

Agilent N4236A

**FB-DIMM Parametric Test
Fixture**

User's Guide



Agilent Technologies

Notices

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Introduction—4**N4236A DIMM Parametric Test Fixture Description—5**

Fixture Technical Feature Summary—5

Equipment Supplied—6

N4236A DIMM Parametric Test Fixture Operation—7

Installing the operating software for the fixture—7

Using ctexec—8**Example—8**

Applying power to the FB-DIMM fixture—9

Controlling the FB-DIMM—9

Configuring the SMBus address of the DIMM—10

Configuring the CTC Slot Type of the DIMM as “Master”—11

Configuring the CTC Slot Type of the DIMM as “Loopback”—11

Daisy chaining multiple fixtures controlled from a single USB connection—11

Connecting test equipment to FBD High-Speed signal pins of DIMM—14

Optional 50 ohm termination of high-speed signals—14

Connecting the reference clock source to the DIMM—15

Resetting the DIMM—15

Configuring the DIMM test pins—16

De-embedding the fixture using on-board SOLT calibration networks—17

Characteristics, Regulatory, and Safety Information—18

Operating Characteristics—18

WEEE Compliance—18**Safety Notices—19**

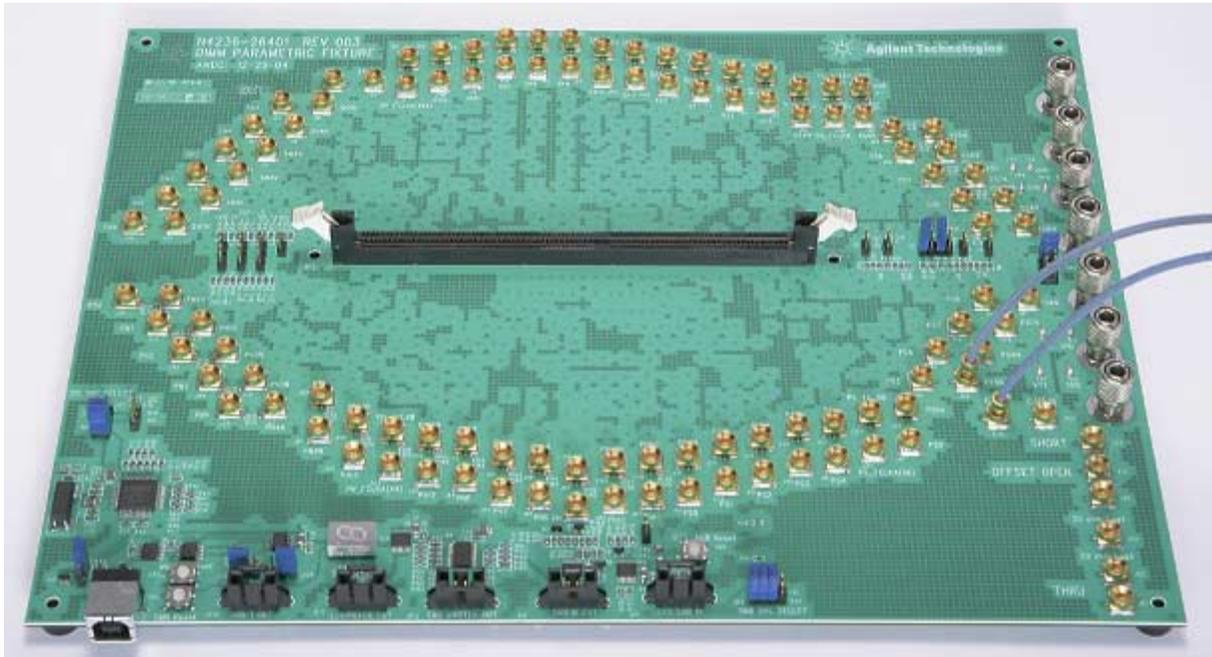
Warnings—19

To clean the instrument—19

Safety Symbols—19

Introduction

This *User's Guide* provides operation and programming information for the N4236A FB-DIMM parametric test fixture.



N4236A DIMM Parametric Test Fixture Description

The N4236A FB-DIMM parametric test fixture is designed to allow accurate and repeatable measurements of key operating parameters and specifications of Fully Buffered Dimm (FBD) DIMM modules. It allows parametric test equipment such as oscilloscopes, pulse generators, bit error ratio testers, TDRs, and vector network analyzers to be connected to the pins of a JEDEC standard FB-DIMM device using standard 50 ohm interconnect.

