

Guidelines for Laying Out T3 and E3 Network Interfaces

This application note shows how to maintain the proper impedances when laying out a circuit board with a T3/E3 networking interface, using the DS315x LIU products.

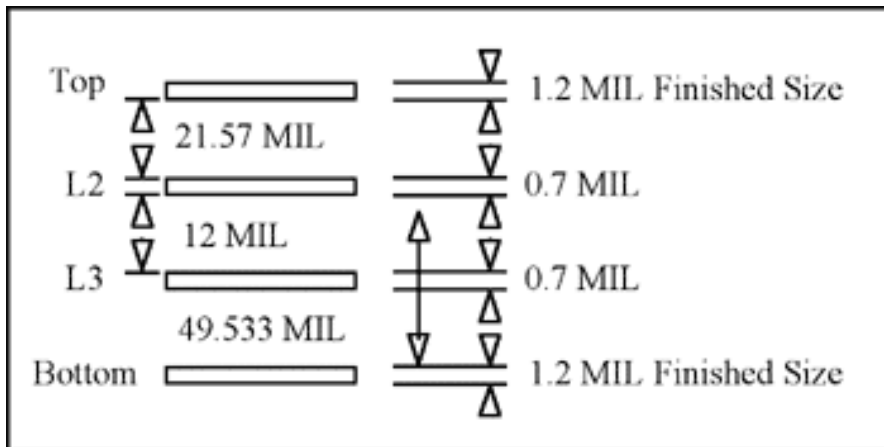
Overview

This application note is a guideline on how to layout the network interface for Dallas Semiconductor T3/E3 line interface units (LIUs). The guideline uses the DS315x products as examples. This application note is also applicable for other Dallas Semiconductor T3/E3 products.

The DS315x products include the DS3151 (single), DS3152 (dual), DS3153 (triple), and DS3154 (quad) LIUs which perform the necessary functions for interfacing at the physical layer to a DS3, E3, or STS-1 line. Each LIU has independent receive and transmit paths.

Each layout shows the communication line routing between the DS315x LIU, the transformer, and the 75Ω BNC connectors. In particular, each layout defines the recommended trace widths to ensure the proper impedance for a given network interface. All board stack-ups are the same.

Board Stackup



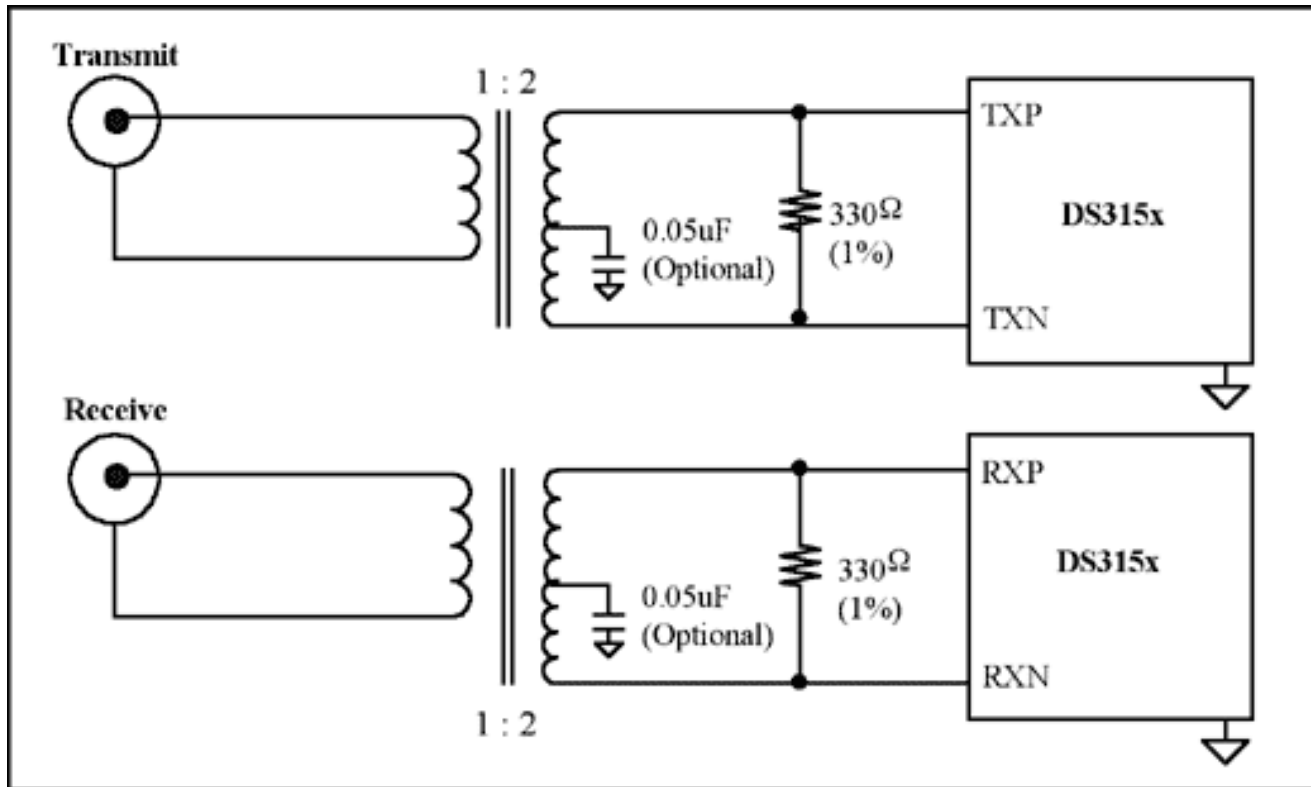
Below is an example of the trace-width calculation for a T3/E3 LIU interface.

	Surface Materials	Thickness	Dielectric Constant	Line Widths	Impedance
TX, RX @ 75Ω					
	Top conductor copper	1.2MIL	N/A	25MIL	75Ω

	Dielectric FR-4	21.57MIL	4.5	N/A	N/A
	L2_GND conductor copper	0.7MIL	N/A	N/A	N/A
TXP, TXN, RXP, RXN @ 150Ω					
	Bottom conductor copper	1.2MIL	N/A	5MIL	150Ω
	Dielectric FR-4	61.53MIL	4.5	N/A	N/A
	L2_GND conductor copper	0.7MIL	N/A	N/A	N/A

Note: The impedance was calculated with Cadence® Allegro.

Basic Network Interface



Layout Considerations

1. Impedance
2. Location—keep termination resistors as close to the LIU as possible.
3. Trace widths—keep trace widths as short as possible.
4. Do not route the GND plane under the transformer to reduce noise.
5. Do not route the VCC plane under the transformer or TXP, TXN, RXP, RXN routes.
6. Isolate the GND plane between board and cable.

Layout Examples

Example 1: DS3151—The layout of a single-port T3/E3 LIU

Table 1-1. Layout Components

Name	Qty	Description	Supplier	Part Number
U1	1	Single DS3/E3/STS1 LIU, 144P BGA	Dallas Semiconductor	DS3151
C1,C2	2	0805 Ceram 56000pF, 25V 10%	Panasonic	ECJ-2VB1E563K
R1,R2	2	Resistor, 0603 332Ohm, 1/16W 1%	Panasonic	ERJ-3EKF3320V
T1,T2	2	Transformer, 1:2 T3/E3/STS-1, industrial	Pulse	T3012
J1,J2	2	Connector, BNC 75Ohm, RA 5-pin	Trompetor	UCBJR220

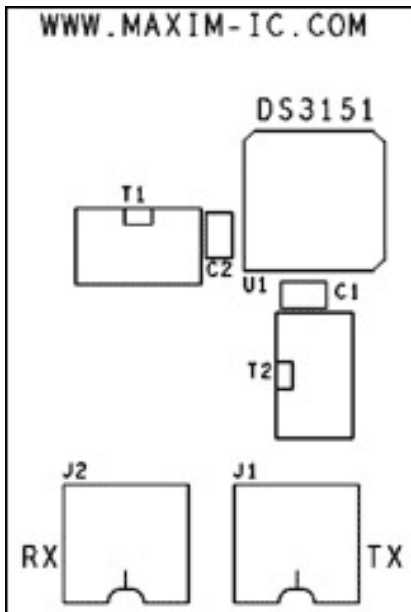


Figure 1-1. DS3151 Single-Port, T3/E3 LIU Layout—Silkscreen Top Layer

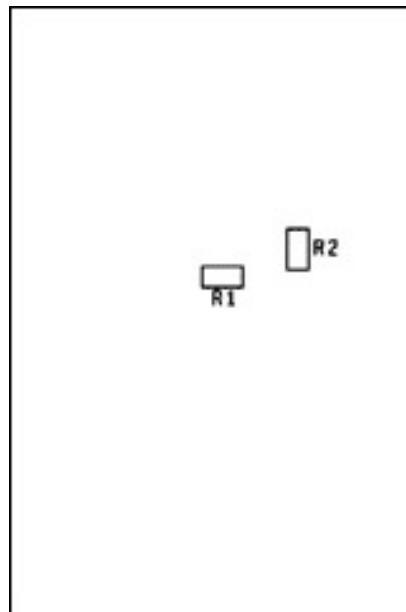


Figure 1-2. DS3151 Single-Port, T3/E3 LIU Layout—Silkscreen Bottom Layer (view mirrored)

