

DATA SHEET

CURRENT SENSOR - LOW TCR

AUTOMOTIVE GRADE

PE_L series

5%, 1%, 0.5%, 0.1%

sizes

0201/0402/ 0603/ 0805/ 1206/ 2010/ 2512

RoHS compliant & Halogen free



SCOPE

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

APPLICATIONS

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

FEATURES

- AEC-Q200 qualified
- Halogen-free Epoxy
- RoHS compliant
- Reduce environmentally hazardous wastes
- High component and equipment reliability
- None 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 L
 (1) (2) (3) (4) (5) (6) (7)

(1) SIZE

0201/ 0402/ 0603/ 0805/ 1206/ 2010/ 2512

(2) TOLERANCE

- B = ±0.1% (only for 0805, > 50mΩ)
- D = ±0.5% (≥10mΩ)
- F = ±1%
- J = ±5%

(3) PACKAGING TYPE

- R = Paper/ PE taping reel
- K = Embossed taping reel

(4) TEMPERATURE COEFFICIENT OF RESISTANCE

- E = ±50 ppm/°C
- M = ±75 ppm/°C
- F = ±100 ppm/°C
- J = ±350 ppm/°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

5 mΩ to 910 mΩ
 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 L is the system default code for ordering only. (Note)

| Resistance code rule | Example |
|----------------------|---------------|
| 0RXXX | 0R001 = 1 mΩ |
| (1 to 910 mΩ) | 0R1 = 100 mΩ |
| | 0R91 = 910 mΩ |

ORDERING EXAMPLE

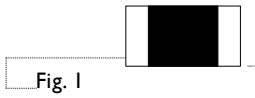
The ordering code of a PE2512 1W chip resistor, value 0.1 Ω with ±1% tolerance, supplied in 7-inch tape reel is: PE2512FKM070R1L

NOTE

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

MARKING

PE0201 / PE0402



No marking

PE0603

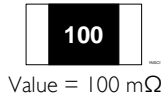
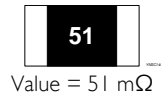
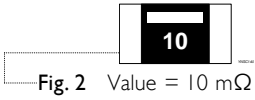
$5\text{m}\Omega \leq R \leq 50\text{m}\Omega$

$51\text{m}\Omega \leq R \leq 99\text{m}\Omega$

$100\text{m}\Omega \leq R \leq 910\text{m}\Omega$

2 digits

resistance range: $5\text{m}\Omega \leq R \leq 99\text{m}\Omega$



3 digits

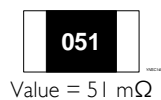
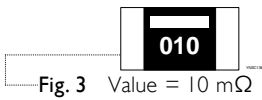
resistance range: $100\text{m}\Omega \leq R \leq 910\text{m}\Omega$

PE0805

$5\text{m}\Omega \leq R \leq 50\text{m}\Omega$

$51\text{m}\Omega \leq R \leq 910\text{m}\Omega$

3 digits



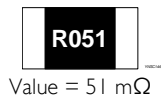
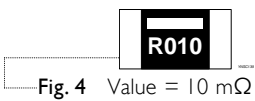
PE1206

$5\text{m}\Omega \leq R \leq 50\text{m}\Omega$

$51\text{m}\Omega \leq R \leq 910\text{m}\Omega$

4 digits

The "R" is used as a decimal point; the other 3 digits are significant.



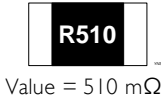
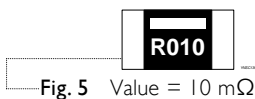
PE2010 / PE2512

$5\text{m}\Omega \leq R \leq 100\text{m}\Omega$

$100\text{m}\Omega < R \leq 910\text{m}\Omega$

4 digits

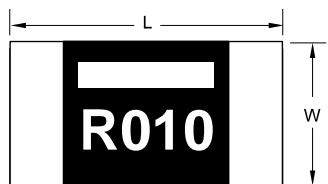
The "R" is used as a decimal point; the other 3 digits are significant.



