



Is Now Part of



ON Semiconductor®

To learn more about ON Semiconductor, please visit our website at
www.onsemi.com

ON Semiconductor and the ON Semiconductor logo are trademarks of Semiconductor Components Industries, LLC dba ON Semiconductor or its subsidiaries in the United States and/or other countries. ON Semiconductor owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of ON Semiconductor's product/patent coverage may be accessed at www.onsemi.com/site/pdf/Patent-Marking.pdf. ON Semiconductor reserves the right to make changes without further notice to any products herein. ON Semiconductor makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does ON Semiconductor assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using ON Semiconductor products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by ON Semiconductor. "Typical" parameters which may be provided in ON Semiconductor data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. ON Semiconductor does not convey any license under its patent rights nor the rights of others. ON Semiconductor products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use ON Semiconductor products for any such unintended or unauthorized application, Buyer shall indemnify and hold ON Semiconductor and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that ON Semiconductor was negligent regarding the design or manufacture of the part. ON Semiconductor is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

FXL4TD245

Low-Voltage Dual-Supply 4-Bit Signal Translator with Configurable Voltage Supplies and Signal Levels and 3-STATE Outputs and Independent Direction Controls

Features

- Bi-directional interface between any 2 levels from 1.1V to 3.6V
- 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/\bar{R}_n , \overline{OE}) levels are referenced to V_{CCA} voltage
- Packaged in 16-terminal DQFN (2.5mm x 3.5mm) and 16-terminal MicroMLP (1.8mm x 2.6mm)
- 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)


General Description

The FXL4TD245 is a configurable 4-bit 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 3.6V 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 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.

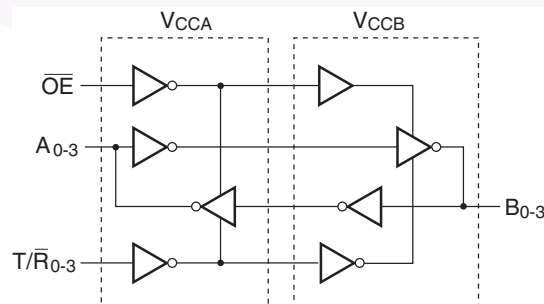
The Transmit/Receive (T/\bar{R}) inputs independently determine the direction of data through each of the four bits. The \overline{OE} input, when HIGH, disables both the A and B Ports by placing them in a 3-STATE condition. The FXL4TD245 is designed so that the control pins (T/\bar{R} and \overline{OE}) are supplied by V_{CCA} .

Ordering Information

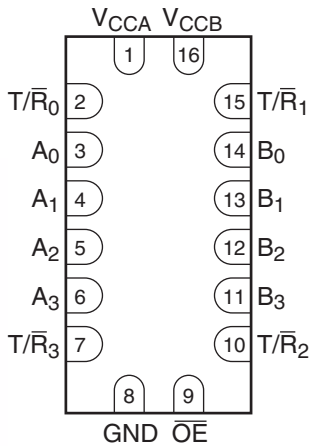
| Order Number | Package Number |  Eco Status | Package Description |
|--------------|----------------|--|--|
| FXL4TD245BQX | MLP016E | Green | 16-Terminal Depopulated Quad Very-Thin Flat Pack, No Leads (DQFN), JEDEC MO-241, 2.5mm x 3.5mm |
| FXL4TD245UMX | UMLP16A | Green | 16-Terminal Quad, Ultrathin, Molded Leadless Package (UMLP), 1.8mm x 2.6mm, 0.4mm Pitch |

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

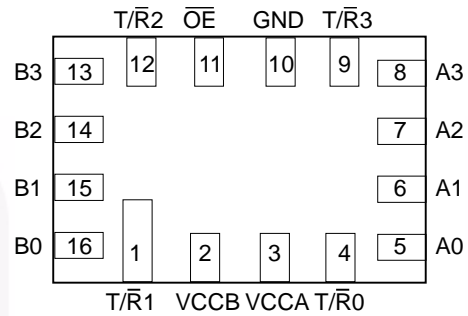
Functional Diagram



Connection Diagrams

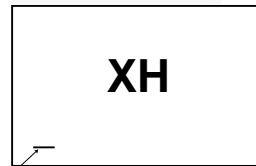


DQFN Pad Assignments (Top Through View)



MicroMLP Pad Assignments (Top Through View)

Top Mark



MicroMLP Top Mark (Top View)

Pin Assignment

| DQFN Pin # | μMLP Pin # | Terminal Name | Description |
|------------|------------|--------------------------------|----------------------------------|
| 1 | 3 | V _{CCA} | Side A Power Supply |
| 2 | 4 | T/R ₀ | Transmit/Receive Input |
| 3-6 | 5-8 | A ₀ -A ₃ | Side A Inputs or 3-STATE Outputs |
| 7 | 9 | T/R ₃ | Transmit/Receive Input |
| 8 | 10 | GND | Ground |
| 9 | 11 | OE | Output Enable Input |
| 10 | 12 | T/R ₂ | Transmit/Receive Input |
| 11-14 | 13-16 | B ₃ -B ₀ | Side B Inputs or 3-STATE Outputs |
| 15 | 1 | T/R ₁ | Transmit/Receive Input |
| 16 | 2 | V _{CCB} | Side B Power Supply |

