

**FAIRCHILD**  
SEMICONDUCTOR®

September 2007

# FDD8453LZ

## N-Channel PowerTrench® MOSFET 40V, 50A, 6.7mΩ

### Features

- Max  $r_{DS(on)}$  = 6.7mΩ at  $V_{GS} = 10V, I_D = 15A$
- Max  $r_{DS(on)}$  = 8.7mΩ at  $V_{GS} = 4.5V, I_D = 13A$
- HBM ESD protection level >7kV typical (Note 4)
- RoHS Compliant

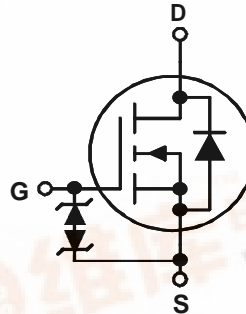
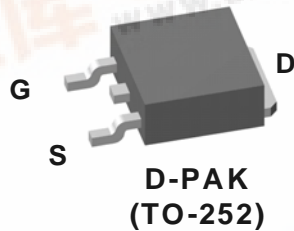


### General Description

This N-Channel MOSFET is produced using Fairchild Semiconductor's advanced PowerTrench® process that has been especially tailored to minimize the on-state resistance and switching loss. G-S zener has been added to enhance ESD voltage level.

### Applications

- Inverter
- Synchronous Rectifier



### MOSFET Maximum Ratings $T_C = 25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Ratings	Units
$V_{DS}$	Drain to Source Voltage	40	V
$V_{GS}$	Gate to Source Voltage	±20	V
$I_D$	Drain Current -Continuous (Package limited) $T_C = 25^\circ\text{C}$	50	A
	-Continuous (Silicon limited) $T_C = 25^\circ\text{C}$	75	
	-Continuous $T_A = 25^\circ\text{C}$ (Note 1a)	16.4	
	-Pulsed	100	
$E_{AS}$	Single Pulse Avalanche Energy (Note 3)	253	mJ
$P_D$	Power Dissipation $T_C = 25^\circ\text{C}$	65	W
	Power Dissipation $T_A = 25^\circ\text{C}$ (Note 1a)	3.1	
$T_J, T_{STG}$	Operating and Storage Junction Temperature Range	-55 to +150	°C

### Thermal Characteristics

$R_{\theta JC}$	Thermal Resistance, Junction to Case	1.9	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1a)	40	

### Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDD8453LZ	FDD8453LZ	D-PAK (TO-252)	13"	12mm	2500 units

FDD8453LZ N-Channel PowerTrench® MOSFET

## 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	$I_D = 250\mu\text{A}, V_{GS} = 0\text{V}$	40			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = 250\mu\text{A}$ , referenced to $25^\circ\text{C}$		36		mV/ $^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 32\text{V}, V_{GS} = 0\text{V}$			1	$\mu\text{A}$
$I_{GSS}$	Gate to Source Leakage Current	$V_{GS} = \pm 20\text{V}, V_{DS} = 0\text{V}$			$\pm 10$	$\mu\text{A}$

### On Characteristics

$V_{GS(th)}$	Gate to Source Threshold Voltage	$V_{GS} = V_{DS}, I_D = 250\mu\text{A}$	1.0	1.8	3.0	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate to Source Threshold Voltage Temperature Coefficient	$I_D = 250\mu\text{A}$ , referenced to $25^\circ\text{C}$		-6.0		mV/ $^\circ\text{C}$
$r_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = 10\text{V}, I_D = 15\text{A}$		5.8	6.7	m $\Omega$
		$V_{GS} = 4.5\text{V}, I_D = 13\text{A}$		6.8	8.7	
		$V_{GS} = 10\text{V}, I_D = 15\text{A}, T_J = 125^\circ\text{C}$		9.1	10.6	
$g_{FS}$	Forward Transconductance	$V_{DS} = 5\text{V}, I_D = 15\text{A}$		77		S

