

# Low Voltage Dual Supply 2-Bit Signal Translator with Configurable Voltage Supplies and Signal Levels and 3-STATE Outputs and Independent Direction Controls

## FXL2TD245

### General Description

The FXL2TD245 is a configurable dual-voltage-supply translator designed for both uni-directional and bi-directional voltage translation between two logic levels. The device allows translation between voltages as high as 3.6 V to as low as 1.1 V. The A Port tracks the  $V_{CCA}$  level, and the B Port tracks the  $V_{CCB}$  level. This allows for bi-directional voltage translation over a variety of voltage levels: 1.2 V, 1.5 V, 1.8 V, 2.5 V, and 3.3 V.

The device remains in 3-STATE until both  $V_{CC}$ s reach active levels allowing either  $V_{CC}$  to be powered-up first. Internal power down control circuits place the device in 3-STATE if either  $V_{CC}$  is removed.

The Transmit/Receive inputs independently determine the direction of data through each of the two bits. The  $\overline{OE}$  input, when HIGH, disables both the A and B Ports by placing them in a 3-STATE condition. The FXL2TD245 is designed so that the control pins ( $T/\overline{R}$  and  $\overline{OE}$ ) are supplied by  $V_{CCA}$ .

### Features

- Bi-directional Interface between Any 2 Levels from 1.1 V to 3.6 V
- Fully Configurable: Inputs Track  $V_{CC}$  Level
- Non-preferential Power-up Sequencing; Either  $V_{CC}$  May be Powered-up First
- Outputs Remain in 3-STATE until Active  $V_{CC}$  Level is Reached
- Outputs Switch to 3-STATE if Either  $V_{CC}$  is at GND
- Power-off Protection
- Control Inputs ( $T/\overline{R}_n$ ,  $\overline{OE}$ ) Levels are Referenced to  $V_{CCA}$  Voltage
- Packaged in the Chipscale MicroPak10 (1.6 mm x 2.1 mm)
- ESD Protections Exceeds:
  - ◆ 4kV HBM ESD (per JESD22-A114 & Mil Std 883e 3015.7)
  - ◆ 8kV HBM I/O to GND ESD (per JESD22-A114 & Mil Std 883e 3015.7)
  - ◆ 1kV CDM ESD (per ESD STM 5.3)
  - ◆ 200V MM ESD (per JESD22-A115 & ESD STM5.2)
- This Device is Pb-Free, Halide Free and is RoHS Compliant



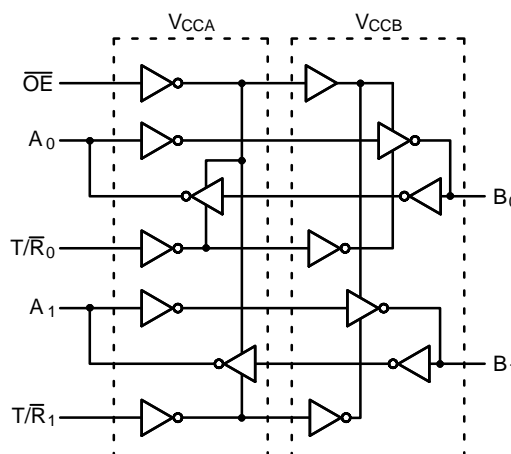
UQFN10 (MICROPAK™), 1.6 x 2.1, 0.5P  
CASE 523AZ

### MARKING DIAGRAM

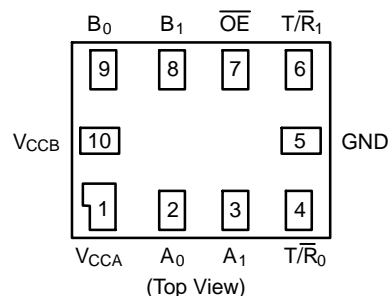


XE = Specific Device Code  
&K = 2-Digits Lot Run Traceability Code  
&2 = 2-Digit Date Code  
&Z = Assembly Plant Code

### FUNCTIONAL DIAGRAM



### CONNECTION DIAGRAM



### ORDERING INFORMATION

See detailed ordering and shipping information on page 8 of this data sheet.

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## PIN ASSIGNMENT

| Pin Number | Terminal Name    |
|------------|------------------|
| 1          | V <sub>CCA</sub> |
| 2          | A <sub>0</sub>   |
| 3          | A <sub>1</sub>   |
| 4          | T/R <sub>0</sub> |
| 5          | GND              |
| 6          | T/R <sub>1</sub> |
| 7          | $\overline{OE}$  |
| 8          | B <sub>1</sub>   |
| 9          | B <sub>0</sub>   |
| 10         | V <sub>CCB</sub> |

## PIN DESCRIPTION

| Pin Names        | Description                      |
|------------------|----------------------------------|
| $\overline{OE}$  | Output Enable Input              |
| T/R <sub>n</sub> | Transmit/Receive Inputs          |
| A <sub>n</sub>   | Side A Inputs or 3-STATE Outputs |
| B <sub>n</sub>   | Side B Inputs or 3-STATE Outputs |
| V <sub>CCA</sub> | Side A Power Supply              |
| V <sub>CCB</sub> | Side B Power Supply              |

