Innovative Service Around the Globe YAGEO

DATA SHEET

CURRENT SENSOR - LOW TCR

AUTOMOTIVE GRADE

PA series

5%, 1%, 0.5%

sizes 0201/0402/0603/0805/1206/2010

RoHS compliant & Halogen free

YAGEO Phycomp

Product specification – May 15, 2020 V.0

SCOPE

This specification describes PA0201/0402/0603/0805/1206/2010 series current sensor - low TCR with lead-free terminations metal substrate.

APPLICATIONS

- Smart Phone
- Batteries
- Computer
- Telecom / Datacom
- Industrial / Power supply
- Car electronics

FEATURES

- AEC-Q200 qualified
- Halogen-free Epoxy
- RoHS compliant
- Reduce environmentally hazardous wastes
- High component and equipment reliability
- Non-forbidden materials used in products/production
- Low resistances applied to current sensing
- Moisture sensitivity level: MSL 1

ORDERING INFORMATION - GLOBAL PART NUMBER

Global part numbers are identified by the series, size, tolerance, packing type, temperature coefficient, taping reel and resistance value.

GLOBAL PART NUMBER

PA	XXXX	X	X	X	XX	XXXX	X
	(1)	(2)	(3)	(4)	(5)	(6)	(7)

(1) SIZE

0201/0402/0603/0805/1206/2010

(2) TOLERANCE

D = ±0.5% (for 5mΩ ~ 20mΩ)

F = ±1%

J = ±5%

(3) PACKAGING TYPE

R = Paper taping reel (PA0201~PA1206)

K = Embossed taping reel (PA2010)

(4) TEMPERATURE COEFFICIENT OF RESISTANCE

E = ± 50ppm/°C

M = ± 75ppm/°C

F = ± 100ppm/°C

L = ± 150ppm/°C

G = ± 200ppm/°C

(5) TAPING REEL

07 / 7W / 7T / 47 / 57 / 87 inch dia. Reel and specific rated power

Detailed power rating are shown in the Table 2.

(6) RESISTANCE VALUE

1 mΩ to 20 mΩ

(7) DEFAULT CODE

Letter L / Z is the system default code for ordering only. (Note)

L is for 0201/0402/0603/0805

Z is for only 1206/2010

Resistance rule of global part number

Resistance code rule	Example
0RXXX	0R001 = 1 mΩ
(1 to 20 mΩ)	0R02 = 20 mΩ

ORDERING EXAMPLE

The ordering code for a PA0805 0.125W chip resistor,TC50 value 0.01Ω (10mR) with ±1% tolerance, supplied in 7-inch tape reel with 5Kpcs quantify is:

PA0805FRE070R01L.

NOTE

1. All our RChip products are RoHS compliant. "LFP" of the internal 2D reel label mentions "Lead-Free Process"

MARKING

PA0201/0402/0603/0805/1206/2010

Fig. 1 Value = 10 mΩ

No Marking

CONSTRUCTION

The resistors are constructed using outstanding TCR level material, which makes Yageo PA resistors excellent for current sensing application in battery charger circuit & DC-DC converter.

The composition of the resistive material is adjusted to give the approximate required resistance. Finally, the three external terminations (Cu / Ni / matte Tin) are added, as shown in Fig. 2.

