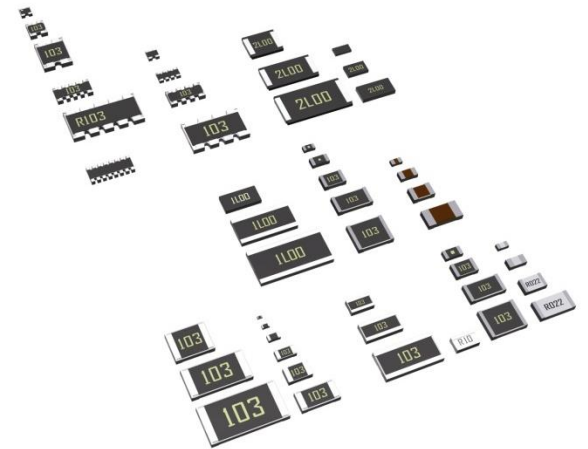


Resistor Products



Development Strategy

Shunt resistors

High power 4W / 5W

High reliability for automotive

Pursue the compact and high power / ultra high voltage

Low ohmic chip resistors for current detection

Ultra-compact chip resistors

Embedded

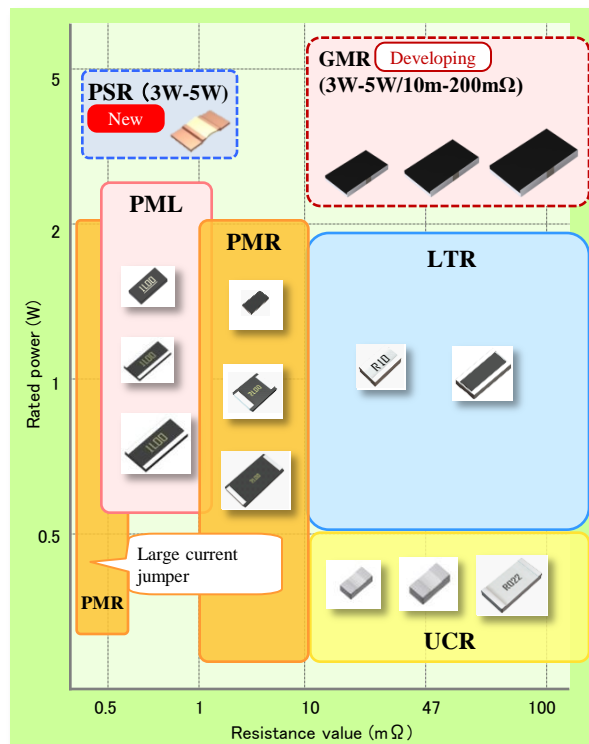
Pursue the compact and thin

Development Strategy

- Ultra low ohmic
- Ultra-compact
- High reliability
- High power

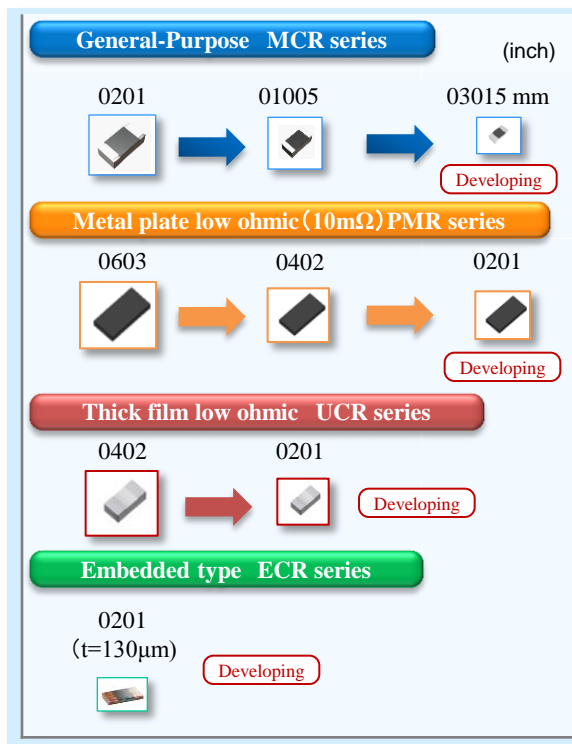
Low ohmic series

Fulfilling line up from compact to high power.



Ultra-compact chip resistors

Pursue the compact and thin.



High reliability for automotive&industrial

Pursue the compact and high power/voltage.

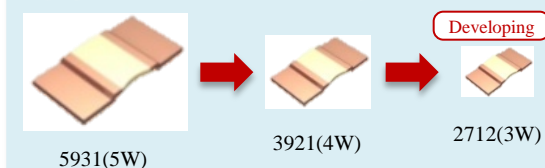
Anti-surge (ESR)



High power • Superior connection reliability against thermal cycling (Wide terminal –LTR –)





High power • Ultra low ohmic Chip Resistors (PSR)



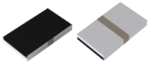
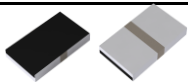
Current sensing resistors

Low Ohmic Resistors Line-up









Metal Plate Type Shunt Resistors PSR Series

Size code(inch)	Part No.	Appearance
New 3921	PSR400	
New 5931	PSR500	






Metal Plate Type Shunt Resistors GMR Series

Size code(inch)	Part No.	Appearance
☆ 2512	GMR100	
☆ 2817	GMR320	





Metal Plate Type

Size code (inch)	Part No.	Appearance
☆ 0201	PMR006	
New 0402	PMR01	
0603	PMR03	
0805	PMR10	
1206	PMR18	
1210	PMR25	
2010	PMR50	
2512	PMR100	





Thick Film Face down type

Size code (inch)	Part No.	Appearance
New 0201	UCR006	
0402	UCR01	
0603	UCR03	
0805	UCR10	
1206	UCR18	

Thick Film <Wide Terminal type>

Size code(inch)	Part No.	Appearance
0805	LTR10	
1206	LTR18	
☆ 2010	LTR50	
2512	LTR100	

