

# DATA SHEET

## CURRENT SENSOR - LOW TCR

PE series

5%, 1%

sizes 0603/0805/1206/2010/2512/4527

RoHS compliant & Halogen free



**SCOPE**

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

**APPLICATIONS**

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

**FEATURES**

- 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**

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

**(1) SIZE**

0603 / 0805 / 1206 / 2010 / 2512 / 4527

**(2) TOLERANCE**

F =  $\pm 1\%$

J =  $\pm 5\%$

**(3) PACKAGING TYPE**

R = Paper taping reel

K = Embossed taping reel

**(4) TEMPERATURE COEFFICIENT OF RESISTANCE**

E =  $\pm 50$  ppm/ $^{\circ}\text{C}$

M =  $\pm 75$  ppm/ $^{\circ}\text{C}$

F =  $\pm 100$  ppm/ $^{\circ}\text{C}$

**(5) TAPING REEL**

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

Detailed power rating are shown in the Table 2.

**(6) RESISTANCE VALUE**

1 m $\Omega$  to 910 m $\Omega$

There are 3~5 digits indicated the resistance value. Letter R is decimal point.

Detailed coding rules of resistance are shown in the table of "Resistance rule of global part number".

**(7) DEFAULT CODE**

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

Resistance rule of global part number

| Resistance code rule   | Example               |
|------------------------|-----------------------|
|                        | 0R001 = 1 m $\Omega$  |
| 0RXXX                  | 0R1 = 100 m $\Omega$  |
| (1 to 910 m $\Omega$ ) | 0R91 = 910 m $\Omega$ |

**ORDERING EXAMPLE**

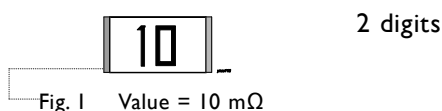
The ordering code of a PE2512 1W chip resistor, value 0.006  $\Omega$  with  $\pm 1\%$  tolerance, supplied in 7-inch tape reel is:  
**PE2512FKM070R006Z**

**NOTE**

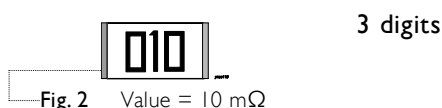
1. All our Rchip products are RoHS compliant. "LFP" of the internal 2D reel label mentions "Lead-Free Process"

## MARKING

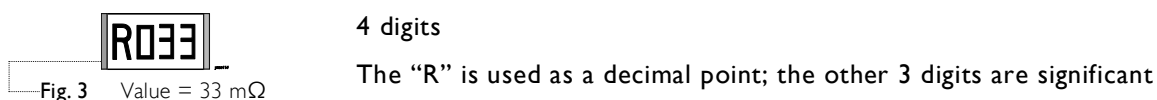
### PE0603



### PE0805



### PE1206 / PE2010 / PE2512 / PE4527



## CONSTRUCTION

The resistors are constructed using outstanding TCR level material, which makes Yageo PE 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

