

# 74VCX163245

## Low Voltage 16-Bit Dual Supply Translating Transceiver with 3-STATE Outputs

### Features

- Bidirectional interface between busses ranging from 1.65V to 3.6V
- Supports Live Insertion and Withdrawal<sup>(1)</sup>
- Static Drive ( $I_{OH}/I_{OL}$ )
  - $\pm 24\text{mA}$  @ 3.0V  $V_{CC}$
  - $\pm 18\text{mA}$  @ 2.3V  $V_{CC}$
  - $\pm 6\text{mA}$  @ 1.65V  $V_{CC}$
- Uses proprietary Quiet Series™ noise/EMI reduction circuitry
- Functionally compatible with 74 series 16245
- Latchup performance exceeds 300mA
- ESD performance:
  - Human Body Model >2000V
  - Machine model >200V
- Also packaged in plastic Fine-Pitch Ball Grid Array (FBGA)

### Note:

1. To ensure the high impedance state during power up or power down,  $OE_n$  should be tied to  $V_{CCB}$  through a pull up resistor. The minimum value of the resistor is determined by the current sourcing capability of the driver.

### General Description

The VCX163245 is a dual supply, 16-bit translating transceiver that is designed for 2 way asynchronous communication between busses at different supply voltages by providing true signal translation. The supply rails consist of  $V_{CCA}$ , which is a higher potential rail operating at 2.3V to 3.6V and  $V_{CCB}$ , which is the lower potential rail operating at 1.65V to 2.7V. ( $V_{CCB}$  must be less than or equal to  $V_{CCA}$  for proper device operation). This dual supply design allows for translation from 1.8V to 2.5V busses to busses at a higher potential, up to 3.3V.

The Transmit/Receive ( $T/\bar{R}$ ) input determines the direction of data flow. Transmit (active-HIGH) enables data from A Ports to B Ports; Receive (active-LOW) enables data from B Ports to A Ports. The Output Enable ( $\overline{OE}$ ) input, when HIGH, disables both A and B Ports by placing them in a High-Z condition. The A Port interfaces with the higher voltage bus (2.7V to 3.3V); The B Port interfaces with the lower voltage bus (1.8V to 2.5V). Also the VCX163245 is designed so that the control pins ( $T/\bar{R}_n$ ,  $\overline{OE}_n$ ) are supplied by  $V_{CCB}$ .

The 74VCX163245 is suitable for mixed voltage applications such as notebook computers using a 1.8V CPU and 3.3V peripheral components. It is fabricated with an Advanced CMOS technology to achieve high speed operation while maintaining low CMOS power dissipation.

### Ordering Information

| Order Number                   | Package Number | Package Description                                                         |
|--------------------------------|----------------|-----------------------------------------------------------------------------|
| 74VCX163245G <sup>(2)(3)</sup> | BGA54A         | 54-Ball Fine-Pitch Ball Grid Array (FBGA), JEDEC MO-205, 5.5mm Wide         |
| 74VCX163245MTD <sup>(3)</sup>  | MTD48          | 48-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 6.1mm Wide |

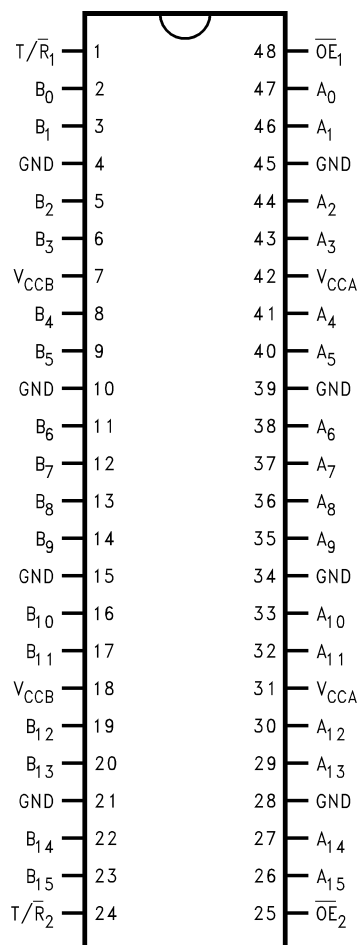
### Notes:

2. Ordering code "G" indicates Trays.
3. Device also available in Tape and Reel. Specify by appending the suffix letter "X" to the ordering code.

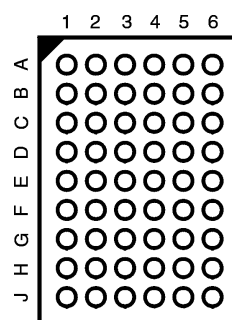
Quiet Series™ is a trademark of Fairchild Semiconductor Corporation.

## Connection Diagram

### Pin Assignment for TSSOP



### Pin Assignment for FBGA



(Top Thru View)

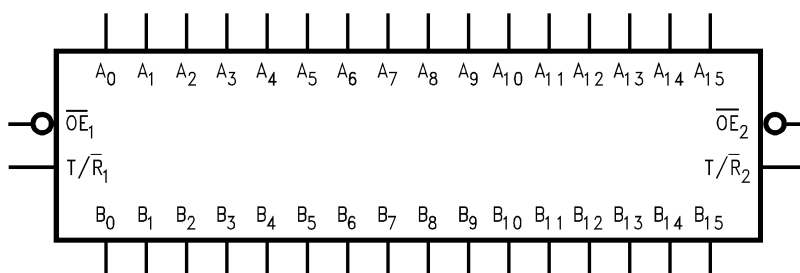
### FBGA Pin Assignments

|   | 1        | 2        | 3                  | 4                 | 5        | 6        |
|---|----------|----------|--------------------|-------------------|----------|----------|
| A | $B_0$    | NC       | $\overline{T/R}_1$ | $\overline{OE}_1$ | NC       | $A_0$    |
| B | $B_2$    | $B_1$    | NC                 | NC                | $A_1$    | $A_2$    |
| C | $B_4$    | $B_3$    | $V_{CCB}$          | $V_{CCA}$         | $A_3$    | $A_4$    |
| D | $B_6$    | $B_5$    | GND                | GND               | $A_5$    | $A_6$    |
| E | $B_8$    | $B_7$    | GND                | GND               | $A_7$    | $A_8$    |
| F | $B_{10}$ | $B_9$    | GND                | GND               | $A_9$    | $A_{10}$ |
| G | $B_{12}$ | $B_{11}$ | $V_{CCB}$          | $V_{CCA}$         | $A_{11}$ | $A_{12}$ |
| H | $B_{14}$ | $B_{13}$ | NC                 | NC                | $A_{13}$ | $A_{14}$ |
| J | $B_{15}$ | NC       | $\overline{T/R}_2$ | $\overline{OE}_2$ | NC       | $A_{15}$ |

