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香港柴湾安业街十二号长益工业大厦**10**字楼**A**座

HONG KONG RESISTORS MANUFACTORY

(wholly owned by Hong Kong Resistors Manufactory International Ltd.)

AN ISO 9001:2015 CERTIFIED MANUFACTURER

AN ISO 45001: 2018 MANUFACTURER

AN ISO 14001: 2015 MANUFACTURER

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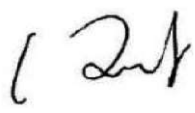
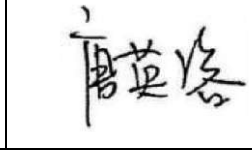
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DATASHEET

Name of Product: Automotive Grade Current Sensing Chip Resistor-ACS Series

Sales Executive:_____ Date:_____

制造 Prepared by	品质 Quality by	业务 Sales by	核准 Authorized by
			
客户 customer approval	客户 customer approval	客户 customer approval	客户 customer approval

Spec. No. ACS 2023

Rev. No.: 2023 Sep

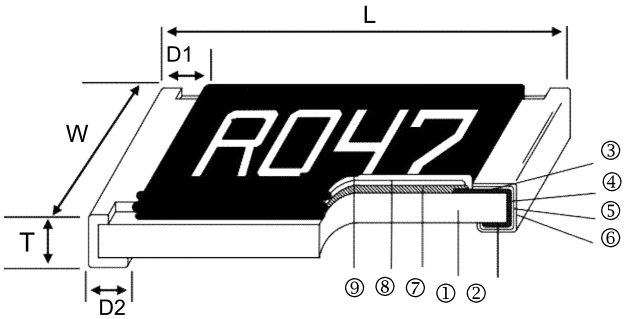
Automotive Grade Current Sensing Chip Resistor



■Features

- AEC-Q200 Compliance
- Highly reliable multilayer electrode construction
- Reduced size of final equipment reliability
- 3 Watts power rating in 1 Watt size, 1225 package
- Low TCR of ±100 PPM/°C
- Resistance values from 1m to 1 ohm
- High purity alumina substrate for high power dissipation
- Long side terminations with higher power rating
- Special construction to prevent sulfuration in a sulfur containing environment
- RoHS Compliance
- 100% CCD inspection

■ Construction



■Applications

- Automotive Industry
- Power Management Applications
- Switching Power Supply
- Over Current Protection in Audio Applications
- Voltage Regulation Module (VRM)
- DC-DC Converter, Battery Pack, Charger, Adaptor
- Automotive Engine Control
- Disk Driver

①	Alumina Substrate	④	Edge Electrode	⑦	Resistor Layer
②	Bottom Electrode	⑤	Barrier Layer	⑧	Primary Overcoat
③	Top Electrode	⑥	External Electrode	⑨	Secondary Overcoat

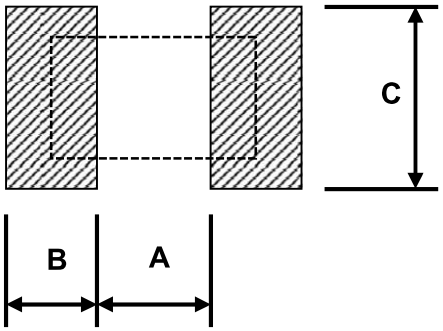
■Dimensions

Type	Size (Inch)	L (mm)	W (mm)	T (mm)	D1 (mm)	D2 (mm)
ACS02	0402	1.00±0.05	0.50±0.05	0.32±0.10	0.25±0.10	0.20±0.10
ACS03	0603	1.60±0.10	0.80±0.10	0.45±0.10	0.30±0.20	0.30±0.20
ACS05	0805	2.00±0.10	1.25±0.10	0.55±0.10	0.30±0.20	0.40±0.25
ACS06	1206	3.10±0.10	1.55±0.10	0.55±0.10	0.50±0.30	0.40±0.25
ACS10	1210	3.10±0.10	2.60±0.15	0.55±0.10	0.50±0.30	0.50±0.25
ACS20	2010	5.00±0.10	2.50±0.15	0.60±0.15	0.60±0.30	0.50±0.25
ACS25	2512	6.35±0.10	3.10±0.15	0.60±0.10	0.60±0.30	0.55±0.25
CS25 (2W)	2512 (10 - 99mΩ)	6.35±0.20	3.15±0.15	0.74±0.10	0.60±0.30	0.55±0.25
ACS25 (2W)	2512 (100 - 1000mΩ)	6.35±0.20	3.15±0.15	0.74±0.10	0.60±0.30	2.10±0.10
ACS12	1225	3.20±0.15	6.45±0.15	0.90±0.15	0.60±0.30	0.80±0.25
ACS37	3720	2.00±0.20	3.75±0.20	0.60±0.10	0.40±0.20	0.40±0.20
ACS75	7520	2.00±0.20	7.50±0.30	0.60±0.10	0.40±0.20	0.40±0.20

