

PRELIMINARY SHEET

**TTL02, TTL04, TTL06, TTL08, TTL12,
TTL20, TTL25**

$\pm 5\%$, $\pm 1\%$, $\pm 0.5\%$

High Power Thin Film Current Sensor

Size:0201,0402,0603,0805,1206,2010,2512



*Contents in this sheet are subject to change without prior notice.

FEATURES

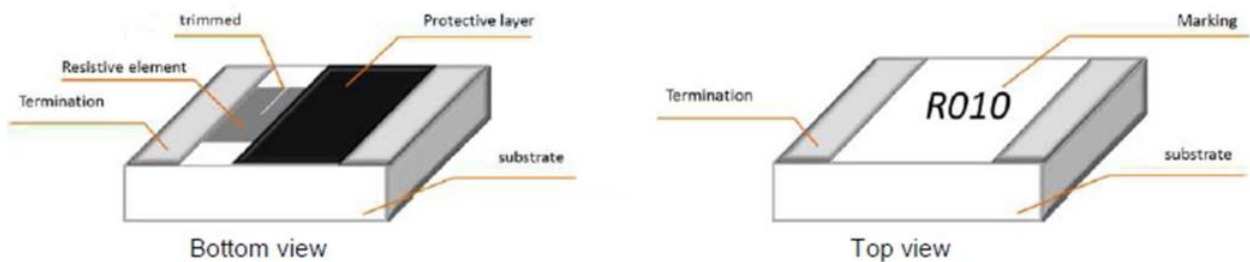
1. Extra high power rating and low TCR.
2. Extra low resistance and high precision.
3. High component and equipment reliability
4. Low resistances applied to current sensing
5. RoHS compliant & Halogen Free.
6. Suitable for lead free soldering.

APPLICATIONS

- Current sensor
- Medical equipment
- Measuring instrument
- Communication device
- Power supply
- Computer

DESCRIPTION

This specification describes TTL series current sensor – Extra high power and low TCR with lead-free terminations made by metal film with substrate.



Quick Reference Data

| Series | Size Code | Functional code | | | | | | | | Resistance Range | Resistance Tolerance | |
|--------|----------------|-----------------|------|------|------|------|------|----|----|-----------------------------------|----------------------|--|
| | | Power | | | | | | | | | | TCR |
| | | G | H | I | J | K | M | P | Q | | | |
| TTL | 0201 (0603) | 1/10W | 1/8W | 1/5W | 1/4W | 1/3W | | | | 350ppm/°C | 5~20mΩ | ±0.5% (>10mΩ) ±1% ±5% |
| | 0402 (1005) | | 1/8W | 1/5W | 1/4W | 1/3W | 1/2W | | | 150ppm/°C | 2.5~20mΩ | |
| | 0603 (1608) | | | 1/5W | 1/4W | 1/3W | 1/2W | | | 75ppm/°C | 5~20mΩ | |
| | 0805 (2012) | | | | 1/4W | 1/3W | 1/2W | | | 75ppm/°C | 5~20mΩ | |
| | 1206 (3216) | | | | 1/4W | 1/3W | 1/2W | 1W | | 75ppm/°C | 5~20mΩ | |
| | 2010 (5025) | | | | | | | 1W | 2W | 50ppm/°C 75ppm/°C 100ppm/°C | 5~20mΩ | |
| | 2512 (6342) | | | | | | | 1W | 2W | 50ppm/°C 75ppm/°C 100ppm/°C | 5~20mΩ | |

Note :

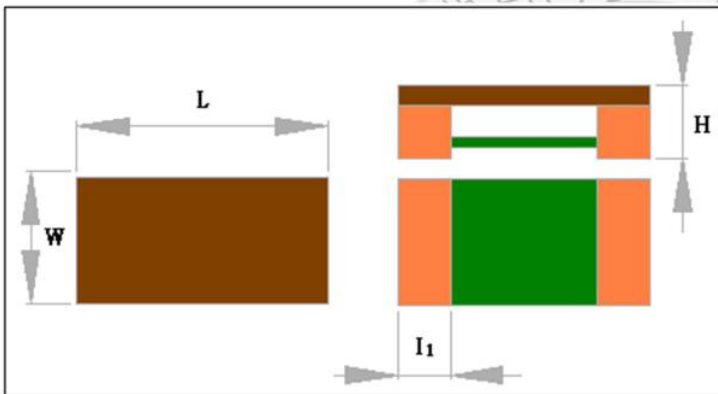
- This is the maximum voltage that may be continuously supplied to the resistor element, see "IEC publication 60115-8"
- Max. Operation Voltage : So called RCWV (Rated Continuous Working Voltage) is determined by