Fixture Technical Feature Summary

- Complete control of DIMM using a USB interface that is compatible with scripts and control software for Intel's Channel Test Card (CTC).
- The fixture may be configured to appear as either the master slot on a CTC, as the Loopback slot, or as any test slot.
- A single fixture may be used to control up to three additional fixtures using a single USB connection.
- Reset of the DIMM is supported via a manual pushbutton as well as via CTC software control.
- 50 ohm controlled impedance connection to JEDEC standard FB-DIMM. Each signal is routed as a 50 ohm ($\pm 7\%$ Max, $\pm 3\%$ Typical) single-ended signal from the pins of the FB-DIMM connector to test equipment connection points. Wide trace separation ensure good isolation between high-speed signals.
- All high speed signal traces are length matched to better than 1 mil to the FB-DIMM connector solder tails.
- Calibration coupons are provided to allow de-embedding of the fixture using SOLT calibration or TDR normalization.
- SMP male connectors are provided for:
 - All Northbound and Southbound high-speed channel signals.
 - Reference clock.
 - Pins reserved for future FBD2 forwarded clocks.
- Optional on-fixture 50 ohm termination network for each high-speed output signal.
- 0.10" Header connections provided for:
 - All other JEDEC defined FB-DIMM connector pins not defined as high-speed signals. Each of these may be terminated to any combination of VCC, VDD, or VSS using user-configurable termination resistors.
- Separate power plane and decoupling provided for each supply.

N4236A DIMM Parametric Test Fixture Description

- DIMM SMBus address (SA0, SA1, SA2) easily programmed using supplied jumpers.

Equipment Supplied

The following components have been shipped with your N4236A fixture:

- N4236A-62401 main board
- USB cable
- 3 pairs of phase matched (2ps) 50 ohm($\pm 5\%$) SMP female to SMA male adapter cables. One pair is 1 meter long to ease connection to test equipment. Two pairs are 16 inches long to minimize cable loss.
- 1 pair of phase matched (2ps) 50ohm($\pm 5\%$) SMP female to SMP female cables to enable loopback testing of one lane.
- This *User's Guide*

N4236A DIMM Parametric Test Fixture Operation

Installing the operating software for the fixture

The N4236A is controlled via a USB connection to a Windows based PC using the same operating software used to control Intel's Channel Test Card. This software allows complete control of the DIMM installed on the fixture using Python scripts. The operating software supplied with the fixture includes the main control program "ctcexec" which connects to the fixture and contains the Python script interpreter. Also supplied is a set of public domain GUI libraries (wxPython) and some example scripts that initialize the fixture and the DIMM, and invoke DIMM IBIST to allow immediate measurement of signals.

To install the operating software on a PC, follow the following steps. Each step need only be done once, so if you have already installed CTC control software or software for another N4235A or N4236A fixture, you can skip the appropriate steps.

NOTE

Do not connect the fixture to the USB port on the PC until instructed to in the procedure below.

- 1** Unpack the supplied .zip files (ctc_n423x.zip, ctc_n423x_python_software.zip, ctc_n423x_gui_software.zip) into the C: directory on your PC. This will create a directory C:\ctc_n423x and install required files in that directory.
- 2** Start a command prompt window and change to the C:\ctc_n423x directory. Subsequent steps will be performed in this window.
- 3** Install the USB drivers for the fixture.
 - a** From the command prompt window execute the "cpydrvrs.bat" command. This will prepare the drivers to recognize the fixture.
 - b** Connect a 3.3V supply to the VDDSPD power supply connector on the N4236A.
 - c** Plug a USB cable into the N4236A USB connector and your PC.
 - d** If the USB drivers for the CTC or N4235A/N4236A fixtures have already been installed you should see the LED on the fixture light up after a few seconds with the USB address assigned to the fixture. If the drivers have not been installed then the PC will detect the new hardware and start the New Hardware Found wizard. If the wizard brings up the dialog that prompts where to search for the drivers, select the "Specify a location" option and select the C:\ctc_n423x directory as the location to search for the drivers. Accept all defaults in the other wizard steps until the wizard completes.

- e From the command prompt window, execute the Python setup file “Python-2.3.4c1.exe”. You may also invoke this by double clicking on the file in a Windows Explorer window. Accept all defaults in the setup dialogs.
- f From the command prompt window, execute the Python GUI utilities setup file “wxPythonWIN32-2.4.2.4-Py23.exe”. You may also invoke this by double clicking on the file in a Windows Explorer window. Accept all defaults in the setup dialogs.

The fixture operating software is now installed.

Using `ctcexec`

To begin using the fixture and running control scripts, apply power as described in the section “Applying power to the DIMM fixture” and invoke the “`ctcexec`” program from the command prompt window previously created. `Ctcexec` accepts two arguments:

1. The USB address of the fixture (indicated on the LED on the fixture)
2. The initial Python script to execute.

The USB address will typically be 0 unless more than one fixture is connected to the same PC, in which case consecutive fixtures will be assigned increasing addresses. The assigned USB address will appear on the LED display on the fixture.

