FAIRCHILD

SEMICONDUCTOR®

November 2013

FFH60UP60S, FFH60UP60S3

60 A, 600 V Ultrafast Rectifier

Features

- Ultrafast Recovery, t_{rr} = 80 ns (@ I_F = 60 A)
- Max Forward Voltage, V_F = 1.7 V (@ T_C = 25°C)
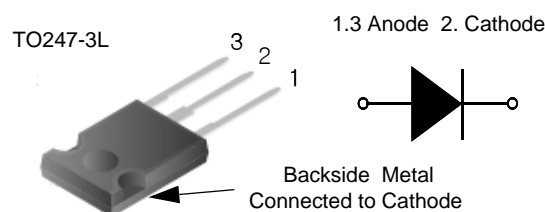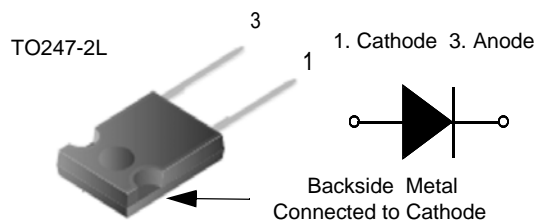- Avalanche Energy Rated
- RoHS compliant

Applications

- General Purpose
- SMPS, Welder, UPS
- Free-wheeling diode for motor application
- Power switching circuits

Description

The FFH60UP60S, FFH60UP60S3 is an ultrafast diode with low forward voltage drop and rugged UIS capability. This device is intended for use as freewheeling and clamping diodes in a variety of switching power supplies and other power switching applications. It is specially suited for use in switching power supplies and industrial applicationa as welder and UPS application.

Pin Assignments

TO247-2L

1. Cathode 3. Anode

Backside Metal
Connected to Cathode

TO247-3L

1.3 Anode 2. Cathode

Backside Metal
Connected to Cathode

Absolute Maximum Ratings T_C = 25°C unless otherwise noted

Symbol	Parameter	Rating	Unit
V_{RRM}	Peak Repetitive Reverse Voltage	600	V
V_{RWM}	Working Peak Reverse Voltage	600	V
V_R	DC Blocking Voltage	600	V
$I_{F(AV)}$	Average Rectified Forward Current @ T_C = 93°C	60	A
I_{FSM}	Non-repetitive Peak Surge Current 60Hz Single Half-Sine Wave	600	A
T_J, T_{STG}	Operating and Storage Temperature Range	-65 to +150	°C

Thermal Characteristics

Symbol	Parameter	Rating	Unit
$R_{\theta JC}$	Maximum Thermal Resistance, Junction to Case	0.7	°C/W

Package Marking and Ordering Information

Device Marking	Device	Package	Packing Methode	Reel Size	Tape Width	Quantity
FFH60UP60S	FFH60UP60S	TO247-2L	Tube	N/A	N/A	30
FFH60UP60S3	FFH60UP60S3	TO247-3L	Tube	N/A	N/A	30

Electrical Characteristics T_C = 25°C unless otherwise noted

Symbol	Parameter		Min.	Typ.	Max.	Unit
V_F1	$I_F = 60$ A	$T_C = 25°C$	-	1.4	1.7	V
		$T_C = 125°C$	-	1.3	-	
I_R1	$V_R = 600$ V	$T_C = 25°C$	-	-	100	µA
		$T_C = 125°C$	-	-	500	
t_{rr}	$I_F = 60$ A, $di_F/dt = 200$ A/µs, $V_R = 390$ V	$T_C = 25°C$	-	60	80	ns
		$T_C = 125°C$	-	138	-	
W_{AVL}	Avalanche Energy (L = 40 mH)		50	-	-	mJ

