# USB 3.1 SuperSpeed 10 Gbps Switch

# FUSB340

### Description

The FUSB340 is a 2:1 data switch for USB SuperSpeed Gen1 and Gen2, 5 Gbps and 10 Gbps data. It is targeted at the mobile device market and for use in Type−C applications where a reversible cable requires a switch.

The FUSB340 data switch offers superior performance various high speed data transmission protocols:

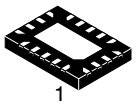
- USB 3.1 SuperSpeed (Gen 2), 10 Gbps
- PCI Express, Gen 3
- SATA
- Fibre Channel
- Display Port 1.3

### Features

- 10 GHz Typical Bandwidth
- USB 3.1 SuperSpeed 5 Gbps and10 Gbps Switch
- −1.0 dB Typical Insertion Loss at 2.5 GHz
- Low Active Power of 12 μA Typical
- Low Shutdown Power of < 1 μA Max.
- 2 kV HBM ESD Protection
- Small Packaging, 18 Lead TMLP
- Wide $V_{DD}$ Operating Range, 1.5 V−5.0 V
- This is a Pb−Free Device

### Applications

- Smartphones
- Tablets
- Notebooks




**X2QFN18**
**CASE 722AB**

### MARKING DIAGRAM


NK = Specific Device Code
&K = Lot Code
&2 = Date Code
&Z = Assembly Plant Code

### ORDERING INFORMATION

See detailed ordering and shipping information on page 6 of this data sheet.

