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Innovative Service Around the Globe YAGEO

DATA SHEET

SURFACE-MOUNT CERAMIC MULTILAYER CHIP VARISTORS

VRS0402/0603

5.5 V TO 38 V

RoHS compliant & Halogen Free

YAGEO Phycomp

Product Specification – Aug. 14, 2014 V.7

SCOPE

This specification describes chip varistors with lead-free terminations.

APPLICATIONS

- Consumer electronic equipment
- Telecommunications
- Notebook
- Electronic data processing

FEATURES

- Excellent clamping voltage
- Excellent energy dissipation capability
- Quick response time (<1n sec.)
- Adjustable capacitance values
- High reliability
- High transient current capability
- Symmetrical voltage-current characteristics

ORDERING INFORMATION-GLOBAL PART NUMBER, PHYCOMP CTC & 12NC

All part numbers are identified by the series, size, tolerance, TC material, packing style, voltage, process code, termination and capacitance value.

YAGEO BRAND ordering code

GLOBAL PART NUMBER (PREFERRED)

VRS	xxxx	x	R	xxx	xxx	x
	(1)	(2)		(3)	(4)	(5)

(1) SIZE – INCH BASED (METRIC)

0402 (1005)

0603 (1608)

(2) TOLERANCE

K = ±10%

L = ±15%

M = ±20%

S = Normal range

(3) WORKING VOLTAGE

2 significant digits+number of zeros

The 3rd digit signifies the multiplying factor, and letter R is decimal point

Example: 55R = 55 x 10-1 = 5.5 V, 380 = 38 x 101 = 38 V

(4) CAPACITANCE VALUE

2 significant digits+number of zeros The 3rd digit signifies the multiplying factor, and letter R is decimal point

Example: 121 = 12 x 10^1 = 120 pF

(5) PROCESS CODE

N = Cap. ±30%

K = Cap. ±10%

L = Cap. ±15%

M = Cap. ±20%

CONSTRUCTION

Lead Free terminations, NiSn terminations
Surface mount multilayer surge suppressor
Very short response time (<1.0 nsec)
Bidirectional clamping
Low capacitance for high frequency applications
Very low leakage current

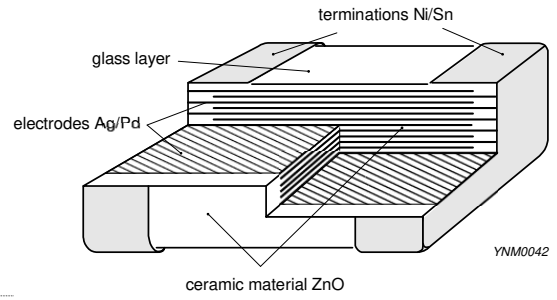


Fig. 1 Cross-section of a multilayer capacitor

DIMENSION

Table 1 For outlines see fig. 2

TYPE	L_1 (mm)	W (mm)	T (MM)	L_2 / L_3 (mm)		L_4 (mm)
				min.	max.	min.
0402	1.0 ±0.10	0.5 ±0.10	0.5 ±0.10	0.15	0.30	0.40
0603	1.6 ±0.15	0.8 ±0.15	0.8 ±0.10	0.20	0.60	0.40

