DIO3343

USB 3.1/3.0 Super-Speed 11 Gbps Switch

Description

The DIO3343 is a two-pair 2:1 data switch for USB Super-Speed Gen1 and Gen2, 5 Gbps and 10 Gbps data. The DIO3343 focuses on the mobile device market, for the use in Type-C applications as a reversible cable switch. It can minimize the switch channel-to-channel skew and channel-to-channel crosstalk of the super-speed signals.

The DIO3343 data switches offer superior performance, support various high-speed data transmission protocols, such as USB 3.0, USB 3.1, 10GE, Thunderbolt, and SAS 3.0.

Features

- Wide VDD input voltage range: 1.5 V to 5.0 V
- Up to 11 Gbps for applications including USB 3.0, USB 3.1, 10GE, thunderbolt, and SAS 3.0
- Bidirectional operation
- Bandwidth: 11 GHz (typ.)
- -0.97 dB typical insertion loss at 2.5 GHz
- Low active power of 14.5 μA (typ.) at 3.6 V V_{DD}
- Low shutdown power of < 0.5 μA (max.)
- Low crosstalk: -58 dB at 2.5 GHz
- Low off-isolation: -27.5 dB at 2.5 GHz
- Operation temperature range: -40°C to 85 °C
- ±2.5 kV HBM ESD protection
- Packaged in QFN2.4×1.6-16

Application

- Smartphones
- Tablets
- Notebooks

Ordering Information

Part Number	Top Marking	RoHS	T_A	Package	
DIO3343EN16	D3DC	Green	-40 to 85°C	QFN2.4×1.6-16	Tape & Reel, 3000

If you encounter any issue in the process of using the device, please contact our customer service at marketing@dioo.com or phone us at (+86)-21-62116882. If you have any improvement suggestions regarding the datasheet, we encourage you to contact our technical writing team at docs@dioo.com. Your feedback is invaluable for us to provide a better user experience.

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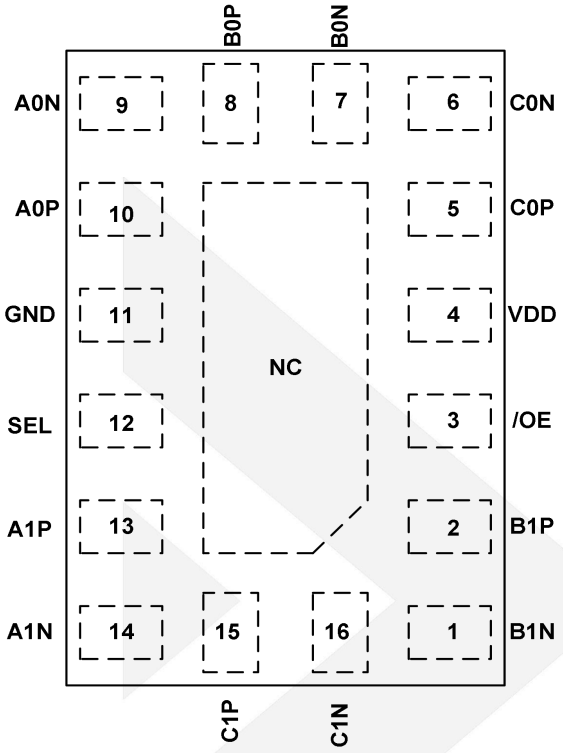
1. Pin Assignment and Functions



QFN2.4×1.6-16
(Top view)

Name	Type	Description
B1N	Differential I/O	USB 3.1 differential RX signals for B port
B1P	Differential I/O	
/OE	CMOS input	Shutdown pin; should be driven LOW for normal operation. When HIGH, all paths are switched off (high impedance state). And supply current consumption is minimized.
VDD	Power	Power supply.
C0P	Differential I/O	USB 3.1 differential TX signals for C port.
C0N	Differential I/O	
B0N	Differential I/O	USB 3.1 differential TX signals for B port.
B0P	Differential I/O	
A0N	Differential I/O	USB 3.1 differential TX signals for A port.
A0P	Differential I/O	
GND	Ground	0 V; must be connected to PCB ground.
SEL	GPIO input	When SEL = LOW, Port A and Port B are mutually connected When SEL = HIGH, port A and port C are mutually connected.
A1P	Differential I/O	USB 3.1 differential RX signals for A port
A1N	Differential I/O	
C1N	Differential I/O	USB 3.1 differential RX signals for A port
C1P	Differential I/O	

2. Absolute Maximum Ratings

Exceeding the maximum ratings listed under Absolute Maximum Ratings when designing is likely to damage the device permanently. Do not design to the maximum limits because long-time exposure to them might impact the device's reliability. The ratings are obtained over an operating free-air temperature range unless otherwise specified.

