## FOD060L, FOD260L

### 3.3V/5V High Speed-10 MBit/s

Logic Gate Optocouplers

## Features

■ FOD060L in SO8 and FOD260L in 8-pin DIP
■ Very high speed - $10 \mathrm{MBit} / \mathrm{s}$
■ Superior CMR - $50 \mathrm{kV} / \mu \mathrm{s}$ at $1,000 \mathrm{~V}$ peak

- Fan-out of 8 over $-40^{\circ} \mathrm{C}$ to $+85^{\circ} \mathrm{C}$
- Logic gate output

■ Strobable output
■ Wired OR-open collector
■ Safety and regulatory approvals

- UL1577
- DIN EN/IEC 60747-5-2


## Applications

\author{

- Ground loop elimination <br> ■ LSTTL to TTL, LSTTL or 5 -volt CMOS
}

■ Line receiver, data transmission
■ Data multiplexing

- Switching power supplies

■ Pulse transformer replacement

- Computer-peripheral interface


## Description

These optocouplers consist of an AIGaAS LED, optically coupled to a very high speed integrated photo-detector logic gate. Devices include a strobable output. This output features an open collector, thereby permitting wired OR outputs. The coupled parameters are guaranteed over the temperature range of $-40^{\circ} \mathrm{C}$ to $+85^{\circ} \mathrm{C}$. A maximum input signal of 5 mA will provide a minimum output sink current of 13 mA (fan out of 8). An internal noise shield provides superior common mode rejection of typically $50 \mathrm{kV} / \mu \mathrm{s}$ at $1,000 \mathrm{~V}$ common mode.

Absolute Maximum Ratings (No derating required up to $85^{\circ} \mathrm{C}$ )
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 | Value | Units |
| :---: | :---: | :---: | :---: |
| $\mathrm{T}_{\text {STG }}$ | Storage Temperature | -40 to +125 | ${ }^{\circ} \mathrm{C}$ |
| TopR | Operating Temperature | -40 to +85 | ${ }^{\circ} \mathrm{C}$ |
| EMITTER |  |  |  |
| $\mathrm{I}_{\mathrm{F}}$ | DC/Average Forward Input Current | 50 | mA |
| $\mathrm{V}_{\mathrm{E}}$ | Enable Input Voltage, not to exceed $\mathrm{V}_{\mathrm{CC}}$ by more than 500 mV | $\mathrm{V}_{\mathrm{CC}}+0.5 \mathrm{~V}$ | V |
| $\mathrm{V}_{\mathrm{R}}$ | Reverse Input Voltage | 5.0 | V |
| $\mathrm{P}_{1}$ | Power Dissipation | 45 | mW |
| DETECTOR |  |  |  |
| $\begin{gathered} \mathrm{V}_{\mathrm{CC}} \\ (1 \text { minute max) } \end{gathered}$ | Supply Voltage | 7.0 | V |
| l | Output Current | 50 | mA |
| $\mathrm{V}_{\mathrm{O}}$ | Output Voltage | 7.0 | V |
| $\mathrm{P}_{\mathrm{O}}$ | Collector Output Power Dissipation | 85 | mW |

Recommended Operating Conditions

| Symbol | Parameter | Min. | Max. | Units |
| :---: | :--- | :---: | :---: | :---: |
| $\mathrm{I}_{\mathrm{FL}}$ | Input Current, Low Level | 0 | 250 | $\mu \mathrm{~A}$ |
| $\mathrm{I}_{\mathrm{FH}}$ | Input Current, High Level | ${ }^{*} 6.3$ | 15 | mA |
| $\mathrm{~V}_{\mathrm{CC}}$ | Supply Voltage, Output | 3.0 | 5.5 | V |
| $\mathrm{~V}_{\mathrm{EL}}$ | Enable Voltage, Low Level | 0 | 0.8 | V |
| $\mathrm{~V}_{\mathrm{EH}}$ | Enable Voltage, High Level | 2.0 | $\mathrm{~V}_{\mathrm{CC}}$ | V |
| $\mathrm{T}_{\mathrm{A}}$ | Operating Temperature | -40 | +85 | ${ }^{\circ} \mathrm{C}$ |
| N | Fan Out (TTL load) |  | 8 |  |
| $\mathrm{R}_{\mathrm{L}}$ | Output Pull-up Resistor | 330 | 4 K | $\Omega$ |

*6.3 mA is a guard banded value which allows for at least $20 \%$ CTR degradation. Initial input current threshold value is 5.0 mA or less.

