

30A, 60V, ESD Rated, 0.047 Ohm, Logic Level N-Channel Power MOSFETs

These are 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 in applications such as switching regulators, switching converters, motor drivers and relay drivers. These transistors can be operated directly from integrated circuits.

These transistors incorporate ESD protection and are designed to withstand 2kV (Human Body Model) of ESD.

Formerly developmental type TA49027.

Ordering Information

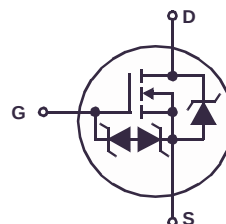
PART NUMBER	PACKAGE	BRAND
RFP30N06LE	TO-220AB	P30N06LE
RF1S30N06LESM	TO-263AB	1S30N06L

NOTE: When ordering use the entire part number. Add suffix, 9A, to obtain the TO-263 variant in tape and reel i.e. RF1S30N06LESM9A.

Features

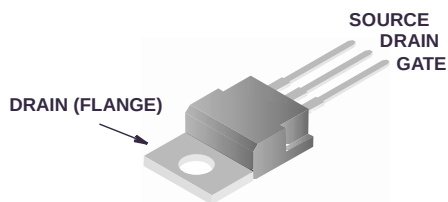
- 30A, 60V
- $r_{DS(ON)} = 0.047\Omega$
- 2kV ESD Protected
- Temperature Compensating PSpice® Model
- Peak Current vs Pulse Width Curve
- UIS Rating Curve
- Related Literature
 - TB334 "Guidelines for Soldering Surface Mount Components to PC Boards"

Symbol

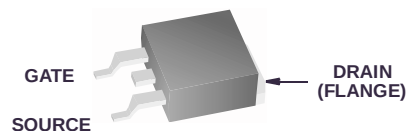


Packaging

JEDEC TO-220AB



JEDEC TO-263AB



RFP30N06LE, RF1S30N06LESM

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

	RFP30N06LE, RF1S30N06LESM	UNITS
Drain to Source Voltage (Note 1)	V_{DS} 60	V
Drain to Gate Voltage ($R_{GS} = 20\text{k}\Omega$) (Note 1)	V_{DGR} 60	V
Gate to Source Voltage	V_{GS} +10, -8	V
Continuous Drain Current	I_D 30	A
Pulsed Drain Current (Note 3)	I_{DM} Refer to Peak Current Curve	
Pulsed Avalanche Rating	E_{AS} Refer to UIS Curve	
Power Dissipation	P_D 96	W
Derate Above 25°C	0.645	W/ $^{\circ}\text{C}$
Electrostatic Discharge Rating, MIL-STD-883, Category B(2)	ESD 2	kV
Operating and Storage Temperature	T_J, T_{STG} -55 to 175	$^{\circ}\text{C}$
Maximum Temperature for Soldering		
Leads at 0.063in (1.6mm) from Case for 10s	T_L 300	$^{\circ}\text{C}$
Package Body for 10s, See Techbrief 334	T_{pk} 260	$^{\circ}\text{C}$

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 150°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 11		60	-	-	V
Gate to Threshold Voltage	V _{GS(TH)}	V _{GS} = V _{DS} , I _D = 250μA, Figure 10		1	-	2	V
Zero Gate Voltage Drain Current	I _{DSS}	V _{DS} = Rated B _{VDSS} , V _{GS} = 0		-	-	25	μA
		V _{DS} = 0.8 x Rated B _{VDSS} , V _{GS} = 0, T _C = 150°C		-	-	250	μA
Gate to Source Leakage Current	I _{GSS}	V _{GS} = +10, -8V		-	-	±10	μA
Drain to Source On Resistance (Note 2)	r _{DS(ON)}	I _D = 30A, V _{GS} = 5V, Figure 9		-	-	0.047	Ω
Turn-On Time	t _{ON}	V _{DD} = 30V, I _D = 30A, R _L = 1Ω, V _{GS} = 5V, R _{GS} = 2.5Ω, Figures 13, 16, 17		-	-	140	ns
Turn-On Delay Time	t _{d(ON)}			-	11	-	ns
Rise Time	t _r			-	88	-	ns
Turn-Off Delay Time	t _{d(OFF)}			-	30	-	ns
Fall Time	t _f			-	40	-	ns
Turn-Off Time	t _{OFF}			-	-	100	ns
Total Gate Charge	Q _{g(TOT)}	V _{GS} = 0V to 10V	V _{DD} = 48V, I _D = 30A, R _L = 1.6Ω, Figures 18, 19	-	51	62	nC
Gate Charge at 5V	Q _{g(5)}	V _{GS} = 0V to 5V		-	28	34	nC
Threshold Gate Charge	Q _{g(TH)}	V _{GS} = 0V to 1V		-	1.8	2.6	nC
Input Capacitance	C _{ISS}	V _{DS} = 25V, V _{GS} = 0V, f = 1MHz, Figure 12		-	1350	-	pF
Output Capacitance	C _{OSS}			-	290	-	pF
Reverse Transfer Capacitance	C _{RSS}			-	85	-	pF
Thermal Resistance Junction to Case	R _{θJC}			-	-	1.55	°C/W
Thermal Resistance Junction to Ambient	R _{θJA}			-	-	80	°C/W

