Keysight Technologies provides a range of Ball Grid Array (BGA) interposers, optimized for oscilloscope or logic analyzer measurements, that enable accurate testing directly at the ball grid array of memory/processor systems.

March 2020
Memory System Validation

Keysight Technologies has the measurement tools you need to validate the very latest memory technologies. These include logic analyzers, oscilloscopes and software for automated compliance, decode, and protocol checking.

To complement our high speed digital instruments and software, Keysight offers probing solutions with a comprehensive range of Ball Grid Array (BGA) interposers. When positioned between the processor memory controller and the memory device, the interposers allow you to make signal quality or protocol measurements with minimal effect on the system-under-test.

Memory technology is constantly advancing in speed and density, and you need probing solutions that keep up with these developments. Keysight Technologies is at the forefront of the latest memory standards, chip technologies, and measurement techniques. Your Keysight Applications Engineer and Keysight’s Interposer Design Team can assist you with selecting the best BGA interposer and probing technique for your application.

You can choose from a large selection of existing interposer designs, or define probing solutions customized to your specific needs. Keysight’s standard interposers are available for several JEDEC standard packages with a variety of ball counts. The selection guide in this catalog gives you an overview of the interposers available and provides links to the corresponding data sheets. For additional DRAM packages or to meet different mechanical requirements, Keysight’s proven development process can produce custom BGA interposer designs of the highest quality.

Browse the catalog and then contact your local Keysight Applications Engineer for advice on the right products and measurement techniques to ensure the successful validation of your memory system.

Mark Schnaible
Applications Engineering Manager
Keysight Technologies
### Selection Guide

**Interposers optimized for Oscilloscope Measurements**

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**Interposers optimized for Logic Analyzer Measurements**

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<td>DDR4 x16 BGA Interposer Cable Adapter</td>
<td>JESD79-4</td>
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See [www.keysight.com](http://www.keysight.com) for information on other DDR2, DDR3, and DDR4 BGA interposers.
**DDR5 78**

BGA Signal Integrity Interposer

Probes JESD209-5, 78 ball DDR5 memory devices

### Signals Probed

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The DDR5 Interposer provides access to the signals highlighted below and passes all power and ground signals between the system and the memory chip. Separate power planes and power filter capacitor locations are used for VDD and VDDQ power rails.

### Key Features

- The DDR5 High Performance Signal Integrity Interposer is a rigid, 78 ball, DDR5, BGA interposer, optimized for oscilloscope use. This interposer is designed to support DDR5-4800 with single channel, x8 DRAM chips.

- Probes a 78 ball DDR5 x8 DRAM chip, JESD209-5 footprint variation MO-207 DT-z, with a maximum chip package size of 9 x 12 mm.

- For tight keep-out volume applications, a DDR5 High Performance Riser is included in the DDR5 High Performance Signal Integrity Interposer Kit.

### Selection Guide

#### Specifications

**JEDEC Standard:**
- JESD209-5

**Ball Count:**
- 78

**DRAM Size:**
- 9 mm x 12 mm

**Configuration:**
- Single channel x8 DRAM (JESD209-5 footprint variation MO-207 DT-z)

**Interposer size:**
- 18.0 mm x 16.0 mm nominal

**Connectors:**
- Solder-down test points and solder balls on bottom
LPDDR3 178

BGA Signal Integrity Interposer

Probes JESD209-3B, 178 ball LPDDR3 memory devices

Signals Probed

The LPDDR3 178 BGA Interposer is optimized for oscilloscope measurements. It provides access to the LPDDR signals highlighted and passes all power and ground signals between the processor and the memory chip.

Key Features

- Enables correct operation of the LPDDR interface while providing access to selected bus signals between the processor and LPDDR memory chip.

- Provides solder pads for use with Keysight E2677A or N5381A InfiniiMax single-ended/differential solder-in or Keysight N5425A ZIF probe head.

- Includes S parameter file to configure the oscilloscope to render waveforms as they exist at the DRAM pins.

- Riser is included to clear surrounding devices in tight keep-out volume applications. Riser dimensions: 11.5 mm x 11 mm.

- For dimensional drawings see final page.

Specifications

JEDEC Standard:
JESD209-3B

Ball Count:
178

DRAM Size:
11.5 mm x 11 mm

Configuration:
Single channel x32 DRAM (JEDEC MO-311A footprint)

Interposer size, pitch:
19 mm x 19 mm nominal, 0.8 mm x 0.65 mm

Connectors:
Solder-down test points and solder balls

Information subject to change
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Probes JESD209-4A, 200 ball LPDDR4 memory devices

Signals Probed

The LPDDR4 200 BGA Signal Integrity Interposer is optimized for oscilloscope measurements. It provides access to LPDDR signals highlighted and passes all power and ground signals between the processor and the memory chip.

Key Features

- Enables correct operation of the LPDDR interface while providing access to selected signals between the processor and LPDDR4 memory chip.
- Provides solder-down test pads with plated-through-holes that connect to Keysight E2677A or N5381A solder-in probe heads, or N5425A ZIF probe tip.
- Includes S-parameter file to configure the oscilloscope to render waveforms as they exist at the DRAM pins.
- Riser is included to clear surrounding devices in tight keep-out volume applications. Riser dimensions: 10x15mm.
- For dimensional drawings see final page.