OUTLINES

For dimension see Table 1

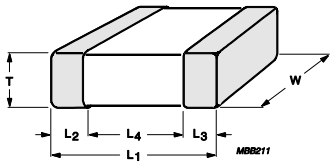


Fig. 2 Surface mounted multilayer ceramic capacitor dimension

ELECTRICAL CHARACTERISTICS

Table 2 Size 0402

PART NUMBER	VARISTOR/ BREAKDOWN VOL.	MAX. WORKING VOL.	CLAMPING VOL.@1A	PEAK CURRENT	LEAKAGE CURRENT R.T. (15~35 °C)		CAPACITANCE @ 1V (RMS)	
	DC @1mA	D.C (max.)	8/20 μS (max.)	8/20 μS (max.)	Voltage	Current	1KHz	1MHz
VRS0402SR55R220N	10 V ~ 14 V	5.5 V	22 V	2 A	5.5 V	10 μA	22 pF	12 pF
VRS0402SR55R330N	10 V ~ 14 V	5.5 V	22 V	4 A	5.5 V	10 μA	33 pF	20 pF
VRS0402SR55R500N	10 V ~ 14 V	5.5 V	22 V	6 A	5.5 V	10 μA	50 pF	30 pF
VRS0402SR55R101N	10 V ~ 14 V	5.5 V	22 V	10 A	5.5 V	10 μA	100 pF	60 pF
VRS0402MR55R101N	7.2 V ~ 10.8 V	5.5 V	18 V	10 A	5.5 V	10 μA	100 pF	60 pF
VRS0402MR55R201N	7.2 V ~ 10.8 V	5.5 V	18 V	15 A	5.5 V	10 μA	200 pF	130 pF
VRS0402MR55R301N	7.2 V ~ 10.8 V	5.5 V	18 V	15 A	5.5 V	10 μA	300 pF	---
VRS0402MR55R361N	7.2 V ~ 10.8 V	5.5 V	18 V	20 A	5.5 V	10 μA	360 pF	220 pF
VRS0402MR55R481N	7.2 V ~ 10.8 V	5.5 V	18 V	20 A	5.5 V	10 μA	480 pF	290 pF
VRS0402MR55R651N	7.2 V ~ 10.8 V	5.5 V	18 V	30 A	5.5 V	10 μA	650 pF	390 pF
VRS0402KR090500N	10.8 V ~ 13.2 V	9 V	22 V	6 A	9 V	20 μA	50 pF	30 pF
VRS0402LR090500N	10.2 V ~ 13.8 V	9 V	22 V	6 A	9 V	20 μA	50 pF	30 pF
VRS0402LR090201N	10.2 V ~ 13.8 V	9 V	22 V	15 A	9 V	20 μA	200 pF	120 pF
VRS0402SR140500N	18 V ~ 24 V	14 V	38 V	7 A	14 V	20 μA	50 pF	30 pF
VRS0402SR140101N	18 V ~ 24 V	14 V	38 V	15 A	14 V	20 μA	100 pF	60 pF
VRS0402SR140121N	18 V ~ 24 V	14 V	38 V	15 A	14 V	20 μA	120 pF	72 pF
VRS0402MR140161N	14.4 V ~ 21.6 V	14 V	35 V	20 A	14 V	20 μA	160 pF	96 pF
VRS0402KR140161N	16.2 V ~ 19.8 V	14 V	33 V	20 A	14 V	20 μA	160 pF	96 pF
VRS0402SR180010N	90 V ~ 135 V	18 V	250 V	1 A	18 V	10 μA	---	1 pF
VRS0402SR180030N	50 V ~ 80 V	18 V	130 V	1 A	18 V	10 μA	3 pF	2 pF
VRS0402SR180050N	50 V ~ 80 V	18 V	130 V	2 A	18 V	10 μA	5 pF	3 pF
VRS0402SR180100N	24 V ~ 34 V	18 V	66 V	3 A	18 V	10 μA	10 pF	5.5 pF
VRS0402SR180150N	24 V ~ 34 V	18 V	66 V	3 A	18 V	10 μA	15 pF	9 pF
VRS0402SR180220N	24 V ~ 34 V	18 V	66 V	3 A	18 V	10 μA	22 pF	13 pF
VRS0402SR180270N	24 V ~ 34 V	18 V	66 V	4 A	18 V	10 μA	27 pF	15 pF
VRS0402SR180400N	24 V ~ 34 V	18 V	66 V	4 A	18 V	10 μA	40 pF	22 pF
VRS0402SR180500N	24 V ~ 34 V	18 V	66 V	4 A	18 V	10 μA	50 pF	30 pF
VRS0402KR180820N	21.6 V ~ 26.4 V	18 V	56 V	10 A	18 V	35 μA	82 pF	50 pF
VRS0402SR180121N	24 V ~ 34 V	18 V	66 V	15 A	18 V	10 μA	120 pF	72 pF
VRS0402SR190500N	27 V ~ 38 V	19 V	60 V	15 A	19 V	4 μA	50 pF	---
VRS0402SR300030N	50 V ~ 80 V	30 V	130 V	1 A	18 V	10 μA	3 pF	---

