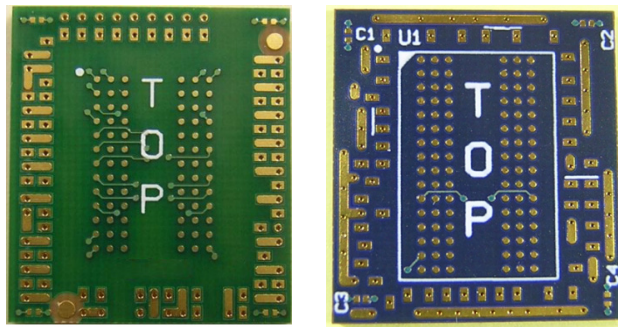


Keysight Technologies

N2114A and N2115A DDR4 BGA Interposers for Infiniium Oscilloscopes

Superior probing for DDR4 compliance test and debug

Data Sheet





Introduction

The DDR4 BGA interposers provide signal access to clock, strobe, data, address and command signals of the DDR4 BGA package for making electrical, timing and eye diagram measurements with an Infiniium oscilloscope. The DDR4 JEDEC1 specification is defined at the DRAM ballout, and the ballout is difficult to access. The BGA interposer provides direct signal access to the BGA package for true compliance testing.

The DDR4 BGA interposers are soldered between the DRAM and PC board or DIMM raw card where the DRAM would normally be soldered. They are designed with the PCB or DIMM footprint on the bottom side and the DRAM footprint on the top side. The BGA interposer passes the signals from the memory controller chip and DRAM directly to the top side of the BGA interposer where they can be accessed with oscilloscope probes.

Buried resistors placed at the signals inside the BGA interposer connect the probed signals to solder pads designed to work with InfiniiMax differential or single-ended solder-in probe heads. These resistors isolate the DDR4 signal and the probe loading effect. This design minimizes capacitive loading of the probe heads and allows high-speed operation without impact on signal integrity.

Probing at the right location is also an important consideration for DDR4 measurement. Many designs have vias or designed-in probe points, but they do not always produce good signal integrity. Probing at the wrong location could cause signal reflection, resulting in non-monotonic edges. This will cause error in your tests such as slew rate, setup and hold time measurements.

When used with N6462A/B DDR4 compliance test application, the BGA interposers provide a fast and easy way to test, debug and characterize your DDR4 designs. The tests covered by the N6462A/B software are based on the JEDEC DDR4 SDRAM specification. The test application offers a user-friendly setup wizard and a comprehensive report that includes margin analysis.

1. The JEDEC (Joint Electronic Device Engineering Council) Solid State Technology Association is a semiconductor engineering standardization body of the Electronic Industries Alliance (EIA), a trade association that represents all areas of the electronic industry.

Features

- Provides signal access points for DDR4 DRAM x4, x8 and x16 packages using JEDEC-standard common BGA footprints to the oscilloscope
- Buried resistors provide signal isolation and minimize capacitive loading
- Perimeter solder-down test points can be used with Logic Analyzer flying leads or Oscilloscope solder-down probe tips to access signals
- Effective bandwidth may be extended with InfiniiSim Waveform Transformation software
- Measurement timing skews reduced by matched trace lengths from DDR4 balls to test points
- Capacitive decoupling of the power and ground is achieved with plane layers within the stack-up of the interposer and four SMT capacitors
- Probing compatibility with InfiniiMax probe, which includes E2677A, N5381A, and N5425A/N5426A differential solder-in probe heads

Installing the DDR4 BGA interposer

The DDR4 BGA interposer is installed by soldering onto the BGA footprint of the PC board or DIMM card where the DRAM normally would be soldered. Then, solder the DDR4 DRAM to the top side of the BGA interposer. A riser may be soldered below the interposer to provide a lift to avoid interference with the adjacent components on the board or DIMM. These attachment steps may occur in any order.

The probe is designed to tolerate lead-free soldering temperature profiles. However, we recommend you apply the minimum temperature required for soldering and use the minimum number of heating and cooling cycles to reduce risk of any damage to the probe. The probe is supplied with lead-free solder balls.

