

## DIO3340

# 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 under USB3.0, USB3.1, 10GE, Thunderbolt, and SAS3.0 protocols
- Bidirectional operation
- Bandwidth: 11 GHz (typ.)
- -0.9 dB typical insertion loss at 2.5 GHz
- Low active power of 15  $\mu$ A (typ.) at 3.6 V  $V_{DD}$
- Low shutdown power of < 0.5  $\mu$ A (max.)
- Low crosstalk: -55 dB at 2.5 GHz
- Low off isolation: -27 dB at 2.5 GHz
- Operation temperature range: -40°C to 85 °C
- $\pm 3$  kV HBM ESD protection
- Packaged in QFN2\*3-18 and QFN2\*2-18

### Descriptions

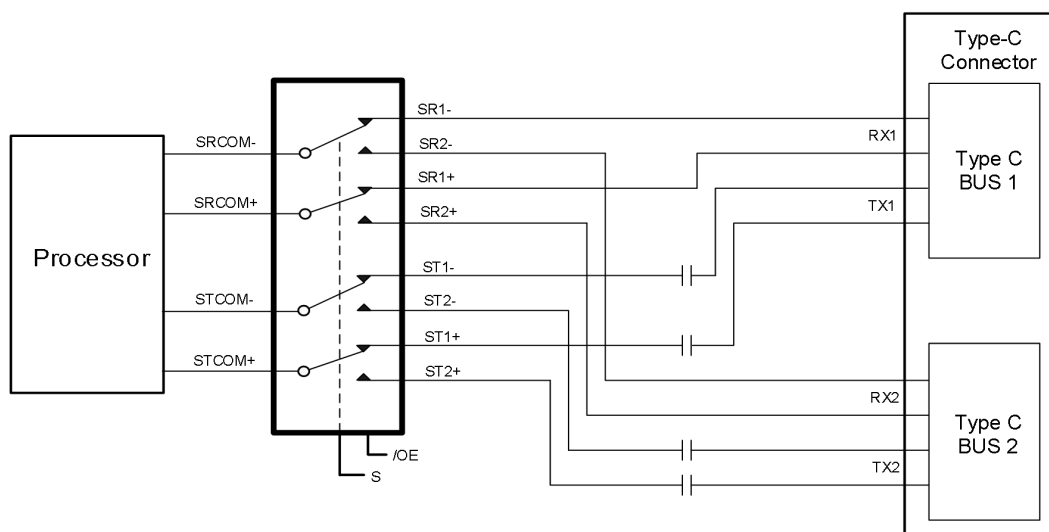
The DIO3340 is a two-pair, 2:1 data switch for USB Super Speed Gen1 and Gen2, 5 Gbps, and 10 Gbps data. The DIO3340 focuses on the mobile device market, for use in Type-C applications as a reversible cable switch. It can minimize the switch channel-to-channel skew and channel-to-channel crosstalk of the super speed signals.

The DIO3340 data switches offer superior performance and support various high-speed data transmission protocols, such as USB3.0, USB3.1, 10GE, Thunderbolt, and SAS3.0.

### Applications

- Smartphones
- Tablets
- Notebooks

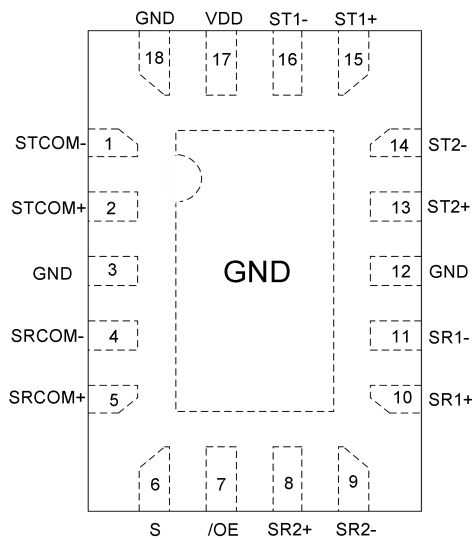
### Block Diagram



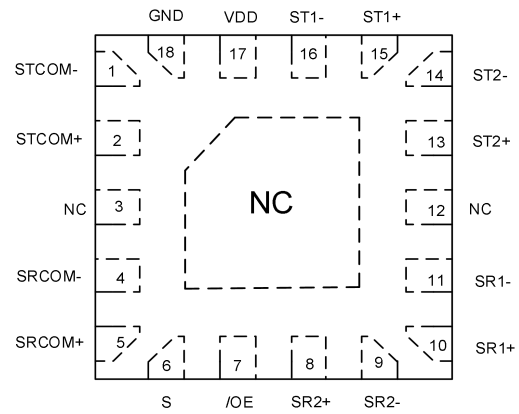
## Ordering Information

| Odering Part No. | Top Marking | MSL | RoHS  | T <sub>A</sub> | Package   |                   |
|------------------|-------------|-----|-------|----------------|-----------|-------------------|
| DIO3340QN18      | D3DV        | 3   | Green | -40 to 85°C    | QFN2*3-18 | Tape & Reel, 3000 |
| DIO3340CN18      | D3DV        | 3   | Green | -40 to 85°C    | QFN2*2-18 | Tape & Reel, 3000 |

