

# **DATA SHEET**

THIN FILM CHIP RESISTORS
High precision - high stability

RT series

0.01% TO 1%, TCR 5 TO 50

sizes 0100/ 0201/ 0402/ 0603/ 0805/ 1206/ 1210/ 2010/ 2512

**RoHS** compliant



**YAGEO** 





RT

SERIES

0100 to 2512

## SCOPE

This specification describes RT series high precision - high stability chip resistors with lead-free terminations made by thin film process.

# **APPLICATIONS**

- Converters
- Printing equipment
- Server board
- Telecom
- Consumer

## **FEATURES**

- Halogen Free Epoxy
- RoHS compliant
- Reducing environmentally hazardous wastes
- High component and equipment reliability
- Saving of PCB space
- None forbidden-materials used in products/production

## ORDERING INFORMATION - GLOBAL PART NUMBER & 12NC

Both part numbers are identified by the series, size, tolerance, packing type, temperature coefficient, taping reel and resistance value.

# YAGEO BRAND ordering code

# **GLOBAL PART NUMBER (PREFERRED)**

# RT XXXX F X X XX XXXX L

(2) (3) (4) (5)

# (I) SIZE

RT0100 / 0201 / 0402 / 0603 / 0805 / 1206 / 1210 / 2010 / 2512

#### (2) TOLERANCE

 $L = \pm 0.01\%$ 

 $P = \pm 0.02\%$ 

 $W = \pm 0.05\%$ 

 $B = \pm 0.1\%$ 

 $C = \pm 0.25\%$ 

 $D = \pm 0.5\%$ 

 $F = \pm 1\%$ 

# (3) PACKAGING TYPE

R = Paper/PE taping reel

K = Embossed taping reel

# (4) TEMPERATURE COEFFICIENT OF RESISTANCE

 $A = 5 ppm/^{\circ}C$ 

 $B = 10 \text{ ppm/}^{\circ}\text{C}$ 

 $C = 15 \text{ ppm/}^{\circ}C$ 

 $D = 25 \text{ ppm/}^{\circ}C$ 

 $E = 50 \text{ ppm/}^{\circ}\text{C}$ 

## (5) TAPING REEL

07 = 7 inch dia. Reel

10 = 10 inch dia, Reel

13 = 13 inch dia. Reel

7W= 7 inch dia. Reel with high power (1W for 2512)

# (6) RESISTANCE VALUE

There are 2~4 digits indicated the resistor value. Letter R/K/M is decimal point. Detailed resistance rules show in table of "Resistance rule of global part number".

# (7) DEFAULT CODE

(1 to 9.76 M $\Omega$ )

Letter L is system default code for order only  $^{(Note)}$ 

#### number Resistance code rule Example $IR = I \Omega$ XRXX $IR5 = 1.5 \Omega$ (1 to 9.76 $\Omega$ ) $9R76 = 9.76 \Omega$ $IOR = IO \Omega$ **XXRX** (10 to 97.6 $\Omega$ ) $97R6 = 97.6 \Omega$ **XXXR** $100R = 100 \Omega$ (100 to 976 $\Omega$ ) XKXX $IK = 1,000 \Omega$ $9K76 = 9760 \Omega$ (I to 9.76 K $\Omega$ ) XMXX $IM = 1,000,000 \Omega$ $9M76 = 9,760,000 \Omega$

Resistance rule of global part

# **ORDERING EXAMPLE**

The ordering code of a RT0603 chip resistor, TC 50 value 56  $\Omega$ with ±0.5% tolerance, supplied in 7-inch tape reel is: RT0603DRE0756RL.

# NOTE

- I. All our RSMD products meet RoHS compliant and Halogen Free. "LFP" of the internal 2D reel label mentions "Lead Free Process"
- 2. On customized label, "LFP" or specific symbol can be printed



0100 to 2512

# **PHYCOMP BRAND** ordering codes

Both GLOBAL PART NUMBER (preferred) and I2NC (traditional) codes are acceptable to order Phycomp brand products. For matching traditional types with size codes, please refer to "Comparison table of traditional types and sizes".