Truth Table

| Inputs | | | | | Outputs |
|-----------------|--------------------|--------------------|--------------------|--------------------|----------------------|
| \overline{OE} | T/\overline{R}_0 | T/\overline{R}_1 | T/\overline{R}_2 | T/\overline{R}_3 | |
| L | L | X | X | X | B0 Data to A0 Output |
| L | H | X | X | X | A0 Data to B0 Output |
| L | X | L | X | X | B1 Data to A1 Output |
| L | X | H | X | X | A1 Data to B1 Output |
| L | X | X | L | X | B2 Data to A2 Output |
| L | X | X | H | X | A2 Data to B2 Output |
| L | X | X | X | L | B3 Data to A3 Output |
| L | X | X | X | H | A3 Data to B3 Output |
| H | X | X | 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_{CC} may be powered up first. This benefit derives from the chip design. When either V_{CC} is at 0 volts, outputs are in a HIGH-Impedance state. The control inputs (T/\overline{R}_n and \overline{OE}) are designed to track the V_{CCA} supply. A pull-up resistor tying \overline{OE} to V_{CCA} 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_{CC} .
2. Apply power to the T/\overline{R}_n 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 other V_{CC} .
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_{CC} .
3. Remove power from other V_{CC} .

Absolute Maximum Ratings

The “Absolute Maximum Ratings” are those values beyond which the safety of the device cannot be guaranteed. The device should not be operated at these limits. The parametric values defined in the Electrical Characteristics tables are not guaranteed at the absolute maximum ratings. The “Recommended Operating Conditions” table will define the conditions for actual device operation.

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

Recommended Operating Conditions⁽²⁾

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

Notes:

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

DC Electrical Characteristics

| Symbol | Parameter | Conditions | V _{CCI} (V) | V _{CC0} (V) | Min. | Max. | Units |
|-----------------|--|---|----------------------|----------------------|-------------------------|-------------------------|-------|
| V _{IH} | High Level Input Voltage ⁽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 Pins \overline{OE} , T/ $\overline{R_n}$ (Referenced to V _{CCA}) | 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 _{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 ⁽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 Pins \overline{OE} , T/ $\overline{R_n}$ (Referenced to V _{CCA}) | 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 _{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 ⁽⁴⁾ | I _{OH} = –100μA | 1.1–3.6 | 1.1–3.6 | V _{CC0} –0.2 | | V |
| | | I _{OH} = –12mA | 2.7 | 2.7 | 2.2 | | |
| | | I _{OH} = –18mA | 3.0 | 3.0 | 2.4 | | |
| | | I _{OH} = –24mA | 3.0 | 3.0 | 2.2 | | |
| | | I _{OH} = –6mA | 2.3 | 2.3 | 2.0 | | |
| | | I _{OH} = –12mA | 2.3 | 2.3 | 1.8 | | |
| | | I _{OH} = –18mA | 2.3 | 2.3 | 1.7 | | |
| | | I _{OH} = –6mA | 1.65 | 1.65 | 1.25 | | |
| | | I _{OH} = –2mA | 1.4 | 1.4 | 1.05 | | |
| | | I _{OH} = –0.5mA | 1.1 | 1.1 | 0.75 x V _{CC0} | | |
| V _{OL} | Low Level Output Voltage ⁽⁴⁾ | I _{OL} = 100μA | 1.1–3.6 | 1.1–3.6 | | 0.2 | V |
| | | I _{OL} = 12mA | 2.7 | 2.7 | | 0.4 | |
| | | I _{OL} = 18mA | 3.0 | 3.0 | | 0.4 | |
| | | I _{OL} = 24mA | 3.0 | 3.0 | | 0.55 | |
| | | I _{OL} = 12mA | 2.3 | 2.3 | | 0.4 | |
| | | I _{OL} = 18mA | 2.3 | 2.3 | | 0.6 | |
| | | I _{OL} = 6mA | 1.65 | 1.65 | | 0.3 | |
| | | I _{OL} = 2mA | 1.4 | 1.4 | | 0.35 | |
| | | I _{OL} = 0.5mA | 1.1 | 1.1 | | 0.3 x V _{CC0} | |