## Pin Assignment



QFN2\*3-18



QFN2\*2-18

Figure 1. Top view



## DIO3340

### USB 3.1/3.0 High-Speed 11 Gbps Switch

#### Pin Descriptions

| Pin Name | Type  | Description                                                 |
|----------|-------|-------------------------------------------------------------|
| STCOM-   | SW    | Super speed TX- common                                      |
| STCOM+   | SW    | Super speed TX+ common                                      |
| SRCOM-   | SW    | Super speed RX- common                                      |
| SRCOM+   | SW    | Super speed RX+ common                                      |
| S        | Input | Switch select (0 = SW1, 1 = SW2)                            |
| /OE      | Input | Output enable (0 = switches enabled, 1 = switches disabled) |
| SR2+     | SW    | Super speed RX2+                                            |
| SR2-     | SW    | Super speed RX2-                                            |
| SR1+     | SW    | Super speed RX1+                                            |
| SR1-     | SW    | Super speed RX1-                                            |
| ST2+     | SW    | Super speed TX2+                                            |
| ST2-     | SW    | Super speed TX2-                                            |
| ST1+     | SW    | Super speed TX1+                                            |
| ST1-     | SW    | Super Speed TX1-                                            |
| 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) <sup>(1)</sup>     | -0.5 to $V_{DD}$ | V    |
| $V_{SW}$    | DC switch I/O voltage <sup>(1,2)</sup>       | -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: JESD22-A114F        | ±3               | kV   |
|             | Charged-device model, ANSI/ESDA/JEDEC JS-002 | ±2               | kV   |

**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) <sup>(1)</sup> | 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.

### 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          | 0.825 |     |       | V             |
|                 |                                                       | S, /OE                                                          | 1.8          | 0.85  |     |       |               |
|                 |                                                       | S, /OE                                                          | 2.5          | 1.3   |     |       |               |
|                 |                                                       | S, /OE                                                          | 3.6          | 1.4   |     |       |               |
|                 |                                                       | S, /OE                                                          | 5.0          | 1.5   |     |       |               |
| $V_{IL}$        | Control input voltage low                             | S, /OE                                                          | 1.5          |       |     | 0.375 | V             |
|                 |                                                       | S, /OE                                                          | 1.8          |       |     | 0.4   |               |
|                 |                                                       | S, /OE                                                          | 2.5          |       |     | 0.5   |               |
|                 |                                                       | S, /OE                                                          | 3.6          |       |     | 0.6   |               |
|                 |                                                       | S, /OE                                                          | 5.0          |       |     | 0.7   |               |
| $I_{IN}$        | Control input leakage                                 | $V_{SW} = -0.6$ to $2.0$ V<br>$V_{CNTRL} = 0$ to $V_{DD}$       | 5.0          | -500  |     | 500   | nA            |
| $I_{OZ}$        | Off-state leakage for open data paths                 | $V_{SW} = 0.0 \leq \text{data} \leq 2.0$ V                      | 5.0          | -0.5  |     | 0.5   | $\mu\text{A}$ |
| $I_{CL}$        | On-state leakage for closed data paths <sup>(1)</sup> | $V_{SW} = 0.0 \leq \text{data} \leq 2.0$ V                      | 5.0          | -0.5  |     | 0.5   | $\mu\text{A}$ |
| $I_{OFF}$       | Power-off leakage current (all I/O ports)             | $V_{SW} = 0$ V or $2.0$ V                                       | 0            | -500  |     | 500   | $\mu\text{A}$ |
| $R_{ON}$        | Switch on-resistance                                  | $V_{SW} = 0.2$ V, $I_{ON} = -8$ mA                              | 1.5          |       | 6   | 8     | $\Omega$      |
| $\Delta R_{ON}$ | Difference in $R_{ON}$ between positive-negative      | $V_{SW} = 0.2$ V, $I_{ON} = -8$ mA                              | 1.5          |       | 0.1 |       | $\Omega$      |
| $R_{ONF}$       | Flatness for $R_{ON}$                                 | $V_{SW} = 0.0 \leq \text{data} \leq 2.0$ V,<br>$I_{ON} = -8$ mA | 1.5          |       |     | 0.5   | $\Omega$      |
| $I_{CC}$        | Quiescent supply current                              | $V_{/OE} = 0$ , $V_{SEL} = 0$ or $V_{DD}$ ,<br>$I_{OUT} = 0$    | 3.6          |       | 15  | 25    | $\mu\text{A}$ |
|                 |                                                       |                                                                 | 5.0          |       | 21  | 30    |               |
| $I_{CCZ}$       | Quiescent supply current (high impedance)             | $V_{SEL} = X$ , $V_{/OE} = V_{DD}$ ,<br>$I_{OUT} = 0$           | 5.0          |       |     | 0.5   | $\mu\text{A}$ |
| $I_{CCT}$       | Increase in quiescent supply current per $V_{CNTRL}$  | $V_{SEL}$ or $V_{/OE} = 1.5$ V                                  | 5.0          |       | 7   | 15    | $\mu\text{A}$ |

**Note:**

- (1) For this test, the data switch is closed with the respective switch pin floating.  
 (2) Specifications subject to change without notice.

