



**UNI-ROYAL**  
厚聲集團

# DATA SHEET

**Product Name** Automotive High Power Thick Film Chip Resistors

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**Part Name** HQ Series

## **Uniroyal Electronics Global Co., Ltd.**

88#, Longteng Road, Economic & Technical Development Zone, Kunshan, Jiangsu, China

Tel +86 512 5763 1411 / 22 /33

Email [marketing@uni-royal.cn](mailto:marketing@uni-royal.cn)

Manufacture Plant Uniroyal Electronics Industry Co., Ltd.

Aeon Technology Corporation

Royal Electronic Factory (Thailand) Co., Ltd.

Royal Technology (Thailand) Co., Ltd.

## 1. Scope

- 1.1 This specification for approve relates to the Automotive High Power Thick Film Chip Resistors manufactured by UNI-ROYAL.
- 1.2 Suitable for reflow & wave soldering
- 1.3 Application car

## 2. Part No. System

Part No. includes 14 codes shown as below:

2.1 1<sup>st</sup>~4<sup>th</sup> codes: Part name. E.g.: HQ02,HQ03,HQ05,HQ06,HQ07,HQ10,HQ12

2.2 5<sup>th</sup>~6<sup>th</sup> codes: Power rating.

E.g.: W=Normal Size		"1~G" = "1~16"								
Wattage	1/32	3/4	1/2	1/3	1/4	1/8	1/10	1/16	1/20	1
Normal Size	WH	07	W2	W3	W4	W8	WA	WG	WM	1W

If power rating is equal or lower than 1 watt, 5<sup>th</sup> code would be "W" and 6<sup>th</sup> code would be a number or letter.

E.g.: WA=1/10W                      W4=1/4W

2.3 7<sup>th</sup> code: Tolerance. E.g.: D=±0.5%      F=±1%                      G=±2%                      J=±5%                      K= ±10%

2.4 8<sup>th</sup>~11<sup>th</sup> codes: Resistance Value.

2.4.1 If value belongs to standard value of E-24 series, the 8<sup>th</sup> code is zero, 9<sup>th</sup>~10<sup>th</sup> codes are the significant figures of resistance value, and the 11<sup>th</sup> code is the power of ten.

2.4.2 If value belongs to standard value of E-96 series, the 8<sup>th</sup>~10<sup>th</sup> codes are the significant figures of resistance value, and the 11<sup>th</sup> code is the power of ten.

2.4.3 11<sup>th</sup> codes listed as following:

0=10<sup>0</sup>    1=10<sup>1</sup>    2=10<sup>2</sup>    3=10<sup>3</sup>    4=10<sup>4</sup>    5=10<sup>5</sup>    6=10<sup>6</sup>    J=10<sup>-1</sup>    K=10<sup>-2</sup>    L=10<sup>-3</sup>    M=10<sup>-4</sup>

2.5 12<sup>th</sup>~14<sup>th</sup> codes.

2.5.1 12<sup>th</sup> code: Packaging Type. E.g.: C=Bulk                      T=Tape/Reel

2.5.2 13<sup>th</sup> code: Standard Packing Quantity.

