

## FDFM2P110

### Integrated P-Channel PowerTrench® MOSFET and Schottky Diode

#### General Description

FDFM2P110 combines the exceptional performance of Fairchild's PowerTrench MOSFET technology with a very low forward voltage drop Schottky barrier rectifier in a MicroFET package.

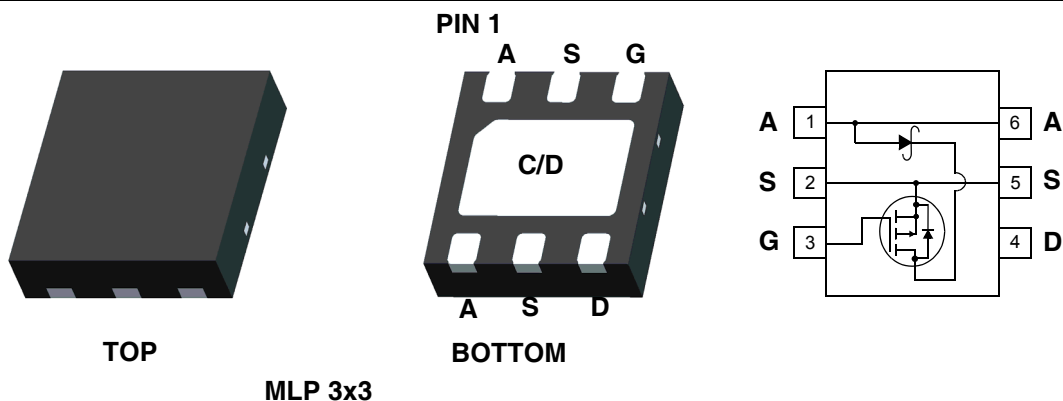
This device is designed specifically as a single package solution for Buck Boost. It features a fast switching, low gate charge MOSFET with very low on-state resistance.

#### Applications

- Buck Boost

#### Features

- -3.5 A, -20 V  $R_{DS(ON)} = 140m\Omega @ V_{GS} = -4.5 V$   
 $R_{DS(ON)} = 200m\Omega @ V_{GS} = -2.5 V$
- Low Profile - 0.8 mm maximum - in the new package  
MicroFET 3x3 mm



#### Absolute Maximum Ratings $T_A = 25^\circ C$ unless otherwise noted

Symbol	Parameter	Ratings	Units
$V_{DSS}$	Drain-Source Voltage	-20	V
$V_{GSS}$	Gate-Source Voltage	$\pm 12$	V
$I_D$	Drain Current - Continuous (Note 1a)	-3.5	A
	- Pulsed	-10	
$V_{RRM}$	Schottky Repetitive Peak Reverse voltage	20	V
$I_O$	Schottky Average Forward Current (Note 1a)	2	A
$P_D$	Power dissipation (Steady State) (Note 1a)	2	W
		0.8 (Note 1b)	
$T_J, T_{STG}$	Operating and Storage Junction Temperature Range	-55 to +150	$^\circ C$

#### Thermal Characteristics

$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient (Note 1a)	60	$^\circ C/W$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient (Note 1b)	145	$^\circ C/W$

#### Package Marking and Ordering Information

Device Marking	Device	Reel Size	Tape Width	Quantity
2P110	FDFM2P110	7inch	12mm	3000 units

### Electrical Characteristics $T_A = 25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
--------	-----------	-----------------	-----	-----	-----	-------

#### Off Characteristics

$B_{VDSS}$	Drain-Source Breakdown Voltage	$I_D = -250\mu\text{A}, V_{GS} = 0\text{V}$	-20	-	-	V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = -250\mu\text{A}$ , Referenced to $25^\circ\text{C}$	-	-11	-	mV/ $^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{GS} = 0\text{V}, V_{DS} = -16\text{V}$	-	-	-1	$\mu\text{A}$
$I_{GSS}$	Gate-Body Leakage,	$V_{GS} = \pm 12\text{V}, V_{DS} = 0\text{V}$	-	-	$\pm 100$	nA