### 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                       | $R_L = 50\ \Omega$ , $C_L = 0\text{ pF}$ ,<br>$V_{SW} = 0\text{ V}$ , $V_{SW} = 0.6\text{ V}$ | 1.5 to 5.0   |     | 420  | 700 | ns            |
| $t_{OFF}$         | Turn-off time, S to output                      | $R_L = 50\ \Omega$ , $C_L = 0\text{ pF}$ ,<br>$V_{SW} = 0\text{ V}$ , $V_{SW} = 3.3\text{ V}$ | 1.5 to 5.0   |     | 60   | 300 | ns            |
| $t_{ZHM,ZL}$      | Enable time, /OE to output                      | $R_L = 50\ \Omega$ , $C_L = 0\text{ pF}$ ,<br>$V_{SW} = 0.6\text{ V}$                         | 1.5 to 5.0   |     | 53   | 150 | $\mu\text{s}$ |
| $t_{LZM,HZ}$      | Disable Time, /OE to output                     | $R_L = 50\ \Omega$ , $C_L = 0\text{ pF}$ ,<br>$V_{SW} = 0.6\text{ V}$                         | 1.5 to 5.0   |     | 100  | 300 | ns            |
| $t_{PD}^{(1)}$    | Propagation delay                               | $C_L = 0\text{ pF}$ , $R_L = 50\ \Omega$                                                      | 1.5 to 5.0   |     | 60   |     | ps            |
| $t_{BBM}^{(1)}$   | Break-before-make                               | $R_L = 50\ \Omega$ , $C_L = 0\text{ pF}$ ,<br>$V_{SW} = 0.6\text{ V}$                         | 1.5 to 5.0   | 120 |      | 600 | ns            |
| $DO_{IRR}^{(1)}$  | Differential off isolation                      | $V_S = 0\text{ dBm}$ , $R_L = 50\ \Omega$ ,<br>$f = 2.5\text{ GHz}$                           | 3.6          |     | -27  |     | dB            |
|                   |                                                 | $V_S = 0\text{ dBm}$ , $R_L = 50\ \Omega$ ,<br>$f = 5.0\text{ GHz}$                           |              |     | -20  |     | dB            |
| $SDDNEXT^{(1)}$   | Differential channel crosstalk                  | $V_S = 0\text{ dBm}$ , $R = 50\ \Omega$ ,<br>$f = 2.5\text{ GHz}$                             | 3.6          |     | -55  |     | dB            |
|                   |                                                 | $V_S = 0\text{ dBm}$ , $R = 50\ \Omega$ ,<br>$f = 5.0\text{ GHz}$                             |              |     | -47  |     | dB            |
| $DIL^{(1)}$       | Differential insertion loss<br>(all data paths) | $V_{IN} = 0\text{ dBm}$ , $f = 2.5\text{ GHz}$ ,<br>$R_L = 50\ \Omega$ , $C_L = 0\text{ pF}$  | 3.6          |     | -0.9 |     | dB            |
|                   |                                                 | $V_{IN} = 0\text{ dBm}$ , $f = 5.0\text{ GHz}$ ,<br>$R_L = 50\ \Omega$ , $C_L = 0\text{ pF}$  |              |     | -1.4 |     |               |
| $BW^{(1)}$        | Differential -3 dB bandwidth                    | $V_{IN} = 1\text{ V}_{pk-pk}$ , $R_L = 50\ \Omega$ ,<br>$C_L = 0\text{ pF}$ (both data paths) | 3.6          |     | 11   |     | GHz           |
| $t_{sk(P)}^{(2)}$ | Skew of opposite transitions of the same output | $R_{PU} = 50\ \Omega$ to $V_{DD}$ , $C_L = 0\text{ pF}$                                       | 3.6          |     | 6    |     | ps            |
| $C_{IN}^{(1)}$    | Control pin input capacitance                   | $V_{DD} = 0\text{ V}$ , $f = 1\text{ MHz}$                                                    |              |     | 2.7  |     | pF            |
| $C_{ON}^{(1)}$    | On capacitance                                  | $V_{DD} = 3.3\text{ V}$ , $f = 2.5\text{ GHz}$                                                |              |     | 0.45 |     | pF            |
| $C_{OFF}^{(1)}$   | Off capacitance                                 | $V_{DD} = 3.3\text{ V}$ , $f = 2.5\text{ GHz}$                                                |              |     | 0.36 |     | pF            |

**Note:**

- (1) Guaranteed by characterization.
- (2) Guaranteed by design.
- (3) Specifications subject to change without notice