Symbol	Parameter	Rating	Unit
V_{DD}	Supply voltage	-0.5 to 6.0	V
V_{CNTRL}	DC input voltage (SEL, /OE)(1)	-0.5 to V_{DD}	V
V_{SW}	DC switch I/O voltage(1,2)	-0.3 to 2.1	V
I_{IK}	DC input diode current	-50	mA
I_{SW}	DC switch current	25	mA
T_{STG}	Storage temperature	-65 to 150	°C

Note:

(1) The input and output negative ratings may be exceeded if the input and output diode current ratings are observed.

(2) V_{SW} refers to analog data switch paths.

3. Recommended Operating Condition

Recommended operating conditions are specified to ensure optimal performance to the datasheet specifications. The ratings are obtained over an operating free-air temperature range unless otherwise specified.

Symbol	Parameter	Rating	Unit
V_{DD}	Supply voltage	1.5 to 5.0	V
V_{CNTRL}	Control input voltage (SEL, /OE)(1)	0 to 5.0	V
V_{SW}	Switch I/O voltage (Both SSUSB switch paths)	0 to 2.0	V
T_A	Operating temperature Range	-40 to 85	°C

Note:

(1) The control inputs must be held HIGH or LOW; they must not float.

4. ESD Ratings

When a statically-charged person or object touches an electrostatic discharge sensitive device, the electrostatic charge might be drained through sensitive circuitry in the device. If the electrostatic discharge possesses sufficient energy, damage might occur to the device due to localized overheating.

Model	Condition	Value	Unit
HBM	Human-body model, JEDEC: JESD22-A114	± 2500	V

5. Electrical Characteristics

5.1. DC and transient characteristics

All typical values are at T_A = 25°C unless otherwise specified.

Symbol	Parameter	Conditions	V_{DD} (V)	Min	Typ	Max	Unit
V_{IH}	Control input voltage high	SEL, /OE	1.5	1.3			V
		SEL, /OE	3.6	1.4			V
		SEL, /OE	5.0	1.5			V
V_{IL}	Control input voltage low	SEL, /OE	1.5			0.4	V
		SEL, /OE	3.6			0.4	V
		SEL, /OE	5.0			0.4	V
I_{IN}	Control input leakage	V_{SW} = -0.6 to 2.0 V, V_{CNTRL} = 0 to V_{DD}	5.0	-500		500	nA
I_{OZ}	Off-state leakage for open data paths	V_{SW} = 0 ≤ DATA ≤ 2.0 V	5.0	-0.5		0.5	μA
I_{CL}	On-state leakage for closed data paths(1)	V_{SW} = 0 ≤ DATA ≤ 2.0 V	5.0	-0.5		0.5	μA
I_{OFF}	Power-off leakage current (All I/O ports)	V_{SW} = 0 V or 2.0 V	0	-500		500	nA
R_{ON}	Switch on resistance	V_{SW} = 0.2 V, I_{ON} = -8 mA	1.5		6	8	Ω
ΔR_{ON}	Difference in R_{ON} between positive-negative	V_{SW} = 0.2 V, I_{ON} = -8 mA	1.5		0.1		Ω
R_{ONF}	Flatness for R_{ON}	V_{SW} = 0 V ≤ DATA ≤ 2.0 V, I_{ON} = -8 mA	1.5			0.5	Ω
I_{CC}	Quiescent supply current	$V_{/OE}$ = 0 V, V_{SEL}= 0 or V_{DD}, I_{OUT} = 0	5.0		21	30	μA
I_{CCZ}	Quiescent supply current (High impedance)	V_{SEL} = X, $V_{/OE}$ = V_{DD}, I_{OUT} = 0	5.0			0.5	μA
I_{CCT}	Increase in quiescent supply current per V_{CNTRL}	V_{SEL} or $V_{/OE}$ = 1.5 V	5.0		7	15	μA

Note:

(1) For this test, the data switch is closed with the respective switch pin floating.

5.2. AC electrical characteristics

All typical values are at V_{DD} = 3.6 V, T_A = 25 °C unless otherwise specified.