Electrical Characteristics $\left(T_{A}=-40^{\circ} \mathrm{C}\right.$ to $+85^{\circ} \mathrm{C}$ unless otherwise specified. Typical value is measured at
$\mathrm{T}_{\mathrm{A}}=25^{\circ} \mathrm{C}$ and $\mathrm{V}_{\mathrm{CC}}=3.3 \mathrm{~V}$ )
Individual Component Characteristics

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| EMITTER |  |  |  |  |  |  |
| $V_{F}$ | Input Forward Voltage | $\mathrm{I}_{\mathrm{F}}=10 \mathrm{~mA}$ |  | 1.4 | 1.8 | V |
|  |  |  |  |  | 1.75 |  |
| $\mathrm{B}_{\mathrm{VR}}$ | Input Reverse Breakdown Voltage | $\mathrm{I}_{\mathrm{R}}=10 \mu \mathrm{~A}$ | 5.0 |  |  | V |
| $\mathrm{C}_{\text {IN }}$ | Input Capacitance | $\mathrm{V}_{\mathrm{F}}=0, \mathrm{f}=1 \mathrm{MHz}$ |  | 6.0 |  | pF |
| $\Delta \mathrm{VF} / \Delta \mathrm{TA}$ | Input Diode Temperature Coefficient | $\mathrm{I}_{\mathrm{F}}=10 \mathrm{~mA}$ |  | -1.9 |  | $\mathrm{mV} /{ }^{\circ} \mathrm{C}$ |
| DETECTOR |  |  |  |  |  |  |
| $\mathrm{I}_{\mathrm{CCH}}$ | High Level Supply Current | $\mathrm{V}_{\mathrm{E}}=0.5 \mathrm{~V}, \mathrm{I}_{\mathrm{F}}=0 \mathrm{~mA}, \mathrm{~V}_{\mathrm{CC}}=3.3 \mathrm{~V}$ |  | 3.5 | 7 | mA |
| $\mathrm{I}_{\text {CCL }}$ | Low Level Supply Current | $\mathrm{V}_{\mathrm{E}}=0.5 \mathrm{~V}, \mathrm{I}_{\mathrm{F}}=0 \mathrm{~mA}, \mathrm{~V}_{\mathrm{CC}}=3.3 \mathrm{~V}$ |  | 3.2 | 10 | mA |
| $\mathrm{I}_{\mathrm{EL}}$ | Low Level Enable Current | $\mathrm{V}_{\mathrm{CC}}=3.3 \mathrm{~V}, \mathrm{~V}_{\mathrm{E}}=0.5 \mathrm{~V}$ |  |  | -1.6 | mA |
| $\mathrm{I}_{\mathrm{EH}}$ | High Level Enable Current | $\mathrm{V}_{\mathrm{CC}}=3.3 \mathrm{~V}, \mathrm{~V}_{\mathrm{E}}=2.0 \mathrm{~V}$ |  |  | -1.6 | mA |
| $\mathrm{V}_{\mathrm{EH}}$ | High Level Enable Voltage | $\mathrm{V}_{\mathrm{CC}}=3.3 \mathrm{~V}, \mathrm{I}_{\mathrm{F}}=10 \mathrm{~mA}$ | 2.0 | 1.27 |  | V |
| $\mathrm{V}_{\mathrm{EL}}$ | Low Level Enable Voltage | $\mathrm{V}_{\mathrm{CC}}=3.3 \mathrm{~V}, \mathrm{I}_{\mathrm{F}}=10 \mathrm{~mA}$ (Note 2) |  | 1.18 | 0.8 | V |

