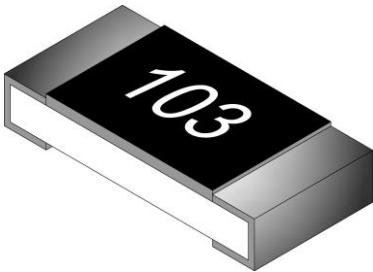




QR Series Automotive Thick Film Chip Resistor Product Specifications

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■ Automotive Thick Film Chip Resistor — QR Series



■ Application

- Automotive electronics
- Navigation equipment, TPMS
- Heating, Ventilating and Air conditioning
- Indoor lighting, Central door locking, Wiper module

■ Features

- Small size and light weight
- Reliability, high quality
- CCD visual quality inspection
- AEC-Q200 Compliant

■ Parts Number Explanation

Example:

QR	0612	J	10R0	P	05	Z
Product Type	Size (Inch)	Resistor Tolerance	Resistor Value	Package	Quantity	Optional
QR: AEC-Q200 Compliance	0402 0603 0805 1206 1210 1812 2010 2512	B : ±0.1% D : ±0.5% F : ±1% G : ±2% J : ±5%	0R=0R00 10mR=R010 100mR=R100 1R=1R00 10R=10R0 100R=100R 1K=1K00 1M=1M00	P : Paper Taping (0603~1210) Q : Paper Taping (0402) E : Embossed Taping	04 : 4000PCS 05 : 5000PCS 10 : 10000PCS 40 : 40000PCS 50 : 50000PCS	Z : Default code

■ Standard Electrical Specifications

Type	Item	Rated Power at 70℃	Max Working Voltage	Max Overload Voltage	T.C.R. (PPM/℃)	Resistance Range		
						B(±0.1%) D(±0.5%)	F(±1%) G(±2%)	J(±5%) K(±10%)
QR0402		0.063 W	50V	100V	±400	-	1Ω ≤ R < 10Ω	
					±100	10Ω ≤ R ≤ 1MΩ	10Ω ≤ R ≤ 10MΩ	
QR0603		0.1 W	75V	150V	±400	-	1Ω ≤ R < 10Ω	
					±100	10Ω ≤ R ≤ 1MΩ	10Ω ≤ R ≤ 10MΩ	
QR0805		0.125 W	150V	300V	±400	-	1Ω ≤ R < 10Ω	
					±100	10Ω ≤ R ≤ 1MΩ	10Ω ≤ R ≤ 10MΩ	
QR1206		0.25 W	200V	400V	±400	-	1Ω ≤ R < 10Ω	
					±100	10Ω ≤ R ≤ 1MΩ	10Ω ≤ R ≤ 10MΩ	
QR1210		0.5 W			±400	-	1Ω ≤ R < 10Ω	
					±100	10Ω ≤ R ≤ 1MΩ	10Ω ≤ R ≤ 10MΩ	
QR1812		0.75 W			±400	-	1Ω ≤ R < 10Ω	
					±100	10Ω ≤ R ≤ 1MΩ	10Ω ≤ R ≤ 10MΩ	
QR2010		0.75 W			±400	-	1Ω ≤ R < 10Ω	
					±100	10Ω ≤ R ≤ 1MΩ	10Ω ≤ R ≤ 10MΩ	
QR2512		1 W			±400	-	1Ω ≤ R < 10Ω	
					±100	10Ω ≤ R ≤ 1MΩ	10Ω ≤ R ≤ 10MΩ	

- For non-standard parts, please contact our sales dept.
- Operating Temperature Range : -55℃ ~ +155℃

Type	0402	0603	0805	1206	1210	1812	2010	2512
Jumper Resistance Value	50mΩ Max							
Jumper Rated Current	1A		2A					



QR Series Automotive Thick Film Chip Resistor Product Specifications

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● Automotive Low Ohm Chip Resistor

