FAIRCHILD

May 2014

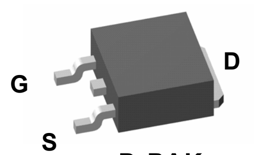
FDD9409_F085

N-Channel PowerTrench® MOSFET

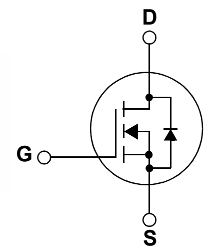
40 V, 90 A, 3.2 mΩ

Features

- Typ $R_{DS(on)}$ = 2.3mΩ at V_{GS} = 10V, I_D = 80A
- Typ $Q_{g(tot)}$ = 42nC at V_{GS} = 10V, I_D = 80A
- UIS Capability
- RoHS Compliant
- Qualified to AEC Q101



D-PAK
(TO-252)



Applications

- Automotive Engine Control
- Powertrain Management
- Solenoid and Motor Drivers
- Electronic Steering
- Integrated Starter/Alternator
- Distributed Power Architectures and VRM
- Primary Switch for 12V Systems

For current package drawing, please refer to the Fairchild website at www.fairchildsemi.com/packaging

MOSFET Maximum Ratings T_J = 25°C unless otherwise noted.

Symbol	Parameter		Ratings	Units
V_{DSS}	Drain-to-Source Voltage		40	V
V_{GS}	Gate-to-Source Voltage		±20	V
I_D	Drain Current - Continuous (V_{GS}=10) (Note 1)	T_C = 25°C	90	A
	Pulsed Drain Current	T_C = 25°C	See Figure 4	
E_{AS}	Single-Pulse Avalanche Energy	(Note 2)	101	mJ
P_D	Power Dissipation		150	W
	Derate Above 25°C		1	W/°C
T_J, T_{STG}	Operating and Storage Temperature		-55 to + 175	°C
$R_{\theta JC}$	Thermal Resistance, Junction to Case		1	°C/W
$R_{\theta JA}$	Maximum Thermal Resistance, Junction to Ambient	(Note 3)	52	°C/W

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDD9409	FDD9409_F085	D-PAK(TO-252)	13”	12mm	2500 units

Notes:
1: Current is limited by bondwire configuration.
2: Starting T_J = 25°C, L = 0.1mH, I_{AS} = 44A, V_{DD} = 40V during inductor charging and V_{DD} = 0V during time in avalanche.
3: $R_{\theta JA}$ 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 $R_{\theta JA}$ is determined by the user's board design. The maximum rating presented here is based on mounting on a 1 in^2 pad of 2oz copper.

Electrical Characteristics T_J = 25°C unless otherwise noted.

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Units
Off Characteristics							
B_{VDSS}	Drain-to-Source Breakdown Voltage	I_D = 250µA, V_{GS} = 0V		40	-	-	V
I_{DSS}	Drain-to-Source Leakage Current	V_{DS}=40V, V_{GS} = 0V	T_J = 25°C	-	-	1	µA
			T_J = 175°C(Note 4)	-	-	1	mA
I_{GSS}	Gate-to-Source Leakage Current	V_{GS} = ±20V		-	-	±100	nA
On Characteristics							
$V_{GS(th)}$	Gate-to-Source Threshold Voltage	V_{GS} = V_{DS}, I_D = 250µA		2.0	3.2	4.0	V
$R_{DS(on)}$	Drain-to-Source On Resistance	I_D = 80A, V_{GS}= 10V	T_J = 25°C	-	2.3	3.2	mΩ
			T_J = 175°C(Note 4)	-	4.1	5.7	mΩ
Dynamic Characteristics							
C_{iss}	Input Capacitance	V_{DS} = 25V, V_{GS} = 0V, f = 1MHz		-	3130	-	pF
C_{oss}	Output Capacitance			-	756	-	pF
C_{rss}	Reverse Transfer Capacitance			-	48	-	pF
R_g	Gate Resistance	f = 1MHz		-	2	-	Ω
$Q_{g(ToT)}$	Total Gate Charge at 10V	V_{GS} = 0 to 10V	V_{DD} = 20V, I_D = 80A	-	42	46	nC
$Q_{g(th)}$	Threshold Gate Charge	V_{GS} = 0 to 2V		-	6	7	nC
Q_{gs}	Gate-to-Source Gate Charge			-	16	-	nC
Q_{gd}	Gate-to-Drain “Miller“ Charge			-	7.7	-	nC