Notes:
1: Pulse: Test Pulse width = 300µs, Duty Cycle = 2%

Test circuit and waveform

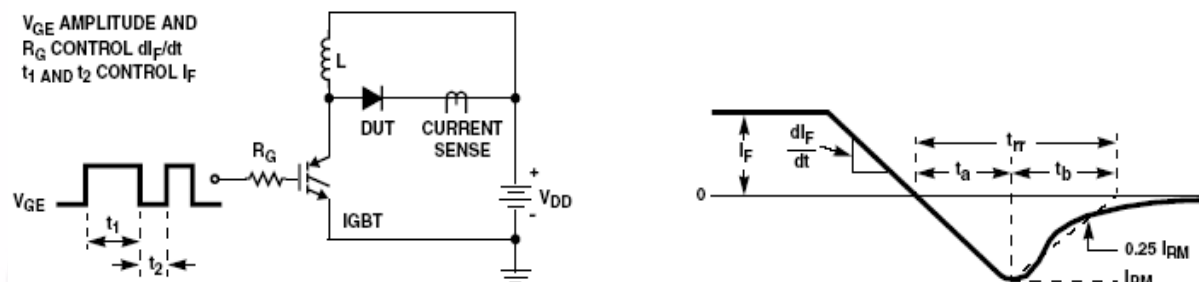**Figure 1. Diode Reverse Recovery Test Circuit & Waveform**

L = 40mH
R < 0.1Ω
V_{DD} = 50V
EAVL = 1/2LI2 [$V_{R(AVL)}$/($V_{R(AVL)}$ - V_{DD})]
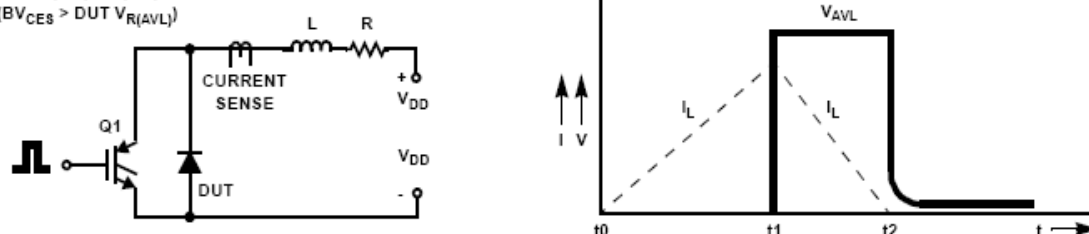Q1 = IGBT (BV_{CES} > DUT $V_{R(AVL)}$)

Figure 2. Unclamped Inductive Switching Test Circuit & Waveform

Typical Performance Characteristics

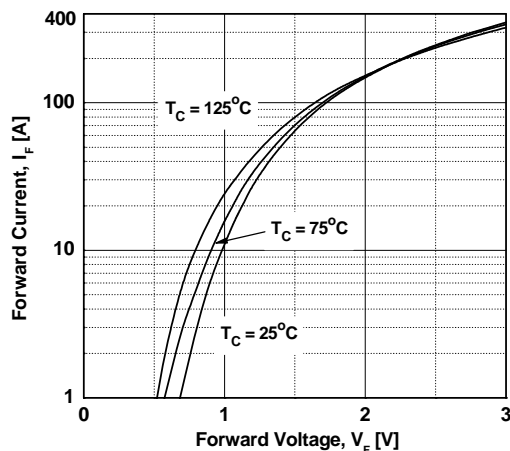**Figure 3. Typical Forward Voltage Drop vs. Forward Current**