$$RCWV = \sqrt{\text{Rated Power} \times \text{Resistance Value}}$$
- Operating Temperature Range
 0201/0402 : -55°C to +125°C
 0603/0805/1206/2010/2512 : -55°C to +170°C

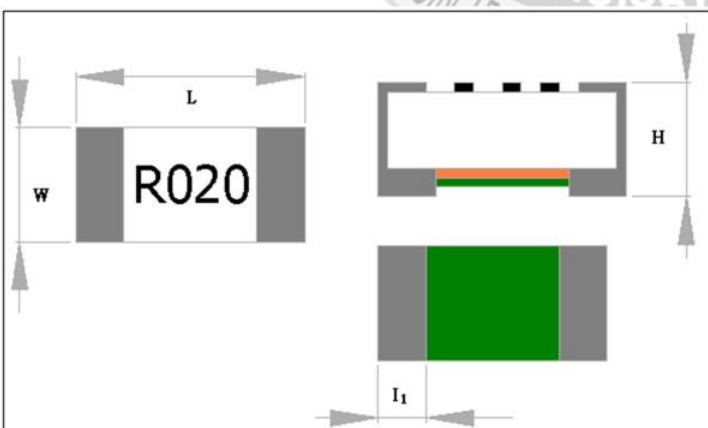
DIMENSIONS:(unit:mm)

| Type | Resistance Range | L(mm) | W(mm) | H(mm) | l ₁ (mm) |
|-------|------------------|-----------|-----------|-----------|---------------------|
| TTL02 | 5~20mΩ | 0.60±0.03 | 0.31±0.04 | Max:0.30 | 0.14±0.16 |
| TTL04 | 2.5~20mΩ | 1.00±0.10 | 0.55±0.10 | Max:0.35 | 0.25±0.10 |
| TTL06 | 5~20mΩ | 1.60±0.20 | 0.76±0.25 | 0.56±0.25 | 0.38±0.25 |
| TTL08 | 5~20mΩ | 2.03±0.25 | 1.27±0.25 | 0.56±0.25 | 0.38±0.25 |
| TTL12 | 5~20mΩ | 3.20±0.25 | 1.60±0.25 | 0.64±0.25 | 0.51±0.25 |
| TTL20 | 5~20mΩ | 5.08±0.25 | 2.54±0.25 | 0.64±0.25 | 0.51±0.25 |
| TTL25 | 5~20mΩ | 6.35±0.25 | 3.18±0.25 | 0.64±0.25 | 0.76±0.25 |

0201/0402



0603/0805/1206/2010/2512

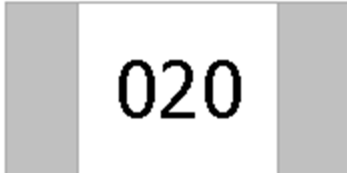


Marking

0201/0402(No Marking)



0603/0805(3 digits)



020=20mΩ

1206/2010/2512(4 digits)



R020=20mΩ

FUNCTIONAL DESCRIPTION

Product characterization

Standard values of nominal resistance are taken from the E96 & E24 series for resistors with a tolerance of $\pm 5.0\%$, $\pm 1.0\%$. The values of the E24/E96 series are in accordance with "IEC publication 60063".



