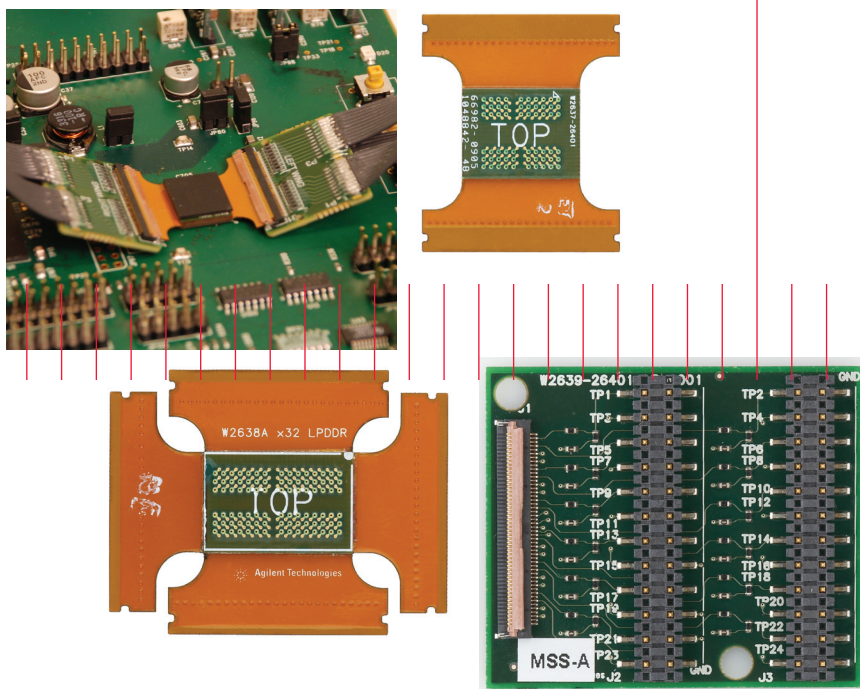


# Keysight Technologies

## W2637A, W2638A and W2639A

### LPDDR BGA Probes for Logic Analyzers and Oscilloscopes

#### Data Sheet



#### Introduction

The W2637A, W2638A and W2639A LPDDR BGA probes provide signal accessibility and probing of embedded memory designs directly at the ball grid array (BGA) package.

The Keysight Technologies, Inc. LPDDR BGA probes enable viewing of data traffic on industry standard LPDDR SDRAM, LPDDR NVM and mobile-DDR DRAM with the Keysight 16900 Series logic analysis system and Infiniium 9000 and 90000 Series oscilloscopes.



| Features                                                                                                                                                                                                          | Benefits                                                                                                                                                                                                                              |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Provides signal accessibility points for the LPDDR SDRAM, LPDDR NVM and mobile-DDR DRAM ball grid array (BGA) package.                                                                                            | Eliminates reflections from mid-bus probing methods. Also eliminates board space and trace routing required for connector probing methods.                                                                                            |
| Supports: <ul style="list-style-type: none"> <li>– x16 package (60 balls) all signals</li> <li>– x32 package (90 balls) all signals</li> </ul> Note: Please refer to Table 1, 2, 3 and 4 for pin-out information. | Get complete signal access to the LPDDR signals critical to your debug and validation effort.                                                                                                                                         |
| Buried resistors provide signal isolation and minimize capacitive loading.                                                                                                                                        | Acquire high-speed signals without impacting the performance of your design. The LPDDR BGA probe provides a non-intrusive electrical and mechanical between the memory device and an Keysight instrument.                             |
| Operating transsfer rate of up to 400 Mb/s 1.5 GHz bandwidth                                                                                                                                                      | Operate at full speed whether you're making measurements with a logic analyzer or oscilloscope.                                                                                                                                       |
| Works with existing designs                                                                                                                                                                                       | Eliminates need for re-design or up front planning                                                                                                                                                                                    |
| Supports either leaded or lead-free solder                                                                                                                                                                        | Easily works with all solder finishes. Designed to tolerate lead-free soldering temperature profiles.                                                                                                                                 |
| Contract manufactures available for those without the in-house expertise or facilities for soldering BGAs                                                                                                         | Eliminates the need to develop BGA soldering expertise.                                                                                                                                                                               |
| Flexible “wings” with ZIF connectors                                                                                                                                                                              | Ensures reliable connection to the ZIF probes. Enables placement of the probe cables around adjacent components. Minimizes the torque to the balls of the BGA                                                                         |
| Attach to E5384A, and E5826A, single-ended ZIF probes for connection to the logic analyzer                                                                                                                        | Optimizes the use of logic analyzer channels by allowing assignments of channels to                                                                                                                                                   |
| Probe points available for oscilloscope E2678A socket probe head to the W2639A scope adapter board that connects to the flex-rigid of the LPDDR BGA probe                                                         | Enables oscilloscope probing of the DRAM signals with Keysight Infiniium 9000 and 90000 Series oscilloscope, giving you a LPDDR compliance test solution covering clock, electrical and timing parameters of the JEDEC specification. |

