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Introduction

The ScanDIMM-SO204/DDR3 Digital Tester module provides an easy-to-use method for structurally testing 204-pin Small Outline Dual Inline Memory Module (SO-DIMM or SODIMM) sockets. Through the use of boundary-scan technology, the ScanDIMM-SO204/DDR3 Digital Tester provides 196 fully bi-directional test signals. A Boundary-Scan Test Access Port (TAP) connects to a host computer, which provides virtually unlimited memory depth for testing each of the SO-DIMM socket pins. The 204-pin sockets are often used for Double Data Rate Dynamic Random Access Memory (DDR3 SDRAM) modules. The ScanDIMM-SO204/DDR3 offers an accurate and easy-to-use mechanical and electrical solution for connecting test equipment to SO-DIMM sockets.

Features of the ScanDIMM-SO204/DDR3

- Tests 204-pin DDR3 SO-DIMM sockets
- Tests for opens on the socket's power and ground pins
- 1.5V DIMM interface, 3.3V tolerant
- 1.8V TAP interface, 3.3V tolerant
- LEDs indicate power status and active TAP connection
- Compatible with the Corelis ScanExpress boundary-scan test development tools and other third party software

The figure below shows the ScanDIMM-SO204/DDR3 module with Pin 1 of the TAP IN connector identified.

![ScanDIMM-SO204/DDR3 module (top view)](image-url)
ScanDIMM-SO204/DDR3 Specifications

Size and Form Factor

Mechanical Compatibility
JEDEC MO-268C (204-pin DDR3 SO-DIMM)

Dimensions
67.6 mm x 30.00 mm ± 0.15 mm
[2.66 inches x 1.18 inches ± 0.01 inches]

PCB thickness
1.00 mm ± 0.10 mm
[0.039 ± 0.01 inches]

Connector Keying
1.5V-compatible

Maximum Test Clock (TCK) Frequency

Maximum TCK Frequency
25 MHz

LEDs

PWR
Indicates the 1.5V power source is present

TAP ON
Indicates the TAP is connected

TAP Connectors

TAP IN Connector
10-pin Single Row 0.100-inch spacing
(Samtec part no. TSM-110-01-G-SH or equivalent)

Power Requirements (Provided by the 204-pin mating socket)

1.50 V
0.250 A (Maximum)

Operating Environment

Temperature
0° C to 55° C

Relative Humidity
10% to 90%, non-condensing
**Absolute Maximum Ratings**

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
<th>Value</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{CC}$</td>
<td>Supply voltage relative to ground</td>
<td>-0.5 to 2.0</td>
<td>V</td>
</tr>
<tr>
<td>$V_{IN}$</td>
<td>Input voltage relative to ground</td>
<td>-0.5 to 4.0</td>
<td>V</td>
</tr>
<tr>
<td>$T_{STG}$</td>
<td>Storage Temperature (ambient)</td>
<td>-65 to +150</td>
<td>°C</td>
</tr>
<tr>
<td>$T_J$</td>
<td>Junction Temperature</td>
<td>+150</td>
<td>°C</td>
</tr>
</tbody>
</table>

*Table 1-1. Absolute Maximum Ratings*

**Recommended Operating Conditions**

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Min</th>
<th>Max</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{CC}$</td>
<td>Supply voltage</td>
<td>1.4</td>
<td>1.6</td>
<td>V</td>
</tr>
</tbody>
</table>

*Table 1-2. Recommended Operating Conditions*

**DC Electrical Characteristics (SO-DIMM Socket Interface)**

(1.5V DC Over Recommended Operating Conditions)

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Typical</th>
<th>Max</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{IH}$</td>
<td>High level input voltage</td>
<td>0.98</td>
<td>3.9</td>
<td>V</td>
</tr>
<tr>
<td>$V_{IL}$</td>
<td>Low level input voltage</td>
<td>-0.3</td>
<td>0.53</td>
<td>V</td>
</tr>
<tr>
<td>$V_{OH}$</td>
<td>High level output voltage</td>
<td>1.05</td>
<td>-</td>
<td>V</td>
</tr>
<tr>
<td>$V_{OL}$</td>
<td>Low level output voltage</td>
<td>-</td>
<td>0.4</td>
<td>V</td>
</tr>
</tbody>
</table>

*Table 1-3. DC Electrical Characteristics (SO-DIMM Socket Interface)*

**DC Electrical Characteristics (JTAG Interface)**

(1.8V DC Over Recommended Operating Conditions)

