



# FDMS8670S

## N-Channel PowerTrench<sup>®</sup> SyncFET<sup>™</sup>

30V, 42A, 3.5mΩ

### Features

- Max  $r_{DS(on)}$  = 3.5mΩ at  $V_{GS} = 10V$ ,  $I_D = 20A$
- Max  $r_{DS(on)}$  = 5.0mΩ at  $V_{GS} = 4.5V$ ,  $I_D = 17A$
- Advanced Package and Silicon combination for low  $r_{DS(on)}$  and high efficiency
- SyncFET Schottky Body Diode
- MSL1 robust package design
- RoHS Compliant

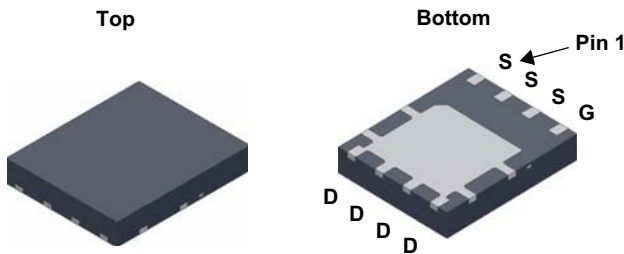


### General Description

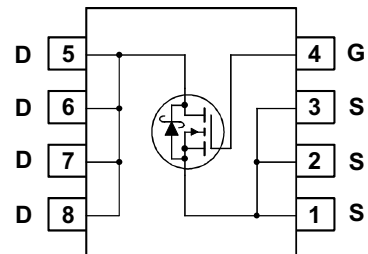
The FDMS8670S has been designed to minimize losses in power conversion application. Advancements in both silicon and package technologies have been combined to offer the lowest  $r_{DS(on)}$  while maintaining excellent switching performance. This device has the added benefit of an efficient monolithic Schottky body diode.

### Application

- Synchronous Rectifier for DC/DC Converters
- Notebook Vcore/ GPU low side switch
- Networking Point of Load low side switch
- Telecom secondary side rectification



Power 56



### MOSFET Maximum Ratings $T_A = 25^\circ\text{C}$ 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 (Package limited) $T_C = 25^\circ\text{C}$	42	A
	-Continuous (Silicon limited) $T_C = 25^\circ\text{C}$	116	
	-Continuous (Silicon limited) $T_C = 100^\circ\text{C}$	74	
	-Continuous $T_A = 25^\circ\text{C}$	20	
	-Pulsed	200	
$P_D$	Power Dissipation $T_C = 25^\circ\text{C}$	78	W
	Power Dissipation $T_A = 25^\circ\text{C}$ (Note 1a)	2.5	
	Power Dissipation $T_A = 85^\circ\text{C}$ (Note 1a)	1.3	
$T_J, T_{STG}$	Operating and Storage Junction Temperature Range	-55 to +150	$^\circ\text{C}$

### Thermal Characteristics

$R_{\theta JC}$	Thermal Resistance, Junction to Case	1.6	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1a)	50	

### Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDMS8670S	FDMS8670S	Power 56	13"	12mm	3000 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	$I_D = 1\text{mA}, V_{GS} = 0\text{V}$	30			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = 10\text{mA}$ , referenced to $25^\circ\text{C}$		17		$\text{mV}/^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 24\text{V}, V_{GS} = 0\text{V}$			500	$\mu\text{A}$
$I_{GSS}$	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	$V_{GS} = V_{DS}, I_D = 1\text{mA}$	1	1.5	3	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate to Source Threshold Voltage Temperature Coefficient	$I_D = 50\text{mA}$ , referenced to $25^\circ\text{C}$		-2.8		$\text{mV}/^\circ\text{C}$
$r_{DS(on)}$	Drain to Source On Resistance	$V_{GS} = 10\text{V}, I_D = 20\text{A}$		2.8	3.5	m $\Omega$
		$V_{GS} = 4.5\text{V}, I_D = 17\text{A}$		3.6	5.0	
		$V_{GS} = 10\text{V}, I_D = 20\text{A}, T_J = 125^\circ\text{C}$		3.9	6.0	
$g_{FS}$	Forward Transconductance	$V_{DS} = 10\text{V}, I_D = 20\text{A}$		98		S

### Dynamic Characteristics

$C_{iss}$	Input Capacitance	$V_{DS} = 15\text{V}, V_{GS} = 0\text{V}$ $f = 1\text{MHz}$		3005	4000	pF
$C_{oss}$	Output Capacitance			865	1150	pF
$C_{rss}$	Reverse Transfer Capacitance			320	480	pF
$R_g$	Gate Resistance	$f = 1\text{MHz}$		1.4	5.0	$\Omega$