DERATING

The power that the resistor can dissipate depends on the operating temperature; see Fig.1&Fig2

0201/0402 Range: -55°C to +125°C (Fig.1)

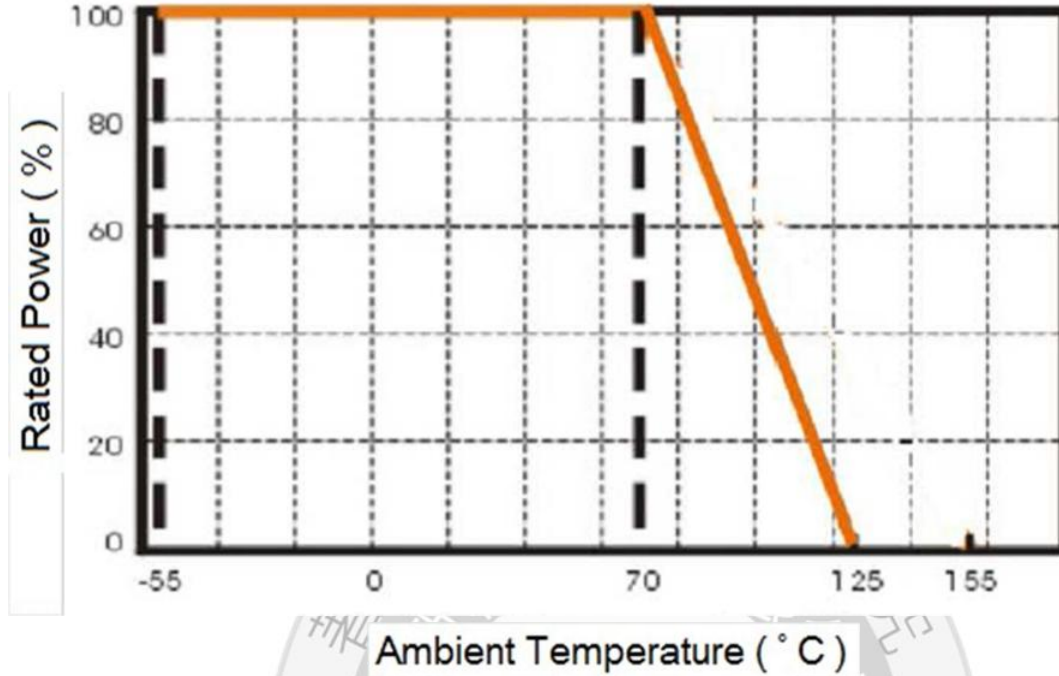


Fig.1 Maximum dissipation in percentage of rated power
As a function of the ambient temperature

0603 to 2512 Range: -55°C to +170°C (Fig.2)

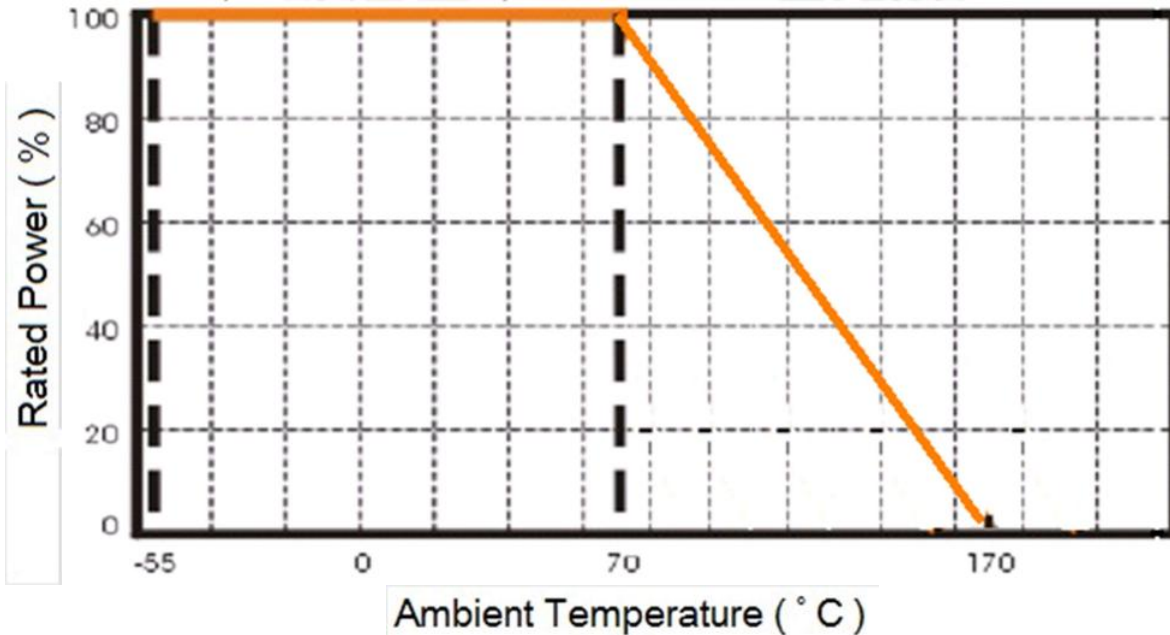


Fig.2 Maximum dissipation in percentage of rated power
As a function of the ambient temperature

