

Keywords: T3, E3, STS-1, line interface units, LIU, layout

APPLICATION NOTE 3410

# Guidelines for Laying Out T3 and E3 Network Interfaces

Dec 22, 2004

*Abstract: 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.*

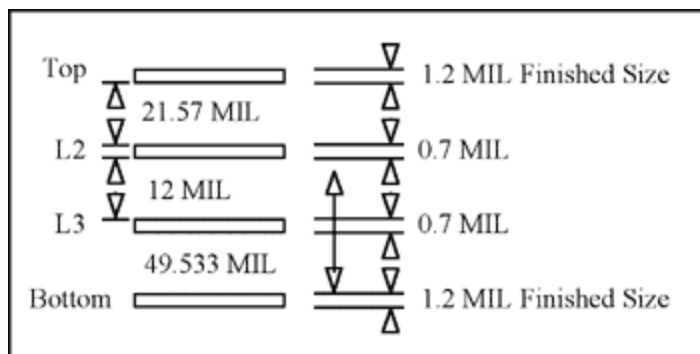
## Overview

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

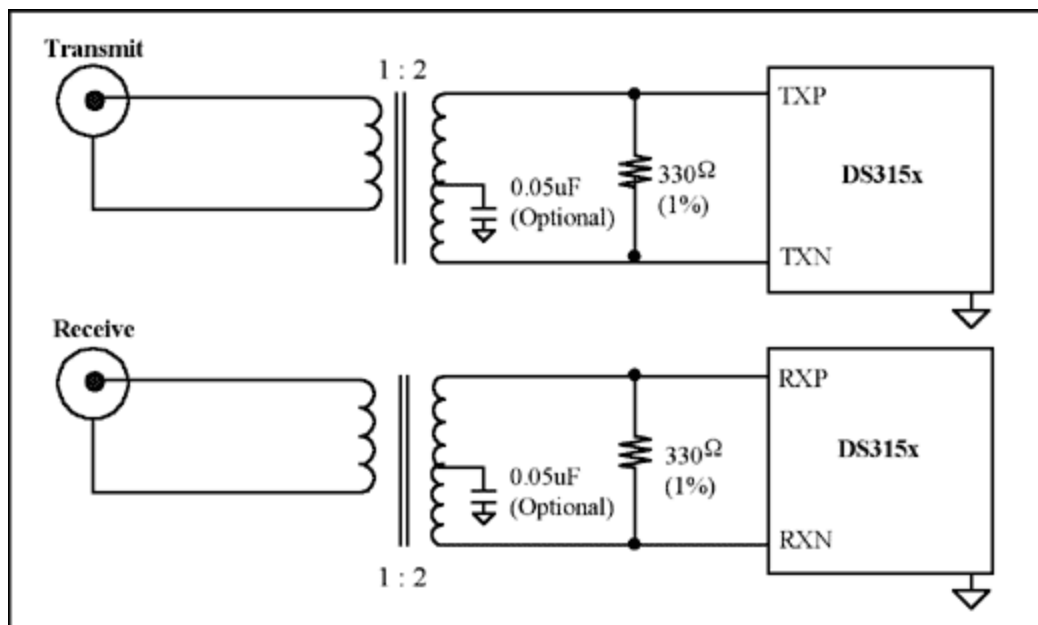


Below is an example of the trace-width calculation for a T3/E3 LIU interface.

	Surface Materials	Thickness	Dielectric Constant	Line Widths	Impedance
<b>TX, RX @ 75Ω</b>					
	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
<b>TXP, TXN, RXP, RXN @ 150Ω</b>					
	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	Maxim	DS3151
C1,C2	2	0805 Ceram 56000pF, 25V 10%	Panasonic	ECJ-2VB1E563K
R1,R2	2	Resistor, 0603 332Ω, 1/16W 1%	Panasonic	ERJ-3EKF3320V
T1,T2	2	Transformer, 1:2 T3/E3/STS-1, industrial	Pulse	T3012
J1,J2	2	Connector, BNC 75Ω, RA 5-pin	Trompetor	UCBJR220

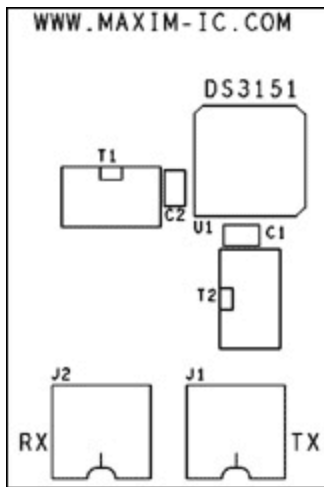


Figure 1-1. DS3151 Single-port, T3/E3 LIU layout—silkscreen top layer.

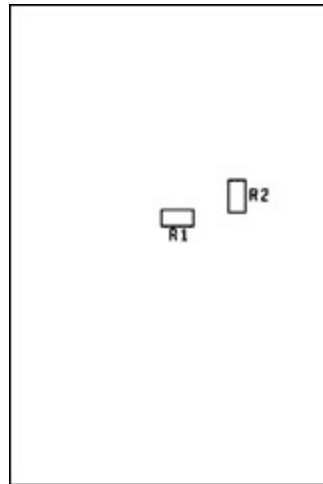


Figure 1-2. DS3151 Single-port, T3/E3 LIU layout—silkscreen bottom layer (view mirrored).

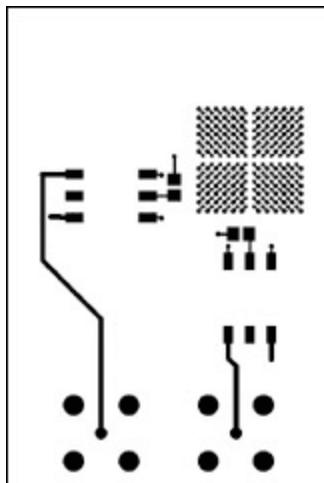


Figure 1-3. DS3151 Single-port, T3/E3 LIU layout—copper top layer.