We recommend you attach the BGA interposer during the manufacturing process. For designs that are manufactured, it will require expertise to attach the BGA interposers. If you lack the in-house expertise to attach the BGA interposer, you may wish to work with a contract manufacturer with this expertise that may be willing to perform the attachment for a fee. You can find more information on BGA soldering and rework techniques that may be useful in attaching the probe at:

<http://www.circuitrework.com/guides/9-1-1.shtml>

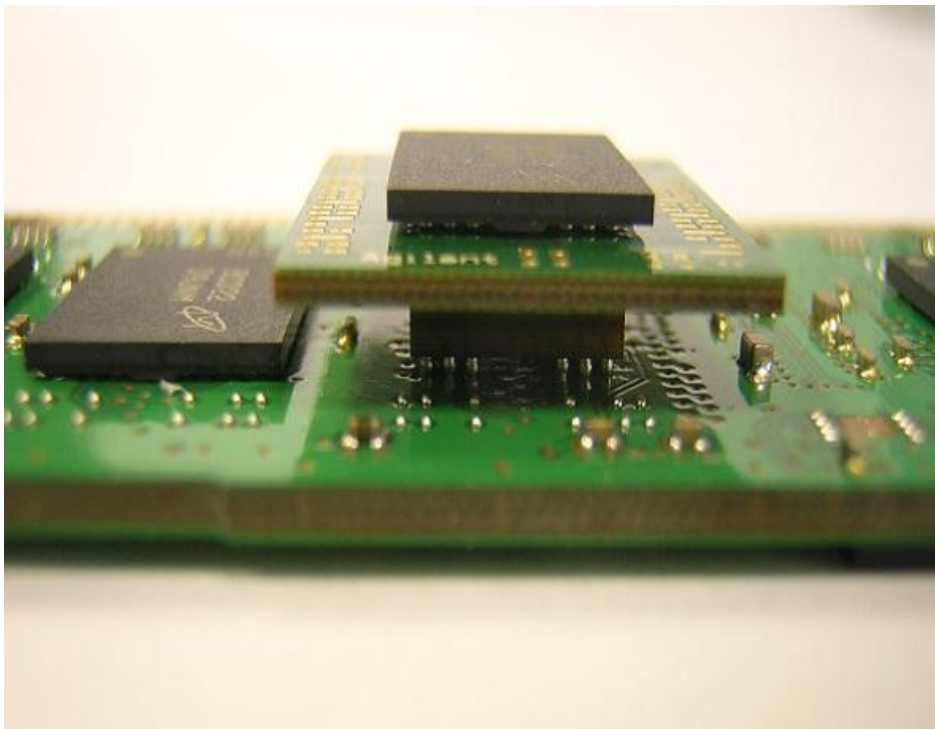


Figure 1. Photo of stacked DIMM-Riser-Interposer-DDR.

Installing the InfiniiMax probe

You can use the DDR4 BGA interposer with various InfiniiMax solder-in probes. Instructions that come with the InfiniiMax probe provide details on the proper soldering procedures for the InfiniiMax probe heads.

DDR4 BGA interposer dimensions, pad numbering and location

Model number: N2114A

Ball count: 78

Size: 16mm x 18mm

Connectors: Solder-down test points and solder balls

Signals to be probed:

- The DDR4 FBGA Interposer provides access to the DDR4 signals highlighted below and passes all power and ground signals between the system and the memory chip.
- Internal power and ground planes are used within the interposer. All VDD and VDDQ signals share a common power plane. All VSS and VSSQ signals share a common ground plane.

1	2	3	4	5	6	7
VDD	GND	TDQS_c	A	DM_N/DBI	GND	GND
VPP	VDD	DQS_c	B	DQ1	VDD	ZQ
VDD	DQ0	DQS_t	C	VDD	GND	VDD
GND	DQ4	DQ2	D	DQ3	DQ5	GND
GND	VDD	DQ6	E	DQ7	VDD	GND
VDD	C2/ODT1	ODT	F	CK_t	CK_c	VDD
GND	C0/CKE1	CKE	G	CS_n	C1/CS1_n	RFU
VDD	WE_n/A14	ACT_n	H	CAS_n/A15	RAS_n/A16	GND
VrefCA	BG0	A10/AP	J	A12/BC_n	BG1	VDD
GND	BA0	A4	K	A3	BA1	GND
RESET_n	A6	A0	L	A12/BC_n	A5	ALERT_n
VDD	A8	A2	M	A9	A7	VPP
GND	A11	PARITY	N	A17	A13	VDD

Figure 2. Highlighted signals are probed (top view).