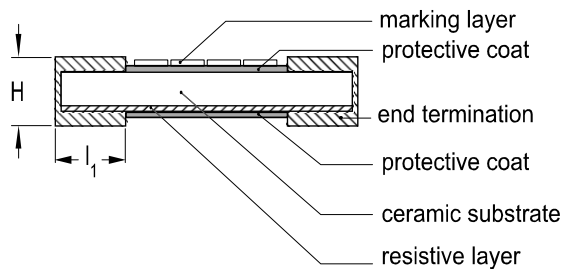
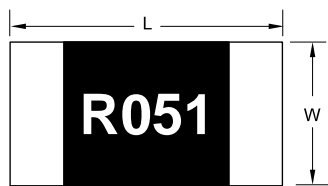
Outlines

For dimensions, please refer to Table I

$5\text{m}\Omega \leq R \leq 50\text{m}\Omega$



$51\text{m}\Omega \leq R \leq 910\text{m}\Omega$



YWSC14E

Fig. 5 Chip resistor outlines

DIMENSION

Table 1 For outlines, please refer to Fig. 4

| TYPE | RESISTANCE RANGE | L (mm) | W (mm) | H (mm) | l _i (mm) |
|--------|--------------------|-----------------|-----------------|-----------|---------------------|
| PE0201 | 50 mΩ ≤ R ≤ 910 mΩ | 0.60±0.03 | 0.31±0.04 | 0.27±0.04 | 0.14±0.06 |
| PE0402 | 10 mΩ ≤ R ≤ 910 mΩ | 1.00+0.10/-0.15 | 0.50+0.10/-0.15 | 0.35±0.15 | 0.25±0.10 |
| PE0603 | 5 mΩ ≤ R ≤ 50 mΩ | 1.60±0.20 | 0.76±0.25 | 0.35±0.25 | 0.38±0.25 |
| | 51 mΩ ≤ R ≤ 910 mΩ | 1.52±0.25 | 0.76±0.25 | 0.45±0.10 | 0.38±0.25 |
| PE0805 | 5 mΩ ≤ R ≤ 6 mΩ | 2.03±0.25 | 1.27±0.25 | 0.35±0.25 | 0.73±0.25 |
| | 7 mΩ ≤ R ≤ 50 mΩ | 2.03±0.25 | 1.27±0.25 | 0.35±0.25 | 0.38±0.25 |
| | 51 mΩ ≤ R ≤ 910 mΩ | 2.03±0.25 | 1.27±0.25 | 0.55±0.10 | 0.35±0.20 |
| PE1206 | 5 mΩ | 3.20±0.25 | 1.60±0.25 | 0.64±0.25 | 0.64±0.25 |
| | 6 mΩ ≤ R ≤ 910 mΩ | 3.20±0.25 | 1.60±0.25 | 0.64±0.25 | 0.51±0.25 |
| PE2010 | 5 mΩ ≤ R ≤ 6 mΩ | 5.08±0.25 | 2.54±0.25 | 0.64±0.25 | 1.47±0.25 |
| | 7 mΩ ≤ R ≤ 910 mΩ | 5.08±0.25 | 2.54±0.25 | 0.64±0.25 | 0.51±0.25 |
| PE2512 | 6 mΩ ≤ R ≤ 910 mΩ | 6.35±0.25 | 3.18±0.25 | 0.64±0.25 | 0.76±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 (1) | | | | | TOLERANCE | RESISTANCE RANGE | TEMPERATURE COEFFICIENT OF RESISTANCE |
|-------------|------------------|-------|------|------|------|------------------------------|--|---|
| | 07 | 7W | 7T | 47 | 57 | | | |
| 0201 | 1/20W | 1/10W | --- | --- | --- | | 50 mΩ ≤ R ≤ 910 mΩ | 50 mΩ ≤ R ≤ 70 mΩ ±350 ppm/°C 70 mΩ < R ≤ 910 mΩ ±100 ppm/°C |
| 0402 | 1/16W | 1/8W | 1/6W | 1/4W | --- | | 10 mΩ ≤ R ≤ 910 mΩ | ±100 ppm/°C |
| 0603 | 1/10W | 1/5W | 1/3W | 2/5W | 1/2W | ±0.1% (only for 0805, >50mΩ) | 5 mΩ ≤ R ≤ 910 mΩ | ±75 ppm/°C |
| PE 0805 | 1/8W | 1/4W | 1/3W | 1/2W | --- | ±0.5% (≥10 mΩ) | | ±100 ppm/°C |
| 1206 | 1/4W | 1/2W | --- | 1W | --- | ±1% ±5% | 5 mΩ ≤ R ≤ 19 mΩ 20 mΩ ≤ R ≤ 910 mΩ | ±75 ppm/°C, ±100 ppm/°C ±50 ppm/°C, ±75 ppm/°C, ±100 ppm/°C |
| 2010 | 1/2W | 1W | --- | --- | --- | | 5 mΩ ≤ R ≤ 910 mΩ | ±50 ppm/°C |
| 2512 | 1W | 2W | --- | --- | --- | | 6 mΩ ≤ R ≤ 910 mΩ | ±75 ppm/°C ±100 ppm/°C |