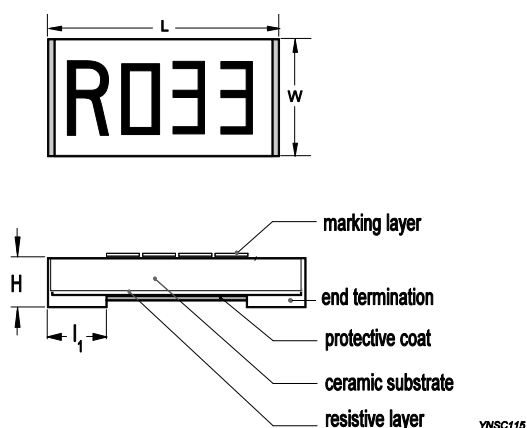


Fig. 4 Chip resistor outlines

**DIMENSION**

Table 1 For outlines, please refer to Fig. 4

| TYPE   | RESISTANCE RANGE   | L (mm)     | W (mm)    | H (mm)    | l <sub>1</sub> (mm) |
|--------|--------------------|------------|-----------|-----------|---------------------|
| PE0603 | 5 mΩ ≤ R ≤ 100 mΩ  | 1.60±0.25  | 0.80±0.25 | 0.60±0.25 | 0.40±0.25           |
|        | 4 mΩ               | 2.00±0.25  | 1.25±0.25 | 0.60±0.25 | 0.70±0.25           |
| PE0805 | 5 mΩ               | 2.00±0.25  | 1.25±0.25 | 0.60±0.25 | 0.73±0.25           |
|        | 6 mΩ               | 2.00±0.25  | 1.25±0.25 | 0.60±0.25 | 0.65±0.25           |
|        | 7mΩ ≤ R ≤ 100 mΩ   | 2.00±0.25  | 1.25±0.25 | 0.60±0.25 | 0.50±0.25           |
| PE1206 | 4 mΩ               | 3.20±0.25  | 1.60±0.25 | 0.60±0.25 | 1.20±0.25           |
|        | 5 mΩ ≤ R ≤ 8 mΩ    | 3.20±0.25  | 1.60±0.25 | 0.60±0.25 | 1.15±0.25           |
|        | 9 mΩ ≤ R ≤ 100 mΩ  | 3.20±0.25  | 1.60±0.25 | 0.60±0.25 | 0.58±0.25           |
| PE2010 | 5 mΩ ≤ R ≤ 9 mΩ    | 5.00±0.25  | 2.50±0.25 | 0.60±0.25 | 1.50±0.25           |
|        | 10 mΩ ≤ R ≤ 100 mΩ | 5.00±0.25  | 2.50±0.25 | 0.60±0.25 | 0.60±0.25           |
| PE2512 | 5 mΩ               | 6.45±0.25  | 3.25±0.25 | 0.70±0.25 | 1.95±0.25           |
|        | 6 mΩ ≤ R ≤ 8mΩ     | 6.45±0.25  | 3.25±0.25 | 0.70±0.25 | 1.90±0.25           |
|        | 9 mΩ ≤ R < 100 mΩ  | 6.45±0.25  | 3.25±0.25 | 0.70±0.25 | 0.95±0.25           |
|        | 100mΩ              | 6.45±0.25  | 3.25±0.25 | 0.70±0.25 | 0.60±0.25           |
| PE4527 | 5 mΩ               | 11.50±0.25 | 7.00±0.25 | 0.60±0.25 | 2.90±0.25           |
|        | 6 mΩ ≤ R < 910 mΩ  | 11.50±0.25 | 7.00±0.25 | 0.60±0.25 | 2.60±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 <sup>(1)</sup> |      |      |      |      | TOLERANCE | RESISTANCE RANGE                                  | TEMPERATURE COEFFICIENT OF RESISTANCE |
|--------|------|-----------------------------|------|------|------|------|-----------|---------------------------------------------------|---------------------------------------|
|        |      | 07                          | 7W   | 7T   | 47   | 57   |           |                                                   |                                       |
| PE     | 0603 | 1/10W                       | 1/5W | 1/3W | 2/5W | 1/2W |           | $5\text{ m}\Omega \leq R \leq 100\text{ m}\Omega$ |                                       |
|        | 0805 | 1/8W                        | 1/4W | 1/3W | 1/2W | ---  |           | $4\text{ m}\Omega \leq R \leq 100\text{ m}\Omega$ |                                       |
|        | 1206 | 1/4W                        | 1/2W | ---  | 1W   | ---  | $\pm 1\%$ | $4\text{ m}\Omega \leq R \leq 100\text{ m}\Omega$ | $\pm 50\text{ ppm}/^\circ\text{C}$    |
|        | 2010 | 1/2W                        | 1W   | ---  | ---  | ---  | $\pm 5\%$ | $5\text{ m}\Omega \leq R \leq 100\text{ m}\Omega$ | $\pm 75\text{ ppm}/^\circ\text{C}$    |
|        | 2512 | 1W                          | 2W   | ---  | ---  | ---  |           | $5\text{ m}\Omega \leq R \leq 100\text{ m}\Omega$ | $\pm 100\text{ ppm}/^\circ\text{C}$   |
|        | 4527 | 2W                          | 3W   | ---  | ---  | ---  |           | $5\text{ m}\Omega \leq R < 910\text{ m}\Omega$    |                                       |

