July 2005

QFET®

FQH35N40
400V N-Channel MOSFET

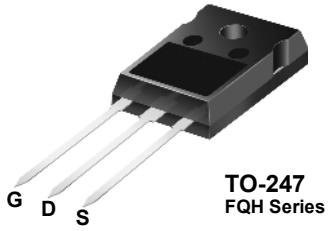
Features

- 35A, 400V, $R_{DS(on)}$ = 0.105Ω @V_{GS} = 10 V
- Low gate charge (typical 110 nC)
- Low Crss (typical 65 pF)
- Fast switching
- 100% avalanche tested
- Improved dv/dt capability

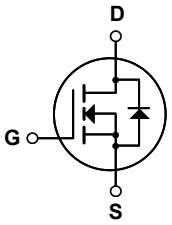
Description

These N-Channel enhancement mode power field effect transistors are produced using Fairchild's proprietary, planar stripe, DMOS technology.

This advanced technology has been especially tailored to minimize on-state resistance, provide superior switching performance, and withstand high energy pulse in the avalanche and commutation mode. These devices are well suited for high efficiency switch mode power supply, electronic lamp ballast based on half bridge.



TO-247
FQH Series



Absolute Maximum Ratings

Symbol	Parameter	FQH35N40	Unit
V_{DSS}	Drain-Source Voltage	400	V
I_D	Drain Current - Continuous (T_C = 25°C) - Continuous (T_C = 100°C)	35 22	A A
I_{DM}	Drain Current - Pulsed (Note 1)	140	A
V_{GSS}	Gate-Source voltage	±30	V
E_{AS}	Single Pulsed Avalanche Energy (Note 2)	1600	mJ
I_{AR}	Avalanche Current (Note 1)	35	A
E_{AR}	Repetitive Avalanche Energy (Note 1)	31	mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)	4.5	V/ns
P_D	Power Dissipation (T_C = 25°C) - Derate above 25°C	310 2.5	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	Min.	Max.	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	--	0.4	°C/W
$R_{\theta CS}$	Thermal Resistance, Case-to-Sink	0.24	--	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	--	40	°C/W

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FQH35N40	FQH35N40	TO-247	-	-	30

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	400	--	--	V
ΔBV_{DSS} / ΔT_J	Breakdown Voltage Temperature Coefficient	I_D = 250μA, Referenced to 25°C	--	0.42	--	V/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 400V, V_{GS} = 0V V_{DS} = 320V, T_C = 125°C	-- --	-- --	1 10	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 = 17.5A	--	0.08	0.105	Ω
g_{FS}	Forward Transconductance	V_{DS} = 50V, I_D = 17.5A (Note 4)	--	35	--	S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = 25V, V_{GS} = 0V, f = 1.0MHz	--	4300	5600	pF
C_{oss}	Output Capacitance		--	730	950	pF
C_{rss}	Reverse Transfer Capacitance		--	65	85	pF
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = 200V, I_D = 35A R_G = 25Ω (Note 4, 5)	--	95	200	ns
t_r	Turn-On Rise Time		--	360	730	ns
$t_{d(off)}$	Turn-Off Delay Time		--	220	450	ns
t_f	Turn-Off Fall Time		--	190	390	ns
Q_g	Total Gate Charge	V_{DS} = 320V, I_D = 35A V_{GS} = 10V (Note 4, 5)	--	110	140	nC
Q_{gs}	Gate-Source Charge		--	27	--	nC
Q_{gd}	Gate-Drain Charge		--	53	--	nC
Drain-Source Diode Characteristics and Maximum Ratings						
I_S	Maximum Continuous Drain-Source Diode Forward Current		--	--	35	A
I_{SM}	Maximum Pulsed Drain-Source Diode Forward Current		--	--	140	A
V_{SD}	Drain-Source Diode Forward Voltage	V_{GS} = 0V, I_S = 35A	--	--	1.5	V
t_{rr}	Reverse Recovery Time	V_{GS} = 0V, I_S = 35A dI_F/dt =100A/μs (Note 4)	--	390	--	ns
Q_{rr}	Reverse Recovery Charge		--	4.5	--	μC

