Interposer PoP

Interposer Package on Package

Amkor’s popular Interposer Package on Package (Interposer PoP) platform supports fine pitch flip chip connection by either thermocompression with non-conductive paste (TCNCP) or mass reflow with capillary underfill (CUF). Top interposer connection is performed by thermocompression bonding with copper core balls (CCB). The CCB connection between the bottom substrate and interposer allows for high speed and high-density interconnect access to interposer mounted devices. This highly reliable package achieves low unit warpage by using epoxy mold compound encapsulating the die in-between two substrates. The top interposer allows for significantly more top side attach flexibility vs. more restrictive Through Mold Via (TMV®) and can be coupled with numerous types of devices (packaged memory, passives, die, etc.).

The tight pitch connection from the bottom substrate to the interposer allows for high density, large quantity I/O interconnects. Interposer PoP processing enables an increase of die size without increasing package body size by utilizing finer pitch interconnects vs. TMV processing.

Amkor has high volume Interposer PoP experience with the most advanced silicon nodes down to 7 nm, and ongoing projects below 7 nm. Amkor has assembled hundreds of millions of units to date with robust performance for a wide range of customers.

Benefits as an Enabling Technology

Interposer PoP offers OEMs and EMS providers a flexible platform to cost effectively integrate logic plus numerous companion devices/packages in a 3D stacked architecture. Integration through Interposer PoP provides technical, business, and logistics benefits:

- Direct, high density electrical connection between top and bottom substrate allows for lower latency and higher signal speeds
- Low unit warpage is achieved through use of EMC encapsulating the die in-between two substrates
- The top interposer allows for significantly more top side attach flexibility vs. the more restrictive TMV interconnect layout
- Due to the Interposer PoP package design, the top interposer can be coupled with numerous types of devices (packaged memory, passives, die, etc.)
- High density, and a large quantity of I/O interconnects are enabled by tight CCB pitch connection and top interposer fan-out routing
- Expertise in high volume manufacturing with hundreds of millions of units assembled
Interposer PoP

Applications
Interposer PoP packages are designed for products requiring efficient memory architectures including multiple buses and increased memory density and performance, while reducing mounted area. Portable electronic products such as mobile phones, portable media players (audio/graphics processor plus memory), gaming and other mobile applications can benefit from the combination of stacked package and small footprint.

Reliability Qualification
Amkor assures reliable performance by continuously monitoring key indices:

Package Level
- Moisture Resistance Testing: JEDEC Level 3 @ 260°C x 4 reflows
- uHAST: 130°C, 85% RH, 96 hours
- Temp/Humidity: 85°C, 85% RH, 1000 hours
- Temp Cycle: -55°C/+125°C, 1000 cycles
- High Temp Storage: 150°C, 1000 hours

Board Level
- Thermal Cycle: -40°C/+125°C, 1000 cycles

Standard Materials
- Package Laminate Substrate:
  ▷ Cored and coreless available
- Chip attach
  ▷ Mass reflow (MR) and thermocompression (TC) available
- Encapsulant
  ▷ Package: Epoxy mold compound (EMC)
  ▷ Die: Capillary underfill (CUF)
  ▷ Die: Non-conductive paste (NCP)
- Solder ball
  ▷ Pb-free (BGA side passives available)
  ▷ LGA

Process Highlights
- Die thickness: <100 μm is available
- Bump pitch: Down to 40/80 μm proven in HVM
- Wafers: 200 mm & 300 mm

Test Services
- Program generation/conversion
- Product engineering
- Dual sided contactor system available
- Tape and reel service

Shipping
- JEDEC trays
- Tape and reel available
Interposer PoP

Interposer PoP Stack Up Table (reference example)

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Interposer PoP – Current HVM (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Min</td>
</tr>
<tr>
<td>A1 (mounted, 0.35 pitch)</td>
<td>0.105</td>
</tr>
<tr>
<td>A2 (3L laminate)</td>
<td>0.100</td>
</tr>
<tr>
<td>A3 (mold cap)</td>
<td>0.130</td>
</tr>
<tr>
<td>B1 (2L laminate)</td>
<td>0.075</td>
</tr>
<tr>
<td>B2 Overall Package Height</td>
<td>0.450</td>
</tr>
</tbody>
</table>

*Both thinner & thicker stack-ups are available. Please contact Sales/Business team for specific design requirements.*

Interposer PoP Design Table

<table>
<thead>
<tr>
<th>A Package Size (mm) 1</th>
<th>B Die Size (mm)</th>
<th>C BGA Count to MB (0.35 mm pitch)</th>
<th>D Interposer Connections (Bottom substrate: Top interposer) 2</th>
<th>E Memory BGA Pads (Memory I/O count) 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>11 x 11</td>
<td>7 x 7</td>
<td>1050</td>
<td>2 sides: 234 4 sides: 432</td>
<td>560</td>
</tr>
<tr>
<td>12 x 12</td>
<td>8 x 8</td>
<td>1235</td>
<td>2 sides: 258 4 sides: 480</td>
<td>672</td>
</tr>
<tr>
<td>13 x 13</td>
<td>9 x 9</td>
<td>1512</td>
<td>2 sides: 282 4 sides: 528</td>
<td>828</td>
</tr>
<tr>
<td>14 x 14</td>
<td>10 x 10</td>
<td>1732</td>
<td>2 sides: 306 4 sides: 576</td>
<td>960</td>
</tr>
<tr>
<td>15 x 15</td>
<td>11 x 11</td>
<td>1992</td>
<td>2 sides: 324 4 sides: 612</td>
<td>1100</td>
</tr>
<tr>
<td>17 x 17</td>
<td>14 x 14</td>
<td>2613</td>
<td>2 sides: 372 4 sides: 708</td>
<td>1512</td>
</tr>
</tbody>
</table>

1 Package sizes above/below this range are possible depending on structure
2 Connection to interposer typically done on 2 sides due to substrate M1 routing constraints; 4 side connection possible depending on design constraints (change in die aspect ratio can change total count)
3 Memory I/O assumes 5 x 5 mm area for substrate marking; increased I/O count can be achieved if memory area is reduced
* BGA side passives available at pitches >/=0.35 mm
Interposer PoP

Cross Sections

Interposer PoP with DDR Attached

Interposer PoP Side by Side Wirebond Die with DDR Attached

Visit amkor.com or email sales@amkor.com for more information.