

FXLH1T45

Level Translator, 1-Bit Bidirectional

Configurable Voltage Supplies and Bushold Data Inputs

The FXLH1T45 is a single bit 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 (T/\bar{R}) input determines the direction of data flow through the device. The FXLH1T45 is designed so that the control pin (T/\bar{R}) is supplied by V_{CCA} .

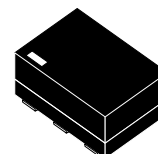
Features

- 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
- Bushold On Data Inputs Eliminates the Need for External Pull-up/Pull-down Resistors
- Control Input (T/\bar{R}) Levels are Referenced to V_{CCA} Voltage
- Packaged in the MicroPak 6 SIP6 (1.0 mm x 1.45 mm)
- ESD Protections Exceeds:
 - ◆ 4 kV HBM ESD (per JESD22-A114 & Mil Std 883e 3015.7)
 - ◆ 8 kV HBM I/O to GND ESD (per JESD22-A114 & Mil Std 883e 3015.7)
 - ◆ 1 kV CDM ESD (per ESD STM 5.3)
 - ◆ 200 V MM ESD (per JESD22-A115 & ESD STM5.2)



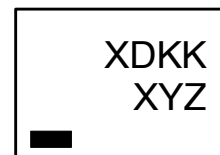
ON Semiconductor®

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SIP6 1.45x1.0
CASE 127EB

MARKING DIAGRAM



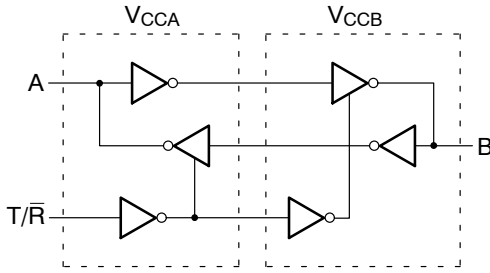
| | |
|----|-----------------------|
| XD | = Device Code |
| KK | = Lot Code |
| XY | = Numeric Date Code |
| Z | = Assembly Plant Code |

ORDERING INFORMATION

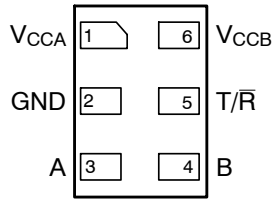
See detailed ordering and shipping information on page 9 of this data sheet.

FXLH1T45

FUNCTIONAL DIAGRAM



PINOUT



(Top Through View)

PIN ASSIGNMENT

| Pin Number | Terminal Name |
|------------|------------------|
| 1 | V _{CCA} |
| 2 | GND |
| 3 | A |
| 4 | B |
| 5 | T/ \bar{R} |
| 6 | V _{CCB} |

PIN DESCRIPTIONS

| Pin Names | Description |
|------------------|------------------------|
| T/ \bar{R} | Transmit/Receive Input |
| A | Side A Input or Output |
| B | Side B Input or Output |
| V _{CCA} | Side A Power Supply |
| V _{CCB} | Side B Power Supply |

FUNCTION TABLE

| Inputs (T/ \bar{R}) | Outputs |
|------------------------|---------------------|
| L | Bus B Data to Bus A |
| H | Bus A Data to Bus B |

H = HIGH Logic Level L = LOW Logic Level

POWER-UP/POWER-DOWN SEQUENCING

FXL translators offer an advantage in that either V_{CC} may be powered up first. This benefit derives from the chip design. When either V_{CC} is at 0V, outputs are in a HIGH-Impedance state. To ensure that bus contention, excessive currents, or oscillations do not occur, a proper power-up sequence is recommended.

The recommended power-up sequence is the following:

1. Apply power to either V_{CC}
2. Apply power to the T/ \bar{R} input (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 other V_{CC}

The recommended power-down sequence is the following:

4. Remove power from either V_{CC}
5. Remove power from other V_{CC}

FXLH1T45

ABSOLUTE MAXIMUM RATINGS

| Symbol | Parameter | Rating |
|--------------------|--|--|
| V_{CCA}, V_{CCB} | Supply Voltage | -0.5 V to +4.6 V |
| V_I | DC Input Voltage I/O Port A I/O Port B Control Input (T/ \bar{R}) | -0.5 V to +4.6 V -0.5 V to +4.6 V -0.5 V to +4.6 V |
| V_O | Output Voltage (Note 1) Outputs 3-STATE Outputs Active (A_n) Outputs Active (B_n) | -0.5 V to +4.6 V -0.5 V to $V_{CCA} + 0.5$ V -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 @ $V_O < 0$ V $V_O > V_{CC}$ | -50 mA +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 | ± 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.

