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A) IMPEL™ OVERVIEW

The Impel™ backplane connector system is designed for systems that target data rates up to 40 Gbps (NRZ) and superior signal density up to 80 differential pairs per inch. The Impel™ system’s broad-edge-coupled technology enables low cross-talk and high signal bandwidth while minimizing channel performance variation across every differential pair within the system. Impel™ is tuned for 92Ω impedance that offers flexibility to support 100Ω and 85Ω system architectures.

The Impel™ backplane connector system is designed for traditional backplane, midplane, or midplane-less (ortho direct) architectures to meet the growing demands of next-generation telecommunication and data networking equipment manufacturers.

The Impel™ backplane connector system is offered in 2-pair, 3-pair, 4-pair, 5-pair, and 6-pair DC connector modules that are matched to traditional headers, coplanar, and orthogonal or orthogonal direct modules with a complete range of power modules and guidance features.
B) MODULE OVERVIEW

BACKPLANE HEADER SIGNAL MODULES:

Left guided vertical module
(See SD-series-0002)

Right guided vertical module
(See SD-series-0004)

Open wall unguided vertical module
(See SD-series-0001)

Left guided vertical module
(See SD-series-0002)

Modules with closed end walls

Right guided vertical module
(See SD-series-0004)

(Note: one or both sides of
the housing can be closed)

Left guided vertical module
(See SD-series-0002)
DAUGHTERCARD (DC) RECEPTACLE SIGNAL MODULES:

- Left guided DC module (See SD-series-0002)
- Unguided DC module (See SD-series-0001)
- Right guided DC module (See SD-series-0004)

COPLANAR (RAM) SIGNAL MODULES:

- Left guided RAM module (See SD-series-0004)
- Unguided RAM module (See SD-series-0001)
- Right guided RAM module (See SD-series-0002)
C) APPLICABLE DOCUMENTS

a. Product Specification:
   [Click here to open PS-171320-999]

b. Routing Guide:
   [Click here to open AS-171320-990]

c. Application Tooling Guide:
   [Click here to open ATS-622018955]

D) DISCLAIMER

Details included in the 2D sales drawings (SD-dwg) take precedence over information included in the Design Guide document.
II. CONNECTOR PHYSICAL ENVELOPE & SELECTION

A) TRADITIONAL BACKPLANE LAYOUT:

<table>
<thead>
<tr>
<th>DIM (mm)</th>
<th>2-pair</th>
<th>3-pair</th>
<th>4-pair</th>
<th>5-pair</th>
<th>6-pair</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>12.2mm</td>
<td>16.9mm</td>
<td>21.6mm</td>
<td>26.3mm</td>
<td>31.0mm</td>
</tr>
<tr>
<td>B</td>
<td>26.7mm</td>
<td>31.3mm</td>
<td>35.9mm</td>
<td>40.6mm</td>
<td>45.1mm</td>
</tr>
</tbody>
</table>

Diff Pair Count 14 Col Per Inch (on 1.5mm pitch):

- A: 27
- B: 40

Available # of columns:

- Contact Molex for available modules.

Limited availability:

B) COPLANAR LAYOUT:

<table>
<thead>
<tr>
<th>DIM (mm)</th>
<th>2-pair</th>
<th>3-pair</th>
<th>4-pair</th>
<th>5-pair</th>
<th>6-pair</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>12.2mm</td>
<td>16.9mm</td>
<td>21.6mm</td>
<td>26.3mm</td>
<td>31.0mm</td>
</tr>
<tr>
<td>B</td>
<td>46.1mm</td>
<td>55.3mm</td>
<td>64.5mm</td>
<td>73.7mm</td>
<td>82.9mm</td>
</tr>
</tbody>
</table>

Diff Pair Count 14 Col Per Inch (on 1.5mm pitch):

- A: 27
- B: 40

Available # of columns:

- Contact Molex for available modules.

