FAIRCHILD SEMICONDUCTOR®

May 2009

# FDMA1023PZ

## Dual P-Channel PowerTrench® MOSFET

### –20V, –3.7A, 72mΩ

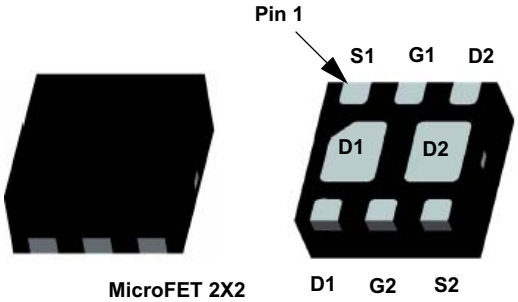
## Features

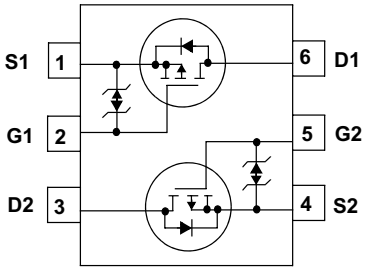
- Max $r_{DS(on)}$ = 72mΩ at $V_{GS}$ = –4.5V, $I_D$ = –3.7A
- Max $r_{DS(on)}$ = 95mΩ at $V_{GS}$ = –2.5V, $I_D$ = –3.2A
- Max $r_{DS(on)}$ = 130mΩ at $V_{GS}$ = –1.8V, $I_D$ = –2.0A
- Max $r_{DS(on)}$ = 195mΩ at $V_{GS}$ = –1.5V, $I_D$ = –1.0A
- Low profile - 0.8 mm maximum - in the new package MicroFET 2x2 mm
- HBM ESD protection level > 2kV typical (Note 3)
- RoHS Compliant
- Free from halogenated compounds and antimony oxides

## General Description

This device is designed specifically as a single package solution for the battery charge switch in cellular handset and other ultra-portable applications. It features two independent P-Channel MOSFETs with low on-state resistance for minimum conduction losses. When connected in the typical common source configuration, bi-directional current flow is possible.

The MicroFET 2X2 package offers exceptional thermal performance for its physical size and is well suited to linear mode applications.




## MOSFET Maximum Ratings $T_A$ = 25°C unless otherwise noted

| Symbol | Parameter | | Ratings | Units |
|---|---|---|---|---|
| $V_{DS}$ | Drain to Source Voltage | | –20 | V |
| $V_{GS}$ | Gate to Source Voltage | | ±8 | V |
| $I_D$ | Drain Current -Continuous | (Note 1a) | –3.7 | A |
| | -Pulsed | | –6 | |
| $P_D$ | Power Dissipation | (Note 1a) | 1.5 | W |
| | | (Note 1b) | 0.7 | |
| $T_J$, $T_{STG}$ | Operating and Storage Junction Temperature Range | | –55 to +150 | °C |

### Thermal Characteristics

| | | | | |
|---|---|---|---|---|
| $R_{\theta JA}$ | Thermal Resistance for Single Operation, Junction to Ambient | (Note 1a) | 86 | °C/W |
| $R_{\theta JA}$ | Thermal Resistance for Single Operation, Junction to Ambient | (Note 1b) | 173 | |
| $R_{\theta JA}$ | Thermal Resistance for Dual Operation, Junction to Ambient | (Note 1c) | 69 | |
| $R_{\theta JA}$ | Thermal Resistance for Dual Operation, Junction to Ambient | (Note 1d) | 151 | |

### Package Marking and Ordering Information

| Device Marking | Device | Package | Reel Size | Tape Width | Quantity |
|---|---|---|---|---|---|
| 023 | FDMA1023PZ | MicroFET 2X2 | 7” | 8mm | 3000 units |