RECOMMENDED OPERATING CONDITIONS (Note 2)

| Symbol | Parameter | Rating |
|------------------------|--|--|
| V_{CCA} or V_{CCB} | Power Supply Operating | 1.1 V to 3.6 V |
| V_i | Input Voltage Port A Port B Control Input (T/ \bar{R}) | 0.0 V to 3.6 V 0.0 V to 3.6 V 0.0 V to V_{CCA} |
| V_o | Output Current in I_{OH}/I_{OL} with V_{CC} @ 3.0 V to 3.6 V 2.3 V to 2.7 V 1.65 V to 1.95 V 1.4 V to 1.65 V 1.1 V to 1.4 V | ± 24 mA ± 18 mA ± 6 mA ± 2 mA ± 0.5 mA |
| T_A | Free Air Operating Temperature | -40°C to +125°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.

NOTES:

- I_O Absolute Maximum Rating must be observed.
- All unused inputs and I/O pins must be held at V_{CC1} or GND.

FXLH1T45

DC ELECTRICAL CHARACTERISTICS ($T_A = -40^\circ\text{C}$ to $+125^\circ\text{C}$, unless otherwise noted. Typical values are at $T_A = +25^\circ\text{C}$)

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

FXLH1T45

DC ELECTRICAL CHARACTERISTICS (continued) ($T_A = -40^\circ\text{C}$ to $+125^\circ\text{C}$, unless otherwise noted. Typical values are at $T_A = +25^\circ\text{C}$)

| Symbol | Parameter | Conditions | V _{CCI} (V) | V _{CCO} (V) | Min. | Typ. | Max. | Units |
|----------------------|--|---|----------------------|----------------------|-------|------|-------|-------|
| I _{I(HOLD)} | Bushold Input Minimum Drive Current | V _{IN} = 0.8 V, T _A = -40°C to +85°C | 3.0 | 3.0 | 75.0 | - | - | μA |
| | | V _{IN} = 0.8 V | 3.0 | 3.0 | 60.0 | - | - | |
| | | V _{IN} = 2 V, T _A = -40°C to +85°C | 3.0 | 3.0 | -75.0 | - | - | |
| | | V _{IN} = 2 V | 3.0 | 3.0 | -60 | - | - | |
| | | V _{IN} = 0.7 V | 2.3 | 2.3 | 45.0 | - | - | |
| | | V _{IN} = 1.6 V | 2.3 | 2.3 | -45.0 | - | - | |
| | | V _{IN} = 0.57 V | 1.65 | 1.65 | 25.0 | - | - | |
| | | V _{IN} = 1.07 V | 1.65 | 1.65 | -25.0 | - | - | |
| | | V _{IN} = 0.49 V | 1.4 | 1.4 | 10.0 | - | - | |
| | | V _{IN} = 0.91 V | 1.4 | 1.4 | -10.0 | - | - | |
| | | V _{IN} = 0.11 V | 1.1 | 1.1 | - | 4.0 | - | |
| | | V _{IN} = 0.99 V | 1.1 | 1.1 | - | -4.0 | - | |
| I _{I(OD)} | Bushold Input Over-Drive Current-to-Change State | (Note 5) | 3.6 | 3.6 | 450 | - | - | μA |
| | | (Note 6) | 3.6 | 3.6 | -450 | - | - | |
| | | (Note 5) | 2.7 | 2.7 | 300 | - | - | |
| | | (Note 6) | 2.7 | 2.7 | -300 | - | - | |
| | | (Note 5) | 1.95 | 1.95 | 200 | - | - | |
| | | (Note 6) | 1.95 | 1.95 | -200 | - | - | |
| | | (Note 5) | 1.6 | 1.6 | 120 | - | - | |
| | | (Note 6) | 1.6 | 1.6 | -120 | - | - | |
| | | (Note 5) | 1.4 | 1.4 | 80.0 | - | - | |
| | | (Note 6) | 1.4 | 1.4 | -80.0 | - | - | |
| I _{OFF} | Power Off Leakage Current | A _n , V _{CCA} = V _{CCI} , V _I = 0 V to 3.6 V | 0 | 3.6 | - | - | ±10.0 | μA |
| | | B _n , V _{CCB} = V _{CCI} , V _I = 0 V to 3.6 V | 0 | 3.6 | - | - | ±10.0 | |
| I _{OZ} | 3-STATE Output Leakage | A _n , V _{CCA} = V _{CCO} , V _O = 0 V or 3.6 V | 0 | 3.6 | - | - | ±10.0 | μA |
| | | B _n , V _{CCB} = V _{CCO} , V _O = 0 V or 3.6 V | 0 | 3.6 | - | - | ±10.0 | |
| I _{CCA/B} | Quiescent Supply Current (Note 7) | V _I = V _{CCI} or GND; I _O = 0 | 1.1-3.6 | 1.1-3.6 | - | - | 20.0 | μA |
| I _{CCA} | Quiescent Supply Current | V _I = V _{CCA} or GND; I _O = 0 | 0 | 1.1-3.6 | - | - | -10.0 | μA |
| | | V _I = V _{CCA} or GND; I _O = 0 | 1.1-3.6 | 0 | - | - | 10.0 | |
| I _{CCB} | Quiescent Supply Current | V _I = V _{CCB} or GND; I _O = 0 | 1.1-3.6 | 0 | - | - | -10.0 | μA |
| | | V _I = V _{CCB} or GND; I _O = 0 | 0 | 1.1-3.6 | - | - | 10.0 | |
| ΔI _{CCA/B} | Increase in I _{CC} per Input; Other Inputs at V _{CC} or GND | V _{IH} = 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.

