

DATA SHEET

CURRENT SENSOR - LOW TCR

PR/PF-Power enhancement series (Pb Free)

5%, 1%

sizes 1206/2010/2512



SCOPE

This specification describes PR/PF-Power enhancement series current sensor - low TCR with lead-free terminations.

ORDERING INFORMATION

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

PHYCOMP ORDERING CODE

I2NC CODE

2350 / 2322 XXX XXXXX L
 (1) (2) (3) (4)

| SIZE TYPE | START IN (1) | TOL. (%) | RESISTANCE RANGE | EMBOSSED (2) | PAPER (units) (2) |
|------------------|--------------|----------|------------------|--------------|-------------------|
| | | | | TAPE ON REEL | TAPE ON REEL |
| | | | | 4,000 | 4,000 |
| PR series | | | | | |
| 2010 PR2010 | 2322 | ±5% | 0.002 to 0.006 Ω | 760 65xxx | - |
| PR2010 | 2322 | ±1% | 0.002 to 0.006 Ω | 761 13xxx | - |
| 2512 MPRC22I | 2322 | ±5% | 0.001 to 0.005 Ω | 762 10xxx | - |
| MPRC22I | 2322 | ±1% | 0.001 to 0.005 Ω | 763 10xxx | - |
| PF series | | | | | |
| 1206 PF1206 | 2350 | ±5% | 0.006 to 1 Ω | - | 510 27xxx |
| PF1206 | 2350 | ±1% | 0.006 to 1 Ω | - | 510 28xxx |
| 2010 PF2010 | 2322 | ±5% | 0.007 to 1 Ω | 760 66xxx | - |
| PF2010 | 2322 | ±1% | 0.007 to 1 Ω | 760 14xxx | - |
| 2512 PF2512 | 2322 | ±5% | 0.006 to 1 Ω | 764 10xxx | - |
| PF2512 | 2322 | ±1% | 0.006 to 1 Ω | 764 30xxx | - |

NOTE

- a. The “L” at the end of the code is only for ordering. On the reel label, the standard CTC will be mentioned an additional stamp “LFP”= lead free production.
- b. Products with lead in terminations fulfil the same requirements as mentioned in this datasheet.
- c. Products with lead in terminations will be phased out in the coming months (before July 1st, 2006).

(1) The resistors have a 12-digit ordering code starting with 2350/2322.

(2) The subsequent 5 digits indicate the resistor tolerance and packaging.

(3) The remaining 3 digits represent the resistance value with the last digit indicating the multiplier as shown in the table of “Last digit of I2NC”.

(4) “L” means lead-free terminations (a).

| Last digit of I2NC | |
|-----------------------|------------|
| Resistance decade (3) | Last digit |
| 0.001 to 0.0976 Ω | 0 |
| 0.1 to 0.976 Ω | 7 |
| 1 to 9.76 Ω | 8 |
| Example: 0.02 Ω = 200 | |
| 0.3 Ω = 307 | |
| 1 Ω = 108 | |

ORDERING EXAMPLE

The ordering code of a MPRC22I resistor with 2W power rating, value 0.005 Ω with ±1% tolerance, supplied in tape of 4,000 units per reel is:
 232276210050L.

CTC CODE

PR/PF XXXX X X X XX XXXX L
 (1) (2) (3) (4) (5)(6) (7) (8)

(1) SIZE

1206
 2010
 2512

(2) TOLERANCE

F = ±1%
 J = ±5%

(3) PACKAGING TYPE

R = Paper taping reel
 K = Embossed taping reel

(4) TEMPERATURE COEFFICIENT OF RESISTANCE

F = ±100 ppm/°C
 G = ±200 ppm/°C

(5) TAPING REEL

7 = 7 inch dia. Reel

(6) POWER RATING

W = 2 x standard power ^(d)

(7) RESISTANCE VALUE

PR series: 0R001, 0R002, 0R003, 0R004, 0R005.
 (0R0015 also available on request)
 PF series: 0R006, 0R056, 0R56, 1R

(8) RESISTOR TERMINATIONS

L = Lead free terminations (matte tin) ^(a)

ORDERING EXAMPLE

The ordering code of a PR2512 chip resistor with 2W power rating, value 0.005 Ω with ±1% tolerance, supplied in 7-inch tape reel is: PR2512FKF7W0R005L.

