Innovative Service Around the Globe YAGEO

DATA SHEET

CURRENT SENSOR - LOW TCR
AUTOMOTIVE GRADE

PA_E series

5%, 1%, 0.5%

sizes 2512

RoHS compliant & Halogen free



YAGEO Phycomp

Product specification – January 31, 2018 V.10

SCOPE

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

APPLICATIONS

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

FEATURES

- AEC-Q200 qualified
- 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
- Anti-sulfur

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

PA	XXXX	X	X	X	XX	XXXX	E
	(1)	(2)	(3)	(4)	(5)	(6)	(7)

(1) SIZE

2512

(2) TOLERANCE

D= ± 0.5%

F = ±1%

J = ±5%

(3) PACKAGING TYPE

K = Embossed taping reel

(4) TEMPERATURE COEFFICIENT OF RESISTANCE

F = ± 100 ppm/°C

M = ± 75ppm/°C

E = ± 50ppm/°C

(5) TAPING REEL

07 = 7 inch dia. Reel & standard power (1W)

7W = 7 inch dia. Reel & 2 x standard power (2W)

7T = 7 inch dia. Reel & 3 x standard power (3W)

(6) RESISTANCE VALUE

0.5 mΩ to 100 mΩ

(7) DEFAULT CODE

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

Resistance rule of global part number

Resistance code rule	Example
XUXX	0U5 = 0.5mΩ
0RXXX	0R001 = 1 mΩ
(1 to 100 mΩ)	0R05 = 50 mΩ

ORDERING EXAMPLE

The ordering code of a PA2512 1W chip resistor, TC100, value 0.003Ω with ±1% tolerance, supplied in 7-inch tape reel is: PA2512FKF070R003E

NOTE

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

MARKING

PA2512

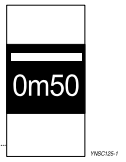


Fig. 1 Value = 0.5 mΩ

4 digits
The "m" is used as decimal point; the other 3 digits are significant and the unit is milliohm

PA2512: 0.5mΩ and 0.75mΩ

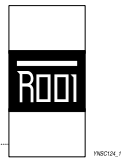


Fig. 2 Value = 1 mΩ

4 digits
The "R" is used as a decimal point; the other 3 digits are significant
PA2512: 1mΩ to 4 mΩ



Fig. 3 Value = 5 mΩ

4 digits
The "R" is used as a decimal point; the other 3 digits are significant
PA2512: 5 mΩ to 100 mΩ

