Texas Instruments

4x4 Crosspoint Switch EVM

User's Guide

January 2004 HPL-D

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Exceeding the specified input range may cause unexpected operation and/or irreversible damage to the EVM. If there are questions concerning the input range, please contact a TI field representative prior to connecting the input power.

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During normal operation, some circuit components may have case temperatures greater than 60°C. The EVM is designed to operate properly with certain components above 60°C as long as the input and output ranges are maintained. These components include but are not limited to linear regulators, switching transistors, pass transistors, and current sense resistors. These types of devices can be identified using the EVM schematic located in the EVM User's Guide. When placing measurement probes near these devices during operation, please be aware that these devices may be very warm to the touch.

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Preface

Read This First

About This Manual

This evaluation module (EVM) user's guide describes the hardware, theory of operation, and use of the EVM for evaluating the high-speed performance and functionality of either the SN65LVDS125A or SN65LVDS250 4x4 crosspoint switches.

How to Use This Manual

Chapter 1 provides an overview of the functional configurations and signal paths. Typical hardware setup and results are discussed in Chapter 2. Chapter 3 provides schematics, the board layout, the board layers, fabrication notes, and bill of materials

Related Documentation from Texas Instruments

SN65LVDS125A, 4x4 1.5 Gbps LVDS Crosspoint Switch Data Sheet (SLLS595).

SN65LVDS250, 4x4 2.5 Gbps LVDS Crosspoint Switch Data Sheet (SLLS594).

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Chapter 1

1 Overview

This chapter provides a high-level description of the 4x4 crosspoint switch EVM mounted with either a SN65LVDS125A, 4x4 1.5-Gbps or a SN65LVDS250, 4x4 2.5-Gbps crosspoint switch.

Topic **Page**

1.1 Sample Functional Configurations

The 4x4 crosspoint switch is a fully non-blocking switch that provides flexibility in switch configuration for the desired application.

A sample of various functions for which the EVMs can be configured is shown in Figure 1-1.

Configuration Examples

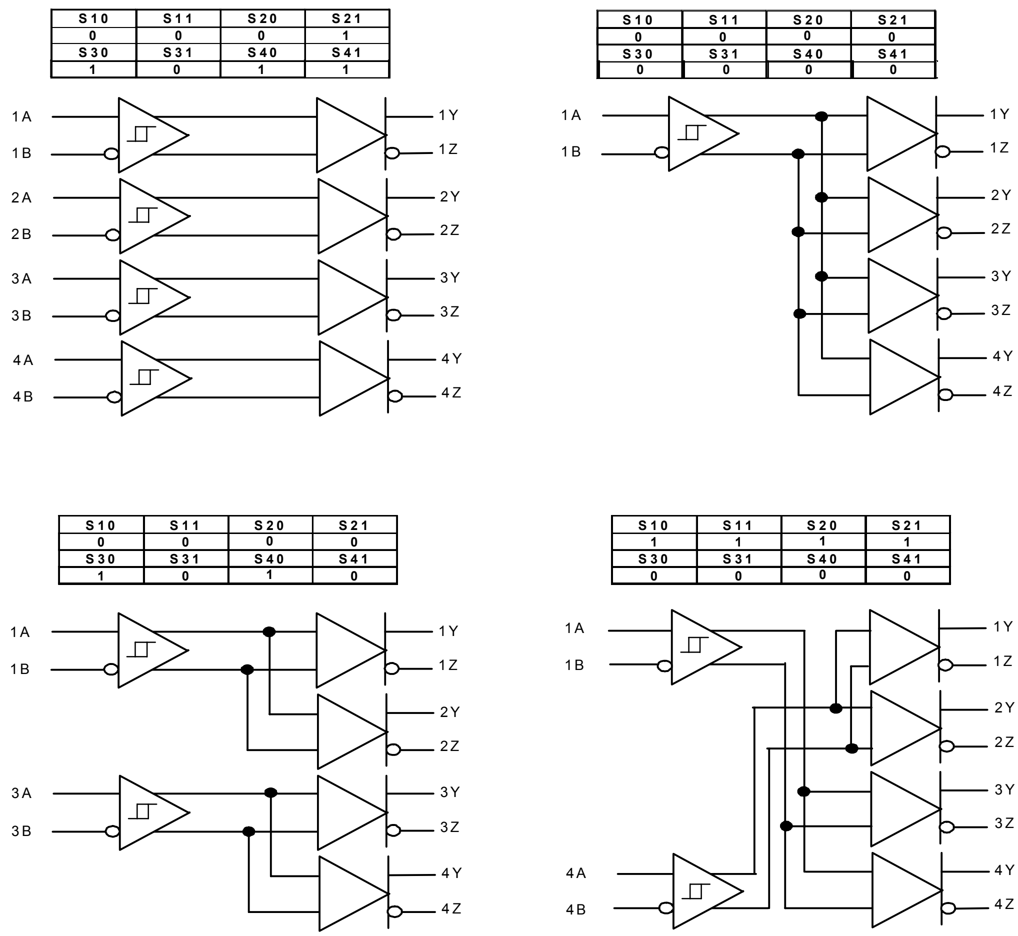


Figure 1-1. Sample Functional Configurations of the 4x4 Crosspoint Switch

Figure 1-2 shows the 4x4 crosspoint switch EVM (part number SN65LVDS125A or SN65LVDS250). The EVM comes with either the SN65LVDS125A or SN65LVDS250 installed and a copy of the data sheet. The latest version of the data sheet is also available from www.ti.com.