## BLOCK DIAGRAM

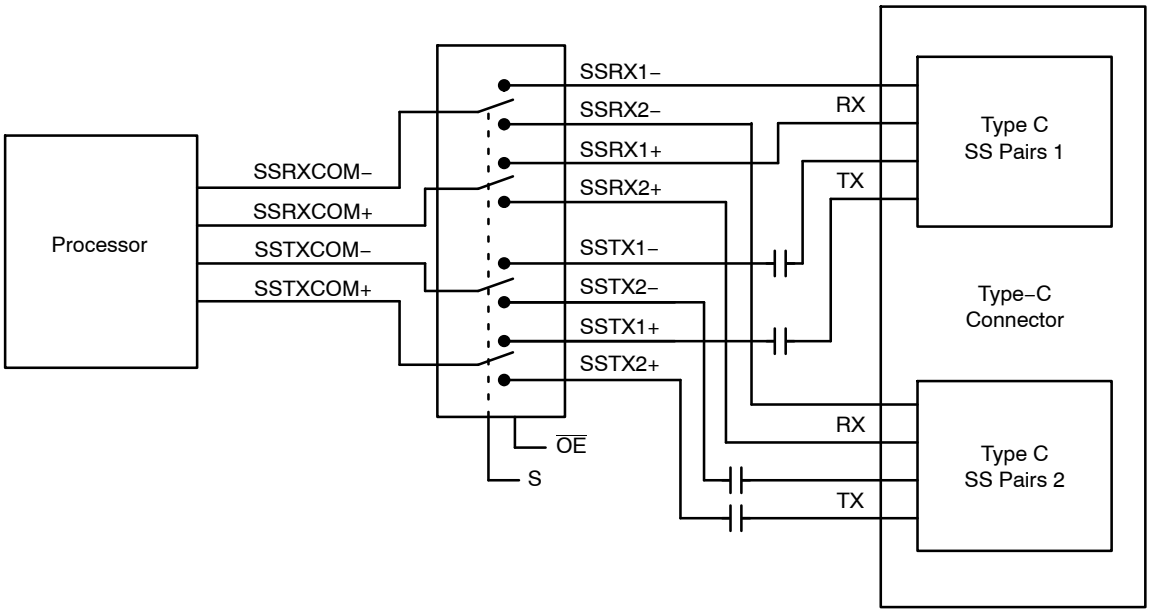



**Figure 1. Block Diagram**

## TYPICAL APPLICATION

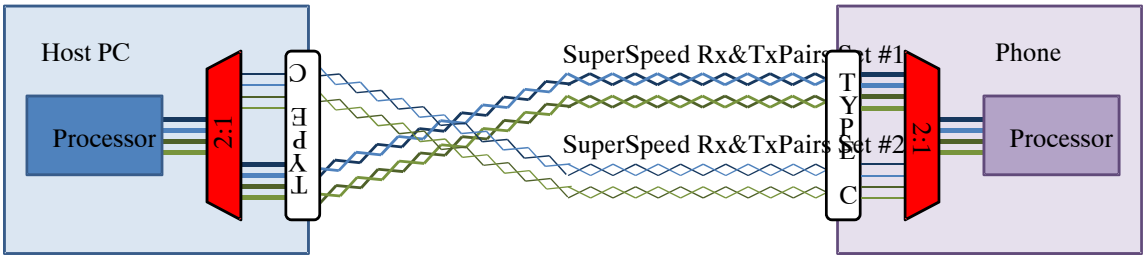



**Figure 2. Typical Application**

## PIN CONFIGURATION

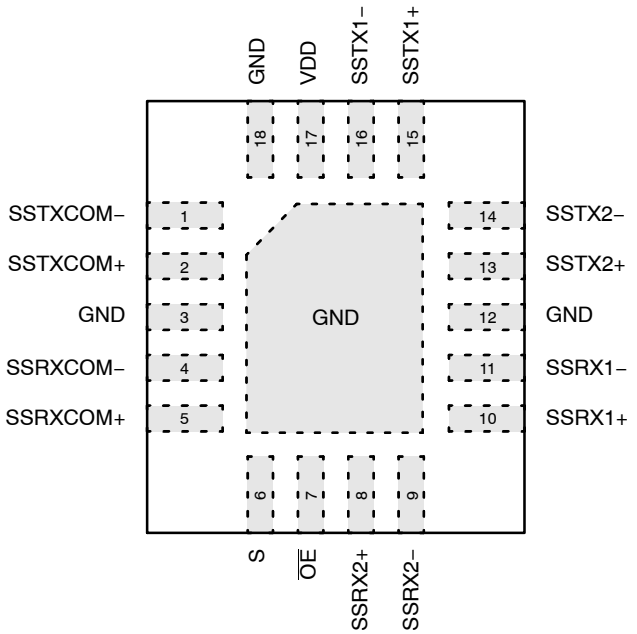



**Figure 3. Pin Assignment (Top Through View)**

### PIN DESCRIPTIONS

| Pin # | Name | Type | Description |
|---|---|---|---|
| 1 | SSTXCOM− | SW | SuperSpeed TX− Common |
| 2 | SSTXCOM+ | SW | SuperSpeed TX+ Common |
| 3 | GND | GND | Ground (connected to die attach pad) |
| 4 | SSRXCOM− | SW | SuperSpeed RX− Common |
| 5 | SSRXCOM+ | SW | SuperSpeed RX+ Common |
| 6 | S | Input | Switch Select (0 = SW1, 1 = SW2) |
| 7 | $\overline{OE}$ | Input | Output Enable (0 = Switches Enabled, 1 = Switches Disabled) |
| 8 | SSRX2+ | SW | SuperSpeed RX2+ |
| 9 | SSRX2− | SW | SuperSpeed RX2− |
| 10 | SSRX1+ | SW | SuperSpeed RX1+ |
| 11 | SSRX1− | SW | SuperSpeed RX1− |
| 12 | GND | GND | Ground (connected to die attach pad) |
| 13 | SSTX2+ | SW | SuperSpeed TX2+ |
| 14 | SSTX2− | SW | SuperSpeed TX2− |
| 15 | SSTX1+ | SW | SuperSpeed TX1+ |
| 16 | SSTX1− | SW | SuperSpeed TX1− |
| 17 | $V_{DD}$ | VDD | Device Power |
| 18 | GND | GND | Ground |