CONSTRUCTION

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

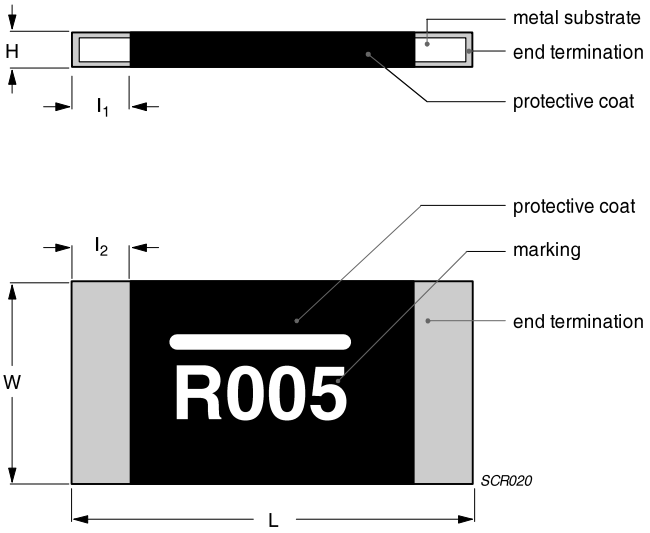


Fig. 4 Chip resistor outlines

DIMENSION

Table 1 For outlines, please refer to Fig. 4

TYPE	RESISTANCE RANGE	L (mm)	W (mm)	H (mm)	I_1 (mm)	I_2 (mm)
PA2512	0.5mΩ ≤ R ≤ 0.75mΩ	6.35±0.25	3.18±0.25	0.63±0.25	2.72±0.25	2.72±0.25
	1mΩ ≤ R ≤ 4mΩ	6.35±0.25	3.18±0.25	0.63±0.25	2.21±0.25	2.21±0.25
	5mΩ ≤ R ≤ 6mΩ	6.35±0.25	3.18±0.25	0.63±0.25	1.19±0.25	1.19±0.25
	7mΩ ≤ R ≤ 100mΩ	6.35±0.25	3.18±0.25	0.63±0.25	0.76±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

TYPE	SIZE	POWER RATING	TOLERANCE	RESISTANCE RANGE	TEMPERATURE COEFFICIENT OF RESISTANCE
PA	2512	1W	±0.5%	0.5mΩ ≤ R ≤ 100mΩ	±50ppm/°C
		2W	±1%		±75ppm/°C
		3W	±5%		±100ppm/°C

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

FUNCTIONAL DESCRIPTION

OPERATING TEMPERATURE RANGE

PA2512 Range: –55°C to +170°C

POWER RATING

Standard rated power at 70°C:

For detail power value, please refer to Table 2.

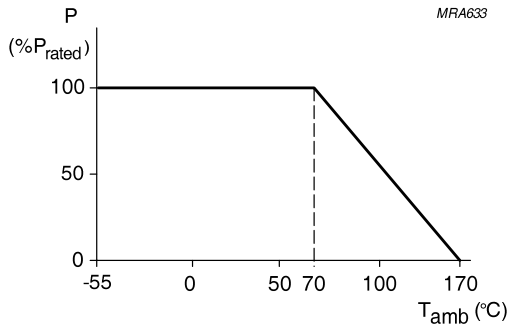


Fig. 5 Maximum dissipation (P_{max}) in percentage of rated power as a function of the operating ambient temperature (T_{amb})

RATED VOLTAGE

The DC or AC (rms) continuous working voltage corresponding to the rated power is determined by the following formula:

$$V = \sqrt{(PxR)}$$

Where

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

P = Rated power (W)

R = Resistance value (Ω)

PACKING STYLE AND PACKAGING QUANTITY

Table 3 Packing style and packaging quantity

PACKING STYLE	REEL DIMENSION	PA2512
Embossed taping reel (K)	7" (178 mm)	4,000

EMBOSSED TAPE

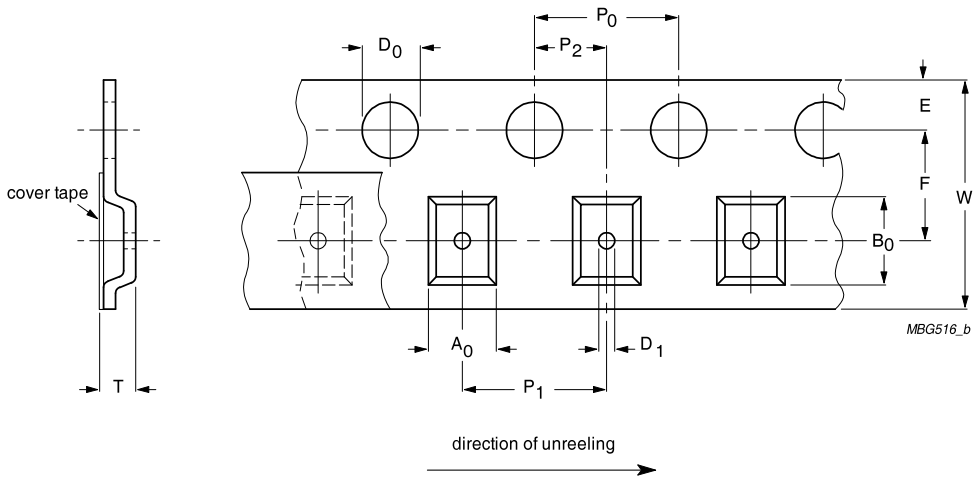


Fig. 6 Embossed Tape

Table 4 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	$\varnothing D_0$	$\varnothing D_1$	T
PA2512	3.40±0.15	6.70±0.15	12.00±0.30	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	0.80±0.15