4=4,000pcs    5=5,000pcs    C=10,000pcs    D=20,000pcs    E=15,000pcs

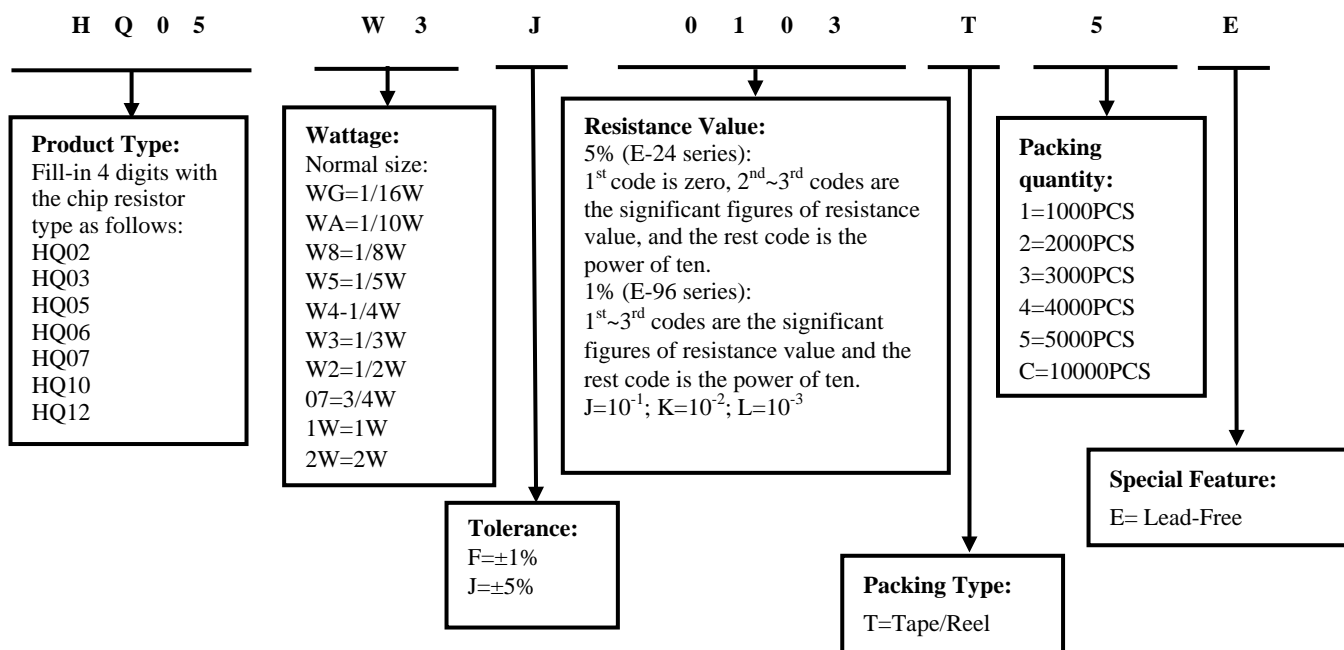
Chip Product: BD=B/B-20000pcs    TC=T/R-10000pcs

2.5.3 14<sup>th</sup> code: Special features.

E = Environmental Protection, Lead Free, or Standard type.

## 3. Ordering Procedure

(Example: HQ05 1/3W ±5% 10KΩ T/R-5000)



**4. Marking**

4.1 For HQ02 size. Due to the very small size of the resistor's body, there is no marking on the body.



4.2 Normally, the marking of 0Ω HQ03, 0Ω HQ05, 0Ω HQ06, 0Ω HQ07, 0Ω HQ10, 0Ω HQ12 resistors as following



4.3 ±5% tolerance products (E-24 series):  
 3 codes.  
 1<sup>st</sup>~2<sup>nd</sup> codes are the significant figures of resistance value, and the rest code is the power of ten.

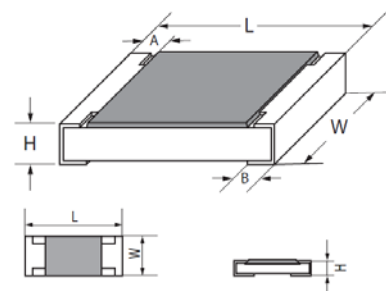


4.4 ±1% tolerance products (E-96 series):  
 4 codes.  
 1<sup>st</sup>~3<sup>rd</sup> codes are the significant figures of resistance value, and the rest code is the power of ten.  
 Letter "R" in mark means decimal point.



