

DIO3350

USB 3.1 / 3.0 Super-Speed 11 Gbps Switch

Features

- Wide V_{DD} input voltage range: 1.5 V to 5.0 V
- Up to 11 Gbps for applications including USB 3.0, USB 3.1, 10GE, and SAS 3.0
- Bi-directional operation
- Bandwidth: 11 GHz (typ.)
- -0.9 dB typical insertion loss at 2.5 GHz
- Low active power of 21 μ A (typ.) at $V_{DD} = 5$ V
- Low shutdown power of < 0.5 μ A (max.)
- Low crosstalk: -38 dB at 2.5 GHz
- Low off isolation: -25 dB at 2.5 GHz
- Operation temperature range: -40°C to 85 °C
- ± 4 kV HBM ESD protection
- Packaged in QFN2.6*1.8-16, QFN2.5*4.5-20 and QFN2*2-18

Descriptions

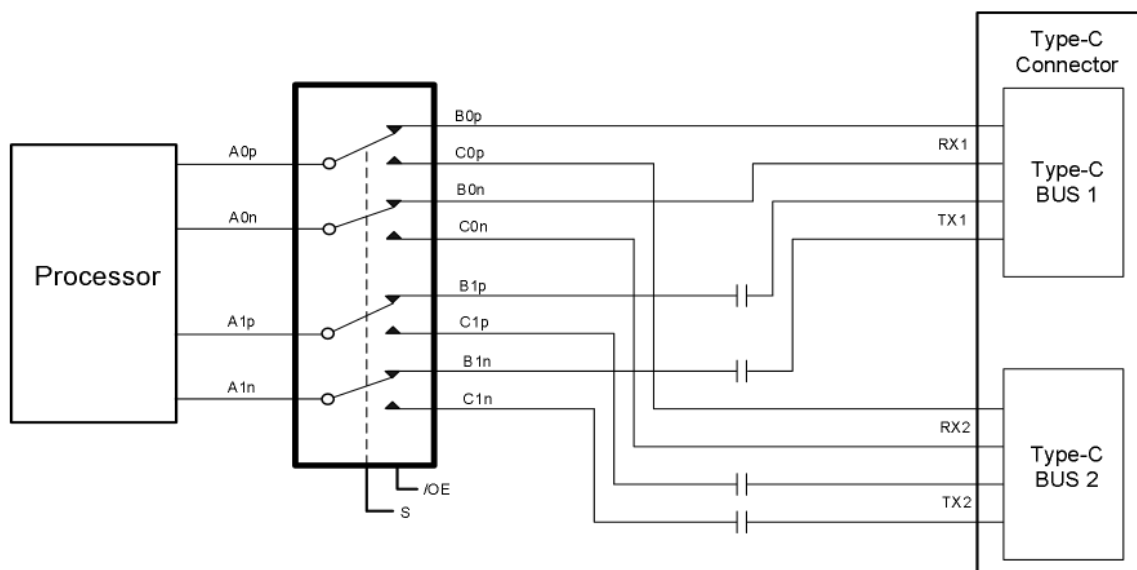
The DIO3350 is a two pairs 2:1 data switch for USB super speed Gen1 and Gen2, 5 Gbps and 10 Gbps data. The DIO3350 focuses on the mobile device market, for the use in Type-C applications as a reversible cable switch. It can minimize the switch channel to channel skew and channel to channel crosstalk of the super speed signals.

The DIO3350 data switches offer superior performance, support various high speed data transmission protocols, such as USB 3.0, USB 3.1, 10GE, and SAS 3.0.

Applications

- Smartphones
- Tablets
- Notebooks

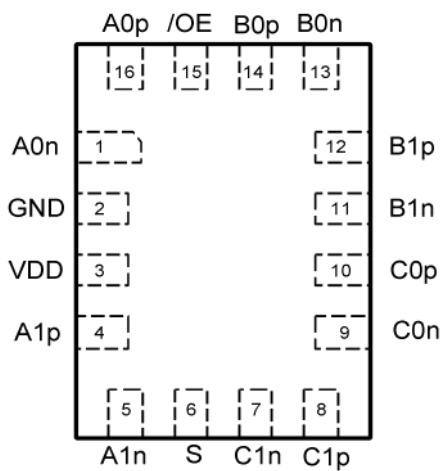
Block Diagram



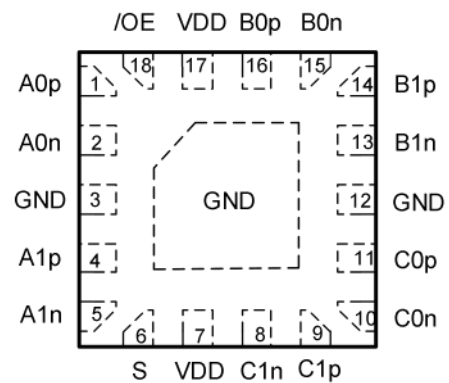
Ordering Information

Ordering Part No.	Top Marking	MSL	RoHS	T _A	Package	
DIO3350LN16	D3EV	1	Green	-40 to 85°C	QFN2.6*1.8-16	Tape & Reel, 3000
DIO3350CN18	D3EV	3	Green	-40 to 85°C	QFN2*2-18	Tape & Reel, 3000
DIO3350AEN20	D3EA	3	Green	-40 to 85°C	QFN2.5*4.5-20	Tape & Reel, 5000
DIO3350BEN20	D3EB	3	Green	-40 to 85°C	QFN2.5*4.5-20	Tape & Reel, 5000

