

# DATA SHEET

## CURRENT SENSOR - LOW TCR

PT series

5%, 2%, 1%

sizes 0402/0603/0805/1206/2010/2512

RoHS compliant & Halogen free



SCOPE

This specification describes PT series current sensor - low TCR and high power with lead-free terminations made by thick film process.

APPLICATIONS

- Converters
- Printer equipment
- Server board
- Telecom
- Consumer electronics
- Car electronics

FEATURES

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

ORDERING INFORMATION - GLOBAL PART NUMBER

Part numbers is identified by the series, size, tolerance, packing type, temperature coefficient, taping reel and resistance value.

**YAGEO BRAND ordering code**

**GLOBAL PART NUMBER (PREFERRED)**

**PT XXXX X X X XX XXXX L**  
 (1) (2) (3) (4) (5) (6) (7)

**(1) SIZE**

0402 / 0603 / 0805 / 1206 / 2010 / 2512

**(2) TOLERANCE**

F = ±1%  
 G = ±2%  
 J = ±5%  
 "-" = jumper ordering

**(3) PACKAGING TYPE**

R = Paper taping reel  
 K = Embossed taping reel

**(4) TEMPERATURE COEFFICIENT OF RESISTANCE**

- = Based on spec.

**(5) TAPING REEL**

07 = 7 inch dia. Reel and standard power  
 13 = 13 inch dia. Reel and standard power  
 7W = 7 inch dia. reel and 2 x standard power  
 3W = 13 inch dia. reel and 2 x standard power  
 7T = 7 inch dia. reel and 3 x standard power

**(6) RESISTANCE VALUE**

There are 3~5 digits indicated the resistor 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 system default code for order only (Note)

| Resistance code rule    | Example  |
|-------------------------|--|
| 0RXXX<br>(25 to 910 mΩ) | 0R025 = 25 mΩ<br>0R1 = 100 mΩ<br>0R91 = 910 mΩ |

**ORDERING EXAMPLE**

The ordering code of a PT0603 chip resistor, 1/5W, value 0.56 Ω with ±1% tolerance, supplied in 7-inch tape reel is: PT0603FR-7W0R56L.

**NOTE**

1. All our Rchip products meet RoHS compliant. "LFP" of the internal 2D reel label mentions "Lead Free Process"
2. On customized label, "LFP" or specific symbol printed and the optional "L" at the end of GLOBAL PART NUMBER / 12NC can be added (both are on customer request)

**MARKING**

**PT0402**



No marking

Fig. 4

**PT0603**



E-24 series / Non-E series (R= 250/400/500 mΩ): 3 digits

The “R” is used as a decimal point; the other 2 digits are significant.

Fig. 2

**PT0805 / PT1206 / PT2010 / PT2512**



E-24 series / Non-E series (R= 250/400/500 mΩ): 4 digits

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

Fig. 3

For further marking information, please refer to data sheet “Chip resistors marking”.

**CONSTRUCTION**

The resistors are constructed out of a high-grade ceramic body. Internal metal electrodes are added at each end and connected by a resistive paste. The composition of the paste is adjusted to give the approximately required resistance and laser cutting of this resistive layer that achieves tolerance trims the value. The resistive layer is covered with a protective coat and printed with the resistance value. Finally, the three external terminations (Cu/Ni/matte tin) are added, as shown in Fig.5.

**OUTLINES**



Fig. 5 Chip resistor outlines

**DIMENSIONS**

Table I

| TYPE          | L (mm)     | W (mm)     | H (mm)     | l <sub>1</sub> (mm) | l <sub>2</sub> (mm) |
|---------------|------------|------------|------------|---------------------|---------------------|
| PT0402        | 1.00 ±0.10 | 0.50 ±0.05 | 0.35 ±0.05 | 0.20 ±0.10          | 0.25 ±0.10          |
| PT0603        | 1.60 ±0.10 | 0.80 ±0.10 | 0.45 ±0.10 | 0.25 ±0.15          | 0.25 ±0.15          |
| PT0805        | 2.00 ±0.10 | 1.25 ±0.10 | 0.55 ±0.10 | 0.35 ±0.20          | 0.35 ±0.20          |
| PT1206        | 3.10 ±0.10 | 1.60 ±0.10 | 0.55 ±0.10 | 0.45 ±0.20          | 0.45 ±0.20          |
| PT1206(Notes) | 3.10 ±0.10 | 1.60 ±0.10 | 0.55 ±0.10 | 0.75 ±0.20          | 0.45 ±0.20          |
| PT2010        | 5.00 ±0.10 | 2.50 ±0.15 | 0.55 ±0.10 | 0.60 ±0.20          | 0.50 ±0.20          |
| PT2512        | 6.35 ±0.10 | 3.20 ±0.15 | 0.55 ±0.10 | 0.60 ±0.20          | 0.50 ±0.20          |