■ Standard Electrical Specifications

Type	Item	Rated Power at 70°C	Rated Voltage Range	Max Overload Voltage	T.C.R. (PPM/°C)	Resistance Range (mΩ)
						F(±1%)、J(±5%)
QR0402		0.063 W	0.12~0.25V	0.624 V	±1000	$220 \leq R \leq 450$
					±800	$450 < R < 1000$
QR0603		0.1 W	0.09~0.31V	0.775 V	±1000	$75 \leq R < 100$
					±800	$100 \leq R \leq 330$
					±600	$330 < R < 1000$
QR0805		0.125 W	0.04~0.35V	0.875 V	±1800	$10 \leq R < 50$
					±800	$50 \leq R < 100$
					±600	$100 \leq R < 1000$
QR1206		0.25 W	0.05~0.5V	1.25 V	±1800	$10 \leq R < 50$
					±800	$50 \leq R < 100$
					±600	$100 \leq R < 1000$
QR1210		0.5 W	0.07~0.7V	1.75 V	±1800	$10 \sim 50$
					±800	$51 \sim 100$
					±600	$101 \sim 990$
QR1812		0.75 W	0.08~0.8V	2.15 V	±1800	$10 \leq R < 50$
					±800	$50 \leq R < 100$
					±600	$100 \leq R < 1000$
QR2010		0.75 W	0.08~0.8V	2.15 V	±1800	$10 \leq R < 50$
					±800	$50 \leq R < 100$
					±600	$100 \leq R < 1000$
QR2512		1 W	0.1~0.99V	2.475V	±1800	$10 \leq R < 50$
					±800	$50 \leq R < 100$
					±600	$100 \leq R < 1000$

● For non-standard parts, please contact our sales dept.

● Operating Temperature Range : -55°C ~ +155°C.



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● Automotive High Ohm Chip Resistor

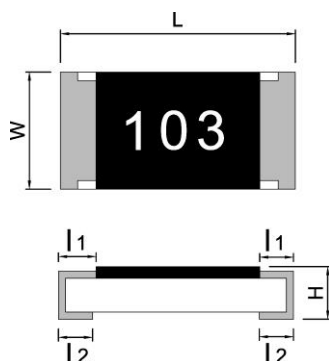
■ Standard Electrical Specifications

Item Type	Rated Power at 70℃	Max Working Voltage	Max Overload Voltage	T.C.R. (PPM/℃)	Resistance Range	
					F(±1%)	J(±5%)
QR0402	0.063 W	50V	100V	±200	10.1 MΩ ~ 30 MΩ	10.1 MΩ ~ 30 MΩ
QR0603	0.1 W	75V	150V			
QR0805	0.125 W	150V	300V			
QR1206	0.25 W	200V	400V			
QR1210	0.5 W					
QR1812	0.75 W					
QR2010	0.75 W					
QR2512	1 W					

● For non-standard parts, please contact our sales dept.

● Operating Temperature Range : -55°C ~ +155°C.

■ Type Dimension



QR0402 / QR0603 / QR0805 / QR1206 /
QR1210 / QR1812 / QR2010 / QR2512

■ Dimension

Unit: mm

Type	L	W	H	l ₁	l ₂
QR0402	1.00 ± 0.05	0.50 ± 0.05	0.30 ± 0.05	0.15 ± 0.10	0.20 ± 0.10
QR0603	1.60 ± 0.10	0.80 ± 0.10	0.40 ± 0.10	0.30 ± 0.20	0.30 ± 0.10
QR0805	2.00 ± 0.10	1.25 ± 0.10	0.50 ± 0.15	0.30 ± 0.15	0.40 ± 0.15
QR1206	3.05 ± 0.10	1.60 ± 0.10	0.55 ± 0.15	0.40 ± 0.20	0.50 ± 0.20
QR1210	3.05 ± 0.10	2.50 ± 0.15	0.55 ± 0.15	0.50 ± 0.20	0.50 ± 0.20
QR1812	4.50 ± 0.10	3.10 ± 0.15	0.55 ± 0.05	0.55 ± 0.20	0.70 ± 0.20
QR2010	5.00 ± 0.20	2.50 ± 0.15	0.55 ± 0.10	0.60 ± 0.20	0.60 ± 0.20
QR2512	6.30 ± 0.20	3.20 ± 0.15	0.55 ± 0.10	0.60 ± 0.20	0.60 ± 0.20



QR Series Automotive Thick Film Chip Resistor Product Specifications

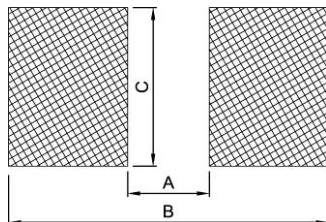
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General Information

