APPROVAL SHEET

TTL02、TTL04、TTL06、TTL08

±1% , ±0.5%

High Power Thin Film Current Sensor
(RoHS Compliant 、Halogen Free)
Size:0201、0402、0603、0805

FEATURES

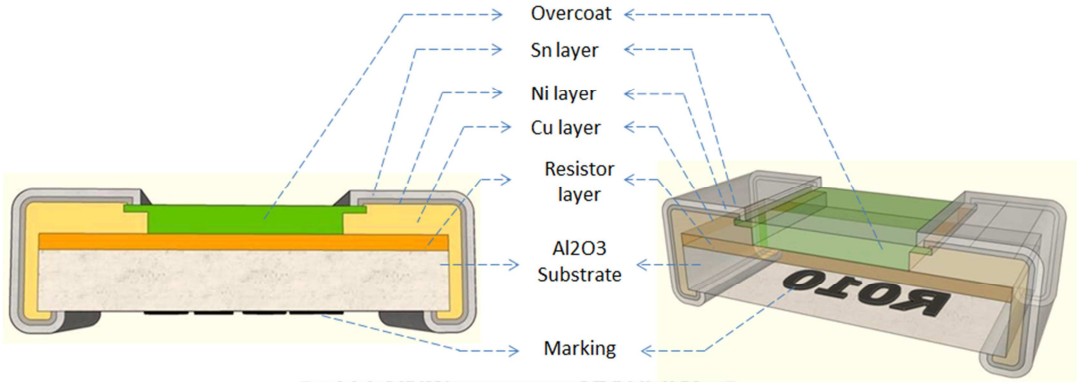
1. Extra high power rating and low TCR.
2. Extra low resistance and high precision.
3. High component and equipment reliability
4. Low resistances applied to current sensing
5. RoHS compliant & Halogen Free.
6. Suitable for lead free soldering.

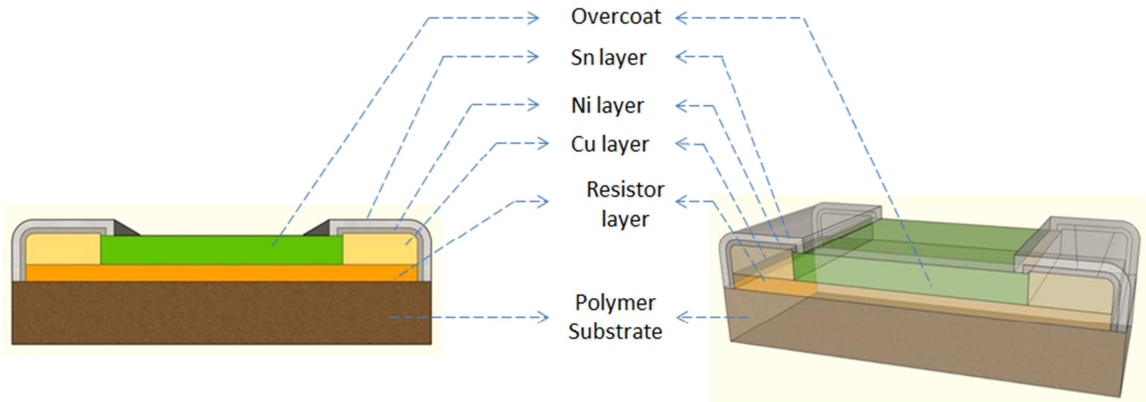
APPLICATIONS

- 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 or metal foil with substrate.





Quick Reference Data

Series	Size	Functional code							TCR (ppm/℃)	Resistance Range	Resistance Tolerance
		Power(W)									
		H	I	J	K	M	P	Q		mΩ	%
TTL	0201 (0603)	1/8	1/5	1/4	1/3				U : ±350	5~20 mΩ	±1%(F)
TTL	0402 (1005)			1/4	1/3	1/2			Q : ±150	2.5 mΩ	±1%(F)
TTL	0402 (1005)			1/4	1/3	1/2			P : ±100	5~20 mΩ	±1%(F)
TTL	0603 (1608)		1/5	1/4	1/3	1/2			Q : ±150	2 ~4 mΩ	±1%(F)
TTL	0603 (1608)			1/4	1/3	1/2			O : ±75	5 ~9 mΩ	±1%(F)
TTL	0603 (1608)			1/4	1/3	1/2			O : ±75	10 ~20 mΩ	±0.5%(D) ±1%(F)
TTL	0805 (2012)			1/4	1/3	1/2			Q : ±150	2~4 mΩ	±1%(F)
TTL	0805 (2012)			1/4	1/3	1/2			O : ±75	5~9 mΩ	±1%(F)
TTL	0805 (2012)			1/4	1/3	1/2			O : ±75	10~20 mΩ	±0.5%(D) ±1%(F)