Note: 1. Global part number (code 10 - 11)

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

**FUNCTIONAL DESCRIPTION****OPERATING TEMPERATURE RANGE**Range:  $-55^\circ\text{C}$  to  $+170^\circ\text{C}$ **POWER RATING**Standard rated power at  $70^\circ\text{C}$ :

PE0603 = 1/10W

PE0805 = 1/8W

PE1206 = 1/4W

PE2010 = 1/2W

PE2512 = 1W

PE4527 = 2W

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)

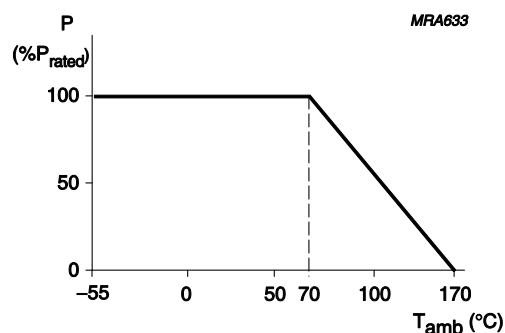
R = Resistance value ( $\Omega$ )

Fig. 5 Maximum dissipation ( $P_{\max}$ ) in percentage of rated power as a function of the operating ambient temperature ( $T_{\text{amb}}$ )

## PACKING STYLE AND PACKAGING QUANTITY

Table 3 Packing style and packaging quantity

| PACKING STYLE            | REEL DIMENSION | PE0603 | PE0805 | PE1206 | PE2010 | PE2512 | PE4527 |
|--------------------------|----------------|--------|--------|--------|--------|--------|--------|
| Paper taping reel (R)    | 7" (178 mm)    | 5,000  | 5,000  | ---    | ---    | ---    | ---    |
| Embossed taping reel (K) | 7" (178 mm)    | ---    | ---    | 4,000  | 4,000  | 4,000  | 1,000  |

## PAPER TAPE

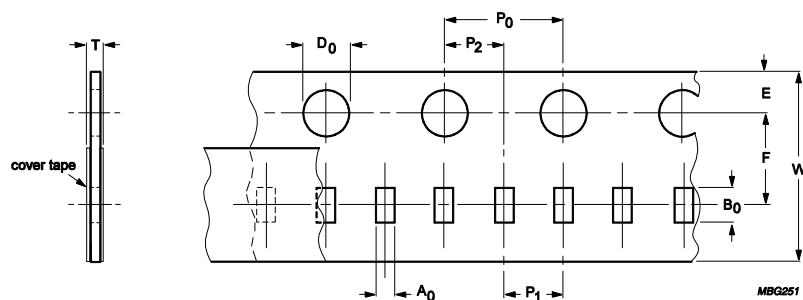


Fig. 6 Paper Tape

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> | T         |          |
| PE0603 | 1.20±0.15      | 1.90±0.15      | 8.00±0.30 | 1.75±0.10 | 3.50±0.10 | 4.00±0.10      | 4.00±0.10      | 2.00±0.10      | 1.50±0.10       | 0.55±0.15 |          |
| PE0805 | 1.60±0.15      | 2.30±0.15      | 8.00±0.30 | 1.75±0.10 | 3.50±0.10 | 4.00±0.10      | 4.00±0.10      | 2.00±0.10      | 1.50±0.10       | 0.85±0.15 |          |