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

PE0201 to PE0402 Range: -55°C to +125°C (Fig. 6-1)

PE0603 to PE2512 Range: -55°C to +170°C (Fig. 6-2)

POWER RATING

Standard rated power at 70°C:

PE0201 = 1/20W

PE0402 = 1/16W

PE0603 = 1/10W

PE0805 = 1/8W

PE1206 = 1/4W

PE2010 = 1/2W

PE2512 = 1W

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:

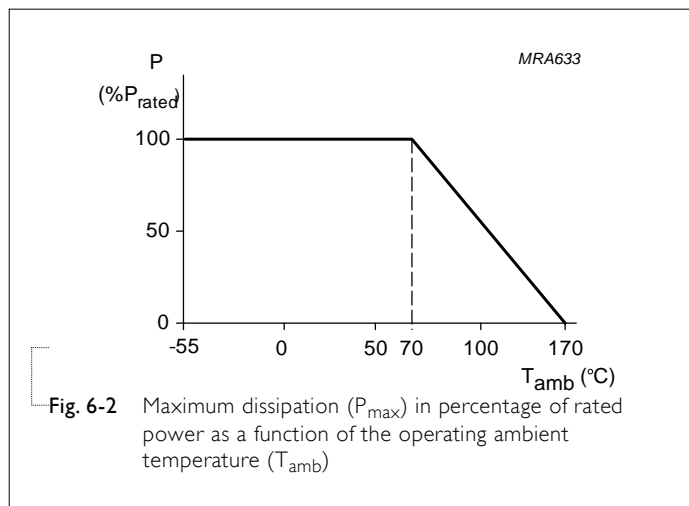
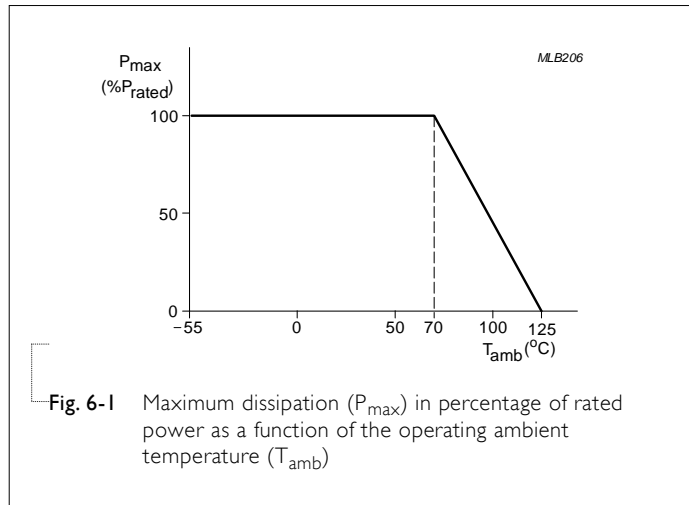
$$V = \sqrt{(P \times R)}$$

