Single Layer Technology

Reliability Testing Procedures			
Reliability Parameter	Test	Tested according to	Condition to be satisfied after testing
AC/DC Bias Reliability	AC/DC Life Test	CECC 42000, Test 4.20 or IEC 1051-1, Test 4.20. 1000 h at UCT	$\|DV_n/V_n$ @ 1 mA$\|$ < 10% R > 10MΩ
Pulse Current Capability	I_{MAX} 8/20 µs	CECC 42000, Test C 2.1 or IEC 1051-1, Test 4.5. 10 pulses in the same direction at 2 pulses per minute at maximum peak current for 10 pulses	$\|DV_n/V_n$ @ 1 mA$\|$ < 10% no visible damage
Pulse Energy Capability	W_{MAX} 10/1000 µs	CECC 42000, Test C 2.1 or IEC 1051-1, Test 4.5. 10 pulses in the same direction at 1 pulse every minute at maximum peak current for 10 pulses	$\|DV_n/V_n$ @ 1 mA$\|$ < 10% no visible damage
Isolation Voltage Capability	Voltage proof	CECC 42000, Test 4.7 or IEC 1051-1, Test 4.8. Metal Ball method, 1 minute AC at isolation voltage	There shall be no breakdown or flashover
Environmental and Storage Reliability	Climatic Sequence	CECC 42000, Test 4.16 or IEC 1051-1, Test 4.17. a. Dry heat, 16 h, UCT, Test Ba, IEC 68-2-2 b. Damp heat, cyclic, the first cycle: 55ºC, 93% RH, 24h, Test Db 68-2-4 c. Cold, LCT, 2h, Test Aa, IEC 68-2-1 d. Damp heat cyclic, remaining 5 cycles: 55ºC, 93% RH, 24 h/cycle, Test Bd, IEC 68-2-30	$\|DV_n/V_n$ @ 1 mA$\|$ < 10% R > 10MΩ
	Thermal Shock	CECC 42000, Test 4.12, Test Na, IEC 68-2-14 5 cycles UCT/LCT, 30 minutes	$\|DV_n/V_n$ @ 1 mA$\|$ < 10% no visible damage
	Steady State Damp Heat	CECC 42000, Test 4.17, Test Ca, IEC 68-2-3 56 days 40ºC, 93% RH	$\|DV_n/V_n$ @ 1 mA$\|$ < 10% R > 10MΩ
Mechanical Reliability	Solderability	CECC 42000, Test 4.10.1, Test Ta, IEC 68-2-20 solder bath method, 235ºC ± 5ºC, 2 s	Solderable at shipment and after 6 months of storage
	Resistance to Soldering Heat	CECC 42000, Test 4.10.2., Test Tb, IEC 68-2-20 260ºC ± 5ºC, 10 s	$\|DV_n/V_n$ @ 1 mA$\|$ < 5%
	Robustness of Termination	CECC 42000, Test 4.11 Test Ua, IEC 68-2-21	$\|DV_n/V_n$ @ 1 mA$\|$ < 5%
	Vibration	CECC 42000, Test 4.15., Test Fc, IEC 68-2-6, Frequency range 10 to 55 Hz Amplitude 0.75mm or 98 m/s^2 Total duration 6 h (3 x 2 h) Waveshape - half sine	$\|DV_n/V_n$ @ 1 mA$\|$ < 10% no visible damage
	Mechanical Shock	CECC 42000, Test 4.14, Test Ea, IEC 68-2-27 Acceleration = 490 m/s^2, Pulse duration = 11 ms, Waveshape - half sine Number of shocks = 3 x 6	$\|DV_n/V_n$ @ 1 mA$\|$ < 10% no visible damage
Fire Hazard	Flammability Test	CECC 42000, Test 4.18.1 or IEC 695-2-2 Needle Flame Test, 10 s	Maximum 5 s

Soldering Recommendations

The techniques used for soldering of components in surface mount technology are Infrared Reflow, Wave and Vapor Phase. With Wave soldering SMD Varicon is attached to the circuit board by an adhesive. The assembly is then placed on a conveyor and run through the soldering process to contact the wave. With Infrared Reflow and Vapor Phase Reflow, SMD Varicon is placed in a solder paste on the substrate. When the solder paste is heated it reflows and solders the unit to the board. Typical recommended solder paste wet layer thickness is 25 to 40 µm.