Specifications

JEDEC Standard:
JESD209-4A
Ball Count:
200
DRAM Size:
10 mm x 15 mm
Pitch:
0.8 mm x 0.65 mm
Configuration:
Dual channel x16 DRAM (JEDEC MO-311 footprint)
Interposer Size:
20 mm x 25 mm,
Connectors:
Solder-down test points and solder balls on bottom.
LPDDR3 253

BGA Signal Integrity Interposer

Probes JESD209-3B, 253 ball LPDDR3 memory devices

Signals Probed

The LPDDR3 253 BGA Interposer is optimized for oscilloscope measurements. It provides access to the LPDDR signals highlighted and passes all power and ground signals between the processor and the memory chip.

Key Features

- Enables correct operation of the LPDDR interface while providing access to selected bus signals between the processor and LPDDR memory chip.

- Provides solder pads for use with Keysight E2677A or N5381A InfiniiMax single-ended/differential solder-in, or Keysight N5425A ZIF probe head.

- Includes S parameter file to configure the oscilloscope to render waveforms as they exist at the DRAM pins.

- Riser is included to clear surrounding devices in tight keep-out volume applications. Riser dimensions: 11x11.5 mm.

- For dimensional drawings see final page.

Specifications

JEDEC Standard:
JESD209-3B

Ball Count:
253

DRAM Size:
11 mm x 11.5 mm

Configuration:
Dual channel x32 RAM (JEDEC MO-276 footprint)

Interposer size, pitch:
16.7 x 16.9 mm nominal, 0.5 mm

Connectors:
Solder-down test points and solder balls
**GDDR5 170**

**BGA Signal Integrity Interposer**

Probes embedded GDDR memory devices

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**Signals Probed**

The GDDR5 170 BGA Interposer is optimized for oscilloscope measurements. It provides access to the GDDR signals highlighted and passes all power and ground signals between the processor and the memory chip.

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**Key Features**

- Enables correct operation of the GDDR5 interface while providing access to selected bus signals between the processor and LPDDR memory chip.

- Provides solder pads for use with Keysight E2677A or N5381A InfiniiMax single-ended/differential solder-in or Keysight N5425A ZIF probe head.

- Includes S parameter file to configure the oscilloscope to render waveforms as they exist at the DRAM pins.

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**Specifications**

**JEDEC Standard:**
JESD212B.01

**Ball Count:**
170

**DRAM Size:**
12 mm x 14 mm

**Configuration:**
Embedded GDDR

**Interposer size, pitch:**
14.2 x 16.4 mm nominal, 0.8 mm

**Connectors:**
Solder-down test points and solder balls
LPDDR2 121

BGA Interposer

Probes JESD209-2F, 121 ball LPDDR2 memory devices

Signals Probed

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The LPDDR2 121 BGA Interposer is optimized for logic analyzer measurements and can also be used for oscilloscope measurements. It provides access to the LPDDR signals highlighted and passes all power and ground signals between the processor and the memory chip.

Key Features

- Enables correct operation of the LPDDR interface while providing access to selected bus signals between the processor and LPDDR memory chip.

- Rigid/flex probe can be soldered in place or used with a BGA socket.

- Logic Analyzer measurements require one modified Keysight E5845A adapter cable (sold separately) to access CKE signals.

- Oscilloscope measurements require two Keysight W3635B scope probe adapters (sold separately).

Specifications

- JEDEC Standard: JESD209-2F

- Ball Count: 121

- DRAM Size: 10 mm x 11 mm

- Configuration: Single channel, x16 RAM

- Interposer size, pitch: 33.4 mm x 21 mm, (Rigid portion 12.5 mm x 11 mm), 0.5mm

- Connectors: Zero Insertion Force (ZIF)
eMMC 153 or 169 NAND

BGA Logic Analyzer Interposer

Probes ONFI NAND 153 or 169 ball memory devices

Signals Probed

The eMMC 153 ball Logic Analyzer Interposer is optimized for protocol measurements with a Keysight logic analyzer. It provides access to the highlighted signals and passes all power and ground signals between the processor and the memory chip.

Key Features
- Enables correct operation of the eMMC interface while providing access to selected signals between the processor and memory chip.
- Rigid-flex-rigid structure with one Soft Touch Pro connector. Requires one E5406A cable (sold separately) to connect to the logic analyzer.
- Includes configuration file for set up of the logic analyzer.
- Riser is included to clear surrounding devices in tight keep-out volume applications. Riser dimensions: 12 mm x 13 mm.
- For dimensional drawings see final page.

Specifications

JEDEC Standard: JESD84-B50 eMMC

Ball Count: 153 or 169

DRAM Size: 11.5 mm x 13 mm

Pitch: 0.5 mm

Configuration: Single channel (JEDEC MO-276 footprint)

Interposer Size (rigid portion): 13 mm x 13.5 mm

Connectors: Single Soft Touch Pro
The LPDDR2/3 168 BGA Interposer is optimized for logic analyzer measurements. It provides access to the LPDDR signals highlighted and passes all power and ground signals between the processor and the memory chip.