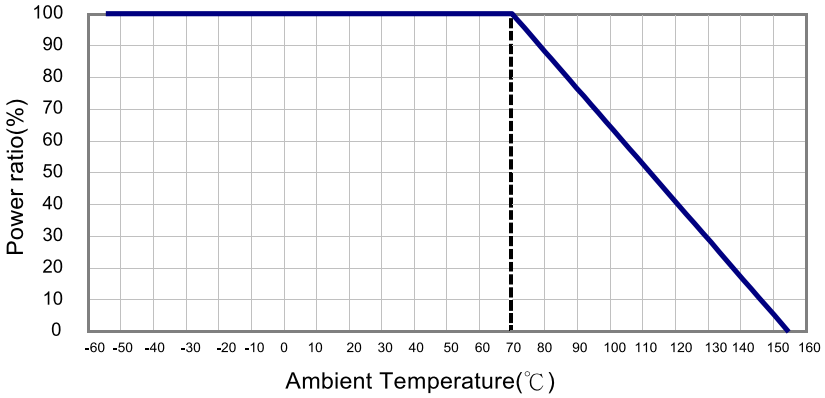
■Part Numbering

ACS	06	0R1	F	G	1/2W
Type	Size	Value	Tolerance	TCR	Power
	02 : 0402		F : ±1%	E: ±100PPM	1/16W
	03 : 0603		G : ±2%	K: ±150PPM	1/10W
	05 : 0805		J : ±5%	F: ±200PPM	1/8W
	06 : 1206			G: ±300PPM	1/5W
	10 : 1210			H: ±400PPM	1/4W
	20 : 2010			J: ±600PPM	1/2W
	25 : 2512				3/4W
	12 : 1225				1W
	37 : 3720				1.5W
	75 : 7520				2W
					3W

■Recommend Land Pattern



■Derating Curve



Pad Layout (Except For ACS25:High Power Rating Series)

Type	A (mm)	B (mm)	C (mm)
ACS02	0.50	0.50	0.60±0.2
ACS03	0.80	1.00	0.90±0.2
ACS05	1.00	1.00	1.35±0.2
ACS06	2.00	1.15	1.70±0.2
ACS10	2.00	1.15	2.50±0.2
ACS20	3.60	1.40	2.50±0.2
ACS25	4.90	1.60	3.20±0.2
ACS12	1.20	2.00	7.00±0.2
ACS37	1.00	1.80	3.90±0.2
ACS75	1.00	1.80	7.60±0.2

