



FXLA108

Low-Voltage Dual-Supply 8-Bit Voltage Translator with Configurable Voltage Supplies and Signal Levels, 3-State Outputs, and Auto Direction Sensing

Features

- Bi-Directional Interface between Two Levels: from 1.1V to 3.6V
- Fully Configurable: Inputs and Outputs Track V_{CC}
- Non-Preferential Power-Up; 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
- Bus-Hold on Data Inputs Eliminates the Need for Pull-Up Resistors
- Control Input (/OE) Referenced to V_{CCA} Voltage
- Packaged in 20-Terminal DQFN (2.5mm x 4.5mm)
- Direction Control Not Necessary
- 100Mbps Throughput when Translating Between 1.8V and 2.5V
- ESD Protection Exceeds:
 - 8kV HBM (per JESD22-A114 & Mil Std 883e 3015.7)
 - 2kV CDM (per ESD STM 5.3)

Description

The FXLA108 is a configurable dual-voltage supply translator for both uni-directional and bi-directional voltage translation between two logic levels. The device allows translation between voltages as high as 3.6V to as low as 1.1V. 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: 1.2V, 1.5V, 1.8V, 2.5V, and 3.3V.

The device remains in three-state until both V_{CCs} 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 /OE input, when HIGH, disables both the A and B ports by placing them in a 3-state condition. The /OE input is supplied by V_{CCA} .

The FXLA108 supports bi-directional translation without the need for a direction control pin. The two ports of the device have auto-direction sense capability. Either port may sense an input signal and transfer it as an output signal to the other port.

Applications

- Laptops, Notebooks,
- Routers, Switches

Ordering Information

| Part Number | Operating Temperature Range | Eco Status | Package | Packing Method |
|-------------|-----------------------------|------------|--|----------------|
| FXLA108BQX | -40 to 85°C | Green | 20-Terminal DQFN 2.5mm x 4.5mm Package | Tape and Reel |

For Fairchild's definition of "green" Eco Status, please visit: http://www.fairchildsemi.com/company/green/rohs_green.html.

Pin Configuration

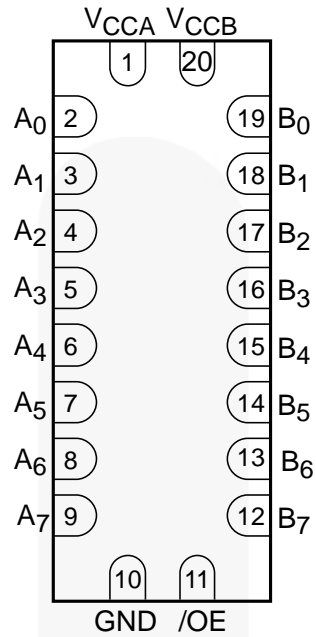


Figure 1. Pin Configuration (Top Through View)

Pin Definitions

| Pin # | Name | Description |
|-------|------------------|----------------------------------|
| 1 | V _{CCA} | A-Side Power Supply |
| 2 | A ₀ | A-Side Inputs or 3-State Outputs |
| 3 | A ₁ | A-Side Inputs or 3-State Outputs |
| 4 | A ₂ | A-Side Inputs or 3-State Outputs |
| 5 | A ₃ | A-Side Inputs or 3-State Outputs |
| 6 | A ₄ | A-Side Inputs or 3-State Outputs |
| 7 | A ₅ | A-Side Inputs or 3-State Outputs |
| 8 | A ₆ | A-Side Inputs or 3-State Outputs |
| 9 | A ₇ | A-Side Inputs or 3-State Outputs |
| 10 | GND | Ground |
| 11 | /OE | Output Enable Input |
| 12 | B ₇ | B-Side Inputs or 3-State Outputs |
| 13 | B ₆ | B-Side Inputs or 3-State Outputs |
| 14 | B ₅ | B-Side Inputs or 3-State Outputs |
| 15 | B ₄ | B-Side Inputs or 3-State Outputs |
| 16 | B ₃ | B-Side Inputs or 3-State Outputs |
| 17 | B ₂ | B-Side Inputs or 3-State Outputs |
| 18 | B ₁ | B-Side Inputs or 3-State Outputs |
| 19 | B ₀ | B-Side Inputs or 3-State Outputs |
| 20 | V _{CCB} | B-Side Power Supply |