#### **GLOBAL PART NUMBER (PREFERRED)**

For detailed information of GLOBAL PART NUMBER and ordering example, please refer to page 2.

## 12NC CODE

2390 (I)	<b>X</b> (2)	<b>XX</b> (3)	<b>X</b> (4)	<b>XXXX</b> (5)	<b>L</b> (6)
START WITH (I)	TCR <sup>(2)</sup> (ppm/°C)	PACKING CODE BY SIZE (inch) (3)	TOL. <sup>(4)</sup> (%)	resistance range	DEFAULT CODE (NOTE)
2390	8 = ±10	0402: 07 = 7" reel	7 = ±1	The remaining 4 digits	Letter L is
	$7 = \pm 15$	47 = 13" reel	$6 = \pm 0.5$	represent the resistance	,
	$6 = \pm 25$	0603: 04 = 7" reel	$5 = \pm 0.25$	value with the last digit indicating the multiplier	
	$4 = \pm 50$	24 = 10" reel	$4 = \pm 0.1$	as shown in the table of	
		44 = 13" reel	$3 = \pm 0.05$	"Last digit of 12NC".	(Note)
		0805: 01 = 7" reel		$0402:4.7\Omega \le R \le 240K\Omega$	
		41 = 13" reel		0603: I $\Omega \le R \le IM\Omega$	
		1206: II = 7" reel		0805: $I\Omega \le R \le 1.5 M\Omega$	
		51 = 13" reel		1206: $1\Omega \le R \le 1.5 M\Omega$	
		1210: 12 = 7" reel		$1210:4.7\Omega \le R \le 1 M\Omega$	
		52 = 13" reel		$2010:4.7\Omega \le R \le 1 M\Omega$	
		2010: 15 = 7" reel		2512: $4.7\Omega \le R \le I M\Omega$	
		2512: 18 = 7" reel			

Comparison table of traditional						
<b>TF</b> (I)	es and sizes <u><b>X</b></u> (2)	<u><b>X</b></u> (3)	<b>X</b> (4)			
START WITH	SIZE CODE	TCR (ppm/°C)	TOL. (%)			
TF	3 = 0402	$4 = \pm 10$	$0 = \pm 1$			
	2 = 0603	$3 = \pm 15$	$I = \pm 0.5$			
	I = 0805	$I = \pm 25$	$2 = \pm 0.25$			
	0 = 1206	$2 = \pm 50$	$3 = \pm 0.1$			
	5 = 1210		$4 = \pm 0.05$			
	7 = 2010					
	6 = 2512					

## • Example:

TF321 = RT0402, TC50,  $\pm$ 0.5% tolerance

Resistance decade <sup>(3)</sup>	Last digit
I to 9.76 Ω	8
10 to 97.6 Ω	9
100 to 976 Ω	1
I to 9.76 kΩ	2
I0 to 97.6 kΩ	3
100 to 976 kΩ	4
I to 9.76 MΩ	5
10 to 97.6 MΩ	6

Example:  $I \Omega = 1008 \text{ or } 108$   $33 \text{ k}\Omega = 3303 \text{ or } 333$  $10 \text{ M}\Omega = 1006 \text{ or } 106$ 

ORDERING EXAMPLE

Exceptions to above packing code definitions:

2512 TC15, in 7" reel, the packing code is 35. 2010 TC15, in 7" reel, the packing code is 31.

0805 TC50 with 1%, supplied in 13" reel, the packing code is 02. 0603 TC50 with 1%, supplied in 13" reel, the packing code is 03.

The ordering code of a TF221 resistor, TC50, value 56  $\Omega$ , with ±0.5% tolerance, supplied in tape of 5,000 units per reel is: 239040465609L or RT0603DRE0756RL.