©2009 Fairchild Semiconductor Corporation

## Electrical Characteristics $T_J$ = 25°C unless otherwise noted

| Symbol | Parameter | Test Conditions | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|
| **Off Characteristics** | | | | | | |
| $BV_{DSS}$ | Drain to Source Breakdown Voltage | $I_D$ = –250μA, $V_{GS}$ = 0V | –20 | | | V |
| $\frac{\Delta BV_{DSS}}{\Delta T_J}$ | Breakdown Voltage Temperature Coefficient | $I_D$ = –250μA, referenced to 25°C | | –11 | | mV/°C |
| $I_{DSS}$ | Zero Gate Voltage Drain Current | $V_{DS}$ = –16V, $V_{GS}$ = 0V | | | –1 | μA |
| $I_{GSS}$ | Gate to Source Leakage Current | $V_{GS}$ = ±8V, $V_{DS}$ = 0V | | | ±10 | μA |
| **On Characteristics** | | | | | | |
| $V_{GS(th)}$ | Gate to Source Threshold Voltage | $V_{GS}$ = $V_{DS}$, $I_D$ = –250μA | –0.4 | –0.7 | –1.0 | V |
| $\frac{\Delta V_{GS(th)}}{\Delta T_J}$ | Gate to Source Threshold Voltage Temperature Coefficient | $I_D$ = –250μA, referenced to 25°C | | 2.5 | | mV/°C |
| $r_{DS(on)}$ | Static Drain to Source On-Resistance | $V_{GS}$ = –4.5V, $I_D$ = –3.7A | | 60 | 72 | mΩ |
| | | $V_{GS}$ = –2.5V, $I_D$ = –3.2A | | 75 | 95 | |
| | | $V_{GS}$ = –1.8V, $I_D$ = –2.0A | | 100 | 130 | |
| | | $V_{GS}$ = –1.5V, $I_D$ = –1.0A | | 130 | 195 | |
| | | $V_{GS}$ = –4.5V, $I_D$ = –3.7A, $T_J$ =125°C | | 81 | 91 | |
| $g_{FS}$ | Forward Transconductance | $V_{DS}$ = –5V, $I_D$ = –3.7A | | 12 | | S |
| **Dynamic Characteristics** | | | | | | |
| $C_{iss}$ | Input Capacitance | $V_{DS}$ = –10V, $V_{GS}$ = 0V, f = 1MHz | | 490 | 655 | pF |
| $C_{oss}$ | Output Capacitance | | | 100 | 135 | pF |
| $C_{rss}$ | Reverse Transfer Capacitance | | | 90 | 135 | pF |
| **Switching Characteristics** | | | | | | |
| $t_{d(on)}$ | Turn-On Delay Time | $V_{DD}$ = –10V, $I_D$ = –1A, $V_{GS}$ = –4.5V, $R_{GEN}$ = 6Ω | | 9 | 18 | ns |
| $t_r$ | Rise Time | | | 12 | 22 | ns |
| $t_{d(off)}$ | Turn-Off Delay Time | | | 64 | 103 | ns |
| $t_f$ | Fall Time | | | 37 | 60 | ns |
| $Q_{g(TOT)}$ | Total Gate Charge | $V_{DD}$ = –10V, $I_D$ = –3.7A, $V_{GS}$ = –4.5V | | 8.6 | 12 | nC |
| $Q_{gs}$ | Gate to Source Gate Charge | | | 0.7 | | nC |
| $Q_{gd}$ | Gate to Drain “Miller” Charge | | | 2.0 | | nC |
| **Drain-Source Diode Characteristics** | | | | | | |
| $I_S$ | Maximum Continuous Source-Drain Diode Forward Current | | | | –1.1 | A |
| $V_{SD}$ | Source to Drain Diode Forward Voltage | $V_{GS}$ = 0V, $I_S$ = –1.1A (Note 2) | | –0.8 | –1.2 | V |
| $t_{rr}$ | Reverse Recovery Time | $I_F$ = –3.7A, di/dt = 100A/μs | | 32 | 48 | ns |
| $Q_{rr}$ | Reverse Recovery Charge | | | 15 | 23 | nC |

**Notes:**

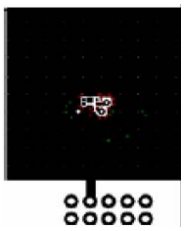
1: $R_{\theta JA}$ is determined with the device mounted on a 1 $in^2$ oz. copper pad on a 1.5 x 1.5 in. board of FR-4 material. $R_{\theta JC}$is guaranteed by design while $R_{\theta JA}$ is determined by the user's board design.

(a) $R_{\theta JA}$ = 86°C/W when mounted on a 1$in^2$ pad of 2 oz copper, 1.5" x 1.5" x 0.062" thick PCB. For single operation.

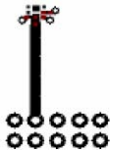
(b) $R_{\theta JA}$ = 173°C/W when mounted on a minimum pad of 2 oz copper. For single operation.

(c) $R_{\theta JA}$ = 69°C/W when mounted on a 1$in^2$ pad of 2 oz copper, 1.5" x 1.5" x 0.062" thick PCB, For dual operation.

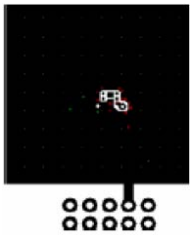
(d) $R_{\theta JA}$ = 151°C/W when mounted on a minimum pad of 2 oz copper. For dual operation.



