

DATA SHEET

CURRENT SENSOR - LOW TCR

AUTOMOTIVE GRADE

PA series

5%, 1%, 0.5%

sizes 0100/0201/0402/0603/0805/1206/2010/2512

RoHS compliant & Halogen free



SCOPE

This specification describes PA0100 to 2512 series current sensor - low TCR with metal substrate.

APPLICATIONS

- Smart Phone
- Batteries
- Computer
- Telecom / Datacom
- Industrial / Power supply
- Car electronics

FEATURES

- AEC-Q200 qualified
- Halogen-free Epoxy
- Total lead free without RoHS exemption
- RoHS compliant
- Reduce environmentally hazardous wastes
- High component and equipment reliability
- Non-forbidden materials used in products/production
- Low resistances applied to current sensing
- Moisture sensitivity level: MSL 1

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 X
 (1) (2) (3) (4) (5) (6) (7)

(1) SIZE

0100/0201/0402/0603/0805/1206/2010/2512

(2) TOLERANCE

D = ±0.5%
 F = ±1%
 J = ±5%

(3) PACKAGING TYPE

R = Paper taping reel (PA0100~PA1206)
 K = Embossed taping reel (PA2010/PA2512)

(4) TEMPERATURE COEFFICIENT OF RESISTANCE

E = ± 50ppm/°C
 M = ± 75ppm/°C
 F = ± 100ppm/°C
 L = ± 150ppm/°C
 G = ± 200ppm/°C
 I = ± 300ppm/°C

(5) TAPING REEL

07 / 7W / 7T / 47 / 57 / 87 / 0L / WL / 4L inch dia. Reel and specific rated power Detailed power rating are shown in the Table 2.

(6) RESISTANCE VALUE

0.5 mΩ to 20 mΩ

(7) DEFAULT CODE

Letter L / Z is the system default code for ordering only. ^(Note)
 L is for 0100/0201/0402/0603/0805
 Z is for only 1206/2010/2512

Resistance rule of global part number

Resistance code rule	Example
0UX	0U5=0.0005Ω
0RXXX	0R001 = 1mΩ 0R02 = 20mΩ

ORDERING EXAMPLE

The ordering code for a PA0805 0.125W chip resistor,TC50 value 0.01Ω (10mR) with ± 1% tolerance, supplied in 7-inch tape reel with 5Kpcs quantify is: PA0805FRE070R01L.

NOTE

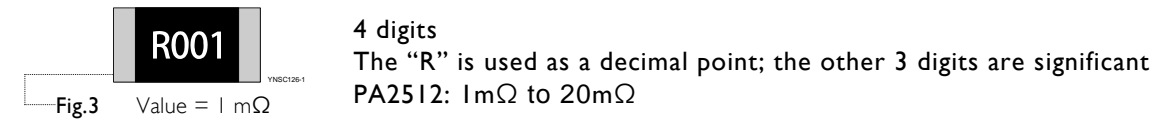
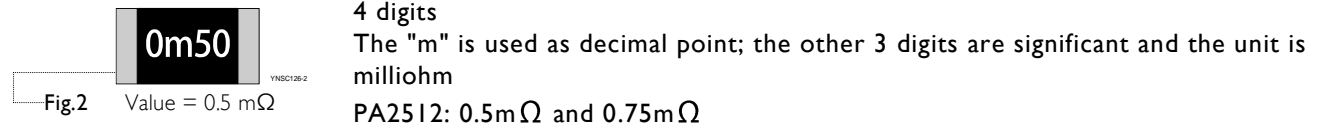
I. All our RChip products are RoHS compliant. "LFP" of the internal 2D reel label mentions "Lead-Free Process"