Switching Characteristics $\left(T_{A}=-40^{\circ} \mathrm{C}\right.$ to $+85^{\circ} \mathrm{C}, \mathrm{V}_{C C}=3.3 \mathrm{~V}, \mathrm{I}_{\mathrm{F}}=7.5 \mathrm{~mA}$ unless otherwise specified. Typical value is measured at $\mathrm{T}_{\mathrm{A}}=25^{\circ} \mathrm{C}$ and $\mathrm{V}_{\mathrm{CC}}=3.3 \mathrm{~V}$ )

| Symbol | AC Characteristics | Test Conditions | Min. | Typ. | Max. | Unit |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\mathrm{T}_{\mathrm{PLH}}$ | Propagation Delay Time to Output High Level | $\mathrm{R}_{\mathrm{L}}=350 \Omega, \mathrm{C}_{\mathrm{L}}=15 \mathrm{pF}$ (Fig. 9) (Note 3) |  | 65 | 90 | ns |
| $\mathrm{T}_{\text {PHL }}$ | Propagation Delay Time to Output Low Level | $\mathrm{R}_{\mathrm{L}}=350 \Omega, \mathrm{C}_{\mathrm{L}}=15 \mathrm{pF}$ (Fig. 9) (Note 4) |  | 43 | 75 | ns |
| IT ${ }_{\text {PHL }}-\mathrm{T}_{\text {PLH }} \mid$ | Pulse Width Distortion | $\mathrm{R}_{\mathrm{L}}=350 \Omega, \mathrm{C}_{\mathrm{L}}=15 \mathrm{pF}$ (Fig. 9) |  | 23 | 25 | ns |
| $t_{\text {PSK }}$ | Propagation Delay Skew | $\mathrm{R}_{\mathrm{L}}=350 \Omega, \mathrm{C}_{\mathrm{L}}=15 \mathrm{pF}$ (Note 5) |  | 31 | 40 | ns |
| $\mathrm{t}_{\mathrm{r}}$ | Output Rise Time (10-90\%) | $\mathrm{R}_{\mathrm{L}}=350 \Omega, \mathrm{C}_{\mathrm{L}}=15 \mathrm{pF}$ (Fig. 9)(Note 6) |  | 22 |  | ns |
| $\mathrm{t}_{\mathrm{f}}$ | Output Fall Time (90-10\%) | $\mathrm{R}_{\mathrm{L}}=350 \Omega, \mathrm{C}_{\mathrm{L}}=15 \mathrm{pF}$ (Fig. 12) (Note 7) |  | 3 |  | ns |
| $t_{\text {ELH }}$ | Enable Propagation Delay Time to Output High Level | $\mathrm{V}_{\mathrm{EH}}=3 \mathrm{~V}, \mathrm{R}_{\mathrm{L}}=350 \Omega, \mathrm{C}_{\mathrm{L}}=15 \mathrm{pF}$ <br> (Fig. 10) (Note 8) |  | 47 |  | ns |
| $t_{\text {EHL }}$ | Enable Propagation Delay Time to Output Low Level | $\mathrm{V}_{\mathrm{EH}}=3 \mathrm{~V}, \mathrm{R}_{\mathrm{L}}=350 \Omega, \mathrm{C}_{\mathrm{L}}=15 \mathrm{pF}$ <br> (Fig. 10) (Note 9) |  | 27 |  | ns |
| $\mathrm{CM}_{\mathrm{H}}$ | Common Mode Transient Immunity (at Output High Level) | $\begin{aligned} & \mathrm{R}_{\mathrm{L}}=350 \Omega, \mathrm{~T}_{\mathrm{A}}=25^{\circ} \mathrm{C}, \mathrm{I}_{\mathrm{F}}=0 \mathrm{~mA}, \\ & \mathrm{~V}_{\mathrm{OH}}(\text { Min. })=2.0 \mathrm{~V}, \mathrm{IV}_{\mathrm{CM}}=1,000 \mathrm{~V} \\ & \text { (Fig. 11) (Note 10) } \end{aligned}$ | 25,000 | 50,000 |  | V/ $/ \mathrm{s}$ |
| $\mathrm{CM}_{\mathrm{L}}$ | Common Mode Transient Immunity (at Output Low Level) | $\begin{aligned} & \mathrm{R}_{\mathrm{L}}=350 \Omega, \mathrm{~T}_{\mathrm{A}}=25^{\circ} \mathrm{C}, \mathrm{I}_{\mathrm{F}}=7.5 \mathrm{~mA}, \\ & \mathrm{~V}_{\mathrm{OL}}(\text { Max. })=0.8 \mathrm{~V}, \mathrm{IV}_{\mathrm{CM}} \mathrm{I}=1,000 \mathrm{~V} \\ & \text { (Fig. 11) (Note 11) } \end{aligned}$ | 25,000 | 50,000 |  | V/ $/ \mathrm{s}$ |