Functional Diagram

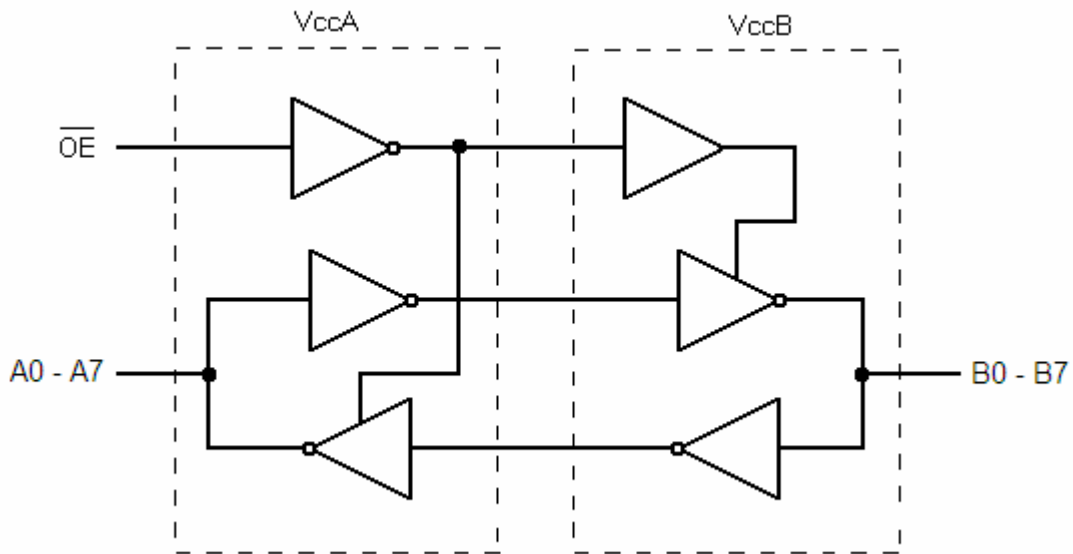


Figure 2. Functional Diagram

Functional Table

| Control | Outputs |
|------------------|------------------|
| \overline{OE} | |
| LOW Logic Level | Normal Operation |
| HIGH Logic Level | 3-State |

Absolute Maximum Ratings

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only.

| Symbol | Parameter | Conditions | Min. | Max. | Unit |
|-----------------|--|-------------------------|------|-----------------|------|
| V_{CC} | Supply Voltage | V_{CCA} | -0.5 | 4.6 | V |
| | | V_{CCB} | -0.5 | 4.6 | |
| V_I | DC Input Voltage | I/O Ports A and B | -0.5 | 4.6 | V |
| | | Control Input (/OE) | -0.5 | 4.6 | |
| V_O | Output Voltage ⁽²⁾ | Output 3-State | -0.5 | 4.6 | V |
| | | Output Active (A_n) | -0.5 | $V_{CCA} + 0.5$ | |
| | | Output Active (B_n) | -0.5 | $V_{CCB} + 0.5$ | |
| I_{IK} | DC Input Diode Current | $V_I < 0V$ | | -50 | mA |
| I_{OK} | DC Output Diode Current | $V_O < 0V$ | | -50 | mA |
| | | $V_O > V_{CC}$ | | +50 | |
| I_{OH}/I_{OL} | DC Output Source/Sink Current | | -50 | +50 | mA |
| I_{CC} | DC V_{CC} or Ground Current (per Supply Pin) | | | ±100 | mA |
| T_{STG} | Storage Temperature Range | | -65 | +150 | °C |

Notes:

- I_O absolute maximum ratings must be observed.
- All unused inputs and input/outputs must be held at V_{CCi} or GND.

Recommended 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. Fairchild does not recommend exceeding them or designing to Absolute Maximum Ratings.

| Symbol | Parameter | Conditions | Min. | Max. | Unit |
|----------|---------------------------------|----------------------------------|------|-----------|------|
| V_{CC} | Power Supply | Operating V_{CCA} or V_{CCB} | 1.1 | 3.6 | V |
| V_{IN} | Input Voltage | Ports A and B | 0 | 3.6 | V |
| | | Control Input (/OE) | 0 | V_{CCA} | V |
| T_A | Operating Temperature, Free Air | | -40 | +85 | °C |
| dt/dV | Minimum Input Edge Rate | $V_{CCA/B} = 1.1$ to $3.6V$ | | 10 | ns/V |

Power-Up/Power-Down Sequence

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. The control input (/OE) is designed to track the V_{CCA} supply. A pull-up resistor tying /OE to V_{CCA} should be used to ensure that bus contention, excessive currents, or oscillations do not occur during power-up or power-down. The size of the pull-up resistor is based upon the current-sinking capability of the device driving the /OE pin.

The recommended power-up sequence is:

1. Apply power to the first V_{CC} .
2. Apply power to the second V_{CC} .
3. Drive the /OE input LOW to enable the device.

The recommended power-down sequence is:

1. Drive /OE input HIGH to disable the device.
2. Remove power from either V_{CC} .
3. Remove power from other V_{CC} .

DC Electrical Characteristics

T_A = -40 to 85°C.

