



NOTE

All numerical values are in metric units [with U.S. customary units in brackets]. Dimensions are in millimeters. Unless otherwise specified, dimensions have a tolerance of ± 0.13 mm and angles have a tolerance of $\pm 2^\circ$. Figures and illustrations are for identification only and are not drawn to scale.

1. INTRODUCTION

This specification covers the Inverted Thru Board Platform for both Card Edge and Poke-In Applications. In both cases, power can be routed to the LEDs on a printed circuit (pc) board thru the pc board via these connector families. The Card Edge version allows the mating of a LED driver pc board perpendicular to the LED pc board. The Poke-In version allows discrete wires ranging from 26 AWG to 18 AWG to poke into the bottom of the connector. The low-profile flat top design minimizes interference of the light cone from the adjacent LEDs, and provides a convenient pick up location for automated pick-and-place machinery. The connectors share a common pc board footprint and are packaged in tape and reel per EIA-481.

When corresponding with TE Connectivity (TE) Personnel, use the terminology provided in this specification to facilitate your inquiries for information. Basic terms and features of this product are provided in Figure 1.

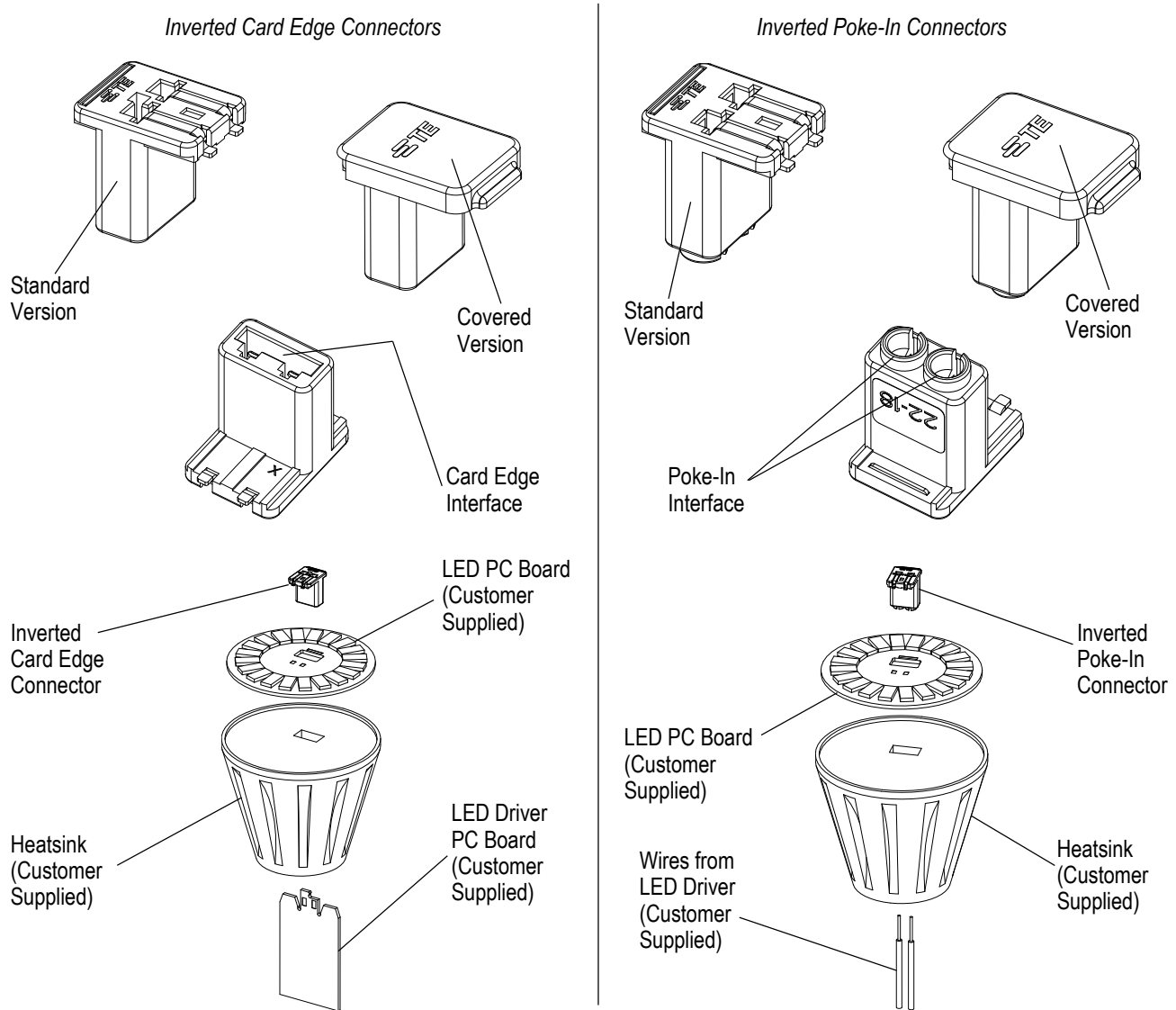


Figure 1

2. REFERENCE MATERIAL

2.1. Revision Summary

- Added or changed information in Paragraph 3.7.A, table in Figure 5, and Figures 8 and 9

2.2. Customer Assistance

Reference Product Base Part Numbers 2213188, 2213189 and Product Code L739 are representative of Inverted Card Edge and Inverted Poke-In Connectors. Use of these numbers will identify the product line and help you to obtain product and tooling information. Such information can be obtained through a local TE Representative, by visiting our website at www.te.com, or by calling PRODUCT INFORMATION or the TOOLING ASSISTANCE CENTER at the numbers at the bottom of page 1.

2.3. Drawings

Customer Drawings for product part numbers are available from the service network. If there is a conflict between the information contained in the Customer Drawings and this specification or with any other technical documentation supplied, the information contained in the Customer Drawings takes priority.

