

# DATA SHEET

**CURRENT SENSOR - LOW TCR  
AUTOMOTIVE GRADE**

PA1206\_L series  
5%, 1%

RoHS compliant & Halogen free



SCOPE

This specification describes PA series current sensor - low TCR with lead-free terminations made by metal substrate.

APPLICATIONS

- Consumer goods
- Computer
- Telecom / Datacom
- Industrial / Power supply
- Alternative Energy
- 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

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   L**  
(1)    (2) (3) (4)   (5)    (6)    (7)

**(1) SIZE**

1206

**(2) TOLERANCE**

D = ±0.5% (for 5mΩ and up)  
 F = ±1%  
 J = ±5%

**(3) PACKAGING TYPE**

R = Paper taping reel

**(4) TEMPERATURE COEFFICIENT OF RESISTANCE**

F = ± 100ppm/°C  
 M = ± 75ppm/°C  
 E = ± 50ppm/°C

**(5) TAPING REEL**

07 = 7 inch dia. Reel & standard power (1/4W)  
 7W = 7 inch dia. Reel & 2 x standard power (1/2W)  
 47 = 7 inch dia. Reel & 4 x standard power (1W)  
 67 = 7 inch dia. Reel & 6 x standard power (1.5W)

**(6) RESISTANCE VALUE**

1 mΩ to 50 mΩ

**(7) DEFAULT CODE**

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

| Resistance code rule | Example       |
|----------------------|---------------|
| 0RXXX                | 0R001 = 1 mΩ  |
| (1 to 50mΩ)          | 0R015 = 15 mΩ |

**ORDERING EXAMPLE**

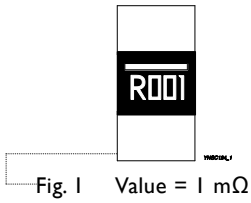
The ordering code of a PA1206 1W chip resistor, TC100, value 0.003Ω with ±1% tolerance, supplied in 7-inch tape reel is: PA1206FRF070R003L

**NOTE**

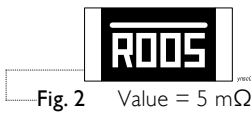
1. All our RChip products are RoHS compliant. "LFP" of the internal 2D reel label mentions "Lead-Free Process"

**MARKING**

**PA1206**



4 digits  
The “R” is used as a decimal point; the other 3 digits are significant  
PA1206: 1mΩ



4 digits  
The “R” is used as a decimal point; the other 3 digits are significant  
PA1206: 2mΩ to 50mΩ

**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 and is covered with a protective coating. Marking is printed on the top side of the resistor.

Finally, the three external terminations (Cu / Ni / matte Tin) are added, as shown in Fig. 4.