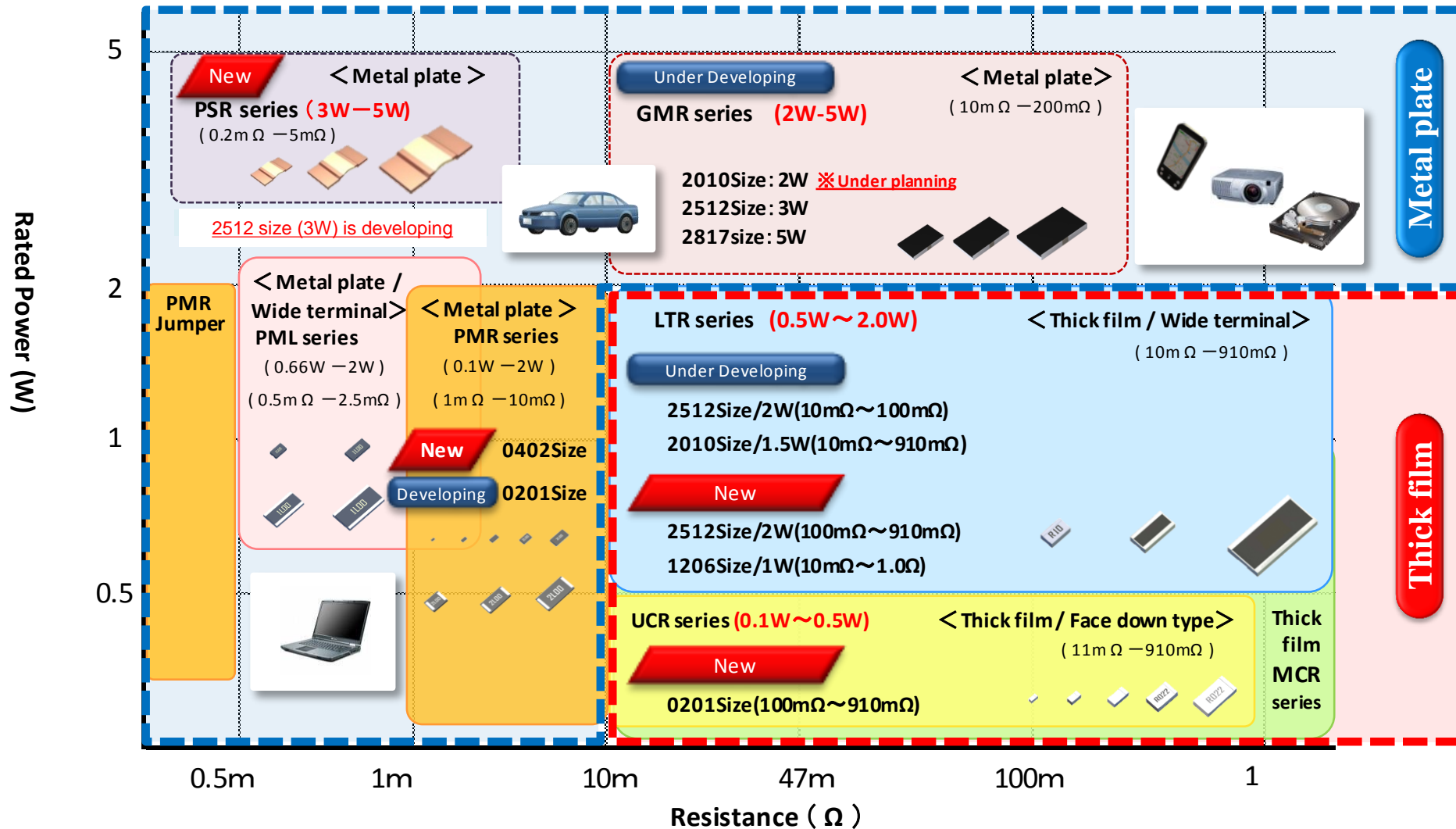
Metal Plate Type <Wide Terminal type>

Size code (inch)	Part No.	Appearance
0805	PML10	
1206	PML18	
☆ 2010	PML50	
2512	PML100	

☆ Under development

Low ohmic Development Map

Growing Low ohmic Resistor demand !! Expanding various lineup



Low Ohmic High Power Chip Resistors / Wide terminal type LTR series

◆ Features

■ High Power

ROHM's unique structure achieved improvement of heat dissipation characteristics, resulting in the higher rated power.

Size mm(inch)	LTR series	MCR series
2012 (0805)	0.5W	0.25W
3216 (1206)	1W	0.25W
6432 (2512)	2W	1W

Superior power ratings

■ Downsizing

<Competitor>
2010 size / 1W
(inch)

<ROHM LTR18>
1206 size / 1W
(inch)



60% Mount space saved

◆ Specification

Part No.	Size mm (inch)	Rated power	Resistance tolerance	Resistance(Ω)	Temperature coefficient (ppm/°C)	Operating temperature range
LTR10	2012 (0805)	0.5W	J (±5%) F (±1%)	47m ~ 9.1	±150	-55~+155°C
LTR18	3216 (1206)	1W		10m ~ 18m	0 ~ 300	
				20m ~ 47m	0 ~ 200	
				51m ~ 470m	0 ~ 150	
				510m ~ 1	±100	
LTR100	6432 (2512)	2W	100m ~ 910m	J : ±200 F : 0~150		

* Design and specification is supposed to change

◆ Application

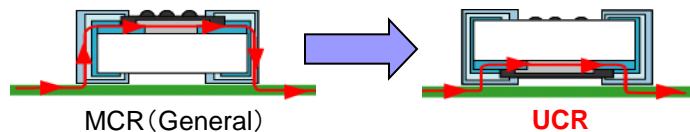
- Automotive, Power supply
- Motor control circuit
- HDD
- Battery
- Laptop PC



Low Ohmic Chip Resistors for Current Detection UCR series

◆ Features

■ Face down type



Resistive element is located at bottom side, which reduces the resistance shift during mounting process.

■ High power 0603 size 0.25W / 0805 size 0.33W

ROHM's unique structure achieved tremendous improvement of heat dissipation characteristics.