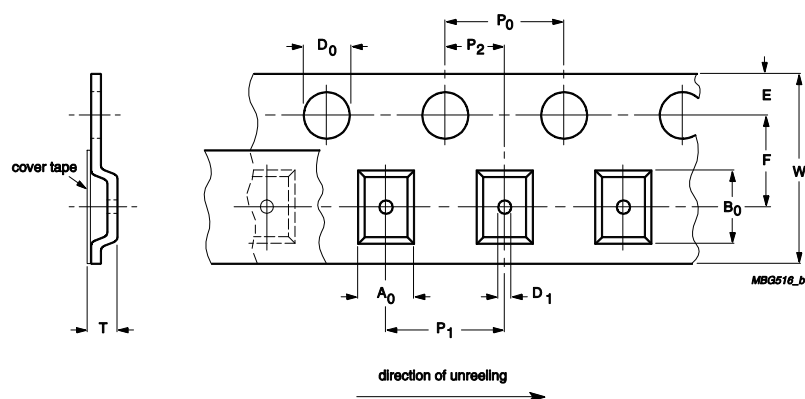
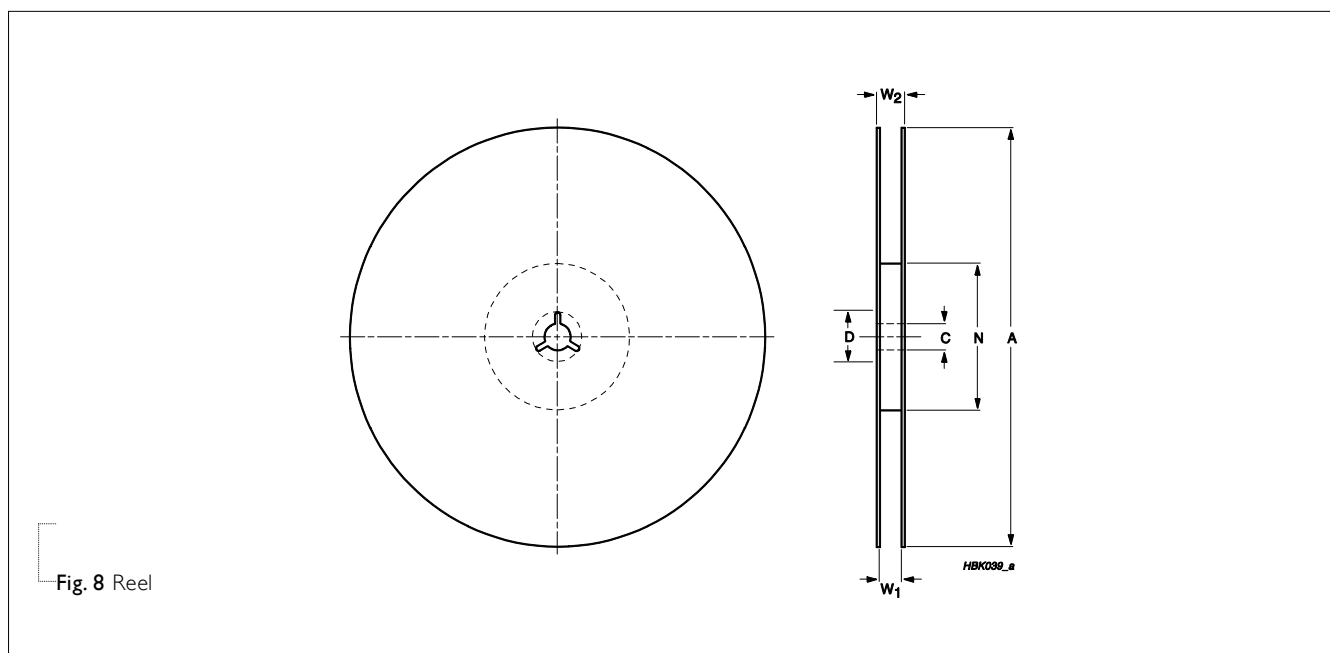
**EMBOSSED TAPE**


Fig. 7 Embossed Tape

Table 5 Dimensions of embossed 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> |           |
| PE1206 | 1.82±0.15      | 3.53±0.15      | 8.00±0.30  | 1.75±0.10 | 3.50±0.10  | 4.00±0.10      | 4.00±0.10      | 2.00±0.10      | 1.50±0.10       | 1.50±0.10       | 0.85±0.15 |
| PE2010 | 3.00±0.15      | 5.60±0.15      | 12.10±0.30 | 1.75±0.10 | 5.50±0.10  | 4.00±0.10      | 4.00±0.10      | 2.00±0.10      | 1.50±0.10       | 1.50±0.10       | 0.80±0.15 |
| PE2512 | 3.40±0.15      | 6.70±0.15      | 12.10±0.30 | 1.75±0.10 | 5.50±0.10  | 4.00±0.10      | 4.00±0.10      | 2.00±0.10      | 1.50±0.10       | 1.50±0.10       | 0.80±0.15 |
| PE4527 | 7.50±0.15      | 12.0±0.15      | 24.00±0.30 | 1.75±0.10 | 11.50±0.10 | 4.00±0.10      | 8.00±0.10      | 2.00±0.10      | 1.50±0.10       | 1.50±0.10       | 0.90±0.15 |