Where

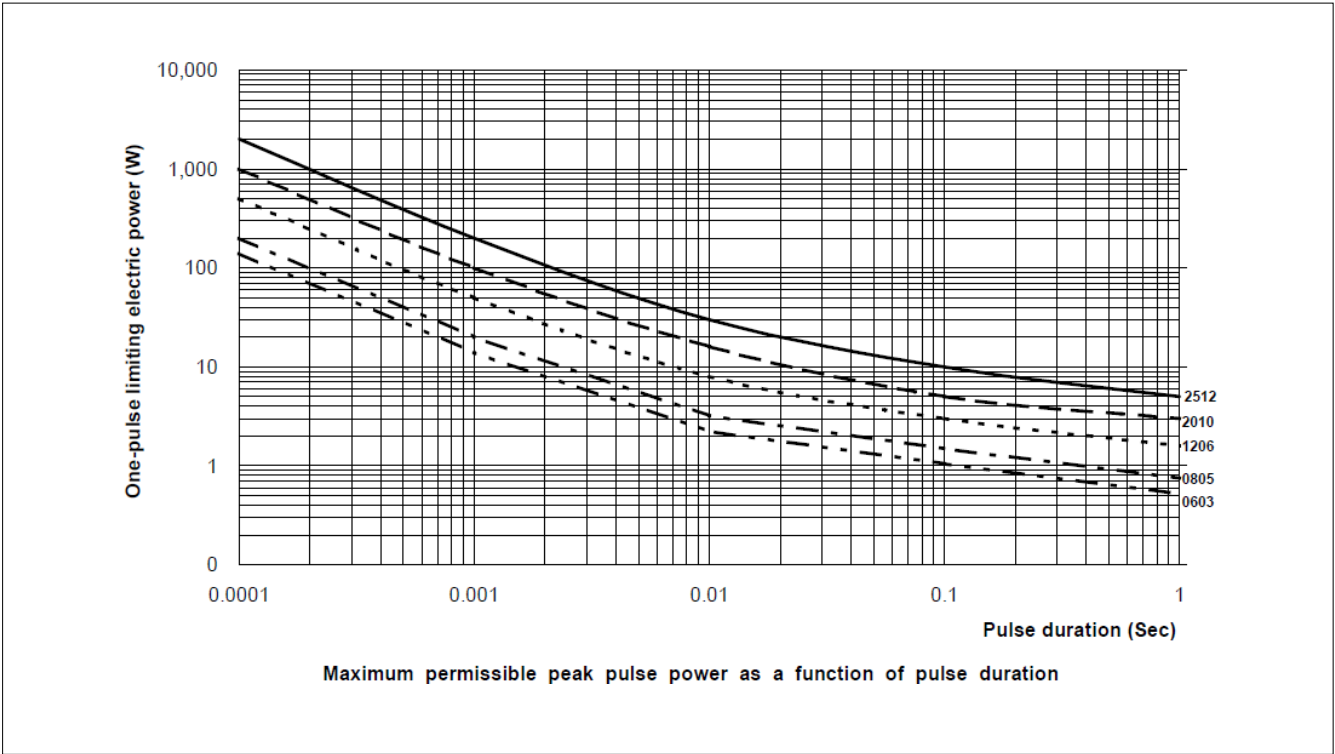
V = Continuous rated DC or AC (rms) working voltage (V)

P = Rated power (W)

R = Resistance value (Ω)



PULSE LOAD BEHAVIOR



PACKING STYLE AND PACKAGING QUANTITY

Table 3 Packing style and packaging quantity

| PACKING STYLE | REEL DIMENSION | PE0201 | PE0402 | PE0603 | PE0805 | PE1206 | PE2010 | PE2512 |
|--------------------------|----------------|--------|--------|--------|--------|--------|--------|--------|
| 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 | 4,000 |