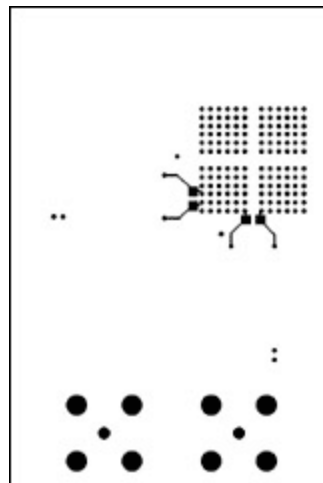


Figure 1-4. DS3151 Single-port, T3/E3 LIU layout—copper bottom layer.

port, T3/E3 LIU layout—top  
conducting layer.

T3/E3 LIU layout—bottom  
conducting layer.

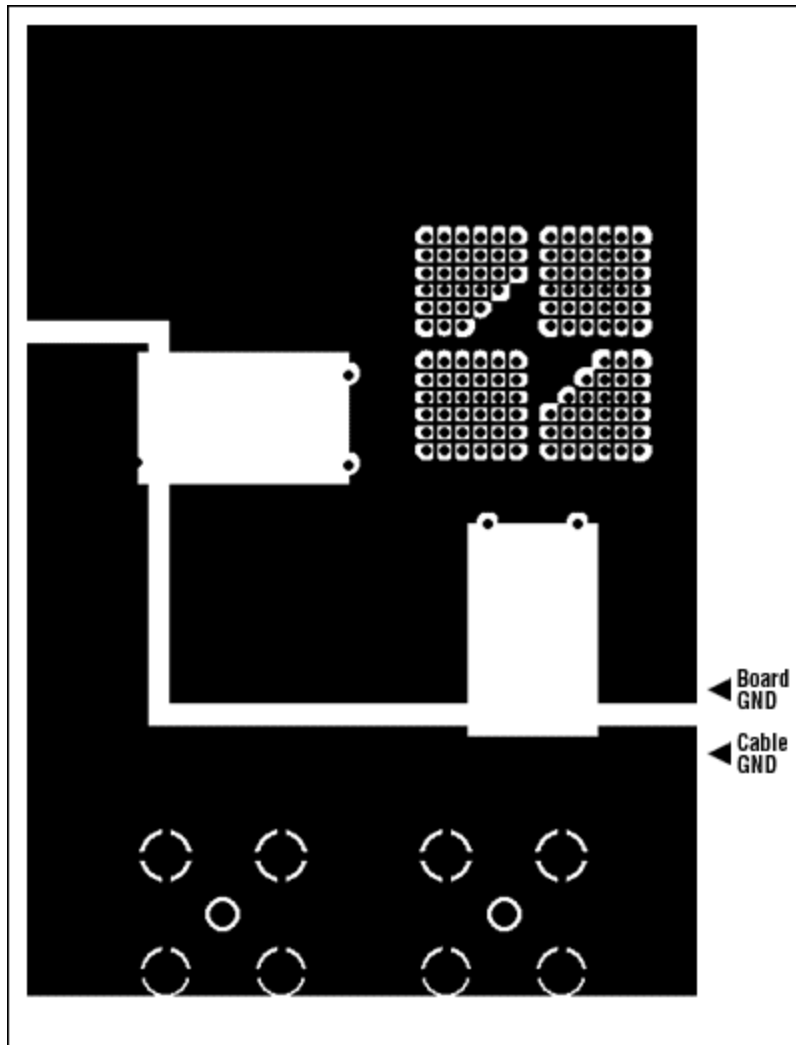


Figure 1-5. DS3151 Single-port, T3/E3 LIU ground plane {layer two} layout—no ground plane under the transformers.

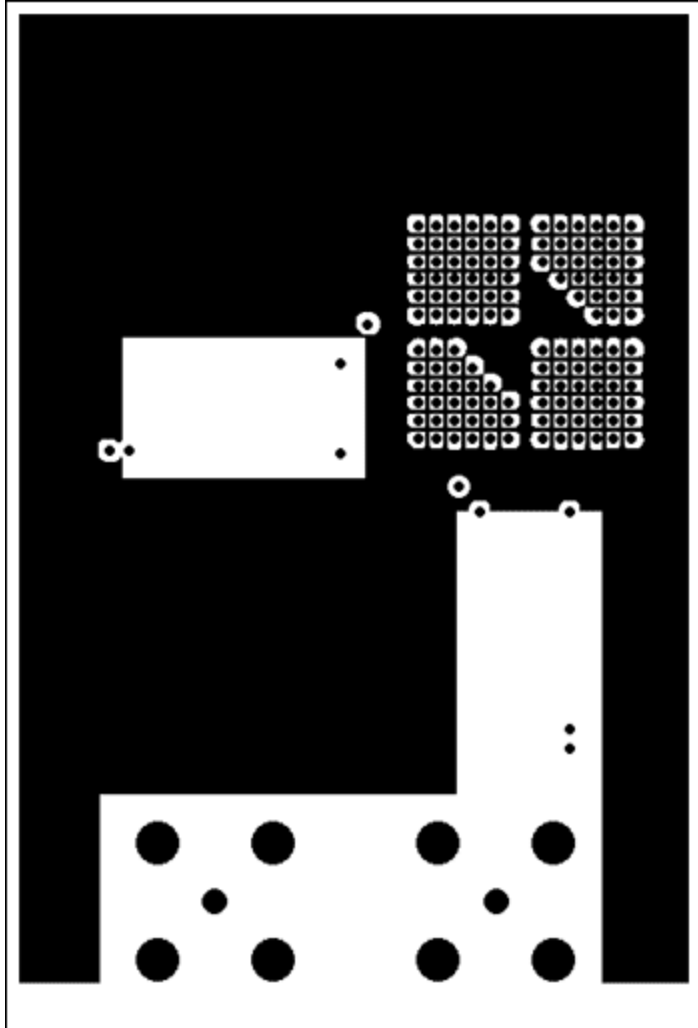


Figure 1-6. DS3151 Single-port, T3/E3 LIU VCC plane {layer three} layout—no VCC plane under the transformer or TXP, TXN, RXP, RXN.