DC Electrical Characteristics (Continued)

| Symbol | Parameter | Conditions | V _{CCI} (V) | V _{CCO} (V) | Min. | Max. | Units |
|---------------------|---|--|----------------------|----------------------|------|-------|-------|
| I _I | Input Leakage Current. Control Pins | V _I = V _{CCA} or GND | 1.1–3.6 | 3.6 | | ±1.0 | μA |
| I _{OFF} | Power Off Leakage Current | A _n , V _I or V _O = 0V to 3.6V | 0 | 3.6 | | ±10.0 | μA |
| | | B _n , V _I or V _O = 0V to 3.6V | 3.6 | 0 | | ±10.0 | |
| I _{OZ} | 3-STATE Output Leakage ⁽⁵⁾ 0 ≤ V _O ≤ 3.6V V _I = V _{IH} or V _{IL} | A _n , B _n $\overline{OE} = V_{IH}$ | 3.6 | 3.6 | | ±10.0 | μA |
| | | B _n , $\overline{OE} = \text{Don't Care}$ | 0 | 3.6 | | +10.0 | |
| | | A _n , $\overline{OE} = \text{Don't Care}$ | 3.6 | 0 | | +10.0 | |
| I _{CCA/B} | Quiescent Supply Current ⁽⁶⁾ | V _I = V _{CCI} or GND; I _O = 0 | 1.1–3.6 | 1.1–3.6 | | 20.0 | μA |
| I _{CCZ} | Quiescent Supply Current ⁽⁶⁾ | 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 | μA |
| 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 | μA |
| ΔI _{CCA/B} | Increase in I _{CC} per Input; Other Inputs at V _{CC} or GND | V _{IH} = 3.0 | 3.6 | 3.6 | | 500 | μA |

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. Don't Care = Any valid logic level.
6. Reflects current per supply, V_{CCA} or V_{CCB}.

AC Electrical Characteristics

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

| Symbol | Parameter | $T_A = -40^\circ C$ to $+85^\circ C$ | | | | | | | | | | Units |
|--------------------|-------------------------------------|--------------------------------------|------|----------------------------|------|------------------------------|------|----------------------------|------|----------------------------|------|-------|
| | | $V_{CCB} = 3.0V$ 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 $1.3V$ | | |
| | | 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} | 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 | |

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

| Symbol | Parameter | $T_A = -40^\circ C$ to $+85^\circ C$ | | | | | | | | | | Units |
|--------------------|-------------------------------------|--------------------------------------|------|----------------------------|------|------------------------------|------|----------------------------|------|----------------------------|------|-------|
| | | $V_{CCB} = 3.0V$ 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 $1.3V$ | | |
| | | 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} | 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 | |

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

| Symbol | Parameter | $T_A = -40^\circ C$ to $+85^\circ C$ | | | | | | | | | | Units |
|--------------------|-------------------------------------|--------------------------------------|------|----------------------------|------|------------------------------|------|----------------------------|------|----------------------------|------|-------|
| | | $V_{CCB} = 3.0V$ 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 $1.3V$ | | |
| | | 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} | 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 | |

AC Electrical Characteristics (Continued)

$V_{CCA} = 1.4V$ to $1.6V$

| Symbol | Parameter | $T_A = -40^{\circ}C$ to $+85^{\circ}C$ | | | | | | | | | | Units |
|--------------------|-------------------------------------|--|------|----------------------------|------|------------------------------|------|----------------------------|------|----------------------------|------|-------|
| | | $V_{CCB} = 3.0V$ 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 $1.3V$ | | |
| | | 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} | 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 | |

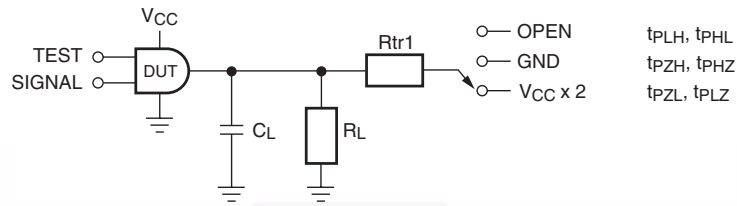
$V_{CCA} = 1.1V$ to $1.3V$

| Symbol | Parameter | $T_A = -40^{\circ}C$ to $+85^{\circ}C$ | | | | | | | | | | Units |
|--------------------|-------------------------------------|--|------|----------------------------|------|------------------------------|------|----------------------------|------|----------------------------|------|-------|
| | | $V_{CCB} = 3.0V$ 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 $1.3V$ | | |
| | | 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} | 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 | $T_A = +25^{\circ}C$ | Units |
|-----------|---|--|----------------------|-------|
| | | | Typical | |
| C_{IN} | Input Capacitance Control Pins (\overline{OE} , T/\overline{R}) | $V_{CCA} = V_{CCB} = 3.3V$, $V_I = 0V$ or $V_{CCA/B}$ | 4.0 | pF |
| $C_{I/O}$ | Input/Output Capacitance A_n , B_n Ports | $V_{CCA} = V_{CCB} = 3.3V$, $V_I = 0V$ or $V_{CCA/B}$ | 5.0 | pF |
| C_{PD} | Power Dissipation Capacitance | $V_{CCA} = V_{CCB} = 3.3V$, $V_I = 0V$ or V_{CC} , $F = 10MHz$ | 20.0 | pF |

