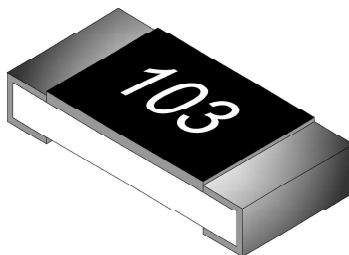




QRH Series Automotive High Power Chip Resistor Product Specifications

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■ Automotive High Power Chip Resistor — QRH 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 Compliance

■ Parts Number Explanation

■ Example:

QRH	2512	J	100R	E	04	Z
Product Type	Size (Inch)	Resistor Tolerance	Resistor Value	Package	Quantity	Optional
QRH	0402 0603 0805 1206 1210 1812 2010 2512	F : $\pm 1\%$ J : $\pm 5\%$	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 7 : TCR ± 200 ppm



QRH Series Automotive High Power Chip Resistor Product Specifications

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High Power Electrical Specifications

Item Type	Rated Power at 70°C	Max Working Voltage	Max Overload Voltage	T.C.R. (PPM/ °C)	Resistance Range	
					F(±1%)	J(±5%)
QRH0402	0.1W	50V	100V	±400	$1\Omega \leq R < 10\Omega$	
				±100	$10\Omega \leq R \leq 10M\Omega$	
QRH0603	0.125 W	75V	150V	±400	$1\Omega \leq R < 10\Omega$	
				±100	$10\Omega \leq R \leq 10M\Omega$	
QRH0805	0.25 W	150V	300V	±400	$1\Omega \leq R < 10\Omega$	
				±100	$10\Omega \leq R \leq 10M\Omega$	
QRH1206	0.5 W	200V	400V	±400	$1\Omega \leq R < 10\Omega$	
				±100	$10\Omega \leq R \leq 10M\Omega$	
QRH1210	0.66 W			±400	$1\Omega \leq R < 10\Omega$	
				±100	$10\Omega \leq R \leq 10M\Omega$	
QRH1812	1 W			±400	$1\Omega \leq R < 10\Omega$	
				±100	$10\Omega \leq R \leq 10M\Omega$	
QRH2010	1 W			±400	$1\Omega \leq R < 10\Omega$	
				±100	$10\Omega \leq R \leq 10M\Omega$	
QRH2512	2 W			±400	$1\Omega \leq R < 10\Omega$	
				±100	$10\Omega \leq R \leq 10M\Omega$	

- For non-standard parts, please contact our sales dept.
- Operating Temperature Range : -55°C ~ +155°C.
- Type QRH0402/0603/0805/1206/1210/1812/2010/2512 $1\Omega \leq R < 10\Omega$ optional code 「7」 is TCR: ±200PPM

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



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● Automotive High Power Low Ohm Chip Resistor

■ Automotive High Power 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%)
QRH0402		0.1W	0.15~0.31V	0.786V	±1000	220 ≤ R ≤ 450
					±800	450 < R < 1000
QRH0603		0.125W	0.1~0.35V	0.879V	±1000	75 ≤ R < 100
					±800	100 ≤ R ≤ 330
					±600	330 < R < 1000
QRH0805		0.25W	0.05~0.5V	1.244V	±1800	10 ≤ R < 50
					±800	50 ≤ R < 100
					±600	100 ≤ R < 1000
QRH1206		0.5W	0.07~0.7V	1.759V	±1800	10 ≤ R < 50
					±800	50 ≤ R < 100
					±600	100 ≤ R < 1000
QRH1210		0.66W	0.08~0.81V	2.021V	±1800	10 ≤ R < 50
					±800	50 ≤ R < 100
					±600	100 ≤ R < 1000
QRH1812		1W	0.1~0.99V	2.487V	±1800	10 ≤ R < 50
					±800	50 ≤ R < 100
					±600	100 ≤ R < 1000
QRH2010		1W	0.1~0.99V	2.487V	±1800	10 ≤ R < 50
					±800	50 ≤ R < 100
					±600	100 ≤ R < 1000
QRH2512		2W	0.14~1.41V	3.518V	±1800	10 ≤ R < 50
					±800	50 ≤ R < 100
					±600	100 ≤ R < 1000

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

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



QRH Series Automotive High Power Chip Resistor Product Specifications

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- Automotive High Power High Ohm Chip Resistor
- Automotive High Power Electrical Specifications