## ABSOLUTE MAXIMUM RATINGS

| Symbol | Parameter | | Min | Max | Unit |
|---|---|---|---|---|---|
| $V_{DD}$ | Supply Voltage | | −0.5 | 6.0 | V |
| $V_{CNTRL}$ | DC Input Voltage (S, $\overline{OE}$) (Note 1) | | −0.5 | $V_{DD}$ | V |
| $V_{SW}$ | DC Switch I/O Voltage (Notes 1, 2) | | −0.3 | 2.1 | V |
| $I_{IK}$ | DC Input Diode Current | | −50 | – | mA |
| $I_{sw}$ | DC Switch Current | | – | 25 | mA |
| $T_{STG}$ | Storage Temperature | | −65 | +150 | °C |
| MSL | Moisture Sensitivity Level (JEDEC J−STD−020A) | | – | 1 | |
| ESD | Human Body Model, JEDEC: JESD22−A114 | All Pins | 2 | – | kV |
| | IEC 61000−2−4, Level 4, for Switch Pins | Contact | 8 | – | |
| | | Air | 15 | – | |
| | Charged Device Model, JESD22−C101 | | 1 | – | |

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

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.

## RECOMMENDED OPERATING RANGES

| Symbol | Parameter | Min | Max | Unit |
|---|---|---|---|---|
| $V_{DD}$ | Supply Voltage | 1.5 | 5.0 | V |
| $t_{RAMP(VDD)}$ | Power Supply Slew Rate | 100 | 1000 | μs/V |
| $V_{CNTRL}$ | Control Input Voltage (S, $\overline{OE}$) (Note 3) | 0 | 5.0 | V |
| $V_{SW}$ | Switch I/O Voltage (Both SSUSB Switch Paths) | 0 | 2.0 | V |
| $T_A$ | Operating Temperature | −40 | +85 | °C |

Functional operation above the stresses listed in the Recommended Operating Ranges is not implied. Extended exposure to stresses beyond the Recommended Operating Ranges limits may affect device reliability.

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°C unless otherwise specified.

| Symbol | Parameter | Conditions | $V_{DD}$ (V) | $T_A$ = −40°C to +85°C | | | Unit |
|---|---|---|---|---|---|---|---|
| | | | | Min | Typ | Max | |
| $V_{IK}$ | Clamp Diode Voltage S, $\overline{OE}$ | $I_{IN}$ = −18 mA | 1.5 | −1.2 | – | −0.6 | V |
| $I_{IK}$ | Clamp Diode Current (Switch Pins) | $V_{IN}$ = −0.3 V | 0 | – | – | 18 | μA |
| $V_{IH}$ | Control Input Voltage High | S, $\overline{OE}$ | 1.5 | 1.30 | – | – | V |
| | | S, $\overline{OE}$ | 3.6 | 1.4 | – | – | V |
| | | S, $\overline{OE}$ | 5.0 | 1.5 | – | – | V |
| $V_{IL}$ | Control Input Voltage Low | S, $\overline{OE}$ | 1.5 | – | – | 0.4 | V |
| | | S, $\overline{OE}$ | 3.6 | – | – | 0.4 | V |
| | | S, $\overline{OE}$ | 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 | $V_{SW}$ = 0.0 ≤ DATA ≤ 2.0 V | 5.0 | −0.5 | – | 0.5 | μA |
| $I_{CL}$ | On−State Leakage for Closed Data Paths (Note 4) | $V_{SW}$ = 0.0 ≤ 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 |

## DC AND TRANSIENT CHARACTERISTICS (continued)

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

| Symbol | Parameter | Conditions | $V_{DD}$ (V) | $T_A$ = −40°C to +85°C | | | Unit |
|---|---|---|---|---|---|---|---|
| | | | | Min | Typ | Max | |
| $R_{ON}$ | Switch On Resistance | $V_{SW}$ = 0 V, $I_{ON}$ = −8 mA | 1.5 | – | 5.4 | 8.0 | Ω |
| $\Delta R_{ON}$ | Difference in RON Between Positive−Negative | $V_{SW}$ = 0 V, $I_{ON}$ = −8 mA | 1.5 | – | 0.1 | – | Ω |
| $R_{ONF}$ | Flatness for RON | $V_{SW}$ = 0 ≤ DATA ≤ 2.0 V, $I_{ON}$ =−8 mA | 1.5 | – | 0.9 | – | Ω |
| $I_{CC}$ | Quiescent Supply Current | $V_{\overline{OE}}$ = 0, $V_{SEL}$ = 0 or $V_{DD}$, $I_{OUT}$ = 0 | 5.0 | – | 12 | 30 | μA |
| $I_{CCZ}$ | Quiescent Supply Current (High Impedance) | $V_{SEL}$ = X, $V_{\overline{OE}}$ = $V_{DD}$, $I_{OUT}$ = 0 | 5.0 | – | – | 1 | μA |
| $I_{CCT}$ | Increase in Quiescent Supply Current per VCNTRL | $V_{SEL}$ or $V_{\overline{OE}}$ = 1.5 V | 5.0 | – | 5 | 15 | μA |