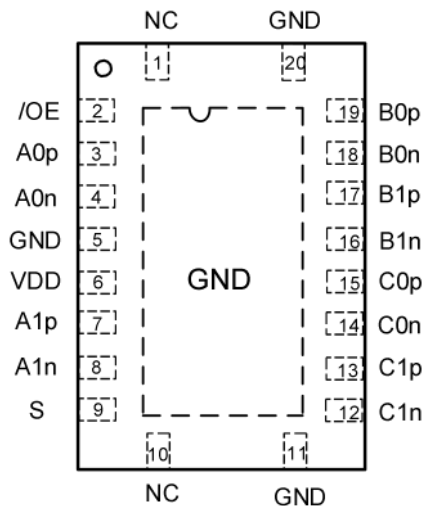
Pin Assignment



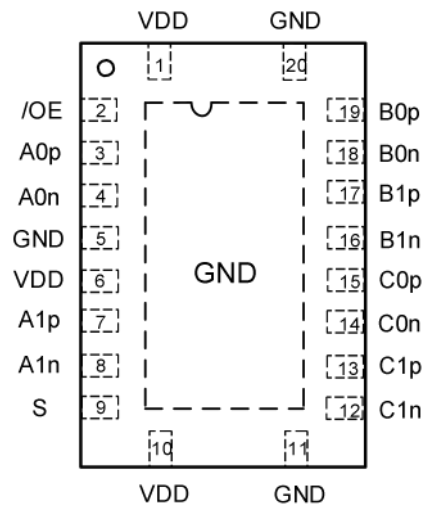
DIO3350LN16
QFN2.6*1.8-16



DIO3350CN18
QFN2*2-18



DIO3350AEN20
QFN2.5*4.5-20



DIO3350BEN20
QFN2.5*4.5-20

Figure 1. Top view



DIO3350

USB 3.1/3.0 High-Speed 11 Gbps Switch

Pin Descriptions

Pin Name	I/O	Description
A0n	I/O	Port A, channel 0, high-speed negative signal
A1p	I/O	Port A, channel 1, high-speed positive signal
A1n	I/O	Port A, channel 1, high-speed negative signal
S	I	Switch selection (L: port A to port B; H: port A to port C)
C1n	I/O	Port C, channel 1, high-speed negative signal (connector side)
C1p	I/O	Port C, channel 1, high-speed positive signal (connector side)
C0n	I/O	Port C, channel 0, high-speed negative signal (connector side)
C0p	I/O	Port C, channel 0, high-speed positive signal (connector side)
B1n	I/O	Port B, channel 1, high-speed negative signal (connector side)
B1p	I/O	Port B, channel 1, high-speed positive signal (connector side)
B0n	I/O	Port B, channel 0, high-speed negative signal (connector side)
B0p	I/O	Port B, channel 0, high-speed positive signal (connector side)
A0p	I/O	Port A, channel 0, high-speed positive signal
/OE	I	Output enable (0 = switches enabled, 1 = switches disabled)
VDD	VDD	Device power
GND	GND	Ground
NC	NC	No connection

Absolute Maximum Ratings

Stresses beyond those listed under the Absolute Maximum Rating table may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other condition beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

Symbol	Parameter	Rating	Unit
V _{DD}	Supply voltage	-0.5 to 6.0	V
V _{CNTRL}	DC input voltage (S, /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
ESD	Human body model, JEDEC EIA/JESD22-A114F	±4	kV
θ _{JA}	Junction-to-ambient thermal resistance	QFN2.6*1.8-16	117.3
		QFN2*2-18	120
		QFN2.5*4.5-20	46.6

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.

Recommend Operating Conditions

The Recommended Operating Conditions table defines the conditions for actual device operation. Recommended operating conditions are specified to ensure optimal performance to the datasheet specifications. DIOO does not recommend exceeding them or designing to absolute maximum ratings.

Symbol	Parameter	Rating	Unit
V _{DD}	Supply voltage	1.5 to 5.0	V
V _{CNTRL}	Control input voltage (S, /OE) ⁽³⁾	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:

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

DC and Transient Characteristics

All typical values are at $T_A = 25^\circ\text{C}$, unless otherwise specified.

Symbol	Parameter	Conditions	V_{DD} (V)	Min	Typ	Max	Unit
V_{IH}	Control input voltage high	S, /OE	1.5	1.3			V
		S, /OE	3.6	1.4			
		S, /OE	5.0	1.5			
V_{IL}	Control input voltage low	S, /OE	1.5			0.4	V
		S, /OE	3.6			0.4	
		S, /OE	5.0			0.4	
I_{IN}	Control input leakage current	$V_{CNTRL} = 0$ to V_{DD}	5.0	-500		500	nA
I_{OZ}	Off-state leakage for open data paths	$V_{SW} = 0$ to 2 V	5.0	-500		500	nA
I_{CL}	On-state leakage for closed data paths ⁽⁴⁾	$V_{SW} = 0$ to 2 V	5.0	-500		500	nA
I_{OFF}	Power-off leakage current (all I/O Ports)	$V_{SW} = 0$ V to 2.0 V	0	-500		500	nA
R_{ON}	Switch on resistance	$V_{SW} = 0$ to 2 V, $I_{ON} = -8$ mA	1.5		6	8	Ω
ΔR_{ON}	Difference in R_{ON} between positive-negative	$V_{SW} = 0$ to 2 V, $I_{ON} = -8$ mA	1.5		0.1		Ω
R_{ONF}	Flatness for R_{ON}	$V_{SW} = 0$ to 2.0 V, $I_{ON} = -8$ mA	1.5			0.5	Ω
I_{CC}	Quiescent supply current	$V_{IOE} = 0$, $V_{SEL} = 0$ or V_{DD} , $I_{OUT} = 0$	5.0		21	30	μA
I_{CCZ}	Quiescent supply current (high impedance)	$V_{SEL} = X$, $V_{IOE} = V_{DD}$, $I_{OUT} = 0$	5.0			0.5	μA
I_{CCT}	Increase in quiescent supply current per V_{CNTRL}	V_{SEL} or $V_{IOE} = 1.5$ V	5.0		7	15	μA

Note:

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

AC Electrical Characteristics

All typical values are at $V_{DD} = 3.6\text{ V}$, $T_A = 25^\circ\text{C}$, unless otherwise specified.