### Dynamic Characteristics

$C_{iss}$	Input Capacitance	$V_{DS} = 20\text{V}, V_{GS} = 0\text{V}, f = 1\text{MHz}$		2640	3515	pF
$C_{oss}$	Output Capacitance			320	425	pF
$C_{rss}$	Reverse Transfer Capacitance			190	285	pF
$R_g$	Gate Resistance		$f = 1\text{MHz}$		2.3	

### Switching Characteristics

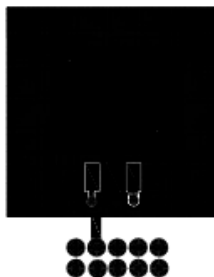
$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 20\text{V}, I_D = 15\text{A}, V_{GS} = 10\text{V}, R_{GEN} = 6\Omega$		11	19	ns
$t_r$	Rise Time			6	12	ns
$t_{d(off)}$	Turn-Off Delay Time			37	58	ns
$t_f$	Fall Time			5	10	ns
$Q_g$	Total Gate Charge		$V_{GS} = 0\text{V to } 10\text{V}$	$V_{DD} = 20\text{V}, I_D = 15\text{A}$	46	64
$Q_g$	Total Gate Charge	$V_{GS} = 0\text{V to } 5\text{V}$	24		33	nC
$Q_{gs}$	Gate to Source Charge		7			nC
$Q_{gd}$	Gate to Drain "Miller" Charge		8			nC

### Drain-Source Diode Characteristics

$V_{SD}$	Source to Drain Diode Forward Voltage	$V_{GS} = 0\text{V}, I_S = 2.0\text{A}$ (Note 2)		0.7	1.2	V
		$V_{GS} = 0\text{V}, I_S = 15\text{A}$ (Note 2)		0.8	1.3	
$t_{rr}$	Reverse Recovery Time	$I_F = 15\text{A}, di/dt = 100\text{A}/\mu\text{s}$		25	40	ns
$Q_{rr}$	Reverse Recovery Charge			20	32	nC

#### Notes:

- 1:  $R_{\theta JA}$  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.



a)  $40^\circ\text{C}/\text{W}$  when mounted on a  $1\text{ in}^2$  pad of 2 oz copper



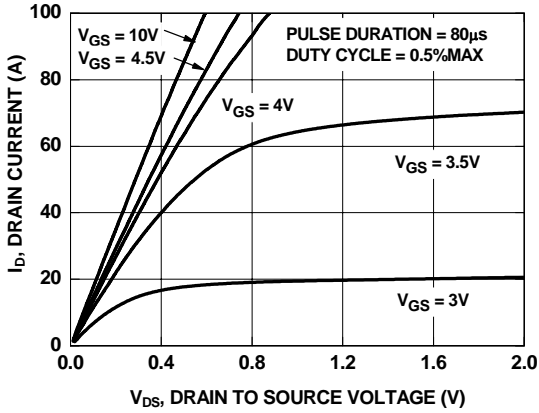
b)  $96^\circ\text{C}/\text{W}$  when mounted on a minimum pad.

2: Pulse Test: Pulse Width <  $300\mu\text{s}$ , Duty cycle < 2.0%.

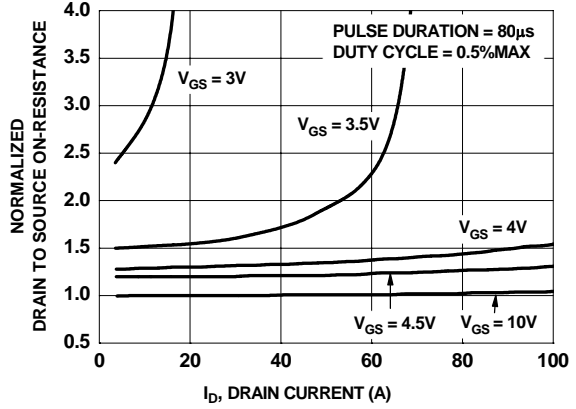
3: Starting  $T_J = 25^\circ\text{C}$ ,  $L = 3\text{mH}$ ,  $I_{AS} = 13\text{A}$ ,  $V_{DD} = 40\text{V}$ ,  $V_{GS} = 10\text{V}$ .

