

# DATA SHEET

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## Multi-Layer Chip Varistors (MLV)

- DESCRIPTION

Yageo Multilayer Chip Varistors (MLV) are designed to protect sensitive electronics devices against high voltage transient surges in the low voltage region. They offer excellent transient energy absorption due to improved energy volume distribution and power dissipation. The wide operating voltage and energy range make them suitable for numerous applications on Vcc protection, I/O protection, Keyboard protection, LCD protection and Sensor protection...etc.

- FEATURES

1. Excellent clamping voltage
2. Excellent energy dissipation capability
3. Quick response time (<1n sec.)
4. Adjustable capacitance values
5. High reliability
6. High transient current capability
7. Symmetrical Voltage-Current characteristics

- APPLICATIONS

Major application areas for Yageo's Phycomp-branded Multilayer Chip Varistors (MLV) series include:

- Consumer electronic equipment
- Telecommunications
- Notebook

• DIMENSIONS

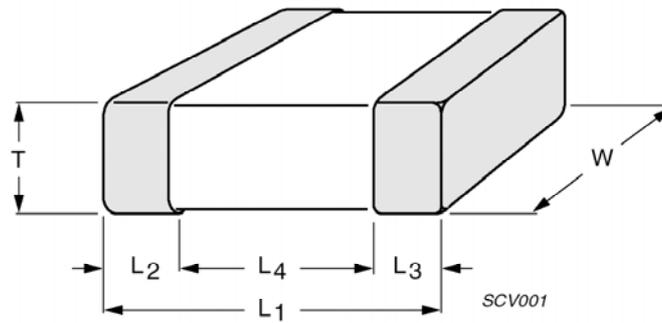


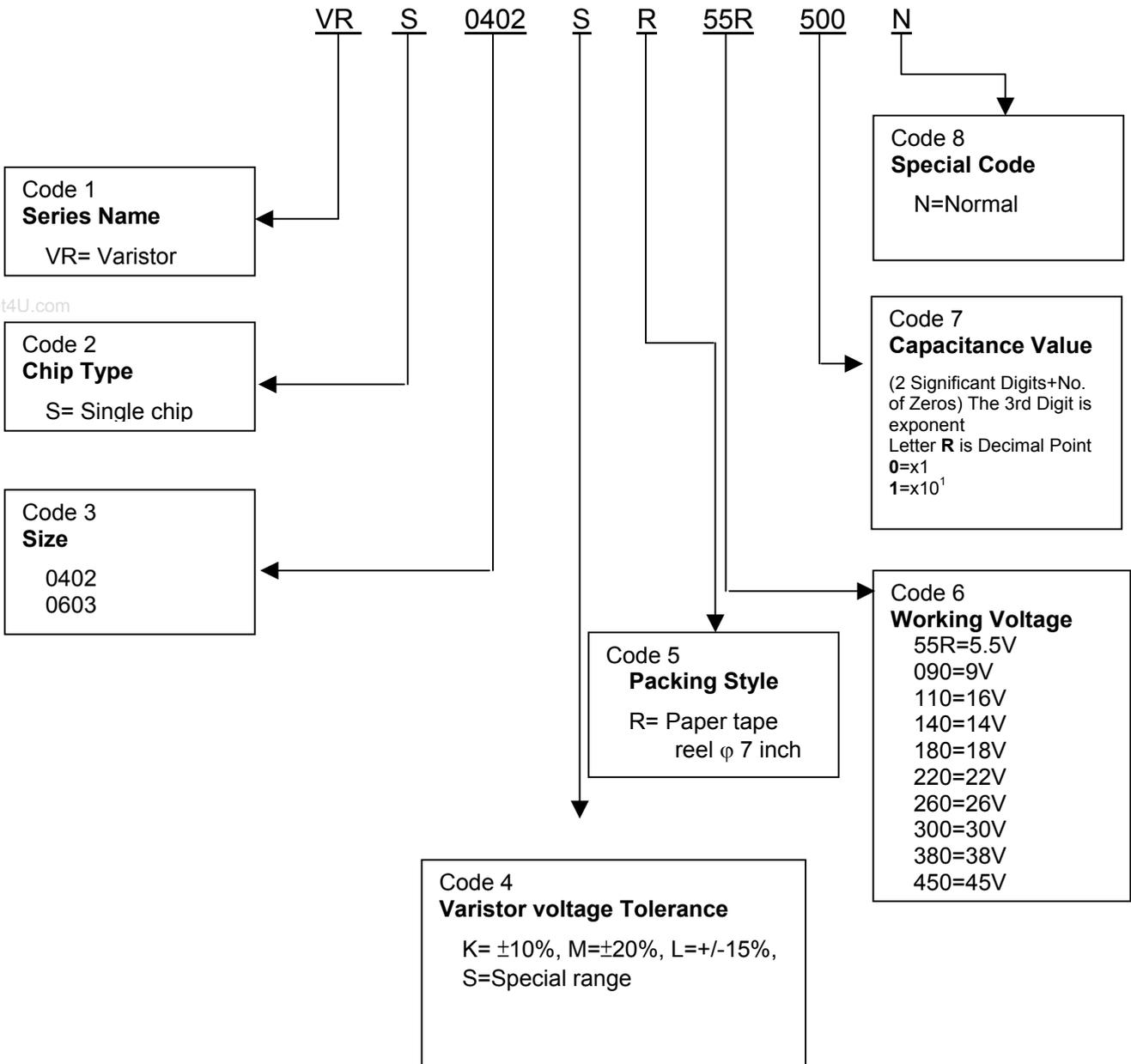
Fig1. outline

size	L <sub>1</sub>	W	T		L <sub>2</sub> and L <sub>3</sub>		L <sub>4</sub>
			MIN.	MAX.	MIN.	MAX.	
0402	1.0 ± 0.05	0.5 ± 0.05	0.45	0.55	0.15	0.30	0.40
0603	1.6 ± 0.10	0.8 ± 0.07	0.73	0.87	0.20	0.60	0.40

Thickness classification and packaging quantities:

Thickness Classification (mm)	8mm Tape width/ Amount per reel	
	Ø180mm; 7"	
	Paper	
0.5±0.05	10000	
0.8±0.07	4000	

Ordering information



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• **DEVICE RATING AND SPECIFICATIONS**

Table 1  
0402

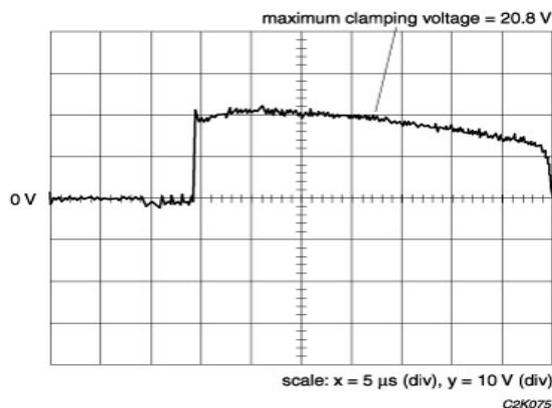