NOTE

- a. The "L" at the end of the code is only for ordering. On the reel label, the standard CTC will be mentioned an additional stamp "LFP"= lead free production.
- b. Products with lead in terminations fulfil the same requirements as mentioned in this datasheet.
- c. Products with lead in terminations will be phased out in the coming months (before July 1st, 2006).
- d. Standard power for size 1206 is 1/4 Watt, size 2010 is 1/2 Watt, and size 2512 is 1 Watt.

MARKING

$1\text{ m}\Omega \leq R < 20\text{ m}\Omega$



Fig. 1 Value = 5 mΩ

4 digits: $10\text{ m}\Omega \leq R$, E-24 series; and $R = 1/2/3/4/5/6/7/8/9\text{ m}\Omega$

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

$20\text{ m}\Omega \leq R \leq 1,000\text{ m}\Omega$



Fig. 2 R820 = 820 mΩ

E-24 series: 4 digits

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

For marking codes, please see EIA-marking code rules in data sheet “Chip resistors marking”.

CONSTRUCTION

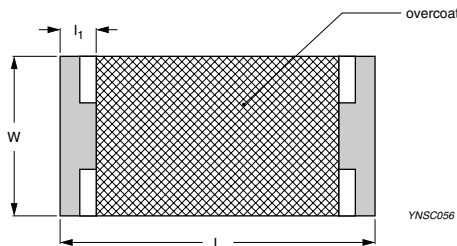
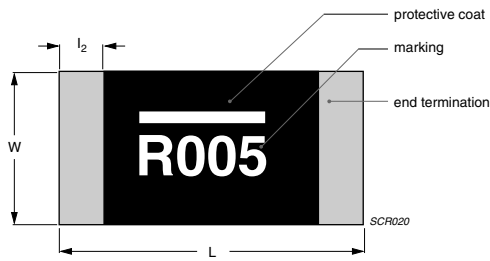
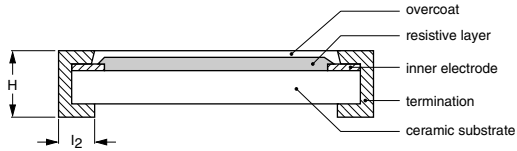
The resistors are constructed using outstanding TCR level material, which makes Yageo PR/PF resistors excellent for current sensing application in battery charger circuit & DC-DC converter.

The composition of the resistive material is adjusted to give the approximate required resistance and is covered with a protective coating, which printed with the resistance value.

Finally, the two external terminations (matte Tin) are added. See fig. 3.

OUTLINES

For dimension see Table 1 & 2



PR series

PF series

Note: construction will be adjusted to resistance value (only for PF series).

Fig. 3 Chip resistor outlines

DIMENSION

Table 1 Chip resistor type and relevant physical dimensions for "PR-Power enhancement series"; see fig. 3

| TYPE | RESISTANCE RANGE | L (mm) | W (mm) | H (mm) | l ₁ (mm) | l ₂ (mm) |
|--------|------------------|------------|------------|------------|---------------------|---------------------|
| PR2010 | 0.001 to 0.006 Ω | 5.10 ±0.25 | 2.54 ±0.25 | 0.60 ±0.25 | 0.50 ±0.25 | 0.50 ±0.25 |
| | 0.001 to 0.002 Ω | 6.40 ±0.20 | 3.20 ±0.20 | 0.75 ±0.15 | 1.20 ±0.20 | 1.20 ±0.20 |
| PR2512 | 0.003 to 0.005 Ω | 6.40 ±0.20 | 3.20 ±0.20 | 0.55 ±0.15 | 0.60 ±0.20 | 0.60 ±0.20 |