ELECTRICAL CHARACTERISTICS

Table 3 Size 0603

PART NUMBER	VARISTOR/ BREAKDOWN VOL.	MAX. WORKING VOL.	CLAMPING VOL.@1A	PEAK CURRENT	LEAKAGE CURRENT R.T. (15~35 °C)		CAPACITANCE @ 1V (RMS)	
	DC @1mA	D.C (max.)	8/20 μS (max.)	8/20 μS (max.)	Voltage	Current	1KHz	1MHz
VRS0603SR55R181N	10 V ~ 14 V	5.5 V	20 V	12 A	5.5 V	10 μA	180 pF	100 pF
VRS0603MR55R301N	7.2 V ~ 10.8 V	5.5 V	18 V	15 A	5.5 V	10 μA	300 pF	180 pF
VRS0603MR55R361N	7.2 V ~ 10.8 V	5.5 V	18 V	20 A	5.5 V	10 μA	360 pF	180 pF
VRS0603SR55R471N	10 V ~ 14 V	5.5 V	20 V	30 A	5.5 V	10 μA	470 pF	280 pF
VRS0603MR55R681N	7.2 V ~ 10.8 V	5.5 V	18 V	30 A	5.5 V	10 μA	680 pF	410 pF
VRS0603MR55R801N	7.2 V ~ 10.8 V	5.5 V	18 V	30 A	5.5 V	10 μA	800 pF	480 pF
VRS0603MR55R901N	7.2 V ~ 10.8 V	5.5 V	18 V	30 A	5.5 V	10 μA	900 pF	540 pF
VRS0603SR090090N	18 V ~ 24 V	9 V	36 V	3 A	9 V	20 μA	9 pF	5.5 pF
VRS0603KR140351N	16.2 V ~ 19.8 V	14 V	33 V	30 A	14 V	20 μA	350 pF	---
VRS0603SR180030N	50 V ~ 80 V	18 V	130 V	1 A	18 V	10 μA	3 pF	2 pF
VRS0603SR180050N	50 V ~ 80 V	18 V	130 V	2 A	18 V	10 μA	5 pF	3 pF
VRS0603SR180100N	24 V ~ 32 V	18 V	66 V	5 A	18 V	10 μA	10 pF	6 pF
VRS0603SR180150N	24 V ~ 32 V	18 V	66 V	3 A	18 V	10 μA	15 pF	10 pF
VRS0603SR180121N	24 V ~ 32 V	18 V	66 V	20 A	18 V	10 μA	120 pF	72 pF
VRS0603KR300121N	35.1 V ~ 42.9 V	30 V	86 V	20 A	30 V	35 μA	120 pF	72 pF
VRS0603KR310161N	35.1 V ~ 42.9 V	31 V	86 V	20 A	31 V	35 μA	160 pF	96 pF

STANDARD TESTING CONDITION

1. Temperature: 15 °C to 35 °C
2. Humidity: 25% RH to 85% RH
3. Atmospheric pressure: 86 to 106 kPa

ESD (ELECTROSTATIC DISCHARGE) TEST

ESD discharge circuit according to IEC 61000-4-2

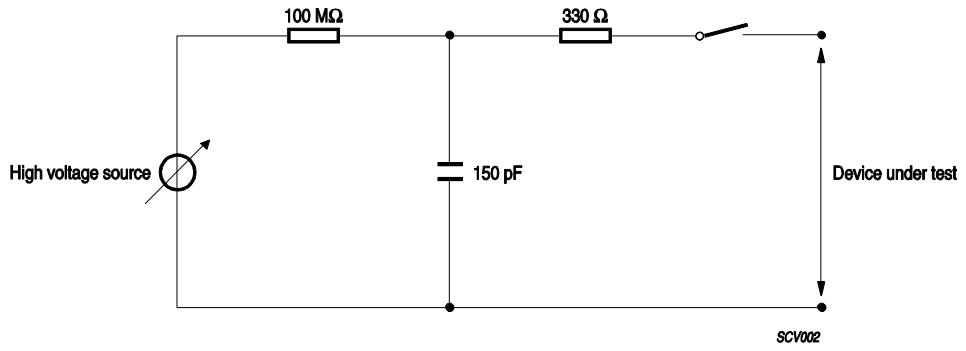


Fig. 3 ESD discharge circuit diagram

SPECIFICATION OF ELECTROSTATIC DISCHARGE (ESD) TEST:

According to standard EN 61000-4-2, up to 8 KV direct contact (contact discharge)

THICKNESS CLASSES AND PACKING QUANTITY

Table 4

SIZE CODE	THICKNESS CLASSIFICATION	TAPE WIDTH QUANTITY PER REEL	Ø180 MM / 7 INCH (PAPER)
0402	0.5 ±0.03 mm	8 mm	10,000
0603	0.8 ±0.1 mm	8 mm	4,000

METHOD OF MOUNTING

For normal use the varistor may be mounted on printed-circuit boards or ceramic substrates by applying wave soldering, reflow soldering (including vapour phase soldering) or conductive adhesive in accordance with CECC 00802 classification A. For advised soldering profiles see Figs 4, 5, and 6.