Phycomp Part number	Size	Varistor voltage/ Breakdown Voltage	Maximum Continuous Voltage/ Working Voltage	Clamping Voltage		Peak current	Resistance		Capacitance @ 1 V(rms)  (pF)	
				R.T.(15~35°C)			Voltage	Resistance		
	(Inch)	DC @1mA	D.C	8/20 $\mu$ s	8/20 $\mu$ s	(V)			(M $\Omega$ ) min.	1KHz
VRS0402MR55R651N	0402	6.4~9.6	5.5	14	1	30	3	1	650	390
VRS0402MR55R331N	0402	6.4~9.6	5.5	15	1	30	3	1	330	200
VRS0402KR090500N	0402	10.2~13.8	9	22	1	20	3	1	50	30
VRS0402KR090101N	0402	10.2~13.8	9	22	1	20	3	1	100	60
VRS0402LR090201N	0402	10.2~13.8	9	22	1	20	3	1	200	120
VRS0402LR110181N	0402	12.75~17.25	11	27	1	20	3	1	180	110
VRS0402LR140161N	0402	15.3~20.7	14	33	1	20	3	1	160	96
VRS0402KR160121N	0402	19.8~24.2	16	40	1	18	3	1	120	72
VRS0402KR180900N	0402	21.6~26.4	18	44	1	14	3	1	90	54
VRS0402KR220820N	0402	24.3~29.7	22	49	1	14	3	1	82	50
VRS0402KR260550N	0402	29.7~36.3	26	60	1	10	3	1	55	33
VRS0402KR300400N	0402	35.1~42.9	30	71	1	8	3	1	40	24
VRS0402SR55R220N	0402	10~14	5.5	22	1	2	3	1	22	13
VRS0402SR55R330N	0402	10~14	5.5	22	1	4	3	1	33	20
VRS0402SR55R500N	0402	10~14	5.5	22	1	6	3	1	50	30
VRS0402SR55R680N	0402	10~14	5.5	22	1	8	3	1	68	41
VRS0402SR55R820N	0402	10~14	5.5	22	1	9	3	1	82	49
VRS0402SR55R101N	0402	10~14	5.5	22	1	11	3	1	100	60
VRS0402SR55R601N	0402	10~14	5.5	22	1	65	3	1	600	360
VRS0402SR140500N	0402	18~24	14	38	1	7	3	1	50	30
VRS0402SR140101N	0402	18~24	14	38	1	15	3	1	100	60
VRS0402SR180820N	0402	24~32	18	51	1	2	3	1	82	49
VRS0402SR180120N	0402	24~32	18	51	1	2	3	1	12	7
VRS0402SR180150N	0402	24~32	18	51	1	3	3	1	15	9
VRS0402SR180270N	0402	24~32	18	51	1	5	3	1	27	16
VRS0402SR180121N	0402	24~32	18	51	1	20	3	1	120	72
VRS0402SR180181N	0402	24~32	18	51	1	20	3	1	180	108
VRS0402SR180030N	0402	38~46	18	76	1	3	3	1	3	1.8