**Outlines**

For dimensions, please refer to Table I

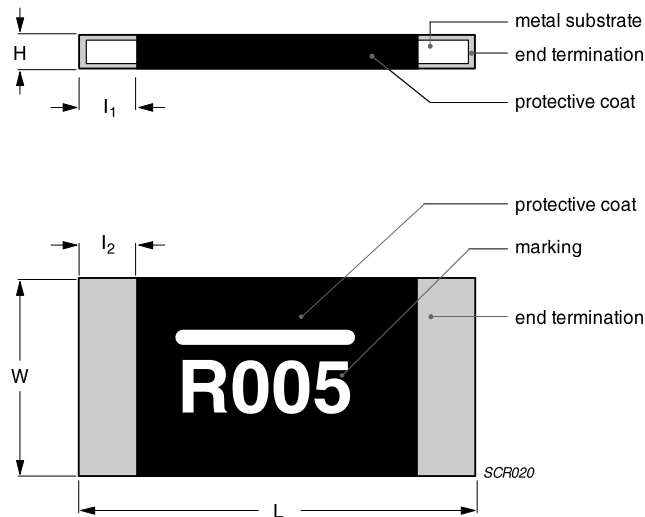


Fig. 3 Chip resistor outlines

**DIMENSION**

Table 1 For outlines, please refer to Fig. 4

| TYPE   | RESISTANCE RANGE | POWER RATING       | L (mm)      | W (mm)    | H (mm)    | I <sub>1</sub> (mm) | I <sub>2</sub> (mm) |
|--------|------------------|--------------------|-------------|-----------|-----------|---------------------|---------------------|
| PA1206 | 1mΩ              | 1/4W               | 3.20 ± 0.25 | 1.60±0.25 | 0.65±0.25 | 1.04±0.25           | 1.04±0.25           |
|        | 2mΩ ≤ R ≤ 5mΩ    | 1/2W               | 3.20 ± 0.25 | 1.60±0.25 | 0.65±0.25 | 0.64±0.25           | 0.64±0.25           |
|        | 6mΩ ≤ R ≤ 50mΩ   | 1W<br>1.5W (1~5mΩ) | 3.20 ± 0.25 | 1.60±0.25 | 0.65±0.25 | 0.51±0.25           | 0.51±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

| SERIES | SIZE | POWER RATING | TOLERANCE  | RESISTANCE RANGE | TEMPERATURE COEFFICIENT OF RESISTANCE |
|--------|------|--------------|------------|------------------|---------------------------------------|
| PA     | 1206 | 1/4W         | ±1%<br>±5% | 1mΩ ≤ R ≤ 2mΩ    | ±75ppm/°C, ±100ppm/°C                 |
|        |      | 1/2W         |            | 3mΩ ≤ R ≤ 50mΩ   | ±50ppm/°C, ±75ppm/°C, ±100ppm/°C      |
|        |      | 1W           |            | 1mΩ ≤ R ≤ 2mΩ    | ±75ppm/°C, ±100ppm/°C                 |
|        |      | 1.5W         |            | 3mΩ ≤ R ≤ 5mΩ    | ±50ppm/°C, ±75ppm/°C, ±100ppm/°C      |

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

**FUNCTIONAL DESCRIPTION**

**OPERATING TEMPERATURE RANGE**

PA1206 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:

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

Where

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

P = Rated power (W)

R = Resistance value (Ω)