## LPDDR BGA Connection to an Keysight Logic Analyzer

The W2637A LPDDR BGA probe connects to E5384A to provide connection to the logic analyzer for the x16 LPDDR package. The W2638A LPDDR BGA probe connects connection to the logic analyzer to E5384A and E5826A to provide for the x32 LPDDR package.



Figure 1. E5384A 46-ch single-ended ZIF probe for x16 and x32 DRAM BGA probe connects to 90-pin logic analyzer cables.

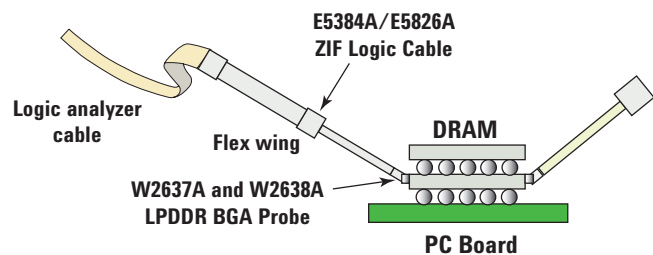


Figure 2. Probe connection to the logic analyzer

## LPDDR BGA Connection to a Keysight Oscilloscope

The LPDDR BGA probe is used with W2639A scope adapter board and the E2678A scope socket probe head to connect to the oscilloscope. The scope socket probe head is attached to the pin headers on the scope adapter board. The scope socket probe head makes a 1.5 GHz bandwidth connection with the solder points on the BGA probe.

The other alternative is using the W3635A scope probe adapter board and the N5425/26/51A ZIF tips. This method requires the ZIF tips to be soldered to the test points on the W3635A.

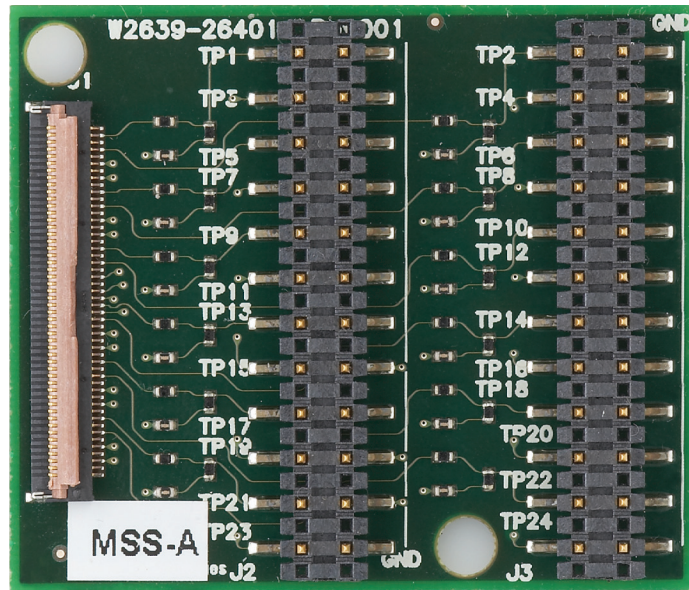


Figure 3. W2639A LPDDR scope probe adapter board with test points for connection to oscilloscope