### Pin Descriptions

| Pin Names          | Description                      |
|--------------------|----------------------------------|
| $\overline{OE}_n$  | Output Enable Input (Active LOW) |
| $\overline{T/R}_n$ | Transmit/Receive Input           |
| $A_0$ – $A_{15}$   | Side A Inputs or 3-STATE Outputs |
| $B_0$ – $B_{15}$   | Side B Inputs or 3-STATE Outputs |
| NC                 | No Connect                       |

### Logic Diagram



## Truth Tables

| Inputs            |                    | Outputs                                                                         |
|-------------------|--------------------|---------------------------------------------------------------------------------|
| $\overline{OE}_1$ | $T/\overline{R}_1$ |                                                                                 |
| L                 | L                  | Bus B <sub>0</sub> –B <sub>7</sub> Data to Bus A <sub>0</sub> –A <sub>7</sub>   |
| L                 | H                  | Bus A <sub>0</sub> –A <sub>7</sub> Data to Bus B <sub>0</sub> –B <sub>7</sub>   |
| H                 | X                  | HIGH Z State on A <sub>0</sub> –A <sub>7</sub> , B <sub>0</sub> –B <sub>7</sub> |

H = HIGH Voltage Level

L = LOW Voltage Level

X = Immaterial (HIGH or LOW, inputs may not float)

Z = High Impedance

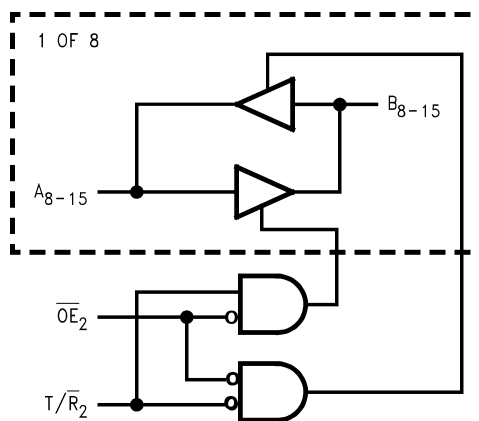
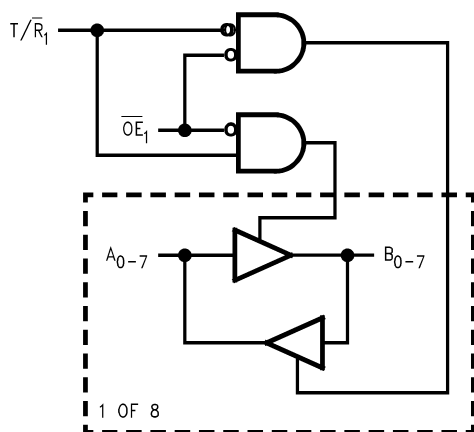
| Inputs            |                    | Outputs                                                                           |
|-------------------|--------------------|-----------------------------------------------------------------------------------|
| $\overline{OE}_2$ | $T/\overline{R}_2$ |                                                                                   |
| L                 | L                  | Bus B <sub>8</sub> –B <sub>15</sub> Data to Bus A <sub>8</sub> –A <sub>15</sub>   |
| L                 | H                  | Bus A <sub>8</sub> –A <sub>15</sub> Data to Bus B <sub>8</sub> –B <sub>15</sub>   |
| H                 | X                  | HIGH-Z State on A <sub>8</sub> –A <sub>15</sub> , B <sub>8</sub> –B <sub>15</sub> |

## VCX163245 Translator Power Up Sequence Recommendations

To guard against power up problems, some simple guidelines need to be adhered to. The VCX163245 is designed so that the control pins ( $T/\overline{R}_n$ ,  $\overline{OE}_n$ ) are supplied by  $V_{CCB}$ . Therefore the first recommendation is to begin by powering up the control side of the device,  $V_{CCB}$ . The  $\overline{OE}_n$  control pins should be ramped with or ahead of  $V_{CCB}$ , this will guard against bus contentions and oscillations as all A Port and B Port outputs will be disabled. To ensure the high impedance state during power up or power down,  $\overline{OE}_n$  should be tied to  $V_{CCB}$  through a pull up resistor. The minimum value of the resistor is determined by the current sourcing capability of the driver. Second, the  $T/\overline{R}_n$  control pins should be

placed at logic LOW (0V) level, this will ensure that the B-side bus pins are configured as inputs to help guard against bus contention and oscillations. B-side Data Inputs should be driven to a valid logic level (0V or  $V_{CCB}$ ), this will prevent excessive current draw and oscillations.  $V_{CCA}$  can then be powered up after  $V_{CCB}$ , however  $V_{CCA}$  must be greater than or equal to  $V_{CCB}$  to ensure proper device operation. Upon completion of these steps the device can then be configured for the users desired operation. Following these steps will help to prevent possible damage to the translator device as well as other system components.

## Logic Diagrams



Please note that these diagrams are provided only for the understanding of logic operations and should not be used to estimate propagation delays.

