ISO9001 ISO14001 IATF16949 CHILISIN ELECTRONICS CORP.

SPECIFICATION FOR APPROVAL

Customer：

Customer P/N:

Drawing No：

Quantity： **0** **Pcs.** **Date：** **2021/7/15**

Chilisin P/N： **ACTH Series**

Automotive Grade Resistor

Halogen Free
RoHS Compliant
REACH Compliant
Lead Free Solders
AEC-Q200

奇力新電子股份有限公司
Chilisin Electronics Corp
No. 29, Alley 301, Tehhsin Rd., Hukou,Hsinchu 303, Taiwan
TEL：+886-3- 599-2646
FAX：+886-3- 599-9176
E-mail：sales@chilisin.com
http：//www.chilisin.com

東莞奇力新電子(東莞廠)有限公司
Chilisin Electronics (Dongguan) Co., Ltd.
No. 78, Puxing Rd., Yuliangwei Administration Area, Qingxi Town, Dongguan City, Guangdong,China
TEL：+86-769-8773-0251~3
FAX： +86-769-8773-0232
E-mail：cect@chilisin.com

奇力新電子(越南廠)有限公司
Chilisin Electronics (Vietnam) Limited
No 143 - 145, Road No 10, VSIP Hai Phong, Lap Le Commune, Thuy Nguyen Dist, Haiphong City, Vietnam

奇力新電子(湖南廠)有限公司
HuNan Chilisin Electronics Technology Co., Ltd
No. 8, Shaziao Liangshuijing Town, Yuanling County, Huaihua City, Hunan Province 419601, China
Tel：86-745-867-5882

Drawn by	Checked by	Approved by
Desmond.Wu	**Cf.Hsieh**	**Wl.Liu**

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ACTH Series Specification

1 Scope:

1-1 This specification is applicable to lead free and halogen free of ROHS directive for ACTH series high power thick film chip resistors.

1-2 This product is for automotive electronic application.

1-3 AEC-Q200 qualified , grade 0.

2 Part Numbering:

A C T H	0 0	1 2 0 6	-	4 R 7 x	J	T P
Series	**Internal Code**	**Dimension (inch)**		**Resistance Value**	**Tolerance**	**Taping Code**
ACTH: High Power Thick Film Chip Resistors		0402 0603 0805 1206 1210 2010 2512		**J Tol 3 digit + X:** Ex. 10Ω = 100 4.7Ω=4R7 **F /D Tol 4 digit:** 10.2Ω=10R2 10KΩ=1002 0.10Ω=R100 0.33Ω=R330 0.56Ω=R560	B = ± 0.1% D = ± 0.5% F = ± 1% J = ± 5%	TH 10,000pcs/reel: 0402 TP 5,000pcs/reel: 0603, 0805, 1206,1210 TE 4,000pcs/reel: 2010, 2512

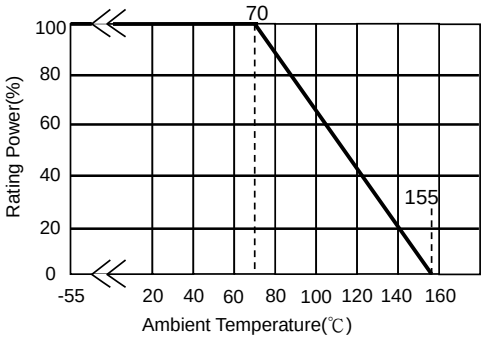
3 SPECIFICATIONS:

Type	Rated Power at 70℃	Max. Working Voltage	Max. Overload Voltage	T.C.R (ppm/℃)	Resistance Range			
					B(±0.1%) E-24、E-96	D(±0.5%) E-24、E-96	F(±1%) E-24、E-96	J(±5%) E-24
0402	1/10W	75V	100V	±100	100Ω≦R≦1MΩ	10Ω≦R＜1MΩ	10Ω≦R＜10MΩ	10Ω≦R＜20MΩ
				±200	------	1Ω≦R＜10Ω	1Ω≦R＜10Ω	1Ω≦R＜10Ω
0603	1/4W	75V	150V	±150	100Ω≦R≦1MΩ	10Ω≦R＜1MΩ	10Ω≦R＜10MΩ	10Ω≦R＜20MΩ
				±200	------	------	1Ω≦R＜10Ω	1Ω≦R＜10Ω
0805	2/5W	150V	300V	±100	100Ω≦R≦1MΩ	10Ω≦R＜1MΩ	10Ω≦R＜10MΩ	10Ω≦R＜20MΩ
				±200	------	------	1Ω≦R＜10Ω	1Ω≦R＜10Ω
1206	1/2W	150V	400V	±100	10Ω≦R≦1MΩ	10Ω≦R＜1MΩ	10Ω≦R＜10MΩ	10Ω≦R＜20MΩ
				±200	3Ω≦R＜10Ω	------	1Ω≦R＜10Ω	1Ω≦R＜10Ω
1210	3/4W	200V	400V	±100	100Ω≦R≦1MΩ	10Ω≦R＜1MΩ	10Ω≦R＜10MΩ	10Ω≦R＜20MΩ
				±200	------	------	1Ω≦R＜10Ω	1Ω≦R＜10Ω
2010	1W	200V	400V	±100	100Ω≦R≦1MΩ	10Ω≦R＜1MΩ	10Ω≦R＜10MΩ	10Ω≦R＜10MΩ
				±200	------	------	1Ω≦R＜10Ω	1Ω≦R＜10Ω
2512	2W	200V	400V	±100	100Ω≦R≦1MΩ	10Ω≦R＜1MΩ	10Ω≦R＜10MΩ	10Ω≦R＜10MΩ
				±200	------	------	1Ω≦R＜10Ω	1Ω≦R＜10Ω
Operating Temperature Range				－55℃ ~ ＋155℃				