4: The diode connected between the gate and source serves only as protection against ESD. No gate overvoltage rating is implied.

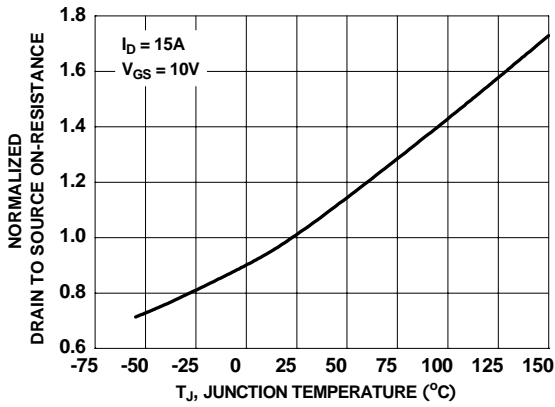
**Typical Characteristics**  $T_J = 25^\circ\text{C}$  unless otherwise noted



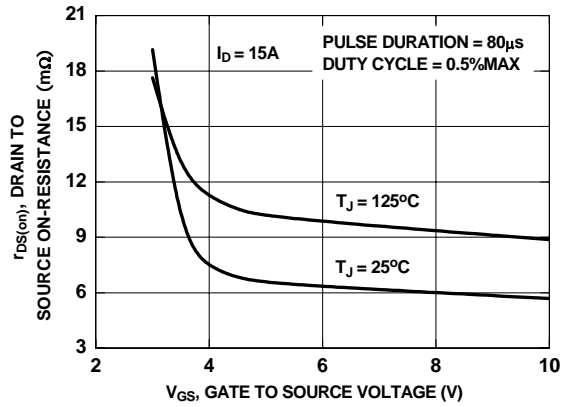
**Figure 1. On-Region Characteristics**



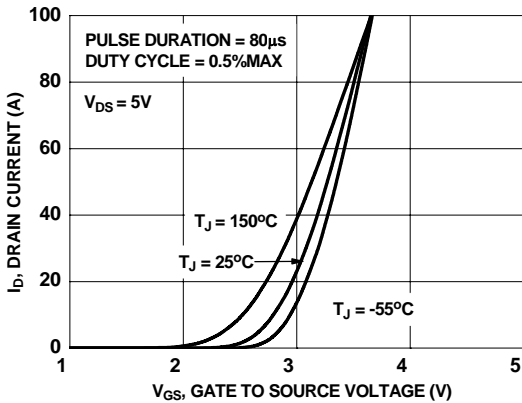
**Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage**



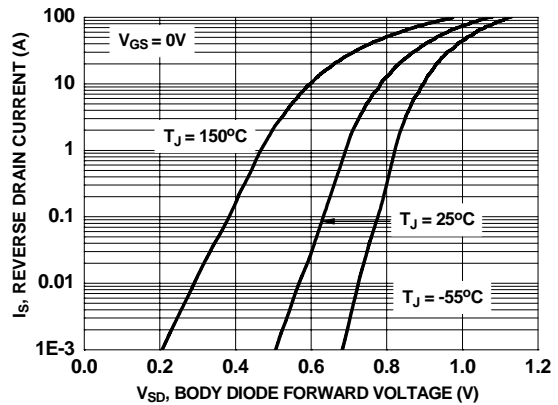
**Figure 3. Normalized On-Resistance vs Junction Temperature**



