

# FDFS6N548

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

30V, 7A, 23mΩ

### Features

- Max  $r_{DS(on)}$  = 23mΩ at  $V_{GS} = 10V$ ,  $I_D = 7A$
- Max  $r_{DS(on)}$  = 30mΩ at  $V_{GS} = 4.5V$ ,  $I_D = 6A$
- $V_F < 0.45V @ 2A$   
 $V_F < 0.28V @ 100mA$
- Schottky and MOSFET incorporated into single power surface mount SO-8 package
- Electrically independent Schottky and MOSFET pinout for design flexibility
- Low Miller Charge



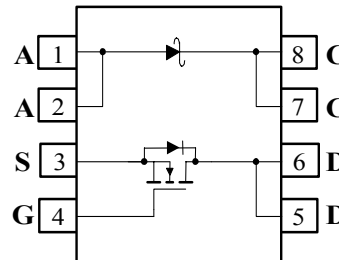
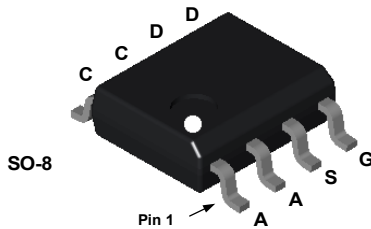
### General Description

The FDFS6N548 combines the exceptional performance of Fairchild's PowerTrench MOSFET technology with a very low forward voltage drop Schottky barrier rectifier in an SO-8 package.

This device is designed specifically as a single package solution for DC to DC converters. It features a fast switching, low gate charge MOSFET with very low on-state resistance. The independently connected Schottky diode allows its use in a variety of DC/DC converter topologies.

### Application

- DC/DC Conversion



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

Symbol	Parameter	Ratings	Units
$V_{DS}$	Drain to Source Voltage	30	V
$V_{GS}$	Gate to Source Voltage	$\pm 20$	V
$I_D$	Drain Current -Continuous (Note 1a)	7	A
	-Pulsed	30	
$P_D$	Power Dissipation for Dual Operation	2	W
	Power Dissipation for Single Operation (Note 1a)	1.6	
$E_{AS}$	Drain-Source Avalanche Energy (Note 3)	12	mJ
$V_{RRM}$	Schottky Repetitive Peak Reverse Voltage	20	V
$I_O$	Schottky Average Forward Current (Note 1a)	2	A
$T_J, T_{STG}$	Operating and Storage Junction Temperature Range	-55 to +150	$^\circ C$

### Thermal Characteristics

$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1a)	78	$^\circ C/W$
$R_{\theta JC}$	Thermal Resistance, Junction to Case (Note 1)	40	

### Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDFS6N548	FDFS6N548	SO-8	330mm	12mm	2500 units

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

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

### Off Characteristics

$BV_{DSS}$	Drain to Source Breakdown Voltage	$I_D = 250\mu\text{A}, V_{GS} = 0\text{V}$	30			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = 250\mu\text{A}$ , referenced to $25^\circ\text{C}$		22		mV/ $^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 24\text{V}, V_{GS} = 0\text{V}, T_J = 125^\circ\text{C}$			1 250	$\mu\text{A}$
$I_{GSS}$	Gate to Source Leakage Current	$V_{GS} = \pm 20\text{V}, V_{DS} = 0\text{V}$			$\pm 100$	nA

### On Characteristics

$V_{GS(th)}$	Gate to Source Threshold Voltage	$V_{GS} = V_{DS}, I_D = 250\mu\text{A}$	1.2	1.8	2.5	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate to Source Threshold Voltage Temperature Coefficient	$I_D = 250\mu\text{A}$ , referenced to $25^\circ\text{C}$		-5		mV/ $^\circ\text{C}$
$r_{DS(on)}$	Drain to Source On-Resistance	$V_{GS} = 10\text{V}, I_D = 7\text{A}$		19	23	m $\Omega$
		$V_{GS} = 4.5\text{V}, I_D = 6\text{A}$		23	30	
		$V_{GS} = 10\text{V}, I_D = 7\text{A}, T_J = 125^\circ\text{C}$		26	31	
$g_{FS}$	Forward Transconductance	$V_{DS} = 5\text{V}, I_D = 7\text{A}$		20		S