## TRUTH TABLE

| Inputs          |                  |                  | Outputs                                      |
|-----------------|------------------|------------------|--|
| $\overline{OE}$ | T/R <sub>0</sub> | T/R <sub>1</sub> |  |
| L               | L                | X                | B <sub>0</sub> Data to A <sub>0</sub> Output |
| L               | H                | X                | A <sub>0</sub> Data to B <sub>0</sub> Output |
| L               | X                | L                | B <sub>1</sub> Data to A <sub>1</sub> Output |
| L               | X                | H                | A <sub>1</sub> Data to B <sub>1</sub> Output |
| H               | X                | X                | 3-STATE                                      |

H = HIGH Voltage Level  
 L = LOW Voltage Level  
 X = Don't Care

## Power-Up / Power-Down Sequencing

FXL translators offer an advantage in that either V<sub>CC</sub> may be powered up first. This benefit derives from the chip design. When either V<sub>CC</sub> is at 0 volts, outputs are in a HIGH-Impedance state. The control inputs (T/R<sub>n</sub> and  $\overline{OE}$ ) are designed to track the V<sub>CCA</sub> supply. A pull-up resistor tying  $\overline{OE}$  to V<sub>CCA</sub> should be used to ensure that bus contention, excessive currents, or oscillations do not occur during power-up/power-down. The size of the pull-up resistor is based upon the current-sinking capability of the  $\overline{OE}$  driver.

The recommended power-up sequence is the following:

1. Apply power to either V<sub>CC</sub>.
2. Apply power to the T/R<sub>n</sub> inputs (Logic HIGH for A-to-B operation; Logic LOW for B-to-A operation) and to the respective data inputs (A Port or B Port). This may occur at the same time as Step 1.
3. Apply power to the other V<sub>CC</sub>.
4. Drive the  $\overline{OE}$  input LOW to enable the device.

The recommended power-down sequence is the following:

1. Drive  $\overline{OE}$  input HIGH to disable the device.
2. Remove power from either V<sub>CC</sub>.
3. Remove power from the other V<sub>CC</sub>.

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## ABSOLUTE MAXIMUM RATINGS

| Symbol             | Parameter  | Rating   |
|--------------------|--|--|
| $V_{CCA}, V_{CCB}$ | Supply Voltage   | -0.5 V to +4.6 V   |
| $V_I$              | DC Input Voltage<br>I/O Port A<br>I/O Port B<br>Control Inputs ( $T/\bar{R}_n, \bar{OE}$ )         | -0.5 V to +4.6 V<br>-0.5 V to +4.6 V<br>-0.5 V to +4.6 V                       |
| $V_O$              | Output Voltage (Note 1)<br>Outputs 3-STATE<br>Outputs Active ( $A_n$ )<br>Outputs Active ( $B_n$ ) | -0.5 V to +4.6 V<br>-0.5 V to $V_{CCA} + 0.5$ V<br>-0.5 V to $V_{CCB} + 0.5$ V |
| $I_{IK}$           | DC Input Diode Current @ $V_I < 0$ V   | -50 mA   |
| $I_{OK}$           | DC Output Diode Current @<br>$V_O < 0$ V<br>$V_O > V_{CC}$   | -50 mA<br>+50 mA   |
| $I_{OH} / I_{OL}$  | DC Output Source/Sink Current  | -50 mA / +50 mA  |
| $I_{CC}$           | DC $V_{CC}$ or Ground Current per Supply Pin   | $\pm 100$ mA   |
| $T_{STG}$          | Storage Temperature Range  | -65 °C to +150 °C  |

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.  $I_O$  Absolute Maximum Rating must be observed.

## RECOMMENDED OPERATING CONDITIONS (Note 2)

| Symbol                 | Parameter  | Rating   |
|------------------------|--|--|
| $V_{CCA}$ or $V_{CCB}$ | Power Supply Operating   | 1.1 V to 3.6 V   |
|                        | Input Voltage<br>Port A<br>Port B<br>Control Inputs ( $T/\bar{R}_n, \bar{OE}$ )  | 0.0 V to 3.6 V<br>0.0 V to 3.6 V<br>0.0 V to $V_{CCA}$                 |
|                        | Output Current in $I_{OH}/I_{OL}$ with $V_{CC}$ @<br>3.0 V to 3.6 V<br>2.3 V to 2.7 V<br>1.65 V to 1.95 V<br>1.4 V to 1.65 V<br>1.1 V to 1.4 V | $\pm 24$ mA<br>$\pm 18$ mA<br>$\pm 6$ mA<br>$\pm 2$ mA<br>$\pm 0.5$ mA |
| $T_A$                  | Free Air Operating Temperature   | -40 °C to +85 °C   |
| $\Delta t/\Delta V$    | Maximum Input Edge Rate $V_{CCA/B} = 1.1$ V to 3.6 V   | 10 ns/V  |

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.