Note: For resistance range:  $75\text{m}\Omega \leq R < 91\text{m}\Omega$



**ELECTRICAL CHARACTERISTICS**

Table 2

| Type   | Power | Operating Temp. range | Max working voltage  | Tolerance                   | Temperature Coefficient of Resistance | Jumper criteria     |                      |              |                     |
|--------|-------|-----------------------|----------------------|-----------------------------|---------------------------------------|---------------------|----------------------|--------------|---------------------|
| PT0402 | 1/16W | -55°C to +155°C       | (PxR) <sup>1/2</sup> | E24 ±2%, ±5%<br>E24/E96 ±1% | 50mΩ ≤ R < 68mΩ                       | ±600ppm/°C          | Max. resistance 10mΩ |              |                     |
|        |       |                       |                      |                             | 68mΩ ≤ R < 100mΩ                      | ±300ppm/°C          | Rated current 3A     |              |                     |
| 1/8 W  |       |                       |                      |                             | 100mΩ ≤ R < 1Ω                        | ±200ppm/°C          | --                   |              |                     |
| PT0603 | 1/10W |                       |                      |                             |                                       |                     | 50mΩ                 | 0/+400ppm/°C | Max. resistance 8mΩ |
|        |       |                       |                      |                             |                                       |                     | 50mΩ < R < 68mΩ      | 0/+350ppm/°C | Rated current 5A    |
|        | 1/5 W |                       |                      |                             |                                       |                     | 68mΩ ≤ R < 100mΩ     | 0/+300ppm/°C | --                  |
|        |       |                       |                      |                             |                                       |                     | 100mΩ ≤ R < 1Ω       | ±200ppm/°C   | --                  |
| PT0805 | 1/3 W |                       |                      |                             |                                       |                     | 50mΩ                 | 0/+400ppm/°C | --                  |
|        |       |                       |                      |                             |                                       |                     | 50mΩ < R < 68mΩ      | 0/+350ppm/°C | --                  |
|        |       |                       |                      |                             |                                       |                     | 68mΩ                 | 0/+300ppm/°C | --                  |
| PT1206 | 1/8 W |                       |                      | 50mΩ                        | 0/+350ppm/°C                          | Max. resistance 5mΩ |                      |              |                     |
|        | 1/4 W |                       |                      | 50mΩ < R < 68mΩ             | 0/+300ppm/°C                          | Rated current 6A    |                      |              |                     |
| PT1206 | 1/4 W |                       |                      | 68mΩ ≤ R < 100mΩ            | 0/+250ppm/°C                          | --                  |                      |              |                     |
|        | 1/2 W |                       |                      | 100mΩ ≤ R < 1Ω              | ±100ppm/°C                            | --                  |                      |              |                     |
| PT2010 | 1/4 W |                       |                      | 50mΩ ≤ R < 75mΩ             | ±350ppm/°C                            | Max. resistance 5mΩ |                      |              |                     |
|        | 1/2 W |                       |                      | 75mΩ ≤ R ≤ 100mΩ            | ±100ppm/°C                            | Rated current 10A   |                      |              |                     |
| PT2010 | 3/4 W |                       |                      | 100mΩ < R < 1Ω              | ±75ppm/°C                             | --                  |                      |              |                     |
|        | 1W    |                       |                      |                             |                                       | --                  |                      |              |                     |
| PT2512 | 1W    |                       |                      | 100 mΩ                      | ±100 ppm/°C                           | --                  |                      |              |                     |
|        | 2W    |                       |                      | 100 mΩ < R < 1 Ω            | ±75 ppm/°C                            | --                  |                      |              |                     |

**FOOTPRINT AND SOLDERING PROFILES**

Recommended footprint and soldering profiles, please refer to data sheet “Chip resistors mounting”.

**PACKING STYLE AND PACKAGING QUANTITY**

Table 3 Packing style and packaging quantity

| PACKING STYLE            | REEL DIMENSION | PT0402 | PT0603 | PT0805 | PT1206 | PT2010 | PT2512 |
|--------------------------|----------------|--------|--------|--------|--------|--------|--------|
| Paper taping reel (R)    | 7" (178 mm)    | 10,000 | 5,000  | 5,000  | 5,000  | ---    | ---    |
|                          | 13" (330 mm)   | 50,000 | 20,000 | 20,000 | 20,000 | ---    | ---    |
| Embossed taping reel (K) | 7" (178 mm)    | ---    | ---    | ---    | ---    | 4,000  | 4,000  |