NOTES:

1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. L = 2.3mH, I_{AS} = 35A, V_{DD} = 50V, R_G = 25Ω, Starting T_J = 25°C
3. I_{SD} ≤ 35A, di/dt ≤ 200A/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

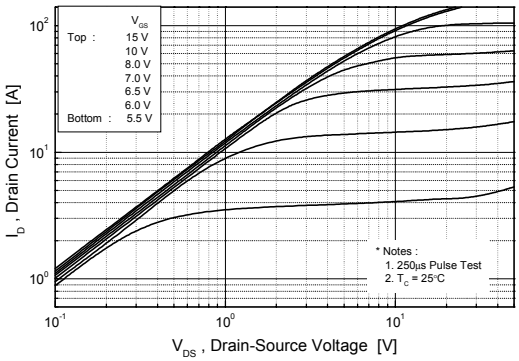


Figure 2. Transfer Characteristics

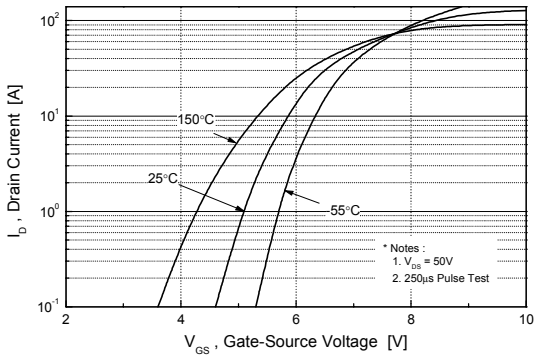


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

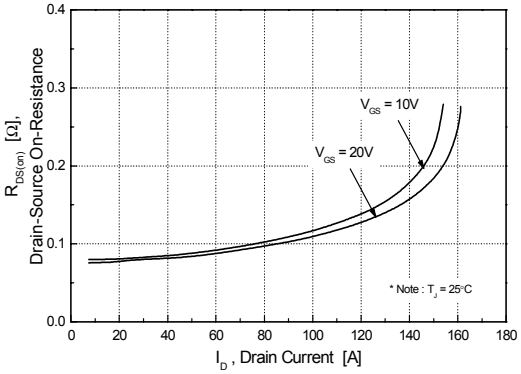


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperatue

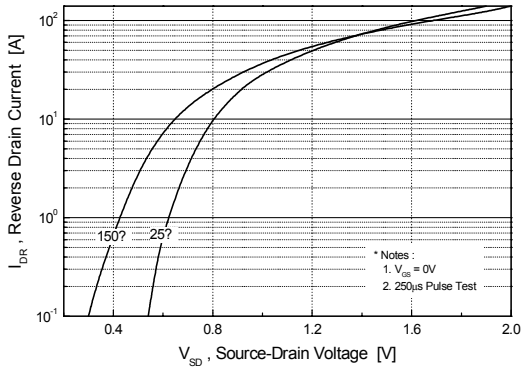


Figure 5. Capacitance Characteristics

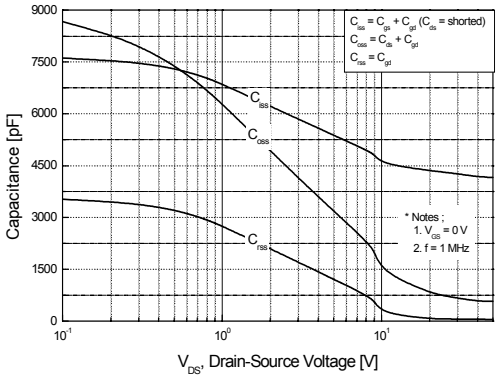
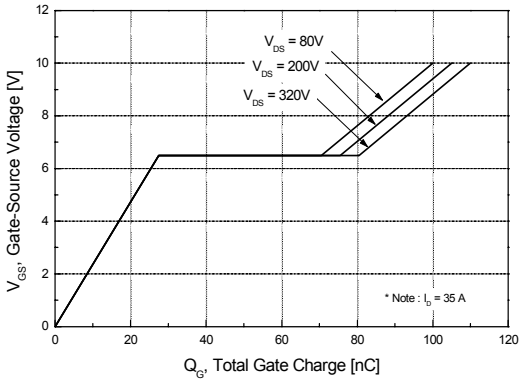