Table 2 Chip resistor type and relevant physical dimensions for "PF-Power enhancement series" see fig. 3

| TYPE | RESISTANCE RANGE | L (mm) | W (mm) | H (mm) | l ₁ (mm) | l ₂ (mm) |
|--------|------------------|------------|------------|------------|---------------------|---------------------|
| PF1206 | 0.006 to 0.014 Ω | 3.20 ±0.25 | 1.60 ±0.25 | 0.60 ±0.25 | 0.55 ±0.25 | 0.35 ±0.25 |
| | 0.015 to 1 Ω | 3.20 ±0.25 | 1.60 ±0.25 | 0.60 ±0.25 | 0.55 ±0.25 | 0.75 ±0.25 |
| PF2010 | 0.007 to 0.014 Ω | 5.10 ±0.25 | 2.54 ±0.25 | 0.60 ±0.25 | 1.00 ±0.25 | 0.45 ±0.25 |
| | 0.015 to 1 Ω | 5.10 ±0.25 | 2.54 ±0.25 | 0.60 ±0.25 | 1.00 ±0.25 | 1.55 ±0.25 |
| PF2512 | 0.006 to 0.014 Ω | 6.50 ±0.25 | 3.15 ±0.25 | 0.60 ±0.25 | 1.00 ±0.25 | 1.75 ±0.25 |
| | 0.015 to 1 Ω | 6.50 ±0.25 | 3.15 ±0.25 | 0.60 ±0.25 | 1.00 ±0.25 | 0.60 ±0.25 |

ELECTRICAL CHARACTERISTICS

Table 3

| TYPE / RESISTANCE RANGE | | TEMPERATURE COEFFICIENT OF RESISTANCE | |
|-------------------------|----------------------------|---------------------------------------|-----------------|
| PR series | PR2010 2 mΩ ≤ R < 7 mΩ | 2 mΩ | 2 mΩ < R < 7 mΩ |
| | | ±200 ppm/°C | ±100 ppm/°C |
| | PR2512 1 mΩ ≤ R < 6 mΩ | 1 mΩ ≤ R ≤ 2 mΩ | 2 mΩ < R < 6 mΩ |
| | | ±200 ppm/°C | ±100 ppm/°C |
| PF series | PF1206 6 mΩ ≤ R ≤ 1,000 mΩ | ±100 ppm/°C | |
| | PF2010 7 mΩ ≤ R ≤ 1,000 mΩ | ±100 ppm/°C | |
| | PF2512 6 mΩ ≤ R ≤ 1,000 mΩ | ±100 ppm/°C | |

FOOTPRINT AND SOLDERING PROFILES

For recommended footprint and soldering profiles, please see the special data sheet “Chip resistors mounting”.

ENVIRONMENTAL DATA

For material declaration information (IMDS-data) of the products, please see the separated info “Environmental data” conformed to EU RoHS.

PACKING STYLE AND PACKAGING QUANTITY

Table 4 Packing style and packaging quantity

| PACKING STYLE | REEL DIMENSION | PF 1206 | PR/PF 2010 | PR/PF 2512 |
|--------------------------|----------------|---------|------------|------------|
| Paper taping reel (R) | 7" (178 mm) | 4,000 | --- | --- |
| Embossed taping reel (K) | 7" (178 mm) | --- | 4,000 | 4,000 |

NOTE

1. For Paper/PE/Embossed tape and reel specification/dimensions, please see the special data sheet “Packing” document.

FUNCTIONAL DESCRIPTION

OPERATING TEMPERATURE RANGE

Range: -55°C to +155°C

POWER RATING

Each type rated power at 70°C:
 PF1206=1/2 W; PR/PF2010=1 W;
 PR/PF2512=2 W.