MARKING

PA0100/0201/0402/0603/0805/1206/2010



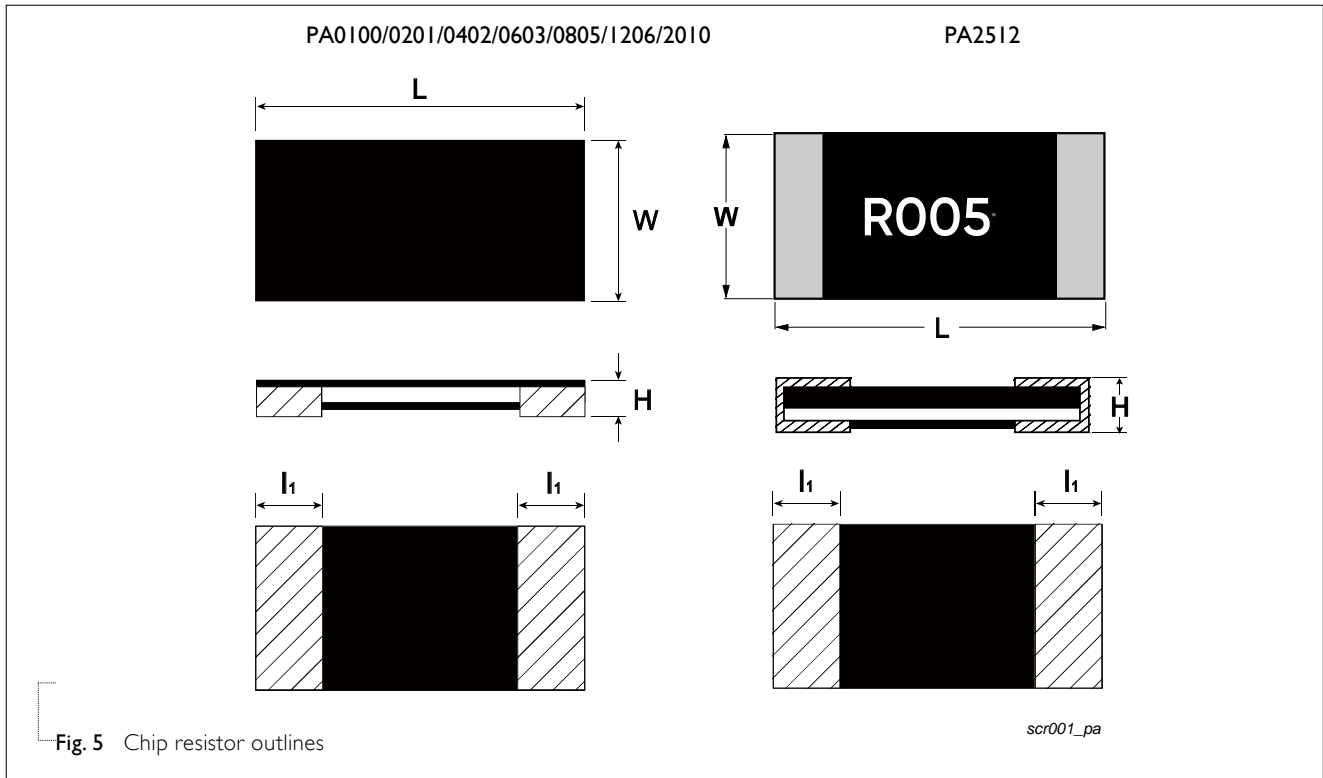
PA2512



CONSTRUCTION

The resistors are constructed by using outstanding TCR level materials, which make Yageo PA resistors excellent for current sensing application in battery charger circuit & DC-DC converter. The advanced resistive materials are adopted to get the precisely required resistance. Finally, the three materials of external terminations (Cu / Ni / matte Tin) are added, as shown in Fig. 5.

Outlines



DIMENSION

Table I For outlines, please refer to Fig. 5

TYPE	RESISTANCE RANGE	L (mm)	W (mm)	H (mm)	ll (mm)
PA0100	$10\text{m}\Omega \leq R < 100\text{m}\Omega$	0.40 ± 0.03	0.20 ± 0.03	Max. 0.15	0.10 ± 0.03
PA0201	$5\text{m}\Omega \leq R < 50\text{m}\Omega$	0.60 ± 0.03	0.31 ± 0.04	Max. 0.30	0.15 ± 0.06
PA0402	$2\text{m}\Omega \leq R \leq 20\text{m}\Omega$	1.00 ± 0.10	0.55 ± 0.10	Max. 0.40	0.25 ± 0.10
PA0603	$1\text{m}\Omega$	1.60 ± 0.20	0.80 ± 0.20	0.55 ± 0.15	0.38 ± 0.12
	$2\text{m}\Omega$	1.60 ± 0.20	0.80 ± 0.20	0.45 ± 0.15	0.38 ± 0.12
	$2.5\text{m}\Omega \leq R \leq 20\text{m}\Omega$	1.60 ± 0.20	0.80 ± 0.20	0.30 ± 0.15	0.38 ± 0.12
PA0805	$0.5\text{m}\Omega$	2.03 ± 0.20	1.27 ± 0.20	Max. 0.90	0.70 ± 0.10
	$1\text{m}\Omega$	2.03 ± 0.20	1.27 ± 0.20	0.55 ± 0.15	0.60 ± 0.15
	$1.5/2\text{m}\Omega$	2.03 ± 0.20	1.27 ± 0.20	0.45 ± 0.15	0.50 ± 0.15
	$2.5\text{m}\Omega \leq R \leq 20\text{m}\Omega$	2.03 ± 0.20	1.27 ± 0.20	0.30 ± 0.15	0.35 ± 0.20
PA1206 (0L/WL/4L)	$1\text{m}\Omega$	3.20 ± 0.25	1.60 ± 0.25	0.50 ± 0.10	1.04 ± 0.25
	$2\text{m}\Omega$	3.20 ± 0.25	1.60 ± 0.25	0.45 ± 0.10	1.04 ± 0.25
PA1206 (07/7W/47)	$1\text{m}\Omega$	3.20 ± 0.25	1.60 ± 0.25	0.65 ± 0.25	0.51 ± 0.25
	$2\text{m}\Omega$	3.20 ± 0.25	1.60 ± 0.25	0.55 ± 0.25	0.60 ± 0.25
	$2.5/3\text{m}\Omega$	3.20 ± 0.25	1.60 ± 0.25	0.40 ± 0.25	0.80 ± 0.30
	$4\text{m}\Omega \leq R \leq 20\text{m}\Omega$	3.20 ± 0.25	1.60 ± 0.25	0.40 ± 0.25	0.60 ± 0.30
PA2010	$1\text{m}\Omega \leq R \leq 3\text{m}\Omega$	5.08 ± 0.25	2.54 ± 0.25	0.50 ± 0.25	1.40 ± 0.25
	$4\text{m}\Omega \leq R \leq 20\text{m}\Omega$	5.08 ± 0.25	2.54 ± 0.25	0.40 ± 0.25	0.70 ± 0.25
PA2512	$0.5\text{m}\Omega \leq R \leq 0.75\text{m}\Omega$	6.35 ± 0.25	3.18 ± 0.25	0.40 ± 0.25	2.72 ± 0.25
	$1\text{m}\Omega \leq R \leq 4\text{m}\Omega$	6.35 ± 0.25	3.18 ± 0.25	0.40 ± 0.25	2.21 ± 0.25
	$5\text{m}\Omega \leq R \leq 6\text{m}\Omega$	6.35 ± 0.25	3.18 ± 0.25	0.40 ± 0.25	1.19 ± 0.25
	$7\text{m}\Omega \leq R \leq 20\text{m}\Omega$	6.35 ± 0.25	3.18 ± 0.25	0.40 ± 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