**Figure 4. On-Resistance vs Gate to Source Voltage**

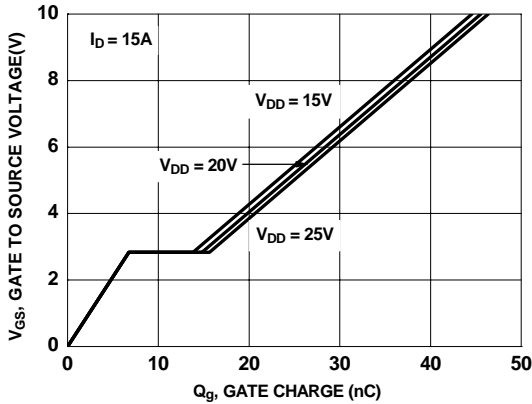


**Figure 5. Transfer Characteristics**

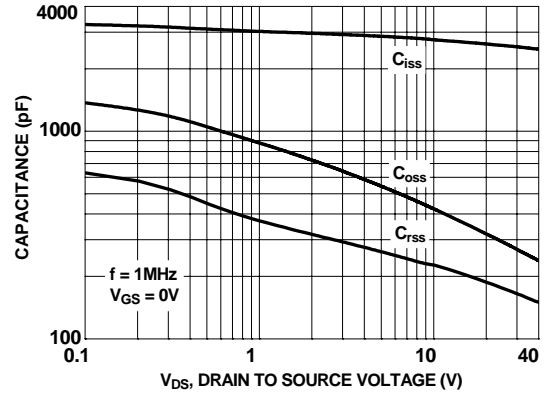


**Figure 6. Source to Drain Diode Forward Voltage vs Source Current**

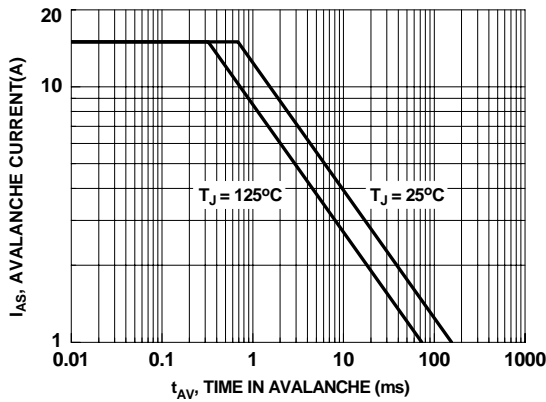
**Typical Characteristics**  $T_J = 25^\circ\text{C}$  unless otherwise noted



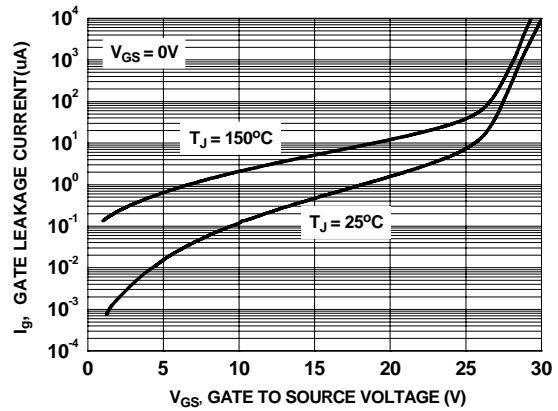
**Figure 7. Gate Charge Characteristics**



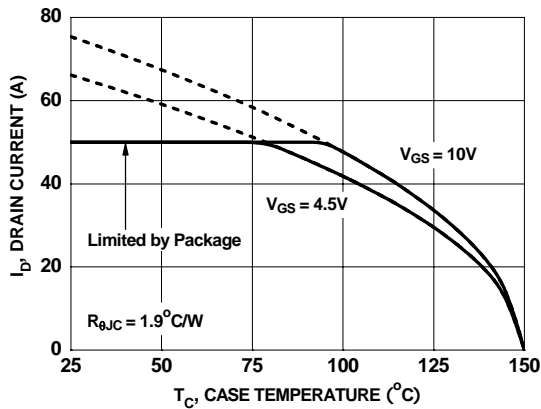
**Figure 8. Capacitance vs Drain to Source Voltage**



