

# CeraDiodes

## Soldering directions

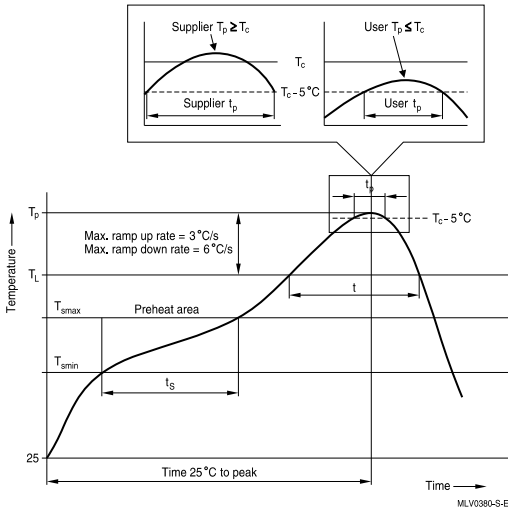
Date: July 2014

## Soldering directions

### 1 Recommended soldering temperature profiles

#### 1.1 Reflow soldering temperature profile

Recommended temperature characteristic for reflow soldering following JEDEC J-STD-020D



Profile feature		Sn-Pb eutectic assembly	Pb-free assembly
Preheat and soak			
- Temperature min	$T_{smin}$	100 °C	150 °C
- Temperature max	$T_{smax}$	150 °C	200 °C
- Time	$t_{smin}$ to $t_{smax}$	60 ... 120 s	60 ... 180 s
Average ramp-up rate	$T_{smax}$ to $T_p$	3 °C/ s max.	3 °C/ s max.
Liquidous temperature	$T_L$	183 °C	217 °C
Time at liquidous	$t_L$	60 ... 150 s	60 ... 150 s
Peak package body temperature	$T_p$ <sup>1)</sup>	220 °C ... 235 °C <sup>2)</sup>	245 °C ... 260 °C <sup>2)</sup>
Time ( $t_p$ ) <sup>3)</sup> within 5 °C of specified classification temperature ( $T_c$ )		20 s <sup>3)</sup>	30 s <sup>3)</sup>
Average ramp-down rate	$T_p$ to $T_{smax}$	6 °C/ s max.	6 °C/ s max.
Time 25 °C to peak temperature		maximum 6 min	maximum 8 min

1) Tolerance for peak profile temperature ( $T_p$ ) is defined as a supplier minimum and a user maximum.

2) Depending on package thickness. For details please refer to JEDEC J-STD-020D.

3) Tolerance for time at peak profile temperature ( $t_p$ ) is defined as a supplier minimum and a user maximum.

**Note:** All temperatures refer to topside of the package, measured on the package body surface.  
Number of reflow cycles: 3

## Soldering directions

### 2 Soldering guidelines

The use of mild, non-activated fluxes for soldering is recommended, as well as proper cleaning of the PCB.

The components are suitable for reflow soldering to JEDEC J-STD-020D.

### 3 Solder joint profiles / solder quantity

#### 3.1 Cement quantity

The component is fixed onto the circuit board with cement prior to soldering. It must still be able to move slightly. When the board is placed into the reflow oven, excessively rigid fixing can lead to high forces acting on the component and thus to a break. In addition, too much cement can lead to unsymmetrical stressing and thus to mechanical fracture of the component. The cement must also be so soft during mounting that no mechanical stressing occurs.

#### 3.2 Mounting the components on the board

It is best to mount the components on the board before soldering so that one termination does not enter the oven first and the second termination is soldered subsequently. The ideal case is simultaneous wetting of both terminations.

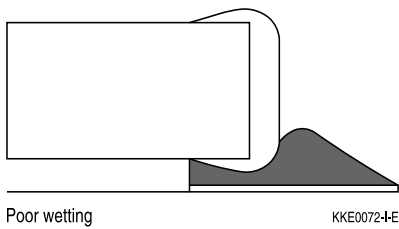
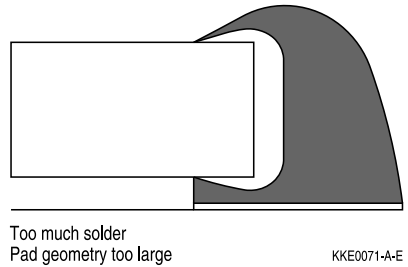
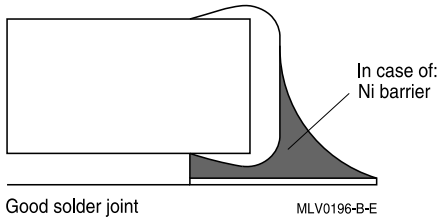
#### 3.3 Solder joint profiles

If the meniscus height is too low, that means the solder quantity is too low, the solder joint may break, i.e. the component becomes detached from the joint. This problem is sometimes interpreted as leaching of the external terminations.

If the solder meniscus is too high, i.e. the solder quantity is too large, the vise effect may occur. As the solder cools down, the solder contracts in the direction of the component. If there is too much solder on the component, it has no leeway to evade the stress and may break, as in a vise.