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

## AC ELECTRICAL CHARACTERISTICS

All typical value are for $V_{DD}$ = 3.6 V and $T_A$ = 25°C unless otherwise specified.

| Symbol | Parameter | Conditions | $V_{DD}$ (V) | $T_A$ = −40°C to +85°C | | | Unit |
|---|---|---|---|---|---|---|---|
| | | | | Min | Typ | Max | |
| $t_{ON}$ | 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 | – | 350 | 600 | ns |
| $t_{OFF}$ | Turn−Off 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 | – | 125 | 300 | ns |
| $t_{ZHM,ZL}$ | Enable Time, $\overline{OE}$ 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, $\overline{OE}$ to Output | $R_L$ = 50 Ω, $C_L$ = 0 pF, $V_{SW}$ = 0.6 V | 1.5 to 5.0 V | – | 35 | 240 | ns |
| $t_{PD}$ | Propagation Delay (Note 5) | $C_L$ = 0 pF, $R_L$ = 50 Ω | 1.5 to 5.0 V | – | 60 | – | ps |
| $t_{BBM}$ | Break−Before−Make (Note 5) | $R_L$ = 50 Ω, $C_L$ = 0 pF, $V_{SW1}$ = 0.6 V, $V_{SW2}$ = −0.6 V | 1.5 to 5.0 V | 100 | – | 350 | ns |
| $DO_{IRR}$ | Differential Off Isolation (Note 5) | $V_S$ = 0dBm, $R_L$ = 50 Ω, f = 2.5 GHz | 3.6 V | – | −28 | – | dB |
| | | $V_S$ = 0 dBm, $R_L$ = 50 Ω, f = 5.0 GHz | | | −25 | | |
| SDDNEXT | Differential Channel Crosstalk (Note 5) | $V_S$ = 0 dBm, R = 50 Ω, f = 2.5 GHz | 3.6 V | – | −44 | – | dB |
| | | $V_S$ = 0 dBm, R = 50 Ω, f = 5.0 GHz | | | −40 | | |
| DIL | Differential Insertion Loss (Note 5) (All Data Paths) | $V_{IN}$ = 0dBm, f = 2.5 GHz, $R_L$ = 50 Ω, $C_L$ = 0 pF | 3.6 V | – | −1.0 | – | dB |
| | | $V_{IN}$ = 0 dBm, f = 5.0 GHz, $R_L$ = 50 Ω, $C_L$ = 0 pF | | | −1.8 | | |
| BW | Differential, −3 dB Bandwidth (Note 5) | $V_{IN}$ = 1 Vpk−pk, $R_L$ = 50 Ω, $C_L$ = 0 pF (Both Data Paths) | 3.6 V | – | 10 | – | GHz |
| $t_{SK(P)}$ | Skew of Opposite Transitions of the Same Output (Note 5) | $R_{PU}$ = 50 Ω to $V_{DD}$, $C_L$ = 0 pF | 3.6 V | – | 6 | – | ps |
| $C_{IN}$ | Control Pin Input Capacitance (Note 5) | $V_{DD}$ = 0 V, f = 1 MHz | | – | 2.7 | – | pF |
| $C_{ON}$ | On Capacitance (Note 5) | $V_{DD}$ = 3.3 V, f = 2.5 GHz | | – | 0.5 | – | pF |
| $C_{OFF}$ | Off Capacitance (Note 5) | $V_{DD}$ = 3.3 V, f = 2.5 GHz | | – | 0.4 | – | pF |

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

5. Guaranteed by characterization.

## EYE DIAGRAMS

(All plots below are for $V_{DD}$ = 3.6 V and $T_A$ = 25°C with 0 dBm differential data.)