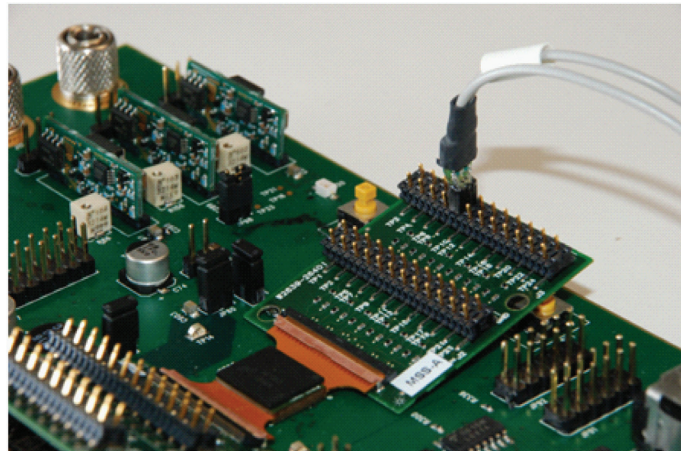


Figure 4. W2637A LPDDR BGA probe connection to the scope through W2639A LPDDR scope probe adapter board and E2678A socket probe head.

## LPDDR BGA Probe Pin-Out to Logic Analyzer

| Left Flex Wing (E5384A) |             |         |
|-------------------------|-------------|---------|
| Pin                     | Signal Name | Group   |
| All odd Pins            | GND         | -       |
| 2                       | NC          | -       |
| 4                       | DQ14        | Data    |
| 6                       | DQ15        | Data    |
| 8                       | DQ13        | Data    |
| 10                      | DQ12        | Data    |
| 12                      | UDQS        | Data    |
| 14                      | DQ10        | Data    |
| 16                      | DQ9         | Data    |
| 18                      | DQ8         | Data    |
| 29                      | DQ11        | Data    |
| 22                      | UDM         | Data    |
| 24                      | LDM         | Data    |
| 26                      | NC          | -       |
| 28                      | LDQS        | Data    |
| 30                      | BAD         | Command |
| 32                      | CS#         | Command |
| 34                      | A9          | Address |
| 36                      | A7          | Address |
| 38                      | A6          | Address |
| 40                      | A8          | Address |
| 42                      | A4          | Address |
| 44                      | A5          | Address |
| 46                      | NC          | -       |
| 48                      | NC          | -       |
| 50                      | GNG         | -       |

| Right Flex Wing (E5384A) |             |         |
|--------------------------|-------------|---------|
| Pin                      | Signal Name | Group   |
| All odd pins             | GND         | -       |
| 100                      | GND         | -       |
| 98                       | DQ0         | Data    |
| 96                       | DQ1         | Data    |
| 94                       | DQ2         | Data    |
| 92                       | DQ3         | Data    |
| 90                       | GND         | -       |
| 88                       | CKE         | Command |
| 86                       | DQ5         | Data    |
| 84                       | DQ6         | Data    |
| 82                       | DQ4         | Data    |
| 80                       | DQ7         | Data    |
| 78                       | CK          | Command |
| 76                       | CK#         | Command |
| 74                       | RAS#        | Command |
| 72                       | WE#         | Command |
| 70                       | CAS#        | Command |
| 68                       | BA1         | Command |
| 66                       | A13         | Address |
| 64                       | A12         | Address |
| 62                       | A11         | Address |
| 60                       | A1          | address |
| 58                       | A0          | Address |
| 56                       | A10         | Address |
| 54                       | A3          | Address |
| 52                       | A2          | Address |

Table 1. W2637A x16 LPDDR BGA Probe Pin-Out

| Left flex wing (E5384A) |             |         |
|-------------------------|-------------|---------|
| Pin                     | Signal Name | Group   |
| All odd Pins            | GND         | -       |
| 2                       | DM3         | Data    |
| 4                       | DQ31        | Data    |
| 6                       | DQ29        | Data    |
| 8                       | DQ27        | Data    |
| 10                      | DQ25        | Data    |
| 12                      | DQS2        | Data    |
| 14                      | DQ9         | Data    |
| 16                      | DQ11        | Data    |
| 18                      | DQ13        | Data    |
| 20                      | DQ15        | Data    |
| 22                      | DM2         | Data    |
| 24                      | WE#         | Command |
| 26                      | CAS#        | Command |
| 28                      | RAS#        | Command |
| 30                      | DM1         | Data    |
| 32                      | DQS1        | Data    |
| 34                      | A9          | Address |
| 36                      | A11         | Address |
| 38                      | A12         | Address |
| 40                      | A6          | Address |
| 42                      | A7          | Address |
| 44                      | A8          | Address |
| 46                      | A4          | Address |
| 48                      | A5          | Address |
| 50                      | GND         | -       |