### Dynamic Characteristics

$C_{iss}$	Input Capacitance	$V_{DS} = 15\text{V}, V_{GS} = 0\text{V}, f = 1\text{MHz}$		525	700	pF
$C_{oss}$	Output Capacitance			100	133	pF
$C_{rss}$	Reverse Transfer Capacitance			65	100	pF
$R_g$	Gate Resistance		$f = 1\text{MHz}$		0.8	$\Omega$

### Switching Characteristics

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 15\text{V}, I_D = 7\text{A}, V_{GS} = 10\text{V}, R_{GEN} = 6\Omega$		6	12	ns
$t_r$	Rise Time			2	10	ns
$t_{d(off)}$	Turn-Off Delay Time			14	25	ns
$t_f$	Fall Time			2	10	ns
$Q_{g(TOT)}$	Total Gate Charge at 10V	$V_{DS} = 15\text{V}, I_D = 7\text{A}$		9	13	nC
$Q_{gs}$	Gate to Source Gate Charge	$V_{GS} = 10\text{V}$		1.5		nC
$Q_{gd}$	Gate to Drain "Miller" Charge			2		nC

### Drain-Source Diode Characteristics

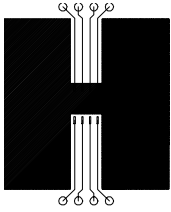
$V_{SD}$	Source to Drain Diode Forward Voltage	$V_{GS} = 0\text{V}, I_S = 7\text{A}$ (Note2)		0.90	1.25	V
$t_{rr}$	Reverse Recovery Time	$I_F = 7\text{A}, di/dt = 100\text{A}/\mu\text{s}$		23	35	ns
$Q_{rr}$	Reverse Recovery Charge			14	21	nC

### Schottky Diode Characteristics

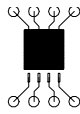
$V_R$	Reverse Breakdown Voltage	$I_R = -1\text{mA}$	-30			V
$I_R$	Reverse Leakage	$V_R = -10\text{V}$	$T_J = 25^\circ\text{C}$	-39	-250	$\mu\text{A}$
			$T_J = 125^\circ\text{C}$	-18		mA
$V_F$	Forward Voltage	$I_F = 100\text{mA}$	$T_J = 25^\circ\text{C}$	225	280	mV
			$T_J = 125^\circ\text{C}$	140	450	
		$I_F = 2\text{A}$	$T_J = 25^\circ\text{C}$	364		
			$T_J = 125^\circ\text{C}$	290		

**Notes:**

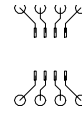
**1:**  $R_{\theta JA}$  is the sum of the junction-to-case and case-to-ambient thermal resistance where the case thermal reference is defined as the solder mounting surface of the drain pins.  $R_{\theta JC}$  is guaranteed by design while  $R_{\theta CA}$  is determined by the user's board design.



a) 78°C/W when mounted on a 0.5in<sup>2</sup> pad of 2 oz copper



b) 125°C/W when mounted on a 0.02 in<sup>2</sup> pad of 2 oz copper



c) 135°C/W when mounted on a minimum pad

**2:** Pulse Test: Pulse Width < 300μs, Duty cycle < 2.0%.

**3:** Starting  $T_J = 25^\circ\text{C}$ ,  $L = 1\text{mH}$ ,  $I_{AS} = 5.0\text{A}$ ,  $V_{DD} = 27\text{V}$ ,  $V_{GS} = 10\text{V}$ .