Transfer Characteristics $\left(T_{A}=-40^{\circ} \mathrm{C}\right.$ to $+85^{\circ} \mathrm{C}$ Unless otherwise specified. Typical value is measured at $\mathrm{T}_{\mathrm{A}}=25^{\circ} \mathrm{C}$ and $\mathrm{V}_{\mathrm{CC}}=3.3 \mathrm{~V}$ )

| Symbol | DC Characteristics | Test Conditions | Min. | Typ. | Max. | Unit |
| :---: | :--- | :--- | :---: | :---: | :---: | :---: |
| $\mathrm{I}_{\mathrm{OH}}$ | High Level Output Current | $\mathrm{I}_{\mathrm{F}}=250 \mu \mathrm{~A}, \mathrm{~V}_{\mathrm{CC}}=3.3 \mathrm{~V}, \mathrm{~V}_{\mathrm{O}}=3.3 \mathrm{~V}$, <br> $\mathrm{V}_{\mathrm{E}}=2.0 \mathrm{~V}(\mathrm{Note} 2)$ | 0.01 | 50 | $\mu \mathrm{~A}$ |  |
| $\mathrm{~V}_{\mathrm{OL}}$ | Low Level Output Voltage | $\mathrm{V}_{\mathrm{CC}}=3.3 \mathrm{~V}, \mathrm{I}_{\mathrm{F}}=5 \mathrm{~mA}, \mathrm{I}_{\mathrm{OL}}=13 \mathrm{~mA}$, <br> $\mathrm{V}_{\mathrm{E}}=2.0 \mathrm{~V}(N o t e 2)$ | 0.3 | 0.6 | V |  |
| $\mathrm{I}_{\mathrm{FT}}$ | Input Threshold Current | $\mathrm{V}_{\mathrm{CC}}=3.3 \mathrm{~V}, \mathrm{~V}_{\mathrm{O}}=0.6 \mathrm{~V}, \mathrm{I}_{\mathrm{OL}}=13 \mathrm{~mA}$, <br> $\mathrm{V}_{\mathrm{E}}=2.0 \mathrm{~V}($ Note 2$)$ | 1 | 5 | mA |  |

Isolation Characteristics $\left(T_{A}=-40^{\circ} \mathrm{C}\right.$ to $+85^{\circ} \mathrm{C}$ Unless otherwise specified. Typical value is measured at $\mathrm{T}_{\mathrm{A}}=25^{\circ} \mathrm{C}$ and $\mathrm{V}_{\mathrm{CC}}=3.3 \mathrm{~V}$ )

| Symbol | Characteristics | Test Conditions | Min. | Typ. | Max. | Unit |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\mathrm{I}_{\text {-O }}$ | Input-Output Insulation Leakage Current | $\begin{aligned} & \text { Relative humidity }=45 \%, \\ & \mathrm{~T}_{\mathrm{A}}=25^{\circ} \mathrm{C}, \mathrm{t}=5 \mathrm{~s}, \\ & \mathrm{~V}_{1-\mathrm{O}}=3000 \mathrm{VDC} \text { (Note 12) } \end{aligned}$ |  |  | 1.0 | $\mu \mathrm{A}$ |
| $\mathrm{V}_{\text {ISO }}$ | Withstand Insulation Test Voltage <br> FOD060L <br> FOD260L | $\begin{aligned} & \mathrm{I}_{\mathrm{IO}} \leq 2 \mu \mathrm{~A}, \mathrm{R}_{\mathrm{H}}<50 \%, \\ & \mathrm{~T}_{\mathrm{A}}=25^{\circ} \mathrm{C}, \mathrm{t}=1 \text { min.(Note 12) } \end{aligned}$ | 3750 |  |  | $\mathrm{V}_{\text {RMS }}$ |
| $\mathrm{R}_{1-\mathrm{O}}$ | Resistance (Input to Output) | $\mathrm{V}_{\text {I-O }}=500 \mathrm{~V}$ (Note 12) |  | $10^{12}$ |  | $\Omega$ |
| $\mathrm{Cl}_{1-\mathrm{O}}$ | Capacitance (Input to Output) | $\mathrm{f}=1 \mathrm{MHz}$ (Note 12) |  | 0.6 |  | pF |