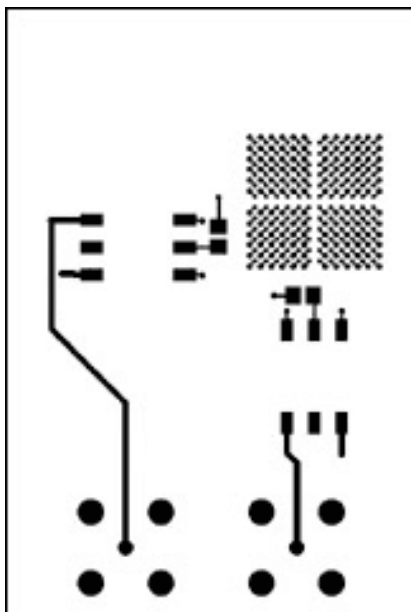


Figure 1-3. DS3151 Single-Port, T3/E3 LIU Layout—Copper Layer

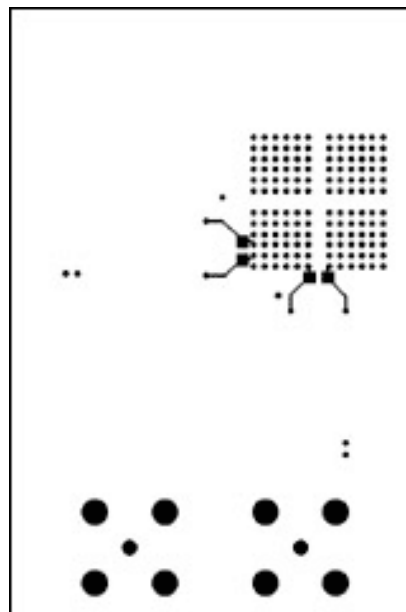


Figure 1-4. DS3151 Single-Port, T3/E3 LIU Layout—Copper Layer (view mirrored)

Port, T3/E3 LIU Layout—Top
Conducting Layer

Port, T3/E3 LIU
Layout—Bottom Conducting
Layer

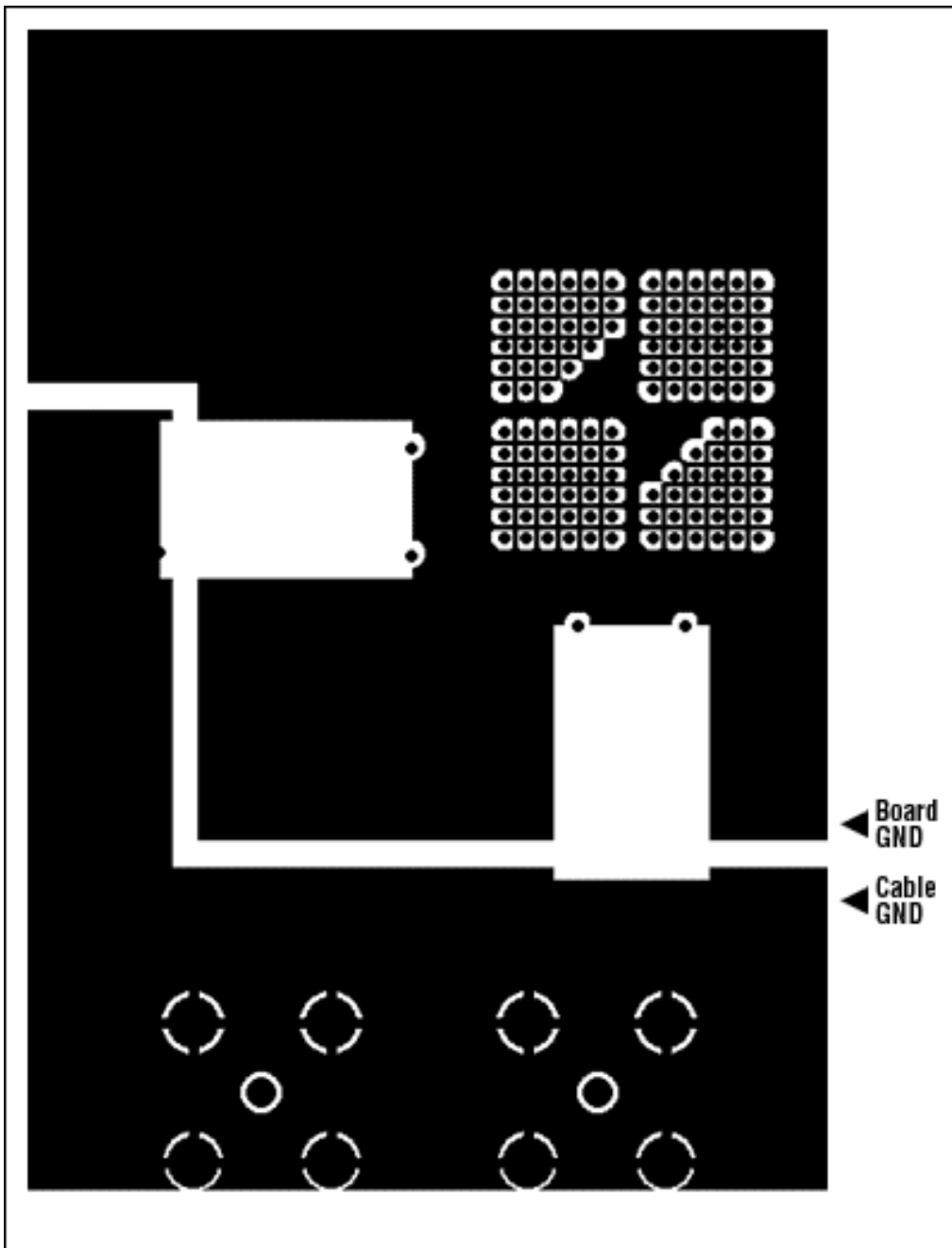


Figure 1-5. DS3151 Single-Port, T3/E3 LIU Ground Plane {layer two} Layout—No Ground Plane under the Transformers

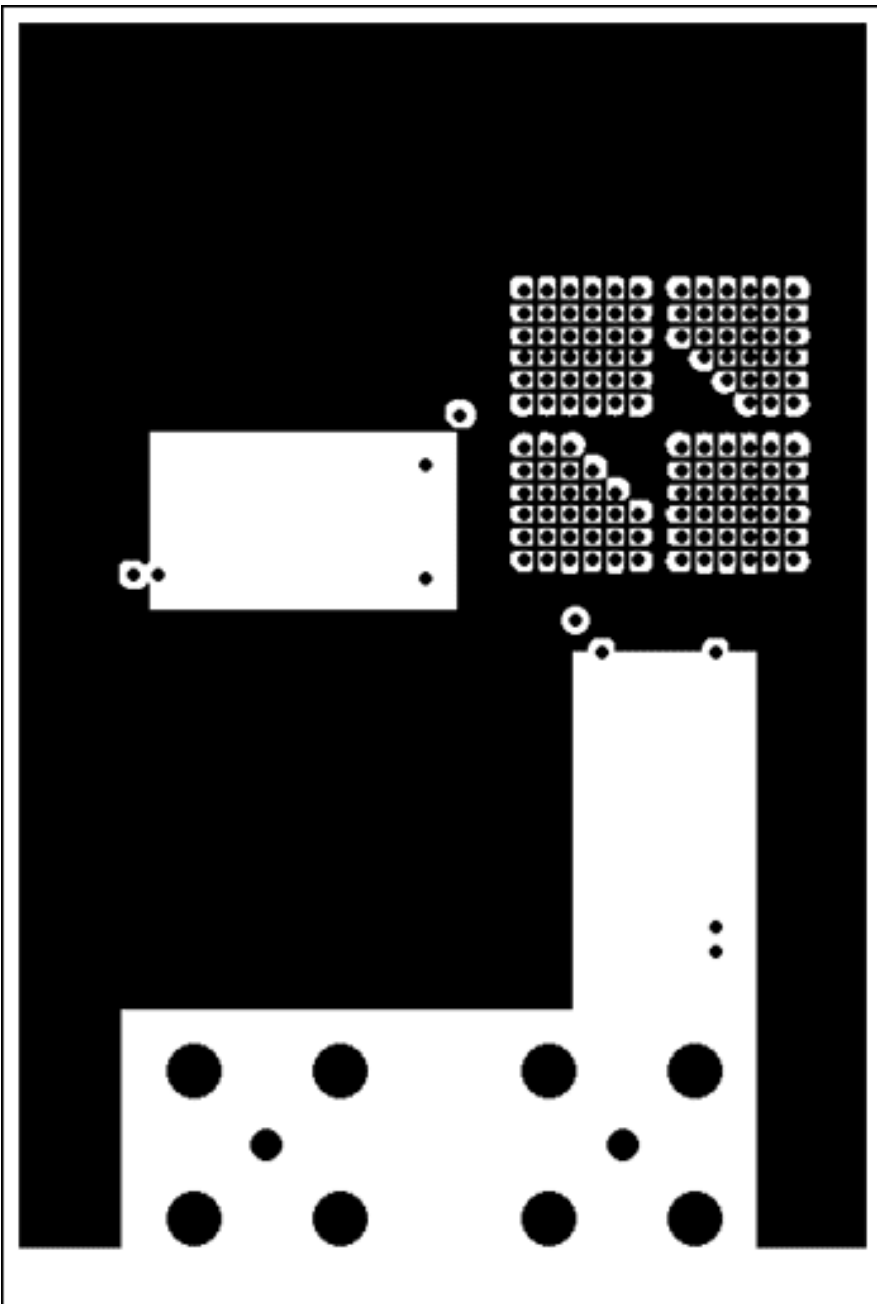


Figure 1-6. DS3151 Single-Port, T3/E3 LIU V_{CC} Plane {layer three} Layout—No V_{CC} Plane under the Transformer or TXP, TXN, RXP, RXN

