Assembly Instructions

GENERAL

Optoelectronic semiconductor devices can be mounted in any position. Connection wires may be bent provided the bend is not less than 1.5 mm from bottom of case. During bending, no forces must be transmitted from pins to case (e.g., by spreading the pins).
If the device is to be mounted near heat generating components, the resultant increase in ambient temperature should be taken into account.

SOLDERING INSTRUCTIONS

Protection against overheating is essential when a device is being soldered. It is recommended, therefore, that the connection wires be left in place as long as possible. The maximum permissible device junction temperature should be exceeded for as little time as possible, and for no longer than specified in the solder profiles, during the soldering process.
In case of plastic encapsulated devices, the maximum permissible soldering temperature is governed by the maximum permissible heat that may be applied to encapsulants rather than by the maximum permissible junction temperature.
Maximum soldering iron (or solder bath) temperatures are given in table 1. During soldering, no forces must be transmitted from pins to case (e.g., by spreading pins).

SOLDERING METHODS

There are several methods in use to solder devices onto the substrate. Some of them are listed in the following sections.

Vapor Phase Soldering

Soldering in saturated vapor is also known as condensation soldering. This soldering process is used as a batch system (dual vapor system) or as a continuous single vapor system. Both systems may also include preheating of the assemblies to prevent high-temperature shock and other undesired effects.

Infrared soldering

With infrared (IR) reflow soldering the heating is contact-free and the energy for heating the assembly is derived from direct infrared radiation and from convection (Refer to CECC00802).
The heating rate in an IR furnace depends on the absorption coefficients of the material surfaces and on the ratio of component's mass to its irradiated surface.
The temperature of components in an IR furnace, with a mixture of radiation and convection, cannot be determined in advance. Temperature measurement may be performed by measuring the temperature of a certain component while it is being transported through furnace.
The temperatures of small components, soldered together with larger ones, may rise up to 280 °C.
The following parameters influence the internal temperature of a component:

- Time and power
- Mass of component
- Size of component
- Size of printed circuit board
- Absorption coefficient of surfaces
- Packaging density
- Wavelength spectrum of radiation source
- Ratio of radiated and convected energy

Temperature-time profiles of the entire process and the above parameters are given in figures 1 and 2.

TABLE 1- MAXIMUM SOLDERING TEMPERATURES

	IRON SOLDERING			WAVE SOLDERING		
	IRON TEMPERATURE	DISTANCE OF THE SOLDERING POSITION FROM THE LOWER EDGE OF THE CASE	MAXIMUM ALLOWABLE SOLDERING TIME	SOLDERING TEMPERATURE SEE TEMPERATURE TIME PROFILES	DISTANCE OF THE SOLDERING POSITION FROM THE LOWER EDGE OF THE CASE	MAXIMUM ALLOWABLE SOLDERING TIME
Devices in metal case	≤ 245 °C	≥ 1.5 mm	5 s	245 °C	≥ 1.5 mm	5 s
	≤ 245 °C	≥ 5.0 mm	10 s			
	≤ 350 °C	≥ 5.0 mm	5 s	300 °C	≥ 5.0 mm	3 s
Devices in plastic case > 3 mm	≤ 260 °C	≥ 2.0 mm	5 s	235 °C	≥ 2.0 mm	8 s
	≤ 300 °C	≥ 5.0 mm	3 s	260 °C	≥ 2.0 mm	5 s
Devices in plastic case ≤ 3 mm	≤ 300 °C	≥ 5.0 mm	3 s	260 °C	≥ 2.0 mm	3 s

Wave soldering

In wave soldering, one or more continuously replenished waves of molten solder are generated, while the substrates to be soldered are moved in one direction across the wave's crest.
Temperature-time profiles of the entire process are given in figure 3.

Iron soldering

This process cannot be carried out in a controlled way.
It should not be considered for use in applications where reliability is important. There is no SMD classification for this process.

Laser soldering

This is an excess heating soldering method. The energy absorbed may heat device to a much higher temperature than desired. There is no SMD classification for this process at the moment.