## 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                                                                                                        | Rating                                                                   |
|--------------------|------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|
| $V_{CCA}$          | Supply Voltage                                                                                                   | –0.5V to +4.6V                                                           |
| $V_{CCB}$          |                                                                                                                  | –0.5V to $V_{CCA}$                                                       |
| $V_I$              | DC Input Voltage                                                                                                 | –0.5V to +4.6V                                                           |
| $V_{I/O}$          | DC Output Voltage<br>Outputs 3-STATE<br>$A_n$ Output Active <sup>(4)</sup><br>$B_n$ Output Active <sup>(4)</sup> | –0.5V to +4.6V<br>–0.5V to $V_{CCA} + 0.5V$<br>–0.5V to $V_{CCB} + 0.5V$ |
| $I_{IK}$           | DC Input Diode Current, $V_I < 0V$                                                                               | –50mA                                                                    |
| $I_{OK}$           | DC Output Diode Current<br>$V_O < 0V$<br>$V_O > V_{CC}$                                                          | –50mA<br>+50mA                                                           |
| $I_{OH}/I_{OL}$    | DC Output Source/Sink Current                                                                                    | ±50mA                                                                    |
|                    | DC $V_{CC}$ or Ground Current                                                                                    | ±100mA                                                                   |
| $I_{CC}$ or Ground | Supply Pin                                                                                                       |                                                                          |
| $T_{STG}$          | Storage Temperature                                                                                              | –65°C to +150°C                                                          |

## Recommended Operating Conditions<sup>(5)</sup>

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                             |
|-----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|
| $V_{CCA}$             | Power Supply <sup>(6)</sup>                                                                                                                         | 2.3V to 3.6V                       |
| $V_{CCB}$             |                                                                                                                                                     | 1.65V to 2.7V                      |
| $V_I$                 | Input Voltage ( ) @ $\overline{OE}$ , $T/\overline{R}$                                                                                              | 0V to $V_{CCB}$                    |
| $V_{I/O}$             | Input/Output Voltage ( )<br>$A_n$<br>$B_n$                                                                                                          | 0V to $V_{CCA}$<br>0V to $V_{CCB}$ |
| $I_{OH}/I_{OL}$       | Output Current in $I_{OH}/I_{OL}$<br>$V_{CCA} = 3.0V$ to 3.6V<br>$V_{CCA} = 2.3V$ to 2.7V<br>$V_{CCB} = 2.3V$ to 2.7V<br>$V_{CCB} = 1.65V$ to 1.95V | ±24mA<br>±18mA<br>±18mA<br>±6mA    |
| $T_A$                 | Free Air Operating Temperature                                                                                                                      | –40°C to +85°C                     |
| $\Delta t / \Delta V$ | Minimum Input Edge Rate, $V_{IN} = 0.8V$ to 2.0V, $V_{CC} = 3.0V$                                                                                   | 10ns/V                             |

### Notes:

4.  $I_O$  Absolute Maximum Rating must be observed.
5. Unused inputs or I/O pins must be held HIGH or LOW. They may not float.
6. Operation requires:  $V_{CCB} \leq V_{CCA}$

**DC Electrical Characteristics** ( $1.65V < V_{CCB} \leq 1.95V$ ,  $2.3V < V_{CCA} \leq 2.7V$ )

| Symbol            | Parameter                                                       | $V_{CCB}$ (V)                   | $V_{CCA}$ (V) | Conditions                    | Min.                                                                                           | Max.                  | Units             |
|-------------------|-----------------------------------------------------------------|---------------------------------|---------------|-------------------------------|------------------------------------------------------------------------------------------------|-----------------------|-------------------|
| $V_{IHA}$         | HIGH Level Input Voltage                                        | $A_n$                           | 1.65–1.95     | 2.3–2.7                       |                                                                                                | 1.6                   | V                 |
| $V_{IHB}$         |                                                                 | $B_n, T/\bar{R}, \overline{OE}$ | 1.65–1.95     | 2.3–2.7                       |                                                                                                | $0.65 \times V_{CCB}$ | V                 |
| $V_{ILA}$         | LOW Level Input Voltage                                         | $A_n$                           | 1.65–1.95     | 2.3–2.7                       |                                                                                                | 0.7                   | V                 |
| $V_{ILB}$         |                                                                 | $B_n, T/\bar{R}, \overline{OE}$ | 1.65–1.95     | 2.3–2.7                       |                                                                                                | $0.35 \times V_{CCB}$ | V                 |
| $V_{OHA}$         | HIGH Level Output Voltage                                       |                                 | 1.65–1.95     | 2.3–2.7                       | $I_{OH} = -100\mu A$                                                                           | $V_{CCA} - 0.2$       | V                 |
|                   |                                                                 |                                 | 1.65          | 2.3–2.7                       | $I_{OH} = -18mA$                                                                               | 1.7                   |                   |
| $V_{OHB}$         | HIGH Level Output Voltage                                       |                                 | 1.65–1.95     | 2.3–2.7                       | $I_{OH} = -100\mu A$                                                                           | $V_{CCB} - 0.2$       | V                 |
|                   |                                                                 |                                 | 1.65–1.95     | 2.3                           | $I_{OH} = -6mA$                                                                                | 1.25                  |                   |
| $V_{OLA}$         | Low Level Output Voltage                                        |                                 | 1.65–1.95     | 2.3–2.7                       | $I_{OL} = 100\mu A$                                                                            | 0.2                   | V                 |
|                   |                                                                 |                                 | 1.65          | 2.3–2.7                       | $I_{OL} = 18mA$                                                                                | 0.6                   |                   |
| $V_{OLB}$         | Low Level Output Voltage                                        |                                 | 1.65–1.95     | 2.3–2.7                       | $I_{OL} = 100\mu A$                                                                            | 0.2                   | V                 |
|                   |                                                                 |                                 | 1.65–1.95     | 2.3                           | $I_{OL} = 6mA$                                                                                 | 0.3                   |                   |
| $I_I$             | Input Leakage Current @ $\overline{OE}$ , $T/\bar{R}$           |                                 | 1.65–1.95     | 2.3–2.7                       | $0V \leq V_I \leq 3.6V$                                                                        |                       | $\pm 5.0$ $\mu A$ |
| $I_{OZ}$          | 3-STATE Output Leakage                                          |                                 | 1.65–1.95     | 2.3–2.7                       | $0V \leq V_O \leq 3.6V$ ,<br>$\overline{OE} = V_{CCB}$ ,<br>$V_I = V_{IH}$ or $V_{IL}$         |                       | $\pm 10$ $\mu A$  |
| $I_{OFF}$         | Power Off Leakage Current                                       | 0                               | 0             | $0 \leq (V_I, V_O) \leq 3.6V$ |                                                                                                | 10                    | $\mu A$           |
| $I_{CCA}/I_{CCB}$ | Quiescent Supply Current, per supply, $V_{CCA} / V_{CCB}$       |                                 | 1.65–1.95     | 2.3–2.7                       | $A_n = V_{CCA}$ or GND,<br>$B_n, \overline{OE}$ , & $T/\bar{R} = V_{CCB}$ or GND               | 20                    | $\mu A$           |
|                   |                                                                 |                                 | 1.65–1.95     | 2.3–2.7                       | $V_{CCA} \leq A_n \leq 3.6V$ ,<br>$V_{CCB} \leq B_n, \overline{OE}$ ,<br>$T/\bar{R} \leq 3.6V$ | $\pm 20$              | $\mu A$           |
| $\Delta I_{CC}$   | Increase in $I_{CC}$ per Input, $B_n, T/\bar{R}, \overline{OE}$ |                                 | 1.65–1.95     | 2.3–2.7                       | $V_I = V_{CCB} - 0.6V$                                                                         | 750                   | $\mu A$           |
|                   | Increase in $I_{CC}$ per Input, $A_n$                           |                                 | 1.65–1.95     | 2.3–2.7                       | $V_I = V_{CCA} - 0.6V$                                                                         | 750                   | $\mu A$           |

