Is Now Part of

ON Semiconductor®

To learn more about ON Semiconductor, please visit our website at
www.onsemi.com

Please note: As part of the Fairchild Semiconductor integration, some of the Fairchild orderable part numbers will need to change in order to meet ON Semiconductor's system requirements. Since the ON Semiconductor product management systems do not have the ability to manage part nomenclature that utilizes an underscore (_), the underscore (_) in the Fairchild part numbers will be changed to a dash (-). This document may contain device numbers with an underscore (_). Please check the ON Semiconductor website to verify the updated device numbers. The most current and up-to-date ordering information can be found at www.onsemi.com. Please email any questions regarding the system integration to Fairchild_questions@onsemi.com.

July 2014

FDFMA3N109

Integrated N-Channel PowerTrench® MOSFET and Schottky Diode

General Description

This device is designed specifically as a single package solution for a boost topology in cellular handset and other ultra-portable applications. It features a MOSFET with low input capacitance, total gate charge and on-state resistance, and an independently connected schottky diode with low forward voltage and reverse leakage current to maximize boost efficiency.

The MicroFET 2x2 package offers exceptional thermal performance for its physical size and is well suited to switching and linear mode applications.

Features

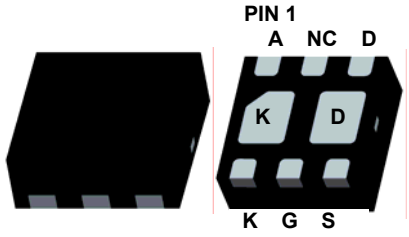
MOSFET:

- 2.9 A, 30 V $R_{DS(ON)}$ = 123 mΩ @ V_{GS} = 4.5 V
  $R_{DS(ON)}$ = 140 mΩ @ V_{GS} = 3.0 V
  $R_{DS(ON)}$ = 163 mΩ @ V_{GS} = 2.5 V

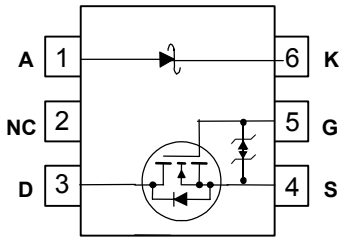
Schottky:

- V_F < 0.46 V @ 500mA

- Low profile – 0.8 mm maximum – in the new package MicroFET 2x2 mm
- HBM ESD protection level = 1.8kV typical (Note 3)
- RoHS Compliant



MicroFET 2x2



Absolute Maximum Ratings

T_A=25°C unless otherwise noted

Symbol	Parameter		Ratings	Units
V_{DS}	Drain-Source Voltage		30	V
V_{GS}	Gate-Source Voltage		±12	V
I_D	Drain Current – Continuous (T_C = 25°C, V_{GS} = 4.5V)		2.9	A
	– Continuous (T_C = 25°C, V_{GS} = 2.5V)		2.7	
	– Pulsed		10	
P_D	Power Dissipation for Single Operation	(Note 1a)	1.5	W
	Power Dissipation for Single Operation	(Note 1b)	0.65	
T_J, T_{STG}	Operating and Storage Temperature		–55 to +150	°C
V_{RRM}	Schottky Repetitive Peak Reverse Voltage		28	V
I_O	Schottky Average Forward Current		1	A

Thermal Characteristics

$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	(Note 1a)	83	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	(Note 1b)	193	
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	(Note 1c)	101	
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	(Note 1d)	228	

Package Marking and Ordering Information

Device Marking	Device	Reel Size	Tape width	Quantity
109	FDFMA3N109	7''	8mm	3000 units