### Switching Characteristics

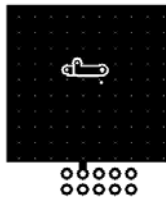
$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 15\text{V}, I_D = 20\text{A}$ $V_{GS} = 10\text{V}, R_{GEN} = 5\Omega$		14	26	ns	
$t_r$	Rise Time			19	35	ns	
$t_{d(off)}$	Turn-Off Delay Time			37	60	ns	
$t_f$	Fall Time			10	20	ns	
$Q_{g(TOT)}$	Total Gate Charge at 10V		$V_{GS} = 0\text{V}$ to $10\text{V}$		52	73	nC
$Q_{g(4.5V)}$	Total Gate Charge at 4.5V	$V_{GS} = 0\text{V}$ to $4.5\text{V}$	$V_{DS} = 15\text{V}$ $I_D = 20\text{A}$		24	34	nC
$Q_{gs}$	Gate to Source Gate Charge				8		nC
$Q_{gd}$	Gate to Drain "Miller" Charge				10		nC

### Drain-Source Diode Characteristics

$V_{SD}$	Source to Drain Diode Forward Voltage	$V_{GS} = 0\text{V}, I_S = 2\text{A}$		0.4	0.7	V
$t_{rr}$	Reverse Recovery Time	$I_F = 20\text{A}, di/dt = 300\text{A}/\mu\text{s}$		26	42	ns
$Q_{rr}$	Reverse Recovery Charge			24	39	nC

#### Notes:

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



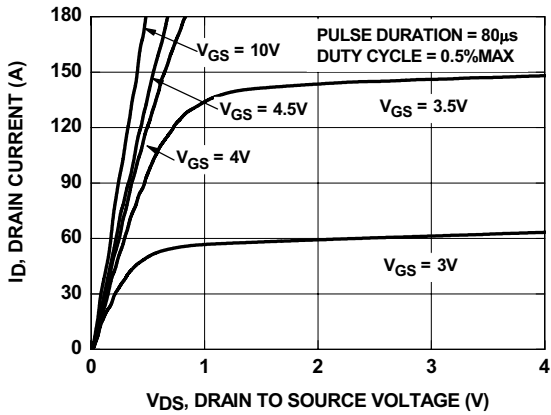
a.  $50^\circ\text{C}/\text{W}$  when mounted on a  $1\text{in}^2$  pad of 2 oz copper



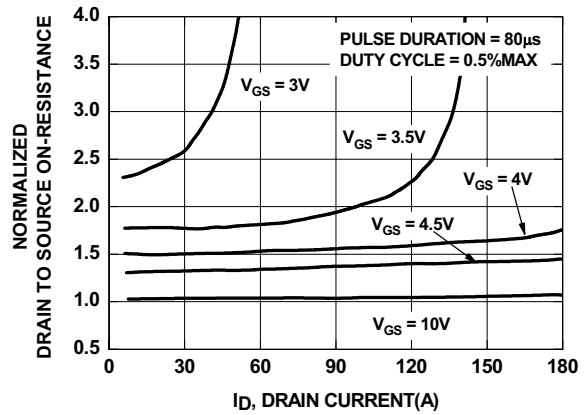
b.  $125^\circ\text{C}/\text{W}$  when mounted on a minimum pad of 2 oz copper

2: Pulse time  $< 300\mu\text{s}$ , Duty cycle  $< 2\%$ .

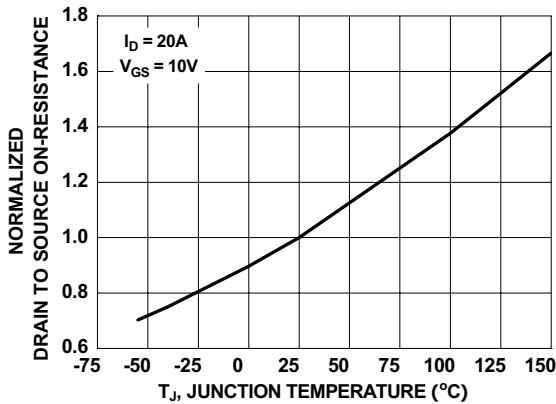
**Typical Characteristics**  $T_J = 25^\circ\text{C}$  unless otherwise noted