Recommend Land Pattern Design



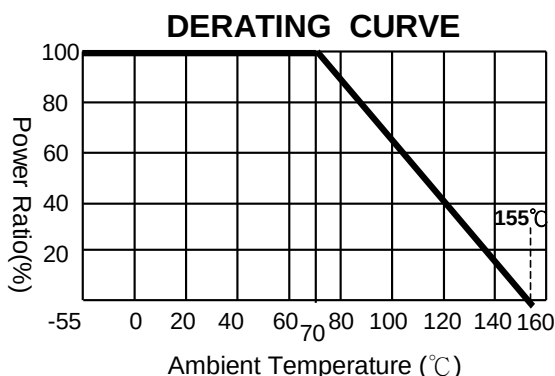
Dimension

Unit: mm

Type	0201	0402	0603	0805	1206	1210	1812	2010	2512
Item									
A	0.25	0.60	0.80	1.30	2.20	2.00	3.11	3.80	4.90
B	1.10	1.60	2.40	2.90	4.20	4.40	5.91	6.60	8.10
C	0.32	0.70	1.00	1.40	1.70	2.70	3.00	2.70	3.40

Performance Characteristics

Power Derating Curve



Power rating or current rating is in the case based on continuous full-load at ambient temperature of 70°C.

For operation at ambient temperature in excess of 70°C, the load should be derated in accordance with figure of derating Curve.

Voltage Rating or Current Rating

Resistance Range: $\geq 1\Omega$

Rated Voltage: The resistor shall have a DC continuous working voltage or a RMS AC continuous working voltage at commercial-line frequency and wave form corresponding to the power rating, as determined formula as following:

$$E(RCWV) = \sqrt{P \times R}$$

E=Rated voltage(V)

P=Power rating(W)

R=Nominal resistance(Ω)



QR Series Automotive Thick Film Chip Resistor Product Specifications

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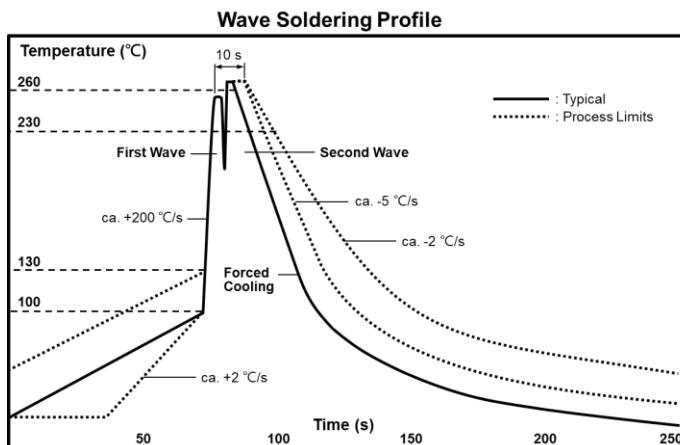
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● Reliability Test and Requirement