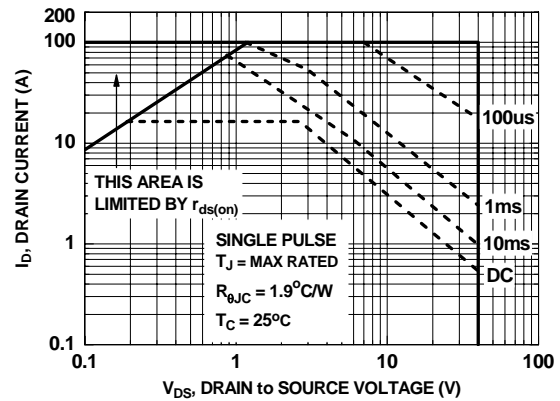
**Figure 9. Unclamped Inductive Switching Capability**



**Figure 10. Gate Leakage Current vs Gate to Source Voltage**



**Figure 11. Maximum Continuous Drain Current vs Ambient Temperature**



**Figure 12. Forward Bias Safe Operating Area**

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

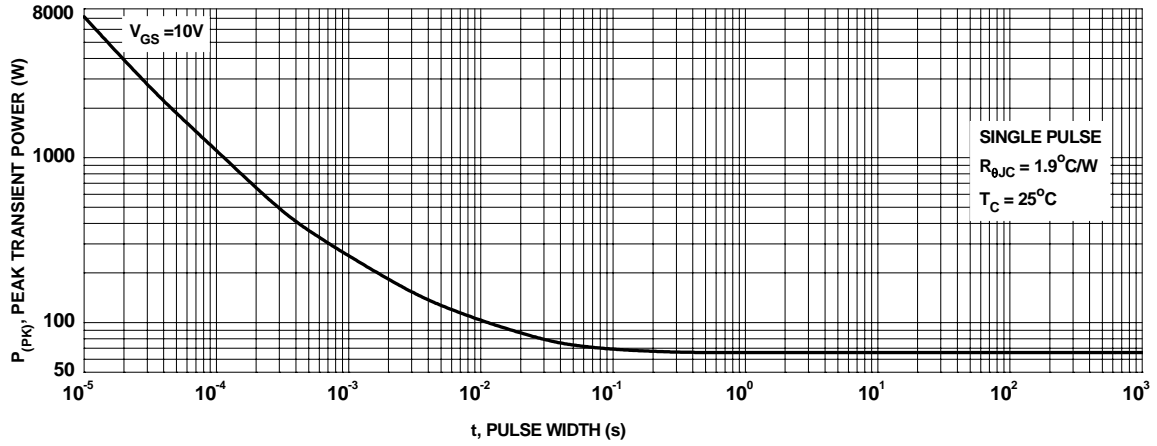


Figure 13. Single Pulse Maximum Power Dissipation

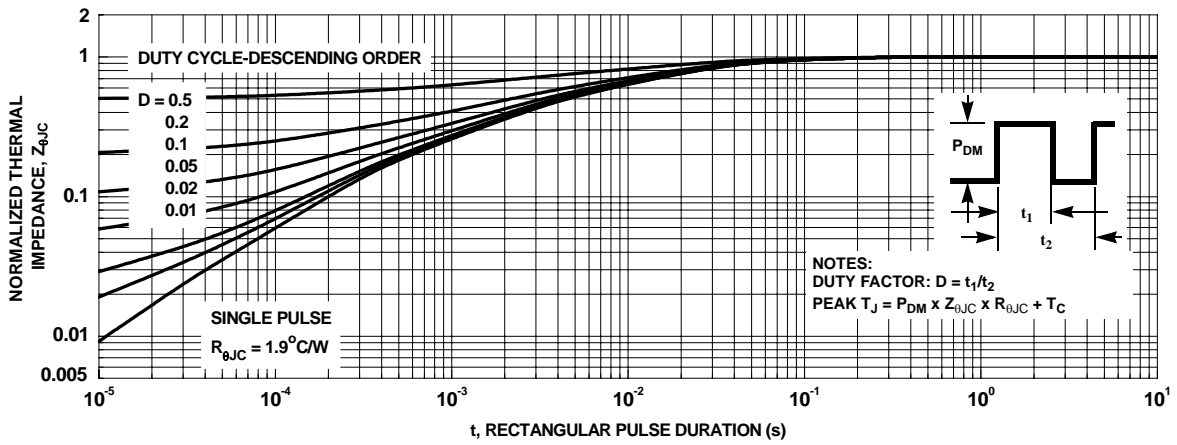


Figure 14. Transient Thermal Response Curve

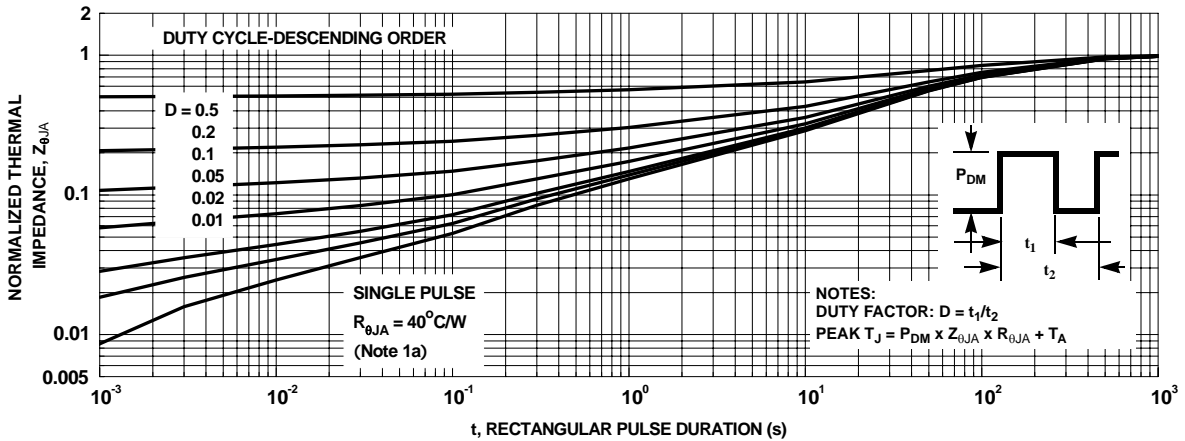
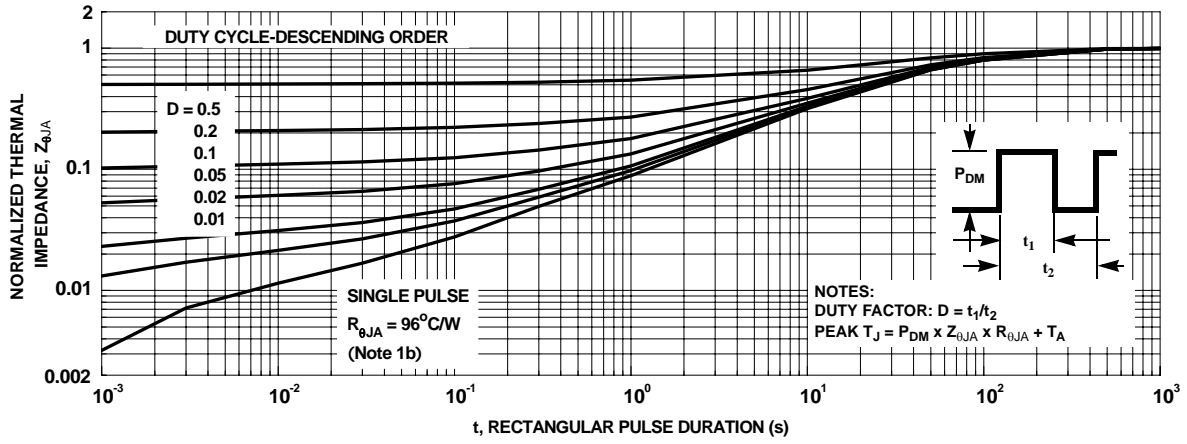