Outlines

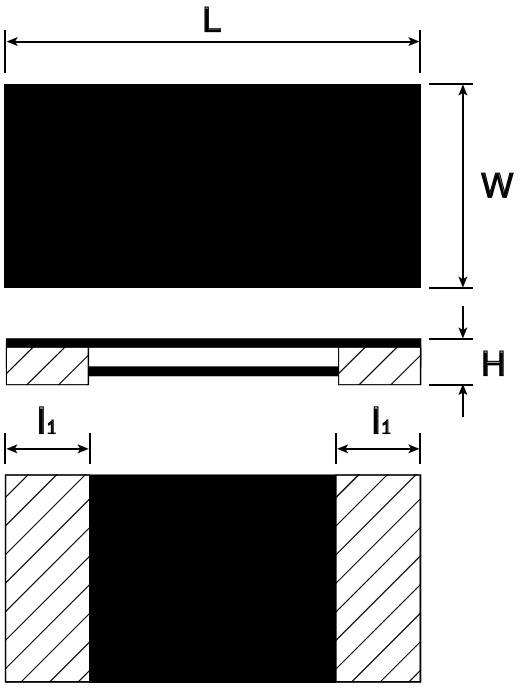

Fig. 2 Chip resistor outlines

DIMENSION

Table 1 For outlines, please refer to Fig. 2

TYPE	RESISTANCE RANGE	L (mm)	W (mm)	H (mm)	I1 (mm)
PA0201	5mΩ ≤ R ≤ 20mΩ	0.60±0.03	0.31±0.04	Max. 0.30	0.15±0.06
PA0402	2mΩ ≤ R ≤ 20mΩ	1.00±0.10	0.55±0.10	Max. 0.40	0.25±0.10
PA0603	1 mΩ	1.60±0.20	0.80±0.20	0.55±0.15	0.38±0.12
	2mΩ ≤ R ≤ 20mΩ	1.60±0.20	0.80±0.20	0.45±0.15	0.38±0.12
PA0805	1mΩ	2.03±0.20	1.27±0.20	0.55±0.15	0.60±0.15
	1.5/ 2mΩ	2.03±0.20	1.27±0.20	0.45±0.15	0.50±0.15
	2.5mΩ ≤ R ≤ 20mΩ	2.03±0.20	1.27±0.20	0.30±0.15	0.35±0.20
PA1206	1mΩ	3.20±0.25	1.60±0.25	0.65±0.25	0.51±0.25
	2mΩ	3.20±0.25	1.60±0.25	0.55±0.25	0.60±0.25
	2.5/ 3mΩ	3.20±0.25	1.60±0.25	0.40±0.25	0.80±0.30
	4mΩ ≤ R ≤ 20mΩ	3.20±0.25	1.60±0.25	0.40±0.25	0.60±0.30
PA2010	1mΩ ≤ R ≤ 3mΩ	5.08±0.25	2.54±0.25	0.50±0.25	1.40±0.25
	4mΩ ≤ R ≤ 20mΩ	5.08±0.25	2.54±0.25	0.40±0.25	0.70±0.25

Note:
1. For relevant physical dimensions, please refer to construction outlines.
2. Please contact with sales offices, distributors and representatives in your region before ordering.

ELECTRICAL CHARACTERISTICS

Table 2

SIZE	POWER RATING (1)						TOLERANCE	RESISTANCE RANGE	TEMPERATURE COEFFICIENT OF RESISTANCE	
	07	7W	7T	47	57	87				
0201	1/20W	1/10W	3/20W	1/4W	--	--	±1% ±5%	5mΩ ≤ R ≤ 20mΩ	±150 ppm/°C	
0402	1/16W	1/8W	1/6W	1/4W	1/3W	--		2mΩ ≤ R ≤ 20mΩ	±150 ppm/°C	
0603	1/10W	1/5W	1/3W	2/5W	1/2W	--		1mΩ ≤ R ≤ 20mΩ	1mΩ 2/ 2.5mΩ 3mΩ ≤ R ≤ 10mΩ	±200 ppm/°C ±150 ppm/°C ±50 ppm/°C, ±75 ppm/°C
0805	1/8W	1/4W	--	1/2W	--	1W	±0.5%	10mΩ	1/ 1.5mΩ 2mΩ ≤ R ≤ 20mΩ	±150 ppm/°C ±50 ppm/°C
							±1% ±5%	1mΩ≤ R ≤ 20mΩ		
1206	1/4W	1/2W	--	1W	--	--	±0.5%	5mΩ ≤ R ≤ 20mΩ	1/ 2mΩ 3mΩ ≤ R ≤ 20mΩ	±100 ppm/°C ±50 ppm/°C
							±1% ±5%	1mΩ ≤ R ≤ 20mΩ		
2010	0.5W	1W	1.5W	-	-	-	±1% ±5%	1mΩ ≤ R ≤ 20mΩ	±50 ppm/°C	
	0.5W	1W	1.5W	2W	-	-		1mΩ ≤ R ≤ 10mΩ		

Note: Please contact with sales offices, distributors and representatives in your region before ordering.