Symbol	Parameter	Conditions	V_{DD} (V)	Min	Typ	Max	Unit
t_{ON}	Turn-on time, S to output	$R_L = 50\ \Omega$, $V_{SW} = 0.6\text{ V}$	1.5 to 5.0		420		ns
t_{OFF}	Turn-off time, S to output	$R_L = 50\ \Omega$, $V_{SW} = 2\text{ V}$	1.5 to 5.0		100		ns
$t_{ZHM,ZL}$	Enable time, /OE to output	$R_L = 50\ \Omega$, $V_{SW} = 0.6\text{ V}$	1.5 to 5.0		120		μs
$t_{LZM,HZ}$	Disable time, /OE to output	$R_L = 50\ \Omega$, $V_{SW} = 0.6\text{ V}$	1.5 to 5.0		110		ns
t_{PD}	Propagation delay ⁽⁵⁾	$R_L = 50\ \Omega$	1.5 to 5.0		60		ps
t_{BBM}	Break-before-make	$R_L = 50\ \Omega$, $V_{SW} = 0.6\text{ V}$	1.5 to 5.0	120			ns
DOIRR	Differential off isolation	$V_{SW} = 0\text{ dBm}$, $R_L = 50\ \Omega$, $f = 2.5\text{ GHz}$	3.6		-25		dB
		$V_{SW} = 0\text{ dBm}$, $R_L = 50\ \Omega$, $f = 5.0\text{ GHz}$			-22		dB
SDDNEXT	Differential channel crosstalk	$V_{SW} = 0\text{ dBm}$, $R_L = 50\ \Omega$, $f = 2.5\text{ GHz}$	3.6		-38		dB
		$V_{SW} = 0\text{ dBm}$, $R_L = 50\ \Omega$, $f = 5.0\text{ GHz}$			-36		dB
DIL	Differential insertion loss (all data paths)	$V_{IN} = 0\text{ dBm}$, $f = 2.5\text{ GHz}$, $R_L = 50\ \Omega$, $C_L = 0\text{ pF}$	3.6		-0.9		dB
		$V_{IN} = 0\text{ dBm}$, $f = 5.0\text{ GHz}$, $R_L = 50\ \Omega$, $C_L = 0\text{ pF}$			-1.4		
BW	Differential -3 dB bandwidth	$V_{IN} = 0\text{ dBm}$, $R_L = 50\ \Omega$, $C_L = 0\text{ pF}$ (both data paths)	3.6		11		GHz
$t_{SK(P)}$	Skew of opposite transitions of the same output ⁽⁵⁾	$R_{PULL_UP} = 50\ \Omega$ to V_{DD} , $C_L = 0\text{ pF}$	3.6		6		ps
C_{IN}	Control pin input capacitance ⁽⁵⁾	$V_{DD} = 0\text{ V}$, $f = 1\text{ MHz}$			2.7		pF
C_{ON}	On capacitance ⁽⁵⁾	$V_{DD} = 3.3\text{ V}$, $f = 2.5\text{ GHz}$			0.45		pF
C_{OFF}	Off capacitance ⁽⁵⁾	$V_{DD} = 3.3\text{ V}$, $f = 2.5\text{ GHz}$			0.36		pF

Note:

- (5) Guaranteed by design.
- (6) Specifications subject to change without notice.

