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

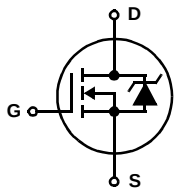
PART NUMBER	PACKAGE	BRAND
RFP50N05L	TO-220AB	F50N05L

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

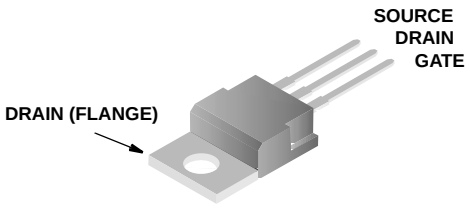
- 50A, 50V
- $r_{DS(ON)} = 0.022\Omega$
- UIS SOA Rating Curve (Single Pulse)
- Design Optimized for 5V Gate Drive
- Can be Driven Directly from CMOS, NMOS, TTL Circuits
- Compatible with Automotive Drive Requirements
- SOA is Power Dissipation Limited
- Nanosecond Switching Speeds
- Linear Transfer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

Symbol



Packaging

JEDEC TO-220AB



Absolute Maximum Ratings $T_C = 25^oC$, Unless Otherwise Specified

		RFP50N05L	UNITS
Drain to Source Voltage (Note 1)	V_{DS}	50	V
Drain to Gate Voltage (R_{GS} = 20kΩ) (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 $T_C = 25^oC$, Derate Linearly		0.88	$W/^oC$
Single Pulse Avalanche Energy Rating		Refer to UIS SOA Curve	-
Operating and Storage Temperature	T_J, T_{STG}	-55 to 150	^oC
Maximum Temperature for Soldering			
Leads at 0.063in (1.6mm) from Case for 10s	T_L	300	^oC
Package Body for 10s, See Techbrief 334	T_{pkg}	260	^oC

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. $T_J = 25^oC$ to 125^oC.

Electrical Specifications $T_C = 25^oC$, 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, $T_C = 150^oC$		-	-	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	$R_{\theta JC}$			-	-	1.14	$^oC/W$
Thermal Resistance Junction to Ambient	$R_{\theta JA}$			-	-	80	$^oC/W$

Source to Drain Diode Specifications

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

NOTES:

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

Typical Performance Curves

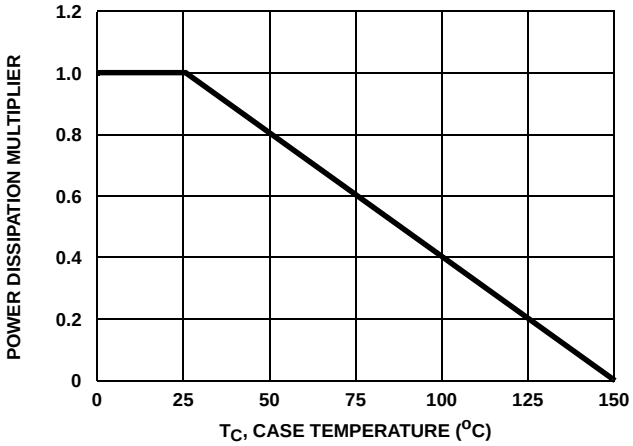


FIGURE 1. NORMALIZED POWER DISSIPATION vs CASE TEMPERATURE

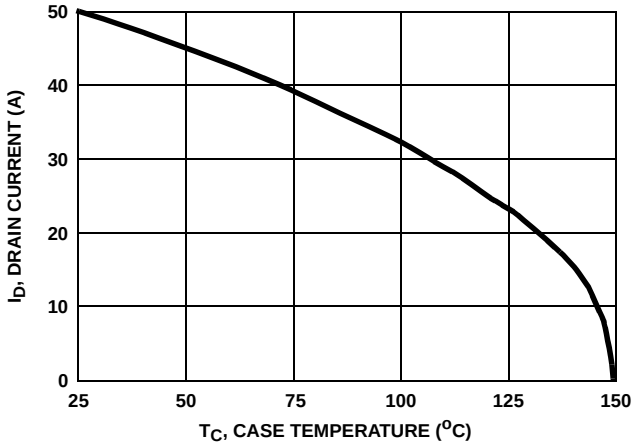


FIGURE 2. MAXIMUM CONTINUOUS DRAIN CURRENT vs CASE TEMPERATURE

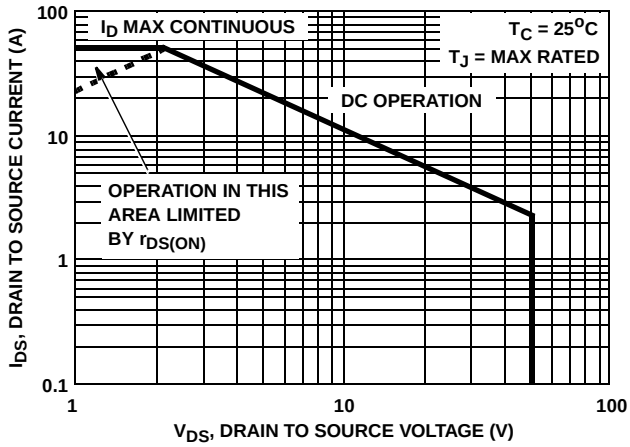


FIGURE 3. FORWARD BIAS SAFE OPERATING AREA

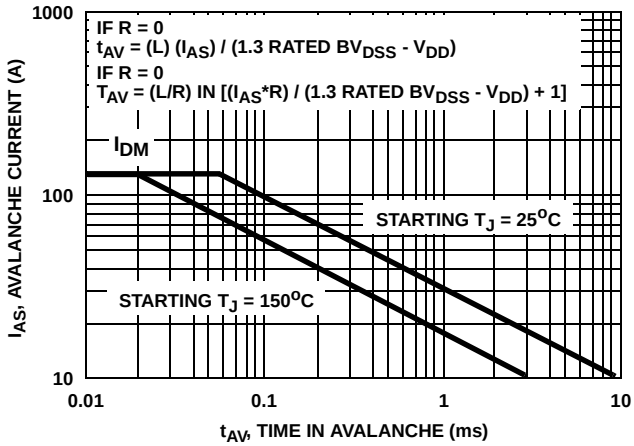


FIGURE 4. UNCLAMPED INDUCTIVE SWITCHING SAFE OPERATING AREA

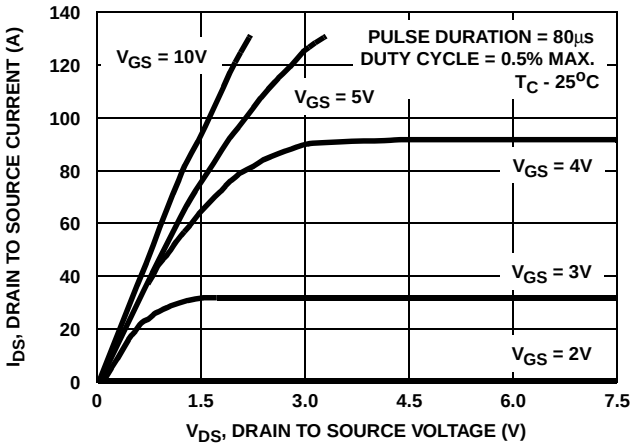


FIGURE 5. SATURATION CHARACTERISTICS

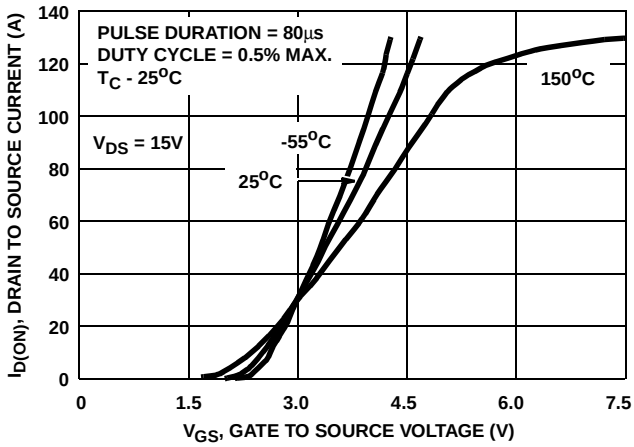


FIGURE 6. TRANSFER CHARACTERISTICS

Typical Performance Curves (Continued)