Symbol	Parameter	Conditions	V_{DD} (V)	Min	Typ	Max	Unit
t_{ON}	Turn-on time, S to output	R_L = 50 Ω, C_L = 0 pF, V_{SW} = 0 V, V_{SW} = 0.6 V	1.5 to 5.0 V		480	700	ns
t_{OFF}	Turn-off time, S to output	R_L = 50 Ω, CL = 0 pF, V_{SW} = 0 V, V_{SW} = 3.3 V	1.5 to 5.0 V		60	300	ns
$t_{ZHM,ZL}$	Enable time, /OE to output	R_L = 50 Ω, C_L = 0 pF, V_{SW} = 0.6 V	1.5 to 5.0 V		60	150	µs
$t_{LZM,HZ}$	Disable time, /OE to output	R_L = 50 Ω, C_L = 0 pF, V_{SW} = 0.6 V	1.5 to 5.0 V		95	300	ns
t_{PD}	Propagation delay	C_L= 0 pF, R_L = 50 Ω	1.5 to 5.0 V		60		ps
t_{BBM}	Break-before-make	R_L = 50 Ω, C_L =0 pF, V_{SW} = 0.6 V	1.5 to 5.0 V	120		600	ns
DO_{IRR}	Differential off isolation	V_{SEL} = 0 dBm, R_L = 50 Ω, f = 2.5 GHz	3.6 V		-27.5		dB
		V_{SEL} = 0 dBm, R_L = 50 Ω, f = 5.0 GHz	3.6 V		-19.5		dB
SDDNEXT	Differential channel crosstalk	V_{SEL} = 0 dBm, R = 50 Ω, f = 2.5 GHz	3.6 V		-58		dB
		V_{SEL} = 0 dBm, R = 50 Ω, f = 5.0 GHz	3.6 V		-55		dB
DIL	Differential insertion loss (All data paths)	V_{IN} = 0 dBm, f = 2.5 GHz, R_L = 50 Ω, C_L = 0 pF	3.6 V		-0.97		dB
		V_{IN} = 0 dBm, f = 5.0 GHz, R_L = 50 Ω, C_L = 0 pF	3.6 V		-1.54		dB
BW	Differential -3 dB bandwidth	V_{IN} = 1 Vpk-pk, R_L = 50 Ω, C_L = 0 pF, (Both data paths)	3.6 V		11		GHz
$t_{SK(P)}$	Skew of opposite transitions of the same output	R_{PU} = 50 Ω to V_{DD}, C_L = 0 pF	3.6 V		6		ps
C_{IN}	Control pin input capacitance	V_{DD} = 0 V, f = 1 MHz			2.7		pF
C_{ON}	On capacitance	V_{DD} = 3.3 V, f = 2.5 GHz			0.45		pF
C_{OFF}	Off capacitance	V_{DD} = 3.3 V, f = 2.5 GHz			0.36		pF

Note: Specifications subject to change without notice.

