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# SPECIFICATIONS

Thick Film Chip Resistor

**TSR20G-Serie**

Version October 2017

Customer

Swissdis AG

## SPECIFICATIONS

Rev. 1

Document Number DSD1703101

Thick Film Chip Resistor

TSR 20G Series

After you approve this specification, please return it to us with your company chop and signature in a month.

If your order is given to us, we regard that this specification shall be perfectly accepted by you.

Date: Oct-31-2017

Approved : K. Tanikawa

Checked : -

Drawn : J. Nogami

TATEYAMA KAGAKU IND. CO., LTD.  
TATEYAMA KAGAKU DEVAICE THCHNOLOGY CO., LTD.



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1. Scope

This specification specifies TSR 20G Series of Thick Film Chip Resistor (herein after referred as resistor).

2. Part number

Example)

TSR   20   G   J   101   V  
 ①   ②   ③   ④   ⑤   ⑥

Item	Contents
① Product code	TSR : Thick Film Chip Resistor
② Size	20: 0603 (mm)
③ Feature	G : Standard
④ Resistance tolerance	F : ±1%, G : ±2%, J : ±5% Nil : Jumper
⑤ Nominal resistance	Shown by 3(E-24) or 4(E-96) digits. Ex) 100 : $10 \times 10^0 = 10(\Omega)$ 103 : $10 \times 10^3 = 10,000(\Omega) = 10k(\Omega)$ 4752 : $475 \times 10^2 = 45,700(\Omega) = 47.5k(\Omega)$ Decimal point is shown by " R ". Ex) 4R7 : 4.7(Ω) Jumper is shown by " R00 "
⑥ Packaging	V : φ180 reel

3. Rating

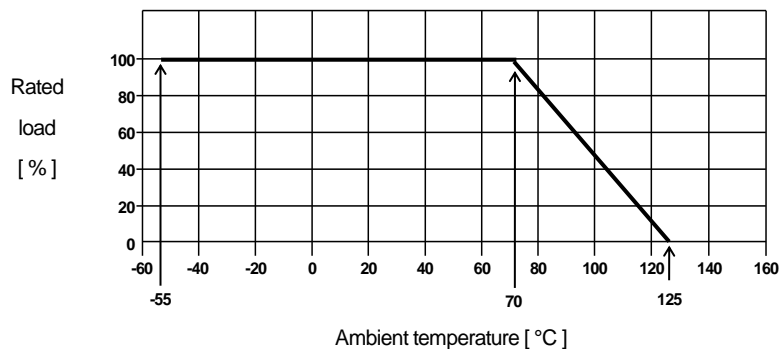
3.1. Rating

**Table - 1 Rating**

Rated power (W)	0.05
Maximum Working Voltage (V)	25
Maximum Overload Voltage (V)	50
Jumper Rated Current (A)	0.5
Jumper Maximum Overload Current (A)	1.0
Category temperature range	-55~125°C

### 3.2. Derating curve

In case of ambient temperature above 70°C, power derating shall be applied in accordance with Figure - 1.



**Figure - 1 Derating curve**

### 3.3. Rated voltage

Rated voltage means DC or AC (rms) voltage corresponds to rated power. If the rated voltage exceeds the Maximum Working Voltage, the Maximum Working Voltage shall be regarded as the rated voltage.

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

E : Rated voltage (V)  
P : Rated power (W)  
R : Nominal resistance (Ω)

### 4. Range and tolerance of resistance

**Table - 2 Resistance value range**

	TCR (ppm/°C)	Resistance Value range ( Ω )		
		F : ±1% (E-24,E-96)	G : ±2% (E-24)	J : ±5% (E-24)
20G	±200	100~1M	100~1M	100~1M
	±250	10~97.6	10~91	10~91
	±400	200~1M	—	1.0~9.1
Jumper		Under 50mΩ		

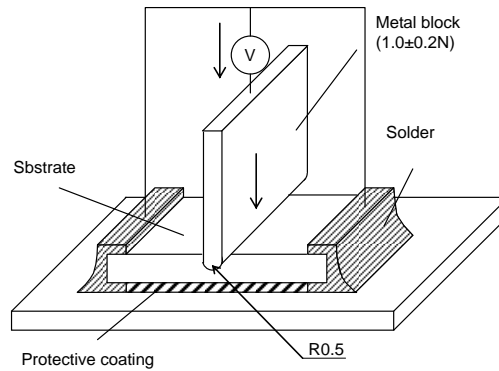
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5. Performances