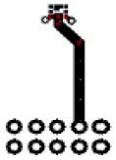
a) 86°C/W when mounted on a 1 $in^2$ pad of 2 oz copper.



b) 173°C/W when mounted on a minimum pad of 2 oz copper.



c) 69°C/W when mounted on a 1 $in^2$ pad of 2 oz copper.



d) 151°C/W when mounted on a minimum pad of 2 oz copper.

2: Pulse Test : Pulse Width < 300us, Duty Cycle < 2.0%

3: The diode connected between the gate and source serves only as protection against ESD. No gate overvoltage rating is implied.

## Typical Characteristics $T_J$ = 25°C unless otherwise noted

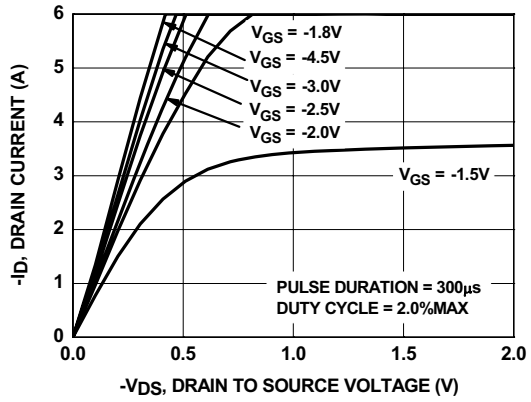



**Figure 1. On Region Characteristics**

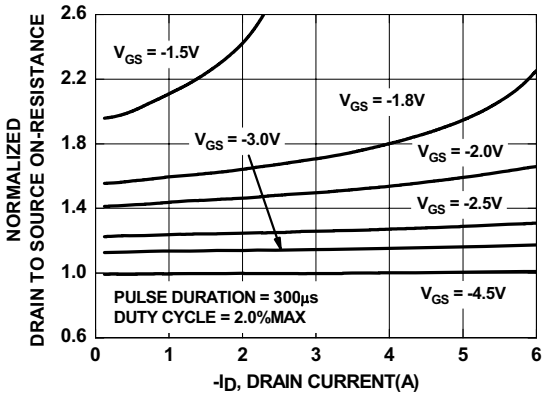



**Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage**

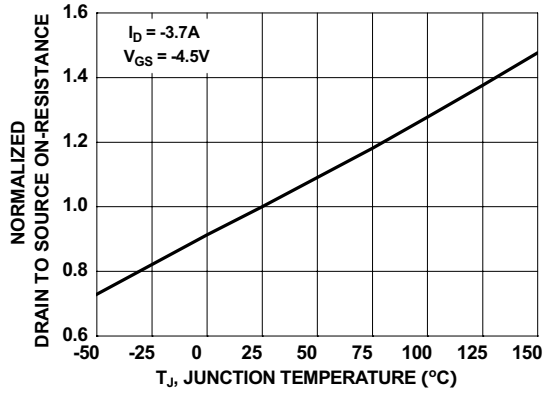



**Figure 3. Normalized On-Resistance vs Junction Temperature**

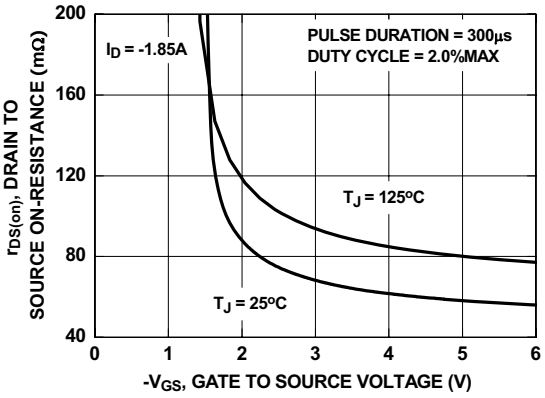