Example

To invoke the example fixture control software, for example, you would execute the following command in the command prompt window – “`ctcexec 0 train_env.py`”. This assumes the fixture shows address 0 on its LED.

When the example script is invoked, a small GUI will pop up with two buttons labeled “Reset” and “Start IBIST”. If proper operating power and a reference clock has been supplied to the fixture then you can use this example GUI to initialize the AMB on the DIMM and start IBIST. (See the Section [Applying power to the FB-DIMM fixture](#).) Click the Reset button to reset the DIMM/AMB. Click the Start IBIST button to program the AMB on the DIMM to start running IBIST continuously. This will drive a repeating pattern on all high-speed channel output signals (Primary NB and Secondary SB) using the default IBIST settings.

The example script may be modified as desired to change its behavior or the IBIST settings. Open the file “`train_env.py`” and follow the sequence of calls to identify the code to be changed.

Applying power to the FB-DIMM fixture

The N4236A fixture must be supplied with power using external power supplies. Banana posts are provided for VDDspd (3.3v), VDD (1.8V), VCC (1.5V), and VTT (0.9V). Each supply is connected to the DIMM using a separate power plane with bulk decoupling as well as high-frequency decoupling.

CAUTION

Use a benchtop power supply with current limiting capability. Set the current limit to 3A. If your device draws more than 3A, set the current limit to the current required by your device, plus 20 percent.

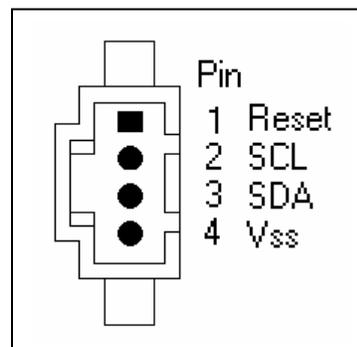
Power supply test points are provided for each supply voltage. This allows monitoring of actual DIMM supply voltage or the use of remote sensing power supplies to precisely control DIMM supply voltage given normal voltage drops on the power supply cables. Each test point is labeled on the fixture with the name of the supply monitored by the test point.

The VDDspd supply powers the USB/SMBus controller circuitry as well as supplying VDDspd power to the DIMM. This supply must be operating for the SMBus control circuitry on the N4236A fixture to function.

Controlling the FB-DIMM

The DIMM on the N4236A may be controlled using the on-board SMBus controller or with a user-supplied SMBus controller. By default the on-board controller is used and the fixture appears as CTC test slot 0.

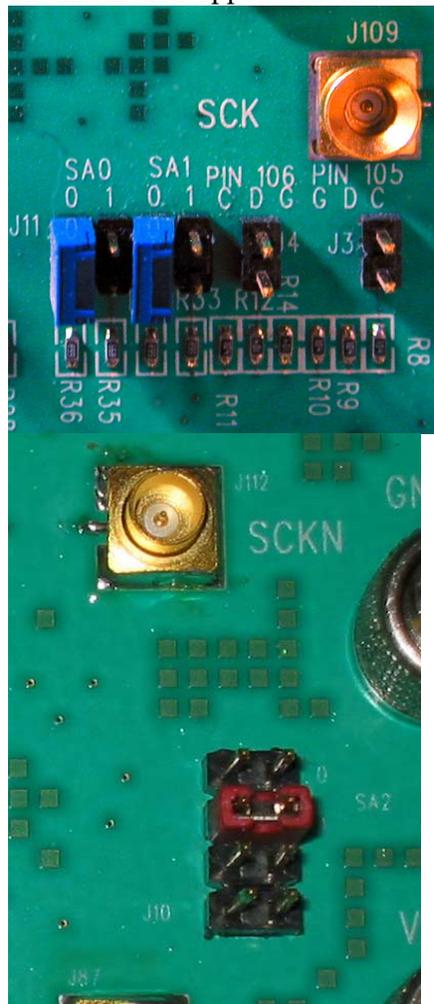
The “Ext SMB In” connector (P25) can be used to control the DIMM using an external SMBus controller. This controller can either be another N4236 or N4235 fixture, or an SMBus controller of your own design. The N4236A provides four external SMBus outputs so that up to four fixtures can be controlled from a single main fixture. Each external SMBus connector carries the SDA, SCL, DIMM_Reset, and VSS signal as shown below:



The standard CTC software provided by Intel may be used to control the DIMM SMBus signals and the reset signal of the DIMM via the USB port on the N4236A fixture. A copy of this software is also available from Agilent. Contact your local Agilent sales representative to request a copy. Refer to the Intel CTC documentation for information on how to control the DIMM using this software.

