High Speed, Matched-Impedance, Parallel Board-to-board Connector

IT1 Series Outline

High-speed matched-impedance parallel board-to-board connector designed for applications requiring board-to-board spacing with transmission speeds exceeding 1GHz. The connection system has matched impedance of 50 ohms or can be customized. Contacts are on 0.5mm pitch.

■ Features

1. Impedance Matching using a 4-Layer Board
   The innovative transmission module uses PC boards with a strip line design of transmission lines, providing matched impedance of 50 ohms, for standard product.

2. Supports Multiple Connectors per board
   Designed with a tolerance of +/- 0.2mm for both the X and Y-axis. The three-piece structure and the +/- 0.2mm tolerance allows 3 or more IT1’s to be mounted on a single board.

3. Customized Board-to-Board Distance
   Board-to-board distance can be customized, from 16mm to 40mm.
   Ground lines or additional traces can be added to support high level, high speed transmission or mixed power/signal applications.

4. Signal to Ground Ratio
   The standard signal-to-ground ratio is 10:2, which makes reliable matching of the characteristic impedance of each transmission line. This ratio also can be customized.

5. Contact Reliability
   Use of double contact points on each of the contacts assures highly reliable performance.

■ Applications

Routers, servers, base stations and other telecommunication equipment.
■ Product Specifications

<table>
<thead>
<tr>
<th>Item</th>
<th>Specification</th>
<th>Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Insulation resistance</td>
<td>100 M ohms min.</td>
</tr>
<tr>
<td>2.</td>
<td>Withstanding voltage</td>
<td>No flashover or insulation breakdown</td>
</tr>
<tr>
<td>3.</td>
<td>Contact resistance</td>
<td>100 m ohms max.</td>
</tr>
<tr>
<td>4.</td>
<td>Vibration</td>
<td>No electrical discontinuity of 1 μs or more. No damage, cracks, or parts dislocation.</td>
</tr>
<tr>
<td>5.</td>
<td>Shock</td>
<td>No electrical discontinuity of 1 μs. min. No damage, cracks, or parts dislocation</td>
</tr>
<tr>
<td>6.</td>
<td>Humidity</td>
<td>Contact resistance: 110 m ohms max. Insulation resistance: 100 M ohms min. No damage, cracks, or parts dislocation</td>
</tr>
<tr>
<td>7.</td>
<td>Temperature cycle</td>
<td>Contact resistance: 110 m ohms max. Insulation resistance: 100 M ohms min. No damage, cracks, or parts dislocation</td>
</tr>
<tr>
<td>8.</td>
<td>Durability (insertion/withdrawal)</td>
<td>Contact resistance: 110 m ohms max. No damage, cracks, or parts dislocation.</td>
</tr>
</tbody>
</table>

Note1: If the connector is going to be used at a current in excess of the 0.4 A, please contact your Sales Representative.

Note2: The term “storage” refers to products stored for long period of time prior to mounting and use. Operating Temperature Range and Humidity range covers non-conducting condition of installed connectors in storage, shipment or during transportation.

Note3: Information contained in this catalog represents general requirements for this Series. Contact us for the drawings and specifications for a specific part number shown.

■ Material

Receptacles

<table>
<thead>
<tr>
<th>Part</th>
<th>Material</th>
<th>Finish</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insulator</td>
<td>LCP</td>
<td>Color : Beige</td>
<td>UL94V-0</td>
</tr>
<tr>
<td>Contacts</td>
<td>Phosphor bronze</td>
<td>Gold plating</td>
<td>—</td>
</tr>
<tr>
<td>Metal fittings</td>
<td>Phosphor bronze</td>
<td>Tin plating</td>
<td>—</td>
</tr>
</tbody>
</table>

Transmission Module

<table>
<thead>
<tr>
<th>Part</th>
<th>Material</th>
<th>Finish</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insulator</td>
<td>PBT</td>
<td>Color : Black</td>
<td>UL94V-0</td>
</tr>
<tr>
<td>Board</td>
<td>FR-4</td>
<td>Contact portion : Gold plating</td>
<td>—</td>
</tr>
</tbody>
</table>

■ Ordering Information

Receptacles

IT 1 # - * S - SV (* *)