NOTES:

3. V_{CCI} = the V_{CC} associated with the data input under test.
4. V_{CCO} = the V_{CC} associated with the output under test.
5. An external driver must source at least the specified current to switch LOW-to-HIGH.
6. An external driver must source at least the specified current to switch HIGH-to-LOW.
7. Reflects current per supply, V_{CCA} or V_{CCB}.

FXLH1T45

AC Electrical Characteristics ($T_A = -40^{\circ}\text{C}$ to $+125^{\circ}\text{C}$, unless otherwise noted. Typical values are at $T_A = +25^{\circ}\text{C}$.)

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

| Symbol | Parameter | $V_{CCB} = 3.0\text{ V to }3.6\text{ V}$ | | $V_{CCB} = 2.3\text{ V to }2.7\text{ V}$ | | $V_{CCB} = 1.65\text{ V to }1.95\text{ V}$ | | $V_{CCB} = 1.4\text{ V to }1.6\text{ V}$ | | $V_{CCB} = 1.1\text{ V to }1.3\text{ V}$ | | Units |
|--------------------------------|--|--|------|--|------|--|------|--|------|--|------|-------|
| | | Min. | Max. | Min. | Max. | Min. | Max. | Min. | Max. | Min. | Max. | |
| 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} (Note 8) | Output Enable T/\bar{R} to B | 0.4 | 7.2 | 0.5 | 7.6 | 0.7 | 9.1 | 0.8 | 10.5 | 1.6 | 25.7 | ns |
| | Output Enable T/\bar{R} to A | 0.4 | 7.3 | 0.4 | 7.8 | 1.0 | 8.8 | 2.0 | 10.5 | 2.8 | 30.0 | |
| t_{PHZ}, t_{PLZ} | Output Disable T/\bar{R} to B | - | 3.9 | - | 5.3 | - | 7.3 | - | 7.6 | - | 17.0 | ns |
| | $T_A = -40^{\circ}\text{C to }+85^{\circ}\text{C}$ | - | 5.6 | - | 4.2 | - | 6.3 | - | 6.9 | - | 17.0 | |
| | Output Disable T/\bar{R} to A | - | 4.9 | - | 5.8 | - | 3.7 | - | 5.7 | - | 3.7 | |
| | $T_A = -40^{\circ}\text{C to }+85^{\circ}\text{C}$ | - | 4.6 | - | 4.8 | - | 4.5 | - | 4.9 | - | 4.5 | |