2. All unused inputs and I/O pins must be held at  $V_{CC1}$  or GND.

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## DC ELECTRICAL CHARACTERISTICS

| Symbol          | Parameter                             | Conditions  | V <sub>CCI</sub> (V) | V <sub>CC0</sub> (V) | Min                     | Max                     | Unit |
|-----------------|---------------------------------------|---|----------------------|----------------------|-------------------------|-------------------------|------|
| V <sub>IH</sub> | High Level Input Voltage<br>(Note 3)  | Data Inputs A <sub>n</sub> , B <sub>n</sub>   | 2.7–3.6              | 1.1–3.6              | 2.0                     | –                       | V    |
|                 |                                       |   | 2.3–2.7              |                      | 1.6                     | –                       |      |
|                 |                                       |   | 1.65–2.3             |                      | 0.65 x V <sub>CCI</sub> | –                       |      |
|                 |                                       |   | 1.4–1.65             |                      | 0.65 x V <sub>CCI</sub> | –                       |      |
|                 |                                       |   | 1.1–1.4              |                      | 0.9 x V <sub>CCI</sub>  | –                       |      |
|                 |                                       | Control Pins $\overline{OE}$ , T/ $\overline{R}_n$<br>(Referenced to V <sub>CCA</sub> ) | 2.7–3.6              | 1.1–3.6              | 2.0                     | –                       |      |
|                 |                                       |   | 2.3–2.7              |                      | 1.6                     | –                       |      |
|                 |                                       |   | 1.65–2.3             |                      | 0.65 x V <sub>CCA</sub> | –                       |      |
|                 |                                       |   | 1.4–1.65             |                      | 0.65 x V <sub>CCA</sub> | –                       |      |
|                 |                                       |   | 1.1–1.4              |                      | 0.9 x V <sub>CCA</sub>  | –                       |      |
| V <sub>IL</sub> | Low Level Input Voltage<br>(Note 3)   | Data Inputs A <sub>n</sub> , B <sub>n</sub>   | 2.7–3.6              | 1.1–3.6              | –                       | 0.8                     | V    |
|                 |                                       |   | 2.3–2.7              |                      | –                       | 0.7                     |      |
|                 |                                       |   | 1.65–2.3             |                      | –                       | 0.35 x V <sub>CCI</sub> |      |
|                 |                                       |   | 1.4–1.65             |                      | –                       | 0.35 x V <sub>CCI</sub> |      |
|                 |                                       |   | 1.1–1.4              |                      | –                       | 0.1 x V <sub>CCI</sub>  |      |
|                 |                                       | Control Pins $\overline{OE}$ , T/ $\overline{R}_n$<br>(Referenced to V <sub>CCA</sub> ) | 2.7–3.6              | 1.1–3.6              | –                       | 0.8                     |      |
|                 |                                       |   | 2.3–2.7              |                      | –                       | 0.7                     |      |
|                 |                                       |   | 1.65–2.3             |                      | –                       | 0.35 x V <sub>CCA</sub> |      |
|                 |                                       |   | 1.4–1.65             |                      | –                       | 0.35 x V <sub>CCA</sub> |      |
|                 |                                       |   | 1.1–1.4              |                      | –                       | 0.1 x V <sub>CCA</sub>  |      |
| V <sub>OH</sub> | High Level Output Voltage<br>(Note 4) | I <sub>OH</sub> = –100 μA   | 1.1–3.6              | 1.1–3.6              | V <sub>CC0</sub> –0.2   | –                       | V    |
|                 |                                       | I <sub>OH</sub> = –12 mA  | 2.7                  | 2.7                  | 2.2                     | –                       |      |
|                 |                                       | I <sub>OH</sub> = –18 mA  | 3.0                  | 3.0                  | 2.4                     | –                       |      |
|                 |                                       | I <sub>OH</sub> = –24 mA  | 3.0                  | 3.0                  | 2.2                     | –                       |      |
|                 |                                       | I <sub>OH</sub> = –6 mA   | 2.3                  | 2.3                  | 2.0                     | –                       |      |
|                 |                                       | I <sub>OH</sub> = –12 mA  | 2.3                  | 2.3                  | 1.8                     | –                       |      |
|                 |                                       | I <sub>OH</sub> = –18 mA  | 2.3                  | 2.3                  | 1.7                     | –                       |      |
|                 |                                       | I <sub>OH</sub> = –6 mA   | 1.65                 | 1.65                 | 1.25                    | –                       |      |
|                 |                                       | I <sub>OH</sub> = –2 mA   | 1.4                  | 1.4                  | 1.05                    | –                       |      |
|                 |                                       | I <sub>OH</sub> = –0.5 mA   | 1.1                  | 1.1                  | 0.75 x V <sub>CC0</sub> | –                       |      |
| V <sub>OL</sub> | Low Level Output Voltage<br>(Note 4)  | I <sub>OL</sub> = 100 μA  | 1.1–3.6              | 1.1–3.6              | –                       | 0.2                     | V    |
|                 |                                       | I <sub>OL</sub> = 12 mA   | 2.7                  | 2.7                  | –                       | 0.4                     |      |
|                 |                                       | I <sub>OL</sub> = 18 mA   | 3.0                  | 3.0                  | –                       | 0.4                     |      |
|                 |                                       | I <sub>OL</sub> = 24 mA   | 3.0                  | 3.0                  | –                       | 0.55                    |      |
|                 |                                       | I <sub>OL</sub> = 12 mA   | 2.3                  | 2.3                  | –                       | 0.4                     |      |
|                 |                                       | I <sub>OL</sub> = 18 mA   | 2.3                  | 2.3                  | –                       | 0.6                     |      |
|                 |                                       | I <sub>OL</sub> = 6 mA  | 1.65                 | 1.65                 | –                       | 0.3                     |      |
|                 |                                       | I <sub>OL</sub> = 2 mA  | 1.4                  | 1.4                  | –                       | 0.35                    |      |
|                 |                                       | I <sub>OL</sub> = 0.5 mA  | 1.1                  | 1.1                  | –                       | 0.3 x V <sub>CC0</sub>  |      |
| I <sub>I</sub>  | Input Leakage Current<br>Control Pins | V <sub>I</sub> = V <sub>CCA</sub> or GND  | 1.1–3.6              | 3.6                  | –                       | ±1.0                    | μA   |

