

# **DATA SHEET**

# **GENERAL PURPOSE CHIP RESISTORS**

RC\_L series ±0.1%, ±0.5%, ±1%, ±5%

Sizes 0075/0100/0201/0402/0603/0805/ 1206/1210/1218/2010/2512

RoHS compliant & Halogen free



YAGEO Phicomp



#### SCOPE

This specification describes RC series chip resistors with lead free terminations made by thick film process.

#### **APPLICATIONS**

• All general purpose application

#### FEATURES

- Halogen Free Epoxy
- RoHS compliant
  - Products with lead free terminations meet RoHS requirements
  - Pb-glass contained in electrodes, resistors element and glass are exempted by RoHS
- 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

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

#### **GLOBAL PART NUMBER**

#### RC XXXX X X X XX XXXX L

(1) (2) (3) (4) (5)

) (6

#### (I) SIZE

0075/0100/0201/0402/0603/0805/1206/1210/1218/2010/2512

#### (2) TOLERANCE

 $B = \pm 0.1\%$ 

 $D = \pm 0.5\%$ 

 $F = \pm 1.0\%$ 

 $J = \pm 5.0\%$  (for jumper ordering, use code of J)

#### (3) PACKAGING TYPE

R = Paper taping reel

K = Embossed taping reel

S = ESD safe reel (0075/0100 only)

#### (4) TEMPERATURE COEFFICIENT OF RESISTANCE

- = Based on spec.

#### (5) TAPING REEL

07= 7 inch dia, Reel

10=10 inch dia, Reel

13=13 inch dia, Reel

7W = 7 inch dia. Reel & 2 x standard power

7N = 7 inch dia. Reel, ESD safe reel (0075/0100 only)

3W = 13 inch dia. Reel & 2 x standard power

#### (6) RESISTANCE VALUE

There are 2~4 digits indicated the resistance value.

Letter R/K/M is decimal point

Example:

 $97R6 = 97.6\Omega$ 

 $9K76 = 9760\Omega$ 

 $IM = 1,000,000\Omega$ 

#### (7) DEFAULT CODE

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

#### **ORDERING EXAMPLE**

The ordering code for a RC0402 0.0625W chip resistor value  $100K\Omega$ with  $\pm 5\%$  tolerance, supplied in 7-inch tape reel of 10,000 units per reel is: RC0402JR-07100KL.

#### 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.



**Chip Resistor Surface Mount** 

RC\_L

SERIES

0075 to 2512

#### **MARKING**

#### RC0075 / RC0100 / RC0201 / RC0402



No Marking

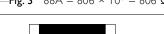
#### RC0603

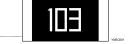


1%, 0.5%,E24 exception values 10/11/13/15/20/75 of E24 series



1%, 0.5%, E96 refer to EIA-96 marking method, including values 10/11/13/15/20/75 of E24 series





5%, E24 series: 3 digits

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

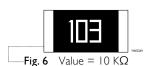
#### RC0805 / RC1206 / RC1210 / RC2010 / RC2512



Fig. 4 Value =  $10 \text{ K}\Omega$ 

1%, 0.5%, E24/E96 series : 4 digits

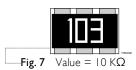
First three digits for significant figure and 4th digit for number of zeros



5%, E24 series: 3 digits

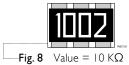
First two digits for significant figure and 3rd digit for number of zeros

#### RC1218



E-24 series: 3 digits, ±5%

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



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

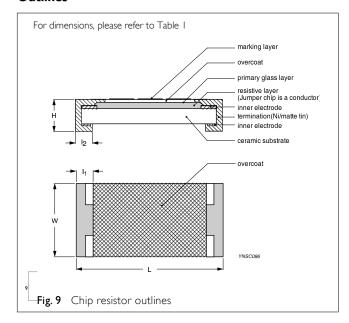
First three digits for significant figure and 4th digit for number of zeros

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

#### CONSTRUCTION

The 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 environmental 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, as shown in Fig.9.