2.4. Manuals

Manual [402-40](#) can be used as a guide to soldering. This manual provides information on various flux types and characteristics with the commercial designation and flux removal procedures. A checklist is included in the manual as a guide for information on soldering problems.

2.5. Specifications

Product Specification [108-32040](#) provides product performance and test information for the Inverted Poke-In Connector; and Product Specification [108-32041](#) for the Inverted Card Edge Connector. Workmanship Specification IPC-A-610 and provides solderability requirements and evaluation methods.

3. REQUIREMENTS

3.1. Safety

Do not stack product shipping containers so high that the containers buckle or deform.

3.2. Limitations

The connectors are designed to operate in a temperature range of -40° to 130°C [-40° to 266°F].

3.3. Material

The housing is made of UL 94V-0 rated thermoplastic. The contacts and hold-downs are made of copper alloy, under-plated with nickel, and plated overall with tin.

3.4. Storage

A. Ultraviolet Light

Prolonged exposure to ultraviolet light may deteriorate the chemical composition used in the product material.

B. Shelf Life

The product should remain in the shipping containers until ready for use to prevent deformation to components. The product should be used on a first in, first out basis to avoid storage contamination that could adversely affect performance.

C. Chemical Exposure

Do not store product near any chemical listed below as they may cause stress corrosion cracking in the material.

Alkalies	Ammonia	Citrates	Phosphates	Citrates	Sulfur Compounds
Amines	Carbonates	Nitrites	Sulfur	Nitrites	Tartrates

D. Reeled Products

Care must be taken to prevent stretching, sagging, or other distortion that would prevent smooth feeding of the tape and reel through automatic machine feed mechanisms. Store coil wound reels horizontally and traverse wound reels vertically.

3.5. Wire Selection and Preparation for Inverted Poke-In Connectors

A. Wire Selection and Preparation

Inverted Poke-In Connectors will accept 24 and 26 AWG solid copper wire or alternately, 18, 20, and 22 AWG solid copper wire; 18 and 20 AWG prebond copper wire; and 18 AWG stranded copper wire. See the customer print to determine the wire gage range for each specific part number of the Inverted Poke-In Connector.

The Inverted Poke-In connectors are provided with markings on the side of the connector to indicate the wire gage range. Connectors marked 26-24 and 22-18 for wire gage ranges from 22 to 24 AWG and 22 to 18 AWG respectively. The table in Figure 2 provides wire selection for the Poke-In Connectors. The wire strip length is 7.25 ± 0.75 mm for the poke-in cavity with an insulation diameter of <2.10 mm for connectors marked with 22-18 and an insulation diameter <1.40 mm for connectors marked with 26-24. See Figure 2.

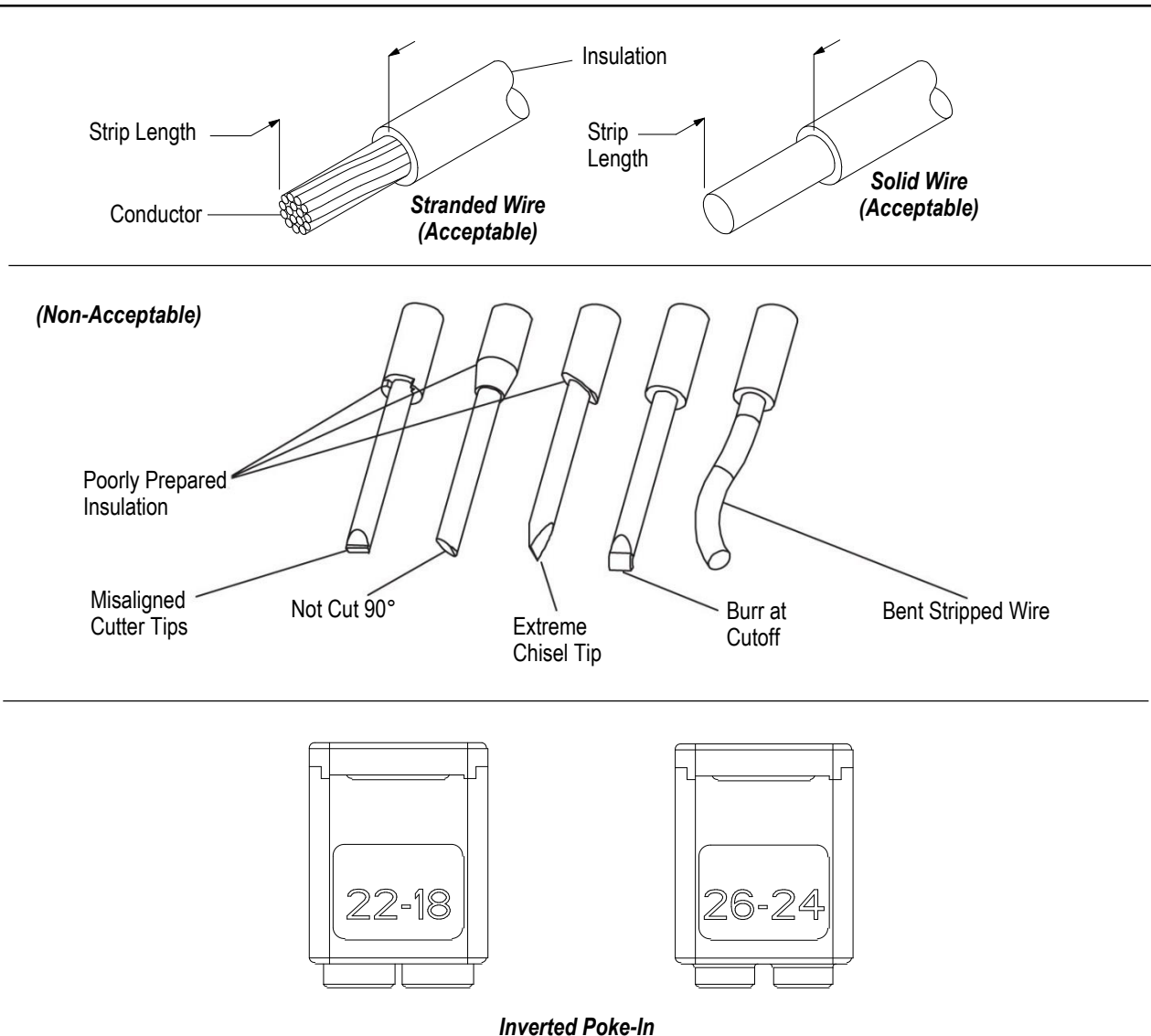


Figure 2 (cont'd)