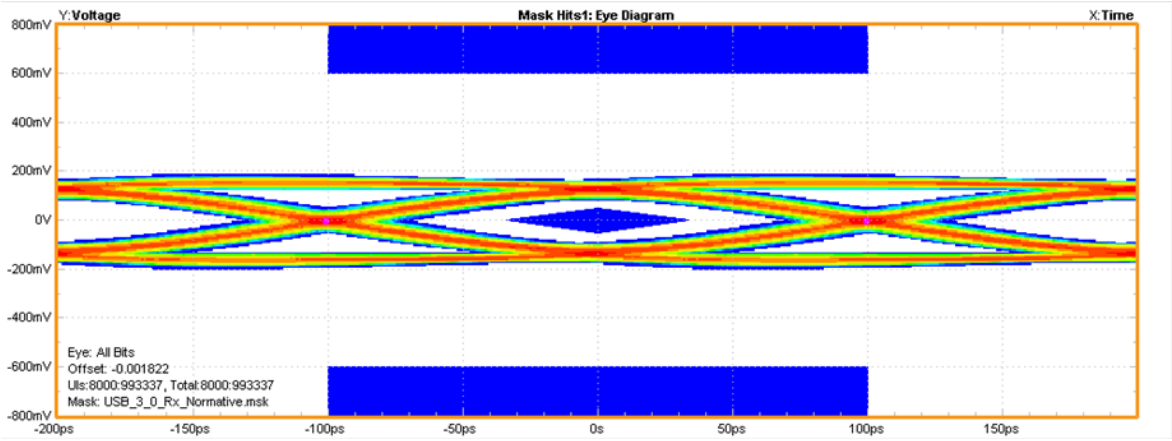



**Figure 4. 5 Gbps Eye Diagram with Eye Mask**

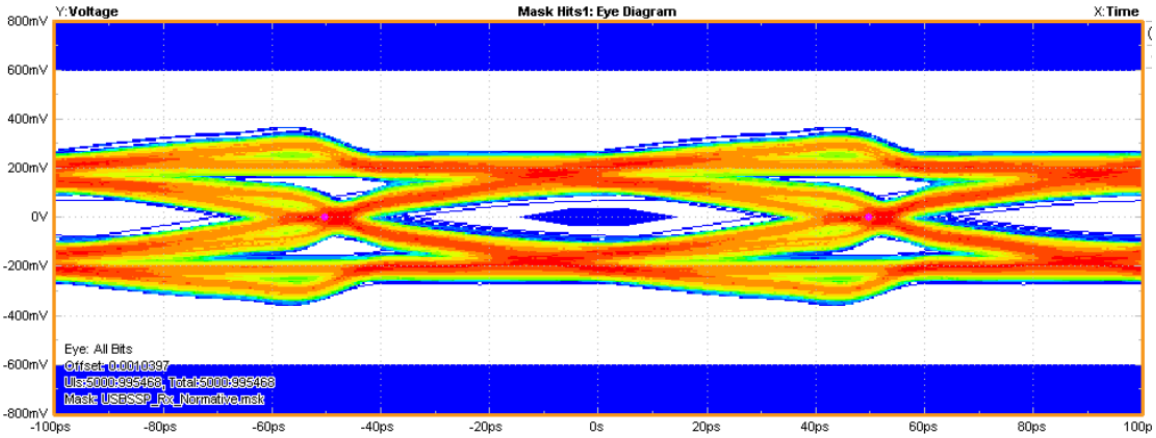



**Figure 5. 10 Gbps Eye Diagram with Eye Mask**

## ORDERING INFORMATION

| Part Number | Operating Temperature Range | Package | Shipping† |
|---|---|---|---|
| FUSB340TMX | −40 to +85°C | 18−Lead, Quad, Ultra−ultrathin Molded Leadless Package (TMLP), 2.0 mm × 2.8 mm × 0.375 mm | 5,000 / Tape & Reel |

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

The table below pertains to the UMLP Package drawing on the following page.