Electrical Characteristics

T_A = 25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
Off Characteristics						
BV_{DSS}	Drain–Source Breakdown Voltage	V_{GS} = 0 V, I_D = 250 μA	30			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	I_D = 250 μA, Referenced to 25°C		25		mV/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 24 V, V_{GS} = 0 V			1	μA
I_{GSS}	Gate–Body Leakage Current	V_{GS} = ± 12 V, V_{DS} = 0 V			±10	μA
On Characteristics						
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS} = V_{GS}, I_D = 250 μA	0.4	1.0	1.5	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate Threshold Voltage Temperature Coefficient	I_D = 250 μA, Referenced to 25°C		–3		mV/°C
$R_{DS(on)}$	Static Drain–Source On–Resistance	V_{GS} = 4.5V, I_D = 2.9A		75	123	mΩ
		V_{GS} = 3.0V, I_D = 2.7A		84	140	
		V_{GS} = 2.5V, I_D = 2.5A		92	163	
		V_{GS} = 4.5V, I_D = 2.9A, T_C = 85°C		95	166	
		V_{GS} = 3.0V, I_D = 2.7A, T_C = 150°C		138	203	
		V_{GS} = 2.5V, I_D = 2.5A, T_C = 150°C		150	268	
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = 15 V, V_{GS} = 0 V, f = 1.0 MHz		190	220	pF
C_{oss}	Output Capacitance			30	40	pF
C_{rss}	Reverse Transfer Capacitance			20	30	pF
R_G	Gate Resistance	V_{GS} = 0 V, f = 1.0 MHz		4.6		Ω
Switching Characteristics (Note 2)						
$t_{d(on)}$	Turn–On Delay Time	V_{DD} = 15 V, I_D = 1 A, V_{GS} = 4.5 V, R_{GEN} = 6 Ω		6	12	ns
t_r	Turn–On Rise Time			8	16	ns
$t_{d(off)}$	Turn–Off Delay Time			12	21	ns
t_f	Turn–Off Fall Time			2	4	ns
Q_g	Total Gate Charge	V_{DS} = 15 V, I_D = 2.9 A, V_{GS} = 4.5 V		2.4	3.0	nC
Q_{gs}	Gate–Source Charge			0.35		nC
Q_{gd}	Gate–Drain Charge			0.75		nC
Drain–Source Diode Characteristics and Maximum Ratings						
I_S	Maximum Continuous Drain–Source Diode Forward Current				2.9	A
V_{SD}	Drain–Source Diode Forward Voltage	I_S = 2.0 A		0.9	1.2	V
		I_S = 1.1 A		0.8	1.2	
t_{rr}	Diode Reverse Recovery Time	I_F = 2.9 A, dI_F/dt = 100 A/μs		10		ns
Q_{rr}	Diode Reverse Recovery Charge			2		nC
Schottky Diode Characteristics						
I_R	Reverse Leakage	V_R = 28 V, T_J = 25°C		10	100	μA
		T_J = 85°C		0.07	4.7	mA
V_F	Forward Voltage	I_F = 1 A, T_J = 25°C		0.50	0.57	V
		T_J = 85°C		0.49	0.60	
V_F	Forward Voltage	I_F = 500 mA, T_J = 25°C		0.40	0.46	V
		T_J = 85°C		0.36	0.43	

Electrical Characteristics

T_A = 25°C unless otherwise noted

Notes:

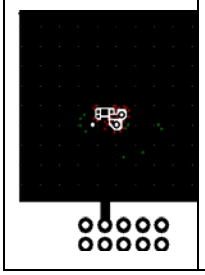
1. $R_{\theta JA}$ is determined with the device mounted on a 1 in^2 oz. copper pad on a 1.5 x 1.5 in. board of FR-4 material. $R_{\theta JC}$ is guaranteed by design while $R_{\theta JA}$ is determined by the user's board design.

(a) MOSFET $R_{\theta JA}$ = 83°C/W when mounted on a 1in^2 pad of 2 oz copper, 1.5” x 1.5” x 0.062” thick PCB

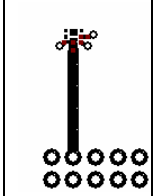
(b) MOSFET $R_{\theta JA}$ = 193°C/W when mounted on a minimum pad of 2 oz copper

(c) Schottky $R_{\theta JA}$ = 101°C/W when mounted on a 1in^2 pad of 2 oz copper, 1.5” x 1.5” x 0.062” thick PCB

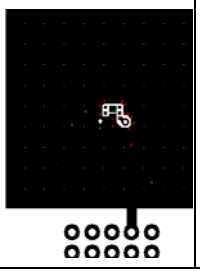
(d) Schottky $R_{\theta JA}$ = 228°C/W when mounted on a minimum pad of 2 oz copper