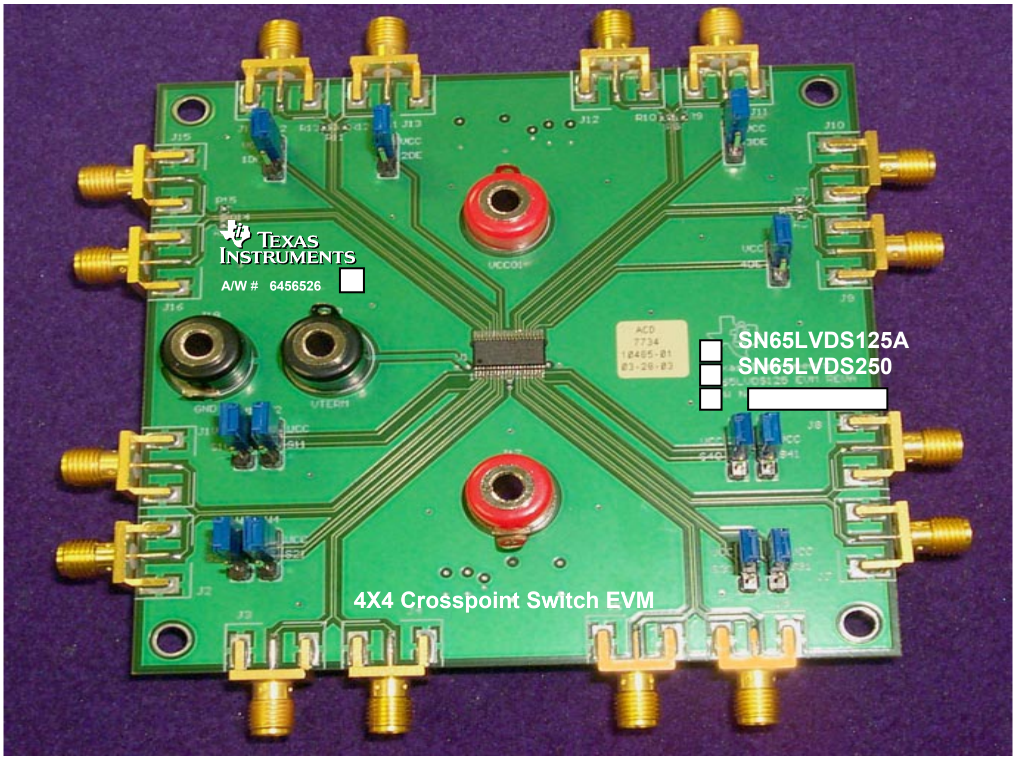


Figure 1-2. 4x4 Crosspoint Switch EVM

1.2 Signal Paths

The signal paths on this EVM (see Figure 1-3) include:

- ❏ Sixteen edge-launch SMA connectors (J1–J16) for high-speed data transmission
- ❏ Eight jumpers (W1– W8) for active switch logic control
- ❏ Four jumpers (W9–W12) for enabling and disabling the outputs
- ❏ Three banana jacks (J17, J18, J19) for power and ground connections. Banana jack J20 is used for non-LVDS type configurations.

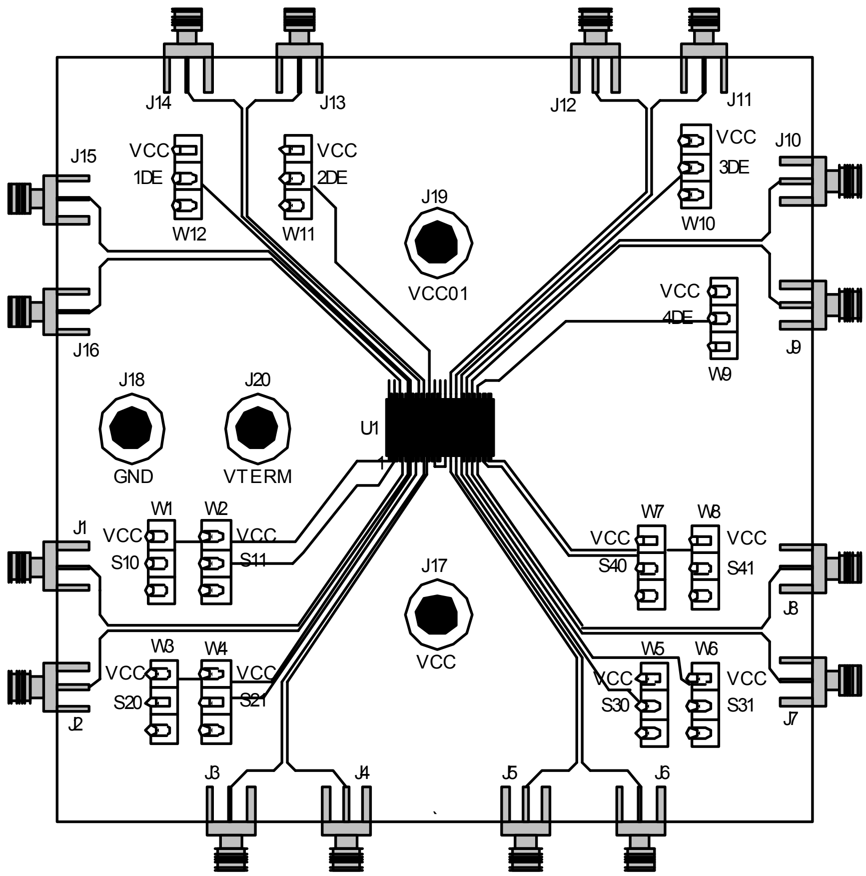


Figure 1-3. 4x4 Crosspoint Switch Signal Paths

Chapter 2

2 Setup and Required Equipment

Both the SN65LVDS125A and the SN65LVDS250 LVDS driver output characteristics are compliant with the requirements of the TIA/EIA-644 standard. LVDS drivers nominally provide a 350-mV differential signal, with a 1.2-V offset from ground. These levels are attained when driving a 100-Ω differential line-termination test load. This requirement includes the effects of up to 32 standard receivers with their ground references offset up to ±1 V from that of the driver. This common-mode loading limitation of LVDS drivers affects how the driver's characteristics are observed with this EVM, and the test setup that follows in this manual.