**DC Electrical Characteristics** ( $1.65V < V_{CCB} \leq 1.95V$ ,  $3.0V < V_{CCA} \leq 3.6V$ )

| Symbol            | Parameter                                                                    | $V_{CCB}$ (V)                        | $V_{CCA}$ (V) | Conditions                    | Min.                                                                                                | Max.                  | Units   |
|-------------------|------------------------------------------------------------------------------|--------------------------------------|---------------|-------------------------------|-----------------------------------------------------------------------------------------------------|-----------------------|---------|
| $V_{IHA}$         | HIGH Level Input Voltage                                                     | $A_n$                                | 1.65–1.95     | 3.0–3.6                       |                                                                                                     | 2.0                   | V       |
| $V_{IHB}$         |                                                                              | $B_n, \overline{T/R}, \overline{OE}$ | 1.65–1.95     | 3.0–3.6                       | $0.65 \times V_{CCB}$                                                                               |                       | V       |
| $V_{ILA}$         | LOW Level Input Voltage                                                      | $A_n$                                | 1.65–1.95     | 3.0–3.6                       |                                                                                                     | 0.8                   | V       |
| $V_{ILB}$         |                                                                              | $B_n, \overline{T/R}, \overline{OE}$ | 1.65–1.95     | 3.0–3.6                       |                                                                                                     | $0.35 \times V_{CCB}$ | V       |
| $V_{OHA}$         | HIGH Level Output Voltage                                                    |                                      | 1.65–1.95     | 3.0–3.6                       | $I_{OH} = -100\mu A$                                                                                | $V_{CCA} - 0.2$       | V       |
|                   |                                                                              |                                      | 1.65          | 3.0–3.6                       | $I_{OH} = -24mA$                                                                                    | 2.2                   |         |
| $V_{OHB}$         | HIGH Level Output Voltage                                                    |                                      | 1.65–1.95     | 3.0–3.6                       | $I_{OH} = -100\mu A$                                                                                | $V_{CCA} - 0.2$       | V       |
|                   |                                                                              |                                      | 1.65–1.95     | 3.0                           | $I_{OH} = -6mA$                                                                                     | 1.25                  |         |
| $V_{OLA}$         | LOW Level Output Voltage                                                     |                                      | 1.65–1.95     | 3.0–3.6                       | $I_{OL} = 100\mu A$                                                                                 | 0.2                   | V       |
|                   |                                                                              |                                      | 1.65          | 3.0–3.6                       | $I_{OL} = 24mA$                                                                                     | 0.55                  |         |
| $V_{OLB}$         | LOW Level Output Voltage                                                     |                                      | 1.65–1.95     | 3.0–3.6                       | $I_{OL} = 100\mu A$                                                                                 | 0.2                   | V       |
|                   |                                                                              |                                      | 1.65–1.95     | 3.0                           | $I_{OL} = 6mA$                                                                                      | 0.3                   |         |
| $I_I$             | Input Leakage Current @ $\overline{OE}$ , $\overline{T/R}$                   |                                      | 1.65–1.95     | 3.0–3.6                       | $0V \leq V_I \leq 3.6V$                                                                             | $\pm 5.0$             | $\mu A$ |
| $I_{OZ}$          | 3-STATE Output Leakage                                                       |                                      | 1.65–1.95     | 3.0–3.6                       | $0V \leq V_O \leq 3.6V$ ,<br>$\overline{OE} = V_{CCB}$ ,<br>$V_I = V_{IH}$ or $V_{IL}$              | $\pm 10$              | $\mu A$ |
| $I_{OFF}$         | Power OFF Leakage Current                                                    | 0                                    | 0             | $0 \leq (V_I, V_O) \leq 3.6V$ |                                                                                                     | 10                    | $\mu A$ |
| $I_{CCA}/I_{CCB}$ | Quiescent Supply Current, per supply, $V_{CCA}/V_{CCB}$                      |                                      | 1.65–1.95     | 3.0–3.6                       | $A_n = V_{CCA}$ or GND,<br>$B_n, \overline{OE}$ , & $\overline{T/R} = V_{CCB}$<br>or GND            | 20                    | $\mu A$ |
|                   |                                                                              |                                      | 1.65–1.95     | 3.0–3.6                       | $V_{CCA} \leq A_n \leq 3.6V$ ,<br>$V_{CCB} \leq B_n, \overline{OE}$ ,<br>$\overline{T/R} \leq 3.6V$ | $\pm 20$              | $\mu A$ |
| $\Delta I_{CC}$   | Increase in $I_{CC}$ per Input, $B_n$ , $\overline{T/R}$ , $\overline{OE}$ , |                                      | 1.65–1.95     | 3.0–3.6                       | $V_I = V_{CCB} - 0.6V$                                                                              | 750                   | $\mu A$ |
|                   | Increase in $I_{CC}$ per Input, $A_n$                                        |                                      | 1.65–1.95     | 3.0–3.6                       | $V_I = V_{CCA} - 0.6V$                                                                              | 750                   | $\mu A$ |

