Innovative Service Around the Globe YAGEO

DATA SHEET

AUTOMOTIVE GRADE HIGH VOLTAGE CHIP RESISTORS

RV series

0.5%, 1%, 5%

sizes 0603/0805/1206/2010/2512

RoHS compliant

IEC 62368-1 Safety Certificate issued by UL Demko: sizes 0603/0805/1206

YAGEO

Product specification – March 01, 2023 V.12

SCOPE

This specification describes RV0603/0805/1206/2010/2512 high voltage chip resistors with lead-free terminations made by thick film process.

APPLICATIONS

- Converter
- Printer equipment
- Battery charger
- Computer
- Power supply
- Car electronics

FEATURES

- AEC-Q200 qualified
- RoHS compliant
- Reducing environmentally hazardous wastes
- High component and equipment reliability
- Non-forbidden materials used in products/production
- Halogen Free Epoxy
- Moisture sensitivity level: MSL 1
- IEC 62368-1:2018 safety certificate issued by UL Demko for the following sizes and resistance ranges:
  - 0603: 100KΩ to 12MΩ
  - 0805: 100KΩ to 24MΩ
  - 1206: 100KΩ to 27MΩ

  *Please refer to UL certification

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)

RV XXXX X X X XX XXXX L
(1) (2) (3) (4) (5) (6) (7)

(1) SIZE

0603/0805/1206/2010/2512

(2) TOLERANCE

D = ±0.5%
F = ±1%
J = ±5%

(3) PACKAGING TYPE

R = Paper/PE taping reel
K = Embossed taping reel

(4) TEMPERATURE COEFFICIENT OF RESISTANCE

– = Base on spec

(5) TAPING REEL

07= 7 inch dia. Reel

(6) RESISTANCE VALUE

There are 2~4 digits indicated the resistor value. Letter R/K/M is decimal point, no need to mention the last zero after R/K/M, e.g.1K2, not 1K20.

Detailed resistance rules show in table of "Resistance rule of global part number".

(7) DEFAULT CODE

Letter L is system default code for ordering only (Note)

Resistance rule of global part number

Resistance code rule	Example
XXKX (10 to 97.6 KΩ)	10K = 10,000 Ω 97K6 = 97,600 Ω
XXXK (100 to 976 KΩ)	100K = 100,000Ω 976K = 976,000Ω
XMXX (1 to 9.76 MΩ)	1M = 1,000,000 Ω 9M76 = 9,760,000 Ω
XXMX (10 to 16 MΩ)	10M = 10,000,000 Ω 27M = 27,000,000 Ω

ORDERING EXAMPLE

The ordering code of a RV1206 chip resistor, value 1 MΩ with ±5% tolerance, supplied in 7-inch tape reel is: RV1206JR-071ML.

NOTE

1. All our R-Chip products meet RoHS compliant. "LFP" of the internal 2D reel label mentions "Lead Free Process"
2. On customized label, "LFP" or specific symbol printed and the optional "L" at the end of GLOBAL PART NUMBER / 12NC can be added (both are on customer request)

PHYCOMP BRAND ordering codes

Both GLOBAL PART NUMBER (preferred) and 12NC (traditional) codes are acceptable to order Phycomp brand products.

GLOBAL PART NUMBER (PREFERRED)

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

12NC CODE

2322 XXX XXXXX L
(1) (2) (3) (4)

SIZE	TYPE	START IN (1)	TOL. (%)	RESISTANCE RANGE	EMBOSSED (2) TAPE ON REEL 4,000	PAPER/PE (2) TAPE ON REEL (units) 5,000
0805	VRC11	2322	±5%	47 to 10M Ω	-	792 61xxx
	VRC12	2322	±1%	47 to 10M Ω	-	793 6xxxx
1206	VRC01	2322	±5%	47 to 27M Ω	-	790 61xxx
	VRC02	2322	±1%	47 to 10M Ω	-	791 6xxxx
2512	VPRC221	2322	±5%	47 to 16M Ω	762 98xxx	-

(1) The resistors have a 12-digit ordering code starting with 2322.

(2) The subsequent 4 or 5 digits indicate the resistor tolerance and packaging.

(3) The remaining 4 or 3 digits represent the resistance value with the last digit indicating the multiplier as shown in the table of "Last digit of 12NC".

(4) "L" is optional symbol (Note).