MOUNTING

Due to their rectangular shapes and small tolerances, Surface Mountable Resistors are suitable for handling by automatic placement systems.

Chip placement can be on ceramic substrates and printed-circuit boards (PCBs).

Electrical connection to the circuit is by individual soldering condition.

The end terminations guarantee a reliable contact.

SOLDERING CONDITION

The robust construction of chip resistors allows them to be completely immersed in a solder bath of 260°C for 10 seconds. Therefore, it is possible to mount Surface Mount Resistors on one side of a PCB and other discrete components on the reverse (mixed PCBs).

Surface Mount Resistors are tested for solderability at 235°C during 2 seconds within lead-free solder bath. The test condition for no leaching is 260°C for 30 seconds. Typical examples of soldering profile and condition that provide reliable joints without any damage are given in Fig 3. and Table 1.

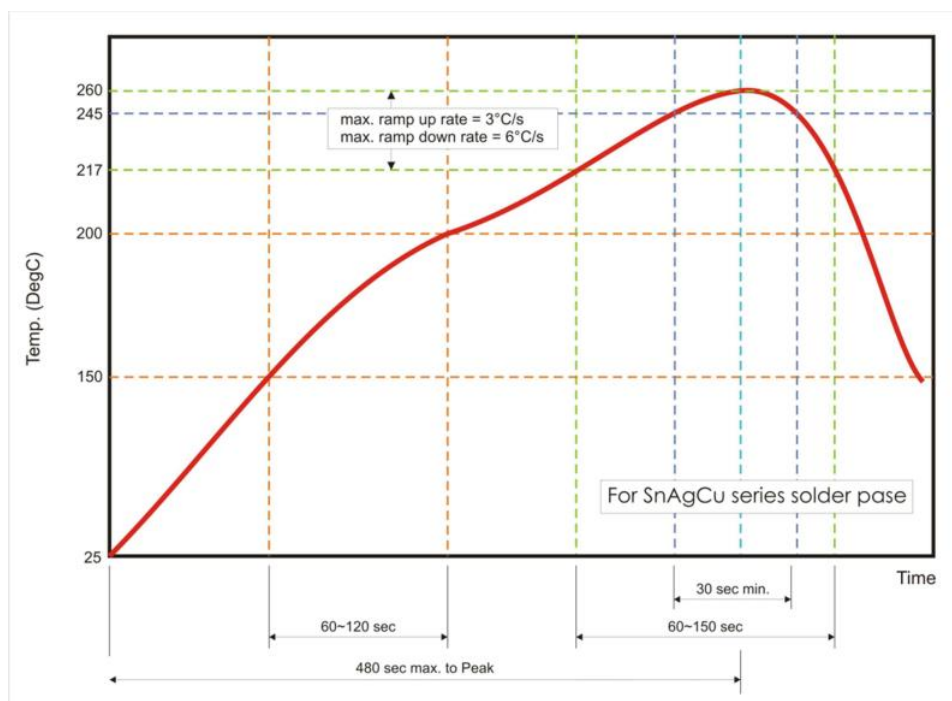


Fig. 3 Infrared soldering profile for Chip Resistors

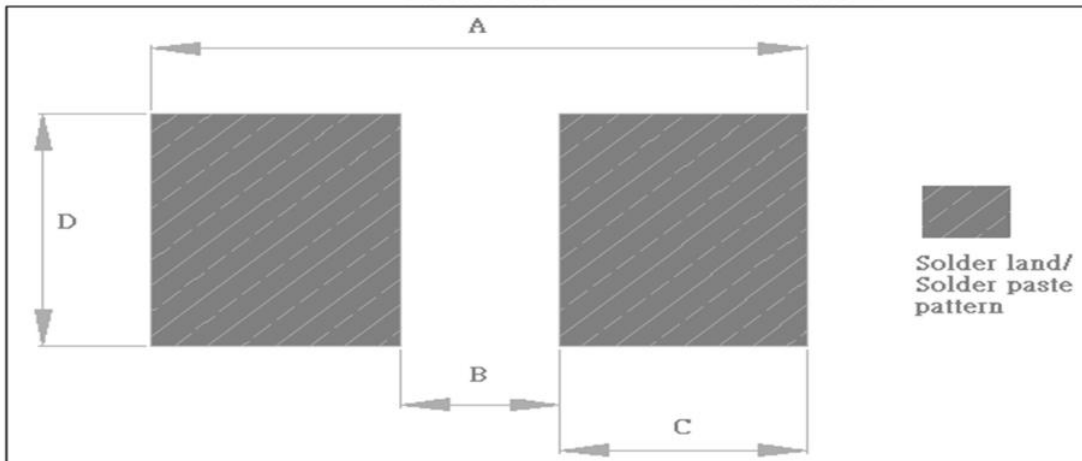
Table 1. Infrared soldering condition for Chip Resistors

| Temperature Condition | Exposure Time |
|---------------------------------------|-----------------------------|
| Average ramp-up rate (217°C to 260°C) | Less than 3°C/second |
| Between 150 and 200°C | Between 60-120 seconds |