**DC Electrical Characteristics** ( $2.3V < V_{CCB} \leq 2.7V$ ,  $3.0V \leq V_{CCA} \leq 3.6V$ )

| Symbol            | Parameter                                                            | $V_{CCB}$ (V)                        | $V_{CCA}$ (V) | Conditions | Min.                                                                                                | Max.            | Units   |
|-------------------|----------------------------------------------------------------------|--------------------------------------|---------------|------------|-----------------------------------------------------------------------------------------------------|-----------------|---------|
| $V_{IHA}$         | HIGH Level Input Voltage                                             | $A_n$                                | 2.3–2.7       | 3.0–3.6    |                                                                                                     | 2.0             | V       |
| $V_{IHB}$         |                                                                      | $B_n, \overline{T/R}, \overline{OE}$ | 2.3–2.7       | 3.0–3.6    |                                                                                                     | 1.6             | V       |
| $V_{ILA}$         | LOW Level Input Voltage                                              | $A_n$                                | 2.3–2.7       | 3.0–3.6    |                                                                                                     | 0.8             | V       |
| $V_{ILB}$         |                                                                      | $B_n, \overline{T/R}, \overline{OE}$ | 2.3–2.7       | 3.0–3.6    |                                                                                                     | 0.7             | V       |
| $V_{OHA}$         | HIGH Level Output Voltage                                            |                                      | 2.3–2.7       | 3.0–3.6    | $I_{OH} = -100\mu A$                                                                                | $V_{CCA} - 0.2$ | V       |
|                   |                                                                      |                                      | 2.3           | 3.0–3.6    | $I_{OH} = -24mA$                                                                                    | 2.2             |         |
| $V_{OHB}$         | HIGH Level Output Voltage                                            |                                      | 2.3–2.7       | 3.0–3.6    | $I_{OH} = -100\mu A$                                                                                | $V_{CCB} - 0.2$ | V       |
|                   |                                                                      |                                      | 2.3–2.7       | 3.0        | $I_{OH} = -18mA$                                                                                    | 1.7             |         |
| $V_{OLA}$         | LOW Level Output Voltage                                             |                                      | 2.3–2.7       | 3.0–3.6    | $I_{OL} = 100\mu A$                                                                                 | 0.2             | V       |
|                   |                                                                      |                                      | 2.3           | 3.0–3.6    | $I_{OL} = 24mA$                                                                                     | 0.55            |         |
| $V_{OLB}$         | LOW Level Output Voltage                                             |                                      | 2.3–2.7       | 3.0–3.6    | $I_{OL} = 100\mu A$                                                                                 | 0.2             | V       |
|                   |                                                                      |                                      | 2.3–2.7       | 3.0        | $I_{OL} = 18mA$                                                                                     | 0.6             |         |
| $I_I$             | Input Leakage Current @ $\overline{OE}$ , $\overline{T/R}$           |                                      | 2.3–2.7       | 3.0–3.6    | $0V \leq V_I \leq 3.6V$                                                                             | $\pm 5.0$       | $\mu A$ |
| $I_{OZ}$          | 3-STATE Output Leakage @ $A_n$                                       |                                      | 2.3–2.7       | 3.0–3.6    | $0V \leq V_O \leq 3.6V$ ,<br>$\overline{OE} = V_{CCA}$ ,<br>$V_I = V_{IH}$ or $V_{IL}$              | $\pm 10$        | $\mu A$ |
| $I_{OFF}$         | Power OFF Leakage Current                                            |                                      | 0             | 0          | $0 \leq (V_I, V_O) \leq 3.6V$                                                                       | 10              | $\mu A$ |
| $I_{CCA}/I_{CCB}$ | Quiescent Supply Current, per supply, $V_{CCA}/V_{CCB}$              |                                      | 2.3–2.7       | 3.0–3.6    | $A_n = V_{CCA}$ or GND,<br>$B_n, \overline{OE}$ , & $\overline{T/R} = V_{CCB}$ or GND               | 20              | $\mu A$ |
|                   |                                                                      |                                      | 2.3–2.7       | 3.0–3.6    | $V_{CCA} \leq A_n \leq 3.6V$ ,<br>$V_{CCB} \leq B_n, \overline{OE}$ ,<br>$\overline{T/R} \leq 3.6V$ | $\pm 20$        | $\mu A$ |
| $\Delta I_{CC}$   | Increase in $I_{CC}$ per Input, $B_n, \overline{T/R}, \overline{OE}$ |                                      | 2.3–2.7       | 3.0–3.6    | $V_I = V_{CCB} - 0.6V$                                                                              | 750             | $\mu A$ |
|                   | Increase in $I_{CC}$ per Input, $A_n$                                |                                      | 2.3–2.7       | 3.0–3.6    | $V_I = V_{CCA} - 0.6V$                                                                              | 750             | $\mu A$ |

## AC Electrical Characteristics

| Symbol                                | Parameter                               | T <sub>A</sub> = −40°C to +85°C, C <sub>L</sub> = 30 pF, R <sub>L</sub> = 500Ω |      |                                                                       |      |                                                                     |      | Units |
|---------------------------------------|-----------------------------------------|--------------------------------------------------------------------------------|------|-----------------------------------------------------------------------|------|---------------------------------------------------------------------|------|-------|
|                                       |                                         | V <sub>CCB</sub> = 1.65V to 1.95V,<br>V <sub>CCA</sub> = 2.3V to 2.7V          |      | V <sub>CCB</sub> = 1.65V to 1.95V,<br>V <sub>CCA</sub> = 3.0V to 3.6V |      | V <sub>CCB</sub> = 2.3V to 2.7V,<br>V <sub>CCA</sub> = 3.0V to 3.6V |      |       |
|                                       |                                         | Min.                                                                           | Max. | Min.                                                                  | Max. | Min.                                                                | Max. |       |
| t <sub>PHL</sub> , t <sub>PLH</sub>   | Propagation Delay,<br>A to B            | 1.5                                                                            | 5.8  | 1.5                                                                   | 6.2  | 0.8                                                                 | 4.4  | ns    |
| t <sub>PHL</sub> , t <sub>PLH</sub>   | Propagation Delay,<br>B to A            | 0.8                                                                            | 5.5  | 0.6                                                                   | 5.1  | 0.6                                                                 | 4.0  | ns    |
| t <sub>PZL</sub> , t <sub>PZH</sub>   | Output Enable Time,<br>OE to B          | 1.5                                                                            | 8.3  | 1.5                                                                   | 8.2  | 0.8                                                                 | 4.6  | ns    |
| t <sub>PZL</sub> , t <sub>PZH</sub>   | Output Enable Time,<br>OE to A          | 0.8                                                                            | 5.3  | 0.6                                                                   | 5.1  | 0.6                                                                 | 4.0  | ns    |
| t <sub>PLZ</sub> , t <sub>PHZ</sub>   | Output Disable Time,<br>OE to B         | 0.8                                                                            | 4.6  | 0.8                                                                   | 4.5  | 0.8                                                                 | 4.4  | ns    |
| t <sub>PLZ</sub> , t <sub>PHZ</sub>   | Output Disable Time,<br>OE to A         | 0.8                                                                            | 5.2  | 0.6                                                                   | 5.6  | 0.6                                                                 | 4.8  | ns    |
| t <sub>osHL</sub> , t <sub>osLH</sub> | Output to Output<br>Skew <sup>(7)</sup> |                                                                                | 0.05 |                                                                       | 0.5  |                                                                     | 0.75 | ns    |