#### **Outlines**



#### **DIMENSION**

Table I

TYPE	L (mm)	W (mm)	H (mm)	I <sub>I</sub> (mm)	I <sub>2</sub> (mm)
RC0075	0.30±0.01	0.15±0.01	0.10±0.01	0.08±0.03	0.08±0.03
RC0100	0.40±0.02	0.20±0.02	0.13±0.02	0.10±0.03	0.10±0.03
RC0201	0.60±0.03	0.30±0.03	0.23±0.03	0.10±0.05	0.15±0.05
RC0402	1.00±0.05	0.50±0.05	0.35±0.05	0.20±0.10	0.25±0.10
RC0603	1.60±0.10	0.80±0.10	0.45±0.10	0.25±0.15	0.25±0.15
RC0805	2.00±0.10	1.25±0.10	0.50±0.10	0.35±0.20	0.35±0.20
RC1206	3.10±0.10	1.60±0.10	0.55±0.10	0.45±0.20	0.40±0.20
RC1210	3.10±0.10	2.60±0.15	0.55±0.10	0.45±0.15	0.50±0.20
RC1218	3.10±0.10	4.60±0.10	0.55±0.10	0.45±0.20	0.40±0.20
RC2010	5.00±0.10	2.50±0.15	0.55±0.10	0.45±0.15	0.50±0.20
RC2512	6.35±0.10	3.10±0.15	0.55±0.10	0.60±0.20	0.50±0.20

# **ELECTRICAL CHARACTERISTICS**

Table 2

CHARAC- TERISTICS	POWER	OPERATING TEMPERATURE RANGE	MAXIMUM WORKING VOLTAGE	MAXIMUM OVERLOAD VOLTAGE	DIELECTRIC WITHSTANDING VOLTAGE	RESISTANCE RANGE		JUMPER CRITERIA
RC0075	1/50 W	-55°C to 125°C	10V	25V	25V	5% (E24) 10Ω≦R≦1MΩ 1% (E24/E96) 10Ω≦R≦1MΩ Jumper<50mΩ	10Ω≦R<100Ω -200~+600ppm°C 100Ω≦R≦1MΩ ±200ppm°C	Rated Current 0.5A Maximum Current 1.0A
RC0100	1/32 W	-55°C to 125°C	15V	30V	30V	5% (E24) IΩ≦R≦22MΩ I% (E24/E96) IΩ≦R≦10MΩ 0.5% (E24/E96) 33Ω≦R≦470KΩ Jumper<50mΩ	$I\Omega \le R < 10\Omega$ $-200 \sim +600 ppm^{\circ}C$ $I0\Omega \le R < 100\Omega:$ $\pm 300 ppm/^{\circ}C$ $I00\Omega \le R \le 10M\Omega:$ $\pm 200 ppm/^{\circ}C$ $I0M\Omega < R \le 22M\Omega:$ $\pm 250 ppm/^{\circ}C$	Rated Current 0.5A Maximum Current 1.0A

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Chip Resistor Surface Mount RC\_L SERIES **0075 to 2512** 