Key Features

- Provides access to memory address, control, and data bus signals between a processor and LPDDR memory chip.

- Enables correct operation of the LPDDR interface while being probed with (2) Keysight U4154A logic analyzer modules.

- Risers of 1.2 mm height is included to clear surrounding devices in tight keep-out volume applications. Risers dimensions: 12 mm x 12 mm.

- For dimensional drawings see final page.
LPDDR4 200

BGA Logic Analyzer Interposer

Probes JESD209-4A, LPDDR4 200 ball memory devices

Signals Probed

The LPDDR4 200 BGA Logic Analyzer Interposer is optimized for protocol measurements with a Keysight logic analyzer. It provides access to the highlighted LPDDR signals and passes all power and ground signals between the processor and the memory chip.

**Key Features**

- Enables correct operation of the LPDDR interface while providing access to selected signals between the processor and LPDDR4 memory chip. Probes a single clock to support single data channel operation.

- Rigid-flex-rigid structure with one Soft Touch Pro connector. Requires one modified E5406A cable (sold separately) to connect to the logic analyzer.

- Includes configuration file for set up of the logic analyzer.

- Riser is included to clear surrounding devices in tight keep-out volume applications. Riser dimensions: 10x15 mm.

- For dimensional drawings see final page.

**Specifications**

- **JEDEC Standard:** JESD209-4A
- **Ball Count:** 200
- **DRAM Size:** 10 mm x 15 mm
- **Pitch:** 0.8 mm x 0.65 mm

**Configuration:**

- Single channel x32 DRAM (JEDEC MO-311 footprint)

**Interposer Size (rigid portion):** 19 mm x 21 mm

**Connectors:**

- Single Soft Touch Pro

![LPDDR4 200 Ball Riser](Image)

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LPDDR3 253
BGA Logic Analyzer Interposer

Probes JESD209-3B, 253 ball LPDDR3 memory devices

Signals Probed

The LPDDR3 253 BGA Interposer is optimized for logic analyzer measurements. It provides access to the LPDDR signals highlighted and passes all power and ground signals between the processor and the memory chip.

Key Features

- Provides access to memory address, control, and data bus signals between a processor and LPDDR memory chip.
- Enables correct operation of the LPDDR interface while being probed with two Keysight U4154A logic analyzer modules.
- Rigid-flex-rigid structure with Soft Touch Pro (STP) connectors requires two modified E5406A cables (sold separately) for connection to the logic analyzer.
- Riser is included to clear surrounding devices in tight keep-out volume applications. Riser dimensions: 11 mm x 11.5 mm.
- For dimensional drawings see final page.

Specifications

JEDEC Standard: JESD209-3B

Ball Count: 253

DRAM Size: 11 mm x 11.5 mm

Configuration: Dual channel x32 RAM (JEDEC MO-276 footprint)

Interposer size, pitch: 70 mm x 70 mm (Rigid Portion 26 mm x 26 mm), 0.5 mm

Connectors: 4 Soft Touch Pro Adapters
LPDDR4 366

BGA Logic Analyzer Interposer

Probes LPDDR4 366 ball memory devices

Signals Probed

The LPDDR4 366 BGA Logic Analyzer Interposer is optimized for protocol measurements with a Keysight logic analyzer. It provides access to the highlighted LPDDR signals and passes all power and ground signals between the processor and the memory chip.

Key Features

– Enables correct operation of the LPDDR interface while providing access to selected address, control, and data bus signals between the processor and LPDDR4 memory chip.

– Rigid structure with four Soft Touch Pro connectors. Requires four modified E5406A cables (sold separately) to connect to the logic analyzer.

– Includes configuration file for set up of the logic analyzer.

– For dimensional drawings see final page.

Specifications

Ball Count: 366

DRAM Size: 15 mm x 15 mm

Pitch: 0.5 mm

Configuration: 4 channel x16 DRAM

Interposer Size: 60 mm x 56 mm

Connectors: Four Soft Touch Pro
**DDDR4 x16**

**Cable Adapter**

**BGA Interposer ZIF to 90-pin Logic Analyzer Connector**

### Signals Probed

![Signal Diagram]

The DDR4 x16 cable adapter, used with the Keysight W4631A DDR4 x16 4-wing BGA Interposer, provides access to DDR4 signals highlighted.

### Key Features

- Logic analyzer cable used to connect Keysight U4154A logic analyzer module to Keysight W4631A DDR4 x16 4-wing BGA interposer.
- Enables all DDR4 x16 data traffic to be monitored using a single U4154A logic analyzer module.
- DDR4 x32 data can be monitored with: (2) W4631A DDR4 x16 BGA interposers, (2) DDR4 x16 cable adapters, and (2) U4154A logic analyzer modules.

### Specifications

**Configuration:**

DDR4 x16 DRAM (JEDEC MO-207 Variation DY-z footprint)

**Connectors:**

Four (4) Zero-Insertion Force (ZIF) to Five (5) 90-Pin Logic Analyzer pods
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