

50A, 50V, 0.022 Ohm, Logic Level, N-Channel Power MOSFETs

These are logic-level N-channel power MOSFETs manufactured using the MegaFET process. This process, which uses feature sizes approaching those of LSI integrated circuits gives optimum utilization of silicon, resulting in outstanding performance. They were designed for use with logic-level (5V) driving sources in applications such as programmable controllers, automotive switching, switching regulators, switching converters, motor relay drivers and emitter switches for bipolar transistors. This performance is accomplished through a special gate oxide design which provides full rated conductance at gate bias in the 3V - 5V range, thereby facilitating true on-off power control directly from integrated circuit supply voltages.

Formerly developmental type TA09872.

Ordering Information

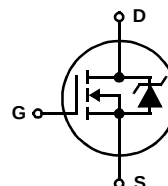
PART NUMBER	PACKAGE	BRAND
RFP50N05L	TO-220AB	F50N05L

NOTE: When ordering, use the entire part number. Add the suffix 9A to obtain the TO-263AB variant in the tape and reel, i.e., RFP50N05L9A.

Features

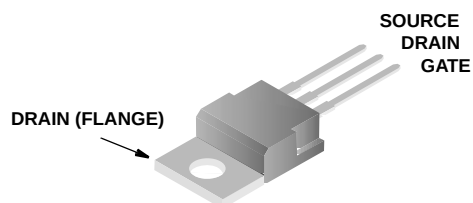
- 50A, 50V
- $r_{DS(ON)} = 0.022\Omega$
- UIS SOA Rating Curve (Single Pulse)
- Design Optimized for 5V Gate Drive
- Can be Driven Directly from CMOS, NMOS, TTL Circuits
- Compatible with Automotive Drive Requirements
- SOA is Power Dissipation Limited
- Nanosecond Switching Speeds
- Linear Transfer Characteristics
- High Input Impedance
- Majority Carrier Device
- Related Literature
 - TB334 "Guidelines for Soldering Surface Mount Components to PC Boards"

Symbol



Packaging

JEDEC TO-220AB



RFP50N05L

Absolute Maximum Ratings $T_C = 25^{\circ}\text{C}$, Unless Otherwise Specified

	RFP50N05L	UNITS	
Drain to Source Voltage (Note 1)	V_{DS}	50	V
Drain to Gate Voltage ($R_{GS} = 20k\Omega$) (Note 1)	V_{DGR}	50	V
Continuous Drain Current	I_D	50	A
Pulsed Drain Current (Note 3)	I_{DM}	130	A
Gate to Source Voltage	V_{GS}	± 10	V
Maximum Power Dissipation	P_D	110	W
Above $T_C = 25^{\circ}C$, Derate Linearly.		0.88	W/ $^{\circ}C$
Single Pulse Avalanche Energy Rating	Refer to UIS SOA Curve		-
Operating and Storage Temperature	T_J, T_{STG}	-55 to 150	$^{\circ}C$
Maximum Temperature for Soldering			
Leads at 0.063in (1.6mm) from Case for 10s.	T_L	300	$^{\circ}C$
Package Body for 10s, See Techbrief 334	T_{pkg}	260	$^{\circ}C$

CAUTION: Stresses above those listed in "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress only rating and operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied.

NOTE:

1. $T_J = 25^{\circ}\text{C}$ to 125°C .