## Notes

1. The $\mathrm{V}_{\mathrm{Cc}}$ supply to each optoisolator must be bypassed by a $0.1 \mu \mathrm{~F}$ capacitor or larger. This can be either a ceramic or solid tantalum capacitor with good high frequency characteristic and should be connected as close as possible to the package $\mathrm{V}_{\mathrm{CC}}$ and GND pins of each device.
2. Enable Input - No pull up resistor required as the device has an internal pull up resistor.
3. $\mathrm{t}_{\mathrm{PLH}}$ - Propagation delay is measured from the 3.75 mA level on the HIGH to LOW transition of the input current pulse to the 1.5 V level on the LOW to HIGH transition of the output voltage pulse.
4. $\mathrm{t}_{\mathrm{PHL}}$ - Propagation delay is measured from the 3.75 mA level on the LOW to HIGH transition of the input current pulse to the 1.5 V level on the HIGH to LOW transition of the output voltage pulse.
5. $t_{P S K}$ is the worst case difference between $t_{P H L}$ and $t_{P L H}$ for any devices at the stated test conditions.
6. $t_{r}$ - Rise time is measured from the $90 \%$ to the $10 \%$ levels on the LOW to HIGH transition of the output pulse.
7. $t_{f}$ - Fall time is measured from the $10 \%$ to the $90 \%$ levels on the HIGH to LOW transition of the output pulse.
8. $t_{E L H}$ - Enable input propagation delay is measured from the 1.5 V level on the HIGH to LOW transition of the input voltage pulse to the 1.5 V level on the LOW to HIGH transition of the output voltage pulse.
9. $\mathrm{t}_{\mathrm{EHL}}$ - Enable input propagation delay is measured from the 1.5 V level on the LOW to HIGH transition of the input voltage pulse to the 1.5 V level on the HIGH to LOW transition of the output voltage pulse.
10. $\mathrm{CM}_{\mathrm{H}}$ - The maximum tolerable rate of rise of the common mode voltage to ensure the output will remain in the high state (i.e., $\mathrm{V}_{\text {OUT }}>2.0 \mathrm{~V}$ ). Measured in volts per microsecond ( $\mathrm{V} / \mu \mathrm{s}$ ).
11. $\mathrm{CM}_{\mathrm{L}}$ - The maximum tolerable rate of fall of the common mode voltage to ensure the output will remain in the low output state (i.e., $\mathrm{V}_{\text {OUT }}<0.8 \mathrm{~V}$ ). Measured in volts per microsecond ( $\mathrm{V} / \mu \mathrm{s}$ ).
12. Device considered a two-terminal device: Pins 1, 2, 3 and 4 shorted together, and Pins 5, 6, 7 and 8 shorted together.

## Typical Performance Curves

Fig. 1 Input Forward Current vs.
Forward Voltage


Fig. 3 Low Level Output Voltage vs. Ambient Temperature


Fig. 5 Low Level Output Current vs. Ambient Temperature


Fig. 2 Input Threshold Current vs. Ambient Temperature


Fig. 4 High Level Output Current vs. Ambient Temperature


Fig. 6 Propagation Delay vs. Ambient Temperature


## Typical Performance Curves

Fig. 7 Rise and Fall Times vs. Ambient Temperature


Fig. 8 Pulse Width Distortion vs. Ambient Temperature



Fig. 9 Test Circuit and Waveforms for $\mathrm{t}_{\text {PLH }}, \mathrm{t}_{\mathrm{PHL}}, \mathrm{t}_{\mathrm{r}}$ and $\mathrm{t}_{\mathrm{f}}$.


Fig. 10 Test Circuit $\mathrm{t}_{\text {EHL }}$ and $\mathrm{t}_{\mathrm{ELH}}$.


Fig. 11 Test Circuit Common Mode Transient Immunity

## Package Dimensions

## Small Outline



Lead Coplanarity : 0.004 (0.10) MAX


## Note:

All dimensions are in millimeters.
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.