PAPER TAPE

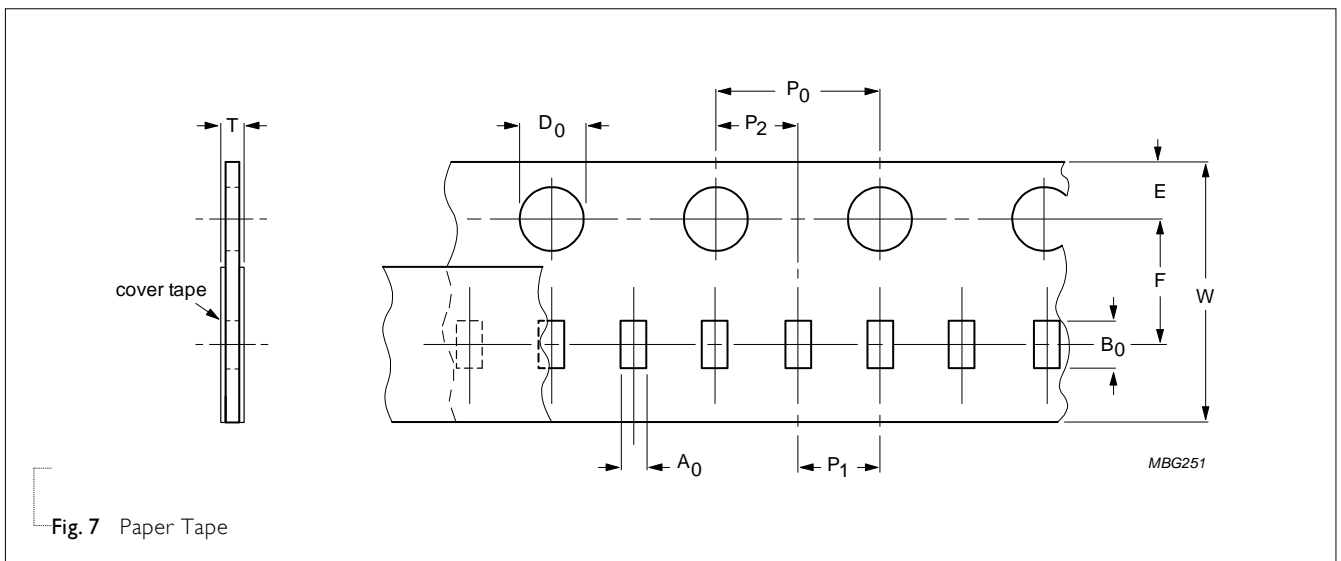


Table 4 Dimensions of paper tape for relevant chip resistors size

| SIZE | SYMBOL | | | | | | | | | | Unit: mm |
|--------|----------------|----------------|-----------|-----------|-----------|----------------|----------------|----------------|-----------------|-----------|----------|
| | A ₀ | B ₀ | W | E | F | P ₀ | P ₁ | P ₂ | ØD ₀ | T | |
| PE0201 | 0.35±0.10 | 1.65±0.10 | 8.00±0.30 | 1.75±0.10 | 3.50±0.10 | 4.00±0.10 | 2.00±0.05 | 2.00±0.05 | 1.50±0.10 | 0.53±0.10 | |
| PE0402 | 0.65±0.10 | 1.15±0.10 | 8.00±0.30 | 1.75±0.10 | 3.50±0.10 | 4.00±0.10 | 2.00±0.05 | 2.00±0.05 | 1.50±0.10 | 0.53±0.10 | |
| 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 | |
| PE1206 | 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 | 1.50±0.10 | 1.50±0.10 | |

EMBOSSED TAPE

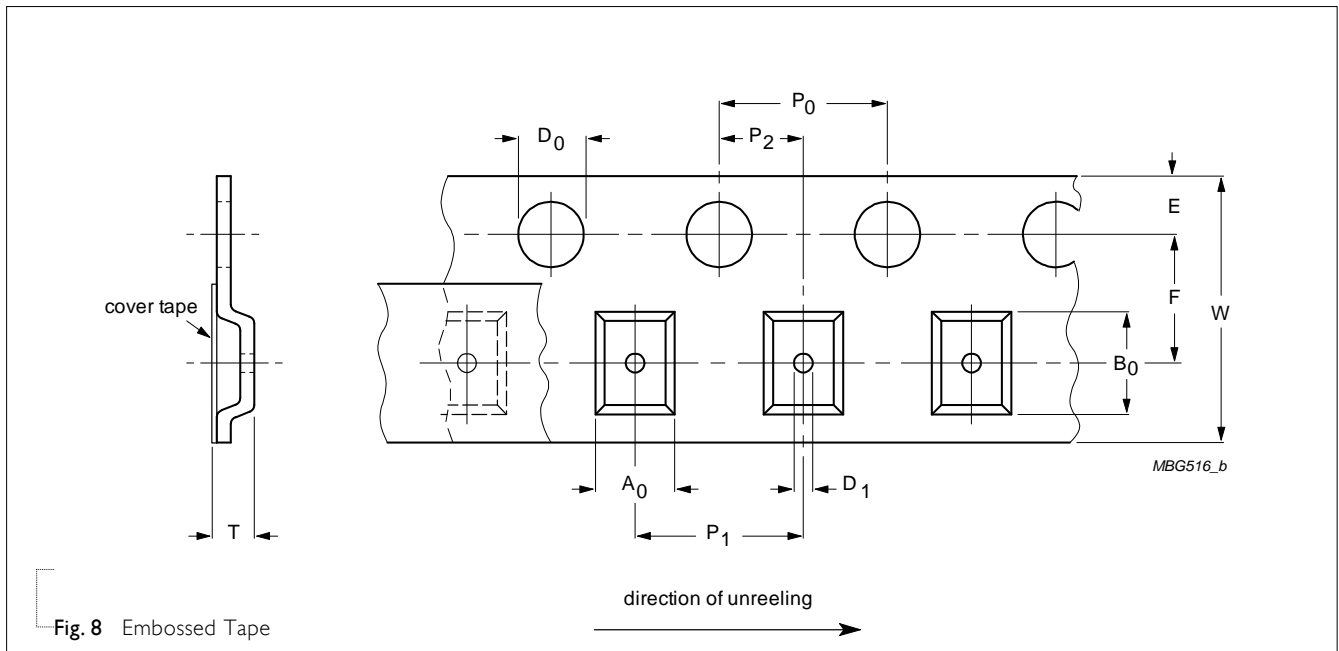


Fig. 8 Embossed Tape

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 | ØD ₀ | ØD ₁ | T |
| 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 |