SIZE	POWER RATING ⁽⁴⁾ @ 70°C						TOLERANCE ⁽²⁾	RESISTANCE RANGE	TEMPERATURE COEFFICIENT OF RESISTANCE ⁽³⁾	
	07 0L ⁽⁵⁾	7W WL ⁽⁵⁾	7T	47 4L ⁽⁵⁾	57	87				
0100	1/32W	1/16W	--	--	--	--	±1%(F) ±5%(J)	10mΩ ≤ R < 100mΩ		±300 ppm/°C(I)
0201	1/20W	1/10W	3/20W	1/5W	--	--	±0.5%(D)	20mΩ		±150 ppm/°C(L)
							±1%(F) ±5%(J)	5mΩ ≤ R < 50mΩ		
0402	1/16W	1/8W	1/6W	1/4W	1/3W	--	±0.5%(D)	15mΩ ≤ R ≤ 20mΩ		±150 ppm/°C(L)
							±1%(F) ±5%(J)	2mΩ ≤ R ≤ 20mΩ		
0603	1/10W	1/5W	1/3W	2/5W	1/2W	--	±0.5%(D)	10mΩ ≤ R ≤ 20mΩ	1mΩ	±200 ppm/°C(G)
							±1%(F) ±5%(J)	1mΩ ≤ R ≤ 20mΩ	2/2.5mΩ	±150 ppm/°C(L)
									3mΩ ≤ R ≤ 20mΩ	
0805	1/8W	1/4W	--	1/2W	--	1W	±0.5%(D)	10mΩ ≤ R ≤ 20mΩ	0.5mΩ	±100 ppm/°C(F)
							±1%(F) ±5%(J)	0.5mΩ ≤ R ≤ 20mΩ	1/1.5mΩ	±150 ppm/°C(L)
1206 (0L/WL/4L)	1/4W	1/2W	--	1W	--	--	±1%(F) ±5%(J)	1m / 2mΩ		±50 ppm/°C(E)
							±0.5%(D)	5mΩ ≤ R ≤ 20mΩ		
1206 (07/7W/47)	1/4W	1/2W	--	1W	--	--	±1%(F) ±5%(J)	1mΩ ≤ R ≤ 20mΩ	1/2mΩ	±100 ppm/°C(F)
							±0.5%(D)	5mΩ ≤ R ≤ 20mΩ	1mΩ ≤ R ≤ 20mΩ	±50 ppm/°C(E)
2010	1/2W	1W	3/2W	2W	--	--	±0.5%(D)	5mΩ ≤ R ≤ 20mΩ (2W : 5mΩ ≤ R ≤ 10mΩ)		±50 ppm/°C(E)
							±1%(F) ±5%(J)	1mΩ ≤ R ≤ 20mΩ (2W : 1mΩ ≤ R ≤ 10mΩ)		
2512	1W	2W	--	--	--	--	±0.5%(D)	(1W : 0.5mΩ ≤ R ≤ 20mΩ)	1mΩ ≤ R ≤ 20mΩ	±50 ppm/°C(E)
							±1%(F) ±5%(J)	(2W : 0.5mΩ ≤ R ≤ 5mΩ)	0.5mΩ ≤ R ≤ 0.75mΩ	±75 ppm/°C(M)

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

2. Global part number (code7)
3. Global part number (code9)
4. Global part number (code10-11)
5. 0L/WL/4L are only for PA1206 1m/2mΩ

FUNCTIONAL DESCRIPTION

OPERATING TEMPERATURE RANGE

PA0100 to PA0402 Range: -55°C to +125°C

PA0603/ 0805 Range: -55°C to +155°C

PA1206/ 2010/ 2512 Range: -55°C to +170°C

POWER RATING

Standard rated power at 70°C: 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:

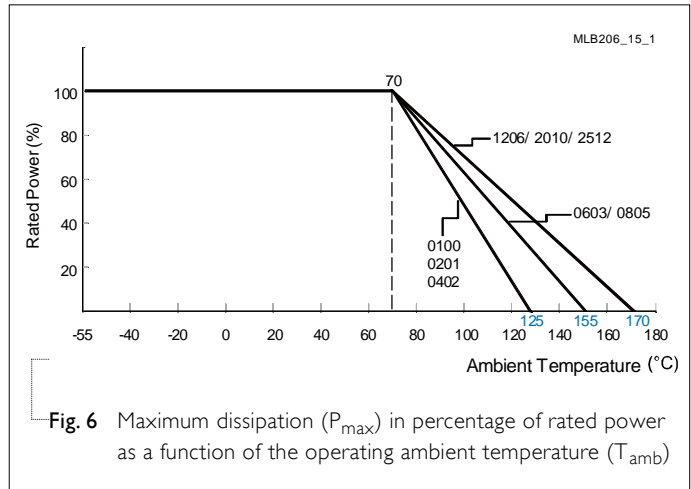
$$V = \sqrt{P \times R}$$

Where

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

P = Rated power (W)

R = Resistance value (Ω)

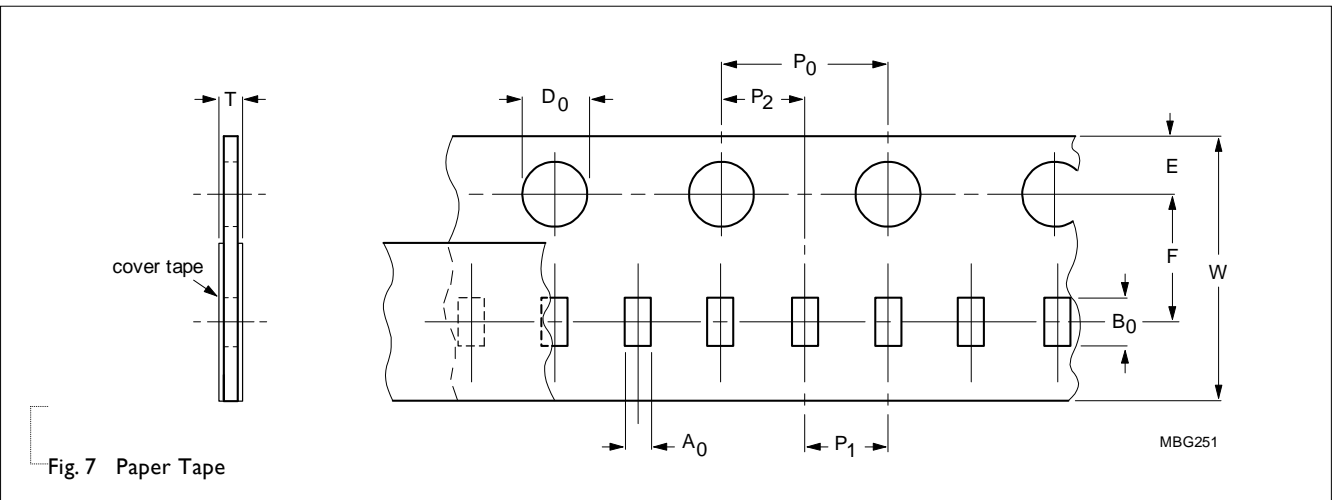


PACKING STYLE AND PACKAGING QUANTITY

Table 3 Packing style and packaging quantity

PACKING STYLE	REEL DIMENSION	PA0100	PA0201	PA0402	PA0603	PA0805	PA1206	PA2010	PA2512
Paper Taping Reel (R)	7" (178 mm)	20,000	10,000	10,000	5,000	5,000	4,000	-	-
Embossed Taping Reel (K)	7" (178 mm)	-	-	-	-	-	-	4,000	4,000