Typical Performance Characteristics

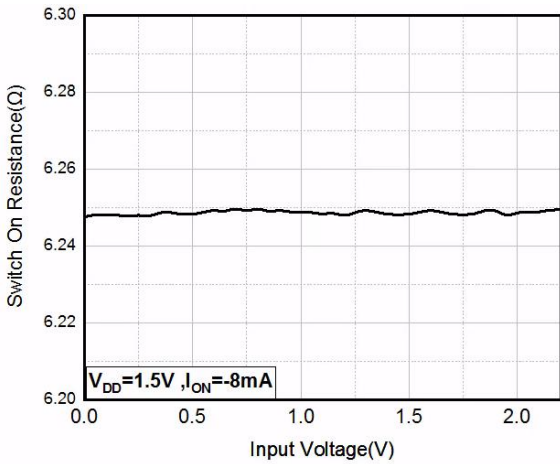


Figure 2. R_{ON} vs. V_{IN}

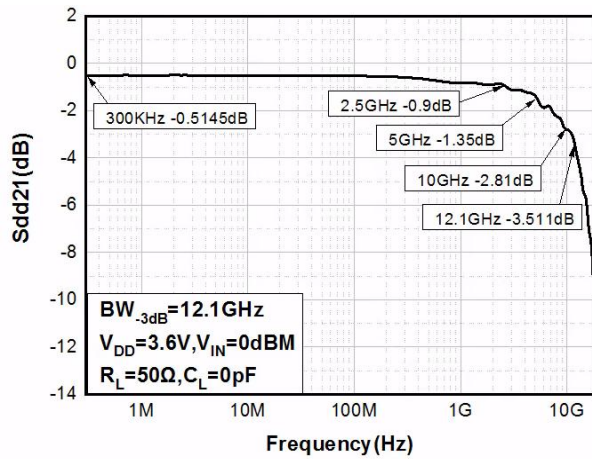


Figure 3. Differential -3 dB bandwidth

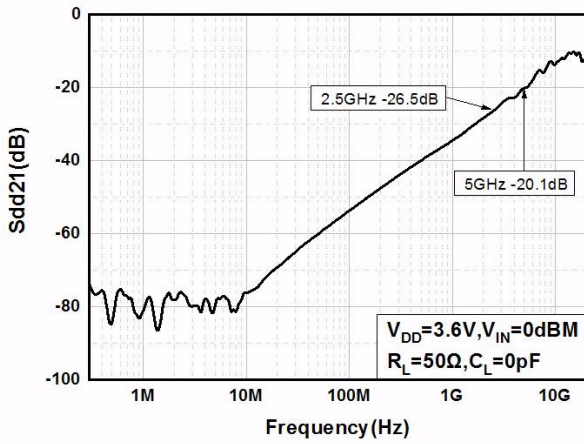


Figure 4. Differential off isolation

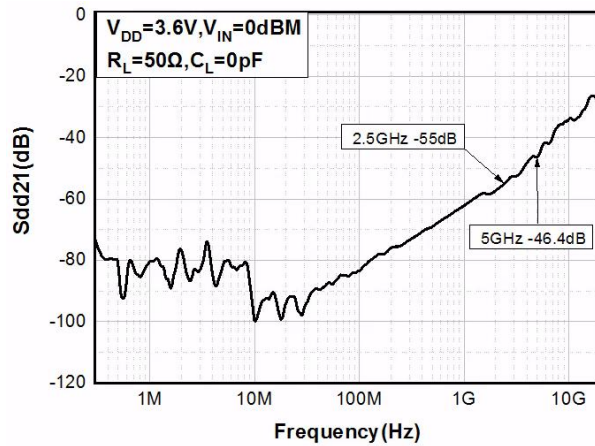
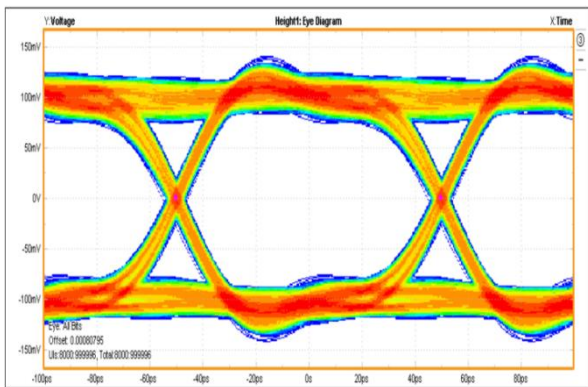
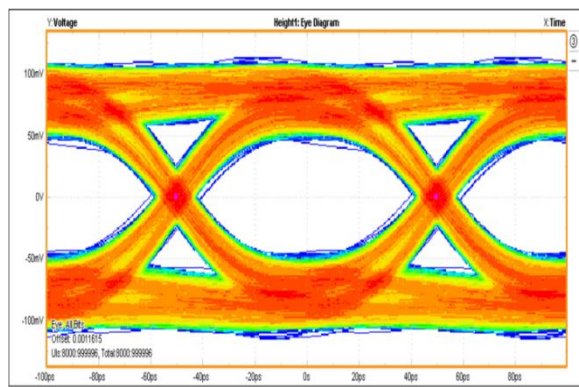