Last digit of 12NC

Resistance decade (3)	Last digit
0.01 to 0.0976 Ω	0
0.1 to 0.976 Ω	7
1 to 9.76 Ω	8
10 to 97.6 Ω	9
100 to 976 Ω	1
1 to 9.76 KΩ	2
10 to 97.6 KΩ	3
100 to 976 KΩ	4
1 to 9.76 MΩ	5
10 to 97.6 MΩ	6

Example:
0.02 Ω = 0200 or 200
0.3 Ω = 3007 or 307
1 Ω = 1008 or 108
33 KΩ = 3303 or 333
10 MΩ = 1006 or 106

ORDERING EXAMPLE

The ordering code of a VRC01 resistor, value 1 MΩ with ±5% tolerance, supplied in tape of 5,000 units per reel is: 232279061105L or RV1206JR-071ML.

NOTE

1. All our R-Chip products are RoHS compliant. "LFP" of the internal 2D reel label mentions "Lead Free Process"
2. On customized label, "LFP" or specific symbol printed and the optional "L" at the end of GLOBAL PART NUMBER / 12NC can be added (both are on customer request)

MARKING

RV0603/0805/1206/2010/2512

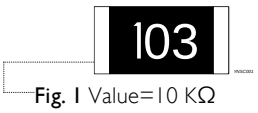

Fig. 1 Value=10 KΩ

E-24 series: 3 digits, ±5%

First two digits for significant figure and 3rd digit for number of zeros

RV0603

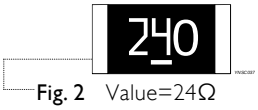

Fig. 2 Value=24Ω

E-24 series: 3 digits, ±0.5% & ±1%

Exception values 10/11/13/15/20/75 of E24 series

One short bar under marking letter

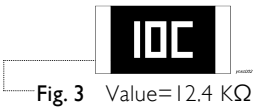

Fig. 3 Value=12.4 KΩ

E-96 series: 3 digits, ±0.5% & ±1%

Including values 10/11/13/15/20/75 of E24 series

First two digits for E-96 marking rule and 3rd letter for number of zeros

RV0805/1206/2010/2512

Fig. 4 Value=10 KΩ

Both E-24 and E-96 series: 4 digits, ±0.5% & ±1%

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

For further marking information, please refer to data sheet "Chip resistors marking".

CONSTRUCTION

The resistor is constructed on top of a high-grade ceramic body. Internal metal electrodes are added on each end to make the contacts to the thick film resistive element. The composition of the resistive element is a noble metal imbedded into a glass and covered by a second glass to prevent environment influences. The resistor is laser trimmed to the rated resistance value. The resistor is covered with a protective epoxy coat, finally the two external terminations (matte tin on Ni-barrier) are added. See fig.5

DIMENSIONS

Table 1 For outlines see fig. 5

TYPE	L (mm)	W (mm)	H (mm)	I_1 (mm)	I_2 (mm)
RV0603	1.60 ±0.10	0.80 ±0.10	0.45 ±0.10	0.25 ±0.15	0.25 ±0.15
RV0805	2.00 ±0.10	1.25 ±0.10	0.50 ±0.10	0.35 ±0.20	0.35 ±0.20
RV1206	3.10 ±0.10	1.60 ±0.10	0.55 ±0.10	0.45 ±0.20	0.45 ±0.20
RV2010	5.00 ±0.10	2.50 ±0.15	0.55 ±0.10	0.55 ±0.15	0.55 ±0.20
RV2512	6.35 ±0.10	3.10 ±0.15	0.55 ±0.10	0.60 ±0.20	0.60 ±0.20

