1. INTRODUCTION

This specification covers the requirement for application of AMP 1.0 mm FH Plug and Receptacle Connectors for surface mount printed circuit (PC) board applications. These plug and receptacle connectors have solder tines spaced on 1 mm [.039 in.] centers and are available in (IEEE Standard) 64– or optional 84–position versions. The connectors can be positioned by hand or by robotic equipment and are designed for board stacking applications that have 8 stacking heights from 8.0 [.315] to 15.0 [.591].

Figure 1 provides connector features and terms used throughout this specification. Use these terms when corresponding with Tyco Electronics representatives to facilitate assistance.

2. REFERENCE MATERIAL

2.1. Revision Summary

This paragraph is reserved for a revision summary covering the most recent additions and changes made to this specification which include the following:

Per EC 0990–1087–01
- Updated document to corporate requirements
- Changed nomenclature in paragraph 3.3

2.2. Customer Assistance

Reference Part Number 120521 and Product Code 6537 are representative numbers of 1.0 mm FH Plug and Receptacle Connectors. Use of these numbers will identify the product line and expedite your inquiries through a service network established to help you obtain product information. Such information can be obtained through a local Tyco Electronics Representative (Field Sales Engineer, Field Applications Engineer, etc) or, after purchase, by calling the Tooling Assistance Center or the AMP FAX/Product Information Center number at the bottom of this page.
2.3. Drawings
Customer Drawings for each connector are available from the service network. The information contained in Customer Drawings takes priority if there is a conflict with this specification or with any technical documentation supplied by Tyco Electronics.

2.4. Agency Specifications
EIA–364–52, EIA–700AAAB, and IEEE 1386 provide requirements and evaluation methods.

2.5. Manuals
Manual 402–40 is available upon request and can be used as a guide in soldering. This manual provides information on various flux types and characteristics along with the commercial designation and flux removal procedures. A checklist is attached to the manual as a guide for information on soldering problems.

3. REQUIREMENTS

3.1. Storage
A. Ultraviolet Light
Prolonged exposure to ultraviolet light may deteriorate the chemical composition used in the connector housing material.

B. Shelf Life
Connectors are packaged and shipped on reels inside EIA–481 carrier tape. To prevent damage to the housings and contacts, the connectors should remain in the container until ready for installation. Also, to prevent possible storage contamination and ensure maximum solderability for SMT solder tines, the connectors should be used on a first in, first out basis.

C. Chemical Exposure
Do not store connectors near any chemical listed below as they may cause stress corrosion cracks in the contacts.

<table>
<thead>
<tr>
<th>Alkalies</th>
<th>Ammonia</th>
<th>Citrates</th>
<th>Phosphates Citrates</th>
<th>Sulfur Compounds</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amines</td>
<td>Carbonates</td>
<td>Nitrites</td>
<td>Sulfur Nitrites</td>
<td>Tartrates</td>
</tr>
</tbody>
</table>

3.2. Product Materials

FH Connector Housings are constructed of high temperature thermoplastic – Liquid Crystal Polymer, UL94V–0. The plug and receptacle contacts are made of phosphor bronze with the mating interface of the contacts underplated with nickel and finished with gold plating. The solder tines have 93/7 matte tin–lead plating.

3.3. Circuit Identification

1.0 mm FH Plug and Receptacle Connectors are not polarized with respect to either the X or Y axis, and therefore pin 1 location is arbitrary. Pin layout is to be established by the OEM.

3.4. Spacing

A. Connector Alignment
Connectors can be placed in close proximity to each other on the pc board. The dimensions provided do NOT include space needed for other pc board components or robotic tooling. Check spacing requirements for other components before making your placement layout on the pc board. Figure 2 provides recommended placement variations to ensure vertical board–to–board plug and receptacle mating and unmating.

**CAUTION** Careful consideration to the tolerances must be observed when more than one connector pair is to be used between pc boards. Tolerance build-up on the pc board in conjunction with the tolerances associated with placing the connectors could cause a stress load on the solder joints which could affect their reliability. Consult Tyco Electronics Engineering by calling one of the telephone numbers at the bottom of page 1.
B. Board Stacking Heights

Board stacking heights for the 1.0 mm FH Connectors are provided in Figure 3.

**NOTE**  The dimension provided does not include the paste thickness between the solder tines and solder pads of both connectors.

The system should be designed with support for the pc boards to minimize stress on the solder tines of surface-mounted connectors.

**CAUTION**  The distance between pc boards will be determined by the dimension needed for fully mated connectors as provided in Figure 3. However, we emphasize that the connectors MUST NOT be used as the only standoff between pc boards.