## Note:

7. Skew is defined as the absolute value of the difference between the actual propagation delay for any two separate outputs of the same device. The specification applies to any outputs switching in the same direction, either HIGH-to-LOW ( $t_{osHL}$ ) or LOW-to-HIGH ( $t_{osLH}$ ).

## Dynamic Switching Characteristics

| Symbol    | Parameter                                     | $V_{CCB}$ (V) | $V_{CCA}$ (V) | Conditions                                                 | $T_A = +25^{\circ}\text{C}$<br>Typical | Units |
|-----------|-----------------------------------------------|---------------|---------------|------------------------------------------------------------|----------------------------------------|-------|
| $V_{OLP}$ | Quiet Output Dynamic Peak $V_{OL}$ , A to B   | 1.8           | 2.5           | $C_L = 30 \text{ pF}, V_{IH} = V_{CC}, V_{IL} = 0\text{V}$ | 0.25                                   | V     |
|           |                                               | 1.8           | 3.3           |                                                            | 0.25                                   |       |
|           |                                               | 2.5           | 3.3           |                                                            | 0.6                                    |       |
| $V_{OLP}$ | Quiet Output Dynamic Peak $V_{OL}$ , B to A   | 1.8           | 2.5           | $C_L = 30 \text{ pF}, V_{IH} = V_{CC}, V_{IL} = 0\text{V}$ | 0.6                                    | V     |
|           |                                               | 1.8           | 3.3           |                                                            | 0.8                                    |       |
|           |                                               | 2.5           | 3.3           |                                                            | 0.8                                    |       |
| $V_{OLV}$ | Quiet Output Dynamic Valley $V_{OL}$ , A to B | 1.8           | 2.5           | $C_L = 30 \text{ pF}, V_{IH} = V_{CC}, V_{IL} = 0\text{V}$ | -0.25                                  | V     |
|           |                                               | 1.8           | 3.3           |                                                            | -0.25                                  |       |
|           |                                               | 2.5           | 3.3           |                                                            | -0.6                                   |       |
| $V_{OLV}$ | Quiet Output Dynamic Valley $V_{OL}$ , B to A | 1.8           | 2.5           | $C_L = 30 \text{ pF}, V_{IH} = V_{CC}, V_{IL} = 0\text{V}$ | -0.6                                   | V     |
|           |                                               | 1.8           | 3.3           |                                                            | -0.8                                   |       |
|           |                                               | 2.5           | 3.3           |                                                            | -0.8                                   |       |
| $V_{OHV}$ | Quiet Output Dynamic Valley $V_{OH}$ , A to B | 1.8           | 2.5           | $C_L = 30 \text{ pF}, V_{IH} = V_{CC}, V_{IL} = 0\text{V}$ | 1.3                                    | V     |
|           |                                               | 1.8           | 3.3           |                                                            | 1.3                                    |       |
|           |                                               | 2.5           | 3.3           |                                                            | 1.7                                    |       |
| $V_{OHV}$ | Quiet Output Dynamic Valley $V_{OH}$ , B to A | 1.8           | 2.5           | $C_L = 30 \text{ pF}, V_{IH} = V_{CC}, V_{IL} = 0\text{V}$ | 1.7                                    | V     |
|           |                                               | 1.8           | 3.3           |                                                            | 2.0                                    |       |
|           |                                               | 2.5           | 3.3           |                                                            | 2.0                                    |       |

## Capacitance

| Symbol    | Parameter                     | Conditions                                                                                                | $T_A = +25^\circ\text{C}$ | Units |
|-----------|-------------------------------|-----------------------------------------------------------------------------------------------------------|---------------------------|-------|
| $C_{IN}$  | Input Capacitance             | $V_{CCB} = 2.5\text{V}$ , $V_{CCA} = 3.3\text{V}$ , $V_I = 0\text{V}$ or $V_{CCA/B}$                      | 5                         | pF    |
| $C_{I/O}$ | Input/Output Capacitance      | $V_{CCB} = 2.5\text{V}$ , $V_{CCA} = 3.3\text{V}$ , $V_I = 0\text{V}$ or $V_{CCA/B}$                      | 6                         | pF    |
| $C_{PD}$  | Power Dissipation Capacitance | $V_{CCB} = 2.5\text{V}$ , $V_{CCA} = 3.3\text{V}$ , $V_I = 0\text{V}$ or $V_{CCA/B}$ , $f = 10\text{MHz}$ | 20                        | pF    |