## 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	Maxim	DS3152
R1-R4	4	Resistor, 0603 332Ω, 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 75Ω, RA 5-pin	Trompetor	UCBJR220

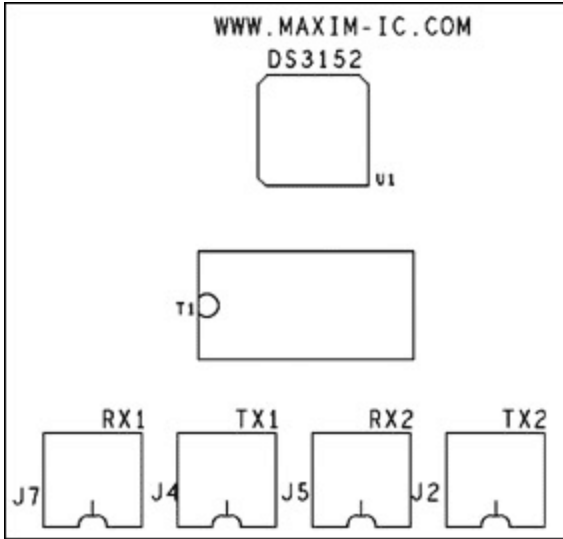


Figure 2-1. DS3152 dual-port, T3/E3 LIU layout — silkscreen top layer.

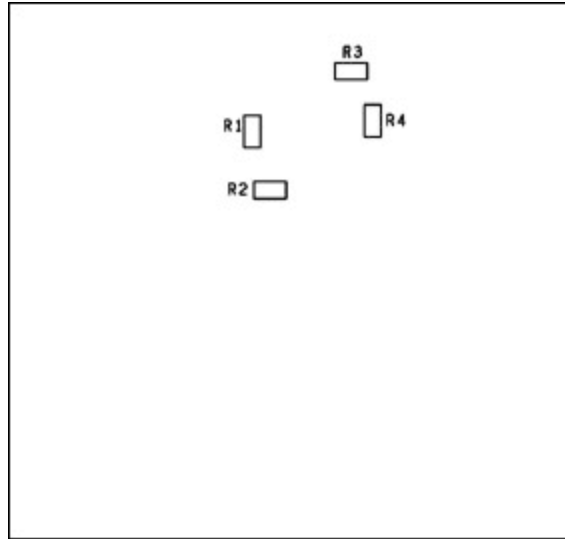


Figure 2-2. DS3152 dual-port, T3/E3 LIU layout — silkscreen bottom layer (view mirrored).

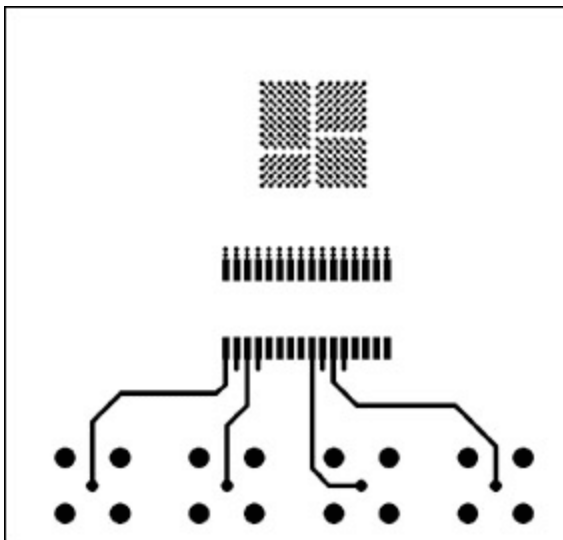


Figure 2-3. DS3152 Dual-port, T3/E3 LIU layout —top conducting layer.

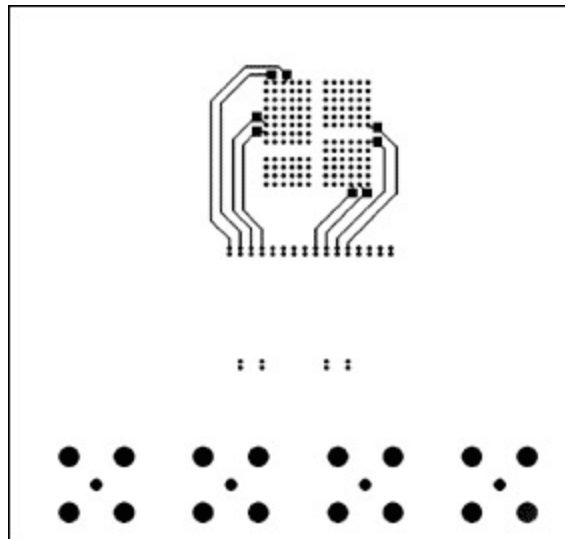


Figure 2-4. DS3152 dual-port, T3/E3 LIU layout —bottom conducting layer.

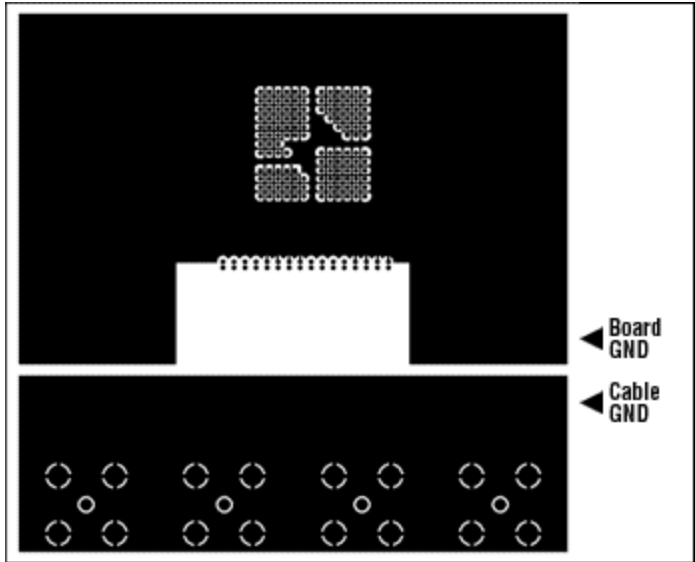


Figure 2-5. DS3152 dual-port, T3/E3 LIU ground plane {layer two} layout—no ground plane under the transformer.