| > 217°C | Between 60-150 seconds |
| Peak Temperature | 260°C +0/-5°C |
| Time within 245°C | Min. 30 seconds |
| Ramp-down rate (Peak to 217°C) | Less than 6°C/second |
| Time from 25°C to Peak | No greater than 480 seconds |

CATALOGUE NUMBERS

| TTL | 02 | Q | N | XXXX | F | T | L |
|----------------|--|---|--|--|--------------------------------|----------------------|------------------------|
| Type code | Size code | Power Rating | TCR | Resistance | Tolerance | Packaging code | Termination Code |
| Low Resistance | 02: 0201 04: 0402 06: 0603 08: 0805 12: 1206 20: 2010 25: 2512 | Q:2W P:1W M:1/2W K:1/3W J:1/4W I:1/5W H:1/8W G:1/10W | N:50ppm/°C O:75ppm/°C P:100ppm/°C Q:150ppm/°C R:200ppm/°C U:350ppm/°C | e.g. : R020 = 20mΩ R005 = 5mΩ R2L5 =2.5mΩ | D: 0.5% F: 1.0% J : 5.0% | T: 7" Taped & Reeled | L: Sn base (lead-free) |

Recommend Solder Pad Dimensions



| Type | Resistance Range | A(mm) | B(mm) | C(mm) | D(mm) |
|-------|------------------|-------|-------|-------|-------|
| TTL02 | 5~20mΩ | 1.00 | 0.30 | 0.35 | 0.40 |
| TTL04 | 2.5~20mΩ | 2.00 | 0.40 | 0.80 | 0.60 |
| TTL06 | 5~20mΩ | 2.52 | 0.50 | 1.01 | 1.01 |
| TTL08 | 5~20mΩ | 2.54 | 0.50 | 1.02 | 1.27 |
| TTL12 | 5~20mΩ | 3.90 | 0.76 | 1.57 | 1.78 |
| TTL20 | 5~20mΩ | 6.10 | 3.30 | 1.40 | 3.05 |
| TTL25 | 5~20mΩ | 7.36 | 4.06 | 1.65 | 3.68 |

TEST AND REQUIREMENTS(JIS C 5201-1 : 1998)