RECOMMENDED WIRE FOR INVERTED POKE-IN CONNECTORS 2213189-[]				
MARKING ON 2213189-[]	MAX INSULATION Ø	WIRE GAGE	WIRE TYPE	WIRE STRAND
22-18	2.1 mm	18	UL 1007-18	Solid
22-18		18	UL 1007-18 (16)	Prebond
22-18		18	UL 1007-18 (16)	Stranded
22-18		20	UL 1007-20	Solid
22-18		20	UL 1007-20 (7)	Prebond
22-18		22	UL 1007-22	Solid
26-24	1.4 mm	24	UL 1007-24	Solid
26-24		26	UL 1007-26	Solid

Figure 2 (end)



NOTE

If stranded wire is used, it must be 16 strands, if prebond wire is used, the strand count must be 16 strands or less.



NOTE

When preparing stranded wire, it is recommended NOT to twist strands after stripping the insulation. The stranded wire will insert best if the strands are straight (or slightly twisted) as the wire is manufactured.

B. Workmanship



CAUTION

The housing must not be damaged in any way. There shall be no bending of the contacts. There shall be no exposed copper wire or broken or bent conductor strands.

C. Conductor Insertion

All wires must be pushed firmly inside the contact wire openings. The wires must be fully inserted so that the wire insulation is inserted into and surrounded by the end of the housing. Refer to Figure 3.

D. Wire Termination Depth

The required wire termination depth is achieved when the wire, with insulation stripped to 7.25 ± 0.75 mm, has bottomed in the connector housing. Refer to Figure 3.

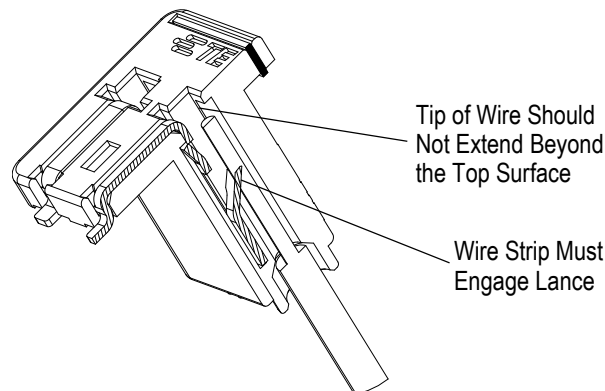


Figure 3

3.6. Strain Relief

It is recommended that a means be provided to support the wire bundle extending away from the connector to prevent inadvertent application of high force to the wire bundle from transmitting into the wire/connector interface. When the wire/connector interface is expected to be exposed to a force greater than 22 N [5.0 lbs], an external strain relief is recommended. An external strain relief is also recommended for 18 AWG 16-stranded wire. The suggested strain relief method is to use a cable tie and anchor. Refer to Figure 4.

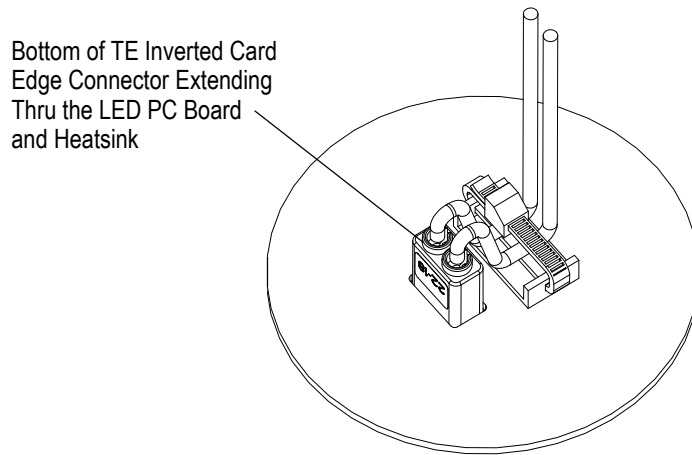


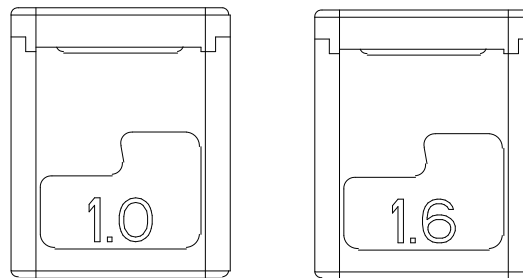
Figure 4

3.7. PC Board

A. Material and Thickness

Glass epoxy (FR-4 or G-10) or Insulated Metal Substrate (IMS) pc boards may be used for both the LED pc board and the LED driver pc board. The LED driver board thickness should be 1.0 mm $\pm 10\%$ (0.8 mm $\pm 10\%$) or 1.6 mm $\pm 10\%$. See Figure 5.