Switching Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
t_{on}	Turn-On Time	V_{DD} = 20V, I_D = 80A, V_{GS} = 10V, R_{GEN} = 6Ω	-	-	72	ns
$t_{d(on)}$	Turn-On Delay		-	23	-	ns
t_r	Rise Time		-	22	-	ns
$t_{d(off)}$	Turn-Off Delay		-	41	-	ns
t_f	Fall Time		-	15	-	ns
t_{off}	Turn-Off Time		-	-	76	ns

Drain-Source Diode Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
V_{SD}	Source-to-Drain Diode Voltage	I_{SD} = 80A, V_{GS} = 0V	-	-	1.25	V
		I_{SD} = 40A, V_{GS} = 0V	-	-	1.2	V
t_{rr}	Reverse-Recovery Time	I_F = 80A, dI_{SD}/dt = 100A/µs, V_{DD}=32V	-	54	73	ns
Q_{rr}	Reverse-Recovery Charge		-	42	61	nC

Note:

4: The maximum value is specified by design at TJ = 175°C. Product is not tested to this condition in production.

Typical Characteristics

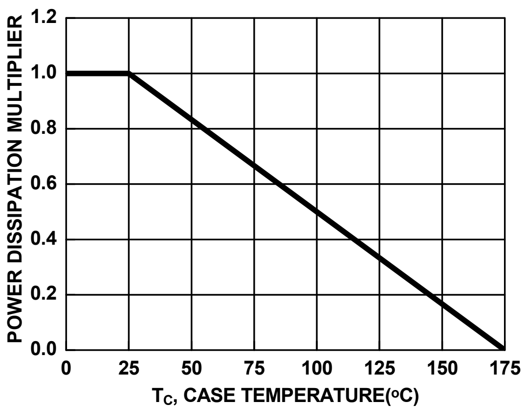


Figure 1. Normalized Power Dissipation vs. Case Temperature

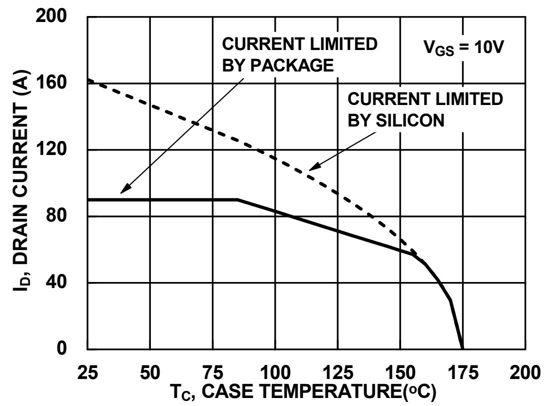


Figure 2. Maximum Continuous Drain Current vs. Case Temperature

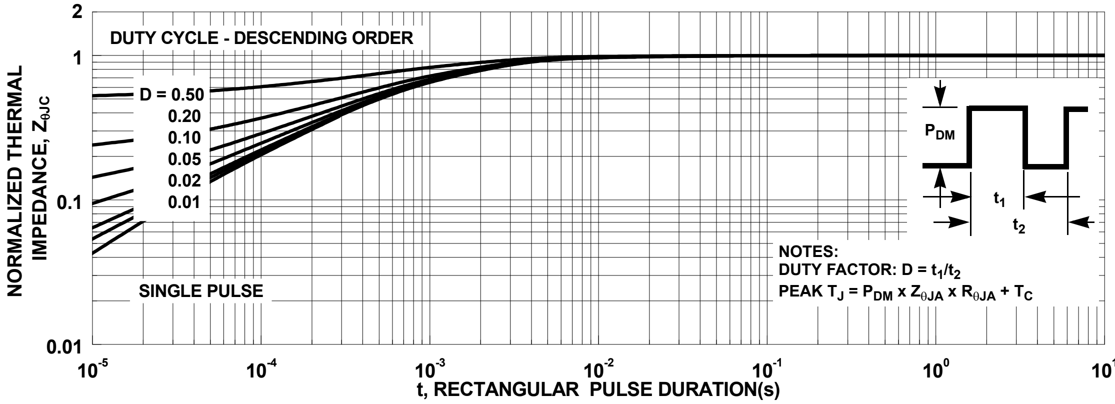


Figure 3. Normalized Maximum Transient Thermal Impedance

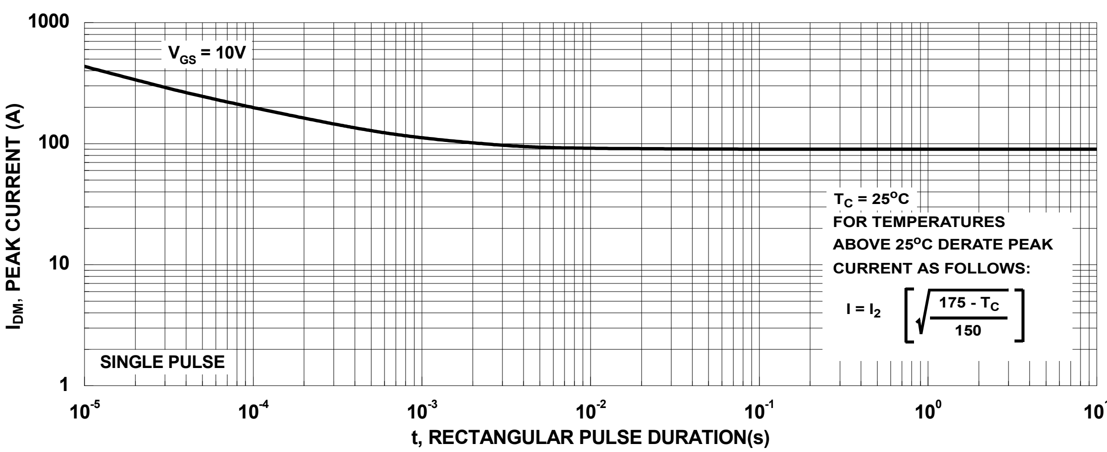


Figure 4. Peak Current Capability

Typical Characteristics

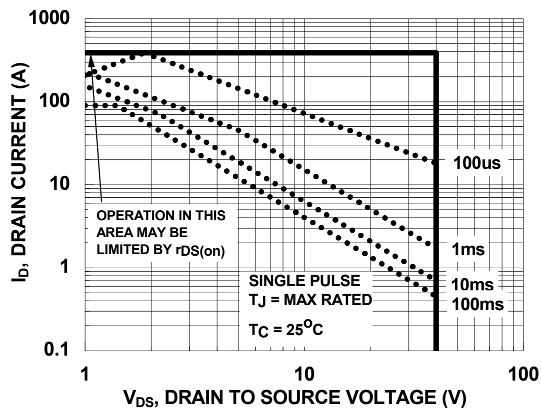
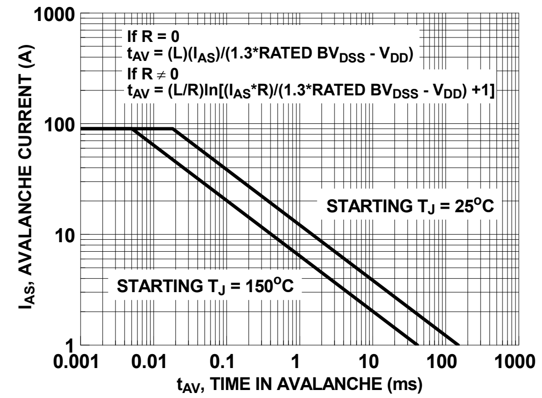