| Symbol | Parameter | Conditions | V _{CCA} (V) | V _{CCB} (V) | Min. | Typ. | Max. | Units |
|-----------------------------|--|---|----------------------|----------------------|------------------------|------|----------------------|-------|
| V _{IHA} | High-Level Input Voltage | Data Inputs A _n Control Pin /OE | 2.70 to 3.60 | 1.10 to 3.60 | 2.00 | | | V |
| | | | 2.30 to 2.70 | | 1.60 | | | |
| | | | 1.65 to 2.30 | | .65xV _{CCA} | | | |
| | | | 1.40 to 1.65 | | .65xV _{CCA} | | | |
| | | | 1.10 to 1.40 | | .90xV _{CCA} | | | |
| V _{IHB} | High-Level Input Voltage | Data Inputs B _n | 2.70 to 3.60 | 1.10 to 3.60 | 2.00 | | | V |
| | | | 2.30 to 2.70 | | 1.60 | | | |
| | | | 1.65 to 2.30 | | .65xV _{CCB} | | | |
| | | | 1.40 to 1.65 | | .65xV _{CCB} | | | |
| | | | 1.10 to 1.40 | | .90xV _{CCB} | | | |
| V _{I_{LA}} | Low-Level Input Voltage | Data Inputs A _n Control Pin /OE | 2.70 to 3.60 | 1.10 to 3.60 | | | .80 | V |
| | | | 2.30 to 2.70 | | | | .70 | |
| | | | 1.65 to 2.30 | | | | .35xV _{CCA} | |
| | | | 1.40 to 1.65 | | | | .35xV _{CCA} | |
| | | | 1.10 to 1.40 | | | | .10xV _{CCA} | |
| V _{I_{LB}} | Low-Level Input Voltage | Data Inputs B _n | 2.70 to 3.60 | 1.10 to 3.60 | | | .80 | V |
| | | | 2.30 to 2.70 | | | | .70 | |
| | | | 1.65 to 2.30 | | | | .35xV _{CCB} | |
| | | | 1.40 to 1.65 | | | | .35xV _{CCB} | |
| | | | 1.10 to 1.40 | | | | .10xV _{CCB} | |
| V _{OHA} | High-Level Output Voltage ⁽³⁾ | I _{OH} = -4μA | 1.10 to 3.60 | 1.10 to 3.60 | V _{CCA} - .40 | | | V |
| V _{OHB} | | I _{OH} = -4μA | 1.10 to 3.60 | 1.10 to 3.60 | V _{CCB} - .40 | | | |
| V _{OLA} | Low-Level Output Voltage ⁽³⁾ | I _{OL} = 4μA | 1.10 to 3.60 | 1.10 to 3.60 | | | .4 | V |
| V _{OLB} | | I _{OL} = 4μA | 1.10 to 3.60 | 1.10 to 3.60 | | | .4 | |
| I _{I(HOLD)} | Bus-Hold Input Minimum Drive Current | V _{IN} = 0.80V | 3.00 | 3.00 | 75.0 | | | μA |
| | | V _{IN} = 2.00V | 3.00 | 3.00 | -75.0 | | | |
| | | V _{IN} = 0.7V | 2.30 | 2.30 | 45.0 | | | |
| | | V _{IN} = 1.60V | 2.30 | 2.30 | -45.0 | | | |
| | | V _{IN} = 0.57V | 1.65 | 1.65 | 25.0 | | | |
| | | V _{IN} = 1.07V | 1.65 | 1.65 | -25.0 | | | |
| | | V _{IN} = 0.49V | 1.40 | 1.40 | 11.0 | | | |
| | | V _{IN} = 0.91V | 1.40 | 1.40 | -11.0 | | | |
| | | V _{IN} = 0.11V | 1.10 | 1.10 | | 4.0 | | |
| | | V _{IN} = 0.99V | 1.10 | 1.10 | | -4.0 | | |

Continued on following page...

DC Electrical Characteristics (Continued)

T_A=-40 to 85°C.

| Symbol | Parameter | Conditions | V _{CCA} (V) | V _{CCB} (V) | Min. | Max. | Units |
|---------------------|--|---|----------------------|----------------------|---------|-------|-------|
| I _{I(ODH)} | Bus-Hold Input Overdrive High Current ⁽⁴⁾ | Data Inputs A _n , B _n | 3.60 | 3.60 | 450.00 | | μA |
| | | | 2.70 | 2.70 | 300.00 | | |
| | | | 1.95 | 1.95 | 200.00 | | |
| | | | 1.60 | 1.60 | 120.00 | | |
| | | | 1.40 | 1.40 | 80.00 | | |
| I _{I(ODL)} | Bus-Hold Input Overdrive Low Current ⁽⁵⁾ | Data Inputs A _n , B _n | 3.60 | 3.60 | -450.00 | | μA |
| | | | 2.70 | 2.70 | -300.00 | | |
| | | | 1.95 | 1.95 | -200.00 | | |
| | | | 1.60 | 1.60 | -120.00 | | |
| | | | 1.40 | 1.40 | -80.00 | | |
| I _I | Input Leakage Current | Control Inputs /OE, V _I =V _{CCA} or GND | 1.10 to 3.60 | 3.60 | | ±1.0 | μA |
| I _{OFF} | Power-Off Leakage Current | A _n V _O =0V to 3.6V | 0 | 3.6 | | ±2.0 | μA |
| | | B _n V _O =0V to 3.6V | 3.60 | 0 | | ±2.0 | |
| I _{OZ} | 3-State Output Leakage | A _n , B _n V _O =0V or 3.6V, /OE=V _{IH} | 3.6 | 3.60 | | ±5.0 | μA |
| | | A _n V _O =0V or 3.6V, /OE=GND | 3.60 | 0 | | ±5.0 | |
| | | B _n V _O =0V or 3.6V, /OE=GND | 0 | 3.60 | | ±5.0 | |
| I _{CCA/B} | Quiescent Supply Current ^(6,7) | V _I =V _{CCI} or GND; I _O =0, /OE=GND | 1.10 to 3.60 | 1.10 to 3.60 | | 10.0 | μA |
| I _{CCZ} | | V _I =V _{CCI} or GND; I _O =0, /OE=V _{IH} | 1.10 to 3.60 | 1.10 to 3.60 | | 10.0 | μA |
| I _{CCA} | Quiescent Supply Current | V _I =V _{CCB} or GND; I _O =0 B-to-A Direction, /OE=GND | 0 | 1.10 to 3.60 | | -10.0 | μA |
| | | V _I =V _{CCA} or GND; I _O =0 A-to-B Direction | 1.10 to 3.60 | 0 | | 10.0 | |
| I _{CCB} | Quiescent Supply Current | V _I =V _{CCA} or GND; I _O =0, A-to-B Direction, /OE=GND | 1.10 to 3.60 | 0 | | -10.0 | μA |
| | | V _I =V _{CCB} or GND; I _O =0 B-to-A Direction | 0 | 1.10 to 3.60 | | 10.0 | |