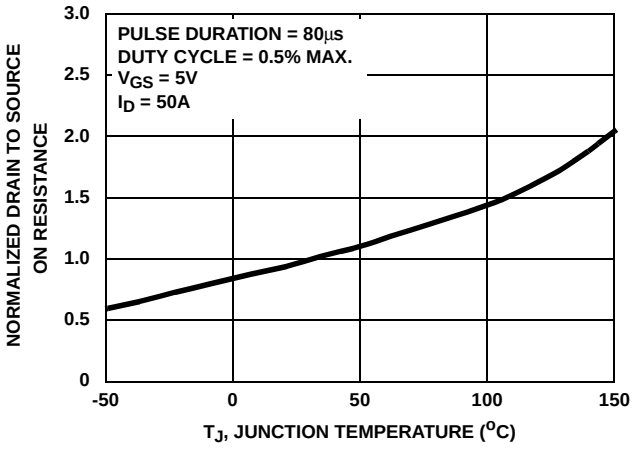


FIGURE 7. NORMALIZED DRAIN TO SOURCE ON RESISTANCE vs JUNCTION TEMPERATURE

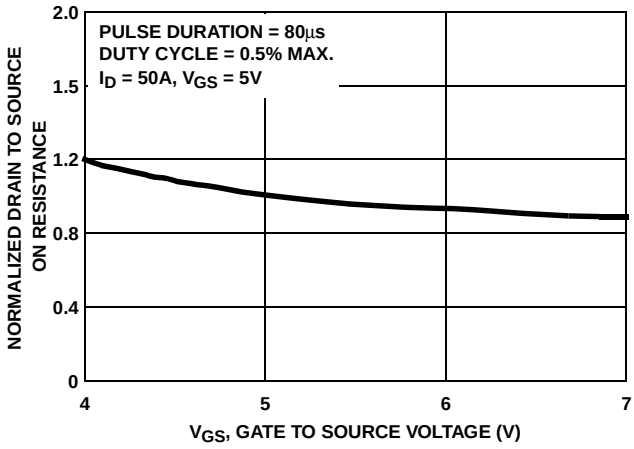


FIGURE 8. NORMALIZED DRAIN TO SOURCE ON RESISTANCE vs GATE VOLTAGE

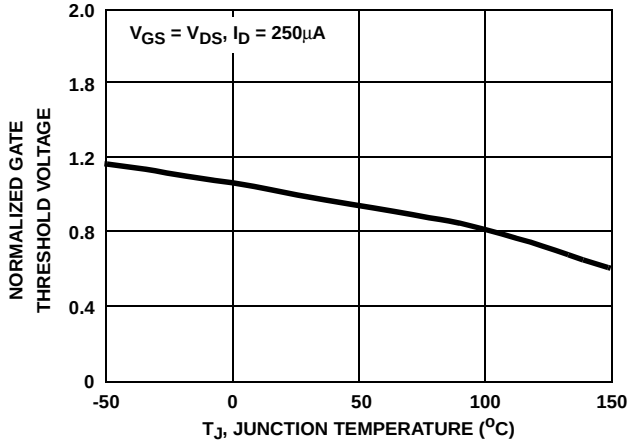


FIGURE 9. NORMALIZED GATE THRESHOLD VOLTAGE