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)

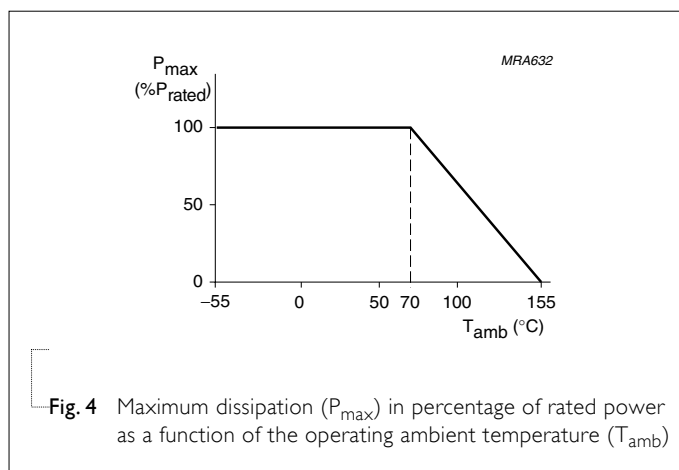


Fig. 4 Maximum dissipation (P_{max}) in percentage of rated power as a function of the operating ambient temperature (T_{amb})

TESTS AND REQUIREMENTS

Table 5 Test condition, procedure and requirements

| TEST | TEST METHOD | PROCEDURE | REQUIREMENTS |
|--|---|--|---|
| Temperature Coefficient of Resistance (T.C.R.) | MIL-STD-202F-method 304; | At +25/-55 °C and +25/+125 °C | Refer to table 3 |
| | JIS C 5202-4.8 | <p>Formula:</p> $T.C.R = \frac{R_2 - R_1}{R_1(t_2 - t_1)} \times 10^6 \text{ (ppm/°C)}$ <p>Where $t_1 = +25 \text{ °C}$ or specified room temperature $t_2 = -55 \text{ °C}$ or +125 °C test temperature $R_1 =$resistance at reference temperature in ohms $R_2 =$resistance at test temperature in ohms</p> | |
| Thermal Shock | MIL-STD-202F-method 107G; IEC 60115-1 4.19 | At -65 (+0/-10) °C for 2 minutes and at +125 (+10/-0) °C for 2 minutes; 25 cycles | ±(0.5%+0.0005 Ω) |
| Low Temperature Operation | MIL-R-55342D-Para 4.7.4 | At -65 (+0/-5) °C for 1 hour; RCWV applied for 45 (+5/-0) minutes | ±(0.5%+0.0005 Ω) No visible damage |
| Short Time Overload | MIL-R-55342D-Para 4.7.5; IEC 60115-1 4.13 | 2.5 × RCWV applied for 5 seconds at room temperature | ±(0.5%+0.0005 Ω) No visible damage |
| Resistance to Soldering Heat | MIL-STD-202F-method 210C; IEC 60115-1 4.18 | Unmounted chips; 260 ±5 °C for 10 ±1 seconds | ±(0.5%+0.0005 Ω) No visible damage |
| Life | MIL-STD-202F-method 108A; IEC 60115-1 4.25.1 | At 70±2 °C for 1,000 hours; RCWV applied for 1.5 hours on and 0.5 hour off | ±(1.0%+0.0005 Ω) |
| Solderability | MIL-STD-202F-method 208A; IEC 60115-1 4.17 | Solder bath at 245±3 °C Dipping time: 2±0.5 seconds | Well tinned (≥95% covered) No visible damage |
| Humidity (steady state) | JIS C 5202 7.5; IEC 60115-8 4.24.8 | 1,000 hours; 40±2 °C; 93(+2/-3)% RH RCWV applied for 1.5 hours on and 0.5 hour off | ±(0.5%+0.0005 Ω) |

Table 5 Test condition, procedure and requirements (continued)

| TEST | TEST METHOD | PROCEDURE | REQUIREMENTS |
|---------------------------|---|---|---------------------------------------|
| Leaching | EIA/IS 4.13B; IEC 60115-8 4.18 | Solder bath at 260±5 °C Dipping time: 30±1 seconds | No visible damage |
| Moisture Resistance Heat | MIL-STD-202F-method 106F; IEC 60115-1 4.24.2 | 42 cycles; total 1,000 hours Shown as fig. 5 | ±(0.5%+0.0005 Ω) No visible damage |
| High Temperature Exposure | MIL-STD-202 Method 108 | Unpowered chips at =150 °C for 1,000 hours | ±(1%+0.0005 Ω) |