REEL SPECIFICATION

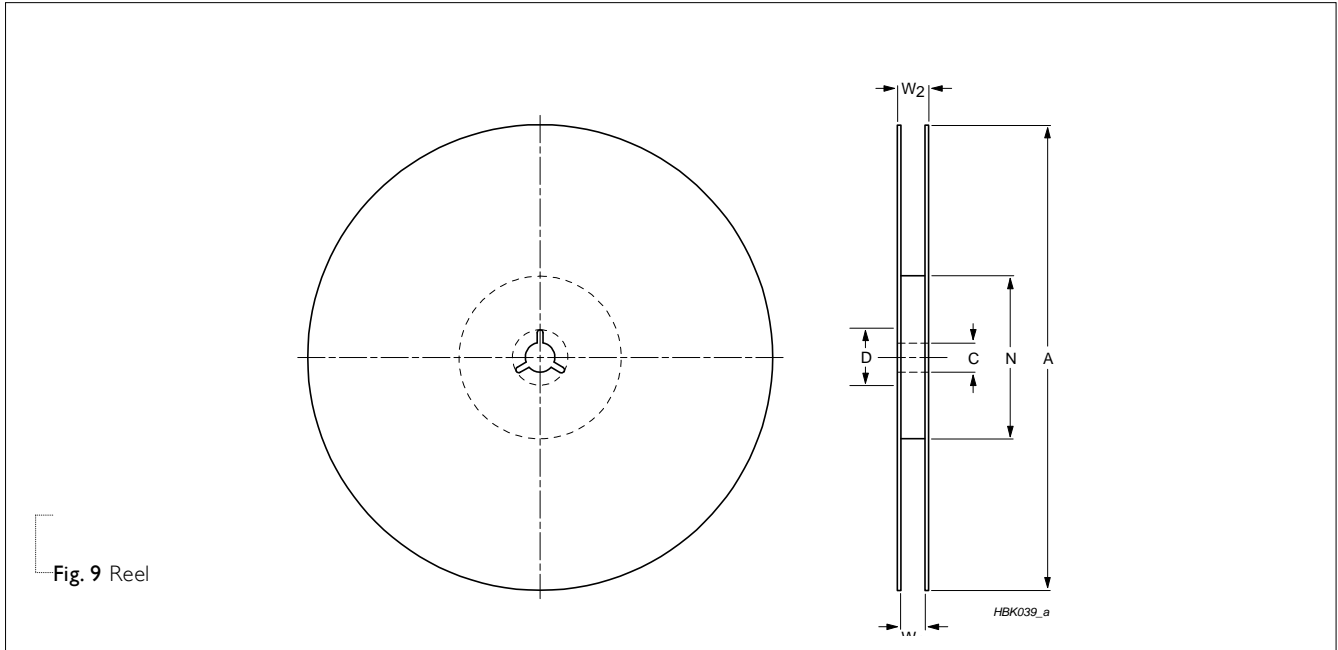


Fig. 9 Reel

Table 6 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 | 24 mm TAPE WIDE | A | N | C | D | W ₁ | W ₂ MAX. | |
| PE0201 | 10,000 | 7" (Ø178 mm) | --- | --- | 180.0+0/-3 | 60.0+1/-0 | 13.0±0.2 | 21.0±0.8 | 9.0±0.30 | 12.4 | |
| PE0402 | 10,000 | 7" (Ø178 mm) | --- | --- | 180.0+0/-3 | 60.0+1/-0 | 13.0±0.2 | 21.0±0.8 | 9.0±0.30 | 12.4 | |
| PE0603 | 5000 | 7" (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" (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" (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 | -- (Ø178 mm) | 7" | -- | 180.0+0/-3 | 60.0+1/-0 | 13.0±0.2 | 21.0±0.8 | 12.3 +1/-0 | 18.4 | |
| PE2512 | 4000 | -- (Ø178 mm) | 7" | -- | 180.0+0/-3 | 60.0+1/-0 | 13.0±0.2 | 21.0±0.8 | 12.3 +1/-0 | 18.4 | |