AC Loading and Waveforms

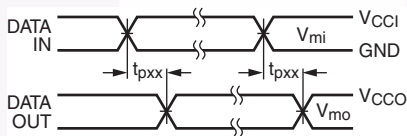


| Test | Switch |
|-----------------------|--|
| t_{PLH} , t_{PHL} | OPEN |
| t_{PZL} , t_{PZL} | $V_{CCO} \times 2$ at $V_{CCO} = 3.3V \pm 0.3V, 2.5V \pm 0.2V, 1.8V \pm 0.15V, 1.5V \pm 0.1V, 1.2V \pm 0.1V$ |
| t_{PHZ} , t_{PZH} | GND |

Figure 1. AC Test Circuit

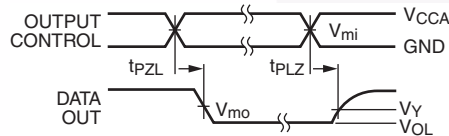
AC Load Table

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



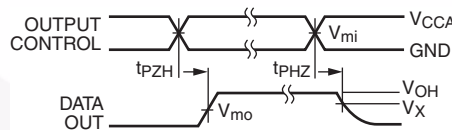
Input $t_R = t_F = 2.0$ ns, 10% to 90%
 Input $t_R = t_F = 2.5$ ns, 10% to 90%, @ $V_I = 3.0V$ to $3.6V$ only

Figure 2. Waveform for Inverting and Non-Inverting Functions



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

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



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

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

| Symbol | V_{CC} | | | | |
|----------|-----------------|------------------|------------------|-----------------|-----------------|
| | $3.3V \pm 0.3V$ | $2.5V \pm 0.2V$ | $1.8V \pm 0.15V$ | $1.5V \pm 0.1V$ | $1.2V \pm 0.1V$ |
| V_{mi} | $V_{CC1}/2$ | $V_{CC1}/2$ | $V_{CC1}/2$ | $V_{CC1}/2$ | $V_{CC1}/2$ |
| V_{mo} | $V_{CCO}/2$ | $V_{CCO}/2$ | $V_{CCO}/2$ | $V_{CCO}/2$ | $V_{CCO}/2$ |
| V_X | $V_{OH} - 0.3V$ | $V_{OH} - 0.15V$ | $V_{OH} - 0.15V$ | $V_{OH} - 0.1V$ | $V_{OH} - 0.1V$ |
| V_Y | $V_{OL} + 0.3V$ | $V_{OL} + 0.15V$ | $V_{OL} + 0.15V$ | $V_{OL} + 0.1V$ | $V_{OL} + 0.1V$ |

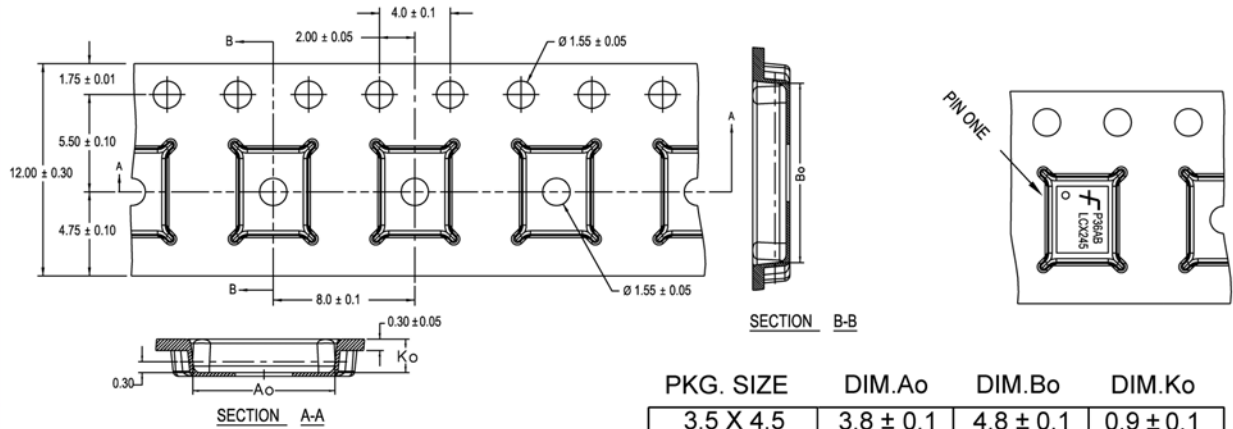
For V_{mi} : $V_{CC1} = V_{CCA}$ for Control Pins T/\bar{R} and \bar{OE} , or $V_{CCA}/2$

Tape and Reel Specification

Tape Format for DQFN 10

| Package Designator | Tape Section | Number Cavities | Cavity Status | Cover Tape Status |
|--------------------|--------------------|-----------------|---------------|-------------------|
| BQX | Leader (Start End) | 125 (typ) | Empty | Sealed |
| | Carrier | 2500/3000 | Filled | Sealed |
| | Trailer (Hub End) | 75 (typ) | Empty | Sealed |