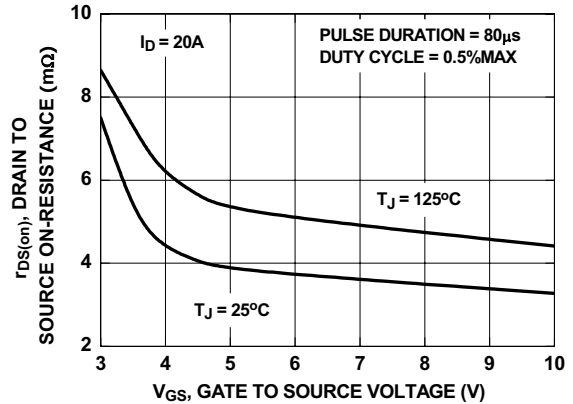
**Figure 1. On Region Characteristics**



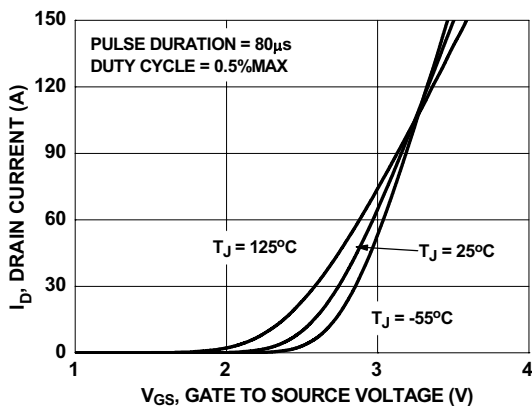
**Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage**



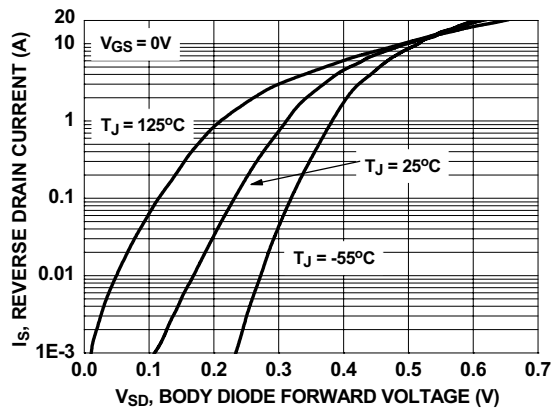
**Figure 3. Normalized On Resistance vs Junction Temperature**