## Typical Performance Characteristics

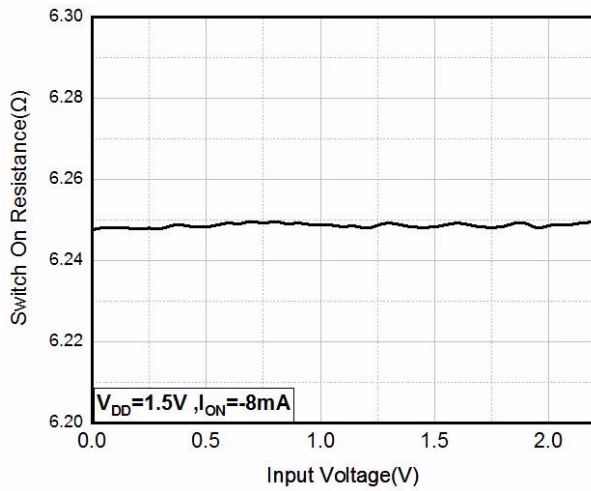


Figure 2.  $R_{ON}$  vs.  $V_{IN}$

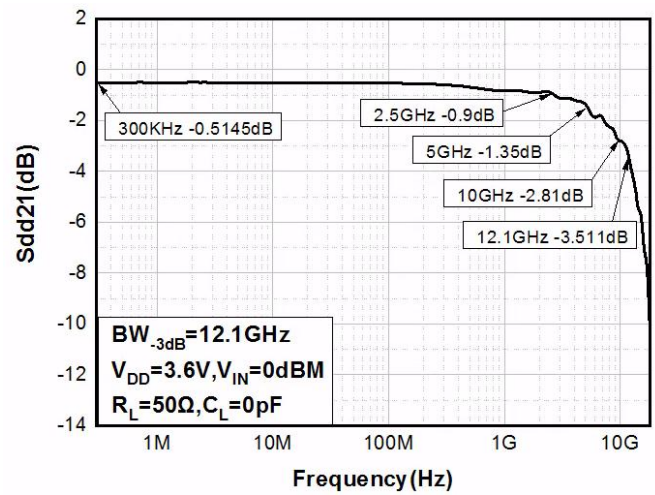


Figure 3. Differential -3 dB bandwidth

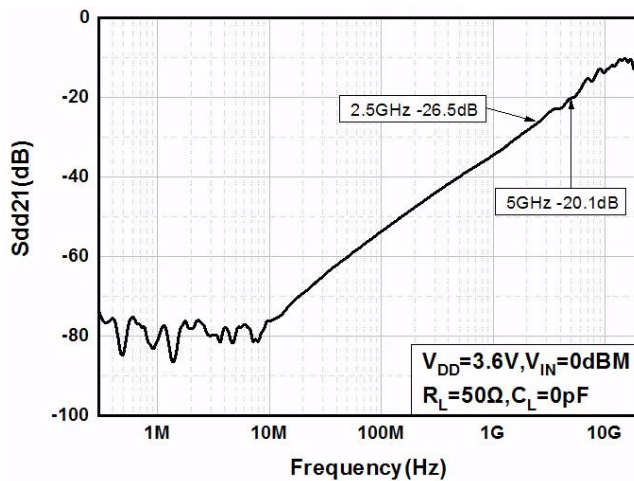


Figure 4. Differential off isolation

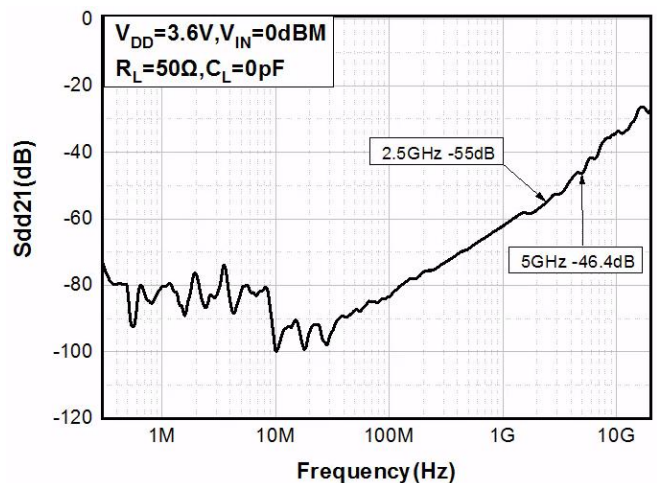


Figure 5. Differential channel crosstalk

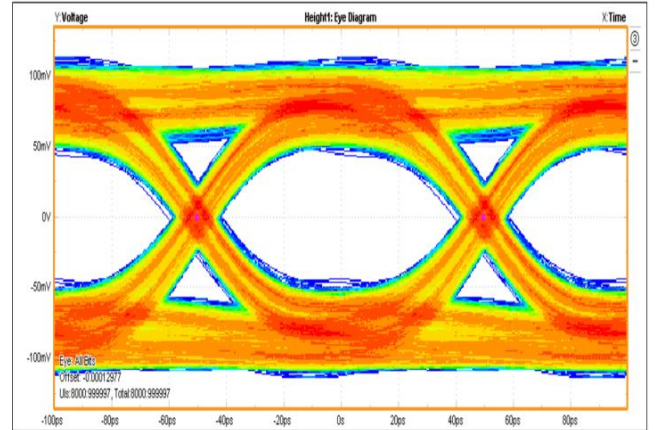
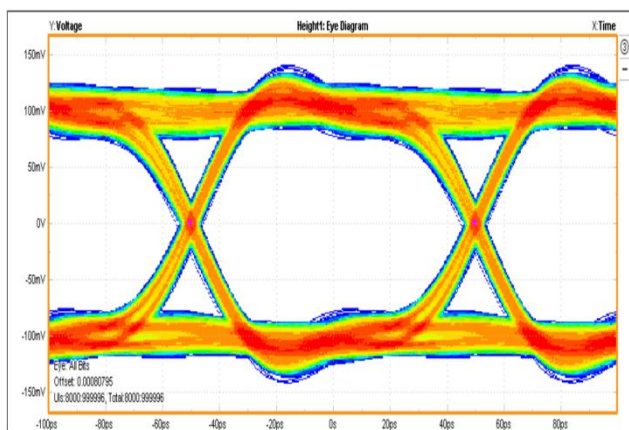