◆ Specification

Part No.	Size mm(inch)	Rated power	Resistance tolerance	Resistance (Ω)	Operating temperature range
★ UCR006	0603 (0201)	0.1W	J (±5%) F (±1%)	0.1 ~ 1	-55~+155°C
UCR01	1005 (0402)	0.125W	J (±5%) F (±1%)	0.068 ~ 0.91	
UCR03	1608 (0603)	0.25W	J (±5%)	0.02 ~ 0.2	
		0.2W	F (±1%)	0.22 ~ 0.91	
UCR10	2012 (0805)	0.33W	J (±5%)	0.011 ~ 0.1	
			F (±1%)	0.02 ~ 0.1	
UCR18	3216 (1206)	0.5W	J (±5%) F (±1%)	0.011 ~ 0.1	

★ : Under development

* Design and specification is supposed to change

■ Low TCR

Part No.	Size mm(inch)	Resistance range	Temperature Coefficient [ppm/°C]
UCR10	2012 (0805)	47mΩ	0 ~ 250
MCR10	2012 (0805)	47mΩ	500 ± 300

◆ Structure

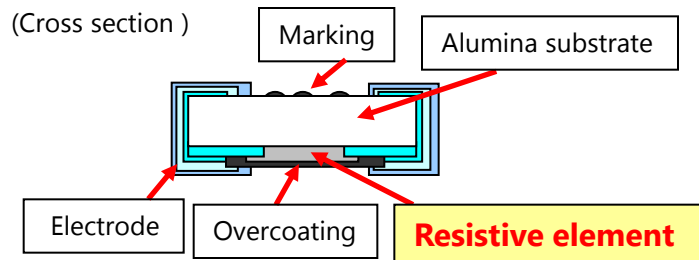


(Top view)



(Bottom view: Mounting view)

(Cross section)

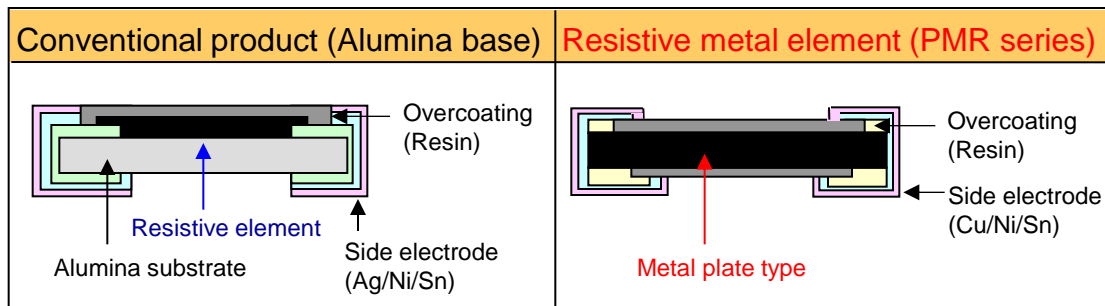


◆ Applications

Notebook PC, Mobile phones, HDD,
Portable audioDC/DC converter,
Power supply etc

Ultra Low Ohmic Chip for Current Detection PMR series

◆ Structure



◆ Specification

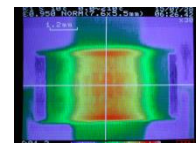
Line up from world's smallest 0603 size!

Part No.	Size mm (inch)	Rated power	Resistance tolerance	Resistance (mΩ)	Temperature coefficient (ppm/°C)	Operating temperature range
PMR006	0603 (0201)	0.1W	J (±5%)	10	0~300	-55~+155°C
PMR01	1005 (0402)	0.2W	J (±5%)	10	0~200	
PMR03	1608 (0603)	0.25W	J (±5%)	10	0~150	
			F (±1%)			
PMR10	2012 (0805)	0.5W	J (±5%)	2,3,4,5,6, 7,8,9,10	±150	
			G (±2%)			
			F (±1%)			
PMR18	3216 (1206)	1W	J (±5%)	1,2,3,4,5,6, 7,8,9,10	±100	
			F (±1%)			
PMR25	3225 (1210)	1W	J (±5%)	1,2,3,4,5	±100	
			F (±1%)			
PMR50	5025 (2010)	1W	J (±5%)	1,2,3,4,5,6, 7,8,9,10	±100	
			F (±1%)			
PMR100	6432 (2512)	2W	J (±5%)	1,2,3,4,5,6, 7,8,9,10	±100	
			F (±1%)		(±150: 1,2mΩ)	

Surface Temperature

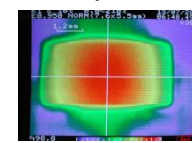
Size: 2512
Rated power: 1W
ROHM: PMR
Competitor: Metal element type

<ROHM>



(88.7 °C)

<Competitor>

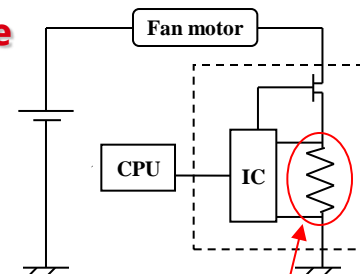


(98.8 °C)

Temperature diffusion occurs with our unique design.

◆ Circuit example

<Overcurrent detection>



Ultra-low ohmic resistor for current detection

◆ Applications

Current detection purpose

Notebook PC, HDD, Mobile phones, Small batteries, Chargers, DC/DC converter, and other general Power supplies



☆ : Under development

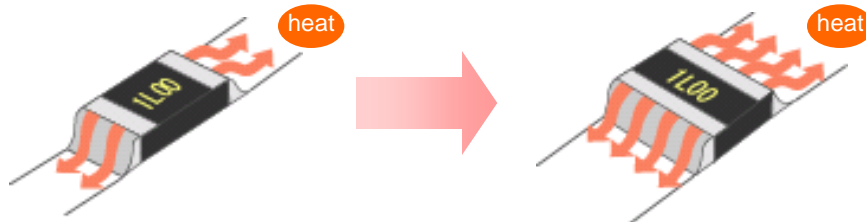
* Design and specification is supposed to change

◆ Feature

Wide terminal configuration for high joint reliability.

Standard terminal type

Wide terminal type



- Rohm original trimming-less structure improved current /heat dissipation characteristics.
- Wide terminal structure improved heat dissipation characteristics.