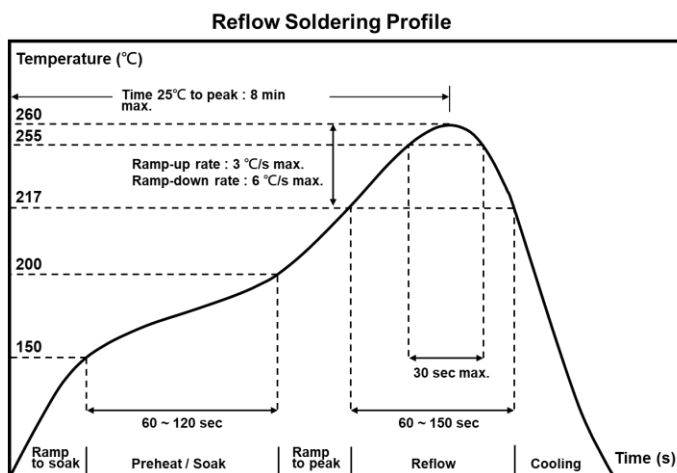
Test Item	Test Method	Procedure	Requirements
Temperature Coefficient of Resistance (T.C.R)	JIS-C-5201-1 4.8 IEC-60115-1 4.8	At 25°C / -55°C and 25°C / +155°C, 25°C is the reference temperature	As Spec
Short Time Overload	JIS-C-5201-1 4.13 IEC-60115-1 4.13	2.5 times RCWV or Max. Overload voltage whichever is less for 5 seconds.	$\pm 1 : \pm(1.0\%+0.05\Omega)$ $\pm 5 : \pm(2.0\%+0.1\Omega)$ Value $< 1\Omega : \pm(2.0\%+0.1\Omega)$
Leaching	JIS-C-5201-1 4.18 IEC-60068-2-58 8.2.1	260 $\pm$ 5°C for 30 seconds.	Individual leaching area $\leq 5\%$ Total leaching area $\leq 10\%$
Resistance to Soldering Heat	JIS-C-5201-1 4.18 IEC-60115-1 4.18	260 $\pm$ 5°C for 10 seconds.	$\pm 1 : \pm(0.5\%+0.05\Omega)$ $\pm 5 : \pm(1.0\%+0.05\Omega)$ Value $< 1\Omega : \pm(1.0\%+0.05\Omega)$
Insulation Resistance	JIS-C-5201-1 4.6 IEC-60115-1 4.6	Apply 100VDC for 1 minute.	$\geq 10G\Omega$
Temperature Cycling	JESD22 Method JA-104	1000 Cycles (-55°C to +125°C) Measurement at 24 $\pm$ 4 hours after test conclusion. 30min maximum dwell time at each temperature extreme.	1% : $\pm(0.5\%+0.05\Omega)$ 5% : $\pm(1.0\%+0.10\Omega)$
Resistance to Solvent	MIL-STD-202 Method 215	Add Aqueous wash chemical - OKEM Clean or equivalent.	1% : $\pm(0.5\%+0.05\Omega)$ 5% : $\pm(0.5\%+0.05\Omega)$
Biased Humidity	MIL-STD-202 Method 103	1,000 hours; 85°C / 85% RH, 10% of operating power. Measurement at 24 $\pm$ 4 hours after test conclusion.	1% : $\pm(1.0\%+0.05\Omega)$ 5% : $\pm(3.0\%+0.05\Omega)$
High Temperature Exposure (Storage)	MIL-STD-202 Method 108	1000 hrs. @ T=155°C. Unpowered. Measurement at 24 $\pm$ 4 hours after test conclusion.	1% : $\pm(0.5\%+0.05\Omega)$ 5% : $\pm(2.0\%+0.05\Omega)$
Operational Life	MIL-STD-202 Method 108	Condition D Steady State TA=125°C at derated power. Measurement at 24 $\pm$ 4 hours after test conclusion.	1% : $\pm(1.0\%+0.05\Omega)$ 5% : $\pm(3.0\%+0.10\Omega)$
External Visual	MIL-STD-883 Method 2009	Electrical test not required. Inspect device construction, marking and workmanship.	—
Mechanical Shock	MIL-STD-202 Method 213	Wave Form : Tolerance for half sine shock pulse. Peak value is 100g's. Normal duration(D) is 6(ms)	$\pm 1 : \pm(1.0\%+0.05\Omega)$ $\pm 5 : \pm(2.0\%+0.1\Omega)$
Vibration	MIL-STD-202 Method 204	5 g's for 20 min., 12 cycles each of 3 orientations. Note: Test from 10-2000 Hz	$\pm 1 : \pm(1.0\%+0.05\Omega)$ $\pm 5 : \pm(2.0\%+0.1\Omega)$
ESD	AEC-Q200- 002 or ISO/DIS 10605	Human body model 0402 / 0603 : 1KV 0805 and above : 2KV	$\pm(3\%+0.05\Omega)$
Solderability	J-STD-002	(1) 4 hrs 155°C dry heat (2) 245 $\pm$ 5°C 3 sec.	$\pm 1 : \pm(0.5\%+0.05\Omega)$ $\pm 5 : \pm(1.0\%+0.05\Omega)$
Terminal Strength (SMD)	AEC Q200-006	Pressurizing force for 60 seconds 0402 / 0603 : 8N ; 0805 and above : 17.7N	No broken
Board Flex	AEC Q200-005	Bending once for 60 seconds 2010, 2512 sizes: 2mm Other sizes: 3mm	$\pm 1 : \pm(1.0\%+0.05\Omega)$ $\pm 5 : \pm(1.0\%+0.05\Omega)$

■ Recommended Customer Soldering Parameters

■ Wave solder Temperature condition



■ Solder reflow Temperature condition



■ Rework temperature (hot air equipment) : 350°C, 3~5seconds

■ Recommended reflow methods

IR, vapor phase oven, hot air oven

If reflow temperatures exceed the recommended profile, devices may not meet the performance requirements.