Table 2

CHARAC- TERISTICS	POWER	OPERATING TEMPERATURE RANGE	MAXIMUM WORKING VOLTAGE	MAXIMUM OVERLOAD VOLTAGE	DIELECTRIC WITHSTANDING VOLTAGE	resistance range	TEMPERATURE COEFFICIENT	JUMPER CRITERIA
RC0201	1/20 W	-55°C to 125°C	25 <b>Y</b>	50V	50V	5% (E24) IΩ≦R≦I0MΩ I% (E24/E96) IΩ≦R≦I0MΩ 0.1%, 0.5% (E24/E96) I0Ω≦R≦IMΩ Jumper<50mΩ	IΩ≦R≦I0Ω -100~+350ppm°C I0Ω <r≦i0mω ±200ppm°C</r≦i0mω 	Rated Current 0.5A Maximum Current 1.0A
RC0402	1/16 W	-55°C to 155°C	50V	100V	100V	5% (E24) IΩ≦R≦22MΩ I% (E24/E96) IΩ≦R≦10MΩ 0.1%, 0.5% (E24/E96) I0Ω≦R≦IMΩ Jumper<50mΩ	IΩ≦R≦I0Ω ±200ppm°C I0Ω <r≦i0mω ±I00ppm°C I0MΩ<r≦22mω ±200ppm°C</r≦22mω </r≦i0mω 	Rated Current I.0A Maximum Current 2.0A
	I/8W	-55°C to 155°C	50V	I00V	100V	5% (E24) ΙΩ≦R≦ΙΜΩ Ι% (E24/E96) ΙΩ≦R≦ΙΜΩ	IΩ≦R≦IMΩ ±200ppm°C	
RC0603	1/10 W	-55°C to 155°C	75V	150V	150V	5% (E24) IΩ≦R≦22MΩ I% (E24/E96) IΩ≦R≦10MΩ 0.1%, 0.5% (E24/E96) I0Ω≦R≦IMΩ Jumper<50mΩ	IΩ≦R≦I0Ω ±200ppm°C I0Ω <r≦i0mω ±100ppm°C I0MΩ<r≦22mω ±200ppm°C</r≦22mω </r≦i0mω 	Rated Current I.0A Maximum Current 2.0A
	1/5 W	-55℃ to 155℃	75V	150V	150V	5% (E24) IΩ≦R≦IMΩ I% (E24/E96) IΩ≦R≦IMΩ	IΩ≦R≦IMΩ ±200ppm°C	
RC0805	1/8 W	-55°C to 155°C	150V	300V	300V	5% (E24) IΩ≦R≦I00MΩ I% (E24/E96) IΩ≦R≦I0MΩ 0.1%, 0.5% (E24/E96) I0Ω≦R≦IMΩ I0%, 20% (E24) 24MΩ≦R≦I00MΩ Jumper<50mΩ	$\begin{split} & I\Omega \leqq R \leqq I0\Omega \\ & \pm 200 ppm^{\circ}C \\ & I0\Omega < R \leqq I0M\Omega \\ & \pm I00 ppm^{\circ}C \\ & I0M\Omega < R \leqq 22M\Omega \\ & \pm 200 ppm^{\circ}C \\ & 24M\Omega < R \leqq I00M\Omega \\ & \pm 300 ppm^{\circ}C \end{split}$	Rated Current 2.0A Maximum Current 5.0A
	1/4 W	-55°C to 155°C	150V	300V	300V	5% (E24) IΩ≦R≦IMΩ I% (E24/E96) IΩ≦R≦IMΩ	IΩ≦R≦IMΩ ±200ppm°C	

## FOOTPRINT AND SOLDERING PROFILES

For recommended footprint and soldering profiles, please refer to data sheet "Chip resistors mounting"