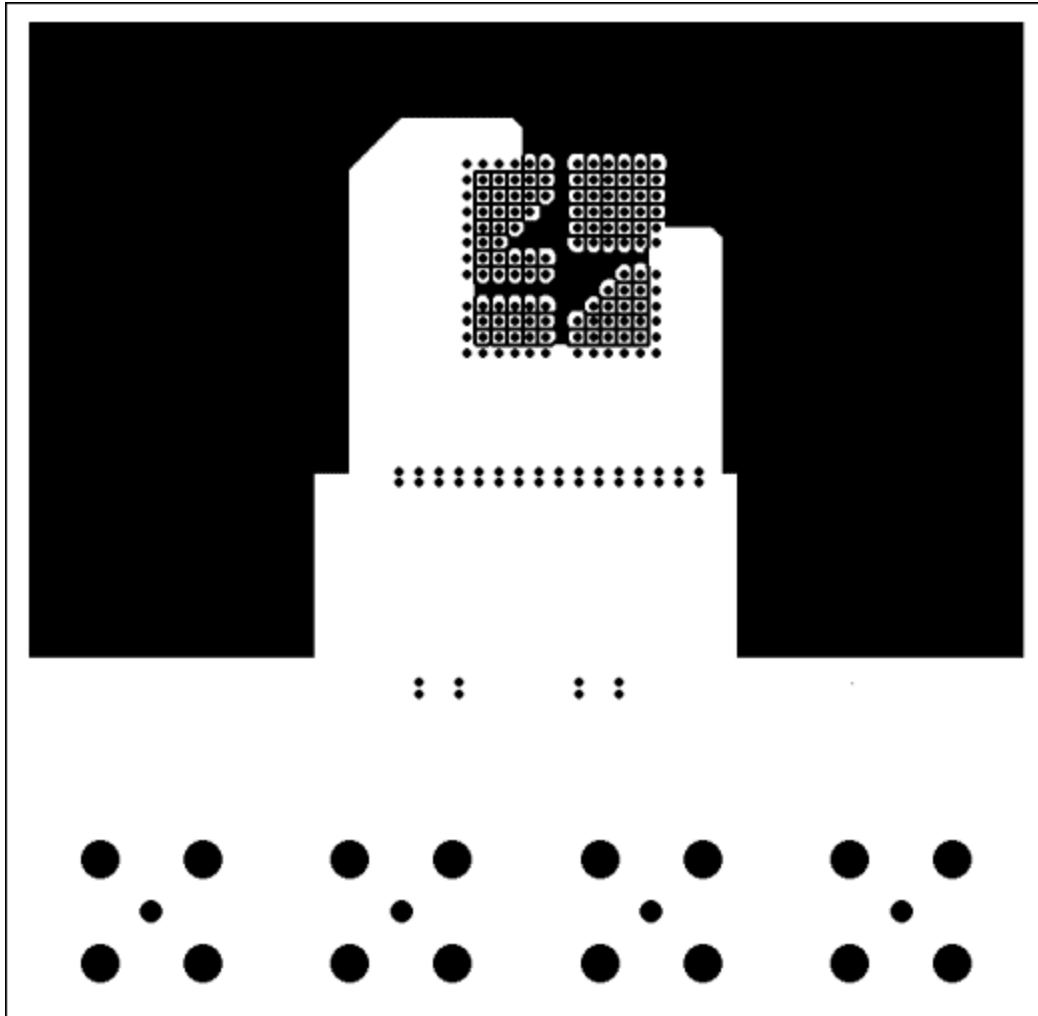


Figure 2-6. DS3152 dual-port, T3/E3 LIU V<sub>CC</sub> plane {layer three} layout—no V<sub>CC</sub> plane under the transformer or TXP, TXN, RXP, RXN.

### 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	Maxim	DS3153
R1-R5,R7	6	Resistor, 0603 332Ω, 1/16W 1%	Panasonic	ERJ-3EKF3320V
T1	1	Transformer, OCTAL T3/E3, 1:2, SMT 32-pin	Pulse	T3049
J2-J7	6	Connector, BNC 75Ω, RA 5-pin	Trompetor	UCBJR220



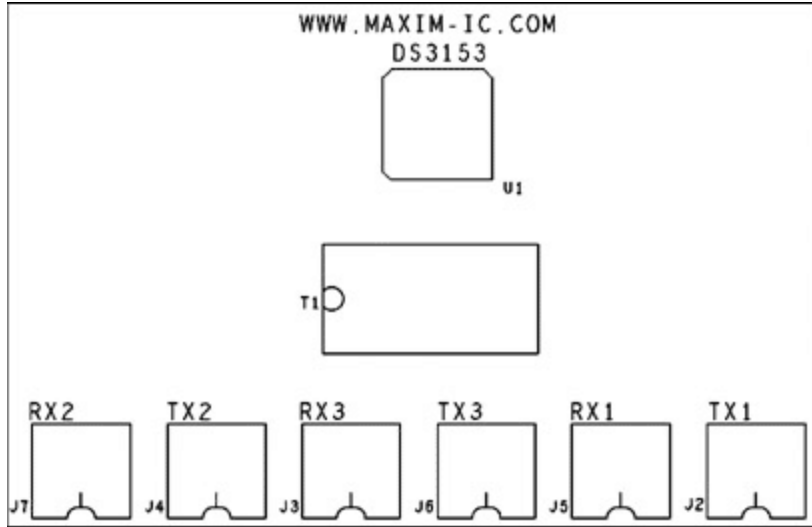


Figure 3-1. DS3153 triple-port, T3/E3 LIU layout—silkscreen top layer.