Electrical Specifications $T_C = 25^{\circ}\text{C}$, Unless Otherwise Specified

PARAMETER	SYMBOL	TEST CONDITIONS		MIN	TYP	MAX	UNITS
Drain to Source Breakdown Voltage	BV _{DSS}	I _D = 250μA, V _{GS} = 0V (Figure 10)		50	-	-	V
Gate Threshold Voltage	V _{GS(TH)}	V _{GS} = V _{DS} , I _D = 250μA (Figure 9)		1	-	2	V
Zero Gate Voltage Drain Current	I _{DSS}	V _{DS} = Rated BV _{DSS} , V _{GS} = 0		-	-	25	μA
		V _{DS} = 0.8 x Rated BV _{DSS} , V _{GS} = 0, T _C = 150 ⁰ C		-	-	250	μA
Gate to Source Leakage Current	I _{GSS}	V _{GS} = ±10V, V _{DS} = 0V		-	-	±100	nA
Drain to Source On Resistance (Note 2)	r _{DS(ON)}	I _D = 50A, V _{GS} = 5V (Figure 7)		-	-	0.022	Ω
		I _D = 50A, V _{GS} = 4V		-	-	0.027	Ω
Turn-On Time	t _(ON)	V _{GS} = 5V, R _{GS} = 2.5Ω, R _L = 1Ω (Figures 12, 15, 16)		-	-	100	ns
Turn-On Delay Time	t _{D(ON)}			-	15	-	ns
Rise Time	t _r			-	50	-	ns
Turn-Off Delay Time	t _{D(OFF)}			-	50	-	ns
Fall Time	t _f			-	15	-	ns
Turn-Off Time	t _(OFF)			-	-	100	ns
Total Gate Charge	Q _{G(TOT)}	V _{GS} = 0 to 10V	V _{DD} = 40V, I _D = 50A R _L = 0.8Ω (Figures 17, 18)	-	-	140	nC
Gate Charge at 5V	Q _{G(5)}	V _{GS} = 0 to 5V		-	-	80	nC
Threshold Gate Charge	Q _{G(th)}	V _{GS} = 0 to 1V		-	-	6	nC
Thermal Resistance Junction to Case	R _{θJC}			-	-	1.14	⁰ C/W
Thermal Resistance Junction to Ambient	R _{θJA}			-	-	80	⁰ C/W

Source to Drain Diode Specifications

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNITS
Source to Drain Diode Voltage (Note 2)	V_{SD}	$I_{SD} = 50\text{A}$	-	-	1.5	V
Diode Reverse Recovery Time	t_{rr}	$I_{SD} = 50\text{A}$, $dI_{SD}/dt = 100\text{A}/\mu\text{s}$	-	-	1.25	ns

NOTES:

2. Pulsed: pulse duration = 300 μs maximum, duty cycle = 2%.
3. Repetitive rating: pulse width limited by maximum junction temperature.