Figure 5. Differential channel crosstalk



Before Switch



After Switch

Figure 6. Eye opening at 10 Gb/s using PRBS15 pattern

Typical Applications

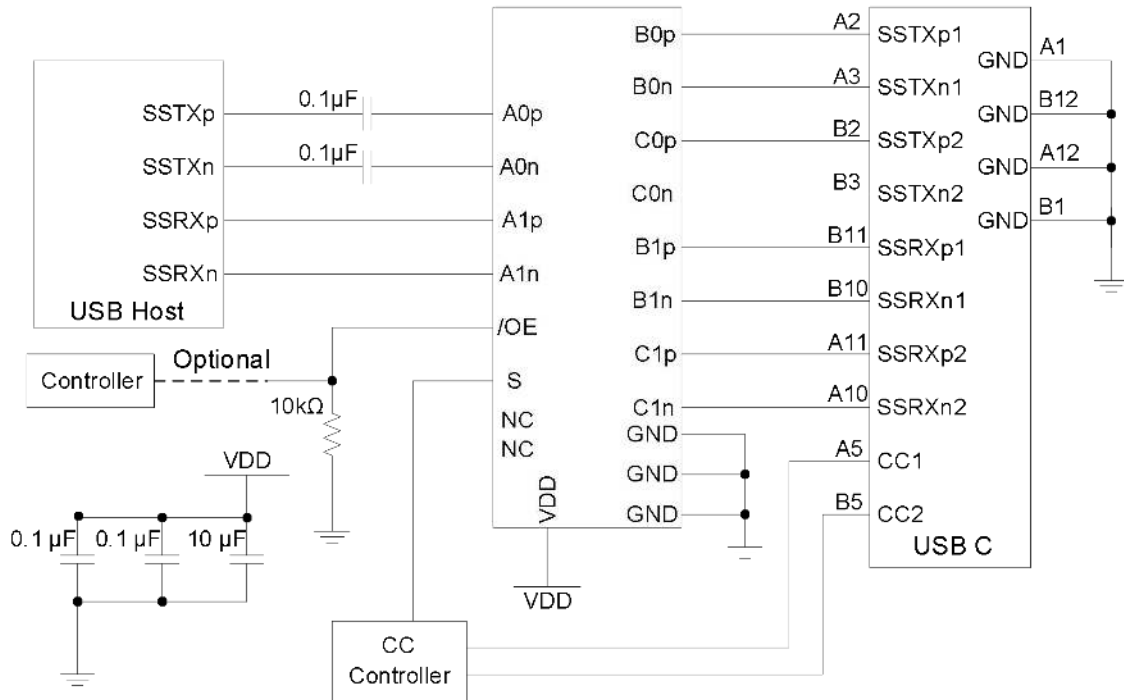


Figure 7. Down facing port for USB 3.1 Type-C connector

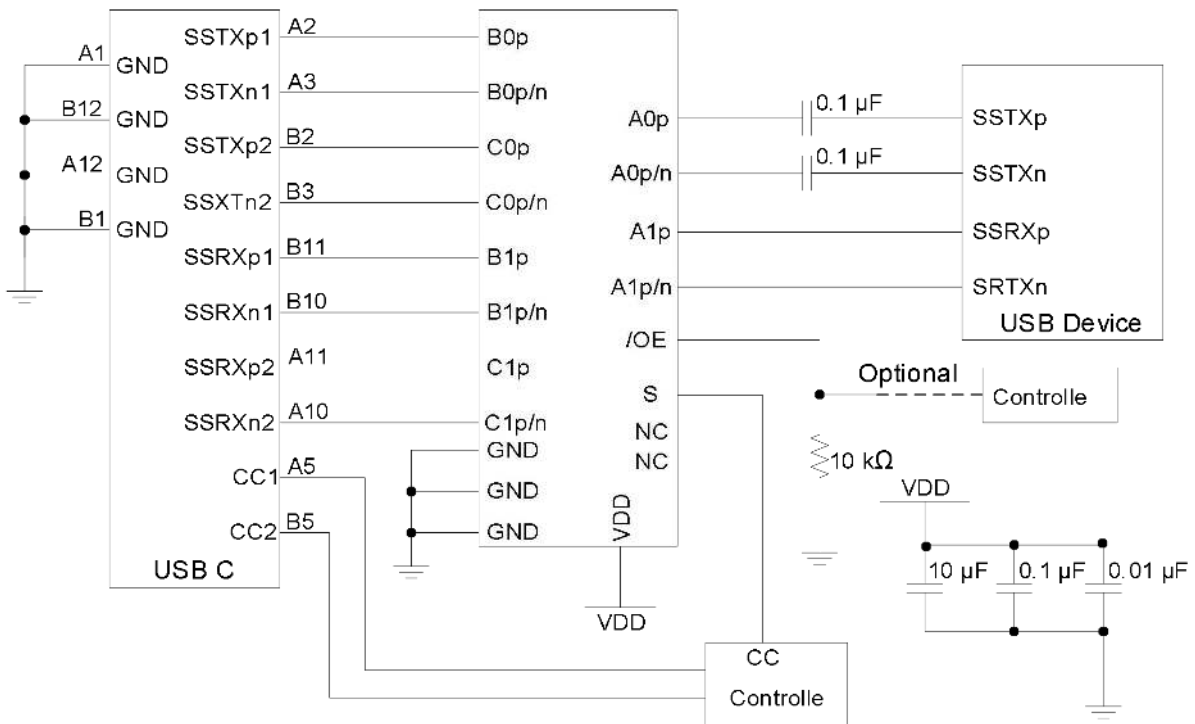


Figure 8. Up facing port for USB 3.1 Type-C connector

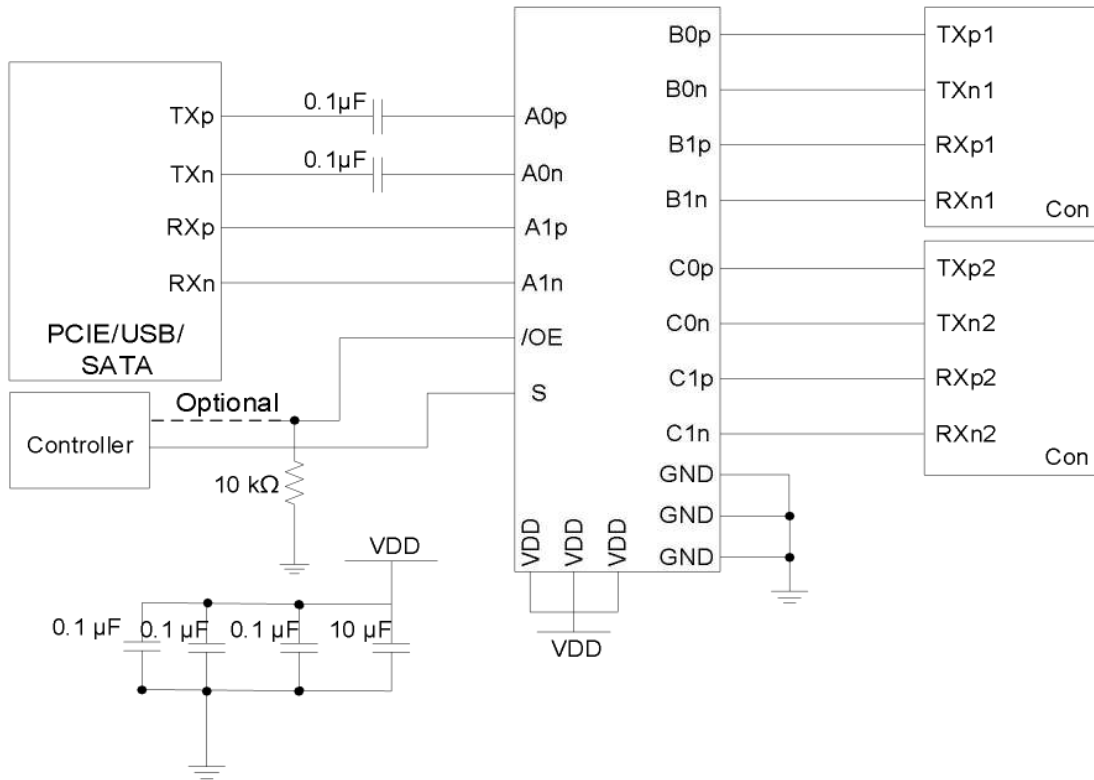