Limited availability:
C) CONNECTOR SELECTION:

1. Signal Types:
   - Differential Pairs for High Speed
   - Single Ended pins for Low Speed
   - Use the online tool to help you with initial pin mapping:
     [Click here to open Pin Mapping Configurator sheet]

2. Power:
   - For low voltage applications (under 30V), signal pins can be used. Each pin is rated 0.75A.
   - For higher voltage and current applications, use dedicated power modules (see below):

   **High Power Modules:**

<table>
<thead>
<tr>
<th>Module</th>
<th>[30A in/out]</th>
<th>[40A in/out]</th>
<th>[50A in/out]</th>
<th>[60A in/out]</th>
</tr>
</thead>
<tbody>
<tr>
<td>RA Plug</td>
<td><img src="78347" alt="Image" /></td>
<td><img src="78349" alt="Image" /></td>
<td><img src="78351" alt="Image" /></td>
<td><img src="78353" alt="Image" /></td>
</tr>
<tr>
<td>Vertical Plug</td>
<td><img src="78399" alt="Image" /> (15mm)</td>
<td>Not Toolied</td>
<td><img src="78446" alt="Image" /> (22, 38, 40mm)</td>
<td><img src="78442" alt="Image" /></td>
</tr>
<tr>
<td>Vertical Recpt.</td>
<td><img src="78212" alt="Image" /></td>
<td><img src="78214" alt="Image" /></td>
<td><img src="78216" alt="Image" /></td>
<td><img src="78218" alt="Image" /></td>
</tr>
<tr>
<td>R/A Recpt.</td>
<td><img src="78348" alt="Image" /></td>
<td><img src="78350" alt="Image" /></td>
<td>In tooling process</td>
<td>Not Toolied</td>
</tr>
<tr>
<td>Current</td>
<td>15A / Blade</td>
<td>20A / Blade</td>
<td>25A / Blade</td>
<td>20A / Blade</td>
</tr>
<tr>
<td></td>
<td>60A / Module</td>
<td>80A / Module</td>
<td>100A / Module</td>
<td>120A / Module</td>
</tr>
</tbody>
</table>

   **Refer to sales drawing for latest tooling status.**

3. Plated Through Hole Dimension;
   - Refer to AS-171320-990 for details regarding the required plated though hole and via construction. Impel™ modules utilize compliant tails that are designed for a 0.36mm diameter plated through hole. For thicker backplane boards (>7mm), header modules are available with compliant tails designed for a 0.46mm diameter plated through hole. Please contact Molex for recommendations.
III: MECHANICAL LAYOUT

A) ESTABLISHING COLUMN #1 (HEADER)
A small notch on the header housing indicates column #1.

B) SPACING BETWEEN MODULES
Use footprint to establish distance between adjacent modules. For standard 1.9mm pitch modules, the minimum distance between two adjacent modules is 2.65mm (column-to-column). For 3.0mm pitch modules, the minimum distance between two adjacent modules is 3.00mm (column-to-column). If headers with end-walls are used, add 1.4mm additional spacing for each plastic wall.
C) FULLY MATED CONDITION:

D) SIGNAL PIN LENGTHS AND MINIMUM WIPE

When the connector is fully seated, the minimum signal pins wipes are as follows:

(Note that Impel™ headers are available with two pin lengths: 4.9 and 5.5mm)

<table>
<thead>
<tr>
<th>Daughtercard Matting Point</th>
<th>4.9mm Pin</th>
<th>5.5mm Pin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ground</td>
<td>3.70 mm</td>
<td>3.70 mm</td>
</tr>
<tr>
<td>Long Signal</td>
<td>2.60 mm</td>
<td>3.20 mm</td>
</tr>
<tr>
<td>Short Signal</td>
<td>1.60 mm</td>
<td>2.20 mm</td>
</tr>
</tbody>
</table>

Each signal ckt features 2 points of contact (dual beam design)
E) PAIRING IMPEL™ MODULE WITH POWER MODULES

1.) Right Angle to Vertical header

Molex recommends using the power modules that have a Hold-down feature on Line Card (LC) applications. Molex recommends 0.50mm spacing between the Power and Signal housings – allowing sufficient spacing for easy assembly processing. Note that on the LC side – Power modules require an extra 4.0mm due to the Hold-down feature. If signal modules on the backplane side feature end wall housings, 1.4mm of extra space is required per plastic wall (refer to SD-dwg for keep out zone).
2.) Coplanar