**NOTE**

1. For paper/embossed tape and reel specification/dimensions, please refer to data sheet “Chip resistors packing”.

**FUNCTIONAL DESCRIPTION**

**OPERATING TEMPERATURE RANGE**

Range: -55 °C to +155 °C

**POWER RATING**

Each type rated power at 70 °C:

PT0402=1/16W, 1/8W

PT0603=1/10W, 1/5W, 1/3W

PT0805=1/8W, 1/4W

PT1206=1/4W, 1/2W

PT2010=3/4W, 1W

PT2512=1W, 2W

**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)



**TESTS AND REQUIREMENTS**
**Table 4** Test condition, procedure and requirements

| TEST   | TEST METHOD                                   | PROCEDURE  | REQUIREMENTS      |
|--|---|--|-------------------|
| Temperature Coefficient of Resistance (T.C.R.) | MIL-STD-202 Method 304                        | At +25/+125 °C<br><br><b>Formula:</b><br>$T.C.R = \frac{R_2 - R_1}{R_1(t_2 - t_1)} \times 10^6 \text{ (ppm/°C)}$<br>Where<br>t <sub>1</sub> =+25 °C or specified room temperature<br>t <sub>2</sub> =+125 °C test temperature<br>R <sub>1</sub> =resistance at reference temperature in ohms<br>R <sub>2</sub> =resistance at test temperature in ohms | Refer to table 2  |
| Life/Endurance                                 | MIL-STD-202 Method 108A<br>IEC 60115-1 4.25.1 | 1,000 hours at 70±2 °C applied RCWV<br>1.5 hours on, 0.5 hour off, still air required  | ± (1.0%+0.0005 Ω) |
| High Temperature Exposure                      | MIL-STD-202 Method 108A<br>IEC 60068-2-2      | 1,000 hours at maximum operating temperature depending on specification, unpowered<br>No direct impingement of forced air to the parts<br>Tolerances: 155±3 °C   | ± (1.0%+0.0005 Ω) |
| 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 °C / 65 °C 95% R.H, without steps 7a & 7b, unpowered<br>Parts mounted on test-boards, without condensation on parts<br>Measurement at 24±2 hours after test conclusion  | ± (0.5%+0.0005 Ω) |
| Thermal Shock                                  | MIL-STD-202 Method 107                        | -55/+125 °C<br>Number of cycles required is 300. Maximum Devices mounted:<br>transfer time is 20 seconds. Dwell time is 15 minutes. Air – Air  | ± (1.0%+0.0005 Ω) |

| TEST                           | TEST METHOD      | PROCEDURE  | REQUIREMENTS  |
|--------------------------------|------------------|--|---|
| Short Time Overload            | IEC60115-I 4.13  | PT standard power: 2.5 times rated voltage for 5 sec at room temperature<br><br>PT high power: 5 times rated power for 5 sec at room temperature<br><br>PT jumper: 2.5 times rated current for 5 sec at room temperature                       | $\pm (1.0\%+0.0005 \Omega)$<br>No visible damage        |
| Board Flex/<br>Bending         | IEC 60115-I 4.33 | Device mounted on PCB test board as described, only 1 board bending required<br><br>Bending for 0402: 5 mm<br>0603/0805: 3 mm<br>1206 and above: 2 mm<br><br>Holding time: minimum $60\pm 1$ seconds<br><br>Ohmic value checked during bending | $\pm (1.0\%+0.0005 \Omega)$<br>No visible damage        |
| Solderability<br>- Wetting     | J-STD-002 test B | Electrical Test not required<br>Magnification 50X<br>SMD conditions:<br>1 <sup>st</sup> step: method B, aging 4 hours at 155 °C dry heat<br>2 <sup>nd</sup> step: leadfree solder bath at $245\pm 3$ °C<br>Dipping time: $3\pm 0.5$ seconds    | Well tinned ( $\geq 95\%$ covered)<br>No visible damage |
| - Leaching                     | J-STD-002 test D | Leadfree solder, 260 °C, 30 seconds immersion time   | No visible damage                                       |
| - Resistance to Soldering Heat | IEC 60115-I 4.18 | Condition B, no pre-heat of samples.<br>Leadfree solder, $260\pm 5$ °C, $10\pm 1$ 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        |



REVISION HISTORY

| REVISION  | DATE          | CHANGE NOTIFICATION | DESCRIPTION  |
|-----------|---------------|---------------------|--|
| Version 2 | May 24, 2018  | -                   | - Update PT0603 7T coding  |
| Version 1 | Jul. 02, 2015 | -                   | - Extend resistor value  |
| Version 0 | Aug. 21, 2014 | -                   | - New datasheet for current sensor - low TCR PT series sizes of 0402/0603/0805/1206/2010/2512, 1%, 2%, 5% with lead-free termination |

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