#### On Characteristics (Note 2)

$V_{GS(TH)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = -250\mu\text{A}$	-0.6	-1.0	-1.5	V
$\frac{\Delta V_{GS(TH)}}{\Delta T_J}$	Gate Threshold Voltage Temperature Coefficient	$I_D = -250\mu\text{A}$ , Referenced to $25^\circ\text{C}$	-	3	-	mV/ $^\circ\text{C}$
$R_{DS(ON)}$	Static Drain-Source On-Resistance	$I_D = -3.5\text{A}, V_{GS} = -4.5\text{V}$	-	101	140	m $\Omega$
		$I_D = -3.0\text{A}, V_{GS} = -2.5\text{V}$	-	145	200	
		$I_D = -3.5\text{A}, V_{GS} = -4.5\text{V}$ , $T_J = 125^\circ\text{C}$	-	136	202	
$I_{D(ON)}$	On-State Drain Current	$V_{GS} = -2.5\text{V}, V_{DS} = -5\text{V}$	-10	-	-	A
$g_{FS}$	Forward Transconductance	$I_D = -3.5\text{A}, V_{DS} = -5\text{V}$	-	6	-	S

#### Dynamic Characteristics

$C_{ISS}$	Input Capacitance	$V_{DS} = -10\text{V}, V_{GS} = 0\text{V}$ , $f = 1\text{MHz}$	-	280	-	pF
$C_{OSS}$	Output Capacitance		-	65	-	pF
$C_{RSS}$	Reverse Transfer Capacitance		-	35	-	pF
$R_G$	Gate Resistance	$f = 1\text{MHz}$	-	7	-	$\Omega$

#### Switching Characteristics (Note 2)

$t_{d(ON)}$	Turn-On Delay Time	$V_{DD} = -10\text{V}, I_D = -1\text{A}$ $V_{GS} = -4.5\text{V}, R_{GEN} = 16\Omega$	-	8	16	ns
$t_r$	Turn-On Rise Time		-	12	22	ns
$t_{d(OFF)}$	Turn-Off Delay Time		-	11	20	ns
$t_f$	Turn-Off Fall Time		-	3.2	6.4	ns
$Q_g$	Total Gate Charge	$V_{DS} = -10\text{V}, I_D = -3.5\text{A}$ , $V_{GS} = -4.5\text{V}$	-	3	4	nC
$Q_{gs}$	Gate-Source Charge		-	0.7	-	nC
$Q_{gd}$	Gate-Drain Charge		-	1	-	nC

#### Drain-Source Diode Characteristics and Maximum Ratings

$I_S$	Maximum Continuous Drain-Source Diode Forward Current	-	-	-2	A	
$V_{SD}$	Drain-Source Diode Forward Voltage	$V_{GS} = 0\text{V}, I_S = -2\text{A}$ (Note 2)	-	-0.9	-1.2	V
$t_{rr}$	Diode Reverse Recovery Time	$I_F = -3.5\text{A}, dI_F/dt = 100\text{A}/\mu\text{s}$	-	13	-	ns
$Q_{rr}$	Diode Reverse Recovery Charge		-	3	-	nC

#### Schottky Diode Characteristic

$V_R$	Reverse Voltage	$I_R = 1\text{mA}$	20	-	-	V	
$I_R$	Reverse Leakage	$V_R = 5\text{V}$	$T_J = 25^\circ\text{C}$	-	-	100	$\mu\text{A}$
			$T_J = 100^\circ\text{C}$	-	-	10	mA
$V_F$	Forward Voltage	$I_F = 1\text{A}$	$T_J = 25^\circ\text{C}$	-	0.32	0.39	V

**Electrical Characteristics**  $T_A = 25^\circ\text{C}$  unless otherwise noted

**Notes:**

1.  $R_{\theta JA}$  is the sum of the junction-to-case and case-to-ambient thermal resistance where the case thermal reference is defined as the solder mounting surface of the drain pins.  $R_{\theta CA}$  is guaranteed by design while  $R_{\theta JA}$  is determined by the user's board design.