Figure 9. PCIE motherboard

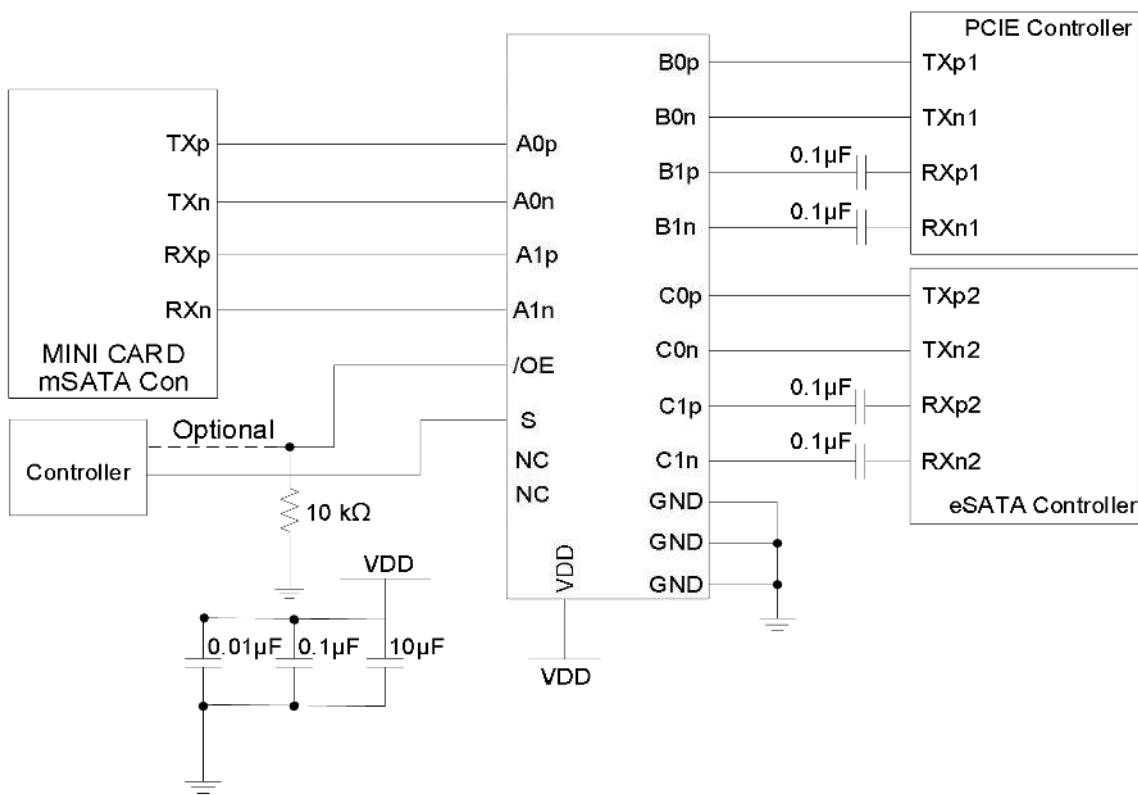


Figure 10. PCIE and eSATA combo

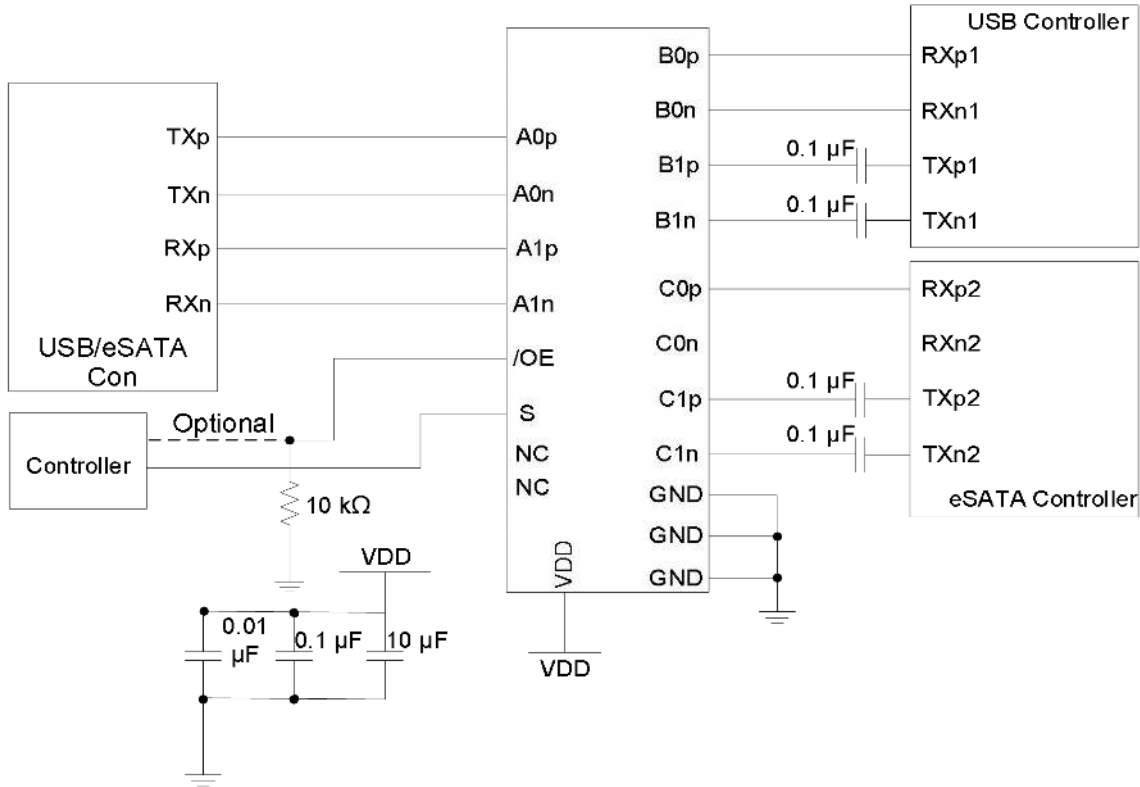


Figure 11. eSATA and USB 3.0 combo connector

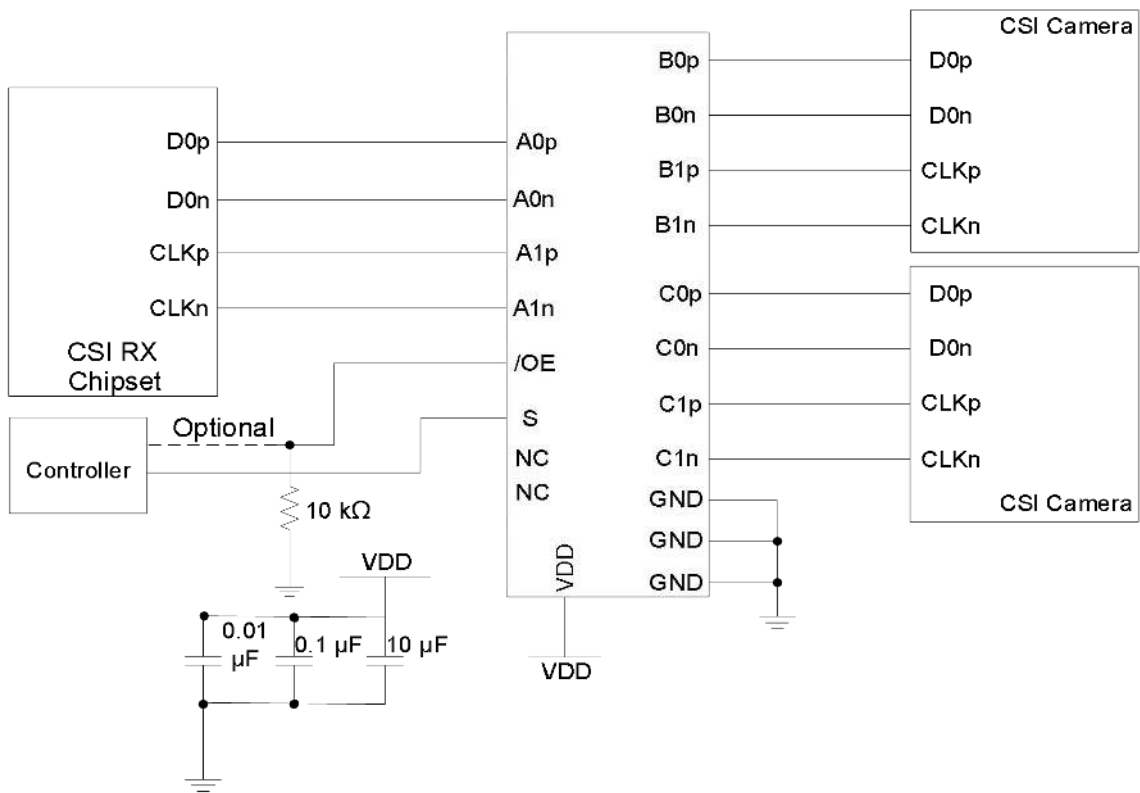
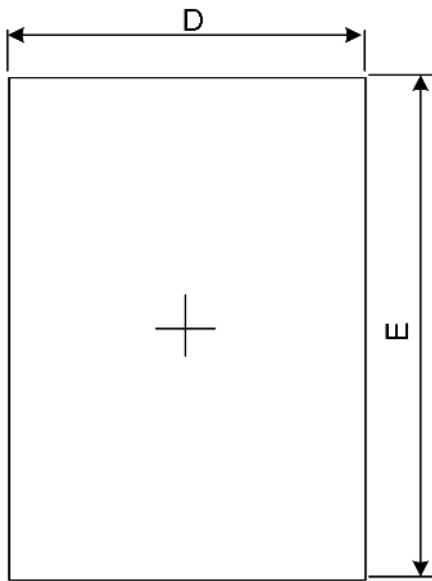
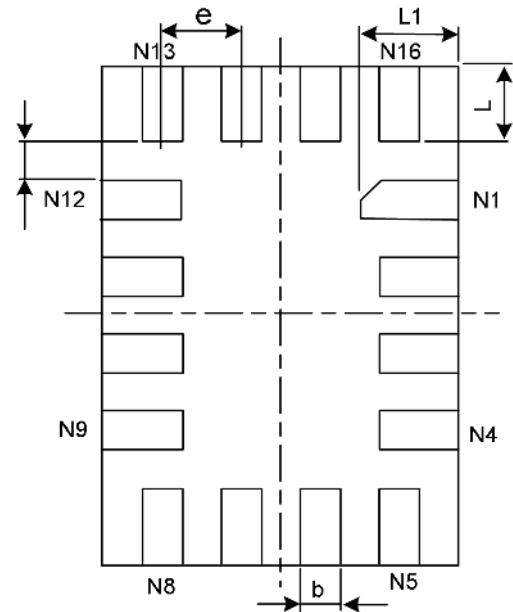


Figure 12. CSI camera array

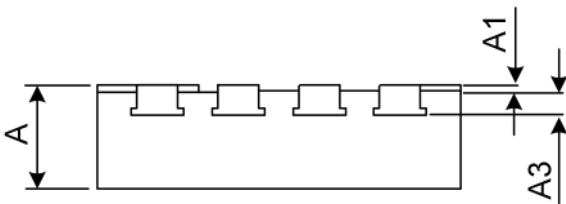