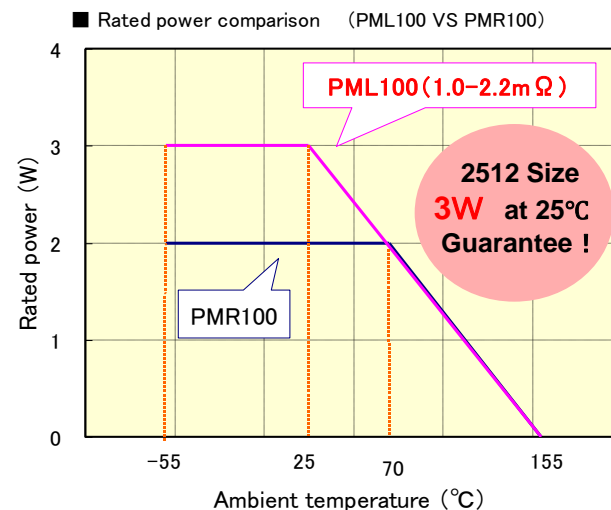
◆ Specification

Ultra-low resistance range(0.5mΩ-)

Part No.	Size mm(inch)	Rated power	Resistance tolerance	Resistance (Ω)	Temperature coefficient (ppm/°C)	Operating temperature range
PML10	2012 (0805)	0.66W	J (±5%) G (±2%)	1.0, 1.2, 1.5, 1.8, 2.0, 2.4, 2.5	±200	-55~+155°C
PML18	3216 (1206)	1W	J (±5%) G (±2%)	0.5, (0.75), 1.0, 1.2, 1.5, 1.8, 2.0, 2.4, 2.5	±150	
PML50	5025 (2010)	1.5W (2W at 25°C)	J (±5%)	0.5, 1.0, 1.5, 2.0, 2.2	±200	
PML100	6432 (2512)	2W (3W at 25°C)	J (±5%)	1.0, 1.5, 2.0, 2.2	±100	
		2W		0.5	±150	

★: Under development, (): Under development, * Design and specification is supposed to change

◆ Rated power comparison



◆ Appearance

Automotive motors, EPS, Laptop PC,
Current detection circuit, etc



Suitable for the detection
of high current

Power current sensing resistor (PSR series)

◆ Feature

High power up to 5W

Ultra low-ohmic (min 0.2mΩ)

Low TCR



PSR500

PSR400

PSR100

◆ Specification

◆ Application

Current detection

Automotive

(EPS, EV battery)

Industrial

(Power conditioner e.g.)

White goods

(Air conditioner e.g.)



Design and target spec may be subject to change.

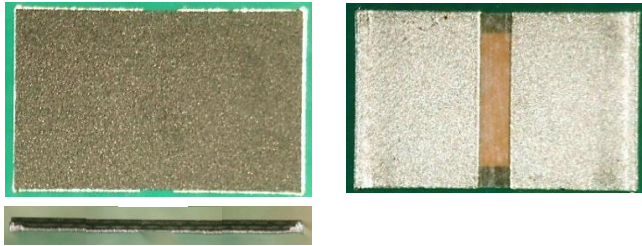
Code	Size (mm)	Rated power	Tol.	R.V range (mΩ)	Temperature coefficient +20~125°C (ppm/°C)		Operating Temp.
PSR500	15 × 7.75	5W	F (±1%) J (±5%)	0.2~2.0	0.2,0.3mΩ	±225	-55~170°C
					0.4,0.5mΩ	±175	
					1.0,2.0mΩ	±75	
PSR400	10 × 5.2	4W	F (±1%) J (±5%)	0.3~3.0	0.3,0.5mΩ	±75	-55~170°C
					1.0,2.0,3.0mΩ		
PSR100	6.4 × 3.2	3W	F (±1%) J (±5%)	0.3~5.0	0.2mΩ 0.5mΩ	±150	-55~170°C
					1.0mΩ	±100	
					2.0~5.0mΩ	±50	

Under development

◆ Features

- High power up to 2W,3W,5W
- High heat dissipation
- Low-ohmic (min 10mΩ)
- Low TCR

◆ Appearance



◆ Application



For current detection circuit

Automotive

(ECU, Body ECU, Motor control)

Industrial

(Power conditioner, Pump e.g.)

White goods

◆ Target Specification






Design and target spec may be subject to change.

Code Name	Size (inch)	Rated power	Tolerance	R.V range (mΩ)	Temperature coefficient (ppm/°C)	Operating Temp.
GMR320	2817	5W	F (±1%) J (±5%)	10~220	+25 (20~60°C)	-55°C ~170°C
GMR100	2512	3W				
GMR50	2010	2W				





High reliability Resistors

Resistor Line-up (Specialty Items)





■ Anti-surge Chip Resistors

Size code (inch)	Part No.	Appearance
0402	ESR01	
0603	ESR03	
0805	ESR10	
1206	ESR18	
1210	ESR25	





■ High Voltage Resistance Chip Resistors

Size code (inch)	Part No.	Appearance
0603	KTR03	
0805	KTR10	
1206	KTR18	
1210	KTR25	


■ High Power Chip Resistors <Wide Terminal type>

Size code (inch)	Part No.	Appearance
0805	LTR10	
1206	LTR18	
2010	LTR50	
2512	LTR100	

■ Sulfur Tolerant Chip Resistors

Size code (inch)	Part No.	Appearance
0402	TRR01	
0603	TRR03	
0805	TRR10	
1206	TRR18	