OUTLINES

For dimension see Table 1

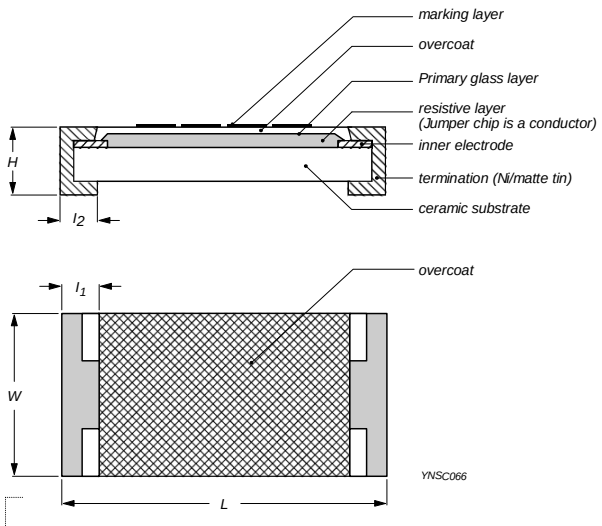

Fig. 5 Chip resistor outlines

ELECTRICAL CHARACTERISTICS

Table 2

TYPE	RESISTANCE RANGE	CHARACTERISTICS					
		Rated Power	Operating Temperature Range	Max. Working Voltage	Max. Overload Voltage	Dielectric Withstanding Voltage	Temperature Coefficient of Resistance
RV0603	5% (E-24) 47Ω to 10MΩ 1% (E-24/E-96) 47Ω to 10MΩ 0.5% (E-24/E-96) 47Ω to 10MΩ	1/10W	–55 °C to +155 °C	350V	500V	500V	47Ω≤R≤10MΩ ± 100ppm°C 10MΩ<R≤27MΩ ± 200ppm°C
RV0805	5% (E-24) 47Ω to 22MΩ 1% (E-24/E-96) 47Ω to 22MΩ 0.5% (E-24/E-96) 47Ω to 10MΩ	1/8 W		400 V	800 V	800 V	
RV1206	5% (E-24) 47Ω to 27MΩ 1% (E-24/E-96) 47Ω to 27MΩ 0.5% (E-24/E-96) 47Ω to 15MΩ	1/4 W		500 V	1,000 V	1,000 V	
RV2010	5% (E-24) 47Ω to 22MΩ 1% (E-24/E-96) 47Ω to 22MΩ 0.5% (E-24/E-96) 47Ω to 10MΩ	3/4W		500 V	1,000 V	1,000 V	
RV2512	5% (E-24) 47Ω to 16MΩ 1% (E-24/E-96) 47Ω to 16MΩ 0.5% (E-24/E-96) 47Ω to 10MΩ	1 W		500 V	1,000 V	1,000 V	

FOOTPRINT AND SOLDERING PROFILES

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

PACKING STYLE AND PACKAGING QUANTITY

Table 3 Packing style and packaging quantity

PACKING STYLE	REEL DIMENSION	RV0603	RV0805	RV1206	RV2010	RV2512
Paper/PE taping reel (R)	7" (178 mm)	5,000	5,000	5,000	---	---
Embossed taping reel (K)	7" (178 mm)	---	---	---	4,000	4,000

NOTE

1. For Paper/PE/Embossed tape and reel specification/dimensions, please refer to data sheet “Chip resistors packing”.

FUNCTIONAL DESCRIPTION

OPERATING TEMPERATURE RANGE

Range: –55 °C to +155 °C

POWER RATING

Each type rated power at 70 °C:
RV0603=1/10W; RV0805=1/8W; RV1206=1/4W;
RV2010=3/4W; RV2512=1W

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 (Ω)

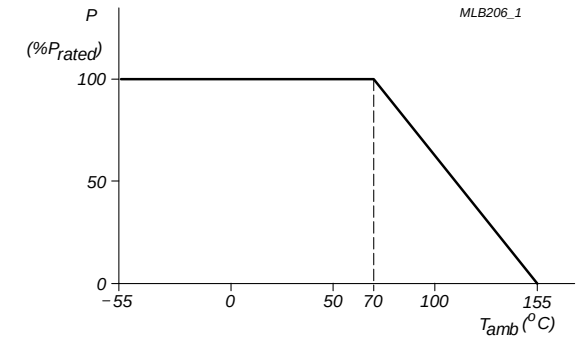

Fig. 6 Maximum dissipation (P_{max}) in percentage of rated power as a function of the operating ambient temperature (T_{amb})

Maximum working voltage can be applicable to resistors only if the resistance value is equal to or higher than the critical resistance value.