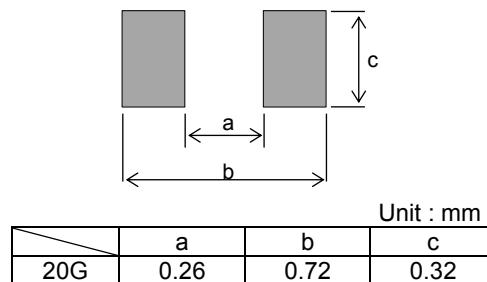
5.1. Electric performance

**Table - 3 Electric performances**

Test items	performances	Conditions
TCR	Refer to Table - 2	Temperature : 25°C⇒-55°C, 25°C⇒125°C $TCR(ppm/°C) = (R-R_0)/R_0 \times 1/(T-T_0) \times 10^6$ $T_0 (°C) : 25°C$ $T (°C) : -55°C, \text{ or } 125°C$ $R_0 (\Omega) : \text{Resistance value at } 25°C$ $R (\Omega) : \text{Resistance value at } -55°C, \text{ or } 125°C$
Short-time overload	Change of resistance value : ±(2.0%+0.1Ω) Jumper : under 50mΩ	Applied voltage : Rated voltage ×2.5 or maximum overload voltage, smaller. (Jumper: maximum overload current) Time : 5s
Insulation resistance	1,000MΩ or over (from termination to substrate)	Applied voltage : DC100V±15V Time : 1 min
Dielectric withstanding voltage	Leak current : ≤2mA No damage by flash-over	Applied voltage : Maximum overload voltage (AC) Time : 60±5 s



**Figure - 2 Insulation resistance, Dielectric withstanding voltage**

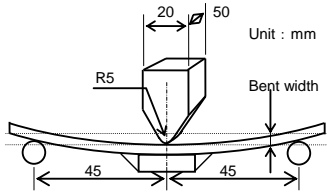


**Figure - 3 Recommend rand pattern**

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5.2. Mechanical performance

**Table - 4 Mechanical performance**

Test items	performances	Conditions
Substrate bending	Change of resistance value : $\pm(1.0\%+0.1\Omega)$ Jumper : under 50m $\Omega$	Bent width : 3mm Holding time : 10s Test board : Glass fiber base epoxy resin / t=1.6mm 
Resistance to soldering heat	Change of resistance value : $\pm(1.0\%+0.1\Omega)$ Jumper : under 50m $\Omega$	Solder temperature : 260 $\pm$ 5 $^{\circ}$ C Immersion time : 10 $\pm$ 1 s
Solderability	At least 95% of termination shall be coated by new solder	Solder temperature : 245 $\pm$ 5 $^{\circ}$ C Immersion time : 3 $\pm$ 0.5s

5.3. Climatic performance

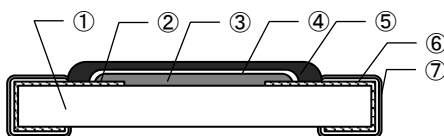
**Table - 5 Climatic performance**

Test items	performances	Conditions
Temperature cycling	Change of resistance value : $\pm(1.0\%+0.1\Omega)$ Jumper : under 50m $\Omega$	Repeat 100 cycles Step1 : -55 $^{\circ}$ C / 30min Step2 : Room temperature 3min(max) Step3 : +125 $^{\circ}$ C / 30min Step4 : Room temperature 3min(max)
Stability	Change of resistance value : $\pm(1.0\%+0.1\Omega)$ Jumper : under 50m $\Omega$	Temperature : 155 $\pm$ 3 $^{\circ}$ C Time : 1,000 $_{-0}^{+48}$ h
Low temperature	Change of resistance value : $\pm(1.0\%+0.1\Omega)$ Jumper : under 50m $\Omega$	Temperature : -55 $\pm$ 3 $^{\circ}$ C Time : 1,000 $_{-0}^{+48}$ h
Humidity	Change of resistance value : $\pm(1.0\%+0.1\Omega)$ Jumper : under 50m $\Omega$	Temperature/Humidity : 40 $\pm$ 2 $^{\circ}$ C / 90~95% Time : 1,000 $_{-0}^{+48}$ h
Load life	Change of resistance value : $\pm(3.0\%+0.1\Omega)$ Jumper : under 50m $\Omega$	Temperature : 70 $\pm$ 2 $^{\circ}$ C Applied voltage : Rated voltage (Jumper : rated current) Time : ON 90min $\Leftrightarrow$ OFF 30min / 1,000 $_{-0}^{+48}$ h
Load humidity	Change of resistance value : $\pm(3.0\%+0.1\Omega)$ Jumper : under 50m $\Omega$	Temperature/Humidity : 40 $\pm$ 2 $^{\circ}$ C / 90~95% Applied voltage : Rated voltage (Jumper : rated current) Time : ON 90min $\Leftrightarrow$ OFF 30min / 1,000 $_{-0}^{+48}$ h