By using three power jacks (J17, J18, and J19) and by optionally installing termination resistors, different methods of probing can be used to evaluate the device output characteristics. The typical setup for the 4x4 crosspoint switch EVM is shown in Figure 2-1.

2.1 Applying an Input

While the use of a split power plane allows the EVM to be terminated within the oscilloscope, offsetting the EVM ground requires the inputs to the device to also be offset. Figure 2-1 shows how to offset the EVM and the inputs to the device. Setting power supply 1 to 3.3 V and power supply 2 to 1.2 V causes the voltage swing of the LVDS outputs to be within the limits of -200 mV to 200 mV instead of the typical 1 V to 1.4 V. This requires the inputs of the 4x4 crosspoint switch EVM to also be offset by 1.2 V, resulting in a voltage swing of -200 mV to 200 mV. VTERM, banana jack J20, is provided for non-LVDS input terminations such as LVPECL, which requires a termination voltage. When applying an LVDS input, VTERM can be left open or connected to GND, which is the common-mode voltage when using the aforementioned –200-mV to 200-mV input swing.

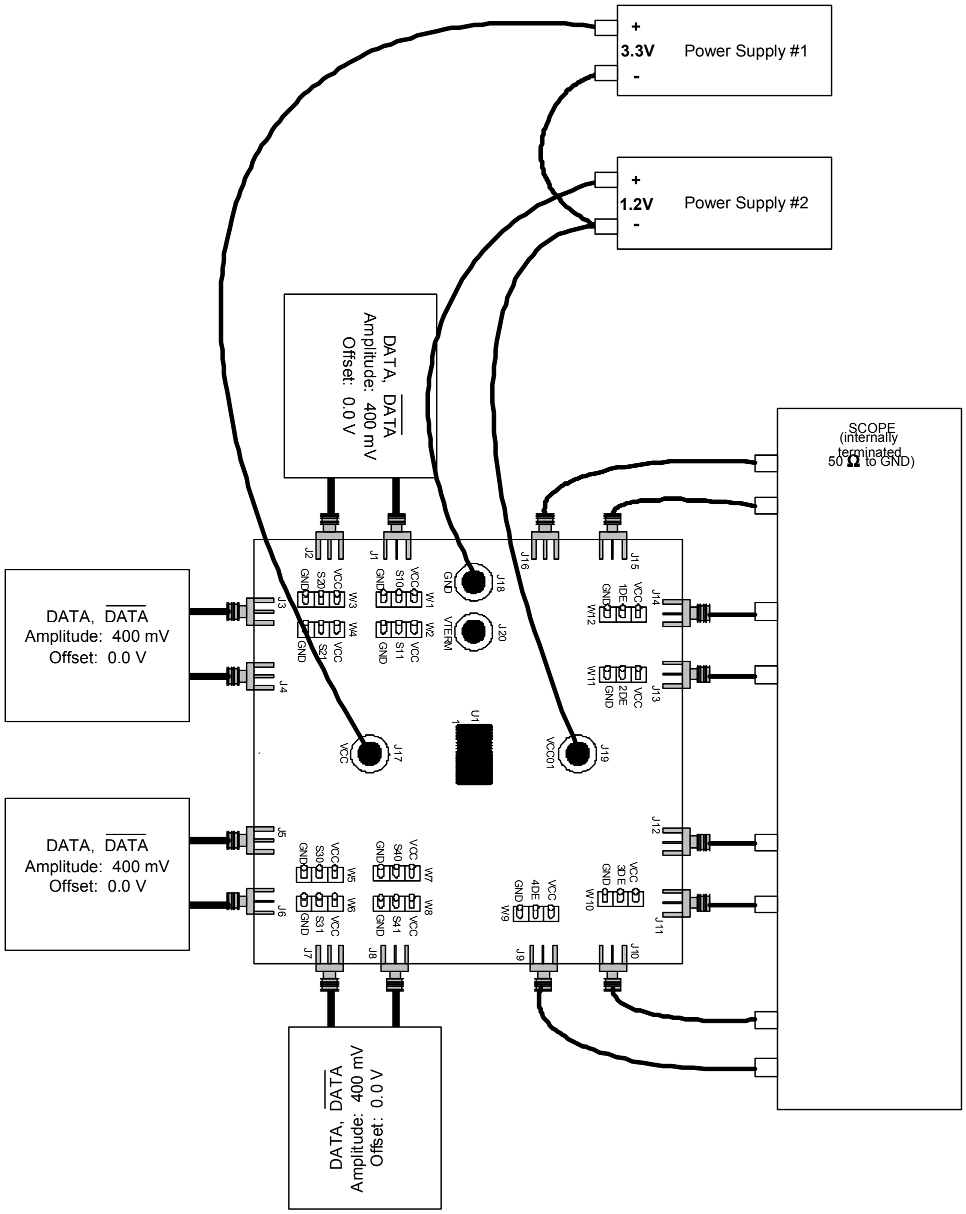


Figure 2-1. EVM Power Connections for Either SN65LVDS125A or SN65LVDS250 Evaluation.

Many possible configurations for the 4x4 crosspoint switches are made available. Table 2-1 provides a description of the different functions and the required selector settings.

Table 2-1 Crosspoint Function Table

Output Channel 1			**Output Channel 2**			**Output Channel 3**			**Output Channel 4**		
Control Pins		**Input Selected**	**Control Pins**		**Input Selected**	**Control Pins**		**Input Selected**	**Control Pins**		**Input Selected**
S10	**S11**	**1Y/1Z**	**S20**	**S21**	**2Y/2Z**	**S30**	**S31**	**3Y/3Z**	**S40**	**S41**	**4Y/4Z**
0	0	1A/1B	0	0	1A/1B	0	0	1A/1B	0	0	1A/1B
0	1	2A/2B	0	1	2A/2B	0	1	2A/2B	0	1	2A/2B
1	0	3A/3B	1	0	3A/3B	1	0	3A/3B	1	0	3A/3B
1	1	4A/4B	1	1	4A/4B	1	1	4A/4B	1	1	4A/4B

Apply inputs to the SMA connectors J1–J8. The EVM comes with 50-Ω resistors installed to VTERM, providing a termination scheme easily adjusted to accommodate LVDS, LVPECL, or CML output structures. (See Figure 2-2).