**5. Dimension**

Type	Dimension(mm)				
	L	W	H	A	B
HQ02(0402)	1.00±0.10	0.50±0.05	0.35±0.05	0.20±0.10	0.25±0.10
HQ03(0603)	1.60±0.10	0.80±0.10	0.45±0.10	0.30±0.20	0.30±0.20
HQ05(0805)	2.00±0.15	1.25+0.15/-0.10	0.55±0.10	0.40±0.20	0.40±0.20
HQ06(1206)	3.10±0.15	1.55+0.15/-0.10	0.55±0.10	0.45±0.20	0.45±0.20
HQ07(1210)	3.10±0.10	2.60±0.20	0.55±0.10	0.50±0.25	0.50±0.20
HQ10(2010)	5.00±0.10	2.50±0.20	0.55±0.10	0.60±0.25	0.50±0.20
HQ12(2512)	6.35±0.10	3.20±0.20	0.55±0.10	0.60±0.25	0.50±0.20



**6. Resistance Range**

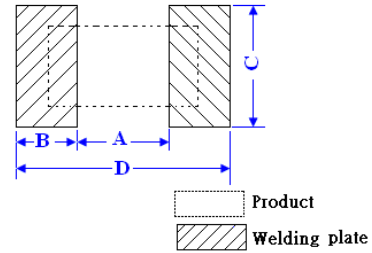
Type	Power Rating at 70°C	Power Rating at 125°C	Resistance Range	
			1.0%	5.0%
HQ02	1/10W	1/16W	1Ω~10M	1Ω~10M
HQ03	1/5W	1/10W	1Ω~10M	1Ω~10M
HQ05	1/3W	1/8W	1Ω~10M	1Ω~10M
HQ06	1/2W	1/4W	1Ω~10M	1Ω~10M
HQ07	3/4W	1/3W	1Ω~10M	1Ω~10M
HQ10	1W	3/4W	1Ω~10M	1Ω~10M
HQ12	2W	1W	1Ω~10M	1Ω~10M

**7. Ratings**

Type	Max. Working Voltage	Max. Overload Voltage	Dielectric withstanding Voltage	Resistance Value of Jumper	Rated Current of Jumper	Max. Overload Current of Jumper	Operating Temperature
HQ02	50V	100V	100V	<50mΩ	1A	2A	-55°C~155°C
HQ03	75V	100V	300V	<50mΩ	1A	2A	-55°C~155°C
HQ05	150V	300V	500V	<50mΩ	2A	5A	-55°C~155°C
HQ06	200V	400V	500V	<50mΩ	2A	10A	-55°C~155°C
HQ07	200V	500V	500V	<50mΩ	2A	10A	-55°C~155°C
HQ10	200V	500V	500V	<50mΩ	2A	10A	-55°C~155°C
HQ12	200V	500V	500V	<50mΩ	2A	10A	-55°C~155°C

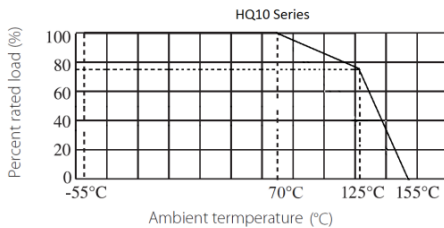
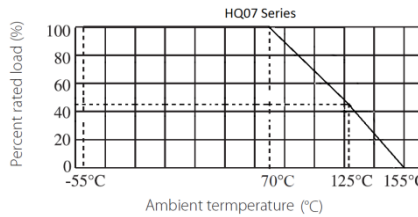
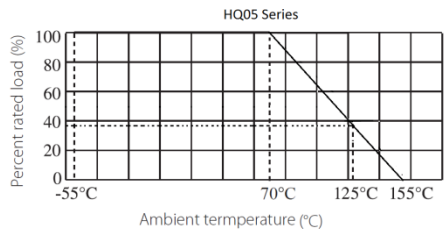
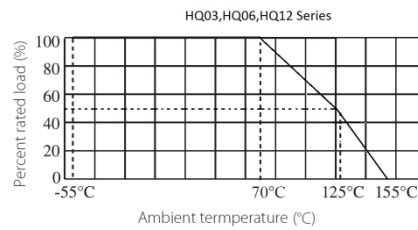
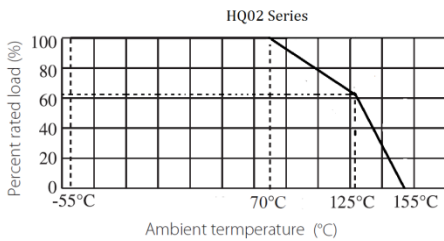
8. Soldering pad size recommended