## PRODUCT−SPECIFIC DIMENSIONS

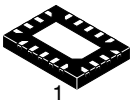
| Product | A | B |
|---|---|---|
| FUSB340TMX | 2.00 mm | 2.80 mm |

# MECHANICAL CASE OUTLINE
## PACKAGE DIMENSIONS

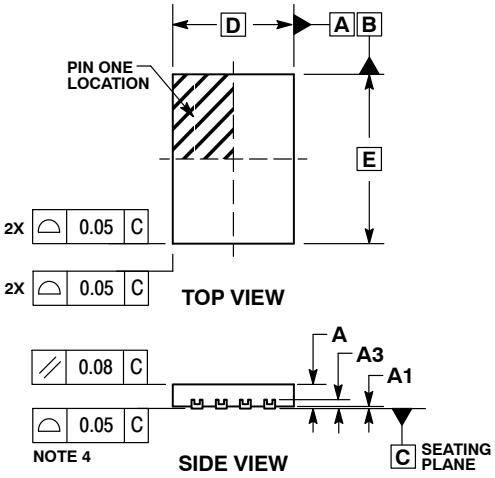
ON Semiconductor®

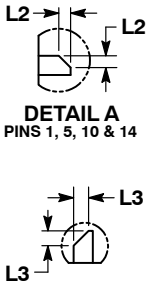
**X2QFN18, 2.0x2.8, 0.4P**
CASE 722AB
ISSUE O

DATE 17 MAY 2016



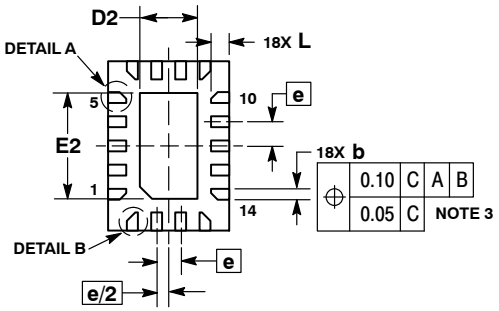
SCALE 4:1



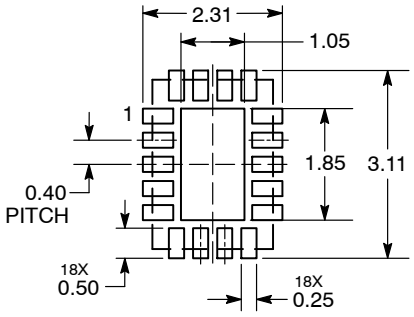




NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS
3. DIMENSION b APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.15 AND 0.25 MM FROM THE TERMINAL TIP.
4. COPLANARITY APPLIES TO THE EXPOSED PAD AS WELL AS THE TERMINALS.

| | MILLIMETERS | |
|---|---|---|
| DIM | MIN | MAX |
| A | --- | 0.40 |
| A1 | 0.00 | 0.05 |
| A3 | 0.13 REF | |
| b | 0.13 | 0.23 |
| D | 2.00 BSC | |
| D2 | 0.90 | 1.00 |
| E | 2.80 BSC | |
| E2 | 1.70 | 1.80 |
| e | 0.40 BSC | |
| L | 0.25 | 0.35 |
| L2 | 0.11 REF | |
| L3 | 0.14 REF | |



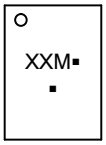

### RECOMMENDED MOUNTING FOOTPRINT




DIMENSIONS: MILLIMETERS

*For additional information on our Pb−Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

### GENERIC MARKING DIAGRAM*




XX = Specific Device Code
M = Month Code
▪ = Pb−Free Package

(Note: Microdot may be in either location)

*This information is generic. Please refer to device data sheet for actual part marking. Pb−Free indicator, “G”, may or not be present.

| | | |
|---|---|---|
| **DOCUMENT NUMBER:** | **98AON11641G** | Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped “CONTROLLED COPY” in red. |
| **DESCRIPTION:** | **X2QFN18, 2.0 X 2.8, 0.4P** | **PAGE 1 OF 1** |

## ADDITIONAL INFORMATION

**TECHNICAL PUBLICATIONS**:
**Technical Library:** www.onsemi.com/design/resources/technical−documentation
**onsemi Website:** www.onsemi.com

**ONLINE SUPPORT**: www.onsemi.com/support
**For additional information, please contact your local Sales Representative at** www.onsemi.com/support/sales