Figure 15. Transient Thermal Response Curve

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




**Figure 16. Transient Thermal Response Curve**



## TRADEMARKS

The following are registered and unregistered trademarks and service marks Fairchild Semiconductor owns or is authorized to use and is not intended to be an exhaustive list of all such trademarks.

ACE <sup>®</sup>	Green FPST <sup>™</sup>	Power247 <sup>®</sup>	SuperSOT <sup>™</sup> -8
Build it Now <sup>™</sup>	Green FPST <sup>™</sup> e-Series <sup>™</sup>	POWEREDGE <sup>®</sup>	SyncFET <sup>™</sup>
CorePLUS <sup>™</sup>	GTO <sup>™</sup>	Power-SPM <sup>™</sup>	The Power Franchise <sup>®</sup>
CROSSVOLT <sup>™</sup>	<i>i-Lo</i> <sup>™</sup>	PowerTrench <sup>®</sup>	the <b>power</b> franchise
CTL <sup>™</sup>	IntelliMAX <sup>™</sup>	Programmable Active Droop <sup>™</sup>	TinyBoost <sup>™</sup>
Current Transfer Logic <sup>™</sup>	ISOPLANAR <sup>™</sup>	QFET <sup>®</sup>	TinyBuck <sup>™</sup>
EcoSPARK <sup>®</sup>	MegaBuck <sup>™</sup>	QS <sup>™</sup>	TinyLogic <sup>®</sup>
<b>F</b> <sup>®</sup>	MICROCOUPLER <sup>™</sup>	QT Optoelectronics <sup>™</sup>	TINYOPTO <sup>™</sup>
Fairchild <sup>®</sup>	MicroFET <sup>™</sup>	Quiet Series <sup>™</sup>	TinyPower <sup>™</sup>
Fairchild Semiconductor <sup>®</sup>	MicroPak <sup>™</sup>	RapidConfigure <sup>™</sup>	TinyPWM <sup>™</sup>
FACT Quiet Series <sup>™</sup>	MillerDrive <sup>™</sup>	SMART START <sup>™</sup>	TinyWire <sup>™</sup>
FACT <sup>®</sup>	Motion-SPM <sup>™</sup>	SPM <sup>®</sup>	μSerDes <sup>™</sup>
FAST <sup>®</sup>	OPTOLOGIC <sup>®</sup>	STEALTH <sup>™</sup>	UHC <sup>®</sup>
FastvCore <sup>™</sup>	OPTOPLANAR <sup>®</sup>	SuperFET <sup>™</sup>	UniFET <sup>™</sup>
FPST <sup>™</sup>	 <sup>®</sup>	SuperSOT <sup>™</sup> -3	VCX <sup>™</sup>
FRFET <sup>®</sup>	PDP-SPM <sup>™</sup>	SuperSOT <sup>™</sup> -6	
Global Power Resource <sup>SM</sup>	Power220 <sup>®</sup>		

## 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:

- 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 to the user.
- 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.

## PRODUCT STATUS DEFINITIONS

### Definition of Terms

Datasheet Identification	Product Status	Definition
Advance Information	Formative or In Design	This datasheet contains the design specifications for product development. Specifications may change in any manner without notice.
Preliminary	First Production	This 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	This datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve design.
Obsolete	Not In Production	This datasheet contains specifications on a product that has been discontinued by Fairchild Semiconductor. The datasheet is printed for reference information only.

Rev. 131