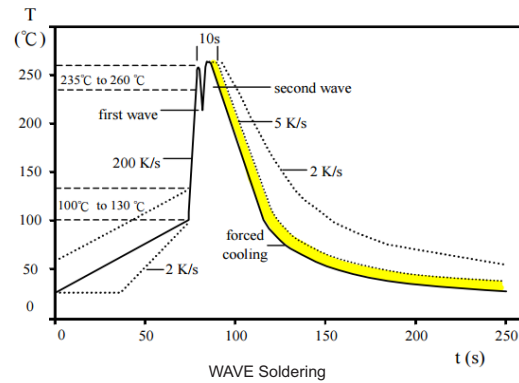
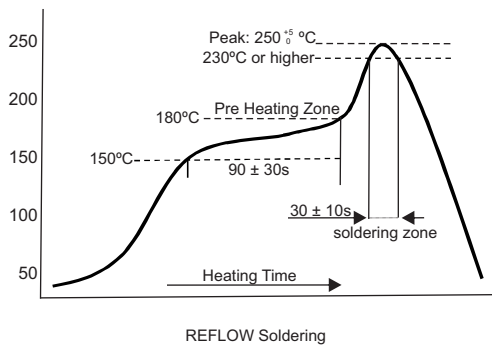
Figure 1



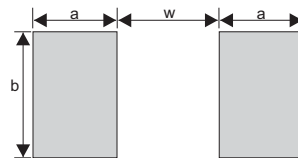
### TEST PROCEDURES : for Jumper

Test Item	Test Method	Procedure	Requirement
Short Time Overload	JIS C 5201-1 clause 4.13	4 times of rated power, 5 seconds	$\leq 0.2m\Omega$
High Temperature Exposure	JIS C 5201-1 clause 4.23.2	1,000hrs at +170°C	$\leq 0.2m\Omega$
Temperature Cycling	JIS C 5201-1 clause 4.19	-55°C to +150°C, 1000 cycles, 15 minutes at each extreme	$\leq 0.2m\Omega$
Bias Humidity	JIS C 5201-1 clause 4.24	1,000hrs @ +85°C / 85%RH, 10% Bias 1.5hrs "ON", 0.5hrs "OFF"	$\leq 0.2m\Omega$
Load at Rated Power	JIS C 5201-1 clause 4.25	1,000hrs @ 70°C, 1.5hrs "ON", 0.5hrs "OFF"	$\leq 0.2m\Omega$
Solderability	JIS C 5201-1 clause 4.17	245 $\pm$ 5 °C for 2 $\pm$ 0.5 seconds	> 95% coverage

### SOLDERING PROFILE



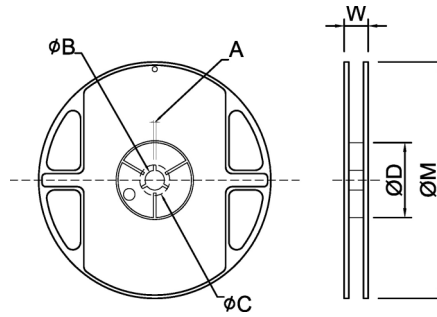
### RECOMMEND LAND PATTERN DESIGN : Dimension (unit: mm)



Type	Resistance Range	a	b	w
1206 - 0.75W & 1W	Jumper : 0.2m $\Omega$	1.00	1.90	1.40
	1m $\Omega$ ~ 100m $\Omega$	1.60	2.18	0.66
2512 - 1W, 2W & 3W	Jumper : 0.2m $\Omega$	2.11	3.68	3.18
	0.5m $\Omega$ ~ 1.5m $\Omega$	3.05		1.27
	2m $\Omega$ ~ 3.5m $\Omega$	2.11		3.18
	3.6m $\Omega$ ~ 500m $\Omega$	1.90		3.50
2725 - 4W	2.5m $\Omega$ ~ 0.5m $\Omega$	3.18	6.86	1.32
	1m $\Omega$ ~ 3m $\Omega$	2.34		3.00
2728 - 4W	4m $\Omega$ ~ 450m $\Omega$	2.75	7.82	3.51
4527 - 2W, 3W & 5W	0.5m $\Omega$ ~ 3m $\Omega$	4.50	8.47	4.50
	3.5m $\Omega$ ~ 100m $\Omega$	3.40		6.43
	101m $\Omega$ ~ 500m $\Omega$	2.93		7.63

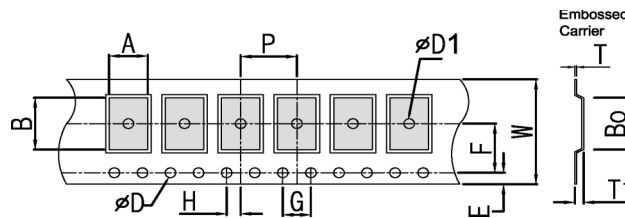
■ **PACKING DIMENSION (mm)**

Tape & Reel



Reel Type / Tape	A	$\phi B$	$\phi C$	$\phi D$	W	$\phi M$
7" reel for 8 mm embossed (for 1206 only)	$2.0 \pm 0.5$	$13.2 \pm 0.5$	$17.7 \pm 0.5$	$60.0 \pm 0.5$	$12.00 \pm 0.5$	$178 \pm 1.0$
7" reel for 12 mm embossed	$2.5 \pm 0.5$	$13.5 \pm 0.5$	$17.7 \pm 0.5$	$60.0 \pm 0.5$	$16.2 \pm 0.5$	$178 \pm 1.0$
7" reel for 24 mm embossed	$2.0 \pm 0.5$	$13.5 \pm 0.5$	$17.7 \pm 0.5$	$60.0 \pm 0.5$	$24.4 \pm 2.0$	$178 \pm 1.0$

Embossed



Size	W ( $\pm 0.30$ )	P ( $\pm 0.10$ )	E ( $\pm 0.10$ )	F ( $\pm 0.10$ )	$\phi D$	$\phi D1$ ( $\pm 0.10$ )	G ( $\pm 0.10$ )	H ( $\pm 0.10$ )	A ( $\pm 0.10$ )	Bo ( $\pm 0.10$ )	T1 ( $\pm 0.10$ )	T
1206	8.0	4.0	1.75	3.5	$1.5^{+0.1}_{-0}$	1.00	4.0	2.0	2.03	3.55	0.70	$0.20 \pm 0.05$
2512	12.0	4.0	1.75	5.5		1.55	4.0	2.0	3.50	6.75	0.90	$0.20 \pm 0.05$
2725	12.0	8.0	1.75	5.5		1.55	4.0	2.0	6.81	7.16	1.05	$0.25 \pm 0.05$
2728	12.0	8.0	1.75	5.5		1.55	4.0	2.0	7.10	7.05	0.95	$0.20 \pm 0.05$
4527	24.0	12.0	1.75	11.5		1.50	4.0	2.0	7.38	12.0	1.05	$0.30 \pm 0.10$

■ **PACKAGE QUANTITY**

Size	PCS / Reel
1206	5000
2512	4000
2725	2000
2728	2000
4527	1000

■ **STORAGE TEMPERATURE**

Temperature :  $25 \pm 5$  °C  
Humidity :  $60 \pm 20$ %