**Typical Characteristics**  $T_J = 25^\circ\text{C}$  unless otherwise noted

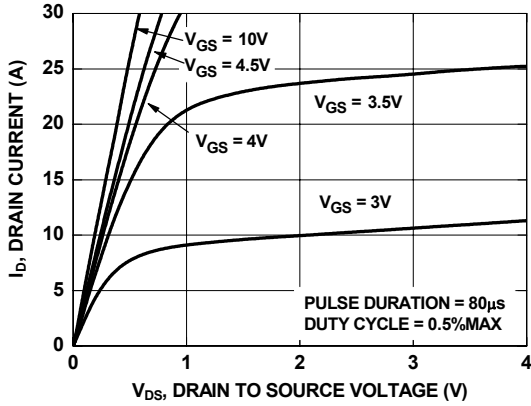


Figure 1. On Region Characteristics

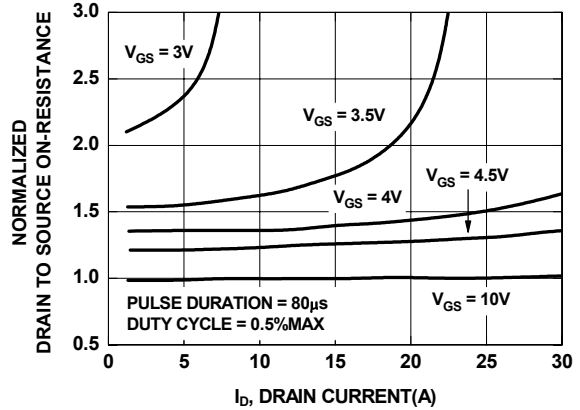


Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage

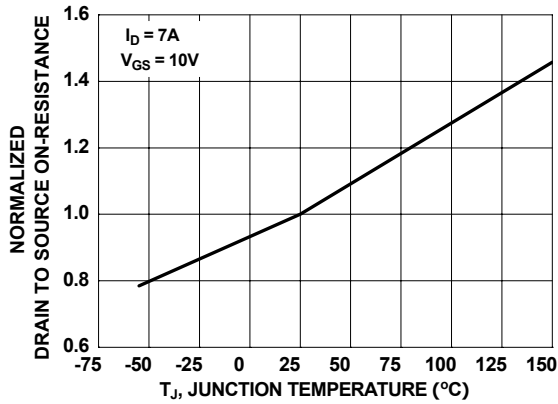


Figure 3. Normalized On-Resistance vs Junction Temperature

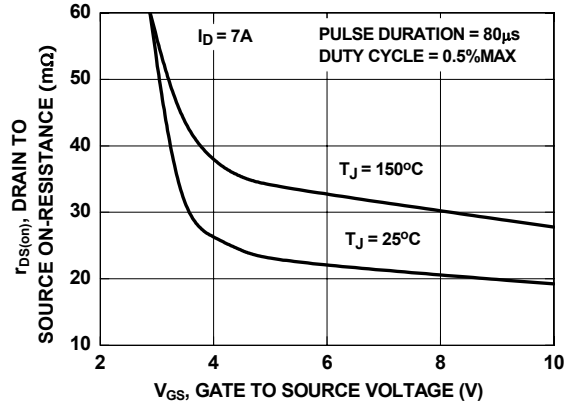


Figure 4. On-Resistance vs Gate to Source Voltage

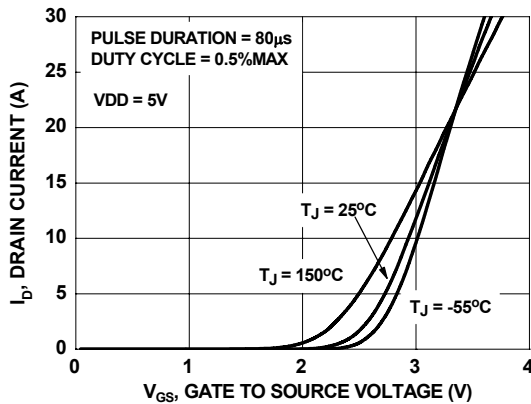