## AC Loading and Waveforms

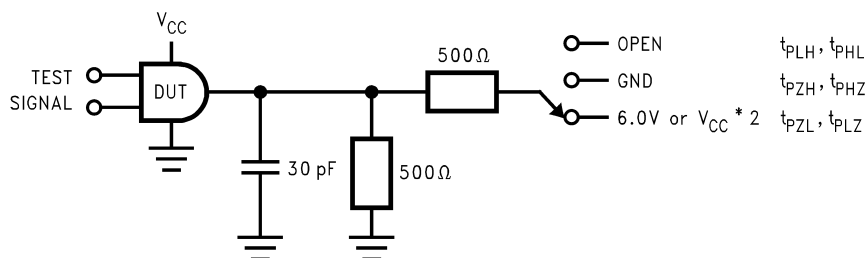


Figure 1. AC Test Circuit

| Test                  | Switch                                                                                                                            |
|-----------------------|-----------------------------------------------------------------------------------------------------------------------------------|
| $t_{PLH}$ , $t_{PHL}$ | OPEN                                                                                                                              |
| $t_{PZL}$ , $t_{PLZ}$ | 6V at $V_{CC} = 3.3 \pm 0.3\text{V}$ ;<br>$V_{CC} \times 2$ at $V_{CC} = 2.5 \pm 0.2\text{V}$ ;<br>$1.8\text{V} \pm 0.15\text{V}$ |
| $t_{PZH}$ , $t_{PHZ}$ | GND                                                                                                                               |

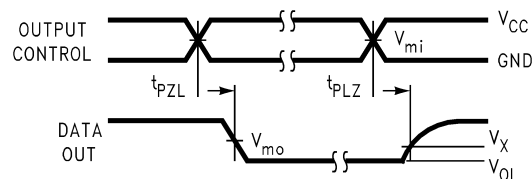


Figure 4. 3-STATE Output Low Enable and Disable Times for Low Voltage Logic  
 $t_R = t_F \leq 2.0 \text{ ns}$ , 10% to 90%

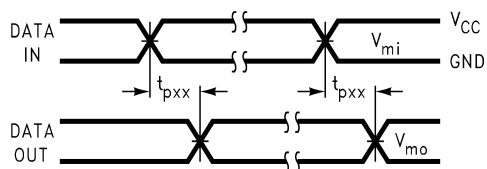


Figure 2. Waveform for Inverting and Non-inverting Functions  
 $t_R = t_F \leq 2.0 \text{ ns}$ , 10% to 90%

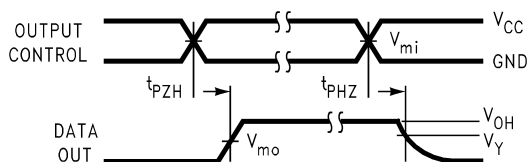


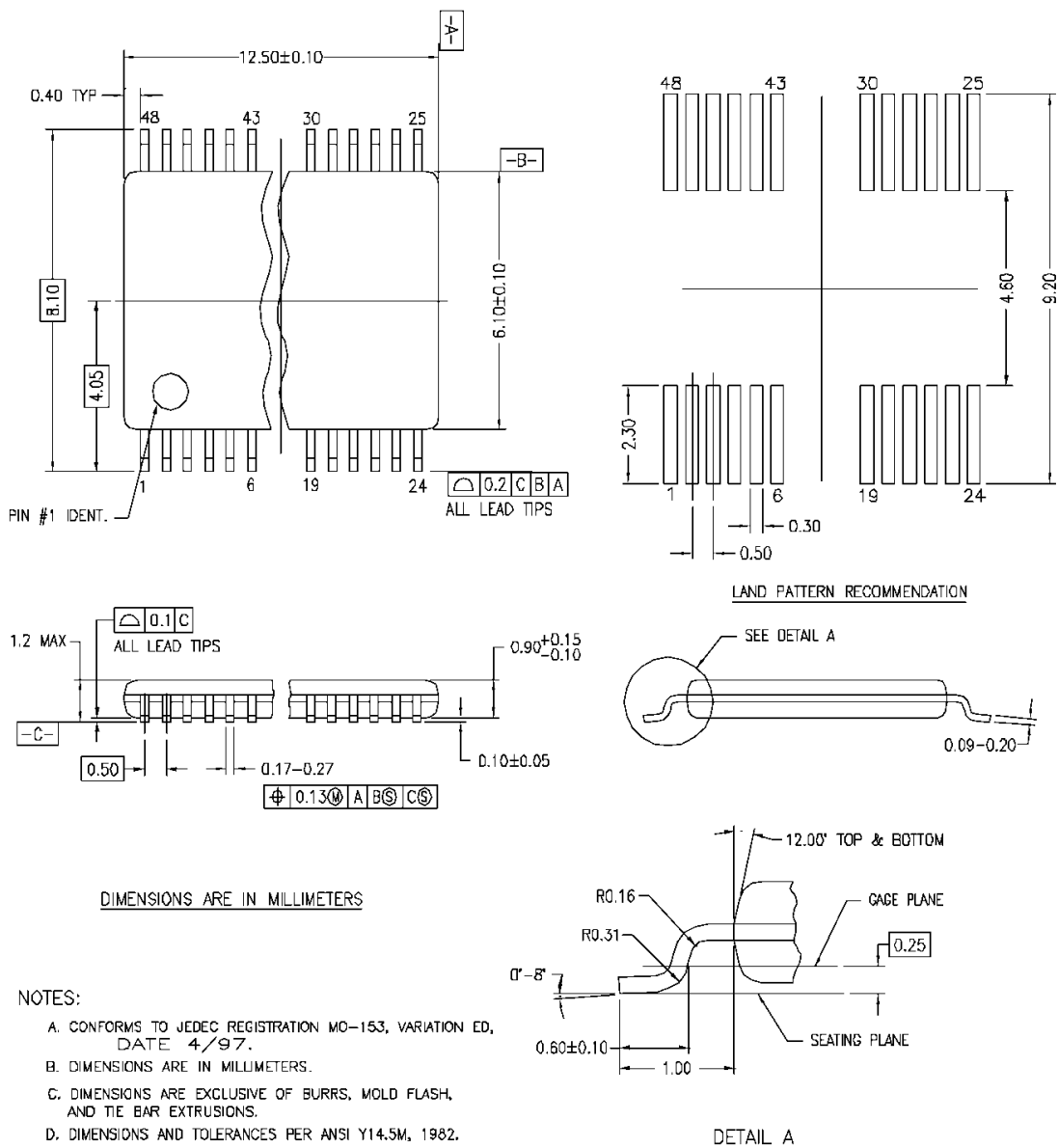
Figure 3. 3-STATE Output High Enable and Disable Times for Low Voltage Logic  
 $t_R = t_F \leq 2.0 \text{ ns}$ , 10% to 90%

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



# Physical Dimensions (Continued)

Dimensions are in millimeters unless otherwise noted.