3.2 Power Derating Curve:

Temperature Range: －55℃ ~ ＋155℃

If the ambient temperature exceeds 70 degrees centigrade to 155 degrees centigrade, the power can be modified by the curve as below



3.4 Voltage Rating:

Rated Voltage: DC voltage or AC voltage (rms) based on the rated power
The voltage can be calculated by the following formula. If the calculated value exceeds the Max. voltage specified in the Table 3, the Max. voltage rating is set as the voltage rating.

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

E= Rated voltage (v)
P= Power rating (w)
R= Nominal resistance(Ω)

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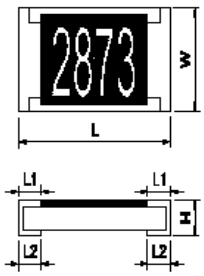
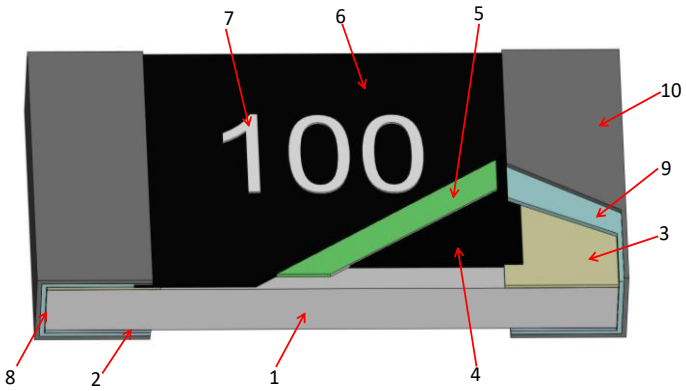
4 Dimensions:



DIM / Size	L	W	H	L1	L2
0402	1.00±0.10	0.50±0.05	0.30±0.05	0.20±0.10	0.25±0.10
0603	1.55±0.10	0.80±0.10	0.45±0.10	0.30±0.15	0.30±0.15
0805	2.00±0.10	1.25±0.10	0.50±0.10	0.35±0.20	0.35±0.20
1206	3.05±0.10	1.55±0.10	0.50±0.10	0.45±0.20	0.35±0.20
1210	3.05±0.10	2.55±0.10	0.55±0.10	0.50±0.20	0.50±0.20
2010	4.95±0.20	2.45±0.10	0.70±0.10	0.65±0.20	0.60±0.20
2512	6.40±0.20	3.20±0.20	0.70±0.10	0.60±0.20	1.25±0.20

5 Structure Graph:



1	Ceramic substrate	6	2nd Protective coating
2	Bottom inner electrode	7	Marking
3	Top inner electrode	8	Terminal inner electrode
4	Resistive layer	9	Ni plating
5	1st Protective coating	10	Sn plating

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6 Reliability Test:

No	Item	Conditions	Specifications Resistors
1-1	High Temperature Exposure (Storage)	Put the specimens in the chamber with temperature of 155±3℃ for 1000 hours. Then take them out to stabilize in room temperature for 24±2hr or more, and measure of its resistance variance rate. Experiment evidence: AEC-Q200	0.5%, 1%：△R%=±1.0% 5%：△R%=±2.0%
1-2	Temperature Cycling	Put the specimens in the High & low temperature test chamber with temperature varies from -55℃ to 125℃ for 15 minutes and total 1000 cycles. Then take them out to stabilize in room temperature for 24±2hr or more, and measure of its resistance variance rate. Experiment evidence: AEC-Q200	0.5%, 1%：△R%=±1.0% 5%：△R%=±2.0%
1-3	Short Time Overload	Applied 2.5 times rated voltage for 5 seconds and release the load for about 30 minutes, then measure its resistance variance rate. (Rated voltage refer to item 3. general specifications) Refer to JIS-C5201-1 4.13	0.5%, 1%：△R%=±1.0% 5%：△R%=±2.0%
1-4	Biased Humidity	Solder the specimens on the test PCB and put them into the constant temperature humidity chamber with 85±2℃ and 85±5%RH. Then apply the test voltage that calculates based on the 10% of rated power for 1000hrs. Then take them out to stabilize in room temperature for 24±2hr or more, and measure of its resistance variance rate. Experiment evidence: AEC-Q200	0.5%, 1%：△R%= ± 2.0% 5%：△R%=± 3.0%
1-5	Operational Life	Solder the specimens on the test PCB and Put them in the chamber with temperature of 125±3℃ and load the rated voltage for 1000 hours. Then take them out to stabilize in room temperature for 24±4hr or more, and measure of its resistance variance rate. Experiment evidence: AEC-Q200	0.5%, 1%：△R%= ± 2.0% 5%：△R%=± 3.0%
1-6	Resistance to Soldering Heat	The specimens are fully immersed into the Pb-free solder pot, then take them out to stabilize for 1 hour or more and measure of its resistance variance rate. Temp of solder pot：260±5℃ Soldering duration：10±1sec. Experiment evidence AEC-Q200	0.5%, 1%：△R%=±1.0% 5%：△R%=± 3.0%
1-7	ESD	Put the specimens on the test fixture and two (2)discharges (2KVDC) shall be applied to each PUT, one (1) with a positive polarity and one (1) with a negative polarity. Afterwards, the specimens stabilize for 30min or more and measure of its resistance variance rate. The test is performed with direct contact and regular discharge mode. The resistor and capacitor used on the spearhead is 2000Ω and 150pF respectively. Experiment evidence AEC-Q200	△R%=±3.0%

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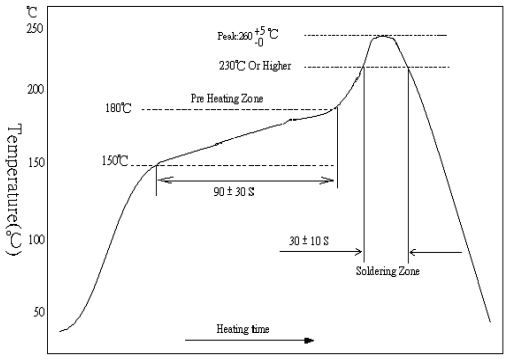
No	Item	Conditions	Specifications Resistors
1-8	Solderability	Test method: **Test item 1 (solder pot test): Method B** Precondition: The specimens are subjected to 155℃ dry bake for 4hrs±15min. The specimens are immersed into the flux first, then fully immersed into the solder pot, at a temperature of 235± 5℃ for 5+0/-0.5 sec. Then rinse with water and observe the soldering coverage under the microscope. **Test item 2 (Leaching test): Method D** The specimens are immersed into the flux first, then fully immersed into the solder pot, at a temperature of 260±5℃ for 30+0/-0.5 sec. Then rinse with water and observe the soldering coverage under the microscope. Experiment evidence AEC-Q200	1.Soldering coverage over 95% 2.At the edge of terminal, the object underneath (e.g. white ceramic) shall not expose.
1-9	Electrical Characterization	TCR（ppm/℃）$=\frac{(R2-R1)}{R1(T2-T1)}\times10^6$ R1: Resistance at room temperature (Ω) R2: Resistance at -55℃or +125℃(Ω) T1: Room temperature (℃) T2: Temperature -55℃or +125℃ Experiment evidence: AEC-Q200	Refer to item 3. general specifications
1-10	Board Flex (Bending Test)	Solder the specimens on the test PCB and put the PCBA onto the Bending Tester. Add force at the central part of PCB, and the duration of the applied forces shall be 60 (+ 5) Sec. Measure of its resistance variance rate in load. Bending depth (D) 0402、0603, 0805=5mm 1206、1210=3mm 2010、2512= 2mm Experiment evidence: AEC-Q200	0.5%, 1%：△R%=±1.0% 5%：△R%=±2.0% No mechanical damage, peel-off of side end or chip crack.