Figure 6. Eye opening at 10Gb/s by using PRBS15 pattern

### Typical Applications

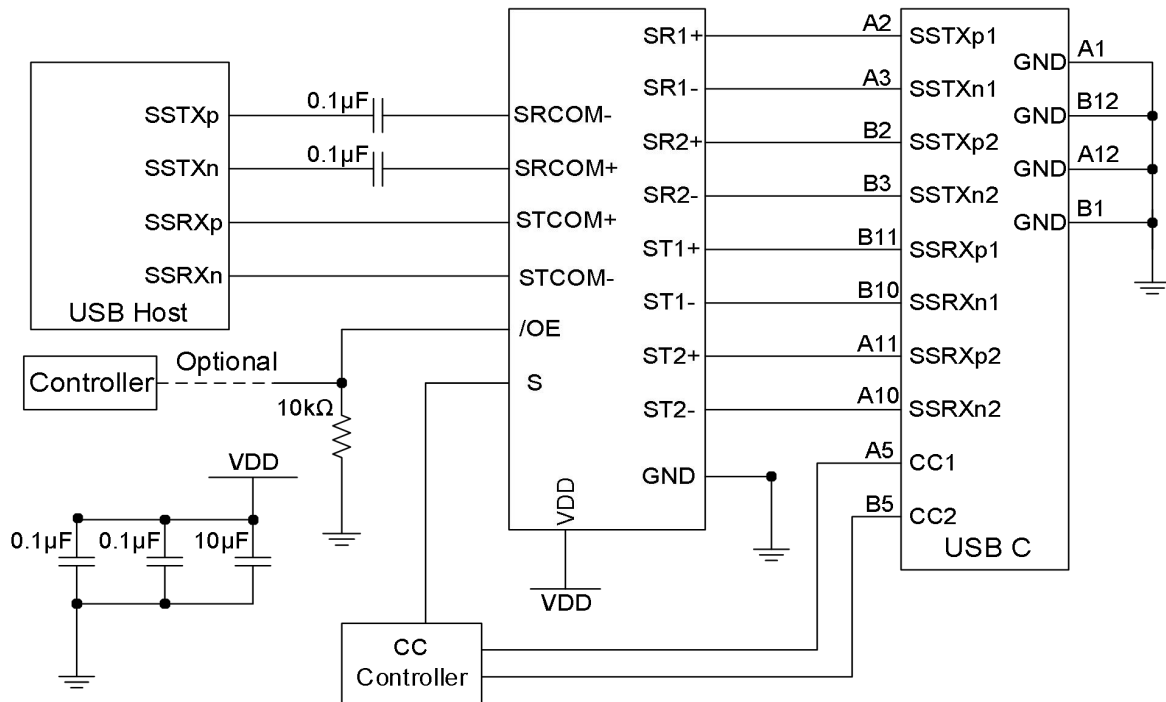


Figure 7. Down facing port for USB3.1 type C connector

### Systems Examples

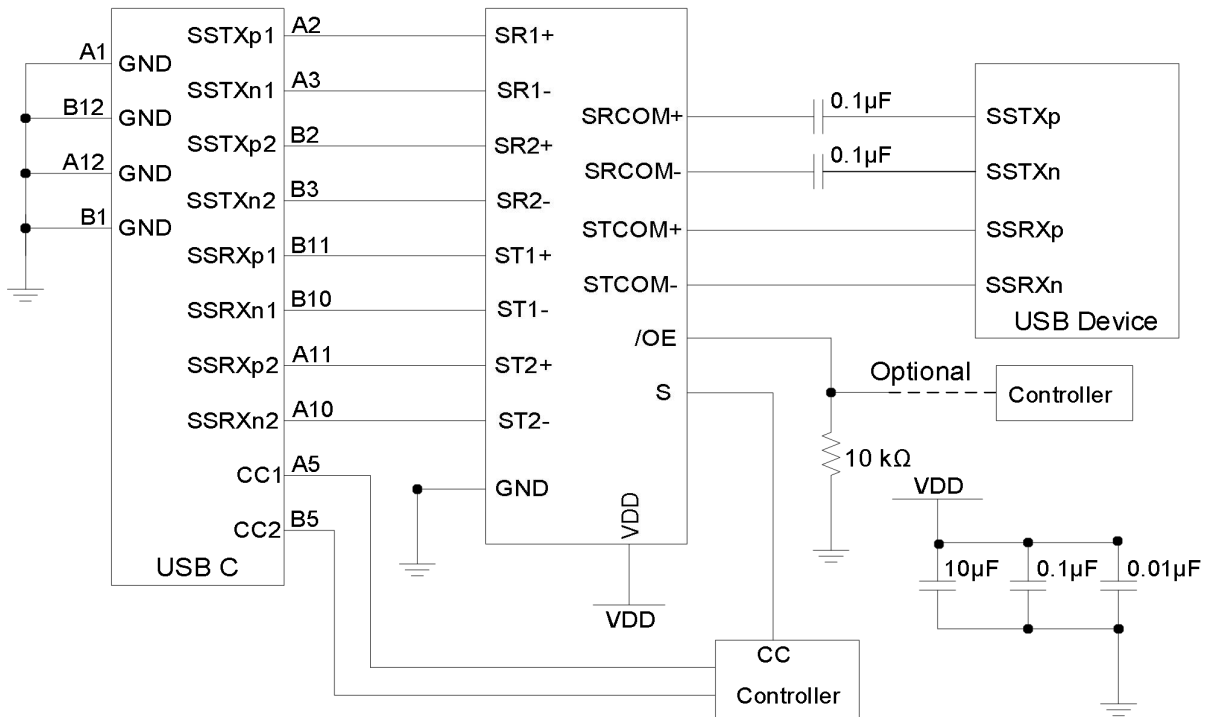