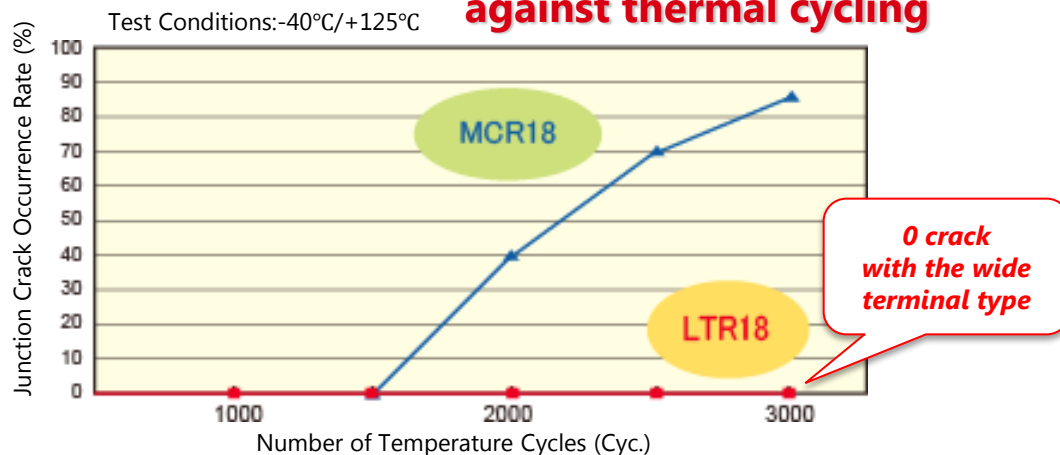
■ Embedded Chip Resistors

Size code (inch)	Part No.	Appearance
☆ 0201	ECR006	

☆ Under development

High Power Chip Resistors / Wide Terminal LTR series

◆ Superior connection reliability against thermal cycling



Arranging the electrode in length side shortens the interelectrode distance, and it improves joint reliability to the temperature cycle tremendously.

◆ Specification

Guaranteed anti-surge characteristic in all series!

Part No.	Size mm (inch)	Rated power	Resistance tolerance	Resistance (Ω)	Temperature coefficient (ppm/°C)	Operating temperature range
LTR10	2012 (0805)	0.25W	J (±5%) F (±1%) D (±0.5%)	1~1M (D: 10~1M)	J: ±200 F, D: ±100	-55~155°C
LTR18	3216 (1206)	0.75W				
LTR50	5025 (2010)	1W				
LTR100	6432 (2512)	2W				

◆ Superior rated power!

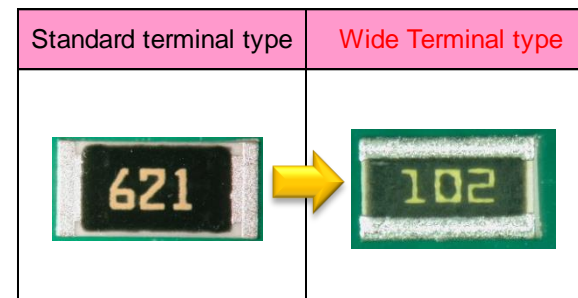
Part No. mm (inch)	LTR Series	MCR Series
2012 (0805)	0.25W	0.125W
3216 (1206)	0.5W	0.25W
5025 (2012)	1W	0.5W
6432 (2512)	2W	1W

Improvement of rated power enables to displace smaller size of resistors, and it contributes space savings in your set.

◆ Applications

Automotive systems: requiring high temperature cycling strength and surge resistance characteristics.

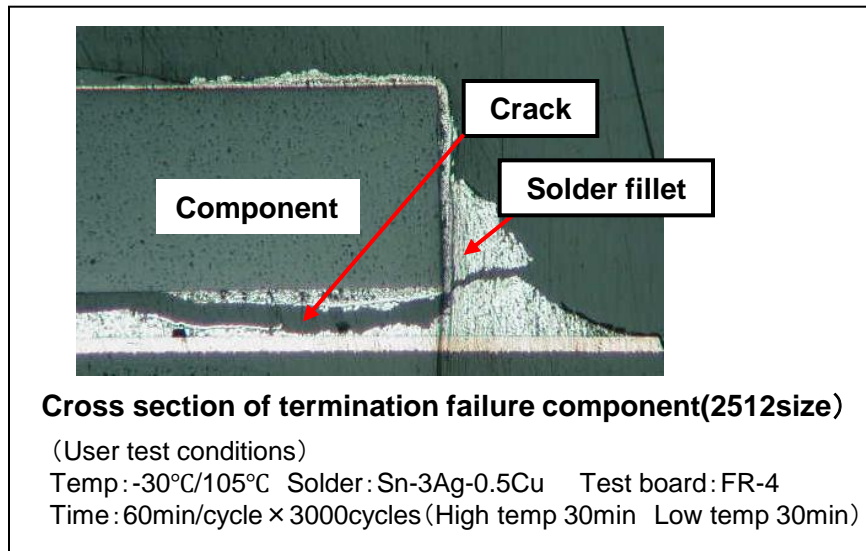
◆ Appearance



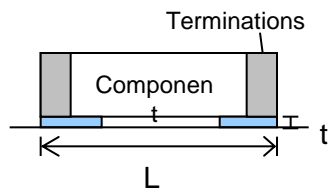
High Power Chip Resistors / Wide Terminal (LTR series)

◆ Crack problem by temperature cycles

- Higher possibility of solder crack by TCY with larger size
- Higher possibility of solder crack with Pb-free terminations



< Model >



$$S = \Delta\alpha \cdot \Delta T \cdot L / 2t$$

S : Stress parameter

$\Delta\alpha$: Difference in thermal expansion coefficient
between the component and board

ΔT : Temp range

L : Component length

t : Solder thickness

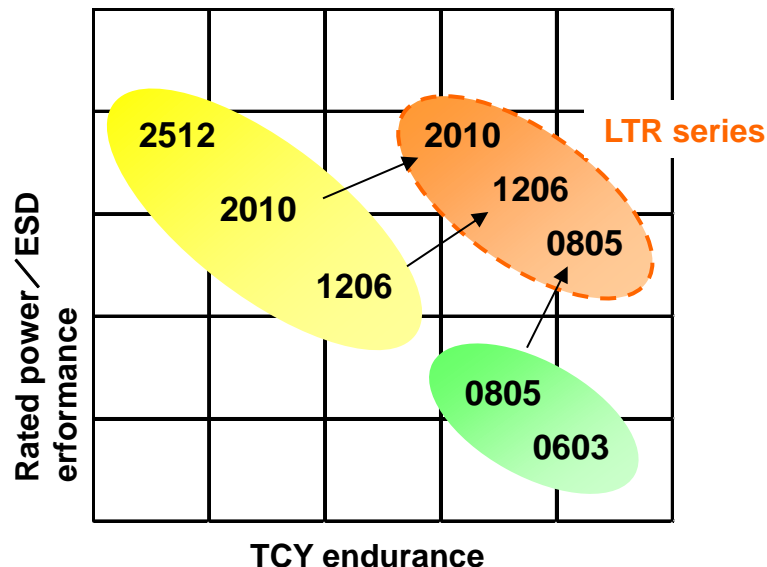
Usage could be regulated in 1206 or larger size

