

# DATA SHEET

## CURRENT SENSOR - LOW TCR

PR series

5%, 1%

sizes 0805/1206/2010/2512

RoHS compliant & Halogen free



SCOPE

This specification describes PR series current sensor - low TCR with lead-free terminations made by metal 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**

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

**(1) SIZE**

0805/1206 / 2010 / 2512

**(2) TOLERANCE**

F = ±1%  
 J = ±5%

**(3) PACKAGING TYPE**

R = Paper taping reel  
 K = Embossed taping reel

**(4) TEMPERATURE COEFFICIENT OF RESISTANCE**

D = ±25 ppm/°C  
 E = ±50 ppm/°C  
 F = ±100ppm/°C

**(5) TAPING REEL**

07 / 7W / 7T / 47 = 7 inch dia. Reel and specific rated power  
 Detailed power rating are shown in the Table 2.

**(6) RESISTANCE VALUE**

0.5 mΩ to 100 mΩ  
 There are 3~5 digits indicated the resistance value.  
 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. <sup>(Note)</sup>

Resistance rule of global part number

Resistance code rule	Example
0RXXX	0U5 = 0.5 mΩ
(0.5 to 100 mΩ)	0R001 = 1 mΩ
	0R1 = 100 mΩ

**ORDERING EXAMPLE**

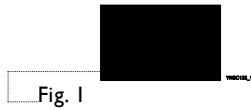
The ordering code of a PR1206 1/4W chip resistor, TC50, value 0.003Ω with ± 1% tolerance, supplied in 7-inch tape reel is: PR1206FKE070R003Z

**NOTE**

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

MARKING

**PR0805**



No marking

**PR1206 / PR2010 / PR2512**

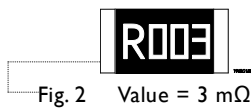


Fig. 2 Value = 3 mΩ

4 digits

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

PR1206: 1 mΩ to 50 mΩ

PR2010: 4 mΩ to 100 mΩ

PR2512: 5 mΩ to 100 mΩ

**PR2010 / PR2512**

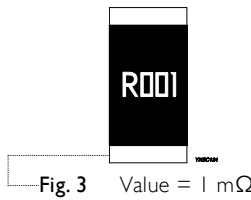


Fig. 3 Value = 1 mΩ

4 digits

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

PR2010: 1 mΩ to 3 mΩ

PR2512: 1 mΩ to 4 mΩ

**PR2512**

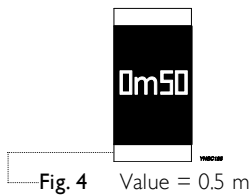


Fig. 4 Value = 0.5 mΩ

4 digits

The “m” is used as a decimal point; the other 3 digits are significant and the unit is milliohm

PR2512: 0.5 mΩ to 2.5 mΩ

CONSTRUCTION

The resistors are constructed using outstanding TCR level material, which makes Yageo PR 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. 5.