Molex recommends using the power modules that have a Hold-down feature on Line Card (LC) applications. Molex recommends 0.50mm spacing between the Power and Signal housings – allowing sufficient spacing for easy assembly processing. RAM (Right Angle Male) Signal modules require a 2.70 notch in PCB.
F) MATING FORCES / UN-MATING FORCES

<table>
<thead>
<tr>
<th>IMPEL™ Signal Modules</th>
<th>Mating Force per Differential Pair</th>
<th>Un-Mating Force per Differential Pair</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>By Specification</td>
<td></td>
</tr>
<tr>
<td></td>
<td>200g max</td>
<td>45g min</td>
</tr>
<tr>
<td></td>
<td>As Tested</td>
<td></td>
</tr>
<tr>
<td></td>
<td>146g max (4.9mm pin)</td>
<td>60g min</td>
</tr>
<tr>
<td></td>
<td>184g max (5.5mm pin)</td>
<td></td>
</tr>
</tbody>
</table>

(tested on 4-pair modules)

G) SYSTEM GATHERABILITY

The Impel™ connector system provides 2.0mm of gatherability when the integrated guides (pin and receptacle) are used. Without the integrated guides, the connector housings provide 1.2mm of gatherability.
Stand-alone guide pins are available. Use LC side to establish the minimum spacing. Molex recommends 0.5mm minimum spacing between signal/power modules and guiding components. If a header with end walls is used, 1.4mm additional space is required per plastic wall (refer to SD-dwg for keep-out zone).

H) ANGULAR MATING:

Nominal gatherability w/stand-alone guiding system:
(Guid pin p/n: 75234-0478
Guide block p/n: 76153-1001)
IV. SYSTEM LEVEL RECOMMENDATIONS

A) USE OF GUIDING OPTIONS:

Molex recommends the use of integrated guide pins to insure proper mating. The overall connector span and the assembled card weight should be considered when determining the guidance. The following chart describes general guidance recommendations based on connector span and card weight.

GUIDE PIN RECOMMENDATIONS

<table>
<thead>
<tr>
<th>DAUGHTERCARD CONNECTOR SPAN</th>
<th>DAUGHTERCARD WEIGHT</th>
<th>RECOMMENDED GUIDANCE (Minimum)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 125mm</td>
<td>Less than 7 lbs</td>
<td>1 Standard Guide</td>
</tr>
<tr>
<td>7 lbs – 14 lbs</td>
<td></td>
<td>2 Standard Guides or 1 Heavy Duty Guide</td>
</tr>
<tr>
<td>14 lbs – 21 lbs</td>
<td></td>
<td>3 Standard Guides or 2 Heavy Duty Guides</td>
</tr>
<tr>
<td>Over 21 lbs</td>
<td></td>
<td>Contact Molex Field Application Engineer</td>
</tr>
<tr>
<td>125mm – 250mm</td>
<td>Less than 14 lbs</td>
<td>2 Standard Guides</td>
</tr>
</tbody>
</table>

BP Connector Stack with Integrated Standard Guidance
B) MATING SEQUENCE:

1. When paired with Power

Typical mating sequence with 4.9mm pins:

- 1\textsuperscript{st} to mate is long power blade (GND)
- 2\textsuperscript{nd} to mate is GND shield of the signal module
- 3\textsuperscript{rd} to mate is short power blade (supply)
- Signal pins (diff-pairs) inside the signal module will mate last.
2. When paired with Power and Impact modules.

Impact™ and Impel™ modules can be used side-by-side on a single LC. Note that Impel™ modules are taller than comparable Impact™ modules.

Top View shown:

C) QUAD ROUTEABLE MODULES:

Standard modules have 1.9mm column-to-column pitch. This spacing allows for one pair to be routed per column, per layer. Impel™ modules are also available with a wider 3.0mm pitch that allows routing of 2 pairs (4 tracks) of traces per column, per layer. Please contact Molex for availability.
Quad Route Example – Two Pairs Routed per Layer