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Typical</th>
<th>Max</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{IH}$</td>
<td>High level input voltage</td>
<td>1.17</td>
<td>1.5</td>
<td>V</td>
</tr>
<tr>
<td>$V_{IL}$</td>
<td>Low level input voltage</td>
<td>-0.3</td>
<td>0.63</td>
<td>V</td>
</tr>
<tr>
<td>$V_{OH}$</td>
<td>High level output voltage</td>
<td>1.35</td>
<td>-</td>
<td>V</td>
</tr>
<tr>
<td>$V_{OL}$</td>
<td>Low level output voltage</td>
<td>-</td>
<td>0.45</td>
<td>V</td>
</tr>
</tbody>
</table>

*Table 1-4. DC Electrical Characteristics (JTAG Interface)*
Chapter 2:
ScanDIMM-SO204/DDR3 Installation

Overview

To ensure reliable operation of the ScanDIMM-SO204/DDR3, it is important to connect it properly to both the Corelis boundary-scan controller and the 204-pin DDR3 SO-DIMM socket on the unit under test (UUT).

ScanDIMM-SO204/DDR3 Hardware

The ScanDIMM-SO204/DDR3 product consists of the following components:

- ScanDIMM-SO204/DDR3, Corelis P/N 10408
- User’s Manual, Corelis P/N 70405
- Host Adapter Cable, 10-pin, Corelis P/N 15336

The ScanDIMM-SO204/DDR3 product is also available in a 'mirrored' version that is functionally identical but has a reversed form factor.

The ScanDIMM-SO204/DDR3/Mirrored product consists of the following components:

- ScanDIMM-SO204/DDR3/Mirrored, Corelis P/N 10409
- User’s Manual, Corelis P/N 70405
- Host Adapter Cable, 10-pin, Corelis P/N 15336

The files related to the ScanDIMM-SO204/DDR3 are installed by the ScanExpress installer.

Ensure that all materials listed are present and free from visible damage or defects before proceeding. If anything appears to be missing or damaged, contact Corelis at the number listed on the title page immediately.

The figure below shows the ScanDIMM-SO204/DDR3 and the cables that are included with the product.

![ScanDIMM-204/DDR3 and Cable Accessories](image_url)

*Figure 2-1. ScanDIMM-SO204/DDR3 and Cable Accessories*
ScanDIMM-SO204/DDR3 Software

The ScanExpress CD installs the files to a subdirectory of the ScanExpress TPG application.

The default location is: "C:\Program Files\Corelis\ScanExpressTPG\ScanDIMM-SO204-DDR3".

<table>
<thead>
<tr>
<th>Filename</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ScanDIMM-SO204-DDR3.bsd</td>
<td>The BSDL file for the ScanDIMM-SO204/DDR3 Boundary-Scan component</td>
</tr>
<tr>
<td>ScanDIMM-SO204-DDR3.top</td>
<td>Sample topology file for the ScanDIMM-SO204/DDR3</td>
</tr>
<tr>
<td>ScanDIMM-SO204-DDR3_Selftest_inf.cvf</td>
<td>An infrastructure test for a single ScanDIMM-SO204/DDR3. It is used with ScanExpress Runner as a basic functionality check</td>
</tr>
</tbody>
</table>

Table 2-5. ScanDIMM-SO204/DDR3 Files

Connecting to the Boundary-Scan Controller

The external boundary-scan controller connects to the ScanDIMM-SO204/DDR3 TAP IN connector via the 10-pin Host Adapter Cable.

Connect one end of the Host Adapter Cable P/N 15336 to the TAP IN connector of the ScanDIMM-SO204/DDR3.

Connect the 10-pin cable from the boundary-scan controller (ScanTAP-4, ScanTAP-8, etc.) to the other end of the adapter cable.

The TAP Voltage for the boundary-scan controller should be set to 1.8V

The figure below shows a block diagram for the typical TAP connection to a ScanDIMM-SO204/DDR3 module.

![Figure 2-2. Block Diagram of Connection to a ScanDIMM-SO204/DDR3](image)
This table shows the pin assignments for the TAP IN connector.