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### DC ELECTRICAL CHARACTERISTICS (continued)

| Symbol              | Parameter   | Conditions   | V <sub>CCI</sub> (V) | V <sub>CCO</sub> (V) | Min | Max   | Unit |
|---------------------|---|--|----------------------|----------------------|-----|-------|------|
| I <sub>OFF</sub>    | Power Off Leakage Current   | A <sub>n</sub> , V <sub>I</sub> or V <sub>O</sub> = 0 V to 3.6 V | 0                    | 3.6                  | –   | ±10.0 | μA   |
|                     |   | B <sub>n</sub> , V <sub>I</sub> or V <sub>O</sub> = 0 V to 3.6 V | 3.6                  | 0                    | –   | ±10.0 |      |
| I <sub>OZ</sub>     | 3-STATE Output Leakage<br>(Note 5)<br>0 ≤ V <sub>O</sub> ≤ 3.6 V<br>V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> | A <sub>n</sub> , B <sub>n</sub> $\overline{OE} = V_{IH}$         | 3.6                  | 3.6                  | –   | ±10.0 | μA   |
|                     |   | B <sub>n</sub> , $\overline{OE} = \text{Don't Care}$             | 0                    | 3.6                  | –   | +10.0 |      |
|                     |   | A <sub>n</sub> , $\overline{OE} = \text{Don't Care}$             | 3.6                  | 0                    | –   | +10.0 |      |
| I <sub>CCA/B</sub>  | Quiescent Supply Current<br>(Note 6)  | V <sub>I</sub> = V <sub>CCI</sub> or GND; I <sub>O</sub> = 0     | 1.1–3.6              | 1.1–3.6              | –   | 20.0  | μA   |
| I <sub>CCZ</sub>    | Quiescent Supply Current<br>(Note 6)  | V <sub>I</sub> = V <sub>CCI</sub> or GND; I <sub>O</sub> = 0     | 1.1–3.6              | 1.1–3.6              | –   | 20.0  | μA   |
| I <sub>CCA</sub>    | Quiescent Supply Current  | V <sub>I</sub> = V <sub>CCA</sub> or GND; I <sub>O</sub> = 0     | 0                    | 1.1–3.6              | –   | –10.0 | μA   |
|                     |   | V <sub>I</sub> = V <sub>CCA</sub> or GND; I <sub>O</sub> = 0     | 1.1–3.6              | 0                    | –   | 10.0  | μA   |
| I <sub>CCB</sub>    | Quiescent Supply Current  | V <sub>I</sub> = V <sub>CCB</sub> or GND; I <sub>O</sub> = 0     | 1.1–3.6              | 0                    | –   | –10.0 | μA   |
|                     |   | V <sub>I</sub> = V <sub>CCB</sub> or GND; I <sub>O</sub> = 0     | 0                    | 1.1–3.6              | –   | 10.0  | μA   |
| ΔI <sub>CCA/B</sub> | Increase in I <sub>CC</sub> per Input;<br>Other Inputs at V <sub>CC</sub> or GND  | V <sub>IH</sub> = 3.0 V  | 3.6                  | 3.6                  | –   | 500   | μA   |

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.

3. V<sub>CCI</sub> = the V<sub>CC</sub> associated with the data input under test.
4. V<sub>CCO</sub> = the V<sub>CC</sub> associated with the output under test.
5. Don't care = Any valid logic level.
6. Reflects current per supply, V<sub>CCA</sub> or V<sub>CCB</sub>.