## Soldering directions

### 3.3.1 Solder joint profiles for nickel barrier termination



Good and poor solder joints caused by amount of solder in infrared reflow soldering

## Soldering directions

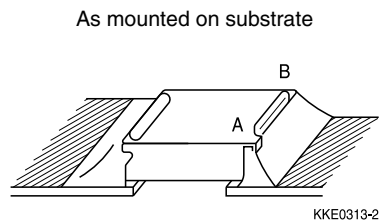
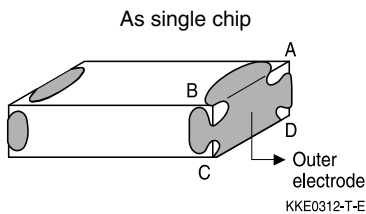
### 4 Solderability tests

Test	Standard	Test conditions / Sn-Pb soldering	Test conditions / Pb-free soldering	Criteria / test results
Wettability	IEC 60068-2-58	Immersion in 60/40 SnPb solder using non-activated flux at $215 \pm 3$ °C for $3 \pm 0.3$ s	Immersion in Sn96.5Ag3.0Cu0.5 solder using non- or low activated flux at $245 \pm 5$ °C for $3 \pm 0.3$ s	Covering of 95% of end termination, checked by visual inspection
Leaching resistance	IEC 60068-2-58	Immersion in 60/40 SnPb solder using mildly activated flux without preheating at $255 \pm 5$ °C for $10 \pm 1$ s	Immersion in Sn96.5Ag3.0Cu0.5 solder using non- or low activated flux without preheating at $255 \pm 5$ °C for $10 \pm 1$ s	No leaching of contacts
Tests of resistance to soldering heat for SMDs	IEC 60068-2-58	Immersion in 60/40 SnPb for 10 s at 260 °C	Immersion in Sn96.5Ag3.0Cu0.5 for 10 s at 260 °C	Capacitance change: $-15\% \leq \Delta C \leq 15\%$

#### Note:

#### Leaching of the termination

Effective area at the termination might be lost if the soldering temperature and/or immersion time are not kept within the recommended conditions. Leaching of the outer electrode should not exceed 25% of the chip end area (full length of the edge A-B-C-D) and 25% of the length A-B, shown below as mounted on the substrate.



## Soldering directions

### 5 Notes for proper soldering

#### 5.1 Preheating and cooling

- The average ramp-up rate must not exceed 3 °C/s.
- The cooling rate must not exceed 8 °C/s.

#### 5.2 Repair / rework

Manual soldering with a soldering iron must be avoided, hot-air methods are recommended for making repairs.

#### 5.3 Cleaning

All environmentally compatible agents are suitable for cleaning. Select the appropriate cleaning solution according to the type of flux used. The temperature difference between the components and cleaning liquid must not be greater than 100 °C. Ultrasonic cleaning should be carried out with the utmost caution. Too high ultrasonic power can impair the adhesive strength of the metalized surfaces. Insufficient or excessive cleaning can be detrimental to CeraDiode performance.

#### 5.4 Solder paste printing (reflow soldering)

An excessive application of solder paste results in too high a solder fillet, thus making the chip more susceptible to mechanical and thermal stress. This will lead to the formation of cracks. Too little solder paste reduces the adhesive strength on the outer electrodes and thus weakens the bonding to the PCB. The solder should be applied smoothly to the end surface to a height of min. 0.2 mm.

#### 5.5 Selection of flux

Used flux should have less than or equal to 0.1 wt % of halogenated content, since flux residue after soldering could lead to corrosion of the termination and/or increased leakage current on the surface of the CeraDiode. Strong acidic flux must not be used. The amount of flux applied should be carefully controlled, since an excess may generate flux gas, which in turn is detrimental to solderability.

#### 5.6 Storage

Solderability is guaranteed for one year from date of delivery, provided that components are stored in their original packages.

Storage temperature: -25 °C to +45 °C

Relative humidity: ≤75% annual average, ≤95% on 30 days a year

The solderability of the external electrodes may deteriorate if SMDs are stored where they are exposed to high humidity, dust or harmful gas (hydrogen chloride, sulfurous acid gas or hydrogen sulfide).

Do not store SMDs where they are exposed to heat or direct sunlight. Otherwise the packing material may be deformed or SMDs may stick together, causing problems during mounting.

After opening the factory seals, such as polyvinyl-sealed packages, it is recommended to use the SMDs as soon as possible.

## Soldering directions

Solder CTVS components after shipment from EPCOS within the time specified:

CTVS with Ni barrier termination:	12 months
CTVS with AgPt termination:	6 months
SHCV (leaded components):	24 months

### 5.7 Placement of components on circuit board

It is of advantage to place the components on the board before soldering so that their two terminals do not enter the solder oven at different times. Ideally, both terminals should be wetted simultaneously.

### 5.8 Soldering caution

- Sudden heating or cooling of the component results in thermal destruction by cracks.
- An excessively long soldering time or high soldering temperature results in leaching of the outer electrodes, causing poor adhesion due to loss of contact between electrodes and termination.
- Avoid manual soldering with a soldering iron.
- Wave soldering must not be applied for CeraDiodes designated for reflow soldering only.
- Keep to the recommended down-cooling rate.

### 5.9 Standards

CECC 00802  
IEC 60068-2-58  
IEC 60068-2-20  
JEDEC J-STD-020D