FUNCTIONAL DESCRIPTION

OPERATING TEMPERATURE RANGE

PA0201/ 0402 Range: –55°C to +125°C
PA0603/ 0805 Range: –55°C to +155°C
PA1206/ 2010 Range: –55°C to +170°C

POWER RATING

Standard rated power at 70°C: For detail power value, please refer to Table 2.

RATED VOLTAGE

The DC or AC (rms) continuous working voltage corresponding to the rated power is determined by the following formula:

$$V = \sqrt{(PxR)}$$

Where

V = Continuous rated DC or AC (rms) working voltage (V)

P = Rated power (W)

R = Resistance value (Ω)

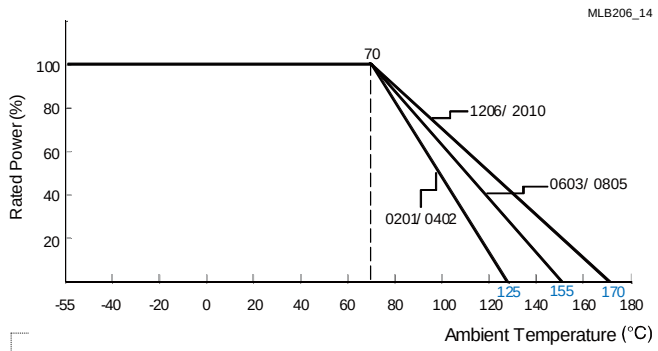

Fig. 3 Maximum dissipation (P_{max}) in percentage of rated power as a function of the operating ambient temperature (T_{amb})

PACKING STYLE AND PACKAGING QUANTITY

Table 3 Packing style and packaging quantity

PACKING STYLE	REEL DIMENSION	PA0201	PA0402	PA0603	PA0805	PA1206	PA2010
Paper Taping Reel (R)	7" (178 mm)	10,000	10,000	5,000	5,000	4,000	-
Embossed Taping Reel (K)	7" (178 mm)	-	-	-	-	-	4,000