A/ways visit Fairchild Semiconductor's online packaging area for the most recent package drawings:
http://www.fairchildsemi.com/packagingl

## Package Dimensions (Continued)

DIP

## Through Hole



## 0.4" Lead Spacing (Option T)



Package drawings are provided as a service to customers considering Fairchild components. Drawings may change in any manner without notice. Please note the revision andlor 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/

## Package Dimensions (Continued)

## SMT

## Surface Mount - 0.3" Lead Spacing (Option S)



Recommended Land Pattern


## Surface Mount - 0.4" Lead Spacing (Option TS)



## Recommended Land Pattern



## Note:

1. All dimensions are in millimeters.
2. Dimensions are exclusive of burrs, mold fash, and tie bar extrusion.

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/

Ordering Information

| Part Number | Package | Packing Method |
| :--- | :--- | :--- |
| FOD060L | Small outline 8-pin | Tube (50 units per tube) |
| FOD060LR2 | Small outline 8-pin | Tape and Reel (2.500 units per reel) |
| FOD260L | DIP 8-Pin | Tube (50 units per tube) |
| FOD260LS | SMT 8-Pin (Lead Bend) | Tube (50 units per tube) |
| FOD260LSD | SMT 8-Pin (Lead Bend) | Tape and Reel (1,000 units per reel) |
| FOD260LV | DIP 8-Pin, DIN EN/IEC 60747-5-2 option | Tube (50 units per tube) |
| FOD260LSV | SMT 8-Pin (Lead Bend), DIN EN/IEC 60747-5-2 option | Tube (50 units per tube) |
| FOD260LSDV | SMT 8-Pin (Lead Bend), DIN EN/IEC 60747-5-2 option | Tape and Reel (1,000 units per reel) |
| FOD260LTV | DIP 8-Pin, 0.4" Lead Spacing, DIN EN/IEC 60747-5-2 option | Tube (50 units per tube) |
| FOD260LTSV | SMT 8-Pin, 0.4" Lead Spacing, DIN EN/IEC 60747-5-2 option | Tube (50 units per tube) |
| FOD260LTSR2 | SMT 8-Pin, 0.4" Lead Spacing | Tape and Reel (700 units per reel) |
| FOD260LTSR2V | SMT 8-Pin, 0.4" Lead Spacing, DIN EN/IEC 60747-5-2 option | Tape and Reel (700 units per reel) |

## Marking Information (Continued)

DIP and SMT

## Carrier Tape Specification

## Small Outline



## Note:

All dimensions are in millimeters.

## Carrier Tape Specification (Continued)

## Option S



| Symbol | Description | Dimension in mm |
| :---: | :--- | :---: |
| W | Tape Width | $16.0 \pm 0.3$ |
| t | Tape Thickness | $0.30 \pm 0.05$ |
| $\mathrm{P}_{0}$ | Sprocket Hole Pitch | $4.0 \pm 0.1$ |
| $\mathrm{D}_{0}$ | Sprocket Hole Diameter | $1.55 \pm 0.05$ |
| E | Sprocket Hole Location | $1.75 \pm 0.10$ |
| F | Pocket Location | $7.5 \pm 0.1$ |
| $\mathrm{P}_{2}$ |  | $2.0 \pm 0.1$ |
| P | Pocket Pitch | $12.0 \pm 0.1$ |
| $\mathrm{~A}_{0}$ | Pocket Dimensions | $10.30 \pm 0.20$ |
| $\mathrm{~B}_{0}$ |  | $10.30 \pm 0.20$ |
| $\mathrm{~K}_{0}$ |  | $4.90 \pm 0.20$ |
| $\mathrm{~W}_{1}$ | Cover Tape Width | $13.2 \pm 0.2$ |
| d | Cover Tape Thickness | 0.1 max |
|  | Max. Component Rotation or Tilt | $10^{\circ}$ |
| R | Min. Bending Radius | 30 |