Resistance soldering

This is a soldering method which uses temperature controlled tools (thermodes) for making solder joints. There is no SMD classification for this process at the moment.

WARNING

Surface-mount devices are sensitive to moisture release if they are subjected to infrared reflow or a similar soldering process (e.g. wave soldering). After opening the bag, they must be:

1. stored at ambient of < 20 % relative humidity (RH)
2. mounted within floor life specified on MSL sticker under factory conditions of T_{amb} < 30 °C/RH < 60 %

Devices require baking before mounting if 1. or 2. is not met and the humidity indicator card is > 20 % at 23 ± 5 °C. If baking is required, devices may be baked for 192 h at 40 °C + 5 °C - 0 °C and < 5 % RH.

TEMPERATURE-TIME PROFILES

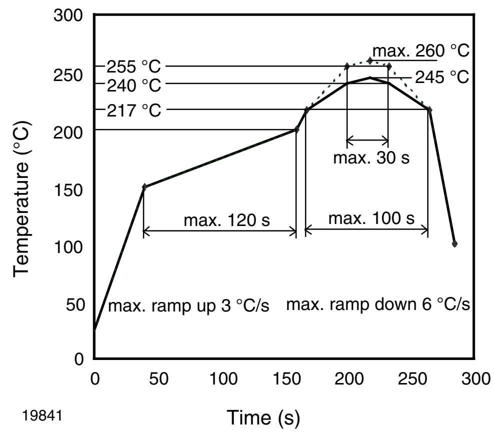

Fig. 1 - Lead (Pb)-free (Sn) Infrared Reflow Solder Profile acc. J-STD020D for Surface-Mount Components

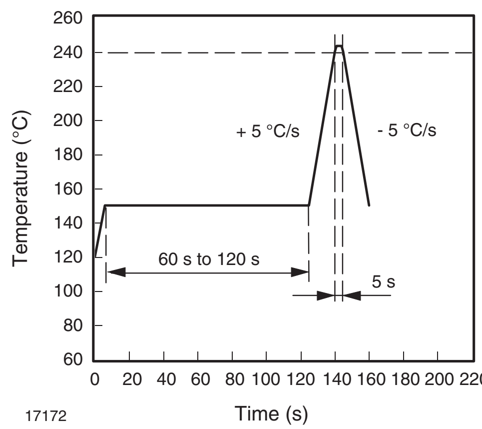

Fig. 2 - Infrared Reflow SnPb Solder Profile for Surface-Mount Components like TEMx1xxx and TSMx1xxx

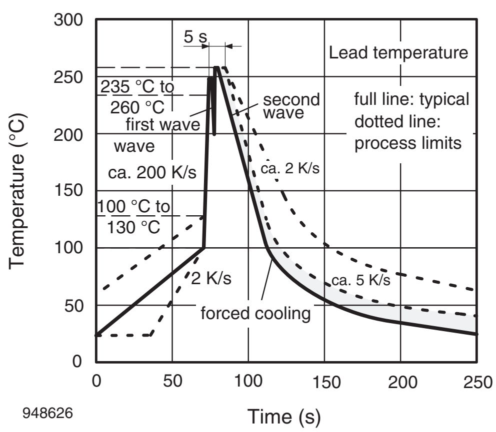

Fig. 3 - Double Wave Solder Profile for Leaded Components

HEAT REMOVAL

To maintain thermal equilibrium, the heat generated in the semiconductor junction(s) must be removed to keep the junction temperature below specified maximum.

In case of low-power devices, the natural heat conductive path between the case and surrounding air is usually adequate for this purpose. The heat generated in the junction is conveyed to the case or the header by conduction rather than convection. A measure of the effectiveness of heat conduction is the inner thermal resistance or the junction-to-case thermal resistance, R_{thJC}, which is governed by the device construction.