Note :

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

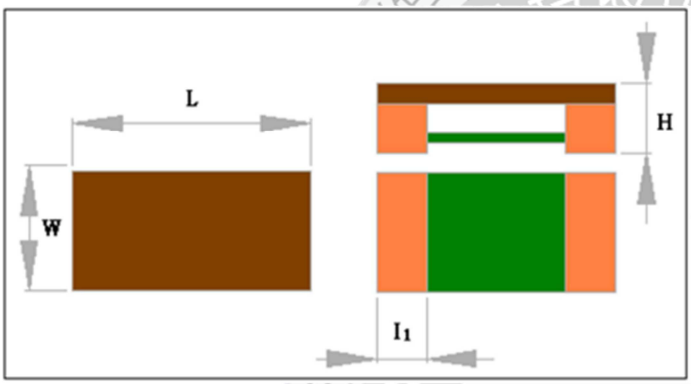
$$RCWV = \sqrt{\text{Rated Power} \times \text{Resistance Value}}$$

DIMENSIONS:(unit:mm)

0201/0402 Series

Type	Resistance Range(mΩ)	L(mm)	W(mm)	H(mm)	l_1(mm)
TTL02HU TTL02IU TTL02JU TTL02KU	5~20	0.60±0.03	0.31±0.04	Max:0.30	0.14±0.16
TTL04JQ TTL04KQ TTL04MQ	2.5	1.00±0.10	0.55±0.10	Max:0.35	0.25±0.10
TTL04JP TTL04KP TTL04MP	5~20	1.00±0.10	0.55±0.10	Max:0.35	0.25±0.10

TTL02HU(IU、JU、KU) 、TTL04JQ(KQ、MQ) 、TTL04JP(KP、MP) Series

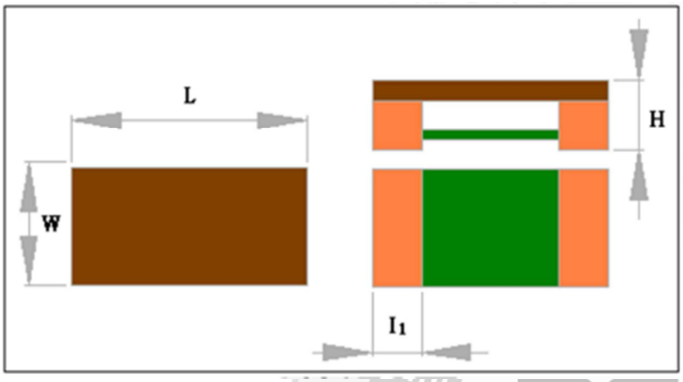


Marking(No mark)

0603 series

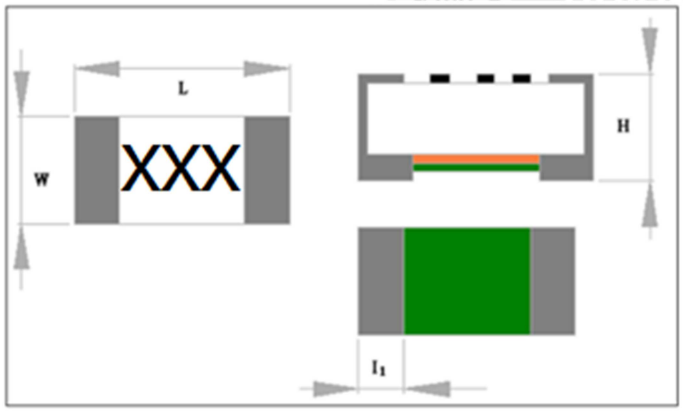
Type	Resistance Range(mΩ)	L(mm)	W(mm)	H(mm)	I1(mm)
TTL06IR TTL06JR TTL06KR TTL06MR	2	1.60±0.25	0.80±0.25	0.40±0.25	0.45±0.20
	2.5~3	1.60±0.25	0.80±0.25	0.40±0.25	0.35±0.20
	4	1.60±0.25	0.80±0.25	0.40±0.25	0.30±0.20
TTL06JO TTL06KO TTL06MO	5~14	1.60±0.20	0.90±0.20	0.65±0.20	0.50±0.20
	15~20	1.60±0.20	0.90±0.20	0.65±0.20	0.40±0.20

