FAIRCHILD SEMICONDUCTOR®

December 2008

SuperFET™

FCB20N60F

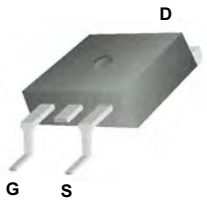
600V N-CHANNEL FRFET

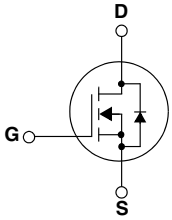
Features

- 650V @T_J = 150°C
- Typ. Rds(on)=0.15Ω
- Fast Recovery Type (t_{rr} = 160ns)
- Ultra low gate charge (typ. Qg=75nC)
- Low effective output capacitance (typ. Coss.eff=165pF)
- 100% avalanche tested
- RoHS Compliant

Description

SuperFET™ is, Fairchild's proprietary, new generation of high voltage MOSFET family that is utilizing an advanced charge balance mechanism for outstanding low on-resistance and lower gate charge performance.
This advanced technology has been tailored to minimize conduction loss, provide superior switching performance, and withstand extreme dv/dt rate and higher avalanche energy. Consequently, SuperFET is very suitable for various AC/DC power conversion in switching mode operation for system miniaturization and higher efficiency.





Absolute Maximum Ratings

Symbol	Parameter		FCB20N60F	Unit
V_{DSS}	Drain-Source Voltage		600	V
I_D	Drain Current	- Continuous (T_C = 25°C) - Continuous (T_C = 100°C)	20 12.5	A A
I_{DM}	Drain Current	- Pulsed (Note 1)	60	A
V_{GSS}	Gate-Source voltage		± 30	V
E_{AS}	Single Pulsed Avalanche Energy	(Note 2)	690	mJ
I_{AR}	Avalanche Current	(Note 1)	20	A
E_{AR}	Repetitive Avalanche Energy	(Note 1)	20.8	mJ
dv/dt	Peak Diode Recovery dv/dt	(Note 3)	50	V/ns
P_D	Power Dissipation	(T_C = 25°C) - Derate above 25°C	208 1.67	W W/°C
T_J, T_{STG}	Operating and Storage Temperature Range		-55 to +150	°C
T_L	Maximum Lead Temperature for Soldering Purpose, 1/8" from Case for 5 Seconds		300	°C

Thermal Characteristics

Symbol	Parameter	FCB20N60F	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	0.6	°C/W
$R_{\theta JA}$*	Thermal Resistance, Junction-to-Ambient*	40	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	62.5	°C/W

* When mounted on the minimum pad size recommended (PCB Mount)

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FCB20N60F	FCB20N60FTM	D2-Pak	330mm	24m	800