LEADER/TRAILER TAPE SPECIFICATION

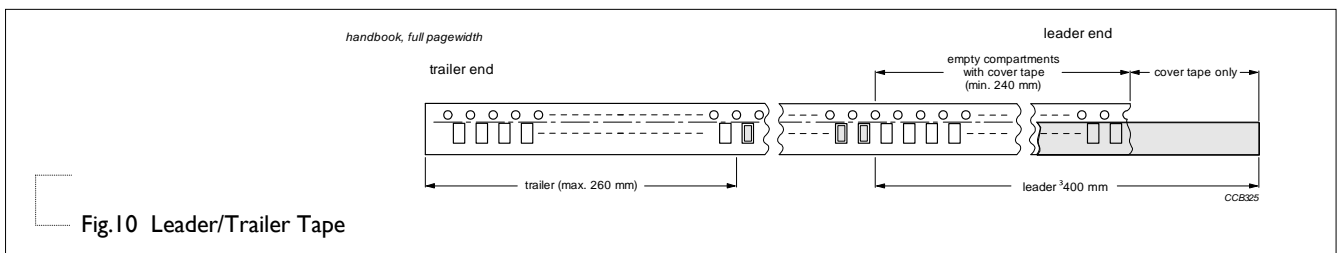


Fig.10 Leader/Trailer Tape

FOOTPRINT AND SOLDERING PROFILES

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

FOOTPRINT

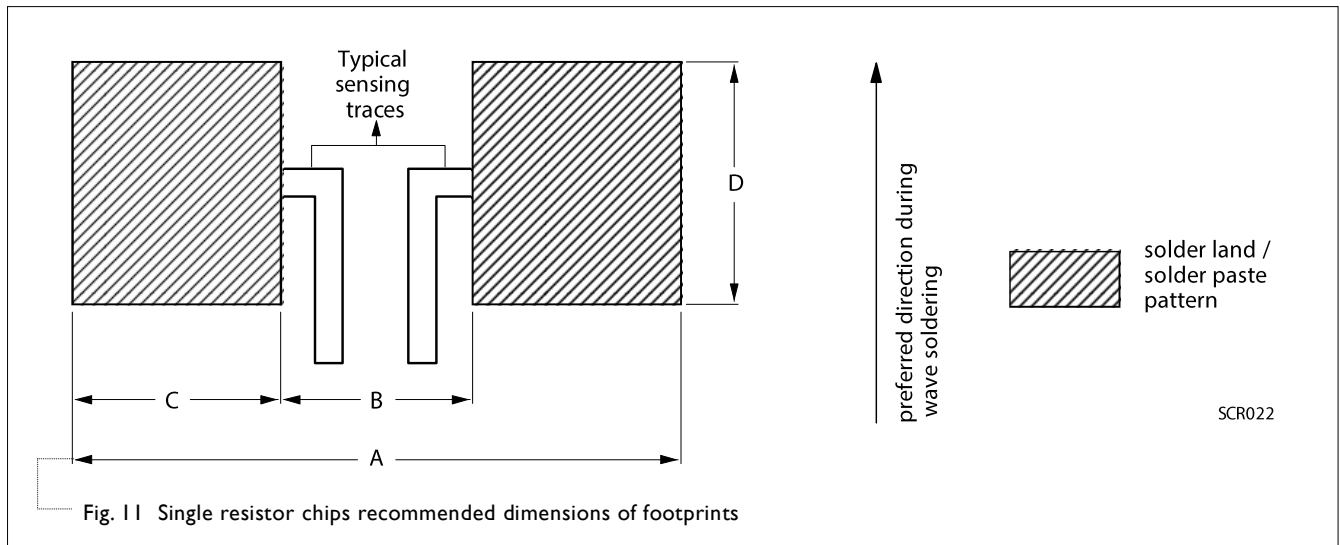


Table 7 Footprint dimensions

| SIZE | RESISTANCE RANGE | Unit: mm | | | |
|--------|--------------------|----------|------|------|------|
| | | A | B | C | D |
| PE0201 | 50 mΩ ≤ R ≤ 910 mΩ | 1.00 | 0.30 | 0.35 | 0.40 |
| PE0402 | 10 mΩ ≤ R ≤ 910 mΩ | 1.45 | 0.35 | 0.55 | 0.55 |
| PE0603 | 5 mΩ ≤ R ≤ 910 mΩ | 2.52 | 0.50 | 1.01 | 1.01 |
| PE0805 | 5 mΩ ≤ R ≤ 910 mΩ | 2.54 | 0.50 | 1.02 | 1.27 |
| PE1206 | 5 mΩ ≤ R ≤ 910 mΩ | 3.90 | 0.76 | 1.57 | 1.78 |
| PE2010 | 5 mΩ ≤ R ≤ 6 mΩ | 6.12 | 1.40 | 2.36 | 3.05 |
| | 7 mΩ ≤ R ≤ 910 mΩ | 6.10 | 3.30 | 1.40 | 3.05 |
| PE2512 | 6 mΩ | 7.40 | 3.18 | 2.11 | 3.68 |
| | 7 mΩ ≤ R ≤ 910 mΩ | 7.36 | 4.06 | 1.65 | 3.68 |