Type	Dimension(mm)			
	A	B	C	D
HQ02	0.5±0.05	0.5±0.05	0.6±0.05	1.5±0.05
HQ03	0.8±0.05	0.8±0.05	0.9±0.05	2.4±0.05
HQ05	1.0±0.1	1±0.1	1.4±0.1	3±0.1
HQ06	2.0±0.1	1.1±0.1	1.8±0.1	4.2±0.1
HQ07	2.0±0.1	1.1±0.1	2.9±0.1	4.2±0.1
HQ10	3.6±0.1	1.4±0.1	3±0.1	6.4±0.1
HQ12	4.9±0.1	1.35±0.1	3.7±0.1	7.6±0.1



9. Derating Curve

Power rating will change based on continuous load at ambient temperature from -55 to 155°C. It is constant between -55 to 70°C or 125°C, and derate to zero when temperature rise from 70°C or 125°C to 155°C.



Voltage rating:

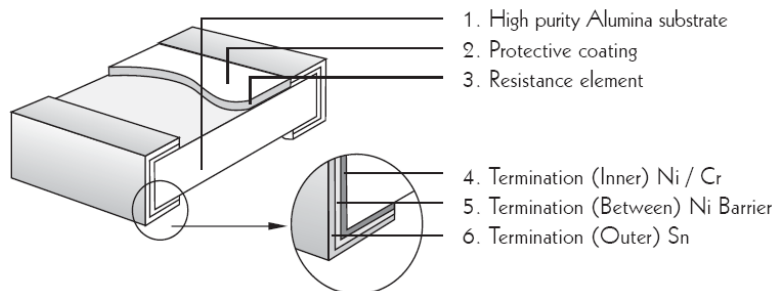
Resistors shall have a rated direct-current (DC) continuous working voltage or an approximate sine-wave root-mean-square (RMS) alternating-current (AC) continuous working voltage at commercial-line frequency and waveform corresponding to the power rating, as determined from the following formula:

$$RCWV = \sqrt{P \times R}$$

Remark: RCWV: Rating Continuous Working Voltage (Volt.) P: power rating (Watt) R: nominal resistance (Ω)

In no case, the rated DC or RMS AC continuous working voltage must be greater than the applicable maximum value. The overload voltage is 2.5 times RCWV or Max. Overload voltage whichever is lower.