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

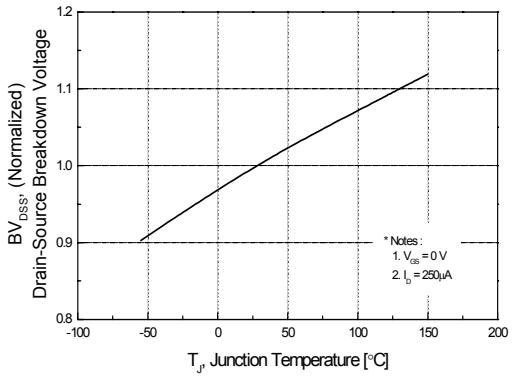


Figure 8. On-Resistance Variation vs. Temperature

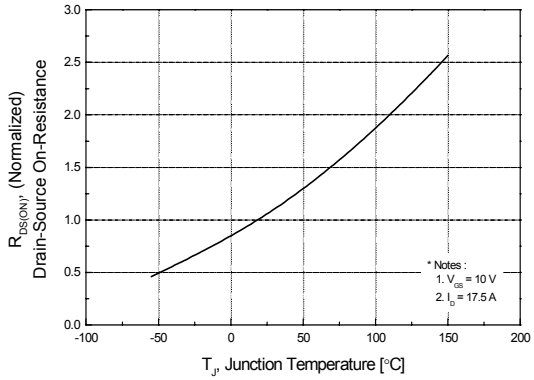


Figure 9. Maximum Safe Operating Area

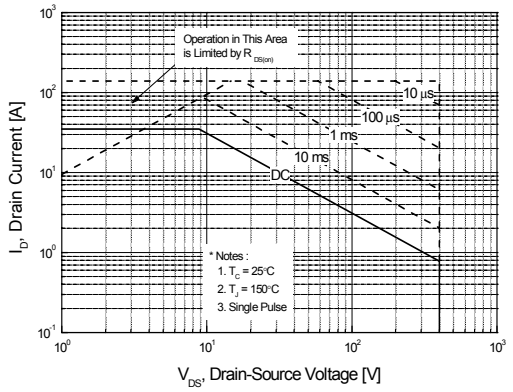