Item Type	Rated Power at 70°C	Max Working Voltage	Max Overload Voltage	T.C.R. (PPM/ °C)	Resistance Range	
					F(±1%)	J(±5%)
QRH0402	0.1W	50V	100V	±200	10.1 MΩ ~ 30 MΩ	10.1 MΩ ~ 30 MΩ
QRH0603	0.125 W	75V	150V			
QRH0805	0.25 W	150V	300V			
QRH1206	0.5 W	200V	400V			
QRH1210	0.66 W					
QRH2010	1 W					
QRH2512	2 W					

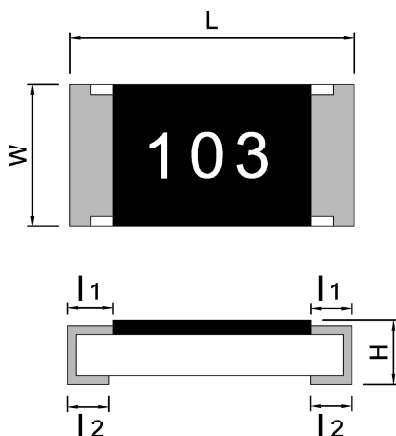
- For non-standard parts, please contact our sales dept.
- Operating Temperature Range : -55°C ~ +155°C.



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■ Type Dimension



QRH0402 / QRH0603 / QRH0805 / QRH1206 / QRH1210 / QRH1812 / QRH2010 / QRH2512

■ Dimension

Unit: mm

TYPE	L	W	H	l_1	l_2
QRH0402	1.00 ± 0.10	0.50 ± 0.05	0.30 ± 0.05	0.15 ± 0.10	0.20 ± 0.10
QRH0603	1.60 ± 0.20	0.80 ± 0.15	0.40 ± 0.10	0.30 ± 0.20	0.30 ± 0.10
QRH0805	2.00 ± 0.20	1.25 ± 0.15	0.50 ± 0.15	0.30 ± 0.15	0.40 ± 0.15
QRH1206	3.05 ± 0.10	1.60 ± 0.20	0.55 ± 0.15	0.40 ± 0.20	0.50 ± 0.20
QRH1210	3.05 ± 0.10	2.50 ± 0.20	0.55 ± 0.15	0.50 ± 0.20	0.50 ± 0.20
QRH1812	4.50 ± 0.10	3.10 ± 0.20	0.55 ± 0.05	0.55 ± 0.20	0.70 ± 0.20
QRH2010	5.00 ± 0.20	2.50 ± 0.20	0.55 ± 0.10	0.60 ± 0.20	0.60 ± 0.20
QRH2512	6.30 ± 0.20	3.20 ± 0.20	0.55 ± 0.10	0.60 ± 0.20	0.60 ± 0.20

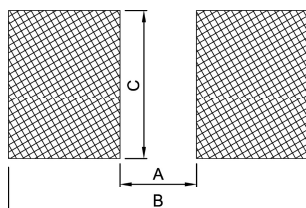


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● General Information

■ Recommend Land Pattern Design



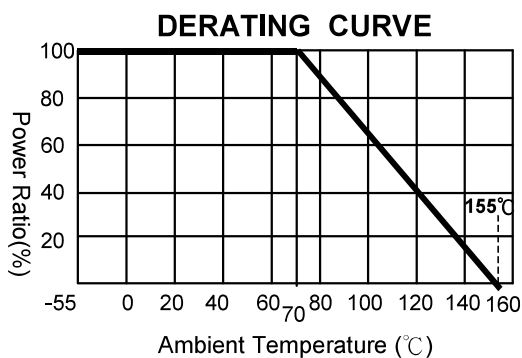
■ Dimension

Unit: mm

Type	0402	0603	0805	1206	1210	1812	2010	2512
A	0.60	0.80	1.30	2.20	2.00	3.11	3.80	4.90
B	1.60	2.40	2.90	4.20	4.40	5.91	6.60	8.10
C	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)