TESTS AND REQUIREMENTS

Table 4 Test condition, procedure and requirements

TEST	TEST METHOD	PROCEDURE	REQUIREMENTS
High Temperature Exposure	AEC-Q200 Test 3 MIL-STD-202 Method 108	1,000 hours at T_A = 155 °C, unpowered	±(1.0%+0.05Ω)
Moisture Resistance	AEC-Q200 Test 6 MIL-STD-202 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	±(2.0%+0.05Ω)
Biased Humidity	AEC-Q200 Test 7 MIL-STD-202 Method 103	1,000 hours; 85 °C / 85% RH 10% of operating power Measurement at 24±4 hours after test conclusion.	±(5.0%+0.05Ω)
Operational Life	AEC-Q200 Test 8 MIL-STD-202 Method 108	1,000 hours at 125 °C, derated voltage applied for 1.5 hours on, 0.5 hour off, still-air required	±(3.0%+0.05Ω)
Resistance to Soldering Heat	AEC-Q200 Test 15 MIL-STD-202 Method 210	Condition B, no pre-heat of samples Lead-free solder, 260±5 °C, 10±1 seconds immersion time Procedure 2 for SMD: devices fluxed and cleaned with isopropanol	±(1.0%+0.05Ω) No visible damage
Thermal Shock	AEC-Q200 Test 16 MIL-STD-202 Method 107	-55/+125 °C Number of cycles is 300. Devices mounted Maximum transfer time is 20 seconds. Dwell time is 15 minutes. Air – Air	±(1.0%+0.05Ω)
ESD	AEC-Q200 Test 17 AEC-Q200-002	Human Body Model, $1_{pos.}$ + $1_{neg.}$ discharges 0201: 500V 0402/0603: 1KV 0805 and above: 2KV	±(4.0%+0.05Ω)

TEST	TEST METHOD	PROCEDURE	REQUIREMENTS
Solderability - Wetting	AEC-Q200 Test 18 J-STD-002	Electrical Test not required Magnification 50X SMD conditions: (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.	Well tinned (≥95% covered) No visible damage
Board Flex	AEC-Q200 Test 21 AEC-Q200-005	Chips mounted on a 90mm glass epoxy resin PCB (FR4) Bending for 0201/0402: 5 mm 0603/0805: 3 mm 1206 and above: 2 mm Holding time: minimum 60 seconds	±(1.0%+0.05Ω)
Temperature Coefficient of Resistance (T.C.R.)	MIL-STD-202 Method 304	At +25/–55 °C and +25/+125 °C **Formula:** $T.C.R= \frac{R_2-R_1}{R_1(t_2-t_1)} \times 10^6$ (ppm/°C) Where t_1=+25 °C or specified room temperature t_2=–55 °C or +125 °C test temperature R_1=resistance at reference temperature in ohms R_2=resistance at test temperature in ohms	Refer to table 2
Short Time Overload	IEC60115-1 4.13	2.5 times of rated voltage or maximum overload voltage whichever is less for 5 sec at room temperature	±(2.0%+0.05Ω)

REVISION HISTORY

REVISION	DATE	CHANGE NOTIFICATION	DESCRIPTION
Version 12	Mar. 01, 2023	-	- TCR updated
Version 11	Aug. 02, 2022	-	- I2 dimension updated, for size1206, size 2010, size 2512
Version 10	Aug. 13, 2021	-	- Upgrade to Automotive Grade
Version 9	Feb. 01, 2021	-	- Update IEC62368-1 safety certificate declaration for sizes 0603/0805/1206
Version 8	Nov. 09, 2018	-	- Add AEC-Q200 for 47ohm ≤ R < 5Mohm
Version 7	Jul. 06, 2017	-	- Add IEC62368-1 safety certificate declaration for sizes 0603/0805/1206
Version 6	Dec. 01, 2016	-	- Extend resistor value of RV1206 0.5%
Version 5	Aug. 27, 2015	-	- Extend resistor range and add 0.5%
Version 4	Jan. 27, 2014	-	- RV0603 resistance range extend to 10MΩ - Add RV2010
Version 3	Aug. 26, 2013	-	- Add RV0603
Version 2	Sep 29, 2011	-	- Type error correction
Version 1	Nov 19, 2008	-	- Change to dual brand datasheet that describes RV0805/1206/2512 with RoHS compliant - Description of "Halogen Free Epoxy" added - Define global part number
Version 0	Feb 14, 2006	-	- New datasheet for high voltage chip resistors sizes of 0805/1206/2512, 5%, 1% tolerance with lead-free terminations - Replace the 0805/1206/2512 parts of pdf files: VRC01_02_11_12_51_3.pdf, VPRC221_5_3.pdf, and combine into a document. - Test method and procedure updated - PE tape added (paper tape will be replaced by PE tape)

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