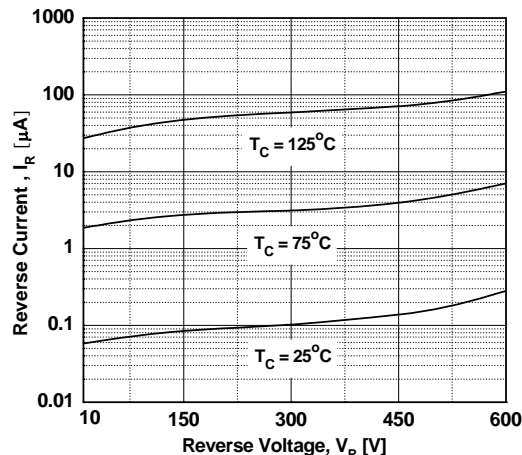**Figure 4. Typical Reverse Current vs. Reverse Voltage**
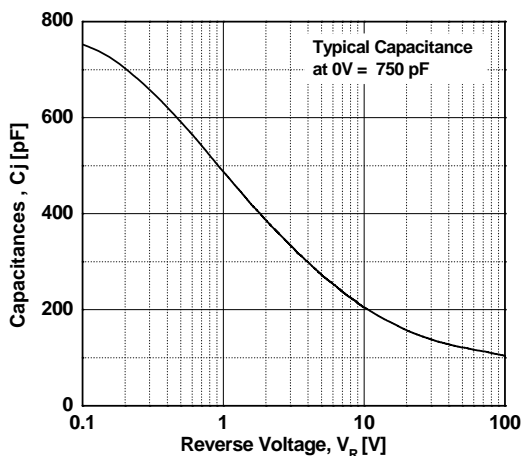

Figure 5.Typical Junction Capacitance

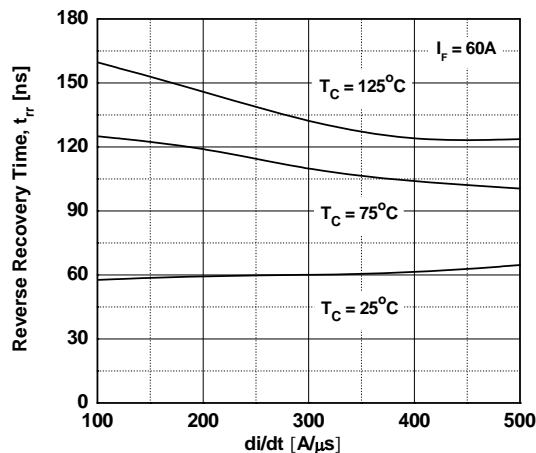**Figure 6. Typical Reverse Recovery Time vs. di$_F$/dt**