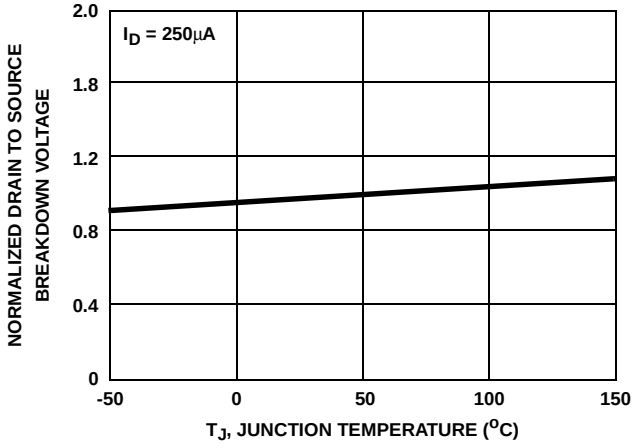


FIGURE 10. NORMALIZED DRAIN TO SOURCE BREAKDOWN VOLTAGE vs JUNCTION TEMPERATURE

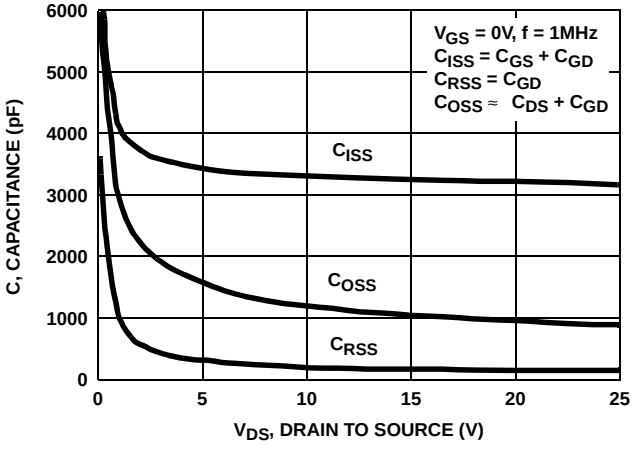
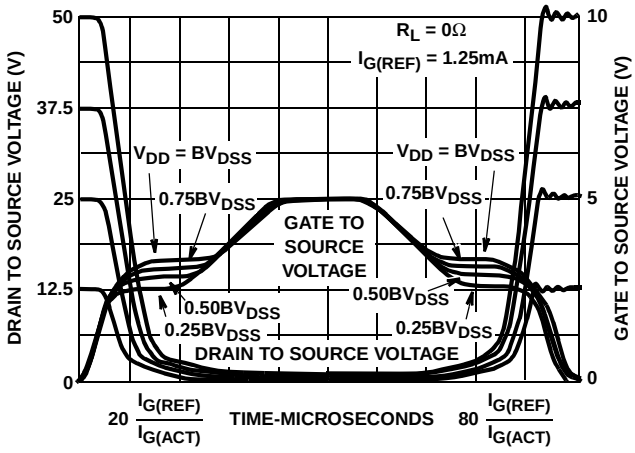


FIGURE 11. CAPACITANCE vs DRAIN TO SOURCE VOLTAGE



NOTE: Refer to Fairchild Application Notes AN7254 and AN7260.