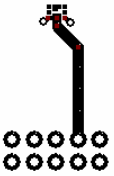
a) 83°C/W when mounted on a 1in^2 pad of 2 oz copper



b) 193°C/W when mounted on a minimum pad of 2 oz copper



c)101 °C/W when mounted on a 1in^2 pad of 2 oz copper



b) 228°C/W when mounted on a minimum pad of 2 oz copper

Scale 1 : 1 on letter size paper

2. Pulse Test: Pulse Width < 300μs, 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

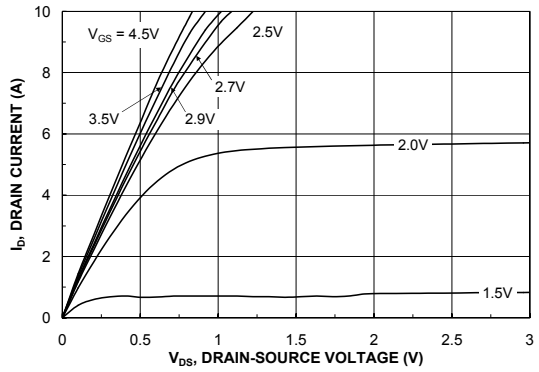


Figure 1. On-Region Characteristics.

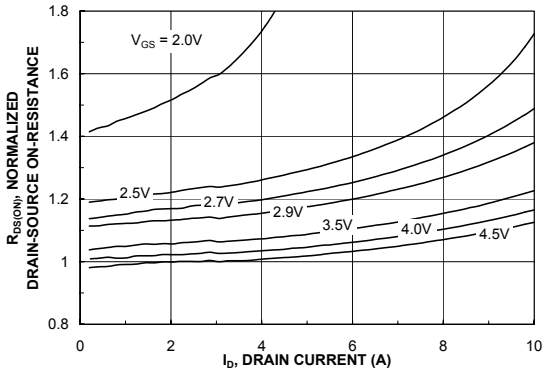


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

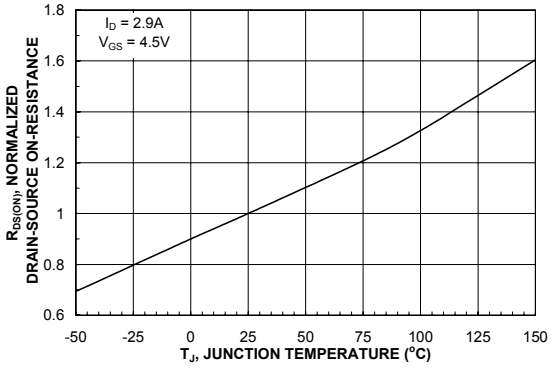


Figure 3. On-Resistance Variation with Temperature.

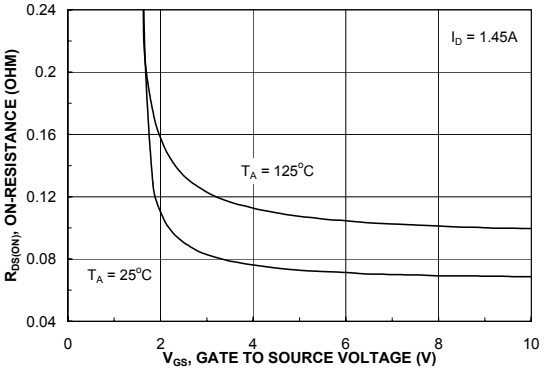


Figure 4. On-Resistance Variation with Gate-to-Source Voltage.

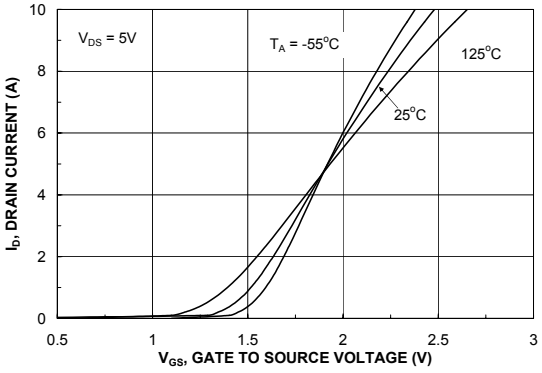


Figure 5. Transfer Characteristics.