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## AC ELECTRICAL CHARACTERISTICS

| Symbol | Parameter | $T_A = -40\text{ }^\circ\text{C to }+85\text{ }^\circ\text{C}$ |     |  |     |  |     |  |     |  |     | Unit |
|--------|-----------|--|-----|--|-----|--|-----|--|-----|--|-----|------|
|        |           | $V_{CCB} = 3.0\text{ V to }3.6\text{ V}$                       |     | $V_{CCB} = 2.3\text{ V to }2.7\text{ V}$ |     | $V_{CCB} = 1.65\text{ V to }1.95\text{ V}$ |     | $V_{CCB} = 1.4\text{ V to }1.6\text{ V}$ |     | $V_{CCB} = 1.1\text{ V to }1.3\text{ V}$ |     |      |
|        |           | Typ  | Max | Typ                                      | Max | Typ  | Max | Typ                                      | Max | Typ                                      | Typ |      |

### $V_{CCA} = 3.0\text{ V to }3.6\text{ V}$

|                    |                                     |     |     |     |     |     |     |     |     |     |      |    |
|--------------------|-------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|----|
| $t_{PLH}, t_{PHL}$ | Propagation Delay A to B            | 0.2 | 3.5 | 0.3 | 3.9 | 0.5 | 5.4 | 0.6 | 6.8 | 1.4 | 22.0 | ns |
|                    | Propagation Delay B to A            | 0.2 | 3.5 | 0.2 | 3.8 | 0.3 | 4.0 | 0.5 | 4.3 | 0.8 | 13.0 |    |
| $t_{PZH}, t_{PZL}$ | Output Enable $\overline{OE}$ to B  | 0.5 | 4.0 | 0.7 | 4.4 | 1.0 | 5.9 | 1.0 | 6.4 | 1.5 | 17.0 | ns |
|                    | Output Enable $\overline{OE}$ to A  | 0.5 | 4.0 | 0.5 | 4.0 | 0.5 | 4.0 | 0.5 | 4.0 | 0.5 | 4.0  |    |
| $t_{PHZ}, t_{PLZ}$ | Output Disable $\overline{OE}$ to B | 0.2 | 3.8 | 0.2 | 4.0 | 0.7 | 4.8 | 1.5 | 6.2 | 2.0 | 17.0 | ns |
|                    | Output Disable $\overline{OE}$ to A | 0.2 | 3.7 | 0.2 | 3.7 | 0.2 | 3.7 | 0.2 | 3.7 | 0.2 | 3.7  |    |

### $V_{CCA} = 2.3\text{ V to }2.7\text{ V}$

|                    |                                     |     |     |     |     |     |     |     |     |     |      |    |
|--------------------|-------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|----|
| $t_{PLH}, t_{PHL}$ | Propagation Delay A to B            | 0.2 | 3.8 | 0.4 | 4.2 | 0.5 | 5.6 | 0.8 | 6.9 | 1.4 | 22.0 | ns |
|                    | Propagation Delay B to A            | 0.3 | 3.9 | 0.4 | 4.2 | 0.5 | 4.5 | 0.5 | 4.8 | 1.0 | 7.0  |    |
| $t_{PZH}, t_{PZL}$ | Output Enable $\overline{OE}$ to B  | 0.6 | 4.2 | 0.8 | 4.6 | 1.0 | 6.0 | 1.0 | 6.8 | 1.5 | 17.0 | ns |
|                    | Output Enable $\overline{OE}$ to A  | 0.6 | 4.5 | 0.6 | 4.5 | 0.6 | 4.5 | 0.6 | 4.5 | 0.6 | 4.5  |    |
| $t_{PHZ}, t_{PLZ}$ | Output Disable $\overline{OE}$ to B | 0.2 | 4.1 | 0.2 | 4.3 | 0.7 | 4.8 | 1.5 | 6.7 | 2.0 | 17.0 | ns |
|                    | Output Disable $\overline{OE}$ to A | 0.2 | 4.0 | 0.2 | 4.0 | 0.2 | 4.0 | 0.2 | 4.0 | 0.2 | 4.0  |    |

### $V_{CCA} = 1.65\text{ V to }1.95\text{ V}$

|                    |                                     |     |     |     |     |     |     |     |     |     |      |    |
|--------------------|-------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|----|
| $t_{PLH}, t_{PHL}$ | Propagation Delay A to B            | 0.3 | 4.0 | 0.5 | 4.5 | 0.8 | 5.7 | 0.9 | 7.1 | 1.5 | 22.0 | ns |
|                    | Propagation Delay B to A            | 0.5 | 5.4 | 0.5 | 5.6 | 0.8 | 5.7 | 1.0 | 6.0 | 1.2 | 8.0  |    |
| $t_{PZH}, t_{PZL}$ | Output Enable $\overline{OE}$ to B  | 0.6 | 5.2 | 0.8 | 5.4 | 1.2 | 6.9 | 1.2 | 7.2 | 1.5 | 18.0 | ns |
|                    | Output Enable $\overline{OE}$ to A  | 1.0 | 6.7 | 1.0 | 6.7 | 1.0 | 6.7 | 1.0 | 6.7 | 1.0 | 6.7  |    |
| $t_{PHZ}, t_{PLZ}$ | Output Disable $\overline{OE}$ to B | 0.2 | 5.1 | 0.2 | 5.2 | 0.8 | 5.2 | 1.5 | 7.0 | 2.0 | 17.0 | ns |
|                    | Output Disable $\overline{OE}$ to A | 0.5 | 5.0 | 0.5 | 5.0 | 0.5 | 5.0 | 0.5 | 5.0 | 0.5 | 5.0  |    |