Figure 8. Up facing port for USB3.1 USB type-C connector

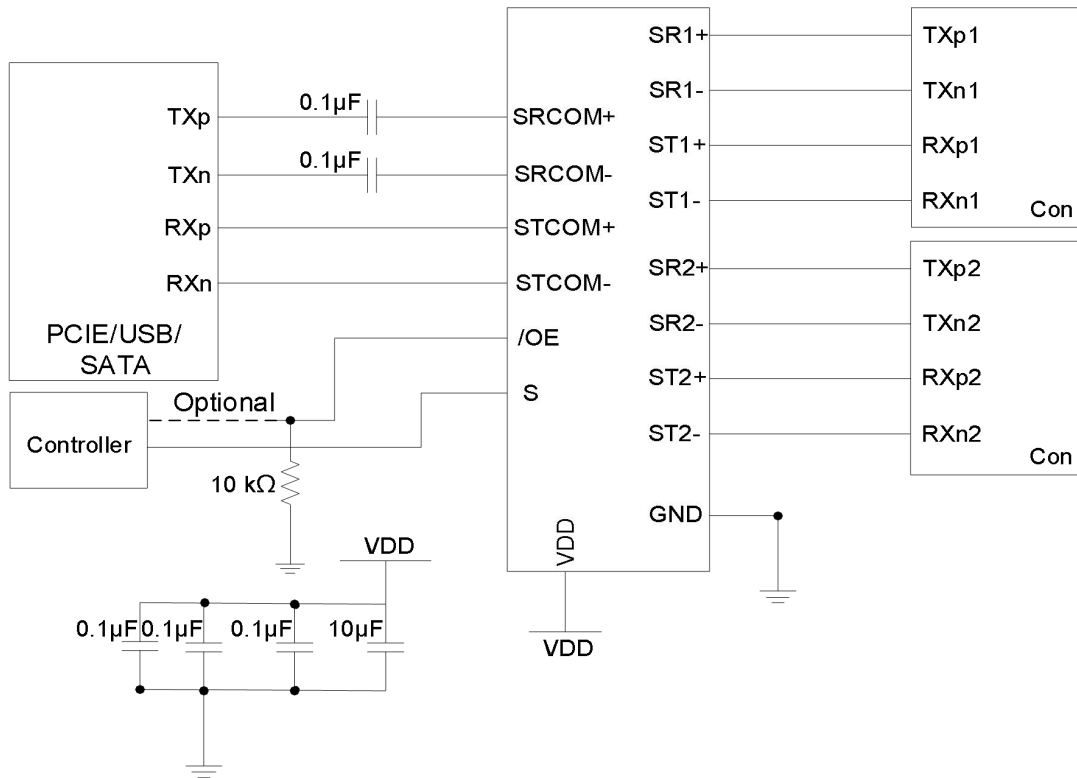


Figure 9. PCIE motherboard

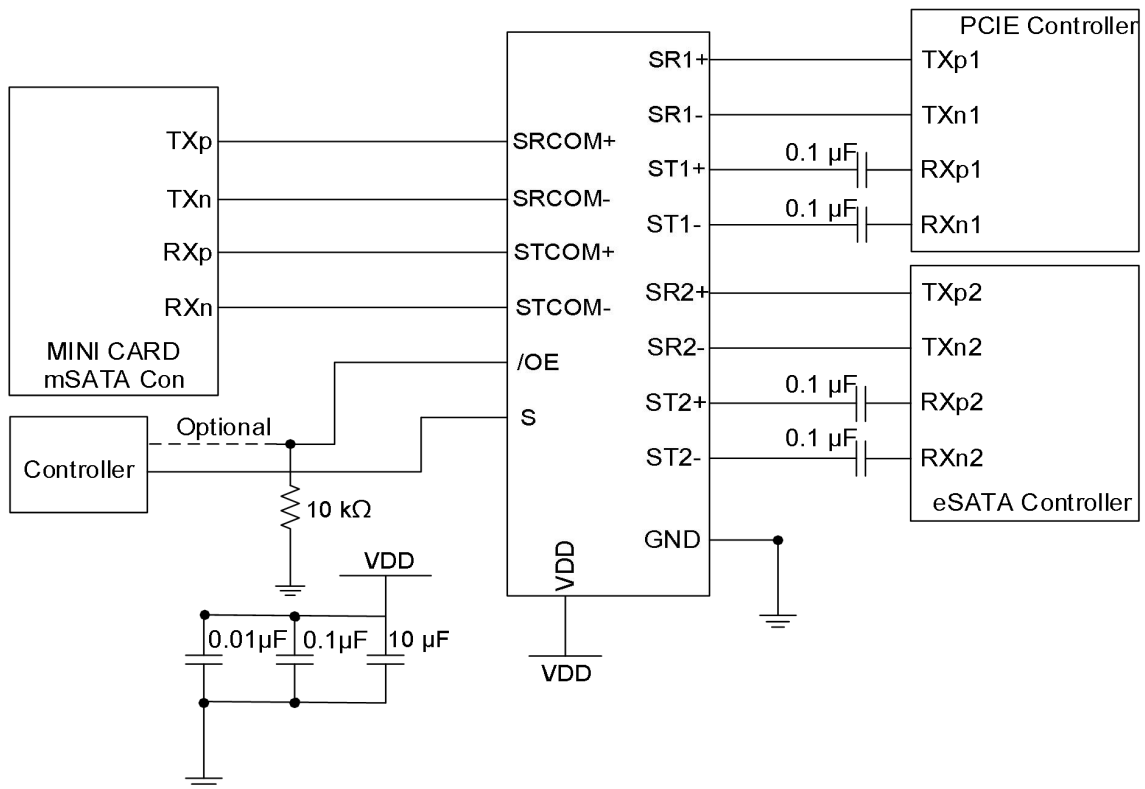


Figure10. PCIE and eSATA combo