**Outlines**

For dimensions, please refer to Table I

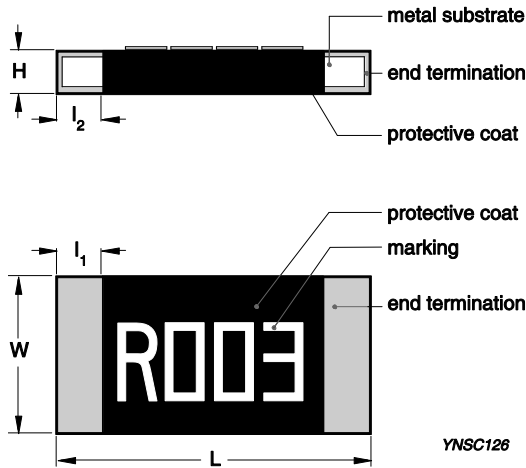


Fig. 5 PR1206~PR2512 Chip resistor outlines

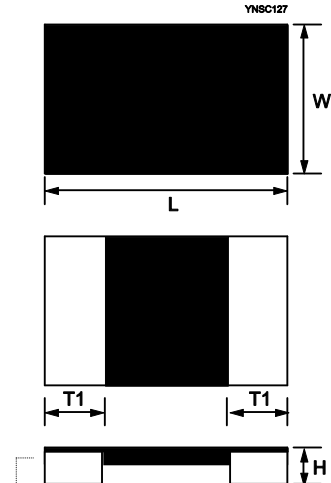


Fig. 5-1 PR0805 Chip resistor outlines

**DIMENSION**

Table I For outlines, please refer to Fig. 5

TYPE	RESISTANCE RANGE	POWER RATING	L (mm)	W (mm)	H (mm)	l <sub>1</sub> (mm)	l <sub>2</sub> (mm)
PR0805	3mΩ ≤ R ≤ 50mΩ	1/8W, 1/4W, 1/2W	2.03±0.25	1.27±0.25	0.30±0.25	0.35±0.25	--
	1mΩ		3.20±0.25	1.60±0.25	0.64±0.25	0.50±0.25	0.50±0.25
PR1206	2mΩ ≤ R ≤ 4mΩ	1/4W, 1/2W, 1W	3.20±0.25	1.60±0.25	0.55±0.25	0.50±0.25	0.50±0.25
	5mΩ		3.20±0.25	1.60±0.25	0.55±0.25	0.60±0.25	0.60±0.25
	6mΩ ≤ R ≤ 50mΩ		3.20±0.25	1.60±0.25	0.55±0.25	0.50±0.25	0.50±0.25
PR2010	1mΩ ≤ R ≤ 3mΩ	1/2W, 1W	5.08±0.25	2.54±0.25	0.78±0.25	1.30±0.25	1.30±0.25
	3mΩ < R ≤ 4mΩ		5.08±0.25	2.54±0.25	0.64±0.25	0.78±0.25	0.78±0.25
	4mΩ < R ≤ 100mΩ		5.08±0.25	2.54±0.25	0.64±0.25	0.78±0.25	0.78±0.25
	0.5mΩ ≤ R ≤ 3mΩ	1W	6.25±0.25	3.20±0.25	0.78±0.25	1.88±0.25	1.88±0.25
	3mΩ < R ≤ 4mΩ		6.25±0.25	3.20±0.25	0.78±0.25	1.88±0.25	1.88±0.25
	4mΩ < R ≤ 75mΩ		6.25±0.25	3.20±0.25	0.64±0.25	1.11±0.25	1.11±0.25
75mΩ < R ≤ 100mΩ	6.25±0.25		3.20±0.25	0.64±0.25	0.86±0.25	0.86±0.25	
PR22512	0.5mΩ ≤ R ≤ 3mΩ	2W	6.25±0.25	3.20±0.25	0.78±0.25	1.88±0.25	1.88±0.25
	3mΩ < R ≤ 4mΩ		6.25±0.25	3.20±0.25	0.78±0.25	1.88±0.25	1.88±0.25
	4mΩ < R ≤ 75mΩ	3W	6.25±0.25	3.20±0.25	0.64±0.25	1.11±0.25	1.11±0.25
	0.5mΩ		6.25±0.25	3.20±0.25	0.78±0.25	1.88±0.25	1.88±0.25
	0.5mΩ < R ≤ 3mΩ		6.25±0.25	3.20±0.25	0.78±0.25	1.11±0.25	1.11±0.25
	3mΩ ≤ R ≤ 4mΩ		6.25±0.25	3.20±0.25	0.78±0.25	1.67±0.25	1.67±0.25
	4mΩ < R ≤ 10mΩ		6.25±0.25	3.20±0.25	0.64±0.25	1.11±0.25	1.11±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				
PR	0805	1/8W	1/4W	1/2W	1W		$3m\Omega \leq R \leq 50m\Omega$	$3m\Omega \leq R < 5m\Omega$	$\pm 100ppm/^{\circ}C$
								$5m\Omega \leq R \leq 50m\Omega$	$\pm 50ppm/^{\circ}C$
	1206	1/4W	1/2W	---	1W	$\pm 1\%$	$1m\Omega \leq R \leq 50m\Omega$		$\pm 50ppm/^{\circ}C$
	2010	1/2W	1W	---	---	$\pm 5\%$	$1m\Omega \leq R \leq 100m\Omega$		
	2512	1W	2W	3W	---		$0.5m\Omega \leq R \leq 100m\Omega$	$0.5m\Omega \leq R \leq 3m\Omega$	$\pm 50ppm/^{\circ}C$
								$3m\Omega < R \leq 100m\Omega$	$\pm 25ppm/^{\circ}C$

Note: 1. Please contact with sales offices, distributors and representatives in your region before ordering.