Electrical Characteristics T_C = 25°C unless otherwise noted

Symbol	Parameter	Conditions	Min	Typ	Max	Units
Off Characteristics						
BV_{DSS}	Drain-Source Breakdown Voltage	V_{GS} = 0V, I_D = 250μA, T_J = 25°C	600	--	--	V
		V_{GS} = 0V, I_D = 250μA, T_J = 150°C	--	650	--	V
ΔBV_{DSS} / ΔT_J	Breakdown Voltage Temperature Coefficient	I_D = 250μA, Referenced to 25°C	--	0.6	--	V/°C
BV_{DSS}	Drain-Source Avalanche Breakdown Voltage	V_{GS} = 0V, I_D = 20A	--	700	--	V
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 600V, V_{GS} = 0V V_{DS} = 480V, T_C = 125°C	-- --	-- --	10 100	μA μA
I_{GSSF}	Gate-Body Leakage Current, Forward	V_{GS} = 30V, V_{DS} = 0V	--	--	100	nA
I_{GSSR}	Gate-Body Leakage Current, Reverse	V_{GS} = -30V, V_{DS} = 0V	--	--	-100	nA
On Characteristics						
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS} = V_{GS}, I_D = 250μA	3.0	--	5.0	V
$R_{DS(on)}$	Static Drain-Source On-Resistance	V_{GS} = 10V, I_D = 10A	--	0.15	0.19	Ω
g_{FS}	Forward Transconductance	V_{DS} = 40V, I_D = 10A (Note 4)	--	17	--	S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = 25V, V_{GS} = 0V, f = 1.0MHz	--	2370	3080	pF
C_{oss}	Output Capacitance		--	1280	1665	pF
C_{rss}	Reverse Transfer Capacitance		--	95	--	pF
C_{oss}	Output Capacitance	V_{DS} = 480V, V_{GS} = 0V, f = 1.0MHz	--	65	85	pF
C_{oss} eff.	Effective Output Capacitance	V_{DS} = 0V to 400V, V_{GS} = 0V	--	165	--	pF
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = 300V, I_D = 20A, R_G = 25Ω	--	62	135	ns
t_r	Turn-On Rise Time		--	140	290	ns
$t_{d(off)}$	Turn-Off Delay Time		--	230	470	ns
t_f	Turn-Off Fall Time	(Note 4, 5)	--	65	140	ns
Q_g	Total Gate Charge	V_{DS} = 480V, I_D = 20A, V_{GS} = 10V	--	75	98	nC
Q_{gs}	Gate-Source Charge		--	13.5	18	nC
Q_{gd}	Gate-Drain Charge	(Note 4, 5)	--	36	--	nC
Drain-Source Diode Characteristics and Maximum Ratings						
I_S	Maximum Continuous Drain-Source Diode Forward Current		--	--	20	A
I_{SM}	Maximum Pulsed Drain-Source Diode Forward Current		--	--	60	A
V_{SD}	Drain-Source Diode Forward Voltage	V_{GS} = 0V, I_S = 20A	--	--	1.4	V
t_{rr}	Reverse Recovery Time	V_{GS} = 0V, I_S = 20A, dI_F/dt =100A/μs (Note 4)	--	160	--	ns
Q_{rr}	Reverse Recovery Charge		--	1.1	--	μC

NOTES:

1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. I_{AS} = 10A, V_{DD} = 50V, R_G = 25Ω, Starting T_J = 25°C
3. I_{SD} ≤ 20A, di/dt ≤ 1200A/μs, V_{DD} ≤ BV_{DSS}, Starting T_J = 25°C
4. Pulse Test: Pulse width ≤ 300μs, Duty Cycle ≤ 2%
5. Essentially Independent of Operating Temperature Typical Characteristics