Recommended solders are 62Sn/36Pb/2Ag, 60Sn/40Pb or Pb free ones.

We recommend the following fluxes (either as a part of the solder paste or themselves):

- non-activated ® flux in cases where it is possible
- mildly activated (RMA) fluxes of class L3CN (such as Multicore Noclean low residue X33F8S-07i flux)
- and class ORL0 (such as Kester VOC Free No Clean977 flux)

Not to be used: activated (RA), water soluble or strong acidic fluxes with chlorine content exceeding 0.2wt %. In case of Wave soldering solvent from the flux must be completely dried before soldering.

To avoid the possibility of generating stress due to the thermal shock, a preheat state to within 100ºC of the peak temperature is recommended. Additionally SMD Varicon should not be subjected to a thermal gradient sleeper than 4ºC/s, the ideal one being 2ºC/s. Peak temperature should be rigidly controlled as well. Examples of soldering conditions for SMD Varicons are given in Fig. 1 to 3.

In case where several different parts are soldered, each having different soldering conditions, use those conditions requiring the least heat and minimum time.

Once soldering has been completed, it is still necessary to ensure that any further thermal shocks are avoided. The hot printed circuit board must be allowed to cool to less than 50ºC before cleaning.

Inspection criteria for soldered SMD Varicons on the board in case of Wave and Reflow soldering are given in Fig. 4.

In case of Vapor Phase Soldering of AgPb end terminations and when peak soldering temperature is < 210ºC the effect of negative or mirror meniscus appears as shown in Fig. 5. The reason is the following: solder forms metallurgical junction with the whole volume of end termination, i.e., it diffuses from pad to end termination across its inner side, forming “negative” or “mirror” meniscus. Height of solder penetration can be clearly seen on the end termination and is always higher than 30% of the chip height.

In case of Ni-barrier end terminations, solder forms metallurgical junction with thin Sn layer (on top of Ni-barrier), and due to its small volume “climbs” the outer side of chip forming classical meniscus as given in Fig. 5.

Both AgPb and Ni-barrier end terminations form reliable metallurgical and electrical contacts between end termination and pads. The same holds for strength of adhesion between end termination and pads, being tested either by vertical upward pull or horizontal force applied to chip. The only difference is optical appearance of meniscus and this should be taken in consideration when programming visual inspection of the PCB after soldering.

Tests related to soldering

We perform the following tests on each lot of Varicons. Samples from each lot are kept for minimum of 2 years and we can check their solderability if the customer needs that information at any time within this period.