MTD48REVC

**Figure 6. 48-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 6.1mm Wide Package Number MTD48**



## TRADEMARKS

The following are registered and unregistered trademarks Fairchild Semiconductor owns or is authorized to use and is not intended to be an exhaustive list of all such trademarks.

|                                                  |                                |                                                                                   |                             |
|--------------------------------------------------|--------------------------------|-----------------------------------------------------------------------------------|-----------------------------|
| ACE <sup>®</sup>                                 | <i>i-Lo</i> <sup>™</sup>       | Power-SPM <sup>™</sup>                                                            | TinyBoost <sup>™</sup>      |
| Across the board. Around the world. <sup>™</sup> | ImpliedDisconnect <sup>™</sup> | PowerTrench <sup>®</sup>                                                          | TinyBuck <sup>™</sup>       |
| ActiveArray <sup>™</sup>                         | IntelliMAX <sup>™</sup>        | Programmable Active Droop <sup>™</sup>                                            | TinyLogic <sup>®</sup>      |
| Bottomless <sup>™</sup>                          | ISOPPLANAR <sup>™</sup>        | QFET <sup>®</sup>                                                                 | TINYOPTO <sup>™</sup>       |
| Build it Now <sup>™</sup>                        | MICROCOUPLER <sup>™</sup>      | QS <sup>™</sup>                                                                   | TinyPower <sup>™</sup>      |
| CoolFET <sup>™</sup>                             | MicroPak <sup>™</sup>          | QT Optoelectronics <sup>™</sup>                                                   | TinyWire <sup>™</sup>       |
| CROSSVOLT <sup>™</sup>                           | MICROWIRE <sup>™</sup>         | Quiet Series <sup>™</sup>                                                         | TruTranslation <sup>™</sup> |
| CTL <sup>™</sup>                                 | Motion-SPM <sup>™</sup>        | RapidConfigure <sup>™</sup>                                                       | μSerDes <sup>™</sup>        |
| Current Transfer Logic <sup>™</sup>              | MSX <sup>™</sup>               | RapidConnect <sup>™</sup>                                                         | UHC <sup>®</sup>            |
| DOVE <sup>™</sup>                                | MSXPro <sup>™</sup>            | ScalarPump <sup>™</sup>                                                           | UniFET <sup>™</sup>         |
| E <sup>2</sup> CMOS <sup>™</sup>                 | OCX <sup>™</sup>               | SMART START <sup>™</sup>                                                          | VCX <sup>™</sup>            |
| EcoSPARK <sup>®</sup>                            | OCXPro <sup>™</sup>            | SPM <sup>®</sup>                                                                  | Wire <sup>™</sup>           |
| EnSigna <sup>™</sup>                             | OPTOLOGIC <sup>®</sup>         | STEALTH <sup>™</sup>                                                              |                             |
| FACT Quiet Series <sup>™</sup>                   | OPTOPLANAR <sup>®</sup>        | SuperFET <sup>™</sup>                                                             |                             |
| FACT <sup>®</sup>                                | PACMAN <sup>™</sup>            | SuperSOT <sup>™</sup> -3                                                          |                             |
| FAST <sup>®</sup>                                | PDP-SPM <sup>™</sup>           | SuperSOT <sup>™</sup> -6                                                          |                             |
| FASTr <sup>™</sup>                               | POP <sup>™</sup>               | SuperSOT <sup>™</sup> -8                                                          |                             |
| FPS <sup>™</sup>                                 | Power220 <sup>®</sup>          | SyncFET <sup>™</sup>                                                              |                             |
| FRFET <sup>®</sup>                               | Power247 <sup>®</sup>          | TCM <sup>™</sup>                                                                  |                             |
| GlobalOptoisolator <sup>™</sup>                  | PowerEdge <sup>™</sup>         | The Power Franchise <sup>®</sup>                                                  |                             |
| GTO <sup>™</sup>                                 | PowerSaver <sup>™</sup>        |  |                             |
| HiSeC <sup>™</sup>                               |                                |                                                                                   |                             |

## 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.

## PRODUCT STATUS DEFINITIONS

### Definition of Terms

| Datasheet Identification | Product Status         | Definition                                                                                                                                                                                               |
|--------------------------|------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Advance Information      | Formative or In Design | This datasheet contains the design specifications for product development. Specifications may change in any manner without notice.                                                                       |
| Preliminary              | First Production       | This 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        | This datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve design.                                                   |
| Obsolete                 | Not In Production      | This datasheet contains specifications on a product that has been discontinued by Fairchild Semiconductor. The datasheet is printed for reference information only.                                      |

Rev. I26

## Данный компонент на территории Российской Федерации

**Вы можете приобрести в компании MosChip.**

Для оперативного оформления запроса Вам необходимо перейти по данной ссылке:

<http://moschip.ru/get-element>

Вы можете разместить у нас заказ для любого Вашего проекта, будь то серийное производство или разработка единичного прибора.

В нашем ассортименте представлены ведущие мировые производители активных и пассивных электронных компонентов.

Нашей специализацией является поставка электронной компонентной базы двойного назначения, продукции таких производителей как XILINX, Intel (ex.ALTERA), Vicor, Microchip, Texas Instruments, Analog Devices, Mini-Circuits, Amphenol, Glenair.

Сотрудничество с глобальными дистрибьюторами электронных компонентов, предоставляет возможность заказывать и получать с международных складов практически любой перечень компонентов в оптимальные для Вас сроки.

На всех этапах разработки и производства наши партнеры могут получить квалифицированную поддержку опытных инженеров.

Система менеджмента качества компании отвечает требованиям в соответствии с ГОСТ Р ИСО 9001, ГОСТ РВ 0015-002 и ЭС РД 009

### Офис по работе с юридическими лицами:

105318, г.Москва, ул.Щербаковская д.3, офис 1107, 1118, ДЦ «Щербаковский»

Телефон: +7 495 668-12-70 (многоканальный)

Факс: +7 495 668-12-70 (доб.304)

E-mail: [info@moschip.ru](mailto:info@moschip.ru)

Skype отдела продаж:

moschip.ru

moschip.ru\_4

moschip.ru\_6

moschip.ru\_9