6. Typical Performance Characteristics

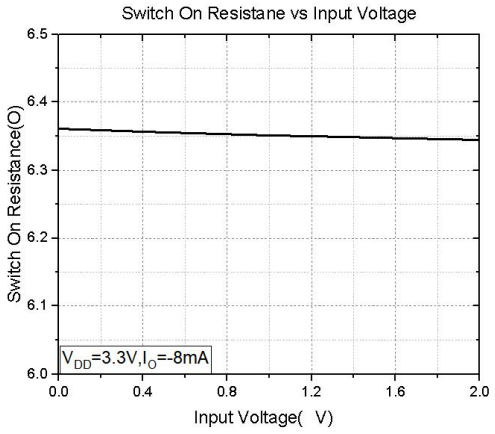


Figure 6.1 Switch on resistance vs input voltage

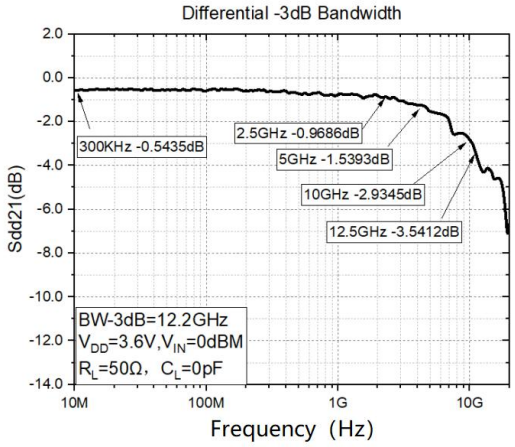


Figure 6.2 Differential -3 dB bandwidth

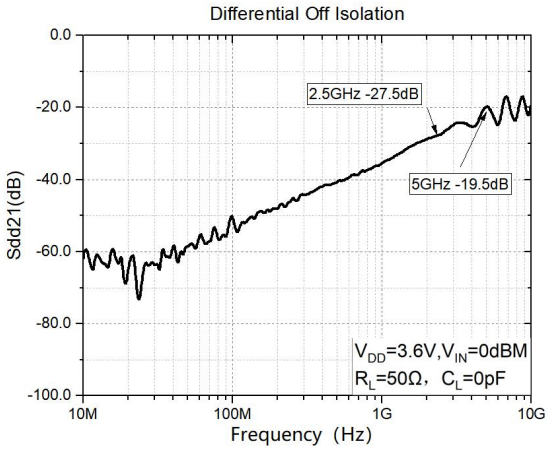


Figure 6.3 Differential off isolation

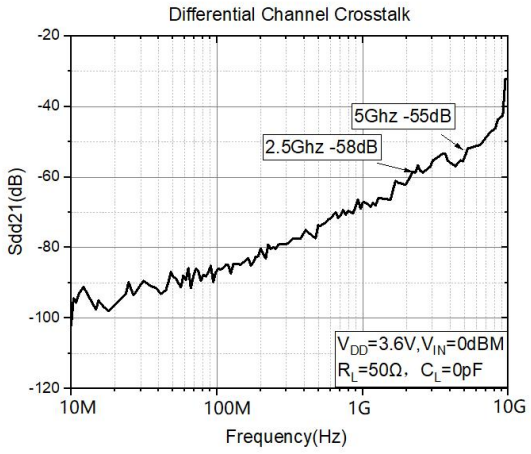
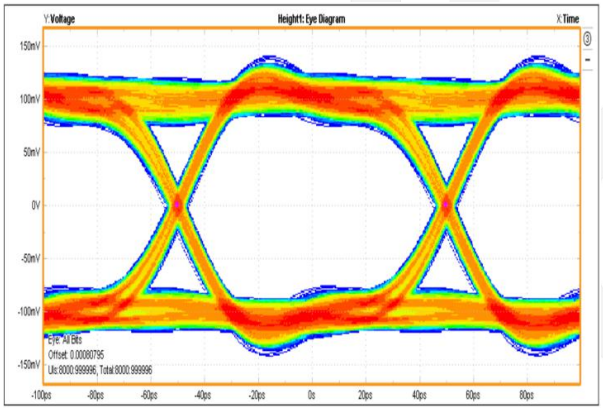


Figure 6.4 Differential channel crosstalk

Before Switch



After Switch

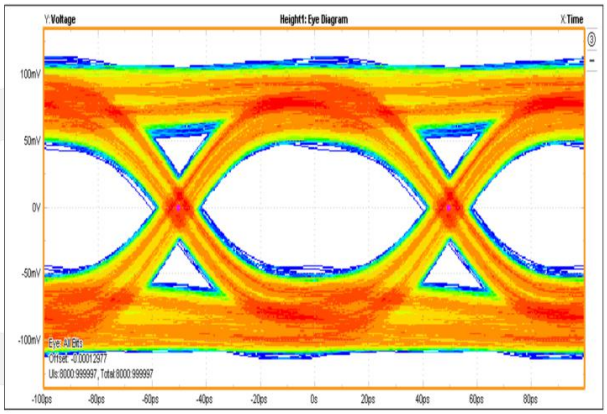


Figure 6.5 Eye opening at 10Gb/s by using PRBS15 pattern

7. Block Diagram

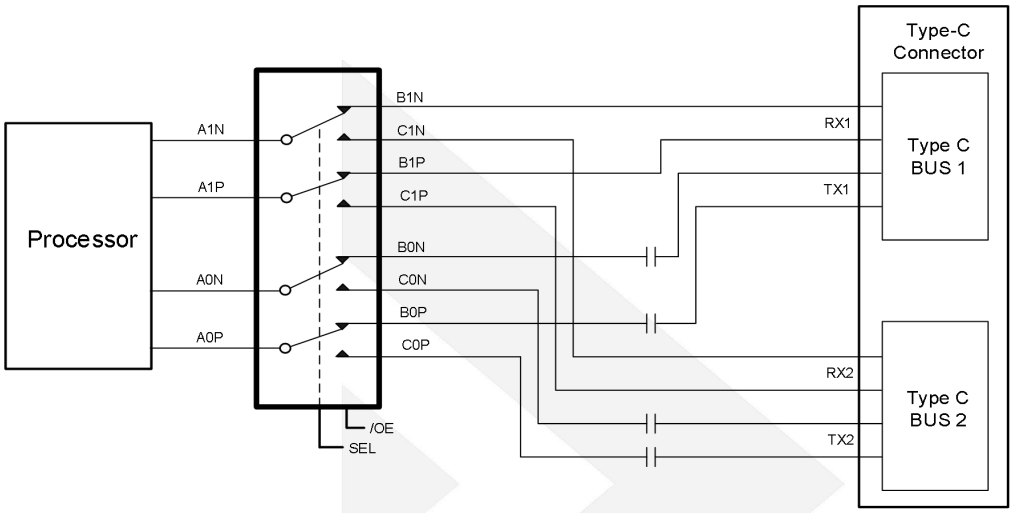


Figure 7.1 Schematic diagram

8. Application Information

Important notice: Validation and testing are the most reliable ways to confirm system functionality. The application information is not part of the specification and is for reference purposes only.