Source to Drain Diode Specifications

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNITS
Source to Drain Diode Voltage (Note 2)	V_{SD}	$I_{SD} = 30\text{A}$	-	-	1.5	V
Diode Reverse Recovery Time	t_{rr}	$I_{SD} = 30\text{A}$, $dI_{SD}/dt = 100\text{A}/\mu\text{s}$	-	-	125	ns

NOTES:

2. Pulse Test: Pulse Width $\leq 300\text{ms}$, Duty Cycle $\leq 2\%$.
3. Repetitive Rating: Pulse Width limited by max junction temperature. See Transient Thermal Impedance Curve (Figure 3) and Peak Current Capability Curve (Figure 5).

Typical Performance Curves Unless Otherwise Specified

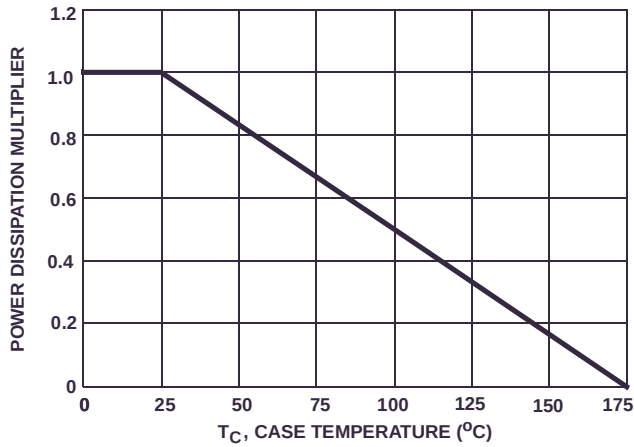


FIGURE 1. NORMALIZED POWER DISSIPATION vs CASE TEMPERATURE

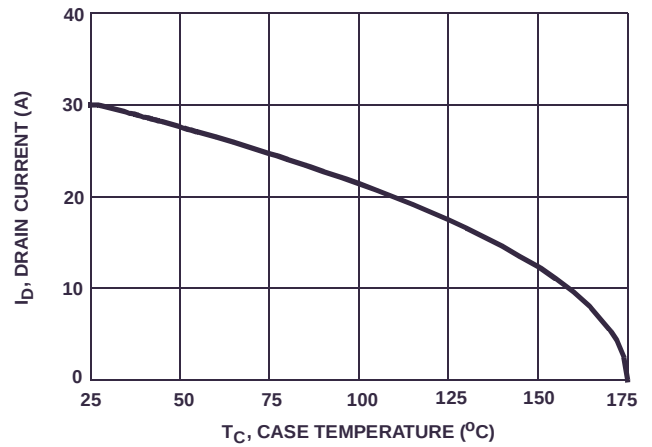


FIGURE 2. MAXIMUM CONTINUOUS DRAIN CURRENT vs CASE TEMPERATURE

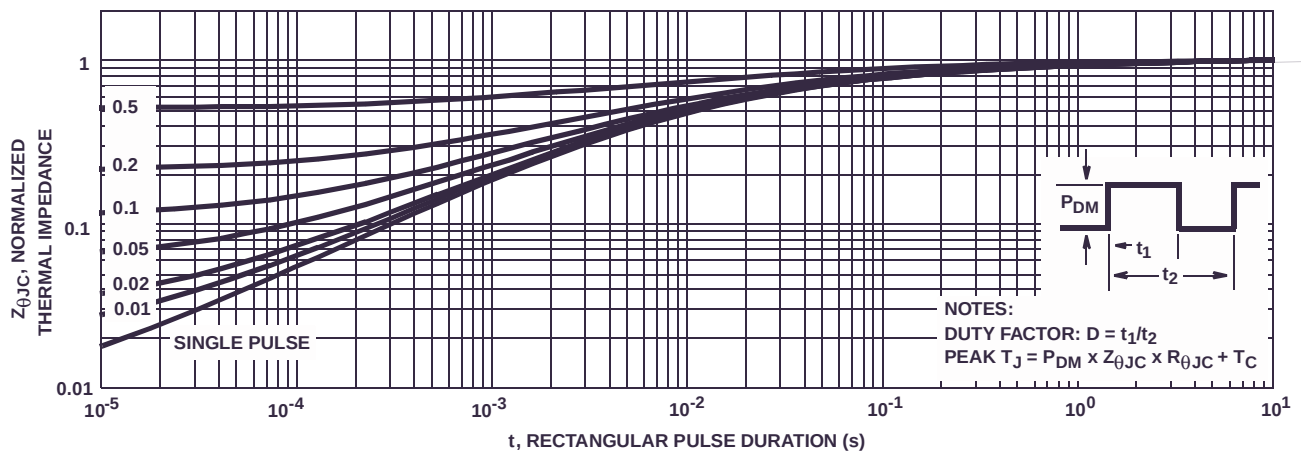


FIGURE 3. NORMALIZED MAXIMUM TRANSIENT THERMAL IMPEDANCE

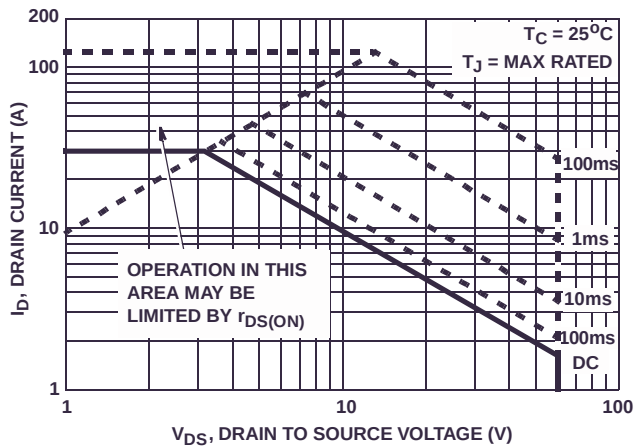


FIGURE 4. FORWARD BIAS SAFE OPERATING AREA

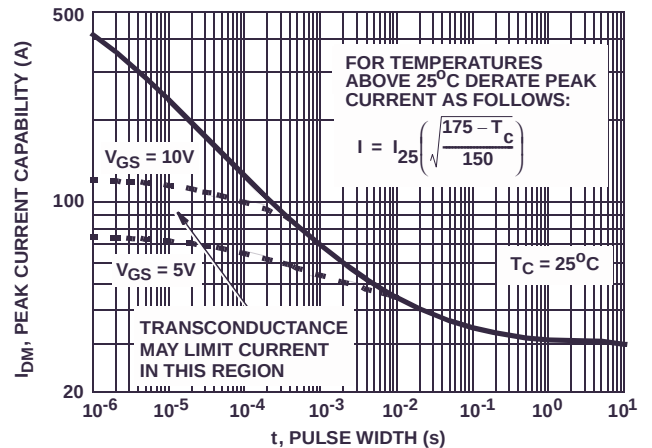
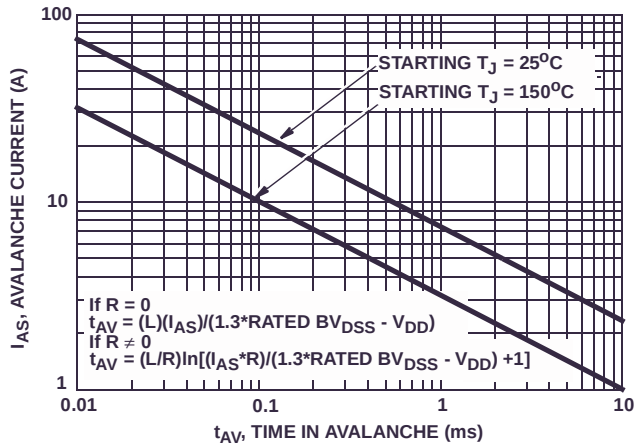