<table>
<thead>
<tr>
<th>Pin</th>
<th>Signal Name</th>
<th>I/O</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>TRST*</td>
<td>In</td>
<td>Test Reset</td>
</tr>
<tr>
<td>2</td>
<td>GND</td>
<td></td>
<td>Ground</td>
</tr>
<tr>
<td>3</td>
<td>TDI</td>
<td>In</td>
<td>Test Data In</td>
</tr>
<tr>
<td>4</td>
<td>GND</td>
<td></td>
<td>Ground</td>
</tr>
<tr>
<td>5</td>
<td>TDO</td>
<td>Out</td>
<td>Test Data Out</td>
</tr>
<tr>
<td>6</td>
<td>GND</td>
<td></td>
<td>Ground</td>
</tr>
<tr>
<td>7</td>
<td>TMS</td>
<td>In</td>
<td>Test Mode Select</td>
</tr>
<tr>
<td>8</td>
<td>GND</td>
<td></td>
<td>Ground</td>
</tr>
<tr>
<td>9</td>
<td>TCK</td>
<td>In</td>
<td>Test Clock</td>
</tr>
<tr>
<td>10</td>
<td>GND</td>
<td></td>
<td>Ground</td>
</tr>
</tbody>
</table>

Table 2-6. TAP IN Connection List

The TAP IN connector conforms to the popular Corelis 10-pin TAP connector pinout except that it is a single row (10 x 1) instead of dual row (5 x 2). The Host TAP Adapter Cable P/N 15336 is a 1:1 adapter cable. The pin assignment is standard, connecting to any Corelis controller using the appropriate standard 10-pin TAP cable. It is best to use the PCI-1149.1/Turbo equipped with a ScanTAP-4 Intelligent Pod, with one TAP connected to the ScanDIMM-SO204/DDR3 and with additional TAP(s) connected to the UUT. Other Corelis controllers like the NetUSB-1149.1/E can also be used so that the UUT can connect on a separate TAP.

The figure below shows the TAP connections for a ScanDIMM-SO204/DDR3 module on TAP1 and the Target UUT on TAP2.

![Figure 2-3. Connection of a ScanDIMM-SO204/DDR3 Module and the Target using Separate TAPs](image)

**Indicator LEDs**

Two LEDs indicate the status of the ScanDIMM-SO204/DDR3 module. D1 is labeled PWR. It illuminates if the ScanDIMM-SO204/DDR3 is receiving power from the target (through pins 57, 60 and 176). If the LED is not illuminated, the ScanDIMM-SO204/DDR3 module is not powered up. D2 is labeled TAP ON. It indicates that a connection to a controller is detected. The ScanDIMM-SO204/DDR3 module will not operate unless D2 is illuminated.
Mating Connectors

The table below shows the mating connectors needed to make cables for the Boundary-Scan connector.

<table>
<thead>
<tr>
<th>Reference</th>
<th>Description</th>
<th>Manufacturer</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Host TAP Adapter Plug</td>
<td>10-pin IDC Plug</td>
<td>3M</td>
<td>4610-6351</td>
</tr>
<tr>
<td></td>
<td>Strain Relief</td>
<td>3M</td>
<td>3448-3010</td>
</tr>
<tr>
<td>Host TAP Adapter Socket</td>
<td>10-pin IDC Socket</td>
<td>3M</td>
<td>3473-6610</td>
</tr>
<tr>
<td>(Connects with Target)</td>
<td>Strain Relief</td>
<td>3M</td>
<td>3448-3010</td>
</tr>
</tbody>
</table>

*Table 2-7. Mating Connectors for the ScanDIMM-SO204/DDR3*

Accessories

Additional TAP Adapter Cables (P/N 15336) can be ordered from Corelis:

<table>
<thead>
<tr>
<th>Description</th>
<th>Corelis Part Number</th>
<th>Other Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>10-pin dual row IDC plug to 10 pin single row 1:1 cable</td>
<td>15336</td>
<td>Custom</td>
</tr>
</tbody>
</table>

*Table 2-8. Cable Accessories for the ScanDIMM-SO204/DDR3*
Chapter 3: Preparation of Test Input Files

Overview

The ScanDIMM-SO204/DDR3 integrates easily with a boundary-scan test plan. When the ScanDIMM-SO204/DDR3 is installed in a socket, the socket behaves like a boundary-scan component. Once the ScanDIMM-SO204/DDR3 is plugged into the socket on the target board, the boundary-scan test system will automatically test the socket. However, regeneration of the boundary-scan tests with ScanExpress TPG is required.

Preparation

Copy the provided BSDL file to your local project directory.

Add the ScanDIMM BSDL File

While in the "Preparation:BSDL Files" stage of ScanExpress TPG, click "Add..." to launch the "Add BSDL Files" dialog.

Figure 3-1. ScanExpress TPG Test Preparation: Select BSDL Files
Add BSDL Files Dialog

Uncheck the box "Show Only Devices Connected to JTAG Signals"

Select the Device that corresponds to the DIMM socket on the board in the left pane.