The Inverted Card Edge Connectors have markings on the side of the housing that indicate the pc board range. Connectors marked with 1.0 are intended for use with 1.0 mm (or 0.8 mm) thick pc boards. Connectors marked with 1.6 are intended for use with 1.6 mm thick pc boards. Please refer to Figure 5 for the pc board thickness and tolerance. Also note, that the pc board thickness specification must be met over the mating tab contact pad areas as shown in Figure 8B. The contact pads that mate to the Inverted Card Edge Connectors shall be plated with tin.



Inverted Card Edge

RECOMMENDED PC BOARD THICKNESS FOR INVERTED CARD EDGE CONNECTORS 2213188-[]		
MARKING ON 2213188	PC BOARD THICKNESS RANGE	PC BOARD THICKNESS TOLERANCE
1.0	1.0 [.039] or 0.8 [.031]	$\pm 10\%$
1.6	1.6 [.063]	$\pm 10\%$

Figure 5

The LED driver pc board should be designed to limit the insertion into the connector by extended tab features that extend from the pc board and provide a positive stop that butts against the bottom of the bulb heatsink. This prevents excessive mating travel that could peel the Inverted Card Edge connector off the top of the LED pc board. See Figure 6. The exact dimensions of the tabs will need to be determined in the final application and depends on the stack up thickness of the LED pc board and the heatsink section thickness below the LED pc board.

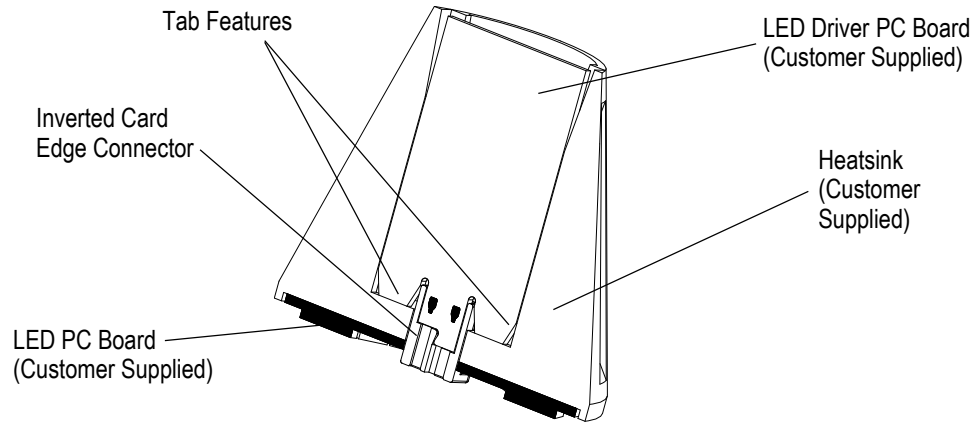


Figure 6

Also, slotted features should be designed into the heatsink to guide the Driver pc board into the Inverted Card Edge contact interface area on the connector. This prevents stubbing the Driver pc board against the bottom face of the connector, which could also peel the connector off the top of the LED pc board. See Figure 7.

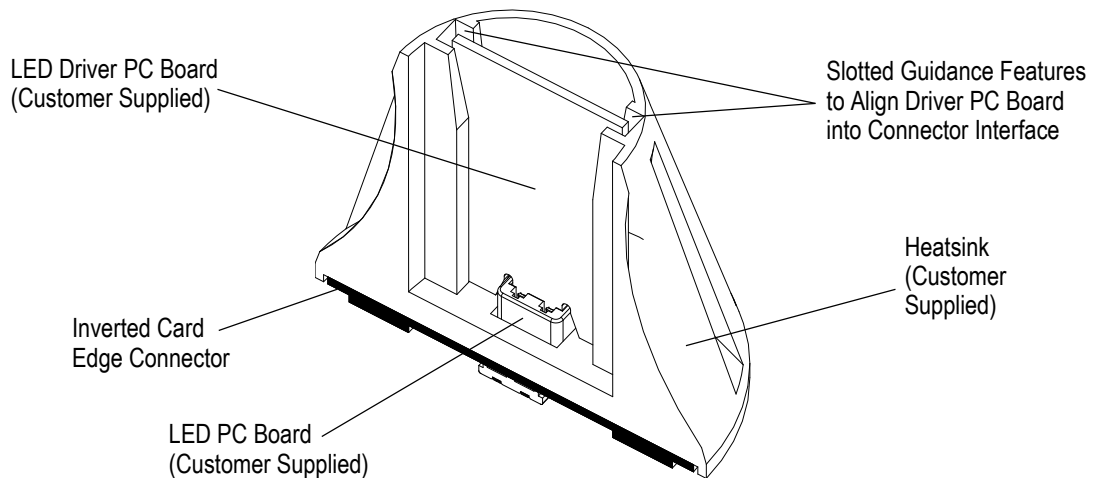


Figure 7



NOTE

It would be advisable to support the top side of the Inverted Card Edge and Inverted Poke-In connectors when possible to reduce the chance of mating forces peeling the connectors off the LED pc boards.

B. Tolerance

The maximum allowable bow of the pc board shall be 0.10 mm over the length of the connector.



CAUTION

Since the connector housings may rest on top of the solder mask, an excessively high mask will allow too much space between the solder tine and pad for a good solder joint. A solder joint under these conditions would be weak, and would not provide long-term performance for the connector.