## NOTE

- I. All our RSMD products meet RoHS compliant and Halogen Free. "LFP" of the internal 2D reel label mentions "Lead Free Process"
- 2. On customized label, "LFP" or specific symbol can be printed



9

# **YAGEO**

# **Chip Resistor Surface Mount**

RT

SERIES

0100 to 2512

## **MARKING**

## RT0100 / RT0201 / RT0402 / RESISTANCE VALUE IS NOT IN E-24 / E96 SERIES



No marking

# RT0603



E-24 series: exception values 10/11/13/15/20/75 of E-24 series, one short bar under marking letter



E-96 series: including values 10/11/13/15/20/75 of E-24 series, 3 digits

## RT0805 / RT1206 / RT1210 / RT2010 / RT2512



Either resistance in E-24 or E-96: 4 digits

First three digits for significant figure and 4th digit for number of zeros

For further marking information, please see special data sheet "Chip resistors marking".

# CONSTRUCTION

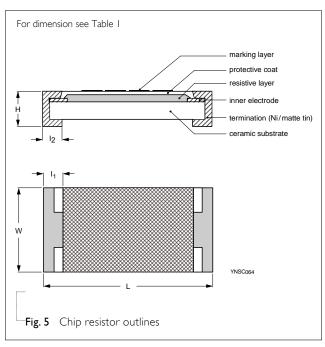
The resistors are constructed out of a high-grade ceramic body. Internal metal electrodes are added at each end and connected by a resistive layer. The resistive layer is adjusted to give the approximate required resistance and laser cutting of this resistive layer that achieves tolerance trims the value. The resistive layer is covered with a protective coat and printed with the resistance value. Finally, the two external terminations (matte tin) are added. See fig. 5.

# **DIMENSION**

**Table I** For outlines see fig. 5

TYPE	L (mm)	W (mm)	H (mm)	I <sub>I</sub> (mm)	I <sub>2</sub> (mm)
RT0100	0.40±0.02	0.20±0.02	0.13±0.02	0.10±0.03	0.10±0.03
RT0201	0.60 ±0.03	0.30 ±0.03	0.23 ±0.03	0.10 ±0.05	0.15 ±0.05
RT0402	1.00 ±0.10	0.50 ±0.05	0.30 ±0.05	0.20 ±0.10	0.25 ±0.10
RT0603	1.60 ±0.10	0.80 ±0.10	0.45 ±0.10	0.25 ±0.15	0.25 ±0.15
RT0805	2.00 ±0.10	1.25 ±0.10	0.50 ±0.10	0.35 ±0.20	0.35 ±0.20
RT1206	3.10 ±0.10	1.60 ±0.10	0.55 ±0.10	0.45 ±0.20	0.40 ±0.20
RT1210	3.10 ±0.10	2.60 ±0.15	0.55 ±0.10	0.50 ±0.20	0.50 ±0.20
RT2010	5.00 ±0.10	2.50 ±0.15	0.55 ±0.10	0.60 ±0.20	0.50 ±0.20
RT2512	6.35 ±0.10	3.20 ±0.15	0.55 ±0.10	0.60 ±0.20	0.50 ±0.20