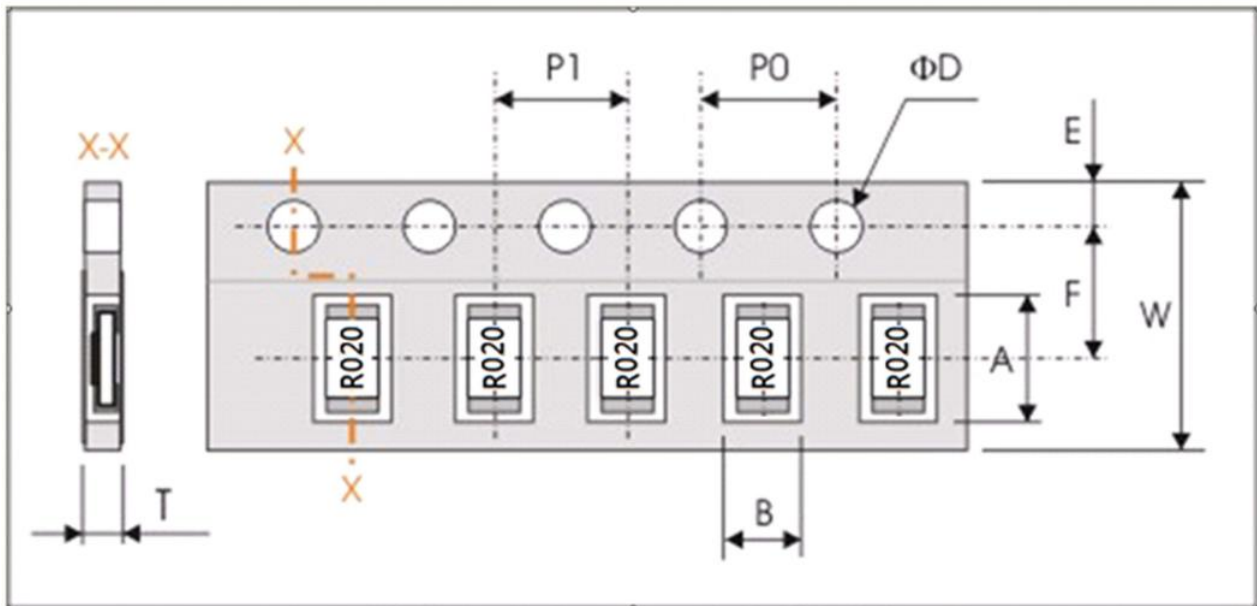
| TEST | PROCEDURE | REQUIREMENT |
|---|--|--|
| | | Resistor |
| DC resistance IEC 60115-1 / JIS C 5201-1 , Clause 4.5 | D: ±0.5%,F: ±1%, G: ±5% | Within the specified tolerance |
| Temperature Coefficient of Resistance(T.C.R) | Natural resistance change per change in degree centigrade. $\frac{R_2 - R_1}{R_1(t_2 - t_1)} \times 10^6$ (ppm/ C) R ₁ : Resistance at reference temperature R ₂ : Resistance at test temperature t ₁ : 20°C+5°C-1°C t ₂ : 125°C+5°C-1°C | Refer to “ QUICK REFERENCE DATA “ |
| Short time overload (S.T.O.L) IEC60115-1 4.13 | 5 times of rated power for 5 seconds at room temperature | No visible damage ±(1.0%+0.0005Ω) |
| Resistance to soldering heat(R.S.H) MIL-STD-202G-method 210F IEC 60115-1 4.18 | 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 | No visible damage ±(0.5%+0.0005Ω) |
| Solderability IPC/JEDEC J-STD-002B test B | SMD conditions: 1st step: method B, aging 4 hours at 155 °C dry heat 2nd step: leadfree solder bath at 245± 3 °C Dipping time: 3± 0.5 seconds | good tinning (>95% covered) no visible damage |
| Thermal Shock MIL-STD-202G-method 107 | -55/+125 °C Note: Number of cycles required is 300. Devices mounted Maximum transfer time is 20 seconds. Dwell time is 15 minutes. Air – Air | ±(1.0%+0.0005Ω) |
| Endurance MIL-STD-202G-method 108 IEC 60115-1 4.25.1 | 70±2°C, 1000 hours, loaded with RCWV,,1.5 hours on and 0.5 hours off | ±(1.0%+0.0005Ω) |
| Bias Humidity MIL-STD-202 Method 103 | 1,000 hours at 85°C/85%R.H. 10% of operating power, no condensation on the devices, circulating air. | ±(1.0%+0.0005Ω) |
| Bending Strength IEC60115-1 4.33 | Device mounted on PCB test board as described, only 1 board bending required Bending for 0201: 3mm 0402 and above: 2mm Holding time: minimum 60 seconds | ±(1.0%+0.0005Ω) |
| High Temperature Exposure MIL-STD-202G-method 108 IEC 60115-1 4.25.3 | 1,000 hours at maximum operating temperature depending on specification, unpowered No direct impingement of forced air to the parts Tolerances: 0201/0402 125± 3°C 0603 and above 170± 3°C | ±(1.0%+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 Parts mounted on test-boards, without condensation on parts Measurement at 24± 2 hours after test conclusion | ± (0.5%+0.0005 Ω) |
|--|--|-------------------|