Configuring the SMBus address of the DIMM

The SMBus address pins of the DIMM (SA0, SA1 and SA2) may be individually set high or low by configuring jumpers on the fixture. For each address signal two jumper positions are provided. Each jumper position is marked on the fixture with the address signal name and a logic value (“1” or “0”). Installing a jumper at the position marked “0” will tie that signal pin to VSS. Installing a jumper at the position marked “1” will tie that signal pin to VDDspd. The fixture is shipped with the SMBus address inputs all set to “0”.



Configuring the CTC Slot Type of the DIMM as “Master”

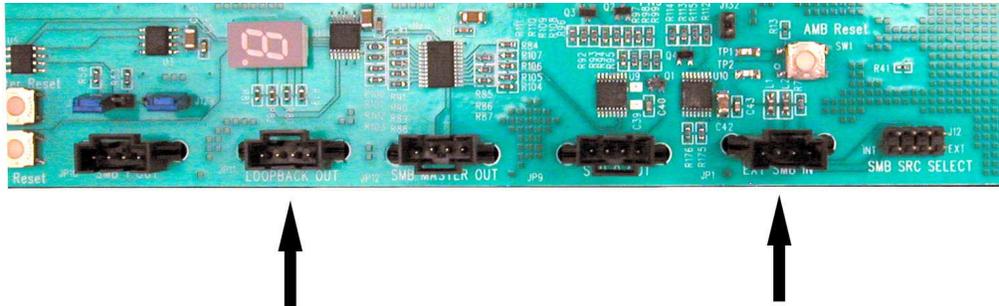
By default the DIMM appears to the control software as if it is installed in Test Slot 0 of a CTC. To configure the fixture so the DIMM appears in the “Master” slot the supplied SMBus expansion cable must be used. This would be used, for example, if the CTC Virtual Host Mode control functions were to be used with the fixture. One end is plugged into the “SMB Master” SMBus expansion connector, and the other end is plugged into the “Ext SMB In” connector. Finally, the three jumpers at J12 must be removed to configure the fixture to drive the DIMM from the Ext SMB In connector rather than the internal SMBus controller.



J12 – SMBs Source Selection Jumpers

Configuring the CTC Slot Type of the DIMM as “Loopback”

To configure the N4236A fixture so the DIMM appears in the “Loopback” slot the supplied SMBus expansion cable must be used. One end is plugged into the “SMB Loopback” SMBus expansion connector, and the other end is plugged into the “Ext SMB In” connector. Finally, the three jumpers at J12 must be removed to configure the fixture to drive the DIMM from the Ext SMB In connector rather than the internal SMBus controller.



Daisy chaining multiple fixtures controlled from a single USB connection

To control two fixtures using a single USB connection to a PC, an SMBus expansion cable (supplied with the fixture) is used to connect from the “EXT SMB IN” connector of the slave fixture to one of the four SMBus out connectors on the main fixture. In this way up to four fixtures total can be controlled using a single USB connection. The CTC slot type of the slave fixture is configured by the choice of the SMBus expansion connector on the main fixture as described Table 1.