**FUNCTIONAL DESCRIPTION**

**OPERATING TEMPERATURE RANGE**

PR0805 Range: -55°C to + 150°C

PR1206~PR2512 Range: -55°C to + 170°C

**POWER RATING**

Standard rated power at 70°C:

PR0805: 1/8W

PR1206: 1/4W

PR2010: 1/2W

PR2512: 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 ( $\Omega$ )

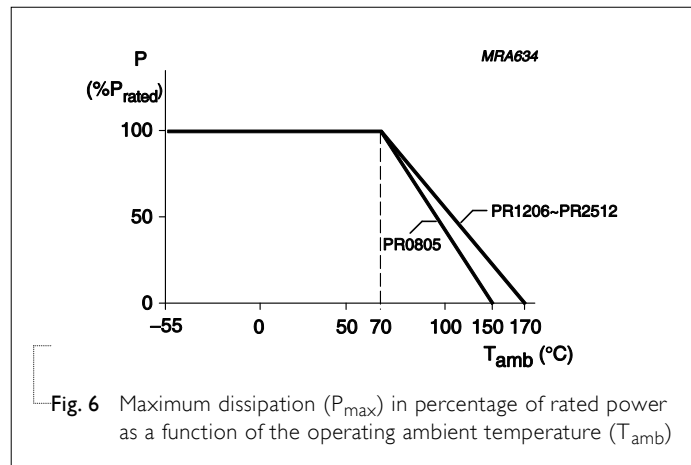


Fig. 6 Maximum dissipation (P<sub>max</sub>) in percentage of rated power as a function of the operating ambient temperature (T<sub>amb</sub>)

**PACKING STYLE AND PACKAGING QUANTITY**

Table 3 Packing style and packaging quantity

PACKING STYLE	REEL DIMENSION	PR0805	PR1206	PR2010	PR2512
Paper taping reel (R)	7" (178 mm)	5,000	---	---	---
Embossed taping reel (K)		---	4,000	2,000	4,000