TESTS AND REQUIREMENTS
Table 8 Test condition, procedure and requirements

| TEST | TEST METHOD | PROCEDURE | REQUIREMENTS |
|---|---|--|---|
| Life/ Operational Life/ Endurance | MIL-STD-202G-method 108 IEC 60115-1 4.25.1 | 1,000 hours at 70±2 °C applied RCWV 1.5 hours on, 0,5 hour off, still air required | ±(1%+0.0005 Ω) |
| High Temperature Exposure/ Endurance at Upper Category Temperature | MIL-STD-202G-method 108 IEC 60115-1 4.25.3 | 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 and above 170±3°C | ±(1%+0.0005 Ω) |
| Moisture Resistance | MIL-STD-202G-method 106 | 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 Parts mounted on test-boards, without condensation on parts Measurement at 24±2 hours after test conclusion | 0201: ±(5%+0.0005 Ω) Others: ±(0.5%+0.0005 Ω) |
| Thermal Shock | MIL-STD-202G-method 107 | -55/+125 °C Note: Number of cycles required is 300. Devices mounted Maximum transfer time is 20 seconds. Dwell time is 15 minutes. Air – Air | ±(1%+0.0005 Ω) |
| Short Time Overload | IEC60115-1 4.13 | 5 times of rated power for 5 seconds at room temperature | ±(1%+0.0005 Ω) No visible damage |
| Board Flex/ Bending | IEC60115-1 4.33 | Device mounted on PCB test board as described, only 1 board bending required Bending for 0201: 3mm 0402 and above: 2mm Holding time: minimum 60 seconds | ±(1%+0.0005 Ω) No visible damage |
| Biased Humidity | MIL-STD-202 Method 103 | 1,000 hours at 85°C/85%R.H. 10% of operating power, no condensation on the devices, circulating air. | 0201: ±(5%+0.0005 Ω) Others : ±(1.0%+0.0005 Ω) |

| TEST | TEST METHOD | PROCEDURE | REQUIREMENTS |
|-----------------------------------|--------------------------------|--|------------------------------------|
| Solderability - Wetting | IPC/JEDEC | Electrical Test not required | Well tinned ($\geq 95\%$ covered) |
| | J-STD-002B test B | Magnification 50X SMD conditions: 1 st step: method B, aging 4 hours at 155 °C dry heat 2 nd step: leadfree solder bath at 245 \pm 3 °C Dipping time: 3 \pm 0.5 seconds | No visible damage |
| - Leaching | IPC/JEDEC J-STD-002B test D | Leadfree solder, 260 °C, 30 seconds immersion time | No visible damage |
| - Resistance to Soldering Heat | MIL-STD-202G-method 210F | Condition B, no pre-heat of samples | $\pm(0.5\%+0.0005 \Omega)$ |
| | IEC 60115-1 4.18 | Leadfree solder, 260 °C, 10 seconds immersion time Procedure 2 for SMD: devices fluxed and cleaned with isopropanol | No visible damage |

REVISION HISTORY

| REVISION | DATE | CHANGE NOTIFICATION | DESCRIPTION |
|-----------|---------------|---------------------|--|
| Version 8 | Jun. 11, 2020 | - | - Update the dimension for PE0805 5mohm & 6mohm - Update the marking for PE0603 - Extend resistance range for PE0201 |
| Version 7 | Jan. 21, 2019 | - | - Extended resistor value for PE2010 and 2512 |
| Version 6 | Oct. 22, 2018 | - | - Extend resistor value for PE0603 and 0805, and 0.1% tol for 0805 > 50mΩ - Add in pulse load behavior |
| Version 5 | Nov 23, 2016 | - | - Extend resistor value for 0.5% |
| Version 4 | Dec. 21, 2015 | - | - Update resistance value |
| Version 3 | Aug. 06, 2015 | - | - Update 0603 to 1206 TCR |
| Version 2 | Apr. 20, 2015 | - | - Extend resistor value |
| Version 1 | Mar. 04, 2015 | - | - Update TCR and operating temperature |
| Version 0 | Feb. 10, 2015 | - | - New datasheet for current sensor - low TCR PE series sizes of 0201/0402/0603/0805/1206/2010/2512, 0.5%, 1%, and 5% |

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