| Right flex wing (E5384A) |             |         |
|--------------------------|-------------|---------|
| Pin                      | Signal Name | Group   |
| Add odd Pins             | GND         | -       |
| 100                      | GND         | -       |
| 98                       | DQ16        | Data    |
| 96                       | DQ18        | Data    |
| 94                       | DQ20        | Data    |
| 92                       | DQ22        | Data    |
| 90                       | GND         | -       |
| 88                       | CKE         | Command |
| 86                       | DQ6         | Data    |
| 64                       | DQ4         | Data    |
| 82                       | DQ2         | Data    |
| 80                       | DQ0         | Data    |
| 78                       | CS#         | Command |
| 76                       | GND         | -       |
| 74                       | BA1         | Command |
| 72                       | BA0         | Command |
| 70                       | DM0         | Data    |
| 68                       | DQS0        | Data    |
| 66                       | NC          | -       |
| 64                       | NC          | -       |
| 62                       | NC          | -       |
| 60                       | A1          | Address |
| 58                       | A0          | Address |
| 56                       | A10         | Address |
| 54                       | A3          | Address |
| 52                       | A2          | Address |

Table 2. W2638A x32 LPDDR BGA Probe Pin-Out (continued on next page)

| Bottom flex wing (E5826A) |             |       |
|---------------------------|-------------|-------|
| Pin                       | Signal Name | Group |
| All odd Pins              | GND         | -     |
| 102                       | NC          | -     |
| 104                       | DQ8         | Data  |
| 106                       | DQ10        | Data  |
| 108                       | DQ12        | Data  |
| 110                       | DQ14        | Data  |
| 112                       | NC          | -     |
| 114                       | DQ1         | Data  |
| 116                       | DQ3         | Data  |
| 118                       | DQ5         | Data  |
| 120                       | DQ7         | Data  |
| 122                       | NC          | -     |
| 124                       | NC          | -     |
| 126                       | NC          | -     |
| 128                       | NC          | -     |
| 130                       | NC          | -     |
| 132                       | NC          | -     |
| 134                       | NC          | -     |
| 136                       | NC          | -     |
| 138                       | NC          | -     |
| 140                       | NC          | -     |
| 142                       | NC          | -     |
| 144                       | NC          | -     |
| 46                        | NC          | -     |
| 148                       | NC          | -     |
| 150                       | GND         | -     |

| Top flex wing (E5826A) |             |         |
|------------------------|-------------|---------|
| Pin                    | Signal Name | Group   |
| Add odd Pins           | GND         | -       |
| 200                    | GND         | -       |
| 198                    | DQ24        | Data    |
| 196                    | DQ26        | Data    |
| 194                    | DQ28        | Data    |
| 192                    | DQ30        | Data    |
| 190                    | GK#         | Command |
| 188                    | CK          | Command |
| 186                    | DQ17        | Data    |
| 164                    | DQ19        | Data    |
| 182                    | DQ21        | Data    |
| 180                    | DQ23        | Data    |
| 178                    | NC          | -       |
| 176                    | NC          | -       |
| 174                    | NC          | -       |
| 172                    | NC          | -       |
| 170                    | NC          | -       |
| 168                    | NC          | -       |
| 166                    | NC          | -       |
| 164                    | NC          | -       |
| 162                    | NC          | -       |
| 160                    | NC          | -       |
| 158                    | NC          | -       |
| 156                    | NC          | -       |
| 154                    | NC          | -       |
| 152                    | NC          | -       |