Thick Film Chip Resistor

6. Construction, dimension

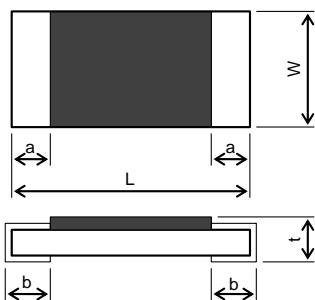
6.1. Construction



No.	Construction	Material
①	Substrate	Al <sub>2</sub> O <sub>3</sub> 96%
②	Inner termination	Ag/Pd thick film (Side termination : Ni thin film)
③	Resistor element	RuO <sub>2</sub> thick film (Jumper : Ag/Pd thick film)
④	Inner protective coat	Glass (except jumper)
⑤	Outer protective coat	Epoxy-resin (black)
⑥	Second termination	Ni (plating)
⑦	Third termination	Sn (plating)

Figure - 4 Construction

6.2. Dimension



( 単位 : mm )

L	W	t	a	b
0.60±0.03	0.30±0.03	0.23±0.03	0.13±0.05	0.15±0.05

Figure - 5 Dimension



Thick Film Chip Resistor

7. Marking

This products have no marking on chip

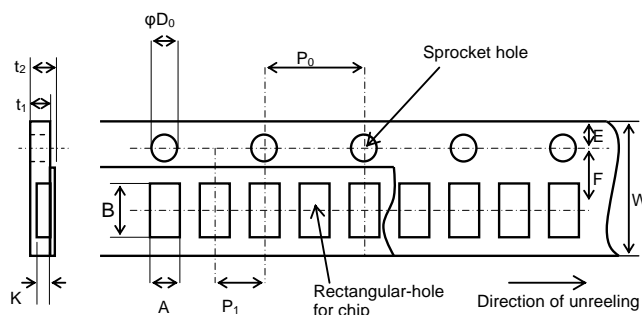
8. Taping

8.1. Tape material

**Table - 6 Tape material**

Type of taping	Carrier tape	Top cover tape	Bottom cover tape
Pressed carrier tape	Paper	Thermal adhesion plastics	—

8.2. Dimension of tape



Unit : mm

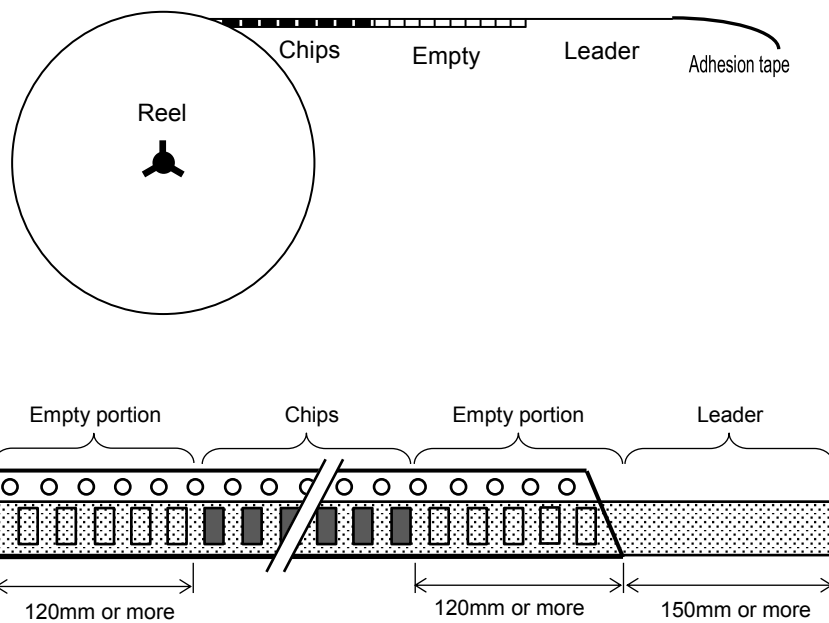
	A	B	W	F	E	P <sub>1</sub>
20G	0.38±0.02	0.68±0.02	8.00±0.20	3.50±0.05	1.75±0.10	2.00±0.05
	P <sub>0</sub>	D <sub>0</sub>	K	t <sub>1</sub>	t <sub>2</sub>	
	4.00±0.10	1.55±0.05	0.27±0.02	0.42±0.05	0.50max	