Figure 7. Typical Reverse Recovery Current vs. di$_F$/dt

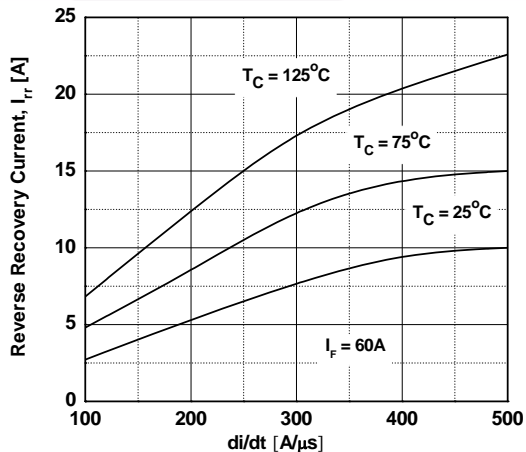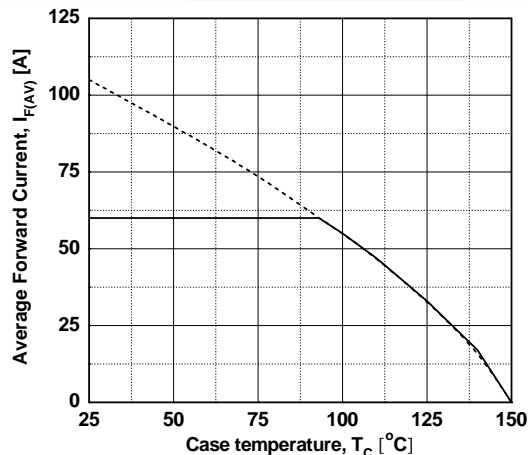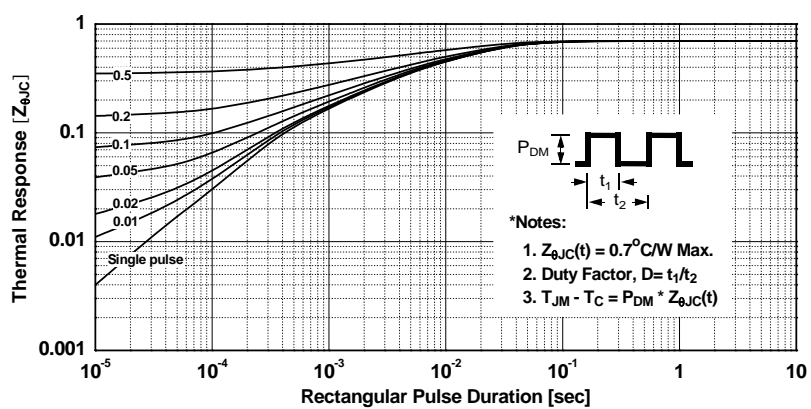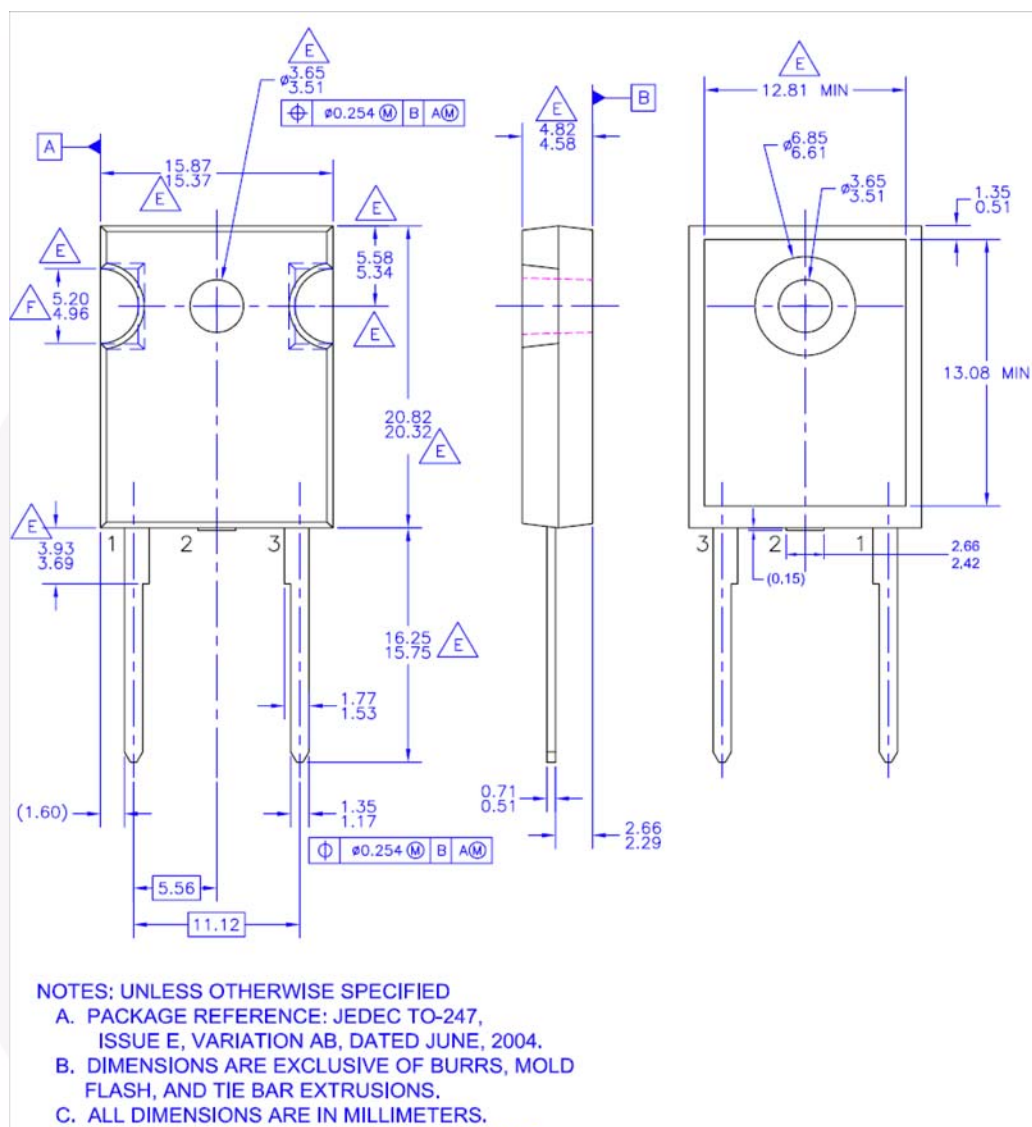**Figure 8. Forward Current Derating Curve**