0603

Phycomp Part number	Size	Varistor voltage/ Breakdown Voltage	Maximum Continuous Voltage/ Working Voltage	Clamping Voltage		Peak current	Resistance		Capacitance @ 1 V(rms)	
		DC @1mA	D.C	8/20 $\mu$ s	8/20 $\mu$ s	Voltage	Resistance	R.T.(15~35°C)		
	(Inch)	(V)	(V) max.	(V) max.	(A)	(A) max.	(V)	(M $\Omega$ ) min.	1KHz	1MHz
VRS0603MR55R801N	0603	6.4~9.6	5.5	15	1	30	3	1	800	480
VRS0603MR55R681N	0603	6.4~9.6	5.5	15	1	30	3	1	680	410
VRS0603MR55R301N	0603	6.4~9.6	5.5	15	1	30	3	1	300	180
VRS0603LR090681N	0603	10.2~13.8	9	22	1	30	3	1	680	410
VRS0603LR110481N	0603	12.75~17.25	11	27	1	30	3	1	480	290
VRS0603LR140361N	0603	15.3~20.7	14	33	1	30	3	1	360	216
VRS0603KR180301N	0603	21.6~26.4	18	44	1	30	3	1	300	180
VRS0603KR220241N	0603	24.3~29.7	22	49	1	30	3	1	240	144
VRS0603KR260201N	0603	29.7~36.3	26	60	1	30	3	1	200	120
VRS0603KR300121N	0603	35.1~42.9	30	70	1	30	3	1	120	72
VRS0603KR380101N	0603	42.3~51.7	38	85	1	20	3	1	100	60
VRS0603KR450800N	0603	50.4~61.6	45	100	1	20	3	1	80	48
VRS0603SR180121N	0603	24~32	18	50	1	20	3	1	120	72
VRS0603SR180100N	0603	90~160	18	225	1	5	3	1	10	6

• STANDARD TESTING CONDITION

- Temperature : 15~35°C
- Humidity: 25%RH~85%RH
- Atmospheric pressure: 86~106 kPa



VRS0402SR55R500N Clamping Voltage  
Spec. 22  
Typical 20.8V

Fig2. Clamping Volatge

- ESD Test
  - Standard IEC 61000-4-2
  - ESD discharge circuit according to IEC 61000-4-2