Typical Performance Curves

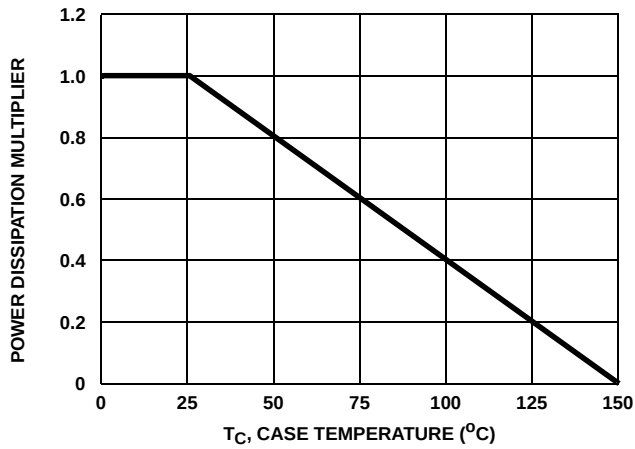


FIGURE 1. NORMALIZED POWER DISSIPATION vs CASE TEMPERATURE

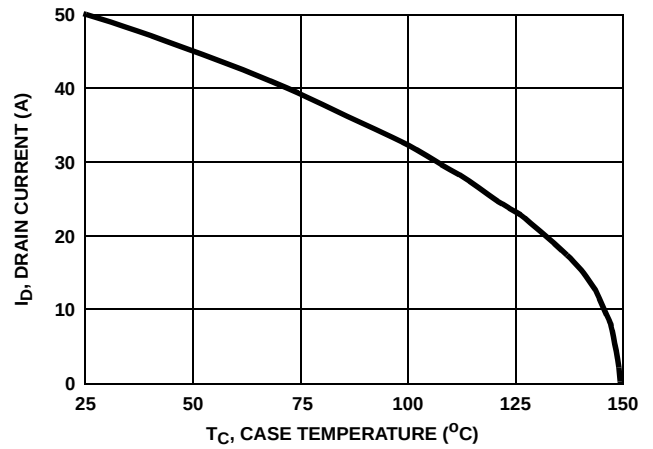


FIGURE 2. MAXIMUM CONTINUOUS DRAIN CURRENT vs CASE TEMPERATURE

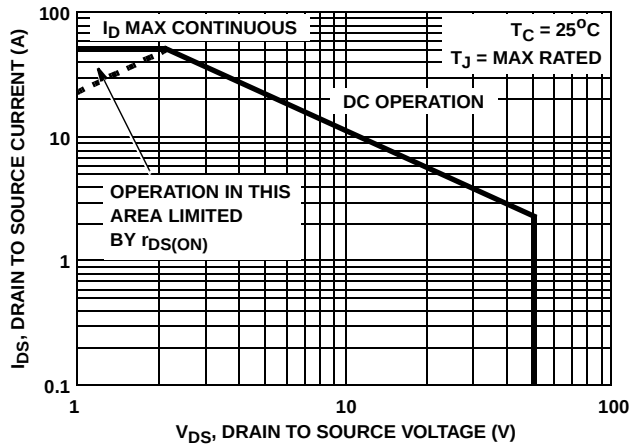


FIGURE 3. FORWARD BIAS SAFE OPERATING AREA

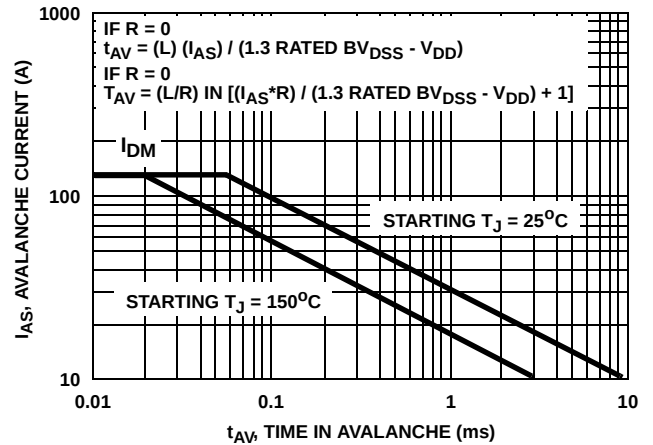


FIGURE 4. UNCLAMPED INDUCTIVE SWITCHING SAFE OPERATING AREA

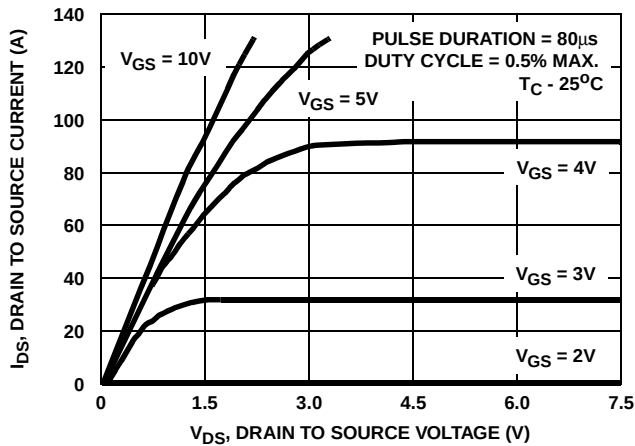


FIGURE 5. SATURATION CHARACTERISTICS

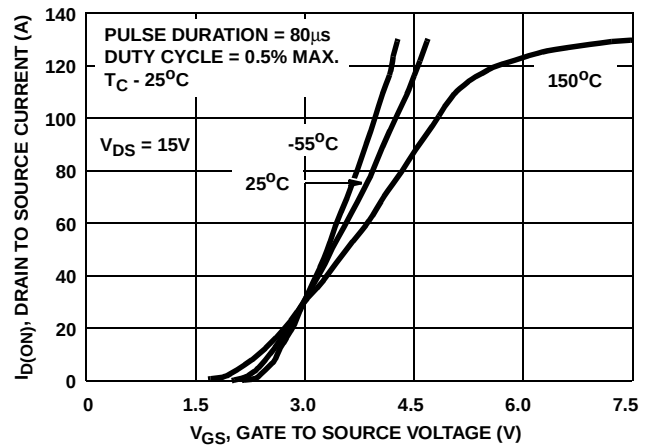


FIGURE 6. TRANSFER CHARACTERISTICS

Typical Performance Curves (Continued)