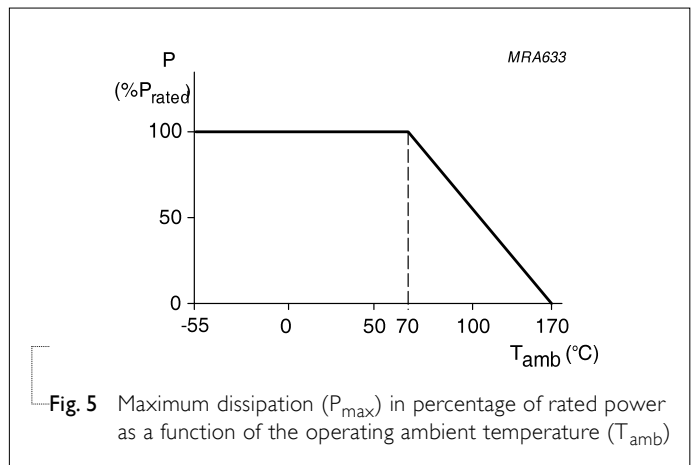


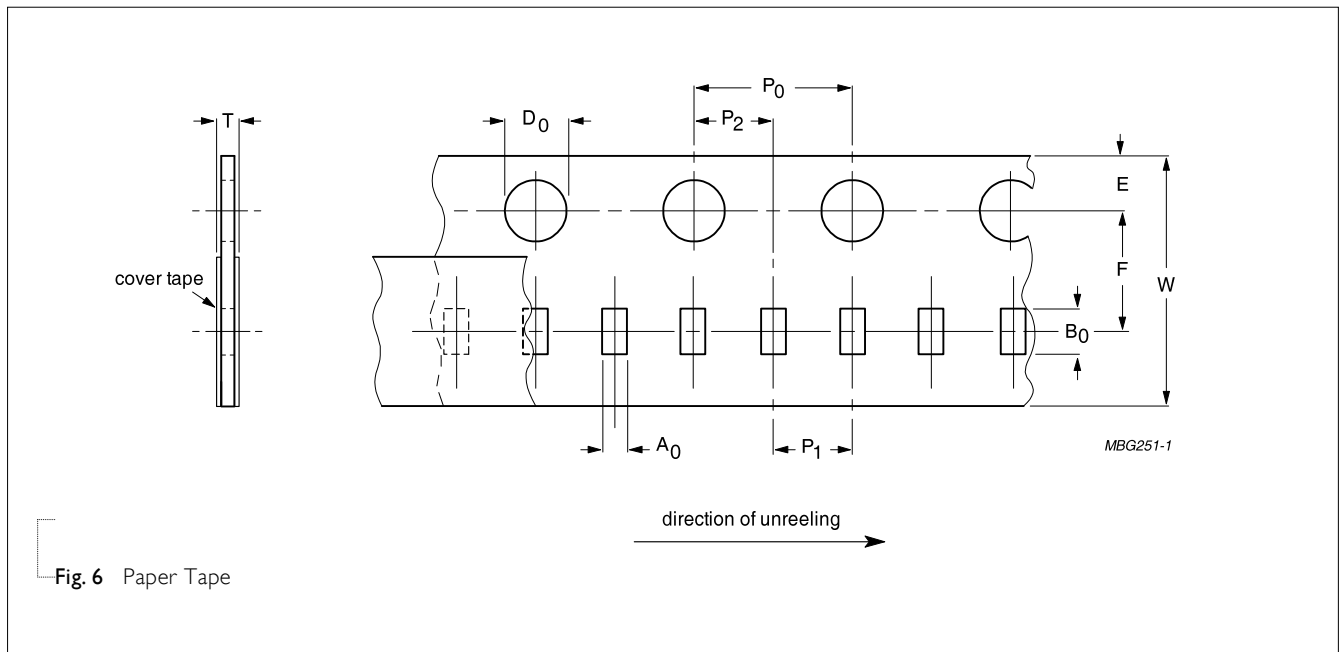
Fig. 5 Maximum dissipation (P<sub>max</sub>) in percentage of rated power as a function of the operating ambient temperature (T<sub>amb</sub>)

**PACKING STYLE AND PACKAGING QUANTITY**

**Table 3** Packing style and packaging quantity

| PACKING STYLE         | REEL DIMENSION | PA1206 |
|-----------------------|----------------|--------|
| Paper Taping Reel (R) | 7" (178 mm)    | 4,000  |

**PAPER TAPE**



**Fig. 6** Paper Tape

**Table 4** Dimensions of paper tape for relevant chip resistors size

| SIZE   | SYMBOL         |                |           |           |           |                |                |                |                 |                 | Unit: mm  |
|--------|----------------|----------------|-----------|-----------|-----------|----------------|----------------|----------------|-----------------|-----------------|-----------|
|        | A <sub>0</sub> | B <sub>0</sub> | W         | E         | F         | P <sub>0</sub> | P <sub>1</sub> | P <sub>2</sub> | ØD <sub>0</sub> | ØD <sub>1</sub> | T         |
| PA1206 | 1.90±0.10      | 3.50±0.10      | 8.00±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       | 1.50±0.10       | 1.50±0.10 |