Physical Dimensions: QFN2.6*1.8-16



TOP VIEW



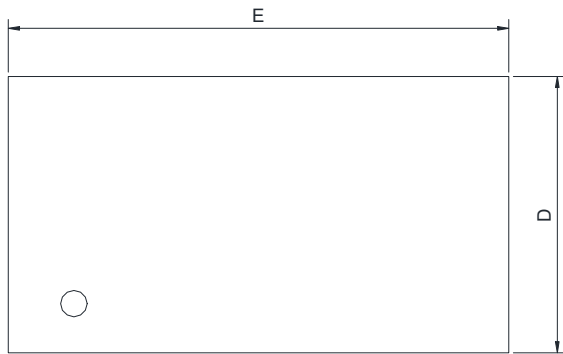
BOTTOM VIEW



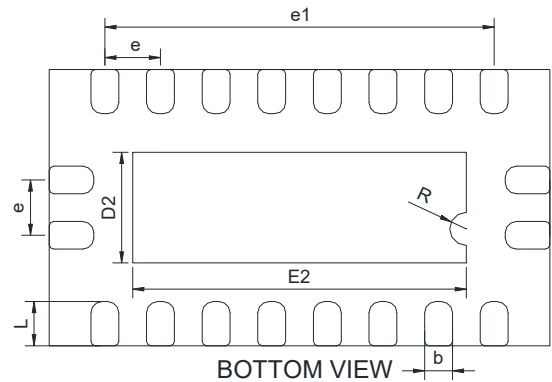
SIDE VIEW

Common Dimensions (Units of measure = Millimeter)		
Symbol	Min	Max
A	0.45	0.55
A1	-0.004	0.046
A3	0.11 REF	
D	1.75	1.85
E	2.55	2.65
D1	-	-
E1	-	-
k	0.15 MIN	
b	0.15	0.25
e	0.40 TYP	
L	0.35	0.45
L1	0.45	0.55