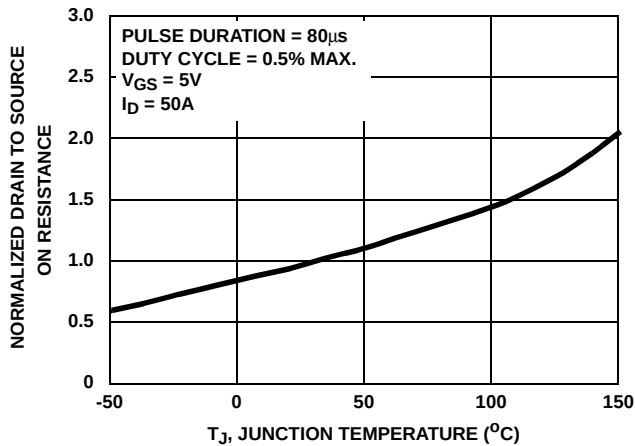


FIGURE 7. NORMALIZED DRAIN TO SOURCE ON RESISTANCE vs JUNCTION TEMPERATURE

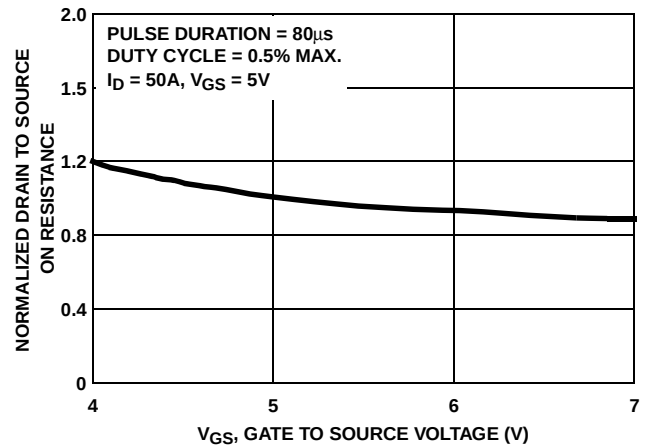


FIGURE 8. NORMALIZED DRAIN TO SOURCE ON RESISTANCE vs GATE VOLTAGE

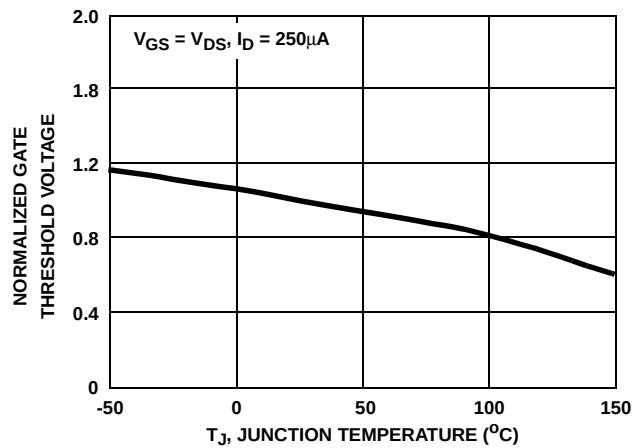


FIGURE 9. NORMALIZED GATE THRESHOLD VOLTAGE

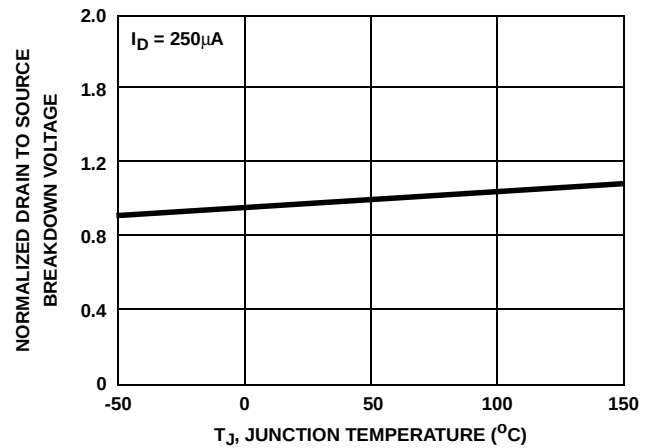


FIGURE 10. NORMALIZED DRAIN TO SOURCE BREAKDOWN VOLTAGE vs JUNCTION TEMPERATURE

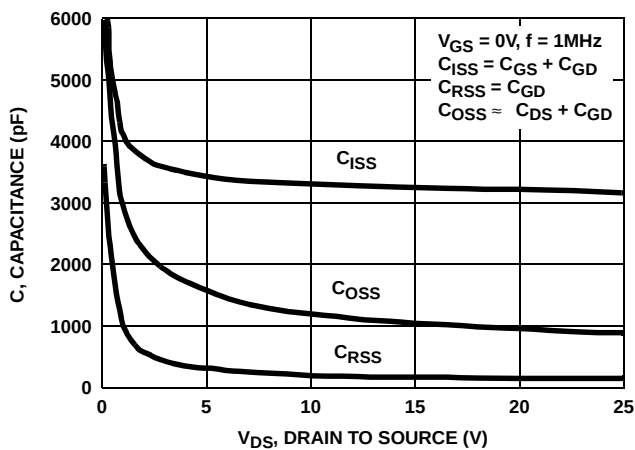
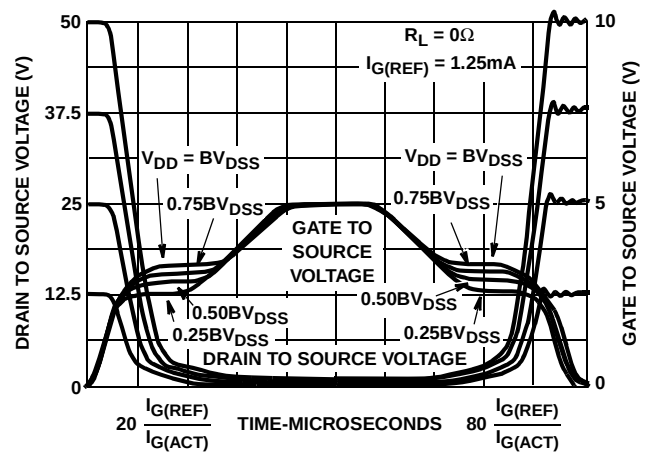


FIGURE 11. CAPACITANCE vs DRAIN TO SOURCE VOLTAGE



NOTE: Refer to Fairchild Application Notes AN7254 and AN7260.