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

| Symbol | Parameter | $V_{CCB} = 3.0\text{ V to }3.6\text{ V}$ | | $V_{CCB} = 2.3\text{ V to }2.7\text{ V}$ | | $V_{CCB} = 1.65\text{ V to }1.95\text{ V}$ | | $V_{CCB} = 1.4\text{ V to }1.6\text{ V}$ | | $V_{CCB} = 1.1\text{ V to }1.3\text{ V}$ | | Units |
|--------------------------------|--|--|------|--|------|--|------|--|------|--|------|-------|
| | | Min. | Max. | Min. | Max. | Min. | Max. | Min. | Max. | Min. | Max. | |
| 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} (Note 8) | Output Enable T/\bar{R} to B | 0.4 | 7.8 | 0.6 | 8.2 | 0.7 | 9.6 | 1.0 | 10.9 | 1.6 | 26.0 | ns |
| | Output Enable T/\bar{R} to A | 0.5 | 8.0 | 0.6 | 8.5 | 1.2 | 9.3 | 2.0 | 11.5 | 3.0 | 24.0 | |
| t_{PHZ}, t_{PLZ} | Output Disable T/\bar{R} to B | - | 4.1 | - | 4.3 | - | 7.0 | - | 6.7 | - | 17.0 | ns |
| | $T_A = -40^{\circ}\text{C to }+85^{\circ}\text{C}$ | - | 5.7 | - | 4.3 | - | 5.7 | - | 6.7 | - | 17.0 | |
| | Output Disable T/\bar{R} to A | - | 5.3 | - | 5.9 | - | 4.0 | - | 6.0 | - | 5.9 | |
| | $T_A = -40^{\circ}\text{C to }+85^{\circ}\text{C}$ | - | 4.8 | - | 4.8 | - | 4.8 | - | 5.0 | - | 4.8 | |

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

| Symbol | Parameter | $V_{CCB} = 3.0\text{ V to }3.6\text{ V}$ | | $V_{CCB} = 2.3\text{ V to }2.7\text{ V}$ | | $V_{CCB} = 1.65\text{ V to }1.95\text{ V}$ | | $V_{CCB} = 1.4\text{ V to }1.6\text{ V}$ | | $V_{CCB} = 1.1\text{ V to }1.3\text{ V}$ | | Units |
|--------------------------------|--|--|------|--|------|--|------|--|------|--|------|-------|
| | | Min. | Max. | Min. | Max. | Min. | Max. | Min. | Max. | Min. | Max. | |
| 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} (Note 8) | Output Enable T/\bar{R} to B | 0.8 | 9.0 | 1.0 | 9.5 | 1.3 | 10.7 | 1.4 | 12.1 | 2.0 | 27.0 | ns |
| | Output Enable T/\bar{R} to A | 0.7 | 10.5 | 0.7 | 10.8 | 1.6 | 10.9 | 2.5 | 13.0 | 3.2 | 25.0 | |
| t_{PHZ}, t_{PLZ} | Output Disable T/\bar{R} to B | - | 5.1 | - | 5.2 | - | 6.7 | - | 7.0 | - | 17.0 | ns |
| | $T_A = -40^{\circ}\text{C to }+85^{\circ}\text{C}$ | - | 5.7 | - | 5.6 | - | 5.8 | - | 7.0 | - | 17.0 | |
| | Output Disable T/\bar{R} to A | - | 5.0 | - | 6.5 | - | 5.0 | - | 5.0 | - | 5.0 | |
| | $T_A = -40^{\circ}\text{C to }+85^{\circ}\text{C}$ | - | 5.0 | - | 5.0 | - | 5.0 | - | 5.0 | - | 5.0 | |

