

Dual Supply, 2-Bit Voltage Translator / Isolator for I²C Applications

FXMAR2102

Description

The FXMAR2102 is a high-performance configurable dual-voltage-supply translator for bi-directional voltage translation over a wide range of input and output voltages levels. The FXMAR2102 also works in a push-pull environment.

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BLOCK DIAGRAM

Figure 1. Block Diagram, 1 of 2 Channels

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PIN CONFIGURATION

Figure 2. MicroPak (Top-Through View)

Figure 3. UMLP (Top

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ABSOLUTE MAXIMUM RATINGS

| Symbol | Parameter | | Min | Max | Unit |
|--------------------|--|--|------|-------------------|--------------|
| V_{CCA}, V_{CCB} | Supply Voltage | | -0.5 | 7.0 | V |
| V_{IN} | DC Input Voltage | A Port | -0.5 | 7.0 | V |
| | | B Port | -0.5 | 7.0 | |
| | | Control Input (OE) | -0.5 | 7.0 | |
| V_O | Output Voltage (Note 2) | A_n Outputs 3-State | -0.5 | 7.0 | V |
| | | B_n Outputs 3-State | -0.5 | 7.0 | |
| | | A_n Outputs Active | -0.5 | $V_{CCA} + 0.5$ V | |
| | | B_n Outputs Active | -0.5 | $V_{CCB} + 0.5$ V | |
| I_{IK} | DC Input Diode Current | At $V_{IN} < 0$ V | - | -50 | mA |
| I_{OK} | DC Output Diode Current | At $V_O < 0$ V | - | -50 | mA |
| | | At $V_O > V_{CC}$ | - | +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 |
| P_D | Power Dissipation | At 400 KHz | - | 0.129 | mW |
| T_{STG} | Storage Temperature Range | | -65 | +150 | $^{\circ}$ C |
| ESD | Electrostatic Discharge Capability | Human Body Model, B-Port Pins | - | 8 | kV |
| | | Human Body Model, All Pins (JESD22-A114) | - | 4 | |
| | | Charged Device Mode, JESD22-C101 | - | 2 | |

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.

2. I_O absolute maximum rating must be observed.

RECOMMENDED OPERATING CONDITIONS

| Symbol | Parameter | | Min | Max | Unit |
|--------------------|--------------------------------|----------------------|------|-----------|----------------|
| V_{CCA}, V_{CCB} | Power Supply Operating | | 1.65 | 5.50 | V |
| V_{IN} | Input Voltage (Note 3) | A-Port | 0 | 5.5 | V |
| | | B-Port | 0 | 5.5 | |
| | | Control Input (OE) | 0 | V_{CCA} | |
| θ_{JA} | Thermal Resistance | 8-Lead MicroPak | - | 279 | $^{\circ}$ C/W |
| | | 8-Lead Ultrathin MLP | - | 302 | |
| T_A | Free Air Operating Temperature | | -40 | +85 | $^{\circ}$ 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. All unused inputs and I/O pins must be held at V_{CCI} or GND. V_{CCI} is the V_{CC} associated with the input side.

FUNCTIONAL DESCRIPTION

Power-Up / Power-Down Sequencing

FXM 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 0 V, outputs are in a high-

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APPLICATION NOTES

The FXMAR2102 has open-drain I/Os and includes a total of four 10 k Ω internal pull-up resistors (R

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capacitances approaching 400 pF. More I_{OL} increases the voltage drop across the I²C translator. The I²C application benefits when I²C translators exhibit low V_{OL} performance.

Figure 6 depicts typical FXMAR2102 V_{OL} performance vs. the competition, given a 0.4 V V_{IL} .

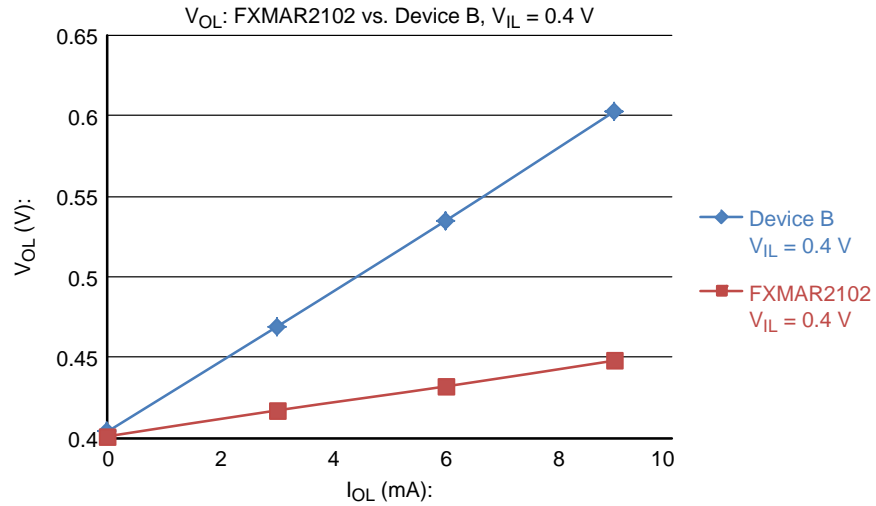


Figure 6. Device Comparison

I²C–Bus Isolation

The FXMAR2102 supports I²C–Bus isolation for the following conditions:

- Bus isolation if bus clear
- Bus isolation if either V_{CC} goes to ground

Bus Clear

Because the I²C specification defines the minimum SCL frequency of DC, the SCL signal can be held LOW forever;

DYNAMIC OUTPUT ELECTRICAL CHARACTERISTICS

OUTPUT RISE / FALL TIME (Note 10) (Output)

| Symbol | Parameter |
|------------|----------------------------------|
| t_{rise} | Output Rise Time; A Port, B Port |
| t_{fall} | Output Fall Time; A Port, B Port |

- 10. Output rise and fall times guaranteed by
- 11. V_{CC0} is the V_{CC} associated with the output
- 12. See Figure 12.
- 13. See Figure 13.