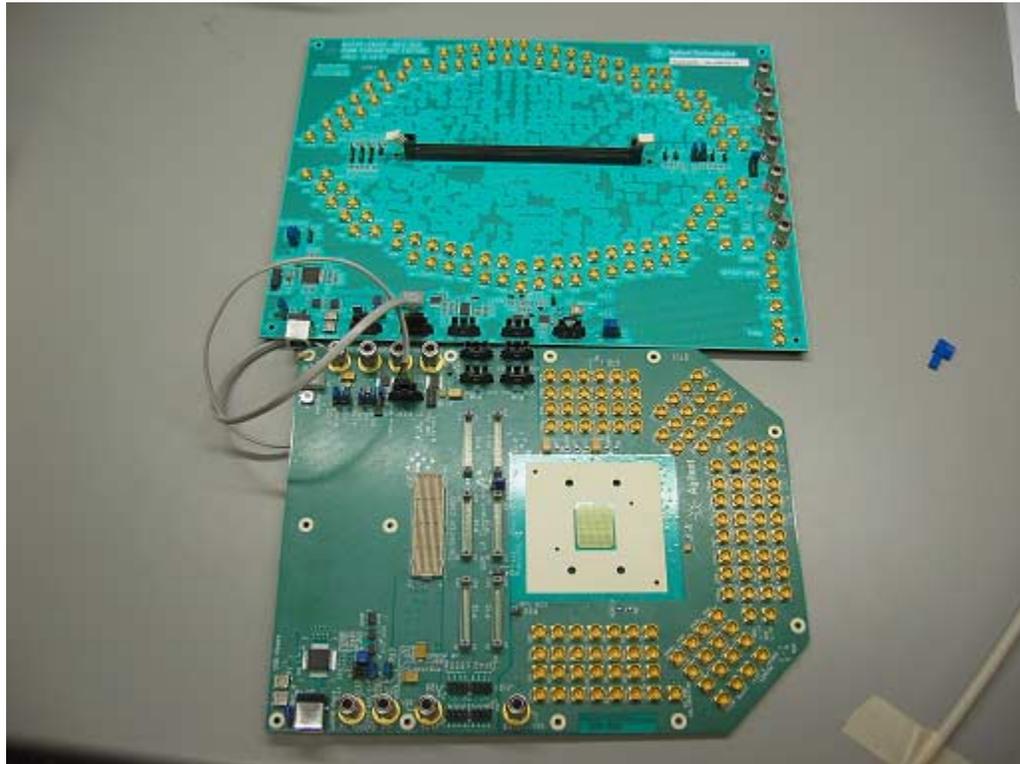
NOTE

The pinout of this connector on the N4236A fixture is REVERSED from the pinout on the N4235A. N4236A and N4235A fixtures can be connected via the supplied SMBus cable, but the pins on one end of the cable should be reversed before using the cable. This issue may be corrected in a future release of the N4236A fixture.

Table 1 CTC slot type

Main Fixture CONNECTOR cabled to Ext SMB In on slave fixture	DIMM/AMB on Slave fixture appears to control SW as if it is located in	Slot address	Reset Pin Function controlled by CTC SW as if the pin is
JP9 / SMB 0 Out	Test slot	Set by SMBus Jumpers	Test Slot 0
JP10 / SMB 1 Out	Test slot	Set by SMBus Jumpers	Test Slot 1
JP11 / Loopback Out	Loopback slot	Set by SMBus Jumpers	Loopback Slot
JP12 / MSTR Out	Master slot	Set by SMBus Jumpers	Master Slot

The photo below shows an N4236 and N4235 fixture connected in a master/slave configuration:



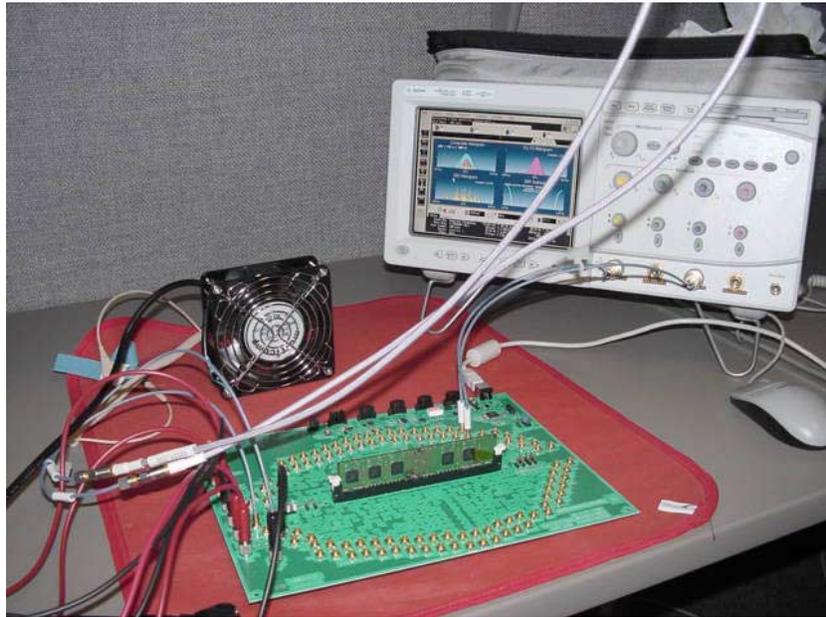
On the CTC the SMBus channels for the test, Loopback, and Master slots are distinct. There are eight test slots on a CTC, each with a different SMBus address hardwired on the CTC itself. All eight test slots share the same SMBus clock and data lines. The Master and Loopback slots each have their own SMBus clock and data lines. That is why the appropriate SMBus channel must be selected (such as with `CTC.SETSMBCHANNEL()`) before performing SMBus transactions on that channel. On the N4236A fixture the SMBus address is selected by configuring the SMBus address jumpers rather than being hardwired specially for each DIMM connector as is done on the CTC. Normally these jumpers are used to choose which Test slot the N4236 DIMM connector presents itself to the CTC control SW as. However it is also possible to configure the DIMM on the N4236A to appear in the Loopback or Master channel at any SMBus address instead of address 0 (which is hardwired on the CTC).