**REEL SPECIFICATION**

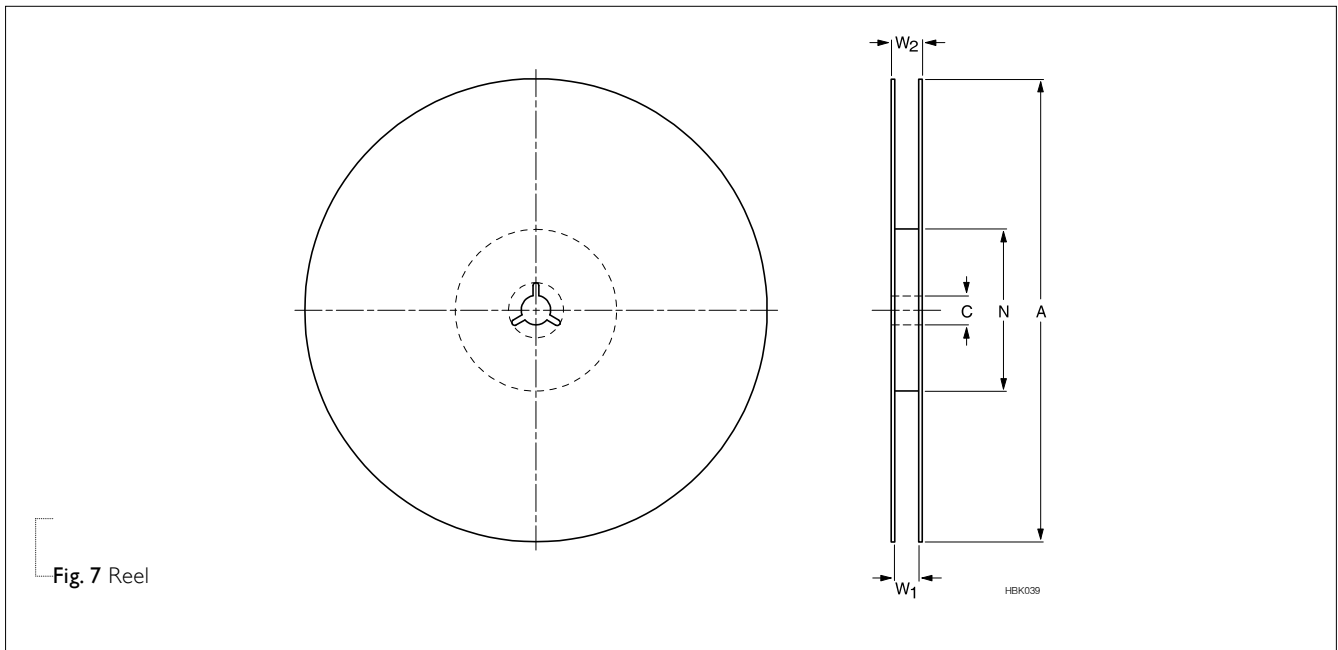
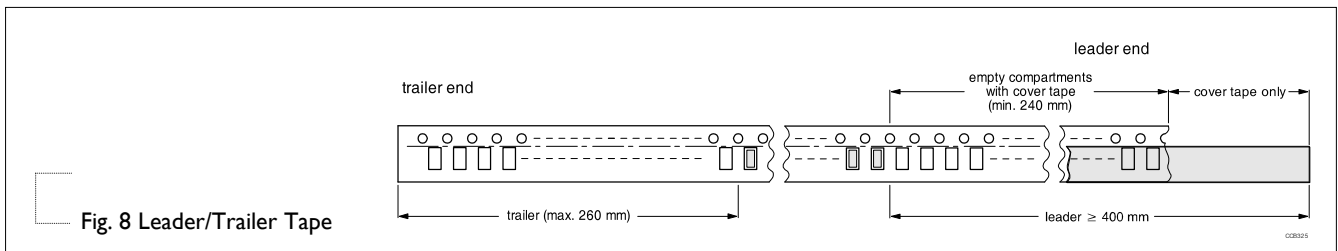


Table 5 Dimensions of reel specification for relevant chip resistors size

| SIZE   | QUANTITY PER REEL | REEL SIZE      |                 | SYMBOL     |           |           |          | Unit: mm       |                     |
|--------|-------------------|----------------|-----------------|------------|-----------|-----------|----------|----------------|---------------------|
|        |                   | 8 mm TAPE WIDE | 12 mm TAPE WIDE | A          | N         | C         | D        | W <sub>1</sub> | W <sub>2</sub> MAX. |
| PA1206 | 4000              | --             | 7"<br>(∅178 mm) | 180.0+0/-3 | 60.0+1/-0 | 13.0± 0.2 | 21.0±0.8 | 8.4 +1/-0      | 12.4                |