FIGURE 5. PEAK CURRENT CAPABILITY

Typical Performance Curves Unless Otherwise Specified (Continued)



NOTE: Refer to Fairchild Application Notes AN9321 and AN9322.

FIGURE 6. UNCLAMPED INDUCTIVE SWITCHING

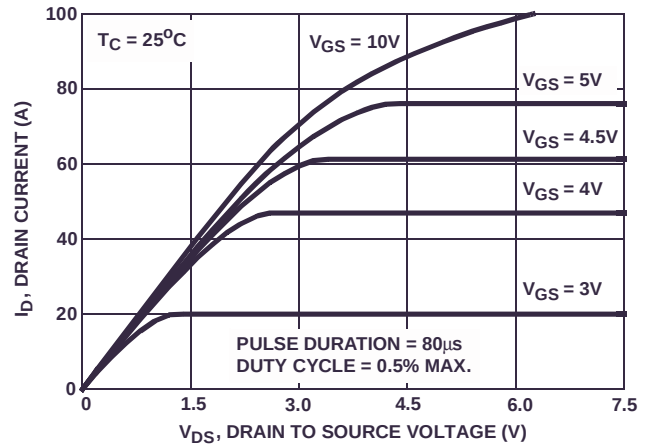


FIGURE 7. SATURATION CHARACTERISTICS

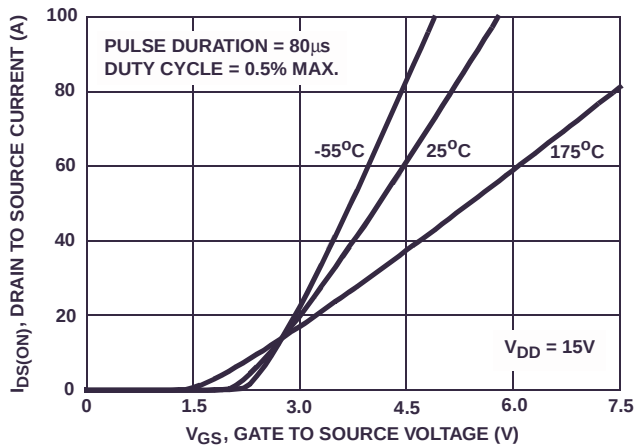


FIGURE 8. TRANSFER CHARACTERISTICS

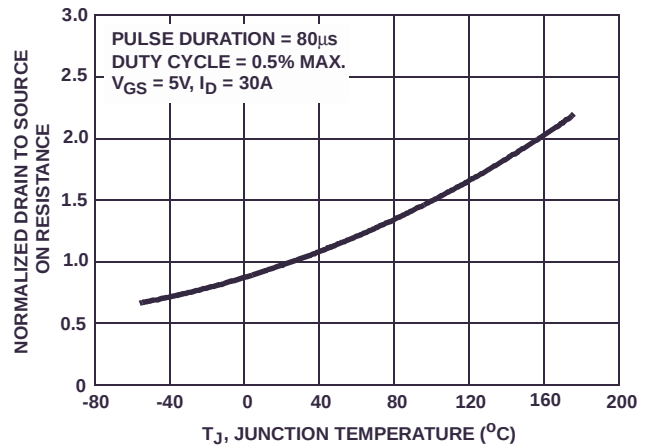


FIGURE 9. NORMALIZED DRAIN TO SOURCE ON RESISTANCE vs JUNCTION TEMPERATURE