FIGURE 12. NORMALIZED SWITCHING WAVEFORMS FOR CONSTANT GATE CURRENT

Test Circuits and Waveforms

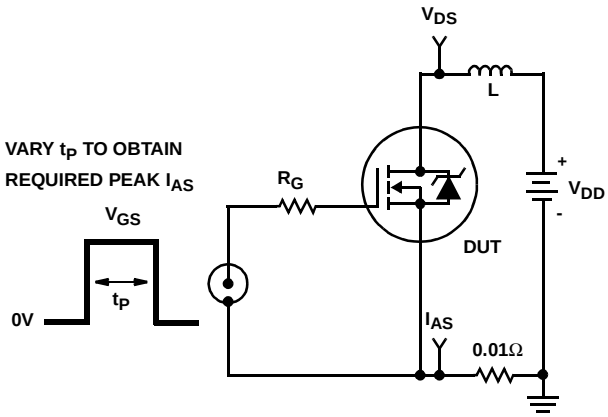


FIGURE 13. UNCLAMPED ENERGY TEST CIRCUIT

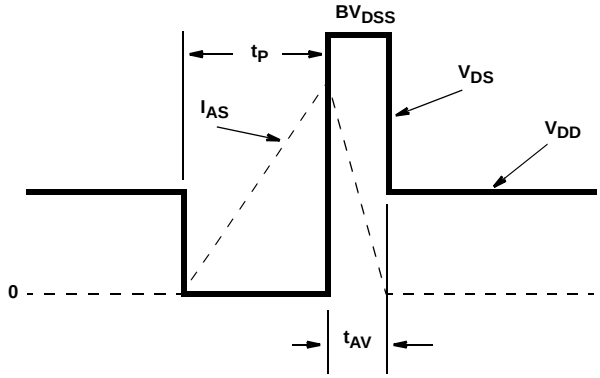


FIGURE 14. UNCLAMPED ENERGY WAVEFORMS

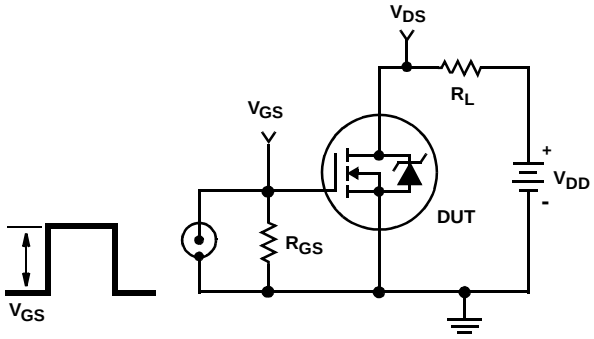


FIGURE 15. SWITCHING TIME TEST CIRCUIT

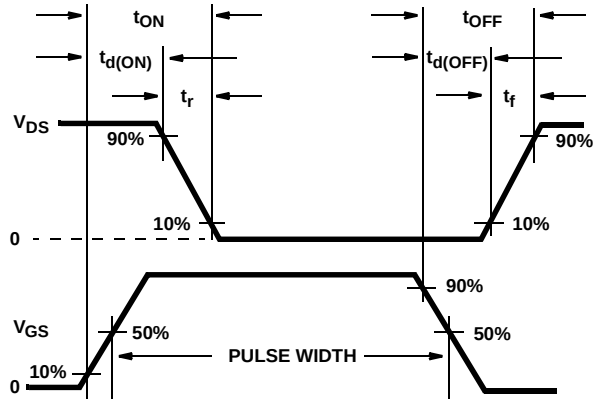


FIGURE 16. RESISTIVE SWITCHING WAVEFORMS

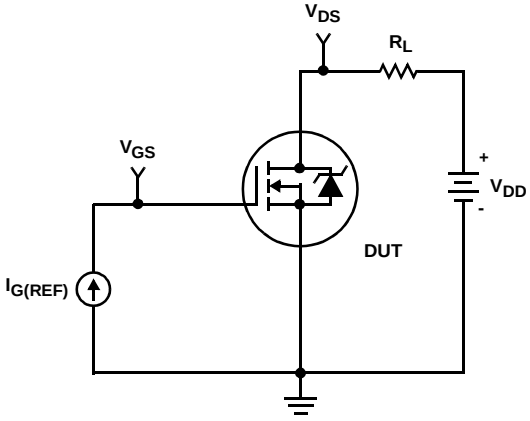


FIGURE 17. GATE CHARGE TEST CIRCUIT

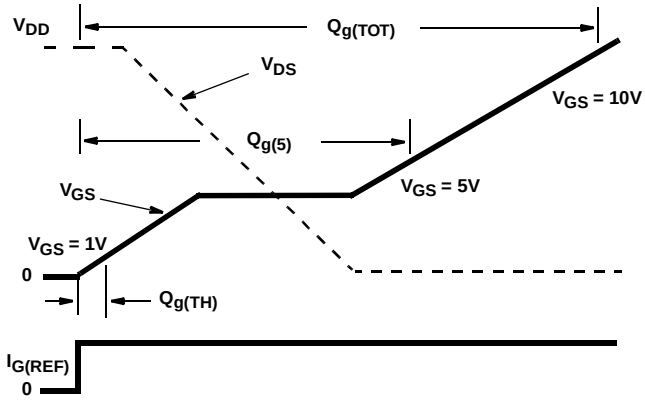


FIGURE 18. GATE CHARGE WAVEFORMS

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^2CMOS™	I^2C™	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™	

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.