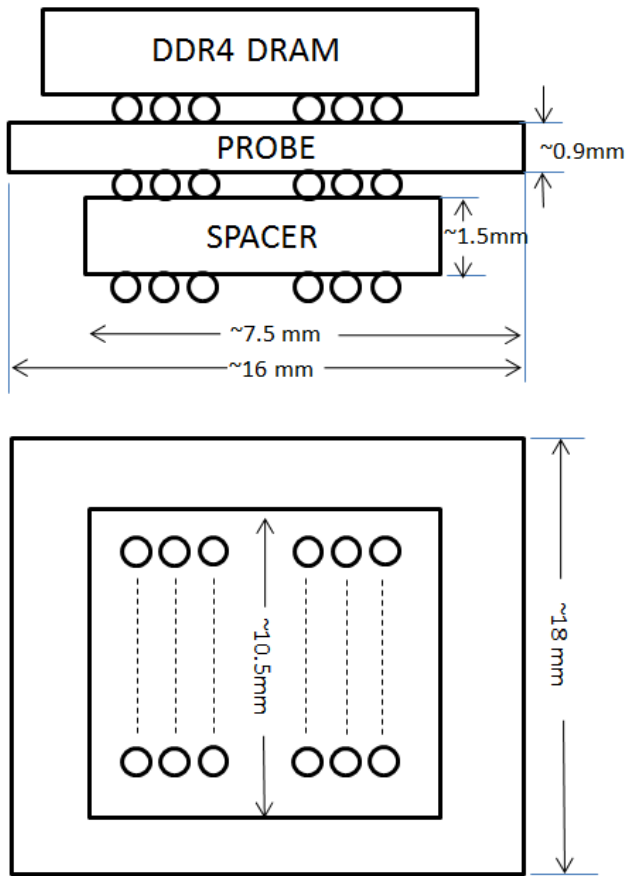


Figure 3. Riser/spacer, Interposer and RAM stack up:

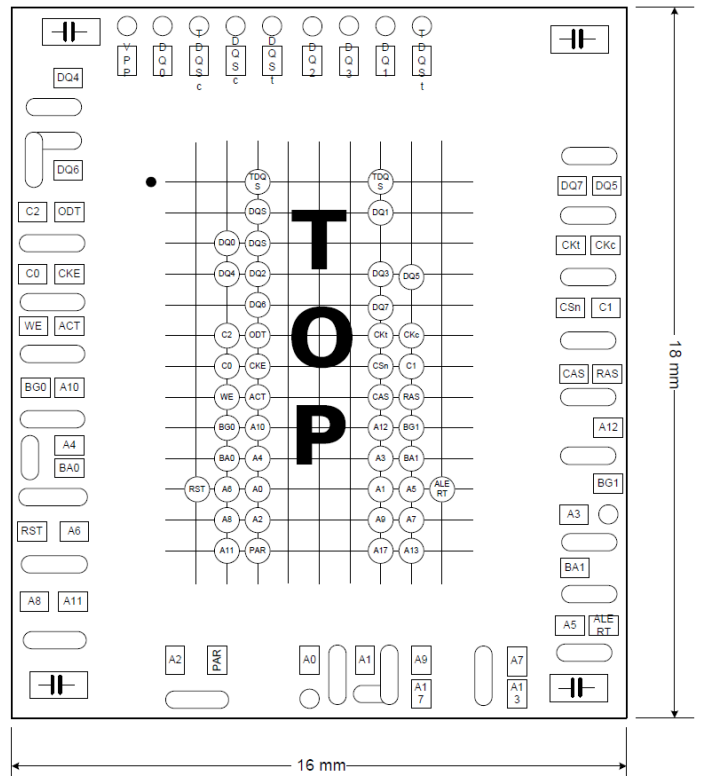


Figure 4. N2114A dimension drawing of interposer.

Model number: N2115A

Ball count: 96

Package size: 12.5 mm x 19.0 mm (max)

Connectors: Solder-down test points and solder balls

Signals to be probed:

- The DDR4 FBGA Interposer provides access to the DDR4 signals highlighted below and passes all power and ground signals between the system and the memory chip.
- There is one common power plane in the interposer. The four sets of surface mount (SMT) capacitor pads are connected to that common power plane. The user can probe the power planes using these SMT pads or attach 0201 size SMT filter capacitors to improve power integrity.