## Carrier Tape Specification (Continued)

## Option TS



| Symbol | Description | Dimension in mm |
| :---: | :--- | :---: |
| W | Tape Width | $24.0 \pm 0.3$ |
| t | Tape Thickness | $0.40 \pm 0.1$ |
| $\mathrm{P}_{0}$ | Sprocket Hole Pitch | $4.0 \pm 0.1$ |
| $\mathrm{D}_{0}$ | Sprocket Hole Diameter | $1.55 \pm 0.05$ |
| E | Sprocket Hole Location | $1.75 \pm 0.10$ |
| F | Pocket Location | $11.5 \pm 0.1$ |
| $\mathrm{P}_{2}$ |  | $2.0 \pm 0.1$ |
| P | Pocket Pitch | $16.0 \pm 0.1$ |
| $\mathrm{~A}_{0}$ | Pocket Dimensions | $12.80 \pm 0.1$ |
| $\mathrm{~B}_{0}$ |  | $10.35 \pm 0.1$ |
| $\mathrm{~K}_{0}$ |  | $5.7 \pm 0.1$ |
| $\mathrm{~W}_{1}$ | Cover Tape Width | $21.0 \pm 0.1$ |
| d | Cover Tape Thickness | 0.1 max |
|  | Max. Component Rotation or Tilt | $10^{\circ}$ |
| R | Min. Bending Radius | 30 |


| Reflow Profile |
| :--- |
| Small Outline |
| Temperature |
| $\left({ }^{\circ} \mathrm{C}\right)$ |
|  |

Reflow Profile (Continued)

## DIP and SMT



| Profile Freature | Pb-Free Assembly Profile |
| :--- | :---: |
| Temperature Min. (Tsmin) | $150^{\circ} \mathrm{C}$ |
| Temperature Max. (Tsmax) | $200^{\circ} \mathrm{C}$ |
| Time ( $\mathrm{t}_{\mathrm{S}}$ ) from (Tsmin to Tsmax) | $60-120$ seconds |
| Ramp-up Rate ( $\mathrm{t}_{\mathrm{L}}$ to $\mathrm{t}_{\mathrm{P}}$ ) | $3^{\circ} \mathrm{C} /$ second max. |
| Liquidous Temperature ( $\mathrm{T}_{\mathrm{L}}$ ) | $217^{\circ} \mathrm{C}$ |
| Time ( $\mathrm{t}_{\mathrm{L}}$ ) Maintained Above ( $\mathrm{T}_{\mathrm{L}}$ ) | $60-150$ seconds |
| Peak Body Package Temperature | $260^{\circ} \mathrm{C}+0^{\circ} \mathrm{C} /-5^{\circ} \mathrm{C}$ |
| Time ( $\mathrm{t}_{\mathrm{P}}$ ) within $5^{\circ} \mathrm{C}$ of $260^{\circ} \mathrm{C}$ | 30 seconds |
| Ramp-down Rate ( $\mathrm{T}_{\mathrm{P}}$ to $\mathrm{T}_{\mathrm{L}}$ ) | $6^{\circ} \mathrm{C} /$ second max. |
| Time $25^{\circ} \mathrm{C}$ to Peak Temperature | 8 minutes max. |