■ Guaranteed plating thickness

Plating Nickel $\geq 2\mu\text{m}$

Plating Tin $\geq 3\mu\text{m}$

(Matte Tin)



QR Series Automotive Thick Film Chip Resistor Product Specifications

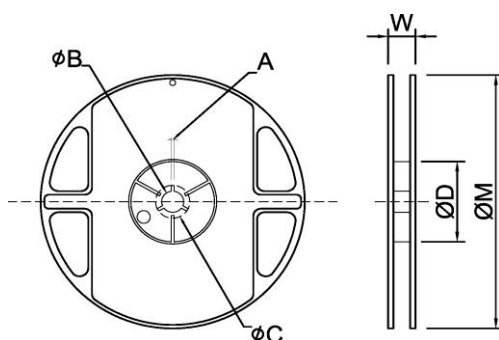
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■ Appendix For SMD Chip Resistor

● Packaging Information

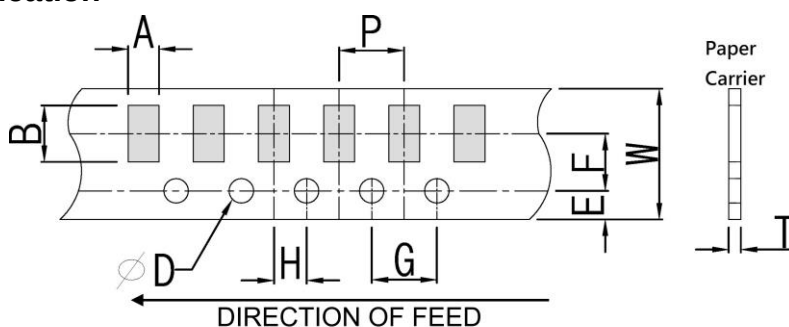


■ Dimension

Unit: mm

Type	Size	A	φB	φC	φD	W	φM
0402	7"	10K/Reel	2.0±0.5	13.5±1.0	21±1.0	60±1.0	178±2.0
	13"	40K/50K Reel	2.0±0.5	13.5±1.0	21±1.0	100±1.0	330±2.0
0603/0805/1206/1210	7"	5K/Reel	2.0±0.5	13.5±1.0	21±1.0	60±1.0	178±2.0
0603/0805/1206	10"	10K/Reel	2.0±0.5	13.5±1.0	21±1.0	100±1.0	254±2.0
	13"	20K/Reel	2.0±0.5	13.5±1.0	21±1.0	100±1.0	330±2.0
2010/2512/1812	7"	4K/Reel	2.0±0.5	13.5±1.0	21±1.0	60±1.0	178±2.0

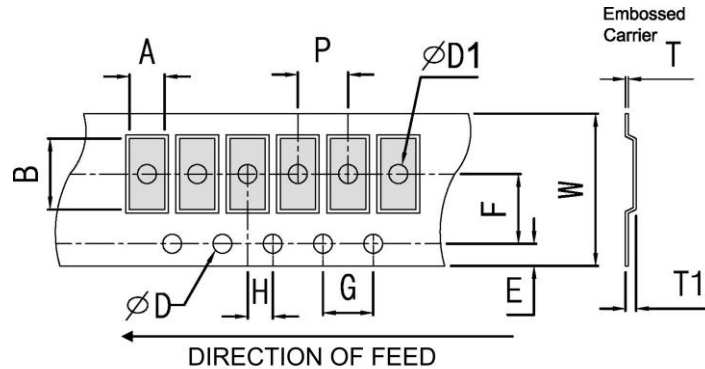
■ Tapping Specification



■ Dimension

Unit: mm

Packaging	Type	A	B	W	E	F	G	H	T	φD	P
Paper Type	0402	0.70±0.1	1.20±0.1	8.0±0.2	1.75±0.1	3.5±0.05	4.0±0.1	2.0±0.05	0.45±0.1	1.50 ^{+0.10} ₋₀	2.0±0.1
	0603	1.05±0.2	1.80±0.2	8.0±0.2	1.75±0.1	3.5±0.05	4.0±0.1	2.0±0.05	0.60±0.1		4.0±0.1
	0805	1.55±0.2	2.30±0.2	8.0±0.2	1.75±0.1	3.5±0.05	4.0±0.1	2.0±0.05	0.75±0.1		
	1206	1.90±0.2	3.50±0.2	8.0±0.2	1.75±0.1	3.5±0.05	4.0±0.1	2.0±0.05	0.75±0.1		
	1210	2.85±0.2	3.50±0.2	8.0±0.2	1.75±0.1	3.5±0.05	4.0±0.1	2.0±0.05	0.75±0.1		