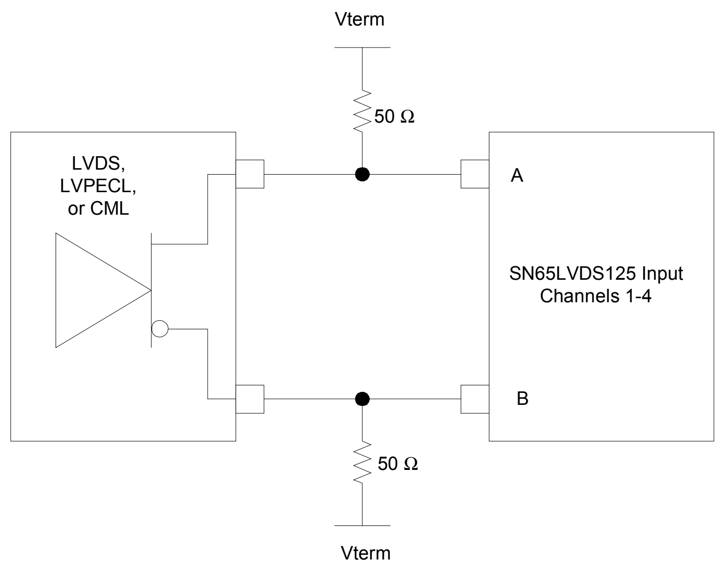


Figure 2-2. Termination for Interfacing LVDS, CML, or LVPECL Drivers

2.2 Observing an Output

In order to minimize the parasitic capacitance in high-speed measurements (probe capacitance), the 4x4 crosspoint switch EVM provides an offset power plane (layer 5). This power plane allows the user to offset the device so that the common-mode output is compatible with the 50 ohms to ground termination within the scope. Terminating the EVM within the scope eliminates any bandwidth limitations introduced by a probe.

Direct connection to an oscilloscope with 50-Ω internal terminations to ground is accomplished without requiring installation of resistors R5 – R16 on the EVM. The outputs are available at J9–J16 for direct connection to oscilloscope inputs. All cabling used to source and measure signals must be electrically matched in length to prevent any skew between conductors of the differential inputs.

Referring back to 2-1, power supply 1 is used to provide the required 3.3 V to the EVM. Power supply 2 is used to offset the EVM ground relative to the device under test (DUT) ground. With this power scheme, the common-mode voltage seen by either the SN65LVDS125A or the SN65LVDS250 is approximately equal to that of the oscilloscope, thus preventing significant common-mode current flow. Using dual supplies and offsetting the EVM ground relative to the DUT ground are simply steps required for the test and evaluation of devices. Actual designs include high-impedance receivers, which do not require the setup steps outlined above. If the EVM outputs are to be evaluated with a high-impedance probe, direct probing on the EVM is supported via installation of a 100-Ω resistor across the solder pads (R5, R8, R11, and R14).

Note: Power Supply 2

.Power supply 2 must be able to sink current.

2.3 Typical Test Results

Figure 2-3 is a typical result obtained with the EVM setup shown in Figure 2-1. The inputs (J1–J8) were stimulated with a 2^{23}–1 PRBS signal at 1.5 Gbps. The input levels for both clock and data were a differential voltage of 400 mV, with a common-mode voltage of 0 V (referenced to the ground of the pattern generator).