FIGURE 12. NORMALIZED SWITCHING WAVEFORMS FOR CONSTANT GATE CURRENT

Test Circuits and Waveforms

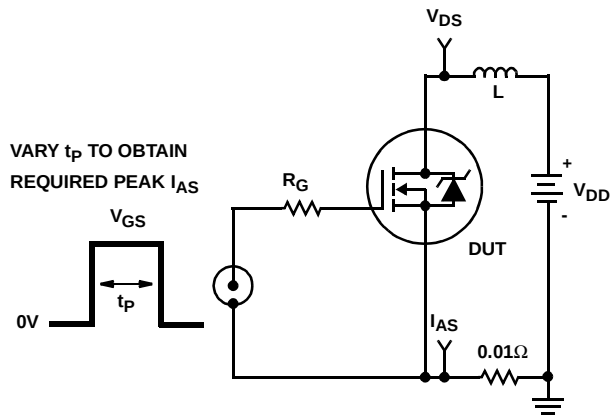


FIGURE 13. UNCLAMPED ENERGY TEST CIRCUIT

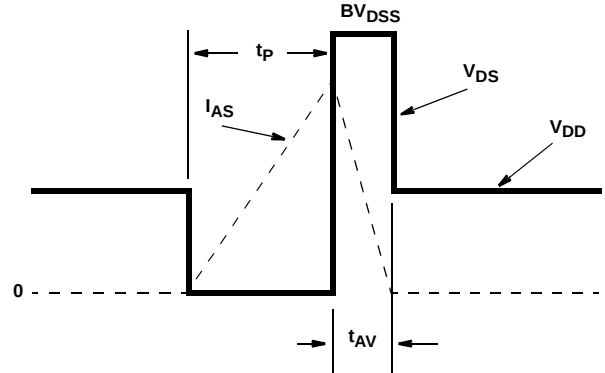


FIGURE 14. UNCLAMPED ENERGY WAVEFORMS

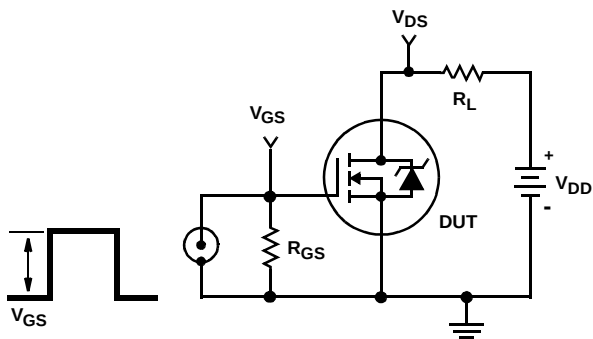


FIGURE 15. SWITCHING TIME TEST CIRCUIT

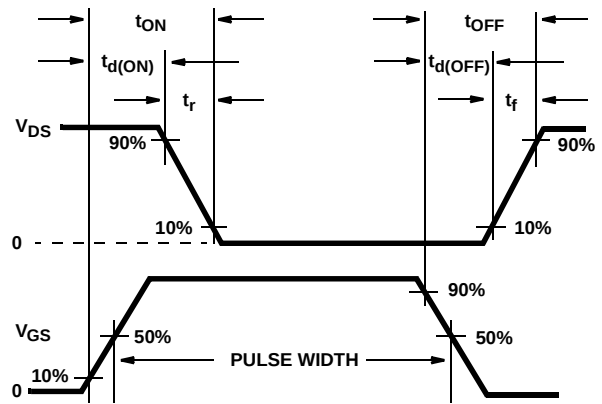


FIGURE 16. RESISTIVE SWITCHING WAVEFORMS

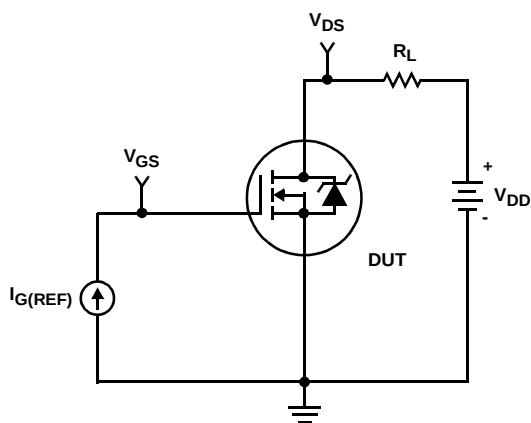


FIGURE 17. GATE CHARGE TEST CIRCUIT

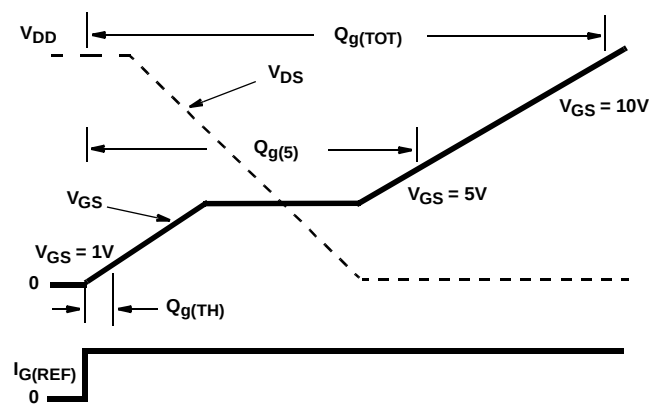


FIGURE 18. GATE CHARGE WAVEFORMS

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™	FAST®	ISOPLANAR™	Power247™	SuperFET™
ActiveArray™	FASTr™	LittleFET™	PowerSaver™	SuperSOT™-3
Bottomless™	FPS™	MICROCOUPLER™	PowerTrench®	SuperSOT™-6
CoolFET™	FRFET™	MicroFET™	QFET®	SuperSOT™-8
CROSSVOLT™	GlobalOptoisolator™	MicroPak™	QS™	SyncFET™
DOME™	GTO™	MICROWIRE™	QT Optoelectronics™	TinyLogic®
EcoSPARK™	HiSeC™	MSX™	Quiet Series™	TINYOPTO™
E ² CMOS™	I ² C™	MSXPro™	RapidConfigure™	TruTranslation™
EnSigna™	i-Lo™	OCX™	RapidConnect™	UHC™
FACT™	ImpliedDisconnect™	OCXPro™	μSerDes™	UltraFET®
FACT Quiet Series™		OPTOLOGIC®	SILENT SWITCHER®	VCX™
Across the board. Around the world.™		OPTOPLANAR™	SMART START™	
The Power Franchise®		PACMAN™	SPM™	
Programmable Active Droop™		POP™	Stealth™	

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.