## FAIREHILD

EEMICONDUCTOR

## 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.

| AccuPowertm | FPS ${ }^{\text {TM }}$ | Power-SPM ${ }^{\text {™ }}$ | The Power Franchise ${ }^{\text {® }}$ |
| :---: | :---: | :---: | :---: |
| Auto-SPM ${ }^{\text {m }}$ | F-PFS ${ }^{\text {TM }}$ | PowerTrench ${ }^{\text {® }}$ | The Right Technology for Your Success ${ }^{\text {™ }}$ |
| AX-CAPт ${ }^{\text {\% }}$ | FRFET ${ }^{\text {® }}$ | PowerXS ${ }^{\text {TM }}$ | therer* |
| Bit $\mathrm{SiC}^{\text {® }}$ | Global Power Resource ${ }^{\text {SM }}$ | Programmable Active Droop ${ }^{\text {™ }}$ | $\rho_{\text {franc }}$ |
| Build it Now ${ }^{\text {TM }}$ | Green FPS ${ }^{\text {m }}$ | QFET ${ }^{\text {® }}$ | TinyBoost ${ }^{\text {m }}$ |
| CorePLUS ${ }^{\text {™ }}$ | Green FPSS ${ }^{\text {TM }}$ e-Series ${ }^{\text {m }}$ | QS ${ }^{\text {TM }}$ | TinyBuck ${ }^{\text {m }}$ |
| CorePOMER ${ }^{\text {m }}$ | Gmax ${ }^{\text {m }}$ | Quiet Series ${ }^{\text {TM }}$ | TinyCalc ${ }^{\text {cm }}$ |
| CROSSVOLT ${ }^{\text {Tm }}$ | GTOTm | RapidConfigure ${ }^{\text {TM }}$ | TinyLogic ${ }^{\text {® }}$ |
| CTL ${ }^{\text {™ }}$ | IntelliMAX ${ }^{\text {Tm }}$ | $\bigcirc{ }^{\text {m }}$ | TINYOPTOTM |
| Current Transfer Logic ${ }^{\text {TM }}$ | ISOPLANARTM | Saving our world, $1 \mathrm{~mW} / \mathrm{N} / \mathrm{kN}$ at a time ${ }^{\text {TM }}$ | TinyPower ${ }^{\text {Tm }}$ |
| DEUXPEED ${ }^{\text {® }}$ | MegaBuck ${ }^{\text {m }}$ | SignalWise ${ }^{\text {TM }}$ | TinyPMM ${ }^{\text {tm }}$ |
| Dual Cool ${ }^{\text {TM }}$ | MICROCOUPLER ${ }^{\text {m }}$ | SmartMax ${ }^{\text {m }}$ | Tiny Miret ${ }^{\text {TM }}$ |
| EfficientMax ${ }^{\text {™ }}$ | MicroFeTtm | SMART START'M | TranSiC ${ }^{\text {a }}$ |
| EfficientM ax ${ }^{\text {™ }}$ | MicroPak ${ }^{\text {™ }}$ | SPM ${ }^{\text {® }}$ | TriFault Detect ${ }^{\text {™ }}$ |
| ESBC'm | MicroPak2 ${ }^{\text {TM }}$ | STEALTH ${ }^{\text {™ }}$ | TRUECURRENT** |
|  | MillerDrive ${ }^{\text {TM }}$ | SuperFET ${ }^{\text {® }}$ | $\mu$ SerDes ${ }^{\text {TM }}$ |
| Fairchild ${ }^{\text {® }}$ | MotionMax ${ }^{\text {TM }}$ | SuperSOT ${ }^{\text {Tm-3 }}$ | $M$ |
| Fairchild Semiconductor ${ }^{\text {® }}$ | Motion-SPM ${ }^{\text {TM }}$ | SuperSOTTM-6 | SerDes |
| FACT Quiet Series ${ }^{\text {m }}$ | mWSavertM | SuperSOTTM-8 | UHC ${ }^{\text {® }}$ |
| $\mathrm{FACT}^{\text {® }}$ | OptoHiT'm | SupreMOS ${ }^{\circ}$ | Ultra FRFET ${ }^{\text {m }}$ |
| FAST ${ }^{\text {® }}$ | OPTOLOGIC ${ }^{\text {® }}$ | SyncFETTm | UniFET ${ }^{\text {Tm }}$ |
| FastvCore ${ }^{\text {m }}$ | OPTOPLANAR | Sync-Lock ${ }^{\text {Tm }}$ | VCX ${ }^{\text {TM }}$ |
| FETBench ${ }^{\text {Tm }}$ |  |  | VisualMax ${ }^{\text {TM }}$ |
| FlashWriter ${ }^{\text {®** }}$ | D |  | $\times S^{\text {TM }}$ |

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

## DISCLAIMER

FAIRCHLLD SEMICONDUCTOR RESERVESTHE RIGHT TO MAKE CHANGES WTHOUT FURTHER NOTICE TO ANY PRODUCTS HEREIN TOIMPROVE RELIABIUTY, FUNCTION, OR DESIGN. FAIRCHILDDOESNOT ASSUME ANY LIABIUTY ARISING OUT OF THE APFUCATION 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 FAIRCHID'S WORLDMDE 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 WRITIEN 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, waw.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 cormmitted 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 / <br> In Design | Datasheet contains the design specifications for product development. Specifications may change <br> in any manner without notice. |
| Preliminary | First Production | Datasheet contains preliminary data; supplementary data will be published at a later date. Fairchild <br> 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 re serves the right to make <br> 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. <br> The datasheet is for reference information only. |