8.1. Typical application

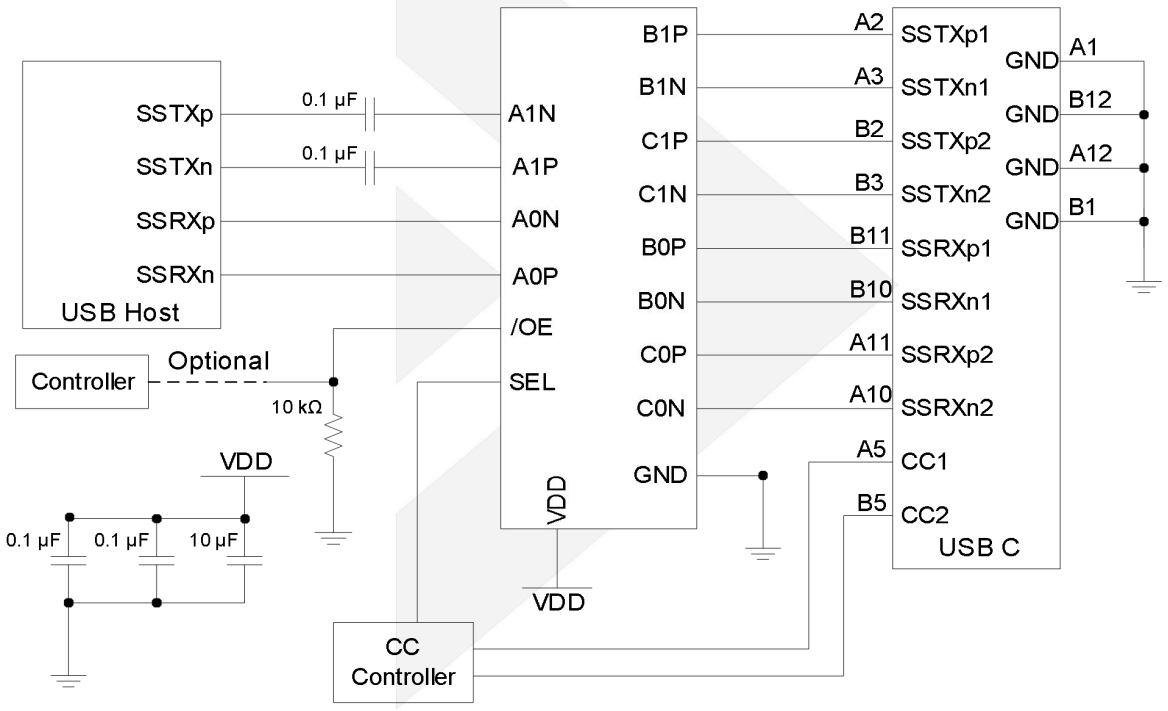


Figure 8.1 Down-facing port for USB 3.1 type-C connector

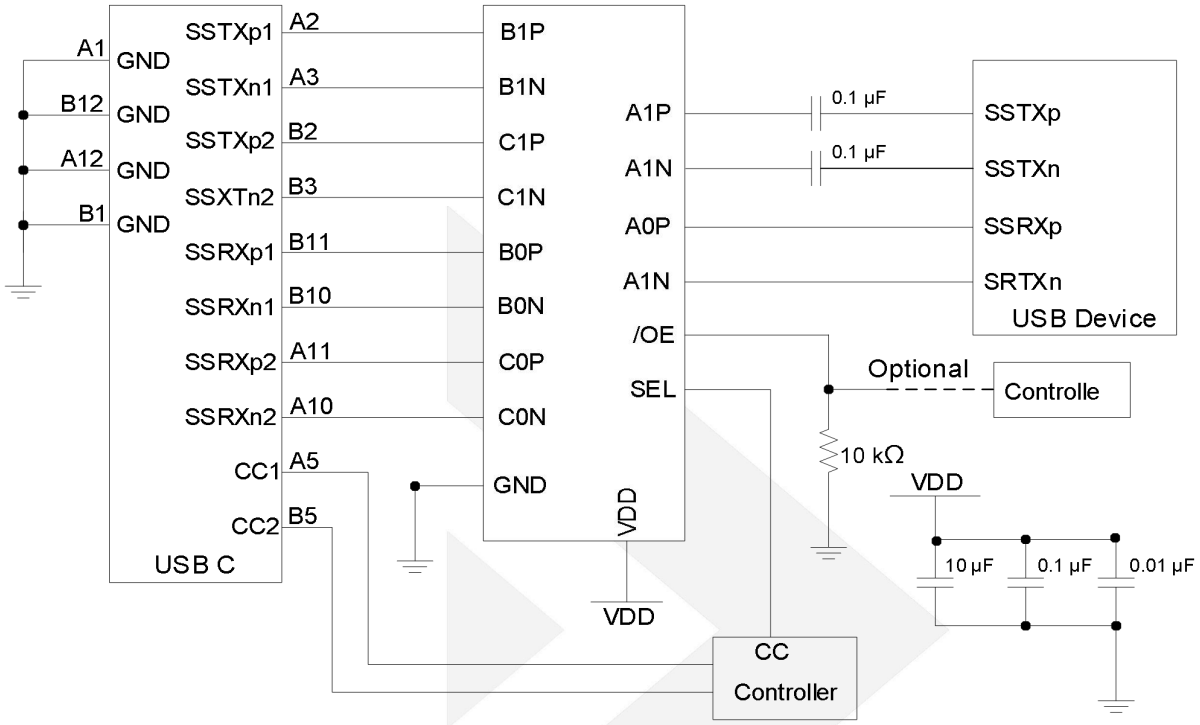


Figure 8.2 Up-facing port for USB 3.1 type-C connector