Transmission Module

IT 1 - * P / * - * H

<table>
<thead>
<tr>
<th></th>
<th>Series name</th>
<th>Lead</th>
<th>Packaging</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>: IT1</td>
<td></td>
<td>SV : Straight SMT</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Locating Post type Blank</td>
<td></td>
<td>Blank : Tray</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>With Locating Post</td>
<td></td>
<td>(25) : Tray (connectors with attached tape for a vacuum board placement)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Without Locating Post</td>
<td></td>
<td>Number of ground contacts : 28, 44</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Number of contacts : 168, 252</td>
<td></td>
<td>Board-to-board Distance: 19mm, 23mm, 30mm</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Connector</td>
<td></td>
<td>S : Receptacle Socket</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P</td>
<td>: Transmission Plug Module</td>
<td></td>
<td>—</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Receptacles - 168 Contacts

![Diagram of Receptacles - 168 Contacts]

<table>
<thead>
<tr>
<th>Part Number</th>
<th>CL No.</th>
<th>Locating Post Type</th>
<th>RoHS</th>
</tr>
</thead>
<tbody>
<tr>
<td>IT1-168S-SV</td>
<td>641-0002-0</td>
<td>With Locating Post</td>
<td>YES</td>
</tr>
<tr>
<td>IT1A-168S-SV</td>
<td>641-0012-4</td>
<td>Without Locating Post</td>
<td></td>
</tr>
</tbody>
</table>

Recommended PCB mounting pattern

![Diagram of Recommended PCB mounting pattern]

Not required for products without Locating Post.
Receptacles - 252 Contacts

Part Number | CL No. | Locating Post Type | RoHS
---|---|---|---
IT1-252S-SV | 641-0003-3 | With Locating Post | YES
IT1A-252S-SV | 641-0013-7 | Without Locating Post | YES

Recommended PCB mounting pattern

Not required for products without locating Post.
### Transmission Module - 168 Contacts

- **Mating side**
- **Board Mounting side**
- **Locking Protrusion (2 Sides)**

#### Connection Table

The connection table indicates contact numbers in the mated condition, as illustrated in Fig. 1.

<table>
<thead>
<tr>
<th>Part Number</th>
<th>CL No.</th>
<th>Board-to-board Distance</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>RoHS</th>
</tr>
</thead>
<tbody>
<tr>
<td>IT1-168P/28-19H</td>
<td>641-0192-8</td>
<td>19mm</td>
<td>8.4</td>
<td>8.4</td>
<td>6.6</td>
<td>YES</td>
</tr>
<tr>
<td>IT1-168P/28-30H</td>
<td>641-0303-7</td>
<td>30mm</td>
<td>13.9</td>
<td>13.9</td>
<td>17.6</td>
<td></td>
</tr>
</tbody>
</table>
### Transmission Module - 252 Contacts

- **2-row type**

![Diagram of Transmission Module - 252 Contacts](image)

**Connection Table**

The connection table indicates contact numbers in the mated condition, as illustrated in Fig. 1.

<table>
<thead>
<tr>
<th>Part Number</th>
<th>CL No.</th>
<th>Board-to-board Distance</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>RoHS</th>
</tr>
</thead>
<tbody>
<tr>
<td>IT1-252P/44-23H</td>
<td>641-0231-8</td>
<td>23mm</td>
<td>10.4</td>
<td>10.4</td>
<td>10.6</td>
<td>YES</td>
</tr>
<tr>
<td>IT1-252P/44-30H</td>
<td>641-0304-0</td>
<td>30mm</td>
<td>13.9</td>
<td>13.9</td>
<td>17.6</td>
<td></td>
</tr>
</tbody>
</table>

**Fig. 1**

![Diagram of Connection Table](image)
## IT1 Series Extraction Tool

<table>
<thead>
<tr>
<th>Part Number</th>
<th>CL No.</th>
<th>Remarks</th>
<th>RoHS</th>
</tr>
</thead>
<tbody>
<tr>
<td>IT1-PICKER(1)</td>
<td>641-1001-3</td>
<td>2-piece Package</td>
<td>YES</td>
</tr>
</tbody>
</table>
1. System Components ......................................................... A302
   • Receptacles
   • Transmission Module Assembly
   • Extraction Tool

2. Recommended Design Guidelines .................................. A303
   2-1 Recommended Solder Land Pattern
   2-2 Board-to-Board Spacer Heights

3. Connector Placement ................................................... A304
   3-1 Receptacle Packaging Types
   3-2 Receptacle Vacuum Pick-and-Place Areas
   3-3 Receptacle Board Placement
   3-4 Recommended Reflow Conditions
   3-5 Solder Repairs

4. Mating Procedure ......................................................... A307

5. Un-mating of Connectors .............................................. A308

6. Removal of the Transmission Module from the stationary side...A309

7. Precautions When Mounting Multiple Connectors .. A310
   • Allowable Amount of Misalignment
   • Recommended Positional Location
**Connector Handling Precautions**

1. System components

- **Receptacles**
  - Contacts
    - Row A and row B contacts are arranged alternately starting with No.1 in row B. Placement on board is polarized.
  - Metal Fittings
    - Permanently inserted to provide lock with the Transmission Module and additional solder areas with the PCB.
  - Insulator body
    - Injection molded single unit provides protection and correct self-alignment of all components.