a)  $60^\circ\text{C/W}$  when mounted on a  $1\text{ in}^2$  pad of 2 oz copper



b)  $145^\circ\text{C/W}$  when mounted on a minimum pad of 2 oz copper

Scale 1: 1 on letter size paper

2. Pulse Test: Pulse Width  $< 300\ \mu\text{s}$ , Duty Cycle  $< 2.0\%$

## Typical Characteristics

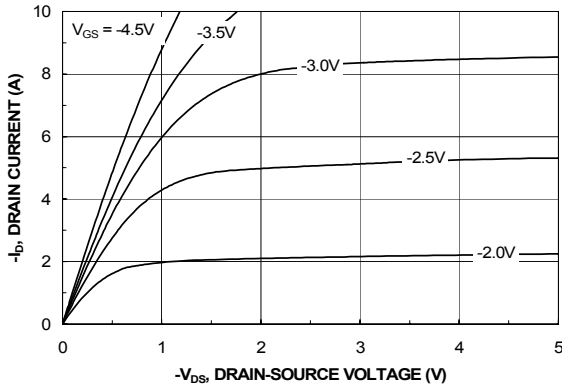


Figure 1. On-Region Characteristics

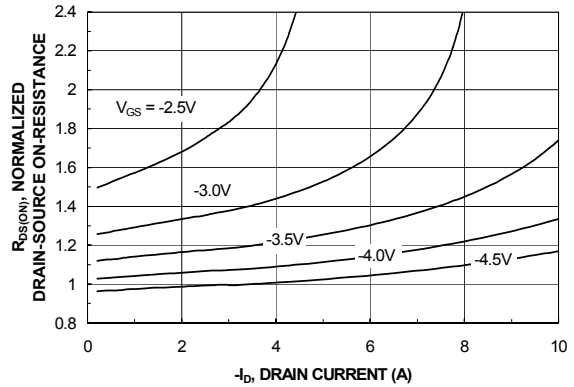


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage

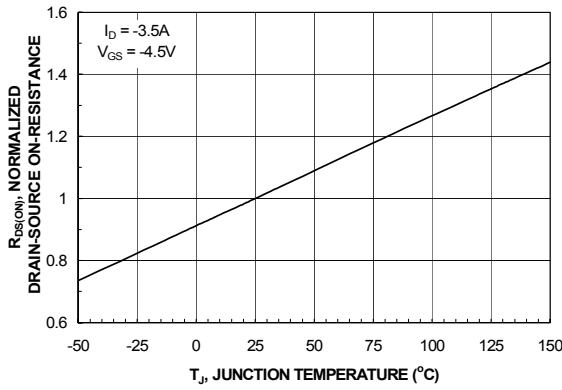