**EMBOSSED TAPE**

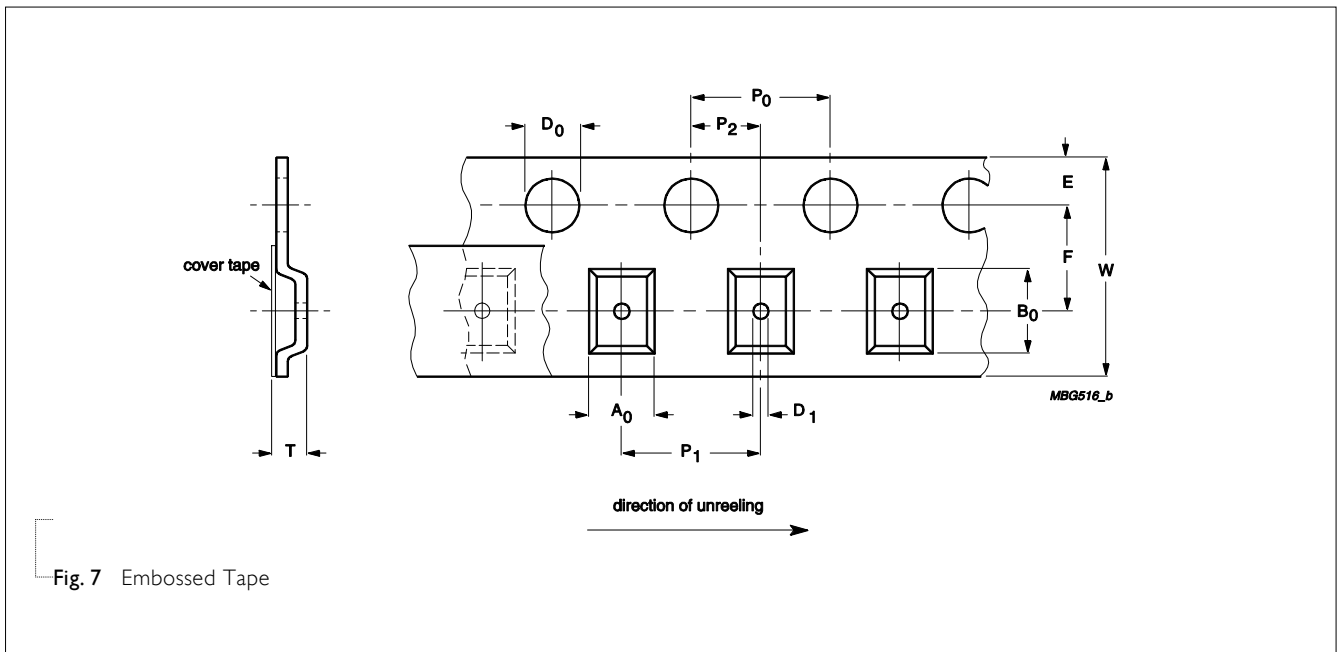


Fig. 7 Embossed Tape

Table 4 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>	T	
PR0805	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	---	0.40+0.20/-0	
PR1206	1.83±0.10	3.50±0.10	8.00±0.15	1.75±0.10	3.50±0.10	4.00±0.10	4.00±0.10	2.00±0.10	1.55±0.05	1.00±0.10	0.90±0.10	
PR2010	2.90±0.10	5.45±0.10	12.00±0.15	1.75±0.10	5.50±0.10	4.00±0.10	4.00±0.10	2.00±0.10	1.50±0.05	1.50±0.10	1.10±0.10	
PR2512	3.90±0.10	6.74±0.10	12.00±0.15	1.75±0.10	5.50±0.10	4.00±0.10	4.00±0.10	2.00±0.10	1.55±0.05	1.50±0.10	1.08±0.10	

**REEL SPECIFICATION**

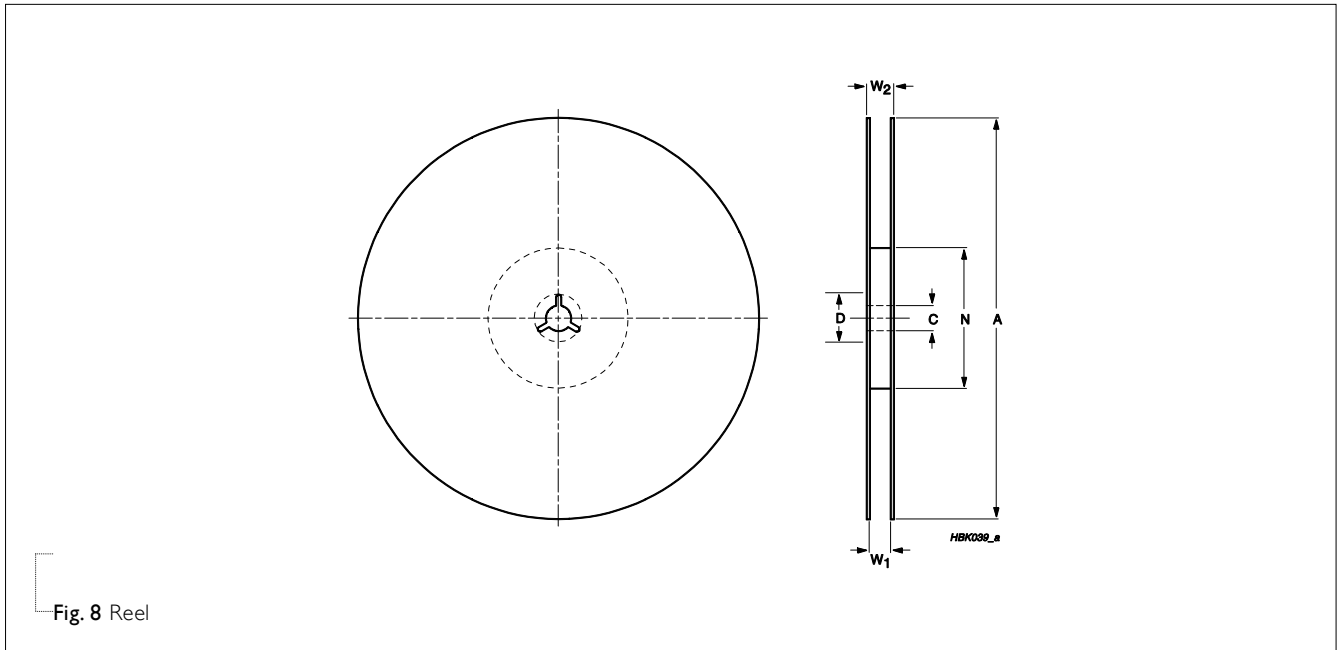


Fig. 8 Reel

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.
PR0805	5000	7" (Ø178 mm)	---	178.0±1.0	60.0+1/-0	13.20±0.5	17.70±0.5	8.4 +1/-0	12.4±0.5
PR1206	4000	7" (Ø178 mm)	--	178.0±1.0	60.0±0.5	13.20±0.5	17.70±0.5	9.0±0.3	12.0±0.5
PR2010	2000	-- (Ø178 mm)	7"	178.0±1.0	60.0±0.5	13.50±0.5	17.70±0.5	13.0±0.5	16.2±0.5
PR2512	4000	-- (Ø178 mm)	7"	178.0±1.0	60.0±0.5	13.50±0.5	17.70±0.5	13.0±0.5	16.2±0.5