# **OUTLINES**





#### **Chip Resistor Surface Mount** RT SERIES 0100 to 2512

# **ELECTRICAL CHARACTERISTICS**

Table 2

TYPE	Operating Temperature	Power	Max. Work	Max. Overload	T.C.R.			R	esistance Rar	ge (E-24/E-9	96 series)(2	.) & Tolera
ITPE	Range	Rating	Vol. (I)		(ppm/°C)	±0.01%	±0.02%	±0.05%	±0.1%	±0.25%	±0.5%	±1.0%
	−55°C				±50				50R~5K	50R~5K	50R~5K	50R~5K
T0100	to +125°C	1/32W	15V	30V	±25				50R~5K	50R~5K	50R~5K	50R~5K
	±125 C								22~75K	22~75K	22~75K	22~75K
					±50							
	−55°C				±25				22~75K	22~75K	22~75K	22~75K
T0201	to	1/20W	25V	50V	±15				22~5K	22~5K		
	+125°C				±10				22~5K	22~5K		
					±5							
					±50	50.1~12K	50.1~12K	20~12K	4.7~500K	4.7~500K	4.7~500K	4.7~500k
					±25	50.1~12K	50.1~12K	20~12K	4.7~240K	4.7~240K	4.7~240K	4.7~240k
T0402		1/16W	50V	100V	±15	20~12K	20~12K	20~12K	20~200K	20~200K		
					±10	20~12K	20~12K	20~12K	20~200K	20~200K		
	_				±5	20~10K	20~10K	20~10K	20~10K	20~10K		
					±50	50.1~30K	50.1~30K	4.7~100K	I~2M	I~2M	I~2M	I~2M
					±25	50.1~30K	50.1~30K	4.7~100K	1~IM	~ M	I~IM	1~1M
T0603		1/10W	75V	150V	±15 ±10	50.1~100K 50.1~100K	50.1~100K	4.7~100K 4.7~100K	4.7~680K 4.7~680K	4.7~680K 4.7~680K		
	−55°C				±5	20~30K	20~30K	20~30K	20~30K	20~30K		
	to				±50	50.1~30K	50.1~30K	4.7~200K	1~3M	1~3M	1~3M	I~3M
	+155°C				±25	50.1~30K	50.1~30K	4.7~200K	I~I.5M	1~1.5M	1~1.5M	1~1,5M
T0805		1/8W	150V	300V	±15	50.1~200K	50.1~200K	4.7~200K	4.7~IM	4.7~IM		
					±10	50.1~200K	50.1~200K	4.7~200K	4.7~IM	4.7~IM		
					±5	20~50K	20~50K	20~50K	20~50K	20~50K		
					±50	50.1~30K	50.1~30K	5.6~500K	1~3M	I~3M	1~3M	1~3M
					±25	50.1~30K	50.1~30K	5.6~500K	1~1.5M	I~1.5M	1~1.5M	I~1.5M
T1206		1/4W	200V	400V	±15	50.1~500K	50.1~500K	5.6~500K	5.6~1.5M	5.6~1.5M		
					±10	50.1~500K	50.1~500K	5.6~500K	5.6~1.5M	5.6~1.5M		
					±5	20~100K	20~100K	20~100K	20~100K	20~100K		47.154
					±50			4.7~IM	4.7~IM	4.7~IM	4.7~IM	4.7~IM
					±25			4.7~IM	4.7~IM	4.7~IM	4.7~IM	4.7~IM
T1210		1/4W	200V	400V	±15			100~100K	4.7~100K	4.7~100K		
					±10			100~100K	4.7~100K	4.7~100K		
					±5							
	=				±50			4,7~IM	4.7~IM	4.7~IM	4.7~IM	4.7~IM
					±25			4.7~IM	4.7~IM	4.7~IM	4.7~IM	4.7~IM
T2010		1 /2) 4 /	2001/	100) /				100~100K	4.7~100K	4.7~100K		
T2010	33 C	1/2W	200V	400V	±15							
	to				±10			100~100K	4.7~100K	4.7~100K		
	+125°C				±5							
					±50			4.7~IM	4.7~IM	4.7~IM	4.7~IM	4.7~IM
					±25			4.7~IM	4.7~IM	4.7~IM	4.7~IM	4.7~IM
		3/4W	200V	400V	±15			100~100K	4.7~100K	4.7~100K		
T2512					±10			100~100K	4.7~100K	4.7~100K		
					±5							
								10Ω~1M	10Ω~IM		10Ω~1Μ	
		IW	200V	400V	±50							
					±25			10Ω~1M	10Ω~1M	10Q~1M	10Ω~IM	10Q~1M

# NOTE

- 1. The maximum working voltage that may be continuously applied to the resistor element, see "IEC publication 60115-8"
- 2. Value of E-192 series is on request





RT SERIES

## FOOTPRINT AND SOLDERING PROFILES

For recommended footprint and soldering profiles, please see the special data sheet "Chip resistors mounting".