FXLH1T45

V_{CCA} = 1.4 V to 1.6 V

| Symbol | Parameter | V _{CCB} = 3.0 V to 3.6 V | | V _{CCB} = 2.3 V to 2.7 V | | V _{CCB} = 1.65 V to 1.95 V | | V _{CCB} = 1.4 V to 1.6 V | | V _{CCB} = 1.1 V to 1.3 V | | Units |
|---|----------------------------------|-----------------------------------|------|-----------------------------------|------|-------------------------------------|------|-----------------------------------|------|-----------------------------------|------|-------|
| | | Min. | Max. | Min. | Max. | Min. | Max. | Min. | Max. | Min. | Max. | |
| 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} (Note 8) | Output Enable T/ \bar{R} to B | 1.5 | 10.3 | 1.5 | 10.8 | 2.0 | 12.0 | 2.0 | 13.3 | 2.5 | 28.0 | ns |
| | Output Enable T/ \bar{R} to A | 1.0 | 12.9 | 1.2 | 13.1 | 1.8 | 13.3 | 2.5 | 14.8 | 3.3 | 27.5 | |
| t _{PHZ} , t _{PLZ} | Output Disable T/ \bar{R} to B | – | 6.1 | – | 6.2 | – | 6.2 | – | 7.5 | – | 18.0 | ns |
| | T _A = –40°C to +85°C | – | 6.1 | – | 6.2 | – | 6.2 | – | 7.5 | – | 18.0 | |
| | Output Disable T/ \bar{R} to A | – | 8.0 | – | 7.5 | – | 6.0 | – | 6.0 | – | 6.0 | |
| | T _A = –40°C to +85°C | – | 6.5 | – | 6.3 | – | 6.0 | – | 6.0 | – | 6.0 | |

V_{CCA} = 1.1 V to 1.3 V

| Symbol | Parameter | V _{CCB} = 3.0 V to 3.6 V | | V _{CCB} = 2.3 V to 2.7 V | | V _{CCB} = 1.65 V to 1.95 V | | V _{CCB} = 1.4 V to 1.6 V | | V _{CCB} = 1.1 V to 1.3 V | | Units |
|---|----------------------------------|-----------------------------------|------|-----------------------------------|------|-------------------------------------|------|-----------------------------------|------|-----------------------------------|------|-------|
| | | Min. | Max. | Min. | Max. | Min. | Max. | Min. | Max. | Min. | Max. | |
| 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} (Note 8) | Output Enable T/ \bar{R} to B | 2.8 | 28.0 | 3.0 | 19.0 | 3.2 | 20.0 | 3.3 | 21.5 | 4.0 | 36.0 | ns |
| | Output Enable T/ \bar{R} to A | 2.4 | 37.0 | 2.1 | 29.0 | 2.5 | 30.0 | 3.5 | 32.0 | 4.0 | 44.0 | |
| t _{PHZ} , t _{PLZ} | Output Disable T/ \bar{R} to B | – | 15.0 | – | 7.0 | – | 8.0 | – | 10.0 | – | 20.0 | ns |
| | T _A = –40°C to +85°C | – | 15.0 | – | 7.0 | – | 8.0 | – | 10.0 | – | 20.0 | |
| | Output Disable T/ \bar{R} to A | – | 15.0 | – | 12.0 | – | 12.0 | – | 12.0 | – | 12.0 | |
| | T _A = –40°C to +85°C | – | 15.0 | – | 12.0 | – | 12.0 | – | 12.0 | – | 12.0 | |

NOTES:

8. The enable time, t_{PZH} or t_{PZL}, is the time for the FXLH1T45 to return to active operation after a direction change. The enable time specifies the worst-case delay from the time the T/ \bar{R} pin is switched until a valid output signal is expected. For example, to change direction to B-to-A operation, the T/ \bar{R} pin is switched from HIGH-to-LOW. The enable time for this case is found by adding the disable time for T/ \bar{R} to B to the propagation delay for B to A. The formulas for calculating enable times are the following:

$$\begin{aligned}
 t_{PZH} (T/\bar{R} \text{ to A}) &= t_{PLZ} (T/\bar{R} \text{ to B}) + t_{PLH} (B \text{ to A}) \\
 t_{PZL} (T/\bar{R} \text{ to A}) &= t_{PHZ} (T/\bar{R} \text{ to B}) + t_{PHL} (B \text{ to A}) \\
 t_{PZH} (T/\bar{R} \text{ to B}) &= t_{PLZ} (T/\bar{R} \text{ to A}) + t_{PLH} (A \text{ to B}) \\
 t_{PZL} (T/\bar{R} \text{ to B}) &= t_{PHZ} (T/\bar{R} \text{ to A}) + t_{PHL} (A \text{ to B})
 \end{aligned}$$