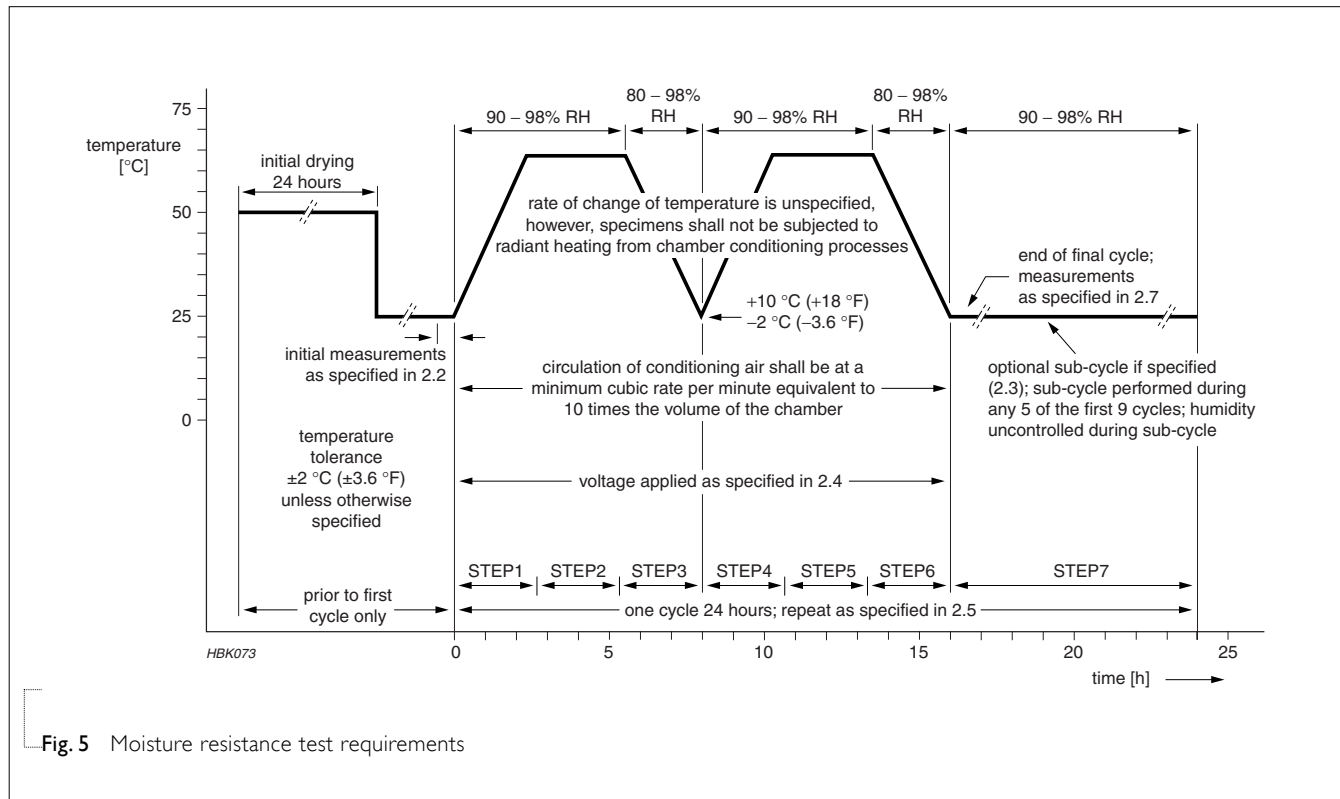


Fig. 5 Moisture resistance test requirements

REVISION HISTORY

| REVISION | DATE | CHANGE NOTIFICATION | DESCRIPTION |
|-----------|--------------|---------------------|---|
| Version 0 | Aug 11, 2005 | - | - New datasheet for current sensor - low TCR PR/PF-Power enhancement series, sizes of 1206/2010/2512, 1% and 5% with lead-free terminations |