Figure 5. Transfer Characteristics

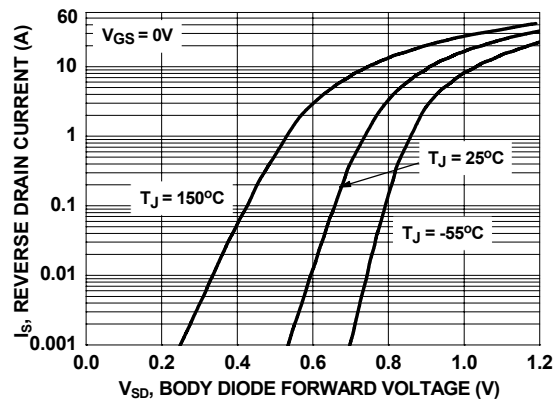
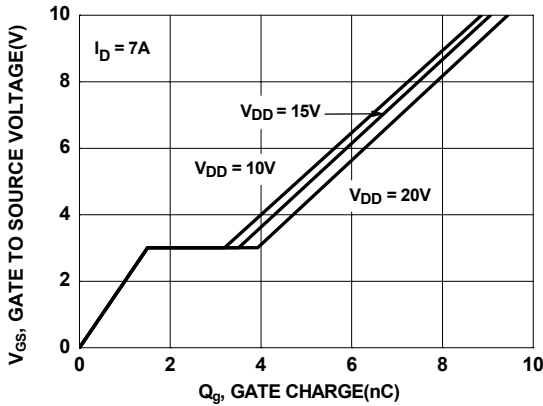
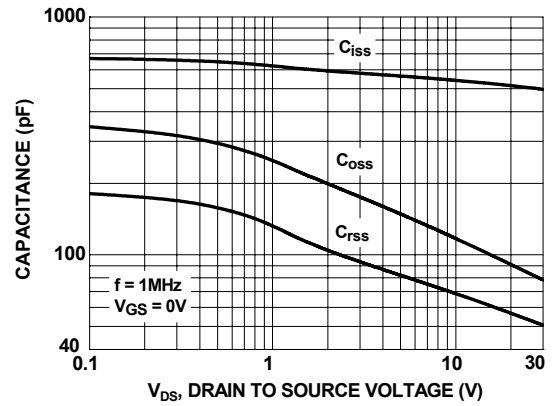


Figure 6. Source to Drain Diode Forward Voltage vs Source Current

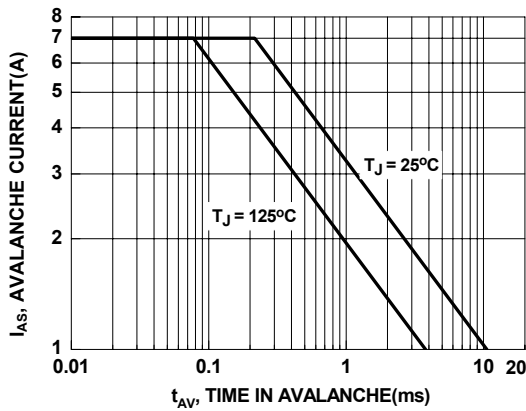
**Typical Characteristics**  $T_J = 25^\circ\text{C}$  unless otherwise noted



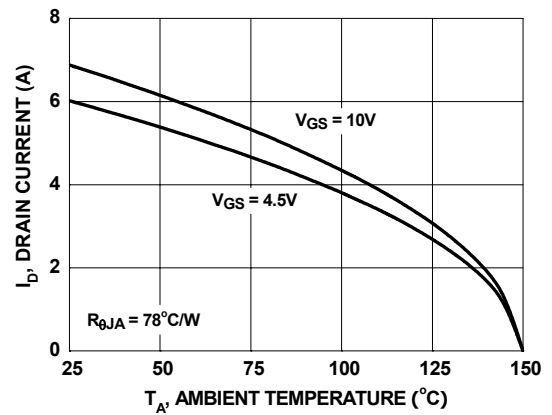
**Figure 7. Gate Charge Characteristics**



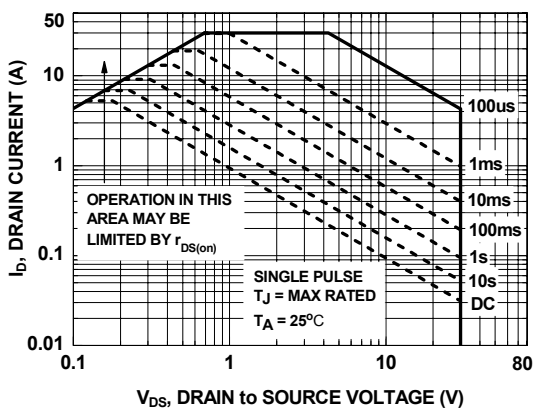
**Figure 8. Capacitance vs Drain to Source Voltage**