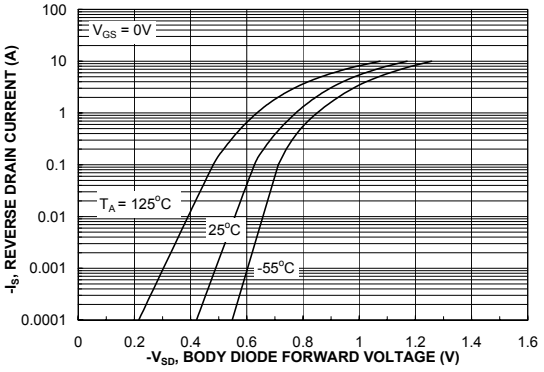


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.

Typical Characteristics

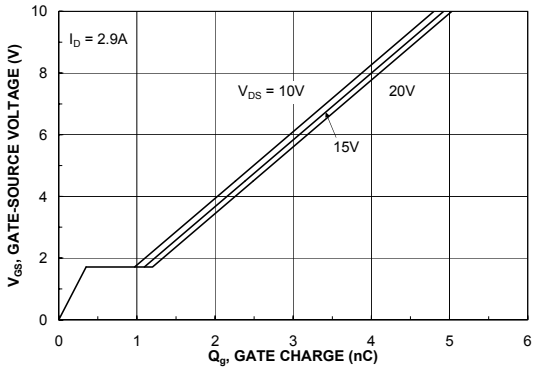


Figure 7. Gate Charge Characteristics.

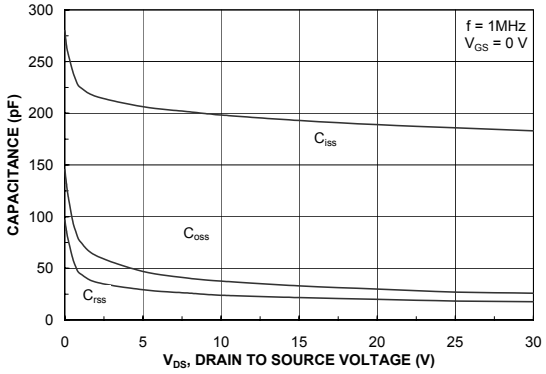


Figure 8. Capacitance Characteristics.

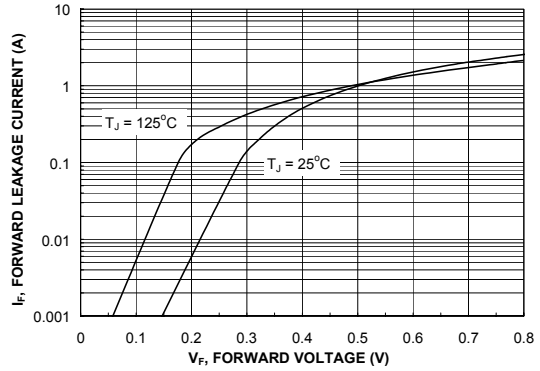


Figure 9. Schottky Diode Forward Voltage.

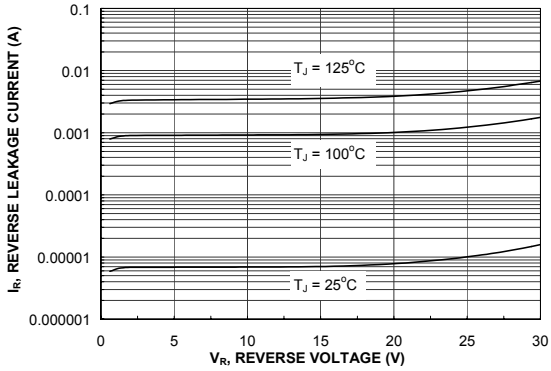


Figure 10. Schottky Diode Reverse Current.