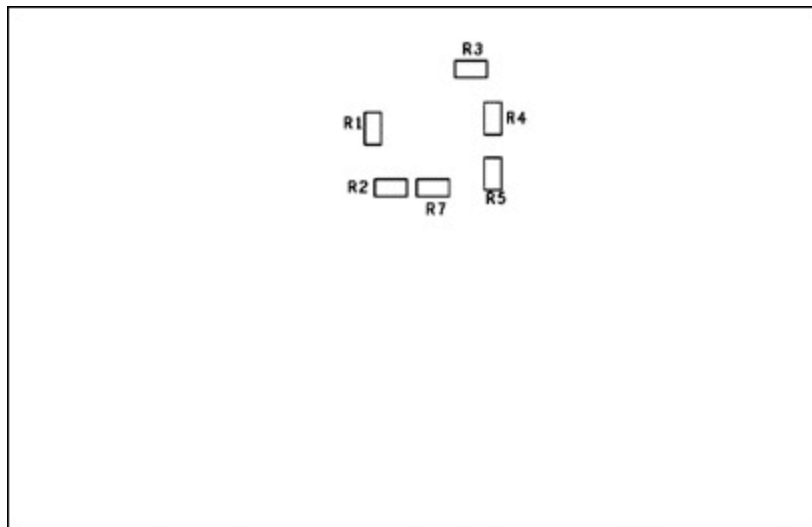


Figure 3-2. DS3153 triple-port, T3/E3 LIU layout—silkscreen bottom layer (view mirrored).

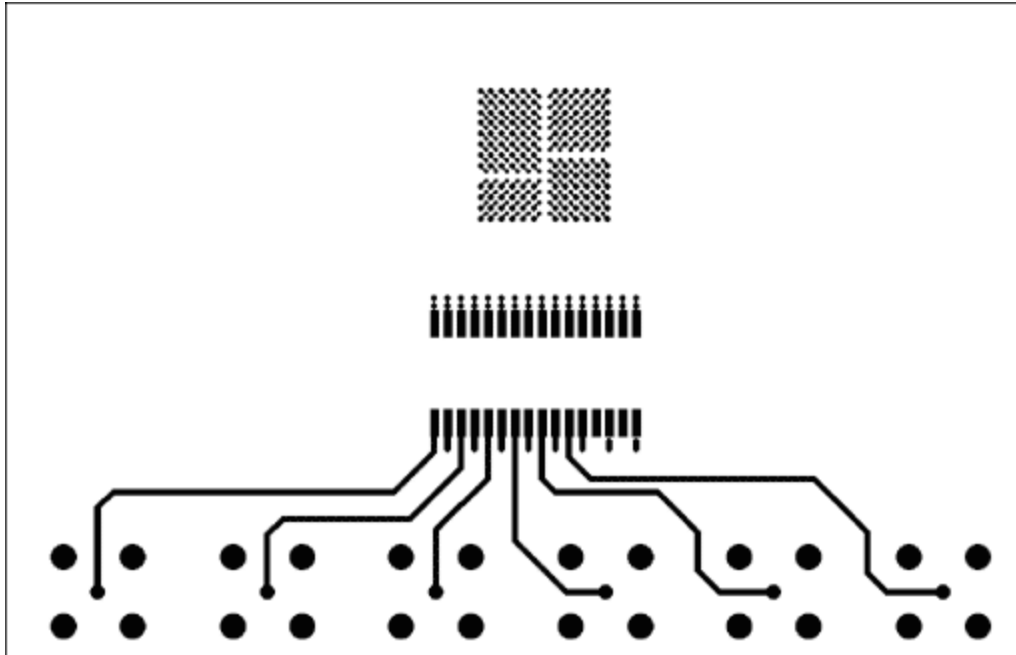


Figure 3-3. DS3153 triple-port, T3/E3 LIU layout—top conducting layer.

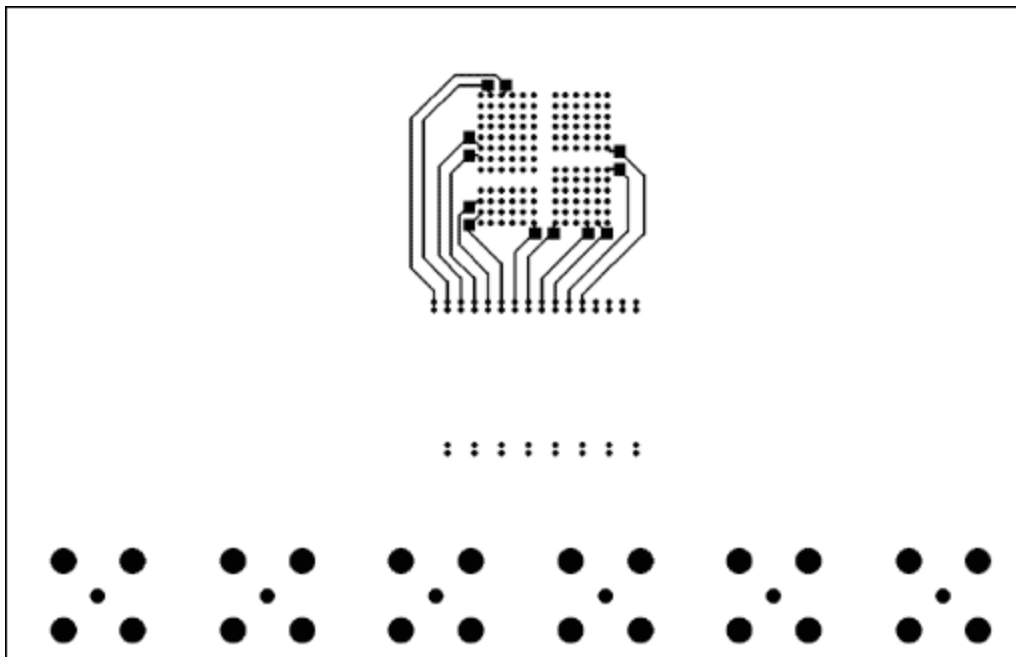


Figure 3-4. DS3153 triple-port, T3/E3 LIU layout—bottom conducting layer.