DYNAMIC OUTPUT ELECTRICAL CHARACTERISTICS

MAXIMUM DATA RATE (Note 14) (Output)

| V_{CCA} | Direction | | | | |
|----------------|-----------|----|----|----|--|
| 4.5 V to 5.5 V | A to B | | | | |
| | B to A | 50 | 50 | 40 | |

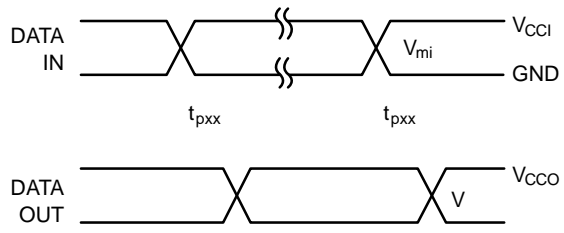
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AC CHARACTERISTICS (Note 15) (Output load: $C_L = 50 \text{ pF}$, $R_{PU} = \text{NC}$, push / pull driver, and $T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$.)

| Symbol | Parameter | V_{CCB} | | | | | | | | Unit |
|---|--------------------------|--------------|------|--------------|------|--------------|------|----------------|------|------|
| | | 4.5 to 5.5 V | | 3.0 to 3.6 V | | 2.3 to 2.7 V | | 1.65 to 1.95 V | | |
| | | Typ | Max | Typ | Max | Typ | Max | Typ | Max | |
| $V_{CCA} = 4.5 \text{ to } 5.5 \text{ V}$ | | | | | | | | | | |
| t_{PLH} | A to B | 1 | 3 | 1 | 3 | 1 | 3 | 1 | 3 | ns |
| | B to A | 1 | 3 | 2 | 4 | 3 | 5 | 4 | 7 | |
| t_{PHL} | A to B | 2 | 4 | 3 | 5 | 4 | 6 | 5 | 7 | ns |
| | B to A | 2 | 4 | 2 | 5 | 2 | 6 | 5 | 7 | |
| t_{PZL} | OE to A | 4 | 5 | 6 | 10 | 5 | 9 | 7 | 15 | ns |
| | OE to B | 3 | 5 | 4 | 7 | 5 | 8 | 10 | 15 | |
| t_{PLZ} | OE to A | 65 | 100 | 65 | 105 | 65 | 105 | 65 | 105 | ns |
| | OE to B | 5 | 9 | 6 | 10 | 7 | 12 | 9 | 16 | |
| t_{skew} | A Port, B Port (Note 16) | 0.50 | 1.50 | 0.50 | 1.00 | 0.50 | 1.00 | 0.50 | 1.00 | ns |
| $V_{CCA} = 3.0 \text{ to } 3.6 \text{ V}$ | | | | | | | | | | |
| t_{PLH} | A to B | 2.0 | 5.0 | 1.5 | 3.0 | 1.5 | 3.0 | 1.5 | 3.0 | ns |
| | B to A | 1.5 | 3.0 | 1.5 | 4.0 | 2.0 | 6.0 | 3.0 | 9.0 | |
| t_{PHL} | A to B | 2.0 | 4.0 | 2.0 | 4.0 | 2.0 | 5.0 | 3.0 | 5.0 | ns |
| | B to A | 2.0 | 4.0 | 2.0 | 4.0 | 2.0 | 5.0 | 3.0 | 5.0 | |
| t_{PZL} | OE to A | 4.0 | 8.0 | 5.0 | 9.0 | 6.0 | 11.0 | 7.0 | 15.0 | ns |
| | OE to B | 4.0 | 8.0 | 6.0 | 9.0 | 8.0 | 11.0 | 10.0 | 14.0 | |
| t_{PLZ} | OE to A | 100 | 115 | 100 | 115 | 100 | 115 | 100 | 115 | ns |
| | OE to B | 5 | 10 | 4 | 8 | 5 | 10 | 9 | 15 | |
| t_{skew} | A Port, B Port (Note 16) | 0.5 | 1.5 | 0.5 | 1.0 | 0.5 | 1.0 | 0.5 | 1.0 | ns |
| $V_{CCA} = 2.3 \text{ to } 2.7 \text{ V}$ | | | | | | | | | | |
| t_{PLH} | A to B | 2.5 | 5.0 | 2.5 | 5.0 | 2.0 | 4.0 | 1.0 | 3.0 | |

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TIMING DIAGRAMS



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ORDERING INFORMATION

| Part Number | Operating Temperature Range | Top Mark | Package | Packing Method [†] |
|--------------|-----------------------------|----------|--|-----------------------------|
| FXMAR2102L8X | -40 to +85°C | BU | 8-Lead MicroPak, 1.6 mm Wide (Pb-Free) | 5000 / Tape & Reel |
| FXMAR2102UMX | | | 8-Lead Ultrathin MLP, 1.2 mm x 1.4 mm (Pb-Free) | |

UQFN8, 1.40x1.20, 0.40P
CASE 523AS
ISSUE B

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