PAPER TAPE



EMBOSSED TAPE

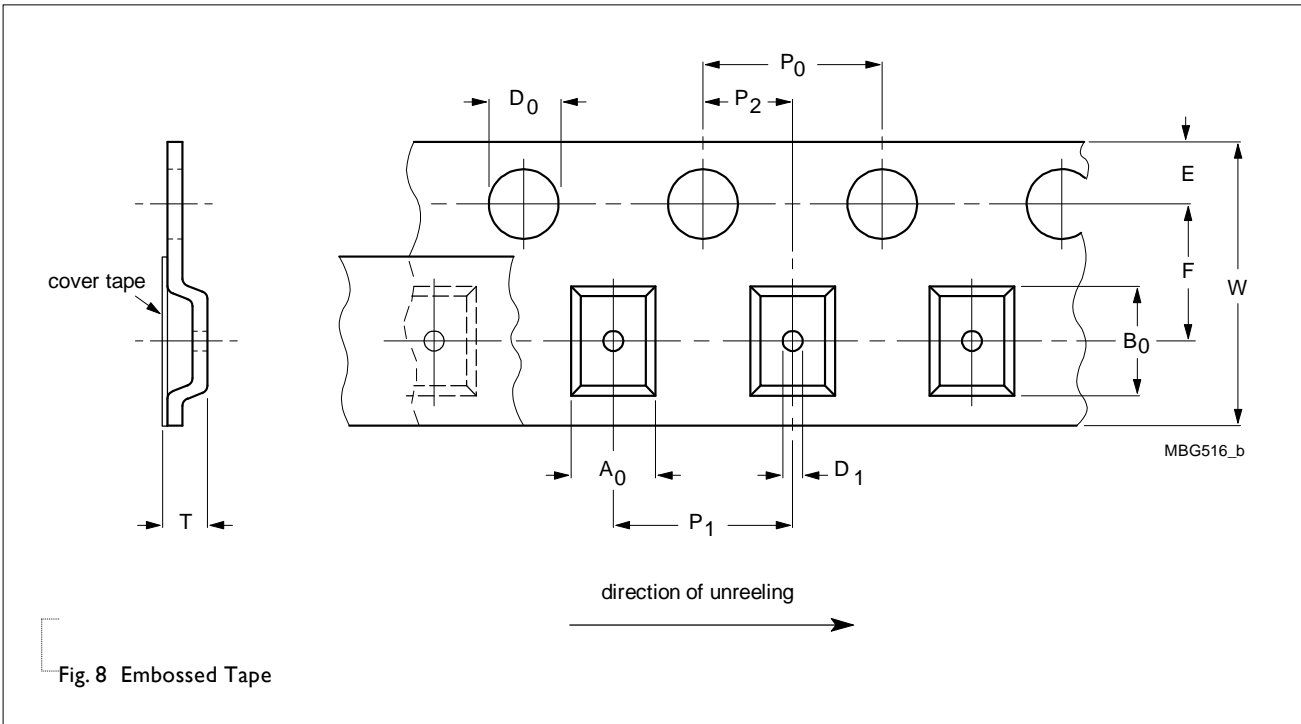


Fig. 8 Embossed Tape

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	ΦD ₀	T	
PA0100	0.24±0.03	0.45±0.03	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.05	2.00±0.10	2.00±0.05	1.50±0.10	0.31±0.10	
PA0201	0.39±0.10	0.70±0.10	8.00±0.30	1.75±0.10	3.50±0.10	4.00±0.10	2.00±0.10	2.00±0.10	1.55±0.05	0.43±0.10	
PA0402	0.59±0.10	1.10±0.10	8.00±0.30	1.75±0.10	3.50±0.10	4.00±0.10	2.00±0.10	2.00±0.10	1.55±0.05	0.53±0.10	
PA0603	1.08±0.10	1.90±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	1.55±0.05	0.60±0.10	
PA0805	1.60±0.10	2.35±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	1.55±0.05	0.60±0.10 ⁽¹⁾	
	1.60±0.10	2.35±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	1.55±0.05	0.53±0.10 ⁽²⁾	
PA1206	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	1.55±0.05	0.85±0.15	

Note: 1. $1\text{m}\Omega \leq R \leq 2\text{m}\Omega$ (T = 0.60± 0.10mm)
 2. $2.5\text{m}\Omega \leq R \leq 20\text{m}\Omega$ (T = 0.53± 0.10mm)

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	ΦD ₀	T	
PA2010	3.40±0.15	6.70±0.15	12.0±0.30	1.75±0.10	5.50±0.10	4.00±0.10	4.00±0.10	2.00±0.10	1.55±0.10	0.85±0.15	
PA2512	3.40±0.15	6.70±0.15	12.0±0.30	1.75±0.10	5.50±0.10	4.00±0.10	4.00±0.10	2.00±0.10	1.55±0.10	0.80±0.15	