TTL 06IR(JR、KR、MR)_(2~4mΩ)



Marking(No mark)

TTL06 JO (KO、MO)_(5~14mΩ) ; TTL06 JO (KO、MO)_(15~20mΩ)



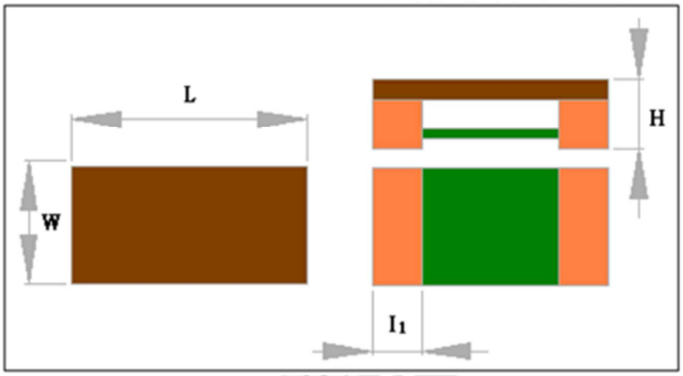
Mark (3digits)

(010=10 mΩ)

0805 series

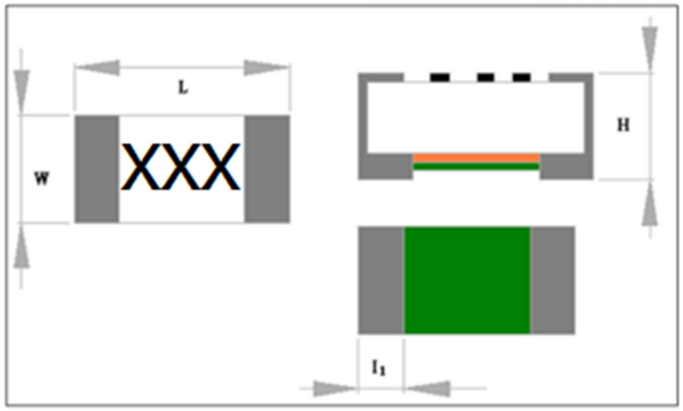
Type	Resistance Range(mΩ)	L(mm)	W(mm)	H(mm)	I1(mm)
TTL08JQ TTL08KQ TTL08MQ	2~4	2.00±0.25	1.25±0.25	0.30±0.25	0.65±0.25
TTL08JO TTL08KO TTL08MO	5~9	2.03±0.20	1.27±0.20	0.65±0.20	0.55±0.20
	10~20	2.03±0.20	1.27±0.20	0.65±0.20	0.50±0.20

TTL08 JQ(KQ、MQ)_(2~4 mΩ)



Marking(No mark)

TTL08 JO(KO、MO) _(5~9mΩ)、TTL08 JO(KO、MO) _(10~20mΩ)



Mark (3digits)

(010=10 mΩ)

FUNCTIONAL DESCRIPTION

Product characterization

Power rating is based on continuous full load operation at rated ambient temperature of 70 ºC. For resistors operated at ambient temp. in excess of 70 ºC, the maximum load shall be derated in accordance with the following curve.