Example 2: DS3152—The Layout of a Dual-Port T3/E3 LIU

Table 2-1. Layout Components

Name	Qty	Description	Supplier	Part Number
U1	1	Dual DS3/E3/STS1 LIU, 144P BGA	Dallas Semiconductor	DS3152
R1-R4	4	Resistor, 0603 332Ohm, 1/16W 1%	Panasonic	ERJ-3EKF3320V
T1	1	Transformer, OCTAL T3/E3, 1:2, SMT 32-pin	Pulse	T3049
J2,J4,J5,J7	4	Connector, BNC 75Ohm, RA 5-pin	Trompetor	UCBJR220

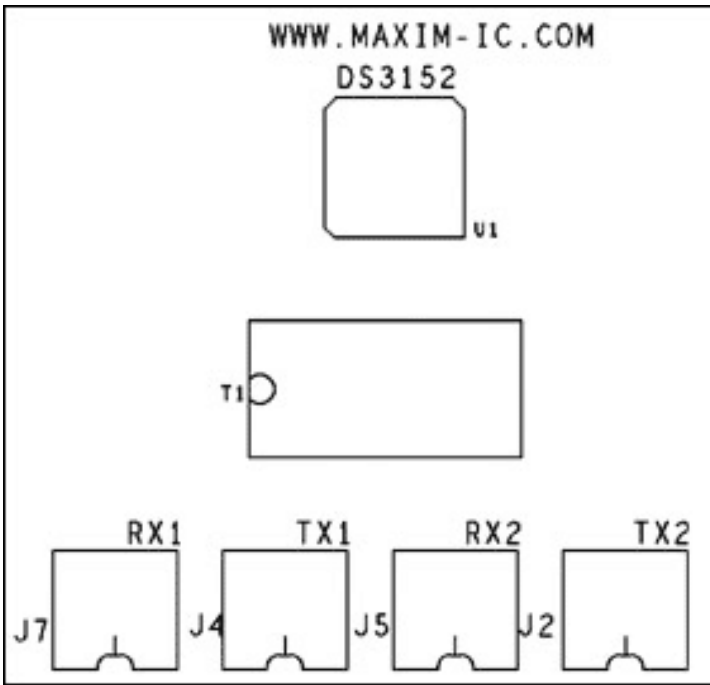


Figure 2-1. DS3152 Dual-Port, T3/E3 LIU Layout—Silkscreen Top Layer

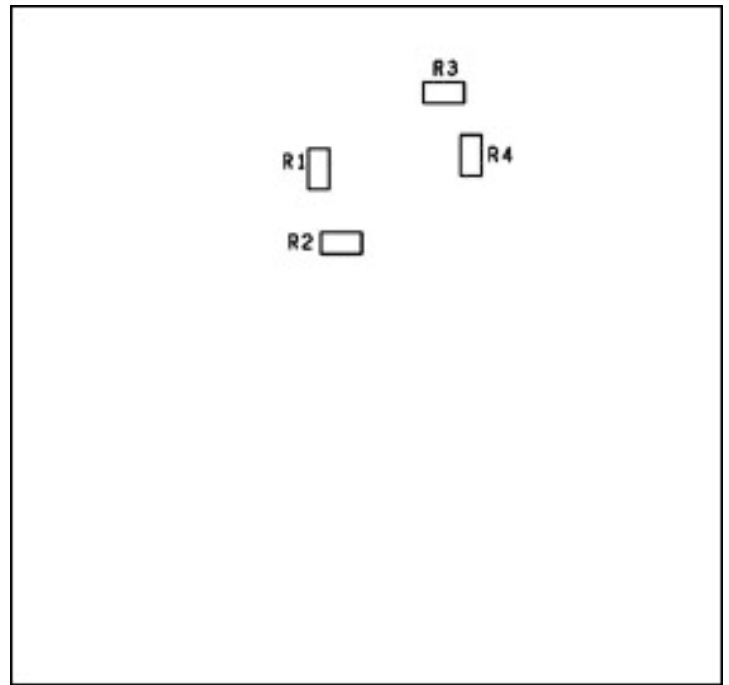


Figure 2-2. DS3152 Dual-Port, T3/E3 LIU Layout—Silkscreen Bottom Layer (view mirrored)