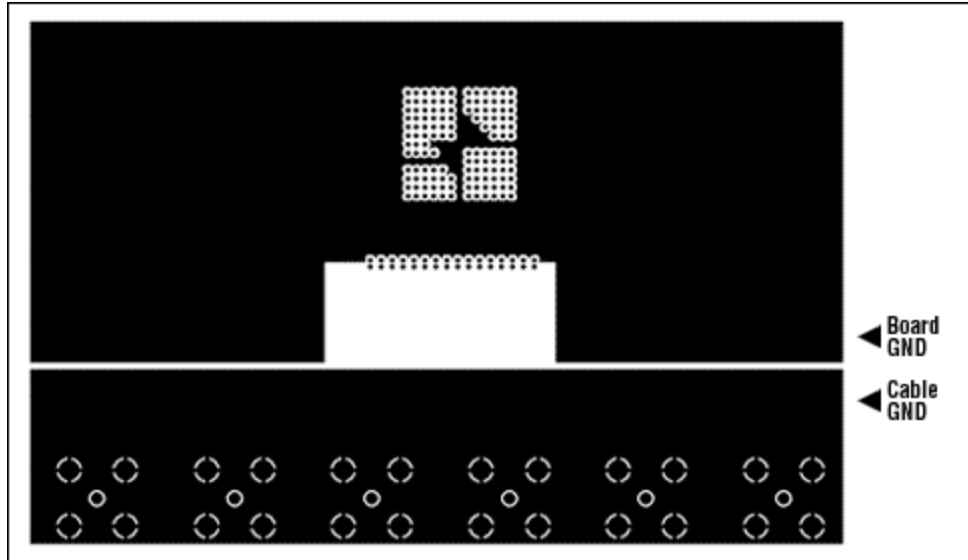


Figure 3-5. DS3153 triple-port, T3/E3 LIU ground plane {layer two} layout—no ground plane under the transformer.

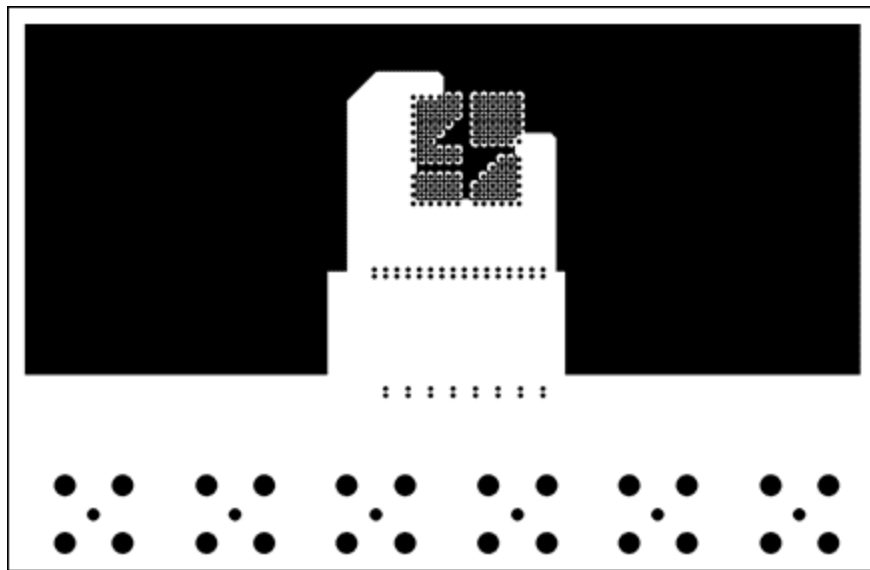


Figure 3-6. DS3153 triple-port, T3/E3 LIU VCC plane {layer three} layout—no VCC plane under the transformer or TXP, TXN, RXP, RXN.

#### 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	Maxim	DS3154
R1-R8	8	Resistor, 0603 332Ω, 1/16W 1%	Panasonic	ERJ-3EKF3320V
T1	1	Transformer, OCTAL T3/E3, 1:2, SMT 32-pin	Pulse	T3049
J1-J8	8	Connector, BNC 75Ω, RA -pin	Trompetor	UCBJR220

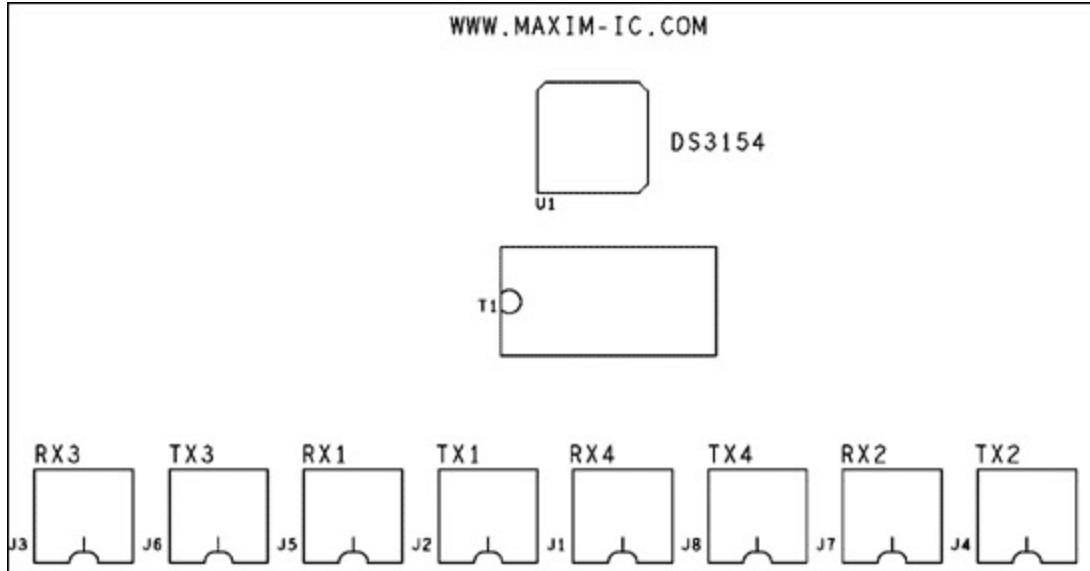


Figure 4-1. DS3154 quad-port, T3/E3 LIU layout—silkscreen top layer.