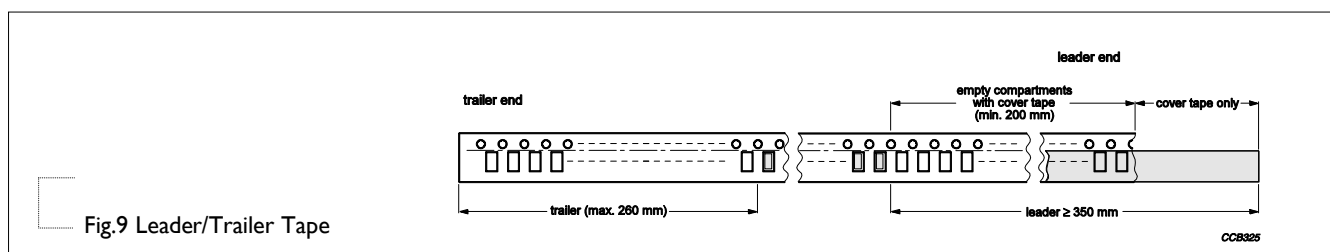
## REEL SPECIFICATION



**Table 6** Dimensions of reel specification for relevant chip resistors size

| SIZE   | QUANTITY<br>PER REEL | REEL SIZE         |                    |                    | SYMBOL     |           |          |          |                | Unit: mm            |
|--------|----------------------|-------------------|--------------------|--------------------|------------|-----------|----------|----------|----------------|---------------------|
|        |                      | 8 mm<br>TAPE WIDE | 12 mm<br>TAPE WIDE | 24 mm<br>TAPE WIDE | A          | N         | C        | D        | W <sub>I</sub> | W <sub>2</sub> MAX. |
| PE0603 | 5000                 | 7"<br>(Ø178 mm)   | --                 | --                 | 180.0+0/-3 | 60.0+1/-0 | 13.0±0.2 | 21.0±0.8 | 8.4 +1/-0      | 12.4                |
| PE0805 | 5000                 | 7"<br>(Ø178 mm)   | --                 | --                 | 180.0+0/-3 | 60.0+1/-0 | 13.0±0.2 | 21.0±0.8 | 8.4 +1/-0      | 12.4                |
| PE1206 | 4000                 | 7"<br>(Ø178 mm)   | --                 | --                 | 180.0+0/-3 | 60.0+1/-0 | 13.0±0.2 | 21.0±0.8 | 8.4 +1/-0      | 12.4                |
| PE2010 | 4000                 | --                | 7"<br>(Ø178 mm)    | --                 | 180.0+0/-3 | 60.0+1/-0 | 13.0±0.2 | 21.0±0.8 | 12.3 +1/-0     | 18.4                |
| PE2512 | 4000                 | --                | 7"<br>(Ø178 mm)    | --                 | 180.0+0/-3 | 60.0+1/-0 | 13.0±0.2 | 21.0±0.8 | 12.3 +1/-0     | 18.4                |
| PE4527 | 1000                 | --                | --                 | 7"<br>(Ø178 mm)    | 180.0+0/-3 | 60.0+1/-0 | 13.0±0.2 | 21.0±0.8 | 24.0 +1/-0     | 26.5                |