### $V_{CCA} = 1.4\text{ V to }1.6\text{ V}$

|                    |                                     |     |     |     |     |     |     |     |     |     |      |    |
|--------------------|-------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|----|
| $t_{PLH}, t_{PHL}$ | Propagation Delay A to B            | 0.5 | 4.3 | 0.5 | 4.8 | 1.0 | 6.0 | 1.0 | 7.3 | 1.5 | 22.0 | ns |
|                    | Propagation Delay B to A            | 0.6 | 6.8 | 0.8 | 6.9 | 0.9 | 7.1 | 1.0 | 7.3 | 1.3 | 9.5  |    |
| $t_{PZH}, t_{PZL}$ | Output Enable $\overline{OE}$ to B  | 1.1 | 7.5 | 1.1 | 7.6 | 1.3 | 7.7 | 1.4 | 7.9 | 2.0 | 20.0 | ns |
|                    | Output Enable $\overline{OE}$ to A  | 1.0 | 7.5 | 1.0 | 7.5 | 1.0 | 7.5 | 1.0 | 7.5 | 1.0 | 7.5  |    |
| $t_{PHZ}, t_{PLZ}$ | Output Disable $\overline{OE}$ to B | 0.4 | 6.1 | 0.4 | 6.2 | 0.9 | 6.2 | 1.5 | 7.5 | 2.0 | 18.0 | ns |
|                    | Output Disable $\overline{OE}$ to A | 1.0 | 6.0 | 1.0 | 6.0 | 1.0 | 6.0 | 1.0 | 6.0 | 1.0 | 6.0  |    |

### $V_{CCA} = 1.1\text{ V to }1.3\text{ V}$

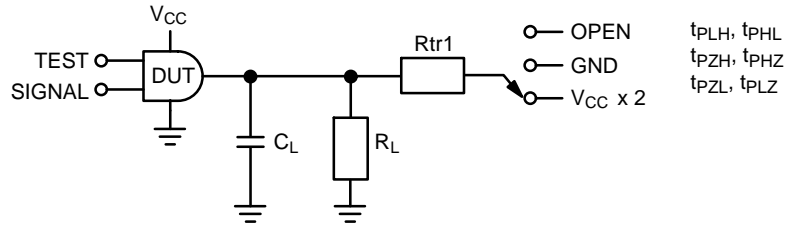
|                    |                                     |     |      |     |      |     |      |     |      |     |      |    |
|--------------------|-------------------------------------|-----|------|-----|------|-----|------|-----|------|-----|------|----|
| $t_{PLH}, t_{PHL}$ | Propagation Delay A to B            | 0.8 | 13.0 | 1.0 | 7.0  | 1.2 | 8.0  | 1.3 | 9.5  | 2.0 | 24.0 | ns |
|                    | Propagation Delay B to A            | 1.4 | 22.0 | 1.4 | 22.0 | 1.5 | 22.0 | 1.5 | 22.0 | 2.0 | 24.0 |    |
| $t_{PZH}, t_{PZL}$ | Output Enable $\overline{OE}$ to B  | 1.0 | 12.0 | 1.0 | 9.0  | 2.0 | 10.0 | 2.0 | 11.0 | 2.0 | 24.0 | ns |
|                    | Output Enable $\overline{OE}$ to A  | 2.0 | 22.0 | 2.0 | 22.0 | 2.0 | 22.0 | 2.0 | 22.0 | 2.0 | 22.0 |    |
| $t_{PHZ}, t_{PLZ}$ | Output Disable $\overline{OE}$ to B | 1.0 | 15.0 | 0.7 | 7.0  | 1.0 | 8.0  | 2.0 | 10.0 | 2.0 | 20.0 | ns |
|                    | Output Disable $\overline{OE}$ to A | 2.0 | 15.0 | 2.0 | 12.0 | 2.0 | 12.0 | 2.0 | 12.0 | 2.0 | 12.0 |    |

## CAPACITANCE

| Symbol    | Parameter  | Conditions  | $T_A = +25\text{ }^\circ\text{C}$ | Unit |
|-----------|--|---|-----------------------------------|------|
|           |  |   | Typical                           |      |
| $C_{IN}$  | Input Capacitance Control Pins ( $\overline{OE}$ , $T/R_n$ ) | $V_{CCA} = V_{CCB} = 3.3\text{ V}$ , $V_I = 0\text{ V}$ or $V_{CCA/B}$                    | 4.0                               | pF   |
| $C_{I/O}$ | Input/Output Capacitance $A_n$ , $B_n$ Ports                 | $V_{CCA} = V_{CCB} = 3.3\text{ V}$ , $V_I = 0\text{ V}$ or $V_{CCA/B}$                    | 5.0                               | pF   |
| $C_{PD}$  | Power Dissipation Capacitance                                | $V_{CCA} = V_{CCB} = 3.3\text{ V}$ , $V_I = 0\text{ V}$ or $V_{CC}$ , $F = 10\text{ MHz}$ | 20.0                              | pF   |