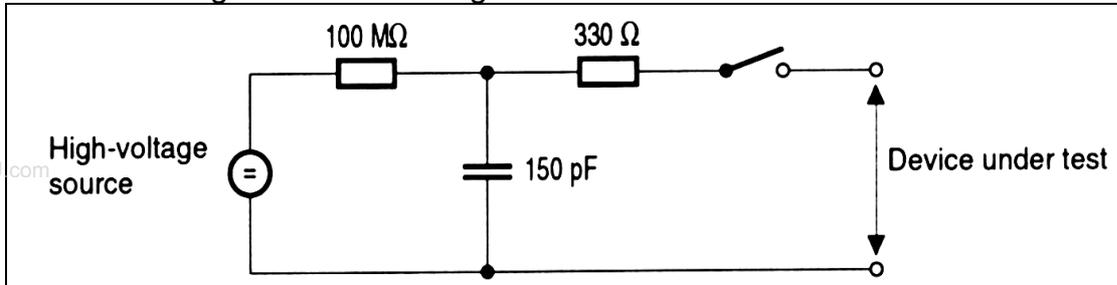
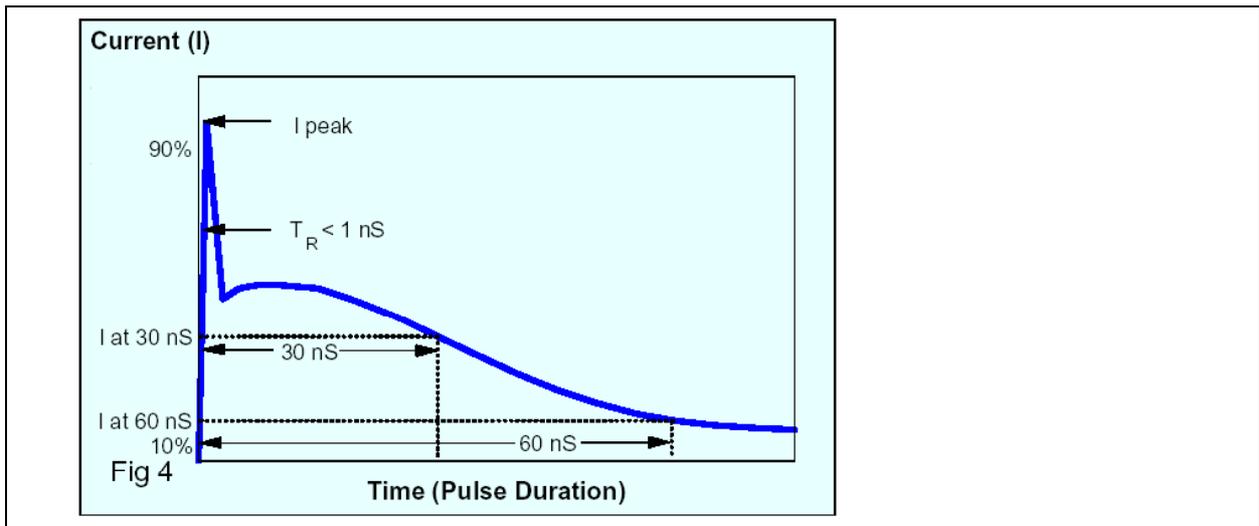


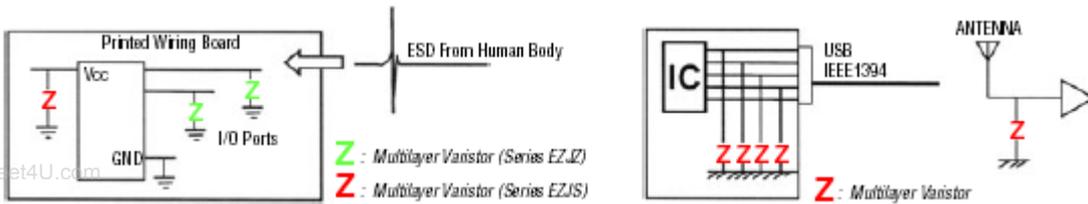
Fig3. ESD discharge circuit

- ESD discharge current according to IEC 61000-4-2 as fig 4

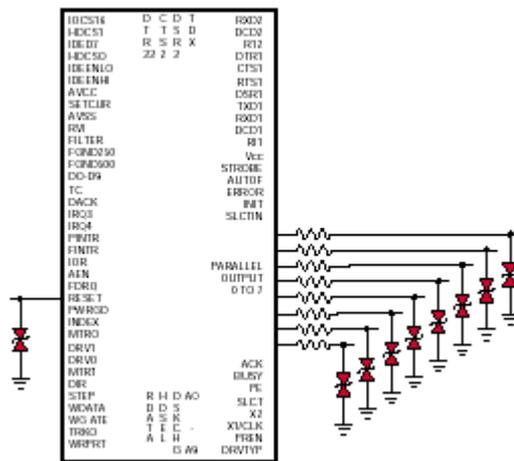


- Specification of Electrostatic discharge (ESD) Test:  
According to Standard EN 61000-4-2 , Up to 15KV(Air discharge).