QRH Series Automotive High Power Chip Resistor Product Specifications

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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 / -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	High Power : 2.5 times RCWW or Max. Overload voltage whichever is less for 2 seconds.	±1 : ±(1.0%+0.05Ω) ±5 : ±(2.0%+0.1Ω) Value <1Ω : ±(2.0%+0.1Ω)
Leaching	JIS-C-5201-1 4.18 IEC-60068-2-58 8.2.1	260±5°C for 30 seconds.	>95% Coverage
Resistance to Soldering Heat	JIS-C-5201-1 4.18 IEC-60115-1 4.18	260±5°C for 10 seconds.	±1 : ±(0.5%+0.05Ω) ±5 : ±(1.0%+0.05Ω) Value <1Ω : ±(1.0%+0.05Ω)
Insulation Resistance	JIS-C-5201-1 4.6 IEC-60115-1 4.6	Apply 100VDC for 1 minute.	≥ 10GΩ
Temperature Cycling	JESD22 Method JA-104	1000 Cycles (-55°C to +125°C) Measurement at 24±4 hours after test conclusion. 30min maximum dwell time at each temperature extreme.	1% : ±(0.5%+0.05Ω) 5% : ±(1.0%+0.10Ω)
Resistance to Solvent	MIL-STD-202 Method 215	Add Aqueous wash chemical - OKEM Clean or equivalent.	1% : ±(0.5%+0.05Ω) 5% : ±(0.5%+0.05Ω)
Biased Humidity	MIL-STD-202 Method 103	1,000 hours; 85°C / 85% RH, 10% of operating power. Measurement at 24±4 hours after test conclusion.	1% : ±(1.0%+0.05Ω) 5% : ±(3.0%+0.05Ω)
High Temperature Exposure (Storage)	MIL-STD-202 Method 108	1000 hrs. @ T=125°C. Unpowered. Measurement at 24±4 hours after test conclusion.	1% : ±(0.5%+0.05Ω) 5% : ±(2.0%+0.05Ω)
Operational Life	MIL-STD-202 Method 108	Condition D Steady State TA=125°C at derated power. Measurement at 24±4 hours after test conclusion.	1% : ±(1.0%+0.05Ω) 5% : ±(3.0%+0.10Ω)
External Visual	MIL-STD-883 Method 2009	Electrical test not required. Inspect device construction, marking and workmanship.	—
Mechanical Shock	MIL-STD-202 Method 213	)Test ½ Sine Pulse, Peak value: 100g, normal duration: 6ms, Velocity change: 12.3ft/sec. 10 shocks in each direction, total 30 shocks.	±1 : ±(1.0%+0.05Ω) ±5 : ±(2.0%+0.1Ω)
Vibration	MIL-STD-202 Method 204	5 g's for 20 min., 12 cycles each of 3 orientations. Note: Test from 10-2000 H	±1 : ±(1.0%+0.05Ω) ±5 : ±(2.0%+0.1Ω)
ESD	AEC-Q200-002 or ISO/DIS 10605	Human body model 0402 / 0603 : 1KV 0805 and above : 2KV	±(3%+0.05Ω)
Solderability	J-STD-002	(1) 4 hrs 155°C dry heat (2) 245±5°C 3 sec.	±1 : ±(0.5%+0.05Ω) ±5 : ±(1.0%+0.05Ω)
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	Beading once for 60 seconds 2010, 2512 sizes: 2mm Other sizes: 3mm	±1 : ±(1.0%+0.05Ω) ±5 : ±(1.0%+0.05Ω)

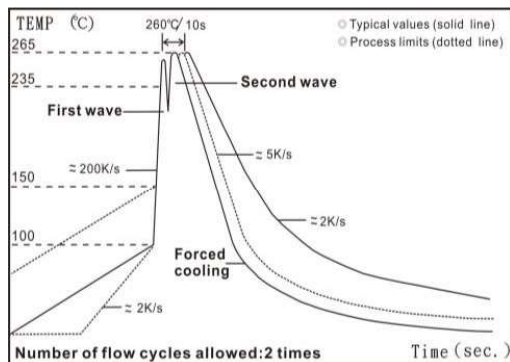


QRH Series Automotive High Power Chip Resistor Product Specifications

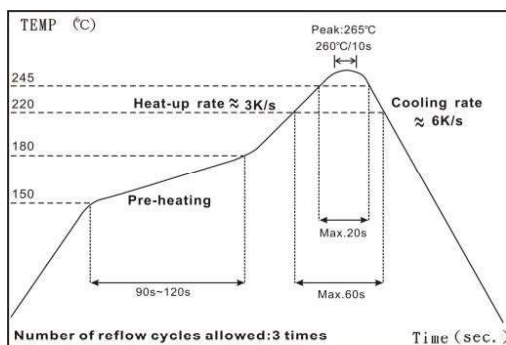
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■ Recommended Customer Soldering Parameters

■ 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.