## LEADER/TRAILER TAPE SPECIFICATION



## FOOTPRINT AND SOLDERING PROFILES

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

### FOOTPRINT

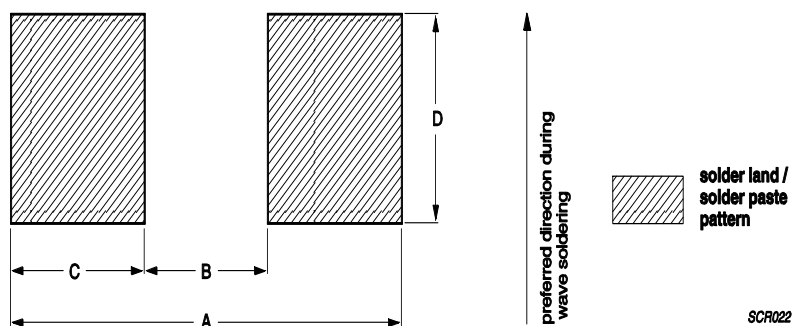


Fig. 10 Single resistor chips recommended dimensions of footprints

Table 7 Footprint dimensions

| SIZE   | RESISTANCE RANGE                                   | Unit: mm |      |      |      |
|--------|----------------------------------------------------|----------|------|------|------|
|        |                                                    | A        | B    | C    | D    |
| PE0603 | $5\text{ m}\Omega \leq R \leq 100\text{ m}\Omega$  | 2.10     | 0.60 | 0.75 | 0.92 |
|        | $4\text{ m}\Omega$                                 | 5.00     | 0.40 | 2.30 | 1.44 |
| PE0805 | $5\text{ m}\Omega$                                 | 5.00     | 0.50 | 2.25 | 1.44 |
|        | $6\text{ m}\Omega$                                 | 4.80     | 0.60 | 2.10 | 1.44 |
|        | $7\text{ m}\Omega \leq R < 100\text{ m}\Omega$     | 5.00     | 0.80 | 2.10 | 1.44 |
|        | $4\text{ m}\Omega$                                 | 6.20     | 0.50 | 2.85 | 1.84 |
| PE1206 | $5\text{ m}\Omega \leq R \leq 8\text{ m}\Omega$    | 6.20     | 0.60 | 2.80 | 1.84 |
|        | $9\text{ m}\Omega \leq R \leq 100\text{ m}\Omega$  | 6.20     | 1.20 | 2.50 | 1.84 |
| PE2010 | $5\text{ m}\Omega \leq R \leq 9\text{ m}\Omega$    | 8.00     | 1.40 | 3.30 | 2.88 |
|        | $10\text{ m}\Omega \leq R \leq 100\text{ m}\Omega$ | 8.00     | 2.70 | 2.65 | 2.88 |
| PE2512 | $5\text{ m}\Omega \leq R \leq 8\text{ m}\Omega$    | 9.30     | 1.60 | 3.85 | 3.57 |
|        | $9\text{ m}\Omega \leq R < 100\text{ m}\Omega$     | 9.30     | 3.10 | 3.10 | 3.57 |
|        | $100\text{ m}\Omega$                               | 9.30     | 3.60 | 2.85 | 3.57 |
| PE4527 | $5\text{ m}\Omega$                                 | 14.50    | 4.00 | 5.25 | 8.05 |
|        | $6\text{ m}\Omega \leq R < 10\text{ m}\Omega$      | 14.50    | 4.40 | 5.05 | 8.05 |