Typical Performance Characteristics (Continued)
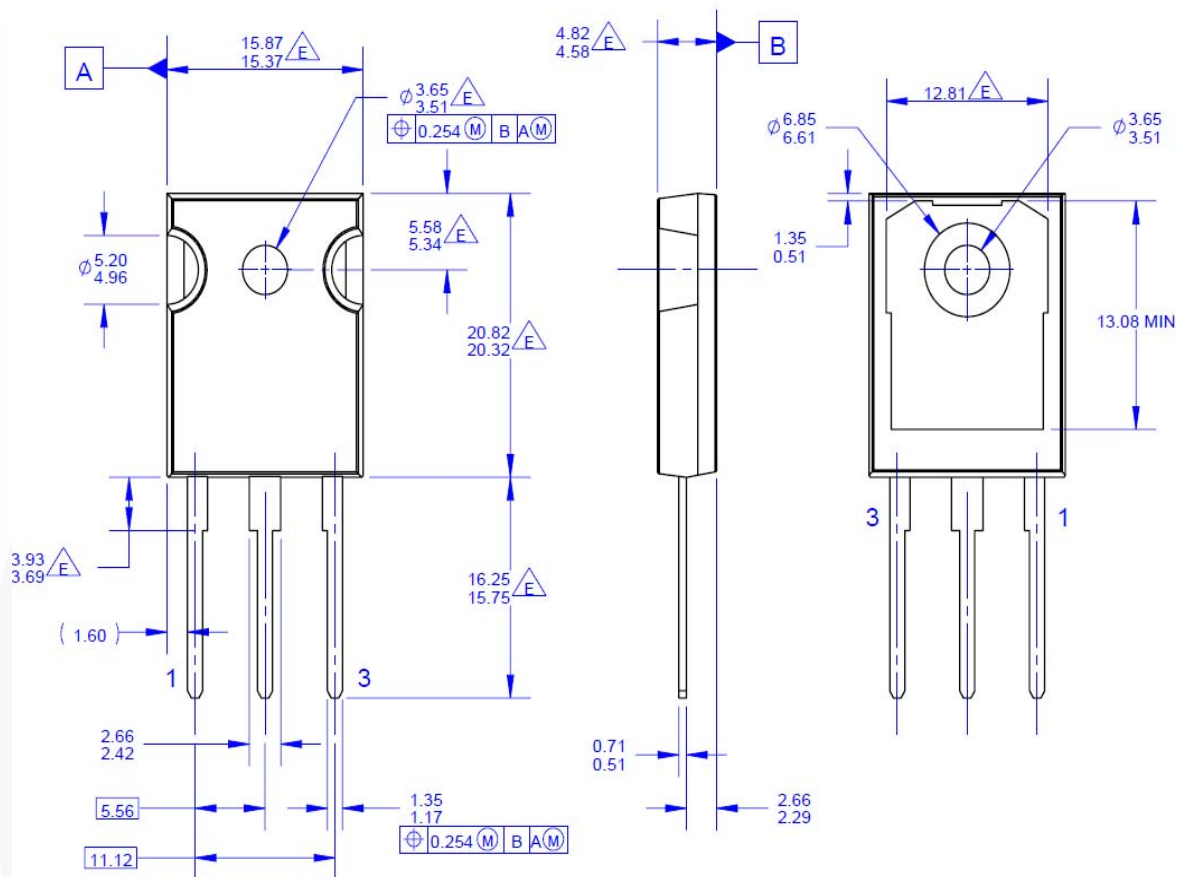
Figure 9. Transient Thermal Response Curve