Figure 10. Maximum Drain Current vs. Case Temperature

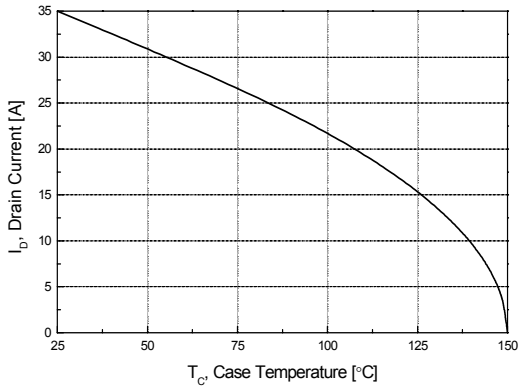
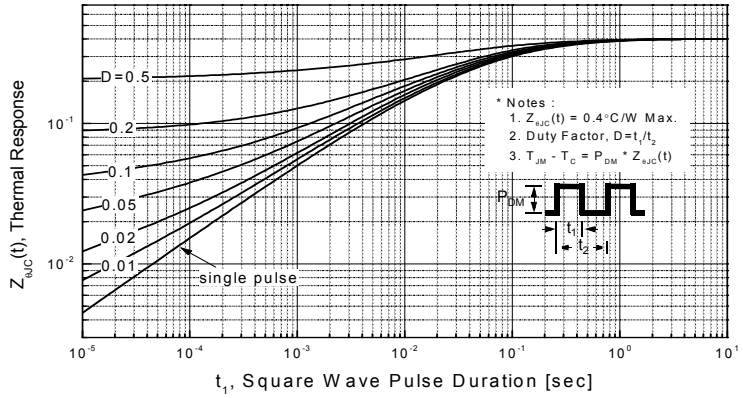
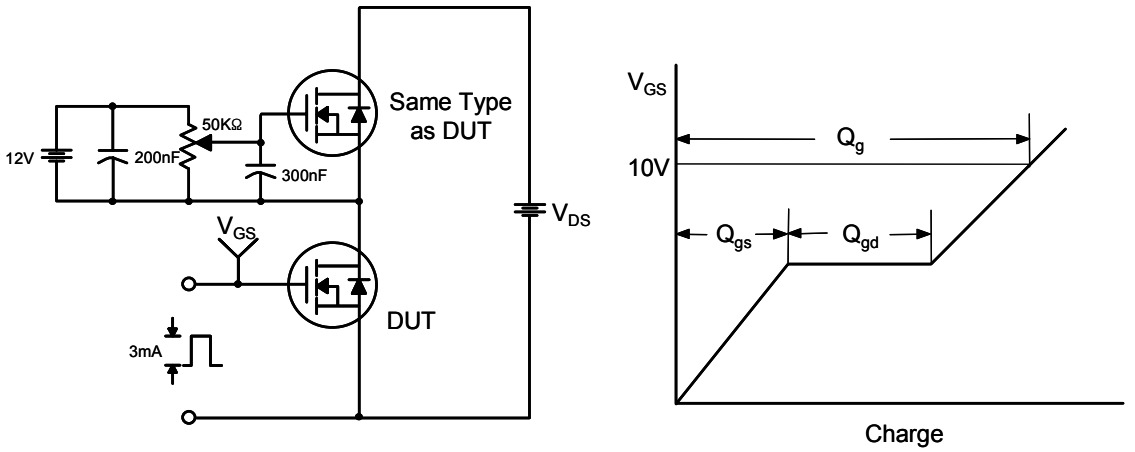


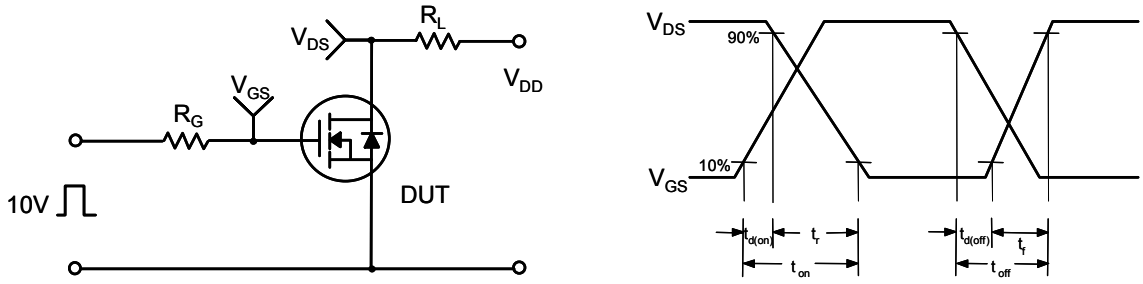
Figure 11. Transient Thermal Response Curve