**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

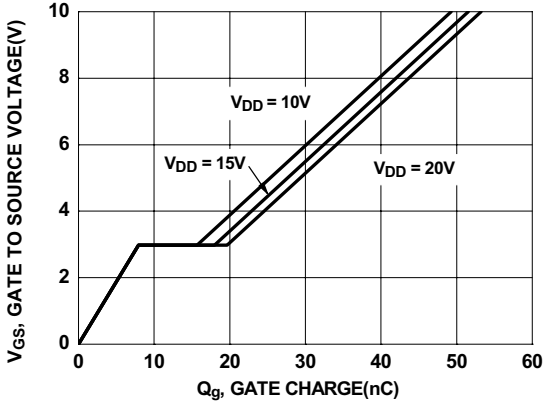


Figure 7. Gate Charge Characteristics

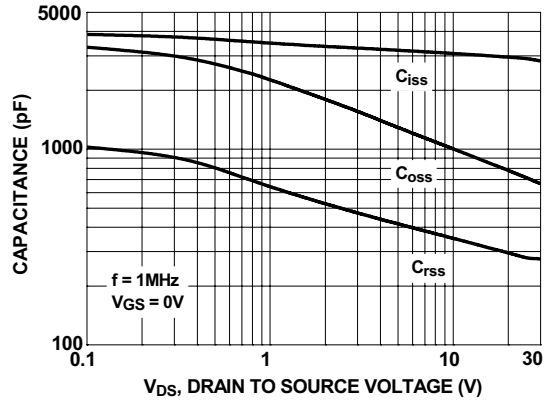


Figure 8. Capacitance vs Drain to Source Voltage

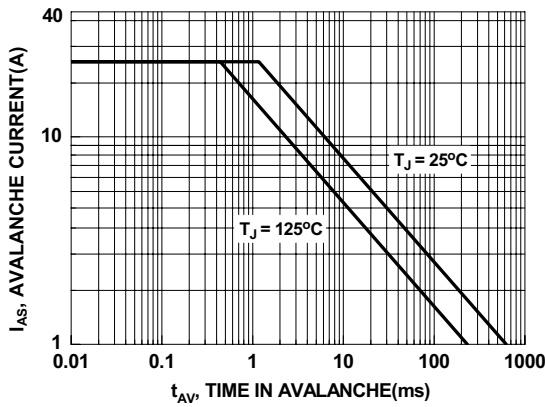


Figure 9. Unclamped Inductive Switching Capability

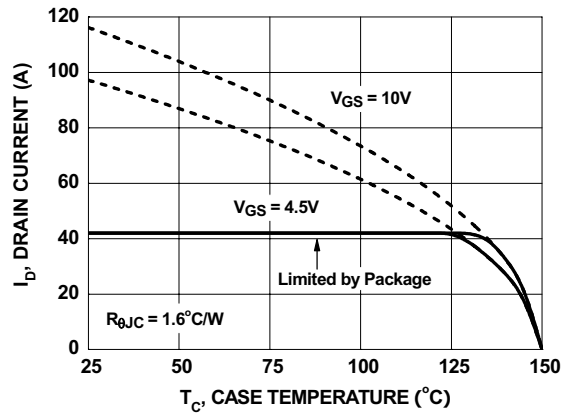


Figure 10. Maximum Continuous Drain Current vs Case Temperature

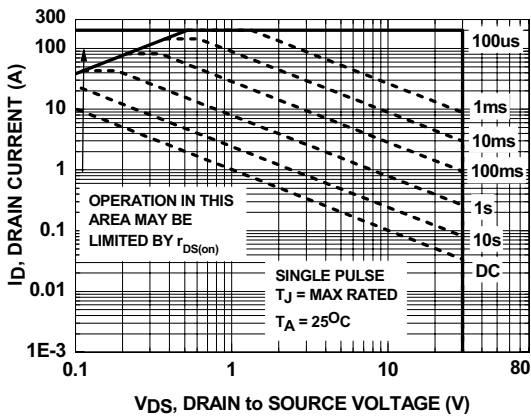


Figure 11. Forward Bias Safe Operating Area

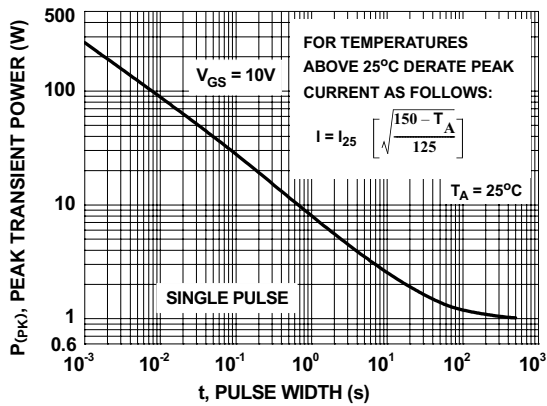
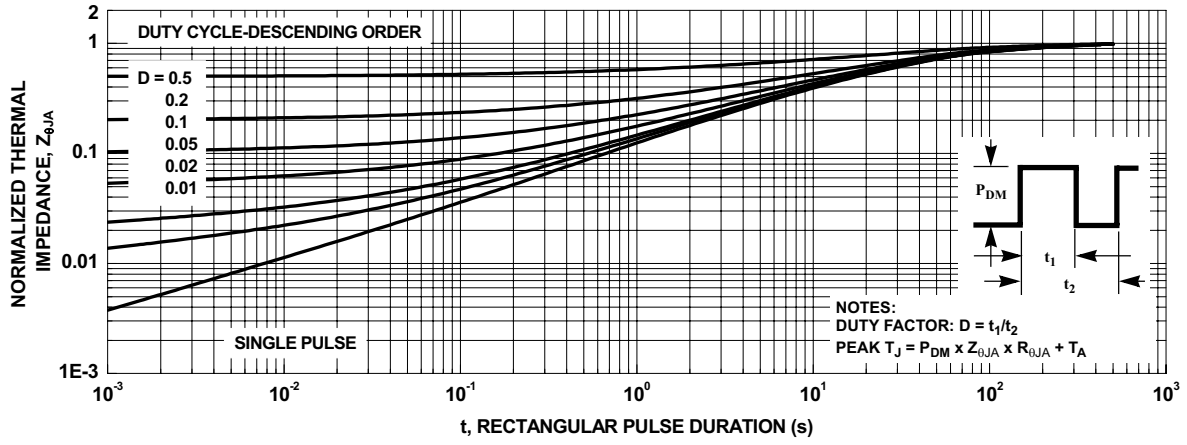


Figure 12. Single Pulse Maximum Power Dissipation

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



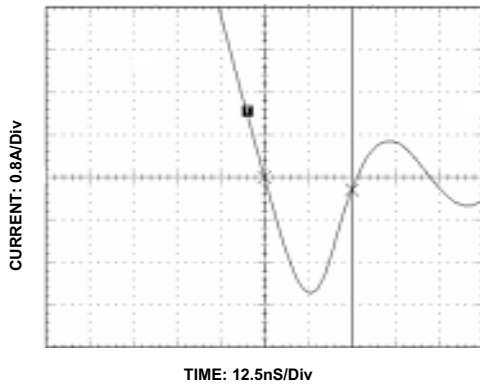
**Figure 13. Transient Thermal Response Curve**