- **Transmission Module Assembly**
  - Each Module has stationary side and a mating/un-mating side.
  - When mounting multiple connectors, please keep uniform orientation of the stationary side.
  - Transmission printed circuit boards used in the module are based on JIS standards and quality standards applicable to memory modules.

- **Extraction Tool**
  - Used to release the transmission module from the stationary receptacle.

**Fully Connected Condition**

The interconnection package consists of 3 main sub-assemblies: Two receptacles and the Transmission Module. The transmission module, held securely by the guide frame has a mating/un-mating side and a stationary side. Once the stationary side is inserted in the receptacle, it can not be removed without the use of extraction tool. The mating/un-mating side allows repeated re-insertion of the receptacle on this side only.
2. Recommended Design Guidelines

2-1 Solder Land Pattern

When placing the receptacles on the Printed Circuit Boards using automatic mounting equipment or manually, assure that the correct diameters of the holes (Fig. 1) are through the entire thickness of the board.

- **Locating post hole diameter**
  The contacts of receptacle assembly are exposed on the bottom surfaces. The exposed areas of the contacts are a distance of 0.25 mm minimum from the surface of the Printed Circuit Board, on which the receptacle assembly is placed (Fig. 2). Consideration should be taken not to place or assure insulation of conductive traces under the receptacle assemblies.

Refer to the separate drawings for recommended solder land pattern dimensions of the receptacle, and signals and ground connection diagram of the transmission module.

2-2 Board-to-Board Spacer heights

The two parallel boards connected by the IT1 connectors should be fastened to additional spacers between them.

Fig. 3 indicates the connector height tolerance and the spacer’s height. When designing the spacer’s height, consideration should be given to the solder paste thickness and any other features, which may affect the full mating of the connector.

Fig. 3 indicates design dimensions for the 19 mm board-to-board distance.
3. Connector Placement

3-1 Packaging Types

- Two types of packaging are available: semi-hard tray and hard tray. Customers may specify a packaging type suitable for their automatic placement machines.
  * Refer to the separate drawings for the detailed dimensions of the trays.

- **Semi-hard tray packaging**
  168 contacts receptacle: 40 pieces per tray
  252 contacts receptacle: 30 pieces per tray

- **Hard tray packaging**
  168 contacts receptacle: 24 pieces per tray
  252 contacts receptacle: 16 pieces per tray

3-2 Automatic placement - Vacuum Pick-and-Place Areas

- Specify "Vacuum Pick-up Tape Specification". The area and position of the pick-and-place surface are indicated in the diagrams below.
3-3 Receptacle Board Placement

- When using automatic placement equipment, verify the packaging type and the Pick-and-place areas.
- When placing manually, pay attention to the possibility of positional shift. Ref. Fig. 4.
  * When placing multiple connectors, to assure positional accuracy, it is advised to use automatic placement equipment.

**Precautions for Manual Placement**

The orientation posts serve as a prevention measure to avoid incorrect placement of the receptacle assemblies on the board. The contact terminals must be placed correctly over the corresponding solder pad as shown on Fig. 4-1.

![Correct Placement](Fig. 4-1)

![Incorrect Placement](Fig. 4-2)

![Incorrect Placement](Fig. 4-3)