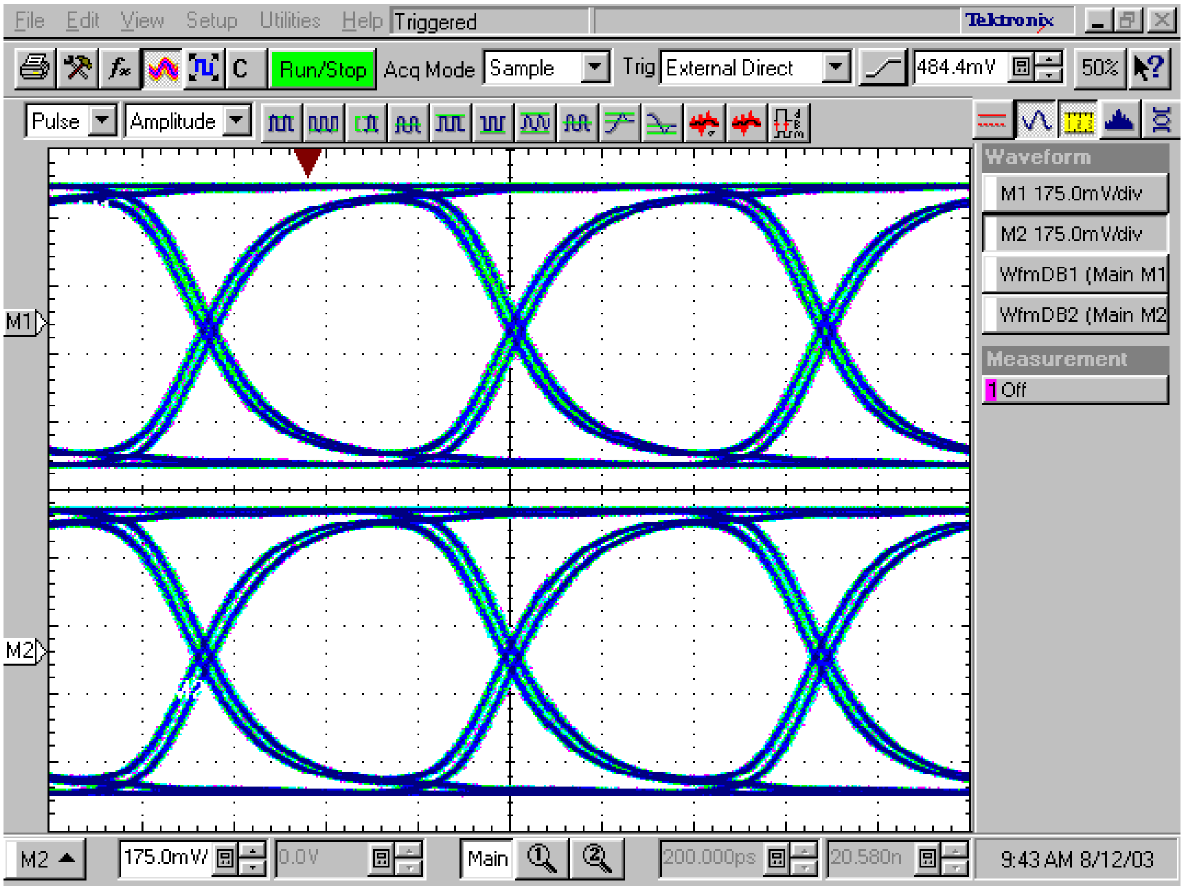


Figure 2-3. Typical Test Results.

Chapter 3

3 EVM Construction

This chapter presents the schematics, board layouts, fabrication information, and the bill of materials.