Figure 3. On-Resistance Variation with Temperature

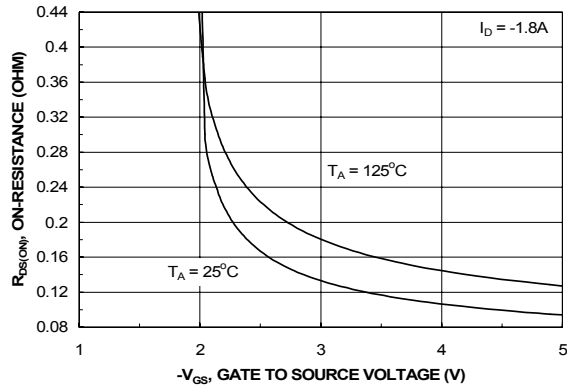


Figure 4. On-Resistance Variation with Gate-to-Source Voltage

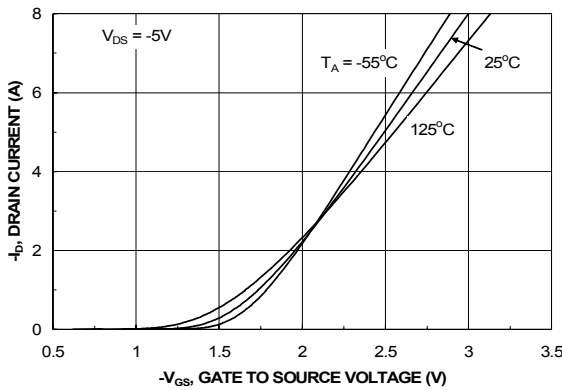


Figure 5. Transfer Characteristics

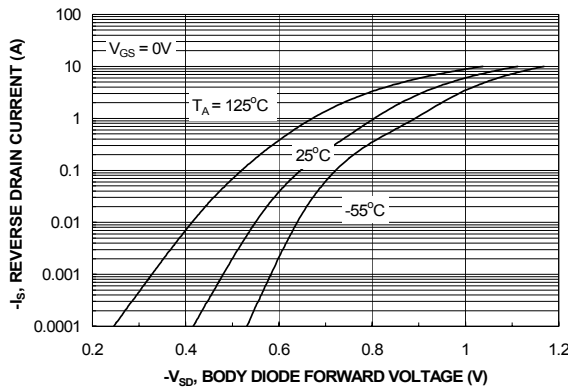


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature

## Typical Characteristics

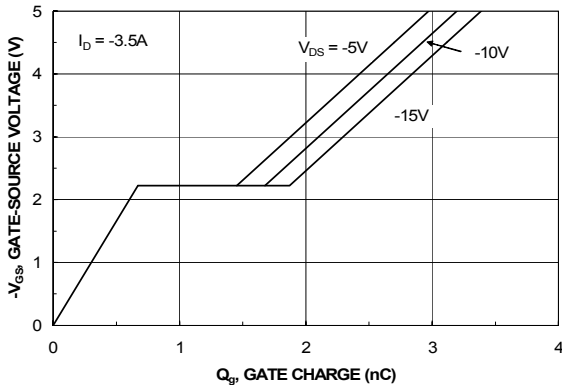


Figure 7. Gate Charge Characteristics

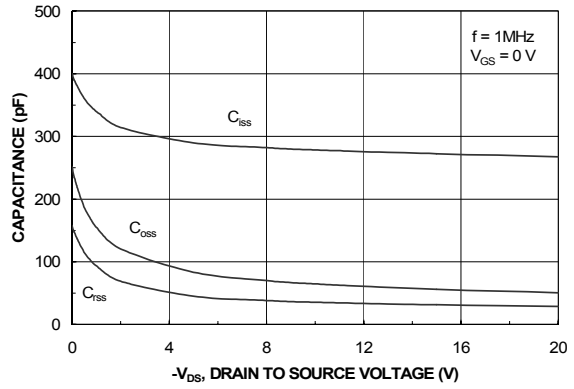


Figure 8. Capacitance Characteristics