Table 2. W2638A x32 LPDDR BGA Probe Pin-Out

## LPDDR Scope Probe Adapter Pin-Out for Scope

| Left Flex wing |             |            |  |             |             | Right Flex Wing |            |             |             |  |            |             |             |
|----------------|-------------|------------|--|-------------|-------------|-----------------|------------|-------------|-------------|--|------------|-------------|-------------|
| Signal Name    | Signal Name | Test point |  | Signal Name | Signal Name | Test point      | Test Point | Signal Name | Signal Name |  | Test Point | Signal Name | Signal Name |
| GND            | DQ14        | TP1        |  | GND         | NC          | TP2             | TP24       | DQ0         | GND         |  | TP23       | DQ1         | GND         |
| GND            | DQ13        | TP3        |  | GND         | DQ15        | TP4             | TP22       | DQ2         | GND         |  | TP21       | DQ3         | GND         |
| GND            | DQ10        | TP5        |  | GND         | DQ12        | TP6             | TP20       | GND         | GND         |  | TP19       | DQ5         | GND         |
| GND            | DQ9         | TP7        |  | GND         | UDQS        | TP8             | TP18       | CKE         | GND         |  | TP17       | DQ6         | GND         |
| GND            | DQ11        | TP9        |  | GND         | DQ8         | TP10            | TP16       | DQ4         | GND         |  | TP15       | DQ7         | GND         |
| GND            | NC          | TP11       |  | GND         | UDM         | TP12            | TP14       | CK          | GND         |  | TP13       | RAS#        | GND         |
| GND            | LDQS        | TP13       |  | GND         | LDM         | TP14            | TP12       | CK#         | GND         |  | TP11       | WE#         | GND         |
| GND            | CS#         | TP15       |  | GND         | BA0         | TP16            | TP10       | CAS#        | GND         |  | TP9        | BA1         | GND         |
| GND            | A6          | TP17       |  | GND         | A9          | TP18            | TP8        | A13         | GND         |  | TP7        | A11         | GND         |
| GND            | A8          | TP19       |  | GND         | A7          | TP20            | TP6        | A12, NC     | GND         |  | TP5        | A1          | GND         |
| GND            | A5          | TP21       |  | GND         | A4          | TP22            | TP4        | AO          | GND         |  | TP3        | A10         | GND         |
| GND            | NC          | TP23       |  | GND         | NC          | TP24            | TP2        | A3          | GND         |  | TP1        | A2          | GND         |

Table 3. W2639A LPDDR BGA Probe Adapter Board Pin-Out for W2637A x16 LPDDR BGA Probe

| Left Flex wing |             |            |             |             |            |
|----------------|-------------|------------|-------------|-------------|------------|
| Signal Name    | Signal Name | Test point | Signal Name | Signal Name | Test point |
| GND            | DM3         | TP1        | GND         | DQ31        | TP2        |
| GND            | DQ29        | TP3        | GND         | DQ27        | TP4        |
| GND            | DQ25        | TP5        | GND         | DQ9         | TP6        |
| GND            | DQS2        | TP7        | GND         | DQ11        | TP8        |
| GND            | DQ13        | TP9        | GND         | DQ15        | TP10       |
| GND            | DM2         | TP11       | GND         | CAS#        | TP12       |
| GND            | WE#         | TP13       | GND         | RAS#        | TP14       |
| GND            | DM1         | TP15       | GND         | DQS1        | TP16       |
| GND            | A9          | TP17       | GND         | A12         | TP18       |
| GND            | A11         | TP19       | GND         | A6          | TP20       |
| GND            | A7          | TP21       | GND         | A8          | TP22       |
| GND            | A4          | TP23       | GND         | A5          | TP24       |

| Right Flex Wing |             |             |            |             |             |
|-----------------|-------------|-------------|------------|-------------|-------------|
| Test Point      | Signal Name | Signal Name | Test Point | Signal Name | Signal Name |
| TP24            | DQ16        | GND         | TP23       | DQ18        | GND         |
| TP22            | DQ20        | GND         | TP21       | DQ22        | GND         |
| TP20            | GND         | GEN         | TP19       | DQ6         | GND         |
| TP18            | CKE         | GND         | TP17       | DQ4         | GND         |
| TP16            | DQ2         | GND         | TP15       | DQ0         | GND         |
| TP14            | CS#         | GND         | TP13       | BA1         | GND         |
| TP12            | GND         | GND         | TP11       | BA0         | GND         |
| TP10            | DM0         | GND         | TP9        | DQS0        | GND         |
| TP8             | NC          | GND         | TP7        | NC          | GND         |
| TP6             | NC          | GND         | TP5        | A1          | GND         |
| TP4             | AO          | GND         | TP3        | A10/AP      | GND         |
| TP2             | A3          | GND         | TP1        | A2          | GND         |