**Figure 4. On-Resistance vs Gate to Source Voltage**

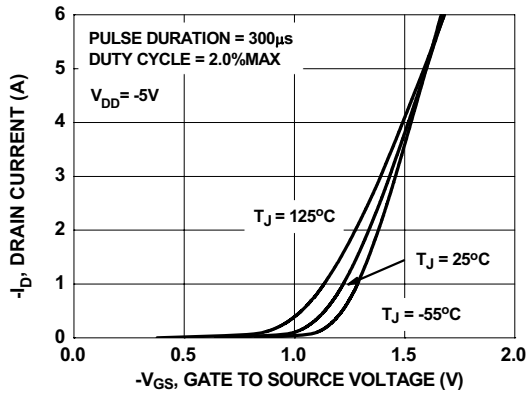



**Figure 5. Transfer Characteristics**

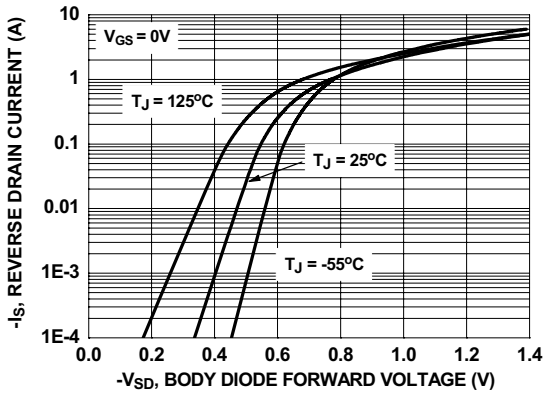



**Figure 6. Source to Drain Diode Forward Voltage vs Source Current**

## Typical Characteristics $T_J$ = 25°C unless otherwise noted

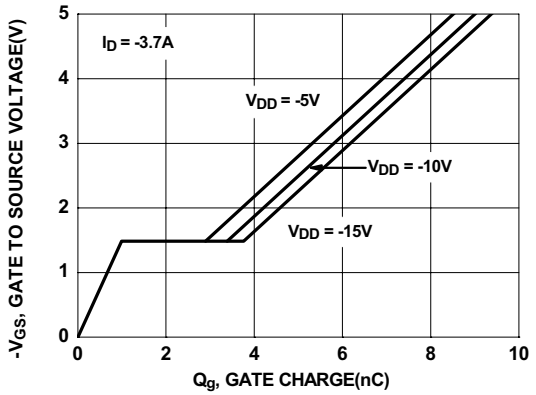



Figure 7. Gate Charge Characteristics

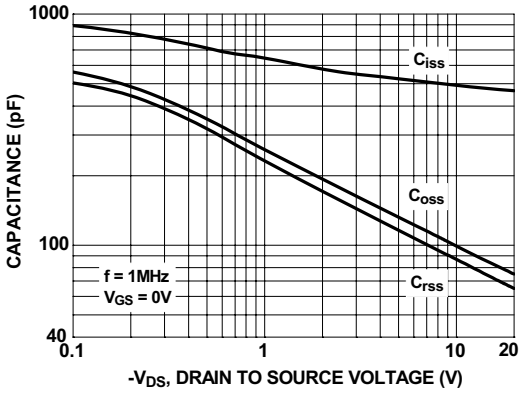



Figure 8. Capacitance Characteristics

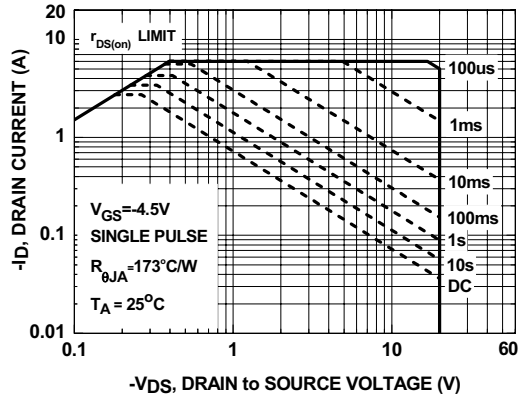



Figure 9. Forward Bias Safe Operating Area

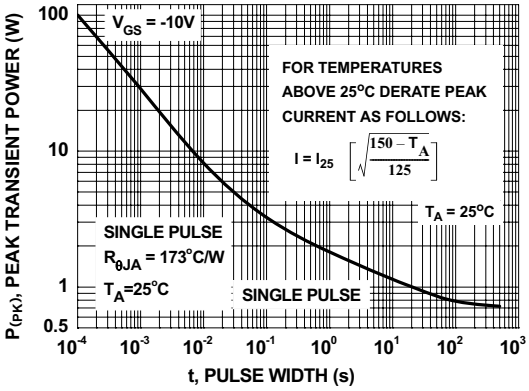



Figure 10. Single Pulse Maximum Power Dissipation

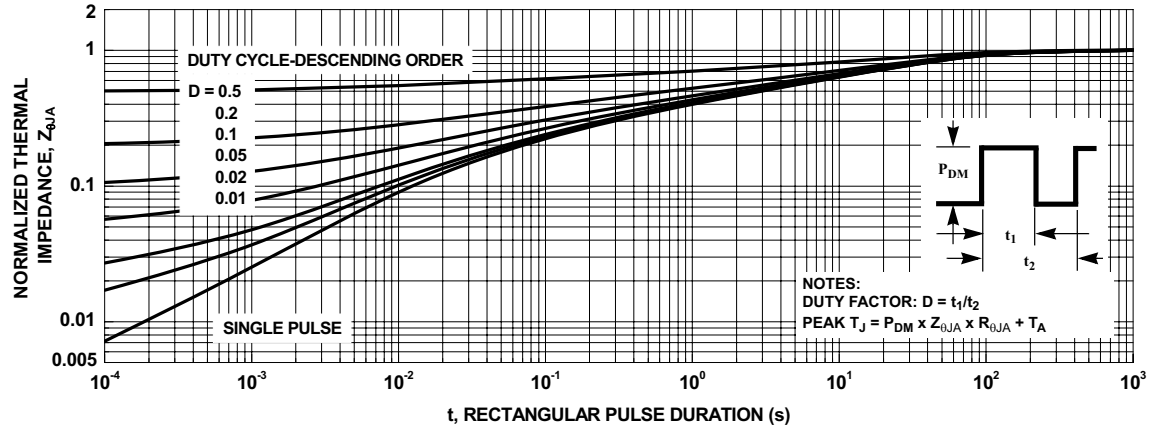
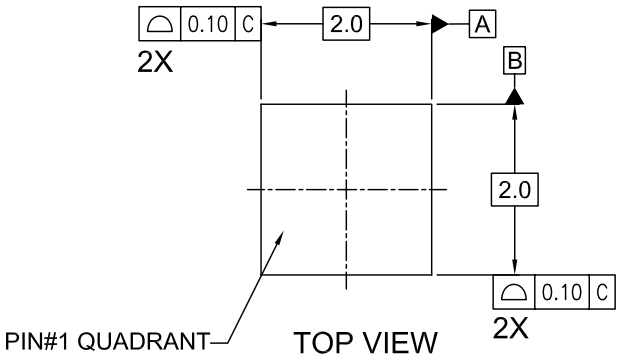
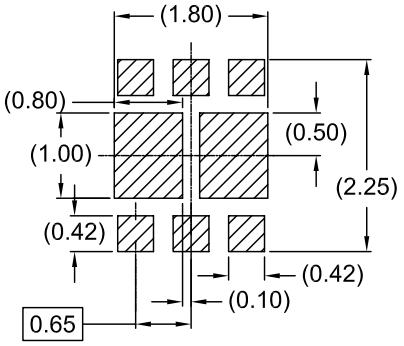


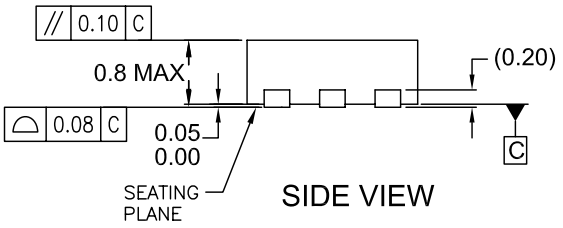