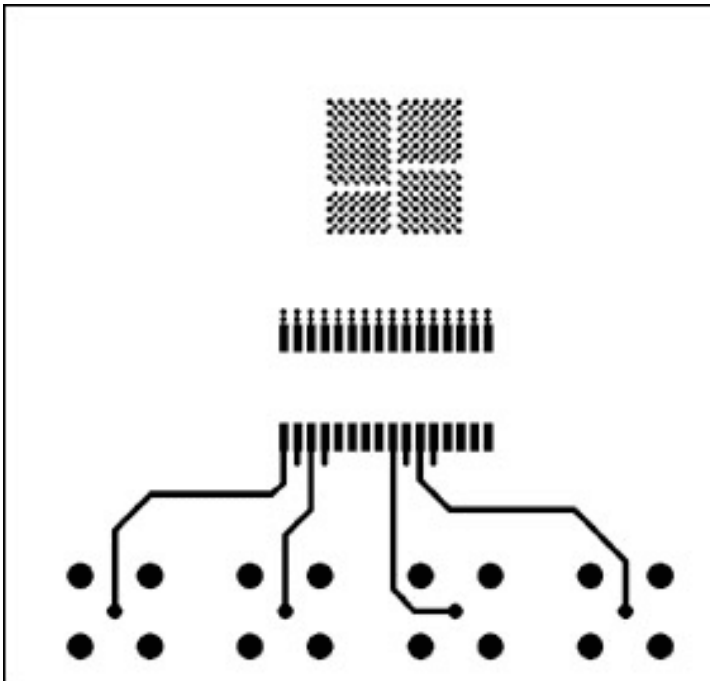


Figure 2-3. DS3152 Dual-Port, T3/E3 LIU Layout—Top Conducting Layer

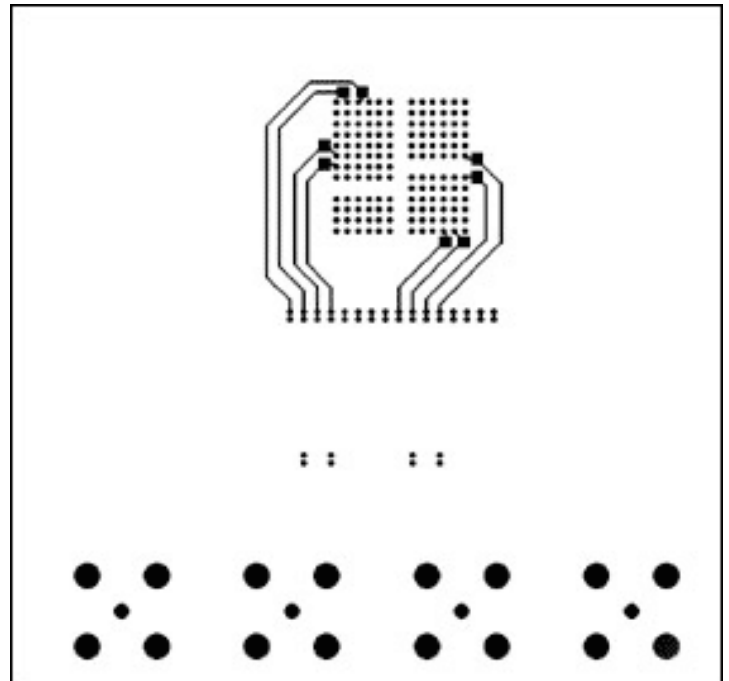


Figure 2-4. DS3152 Dual-Port, T3/E3 LIU Layout—Bottom Conducting Layer

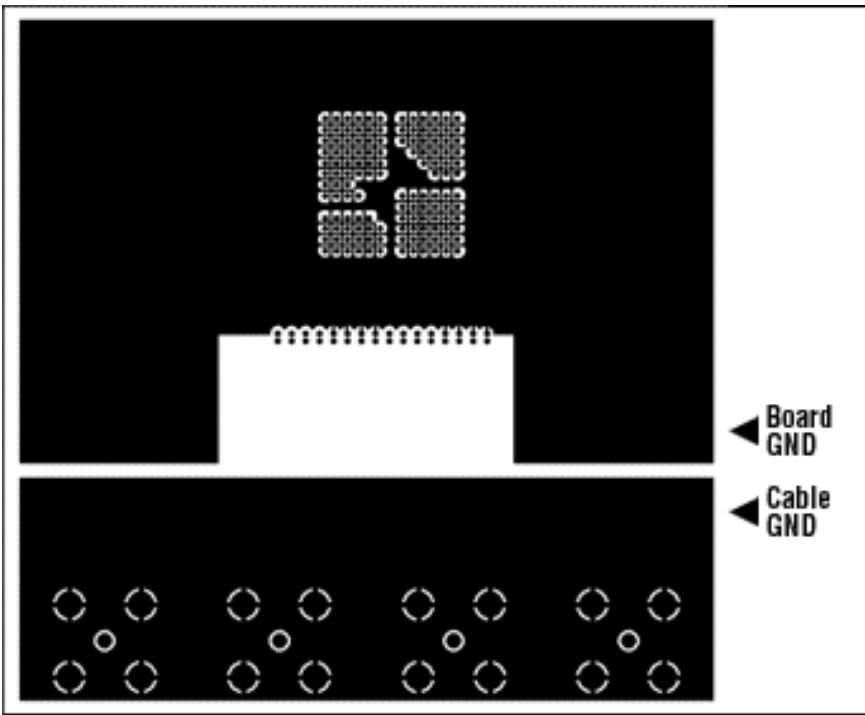


Figure 2-5. DS3152 Dual-Port, T3/E3 LIU Ground Plane {layer two} Layout—No Ground Plane under the Transformer

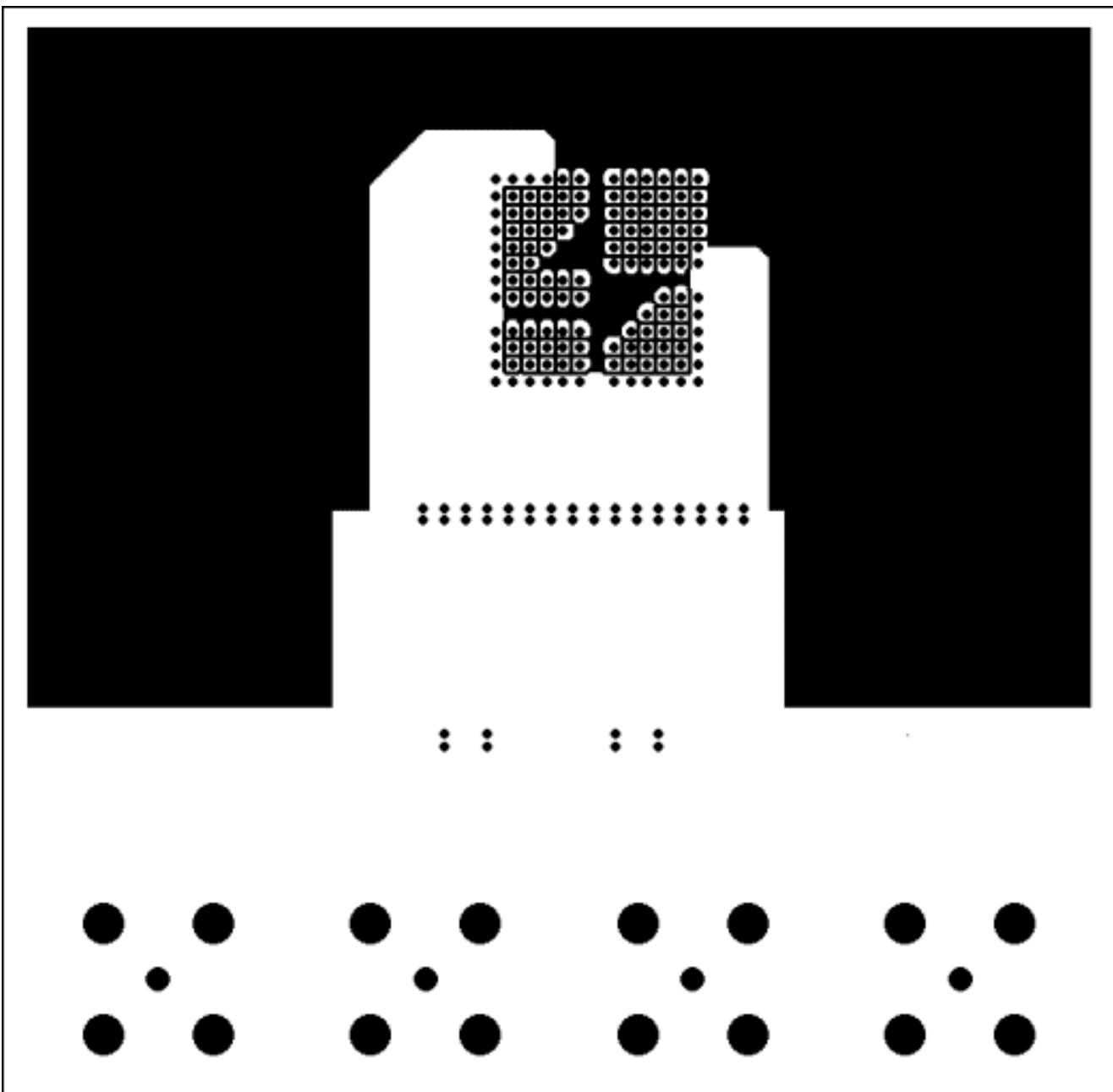


Figure 2-6. DS3152 Dual-Port, T3/E3 LIU V_{CC} Plane {layer three} LAYOUT—NO V_{CC} PLANE under the Transformer or TXP, TXN, RXP, RXN

Example 3: DS3153—The Layout of a Triple-Port, T3/E3 LIU

Table 3-1. Layout Components

Name	Qty	Description	Supplier	Part Number
U1	1	Triple DS3/E3/STS1 LIU, 144P BGA	Dallas Semiconductor	DS3153
R1-R5,R7	6	Resistor, 0603 3320hm, 1/16W 1%	Panasonic	ERJ-3EKF3320V
T1	1	Transformer, OCTAL T3/E3, 1:2, SMT 32-pin	Pulse	T3049
J2-J7	6	Connector, BNC 75Ohm, RA 5-pin	Trompetor	UCBJR220