*Notes:
1. $Z_{\theta JC}(t) = 0.7^{\circ}$C/W Max.
2. Duty Factor, $D = t_1/t_2$
3. $T_{JM} - T_C = P_{DM} * Z_{\theta JC}(t)$

Mechanical Dimensions

TO247-2L

Figure 10. TO-247,Molded, 2LD, Jedec Option AB

NOTES: UNLESS OTHERWISE SPECIFIED
A. PACKAGE REFERENCE: JEDEC TO-247,
    ISSUE E, VARIATION AB, DATED JUNE, 2004.
B. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD
    FLASH, AND TIE BAR EXTRUSIONS.
C. 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.

Always visit Fairchild Semiconductor's online packaging area for the most recent package drawings:

http://www.fairchildsemi.com/package/packageDetails.html?id=PN_TO247-002.

TO247-3L

15.87 / E
15.37

4.82 / E
4.58

B

⌀ 3.65 / E
3.51

⊕ 0.254 (M) B A (M)

12.81 / E

⌀ 6.85
6.61

⌀ 3.65
3.51

⌀ 5.20
4.96

5.58 / E
5.34

1.35
0.51

13.08 MIN

20.82 / E
20.32

3.93 / E
3.69

16.25 / E
15.75

(1.60)

1   3

3   1

2.66
2.42

0.71
0.51

2.66
2.29

5.56

1.35
1.17

11.12

⊕ 0.254 (M) B A (M)

NOTES: UNLESS OTHERWISE SPECIFIED.

A. PACKAGE REFERENCE: JEDEC TO-247,
   ISSUE E, VARIATION AB, DATED JUNE, 2004.
B. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD
   FLASH, AND TIE BAR EXTRUSIONS.
C. ALL DIMENSIONS ARE IN MILLIMETERS.
D. DRAWING CONFORMS TO ASME Y14.5 - 1994

/E\ DOES NOT COMPLY JEDEC STANDARD VALUE
F. DRAWING FILENAME: MKT-TO247A03_REV03

Figure 11. TO-247,Molded, 3LD, Jedec Option AB

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/package/packageDetails.html?id=PN_TO247-003.

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.

AccuPower™	F-PFS™	®	Sync-Lock™
AX-CAP®*	FRFET®		
BitSiC™	Global Power Resource℠	PowerTrench®	**SYSTEM** ®* **GENERAL**
Build it Now™	GreenBridge™	PowerXS™	
CorePLUS™	Green FPS™	Programmable Active Droop™	TinyBoost®
CorePOWER™	Green FPS™ e-Series™	QFET®	TinyBuck®
CROSSVOLT™	G*max*™	QS™	TinyCalc™
CTL™	GTO™	Quiet Series™	TinyLogic®
Current Transfer Logic™	IntelliMAX™	RapidConfigure™	TINYOPTO™
DEUXPEED®	ISOPLANAR™	™	TinyPower™
Dual Cool™	Marking Small Speakers Sound Louder		TinyPWM™
EcoSPARK®	and Better™	Saving our world, 1mW/W/kW at a time™	TinyWire™
EfficentMax™	MegaBuck™	SignalWise™	TranSiC™
ESBC™	MICROCOUPLER™	SmartMax™	TriFault Detect™
	MicroFET™	SMART START™	TRUECURRENT®*
	MicroPak™	Solutions for Your Success™	µSerDes™
®	MicroPak2™	SPM®	
Fairchild®	MillerDrive™	STEALTH™	
Fairchild Semiconductor®	MotionMax™	SuperFET®	
FACT Quiet Series™	mWSaver®	SuperSOT™-3	UHC®
FACT®	OptoHiT™	SuperSOT™-6	Ultra FRFET™
FAST®	OPTOLOGIC®	SuperSOT™-8	UniFET™
FastvCore™	OPTOPLANAR®	SupreMOS®	VCX™
FETBench™		SyncFET™	VisualMax™
FPS™			VoltagePlus™
			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 here in:

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. I66