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

Temperature range of size 0201: -55℃ to +125℃ (Fi g.1)

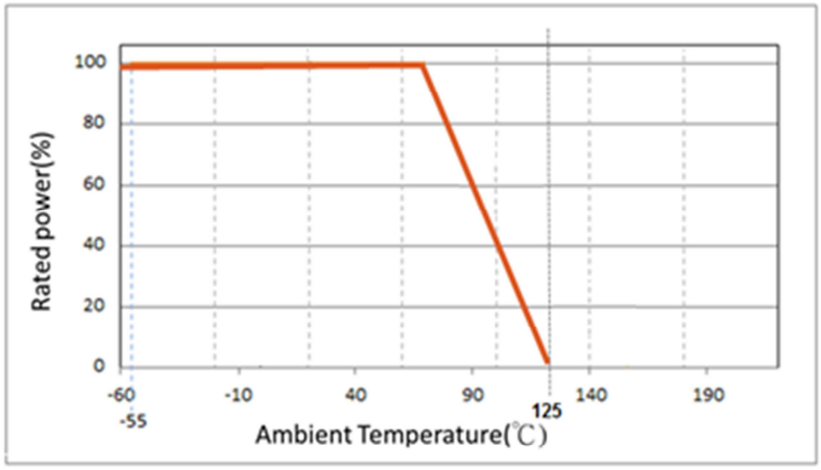


Fig.1 Maximum dissipation in percentage of rated power.
As a function of the ambient temperature.

Temperature range of size 0402 to 0805: -55℃ to +1 55℃ (Fig.2)

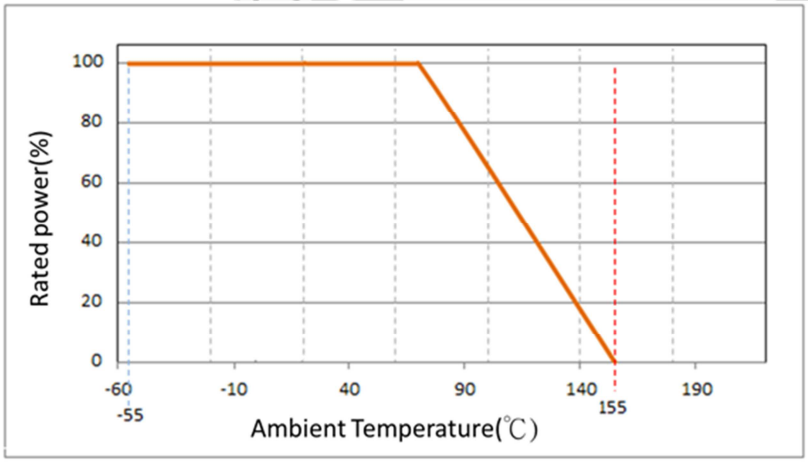


Fig.2 Maximum dissipation in percentage of rated power.
As a function of the ambient temperature.

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.