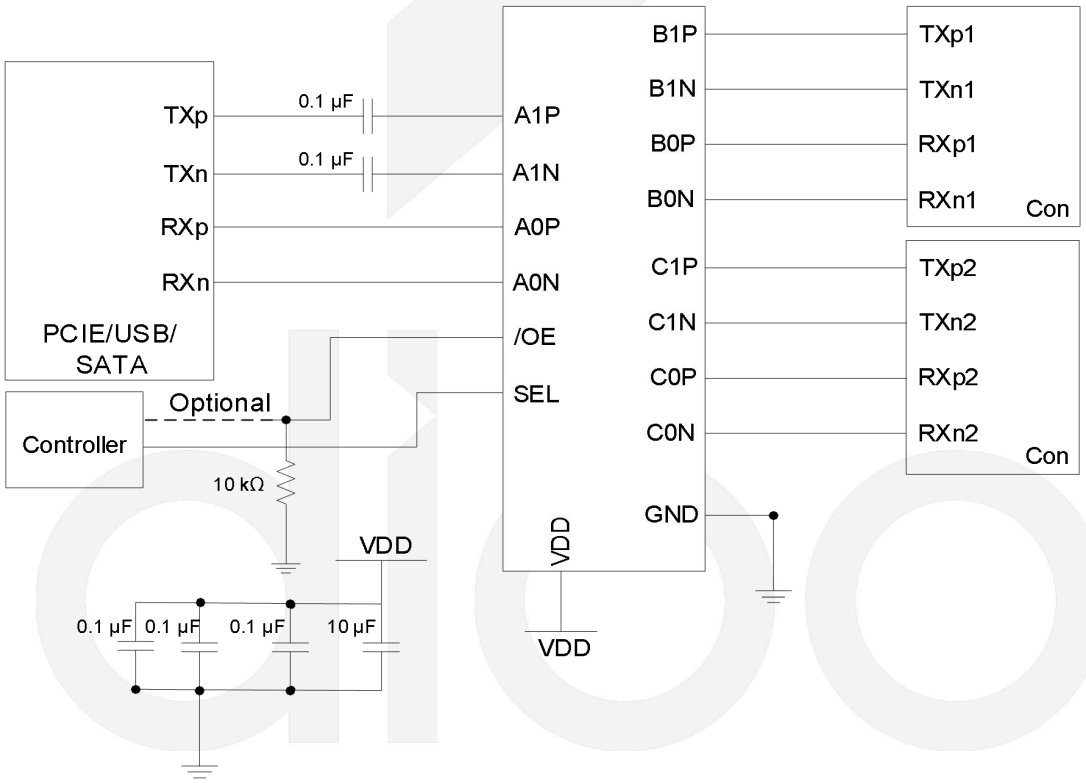


Figure 8.3 PCIE motherboard

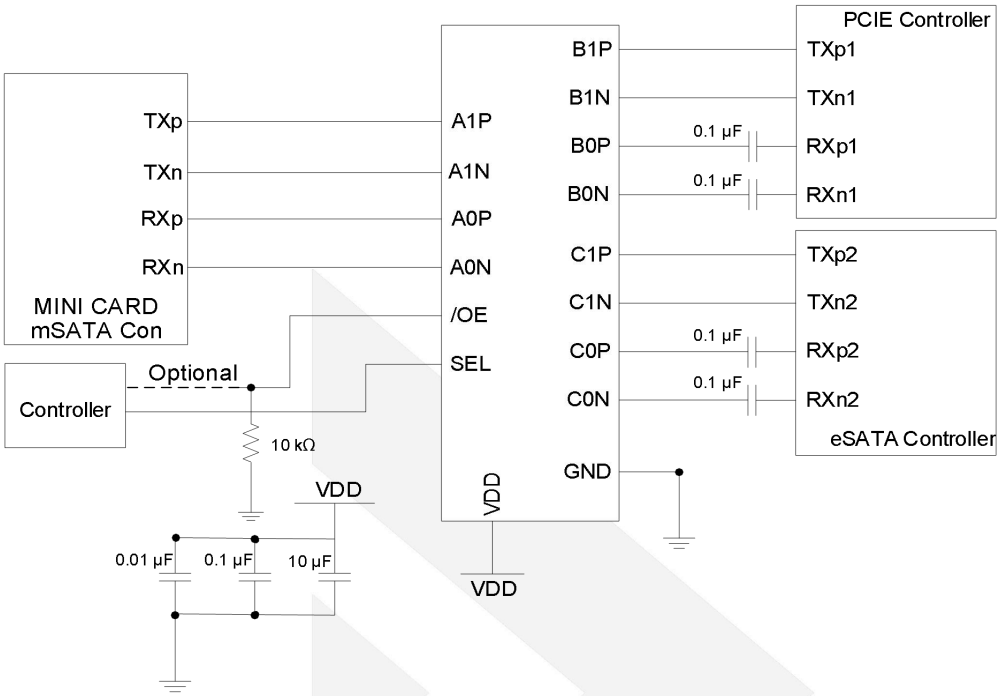


Figure 8.4 PCIE and eSATA combination