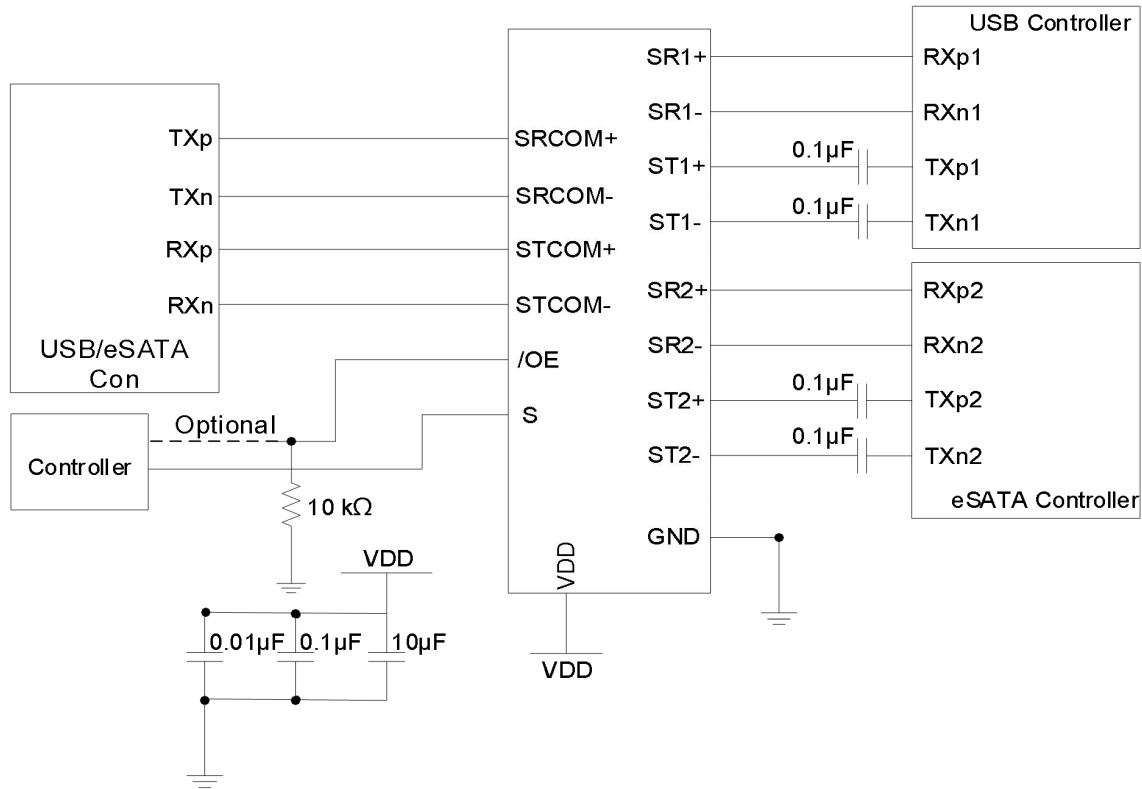


Figure 11. eSATA and USB 3.0 combo connector

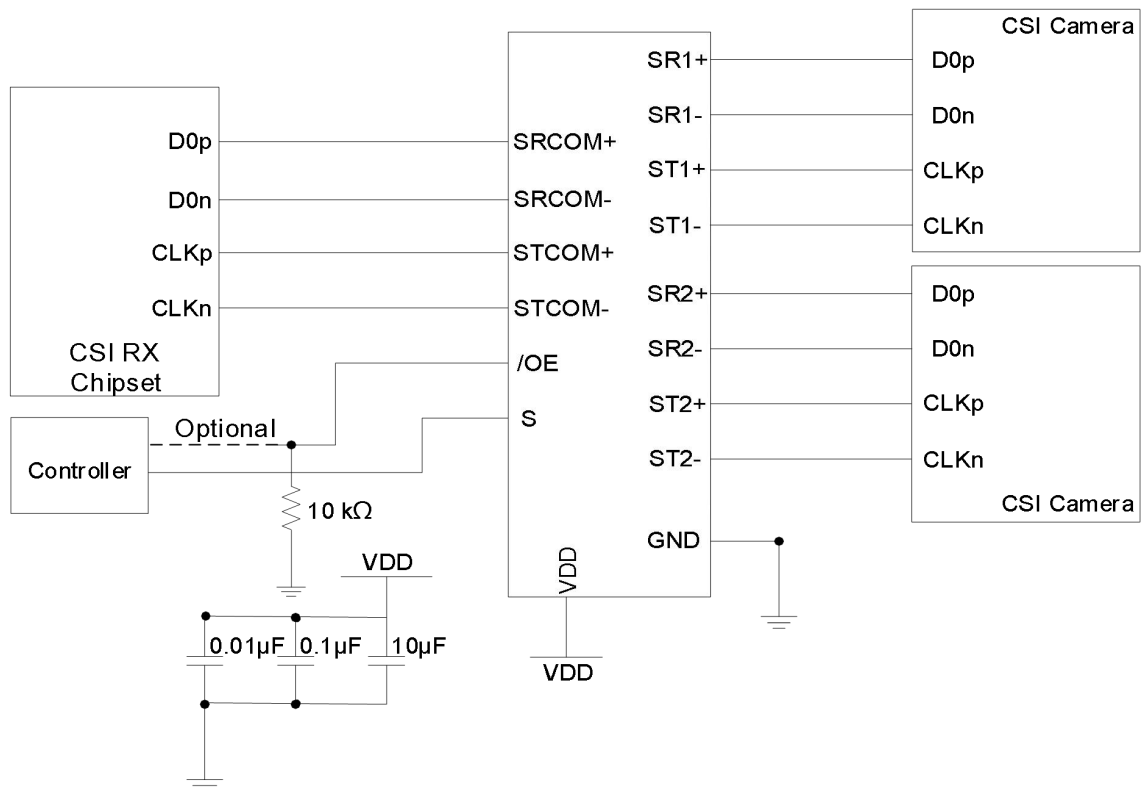
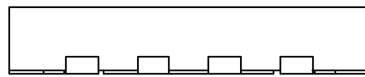
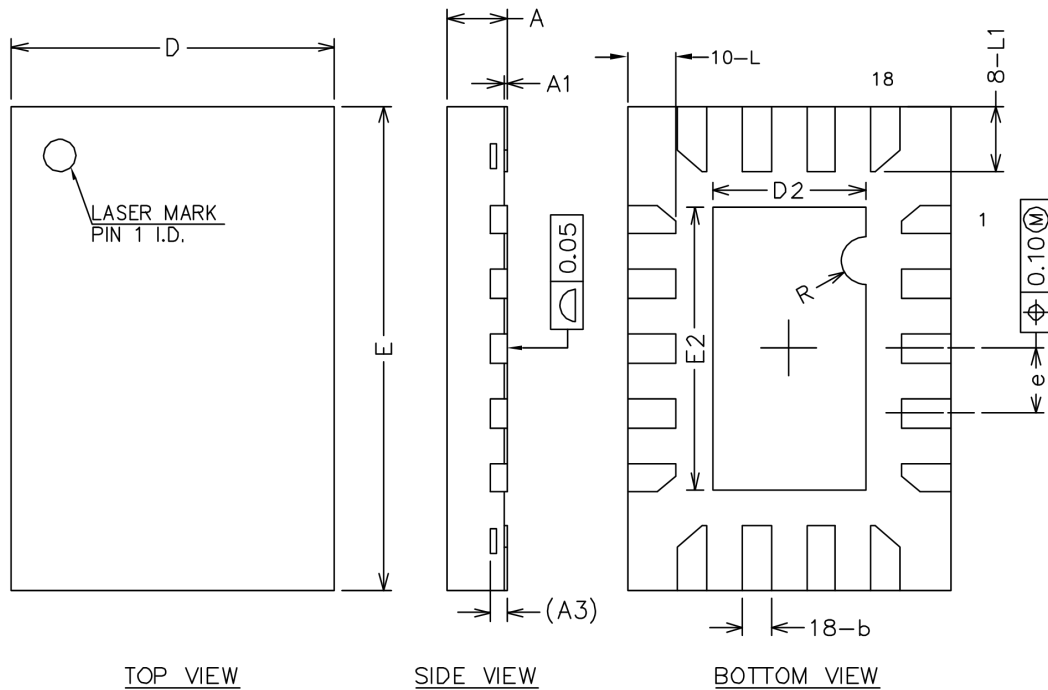
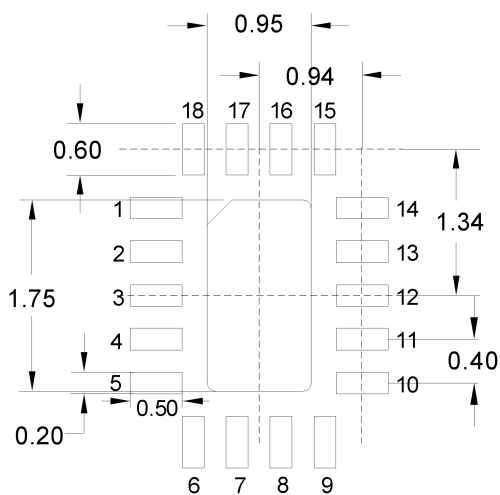