An improper combination of soldering, substrate and chip size can lead to a damaging of the component. The risk increases with the chip size and with temperature fluctuations (>100 °C). More detailed information is available on request.

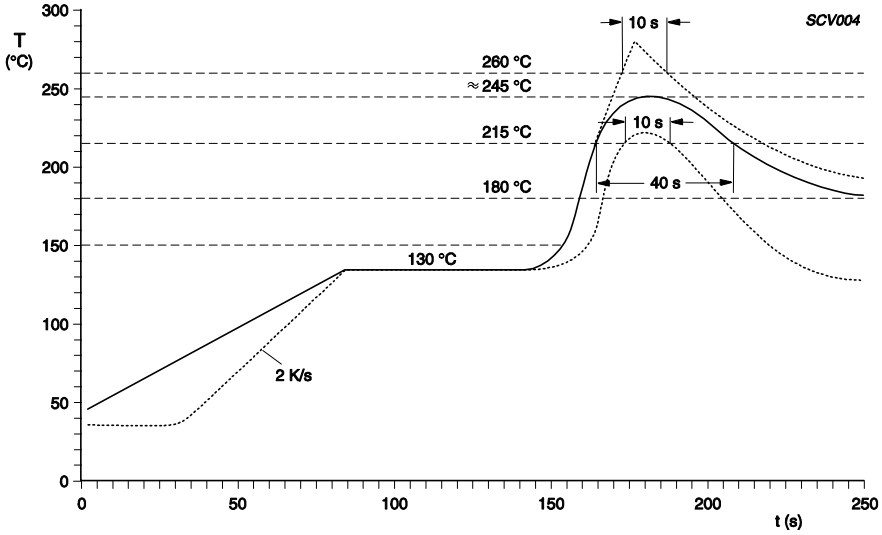
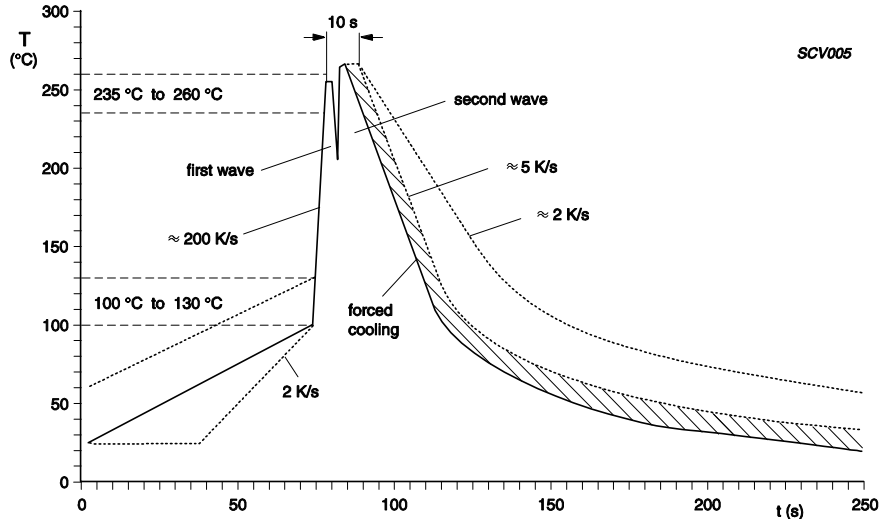


Fig. 4 Reflow soldering

Typical values (solid line) Process limits (dotted lines)



Typical values (solid line)
Process limits (dotted lines)
The capacitors may be soldered twice in accordance with this method if desired