The DIMM reset signals are NOT shared between slots on a CTC, and are connected individually to each Master, Test, and loopback slot. On the N4236A fixture, these specific reset signals are connected to the SMBus expansion connectors as shown in the table above. There are two resets corresponding to Test slots 0 and 1 respectively, and one reset each for the Master and Loopback slots. They are accessed by CTC scripts in exactly the same way as the DIMM resets for Test slots 0 and 1 and the Master and Loopback slots are accessed. Therefore, when configuring the N4236A fixture to place the DIMM at an SMBus address other than test slot 0, or SMBus address 0 in the Loopback or Master slot, your CTC script code needs to be aware that the “normal” method of resetting the DIMM will not work since it will try to access a reset line that does not exist on the N4236A. For example, if you have configured the SMBus address to 0x2 on the fixture, you would see the DIMM at the address you would normally expect for slot 2. However, to reset the DIMM you must use the reset line that the CTC scripts think is connected to Test slot 0, since that is the line that is physically connected to the DIMM on the fixture regardless of what the fixture SMBus jumpers are set to. This applies to the SMBus expansion connectors as well, as described in the table above. For this reason it is recommended that the SMBus address jumpers be left at their factory default settings (Slot 0) unless you clearly understand the implications on your CTC control scripts of changing the SMBus address of the DIMM installed on the N4236A.

Connecting test equipment to FBD High-Speed signal pins of DIMM

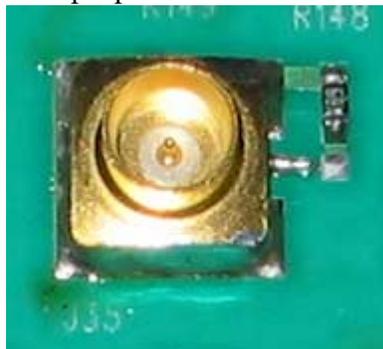
SMP male connectors are provided for each FB-DIMM high-speed signal. The signal attached to each connector is indicated on the fixture. Each connection to the DIMM is via a 50 ohm single ended connection. All traces to the DIMM are length matched to better than 1 mil from the SMP connector to the connector solder tails. The SMP female to SMA male cables supplied with the fixture may be used to connect test equipment such as oscilloscopes, TDRs, VNAs, BERT/ParBerts, and pulse generators to the DIMM.

A typical setup showing the N4236A connected to an oscilloscope is shown below:



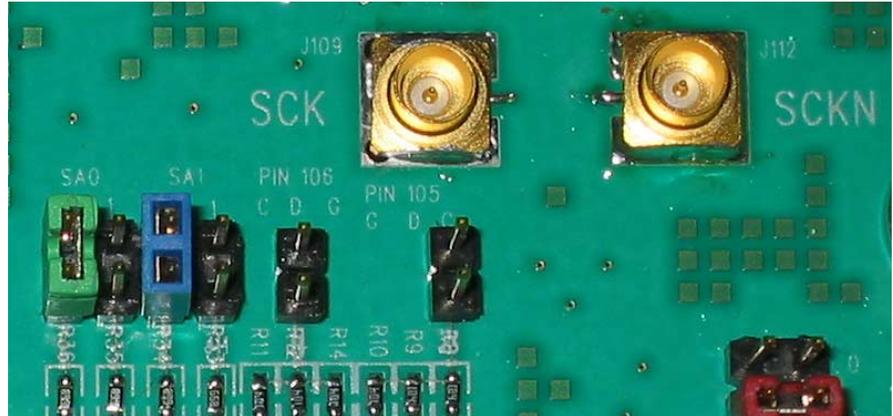
Optional 50 ohm termination of high-speed signals

Near each high-speed output signal SMP connector is placed a 50 ohm resistor connected to VSS. If desired, a short wire or solder bridge may be connected between this resistor and the SMP pin to implement a 50 ohm termination of that output signal. When not connected, there is no additional stub attached to the signal. See the example picture below.



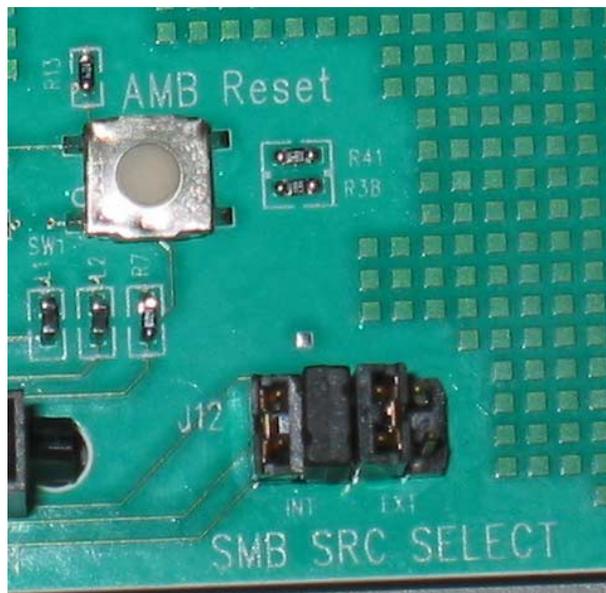
Connecting the reference clock source to the DIMM

Two SMP connectors are provided to connect to the differential reference clock input. These connectors are labeled as “SCK” and “SCKn” on the fixture. Each provides a 50 ohm single ended trace to the DIMM reference clock input pins.