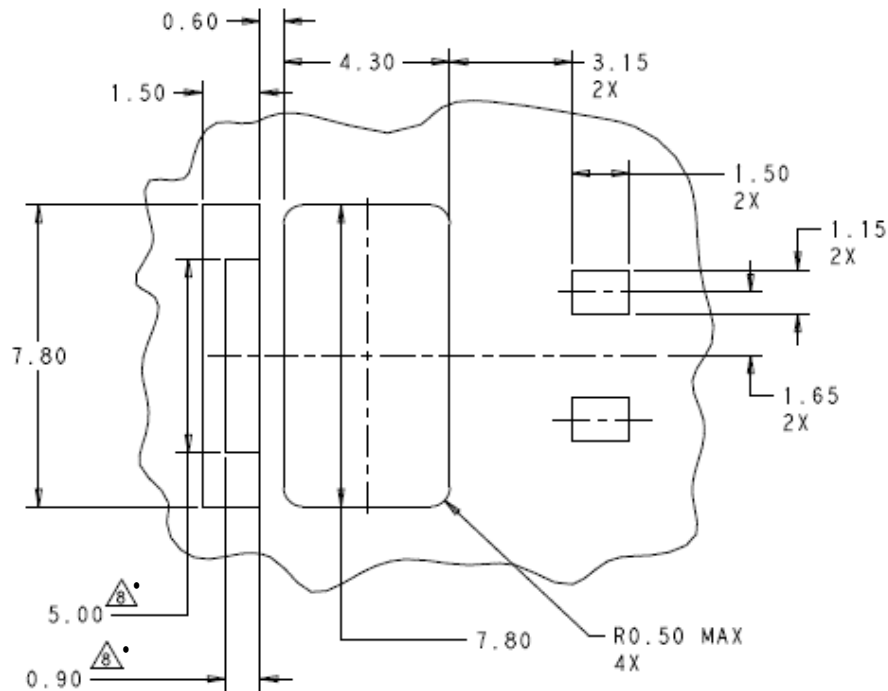
C. Pads

The pc board circuit pads must be solderable in accordance with IPC/EIA-J-STD-003 and Test Specification [TEC 109-11](#).

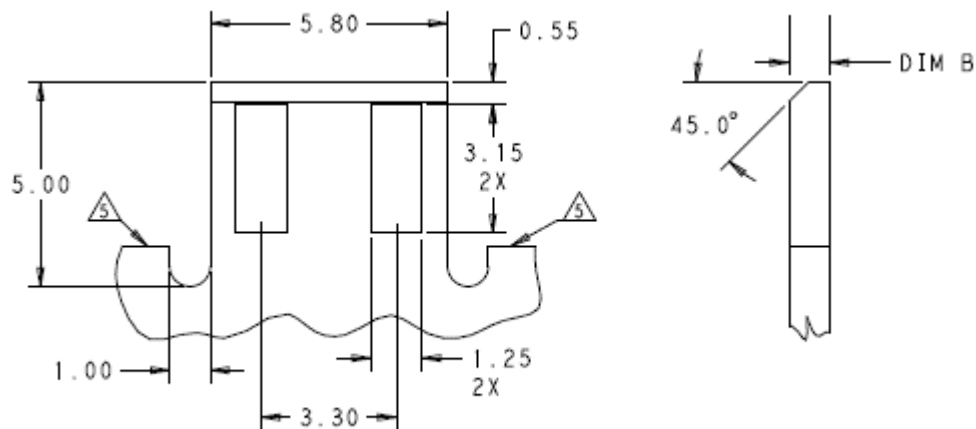
D. Layout

The pc board layout must be designed using the dimensions provided on the customer drawing for the specific connector. The recommended LED pc board layout is shown in Figure 8A. This layout is for the solder mask, and applies to both the Inverted Card Edge and the Inverted Poke-In Connectors. The copper layer of the LED pc board should be etched only enough to create the circuit to the LEDs and provide minimum creep and clearance distances between traces (minimum etching). Maximizing the copper pads used to mount the Inverted Connector will improve the connector's ability to resist peeling off the circuit board when the Driver pc board or Poke-In wires are mated to the bottom side.

The Driver pc board must have a profile as shown in Figure 8B. This profile can be modified to include or remove features as shown in Figure 9. The features options are standard layout with latching and keying, standard layout with the pad on the key side extended to create a make 1st option, an option to remove the pc board latch undercut feature, and an option to remove both the latch and key features.



•Dimension shown is recommended solder mask opening.



MATING PCB DETAILS (PREFERRED OPTION)

Figure 8

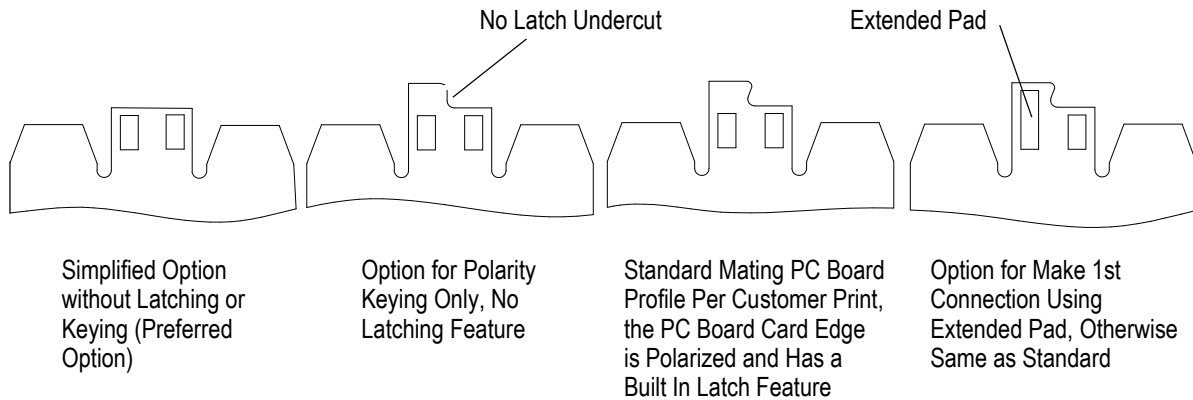


Figure 9

E. Mating Dimension

Figure 10 provides the mating dimension for customers designing their LED bulbs. This figure shows the distance from the ICE connector's solder tails to the mating pc board top edge and helps clarify the "z" position of a properly mated pc board.