PAPER TAPE

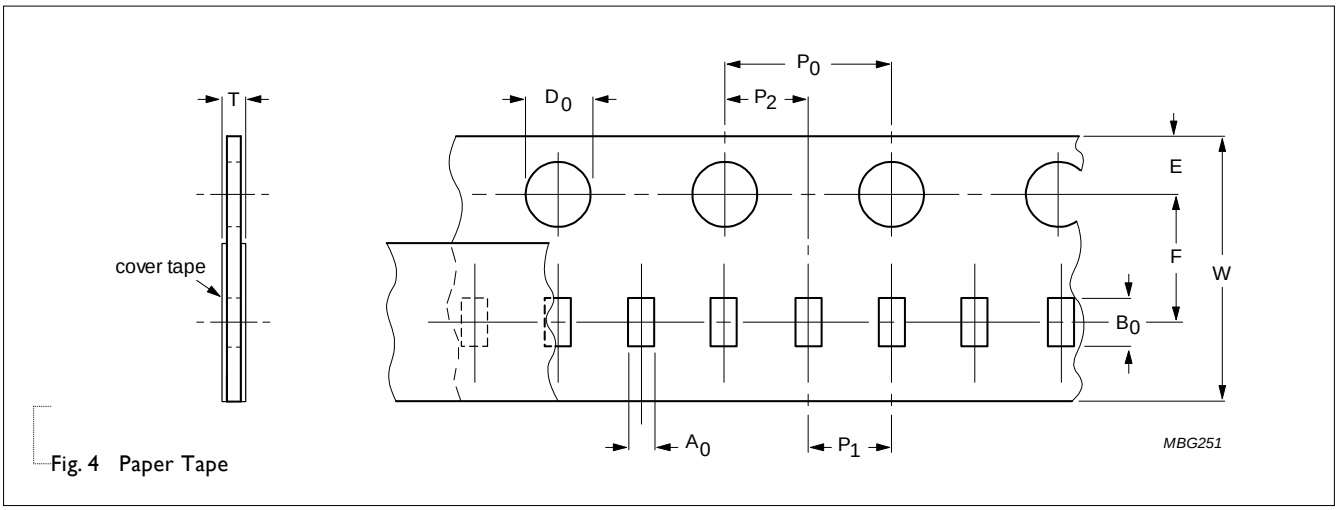

Fig. 4 Paper Tape

EMBOSSED TAPE

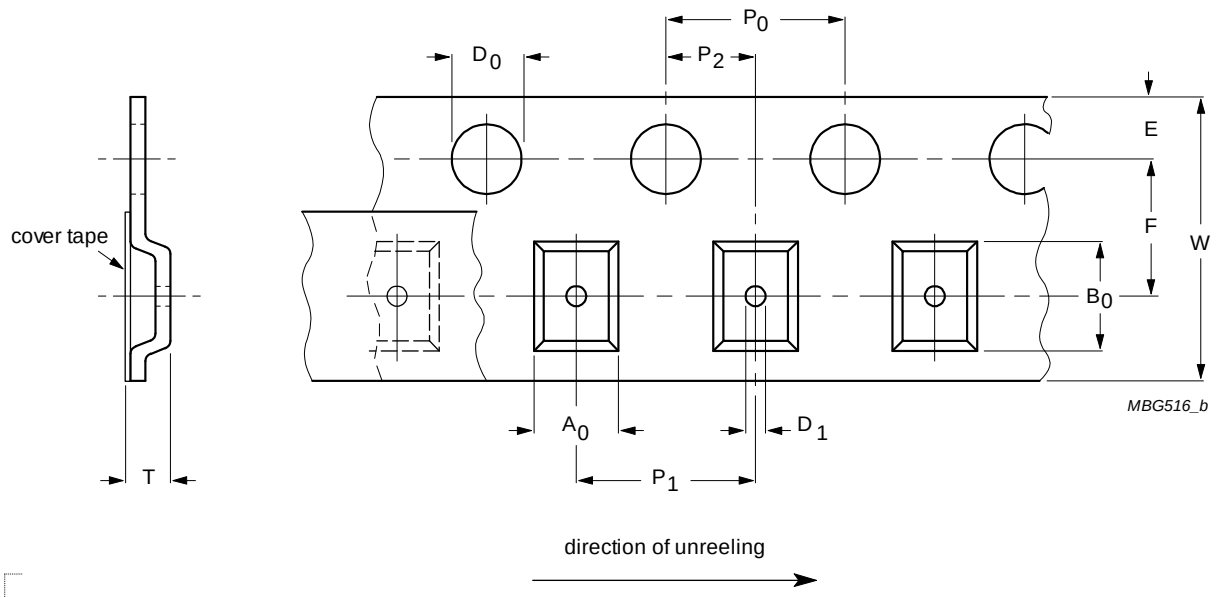

Fig. 5 Embossed Tape

Table 4 Dimensions of paper tape for relevant chip resistors size

SIZE	SYMBOL									Unit: mm
	A_0	B_0	W	E	F	P_0	P_1	P_2	ΦD_0	T
PA0201	0.39±0.10	0.70±0.10	8.0±0.30	1.75±0.10	3.50±0.10	4.00±0.10	2.00±0.10	2.00±0.10	1.55±0.05	0.43±0.10
PA0402	0.59±0.10	1.10±0.10	8.0±0.30	1.75±0.10	3.50±0.10	4.00±0.10	2.00±0.10	2.00±0.10	1.55±0.05	0.53±0.10
PA0603	1.08±0.10	1.90±0.10	8.0±0.30	1.75±0.10	3.50±0.10	4.00±0.10	4.00±0.10	2.00±0.10	1.55±0.05	0.60±0.10
PA0805	1.60±0.10	2.35±0.10	8.0±0.30	1.75±0.10	3.50±0.10	4.00±0.10	4.00±0.10	2.00±0.10	1.55±0.05	0.60±0.10*
	1.60±0.10	2.35±0.10	8.0±0.30	1.75±0.10	3.50±0.10	4.00±0.10	4.00±0.10	2.00±0.10	1.55±0.05	0.53±0.10**
PA1206	1.90±0.10	3.50±0.10	8.0±0.30	1.75±0.10	3.50±0.10	4.00±0.10	4.00±0.10	2.00±0.10	1.55±0.05	0.85±0.15