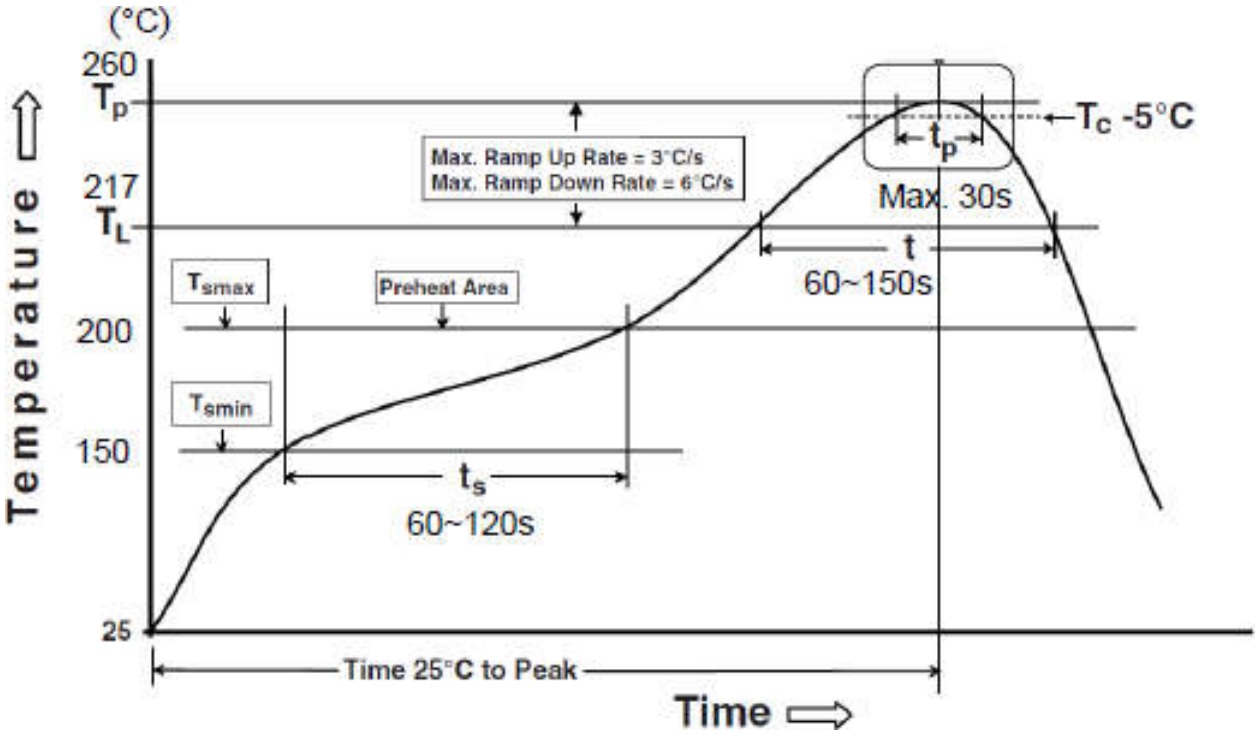
■Marking for 0603

Type	Code
1R0	1.000Ω
R10	0.100Ω
R01	0.010Ω
102	0.102Ω
024	0.024Ω

Pad Layout (For ACS25:High Power Rating Series)

Type	Resistance Range	A (mm)	B (mm)	C (mm)
ACS25	10~99 mΩ	4.9	1.6	3.2±0.2
ACS25	100~1000mΩ	1.0	3.55	3.2±0.2

■Soldering Condition (Ref. IPC/JEDEC J-STD-020 & J-STD-002)



Reflow Profiles	
Profile Feature	**Pb-Free Assembly**
Preheat Min. Temperature (Tsmin) Max Temperature (Tsmax) Preheating time (ts) from (Tsmin to Tsmax)	 150 °C 200 °C 60-120 seconds
Ramp-up rate (T_L to Tp)	3 °C/second max.
Liquidous temperature (T_L) Time (t_L) maintained above T_L	217 °C 60-150 seconds
Min. Peak temperature (Tp min)	235°C
Max. Peak temperature (Tp max)	260°C
Time (tp) within 5 °C of the specified classification temperature (Tc)	30 seconds max.
Ramp-down rate (Tp to T_L)	6 °C/second max.
Time 25 °C to peak temperature	8 minutes max.

■Standard Electrical Specifications

Item / Type	Power Rating at 70°C	Operating Temp. Range	Max. Operating Current	Resistance Range (mΩ) ±1%	±2%	±5%	TCR (PPM/°C)
ACS02 (0402)	1/16W	-55 ~ +155°C	1.11A	50 - 100 102 - 500 510 - 1000			±400 ±300 ±200
ACS03 (0603)	1/10W		2.23A	20 - 50 51 - 100 102 - 300 301 - 1000			±600 ±400 ±300 ±200
ACS05 (0805)	1/8W		2.50A	20 - 50 51 - 100 102 - 196 200 - 1000			±600 ±400 ±300 ±200
ACS06 (1206)	1/4W		5.00A	10 - 20 21 - 50 51 - 91 100 - 1000			±600 ±400 ±300 ±200
ACS10 (1210)	1/2W		7.07A				
ACS20 (2010)	3/4W		8.66A				
ACS25 (2512)	1W		10.0A				
ACS12 (1225)	3W		31.6A	3 - 5 6 - 20 21 - 30 33 - 8000			±300 ±200 ±150 ±100
ACS37 (3720)	1W		10.0A	10 - 18 20 - 500			±300 ±150
ACS75 (7520)	2W		44.7A	—	1 - 4		±300
				5 - 10 11 - 350			±200 ±150