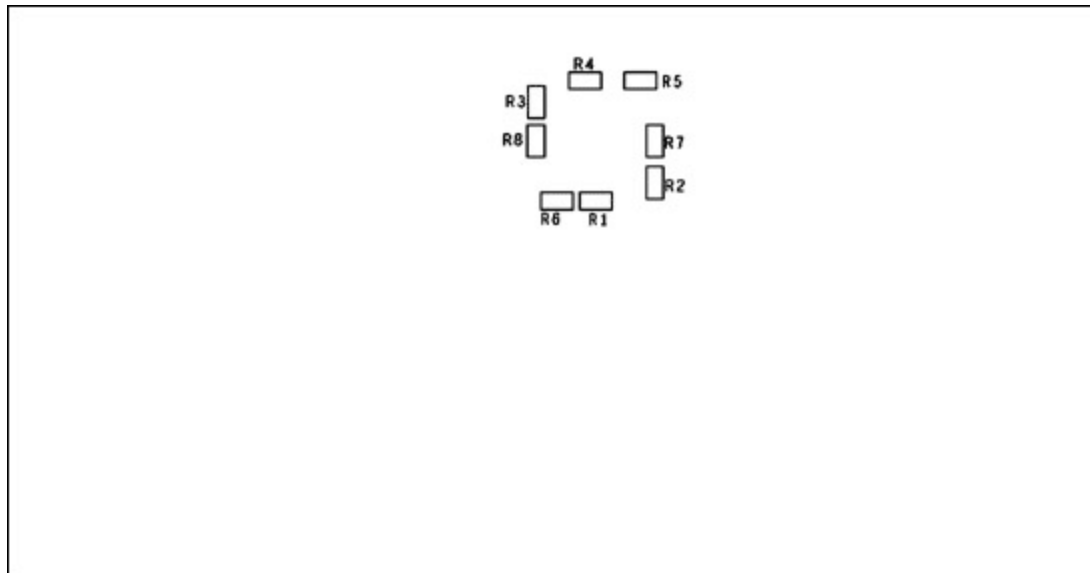


Figure 4-2. DS3154 quad-port, T3/E3 LIU silkscreen layout—bottom layer (view mirrored).

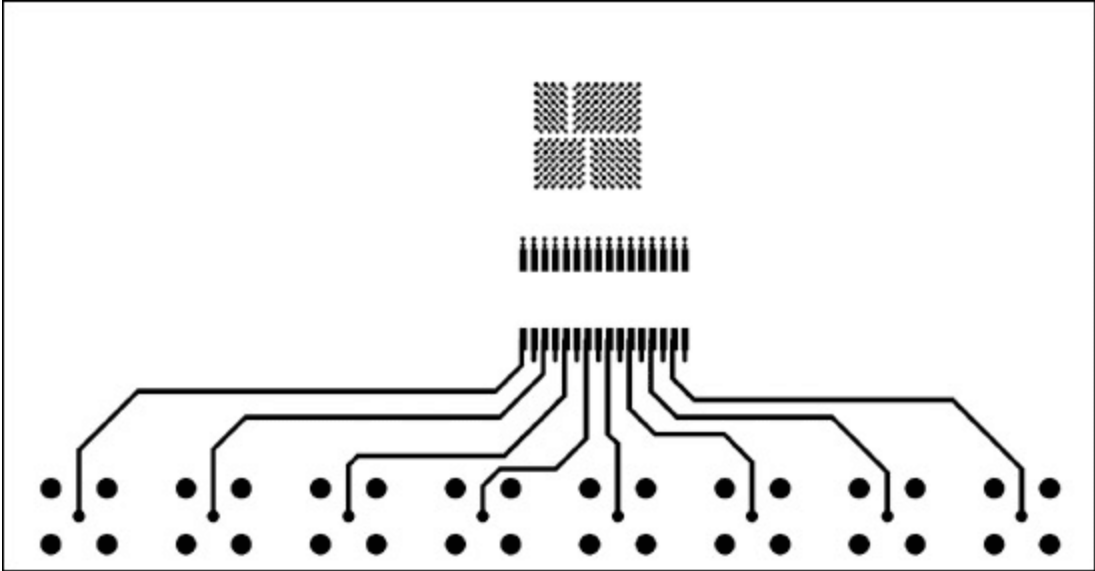


Figure 4-3. DS3154 quad-port, T3/E3 LIU layout—top conducting layer.

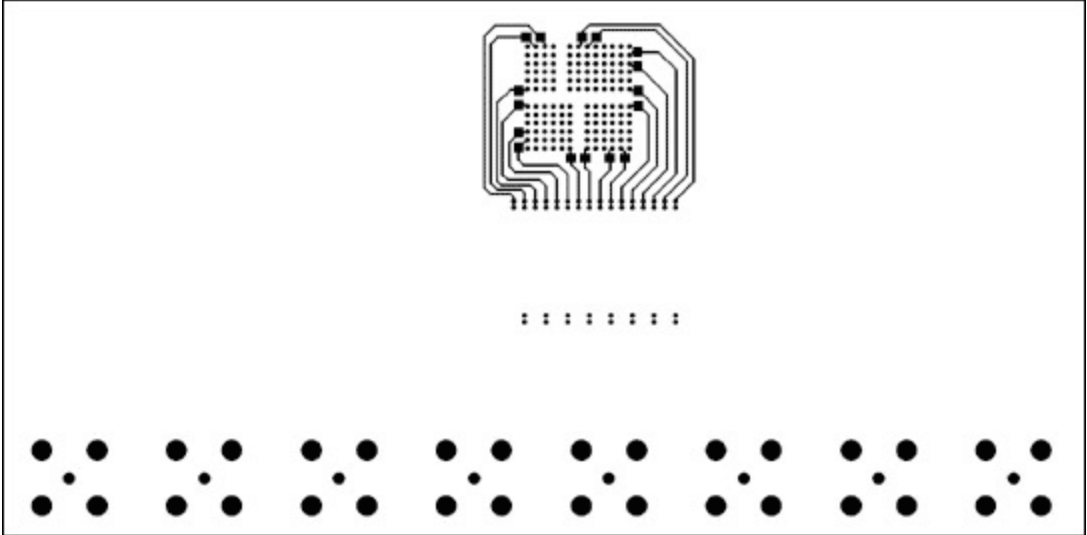


Figure 4-4. DS3154 quad-port, T3/E3 LIU layout—bottom conducting layer.