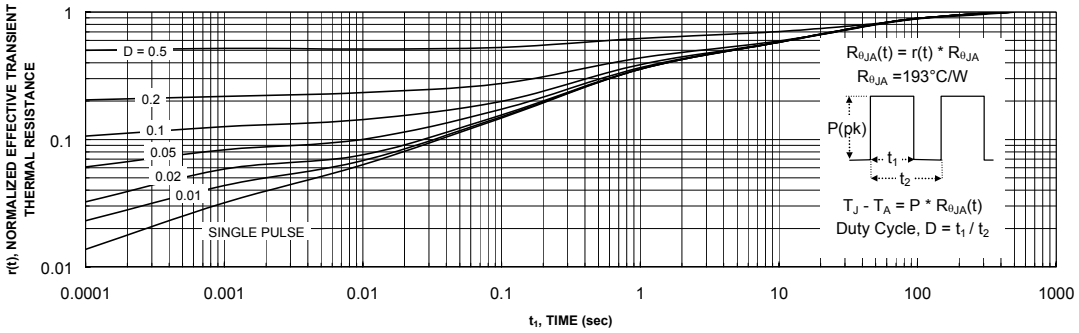
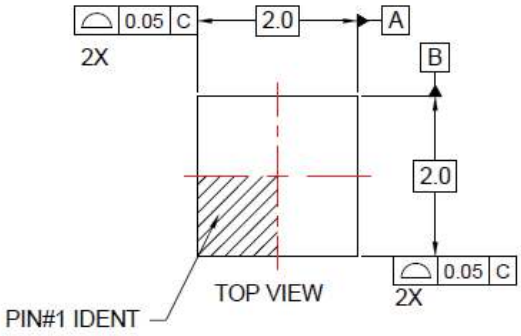
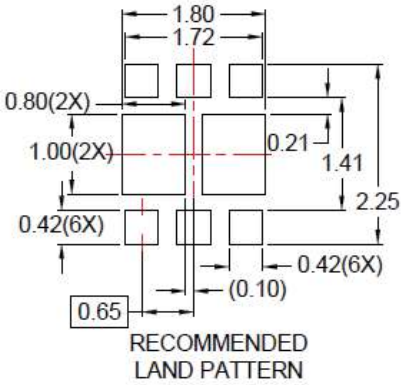


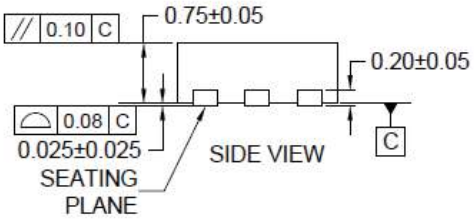
Figure 11. Transient Thermal Response Curve.

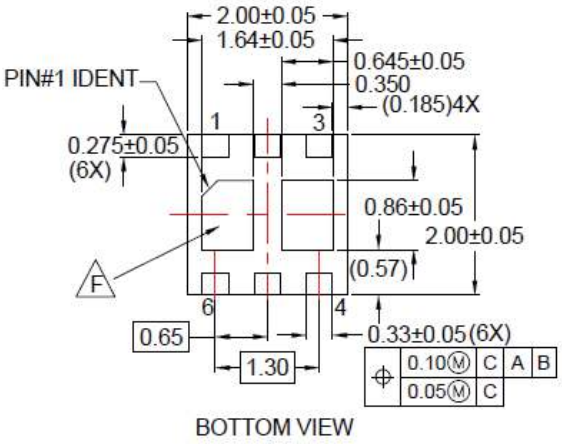
Thermal characterization performed using the conditions described in Note 1b.
Transient thermal response will change depending on the circuit board design.

Dimensional Outline and Pad Layout









NOTES:

A. CONFORM TO JADEC REGISTRATIONS MO-229, VARIATION VCCC, EXCEPT WHERE NOTED.

B. DIMENSIONS ARE IN MILLIMETERS.

C. DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 2009.

D. LAND PATTERN RECOMMENDATION IS EXISTING INDUSTRY LAND PATTERN.

E. DRAWING FILENAME: MKT-UMLP16Erev4

F. NON-JEDEC DUAL DAP

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_MLDEB-X06

FAIRCHILD™

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

*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. I68

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:
Literature Distribution Center for ON Semiconductor
19521 E. 32nd Pkwy, Aurora, Colorado 80011 USA
Phone: 303−675−2175 or 800−344−3860 Toll Free USA/Canada
Fax: 303−675−2176 or 800−344−3867 Toll Free USA/Canada
Email: orderlit@onsemi.com

N. American Technical Support: 800−282−9855 Toll Free USA/Canada
Europe, Middle East and Africa Technical Support:
Phone: 421 33 790 2910
Japan Customer Focus Center
Phone: 81−3−5817−1050

ON Semiconductor Website: **www.onsemi.com**

Order Literature: http://www.onsemi.com/orderlit

For additional information, please contact your local Sales Representative