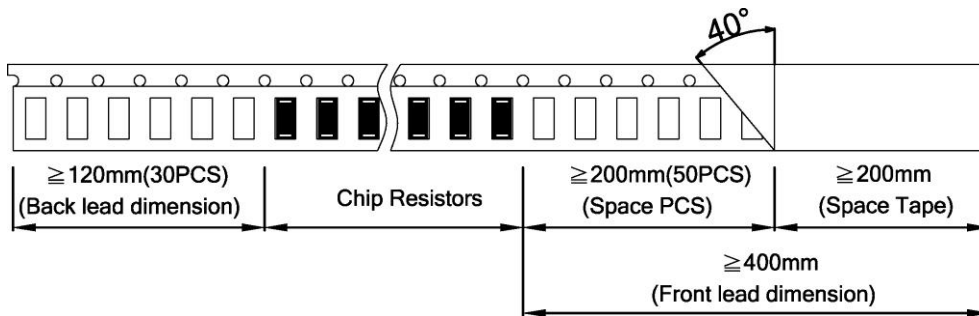
Dimension

Unit: mm

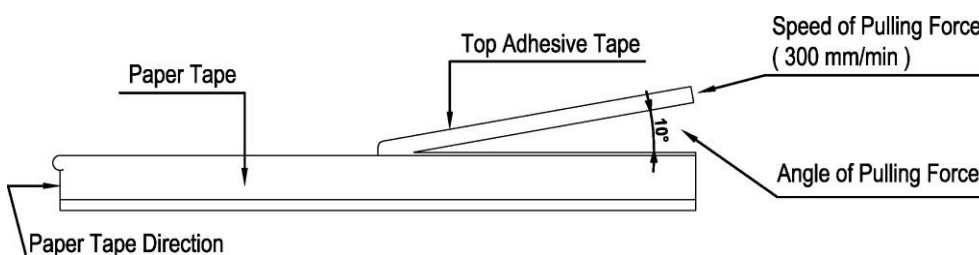
Packaging	Type	A	B	W	E	F	G	H	T	ΦD	ΦD1	T1	P
Embossed Type	2010	2.80±0.2	5.60±0.2	12±0.1	1.75±0.1	5.5±0.05	4.0±0.1	2.0±0.05	0.23±0.1	1.50 ^{+0.10} ₋₀	1.50±0.1	0.85±0.15	4.0±0.1
	2512	3.40±0.2	6.70±0.2	12±0.1	1.75±0.1	5.5±0.05	4.0±0.1	2.0±0.05	0.23±0.1		1.50±0.1	0.85±0.15	
	1812	3.30±0.2	4.60±0.2	12±0.1	1.75±0.1	5.5±0.05	4.0±0.1	2.0±0.05	0.23±0.1		1.50±0.1	0.85±0.15	

Packing Material Data/Storage Data

Front & Back Lead Dimension



Top Adhesive Peel Off Strength : 10~70g



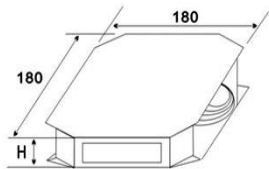


QR Series Automotive Thick Film Chip
Resistor Product Specifications

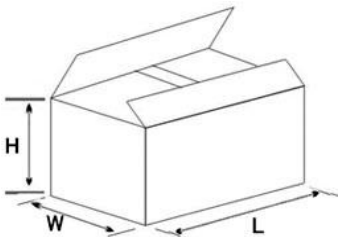
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■ Package

Inner Box Size	
Reel	Size H(mm)
1	13
2	24
3	36
5	60
10	113



External Box Size			
Contain (Kpcs)	Length (mm)	Width (mm)	Height (mm)
25K	180	180	60
50K	180	180	110
150K	430	200	200
300K	400	400	200



■ Storage Data :

Storage time at the environment temp: 25±5℃ & humidity: 60±20% is valid for two years.

■ Product Testing Method:

Our products are tested with our company's tapping & testing equipments by using four-feet probe to touch at the back of both electrodes. Supposed different testing points or methods are requested, please advise beforehand and customized-made production is available.