REEL SPECIFICATION

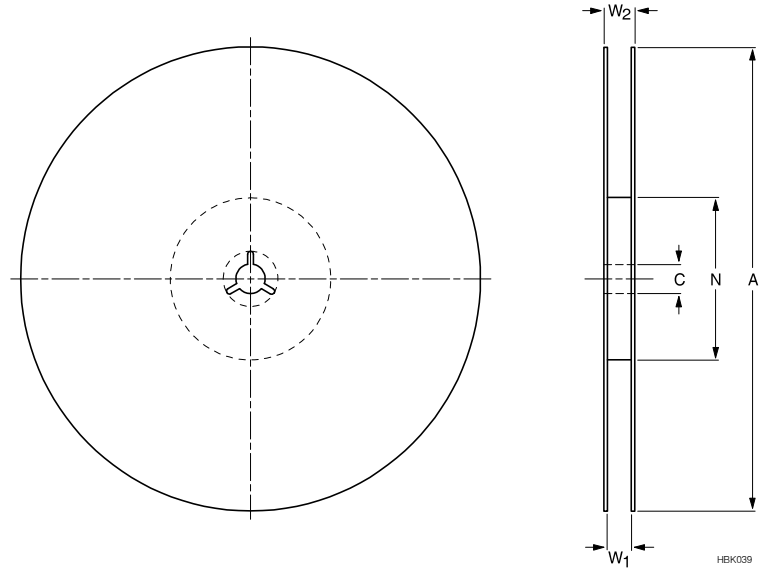


Fig. 7 Reel

Table 5 Dimensions of reel specification for relevant chip resistors size

Unit: mm

SIZE	QUANTITY PER REEL	REEL SIZE		SYMBOL					
		8 mm TAPE WIDE	12 mm TAPE WIDE	A	N	C	D	W_1	$W_{2\ MAX.}$
PA2512	4000	--	7" (Ø178 mm)	178.0±1.0	60.0+1/-0	13.50±0.5	21.0±0.8	13.6±0.5	16.5±0.5