| Bottom Flex wing |             |            |             |             |            |
|------------------|-------------|------------|-------------|-------------|------------|
| Signal Name      | Signal Name | Test point | Signal Name | Signal Name | Test point |
| GND              | NC          | TP1        | GND         | DQ8         | TP2        |
| GND              | DQ10        | TP3        | GND         | DQ12        | TP4        |
| GND              | DQ14        | TP5        | GND         | DQ1         | TP6        |
| GND              | NC          | TP7        | GND         | DQ3         | TP8        |
| GND              | DQ5         | TP9        | GND         | DQ7         | TP10       |
| GND              | NC          | TP11       | GND         | NC          | TP12       |
| GND              | NC          | TP13       | GND         | NC          | TP14       |
| GND              | NC          | TP15       | GND         | NC          | TP16       |
| GND              | NC          | TP17       | GND         | NC          | TP18       |
| GND              | NC          | TP19       | GND         | NC          | TP20       |
| GND              | NC          | TP21       | GND         | NC          | TP22       |
| GND              | NC          | TP23       | GND         | NC          | TP24       |

| Top Flex Wing |             |             |            |             |             |
|---------------|-------------|-------------|------------|-------------|-------------|
| Test Point    | Signal Name | Signal Name | Test Point | Signal Name | Signal Name |
| TP24          | DQ24        | GND         | TP23       | DQ26        | GND         |
| TP22          | DQ28        | GND         | TP21       | DQ30        | GND         |
| TP20          | CK#         | GND         | TP19       | DQ17        | GND         |
| TP18          | CK          | GND         | TP17       | DQ19        | GND         |
| TP16          | DQ21        | GND         | TP15       | DQ23        | GND         |
| TP14          | NC          | GND         | TP13       | NC          | GND         |
| TP12          | NC          | GND         | TP11       | NC          | GND         |
| TP10          | NC          | GND         | TP9        | NC          | GND         |
| TP8           | NC          | GND         | TP7        | NC          | GND         |
| TP6           | NC          | GND         | TP5        | NC          | GND         |
| TP4           | NC          | GND         | TP3        | NC          | GND         |
| TP2           | NC          | GND         | TP1        | NC          | GND         |

Table 4. W2639A LPDDR BGA Probe Adapter Board Pin-Out for W2638A x32 LPDDR BGA Probe



## Electrical Characteristics

The following is the typical electrical characteristics of the LPDDR BGA probes.

**Table 1** Electrical characteristics

|                         |                      |                |
|-------------------------|----------------------|----------------|
| Operating Transfer Rate | W2637A + E5384/E5826 | : 255 Mb/s     |
|                         | W2638A + E5384/E5826 | : 255 Mb/s     |
|                         | W2637A + W2639A      | : 500 Mb/s     |
|                         | W2638A + W2639A      | : 500 Mb/s     |
| Bandwidth (3 dB)        | W2637A + E5384/E5826 | : 510 MHz      |
|                         | W2638A + E5384/E5826 | : 510 MHz      |
|                         | W2637A + W2639A      | : 1.5 GHz      |
|                         | W2638A + W2639A      | : 1.5 GHz      |
| Rise time               | W2637A + E5384/E5826 | : 686 ps       |
|                         | W2638A + E5384/E5826 | : 686 ps       |
|                         | W2637A + W2639A      | : 233 ps       |
|                         | W2638A + W2639A      | : 233 ps       |
| Input Impedance         | W2637A + W2639A      | : 200 $\Omega$ |
|                         | W2638A + W2639A      | : 200 $\Omega$ |