■High Power & Ultra High Rating Electrical Specifications

Item / Type	Power Rating at 70°C	Operating Temp. Range	Max. Operating Current	Resistance Range (mΩ) ±1%	±2%	±5%	TCR (PPM/°C)
ACS02 (0402)	1/8W	-55 ~ +155°C	1.58A	50 - 100 102 - 500 510 - 1000			±400 ±300 ±200
ACS03 (0603)	1/8W 1/5W		1.58A				
ACS05 (0805)	1/4W 1/2W		2.23A				
ACS06 (1206)	1/2W		3.16A	50 - 91 100 - 1000			±300 ±200
ACS10 (1210)	3/4W		3.87A				
ACS20 (2010)	1W		4.47A				
ACS25 (2512)	1.5W		5.47A				
ACS25 (2512)	*2W		6.32A				

*: Ultra High Power

■Low TCR Electrical Specifications

Item / Type	Power Rating at 70°C	Operating Temp. Range	Max. Operating Current	Resistance Range (mΩ) ±1%	±2%	±5%	TCR (PPM/°C)
ACS05 (0805)	1/8W	-55 ~ +155°C	1.11A	100 - 1000			±100
ACS06 (1206)	1/4W		1.58A	100 - 1000			±100
ACS10 (1210)	1/2W		2.58A	75 - 1000			±100
ACS20 (2010)	3/4W		3.87A	50 - 1000			±100
ACS25 (2512)	1W		4.47A	50 - 1000			±100
ACS25 (2512)	2W		6.32A	50 - 1000			±100
ACS37 (3720)	1W		3.16A	100 - 500			±100
ACS75 (7520)	2W		6.32A	50 - 350			±100

Operating Voltage=$\sqrt{}$(P*R) ; Overload Voltage=2.5*$\sqrt{}$(P*R) ; Operating Current=$\sqrt{}$(P/R)

■ HKR is capable of manufacturing the optional spec based on customer's requirement.

■Environmental Characteristics

Item	Requirement	Test Method
Temperature Coefficient of Resistance (T.C.R.)	As Spec.	**JIS C 5201-1 4.8** **IEC 60115-1 4.8** At 25°C/-55°C and 25°C/+125°C, 25°C is the reference temperature
Short Time Overload	±(0.5%+0.05Ω)	**JIS C 5201-1 4.13** **IEC 60115-1 4.13** RCWV*2.5 or Max. Overload Voltage whichever is lower for 5 seconds
	±(1.0%+0.05Ω) for high power rating	
Insulation Resistance	≧10G	**JIS C 5201-1 4.6** **IEC 60115-1 4.6** Max. Overload Voltage for 1 minute
Operational Life	±(1.0%+0.05Ω)	**MIL-STD-202 Method 108** Condition D Steady State TA=125°C at derated power. Measurement at 24±4 hours after test conclusion.
Biased Humidity	±(1.0%+0.05Ω)	**MIL-STD-202 Method 103** 1000 hrs 85°C/85%RH 10% of operating power.
High Temperature Exposure	±(0.5%+0.05Ω)	**MIL-STD-202 Method 108** at +155°C for 1000 hrs
Board Flex	±(1.0%+0.05Ω)	**AEC-Q200-005** Bending once for 60 seconds 2010, 2512 sizes: 2mm Other sizes: 3mm
Solderability	95% min. coverage	**JIS C 5201-1 4.17** **IEC 60115-1 4.17 J-STD-002** 245±5°C for 3 seconds
Resistance to Soldering Heat	±(0.5%+0.05Ω)	**MIL-STD-202 Method 210** 260±5°C for 10 seconds
Voltage Proof	No breakdown or flashover	**JIS C 5201-1 4.7** **IEC 60115-1 4.7** 1.42 times Max. Operating Voltage for 1 minute ACS02:100V; ACS03:150V; ACS05:300V; ACS06/10/20/12/37/75 : 400V; ACS25:500V
Leaching	Individual leaching area ≦5% Total leaching area ≦10%	**JIS C 5201-1 4.18** **IEC 60068-2-58 8.2.1** 260±5°C for 30 seconds
Temperature Cycling	±(0.5%+0.05Ω)	**JESD22 Method JA-104** -55°C to +125°C, 1000 cycles
Mechanical Shock	±(0.25%+0.05Ω)	**MIL-STD-202 Method 213** Wave Form: Tolerance for half sine shock pulse. Peak value is 100g's. Normal duration (D) is 6.
Vibration	±(0.5%+0.05Ω)	**MIL-STD-202 Method 204** 5 g's for 20 min., 12 cycles each of 3 orientations,10-2000 Hz
ESD	±(1%+0.05Ω)	**AEC-Q200-002** Human body, 2KV
Resistance to Solvents	No visible damage on appearance and marking.	**MIL-STD-202 Method 215** Add Aqueous wash chemical - OKEM Clean or equivalent. Do not use banned solvents.
Terminal Strength	No broken	**AEC-Q200-006** Force of 1.8kg for 60 seconds.
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.
Sulfur Test	±(0.5%+0.05Ω)	**EIA-977 (Condition A)** 60±2°C, no power rating for 500 hrs.