• APPLICATION EXAMPLES



SUB NOTEBOOK & PDA'S



NOTEBOOK & WORK STATION

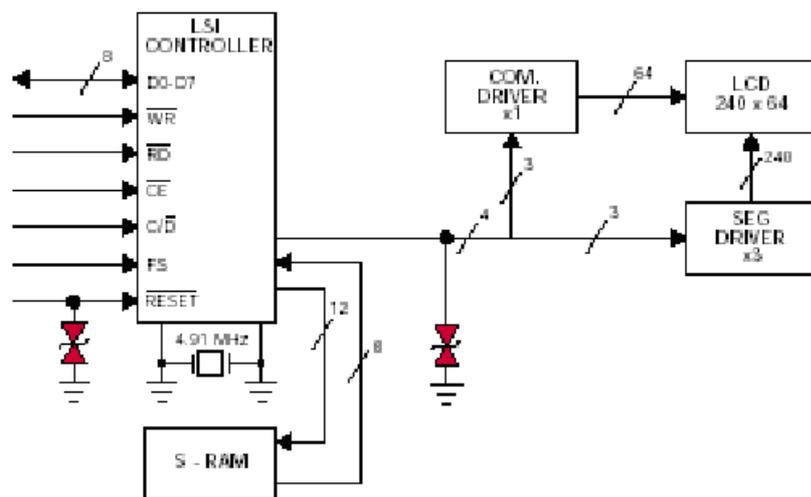
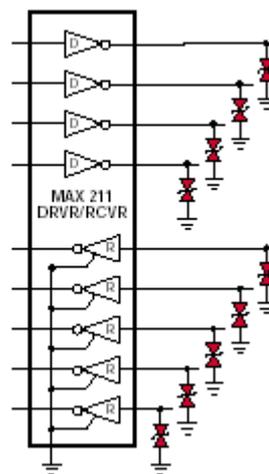


Fig 5.Appl. Example

• Test Condition and Test Method

CECC 42000	IEC 1051-1	Test item	Test condition / Test method	Specification
4.6	4.7	Capacitance	Measuring frequency: 1KHz Measuring voltage: 1.0 Volt Measuring temperature: 25°C	
4.9	4.10	Bending	To be soldered on the glass-epoxy (thickness 1.6mm), the load shall be put on the board bends 1mm.	No mechanical damage shall be caused.
4.10	4.11	Solderability	Solder bath temp. : 235±5 °C 2.Immersion time : 2±0.5s	Dissolution of the each terminations shall not exceed 10%
4.10.2	4.12	Resistance to soldering heat	1.Solder bath temp. : 260±5 °C 2.Immersion time : 10±0.5 s	$\Delta V_{1mA}/V_{1mA} < 10\%$
4.12	4.13	Rapid change of Temperature	-40°C to +85°C, 5 cycles with 30 minutes duration	$\Delta V_{1mA}/V_{1mA} < 10\%$
4.17	4.18	Damp heat	40°C, 90~95% RH with Max. Operating Voltage for 500+/-12 hrs	$\Delta V_{1mA}/V_{1mA} < 10\%$
4.19	4.20	Endurance	85°C with Max. Operating Voltage for 500+/-12 hrs	$\Delta V_{1mA}/V_{1mA} < 10\%$
4.20	4.20	Endurance at upper category temperature	85±2°C for 1000+/-12hrs.	$\Delta V_{1mA}/V_{1mA} < 10\%$
		Adhesion	Solder chip on PCB and applied 2N(0.2Kg) for 10 seconds	No visible damage.
		Cold temperature storage	-40±2°C for 1000 +/-12hrs.	$\Delta V_{1mA}/V_{1mA} < 10\%$

△ After each test has been done, the tested chips shall be left in room ambient for 1~2 hours then measure the breakdown voltage.