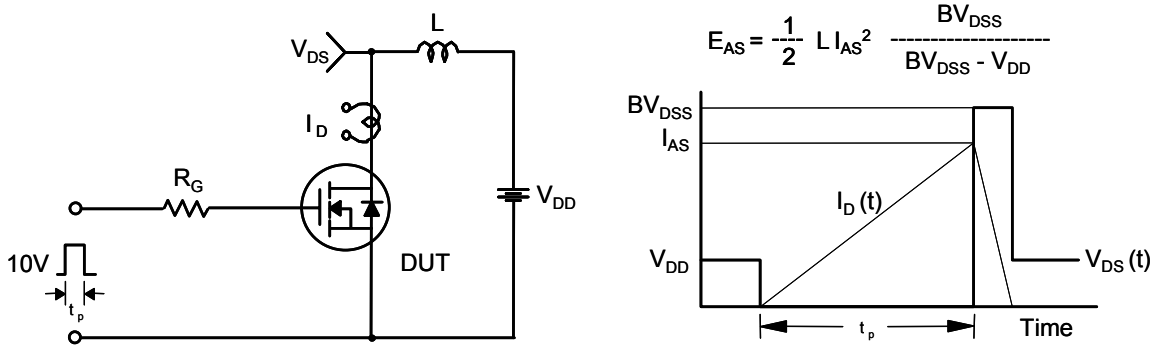
Gate Charge Test Circuit & Waveform



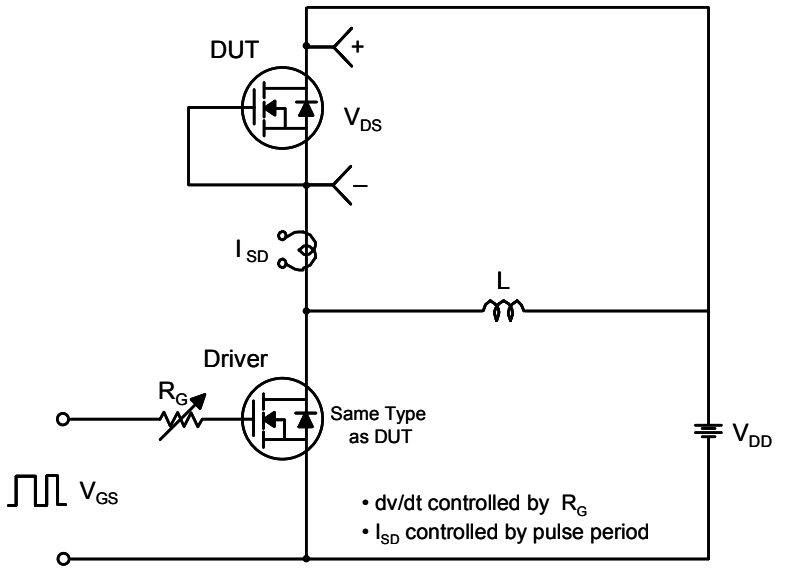
Resistive Switching Test Circuit & Waveforms