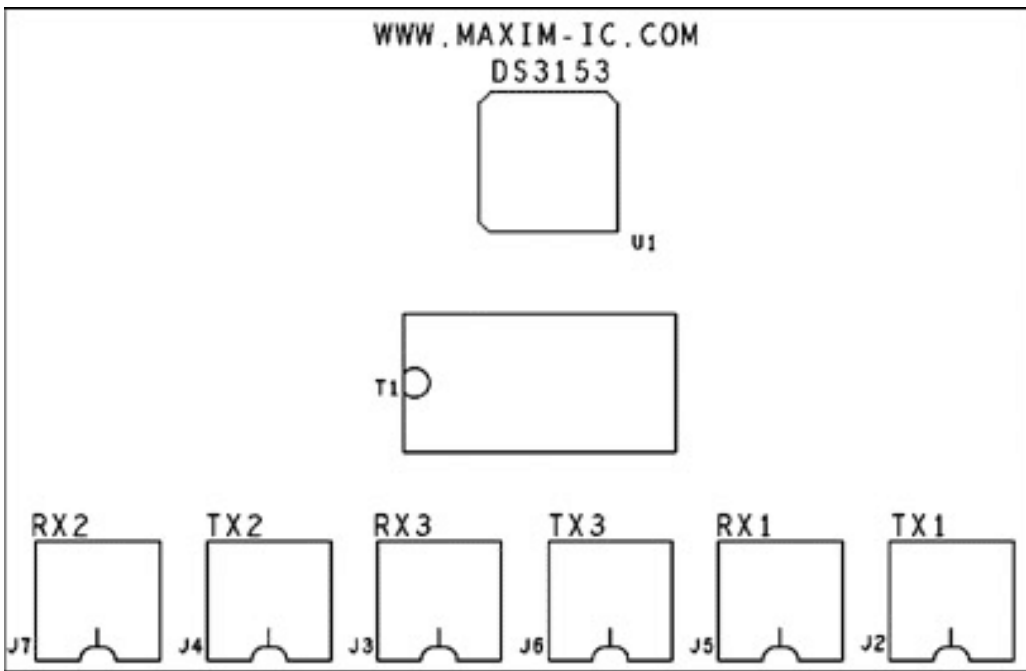


Figure 3-1. DS3153 Triple-Port, T3/E3 LIU Layout—Silkscreen Top Layer

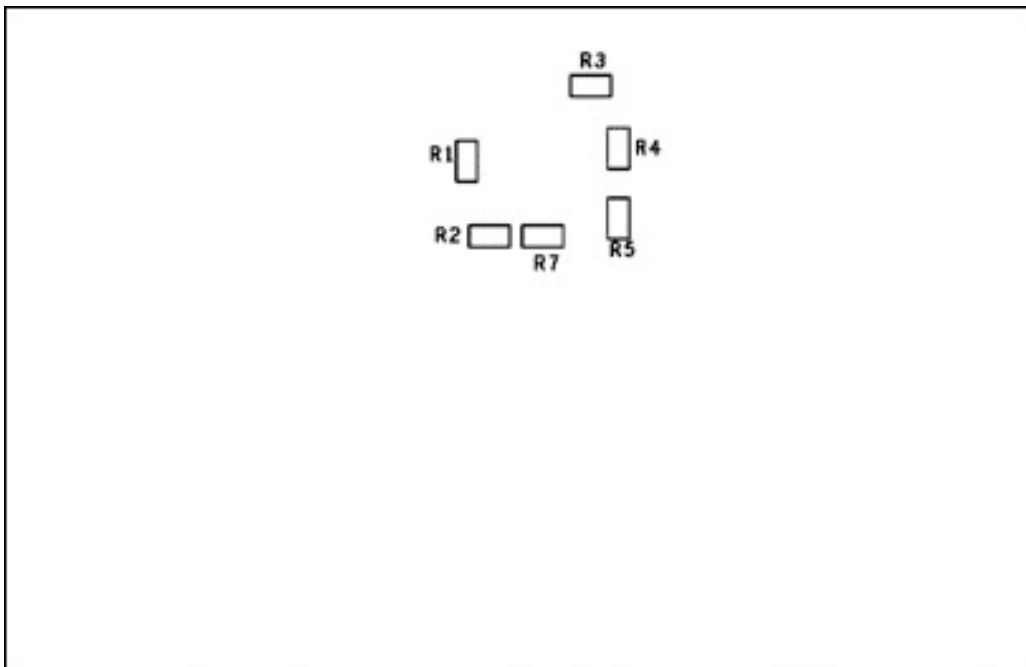


Figure 3-2. DS3153 Triple-Port, T3/E3 LIU Layout—Silkscreen Bottom Layer (view mirrored)