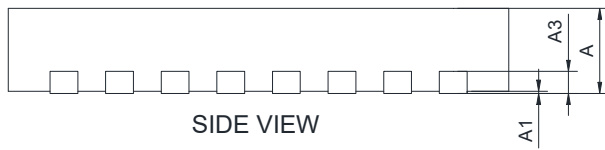
Physical Dimensions: QFN2.5*4.5-20



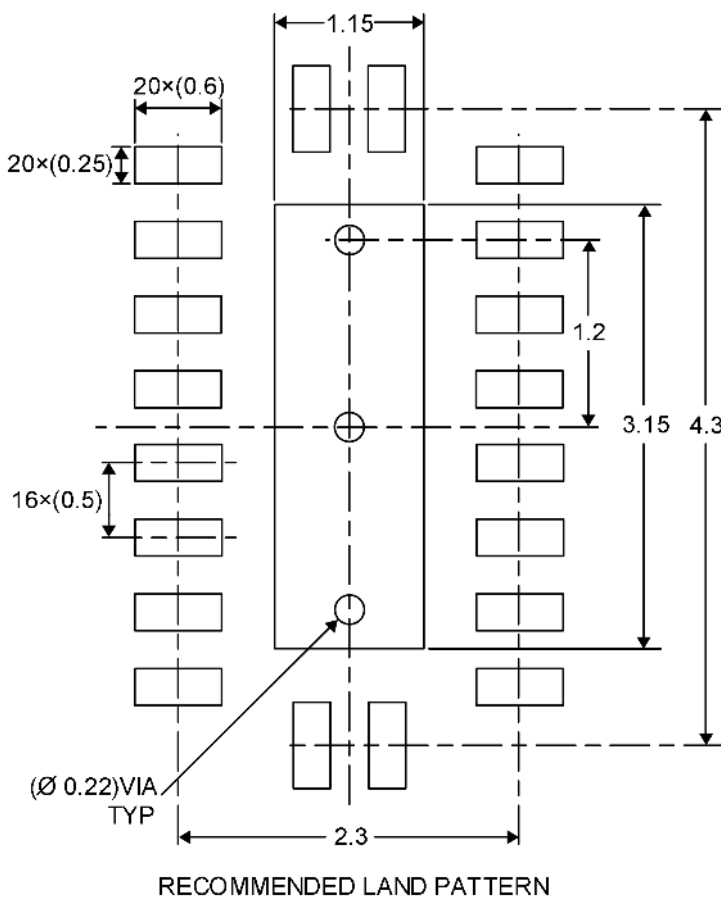
TOP VIEW



BOTTOM VIEW



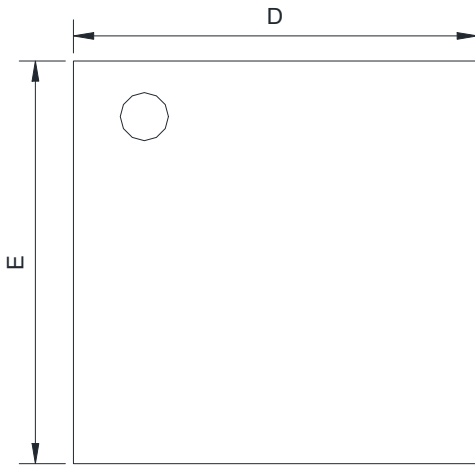
SIDE VIEW



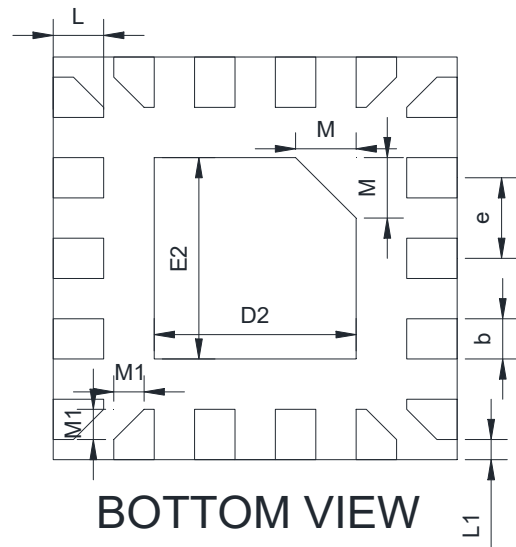
RECOMMENDED LAND PATTERN

Common Dimensions (Units of measure = Millimeter)			
Symbol	Min	Typ	Max
A	0.70	0.75	0.80
A1	0.00	0.02	0.05
A3	0.203 REF		
b	0.20	0.25	0.30
D	2.40	2.50	2.60
E	4.40	4.50	4.60
D2	0.85	1.00	1.15
E2	2.85	3.00	3.15
e	0.45	0.50	0.55
e1	3.40	3.50	3.60
L	0.30	0.40	0.50
R	0.15 REF		

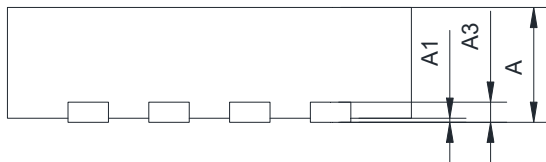
Physical Dimensions: QFN2*2-18



TOP VIEW



BOTTOM VIEW



SIDE VIEW

Common Dimensions (Units of measure = Millimeter)			
Symbol	Min	Typ	Max
A	0.50	0.55	0.60
A1	0.00	0.02	0.05
A3	0.100 REF		
b	0.15	0.20	0.25
D	1.90	2.00	2.10
E	1.90	2.00	2.10
D2	0.90	1.00	1.10
E2	0.90	1.00	1.10
e	0.30	0.40	0.50
L	0.20	0.25	0.30
L1	0.05	0.10	0.15
M	0.30 REF		
M1	0.15 REF		



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USB 3.1/3.0 High-Speed 11 Gbps Switch

CONTACT US

Dioo is a professional design and sales corporation for high-quality performance analog semiconductors. The company focuses on industry markets, such as cell phones, handheld products, laptops, medical equipment, and so on. Dioo's product families include analog signal processing and amplifying, LED drivers, and charger ICs. Go to <http://www.dioo.com> for a complete list of Dioo product families.

For additional product information or full datasheet, please contact our sales department or representatives.