Typical Performance Characteristics

Figure 1. On-Region Characteristics

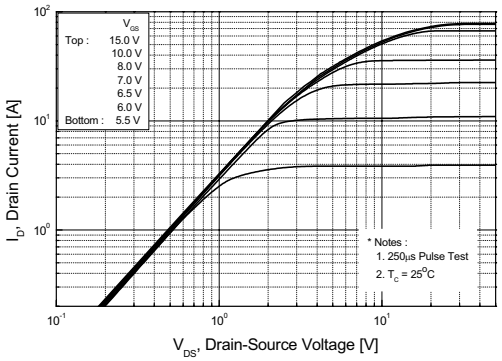


Figure 2. Transfer Characteristics

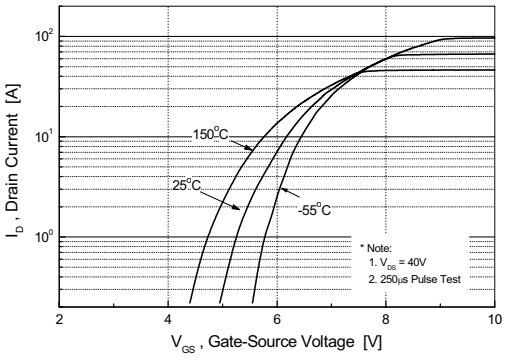


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

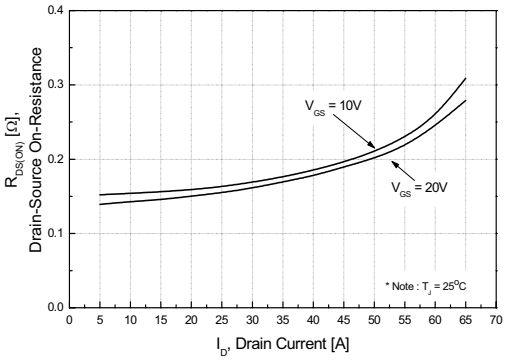


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperatue

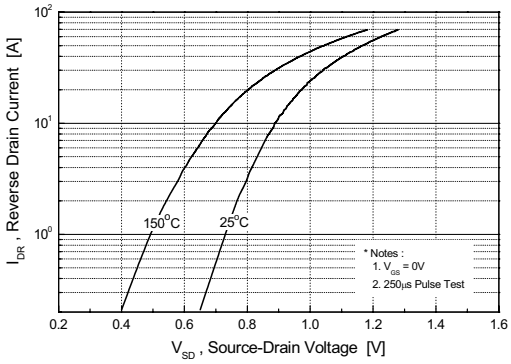


Figure 5. Capacitance Characteristics

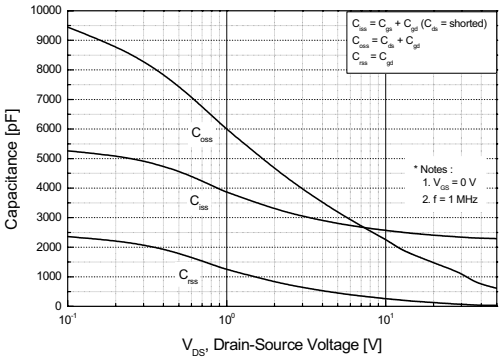
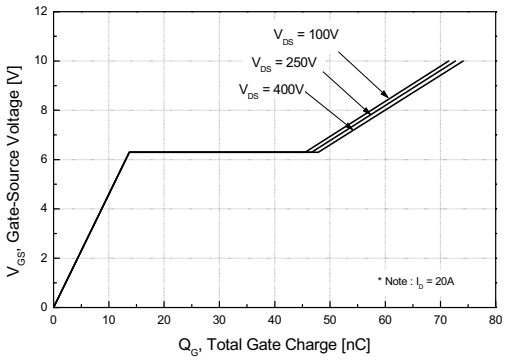