Tape Dimensions millimeters



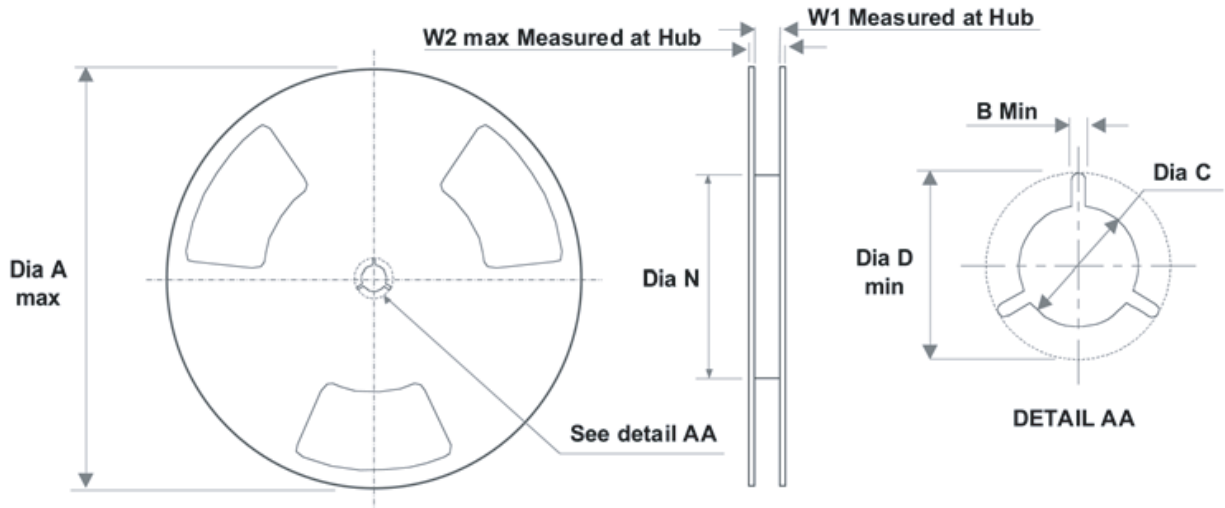
| PKG. SIZE | DIM.Ao | DIM.Bo | DIM.Ko |
|-----------|-----------|-----------|-----------|
| 3.5 X 4.5 | 3.8 ± 0.1 | 4.8 ± 0.1 | 0.9 ± 0.1 |
| 3.0 X 3.0 | 3.3 ± 0.1 | 3.3 ± 0.1 | 0.9 ± 0.1 |
| 2.5 X 4.5 | 2.8 ± 0.1 | 4.8 ± 0.1 | 0.9 ± 0.1 |
| 2.5 X 3.5 | 2.8 ± 0.1 | 3.8 ± 0.1 | 0.9 ± 0.1 |
| 2.5 X 3.0 | 2.8 ± 0.1 | 3.3 ± 0.1 | 0.9 ± 0.1 |
| 2.5 X 2.5 | 2.8 ± 0.1 | 2.8 ± 0.1 | 0.9 ± 0.1 |