1	2	3	4-6	7	8	9
VDDQ	GND	DQU0	A	DQSU_c	GND	VDDQ
VPP	GND	VDD	B	DQSU_t	DQU1	VDD
VDDQ	DQU4	DQU2	C	DQU3	DQU5	GND
VDD	GND	DQU6	D	DQU7	GND	VDDQ
GND	DMU_n/ DBIU_n	GND	E	DML_n/ DBI_n	GND	GND
GND	VDDQ	DQSL_c	F	DQL1	VDDQ	ZQ
VDDQ	DQL0	DQSL_t	G	VDD	GND	VDDQ
GND	DQL4	DQL2	H	DQL3	DQL5	GND
VDD	VDDQ	DQL6	J	DQL7	VDDQ	VDD
GND	CKE	ODT	K	CK_t	CK_c	GND
VDD	WE_n/ A14	ACT_n	L	CS_n	RAS_n/ A16	VDD
VrefCA	BG0	A10/AP	M	A12/BC_n	CAS_n/ A15	GND
GND	BA0	A4	N	A3	BA1	TEN
RESET_n	A6	A0	P	A1	A5	ALERT_n
VDD	A8	A2	R	A9	A7	VPP
GND	A11	PARITY	T	NC	A13	VDD

Figure 5. Highlighted signals are probed (top view).