• Competitor Cross Reference

Yageo part number	Innochips	Littelfuse	TDK	Amotech	EPCOS	AVX
VRS0402MR55R331N	ICVN0505X150	V5.5MLA0402	AVR-M1005C080M-AAB AVR-M1005C080M-ADB	AVL5M02200		VC040205X150
VRS0402LR090201N	ICVN0509X200		AVR-M1005C120M-AAB	AVL8M02200		VC040209X200
VRS0402LR110181N		V9MLA0402		AVL11L02200		
VRS0402LR140161N		V5.5MLA0402L V14MLA0402		AVL14K0200		VC040214X300
VRS0402KR160121N	ICVN0514X300					
VRS0402KR180900N				AVL18K02200	CT0402L14G	VC040218X400
VRS0402KR220820N		V18MLA0402	AVR-M1005C270M-AAB			
VRS0402KR260550N	ICVN0518X400					
VRS0402SR55R500N	ICVL0505600V150			AVLC5S02050		
VRS0402SR55R101N	ICVL0505101V150			AVLC5S02100		
VRS0402SR140500N				AVLC14S02050		
VRS0402SR140101N				AVLC14S02100		
VRS0402SR180120N	ICVL0518100Y500					
VRS0402SR180150N	ICVL0518150Y500			AVLC18S02015		
VRS0402SR180270N	ICVL0518400Y500					
VRS0402SR300030N	ICVL0518030			AVLC18S02003		
VRS0603MR55R801N	ICVN1005A150	V5.5MLA0603	AVR-M1608C080M-AAB	AVL5M03300	CT0603M4G	VC060305A150
VRS0603LR090681N	ICVN1009A200		AVR-M1608C120M-6AB AVR-M1608C120M-2AB	AVL8M03300	CT0603M6G	VC060309A200
VRS0603LR110481N		V9MLA0603		AVL11L03300	CT0603L8G	
VRS0603LR140361N	ICVN1014A300	V14MLA0603	AVR-M1608C180M-6AB	AVL14K03300	CT0603K11G	VC060314A300
VRS0603KR180301N				AVL18K03300	CT0603K14G	VC060318A400
VRS0603KR220241N	ICVN1018A400	V18MLA0603	AVR-M1608C270K-6AB AVR-M1608C270K-2AB		CT0603K17G	
VRS0603KR260201N					CT0603K20G	VC060326A580
VRS0603KR300121N	ICVN1030A650	V26MLA0603				
VRS0603KR380101N	ICVN1026A580	V30MLA0603				

• **Soldering condition**

Typical examples of soldering processes that provide reliable joints without any damage are given in fig. 6, 7 & 8

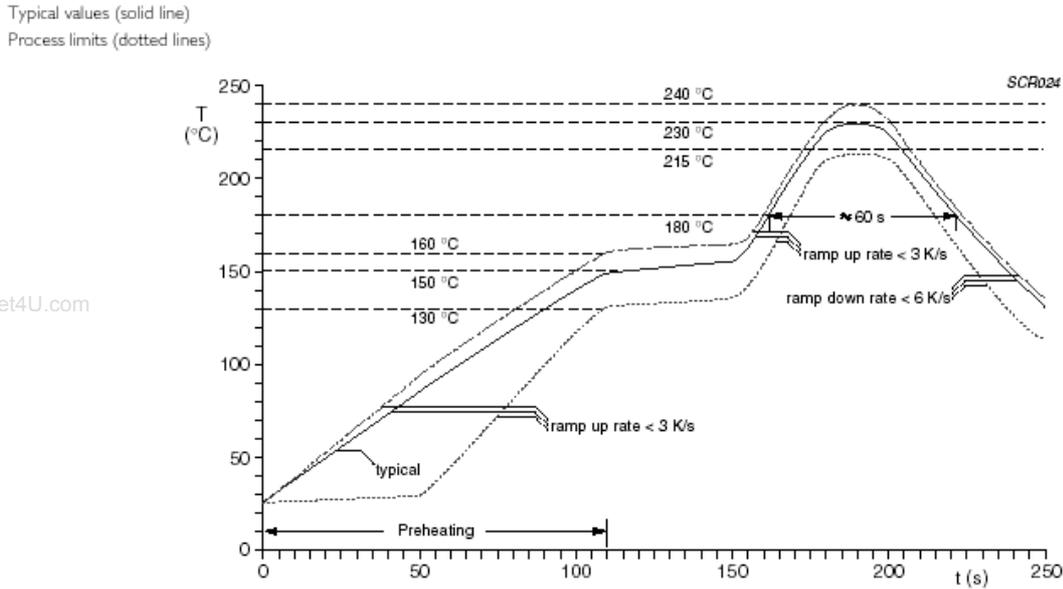


Fig. 6 Infrared soldering, forced air convection reflow soldering-temperature/time profile for SnPb solders