## Typical Characteristics (continued)

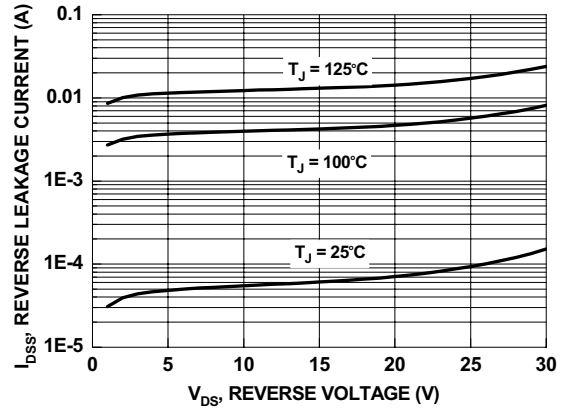
### SyncFET Schottky body diode Characteristics

Fairchild's SyncFET process embeds a Schottky diode in parallel with PowerTrench MOSFET. This diode exhibits similar characteristics to a discrete external Schottky diode in parallel with a MOSFET. Figure 14 shows the reverse recovery characteristic of the FDMS8670S.

Schottky barrier diodes exhibit significant leakage at high temperature and high reverse voltage. This will increase the power in the device.



**Figure 14. FDMS8670S SyncFET Body Diode reverse recovery characteristics**



**Figure 15. SyncFET Body Diode reverse leakage vs drain to source voltage**



TOP VIEW

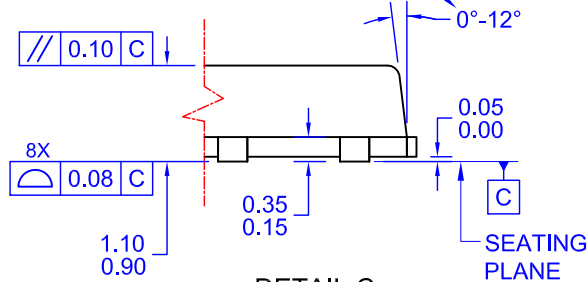


LAND PATTERN RECOMMENDATION



SIDE VIEW

OPTIONAL DRAFT ANGLE MAY APPEAR ON FOUR SIDES OF THE PACKAGE



DETAIL C  
SCALE: 2:1



DETAIL B  
SCALE: 2:1



BOTTOM VIEW

NOTES: UNLESS OTHERWISE SPECIFIED

- A. PACKAGE STANDARD REFERENCE: JEDEC MO-240, ISSUE A, VAR. AA, DATED OCTOBER 2002.
- B. DIMENSIONS DO NOT INCLUDE BURRS OR MOLD FLASH. MOLD FLASH OR BURRS DOES NOT EXCEED 0.10MM.
- C. ALL DIMENSIONS ARE IN MILLIMETERS.
- D. DIMENSIONING AND TOLERANCING PER ASME Y14.5M-2009.
- E. IT IS RECOMMENDED TO HAVE NO TRACES OR VIAS WITHIN THE KEEP OUT AREA.
- F. DRAWING FILE NAME: PQFN08AREV10





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

\* 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. TO OBTAIN THE LATEST, MOST UP-TO-DATE DATASHEET AND PRODUCT INFORMATION, VISIT OUR WEBSITE AT [HTTP://WWW.FAIRCHILDSEMI.COM](http://www.fairchildsemi.com). 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.

**AUTHORIZED USE**

Unless otherwise specified in this data sheet, this product is a standard commercial product and is not intended for use in applications that require extraordinary levels of quality and reliability. This product may not be used in the following applications, unless specifically approved in writing by a Fairchild officer: (1) automotive or other transportation, (2) military/aerospace, (3) any safety critical application – including life critical medical equipment – where the failure of the Fairchild product reasonably would be expected to result in personal injury, death or property damage. Customer's use of this product is subject to agreement of this Authorized Use policy. In the event of an unauthorized use of Fairchild's product, Fairchild accepts no liability in the event of product failure. In other respects, this product shall be subject to Fairchild's Worldwide Terms and Conditions of Sale, unless a separate agreement has been signed by both Parties.

**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](http://www.fairchildsemi.com), under Terms of Use

Counterfeiting of semiconductor parts is a growing problem in the industry. All manufacturers 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 applications, 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 handling 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 any 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.