Notes:

3. This is the output voltage for static conditions. Dynamic drive specifications are given in the Dynamic Output Electrical Characteristics table.
4. An external drive must source at least the specified current to switch LOW-to-HIGH.
5. An external drive must source at least the specified current to switch HIGH-to-LOW.
6. V_{CCI} is the V_{CC} associated with the input side.
7. Reflects current per supply, V_{CCA} or V_{CCB}.

Dynamic Output Electrical Characteristic

A Port (A_n)

Output Load: C_L=15pF, R_L ≥ MΩ (C_{I/O}=4pF), T_A=-40 to 85°C

| Symbol | Parameter | V _{CCA} =3.0V to 3.6V | | V _{CCA} =2.3V to 2.7V | | V _{CCA} =1.65V to 1.95V | | V _{CCA} =1.4V to 1.6V | | V _{CCA} =1.1V to 1.3V | Units |
|-------------------|--|-----------------------------------|------|-----------------------------------|------|-------------------------------------|------|-----------------------------------|------|-----------------------------------|-------|
| | | Typ. | Max. | Typ. | Max. | Typ. | Max. | Typ. | Max. | Typ. | |
| t _{rise} | Output Rise Time A Port ⁽⁹⁾ | | 3.0 | | 3.5 | | 4.0 | | 5.0 | 7.5 | ns |
| t _{fall} | Output Fall Time A Port ⁽¹⁰⁾ | | 3.0 | | 3.5 | | 4.0 | | 5.0 | 7.5 | ns |
| I _{OHD} | Dynamic Output Current High ⁽⁹⁾ | -11.4 | | -7.5 | | -4.7 | | -3.2 | | -1.7 | mA |
| I _{OLD} | Dynamic Output Current Low ⁽¹⁰⁾ | +11.4 | | +7.5 | | +4.7 | | +3.2 | | +1.7 | mA |

B Port (B_n)

Output Load: C_L=15pF, R_L ≥ MΩ (C_{I/O}=5pF), T_A=-40 to 85°C

| Symbol | Parameter | V _{CCB} =3.0V to 3.6V | | V _{CCB} =2.3V to 2.7V | | V _{CCB} =1.65V to 1.95V | | V _{CCB} =1.4V to 1.6V | | V _{CCB} =1.1V to 1.3V | Units |
|-------------------|--|-----------------------------------|------|-----------------------------------|------|-------------------------------------|------|-----------------------------------|------|-----------------------------------|-------|
| | | Typ. | Max. | Typ. | Max. | Typ. | Max. | Typ. | Max. | Typ. | |
| t _{rise} | Output Rise Time B Port ⁽⁹⁾ | | 3.0 | | 3.5 | | 4.0 | | 5.0 | 7.5 | ns |
| t _{fall} | Output Fall Time B Port ⁽¹⁰⁾ | | 3.0 | | 3.5 | | 4.0 | | 5.0 | 7.5 | ns |
| I _{OHD} | Dynamic Output Current High ⁽⁹⁾ | -12.0 | | -7.9 | | -5.0 | | -3.4 | | -1.8 | mA |
| I _{OLD} | Dynamic Output Current Low ⁽¹⁰⁾ | +12.0 | | +7.9 | | +5.0 | | +3.4 | | +1.8 | mA |

Notes:

8. Dynamic output characteristics are guaranteed, but not tested.
9. See Figure 7.
10. See Figure 8.

AC Characteristics

 $V_{CCA} = 3.0V$ to $3.6V$, $T_A = -40$ to $85^\circ C$

| Symbol | Parameter | $V_{CCB}=3.0V$ to $3.6V$ | | $V_{CCB}=2.3V$ to $2.7V$ | | $V_{CCB}=1.65V$ to $1.95V$ | | $V_{CCB}=1.4V$ to $1.6V$ | | $V_{CCB}=1.1V$ to $1.3V$ | Units |
|--------------------|-----------------------------------|-----------------------------|------|-----------------------------|------|-------------------------------|------|-----------------------------|------|-----------------------------|---------|
| | | Min. | Max. | Min. | Max. | Min. | Max. | Min. | Max. | Typ. | |
| t_{PLH}, t_{PHL} | A to B | 0.2 | 4.0 | 0.3 | 4.2 | 0.5 | 5.4 | 0.6 | 6.8 | 6.9 | ns |
| | B to A | 0.2 | 4.0 | 0.2 | 4.1 | 0.3 | 5.0 | 0.5 | 6.0 | 4.5 | ns |
| t_{PZL}, t_{PZH} | /OE to A, /OE to B | | 1.7 | | 1.7 | | 1.7 | | 1.7 | 1.7 | μs |
| t_{SKEW} | A Port, B Port ⁽¹¹⁾ | | 0.5 | | 0.5 | | 0.5 | | 1.0 | 1.0 | ns |