**LEADER/TRAILER TAPE SPECIFICATION**

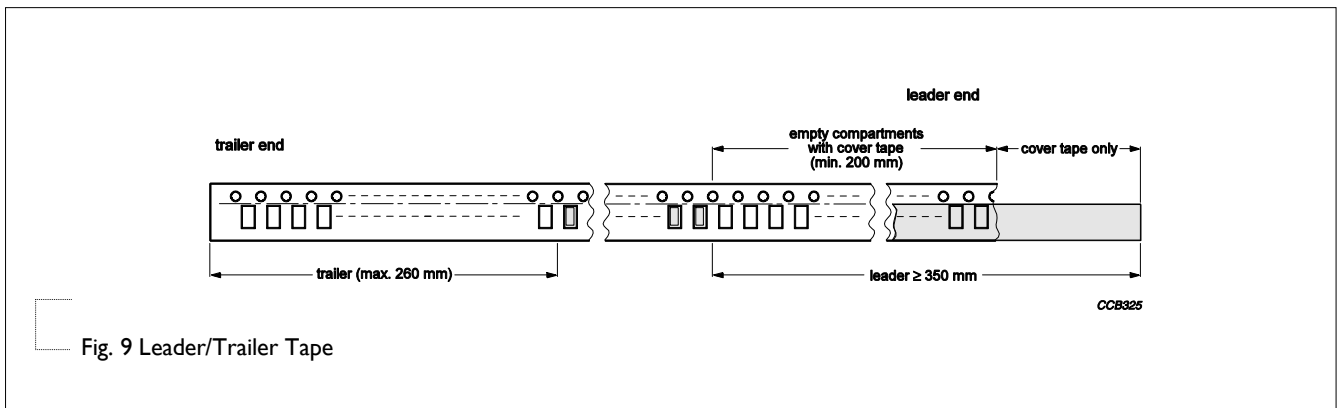


Fig. 9 Leader/Trailer Tape

**FOOTPRINT AND SOLDERING PROFILES**

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

**FOOTPRINT**

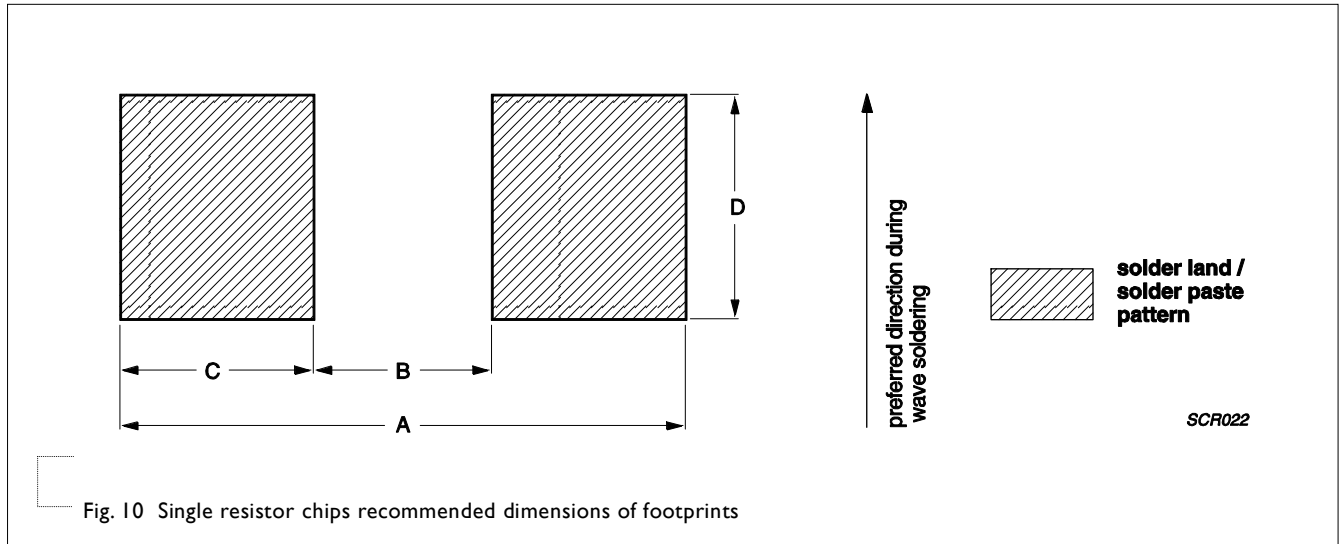


Fig. 10 Single resistor chips recommended dimensions of footprints

Table 6 Footprint dimensions

SIZE	RESISTANCE RANGE	POWER RATING	A	B	C	D	Unit: mm
PR0805	$3\text{m}\Omega \leq R \leq 50\text{ m}\Omega$	1/8W, 1/4W, 1/2W	4.26	0.66	1.80	2.18	
PR1206	$1\text{m}\Omega \leq R \leq 50\text{m}\Omega$	1/4W, 1/2W, 1W	4.20	1.00	1.60	2.18	
PR2010	$1\text{m}\Omega \leq R \leq 3\text{m}\Omega$	1/2W, 1W	7.00	1.22	2.89	2.92	
	$3\text{m}\Omega < R \leq 100\text{ m}\Omega$		6.99	2.41	2.29	2.92	
PR2512	$0.5\text{m}\Omega \leq R \leq 4\text{m}\Omega$	1W, 2W	7.37	1.27	3.05	3.68	
	$4\text{m}\Omega < R \leq 100\text{ m}\Omega$		7.40	3.18	2.11	3.68	
	$0.5\text{m}\Omega$		7.37	1.27	3.05	3.68	
PR2512	$0.5\text{m}\Omega < R < 3\text{m}\Omega$ , $4\text{m}\Omega < R \leq 10\text{ m}\Omega$	3W	7.38	3.00	2.19	3.68	
	$3\text{m}\Omega \leq R \leq 4\text{m}\Omega$		7.38	1.80	2.79	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 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 Temperature Exposure/ Endurance at Upper Category 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 Tolerances: 170±3 °C	
Moisture 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  Parts mounted on test-boards, without condensation on parts  Measurement at 24±2 hours after test conclusion	±(0.5%+0.0005 Ω)