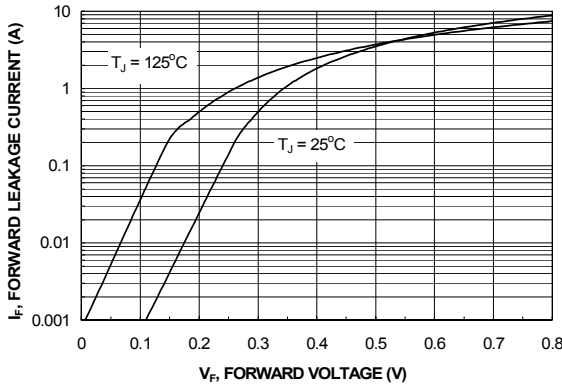


Figure 9. Schottky Diode Forward Voltage

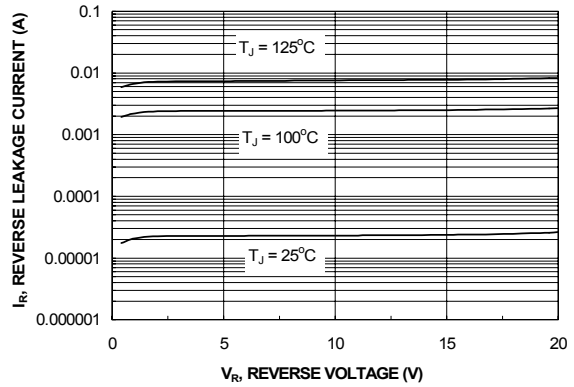


Figure 10. Schottky Diode Reverse Current

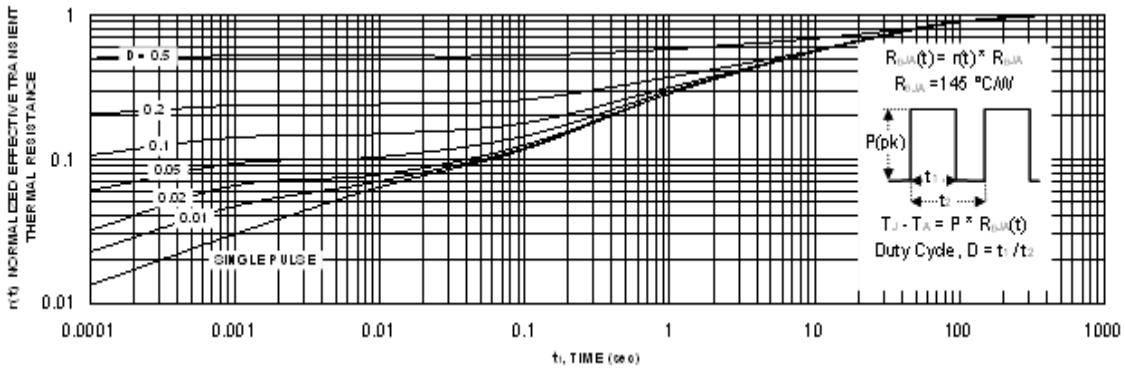
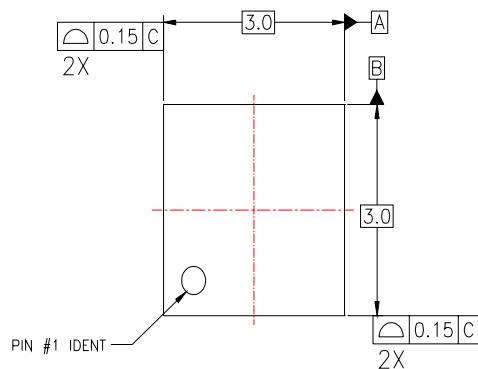
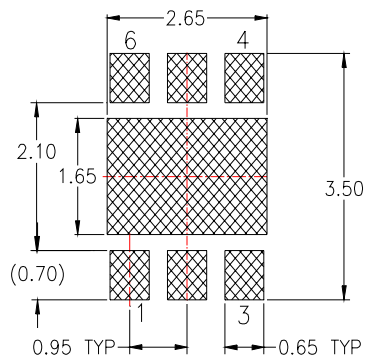


Figure 11. Transient Thermal Response Curve

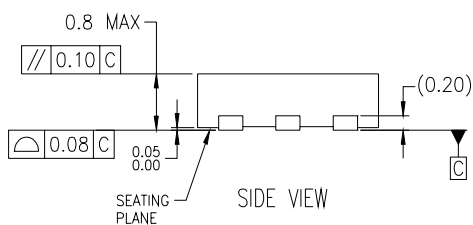
Thermal characterization performed using the conditions described in Note 1b.  
 Transient thermal response will change depending on the circuit board design.