Any heat transfer from the case to the surrounding air involves radiation convection and conduction, the effectiveness of transfer being expressed in terms of an R_{thCA} value, i.e., external or case ambient thermal resistance. The total junction-to-ambient thermal resistance is consequently:

$R_{thJA} = R_{thJC} + R_{thCA}$

The total maximum power dissipation, $P_{totmax.}$ of a semiconductor device can be expressed as follows:

$$P_{totmax.} = \frac{T_{jmax.} - T_{amb}}{R_{thJA}} = \frac{T_{jmax.} - T_{amb}}{R_{thJC} + R_{thCA}}$$

where:

$T_{jmax.}$ the maximum allowable junction temperature

T_{amb} the highest ambient temperature likely to be reached under the most unfavorable conditions

R_{thJC} junction-to-case thermal resistance

R_{thJA} the junction-to-ambient thermal resistance, is specified for the components. The following diagram shows how the different installation conditions effect the thermal resistance

R_{thCA} the case-to-ambient thermal resistance, R_{thCA}, depends on cooling conditions. If a heat dissipator or sink is used, R_{thCA} depends on the thermal contact between the case and heat sink, upon the heat propagation conditions in the sink, and upon the rate at which heat is transferred to the surrounding air

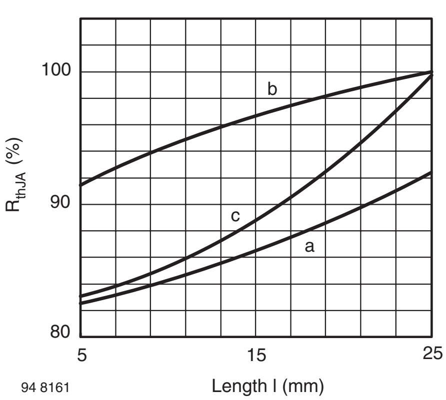

Fig. 4 - Junction-to-Ambient Thermal Resistance vs.

Lead Length at Different Assembly

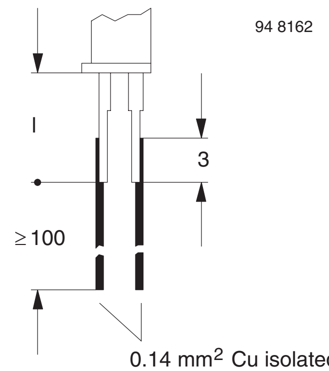

Fig. 5 - In Case of Wire Contacts (Curve B, Figure 4)

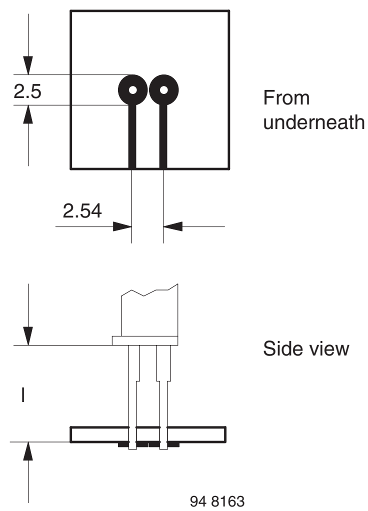

Fig. 6 - In Case of Assembly on PC Board, no Heatsink (Curve C, Figure 4)

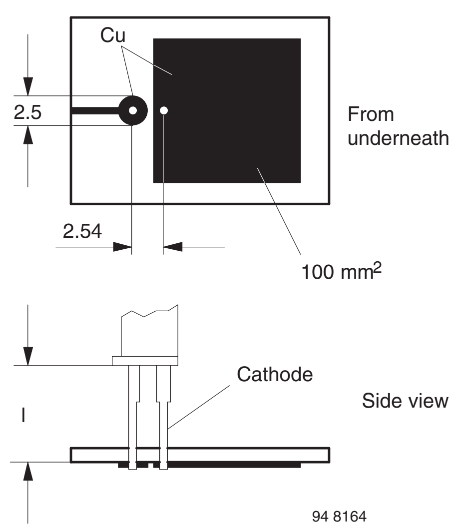

Fig. 7 - In Case of Assembly on PC Board, with Heatsink (Curve A, Figure 4)