Resetting the DIMM

The DIMM may be reset either using the standard CTC DIMM reset control commands or using a manual reset button on the fixture. When the reset button is depressed the DIMM “Resetn” pin is connected to VSS. This overrides any reset generated by the CTC control command.

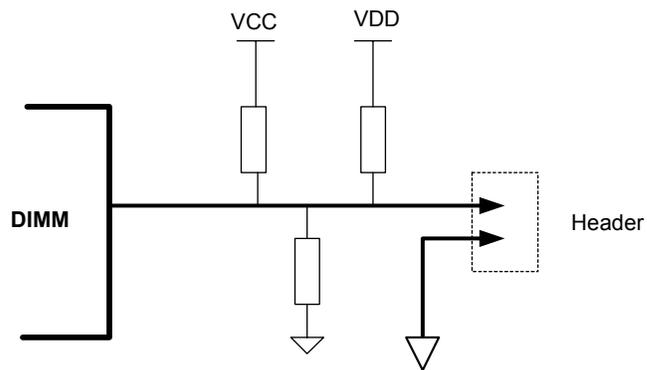


Configuring the DIMM test pins

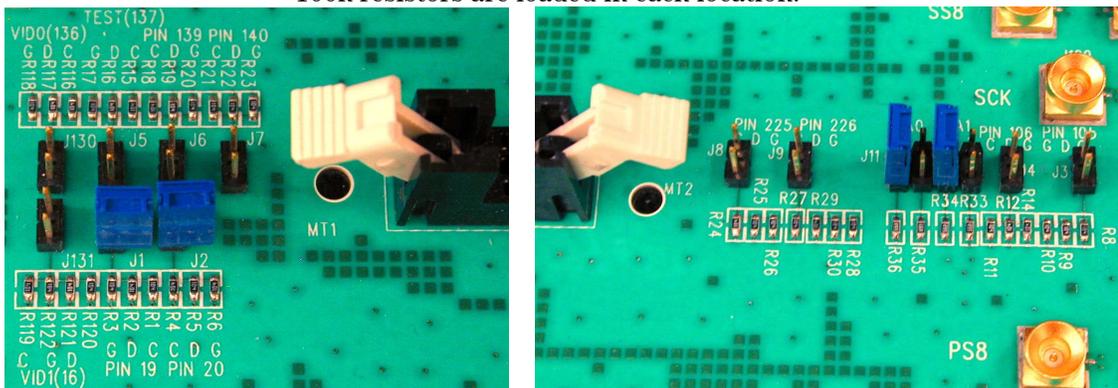
The pins designated TEST, and RFU in the JEDEC DIMM connector specification are all accessible using 0.10" headers provided on the fixture. The DIMM gold finger is connected to one pin of the header along with three resistor pads. The other pin of the header is connected to ground.

Each pin is connected to 0603 resistor pads that allow attaching each pin via resistors to any combination of VCC, VDD and VSS.

The schematic below is representative of the Test pin termination network:



The configuration areas are shown below. The DIMM pin number each resistor/test pin header is connected to is indicated along with the supply the resistor in each position is connected to. By default 100k resistors are loaded in each location.



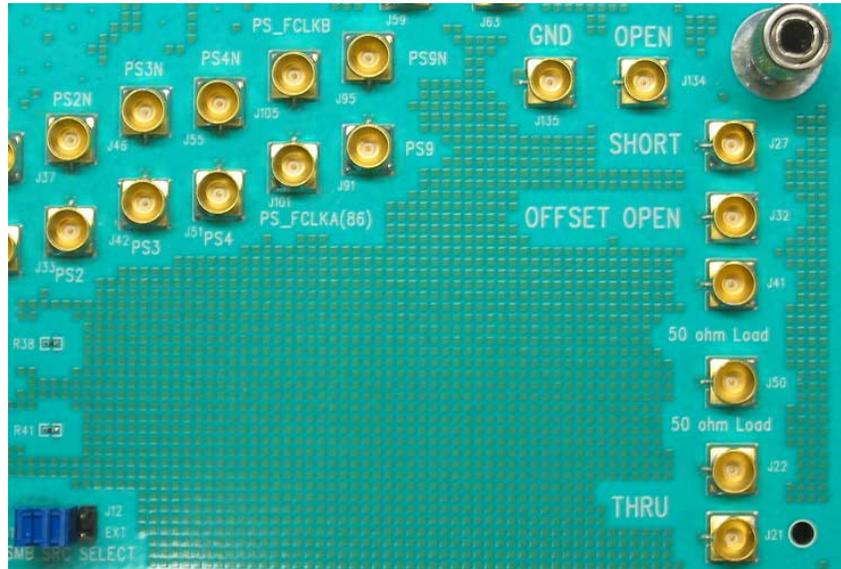
The silkscreen legends indicate which power supply the associated column of resistors is connected to:

Table 2 Meaning of the legend above test pin resistors

Legend	Resistor is connected to this supply
C	VCC
D	VDD
S	VSS (GND)

De-embedding the fixture using on-board SOLT calibration networks

SOLT style calibration networks are provided to allow the reference plane of measurement instruments to be extended to the solder tails of the DIMM connector (essentially the same point a DIMM connector attaches to a system motherboard). They are located in the lower left corner of the fixture as shown below:



The SMP labeled “GND” has its signal pin connected to GND right at the SMP connector. The SMP labeled “OPEN” leaves its signal pin open. These two connections may be used to measure the characteristics of the cables to be connected to the fixture. A 50 ohm load right at the SMP connector is not provided, and can be created by soldering a 50 ohm resistor between the pin and body of the “OPEN” SMP connector.

The “SHORT”, “OFFSET OPEN”, and “50 Ohm Load” SMP connectors have traces routed respectively to a GND connection, an open circuit, and a 50 ohm resistor to ground. The trace length is matched to better than 1 mil to the trace lengths from the high speed signals to the FB-DIMM connector. The “THRU” calibration connection is provided by the pair of SMPs marked “THRU”. The trace length between these SMPs is exactly twice the length of the traces from a high-speed signal SMP to the FB-DIMM connector. When performing the “THRU” calibration the delay of the “THRU” connection should therefore be stated to be 0ps to the calibration software (such as the Agilent Physical Layer Test System).

Characteristics, Regulatory, and Safety Information

Operating Characteristics

The following operating characteristics are not specifications, but are typical operating characteristics for the analysis probe with interposer.

Table 3 Environmental Characteristics (Operating)

Temperature	20° to + 30° C (+68° to +86° F)
Altitude	4,600 m (15,000 ft)
Humidity	Up to 50% noncondensing. Avoid sudden, extreme temperature changes which could cause condensation on the circuit board. For indoor use only.

Table 4 Inputs and Outputs

To probe	Memory bus signals from FB-DIMM under test Power supply connectors, for use with a benchtop power supply as described in this manual.
From probe	SMP connectors for parametric test equipment, as described in this manual. Loopback connectors, as described in this manual. USB connector.

WEEE Compliance



This product complies with the WEEE Directive (2002/96/EC) marking requirements. The affixed label indicates that you must not discard this electrical/electronic product in domestic household waste.

Product Category: With reference to the equipment types in the WEEE Directive Annex I, this product is classed as a "Monitoring and Control Instrumentation" product.

Do not dispose in domestic household waste.

To return unwanted products, contact your local Agilent office, or see www.agilent.com for more information.

Safety Notices

This apparatus has been designed and tested in accordance with IEC Publication 1010, Safety Requirements for Measuring Apparatus, and has been supplied in a safe condition. Before applying power, verify that the correct safety precautions are taken (see the following warnings). In addition, note the external markings on the instrument that are described under "Safety Symbols."

Warnings

Use only the recommended power supply.

Always position the product where it is easy to disconnect power.

If you energize this instrument by an auto transformer (for voltage reduction or mains isolation), the common terminal must be connected to the earth terminal of the power source.

Whenever it is likely that the ground protection is impaired, you must make the instrument inoperative and secure it against any unintended operation.

Service instructions are for trained service personnel. To avoid dangerous electric shock, do not perform any service unless qualified to do so. Do not attempt internal service or adjustment unless another person, capable of rendering first aid and resuscitation, is present.

Do not install substitute parts or perform any unauthorized modification to the instrument.

Capacitors inside the instrument may retain a charge even if the instrument is disconnected from its source of supply.

Do not operate the instrument in the presence of flammable gasses or fumes. Operation of any electrical instrument in such an environment constitutes a definite safety hazard.

Do not use the instrument in a manner not specified by the manufacturer.

To clean the instrument

Do not attempt to clean this product.

Safety Symbols



Instruction manual symbol: the product is marked with this symbol when it is necessary for you to refer to the instruction manual in order to protect against damage to the product.



Hazardous voltage symbol.



Earth terminal symbol: Used to indicate a circuit common connected to grounded chassis.