## LPDDR BGA Probes and Accessories

| Product    | Description                                                                                                        |
|------------|--------------------------------------------------------------------------------------------------------------------|
| W2637A-101 | LPDDR x16 0.8mm BGA command and data probes for logic analyzer and oscilloscope - kit of 1 probe                   |
| W2637A-102 | LPDDR x16 0.8mm BGA command and data probes for logic analyzer and oscilloscope - kit of 2 probes                  |
| W2637A-104 | LPDDR x16 0.8mm BGA command and data probes for logic analyzer and oscilloscope - kit of 4 probes                  |
| W2638A-101 | LPDDR x32 0.8mm BGA command and data probes for logic analyzer and oscilloscope - kit of 1 probes                  |
| W2638A-102 | LPDDR x32 0.8mm BGA command and data probes for logic analyzer and oscilloscope - kit of 2 probes                  |
| W2638A-104 | LPDDR x32 0.8mm BGA command and data probes for logic analyzer and oscilloscope - kit of 4 probes                  |
| W2639A     | LPDDR BGA scope probe adapter board – a kit of 2 boards (1 kit required for W2637A and 2 kits required for W2638A) |

## Logic Analyzer Configuration Guide

| DRAM type | Data width | Access to signals         | Access to signals | Cables | Logic Analyzer | Order summary                    |
|-----------|------------|---------------------------|-------------------|--------|----------------|----------------------------------|
| x16       | x16        | Command, Address and Data | W2637A            | E5384A | 16950Bx1       | 16950B: 1<br>E5384A: 1<br>W2637A |
| x32       | x32        | Command, Address and data | W2638A            | E5384A | 16950Bx2       | 16950B:1<br>E5384A:1             |
|           |            | Data                      |                   | E5826A |                | E5826A:1<br>W2638A               |

## Logic Analyzer Ordering Information

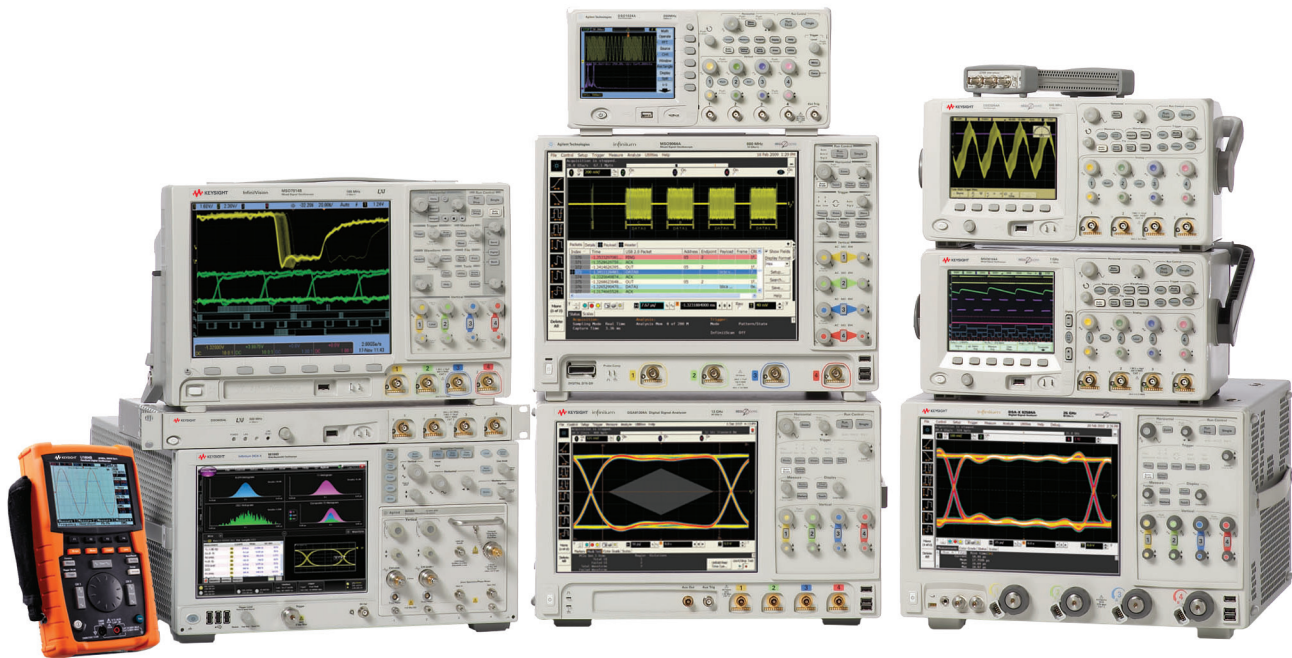
| Product                            | Description                                                                                                |
|------------------------------------|------------------------------------------------------------------------------------------------------------|
| <b>16900 Series Logic Analyzer</b> |                                                                                                            |
| 16900A                             | 6-slot mainframe, requires external display                                                                |
| 16901A                             | 2-slot mainframe, with 15-inch display with touch screen                                                   |
| 16902B                             | 6-slot mainframe, with 15-inch display with touch screen                                                   |
| <b>Logic Analyzer Modules</b>      |                                                                                                            |
| 16950B                             | 68-channel 4 GHz timing, 667 MHz state logic analysis module                                               |
| <b>Logic analyzer ZIF probes</b>   |                                                                                                            |
| E5384A                             | 46-channel single-ended ZIF probe for x16/x32 LPDDR DRAM BGA probe, connect to 90-pin logic analyzer cable |
| E5826A                             | 46-channel single-ended ZIF probe for x32 LPDDR DRAM BGA probe, connect to logic analyzer cable            |