Note:
* 1~2mΩ
** 2.5~20mΩ

Table 5 Dimensions of embossed tape for relevant chip resistors size

SIZE	SYMBOL									Unit: mm
	A_0	B_0	W	E	F	P_0	P_1	P_2	ΦD_0	T
PA2010	3.40±0.15	6.70±0.15	12.0±0.30	1.75±0.10	5.50±0.10	4.00±0.10	4.00±0.10	2.00±0.10	1.55±0.10	0.85±0.15

REEL SPECIFICATION

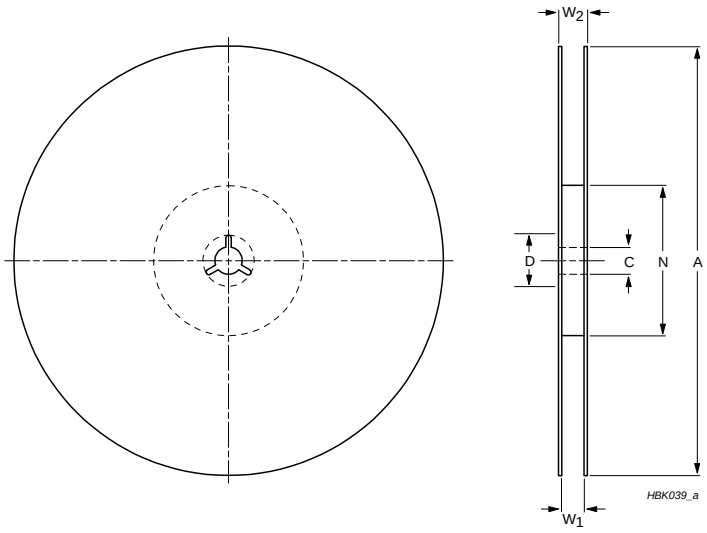

Fig. 6 Reel

Table 6 Dimensions of reel specification for relevant chip resistors size

SIZE	QUANTITY PER REEL	REEL SIZE	REEL SIZE	SYMBOL				
		8mm TAPE WIDE	12mm TAPE WIDE	A	N	C	D	W_1
PA0201	10,000	7" (Φ178mm)	-	178.0±1.0	60.0+1/-0	13.50±0.5	21.0±0.8	9.0±0.5
PA0402	10,000	7" (Φ178mm)	-	178.0±1.0	60.0+1/-0	13.50±0.5	21.0±0.8	9.0±0.5
PA0603	5,000	7" (Φ178mm)	-	178.0±1.0	60.0+1/-0	13.50±0.5	21.0±0.8	9.0±0.5
PA0805	5,000	7" (Φ178mm)	-	178.0±1.0	60.0+1/-0	13.50±0.5	21.0±0.8	9.0±0.5
PA1206	4,000	7" (Φ178mm)	-	178.0±1.0	60.0+1/-0	13.50±0.5	21.0±0.8	9.0±0.5
PA2010	4,000	-	7" (Φ178mm)	178.0±1.0	60.0+1/-0	13.50±0.5	21.0±0.8	13.6±0.5

LEADER/TRAILER TAPE SPECIFICATION

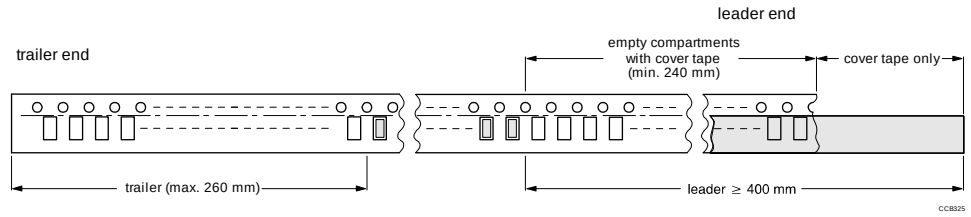

Fig. 7 Leader/Trailer Tape

FOOTPRINT AND SOLDERING PROFILES

For recommended soldering profiles, please refer to data sheet "Chip resistors mounting".