Fig. 1: Infrared Reflow Temperature Profile

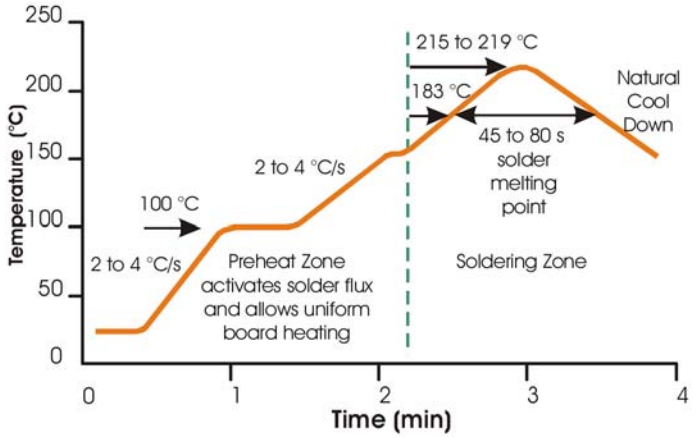


Fig. 2: Wave Soldering Temperature Profile

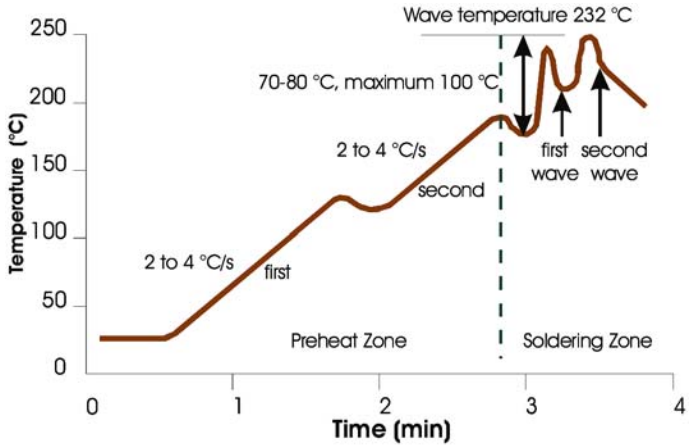
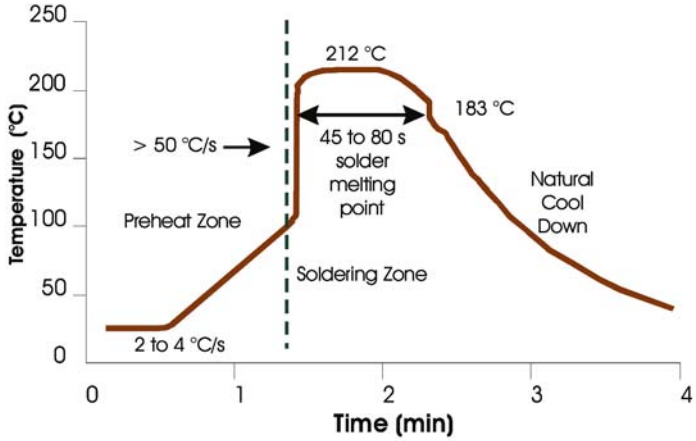


Fig. 3: Vapor Phase Temperature Profile



Soldering Specifications				
Test Parameter	Resistance to Flux	Solderability	Static Leaching	Dynamic Leaching
Soldering method	Dipping	Dipping	Dipping	Dipping with agitation
Flux	L3CN ORLO	L3CN ORLO, R	L3CN ORLO, R	L3CN ORLO, R
Soldering method	62Sn/36 Pb/2 Ag	62Sn/36 Pb/2 Ag	62Sn/36 Pb/2 Ag	62Sn/36 Pb/2 Ag
Sodering temperature (C)	235 ± 5	235 ± 5	260 ± 5	235 ± 5
Soldering Time	2	2	10	>15
Burn-in Conditions	Vdcmax, 48 h	-	-	-
Acceptance Criteria	Vn < 5% I_{dc} must stay unchanged	> 95% of end terminal must be covered by solder	> 95% of end terminal must be covered by solder	> 95% of end terminal must be covered by solder

Reworking with Solder Iron

Do not allow the tip to directly become in contact to the top of the chip. The following conditions must be strictly followed when using a soldering iron:

- Soldering iron power output: 30 Wmax
- Temperature of soldering iron tip: 280ºC max
- Soldering time: 10 s max

Environment Friendly End Terminations

SMD Varicons with AgPb end terminations have soldering performance very close to Ni-barrier ones without use of environmentally problematic Ni-plating process – so we can call them environment friendly. Comparison of SMD Varicon soldering curve typical to AgPb and Ni-barrier ones is given in the Fig. 6.

Storage

SMD Varicons should be used within 1 year. They are to be left in the original package in order to avoid soldering problems caused by oxidized terminals. Air humidity should be less than 40%. In case that SMD Varicons have been in the stock longer than 1 year, KEKO VARICON can refresh them if necessary.