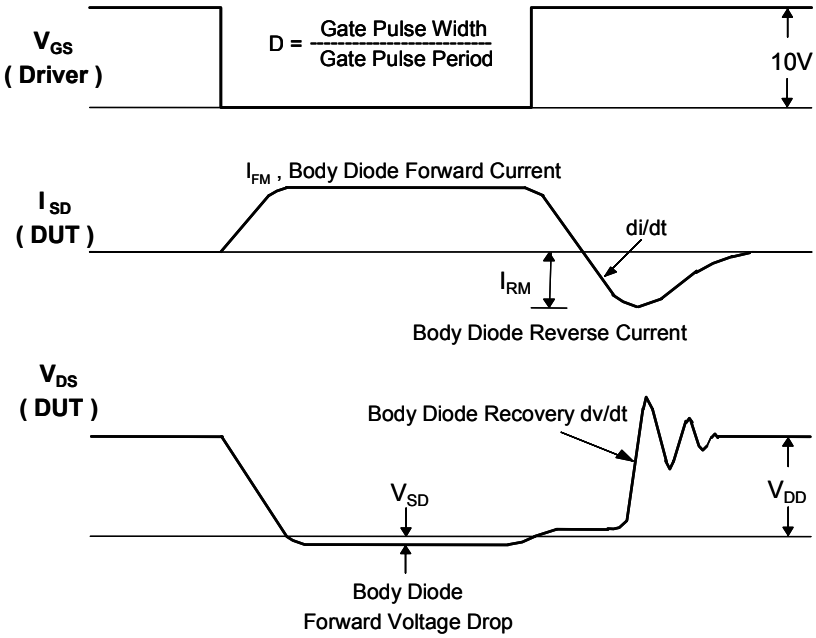


Unclamped Inductive Switching Test Circuit & Waveforms



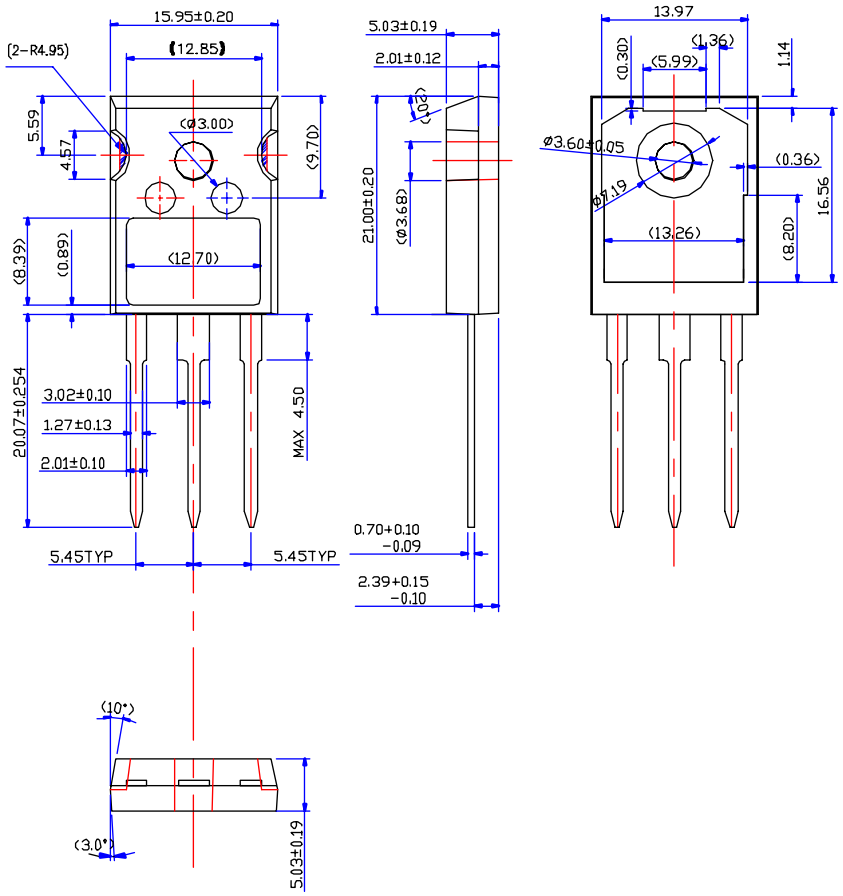
Peak Diode Recovery dv/dt Test Circuit & Waveforms





Mechanical Dimensions

TO-247AD (FKS PKG CODE 001)



Dimensions in Millimeters

TRADEMARKS

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

ACEx™
ActiveArray™
Bottomless™
Build it Now™
CoolFET™
CROSSVOLT™
DOME™
EcoSPARK™
E^2CMOS™
EnSigna™
FACT™
FACT Quiet Series™
FAST®
FASTr™
FPS™
FRFET™
GlobalOptoisolator™
GTO™
HiSeC™
I^2C™
i-Lo™
ImpliedDisconnect™
IntelliMAX™
ISOPLANAR™
LittleFET™
MICROCOUPLER™
MicroFET™
MicroPak™
MICROWIRE™
MSX™
MSXPro™
OCX™
OCXPro™
OPTOLOGIC®
OPTOPLANAR™
PACMAN™
POP™
Power247™
PowerEdge™
PowerSaver™
PowerTrench®
QFET®
QS™
QT Optoelectronics™
Quiet Series™
RapidConfigure™
RapidConnect™
µSerDes™
SILENT SWITCHER®
SMART START™
SPM™
Stealth™
SuperFET™
SuperSOT™-3
SuperSOT™-6
SuperSOT™-8
SyncFET™
TinyLogic®
TINYOPTO™
TruTranslation™
UHC™
UltraFET®
UniFET™
VCX™
Wire™

Across the board. Around the world.™
The Power Franchise®
Programmable Active Droop™

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.

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, or (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 significant injury to the user.

2. A critical component is 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, and supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice in order 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 in order 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. I16