FOOTPRINT

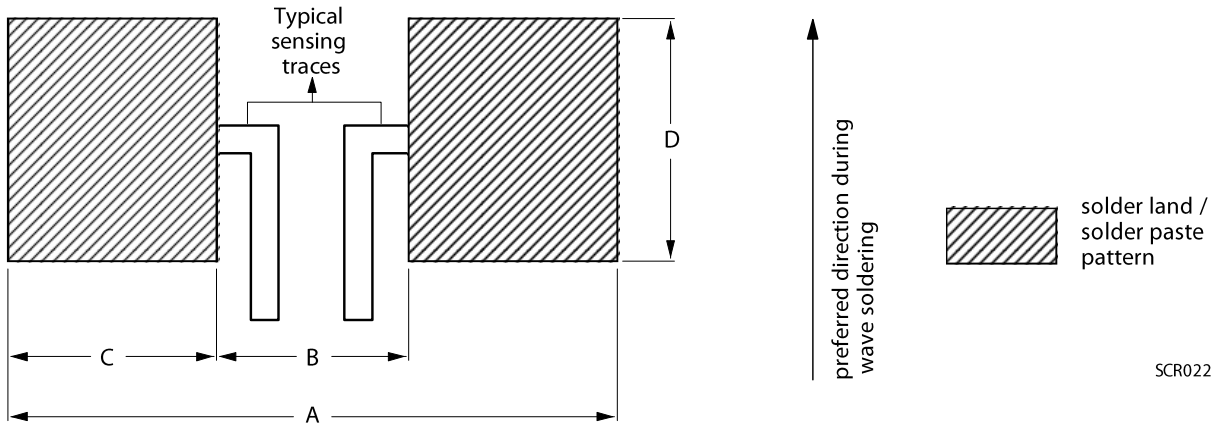

Fig. 8 Single resistor chips recommended dimensions of footprints

Table 7 Footprint dimensions

Unit: mm

TYPE	RESISTANCE RANGE	A	B	C	D
PA0201	5mΩ ≤ R ≤ 20mΩ	1.00	0.30	0.35	0.40
PA0402	2mΩ ≤ R ≤ 20mΩ	2.00	0.40	0.80	0.60
PA0603	1mΩ	2.20	0.50	0.70	0.90
	1mΩ < R ≤ 20mΩ	2.20	0.80	0.70	0.90
PA0805	1mΩ	4.10	0.50	1.80	2.18
	1.5mΩ ≤ R ≤ 20mΩ	4.60	1.00	1.80	2.18
PA1206	1mΩ / 2mΩ	4.20	1.00	1.60	1.84
	2.5mΩ / 3mΩ	4.80	1.00	1.90	1.84
	4mΩ ≤ R ≤ 20mΩ	4.80	1.20	1.80	1.84
PA2010	1mΩ ≤ R ≤ 3mΩ	6.00	1.40	2.30	3.00
	4mΩ ≤ R ≤ 20mΩ	6.00	3.50	1.25	3.00