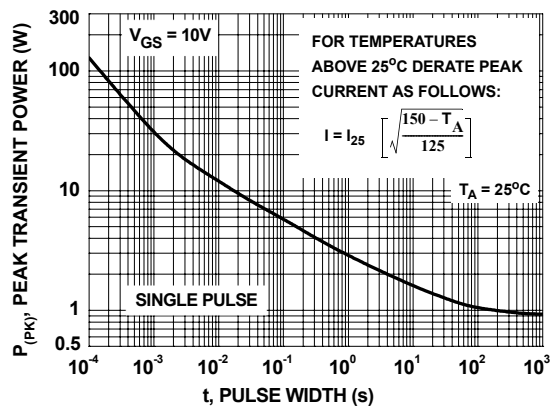
**Figure 9. Unclamped Inductive Switching Capability**



**Figure 10. Maximum Continuous Drain Current vs Ambient Temperature**

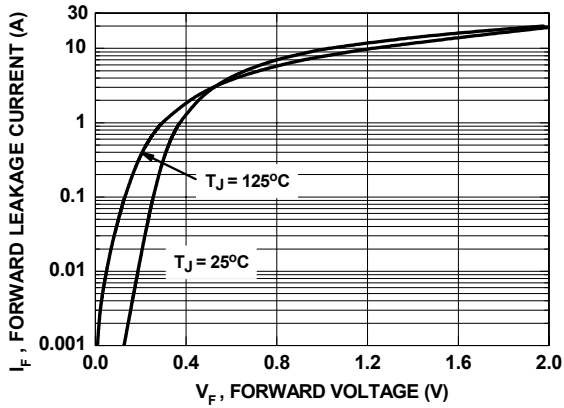


**Figure 11. Forward Bias Safe Operating Area**

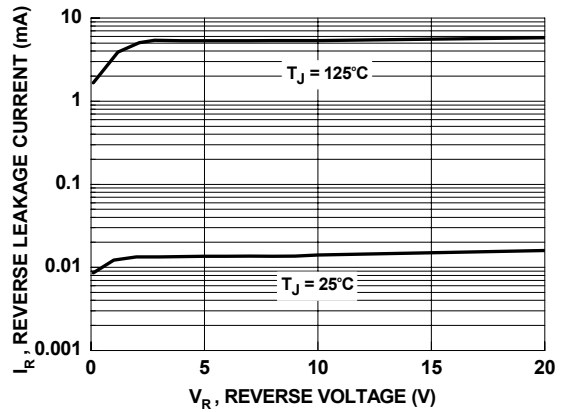


**Figure 12. Single Pulse Maximum Power Dissipation**

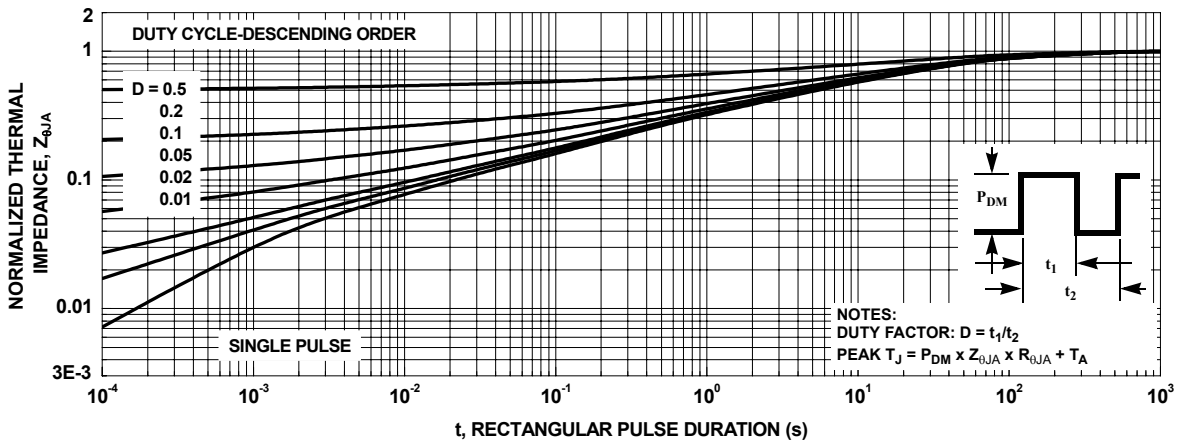
**Typical Characteristics**  $T_J = 25^\circ\text{C}$  unless otherwise noted



**Figure 13. Schottky Diode Forward Characteristics**



**Figure 14. Schottky Diode Reverse Characteristics**



**Figure 15. Transient Thermal Response Curve**

**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.

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

- 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.