# PACKING STYLE AND PACKAGING QUANTITY

Table 3 Packing style and packaging quantity

PACKING STYLE	REEL	RT0100	RT0201	RT0402	RT0603	RT0805	RT1206	RT1210	RT2010	RT2512
	DIMENSION									
Paper/PE taping reel (R)	7" (178 mm)	10,000	10,000	10,000	5,000	5,000	5,000	5,000		
	10" (254 mm)	20,000	20,000	20,000	10,000	10,000	10,000	10,000		
	13" (330 mm)	50,000	50,000	50,000	20,000	20,000	20,000	20,000		
Embossed taping reel (K)	7" (178 mm)								4,000	4,000

#### NOTE

# **FUNCTIONAL DESCRIPTION**

# **POWER RATING**

Each type rated power at 70°C: RT0100=1/32W RT0201=1/20W, RT0402=1/16W, RT0603=1/10W, RT0805=1/8W, RT1206=1/4W, RT1210=1/4W, RT2010=1/2W, RT2512=3/4W, IW

# **RATED VOLTAGE**

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

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

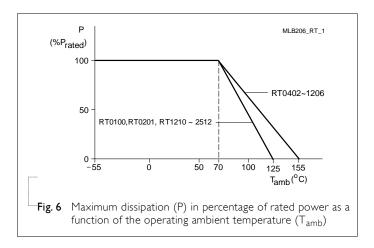
or max. working voltage whichever is less

Where

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

P=Rated power (W)

R=Resistance value ( $\Omega$ )



<sup>1.</sup> For Paper/Embossed tape and reel specification/dimensions, please see the special data sheet "Chip resistors packing"



SERIES

0100 to 2512

# TESTS AND REQUIREMENTS

**Table 4** Test condition, procedure and requirements

TEST	TEST METHOD	PROCEDURE	REQUIREMENTS
Temperature Coefficient of	MIL-STD-202 Method 304	At +25/–55 °C and +25/+125 °C	Refer to table 2
Resistance (T.C.R.)		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	
		$t_2$ =–55 °C or +125 °C test temperature	
		R <sub>I</sub> =resistance at reference temperature in ohms	
		R <sub>2</sub> =resistance at test temperature in ohms	
Life/Endurance	IEC 60115-1 4.25.1 MIL-STD-202 Method 108A	At 70±5 °C for 1,000 hours, rated voltage applied for 1.5 hours on, 0.5 hour off, still air required	±(0.5%+0.05 Ω)
High Temperature Exposure	IEC 60068-2-2	1000 hours at maximum operating temperature depending on specification, unpowered	±(0.5%+0.05 Ω)
Moisture Resistance	MIL-STD-202 Method 106G	Each temperature / humidity cycle is defined at 8 hours, 3 cycles / 24 hours for IOd. with 25 °C / 65 °C 95% R.H, without steps 7a & 7b, unpowered	±(0.5%+0.05 Ω)
		Parts mounted on test-boards, without condensation on parts	
		Measurement at 24±2 hours after test conclusion	
Thermal Shock	MIL-STD-202 Method 107G	-55/+125 °C Number of cycles required is 300. Devices mounted	±(0.5%+0.05 Ω)
		Maximum transfer time is 20 seconds.  Dwell time is 15 minutes. Air – Air	
Humidity (steady state)	IEC 60115-1 4.24.2	Steady state for 1000 hours at 40 °C / 95% R.H. rated voltage applied for 1.5 hours on and 0.5 hour off	±(0.5%+0.05 Ω)











SERIES

0100 to 2512

TEST	TEST METHOD	PROCEDURE	REQUIREMENTS
Short Time Overload	IEC60115-1 4.13	2.5 times of rated voltage or maximum overload voltage whichever is less for 5 sec a room temperature	$\pm (0.5\% + 0.05 \ \Omega)$ No visible damage
Board Flex/ Bending	IEC 60115-1 4.33	Chips mounted on a glass epoxy resin PCB (FR4) Bending: see table 5 for each size Bending time: 60±5 seconds	±(0.25%+0.05 Ω) No visible damage RT0100±(0.5%+0.05 Ω)
Solderability - Wetting	J-STD-002 test B	Electrical Test not required  Magnification 50X  SMD conditions:  Ist 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	Well tinned (≥95% covered) No visible damage
- Leaching	J-STD-002 test D	Leadfree solder, 260 °C, 30 seconds immersion time	No visible damage
- Resistance to IEC 60115-1 4.18 Soldering Heat		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%+0.05 Ω) No visible damage