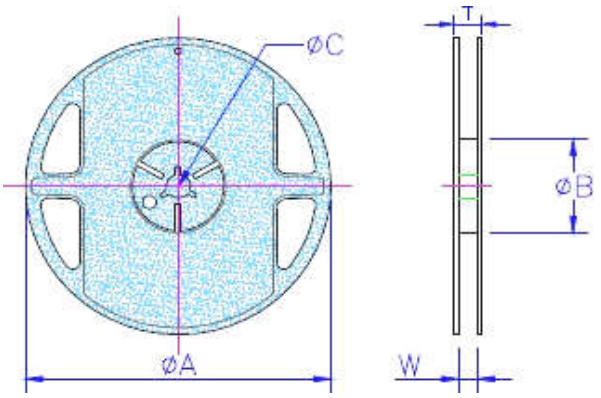
RCWV(Rated Continuous Working Voltage)=$\sqrt{}$(P*R) or Max. Operating Voltage whichever is lower.

■Storage Temperature: 15~28°C; Humidity < 80%RH

■Shelf Life: 2 years from production date.

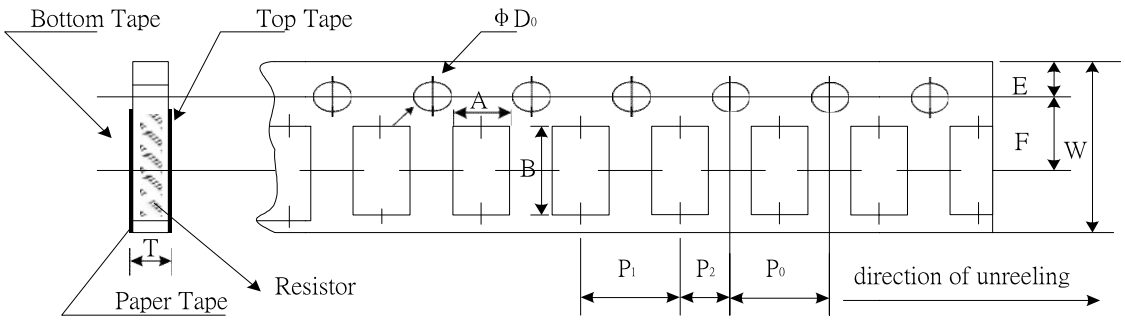
■Packaging

Packaging Quantity & Reel Specifications



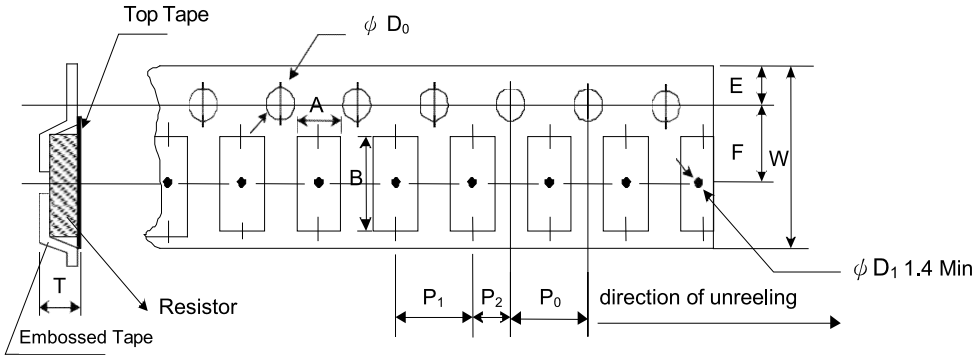
Type	ΦA (mm)	ΦB (mm)	ΦC (mm)	W (mm)	T (mm)	Paper Tape (EA)	Emboss Plastic Tape (EA)
ACS02	178.0±1.0	60.0+1.0	13.5±0.7	9.5±0.1	11.5±1.0	10,000	-
ACS03	178.0±1.0	60.0+1.0	13.5±0.7	9.5±0.1	11.5±1.0	5,000	-
ACS05	178.0±1.0	60.0+1.0	13.5±0.7	9.5±0.1	11.5±1.0	5,000	-
ACS06	178.0±1.0	60.0+1.0	13.5±0.7	9.5±0.1	11.5±1.0	5,000	-
ACS10	178.0±1.0	60.0+1.0	13.5±0.7	9.5±0.1	11.5±1.0	5,000	
ACS20	178.0±1.0	60.0+1.0	13.5±0.7	13.5±1.0	15.5±1.0	-	4,000
ACS25	178.0±1.0	60.0+1.0	13.5±0.7	13.5±1.0	15.5±1.0	-	4,000
ACS25 (2W)	178.0±1.0	60.0+1.0	13.5±0.7	13.5±1.0	15.5±1.0	-	2,000
ACS12	178.0±1.0	60.0+1.0	13.5±0.7	13.5±1.0	15.5±1.0	-	2,000
ACS37	178.0±1.0	60.0+1.0	13.5±0.7	13.5±1.0	15.5±1.0	-	2,000
ACS75	178.0±1.0	60.0+1.0	13.5±0.7	17.5±1.0	19.5±1.0	-	2,000

Paper Tape Specifications



Type	A (mm)	B (mm)	W (mm)	E (mm)	F (mm)	P0 (mm)	P1 (mm)	P2 (mm)	ΦD0 (mm)	T (mm)
ACS02	0.65±0.10	1.15±0.10	8.0±0.20	1.75±0.10	3.50±0.05	4.00±0.10	2.00±0.05	2.00±0.05	1.50+0.1,-0	0.45±0.10
ACS03	1.10±0.10	1.90±0.10	8.0±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.70±0.10