CAPACITANCE

| Symbol | Parameter | Conditions | T _A = +25°C | Units |
|------------------|--|---|------------------------|-------|
| | | | Typical | |
| C _{IN} | Input Capacitance Control Pin (T/ \bar{R}) | V _{CCA} = V _{CCB} = 3.3 V, V _I = 0 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 V, V _I = 0 V or V _{CCA/B} | 5.0 | pF |
| C _{PD} | Power Dissipation Capacitance | V _{CCA} = V _{CCB} = 3.3 V, V _I = 0 V or V _{CC} , F = 10 MHz | 20.0 | pF |

FXLH1T45

AC Loading and Waveforms

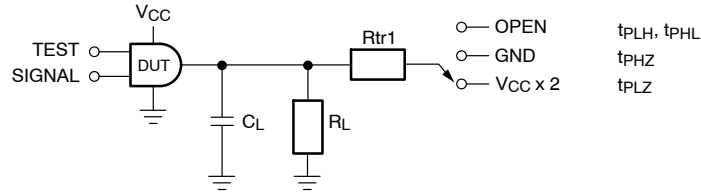


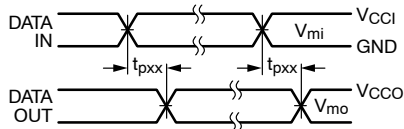
Figure 1. AC Test Circuit

AC TEST CIRCUIT

| Test | Switch |
|-----------------------|--|
| t_{PLH} , t_{PHL} | OPEN |
| t_{PLZ} | $V_{CCO} \times 2$ 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} | GND |

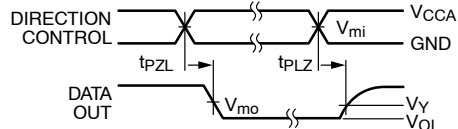
AC LOAD TABLE

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



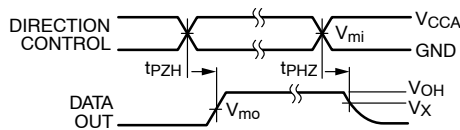
Input $t_R = t_F = 2.0 \text{ ns}$, 10% to 90%
 Input $t_R = t_F = 2.5 \text{ ns}$, 10% to 90%, @ $V_I = 3.0 \text{ V}$ to 3.6 V only

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 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 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 | $V_{OL} + 0.3 \text{ V}$ | $V_{OL} + 0.15 \text{ V}$ | $V_{OL} + 0.15 \text{ V}$ | $V_{OL} + 0.1 \text{ V}$ | $V_{OL} + 0.1 \text{ V}$ |

9. For V_{mi} : $V_{CCI} = V_{CCA}$ for Control Pin T/ \bar{R} or $V_{CCA} / 2$.

FXLH1T45

ORDERING INFORMATION

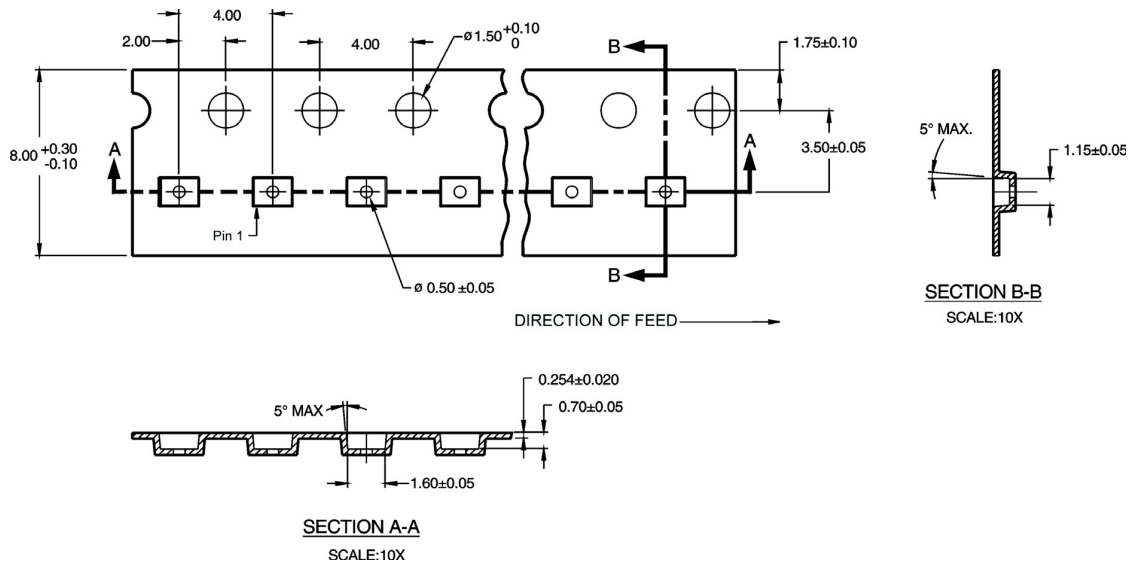
| Order Number | Case Number | Pb-Free | Package Description | Supplied As |
|--------------|-------------|---------|-----------------------------------|---------------------------|
| FXLH1T45L6X | 127EB | Yes | 6-Lead MicroPak/SIP6, 1.0 mm Wide | 5k Units on Tape and Reel |