Topic	Page

3.1 Schematic

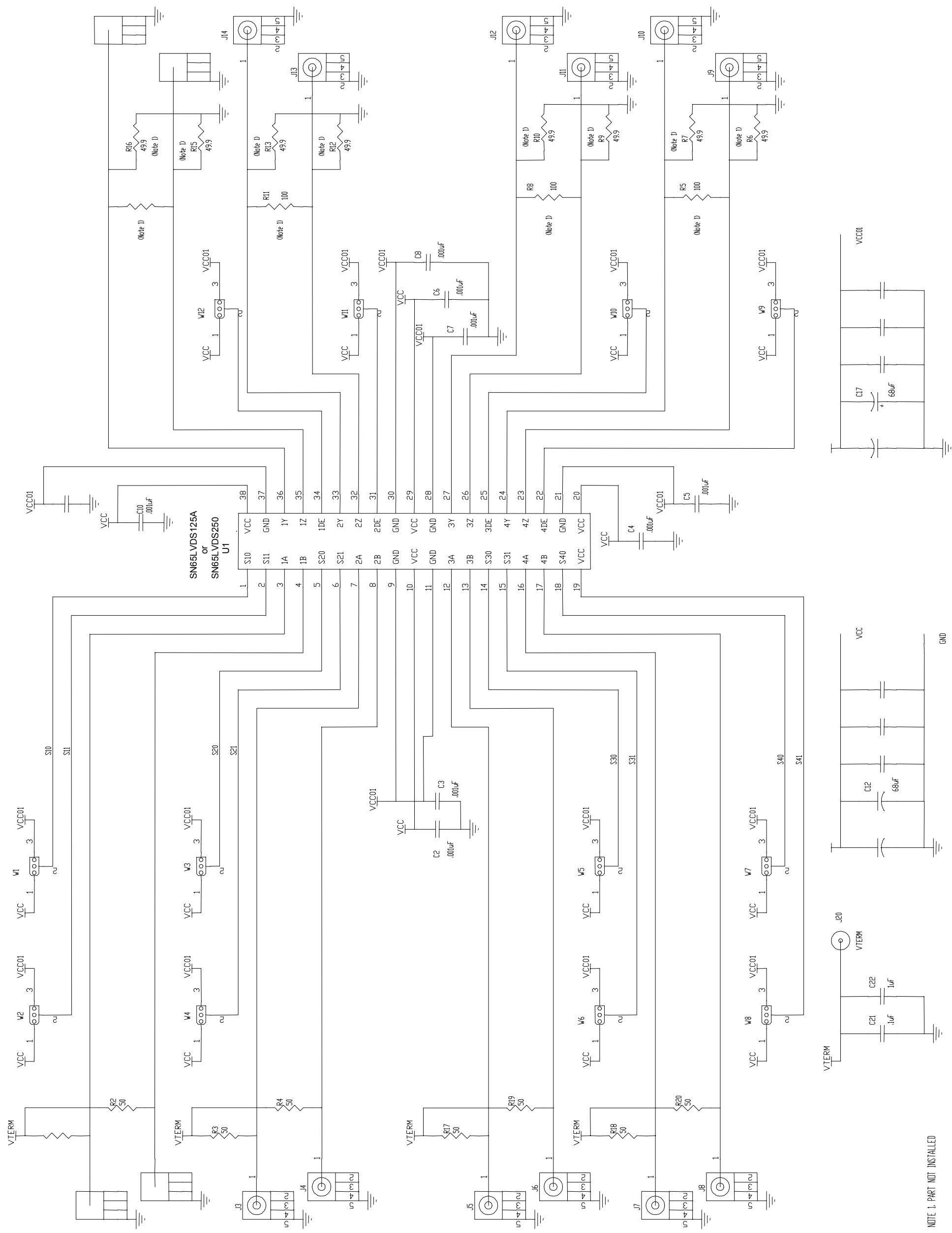


Figure 3-1. 4x4 Crosspoint Switch EVM Schematic

3.2 Board Layout Patterns

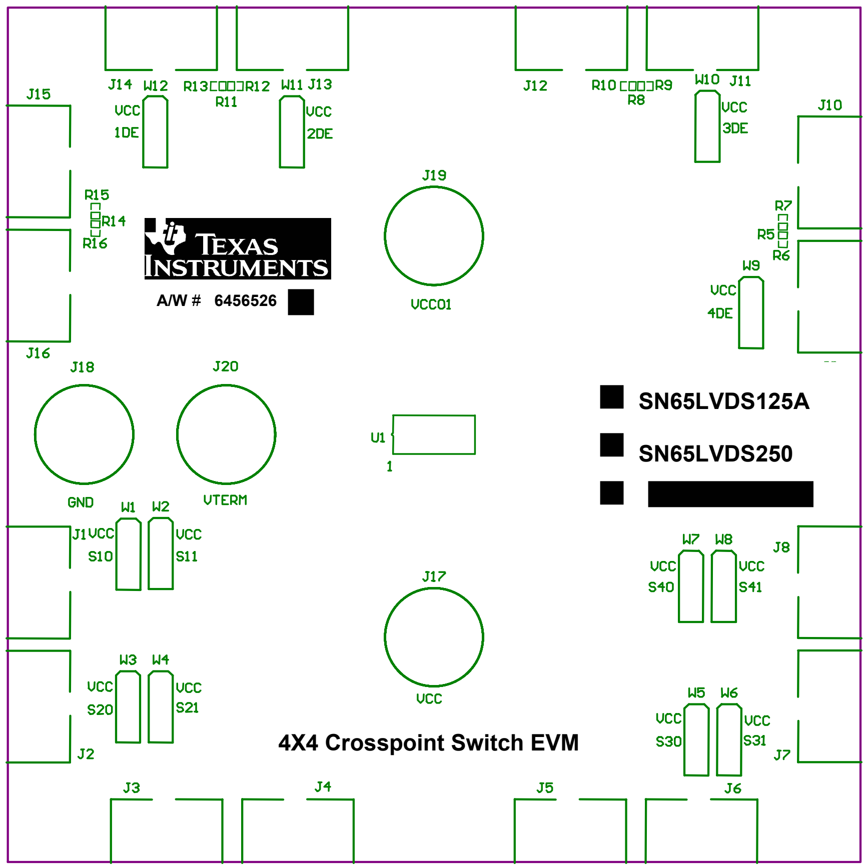


Figure 3-2. 4x4 Crosspoint Switch EVM Board Layout

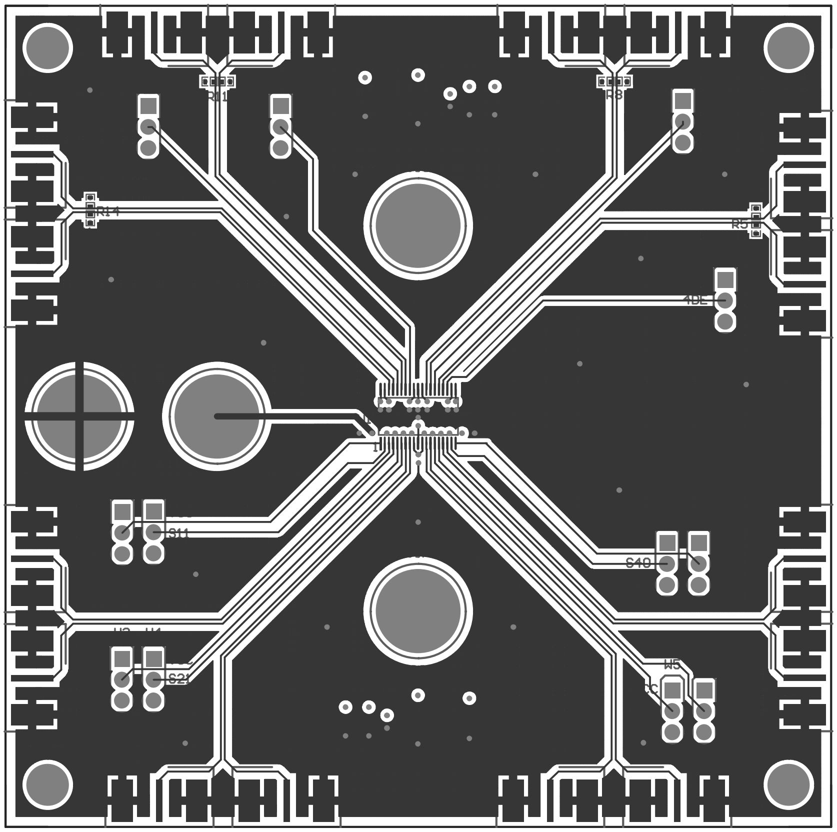


Figure 3-3. Layer 1–Signal Plane

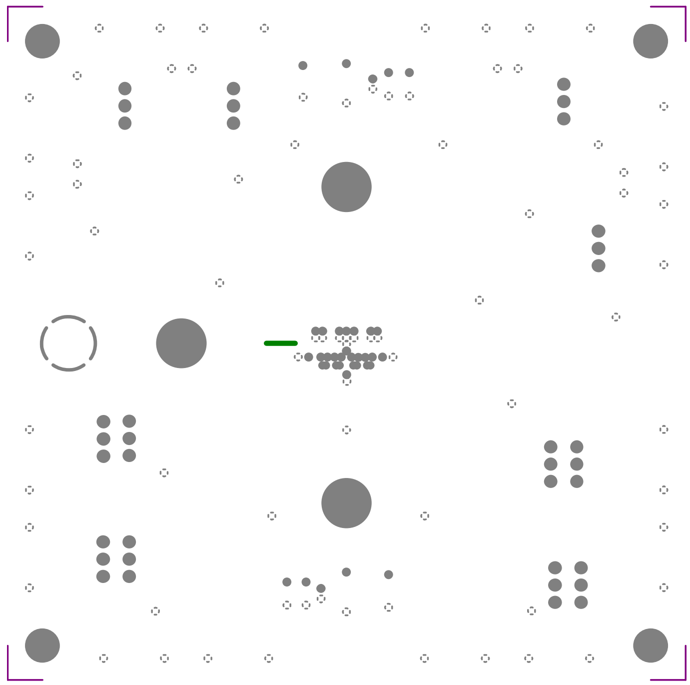


Figure 3-4. GND Plane

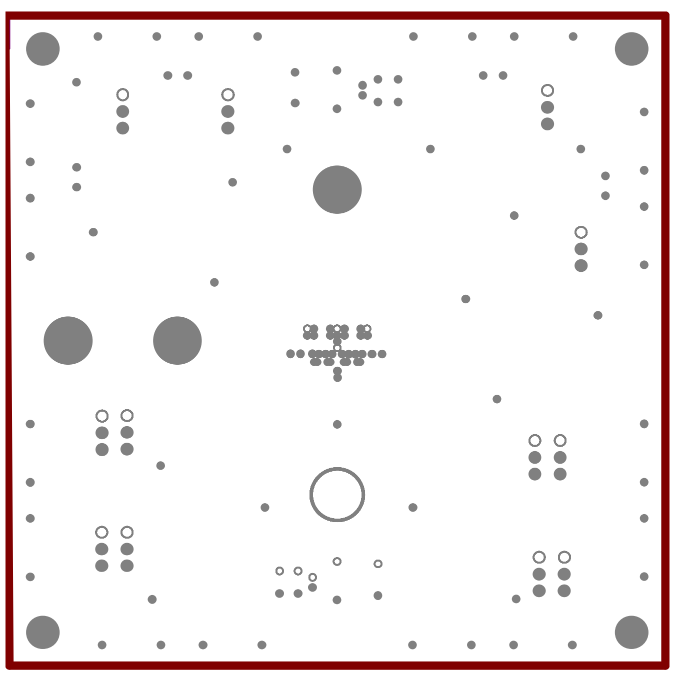


Figure 3-5. Layer 3–Vcc

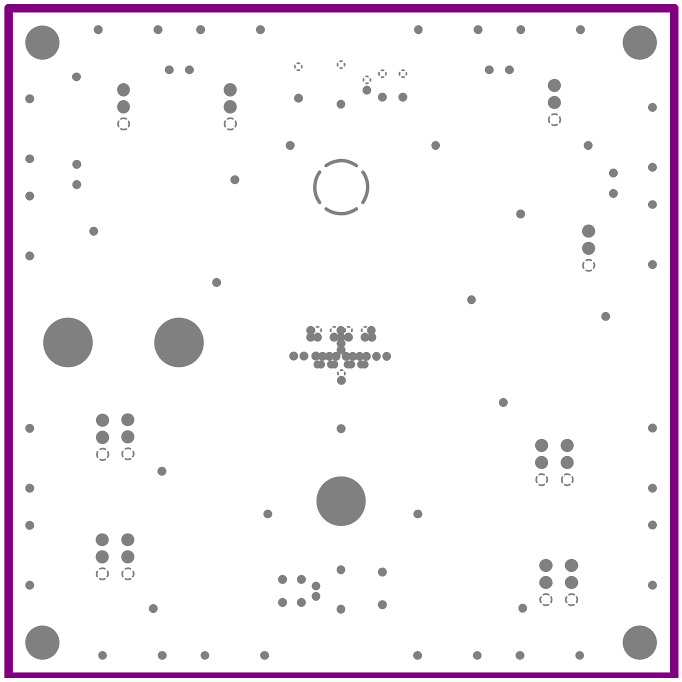


Figure 3-6. Layer 4–Vcc01 Plane

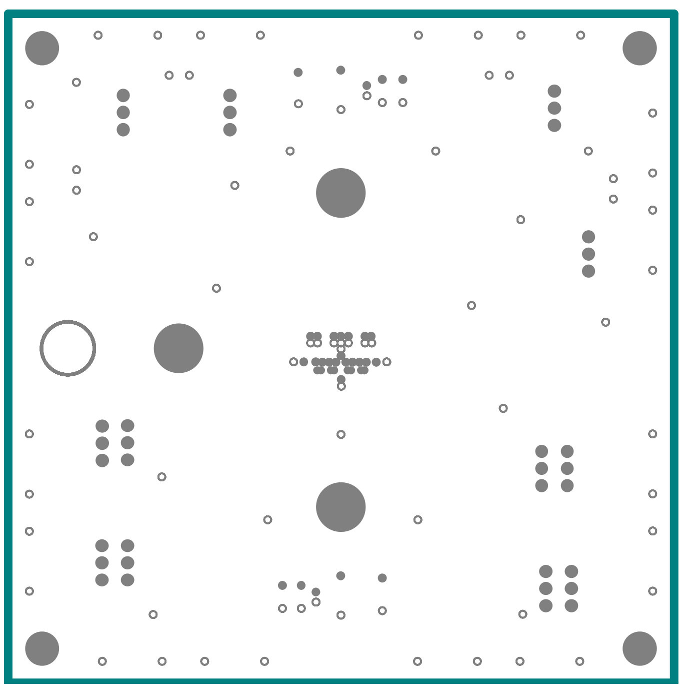


Figure 3-7. Layer 5–GND Plane

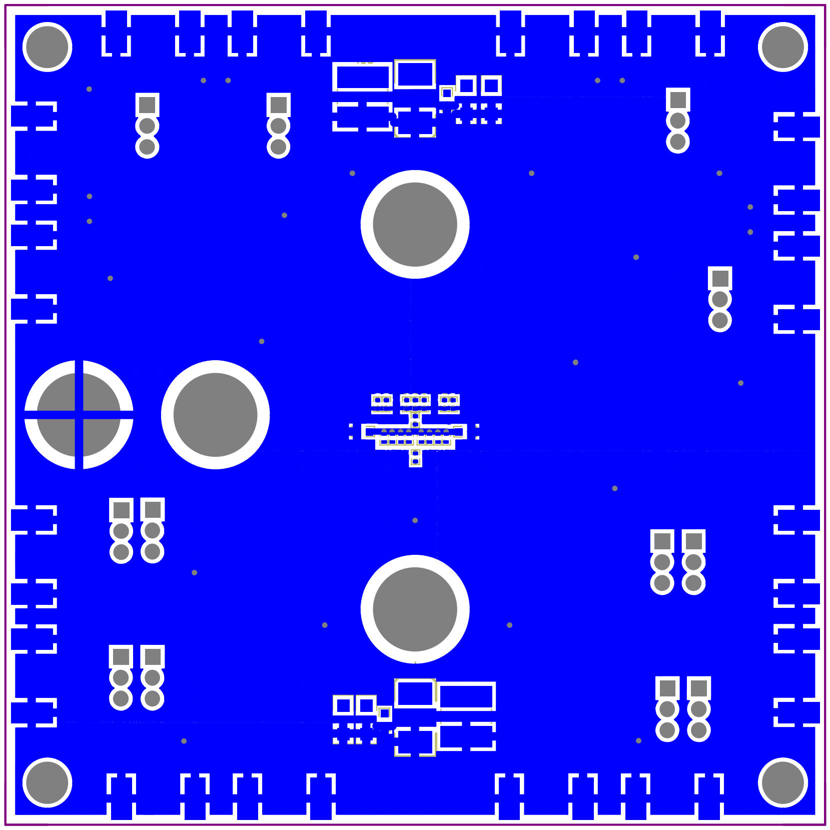


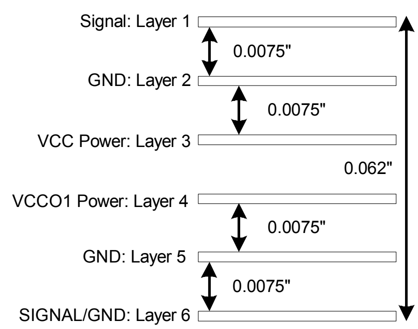
Figure 3-8. Layer 6–GND/Signal Plane

3.3 PCB Fabrication Requirements and Stack Up

Notes:

1. PWB TO BE FABRICATED TO MEET OR EXCEED IPC-6012, CLASS 3 STANDARDS AND WORKMANSHIP SHALL CONFORM TO IPC-A-600, CLASS 3 CURRENT REVISIONS