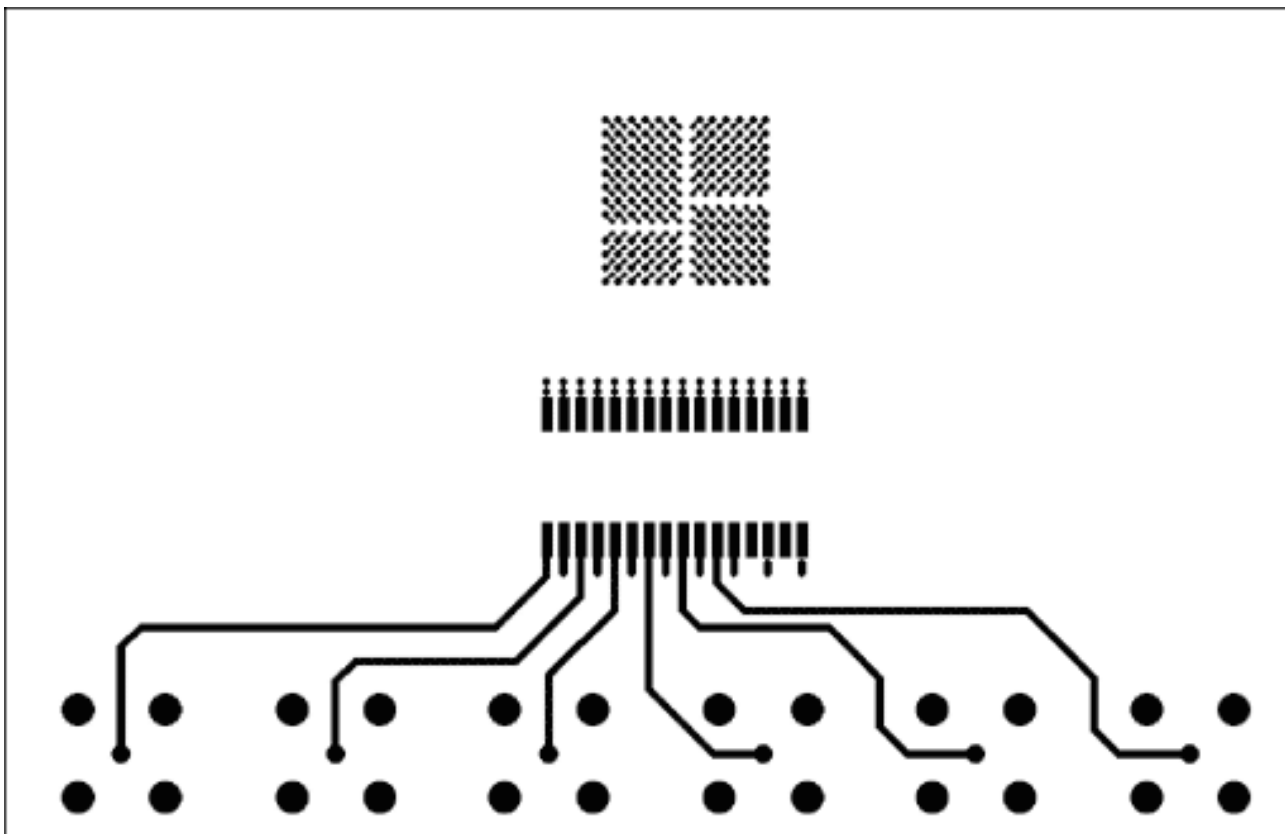


Figure 3-3. DS3153 Triple-Port, T3/E3 LIU Layout—Top Conducting Layer

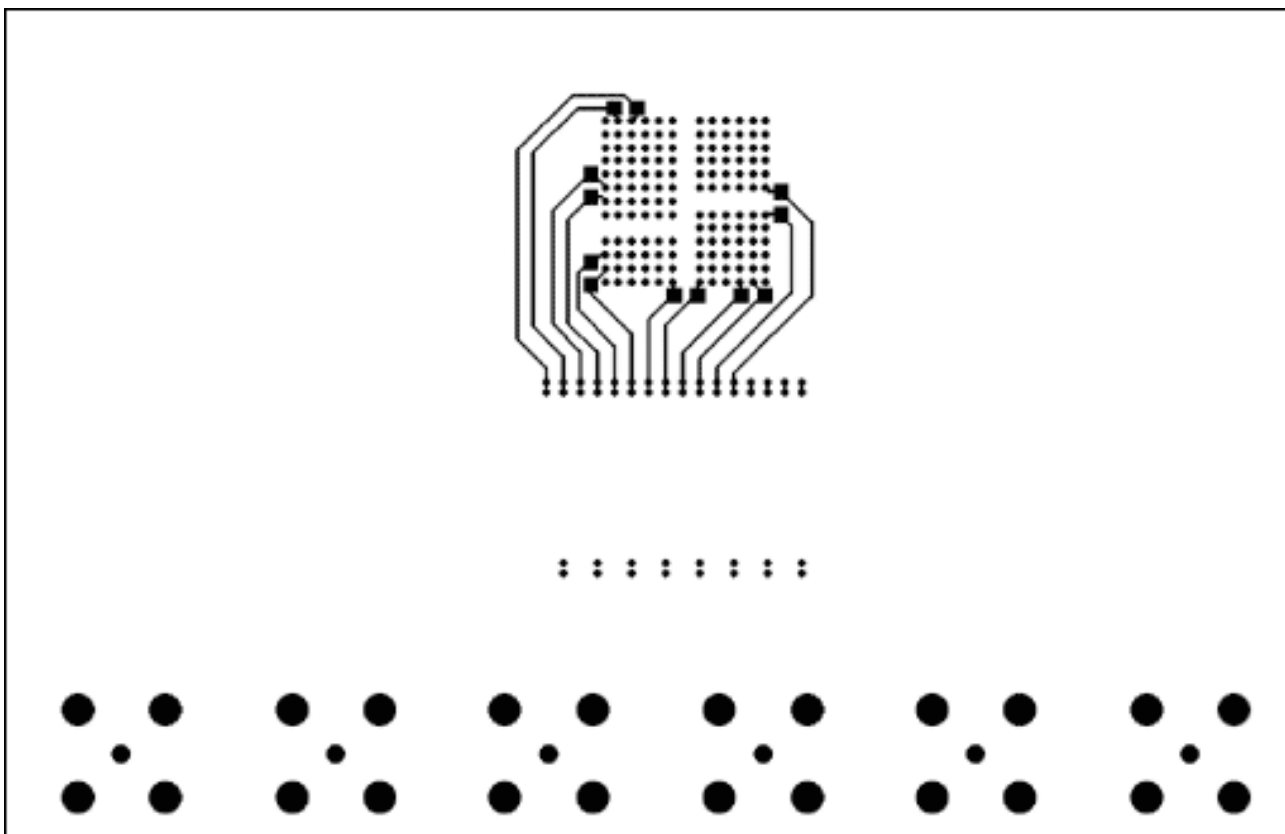


Figure 3-4. DS3153 Triple-Port, T3/E3 LIU Layout—Bottom Conducting Layer

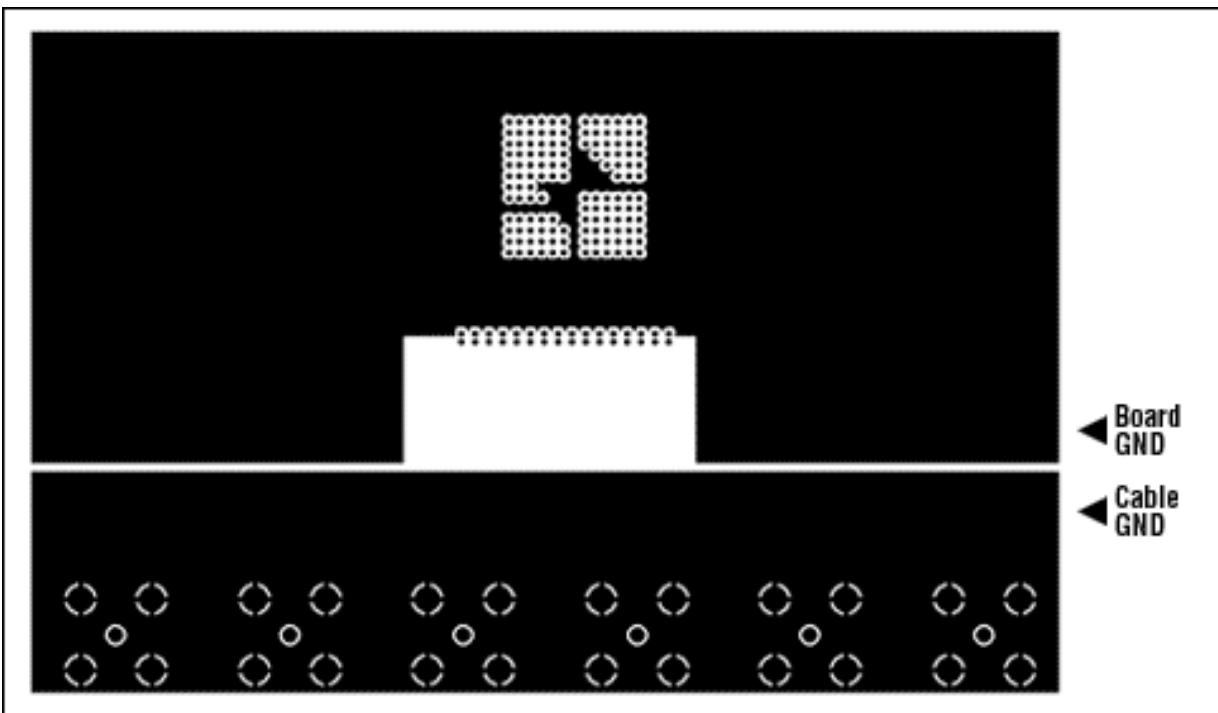


Figure 3-5. DS3153 Triple-Port, T3/E3 LIU Ground Plane {layer two} Layout—No Ground Plane under the Transformer

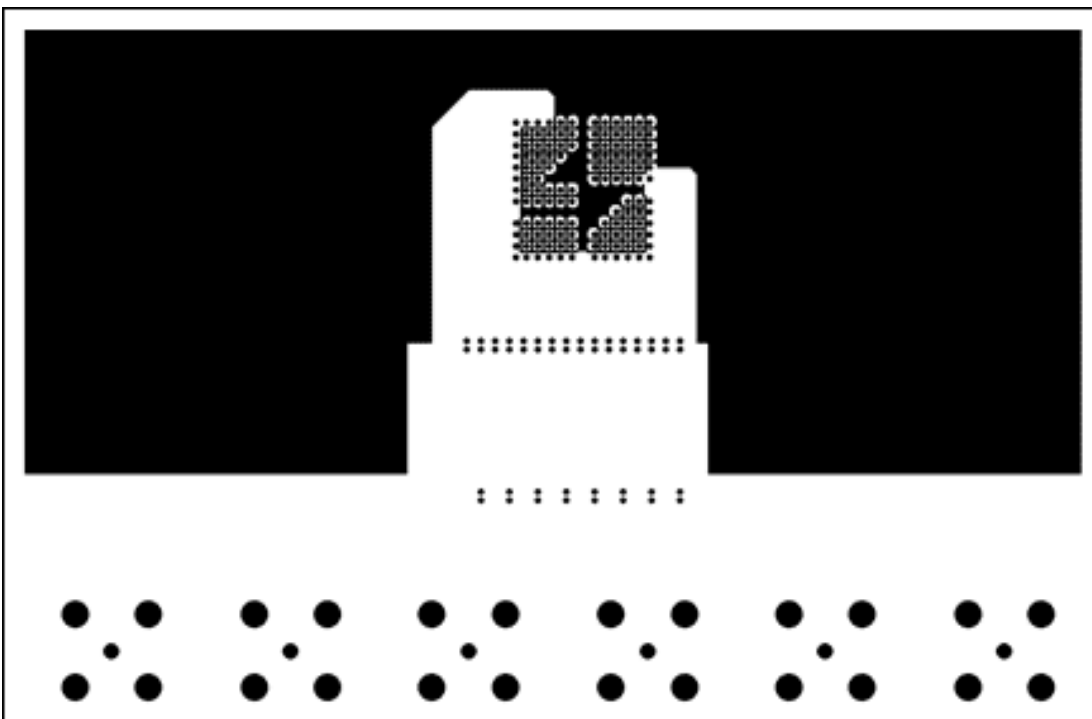


Figure 3-6. DS3153 Triple-Port, T3/E3 LIU V_{CC} Plane {layer three} Layout—No V_{CC} Plane under the Transformer or TXP, TXN, RXP, RXN

Example 4: DS3154—The Layout of a Quad-Port, T3/E3 LIU

Table 4-1. Layout Components

Name	Qty	Description	Supplier	Part Number
U1	1	Quad DS3/E3/STS1 LIU, 144P BGA	Dallas Semiconductor	DS3154

R1-R8	8	Resistor, 0603 332Ohm, 1/16W 1%	Panasonic	ERJ-3EKF3320V
T1	1	Transformer, OCTAL T3/E3, 1:2, SMT 32-pin	Pulse	T3049
J1-J8	8	Connector, BNC 75OHM, RA -pin	Trompetor	UCBJR220