# FXL2TD245

## AC LOADINGS AND WAVEFORMS

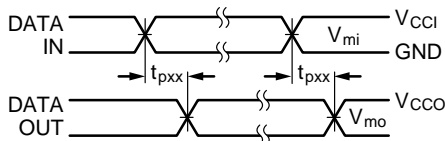


| Test               | Switch   |
|--------------------|--|
| $t_{PLH}, t_{PHL}$ | OPEN   |
| $t_{PLZ}, t_{PZL}$ | $V_{CCO} \times 2$ at $V_{CCO} = 3.3 \pm 0.3 \text{ V}, 2.5 \text{ V} \pm 0.2 \text{ V}, 1.8 \text{ V} \pm 0.15 \text{ V}, 1.5 \text{ V} \pm 0.1 \text{ V}, 1.2 \text{ V} \pm 0.1 \text{ V}$ |
| $t_{PHZ}, t_{PZH}$ | GND  |

**Figure 1. AC Test Circuit**

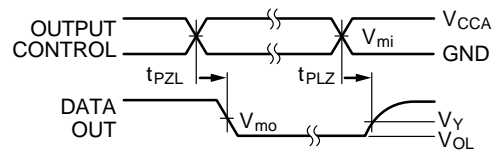
### AC LOAD TABLE

| $V_{CCO}$                          | $C_L$ | $R_L$        | $R_{tr1}$    |
|------------------------------------|-------|--------------|--------------|
| $1.2 \text{ V} \pm 0.1 \text{ V}$  | 15 pF | 2 k $\Omega$ | 2 k $\Omega$ |
| $1.5 \text{ V} \pm 0.1 \text{ V}$  | 15 pF | 2 k $\Omega$ | 2 k $\Omega$ |
| $1.8 \text{ V} \pm 0.15 \text{ V}$ | 15 pF | 2 k $\Omega$ | 2 k $\Omega$ |
| $2.5 \text{ V} \pm 0.2 \text{ V}$  | 15 pF | 2 k $\Omega$ | 2 k $\Omega$ |
| $3.3 \text{ V} \pm 0.3 \text{ V}$  | 15 pF | 2 k $\Omega$ | 2 k $\Omega$ |



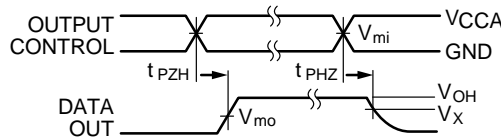
Input  $t_R = t_F = 2.0 \text{ ns}$ , 10% to 90%.  
 Input  $t_R = t_F = 2.5 \text{ ns}$ , 10% to 90%, @  $V_I = 3.0 \text{ V}$  to  $3.6 \text{ V}$  only.

**Figure 2. Waveform for Inverting and Non-Inverting Functions**



Input  $t_R = t_F = 2.0 \text{ ns}$ , 10% to 90%.  
 Input  $t_R = t_F = 2.5 \text{ ns}$ , 10% to 90%, @  $V_I = 3.0 \text{ V}$  to  $3.6 \text{ V}$  only.

**Figure 3. 3-State Output Low Enable and Disable Times for Low Voltage Logic**



Input  $t_R = t_F = 2.0 \text{ ns}$ , 10% to 90%.  
 Input  $t_R = t_F = 2.5 \text{ ns}$ , 10% to 90%, @  $V_I = 3.0 \text{ V}$  to  $3.6 \text{ V}$  only.

**Figure 4. 3-State Output High Enable and Disable Times for Low Voltage Logic**

| Symbol   | $V_{CC}$                          |                                   |                                    |                                   |                                   |
|----------|-----------------------------------|-----------------------------------|------------------------------------|-----------------------------------|-----------------------------------|
|          | $3.3 \text{ V} \pm 0.3 \text{ V}$ | $2.5 \text{ V} \pm 0.2 \text{ V}$ | $1.8 \text{ V} \pm 0.15 \text{ V}$ | $1.5 \text{ V} \pm 0.1 \text{ V}$ | $1.2 \text{ V} \pm 0.1 \text{ V}$ |
| $V_{mi}$ | $V_{CCI} / 2$                     | $V_{CCI} / 2$                     | $V_{CCI} / 2$                      | $V_{CCI} / 2$                     | $V_{CCI} / 2$                     |
| $V_{mo}$ | $V_{CCO} / 2$                     | $V_{CCO} / 2$                     | $V_{CCO} / 2$                      | $V_{CCO} / 2$                     | $V_{CCO} / 2$                     |
| $V_X$    | $V_{OH} - 0.3 \text{ V}$          | $V_{OH} - 0.15 \text{ V}$         | $V_{OH} - 0.15 \text{ V}$          | $V_{OH} - 0.1 \text{ V}$          | $V_{OH} - 0.1 \text{ V}$          |
| $V_Y$    | $V_{OL} + 0.3 \text{ V}$          | $V_{OL} + 0.15 \text{ V}$         | $V_{OL} + 0.15 \text{ V}$          | $V_{OL} + 0.1 \text{ V}$          | $V_{OL} + 0.1 \text{ V}$          |

7. For  $V_{mi}$ :  $V_{CCI} = V_{CCA}$  for Control Pins  $T/\bar{R}$  and  $\bar{OE}$  or  $V_{CCA} / 2$ .

# FXL2TD245

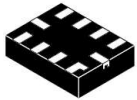
## ORDERING INFORMATION

| Order Number  | Package Number | Package Description  | Shipping†          |
|---------------|----------------|--|--------------------|
| FXL2TD245L10X | MAC010A        | 10-Lead, MicroPak, JEDEC MO255, 1.6 x 2.1 mm<br>(Pb-Free, Halide Free) | 5000 / 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.