Fig. 5 Double wave soldering

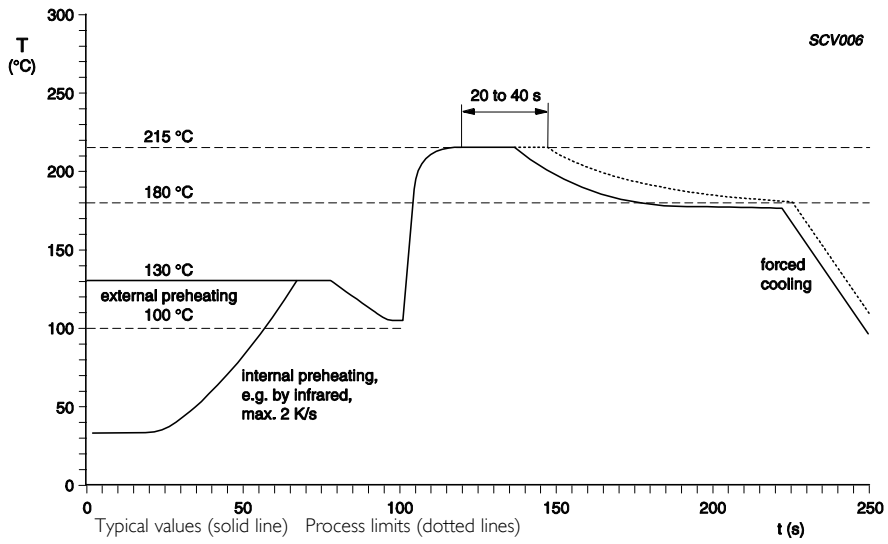


Fig. 6 Vapour phase soldering

TESTS AND REQUIREMENTS

Table 5 Test procedures and requirements

TEST	TEST METHOD		PROCEDURE	REQUIREMENTS
Capacitance	CECC4200 4.6	IEC1051 4.7	f = 1 KHz / 1 MHz Measuring voltage 1 Vrms at 25 °C	> 5 pF: ±30% at 1KHz 3 pF to 5 pF: +80% / -20% at 1KHz < 3 pF: +80% / -20% at 1MHz
Bond Strength of Plating on End Face	4.9	4.10	To be soldered on the glass-epoxy (thickness 1.6 mm), the load shall be put on the board bends 1 mm	No visible damage
Solderability	4.10	4.11	Unmounted chips completely immersed for 2 ±0.5 seconds (dipping time) in a solder bath at 235 ±2 °C	The termination should be well tinned
Resistance to Soldering Heat	4.10.2	4.12	Solder bath temperature: 260 ±5 °C Dipping time: 10 ±0.5 seconds	| Δ V1mA / V1mA | <10%
Rapid Change of Temperature	4.12	4.13	5 cycles with following detail 30 minutes at -40°C 30 minutes at +85 °C	| Δ V1mA / V1mA | <10%
Damp Heat with U_r Load	4.17	4.18	Duration and conditions: 500 ±12 hours at 40 ±2 °C 90 to 95% RH; U_r applied	| Δ V1mA / V1mA | <10%
Endurance	4.19	4.20	Duration and conditions: 500 ±12 hours at 85 °C; U_r applied	| Δ V1mA / V1mA | <10%
Endurance at Upper Category Temperature	4.20	4.20	Duration and conditions: 1,000 ±12 hours at 85 °C	| Δ V1mA / V1mA | <10%
Adhesion	IEC 60384-1 4.34		A force of 2N applied for 10 seconds to the line joining the terminations and in a plane parallel to the substrate	No visible damage
Cold Temperature Storage	4.25		Duration and conditions 1,000 ±12 hours at -40 ±2 °C	| Δ V1mA / V1mA | <10%

REVISION HISTORY

REVISION	DATE	CHANGE NOTIFICATION	DESCRIPTION
Version 7	Aug. 14, 2014	-	- VRS0402SR180220N added - Product range update - Process code update - VRS0402SR180100S, VRS0402SR180100E deleted
Version 6	May 16, 2013	-	- VRS0402SR190500N added
Version 5	Jan 03, 2012	-	- Product range updated - Leakage current updated - Working voltage updated
Version 4	Oct 19, 2011	-	- Product range and dimension updated
Version 3	Aug 05, 2011	-	- Product range updated
Version 2	Dec 02, 2010	-	- Dimension updated - Leakage current updated - VRS0805KR260251N added
Version 1	Jul 22, 2010	-	- Dimension updated
Version 0	Jun 08, 2010	-	- New