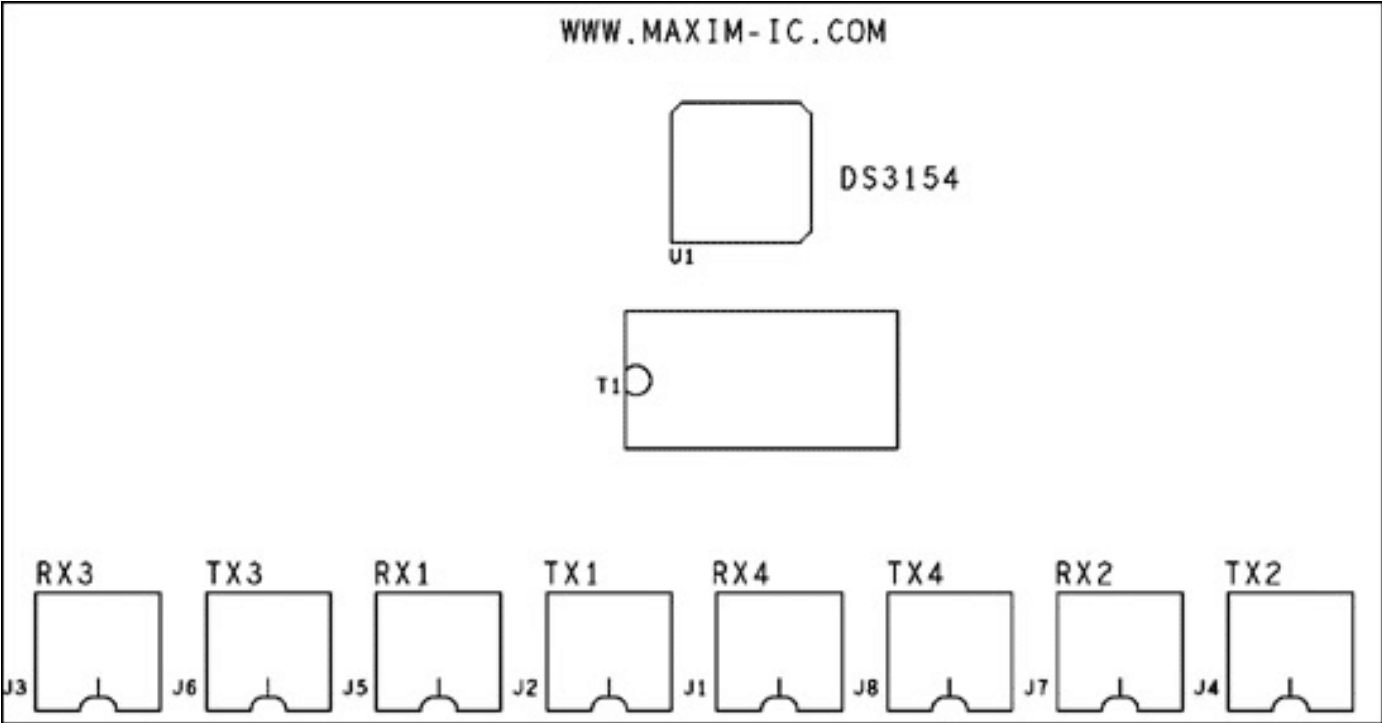


Figure 4-1. DS3154 Quad-Port, T3/E3 LIU Layout—Silkscreen Top Layer

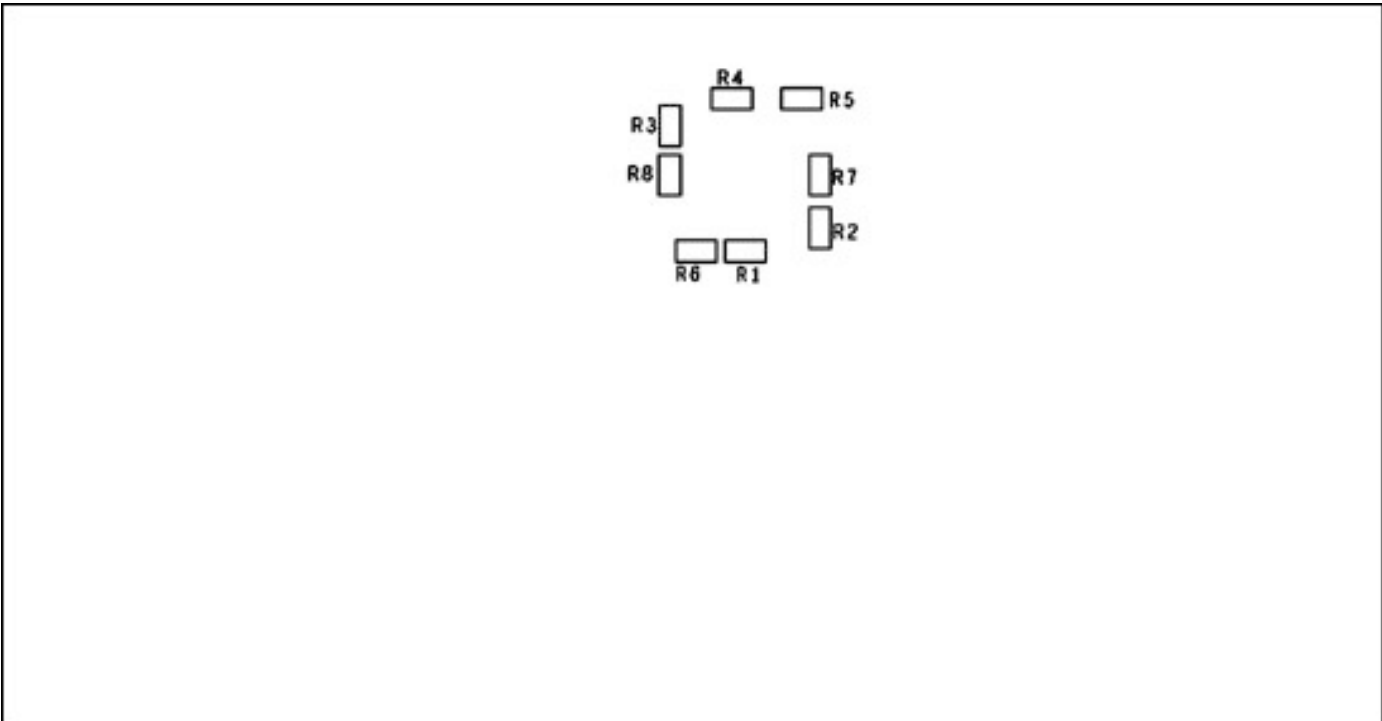


Figure 4-2. DS3154 Quad-Port, T3/E3 LIU Silkscreen Layout—Bottom Layer (view mirrored)