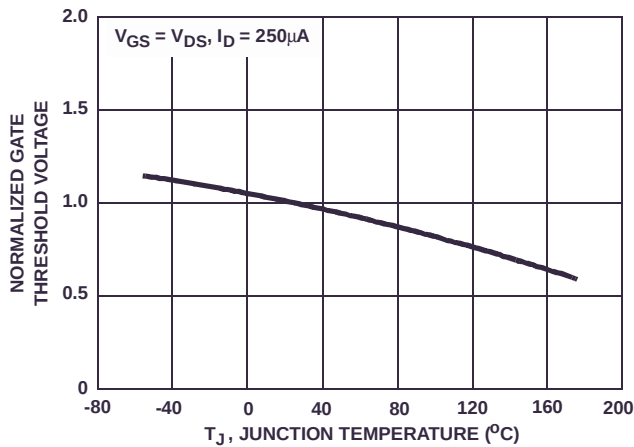


FIGURE 10. NORMALIZED GATE THRESHOLD VOLTAGE vs JUNCTION TEMPERATURE

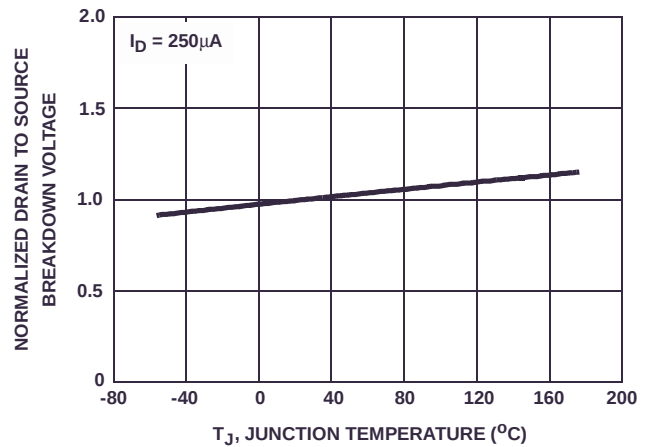


FIGURE 11. NORMALIZED DRAIN TO SOURCE BREAKDOWN VOLTAGE vs JUNCTION TEMPERATURE

Typical Performance Curves Unless Otherwise Specified (Continued)

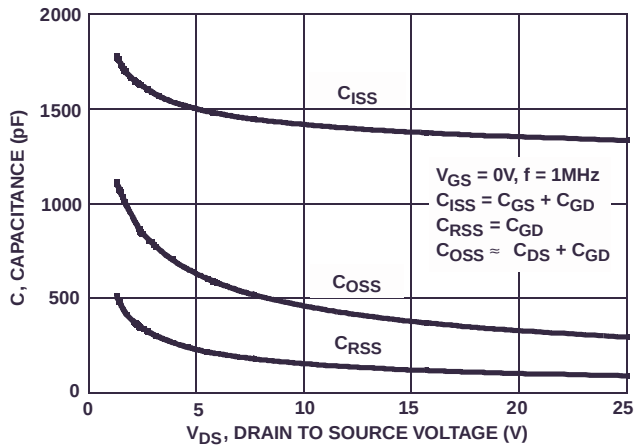
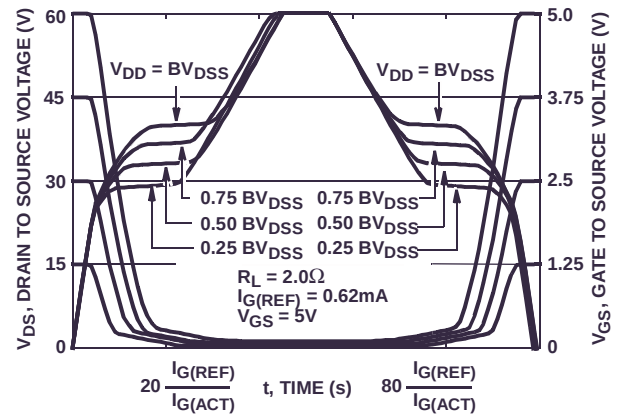


FIGURE 12. CAPACITANCE vs DRAIN TO SOURCE VOLTAGE



NOTE: Refer to Fairchild Application Notes AN7254 and AN7260.