10. Structure



## 11. Performance Specification

Characteristic	Limits	Ref. Standards	Test Method
Operational life	±5%: ±(3.0%+0.1Ω) ±1%: ±(1.0%+0.1Ω)	MIL-STD-202 Method 108	70°C or 125°C of operating power, 1000H (1.5 hours "ON", 0.5 hour "OFF"). Note: Power Rating Refer to item 6.
	<100mΩ		Apply to rate current for 0 Ω
Electrical Characterization	1Ω<R≤10Ω : ±200PPM/°C 10Ω<R≤10MΩ : ±100PPM/°C	User Spec	Parametrically test per lot and sample size requirements, summary to show Min, Max, Mean and Standard deviation at room as well as Min and Max operating temperatures.
Short-time overload	±1%: ±(1.0%+0.05Ω) ±5%: ±(2.0%+0.05Ω)	JIS-C-5201	4.13 Permanent resistance change after the application of a potential of 2.5 times RCWV or Max. Overload Voltage whichever less for 5 seconds..
External Visual	No Mechanical Damage	MIL-STD-883 Method 2009	Electrical test not required. Inspect device construction, marking and workmanship
Physical Dimension	Reference 5. Dimension Standards	JESD22 MH Method JB-100	Verify physical dimensions to the applicable device detail specification. Note: User(s) and Suppliers spec. Electrical test not required.
Resistance to Solvent	Marking Unsmearred	MIL-STD-202 Method 215	Note: Add Aqueous wash chemical – OKEM Clean or equivalent. Do not use banned solvents.
Terminal Strength	Not broken	JIS-C-6429	Force of 1.8kg for 60 seconds.
High Temperature Exposure (Storage)	±(1.0%+0.1Ω)	MIL-STD-202 Method 108	1000hrs. @T=155°C.Unpowered. Measurement at 24±2 hours after test conclusion.
	<50mΩ		Apply to rate current for 0 Ω
Temperature Cycling	±(1.0%+0.1Ω)	JESD22 Method JA-104	1000 Cycles (-55°C to +155°C). Measurement at 24±2 hours after test conclusion.
	<50mΩ		Apply to rate current for 0 Ω
Biased Humidity	±5%: ±(3.0%+0.05Ω) ±1%: ±(1.0%+0.05Ω)	MIL-STD-202 Method 103	1000 hours 85°C,85%RH. Note: Specified conditions: 10% of operating power. Measurement at 24±2 hours after test conclusion.
	<100mΩ		Apply to rate current for 0 Ω
Mechanical Shock	±(1.0%+0.1Ω)	MIL-STD-202 Method 213	Wave Form: Tolerance for half sine shock pulse. Peak value is 100g's. Normal duration (D) is 6.
Vibration	±(1.0%+0.1Ω)	MIL-STD-202 Method 204	5g's for 20 min., 12cycle each of 3 orientations. Note: Use 8"*5"PCB. 031" thick 7 secure points on one long side and 2 secure points at corners of opposite sides. Parts mounted within 2' from any secure point. Test from 10-2000Hz.
ESD	±(1.0%+0.1Ω)	AEC-Q200-002	Test condition: HQ02: 0.5KV; HQ03: 1KV; HQ05:2KV; HQ06: 3KV; HQ07、HQ10、HQ12: 5KV
Soldrability	Coverage must be over 95%.	J-STD-002	For both leaded & SMD. Electrical test not required. Magnification 50X. Conditions: a) Method B 4hrs at 155°C dry heat, the dip in bath with 245°C,5s. b) Method D: at 260°C, 60s.
Flammability	No ignition of the tissue paper or scorching or the pinewood board	UL-94	V-0 or V-1 are acceptable. Electrical test not required.

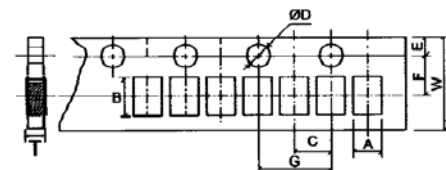
Board Flex	$\pm(1.0\%+0.05\Omega)$	JIS-C-6429	2mm (Min)
	$<50m\Omega$		Apply to rate current for 0 $\Omega$
Flame Retardance	No flame	AEC-Q200-001	Only requested, when voltage/power will increase the surface temp to 350°C. Apply voltage from 9V to 32V. No flame; No explosion.
Resistance to Soldering Heat	$\pm(1.0\%+0.05\Omega)$	MIL-STD-202 Method 210	Condition B No per-heat of samples. Note: Single Wave Solder-Procedure 2 for SMD and Procedure 1 for Leaded with solder within 1.5mm of device body.
	$<50m\Omega$		Apply to rate current for 0 $\Omega$
Sulfuration test	$\pm(1.0\%+0.05\Omega)$	ASTM B-809-95	sulfur(saturated vapor) , Temperature: 50±2 °C H 86 ~ 90%RH, 1000H .

Sulfuration test : H<sub>2</sub>S 3~5PPM 50 °C± °C 91%RH±0.5% (1000H) ; ±1%:(1.0%+0.05Ω)

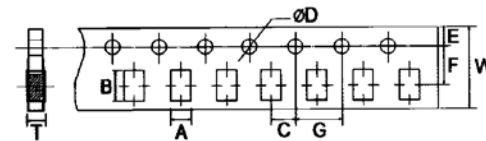
**12. Packing**

**12.1 Dimension of Paper Taping :(Unit: mm)**

Type	A	B	C	$\Phi D^{+0.1}$	E	F	G	W	T
HQ02	±0.1	±0.1	±0.05	±0.1	±0.1	±0.05	±0.1	±0.2	±0.05
HQ02	0.65	1.20	2.00	1.50	1.75	3.50	4.00	8.00	0.42