<table>
<thead>
<tr>
<th>Receptacle</th>
<th>Plug</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.0 [.315]</td>
<td>8.0 [.315]</td>
</tr>
<tr>
<td>9.0 [.354]</td>
<td>9.0 [.354]</td>
</tr>
<tr>
<td>10.0 [.394]</td>
<td>10.0 [.394]</td>
</tr>
<tr>
<td>11.0 [.433]</td>
<td>11.0 [.433]</td>
</tr>
<tr>
<td>12.0 [.472]</td>
<td>12.0 [.472]</td>
</tr>
<tr>
<td>13.0 [.512]</td>
<td>13.0 [.512]</td>
</tr>
<tr>
<td>14.0 [.551]</td>
<td>14.0 [.551]</td>
</tr>
<tr>
<td>15.0 [.591]</td>
<td>15.0 [.591]</td>
</tr>
</tbody>
</table>

**NOTE:** 64 or 84 positions
3.5. Printed Circuit Boards for SMT Connectors

A. Tolerance

At the time of connector placement, the coplanarity of the pad pattern must be held to 0.05 [0.002] maximum. We recommend a solder mask to minimize solder bridging between pads. The mask must not exceed the height of the pad by more than 0.05 [0.002]. Maximum allowable bow of the pc board shall be 0.10 [0.004] 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 line 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.

B. Material and Thickness

The pc board material shall be glass epoxy (FR-4 or G-10). The thickness of the pc board depends on your design requirements. Consult Tyco Electronics Engineering for suitability of other materials. A solder mask is recommended when soldering connectors. Those most suitable are Liquid Photo Imageable and Dry Film.

C. PC Board Layout

Recommended pc board patterns for plug and receptacle connectors are provided in Figure 4.
Datum locations and basic dimensions to be established by the customer. Consult Tyco Electronics when placing multiple connectors on a pc board.

1.5 ±0.05 [.059 ±.002] diameter hole should be used if placed on pc board with vacuum placement equipment.

Shorter solder lands may be used per EIA-700 AAAB. However, 2.7 [.106] length ensures optimum solder fillet regardless of connector manufacturer.

Shorter solder lands may be used per EIA-700 AAAB. However, 2.4 [.094] length assures optimum solder fillet regardless of connector manufacturer.

<table>
<thead>
<tr>
<th>NUMBER OF POSITIONS</th>
<th>DIMENSIONS</th>
<th>DIMENSIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A</td>
<td>D</td>
</tr>
<tr>
<td>Standard 84</td>
<td>31.0 [1.220]</td>
<td>34.4 [1.354]</td>
</tr>
<tr>
<td>Optional 84</td>
<td>41.0 [1.614]</td>
<td>44.4 [1.748]</td>
</tr>
</tbody>
</table>

Figure 4 (end)
3.6. Processing
The pc boards must be solderable in accordance with EIA–364–52.

A. Typical Solder Paste Characteristics
1. Alloy type shall be either 63 Sn/37 Pb or 60 Sn/40 Pb.
2. Flux shall be RMA type.

B. Solder Volume
Solder volume for each component shall be:
- Plug: 0.303 mm³ [0.0000185 in³] max
  0.245 mm³ [0.000015 in³] min per contact
- Receptacle: 0.262 mm³ [0.000016 in³] max
  0.213 mm³ [0.000013 in³] min per contact

NOTE  Solder volume may vary depending on solder paste composition.

C. Stencil
Stencil aperture will be determined by the thickness of the stencil being used. Generally, the thinner stencils will have a larger aperture to maintain a given volume of solder paste. Solder deposition should be within the pad area of the contact solder tines. Typical aperture openings and location of solder disposition are provided in Figure 5.

CAUTION  All traces must be covered by solder mask in the solder deposit area. Vias (non-component interlayer connection holes) must be adequately spaced from pads and separated by solder mask to avoid coverage by solder paste deposits. Exposed traces could cause bridging and create a short, or wick solder away from the solder tines, producing a weak solder joint.

The round holes in the layout are only required when locating posts are used. See Figure 4 for remaining location dimensions.

### Plug Stencil

<table>
<thead>
<tr>
<th>STENCIL</th>
<th>NOMINAL PAD SIZE</th>
<th>THICKNESS</th>
<th>A</th>
<th>B</th>
<th>64–POSN</th>
<th>84–POSN</th>
</tr>
</thead>
<tbody>
<tr>
<td>PLUG</td>
<td>0.6 x 2.7 [0.24 x .106]</td>
<td>0.1 [.004]</td>
<td>0.8 [.032]</td>
<td>3.5 [.139]</td>
<td>63</td>
<td>83</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.15 [.006]</td>
<td>0.7 [.028]</td>
<td>2.8 [.110]</td>
<td>31</td>
<td>41</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.2 [.008]</td>
<td>0.6 [.024]</td>
<td>2.5 [.098]</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 5 (cont'd)
ReceptacleStencil

The round holes in the layout are only required when locating posts are used. See Figure 4 for remaining location dimensions.