REEL SPECIFICATION

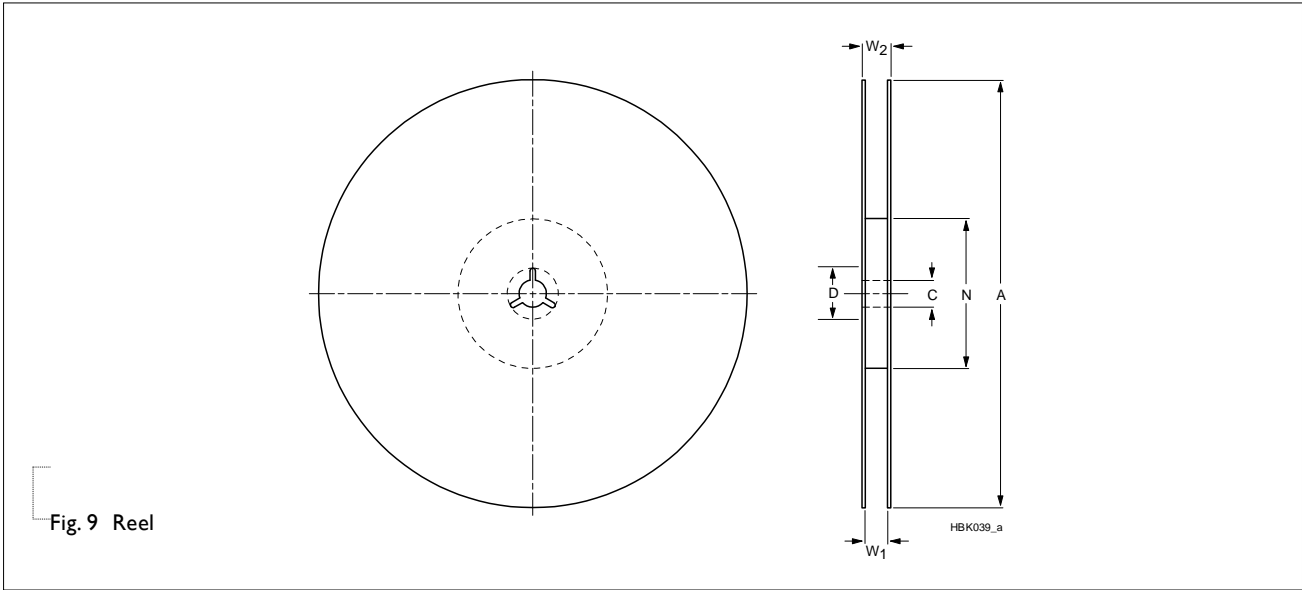
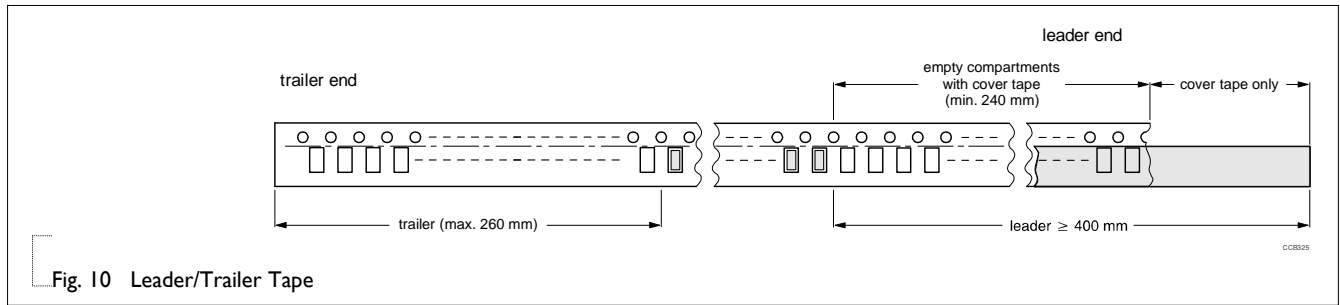


Fig. 9 Reel

Table 6 Dimensions of reel specification for relevant chip resistors size

SIZE	QUANTITY PER REEL	REEL SIZE		SYMBOL				
		8mm TAPE WIDE	12mm TAPE WIDE	A	N	C	D	W_1
PA0100	20,000	7" (Φ 178mm)	-	180.0+0/-3.0	60.0+1/-0	13.00±0.2	21.0±0.8	9.0±0.3
PA0201	10,000	7" (Φ 178mm)	-	178.0±1.0	60.0+1/-0	13.50±0.5	21.0±0.8	9.0±0.5
PA0402	10,000	7" (Φ 178mm)	-	178.0±1.0	60.0+1/-0	13.50±0.5	21.0±0.8	9.0±0.5
PA0603	5,000	7" (Φ 178mm)	-	178.0±1.0	60.0+1/-0	13.50±0.5	21.0±0.8	9.0±0.5
PA0805	5,000	7" (Φ 178mm)	-	178.0±1.0	60.0+1/-0	13.50±0.5	21.0±0.8	9.0±0.5
PA1206	4,000	7" (Φ 178mm)	-	178.0±1.0	60.0+1/-0	13.50±0.5	21.0±0.8	9.0±0.5
PA2010	4,000	-	7" (Φ 178mm)	178.0±1.0	60.0+1/-0	13.50±0.5	21.0±0.8	13.6±0.5
PA2512	4,000	-	7" (Φ 178mm)	178.0±1.0	60.0+1/-0	13.50±0.5	21.0±0.8	13.6±0.5