DIMENSIONS ARE IN MILLIMETERS

NOTES: unless otherwise specified

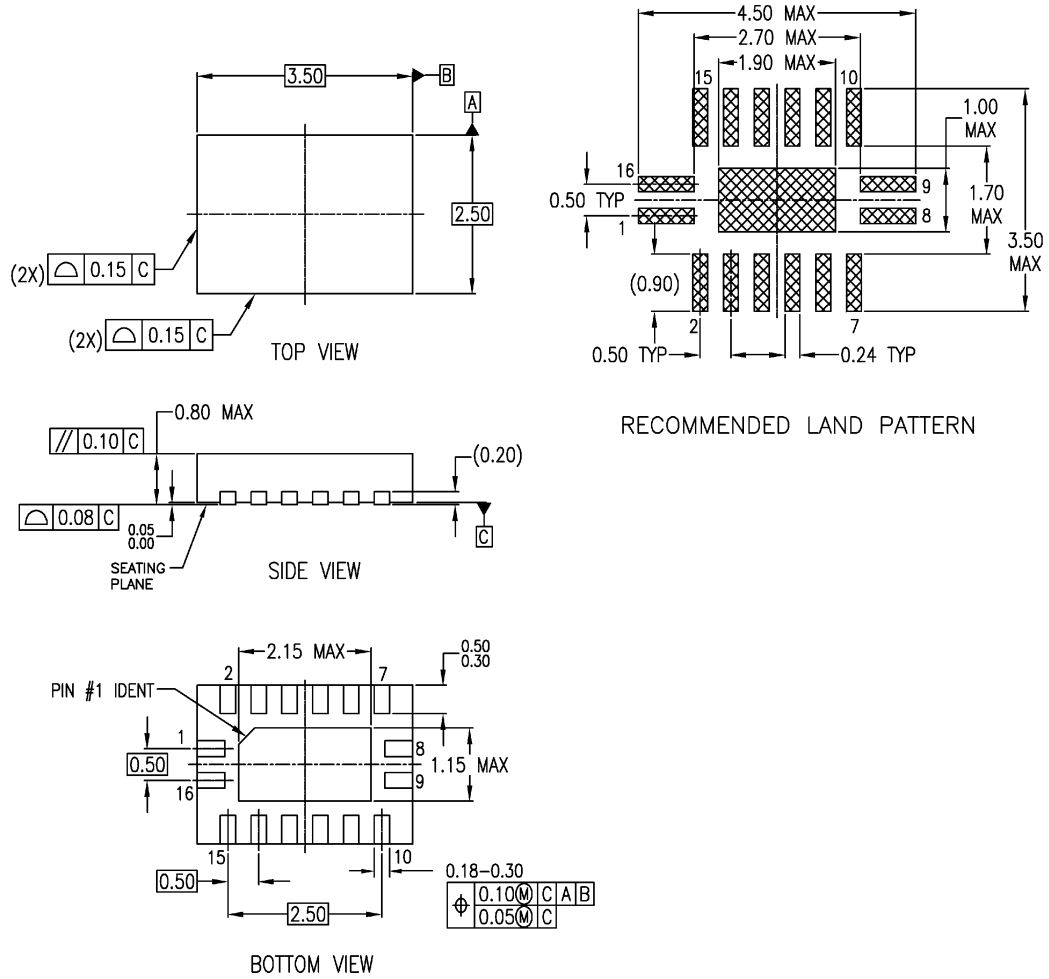
1. Cumulative pitch for feeding holes and cavities (chip pockets) not to exceed 0.008[0.20] over 10 pitch span.
2. Smallest allowable bending radius.
3. Thru hole inside cavity is centered within cavity.
4. Tolerance is $\pm 0.002[0.05]$ for these dimensions on all 12mm tapes.
5. Ao and Bo measured on a plane 0.120[0.30] above the bottom of the pocket.
6. Ko measured from a plane on the inside bottom of the pocket to the top surface of the carrier.
7. Pocket position relative to sprocket hole measured as true position of pocket. Not pocket hole.
8. Controlling dimension is millimeter. Dimension in inches rounded.

Reel Dimensions inches (millimeters)



| Tape Size | A | B | C | D | N | W1 | W2 |
|-----------|---------------|-----------------|------------------|------------------|----------------|-----------------|-----------------|
| 12 mm | 13.0 (330) | 0.059 (1.50) | 0.512 (13.00) | 0.795 (20.20) | 7.008 (178) | 0.488 (12.4) | 0.724 (18.4) |

Physical Dimensions



NOTES:

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

MLP016ErevA

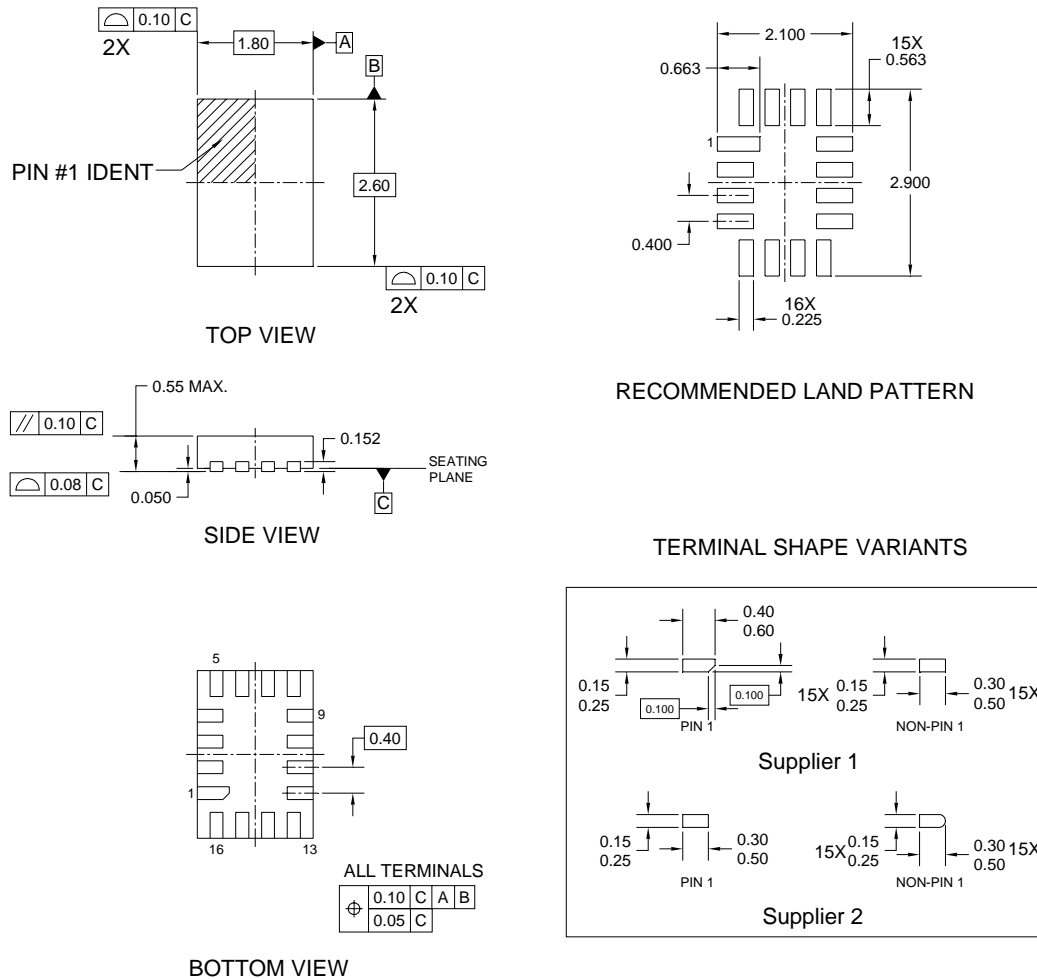
Figure 5. 16-Terminal Depopulated Quad Very-Thin Flat Pack No Leads (DQFN), JEDEC MO-241 2.5 x 3.5mm