Figure 12. CSI camera array

### Physical Dimensions: QFN2\*3-18



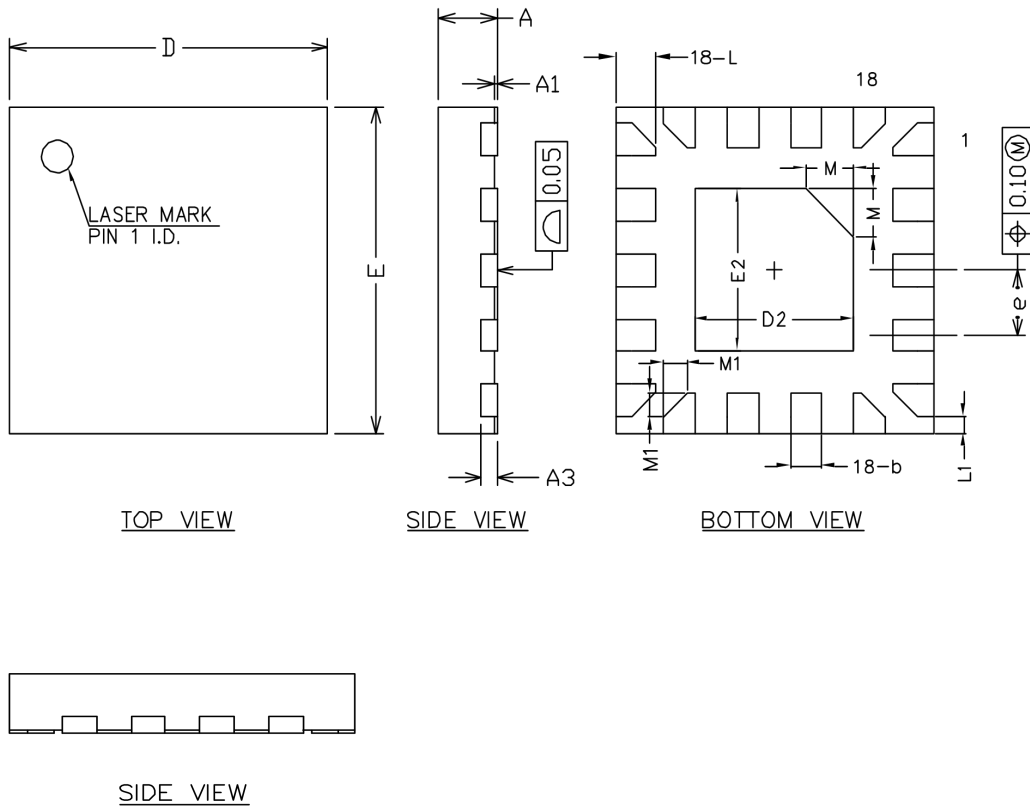
SIDE VIEW



LAND PATTERN RECOMMENDATION

| Common Dimensions<br>(Units of measure = Millimeter) |          |      |      |
|------------------------------------------------------|----------|------|------|
| Symbol                                               | Min      | Nom  | Max  |
| A                                                    | 0.50     | 0.55 | 0.60 |
| A1                                                   | 0        | 0.02 | 0.05 |
| A3                                                   | 0.10 REF |      |      |
| b                                                    | 0.13     | 0.18 | 0.23 |
| D                                                    | 1.90     | 2.00 | 2.10 |
| E                                                    | 2.90     | 3.00 | 3.10 |
| D2                                                   | 0.85     | 0.95 | 1.05 |
| E2                                                   | 1.65     | 1.75 | 1.85 |
| e                                                    | 0.30     | 0.40 | 0.50 |
| L                                                    | 0.25     | 0.30 | 0.35 |
| L1                                                   | 0.35     | 0.40 | 0.45 |
| R                                                    | 0.15 REF |      |      |

### Physical Dimensions: QFN2\*2-18



| Common Dimensions<br>(Units of measure = Millimeter) |          |      |      |
|------------------------------------------------------|----------|------|------|
| Symbol                                               | Min      | Nom  | Max  |
| A                                                    | 0.50     | 0.55 | 0.60 |
| A1                                                   | 0        | 0.02 | 0.05 |
| A3                                                   | 0.10 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 |      |      |



## DIO3340

## USB 3.1/3.0 High-Speed 11 Gbps Switch

### CONTACT US

Dioo is a professional design and sales corporation for high-quality and 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.