2. BOARD MATERIAL AND CONSTRUCTION TO BE UL APPROVED AND MARKED ON THE FINISHED BOARD.
3. LAMINATE MATERIAL:COPPER-CLAD NELCO N4000-13 (DO NOT USE -13SI)
4. COPPER WEIGHT: 1oz FINISHED
5. FINISHED THICKNESS: 0.062" +/- 0.010"
6. MIN PLATING THICKNESS IN THROUGH HOLES: .001"
7. SMOBC / HASL
8. LPI SOLDERMASK BOTH SIDES USING APPROPRIATE LAYER ARTWORK: COLOR = GREEN
9. LPI SILKSCREEN AS REQUIRED: COLOR = WHITE
10. VENDOR INFORMATION TO BE INCORPORATED ON BACK SIDE WHENEVER POSSIBLE
11. MINIMUM COPPER CONDUCTOR WIDTH IS: 0.009"
    MINIMUM CONDUCTOR SPACING IS: 0.006"
12. NUMBER OF FINISHED LAYERS: 6
13. ALL 8 MIL HOLES TO BE PLUGGED AND COPLANAR TO SURFACE
14. SPACING BETWEEN LAYERS 1 AND 2 SHOULD BE 0.0075"
    SPACING BETWEEN LAYERS 2 AND 3 SHOULD BE 0.0075"
    SPACING BETWEEN LAYERS 4 AND 5 SHOULD BE 0.0075"
    SPACING BETWEEN LAYERS 5 AND 6 SHOULD BE 0.0075"

Stackup



3.4 Bill of Materials

Table 3-2. Bill of Materials for SN65LVDS125A / SN65LVDS250 EVM