DDR4 x16 Scope Optimized Interposer

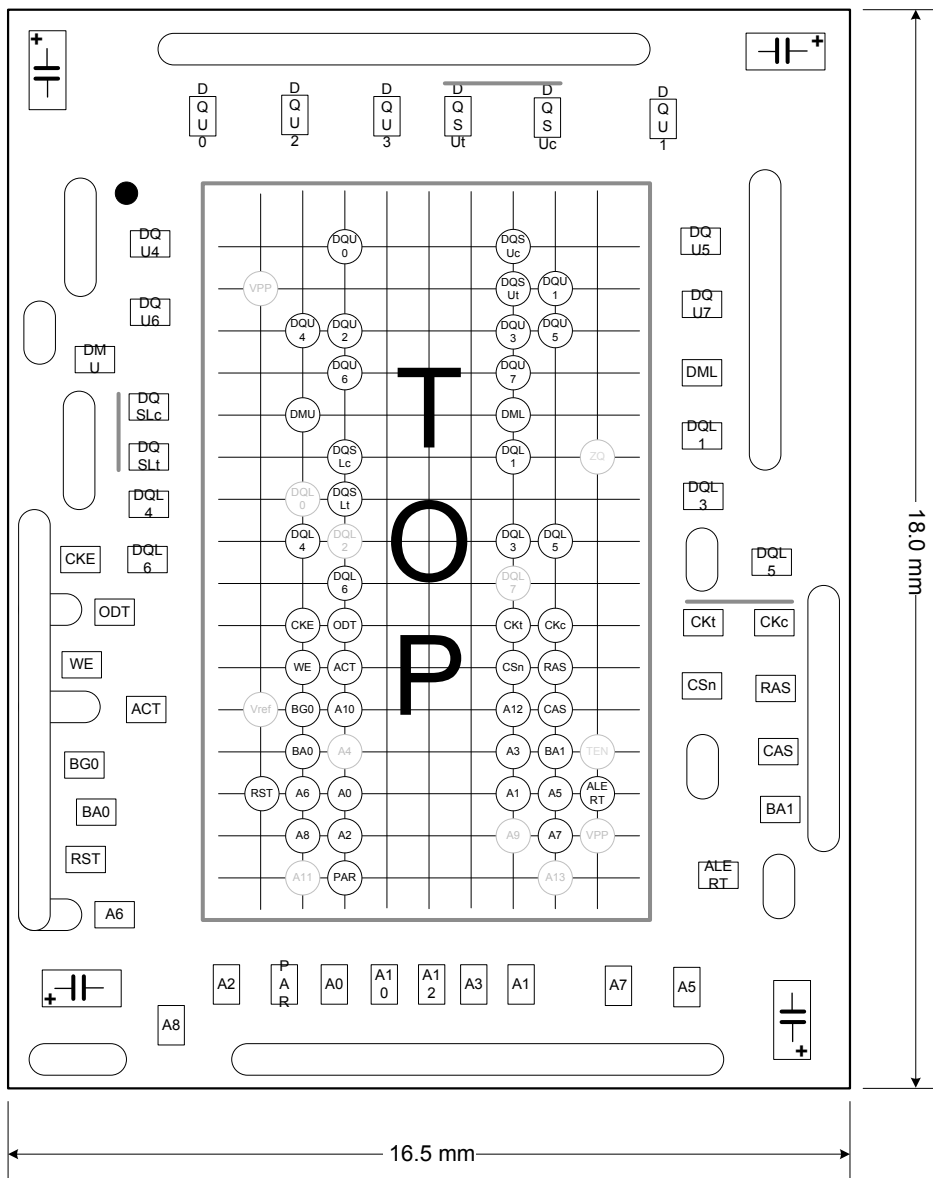


Figure 4. N2115A dimension drawing of interposer.

Ordering information

Model number	Description
N2114A	x4/8 DDR4 scope optimized BGA interposer with riser (quantity 1)
N2115A	x16 DDR4 scope optimized BGA interposer with riser (quantity 1)

Note: S parameter for use with InfiniSim Waveform Transformation Toolset available at www.keysight.com/find/n2114a and www.keysight.com/find/n2115a.

Recommended oscilloscope and probes

Data rate	Minimum bandwidth	Minimum channels	Minimum bandwidth
Up to 3200 MT/s	13 GHz	3	Infiniium 90000 and Z-Series

Probe accessories amplifiers

1169A 12-GHz InfiniiMax II probe amplifier
 N2803A 30 GHz InfiniiMax III probe amplifier
 N2802A 25 GHz InfiniiMax III probe amplifier
 N2801A 20 GHz InfiniiMax III probe amplifier
 N2800A 16 GHz InfiniiMax III probe amplifier
 N2831A 8 GHz InfiniiMax III+ probe amplifier
 N2832A 12 GHz InfiniiMax III+ probe amplifier

InfiniiMax I/II probe heads and accessories

(Compatible with 9000 and 90000 Series,
 use N5442A precision BNC adapter with 90000X/Q Series)
 N5381A InfiniiMax II 12-GHz differential solder-in probe head and accessories
 N5382A InfiniiMax II 12-GHz differential browser
 E2677A InfiniiMax II 12-GHz differential solder-in probe head and accessories
 N5425A InfiniiMax II 12-GHz ZIF probe head
 N5426A InfiniiMax II ZIF tips (x10)

InfiniiMax III probe heads and accessories

N5451A Long wire tips (x10)
 N5439A ZIF probe head
 N5445A Browser (hand held) probe head
 N5441A Solder-in probe head
 N2838A 450 Ω PCB ZIF tips (set of 5)
 N5447A 250 Ω ceramic ZIF tips (set of 5)
 N2848A InfiniiMax III QuickTip head
 N2849A InfiniiMax III QuickTip tips (4 per kit)

To learn more about Infiniium oscilloscope probes and accessories, check out the Infiniium Oscilloscope Probes and Accessories data sheet with the Keysight literature number 5968-7141EN.

For more information about Keysight's InfiniiMax III probing system, check out the InfiniiMax III data sheet with the Keysight literature number 5990-5653EN.

Related literature

Publication Title	Publication Type	Publication Number
<i>Infiniium 90000 Series Oscilloscopes and InfiniiMax Series Probes</i>	Data sheet	5989-7819EN
<i>Infiniium 90000X-Series Oscilloscopes</i>	Data sheet	5990-5271EN
<i>InfiniiScan Event Identification Software for Infiniium Series Oscilloscopes (N5414A and 5415A)</i>	Data sheet	5989-4605EN
<i>E2688A, N5384A High-Speed Serial Data Analysis and Clock Recovery Software for Infiniium Series Oscilloscopes</i>	Data sheet	5989-0108EN
<i>EZJIT and EZJIT Plus Jitter Analysis Software for Infiniium Series Oscilloscopes</i>	Data sheet	5989-0109EN
<i>N5465A InfiniiSim Waveform Transformation Toolset</i>	Data sheet	5990-4059EN

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