Figure 5. Forward Bias Safe Operating Area



NOTE: Refer to Fairchild Application Notes AN7514 and AN7515

Figure 6. Unclamped Inductive Switching Capability

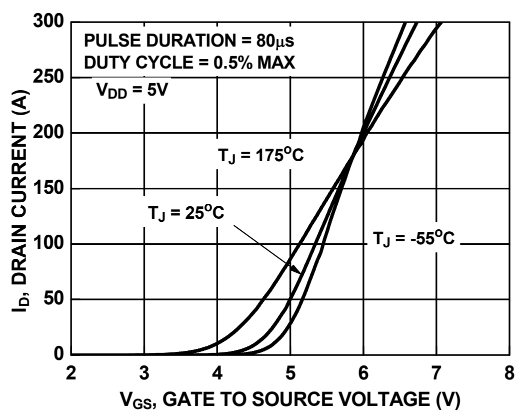


Figure 7. Transfer Characteristics

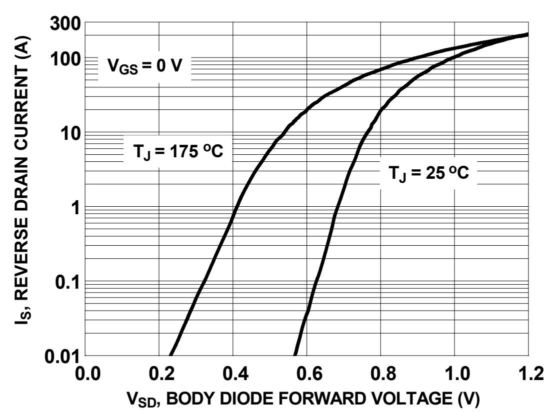


Figure 8. Forward Diode Characteristics

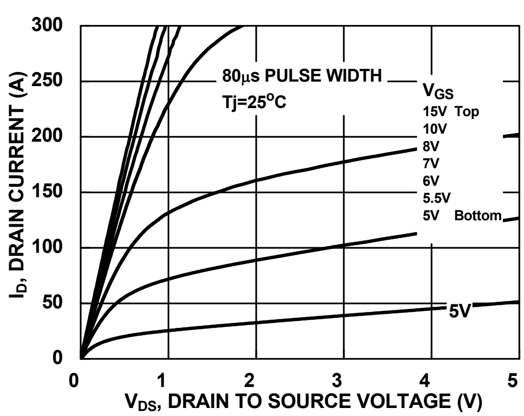


Figure 9. Saturation Characteristics

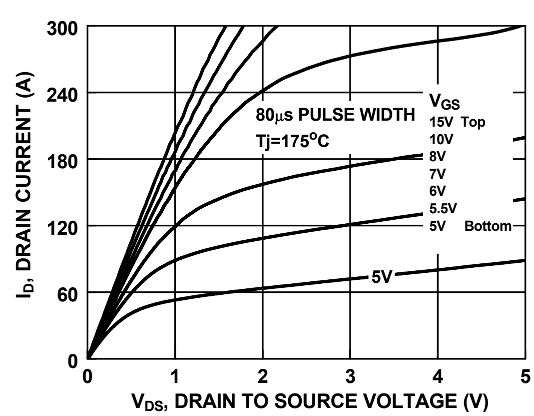


Figure 10. Saturation Characteristics

Typical Characteristics

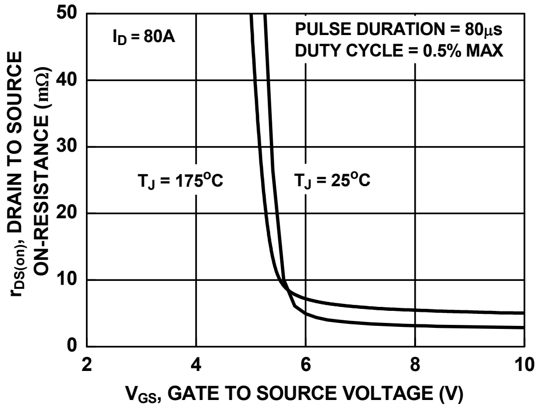


Figure 11. R_{DSON} vs. Gate Voltage

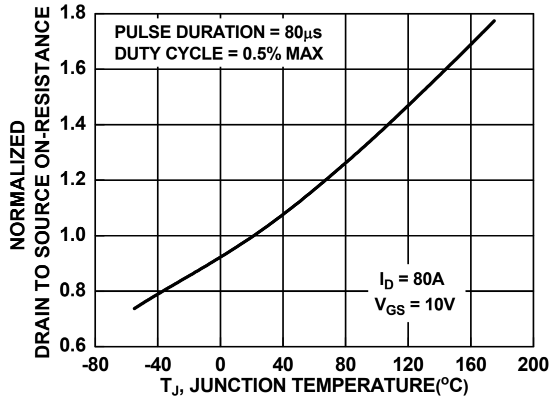