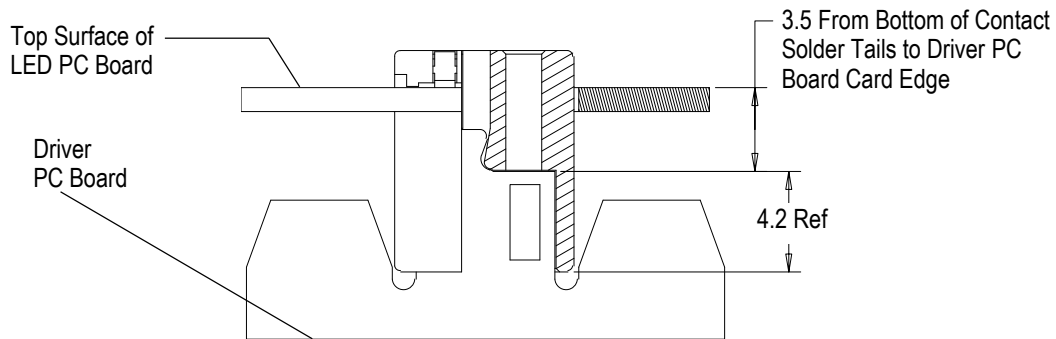


Figure 10

3.8. Connector Placement

This product is packaged in tape and reel packaging per EIA-481. Robotic/gripper placement requires total equipment accuracy of 0.13 mm to locate the connector for insertion. This includes gripper and fixture tolerances, as well as equipment repeatability. Insertion location will be programmed by a simple pantograph/template system or software package. Optimally, the contact solder tines should be centered on the pc board pads. It is imperative that the contact solder tines and board locks are sufficiently pressed into the solder paste. However, slight misalignment is permissible for the performance classifications specified in Association of Connecting Electronics Industries IPC J-STD-001, "Requirements for Soldering Electrical and Electronic Assemblies". See Figure 11.

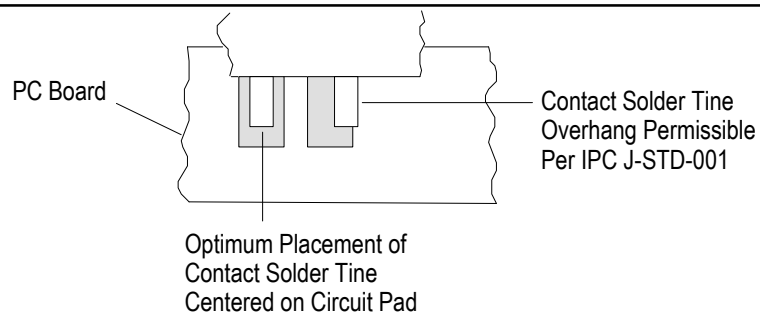


Figure 11

3.9. Flux Selection

Contacts must be fluxed prior to soldering with a mildly active, rosin base flux. Selection of the flux will depend on the type of pc board and other components mounted on the board. Additionally, the flux must be compatible with the wave solder line, manufacturing, health, and safety requirements. Flux that is compatible with the connectors is provided in Figure 12.

FLUX TYPE	ACTIVITY	RESIDUE	COMMERCIAL DESIGNATION	
			ALPHA	KESTER
RMA	Mild	Noncorrosive	611	186

Figure 12

3.10. Soldering

Observe guidelines and procedures when soldering contacts. Solder, clean, and dry all leads to contacts according to the following:

- The connectors should be soldered using vapor phase reflow (VPR), double-sided, non-focused infrared (IR), forced air convection, or equivalent soldering techniques.
- All solder joints should conform to the Workmanship Specification IPC-A-610 and IPC J-STD-001.

A. Solderability

The pc board pads must be solderable in accordance with IPC/EIA J-STD-003 and all other requirements for SMT contacts specified in this document.

B. Solder Paste Characteristics

- Alloy type shall be SAC 305; Sn 96.5/Ag 3.0/Cu 0.5.
- Flux incorporated in the paste shall be rosin, mildly active (RMA) type.
- Paste will be at least 80% solids by volume.
- Mesh designation -200 to +325 (74 to 44 square micron openings, respectively).
- Minimum viscosity of screen print shall be 5x10% cp (centipoise).
- Minimum viscosity of stencil print shall be 7.5x10% cp (centipoise).

C. Solder Volume



NOTE

Solder paste volumes are required as follows (calculated per 50% solids content). Paste volume may vary depending on the composition.

Solder volume for Inverted Card Edge Connector and Inverted Poke-In Connector is the same for both types. It is required to be 0.32 mm³ per contact solder tine and 0.88 mm³ per board lock (calculated per 50% solid content).

D. Screen or (Stencil)

The stencil aperture shall be determined by the circuit pad size and stencil thickness. It may be any shape as long as it prevents solder bridging from one pad to another. Generally, the thinner stencil will need a larger aperture to maintain the given volume of solder paste. TE recommends the use of a minimum of 0.13 mm thick stencil.



CAUTION

All traces must be covered by solder mask in the solder deposit area. Exposed traces could cause bridging and create a short, or wick solder away from the solder tines, producing a weak solder joint.



CAUTION

If a hold-down aperture is required other than that specified, the design must ensure that the connector housing will not sit on the solder deposit.

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E. Solder Mask

Solder mask is recommended between all pads when soldering connectors with surface mount contacts to minimize solder bridging between pads. The mask must not exceed the height of the pad by more than 0.05 mm. If a trace is run between adjacent pads on the solder side of the pc board, a solder mask must be applied over the trace to prevent bridging and wicking of solder away from the contact solder tines. Those most suitable are Liquid Photo Imageable and Dry Film.



CAUTION

Since the connector may rest on top of the solder mask, an excessively high mask will allow too much space between the lead and pad for a good solder joint. A solder joint under these conditions would be weak and would not provide long-term performance for the connector.