LEADER/TRAILER TAPE SPECIFICATION

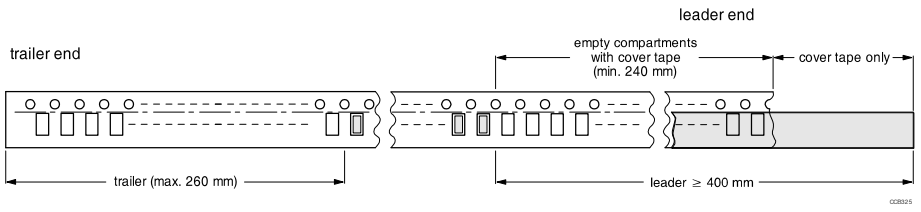


Fig. 8 Leader/Trailer Tape

FOOTPRINT AND SOLDERING PROFILES

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

FOOTPRINT

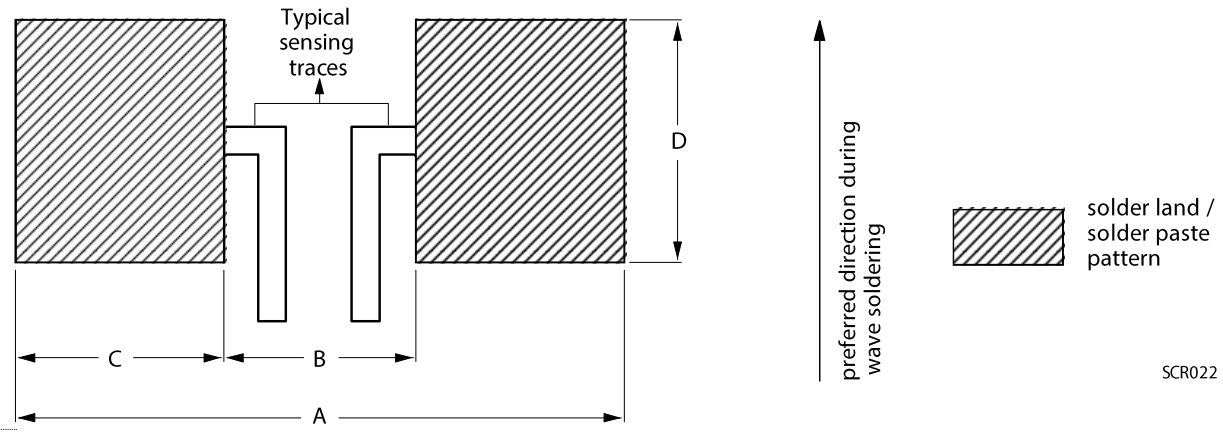


Fig. 9 Single resistor chips recommended dimensions of footprints

Table 6 Footprint dimensions

Unit: mm

SIZE	RESISTANCE RANGE	A	B	C	D
PA2512	0.5mΩ ≤ R < 1mΩ	7.36	0.50	3.43	3.68
	1mΩ ≤ R ≤ 4mΩ	7.37	1.27	3.05	3.68
	5mΩ ≤ R ≤ 6mΩ	7.40	3.18	2.11	3.68
	7mΩ ≤ R ≤ 100mΩ	7.36	4.06	1.65	3.68

TESTS AND REQUIREMENTS

Table 8 Test condition, procedure and requirements

TEST	TEST METHOD	PROCEDURE	REQUIREMENT
Short time overload	IEC60115-1 4.13	5 times of rated power for 5 seconds at room temperature	±(0.5%+0.0005Ω) No visible damage
High Temperature Exposure	MIL-STD-202-Method 108	1,000 hours at maximum operating temperature depending on specification, unpowered No direct impingement of forced air to the parts Tolerances: 170±3°C	±(1.0%+0.0005Ω)
Temperature Cycling	JESD22-A104C	1,000 cycles, -55/+125°C for 1 cycle per hour	±(0.5%+0.0005Ω)
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	±(0.5%+0.0005Ω)
Biased Humidity	MIL-STD-202 Method 103	1,000 hours; 85°C / 85% RH 10% of operating power	±(0.5%+0.0005Ω)
Operational Life/ Endurance	MIL-STD-202-Method 108	1,000 hours at 125±3°C, de-rated voltage applied for 1.5 hours on, 0.5 hour off, still-air required	±(1.0%+0.0005Ω)
		1,000 hours at 70±2°C applied RCWV 1.5 hours on, 0.5 hour off, still air required	±(1.0%+0.0005Ω)
Resistance to Solvents	MIL-STD-202 Method 215	Immerse in isopropyl alcohol for 5 min with ultrasonic at room temperature	No Visible damage
Mechanical Shock	MIL-STD-202 Method 213	Three shocks in each direction shall be applied along the three mutually perpendicular axes of the test specimen. Peak value: 100 g's Duration: 6 ms Velocity change: 12.3 ft/s Waveform: Half sine	±(0.5%+0.0005Ω)
Vibration	MIL-STD-202 Method 204	5 g's for 20 min., 12 cycles each of 3 orientations Test from 10-2000 Hz.	±(0.5%+0.0005Ω)
Resistance to Soldering Heat	MIL-STD-202-method 210	Condition B, no pre-heat of samples Leadfree solder, 260°C, 10 seconds immersion time Procedure 2 for SMD: devices fluxed and cleaned with isopropanol	±(0.5%+0.0005Ω) No visible damage
Thermal Shock	MIL-STD-202 Method 107	-55/+125°C, Number of cycles is 300. Devices mounted. Maximum transfer time is 20 seconds. Dwell time is 15 minutes. Air -Air	±(0.5%+0.0005Ω) No visible damage