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

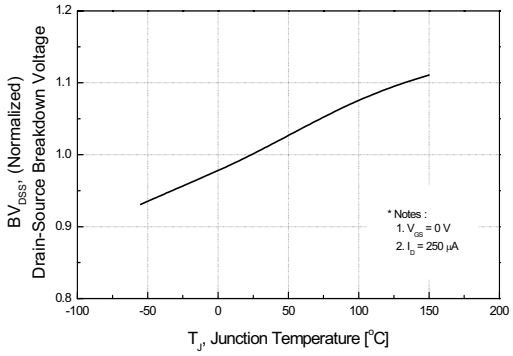


Figure 8. On-Resistance Variation vs. Temperature

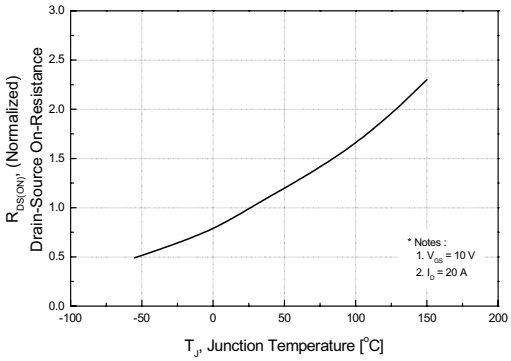


Figure 9-1. Maximum Safe Operating Area

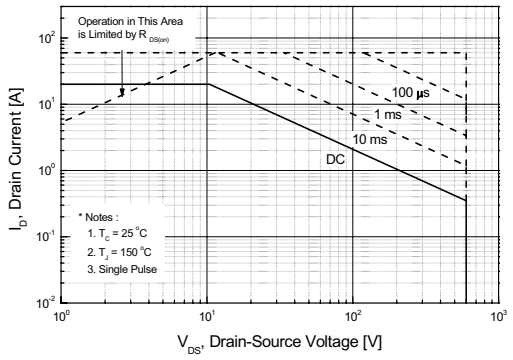


Figure 10. Maximum Drain Current vs. Case Temperature

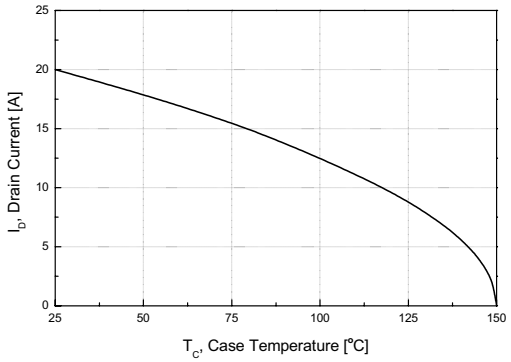
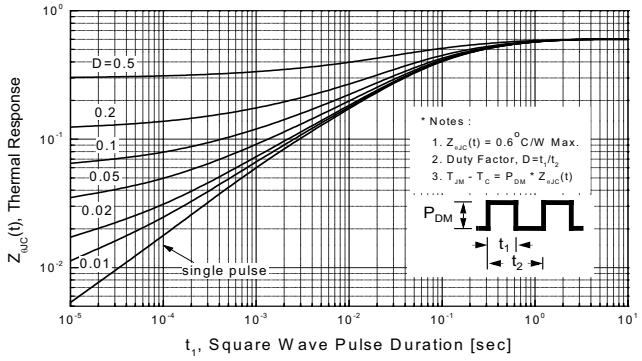
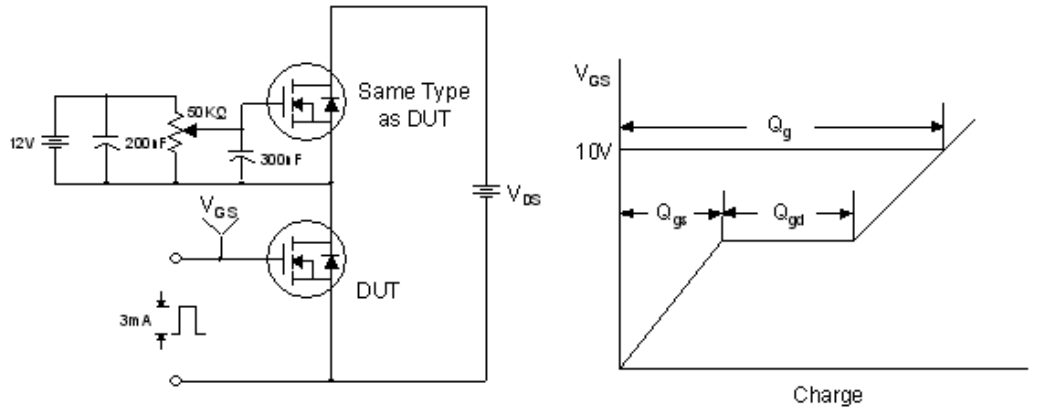


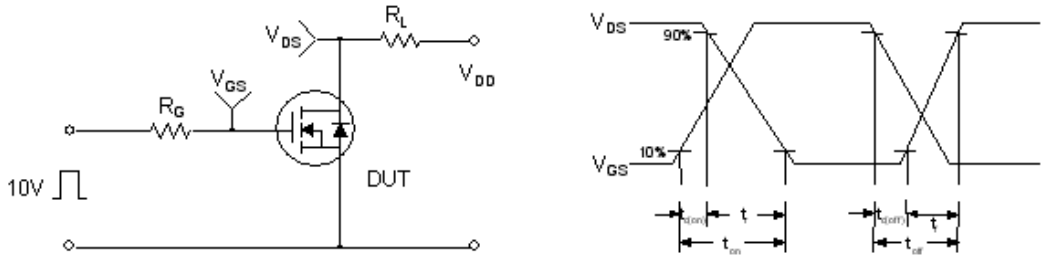
Figure 11. Transient Thermal Response Curve