	IEC 60115-1 4.24.2		
Thermal Shock	MIL-STD-202G-method 107G	PR1206~PR2512 : -55/+155 °C PR0805 : -55/+125 °C  Note: Number of cycles required is 300. Maximum transfer time is 20 seconds. Dwell time is 15 minutes. Air – Air	±(0.5%+0.0005 Ω)
Short Time Overload	MIL-R-55342D-para 4.7.5	5 times of rated power for 5 seconds at room temperature	±(0.5%+0.0005 Ω) No visible damage
	IEC60115-1 4.13		
Board Flex/ Bending	IEC60115-1 4.33	Device mounted on PCB test board as described, only 1 board bending required	±(1%+0.0005 Ω) No visible damage
		Bending for 0805/1206/2010/2512: 2 mm	
		Holding time: minimum 60 seconds	
Humidity	IEC 60115-1 4.21	Steady state for 1000 hours at 40 °C / 95% R.H. RCWV applied for 1.5 hours on and 0.5 hour off	±(1%+0.0005Ω)

TEST	TEST METHOD	PROCEDURE	REQUIREMENTS
Solderability - Wetting	IPC/JEDECJ-STD-002B test B	Electrical Test not required	Well tinned ( $\geq 95\%$ covered)
	IEC 60068-2-58	Magnification 50X SMD conditions: 1 <sup>st</sup> step: method B, aging 4 hours at 155 °C dry heat 2 <sup>nd</sup> step: leadfree solder bath at 245 $\pm$ 3 °C Dipping time: 3 $\pm$ 0.5 seconds	No visible damage
- Leaching	IPC/JEDECJ-STD-002B test D IEC 60068-2-58	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 60068-2-58	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 0	Aug. 22, 2014	-	- New datasheet for current sensor - low TCR PR series sizes of 0805/1206/2010/2512, 1% and 5% with lead-free terminations





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