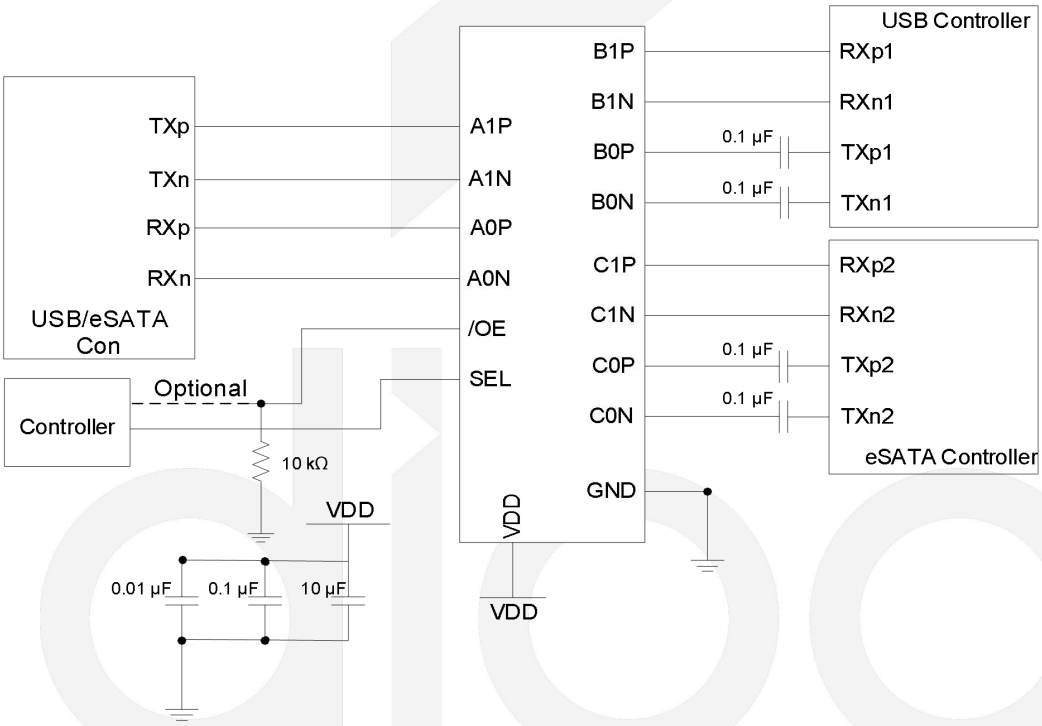


Figure 8.5 eSATA and USB 3.0 combination connector

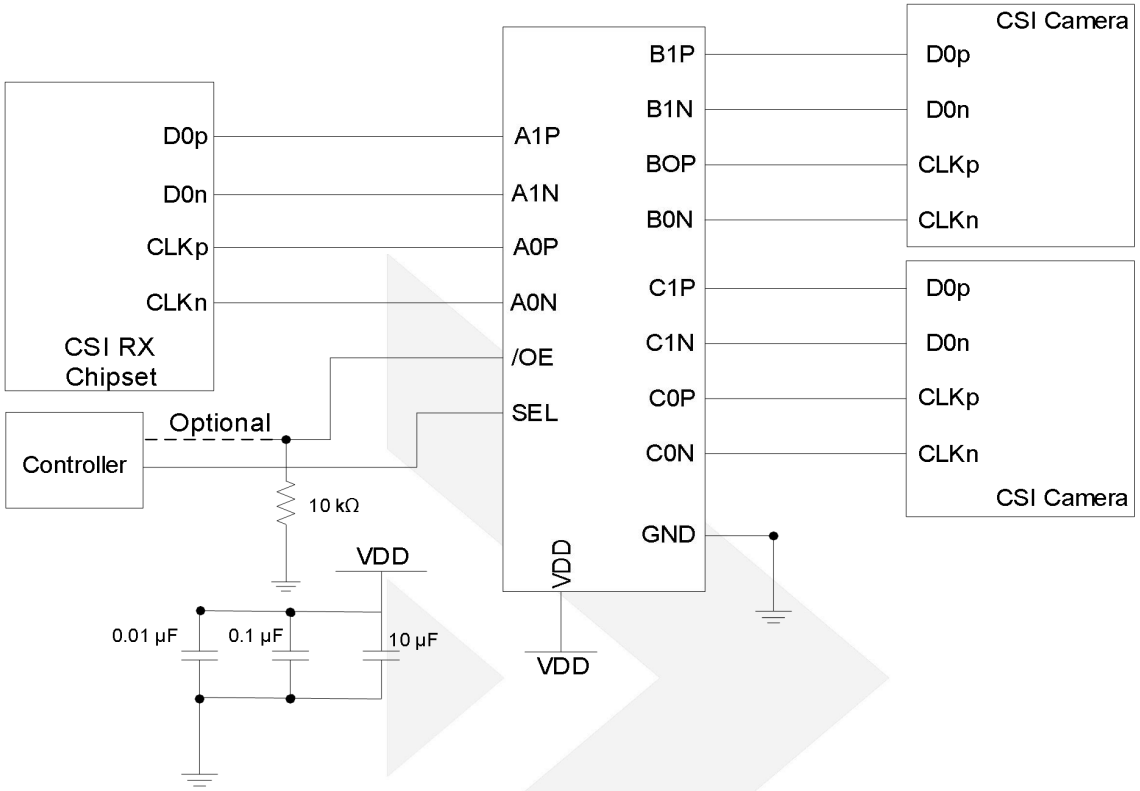
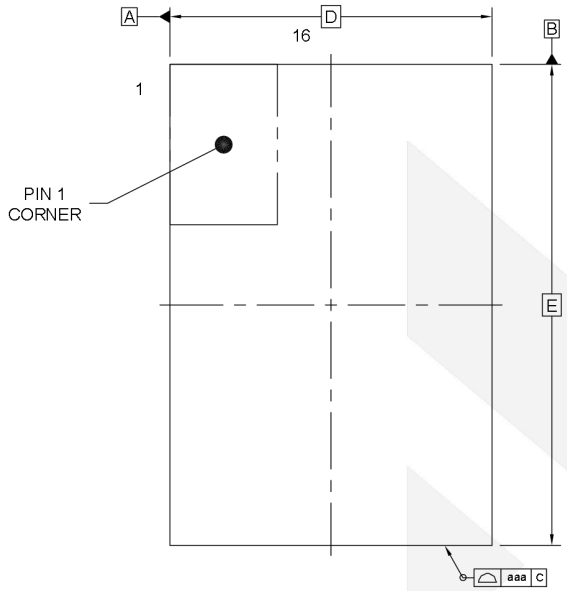
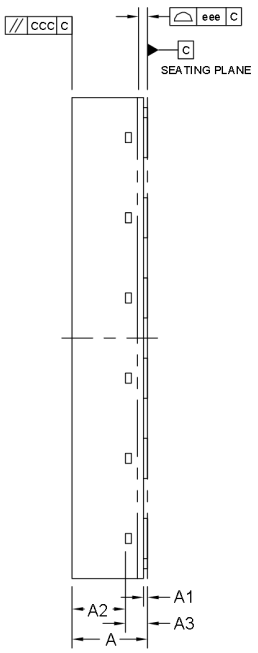