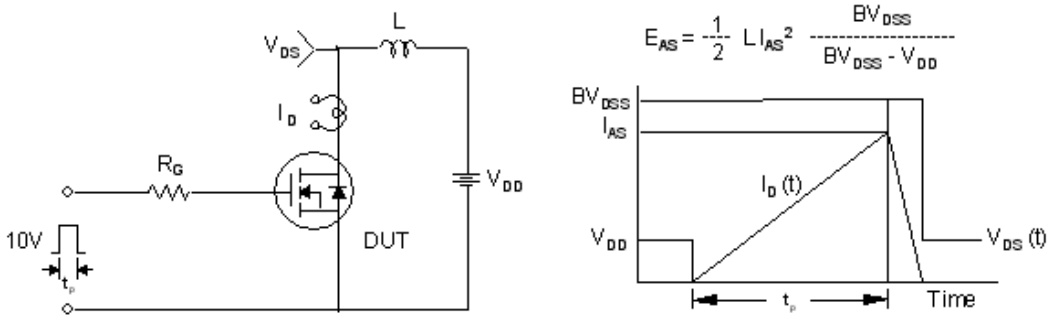
Gate Charge Test Circuit & Waveform



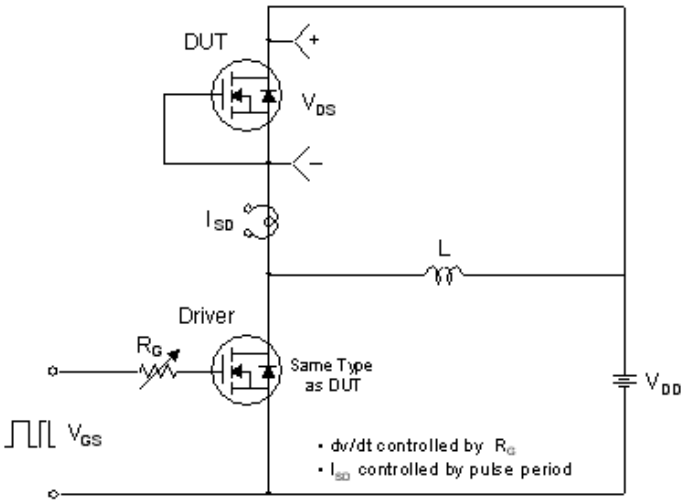
Resistive Switching Test Circuit & Waveforms