Package drawings are provided as a service to customers considering Fairchild components. Drawings may change in any manner without notice. Please note the revision and/or date on the drawing and contact a Fairchild Semiconductor representative to verify or obtain the most recent revision. Package specifications do not expand the terms of Fairchild's worldwide terms and conditions, specifically the warranty therein, which covers Fairchild products.

Always visit Fairchild Semiconductor's online packaging area for the most recent package drawings:

<http://www.fairchildsemi.com/packaging/>

Physical Dimensions



NOTES:

- A. THIS PACKAGE IS NOT CURRENTLY REGISTERED WITH ANY STANDARDS COMMITTEE
- B. DIMENSIONS ARE IN MILLIMETERS.
- C. DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 1994
- D. TERMINAL SHAPE MAY VARY ACCORDING TO PACKAGE SUPPLIER, SEE TERMINAL SHAPE VARIANTS
- E. LAND PATTERN IS A MINIMAL TOE DESIGN
- F. DRAWING FILE NAME : UMLP16AREV3

Figure 5. 16-Terminal Quad, Ultrathin, Molded Leadless Package (UMLP), 1.8mm x 2.6mm

Package drawings are provided as a service to customers considering Fairchild components. Drawings may change in any manner without notice. Please note the revision and/or date on the drawing and contact a Fairchild Semiconductor representative to verify or obtain the most recent revision. Package specifications do not expand the terms of Fairchild's worldwide terms and conditions, specifically the warranty therein, which covers Fairchild products.







Always visit Fairchild Semiconductor's online packaging area for the most recent package drawings:

<http://www.fairchildsemi.com/packaging/>



TRADEMARKS

The following includes registered and unregistered trademarks and service marks, owned by Fairchild Semiconductor and/or its global subsidiaries, and is not intended to be an exhaustive list of all such trademarks.

- | | | | |
|--|---|---|---|
| AccuPower™ | FPST™ | PowerTrench® | The Power Franchise® |
| Auto-SPM™ | F-PFST™ | PowerXS™ | the power franchise |
| Build it Now™ | FRFET® | Programmable Active Droop™ | TinyBoost™ |
| CorePLUS™ | Global Power Resource SM | QFET® | TinyBuck™ |
| CorePOWER™ | Green FPST™ | QST™ | TinyCalc™ |
| CROSSVOLT™ | Green FPST™ e-Series™ | Quiet Series™ | TinyLogic® |
| CTL™ | Gmax™ | RapidConfigure™ | TINYOPTO™ |
| Current Transfer Logic™ | GTO™ |  ™ | TinyPower™ |
| EcoSPARK® | IntelliMAX™ | Saving our world, 1mV/W/kW at a time™ | TinyPWM™ |
| EfficientMax™ | ISOPLANAR™ | SignalWise™ | TinyWire™ |
| EZSWITCH™* | MegaBuck™ | SmartMax™ | TriFault Detect™ |
|  ™* | MICROCOUPLER™ | SMART START™ | TRUECURRENT™* |
|  ® | MicroFET™ | SPM® | μSerDes™ |
| Fairchild® | MicroPak™ | STEALTH™ |  ™ |
| Fairchild Semiconductor® | MillerDrive™ | SuperFET™ | UHC® |
| FACT Quiet Series™ | MotionMax™ | SuperSOT™-3 | Ultra FRFET™ |
| FACT® | Motion-SPM™ | SuperSOT™-6 | UniFET™ |
| FAST® | OPTOLOGIC® | SuperSOT™-8 | VCX™ |
| FastvCore™ | OPTOPLANAR® | SupreMOS™ | VisualMax™ |
| FETBench™ |  ™ | SyncFET™ | XST™ |
| FlashWriter®* | PDP SPM™ | Sync-Lock™ | |
| | Power-SPM™ |  | |

* Trademarks of System General Corporation, used under license by Fairchild Semiconductor.