Figure 8.6 CSI camera array

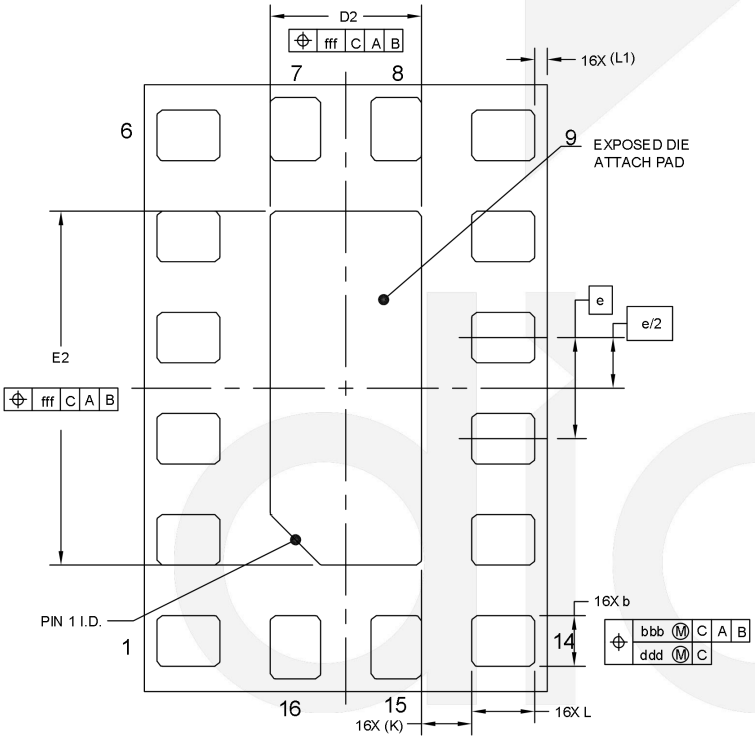
9. Physical Dimensions: QFN2.4×1.6-16



TOP VIEW



SIDE VIEW



BOTTOM VIEW

Dimensions in Millimeters (Units of Measure = Millimeter)			
Symbol	**Min**	**Nom**	**Max**
A	0.32	0.375	0.40
A1	0	-	0.0005
A2	-	0.265	-
A3		0.11 REF	
b	0.15	0.20	0.25
D		1.6 BCS	
E		2.4 BCS	
e		0.4 BCS	
D2	0.55	0.60	0.65
E2	1.35	1.40	1.45
L	0.20	0.25	0.30
L1		0.05 REF	
K		0.20 REF	
aaa		0.1	
bbb		0.1	
ccc		0.05	
ddd		0.07	
eee		0.05	
fff		0.1	

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