Table 2

CHARAC- TERISTICS	POWER	OPERATING TEMPERATURE RANGE	MAXIMUM WORKING VOLTAGE	MAXIMUM OVERLOAD VOLTAGE	DIELECTRIC WITHSTANDING VOLTAGE	resistance range	TEMPERATURE COEFFICIENT	JUMPER CRITERIA
RC1206	1/4 W	-55°C to 155°C	200V	400∨	500V	5% (E24) IΩ≦R≦I00MΩ I% (E24/E96) IΩ≦R≦I0MΩ 0.1%, 0.5% (E24/E96) I0Ω≦R≦IMΩ I0%, 20% (E24) 24MΩ≦R≦I00MΩ Jumper<50mΩ	$I\Omega$ ≦R≤ $I0\Omega$ $\pm 200$ ppm°C $I0\Omega$ <r≤<math>I0M\Omega <math>\pm 100</math>ppm°C <math>I0M\Omega</math><r≤<math>I0M\Omega <math>\pm 200</math>ppm°C <math>I0M\Omega</math>≤R≤<math>I00M\Omega</math> <math>I0M\Omega</math>≤R≤<math>I00M\Omega</math> <math>I0M\Omega</math>5R≤<math>I00M\Omega</math></r≤<math></r≤<math>	Rated Current 2.0A Maximum Current 10.0A
	1/2 W	-55°C to 155°C	200V	400V	500V	5% (E24) IΩ≦R≦IMΩ I% (E24/E96) IΩ≦R≦IMΩ	IΩ≦R≦IMΩ ±200ppm°C	
RC1210	1/2 W	-55°C to 155°C	200V	500V	500V	5% (E24) IΩ≦R≦22MΩ I% (E24/E96) IΩ≦R≦10MΩ 0.1%, 0.5% (E24/E96) I0Ω≦R≦IMΩ Jumper<50mΩ	IΩ≦R≦I0Ω ±200ppm°C I0Ω <r≦i0mω ±I00ppm°C I0MΩ<r≦22mω ±200ppm°C</r≦22mω </r≦i0mω 	Rated Current 2.0A Maximum Current 10.0A
RC1218	ΙW	-55°C to 155°C	200V	500V	500V	5% (E24) IΩ≦R≦IMΩ I% (E24/E96) IΩ≦R≦IMΩ 0.1%, 0.5% (E24/E96) I0Ω≦R≦IMΩ Jumper<50mΩ	IΩ≦R≦I0Ω ±200ppm°C I0Ω <r≦imω ±I00ppm°C</r≦imω 	Rated Current 6.0A Maximum Current 10.0A
RC2010	3/4 W	-55°C to 155°C	200V	500V	500V	5% (E24) IΩ≦R≦22MΩ I% (E24/E96) IΩ≦R≦10MΩ 0.1%, 0.5% (E24/E96) I0Ω≦R≦IMΩ Jumper<50mΩ	IΩ≦R≦I0Ω ±200ppm°C I0Ω <r≦i0mω ±I00ppm°C I0MΩ<r≦22mω ±200ppm°C</r≦22mω </r≦i0mω 	Rated Current 2.0A Maximum Current 10.0A
RC2512	ΙW	-55°C to 155°C	200V	500V	500V	5% (E24) IΩ≦R≦22ΜΩ I% (E24/E96) IΩ≦R≦10ΜΩ 0.1%, 0.5% (E24/E96) I0Ω≦R≦ΙΜΩ Jumper<50mΩ	IΩ≦R≦I0Ω ±200ppm°C I0Ω <r≦i0mω ±I00ppm°C I0MΩ<r≦22mω ±200ppm°C</r≦22mω </r≦i0mω 	Rated Current 2.0A Maximum Current 10.0A
	2 W	-55°C to 155°C	200V	400V	500V	5% (E24) ΙΩ≦R≦ΙΜΩ Ι% (E24/E96) ΙΩ≦R≦ΙΜΩ	IΩ≦R≦IMΩ ±200ppm°C	

## PACKING STYLE AND PACKAGING QUANTITY

Table 3 Packing style and packaging quantity

PACKING STYLE	PAPER TAPINO	G REEL (R)		ESD SAFE REEL (S) (4MM WIDTH, IMM PITCH PLASTIC EMBOSSED)	EMBOSSED TAPING REEL
REEL DIMENSION	7" (178 mm)	10" (254mm)	13" (330 mm)	7" (178 mm)	7" (178 mm)
RC0075				20000	
RC0100	20000		80000	40000	
RC0201	10000	20000	50000		
RC0402	10000	20000	50000		
RC0603	5000	10000	20000		
RC0805	5000	10000	20000		
RC1206	5000	10000	20000		
RC1210	5000	10000	20000		
RC1218					4000
RC2010					4000
RC2512					4000

#### **NOTE**

For tape and reel specification/dimensions, please refer to data sheet "Chip resistors packing".