Tape and Reel Specification

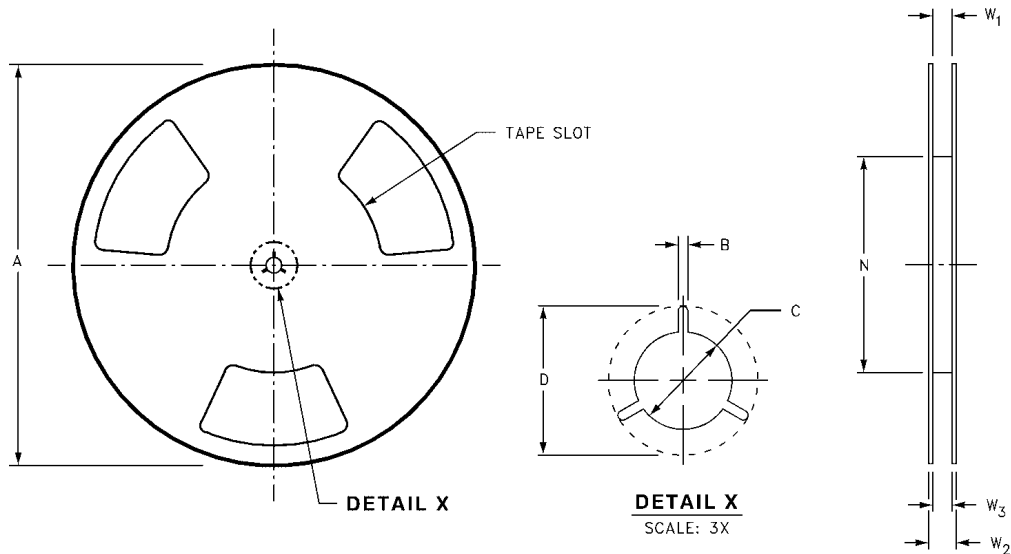
TAPE FORMAT FOR MICROPAK

| Package Designator | Tape Section | Number Cavities | Cavity Status | Cover Tape Status |
|--------------------|--------------------|-----------------|---------------|-------------------|
| L6X | Leader (Start End) | 125 (typ) | Empty | Sealed |
| | Carrier | 5000 | Filled | Sealed |
| | Trailer (Hub End) | 75 (typ) | Empty | Sealed |

Tape Dimensions Millimeters



Reel Dimensions Inches (Millimeters)



| Tape Size | A | B | C | D | N | W1 | W2 | W3 |
|-----------|----------------|-----------------|------------------|------------------|------------------|---|------------------|--|
| 8 mm | 7.0 (177.8) | 0.059 (1.50) | 0.512 (13.00) | 0.795 (20.20) | 2.165 (55.00) | $0.331 + 0.059 / -0.000$ (8.40 + 1.50 / -0.00) | 0.567 (14.40) | $W1 + 0.078 / -0.039$ (W1 + 2.00 / -1.00) |