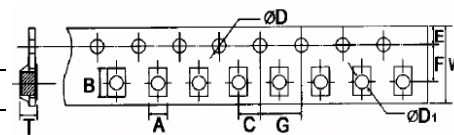


Type	A	B	C	$\Phi D^{+0.1}$	E	F	G	W	T
HQ03	±0.2	±0.2	±0.05	±0.1	±0.1	±0.05	±0.1	±0.2	±0.1
HQ03	1.10	1.90	2.0	1.5	1.75	3.5	4.0	8.0	0.67
HQ05	1.65	2.40	2.0	1.5	1.75	3.5	4.0	8.0	0.81
HQ06	2.00	3.60	2.0	1.5	1.75	3.5	4.0	8.0	0.81
HQ07	2.80	3.50	2.0	1.5	1.75	3.5	4.0	8.0	0.75



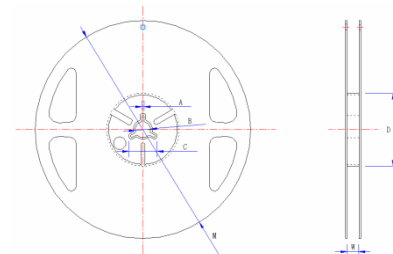
**12.2 Dimension of plastic taping: (Unit: mm)**

Type	A	B	C	$\Phi D^{+0.1}$	$\Phi D1^{+0.25}$	E	F	G	W	T
HQ10	±0.2	±0.2	±0.05	±0.1	±0.1	±0.1	±0.05	±0.1	±0.2	±0.1
HQ10	2.90	5.60	2.00	1.50	1.50	1.75	5.50	4.00	12.00	1.00
HQ12	3.50	6.70	2.00	1.50	1.50	1.75	5.50	4.00	12.00	1.00



**12.3 Dimension of Reel : (Unit: mm)**

Type	Taping	Qty/Reel	A±0.5	B±0.5	C±0.5	D±1	M±2	W±1
HQ02	Paper	10,000pcs	2.0	13.0	21.0	60.0	178.0	10.0
HQ03	Paper	5,000pcs	2.0	13.0	21.0	60.0	178.0	10.0
HQ05	Paper	5,000pcs	2.0	13.0	21.0	60.0	178.0	10.0
HQ06	Paper	5,000pcs	2.0	13.0	21.0	60.0	178.0	10.0
HQ07	Paper	5,000pcs	2.0	13.0	21.0	60.0	178.0	10.0
HQ10	Embossed	4,000pcs	2.0	13.0	21.0	60.0	178.0	13.8
HQ12	Embossed	4,000pcs	2.0	13.0	21.0	60.0	178.0	13.8



**13. Note**

- 13.1. UNI-ROYAL recommend products store in warehouse with temperature between 15 to 35°C under humidity between 25 to 75%RH. Even under storage conditions recommended above, solder ability of products will be degraded stored over 1 year old.
- 13.2. Cartons must be placed in correct direction which indicated on carton, otherwise the reel or wire will be deformed.
- 13.3. Storage conditions as below are inappropriate:
  - a. Stored in high electrostatic environment
  - b. Stored in direct sunshine, rain, snow or condensation.



## 14. Record

Version	Description	Page	Date	Amended by	Checked by
1	First version	1~7	Mar.20, 2018	Haiyan Chen	Nana Chen
2	1. Modify the product name 2. Modify the Power	1~7	Nov.22, 2018	Haiyan Chen	Nana Chen
3	Modify characteristic	5~6	Feb.16, 2019	Haiyan Chen	Yuhua Xu
4	Experimental method and standard for adding vulcanization	6	Mar.05, 2019	Haiyan Chen	Yuhua Xu
5	Modify the Power	4	May.23, 2019	Haiyan Chen	Yuhua Xu

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