#### **FUNCTIONAL DESCRIPTION**

#### **OPERATING TEMPERATURE RANGE**

RC0402 to RC2512 Range: -55°C to +155°C (Fig. 10-1)

RC0075 to RC0201 Range: -55°C to +125°C (Fig. 10-2)

#### **POWER RATING**

Each type rated power at 70 °C:

RC0075=1/50W

RC0100=1/32W

RC0201=1/20W

RC0402=1/16W, 1/8W

RC0603=1/10W, 1/5W

RC0805=1/8W, 1/4W

RC1206=1/4W, 1/2W

RC1210=1/2W

RC1218=1W

RC2010=3/4W

RC2512=1W, 2W

# **RATED VOLTAGE**

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

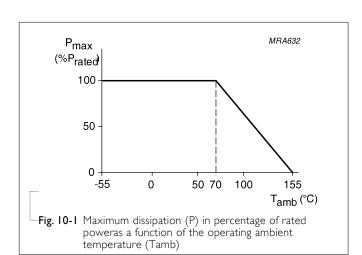
$$V = \sqrt{(PxR)}$$

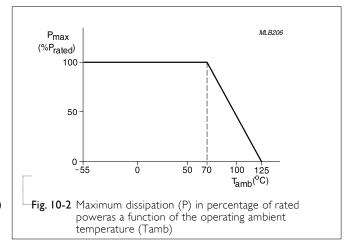
or max. working voltage whichever is less

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

P = Rated power (W)

 $R = Resistance value (\Omega)$ 





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# TESTS AND REQUIREMENTS

# Table 8 Test condition, procedure and requirements

TEST	TEST METHOD	PROCEDURE	REQUIREMENTS
Temperature Coefficient of Resistance	MIL-STD-202 Method 304	At +25/–55°C and +25/+125°C	Refer to table 2
(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 $^{\circ}$ C or specified room temperature	
		$t_2$ =-55 °C or +125 °C test temperature	
		R <sub>1</sub> =resistance at reference temperature in ohms	
		R <sub>2</sub> =resistance at test temperature in ohms	
Life/ Endurance	MIL-STD-202 Method 108A IEC 60115-1 4.25.1	At 70±2°C for 1,000 hours; RCWV applied for 1.5 hours on and 0.5 hour off, still air required	$0075: \pm (5\% + 100 \text{m}\Omega)$ $< 100 \text{m}\Omega \text{ for jumper}$ $01005: \pm (3\% + 50 \text{m}\Omega)$ $< 100 \text{m}\Omega \text{f or jumper}$ $Others:$ $\pm (1\% + 50 \text{m}\Omega) \text{ for B/D/F tol}$ $\pm (3\% + 50 \text{m}\Omega) \text{ for J tol}$ $< 100 \text{mR for jumper}$
High Temperature Exposure	MIL-STD-202 Method 108A IEC 60068-2-2	I,000 hours at maximum operating temperature depending on specification, unpowered.	$0075: \pm (5\% + 100 m\Omega)$ $< 100 m\Omega \text{ for jumper}$ $01005: \pm (1\% + 50 m\Omega)$ $< 50 m\Omega \text{ for jumper}$ $Others:$ $\pm (1\% + 50 m\Omega) \text{ for B/D/F tol}$ $\pm (2\% + 50 m\Omega) \text{ for J tol}$
Moisture Resistance	MIL-STD-202 Method 106G	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	$<50 \text{mR for jumper}$ $0075: \pm (2\% + 100 \text{m}\Omega)$ $<100 \text{m}\Omega \text{ for jumper}$ $01005: \pm (2\% + 50 \text{m}\Omega)$ $<100 \text{m}\Omega \text{f or jumper}$ $Others:$ $\pm (0.5\% + 50 \text{m}\Omega) \text{ for B/ D/F tol}$ $\pm (2\% + 50 \text{m}\Omega) \text{ for J tol}$ $<100 \text{mR for jumper}$
Humidity	IEC 60115-1 4.24.2	Steady state for 1000 hours at 40°C / 95% R.H. RCWV applied for 1.5 hours on and 0.5 hour off	0075: $\pm$ (5%+100m $\Omega$ ) no visible damage 01005: $\pm$ (3% +50m $\Omega$ ) $<$ 100m $\Omega$ f or jumper Others: $\pm$ (1%+50m $\Omega$ ) for B/D/F tol $\pm$ (2%+50m $\Omega$ ) for J tol $<$ 100mR for jumper