7 Technical application notes: (This is for recommendation, please customer perform adjustment according to actual application)

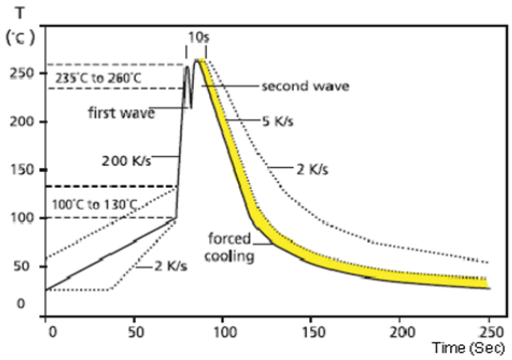
7.1 Recommend Soldering Method:

7.1.1 Lead Free Reflow Soldering Profile



Remark: The peak temperature of soldering heat is 260 +5/-0 ℃ for 10 seconds

7.1.2 Lead Free Double-Wave Soldering Profile. (This applies to 0603 and above size products)



7.1.3 Soldering Iron: temperature 350°C±10°C , dwell time shall be less than 3 s

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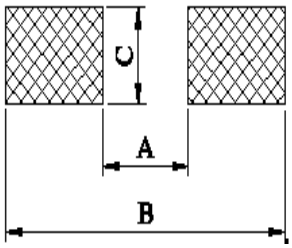
8 Recommend Land Pattern Design (For Reflow Soldering)

When a component is soldered, the resistance after soldering changes slightly depending on the size of the soldering area and the amount of soldering. When designing a circuit, it is necessary to consider the effect of a decrease or increase in its resistance.



Size \ DIM	A	B	C
0402	0.5	1.5	0.6
0603	0.8	2.1	0.9
0805	1.2	3	1.3
1206	2.2	4.2	1.6
1210	2.2	4.2	2.8
2010	3.5	6.1	2.8
2512	3.8	8	3.5

8.2 Automobile Electronic Application:

This specification is for automobile electronic use. CHILISIN will take no responsibility if any damage, cost or loss occurs when the product has been used in any special circumstances.

(a) Information、entertainment、navigation、audio control units.
(b) Comfortable door, window, seat control unit.
(c) Internal lighting control unit.

8.3 Environment Precautions:

If consumer intends to use our company product in special environment or condition (including but not limited to those mentioned below), then will need to make individual recognition of product features and reliability accordingly.

(a) Used in high temperature and humidity environment
(b) Exposed to sea breeze or other corrosive gas, such as Cl2、H2S、NH3、SO2 and NO2.
(c) Used in non-verified liquids including water, oil, chemical and organic solvents.
(d) Using non-verified resin or other coating material to seal or coat our Company product.
(e) After soldering, it is necessary to use water-soluble detergents to clean residual solder

8.4 Momentary Overload Precautions:

The product might be out of function when momentary overloaded.
Please make sure to avoid momentary overloading while using and preserving

8.6 Operation and Processing Precautions:

(a) Avoid damage to the edge of resistor and protective layer caused by mechanical stress.
(b) Handle with care when printing circuit board (PCB) is divided or fixed on support body, because bending of printing circuit board (PCB) mounting will make mechanical stress for resistors.
(c) Make sure the power rating is under the limit when using the resistor.
When power rating is over the limit, the resister will be overloaded.
There might be machinery damage due to the climbing temperature
(d) If the resister will be exposed under massive impact load (shock wave) in a short period of time, the working environment must be set up well before use.
(e) Please make evaluation and confirmation when the product is well used in your company and have a through consideration of its fail-safe design to ensure the system safety.

9 Storage and transportation requirement:

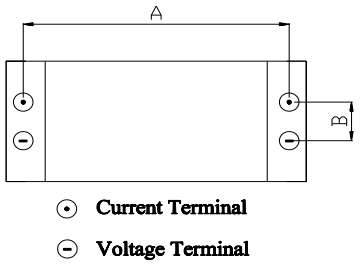
1.1 The temperature condition must be controlled at 25±5℃, the R.H. must be controlled at 60±15%. The stock can maintain quality level in two years.
1.2 Please avoid the mentioned harsh environment below when storing to ensure product performance and its' weldability. Places exposed to sea breeze or other corrosive gas, such as Cl2、H2S、NH3、SO2 and NO2.
1.3 When the product is moved and stored, please ensure the correct orientation of the box. Do not drop or squeeze the box. Otherwise, the electrode or the body of the product may be damaged.

10 Plating Thickness:

9.1 Ni:≧2μm
9.2 Sn(Tin):≧3μm
9.3 Sn(Tin):Matte Sn

11 Measurement Point:

Bottom electrode



Unit : mm

Size \ DIM	A	B
0402	0.80±0.05	0.24±0.05
0603	1.35±0.05	0.35±0.05
0805	1.80±0.05	0.35±0.05
1206	2.90±0.05	0.35±0.05
1210	2.90±0.05	0.35±0.05
2010	4.50±0.05	1.15±0.05
2512	5.90±0.05	1.60±0.05

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11 Stock period:

The temperature condition must be controlled at 25±5℃, the R.H. must be controlled at 60±15%. The stock can maintain quality level in two years.

12 The carton for electronic-information products is made by the symbol as follows: (For china)

	
Marking for control of pollution cause by electronic-information products	Marking for package recovery

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