**LEADER/TRAILER TAPE SPECIFICATION**



**FOOTPRINT AND SOLDERING PROFILES**

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

**FOOTPRINT**

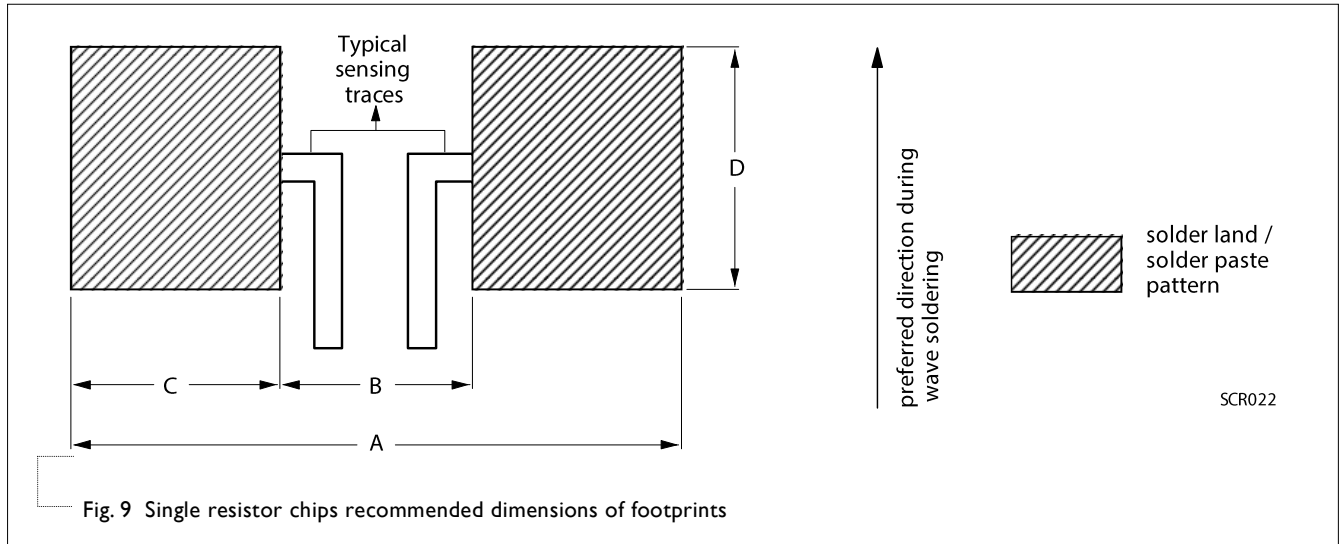


Table 6 Footprint dimensions

| SIZE   | RESISTANCE RANGE                               | A    | B    | C    | D    | Unit: mm |
|--------|------------------------------------------------|------|------|------|------|----------|
| PA1206 | $1\text{m}\Omega \leq R \leq 50\text{m}\Omega$ | 3.90 | 0.76 | 1.57 | 1.78 |          |

**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                                                                                                                                                                        | $\pm 0.5\% + 0.0005\Omega$<br>No visible damage |
| High Temperature Exposure    | MIL-STD-202-Method 108 | 1,000 hours at maximum operating temperature depending on specification, unpowered<br><br>No direct impingement of forced air to the parts Tolerances: $170 \pm 3^\circ\text{C}$                                                | $\pm 1.0\% + 0.0005\Omega$                      |
| Temperature Cycling          | JESD22-A104C           | 1,000 cycles, $-55/+125^\circ\text{C}$ for 1 cycle per hour                                                                                                                                                                     | $\pm 0.5\% + 0.0005\Omega$                      |
| Moisture Resistance          | MIL-STD-202-Method 106 | Each temperature / humidity cycle is defined at 8 hours method 106F, 3 cycles / 24 hours for 10d with $25^\circ\text{C} / 65^\circ\text{C}$ 95% R.H, without steps 7a & 7b, unpowered                                           | $\pm 0.5\% + 0.0005\Omega$                      |
| Biased Humidity              | MIL-STD-202 Method 103 | 1,000 hours; $85^\circ\text{C} / 85\% \text{RH}$<br><br>10% of operating power                                                                                                                                                  | $\pm 0.5\% + 0.0005\Omega$                      |
| Operational Life/ Endurance  | MIL-STD-202-Method 108 | 1,000 hours at $125 \pm 3^\circ\text{C}$ , de-rated voltage applied for 1.5 hours on, 0.5 hour off, still-air required                                                                                                          | $\pm 1.0\% + 0.0005\Omega$                      |
|                              |                        | 1,000 hours at $70 \pm 2^\circ\text{C}$ applied RCWV<br><br>1.5 hours on, 0.5 hour off, still air required                                                                                                                      | $\pm 1.0\% + 0.0005\Omega$                      |
| 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.<br><br>Peak value: 100 g's<br><br>Duration: 6 ms<br><br>Velocity change: 12.3 ft/s<br><br>Waveform: Half sine | $\pm 0.5\% + 0.0005\Omega$                      |
| Vibration                    | MIL-STD-202 Method 204 | 5 g's for 20 min., 12 cycles each of 3 orientations<br><br>Test from 10-2000 Hz.                                                                                                                                                | $\pm 0.5\% + 0.0005\Omega$                      |
| Resistance to Soldering Heat | MIL-STD-202-method 210 | Condition B, no pre-heat of samples<br><br>Leadfree solder, $260^\circ\text{C}$ , 10 seconds immersion time<br><br>Procedure 2 for SMD: devices fluxed and cleaned with isopropanol                                             | $\pm 0.5\% + 0.0005\Omega$<br>No visible damage |
| Thermal Shock                | MIL-STD-202 Method 107 | $-55/+125^\circ\text{C}$ , Number of cycles is 300.<br><br>Devices mounted.<br><br>Maximum transfer time is 20 seconds.<br><br>Dwell time is 15 minutes. Air -Air                                                               | $\pm 0.5\% + 0.0005\Omega$<br>No visible damage |
| TEST                         | TEST METHOD            | PROCEDURE                                                                                                                                                                                                                       | REQUIREMENT                                     |