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		Mount

RC\_L

SERIES

0075 to 2512

Thermal Shock	MIL-STD-202 Method 107G	-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	0075/01005: $\pm$ (1% +50m $\Omega$ ) < 50m $\Omega$ f or jumper Others: $\pm$ (0.5%+50m $\Omega$ ) for B/D/F tol $\pm$ (1%+50m $\Omega$ ) for J tol < 50mR for jumper
Short Time Overload	IEC 60115-1 4.13	2.5 times RCWV or maximum overload voltage which is less for 5 seconds at room temperature	$0075/01005$ : $\pm (2\% + 50 m\Omega)$ $< 50 m\Omega f$ or jumper Others: $\pm (1\% + 50 m\Omega)$ for B/D/F tol $\pm (2\% + 50 m\Omega)$ for J tol < 50 mR for jumper No visible damage
Board Flex/ Bending	IEC 60115-1 4.33	Device mounted or as described only I board bending required bending time: 60±5 seconds 0075/0100/0201/0402:5mm; 0603/0805:3mm; 1206 and above:2mm	$0075/01005$ : $\pm (1\% + 50m\Omega)$ $< 50m\Omega f$ or jumper Others: $\pm (1\% + 50m\Omega)$ for B/D/F/J tol < 50mR for jumper No visible damage
Solderability - Wetting	J-STD-002 test B	Electrical Test not required Magnification 50X SMD conditions:  Ist step: method B, aging 4 hours at I55°C dry heat  2nd step: leadfree solder bath at 245±3°C Dipping time: 3±0.5 seconds	W ell 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 Soldering Heat	MIL-STD-202 Method 210F IEC 60115-1 4.18	Condition B, no pre-heat of samples Leadfree solder, $260^{\circ}\text{C} \pm 5^{\circ}\text{C}$ , $10 \pm 1$ seconds immersion time Procedure 2 for SMD: devices fluxed and cleaned with isopropanol	$0075: \pm (3\% + 50 \text{m}\Omega)$ $< 50 \text{m}\Omega \text{ for jumper}$ $01005: \pm (1\% + 50 \text{m}\Omega)$ $< 50 \text{m}\Omega \text{f or jumper}$ Others: $\pm (0.5\% + 50 \text{m}\Omega) \text{ for B/D/F tol.}$ $\pm (1\% + 50 \text{m}\Omega) \text{ for J tol.}$ $< 50 \text{mR for jumper}$ No visible damage

# **REVISION HISTORY**

REVISION	DATE	CHANGE NOTIFICATION	DESCRIPTION
Version 9	Mar. 06, 2018	-	- Add 0.5%/1% marking rule for RC0603 $\sim$ RC2512 based on marking datasheet
Version 8	July 10, 2017	-	- Add "3W" part number coding for 13" Reel & double power
Version 7	Mar. 7, 2017	-	- Add 10" packing
Version 6	Feb.15, 2017	-	- Extend RC0805 and RC1206 resistance range to 100Mohm
Version 5	Oct. 06, 2016	-	- Description: Update Dimension of I2 of RC2512 (2W)
Version 4	Jan. 22, 2016	-	- update resistance range
Version 3	Dec. 24, 2015	-	- Updated test and requirements
Version 2	Jul. 23, 2015	-	- Updated test and requirements
Version I	Jan. 21, 2015	-	- ESD Safe Reel update
Version 0	Dec. 15, 2014	-	- First issue of this specification

<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."