Select the BSDL File for the ScanDIMM-SO204-DDR3 in the right pane.

Click "Add".

Click "Close" to exit the Add BSDL Files dialog.

TAP Pins Not Found in Netlist Warning (Safe to Ignore)

In some cases a popup message may appear that indicates that the ScanDIMM TAP pins are not found in the netlist. The TAP connection between the boundary-scan controller and ScanDIMM module won’t be in the board netlist and this warning is safe to ignore.
Insert a TAP Break

The ScanDIMM is now in the scan chain. Insert a "TAP Break" by selecting the last device in the scan chain before the ScanDIMM, right clicking and selecting "Insert TAP Break"

![Figure 3-4. ScanExpress TPG Test Preparation: ScanDIMM BSDL File Added](image)

Testing the Socket Power and Ground Pins

To test the power and ground pins on the ScanDIMM-SO204/DDR3 socket, the constraint file should have the following syntax added:

```
SENSE_HIGH VDD
SENSE_LOW GND
```

VDD and GND are the net names of the 1.5V SDRAM power and ground signals on the target board. This syntax may already be present to test other power or ground connections in the target system.

ScanExpress TPG will automatically add these constraints if the power and ground nets are specified during the Power and Ground screen of the preparation phase.
Overview

ScanExpress Runner (sold separately) can load and run the compact vector file, ScanDIMM-SO204-DDR3_Selftest_inf.cvf, and quickly verify that the ScanDIMM-SO204/DDR3 is functional. Both the ScanExpress Runner software and a Corelis Boundary-Scan controller such as the PCI-1149.1/Turbo are required to execute this file.

Infrastructure Test

The infrastructure test verifies the TAP connection between the controller and the ScanDIMM-SO204/DDR3. It also verifies that the boundary-scan infrastructure of the device on the ScanDIMM-SO204/DDR3 is fully functional. The infrastructure test requires a Corelis Boundary-Scan controller, a ScanDIMM-SO204/DDR3 unit and a Host TAP cable (P/N 15336). The following steps execute an infrastructure test.

Steps

1. Remove any memory modules from the Unit Under Test (UUT) DIMM socket(s) to be tested.
2. Install the ScanDIMM-SO204/DDR3 in the socket.
3. Connect the Host TAP Adapter cable P/N 15336 to the "TAP IN" connector on the ScanDIMM-SO204/DDR3.
4. Connect the 10-pin TAP cable from the external controller to the other end of the Host TAP Adapter cable.
5. Apply power to the UUT.
6. Make sure that both LEDs on the ScanDIMM-SO204/DDR3 illuminate.
7. Double-click on the ScanExpress Runner Icon.
8. Select New Test Plan from the File menu and click on the Add button.
9. With the file browser, find and select the "ScanDIMM-SO204-DDR3_Selftest_inf.cvf" file. Click OK.
10. Select Controller from the Setup menu, then choose the appropriate Boundary-Scan controller.
11. Set the TCK frequency to 1 MHz and the TAP voltage to 1.8V.
12. Select Run Test. The test should run and pass.
The figure below shows a passing infrastructure test.

![ScanExpress Runner Infrastructure Test](https://www.corelis.com/image)

*Figure 4-1. ScanExpress Runner Infrastructure Test*
Overview

Use the following general guidelines to troubleshoot problems when the ScanDIMM-SO204/DDR3 is added to the test system.

1. Make sure the ScanDIMM-SO204/DDR3's **TAP Voltage** is set to **1.8V**

2. Make sure power is being supplied to the ScanDIMM-SO204/DDR3, the boundary-scan controller, and the target. The ScanDIMM-SO204/DDR3’s green LEDs will be illuminated if power (1.5V) is being supplied to the DIMM socket and the boundary-scan controller is connected.

3. Run the provided self-test and make sure that it passes.

4. Reduce the **TCK** (test clock) frequency to **1 MHz**. The TCK frequency can be set too high for the scan chain and sometimes using a lower frequency will allow the test steps to pass. Once the scan chain is known to be stable, then the TCK frequency can be increased to the maximum frequency that will allow the test steps to pass.

Notes

1. DDR3 modules are not backwards compatible with DDR2 modules and DDR3 modules will not fit into DDR2 sockets; forcing them can damage the ScanDIMM and/or the board.
Chapter 6: Legal and Contact Information

PRINTING HISTORY
Revision A, May 2010

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