TESTS AND REQUIREMENTS

Table 8 Test condition, procedure and requirements

TEST	TEST METHOD	PROCEDURE	REQUIREMENT
Short time overload	IEC60115-1 4.13	5 times of rated power for 5 seconds at room temperature	±(1.0%+0.0005Ω) No visible damage
High Temperature Exposure/ Endurance at Upper Category Temperature	MIL-STD-202G-Method 108A	1,000 hours at maximum operating temperature depending on specification, unpowered No direct impingement of forced air to the parts Tolerances: 0201/0402: 125±3°C 0603/0805: 155±3°C 1206/2010: 170±3°C	±(1.0%+0.0005Ω)
Temperature Cycling	JESD22-A104C	1,000 cycles, -55/+125°C for 1 cycle per hour	±(1.0%+0.0005Ω)
Moisture Resistance	MIL-STD-202G-Method 106F	Each temperature / humidity cycle is defined at 8 hours (method 106F), 3 cycles / 24 hours for 10d with 25°C / 65°C 95% R.H, without steps 7a & 7b, unpowered	±(0.5%+0.0005Ω)
Biased Humidity	MIL-STD-202 Method 103	1,000 hours; 85°C / 85% RH 10% of operating power	±(1.0%+0.0005Ω)
Operational Life/ Endurance	MIL-STD-202G-Method 108A IEC 60115-1 4.25.1	1,000 hours at 125±3°C, de-rated power applied for 1.5 hours on, 0.5 hour off, still-air required	±(1.0%+0.0005Ω)
		1,000 hours at 70±2°C applied rated power 1.5 hours on, 0.5 hour off, still air required	±(1.0%+0.0005Ω)
Resistance to Solvents	MIL-STD-202 Method 215	Immerse in isopropyl alcohol for 5 min with ultrasonic at room temperature	No visible damage
Mechanical Shock	MIL-STD-202 Method 213	Three shocks in each direction shall be applied along the three mutually perpendicular axes of the test specimen. Peak value: 100 g's Duration: 6 ms Velocity change: 12.3 ft/s Waveform: Half sine	±(0.5%+0.0005Ω)
Vibration	MIL-STD-202 Method 204	5 g's for 20 min., 12 cycles each of 3 orientations Test from 10-2000 Hz.	±(0.5%+0.0005Ω)
Resistance to Soldering Heat	MIL-STD-202G-method 210F	Condition B, no pre-heat of samples Leadfree solder, 260°C, 10 seconds immersion time Procedure 2 for SMD: devices fluxed and cleaned with isopropanol	±(0.5%+0.0005Ω) No visible damage

TEST	TEST METHOD	PROCEDURE	REQUIREMENT
Thermal Shock	MIL-STD-202 Method 107	-55/+125°C, Number of cycles is 300. Maximum transfer time is 20 seconds. Dwell time is 15 minutes. Air -Air	±(1.0%+0.0005Ω) No visible damage
Electrostatic Discharge	AEC-Q200-002	Human Body Model, 1 pos + 1 neg. 0805/ 1206/ 2010 : 2KV 0402/ 0603 : 1KV 0201: 500V	±(1.0%+0.0005Ω) No visible damage
Solderability - Wetting	J-STD-002	(a) Method B, aging 4 hours at 155°C dry heat, dipping at 235±3°C for 5±0.5 seconds. (b) Method B, steam aging 8 hours, dipping at 215±3°C for 5±0.5 seconds. (c) Method D, steam aging 8 hours, dipping at 260±3 °C for 30±0.5 seconds.	Well tinned (>95% covered) No visible damage
Flammability	UL94	Try to inflame a specimen by a needle flame	No ignition of specimen; V-0
Board Flex / Bending	AEC-Q200-005	Chips mounted on a 90mm glass epoxy resin PCB (FR4), Bending for 0201: 3mm 0402 and above: 2mm Holding time: Min.60 seconds	±(1.0%+0.0005Ω)
Terminal Strength (SMD)	AEC-Q200-006	Applied 0201: 3N 0402: 5N 0603/ 0805/ 1206/ 2010: 17.7N for 60±1 seconds.	±(1.0%+0.0005Ω) No visible damage
Flame Retardance	AEC-Q200-001	Apply voltage from 9V to 32V to increase the surface temp to 350°C	No flame, no explosion
Temperature Coefficient of Resistance (T.C.R.)	IEC 60115-1 4.8	At +25/+125°C Formula: $T.C.R = \frac{R2-R1}{R1(t2-t1)} \times 10^6$ (ppm/°C) Where t1 =+25°C or specified room temperature t2 =+125°C test temperature R1=resistance at reference temperature in ohms R2=resistance at test temperature in ohms	Refer to table 2

REVISION HISTORY

REVISION	DATE	CHANGE NOTIFICATION	DESCRIPTION
Version 0	May 07, 2020	-	- New datasheet for automotive grade current sensor – PA0201/0402/0603/0805/1206/2010 series.

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