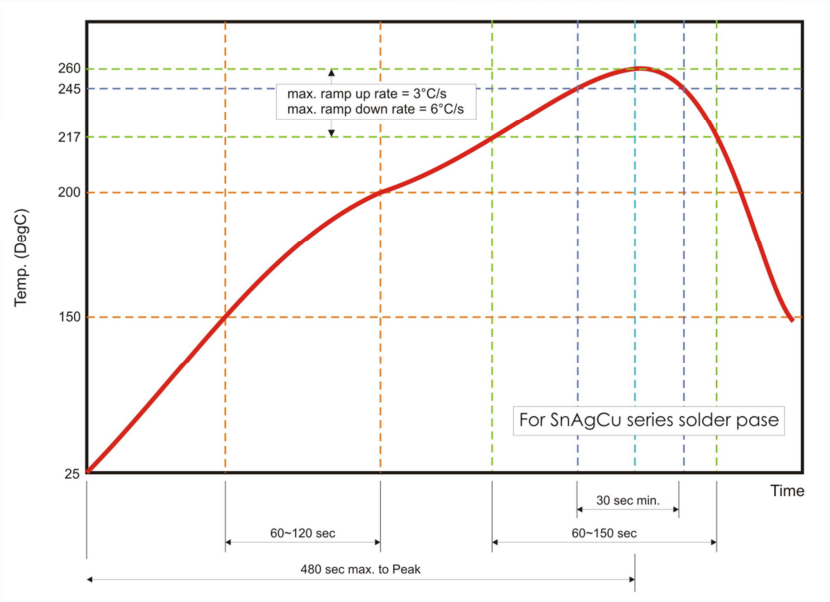


Fig. 3 Infrared soldering profile for Chip Resistors

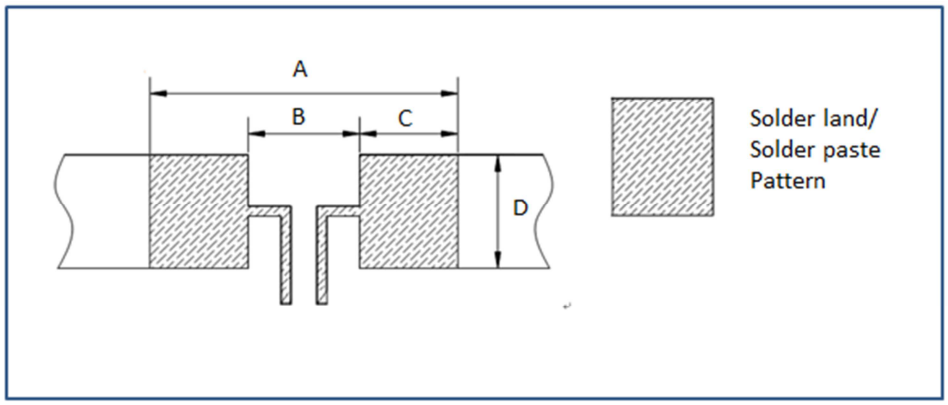
Table 1. Infrared soldering condition for Chip Resistors

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	260ºC +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	06	P	O	XXXX	F	T	L
Type code Low Resistance	**Size code** 02:0201 04:0402 06:0603 08:0805	**Power Rating** M:1/2 W K:1/3 W J: 1/4W I:1/5W H:1/8 W	**TCR** N:50 ppm/℃ O:75ppm/℃ P:100 ppm/℃ Q:150 ppm/℃ R:200 ppm/℃ U:350 ppm/℃	**Resistance** e.q R003=3mΩ R010=10mΩ R2L5=2.5mΩ	**Tolerance** D: ±0.5% F: ±1%	**Packaging code** T:7" Taped Reeled	**Termination code** L:Sn Base (Lead free)

Recommend Solder Pad Dimensions



Dimensions of solder Pad :

Type	Resistance Range	A(mm)	B(mm)	C(mm)	D(mm)
TTL02	5~20mΩ	0.65	0.25	0.20	0.33
TTL04	2.5~20 mΩ	1.60	0.40	0.6	0.60
TTL06	2~4 mΩ	3.20	0.50	1.35	0.92
TTL06	5~20mΩ	3.20	0.60	1.30	0.92
TTL08	2~4 mΩ	3.60	0.50	1.55	1.44
TTL08	5~20 mΩ	3.60	0.80	1.40	1.44

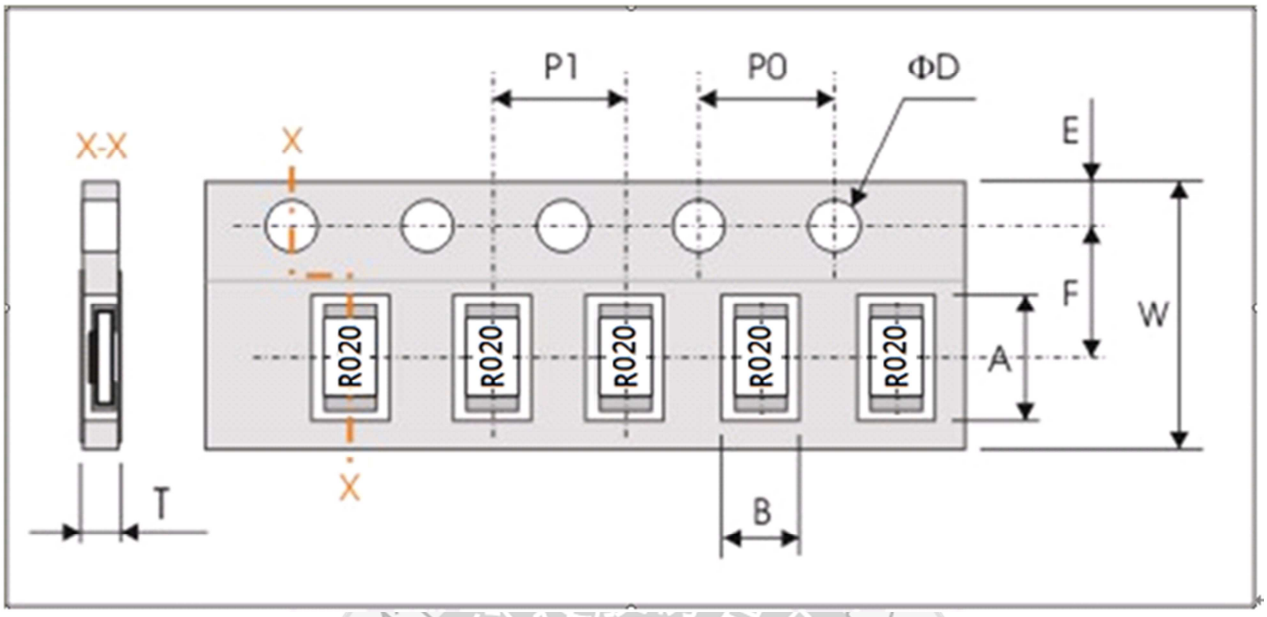
TEST AND REQUIREMENTS(JIS C 5201-1 : 1998)