MECHANICAL CASE OUTLINE

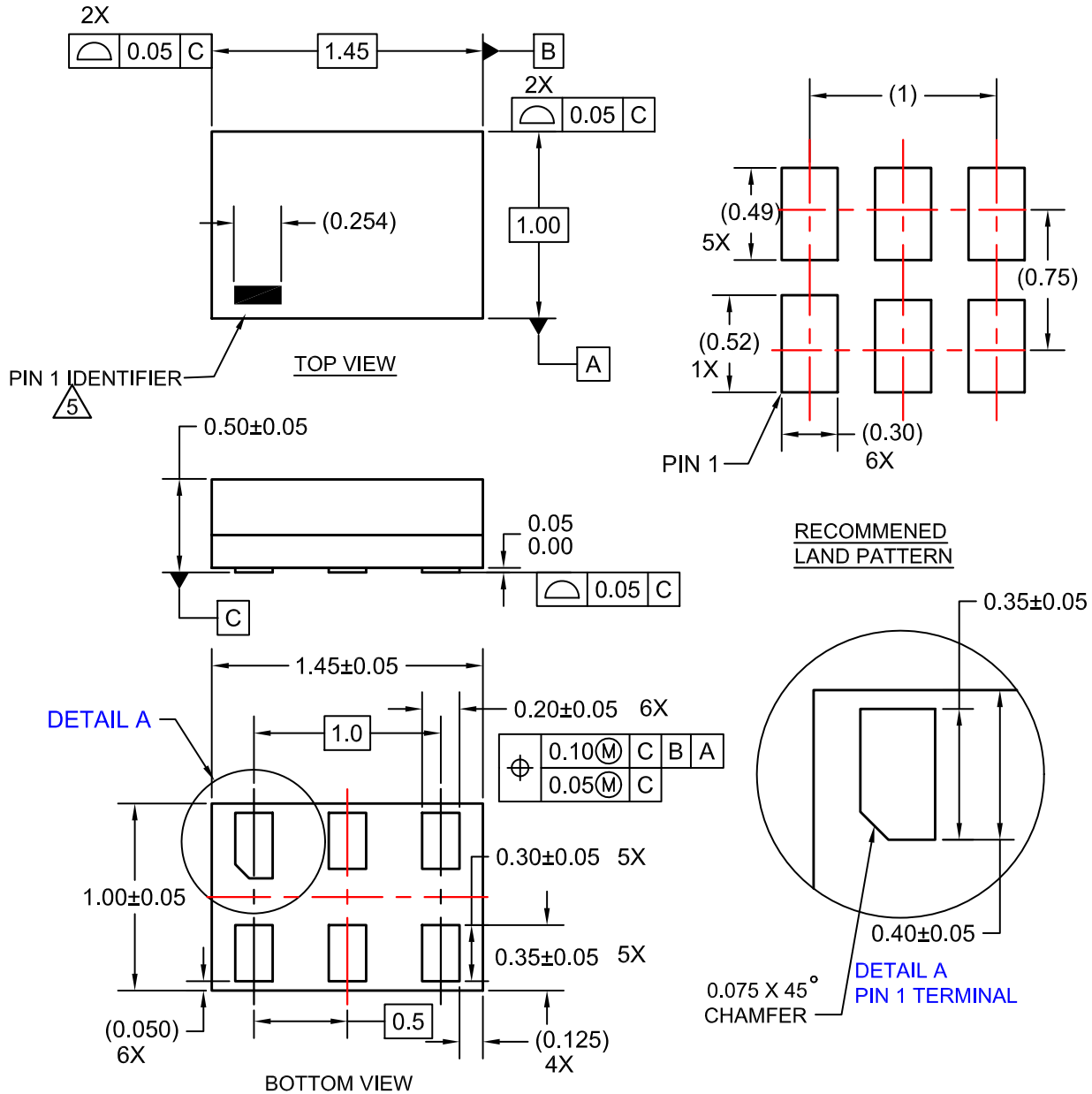
PACKAGE DIMENSIONS

ON Semiconductor®



SIP6 1.45X1.0
CASE 127EB
ISSUE O

DATE 31 AUG 2016



NOTES:

1. CONFORMS TO JEDEC STANDARD MO-252 VARIATION UAAD
2. DIMENSIONS ARE IN MILLIMETERS
3. DRAWING CONFORMS TO ASME Y14.5M-2009
4. PIN ONE IDENTIFIER IS 2X LENGTH OF ANY OTHER LINE IN THE MARK CODE LAYOUT.

| | | |
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