TEST	TEST METHOD	PROCEDURE	REQUIREMENT
Electrostatic Discharge	AEC-Q200-002	Human Body Model, 1 pos + 1 neg. Discharges 2512=2KV	±(1.0%+0.0005Ω) No visible damage
Solderability - Wetting	J-STD-002B test B	(a) Method B, aging 4 hours at 155°C dry heat, dipping at 235±3°C for 5±0.5 seconds. (b) Method B, steam aging 8 hours, dipping at 215±3°C for 5±0.5 seconds. (c) Method D, steam aging 8 hours, dipping at 260±3 °C for 7±0.5 seconds.	Well tinned (>95% covered) No visible damage
Flammability	UL94	Try to inflame a specimen by a needle flame	No ignition of specimen; V-0
Board Flex / Bending	AEC-Q200-005	Chips mounted on a 90mm glass epoxy resin PCB (FR4), Bending for 2512=2 mm Holding time: Min.60 seconds	±(1.0%+0.0005Ω)
Terminal Strength (SMD)	AEC-Q200-006	Applied a 17.7N (1.8Kg) for 60±1 seconds.	±(1.0%+0.0005Ω) No visible damage
Flame Retardance	AEC-Q200-001	Apply voltage from 9V to 32V to increase the surface temp to 350°C	No flame, no explosion
Temperature Coefficient of Resistance (T.C.R.)	MIL-STD-202 Method 304	At +25/+150°C Formula: $T.C.R= \frac{R_2 - R_1}{R1(t_2 - t_1)} \times 10^6 (ppm/°C)$ Where t1=+25°C or specified room temperature t2=+150°C test temperature R1=resistance at reference temperature in ohms R2=resistance at test temperature in ohms	Refer to table 2
Flower-of-Sulfur (FOS)	Modified ASTM B809-95	Sulfur 105°C, 750 hours, unpowered.	±(1.0%+0.0005Ω)

REVISION HISTORY

REVISION	DATE	CHANGE NOTIFICATION	DESCRIPTION
Version 10	Jan. 31, 2018	-	- Extend 0.5% Tolerance
Version 9	Nov. 21, 2017		- Extend resistor value for 3W
Version 8	Oct. 23, 2017	-	- Update footprint dimensions
Version 7	Jul. 24, 2017	-	- Add part number coding details for the relationship between taping reel and rated power
Version 6	Apr. 19, 2017	-	- Extend resistor value
Version 5	Nov. 30, 2016	-	- Extend resistor value
Version 4	Oct. 27, 2016	-	- Modify the error of test procedure
Version 3	Mar. 31, 2016	-	- Update TCR
Version 2	Dec. 31, 2015	-	- Extend resistor value
Version 1	Dec. 18, 2015	-	- Update tests and requirements

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YAGEO:

CC1206JRNPO0BN392 CC1206KKX5R7BB106 MMF204BRC1K5 PA2512FKE7W0R012E
RC0201JR-072M4L RC0402FR-7W300KL RC0805FR-073K3P RE0402FRE0724K9L RL1206FR-070R18L
AC0402BRNPO9BN5R6 AT1206FRE0747KL CC0805JRX7R9BB471 RP0603FRE07470RL
AF0402FR-0724K9L CS8888000000SB000 MFR50SFTE52-2K7 NTE03-020M RC0402FR-7W47RL
RP0402FRE071K5L RT0402BRE0749R9L CC0603FRNPO9BN182 CC0805JRX7RYBB102
RC0201DR-07330KL RP0603FRE0710RL RP0402FRE0733R2L RP0603FRE0724KL MFR-25FTE52-300R
AC0201KRX7R8BB472 AC0402FR-13100KL CC0805JRX7R9BB473