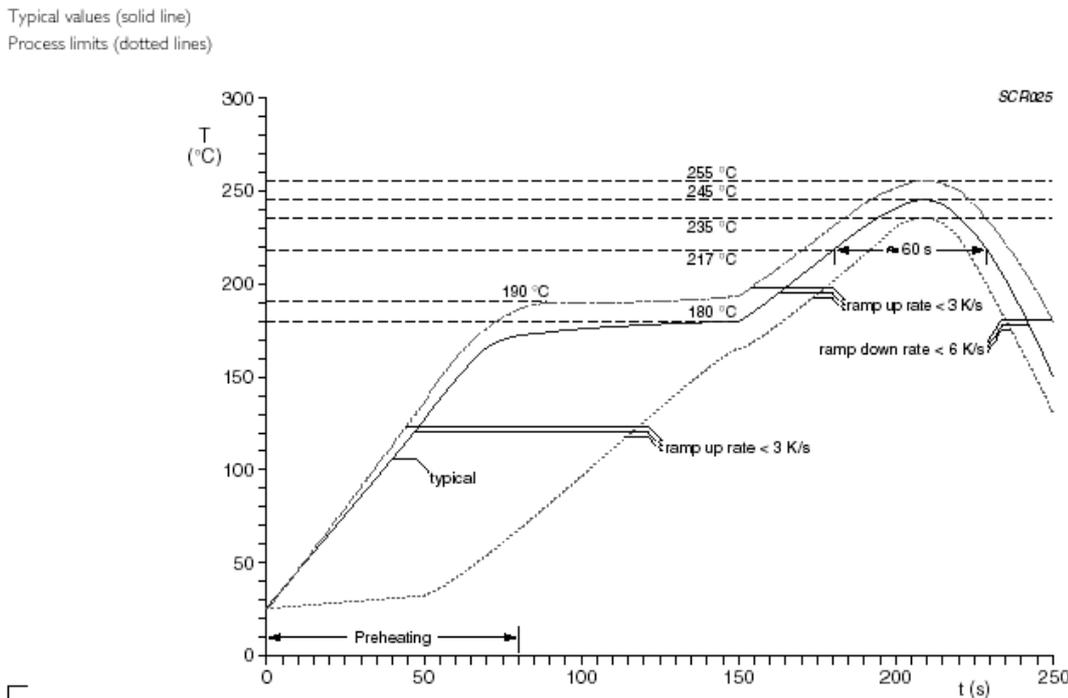


Fig. 7 Infrared soldering, forced air convection reflow soldering-temperature/time profile for SnAgCu solders

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

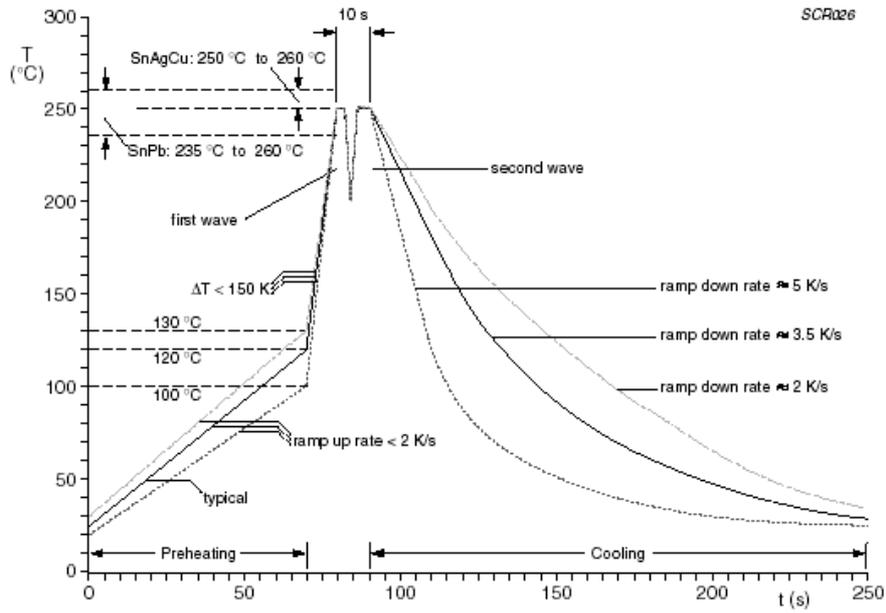


Fig. 8 Double wave soldering for SnPb and leadfree SnAgCu solder- temperature/time profile (terminal temperature)