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- 9. Packing
- 9.1. Tape packing
- 9.1.1. Quantity, Reel

**Table - 7 Quantity, Reel**

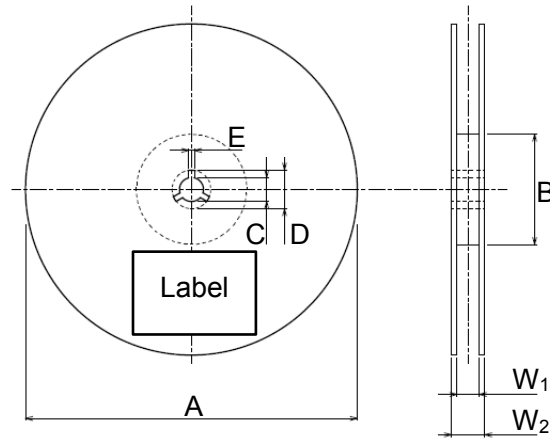
Quantity	Type of reel
15,000	Plastics



**Figure - 6 Reeling specification**

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9.1.2. Dimension of reel



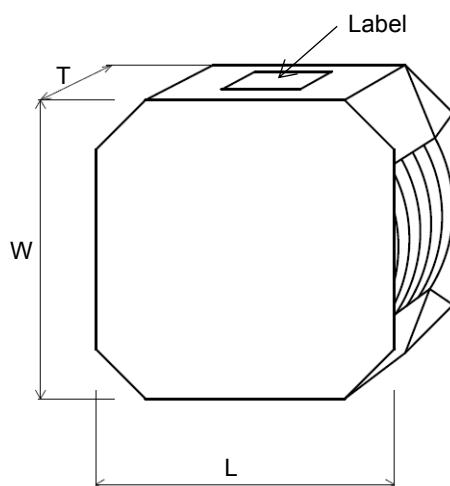
Unit : mm

A	B	C	D	E	W <sub>1</sub>	W <sub>2</sub>
180 <sup>+0.0</sup> <sub>-3.0</sub>	60 <sup>+1.0</sup> <sub>-0.0</sub>	13.0±0.2	21.0±0.8	2.0±0.5	9.0±0.3	11.4±1.0

**Figure - 7 Dimension of reel**

9.2. Packing

9.2.1. Packing of taping reels



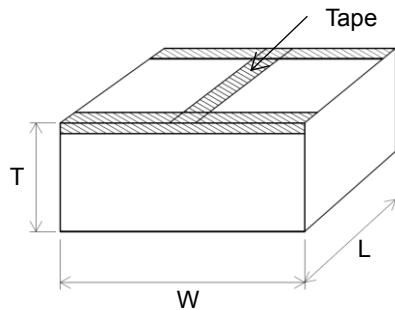
( Unit : mm )

L	W	T
185	179	39
185	179	63
185	179	75

**Figure - 8 Packing specification of taping reels**

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9.2.2. Outer packing



( Unit : mm )

L	W	T
409	405	204
409	208	204

**Figure - 9 Outer packing**

9.3. Labeling

Each reel has a label with contents bellow.