F. Process

Connectors with surface mount contacts should be soldered using vapor phase (VPR), double-sided, non-focused infrared reflow (IR) or equivalent soldering techniques. Due to many variables involved with the reflow process (i.e., component density, orientation, etc.), it is recommended that trial runs be conducted under actual manufacturing conditions to ensure product and process compatibility. These connectors will withstand the temperature and exposure time specified in Figure 13.

SOLDERING PROCESS	TEMPERATURE (Max)	TIME (At Max Temperature)
(IR) Card Edge Connector	220°C [428°F]	3 Minutes
(IR) Poke-In Connector		

Figure 13

The lead-free reflow profile is shown in Figure 14.

Kester Lead-Free Reflow Profile Alloys: Sn96.5/Ag3.0/Cu0.5 and Sn96.5/Ag3.5

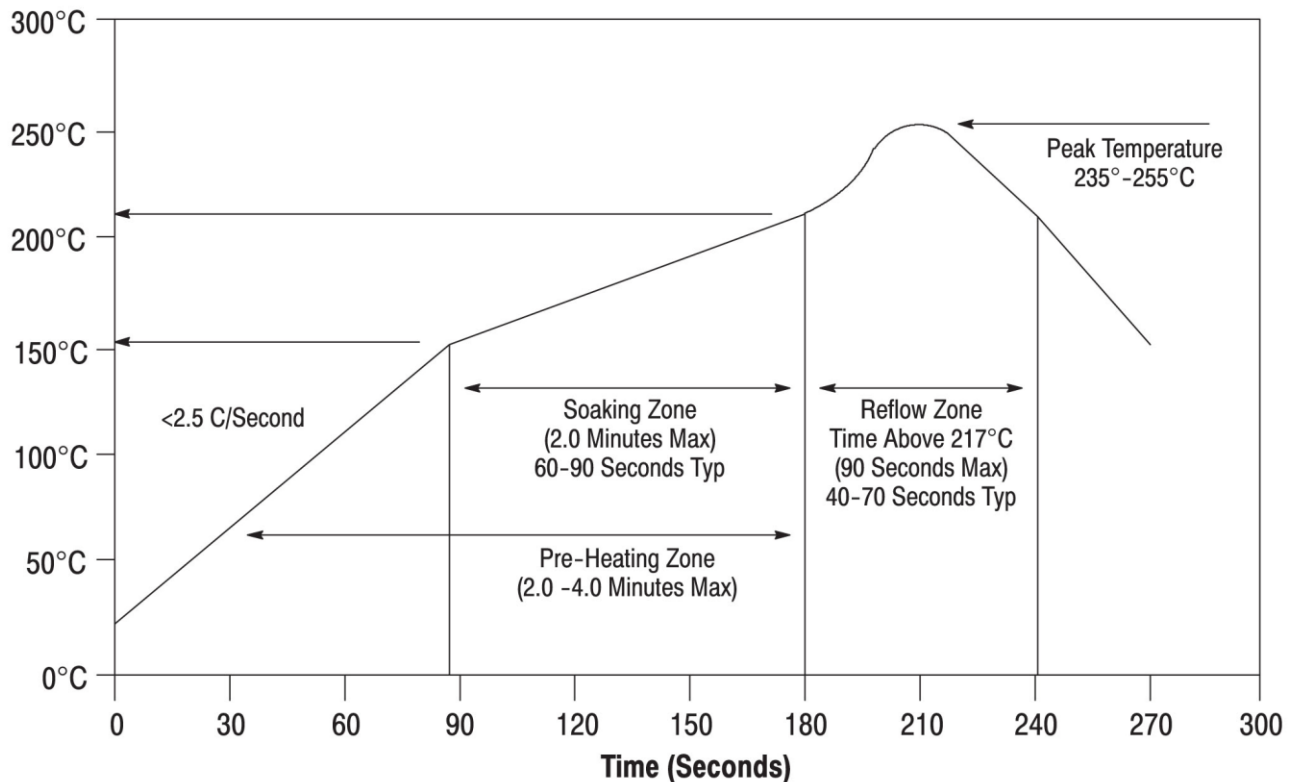


Figure 14

G. Cleaning

After soldering, removal of fluxes, residues, and activators is necessary. Consult with the supplier of the solder and flux for recommended cleaning solvents. Common cleaning solvents that will not affect the connectors or assemblies for the times and temperatures provided without any adverse effects on the connector assembly are listed in Figure 15.



DANGER

Consideration must be given to toxicity and other safety requirements recommended by the solvent manufacturer. Trichloroethylene and Methylene Chloride can be used with no harmful affect to the connectors; however, TE does not recommend them because of the harmful occupational and environmental effects. Both are carcinogenic (cancer-causing) and Trichloroethylene is harmful to the earth's ozone layer.



NOTE

If you have a particular solvent that is not listed, contact TE Tooling Assistance Center or Product Information at the number on the bottom of page 1.

CLEANER		TIME (Minutes)	TEMPERATURE (Max)
NAME	TYPE		
ALPHA 2110	Aqueous	1	132°C [270°F]
BIOACT EC-7	Solvent	5	100°C [212°F]
Butyl CARBITOL	Solvent	1	Ambient Room
Isopropyl Alcohol	Solvent	5	100°C [212°F]
KESTER 5778	Aqueous		
KESTER 5779	Aqueous		
LONCOTERGE 520	Aqueous		
LONCOTERGE 530	Aqueous		
Terpene	Solvent		

Figure 15

H. Drying



CAUTION

Excessive temperatures may cause housing and plating degradation.

When drying cleaned assemblies and pc boards, temperatures to which the connectors are subject should not exceed 220°C [492°F] for more than 3 minutes.