Figure 12. Normalized R_{DSON} vs. Junction Temperature

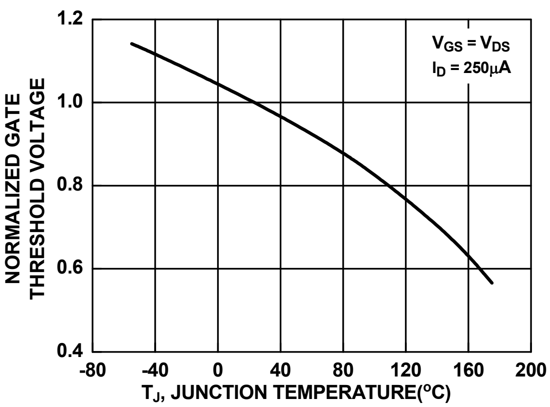


Figure 13. Normalized Gate Threshold Voltage vs. Temperature

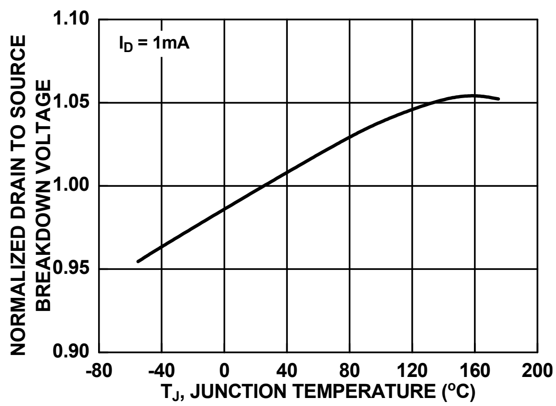


Figure 14. Normalized Drain--Source Breakdown Voltage vs. Junction Temperature

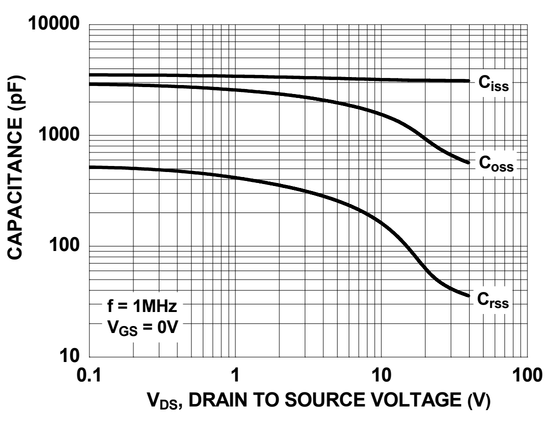


Figure 15. Capacitance vs. Drain--Source Voltage

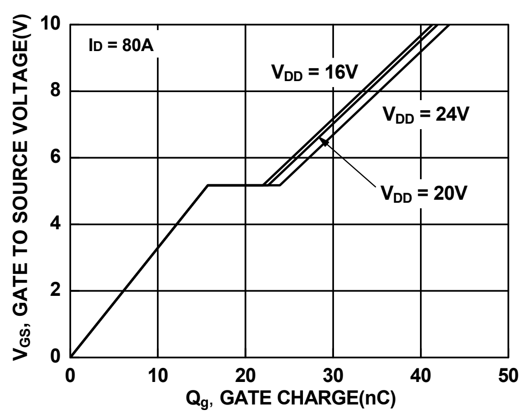


Figure 16. Gate Charge vs. Gate--Source Voltage

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™
®
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™
μ 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