## TESTS AND REQUIREMENTS

Table 8 Test condition, procedure and requirements

| TEST                                                                              | TEST METHOD              | PROCEDURE                                                                                                                                                       | REQUIREMENTS      |
|-----------------------------------------------------------------------------------|--------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|
| Life/<br>Operational Life/<br>Endurance                                           | MIL-STD-202G-method 108A | 1,000 hours at 70±5 °C applied RCWV                                                                                                                             | ±(1%+0.0005 Ω)    |
|                                                                                   | IEC 60115-1 4.25.1       | 1.5 hours on, 0.5 hour off, still air required                                                                                                                  |                   |
|                                                                                   | JIS C 5202-7.10          |                                                                                                                                                                 |                   |
| High<br>Temperature<br>Exposure/<br>Endurance at<br>Upper Category<br>Temperature | MIL-STD-202G-method 108A | 1,000 hours at maximum operating temperature                                                                                                                    | ±(1%+0.0005 Ω)    |
|                                                                                   | IEC 60115-1 4.25.3       | depending on specification, unpowered                                                                                                                           |                   |
|                                                                                   | JIS C 5202-7.11          | No direct impingement of forced air to the parts<br>Tolerances: 155±3 °C                                                                                        |                   |
| Moisture<br>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%+0.0005 Ω)  |
|                                                                                   | IEC 60115-1 4.24.2       | Parts mounted on test-boards, without condensation on parts                                                                                                     |                   |
|                                                                                   |                          | Measurement at 24±2 hours after test conclusion                                                                                                                 |                   |
| Thermal Shock                                                                     | MIL-STD-202G-method 107G | -55/+155 °C                                                                                                                                                     | ±(0.5%+0.0005 Ω)  |
|                                                                                   |                          | Note: Number of cycles required is 300.                                                                                                                         |                   |
|                                                                                   |                          | Maximum transfer time is 20 seconds. Dwell time is 15 minutes. Air – Air                                                                                        |                   |
| Short Time<br>Overload                                                            | MIL-R-55342D-para 4.7.5  | 5 times of rated power for 5 seconds at room temperature                                                                                                        | ±(0.5%+0.0005 Ω)  |
|                                                                                   | IEC60115-1 4.13          |                                                                                                                                                                 | No visible damage |
|                                                                                   |                          |                                                                                                                                                                 |                   |
| Board Flex/<br>Bending                                                            | IEC60115-1 4.33          | Device mounted on PCB test board as described, only 1 board bending required                                                                                    | ±(1%+0.0005 Ω)    |
|                                                                                   |                          | Bending for 0603/0805: 3 mm                                                                                                                                     | No visible damage |
|                                                                                   |                          | 1206/2512/4520/4527: 2 mm                                                                                                                                       |                   |
| Humidity                                                                          | IEC 60115-1 4.21         | Holding time: minimum 60 seconds                                                                                                                                |                   |
|                                                                                   |                          | Steady state for 1000 hours at 40 °C / 95% R.H.                                                                                                                 | ±(1%+0.0005 Ω)    |
|                                                                                   |                          | RCWV applied for 1.5 hours on and 0.5 hour off                                                                                                                  |                   |

| TEST                              | TEST METHOD                                  | PROCEDURE                                                                                                                                                                                                                            | REQUIREMENTS                                    |
|-----------------------------------|----------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------|
| Solderability                     |                                              |                                                                                                                                                                                                                                      |                                                 |
| - Wetting                         | IPC/JEDECJ-STD-002B test B<br>IEC 60068-2-58 | Electrical Test not required<br>Magnification 50X<br>SMD conditions:<br>1 <sup>st</sup> step: method B, aging 4 hours at 155 °C<br>dry heat<br>2 <sup>nd</sup> step: leadfree solder bath at 245±3 °C<br>Dipping time: 3±0.5 seconds | Well tinned (≥95% covered)<br>No visible damage |
| - Leaching                        | IPC/JEDECJ-STD-002B test D<br>IEC 60068-2-58 | Leadfree solder, 260 °C, 30 seconds<br>immersion time                                                                                                                                                                                | No visible damage                               |
| - Resistance to<br>Soldering Heat | MIL-STD-202G-method 210F<br>IEC 60068-2-58   | Condition B, no pre-heat of samples<br>Leadfree solder, 260 °C, 10 seconds<br>immersion time<br>Procedure 2 for SMD: devices fluxed and<br>cleaned with isopropanol                                                                  | ±(0.5%+0.0005 Ω)<br>No visible damage           |

# REVISION HISTORY

| REVISION  | DATE          | CHANGE NOTIFICATION | DESCRIPTION                                                                                                                                                          |
|-----------|---------------|---------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Version 2 | Aug. 22, 2014 | -                   | <ul style="list-style-type: none"> <li>- extend resistance value</li> <li>- update dimensions</li> <li>- remove PE4520</li> <li>- remove 2% and 0.5% tol.</li> </ul> |
| Version 1 | Sep. 14, 2013 | -                   | - Update the PE2512 resistance value.                                                                                                                                |
| Version 0 | May. 28, 2012 | -                   | - New datasheet for current sensor - low TCR PE series sizes of 0603/0805/1206/2010/2512/4520/4527, 0.5%, 1%, 2% and 5% with lead-free terminations                  |

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