Figure 11. Transient Thermal Response Curve

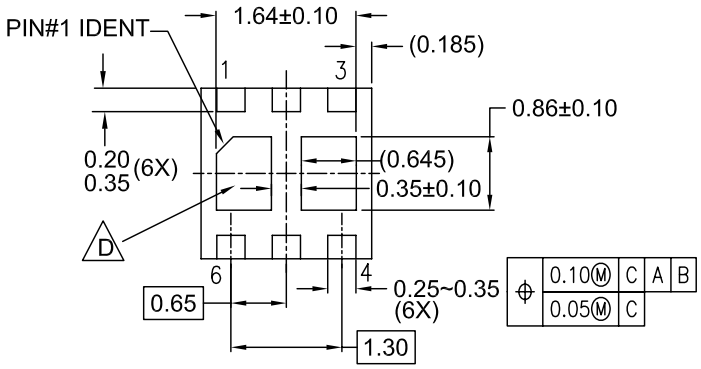
## Dimensional Outline and Pad Layout




RECOMMENDED LAND PATTERN




BOTTOM VIEW

## NOTES:

A. CONFORMS TO JEDEC REGISTRATION MO-229, VARIATION VCCC EXCEPT AS NOTED.

B. DIMENSIONS ARE IN MILLIMETERS.

C. DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 1994

D. NON-JEDEC DUAL DAP

E. DRAWING FILE NAME : MLP06J rev3

FAIRCHILD SEMICONDUCTOR®

**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.

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

*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 manufactures 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 application, 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 handing 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 and 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. I40