◆ Performance trade-off with smaller sized chip resistor

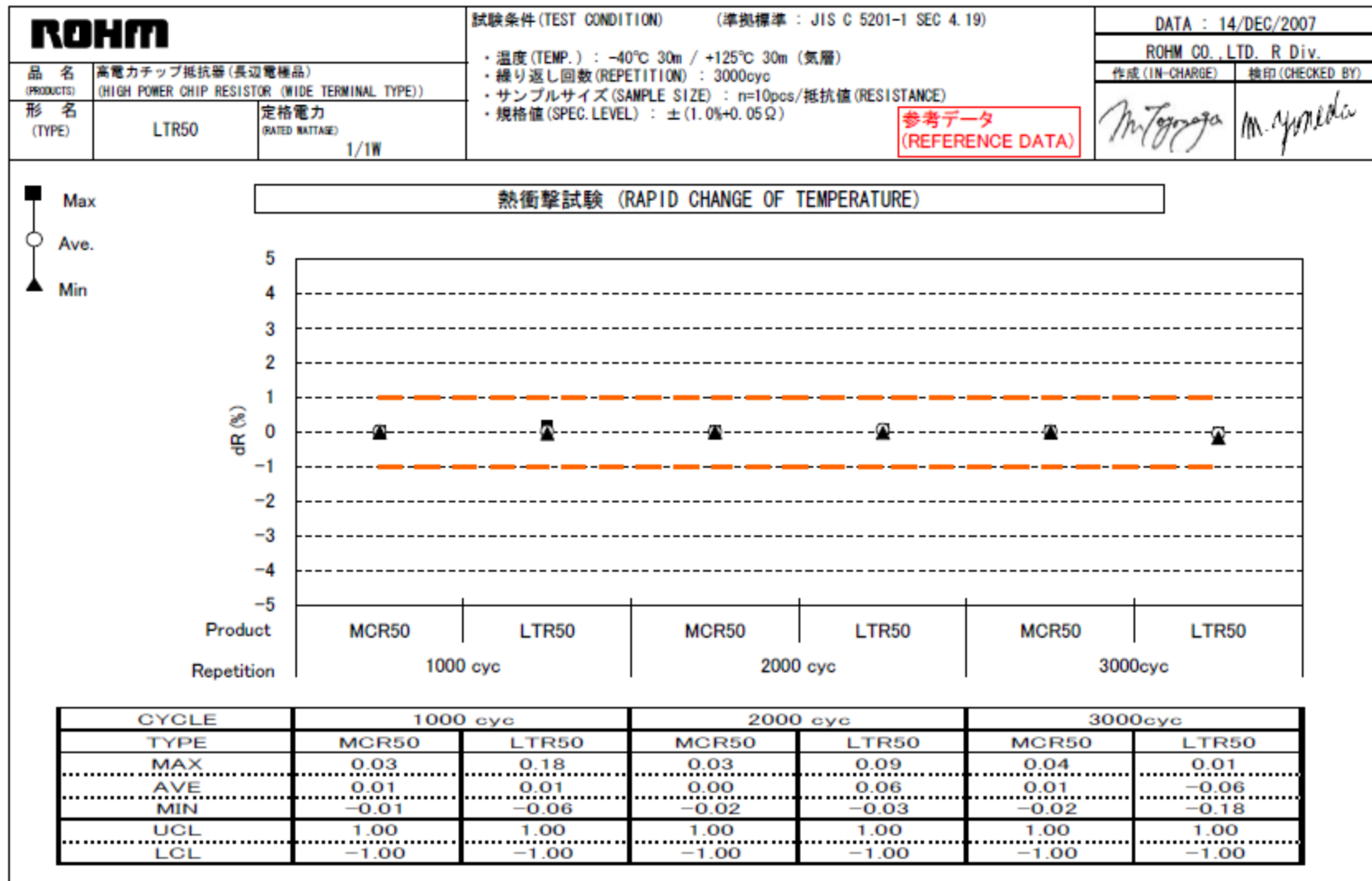
Chip size (inch)	0603	<	2512
TCY endurance	High	>	Low
Rated power	0.1W (Low)	<	1.0W (High)
ESD performance	Low	<	High

◆ Required performance for chip resistor

High { TCY endurance
ESD performance
Rated power



Temperature cycle test (after 3,000 cyc)



Temperature cycle test (after 3,000 cyc)

<Test Condition>

Temp : -40°C ~ +125°C
(30 min by each temp)
Cycles : 3,000 cyc

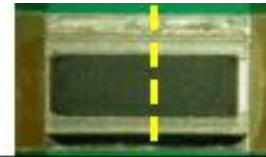
<Board Condition>

Test Board : FR-4
(Glass fabric epoxy)
Size : 58,0 x 25,0 mm
Thickness : 1,6mm
Copper foil thickness : 35um
Land pattern : ROHM recommended