Item	6456526-1 Qty	6456526-2 Qty	6456526-3 Qty	Description	Pattern	Reference Designator
1	9	9	9	0.001 µF	402	C2, C3, C4, C5, C6, C7, C8, C9, C10
2	2	2	2	0.01 µF	603	C13, C18
3	1	1	1	0.1 µF	603	C21
4	2	2	2	0.1 µF	1206	C14, C19
5	4	4	4	100 Ω (uninstalled)	402	R5, R8, R11, R14
6	2	2	2	10 µF	7343	C11, C16
7	1	1	1	1 µF	603	C22
8	2	2	2	1 µF	1206	C15, C20
9	12	12	12	3 pos jumper		W1, W2, W3, W4, W5, W6, W7, W8, W9, W10, W11, W12
10	8	8	8	49.9 Ω (uninstalled)	402	R6, R7, R9, R10, R12, R13, R15, R16
11	8	8	8	49.9 Ω	402	R1, R2, R3, R4, R17, R18, R19, R20
12	2	2	2	68 µF	Cap 592D R	C12, C17
13	4	4	4	Banana jack		J17, J18, J19, J20
14	16	16	16	SMA PCB MT MOD	SMA END 50 Ω	J1, J2, J3, J4, J5, J6, J7, J8, J9, J10, J11, J12, J13, J14, J15, J16
15	1	0	0	SN65LVDS125A	38-TSSOP (DBT)	U1
16	0	1	0	SN65LVDS250	38-TSSOP (DBT)	U1
17	0	0	1	*Special*	38-TSSOP (DBT)	U1
18	4	4	4	Rubber feet	3/8”	
19	1	1	1	PWB	6456526	PWB

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