**Table 5** Bending for sizes 0100 to 2512

TYPE	RT0100	RT0201	RT0402	RT0603	RT0805	RT1206	RT1210	RT2010	RT2512
Specification (mm)	5	5	5	3	3	2	2	2	2



# Chip Resistor Surface Mount RT SERIES 0100 to 2512

# REVISION HISTORY

REVISION	DATE	CHANGE NOTIFICATION	DESCRIPTION
Version 13	July 07, 2022	-	- RT0402/RT0603/RT0805/RT1206 Extend resistor range - Add RT0100
Version 12	Apr. 21, 2020	-	- Modified resistance range
Version 11	July 2, 2019	-	- Add IW for 2512
Version 10	Jun. 12, 2019	-	- Extend resistor value
Version 9	Sep. 12, 2017	-	- Add ±0.02% tol. for 0402 to 1206
Version 8	May 31, 2017	-	- Add 10" packing
Version 7	Jan. 17, 2017	-	- Add ±0.01% tol. for 0402 to 1206
Version 6	May. 11, 2015	-	- Extend resistor value
Version 5	Aug. 22, 2014	-	- Add RT0201 - RT0402/0603/0805/1206: resistance range and operating temperature range updated - Fig. 6 updated
Version 4	Oct 21, 2009	-	- Test Items and methods updated - Test requirements upgraded
Version 3	Jul 11, 2008	-	<ul> <li>Change to dual brand datasheet that describe RT0402 to RT2512 with RoHS compliant</li> <li>Description of "Halogen Free Epoxy" added</li> <li>Define global part number</li> <li>Modify electrical characteristic</li> </ul>
Version 2	Dec 26, 2005	-	- New datasheet for thin film high precision - high stability chip resistors sizes of 0201/0402/0603/0805/1206/1210/2010/2512, 1%, 0.5%, 0.25%, 0.1%, 0.05%, TC25/50 with lead-free terminations - Replace the 0402 to 1210 parts of pdf files: TFx10_1_1, TFx115_2, TFx1225_2, TFx131_3, TFx1405_1, TFx20_1_2, TFx215_2, TFx2225_2, TFx231_2, TFx2405_1, and combine into a document Test method and procedure updated - PE tape added (paper tape will be replaced by PE tape)

<sup>&</sup>quot;YAGEO reserves all the rights for revising the content of this datasheet without further notification, as long as the products itself are unchanged. Any product change will be announced by PCN."



# **X-ON Electronics**

Largest Supplier of Electrical and Electronic Components

Click to view similar products for Thin Film Resistors - SMD category:

Click to view products by Yageo manufacturer:

Other Similar products are found below:

D55342E07B379BR-TR AR05BTC1000 ERA-3EEB2742V NTR06D2001DTRF NTR06F1002CTRF NTR10B1003CTRF
NTR10B4991CTRF CPA2512Q6R80FS-T10 TNPW06036981DT9RT-1 5-18022-5 P1206Y1804FNTA CPA2512E68R0FS-T10
CPA2512Q4R70FS-T10 NCSR150FR003DTRT3F NTR04B3321CTRF NTR06B2002CTRF NTR06B3921BTRF NTR06B5832CTRF
NTR10F5112DTRF M8340107H1001FGUF NCSR200JR002DTRF NRC-S12F4751TRF NTR04B1002CTRF NTR06B1002CTRF
NTR06B1003CTRF NTR12B1003CTRF NTR50D1R00CTRF PRL1632-R008-F-T5 NTR50B30R1CTRF RT1220P-101-M ERA3EEB2212V ERA-3EEB1691V ERA-3EEB1961V ERA-3EEB1402V ERA-3EEB1542V ERA-3EEB1912V ERA-3EEB3741V ERA3EEB4871V ERA-3EEB6041V ERA-3EEB7681V M55342K06B30D1RT3 BLU1206-1001-FT50W BLU1206-7871-FT50W BLU1206-1002-FT50W BLU1206-2002-FT50W BLU1206-1003-FT50W BLU1206-1823-FT50W BLU0603-1003-BT25W RNCF1206DTE6K81
CW12010T0050GTR