LEADER/TRAILER TAPE SPECIFICATION



FOOTPRINT AND SOLDERING PROFILES

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

FOOTPRINT

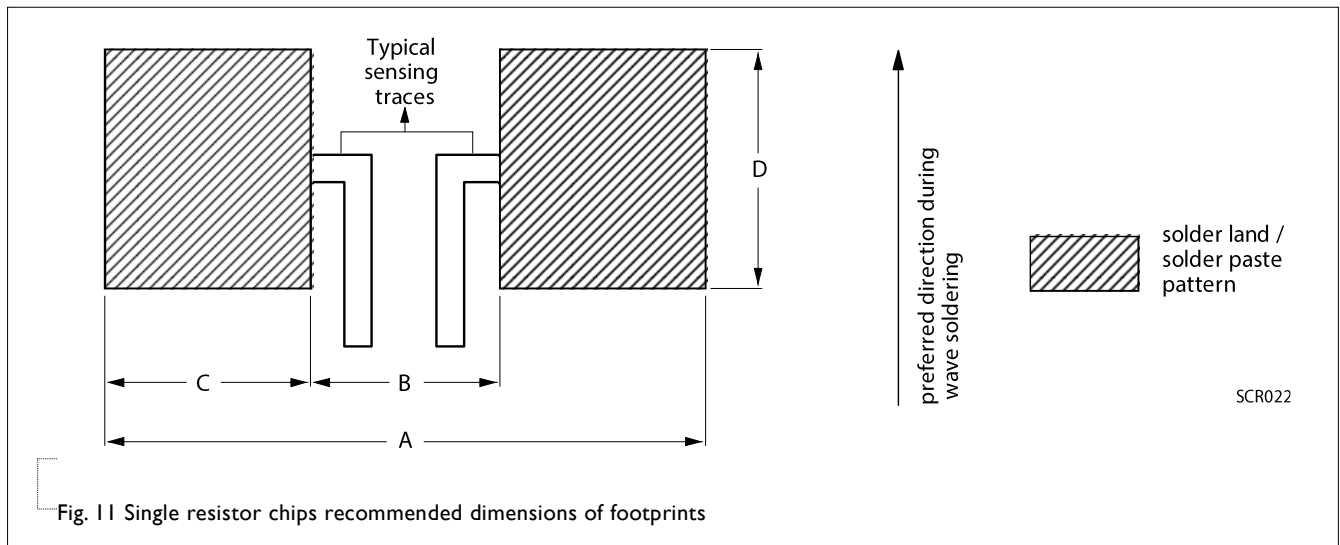


Table 7 Footprint dimensions

TYPE	RESISTANCE RANGE	A	B	C	D	Unit: mm
PA0100	$10m\Omega \leq R < 100m\Omega$	0.5~0.8	0.16~0.2	0.17~0.3	0.2~0.4	
PA0201	$5m\Omega \leq R < 50m\Omega$	1.00	0.30	0.35	0.40	
PA0402	$2m\Omega \leq R \leq 20m\Omega$	2.00	0.40	0.80	0.60	
PA0603	$1m\Omega$	2.20	0.80	0.70	0.90	
	$1m\Omega < R \leq 20m\Omega$	2.20	0.80	0.70	0.90	
PA0805	$0.5m\Omega / 1m\Omega$	4.10	0.50	1.80	1.44	
	$1.5m\Omega \leq R \leq 20m\Omega$	4.60	1.00	1.80	1.44	
PA1206 (0L/WL/4L)	$1m\Omega / 2m\Omega$	3.90	0.90	1.50	1.78	
PA1206 (07/7W/47)	$1m\Omega / 2m\Omega$	4.20	1.00	1.60	1.84	
	$2.5m\Omega / 3m\Omega$	4.80	1.00	1.90	1.84	
	$4m\Omega \leq R \leq 20m\Omega$	4.80	1.20	1.80	1.84	
PA2010	$1m\Omega \leq R \leq 3m\Omega$	6.00	1.60	2.30	3.00	
	$4m\Omega \leq R \leq 20m\Omega$	6.00	3.50	1.25	3.00	
PA2512	$0.5m\Omega \leq R \leq 1m\Omega$	7.36	0.50	3.43	3.68	
	$1m\Omega \leq R \leq 4m\Omega$	7.37	1.27	3.05	3.68	
	$5m\Omega \leq R \leq 6m\Omega$	7.40	3.18	2.11	3.68	
	$7m\Omega \leq R \leq 20m\Omega$	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	0100 : ±(2.0%+0.0005Ω) 0201~2010 : ±(1.0%+0.0005Ω) 2512 : ±(0.5%+0.0005Ω) No visible damage
High Temperature Exposure/ Endurance at Upper Category Temperature	MIL-STD-202G-Method 108	1,000 hours at maximum operating temperature depending on specification, unpowered No direct impingement of forced air to the parts Tolerances: 0100/0201/0402: 125±3°C 0603/0805: 155±3°C 1206/2010/2512: 170±3°C	0100 : ±(3.0%+0.0005Ω) Others : ±(1.0%+0.0005Ω)
Temperature Cycling	JESD22-A104	1,000 cycles, -55/+125°C for 1 cycle per hour	Others : ± (1.0%+0.0005Ω) 2512 : ± (0.5%+0.0005Ω)
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	0100 : ± (3.0%+0.0005Ω) Others : ± (0.5%+0.0005Ω)
Biased Humidity	MIL-STD-202 Method 103	1,000 hours; 85°C / 85% RH 10% of operating power	0100 : ± (3.0%+0.0005Ω) 0201~2010 : ± (1.0%+0.0005Ω) 2512 : ± (0.5%+0.0005Ω)
Operational Life/ Endurance	MIL-STD-202G-Method 108 IEC 60115-1 4.25.1	1,000 hours at 125±3°C, de-rated power applied for 1.5 hours on, 0.5 hour off, still-air required 1,000 hours at 70±2°C applied rated power 1.5 hours on, 0.5 hour off, still air required	0100 : ± (3.0%+0.0005Ω) others ± (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	0100 : ± (1.0%+0.0005Ω) Others : ± (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.	0100 : ± (1.0%+0.0005Ω) Others : ± (0.5%+0.0005Ω)
Resistance to Soldering Heat	MIL-STD-202G-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	0100 : ±(1.0%+0.0005Ω) Others : ±(0.5%+0.0005Ω) No visible damage