|                                                     |                        |                                                                                                                                                                                                                                                                                                       |                                                 |
|-----------------------------------------------------|------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------|
| <b>Electrostatic Discharge</b>                      | AEC-Q200-002           | Human Body Model, 1 pos + 1 neg.<br>Discharges 1206=2KV                                                                                                                                                                                                                                               | ±1.0%+0.0005Ω<br>No visible damage              |
| <b>Solderability - Wetting</b>                      | J-STD-002B test B      | a Method B, aging 4 hours at 155°C dry heat, dipping at 235±3°C for 5±0.5 seconds.<br><br>b Method B, steam aging 8 hours, dipping at 215±3°C for 5±0.5 seconds.<br><br>c Method D, steam aging 8 hours, dipping at 260±3 °C for 7±0.5 seconds.                                                       | Well tinned (>95% covered)<br>No visible damage |
| <b>Flammability</b>                                 | UL94                   | Try to inflame a specimen by a needle flame                                                                                                                                                                                                                                                           | No ignition of specimen;<br>V-0                 |
| <b>Board Flex / Bending</b>                         | AEC-Q200-005           | Chips mounted on a 90mm glass epoxy resin PCB FR4, Bending for 1206=2 mm<br><br>Holding time: Min.60 seconds                                                                                                                                                                                          | ±1.0%+0.0005Ω                                   |
| <b>Terminal Strength SMD</b>                        | AEC-Q200-006           | Applied a 17.7N 1.8Kg for 60±1 seconds.                                                                                                                                                                                                                                                               | ±1.0%+0.0005Ω<br>No visible damage              |
| <b>Flame Retardance</b>                             | AEC-Q200-001           | Apply voltage from 9V to 32V to increase the surface temp to 350°C                                                                                                                                                                                                                                    | No flame,<br>no explosion                       |
| <b>Temperature Coefficient of Resistance T.C.R.</b> | MIL-STD-202 Method 304 | At +25/+150°C<br><br>Formula:<br>$T.C.R = \frac{R_2 - R_1}{R_1(t_2 - t_1)} \times 10^6 \text{ppm}/^\circ\text{C}$<br><br>Where<br>t1=+25°C or specified room temperature<br>t2=+150°C test temperature<br>R1=resistance at reference temperature in ohms<br>R2=resistance at test temperature in ohms | Refer to table 2                                |
| <b>Flower-of-Sulfur FOS</b>                         | Modified ASTM B809-95  | Sulfur 105°C, 750 hours, unpowered.                                                                                                                                                                                                                                                                   | ±1.0%+0.0005Ω                                   |

REVISION HISTORY

| REVISION  | DATE          | CHANGE NOTIFICATION | DESCRIPTION                                                                               |
|-----------|---------------|---------------------|-------------------------------------------------------------------------------------------|
| Version 2 | Jul. 24, 2017 | -                   | - Add part number coding details for the relationship between taping reel and rated power |
| Version 1 | May 05, 2017  | -                   | - Extend resistor value                                                                   |
| Version 0 | Mar. 31, 2017 | -                   | - New datasheet for automotive grade current sensor –PA1206_L series.                     |

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