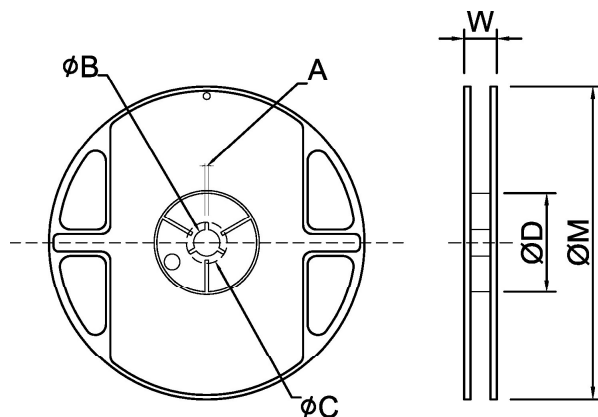


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■ Appendix For SMD Chip Resistor

● Packaging Information



■ Dimension

Unit:mm

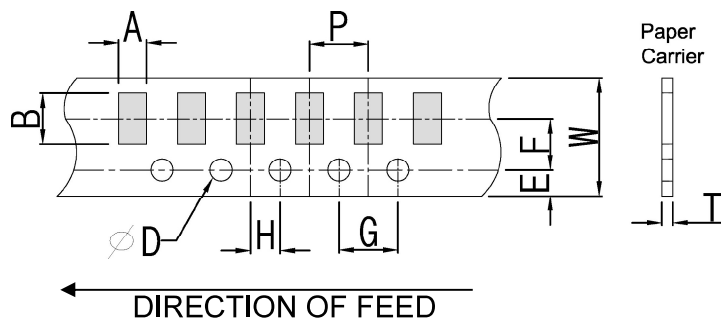
TYPE	SIZE		A	φB	φC	φD	W	φM
0402	7"	10K/Reel	2.0±0.5	13.5±1.0	21±1.0	60±1.0	11.5±2.0	178±2.0
	13"	40K/50K Reel	2.0±0.5	13.5±1.0	21±1.0	100±1.0	11.5±2.0	330±2.0
0603/0805/1206/1210	7"	5K/Reel	2.0±0.5	13.5±1.0	21±1.0	60±1.0	11.5±2.0	178±2.0
0603/0805 /1206	10"	10K/Reel	2.0±0.5	13.5±1.0	21±1.0	100±1.0	11.5±2.0	254±2.0
	13"	20K/Reel	2.0±0.5	13.5±1.0	21±1.0	100±1.0	11.5±2.0	330±2.0
2010/2512/1812	7"	4K/Reel	2.0±0.5	13.5±1.0	21±1.0	60±1.0	16.0±2.0	178±2.0



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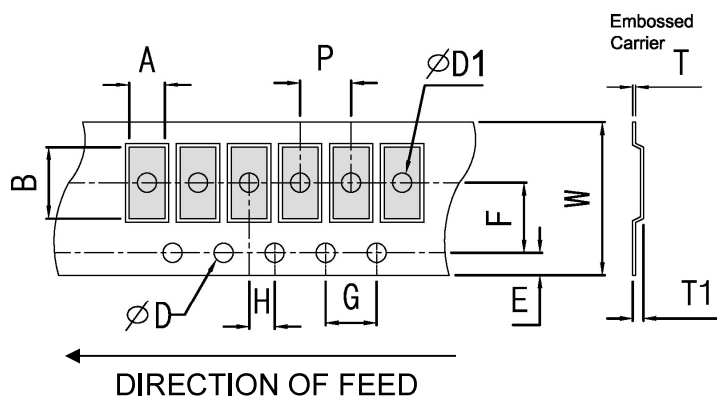
■ Tapping Specification



■ Dimension

Unit:mm

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



■ Dimension

Unit:mm

Packaging	Type	A	B	W	E	F	G	H	T	ϕD	$\phi D1$	T1	P
Embossed Type	2010	2.80 $\pm$ 0.2	5.60 $\pm$ 0.2	12 $\pm$ 0.1	1.75 $\pm$ 0.1	5.5 $\pm$ 0.05	4.0 $\pm$ 0.1	2.0 $\pm$ 0.05	0.23 $\pm$ 0.1	1.50 ^{+0.10} ₋₀	1.50 $\pm$ 0.1	0.85 $\pm$ 0.15	4.0 $\pm$ 0.1
	2512	3.40 $\pm$ 0.2	6.70 $\pm$ 0.2	12 $\pm$ 0.1	1.75 $\pm$ 0.1	5.5 $\pm$ 0.05	4.0 $\pm$ 0.1	2.0 $\pm$ 0.05	0.23 $\pm$ 0.1		1.50 $\pm$ 0.1	0.85 $\pm$ 0.15	
	1812	3.30 $\pm$ 0.2	4.60 $\pm$ 0.2	12 $\pm$ 0.1	1.75 $\pm$ 0.1	5.5 $\pm$ 0.05	4.0 $\pm$ 0.1	2.0 $\pm$ 0.05	0.23 $\pm$ 0.1		1.50 $\pm$ 0.1	0.85 $\pm$ 0.15	