ACS05	1.60±0.10	2.40±0.20	8.0±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.85±0.10
ACS06	1.90±0.10	3.50±0.20	8.0±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.85±0.10
ACS10	2.90±0.10	3.50±0.20	8.0±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.85±0.10

Emboss Plastic Tape Specifications



Type	A (mm)	B (mm)	W (mm)	E (mm)	F (mm)	P_0 (mm)	P_1 (mm)	P_2 (mm)	ΦD_0 (mm)	T (mm)
ACS20	2.80±0.10	5.40±0.20	12.0±0.30	1.75±0.10	5.5±0.05	4.00±0.05	4.00±0.10	2.00±0.05	1.50+0.10	1.00±0.20
ACS25	3.50±0.10	6.70±0.10	12.0±0.30	1.75±0.10	5.5±0.05	4.00±0.05	4.00±0.10	2.00±0.05	1.50+0.10	1.00±0.20
ACS25 (2W)	3.38±0.10	6.68±0.10	12.0±0.30	1.75±0.10	5.5±0.10	4.00±0.10	4.00±0.10	2.00±0.05	1.55+0.05	1.45±0.20
ACS12	3.38±0.10	6.68±0.10	12.0±0.30	1.75±0.10	5.5±0.10	4.00±0.10	4.00±0.10	2.00±0.05	1.55+0.05	1.45±0.20
ACS37	2.50±0.20	4.45±0.20	12.0±0.30	1.75±0.10	5.5±0.05	4.00±0.05	4.00±0.10	2.00±0.05	1.50+0.10	1.20±0.20
ACS75	2.50±0.20	8.30±0.20	16.0±0.30	1.75±0.10	7.8±0.05	4.00±0.05	4.00±0.10	2.00±0.05	1.50+0.10	1.20±0.20

■Marking

No Marking for 0402

1%, 5% for 0805/1206/1210/2010/2512/1225/3720/7520: 4 digits marking

Example:

Resistance	47mΩ	75mΩ	15mΩ	750mΩ	820mΩ
Marking	R047	R075	R015	R750	R820

5% for 0603: 3 digits marking in E24

1% for 0603: 3 digits marking with under-line in E96 (non-including E24 series)



3 digits marking for E24 or R value suffix is zero in E96: R10=100mΩ; R28=280mΩ



3 digits marking for E96: 243=243mΩ; 511=511mΩ