 $V_{CCA} = 2.3V$ to $2.7V$, $T_A = -40$ to $85^\circ C$

| Symbol | Parameter | $V_{CCB}=3.0V$ to $3.6V$ | | $V_{CCB}=2.3V$ to $2.7V$ | | $V_{CCB}=1.65V$ to $1.95V$ | | $V_{CCB}=1.4V$ to $1.6V$ | | $V_{CCB}=1.1V$ to $1.3V$ | Units |
|--------------------|-----------------------------------|-----------------------------|------|-----------------------------|------|-------------------------------|------|-----------------------------|------|-----------------------------|---------|
| | | Min. | Max. | Min. | Max. | Min. | Max. | Min. | Max. | Typ. | |
| t_{PLH}, t_{PHL} | A to B | 0.2 | 4.1 | 0.4 | 4.5 | 0.5 | 5.6 | 0.8 | 6.9 | 7.0 | ns |
| | B to A | 0.3 | 4.2 | 0.4 | 4.5 | 0.5 | 5.5 | 0.5 | 6.5 | 4.8 | ns |
| t_{PZL}, t_{PZH} | /OE to A, /OE to B | | 1.7 | | 1.7 | | 1.7 | | 1.7 | 1.7 | μs |
| t_{SKEW} | A Port, B Port ⁽¹¹⁾ | | 0.5 | | 0.5 | | 0.5 | | 1.0 | 1.0 | ns |

 $V_{CCA} = 1.65V$ to $1.95V$, $T_A = -40$ to $85^\circ C$

| Symbol | Parameter | $V_{CCB}=3.0V$ to $3.6V$ | | $V_{CCB}=2.3V$ to $2.7V$ | | $V_{CCB}=1.65V$ to $1.95V$ | | $V_{CCB}=1.4V$ to $1.6V$ | | $V_{CCB}=1.1V$ to $1.3V$ | Units |
|--------------------|-----------------------------------|-----------------------------|------|-----------------------------|------|-------------------------------|------|-----------------------------|------|-----------------------------|---------|
| | | Min. | Max. | Min. | Max. | Min. | Max. | Min. | Max. | Typ. | |
| t_{PLH}, t_{PHL} | A to B | 0.3 | 5.0 | 0.5 | 5.5 | 0.8 | 6.7 | 0.9 | 7.5 | 7.5 | ns |
| | B to A | 0.5 | 5.4 | 0.5 | 5.6 | 0.8 | 6.7 | 1.0 | 7.0 | 5.4 | ns |
| t_{PZL}, t_{PZH} | /OE to A, /OE to B | | 1.7 | | 1.7 | | 1.7 | | 1.7 | 1.7 | μs |
| t_{SKEW} | A Port, B Port ⁽¹¹⁾ | | 0.5 | | 0.5 | | 0.5 | | 1.0 | 1.0 | ns |

Note:

11. Skew is the variation of propagation delay between output signals and applies only to output signals on the same port A_n or B_n) and switching with the same polarity (LOW-to-HIGH or HIGH-to-LOW) (see Figure 10). Skew is guaranteed, but not tested.

AC Characteristics (Continued) $V_{CCA} = 1.4V$ to $1.6V$, $T_A = -40$ to $85^\circ C$

| Symbol | Parameter | $V_{CCB}=3.0V$ to 3.6V | | $V_{CCB}=2.3V$ to 2.7V | | $V_{CCB}=1.65V$ to 1.95V | | $V_{CCB}=1.4V$ to 1.6V | | $V_{CCB}=1.1V$ to 1.3V | Units |
|--------------------|-----------------------------------|---------------------------|------|---------------------------|------|-----------------------------|------|---------------------------|------|---------------------------|---------|
| | | Min. | Max. | Min. | Max. | Min. | Max. | Min. | Max. | Typ. | |
| t_{PLH}, t_{PHL} | A to B | 0.5 | 6.0 | 0.5 | 6.5 | 1.0 | 7.0 | 1.0 | 8.5 | 7.9 | ns |
| | B to A | 0.6 | 6.8 | 0.8 | 6.9 | 0.9 | 7.5 | 1.0 | 8.5 | 6.1 | ns |
| t_{PZL}, t_{PZH} | /OE to A, /OE to B | | 1.7 | | 1.7 | | 1.7 | | 1.7 | 1.7 | μs |
| t_{SKEW} | A Port, B Port ⁽¹²⁾ | | 1.0 | | 1.0 | | 1.0 | | 1.0 | 1.0 | ns |