TEST	PROCEDURE	REQUIREMENT Resistor
DC resistance **IEC 60115-1 / JIS C 5201-1 , Clause 4.5**	D: ±0.5%,F: ±1%,	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℃+5℃-1℃ t2 : 125℃+5℃-1℃	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 Lead free solder, 260 ℃, 10 seconds immersion time Procedure 2 for SMD: devices fluxed and cleaned with isopropanol	No visible damage ±(0.5%+0.0005□)
Solderability **IPC/JEDEC J-STD-002B test B**	SMD conditions: 1st step: method B, aging 4 hours at 155 ℃ dry heat 2nd step: leadfree solder bath at 245± 3 ℃ Dipping time: 3± 0.5 seconds	good tinning (>95% covered) no visible damage
Thermal Shock **MIL-STD-202G-method 107**	-55/+125 ℃ 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±2ºC, 1000 hours, loaded with RCWV,1.5 hours on and 0.5 hours off	±(2.0%+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: 125± 3℃ 0402 and above 155± 3℃	±(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 ℃ / 65 ℃ 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)
Bias Humidity **MIL-STD-202** **Method 103**	1,000 hours at 85ºC/85%R.H. 10% of operating power, no condensation on the devices, circulating air.	±(1.0%+0.0005Ω)

PACKAGING

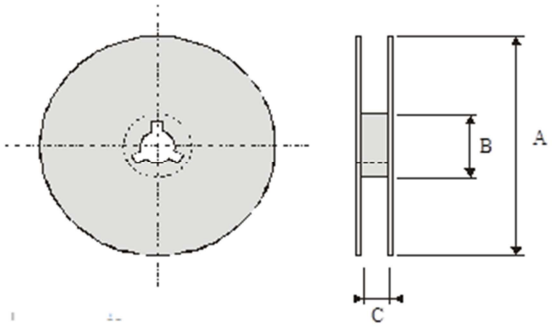
Paper Tape specifications (unit :mm)



Series No.	A	B	W	F	E
TTL02	0.70±0.10	0.40±0.10	8.00±0.30	3.50±0.10	1.75±0.10
TTL04	1.250±0.20	0.75±0.20	8.00±0.30	3.50±0.10	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

Series No.	P1	P0	ΦD	T
TTL02	2.00±0.10	4.00±0.10	$\Phi 1.50^{+0.1}_{-0.0}$	Max 0.5
TTL04	2.00±0.10	4.00±0.10	$\Phi 1.50^{+0.1}_{-0.0}$	Max 0.6
TTL06	4.00±0.10	4.00±0.10	$\Phi 1.50^{+0.1}_{-0.0}$	Max 1.0
TTL08	4.00±0.10	4.00±0.10	$\Phi 1.50^{+0.1}_{-0.0}$	Max 1.1

Reel dimensions



Symbol	A (unit : mm)	B (unit : mm)	C (unit : mm)
(unit : mm)	Φ178.0±5.0	Φ60.0±2.0	9.0±0.5

Taping quantity

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