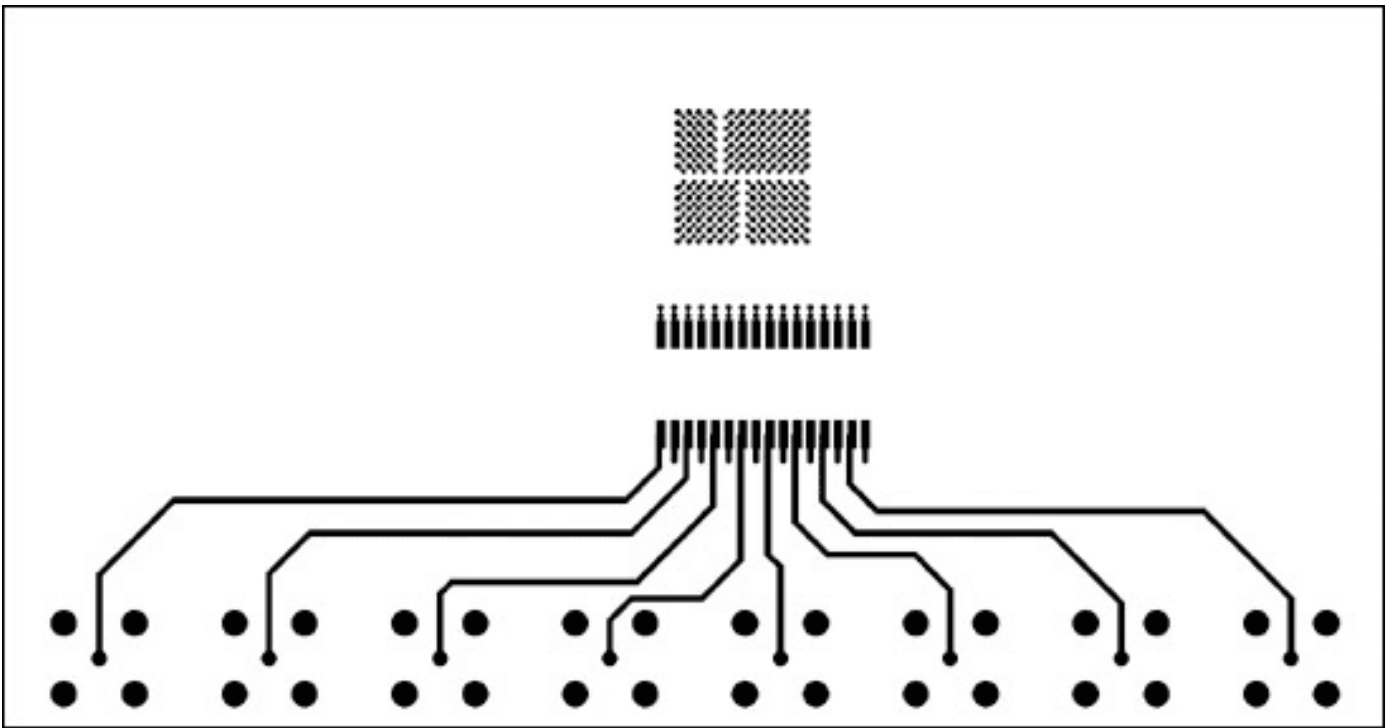


Figure 4-3. DS3154 Quad-Port, T3/E3 LIU Layout—Top Conducting Layer

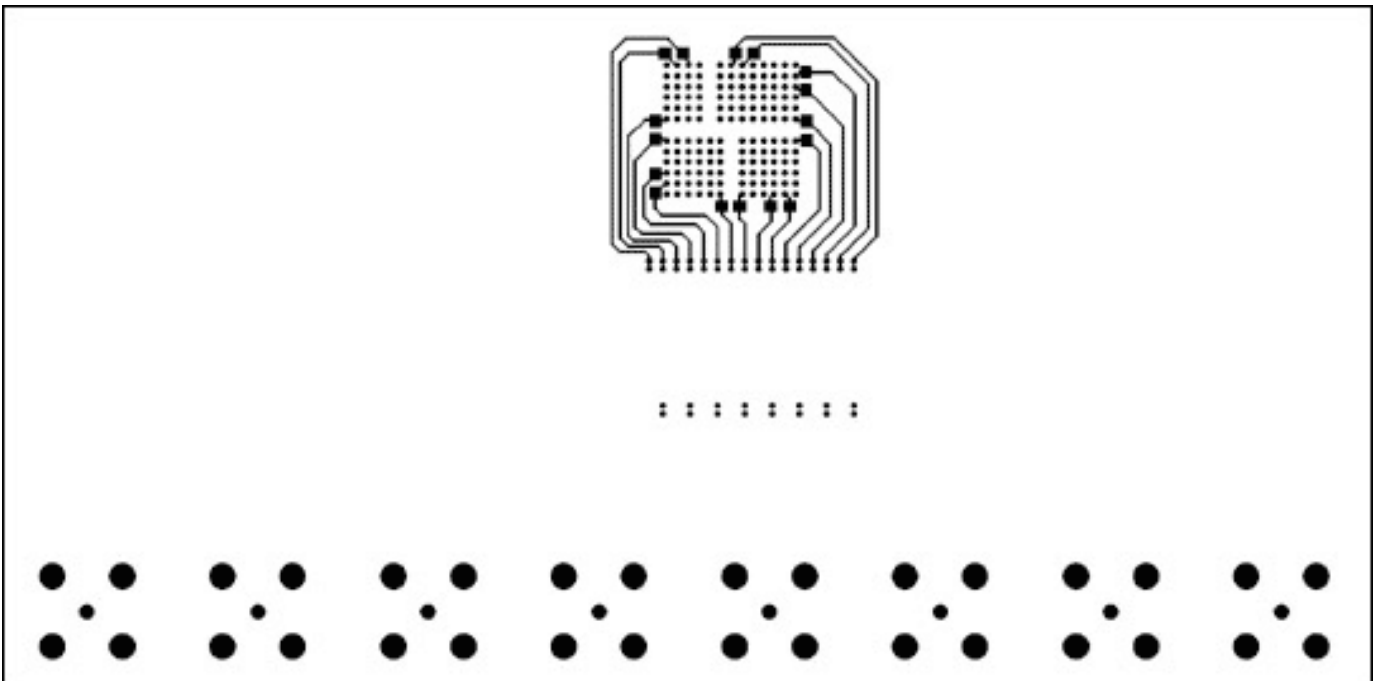


Figure 4-4. DS3154 Quad-Port, T3/E3 LIU Layout—Bottom Conducting Layer

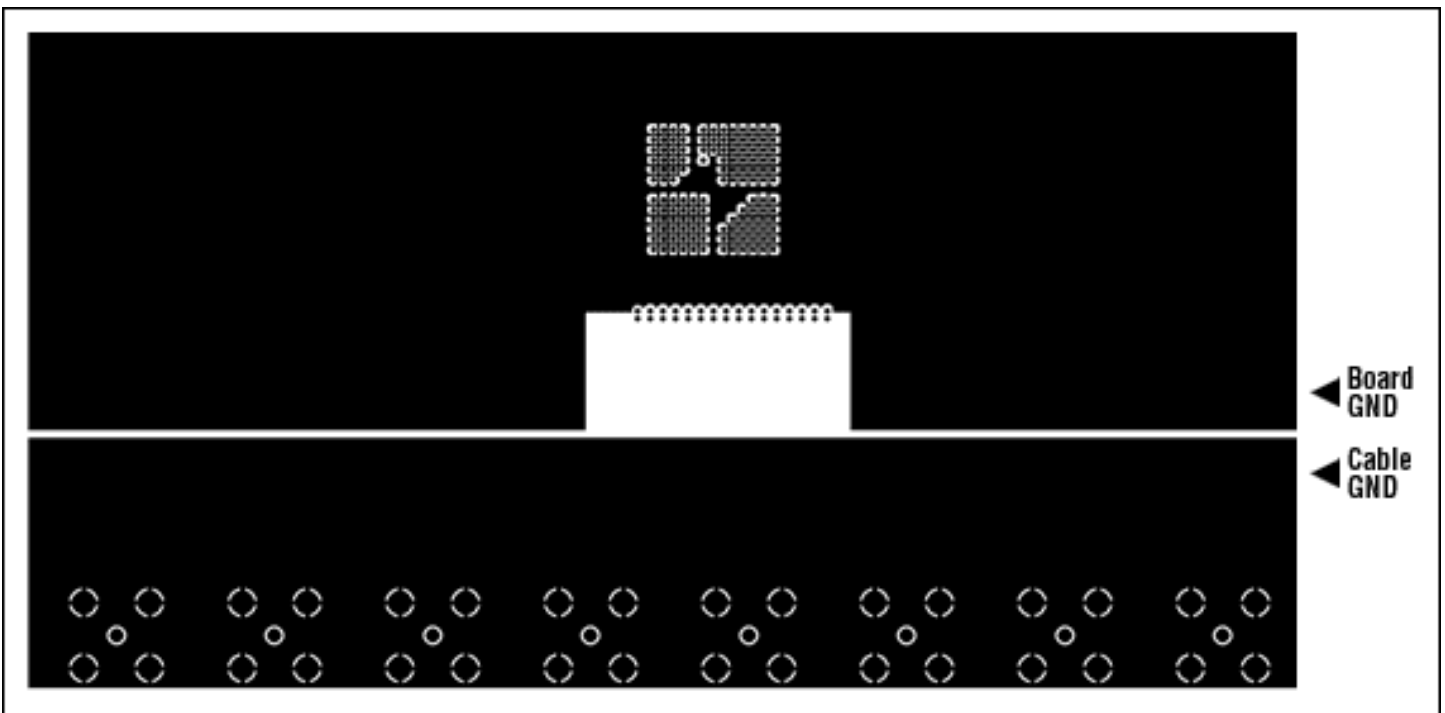


Figure 4-5. DS3154 Quad-Port, T3/E3 LIU Ground Plane {layer two} Layout—No Ground Plane under the Transformer

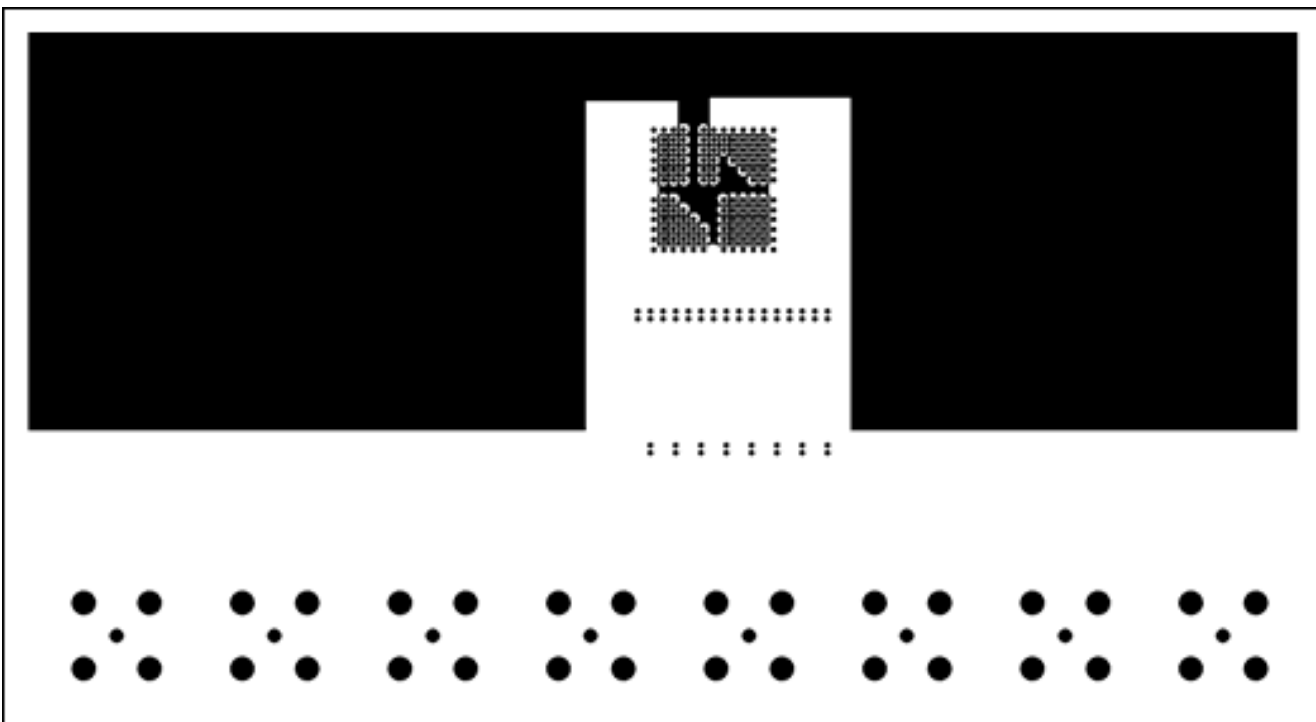


Figure 4-6. DS3154 Quad-Port, T3/E3 LIU VCC Plane {layer three} Layout—No VCC Plane under the Transformer or TXP, TXN, RXP, RXN

Conclusion

This application note illustrated what is necessary to maintain the proper impedance for a T3/E3 networking interface using the DS315x.

If you have further questions about our T3/E3 products, please contact the Telecommunication Applications support team by email, telecom.support@dalsemi

More Information

DS3150: [QuickView](#) -- [Full \(PDF\) Data Sheet](#) -- [Free Samples](#)
DS3151: [QuickView](#) -- [Full \(PDF\) Data Sheet](#) -- [Free Samples](#)
DS3152: [QuickView](#) -- [Full \(PDF\) Data Sheet](#) -- [Free Samples](#)
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