DISCLAIMER

FAIRCHILD SEMICONDUCTOR RESERVES THE RIGHT TO MAKE CHANGES WITHOUT FURTHER NOTICE TO ANY PRODUCTS HEREIN TO IMPROVE RELIABILITY, FUNCTION, OR DESIGN. FAIRCHILD DOES NOT ASSUME ANY LIABILITY ARISING OUT OF THE APPLICATION OR USE OF ANY PRODUCT OR CIRCUIT DESCRIBED HEREIN; NEITHER DOES IT CONVEY ANY LICENSE UNDER ITS PATENT RIGHTS, NOR THE RIGHTS OF OTHERS. THESE SPECIFICATIONS DO NOT EXPAND THE TERMS OF FAIRCHILD'S WORLDWIDE TERMS AND CONDITIONS, SPECIFICALLY THE WARRANTY THEREIN, WHICH COVERS THESE PRODUCTS.

LIFE SUPPORT POLICY

FAIRCHILD'S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS WRITTEN APPROVAL OF FAIRCHILD SEMICONDUCTOR CORPORATION.

As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body or (b) support or sustain life, and (c) whose failure to perform when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury of the user.
2. A critical component in any component of a life support, device, or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

ANTI-COUNTERFEITING POLICY

Fairchild Semiconductor Corporation's Anti-Counterfeiting Policy. Fairchild's Anti-Counterfeiting Policy is also stated on our external website, www.fairchildsemi.com, under Sales Support.

Counterfeiting of semiconductor parts is a growing problem in the industry. All manufacturers of semiconductor products are experiencing counterfeiting of their parts. Customers who inadvertently purchase counterfeit parts experience many problems such as loss of brand reputation, substandard performance, failed applications, and increased cost of production and manufacturing delays. Fairchild is taking strong measures to protect ourselves and our customers from the proliferation of counterfeit parts. Fairchild strongly encourages customers to purchase Fairchild parts either directly from Fairchild or from Authorized Fairchild Distributors who are listed by country on our web page cited above. Products customers buy either from Fairchild directly or from Authorized Fairchild Distributors are genuine parts, have full traceability, meet Fairchild's quality standards for handling and storage and provide access to Fairchild's full range of up-to-date technical and product information. Fairchild and our Authorized Distributors will stand behind all warranties and will appropriately address any warranty issues that may arise. Fairchild will not provide any warranty coverage or other assistance for parts bought from Unauthorized Sources. Fairchild is committed to combat this global problem and encourage our customers to do their part in stopping this practice by buying direct or from authorized distributors.

PRODUCT STATUS DEFINITIONS

Definition of Terms

| Datasheet Identification | Product Status | Definition |
|--------------------------|-----------------------|---|
| Advance Information | Formative / In Design | Datasheet contains the design specifications for product development. Specifications may change in any manner without notice. |
| Preliminary | First Production | Datasheet contains preliminary data; supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve design. |
| No Identification Needed | Full Production | Datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve the design. |
| Obsolete | Not In Production | Datasheet contains specifications on a product that is discontinued by Fairchild Semiconductor. The datasheet is for reference information only. |

Rev. 142

ON Semiconductor and  are trademarks of Semiconductor Components Industries, LLC dba ON Semiconductor or its subsidiaries in the United States and/or other countries. ON Semiconductor owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of ON Semiconductor's product/patent coverage may be accessed at www.onsemi.com/site/pdf/Patent-Marking.pdf. ON Semiconductor reserves the right to make changes without further notice to any products herein. ON Semiconductor makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does ON Semiconductor assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using ON Semiconductor products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by ON Semiconductor. "Typical" parameters which may be provided in ON Semiconductor data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. ON Semiconductor does not convey any license under its patent rights nor the rights of others. ON Semiconductor products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use ON Semiconductor products for any such unintended or unauthorized application, Buyer shall indemnify and hold ON Semiconductor and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that ON Semiconductor was negligent regarding the design or manufacture of the part. ON Semiconductor is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:

Literature Distribution Center for ON Semiconductor
19521 E. 32nd Pkwy, Aurora, Colorado 80011 USA
Phone: 303-675-2175 or 800-344-3860 Toll Free USA/Canada
Fax: 303-675-2176 or 800-344-3867 Toll Free USA/Canada
Email: orderlit@onsemi.com

N. American Technical Support: 800-282-9855 Toll Free
USA/Canada
Europe, Middle East and Africa Technical Support:
Phone: 421 33 790 2910
Japan Customer Focus Center
Phone: 81-3-5817-1050

ON Semiconductor Website: www.onsemi.com
Order Literature: <http://www.onsemi.com/orderlit>
For additional information, please contact your local
Sales Representative