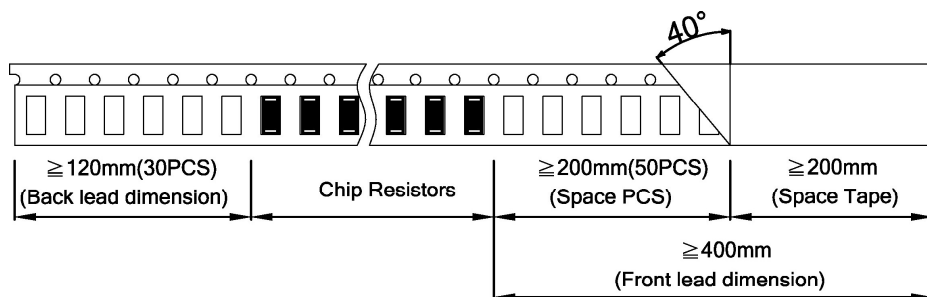


QRH Series Automotive High Power Chip Resistor Product Specifications

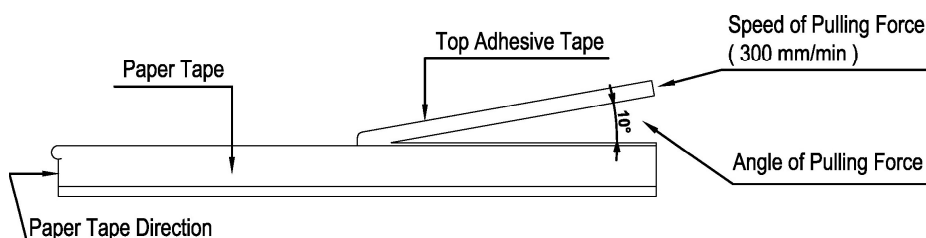
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■ Packing Material Data/Storage Data

■ Front & Back Lead Dimension

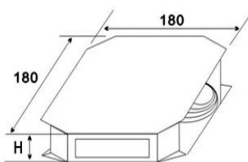


■ Top Adhesive Peel Off Strength : 10~70g

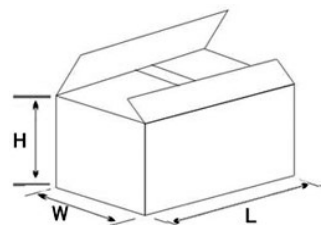


■ Package

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: $25\pm 5^{\circ}\text{C}$ & humidity: $60\pm 20\%$ is valid for one year from the date of delivery.

■ 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.



QRH Series Automotive High Power Chip Resistor Product Specifications

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■ mΩ Resistance Codes



0402: no marking



0603: 3 digits



0805~2512: 4 digits

■ 0402 : No marking

■ 0603 : 3 digit marking

1. For E-24 values:

Resistance value	Code	Example
10mΩ ~ 99mΩ	0XX	068 = 68mΩ
100mΩ ~ 990mΩ	RXX	R68 = 680mΩ

E-24	10	11	12	13	15	16	18	20	22	24	27	30	33	36	39	43	47	51	56	62	68	75	82	91
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2. For E-96 values: excluding values 10/11/13/15/20/75 of E-24 series.

● Standard E-96 Values and 0603 Resistance Codes

R-Value	100	102	105	107	110	113	115	118	121	124	127	130	133	137	140	143	147	150	154	158	162	165	169	174
Code	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
R-Value	178	182	187	191	196	200	205	210	215	221	226	232	237	243	249	255	261	267	274	280	287	294	301	309
Code	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48
R-Value	316	324	332	340	348	357	365	374	383	392	402	412	422	432	442	453	464	475	487	499	511	523	536	549
Code	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72
R-Value	562	576	590	604	619	634	649	665	681	698	715	732	750	768	787	806	825	845	866	887	909	931	953	976
Code	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96

● E-96 Multiplier Code

Code	A	B	C	D	E	F	G	H	X	Y	Z
Multiplier	10 ⁰	10 ¹	10 ²	10 ³	10 ⁴	10 ⁵	10 ⁶	10 ⁷	10 ⁻¹	10 ⁻²	10 ⁻³

0603 3 digits coding formula for E-96 values as following:

CODING FORMULA

XX X
↑ ↙
Resistance Code Multiplier Code

Example: 499 mΩ = 499 x 10⁻³ Ω = **68Z**
68 Z