- a) Part number of purchaser
- b) Part number of vendor
- c) Resistance value, Tolerance, Quantity
- d) Lot number
- e) Vendor name, or trademark
- f) Country of origin

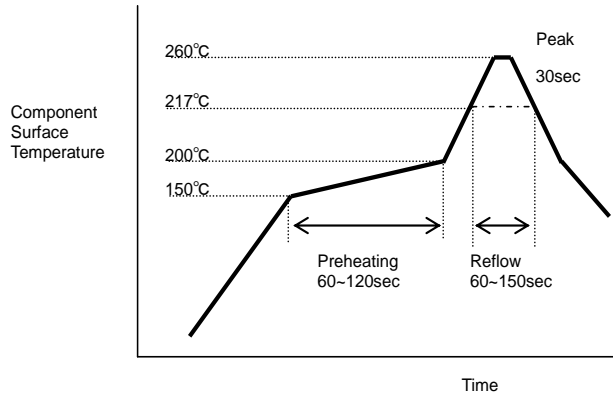
XXXXXXXXXXXXX	} Part number of purchaser
(3N) 1 XXXXXXXXXXXX 5000	} Part number code for Purchaser
Bar code	}
(3N) 2 70110001 114516	} Part number code for vendor
Bar code	}
TSR20G J101V	} Part number of vendor
15000pcs 100Ω ±5.0%	} Quantity, R-value, Tolerance
Bar code	}
LOT 70110001	} Lot number
TATEYAMA KAGAKU IND.CO.,LTD.	} Vendor name, Country of origin
MADE IN JAPAN	}
EIAJ C-3	}

**Figure - 10 Contents of label (example)**

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<p>10. Notes</p> <p>10.1. Storage</p> <p>The products should be kept packed and stored at temperature of 15~35°C and a humidity 25~85%RH. The products should not be left in the place affected by direct sunlight and harmful gas (chlorine, sulfur, etc.).</p> <p>Warranty period : 1 year after shipping date.</p> <p>10.2. Application note</p> <p>Take measures against the damage and crack by mechanical mounting stress.</p> <p>10.3. Priority of specification</p> <p>This specification shall precede the old specifications, the catalogues and others when some differences are found out.</p> <p>10.4. Conference</p> <p>If some problems which is not listed on this specification happen conferences between the two shall be made to solve the problems.</p>		

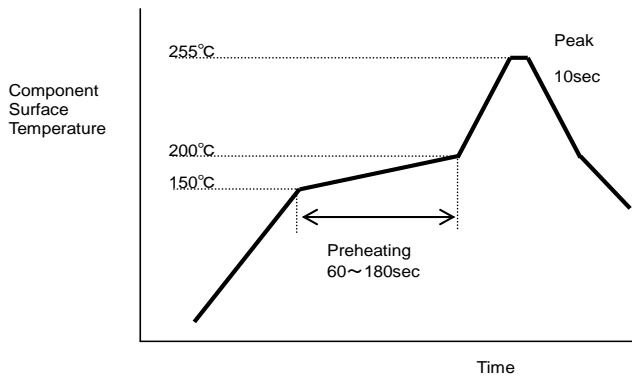
10.5. Soldering heat condition

**Reflow profile (max. 3 cycles)**



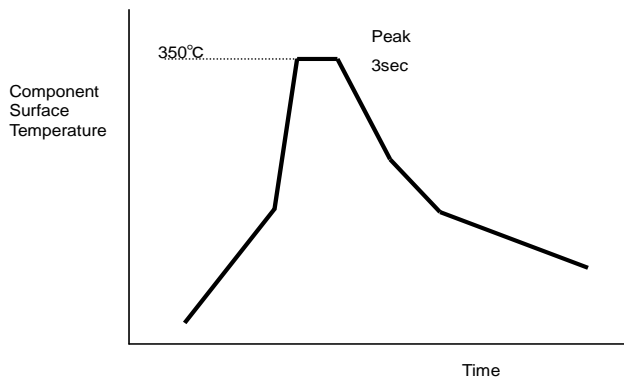
	Pb-free solder Sn-3.0Ag-0.5Cu
Preheat	150~200°C, 60~120sec
Reflow	Min. 217°C, 60~150sec
Peak	255~260°C, 30sec Max.

**Flow profile (max. 3 cycles)**



	Pb-free solder Sn-3.0Ag-0.5Cu
Preheat	150~200°C, 60~180sec
Peak	Max.255°C, 10sec 以下

**Soldering iron condition**



	Pb-free solder Sn-3.0Ag-0.5Cu
Soldering iron	Max.350°C, 3sec