3-4 Recommended Reflow Conditions

<table>
<thead>
<tr>
<th>Temperature (°C)</th>
<th>Time (Seconds)</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>60 to 120</td>
</tr>
<tr>
<td>100</td>
<td>120 to 150</td>
</tr>
<tr>
<td>150</td>
<td>150 to 180</td>
</tr>
<tr>
<td>200</td>
<td>180 to 220</td>
</tr>
<tr>
<td>250</td>
<td>220 to 260</td>
</tr>
<tr>
<td>300</td>
<td>260 to 300</td>
</tr>
<tr>
<td>350</td>
<td>300 to 350</td>
</tr>
<tr>
<td>400</td>
<td>350 to 400</td>
</tr>
<tr>
<td>450</td>
<td>400 to 500</td>
</tr>
<tr>
<td>500</td>
<td>500 to 550</td>
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<tr>
<td>550</td>
<td>550 to 600</td>
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<tr>
<td>600</td>
<td>600 to 650</td>
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<tr>
<td>650</td>
<td>650 to 700</td>
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<tr>
<td>700</td>
<td>700 to 750</td>
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<tr>
<td>750</td>
<td>750 to 800</td>
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<tr>
<td>800</td>
<td>800 to 850</td>
</tr>
<tr>
<td>850</td>
<td>850 to 900</td>
</tr>
<tr>
<td>900</td>
<td>900 to 950</td>
</tr>
<tr>
<td>950</td>
<td>950 to 1000</td>
</tr>
</tbody>
</table>

**Applicable Conditions**

- Reflow system: IR reflow
- Solder: Paste type (Sn:96.5, Ag:3.0, Cu:5.0) (Flux content 9wt%)
- Test board: Glass epoxy (FR-4), 85mm x 110mm x 1.6 mm
- Metal mask thickness: 0.15 mm

* Shown recommended temperature profile.
3-5 Solder Repairs

Assure that flux is not reaching the contact areas of the connector.
Wash the assembly as recommended below.

◆ Cleaning Conditions ◆

<Organic Solvent Cleaning>

<table>
<thead>
<tr>
<th>Solvent Type</th>
<th>Normal temperature</th>
<th>Heated</th>
</tr>
</thead>
<tbody>
<tr>
<td>IPA (Isopropyl alcohol)</td>
<td>Good</td>
<td>Good</td>
</tr>
</tbody>
</table>

<Water Based Cleaning>

When using water based cleaning agents (e.g., terpene, and alkali saponifiers), select the cleaning agent based on the documentation issued by the various manufacturers, which describes its effects on metals and resins. Care should be taken not to leave moisture on the connectors.

<Cleaning Precautions>

Residual flux or cleaning agent remaining on the connectors when cleaning with organic solvents or water based cleaners may cause deterioration of the electrical performance. It is important to check that a thorough washing has been performed.
4. Mating Procedure

Follow the procedure described below.

Note:
- The transmission module must be fully inserted into receptacle assembly already placed and soldered to a board.
- The Transmission Module cannot be exposed to heat temperatures of the soldering process.

Step 1
Receptacle Placement on the board – stationary side
Assure that the orientation posts are aligned with the holes on the board.
When specifying receptacle assemblies without the orientation posts exercise extra caution to assure correct orientation and connection with the solder pads.

Step 2
Insertion of the Transmission Module
Fully insert the Transmission Module in the board-installed receptacle assembly.
It is critical that the insertion is done straight and uniformly.

Step 3
Mating/un-mating
Assure that the receptacle assembly is correctly aligned with the Transmission Module.
Fully insert the receptacle assembly on the Transmission Module.
It is critical that the insertion is done straight and uniformly.

Step 4
Connection completed
5. Un-mating of Connectors

Recommended Method

- Pull uniformly straight up.

Prohibited un-mating Methods

- Do not lift by one side only.
- Do not wiggle side-to-side.
- Do not mate/un-mate when connections are under power.
6. Removal of the Transmission Module - stationary side

- Requires use of dedicated extraction tool. Two are required.

**Step 1**

- Fully insert the tools into each end of the receptacle assembly (Fig. 1) assuring that they will be over the hold areas of the Transmission Module frame. Ref. Fig. 2

**Step 2**

- Pull out the transmission module holding the tools straight.

Inappropriate area

extraction tool Insertion Area
7. Precautions When Mounting Multiple Connectors

Note: Observe the requirements as listed in paragraph 7-1 and 7-2. The mating/un-mating forces will increase with use of multiple assemblies. It is recommended that a dedicated tooling is used for mating/un-mating of multiple connector assemblies in a single operation.

7-1 Allowable Amount of Misalignment

Maximum allowable misalignment in X and Y directions is ±0.2 mm total. Refer to the drawings below.

7-2 Recommended Connector Placement

It is recommended to leave min. of 30 mm space between the adjacent connector assemblies.

7-3 Examples of Prohibited Placement Positions

To assure reliability of solder joints and mating/un-mating without damage, DO NOT PLACE MULTIPLE CONNECTORS as illustrated below.