<2010 inch conventional>



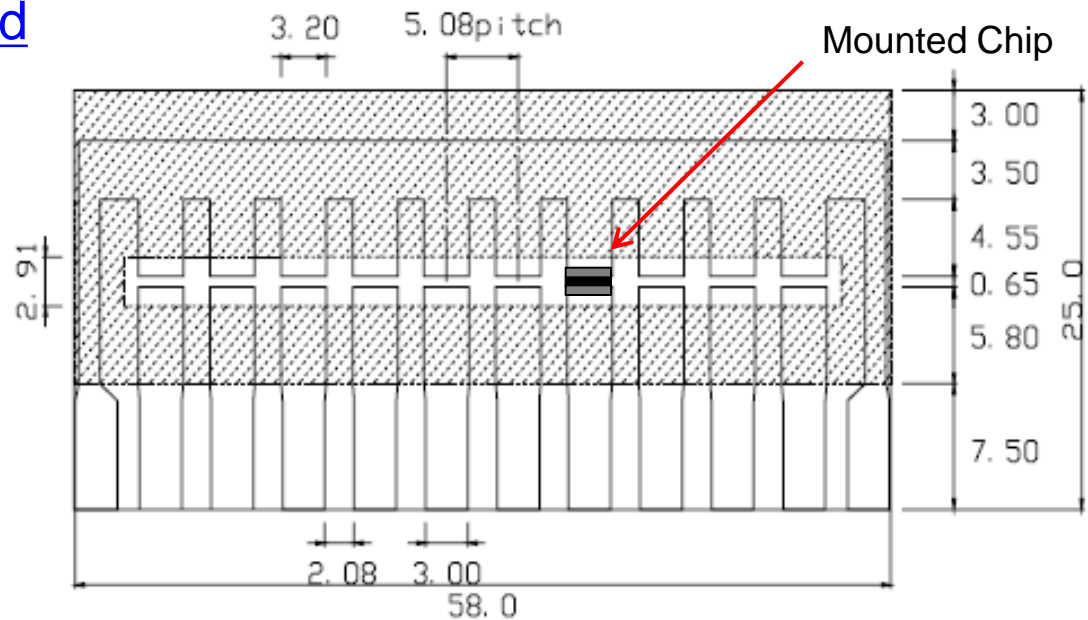
<1020 inch wide terminal>



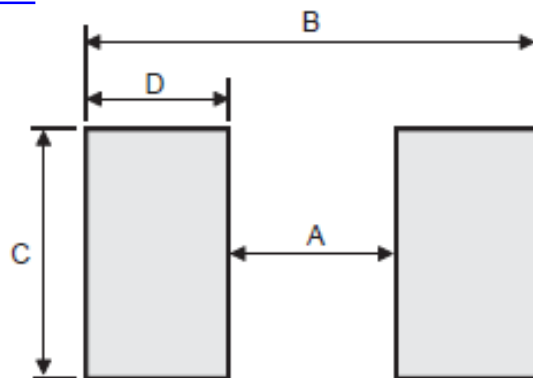
	MCR50		LTR50	
1				
2				
3				

Soldering Crack

Test board



Land pattern

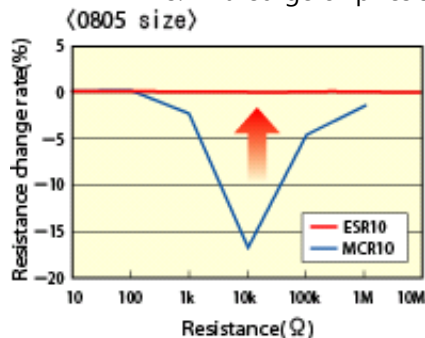


Unit (mm)	A	B	C	D
LTR50	0,75	3,35	5,00	1,30

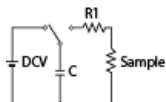
Anti-surge Chip Resistors ESR series

◆ Guaranteed 2~5kV ESD resistance! (EIAJ4701-1 Human Body Model)

■ Conventional chip resistors (MCR series)
vs. Anti-surge chip resistors (ESR series)



Significant
improvement in
endurance surge
characteristics



	ESR01	ESR03/10/18	ESR25
DCV(Applied voltage)	2kV	3kV	5kV
Applied cycle	±5 times	±10 times	±10 times
C(Capacitor)	100pF	100pF	100pF
R1(Discharge resistance)	1.5kΩ	1.5kΩ	1.5kΩ

Surge-resistance is much improved by longer conducting distance and resistance pattern to avoid concentration of voltage burden.

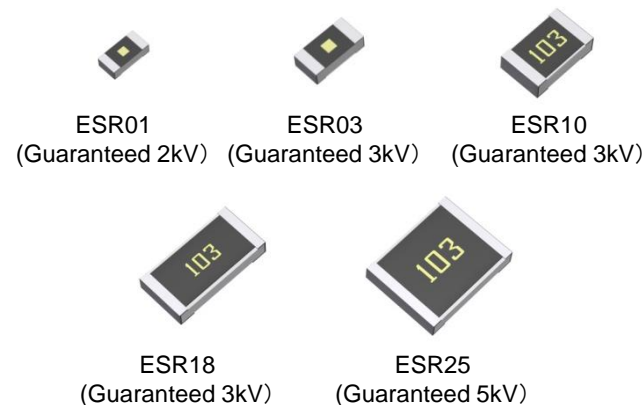
◆ Specification

Part No.	Size mm(inch)	Rated power	Resistance tolerance	Resistance (Ω)	Temperature coefficient (ppm/°C)	Operating temperature range
ESR01	1005 (0402)	0.2W	J (±5%) F (±1%)	10 ~ 1M	J: ±200 F: ±100	-55~+155°C
ESR03	1608 (0603)	0.25W	J (±5%) F (±1%) D (±0.5%)	J,F: 1 ~ 10M D: 10 ~ 1M	J: ±200 F,D: ±100	
ESR10	2012 (0805)	0.4W				
ESR18	3216 (1206)	0.33W				
ESR25	3225 (1210)	0.5W				

◆ Superior rated power!


inch	ESR series	MCR series
0402	0.2W	0.063W
0603	0.25W	0.1W
0805	0.4W	0.125W
1206	0.33W	0.25W
1210	0.5W	0.25W
2010	—	0.5W

Improvement of surge-resistance enables to displace smaller size of resistors, and it contributes space savings in your set.





Downsizing proposal

◆ ESR series & LTR series contribute to downsizing of application !!