PACKAGING

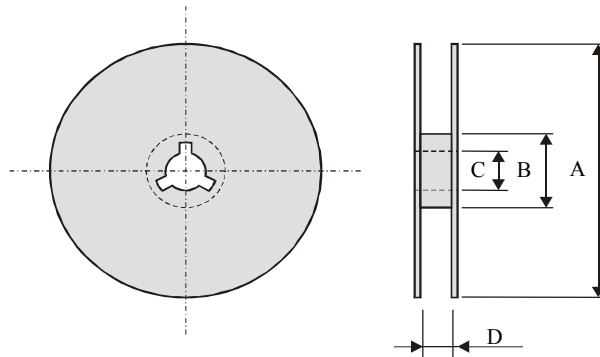
Paper Tape specifications (unit: mm)



| Series No. | A | B | W | F | E |
|------------|------------|-----------|------------|-----------|-----------|
| TTL02 | 0.720±0.05 | 0.42±0.05 | 8.00±0.30 | 3.50±0.05 | 1.75±0.10 |
| TTL04 | 1.20±0.10 | 0.7±0.10 | 8.00±0.30 | 3.50±0.05 | 1.75±0.10 |
| TTL06 | 1.90±0.20 | 1.10±0.20 | 8.00±0.30 | 3.50±0.20 | 1.75±0.10 |
| TTL08 | 2.40±0.20 | 1.65±0.20 | 8.00±0.30 | 3.50±0.20 | 1.75±0.10 |
| TTL12 | 3.60±0.20 | 2.00±0.20 | 8.00±0.30 | 3.50±0.20 | 1.75±0.10 |
| TTL20 | 5.50±0.20 | 2.80±0.20 | 12.00±0.30 | 5.50±0.10 | 1.75±0.10 |
| TTL25 | 6.90±0.20 | 3.60±0.20 | 12.00±0.30 | 5.50±0.10 | 1.75±0.10 |

| Series No. | P1 | P0 | ΦD | T |
|------------|-----------|-----------|---------------------------------------|-----------|
| TTL02 | 2.00±0.10 | 4.00±0.10 | Φ1.50 ^{+0.1} _{-0.0} | 0.4±0.05 |
| TTL04 | 2.00±0.10 | 4.00±0.10 | Φ1.50 ^{+0.1} _{-0.0} | 0.40±0.05 |
| TTL06 | 4.00±0.10 | 4.00±0.10 | Φ1.50 ^{+0.1} _{-0.0} | 0.65±0.05 |
| TTL08 | 4.00±0.10 | 4.00±0.10 | Φ1.50 ^{+0.1} _{-0.0} | Max. 1.0 |
| TTL12 | 4.00±0.10 | 4.00±0.10 | Φ1.50 ^{+0.1} _{-0.0} | Max. 1.0 |
| TTL20 | 4.00±0.10 | 4.00±0.10 | Φ1.50 ^{+0.1} _{-0.0} | Max 1.2 |
| TTL25 | 4.00±0.10 | 4.00±0.10 | Φ1.50 ^{+0.1} _{-0.0} | Max 1.2 |

Reel Dimensions:



| Symbol | A | B | C | D |
|-------------|----------------------|---------------------|----------------|---------------|
| (unit : mm) | $\Phi 178.0 \pm 2.0$ | $\Phi 60.0 \pm 1.0$ | 13.0 ± 0.2 | 9.0 ± 0.5 |

Taping Quantity

- Chip resistors 4,000 pcs per reel (TTL25, TTL20)
- Chip resistors 5,000 pcs per reel (TTL12, TTL08, TTL06)
- Chip resistors 10,000 pcs per reel (TTL04)
- Chip resistors 15,000 pcs per reel (TTL02)