<table>
<thead>
<tr>
<th>STENCIL</th>
<th>NOMINAL PAD SIZE</th>
<th>STENCIL</th>
<th>64-POSN</th>
<th>84-POSN</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>THICKNESS</td>
<td>A</td>
<td>B</td>
</tr>
<tr>
<td>RECEPTACLE</td>
<td>0.6 x 2.4</td>
<td>0.1 [.004]</td>
<td>0.8 [.032]</td>
<td>3.1 [.122]</td>
</tr>
<tr>
<td></td>
<td>[.024 x .106]</td>
<td>0.15 [.066]</td>
<td>0.7 [.028]</td>
<td>2.7 [.106]</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.2 [.086]</td>
<td>0.6 [.024]</td>
<td>2.1 [.083]</td>
</tr>
</tbody>
</table>

D. Solder Mask

Solder mask is recommended between all pads. If a trace is run between adjacent pads on the solder side of the PCB, a solder mask must be applied over the trace to prevent bridging and wicking of solder away from the contact solder fins. Liquid photo imageable or dry film solder masks are recommended.

3.7. Connector Placement

**NOTE** Connectors are on tape reels and should be placed directly from the package to the PCB board. We do NOT recommend emptying them from the package into piles or in bowl feeders prior to placement.

Connectors can be placed on the PCB board by hand by gripping the connector at the ends of the housing without touching the contacts. This procedure will prevent contamination and deformation of the solder lines. They can also be positioned with robotic equipment using vacuum pickup or robotic grippers.

**NOTE** Care must be taken during positioning of the connectors on the PCB board so as to not exceed the allowable misalignment absorption, as recommended by the EIA-7000AAB specification. See Figure 6. Values given are for the mated pair, and not for each connector. This requires each connector to be located within ±0.07 [.003] of nominal center.
Figure 6

NOTE  Optimally, the connector solder tines should be centered on the pc board pads. However, slight misregistration is permissible as long as the entire solder tine is on the pad with no overhang. See Figure 7.

Figure 7

A. Soldering

NOTE  Manual 402–40 provides some guidelines for establishing soldering practices.

1. Fluxing

The contact solder tines and, if applicable, attaching hardware 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. Call the Product Information number at the bottom of page 1 for consideration of other types of flux. Some fluxes that are compatible with these connectors are provided in Figure 8.
2. Parameters

The connectors will withstand temperatures of 230°C [466°F] for a maximum of three minutes. Higher temperatures can be withstood for short periods of time. However, the actual connector temperature should not exceed 250°C [482°F] for more than 15 seconds, with a maximum temperature of 265°C [491°F]. Refer to the recommendations provided in Figure 9 for typical infrared (IR) reflow oven settings. Due to the many variables involved with the reflow process (ie, component density, orientation, etc), we recommend that the user conduct trial runs under actual manufacturing conditions to ensure product and process compatibility.

3. Techniques

It is recommended that the connector be soldered using convection, vapor phase (VPR), double sided non-focused infrared (IR), or equivalent soldering technique provided the temperatures and exposure time are within the ranges specified in Figure 10. Higher temperatures can be withstood for short periods of time as indicated in Figure 9 for the IR reflow. Tyco Electronics recommends using a Corpam Epoxy Vapor Phase† (Model VVP 10 BU) and Vitronics IR‡ (Model SMD 718) equipment.

4. Reflow Parameters

Due to the many variables involved with the reflow process (ie, component density, orientation, etc), we recommend that the user conduct trial runs under actual manufacturing conditions to ensure product and process compatibility.

B. Cleaning

After soldering, removal of fluxes, residues, and activators is necessary. Consult with the supplier of the solder paste and flux for recommended cleaning solvents. The following is a listing of common cleaning solvents that will not affect the connectors. The connectors will be unaffected by any of these solvents for 5 minutes at 105°C [221°F]. See Figure 11.

Cleaners must be free of dissolved flux and other contaminants. We recommend cleaning with the pc board on its edge. If using an aqueous cleaner, we recommend standard equipment such as a soak–tank or an automatic in-line machine

CAUTION

Even when using "no clean" solder paste, it is imperative that the contact interface be kept clean of flux and residue, since it acts as an insulator. Flux may migrate under certain conditions with elevated temperatures and, therefore, cleaning is necessary even with "no clean" paste.