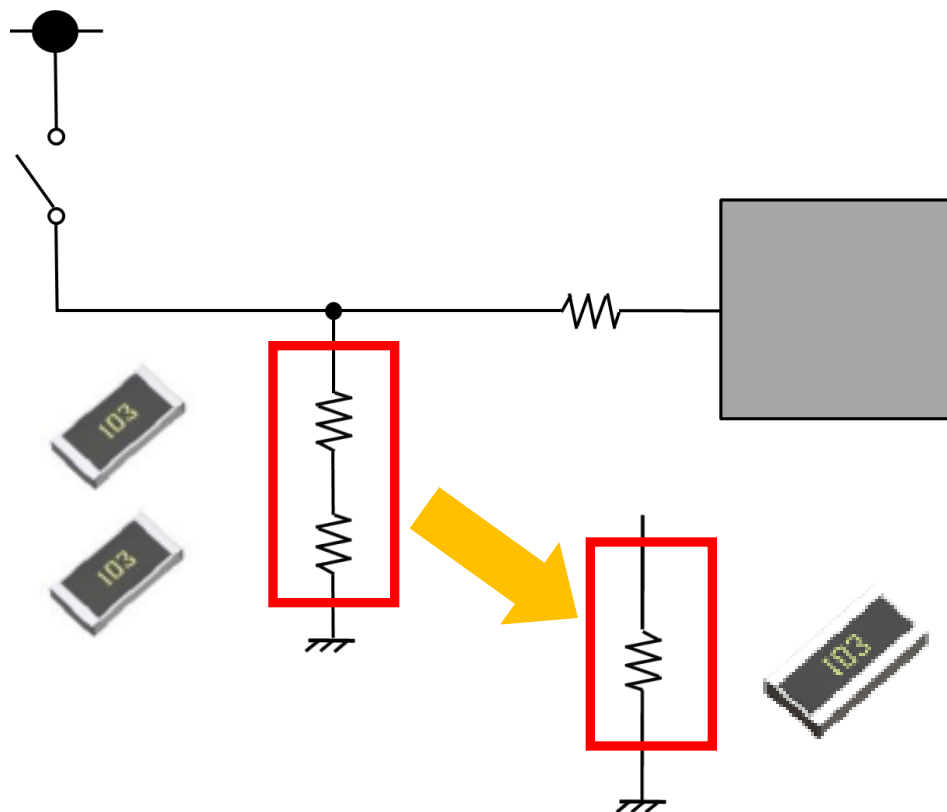
Series Size mm [inch]	MCR series (Standard)	
		
1005 [0402]	MCR01	0.063W
1608 [0603]	MCR03	0.10W
2012 [0805]	MCR10	0.125W
3216 [1206]	MCR18	0.25W
3225 [1210]	MCR25	0.25W
5025 [2010]	MCR50	0.50W
6432 [2512]	MCR100	1.0W



ESR series (Anti-surge)		LTR series (Wide terminal)	
			
ESR01	0.20W	-	
ESR03	0.25W	-	
ESR10	0.40W	LTR10	0.25W
ESR18	0.33W	LTR18	0.75W
ESR25	0.50W	-	
-		LTR50	1.0W
-		LTR100	2.0W

Circuit example

▪ Engine ECU



0805 (0.25W) × 2pcs
MCR10

0612 (0.5W) × 1pcs
LTR18

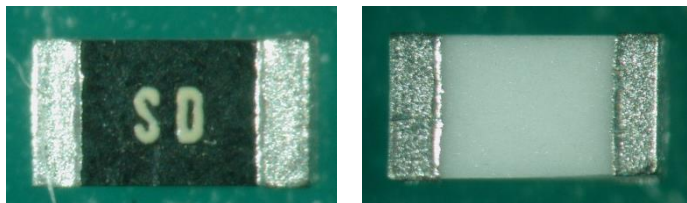
▪ Applications

Engine ECU
Transmission
ABS
Body Control
DCDC Converter
EV inverter
Cluster
EPS
Lighting system
Car Navigation
Mirror
TPMS

◆ Features

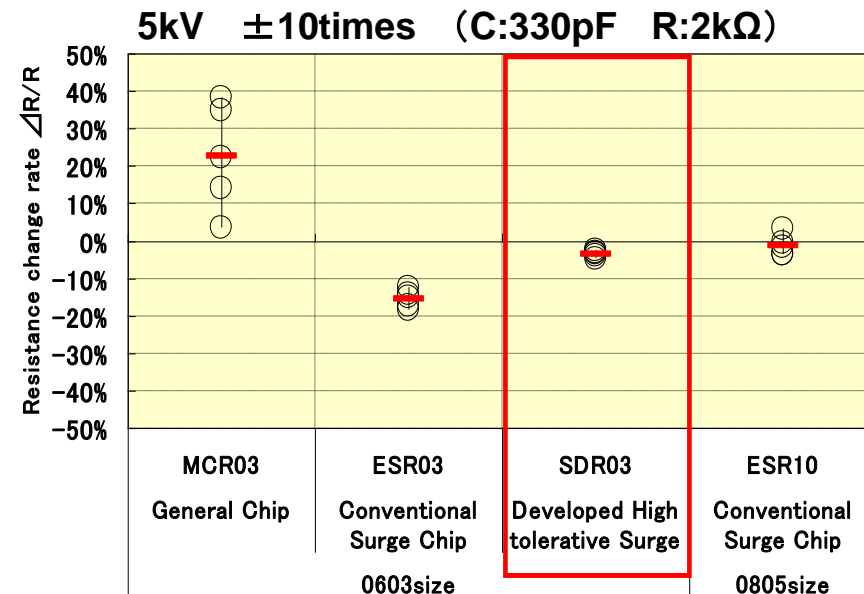
- SDR03(0603size) has high anti-surge characteristic as same as ESR10(0805size)
- SDR03 can contribute to downsizing because of the high rated power (0.25W) and the high anti-surge characteristic .
【 MCR03 0.10W、ESR03 0.20W 】

◆ Appearance



◆ ESD Characteristic

High anti surge characteristic results from improved resistive element and laser trimming design.



◆ Specification

Size	Rated power	Maximum Operating voltage	Tolerance	TCR (ppm/°C)	resistance	Category temperature range
0603	0.25W	150V	J (±5%)	±200	1~10MΩ	-55~+155
			F (±1%)	±100	1~10MΩ	-55~+155
			D (±0.5%)	±100	10~1MΩ	-55~+155

Derating curve comparison