 $V_{CCA} = 1.1V$ to $1.3V$, $T_A = -40$ to $85^\circ C$

| Symbol | Parameter | $V_{CCB}=3.0V$ to 3.6V | $V_{CCB}=2.3V$ to 2.7V | $V_{CCB}=1.65V$ to 1.95V | $V_{CCB}=1.4V$ to 1.6V | $V_{CCB}=1.1V$ to 1.3V | Units |
|--------------------|--------------------------------|---------------------------|---------------------------|-----------------------------|---------------------------|---------------------------|---------|
| | | Typ. | Typ. | Typ. | Typ. | Typ. | |
| t_{PLH}, t_{PHL} | A to B | 4.6 | 4.8 | 5.4 | 6.2 | 9.2 | ns |
| | B to A | 6.8 | 7.0 | 7.4 | 7.8 | 9.1 | ns |
| t_{PZL}, t_{PZH} | /OE to A, /OE to B | 1.7 | 1.7 | 1.7 | 1.7 | 1.7 | μs |
| t_{SKEW} | A Port, B Port ⁽¹²⁾ | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | ns |

Note:

12. Skew is the variation of propagation delay between output signals and applies only to output signals on the same port (A_n or B_n) and switching with the same polarity (LOW-to-HIGH or HIGH-to-LOW) (see Figure 10). Skew is guaranteed, but not tested.

Maximum Data Rate^(13, 14)

$T_A = -40$ to 85°C .

| V_{CCA} | $V_{CCB}=3.0\text{V}$ to 3.6V | $V_{CCB}=2.3\text{V}$ to 2.7V | $V_{CCB}=1.65\text{V}$ to 1.95V | $V_{CCB}=1.4\text{V}$ to 1.6V | $V_{CCB}=1.1\text{V}$ to 1.3V | Units |
|--|---|---|---|---|---|-------|
| | Min. | Min. | Min. | Min. | Typ. | |
| $V_{CCA}=3.00\text{V}$ to 3.60V | 140 | 120 | 100 | 80 | 40 | Mbps |
| $V_{CCA}=2.30\text{V}$ to 2.70V | 120 | 120 | 100 | 80 | 40 | Mbps |
| $V_{CCA}=1.65\text{V}$ to 1.95V | 100 | 100 | 80 | 60 | 40 | Mbps |
| $V_{CCA}=1.40\text{V}$ to 1.60V | 80 | 80 | 60 | 60 | 40 | Mbps |
| $V_{CCA}=1.10\text{V}$ to 1.30V | Typ. | Typ. | Typ. | Typ. | Typ. | |
| | 40 | 40 | 40 | 40 | 40 | Mbps |

Notes:

13. Maximum data rate is guaranteed, but not tested.

14. Maximum data rate is specified in megabits per second (see Figure 9). It is equivalent to two times the F-toggle frequency, specified in megahertz. For example, 100Mbps is equivalent to 50MHz.

Capacitance

| Symbol | Parameter | Conditions | $T_A = +25^\circ\text{C}$ Typical | Units | |
|-----------|-------------------------------------|--|--------------------------------------|-------|----|
| C_{IN} | Input Capacitance Control Pin (/OE) | $V_{CCA}=V_{CCB}=\text{GND}$ | 3 | pF | |
| $C_{I/O}$ | Input/Output Capacitance | $V_{CCA}=V_{CCB}=3.3\text{V}$, /OE= V_{CCA} | A_n | 4 | pF |
| | | | B_n | 5 | |
| C_{pd} | Power Dissipation Capacitance | $V_{CCA}=V_{CCB}=3.3\text{V}$, $V_I=0\text{V}$ or V_{CC} , $f=10\text{MHz}$ | 25 | pF | |

Test Diagrams

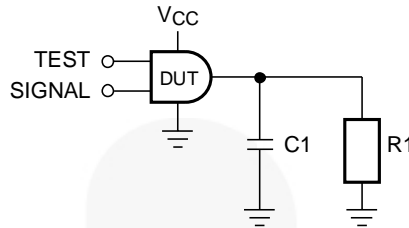


Figure 3. Test Circuit

Table 1. AC Test Conditions

| Test | Input Signal | Output Enable Control |
|-----------------------|--------------|-----------------------|
| t_{PLH} , t_{PHL} | Data Pulses | 0V |
| t_{PZL} | 0V | HIGH to LOW Switch |
| t_{PZH} | V_{CCI} | HIGH to LOW Switch |

Table 2. AC Load

| V_{CCO} | C1 | R1 |
|------------------|------|-------------|
| $1.2V \pm 0.1V$ | 15pF | 1M Ω |
| $1.5V \pm 0.1V$ | 15pF | 1M Ω |
| $1.8V \pm 0.15V$ | 15pF | 1M Ω |
| $2.5V \pm 0.2V$ | 15pF | 1M Ω |
| $3.3V \pm 0.3V$ | 15pF | 1M Ω |

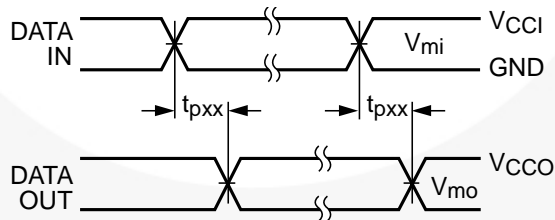


Figure 4. Waveform for Inverting and Non-Inverting Functions

Notes:

- 15. Input $t_R = t_F = 2.0ns$, 10% to 90%.
- 16. Input $t_R = t_F = 2.5ns$, 10% to 90%, at $V_I = 3.0V$ to $3.6V$ only.