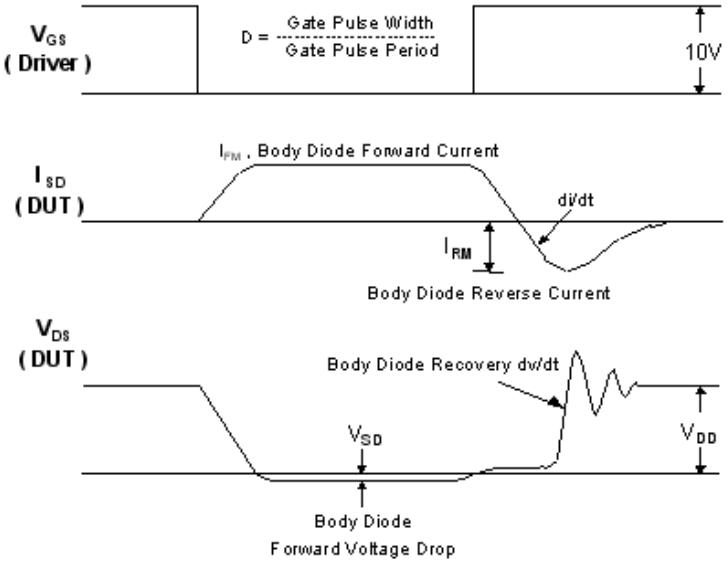


Unclamped Inductive Switching Test Circuit & Waveforms



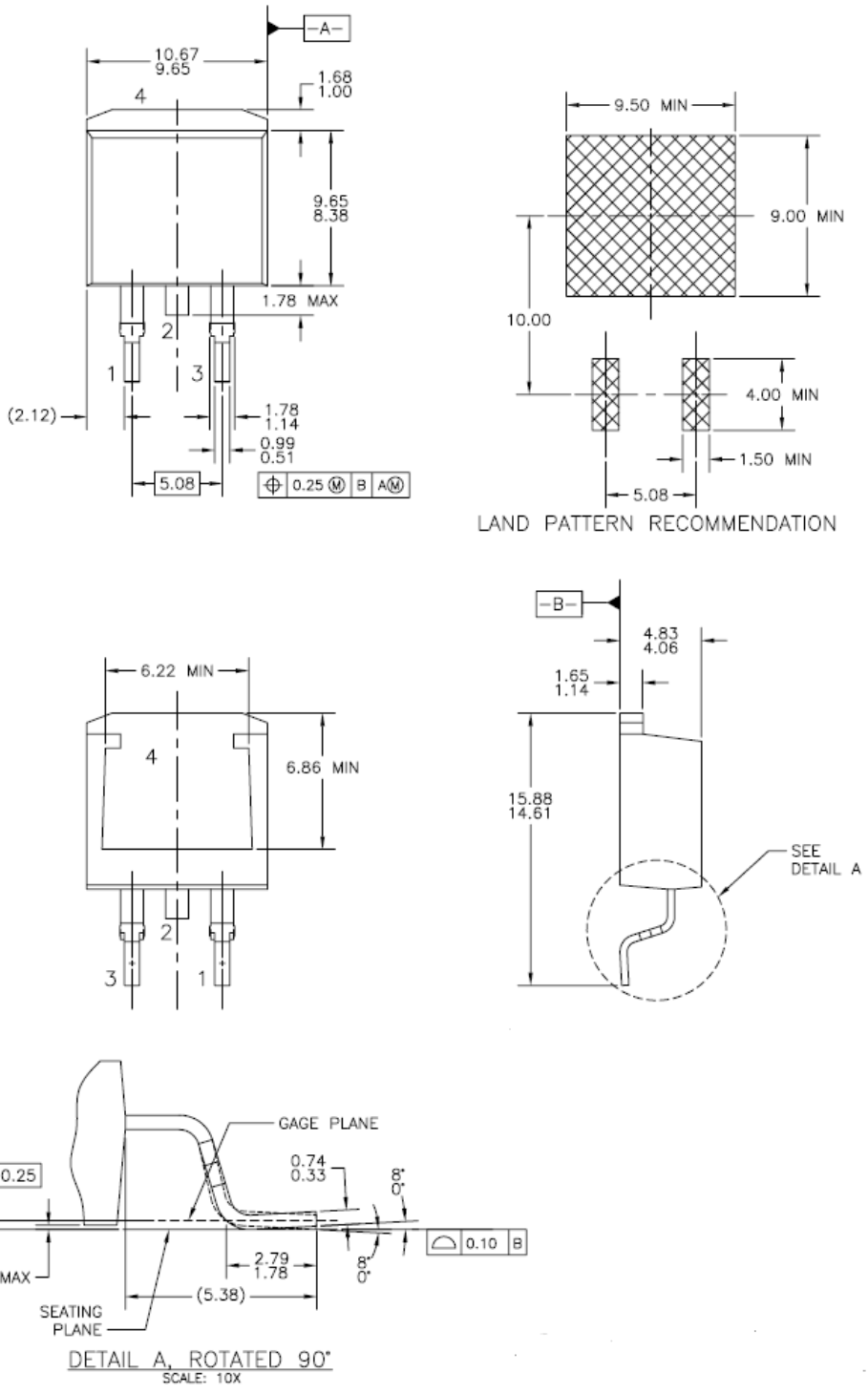
Peak Diode Recovery dv/dt Test Circuit & Waveforms





Mechanical Dimensions

D^2 - PAK



Dimensions in Millimeters

FAIRCHILD SEMICONDUCTOR®

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.

Build it Now™
CorePLUS™
CorePOWER™
CROSSVOLT™
CTL™
Current Transfer Logic™
EcoSPARK®
EfficentMax™
EZSWITCH™ *
™
®
Fairchild®
Fairchild Semiconductor®
FACT Quiet Series™
FACT®
FAST®
FastvCore™
FlashWriter® *
FPS™
F-PFS™
FRFET®
Global Power Resource℠
Green FPS™
Green FPS™ e-Series™
GTO™
IntelliMAX™
ISOPLANAR™
MegaBuck™
MICROCOUPLER™
MicroFET™
MicroPak™
MillerDrive™
MotionMax™
Motion-SPM™
OPTOLOGIC®
OPTOPLANAR®
®
PDP SPM™
Power-SPM™
PowerTrench®
PowerXS™
Programmable Active Droop™
QFET®
QS™
Quiet Series™
RapidConfigure™
™
Saving our world, 1mW /W /kW at a time™
SmartMax™
SMART START™
SPM®
STEALTH™
SuperFET™
SuperSOT™-3
SuperSOT™-6
SuperSOT™-8
SupreMOS™
SyncFET™
SYSTEM GENERAL ®
The Power Franchise®
the power franchise
TinyBoost™
TinyBuck™
TinyLogic®
TINYOPTO™
TinyPower™
TinyPWM™
TinyWire™
µSerDes™
SerDes
UHC®
Ultra FRFET™
UniFET™
VCX™
VisualMax™
XS™

* EZSWITCH™ and FlashWriter® are 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 herein:

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. Farichild'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. Farichild strongly encourages customers to purchase Farichild 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 Farichild'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. Farichild 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. I37