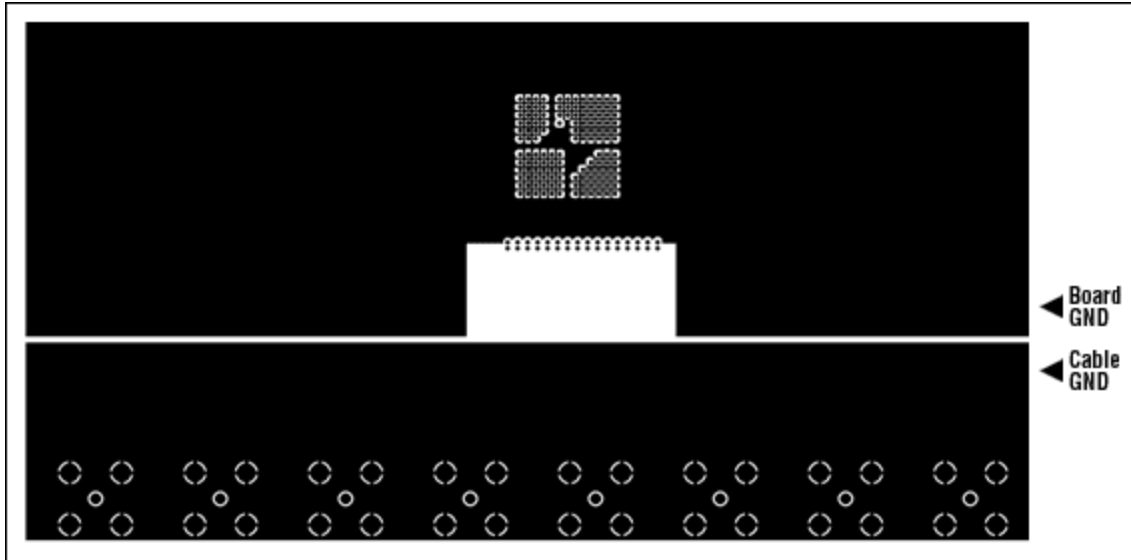


Figure 4-5. DS3154 quad-port, T3/E3 LIU ground plane {layer two} layout—no ground plane under the transformer.

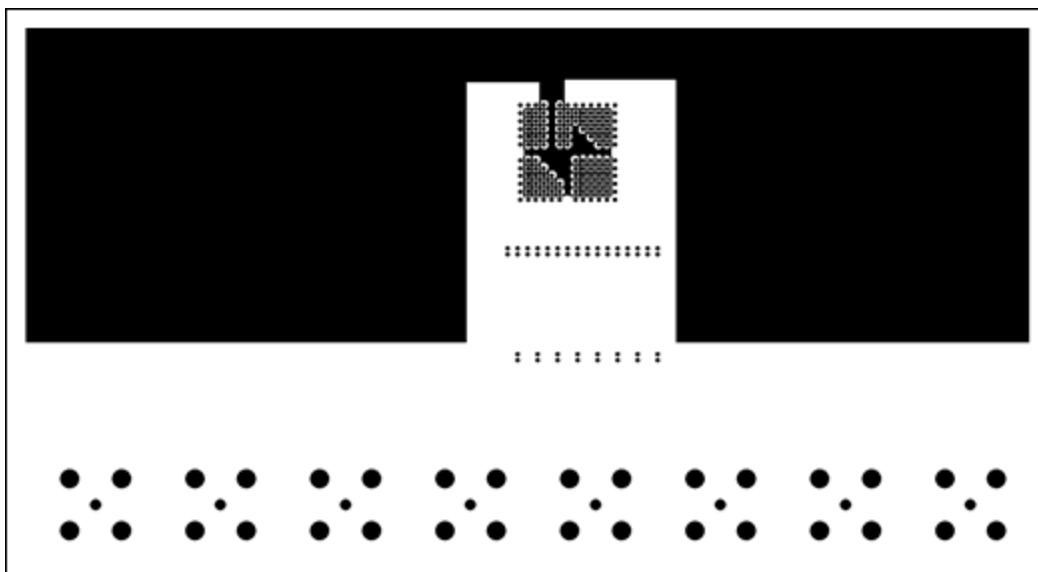


Figure 4-6. DS3154 quad-port, T3/E3 LIU VCC plane {layer three} layout—no VCC plane under the transformer or TXP, TXN, RXP, RXN.

## 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](#).

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Related Parts		
DS3150	3.3V, DS3/E3/STS-1 Line Interface Unit	Free Samples
DS3151	Single/Dual/Triple/Quad DS3/E3/STS-1 LIUs	
DS3152	Single/Dual/Triple/Quad DS3/E3/STS-1 LIUs	
DS3153	Single/Dual/Triple/Quad DS3/E3/STS-1 LIUs	
DS3154	Single/Dual/Triple/Quad DS3/E3/STS-1 LIUs	Free Samples
DS3170	DS3/E3 Single-Chip Transceiver	Free Samples
DS3171	Single/Dual/Triple/Quad DS3/E3 Single-Chip Transceivers	Free Samples
DS3172	Single/Dual/Triple/Quad DS3/E3 Single-Chip Transceivers	Free Samples
DS3173	Single/Dual/Triple/Quad DS3/E3 Single-Chip Transceivers	
DS3174	Single/Dual/Triple/Quad DS3/E3 Single-Chip Transceivers	Free Samples
DS3181	Single/Dual/Triple/Quad ATM/Packet PHYs with Built-In LIU	Free Samples
DS3182	Single/Dual/Triple/Quad ATM/Packet PHYs with Built-In LIU	Free Samples
DS3183	Single/Dual/Triple/Quad ATM/Packet PHYs with Built-In LIU	
DS3184	Single/Dual/Triple/Quad ATM/Packet PHYs with Built-In LIU	Free Samples
DS3251	Single/Dual/Triple/Quad DS3/E3/STS-1 LIUs	Free Samples
DS3252	Single/Dual/Triple/Quad DS3/E3/STS-1 LIUs	Free Samples
DS3253	Single/Dual/Triple/Quad DS3/E3/STS-1 LIUs	Free Samples
DS3254	Single/Dual/Triple/Quad DS3/E3/STS-1 LIUs	Free Samples

#### More Information

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