† Manufactured by Corpam Industries Incorporated, Louisville, KY
‡ Manufactured by Vitronics Corporation, Newburyport, MA
### CLEANER

<table>
<thead>
<tr>
<th>NAME</th>
<th>TYPE</th>
<th>TIME (Minutes)</th>
<th>TEMPERATURES (Maximum)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alpha 2110</td>
<td>Aqueous</td>
<td>1</td>
<td>132 270</td>
</tr>
<tr>
<td>Sicoct EC-7</td>
<td>Solvent</td>
<td>5</td>
<td>100 212</td>
</tr>
<tr>
<td>Butyl Celolite</td>
<td>Solvent</td>
<td>1</td>
<td>Room Ambient</td>
</tr>
<tr>
<td>Isopropyl Alcohol</td>
<td>Solvent</td>
<td>5</td>
<td>100 212</td>
</tr>
<tr>
<td>Kester 5778</td>
<td>Aqueous</td>
<td>5</td>
<td>100 212</td>
</tr>
<tr>
<td>Kester 5779</td>
<td>Aqueous</td>
<td>5</td>
<td>100 212</td>
</tr>
<tr>
<td>Loncoler 520</td>
<td>Aqueous</td>
<td>5</td>
<td>100 212</td>
</tr>
<tr>
<td>Loncoler 530</td>
<td>Aqueous</td>
<td>5</td>
<td>100 212</td>
</tr>
<tr>
<td>Terpene Solvent</td>
<td>Solvent</td>
<td>5</td>
<td>100 212</td>
</tr>
</tbody>
</table>

---

**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, Tyco Electronics 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 the Product Information number at the bottom of page 1.

---

**C. Drying**

Air drying of cleaned connectors is recommended. Temperature for the connectors should not exceed —55 to 105°C [—67 to 221°F]. Degradation of the housings could result from extreme temperatures.

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**D. Checking Installed Connector**

All solder joints should conform to those specified in Workmanship Specification 101—21. The housing must seat on the pc board to within the tolerance provided in Figure 12.

---

**E. Mating/Unmating Connectors**

**CAUTION**

The use of uneven or off-angle forces during mating and unmating of the connectors could cause overstress and damage to the contacts and/or housings. Using the “peel-back” method of unmating one end and pulling it until the other end is unmated is permissible. Do NOT use a severe side-to-side rocking motion to unmate connectors.

Connectors must be pushed straight in when mating and pulled straight out when unmating. A slight end-to-end motion may be used to start extraction, but it must not continue through full extraction cycle.
NOTE  The angles of 5° and 6° in Figure 13 are specified as 3° and 1.5° respectively per EIA–700AAAB, and this should be considered if mating AMP connectors with any other manufacturers’ connectors.

Miniaturization is a design feature of these connectors and the systems in which they are used. Component density, connector location, and pc board size may make it difficult to remove the connector. Two methods are recommended to facilitate removal. If unmating board-to-board connectors, the preferred method is to have one of the pc boards securely fastened and adequately supported to withstand the pulling force applied to the other pc board. The second method is to construct a tool for your system design that will produce a straight-away separation of the connectors. See Figure 13.

3.8. Repair/Removal
Connectors may be removed from the pc board by standard de-soldering methods. Damaged connectors must be replaced.

4. QUALIFICATIONS
1.0 mm FH Plug and Receptacle Connectors are listed by Underwriters Laboratories Inc. (UL) under File No. E28476 and certified by the Canadian Standards Association (CSA) under File No. LR7189A–319.

5. TOOLING
We recommend that you contact a reliable robotic equipment designer for assistance in developing equipment that meets your specific application requirements. The equipment must have a placement position accuracy tolerance of ±0.05 [±.002] to properly locate the connector for placement. This includes gripper and fixture tolerances as well as equipment repeatability. It must use the connector datum surfaces detailed on the Customer Drawing for the connector being used to ensure reliable placement of the connector.

The equipment feed mechanism must be compatible with the connector shipping containers. See shipping containers shown in Figure 14.
6. VISUAL AID

Figure 15 shows a typical application of 1.0 mm FH Plug and Receptacle Connectors. This illustration should be used by production personnel to visually ensure suitable applications. Installations which appear visually incorrect should be inspected using the dimensional information given in the preceding pages of this application specification.

**FIGURE 15. VISUAL AID**

- **PLUG AND RECEPTACLE MUST BE ALIGNED PRIOR TO MATING**
- **WHEN USING ROBOTICS, VACUUM CLIP MUST BE USED**
- **SOLDER TINES MUST BE LOCATED ON SOLDER PADS**
- **CONNECTOR MUST BE SEATED ON PC BOARD**
- **SOLDER TINES MUST NOT BE BENT**
- **PLUG AND RECEPTACLE MUST BE BOTTOMED WHEN JOINED**
- **SOLDER FILLET MUST BE EVENLY FORMED**