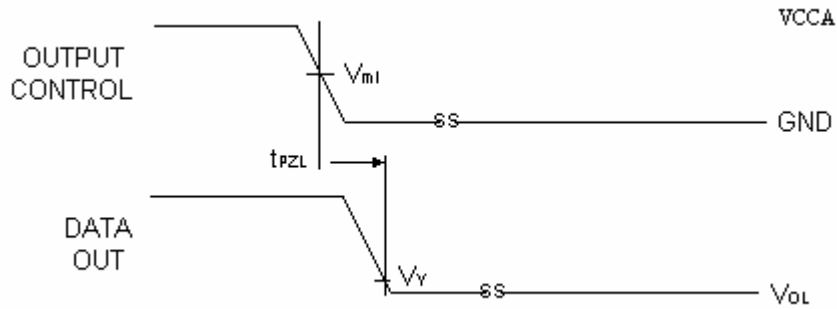


Figure 5. 3-State Output Low Enable Time for Low Voltage Logic

Notes:

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

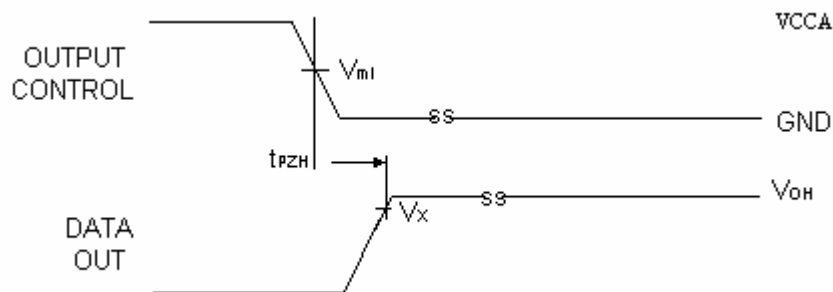


Figure 6. 3-State Output High Enable Time for Low Voltage Logic

Notes:

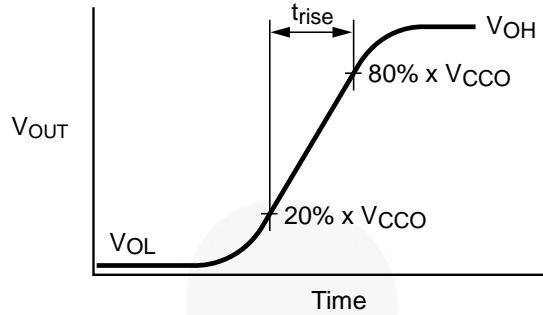
- 19. Input $t_R = t_F = 2.0\text{ns}$, 10% to 90%.
- 20. Input $t_R = t_F = 2.5\text{ns}$, 10% to 90%, at $V_I = 3.0\text{V}$ to 3.6V only.

Table 3. Test Measure Points

| Symbol | V_{DD} |
|-----------------|----------------------|
| $V_{MI}^{(21)}$ | $V_{CC1} / 2$ |
| V_{MO} | $V_{CC0} / 2$ |
| V_X | $0.9 \times V_{CC0}$ |
| V_Y | $0.1 \times V_{CC0}$ |

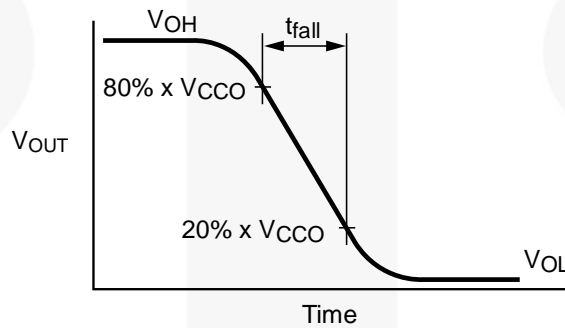
Note:

- 21. $V_{CC1} = V_{CCA}$ for control pin /OE or $V_{MI} = (V_{CCA} / 2)$.



$$I_{OHD} \approx (C_L + C_{I/O}) \times \frac{\Delta V_{OUT}}{\Delta t} = (C_L + C_{I/O}) \times \frac{(20\% - 80\%) \cdot V_{CCO}}{t_{RISE}}$$

Figure 7. Active Output Rise Time and Dynamic Output Current High



$$I_{OLD} \approx (C_L + C_{I/O}) \times \frac{\Delta V_{OUT}}{\Delta t} = (C_L + C_{I/O}) \times \frac{(80\% - 20\%) \cdot V_{CCO}}{t_{FALL}}$$