## Oscilloscope Ordering Information

| Product                              | Description                                        |
|--------------------------------------|----------------------------------------------------|
| <b>90000 Series Oscilloscope</b>     |                                                    |
| 91304A                               | 13 GHz 4 channels 20 GSa/s Infiniium oscilloscope  |
| 91204A                               | 12 GHz 4 channels 20 GSa/s Infiniium oscilloscope  |
| 90804A                               | 8 GHz 4 channels 20 GSa/s Infiniium oscilloscope   |
| 90604A                               | 6 GHz 4 channels 20 GSa/s Infiniium oscilloscope   |
| 90404A                               | 4 GHz 4 channels 20 GSa/s Infiniium oscilloscope   |
| 90254A                               | 2.5 GHz 4 channels 20 GSa/s Infiniium oscilloscope |
| <b>9000 Series Oscilloscope</b>      |                                                    |
| 9404A                                | 4 GHz 4 channels 10 GSa/s Infiniium oscilloscope   |
| 9254A                                | 2.5 GHz 4 channels 10 GSa/s Infiniium oscilloscope |
| 9104A                                | 1 GHz 4 channels 10 GSa/s Infiniium oscilloscope   |
| <b>Oscilloscope Probes Amplifier</b> |                                                    |
| 1169A                                | 12 GHz InfiniiMax differential probe amplifier     |
| 1168A                                | 10 GHz InfiniiMax differential probe amplifier     |
| 1134A                                | 7 GHz InfiniiMax differential probe amplifier      |
| 1132A                                | 5 GHz InfiniiMax differential probe amplifier      |
| 1131A                                | 3.5 GHz InfiniiMax differential probe amplifier    |
| 1130A                                | 1.5 GHz InfiniiMax differential probe amplifier    |
| <b>DDR Application Software</b>      |                                                    |
| U7233A                               | DDR and LPDDR Compliance Test Application Software |
| N5413A                               | DDR2 Compliance Test Application Software          |
| U7231A                               | DDR3 Compliance Test Application Software          |
| N5414A                               | InfiniiScan Event Identification Software          |

## Related Literature

| Publication Title                                                                                                 | Publication Type | Publication Number |
|-------------------------------------------------------------------------------------------------------------------|------------------|--------------------|
| <i>Keysight W2637A, W2638A and W2639A LPDDR BGA Probe</i>                                                         | Manual           | W2637-97000        |
| <i>Keysight Technologies 16900 Series Logic Analysis System</i>                                                   | Data sheet       | 5989-0420EN        |
| <i>Keysight Technologies Infiniium DSO90000 Series Oscilloscopes and InfiniiMax Series Probes</i>                 | Data sheet       | 5989-7819EN        |
| <i>Keysight Technologies U7233A DDR1 and LPDDR1 Compliance Test Application for Infiniium Series Oscilloscope</i> | Data sheet       | 5989-7366EN        |
| <i>Keysight Technologies N5413A DDR2 Compliance Test Application for Infiniium Series Oscilloscope</i>            | Data sheet       | 5989-3195EN        |
| <i>Keysight Technologies U7231A DDR3 Compliance Test Application for Infiniium Series Oscilloscope</i>            | Data sheet       | 5989-7243ED        |
| <i>A Time-Saving Method for Analyzing Signal Integrity in DDR Memory Buses</i>                                    | Application note | 5989-6664EN        |



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