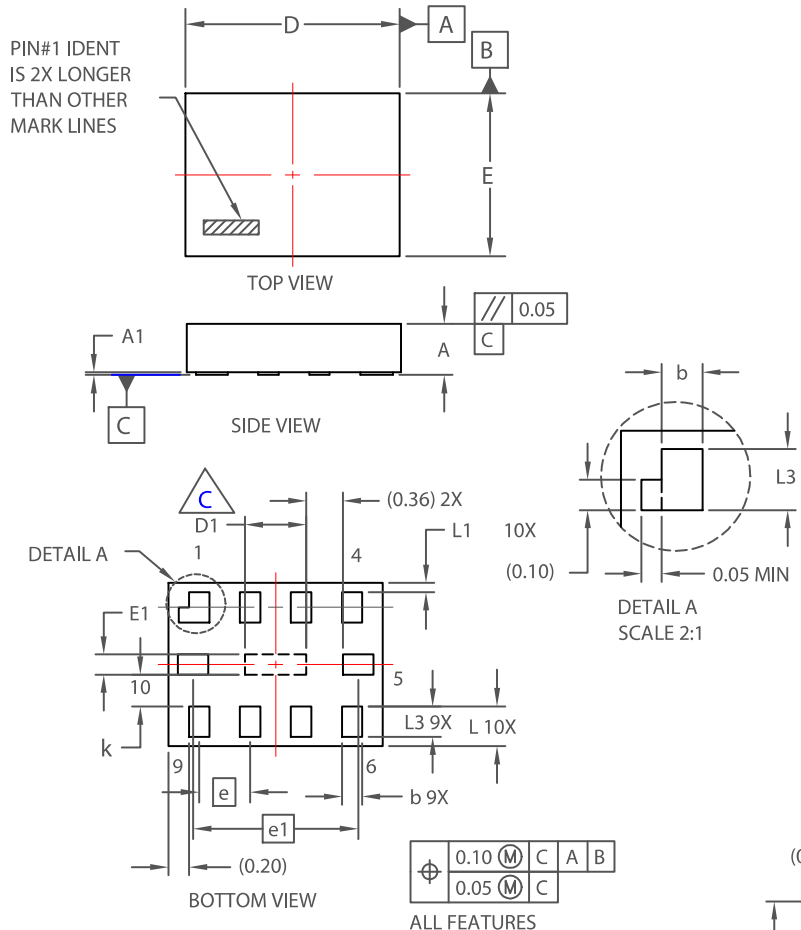
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CASE 523AZ  
ISSUE A

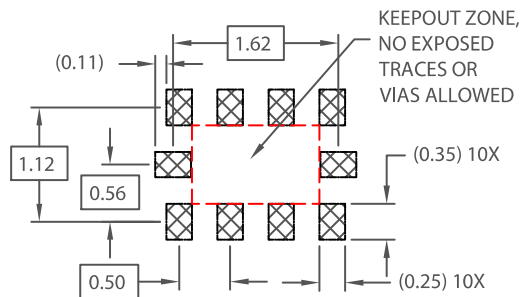
DATE 11 DEC 2019



NOTES:

- A. PACKAGE CONFORMS TO JEDEC REGISTRATION MO-255, VARIATION UABD.
- B. DIMENSIONS ARE IN MILLIMETERS.
- C. PRESENCE OF CENTER PAD IS PACKAGE SUPPLIER DEPENDENT. IF PRESENT IT IS NOT INTENDED TO BE SOLDERED AND HAS A BLACK OXIDE FINISH.
- D. DIMENSIONS WITHIN ( ) ARE UNCONTROLLED.

| DIM | MIN.     | NOM.  | MAX. |
|-----|----------|-------|------|
| A   | 0.50     | 0.55  | 0.65 |
| A1  | 0.00     | 0.025 | 0.05 |
| b   | 0.15     | 0.20  | 0.25 |
| D   | 2.00     | 2.10  | 2.20 |
| D1  | 0.55     | 0.60  | 0.65 |
| E   | 1.50     | 1.60  | 1.70 |
| E1  | 0.15     | 0.20  | 0.25 |
| e   | 0.50 BSC |       |      |
| e1  | 1.62 BSC |       |      |
| k   | 0.20     | --    | --   |
| L   | 0.25     | 0.30  | 0.42 |
| L1  | 0.00     | 0.09  | 0.15 |
| L3  | 0.25     | 0.30  | 0.35 |



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\*FOR ADDITIONAL INFORMATION ON OUR Pb-FREE STRATEGY AND SOLDERING DETAILS, PLEASE DOWNLOAD THE ON SEMICONDUCTOR SOLDERING AND MOUNTING TECHNIQUES REFERENCE MANUAL, SOLDERRM/D.

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