Figure 8. Active Output Fall Time and Dynamic Output Current Low

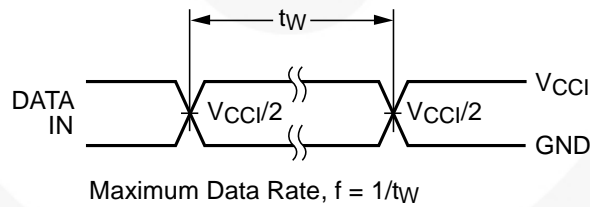


Figure 9. Maximum Data Rate

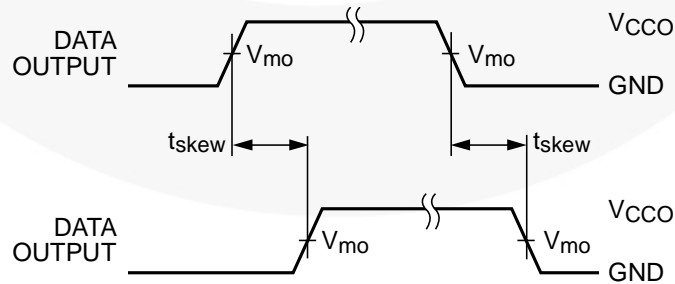
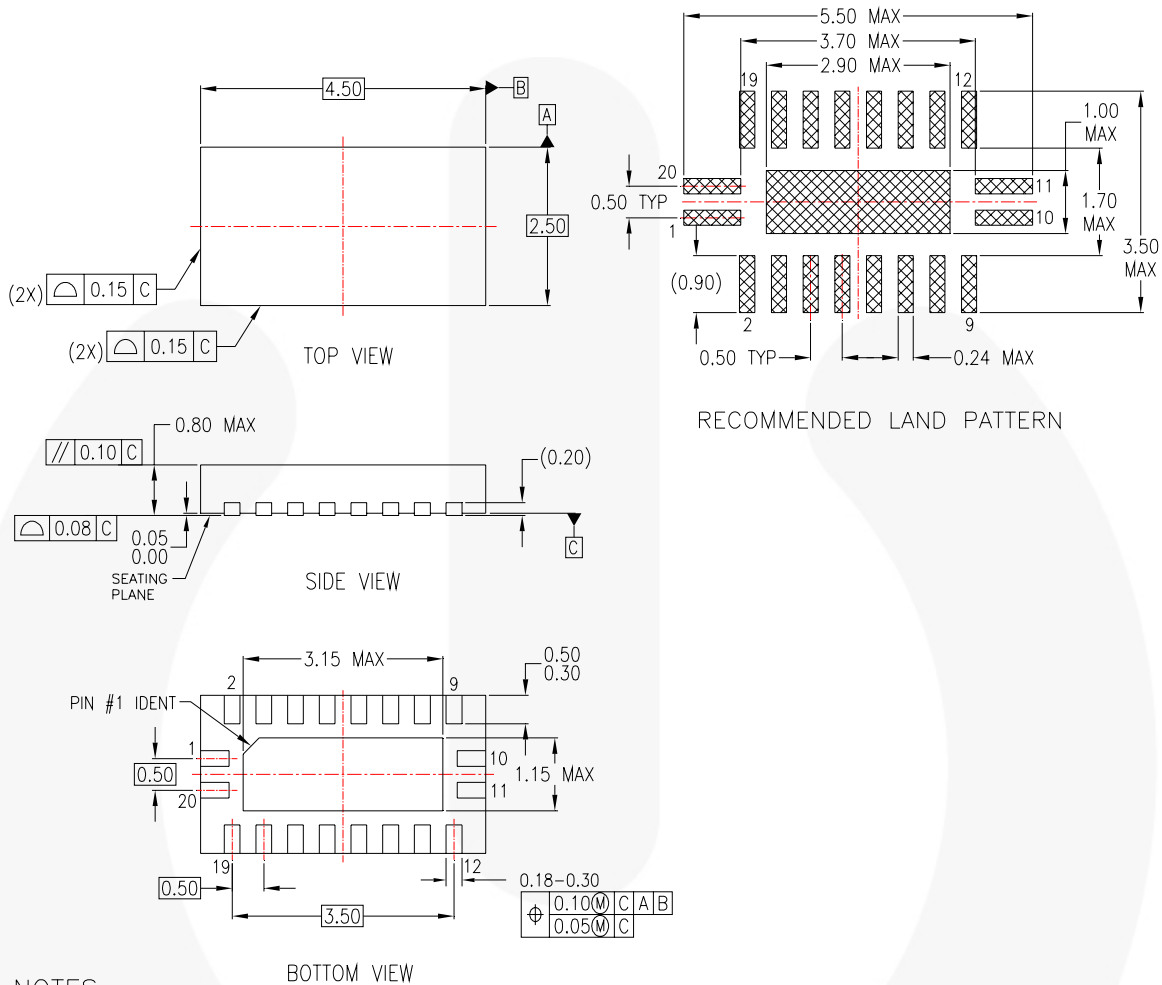


Figure 10. Output Skew Time

Note:

$$22. t_{SKEW} = (t_{pHLmax} - t_{pHLmin}) \text{ OR } (t_{pLHmax} - t_{pLHmin})$$

Physical Dimensions



NOTES:

- A. CONFORMS TO JEDEC REGISTRATION MO-241, VARIATION AC
- B. DIMENSIONS ARE IN MILLIMETERS.
- C. DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 1994

MLP20BrevA

Figure 11. 20-Terminal DQFN 2.5mm x 4.5mm Package






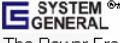
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Rev. I39