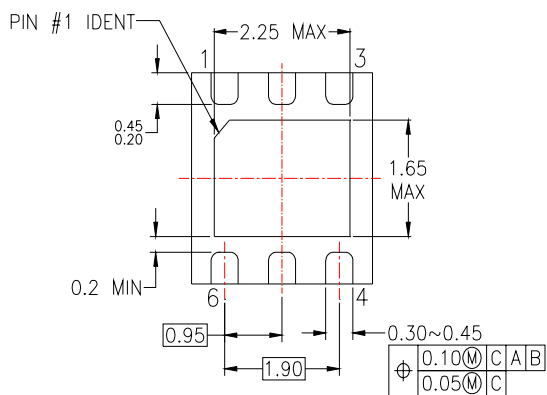
TOP VIEW



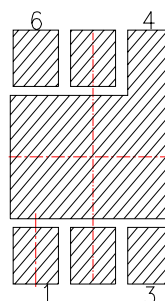
RECOMMENDED LAND PATTERN



SIDE VIEW



BOTTOM VIEW



RECOMMENDED COPPER TRACE

NOTES:

- A. CONFORMS TO JEDEC REGISTRATION MO-229, VARIATION WEEA, DATED 11/2001
- B. DIMENSIONS ARE IN MILLIMETERS.
- C. DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 1994

MLP06GrevA

## 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>x</sup> <sup>TM</sup>	FACT <sup>TM</sup>	<i>i-Lo</i> <sup>TM</sup>	PACMAN <sup>TM</sup>	SPM <sup>TM</sup>
ActiveArray <sup>TM</sup>	FACT Quiet Series <sup>TM</sup>	ImpliedDisconnect <sup>TM</sup>	POP <sup>TM</sup>	Stealth <sup>TM</sup>
Bottomless <sup>TM</sup>	FAST <sup>®</sup>	IntelliMAX <sup>TM</sup>	Power247 <sup>TM</sup>	SuperFET <sup>TM</sup>
Build it Now <sup>TM</sup>	FAST <sup>r</sup> <sup>TM</sup>	ISOPLANAR <sup>TM</sup>	PowerEdge <sup>TM</sup>	SuperSOT <sup>TM</sup> -3
CoolFET <sup>TM</sup>	FPST <sup>TM</sup>	LittleFET <sup>TM</sup>	PowerSaver <sup>TM</sup>	SuperSOT <sup>TM</sup> -6
CROSSVOLT <sup>TM</sup>	FRFET <sup>TM</sup>	MICROCOUPLER <sup>TM</sup>	PowerTrench <sup>®</sup>	SuperSOT <sup>TM</sup> -8
DOME <sup>TM</sup>	GlobalOptoisolator <sup>TM</sup>	MicroFET <sup>TM</sup>	QFET <sup>®</sup>	SyncFET <sup>TM</sup>
EcoSPARK <sup>TM</sup>	GTO <sup>TM</sup>	MicroPak <sup>TM</sup>	QS <sup>TM</sup>	TinyLogic <sup>®</sup>
E <sup>2</sup> C <sup>MOS</sup> <sup>TM</sup>	HiSeC <sup>TM</sup>	MICROWIRE <sup>TM</sup>	QT Optoelectronics <sup>TM</sup>	TINYOPTO <sup>TM</sup>
EnSigna <sup>TM</sup>	I <sup>2</sup> C <sup>TM</sup>	MSX <sup>TM</sup>	Quiet Series <sup>TM</sup>	TruTranslation <sup>TM</sup>
		MSXPro <sup>TM</sup>	RapidConfigure <sup>TM</sup>	UHC <sup>TM</sup>
Across the board. Around the world. <sup>TM</sup>		OCX <sup>TM</sup>	RapidConnect <sup>TM</sup>	UltraFET <sup>®</sup>
The Power Franchise <sup>®</sup>		OCXPro <sup>TM</sup>	µSerDes <sup>TM</sup>	UniFET <sup>TM</sup>
Programmable Active Droop <sup>TM</sup>		OPTOLOGIC <sup>®</sup>	SILENT SWITCHER <sup>®</sup>	VCX <sup>TM</sup>
		OPTOPLANAR <sup>TM</sup>	SMART START <sup>TM</sup>	Wire <sup>TM</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.

## 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:

- 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, or (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 significant injury to the user.
- A critical component is 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, and supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice in order 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 in order 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. I16