Fig. 4: Soldering Criteria in case of Wave and IR Reflow Soldering

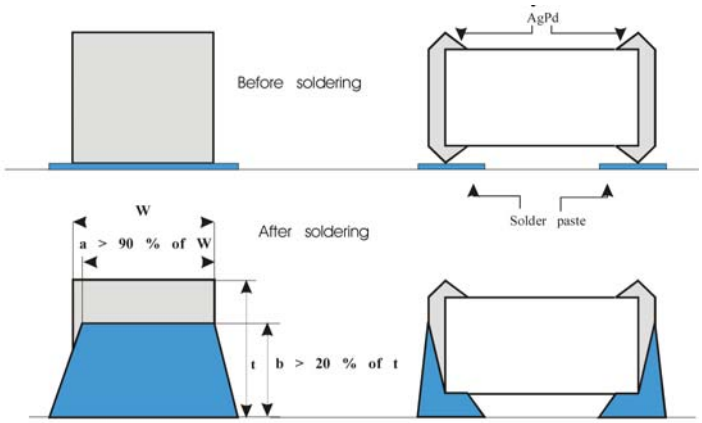


Fig. 5: Soldering Criteria in case of Vapor Soldering

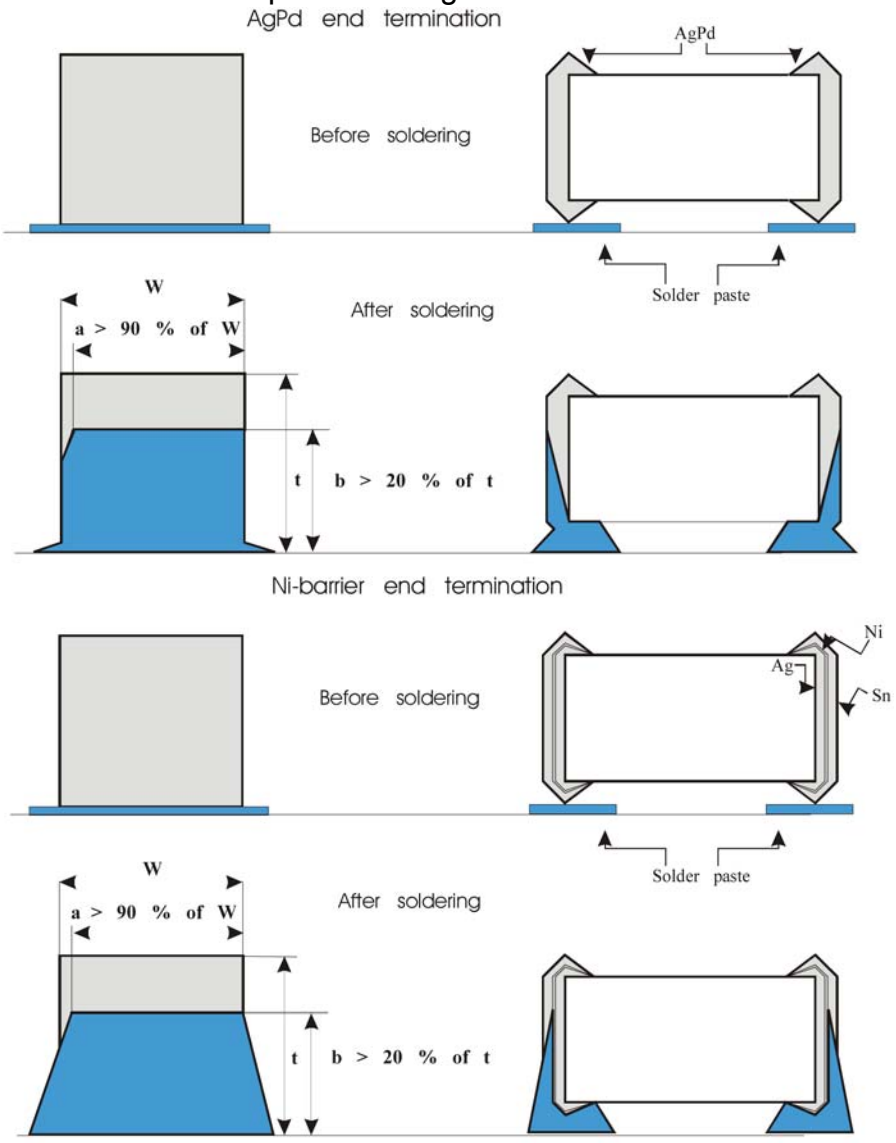


Fig. 6: Soldering Temperature-Time Characteristics