TEST	TEST METHOD	PROCEDURE	REQUIREMENT
Thermal Shock	MIL-STD-202 Method 107	-55/+125°C, Number of cycles is 300. Maximum transfer time is 20 seconds. Dwell time is 15 minutes. Air -Air	Others :±(1.0%+0.0005Ω) 2512 : ± (0.5%+0.0005Ω) No visible damage
Electrostatic Discharge	AEC-Q200-002	Human Body Model, 1 pos + 1 neg. 0805/ 1206/ 2010/ 2512 : 2KV 0402/ 0603 : 1KV 0100/ 0201: 500V	±(1.0%+0.0005Ω) No visible damage
Solderability - Wetting	J-STD-002	0201 to 2512 : (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 30±0.5 seconds. 0100 : 1st step: Method B, aging 4 hours at 155°C dry heat. 2nd step: Lead-free solder bath at 245±3°C, dipping at 245±3°C for 3±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 0100: 5mm 0201: 3mm 0402 and above: 2mm Holding time: Min.60 seconds	±(1.0%+0.0005Ω)
Terminal Strength (SMD)	AEC-Q200-006	Applied 0100: 1N 0201: 3N 0402: 5N 0603/0805/1206/2010/2512: 17.7N for 60±1 seconds.	±(1.0%+0.0005Ω) No visible damage
Flame Retardance	AEC-Q200-001	Apply voltage to increase the surface temp to 350 °C	No flame, no explosion
Temperature Coefficient of Resistance (T.C.R.)	IEC 60115-1 4.8	0100~2010 at +25/+125 °C 2512 at +25/+150°C Formula: $T.C.R = \frac{R_2 - R_1}{R_1(t_2 - t_1)} \times 10^6 \text{ (ppm/°C)}$ Where t ₁ =+25 °C or specified room temperature 0100~2010: t ₂ =+125 °C test temperature 2512 : t ₂ =+150°C test temperature R ₁ =resistance at reference temperature in ohms R ₂ =resistance at test temperature in ohms	Refer to table 2

REVISION HISTORY

REVISION	DATE	CHANGE NOTIFICATION	DESCRIPTION
Version 3	Jan. 05, 2023	-	- Extend PA01005, PA0201 and PA0805's resistance range
Version 2	Aug. 06, 2021	-	- Add size of PA2512 and PA1206(0L/WL/4L)
Version 1	Jun. 10, 2021	-	- Add size of PA0100 and tol. $\pm 0.5\%$ for 0201/0402/0603/2010
Version 0	May. 07, 2020	-	- New datasheet for automotive grade current sensor – PA0201/0402/0603/0805/1206/2010 series.

LEGAL DISCLAIMER

YAGEO, its distributors and agents (collectively, "YAGEO"), hereby disclaims any and all liabilities for any errors, inaccuracies or incompleteness contained in any product related information, including but not limited to product specifications, datasheets, pictures and/or graphics. YAGEO may make changes, modifications and/or improvements to product related information at any time and without notice.

YAGEO makes no representation, warranty, and/or guarantee about the fitness of its products for any particular purpose or the continuing production of any of its products. To the maximum extent permitted by law, YAGEO disclaims (i) any and all liability arising out of the application or use of any YAGEO product, (ii) any and all liability, including without limitation special, consequential or incidental damages, and (iii) any and all implied warranties, including warranties of fitness for a particular purpose, non-infringement and merchantability.

YAGEO products are designed for general purpose applications under normal operation and usage conditions. Please contact YAGEO for the applications listed below which require especially high reliability for the prevention of defects which might directly cause damage to the third party's life, body or property: Aerospace equipment (artificial satellite, rocket, etc.), Atomic energy-related equipment, Aviation equipment, Disaster prevention equipment, crime prevention equipment, Electric heating apparatus, burning equipment, Highly public information network equipment, data-processing equipment, Medical devices, Military equipment, Power generation control equipment, Safety equipment, Traffic signal equipment, Transportation equipment and Undersea equipment, or for any other application or use in which the failure of YAGEO products could result in personal injury or death, or serious property damage. Particularly **YAGEO Corporation and its affiliates do not recommend the use of commercial or automotive grade products for high reliability applications or manned space flight.**

Information provided here is intended to indicate product specifications only. YAGEO reserves all the rights for revising this content without further notification, as long as products are unchanged. Any product change will be announced by PCN.