3.11. Checking Installed Connector

All solder joints should conform to those specified in Workmanship Specification 101-21, IPC-A-610, and all other requirements specified in this document.



CAUTION

Connectors or pc boards should not be tested by the insertion of probes of any type into the contact wire openings. This will result in damage to the contacts. Poke-in contacts are designed for a single wire insertion, of the gage and type listed in Paragraph 3.5.



NOTE

Both the Inverted Card Edge and Inverted Poke-In Connectors are available in a covered version where the metallic contacts and metallic board lock components are not accessible from the top side. The cover is pre-installed at TE and provides a touch proof assembly once the connectors are soldered to the LED pc board. In versions with the covers, the solder joints will not be able to be visually inspected unless X-Ray inspection is employed.

3.12. Repair and Replacement



CAUTION

The contacts and housings are not repairable. DO NOT use damaged or defective contacts or housings. DO NOT remove the wire and re-terminate contacts.

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4. QUALIFICATION

Inverted Card-Edge and Inverted Poke-In Connectors are Recognized Compliant to Underwriters Laboratories Inc. (UL) and CSA International requirements as Listed in UL File Number E28476.

5. TOOLING

For automatic machine placement, a pc board support must be used to prevent bowing of the pc board during the placement of connectors on the board. It should have flat surfaces with a cutout large enough and deep enough to receive the connector housing. The robotic equipment must have a true position accuracy tolerance of 0.25 mm to properly locate the connector. This includes gripper and fixture tolerances as well as equipment repeatability. It must use the datum surfaces detailed on the customer drawing to ensure reliable placement.

**NOTE**

Automatic machine placement is recommended for connectors instead of manual placement with surface mount contacts.

6. VISUAL AID

The illustration below shows a typical application of this product. This illustration should be used by production personnel to ensure a correctly applied product. Applications which do not appear correct should be inspected using the information in the preceding pages of this specification and in the instructional material shipped with the product or tooling.

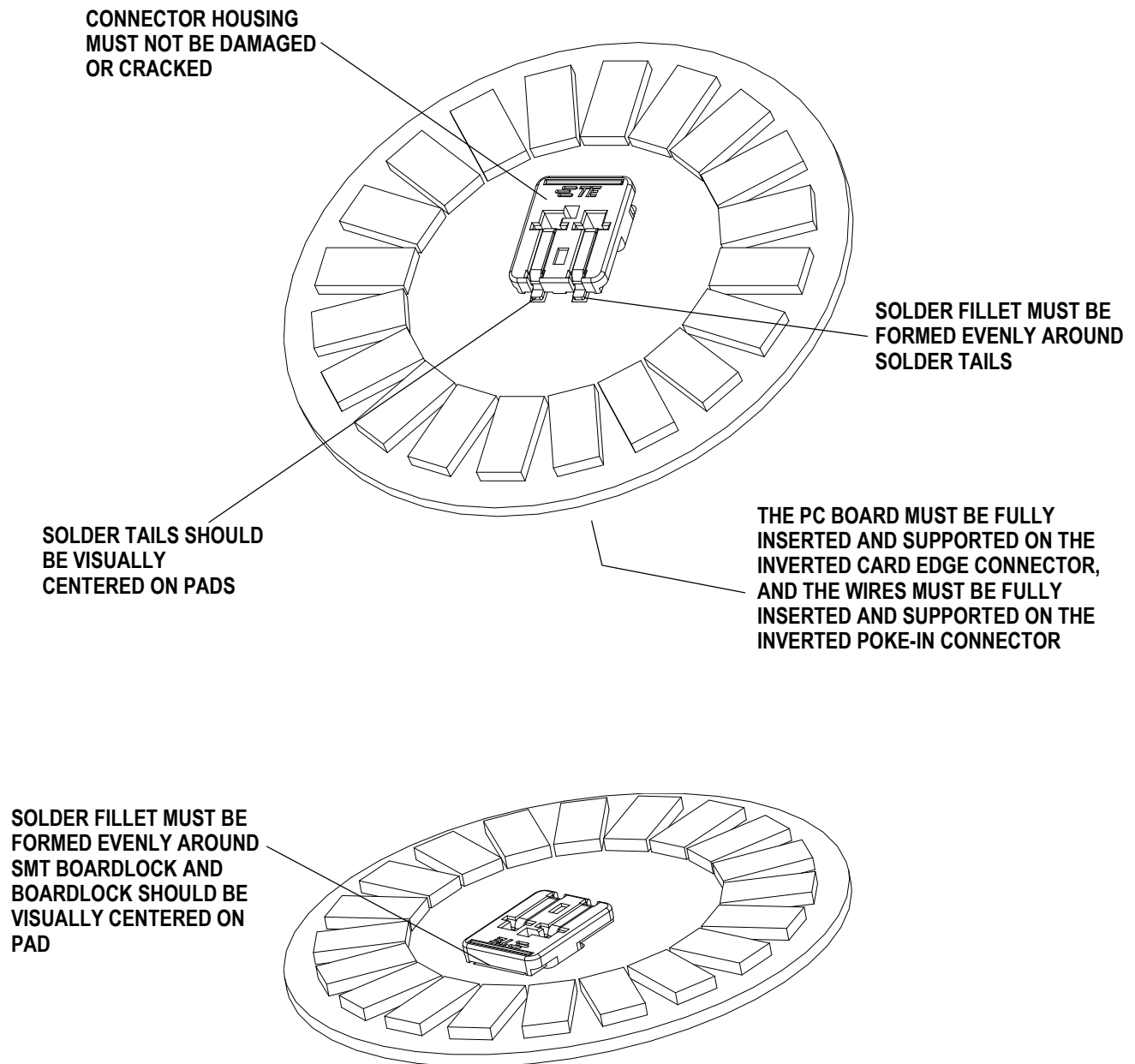


FIGURE 16. VISUAL AID