FIGURE 13. NORMALIZED SWITCHING WAVEFORMS FOR CONSTANT GATE CURRENT

Test Circuits and Waveforms

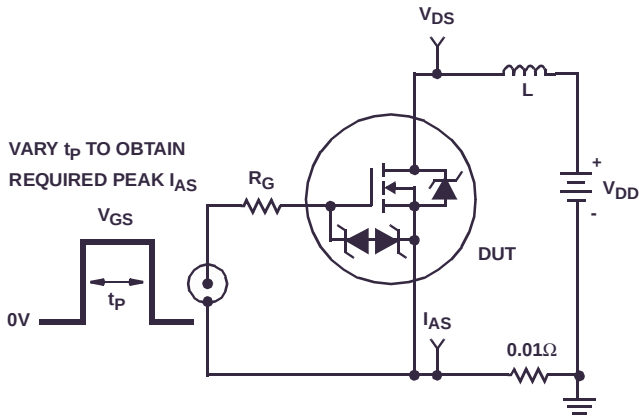


FIGURE 14. UNCLAMPED ENERGY TEST CIRCUIT

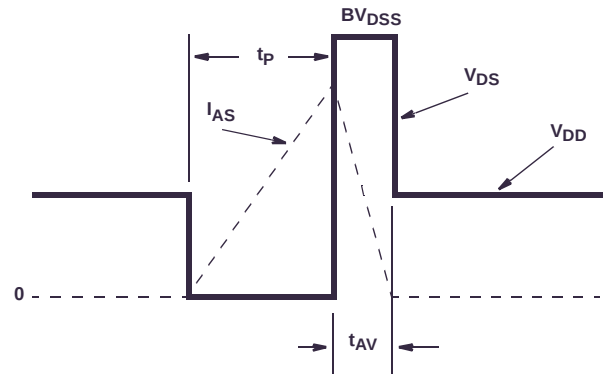


FIGURE 15. UNCLAMPED ENERGY WAVEFORMS

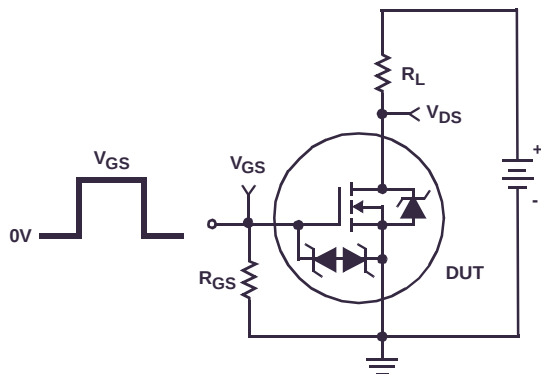


FIGURE 16. SWITCHING TIME TEST CIRCUIT

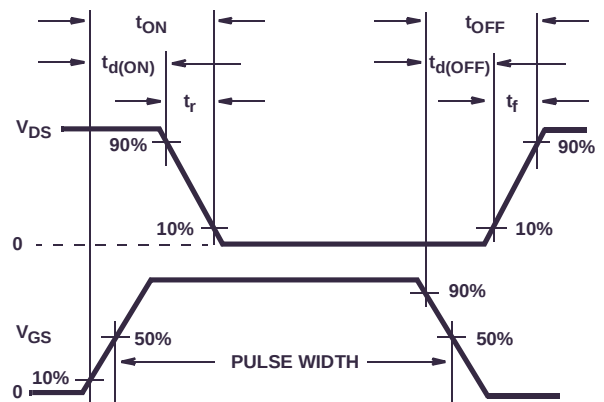


FIGURE 17. RESISTIVE SWITCHING WAVEFORMS

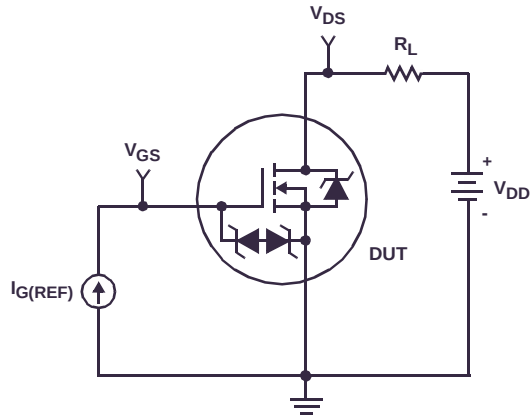
Test Circuits and Waveforms (Continued)

FIGURE 18. GATE CHARGE TEST CIRCUIT

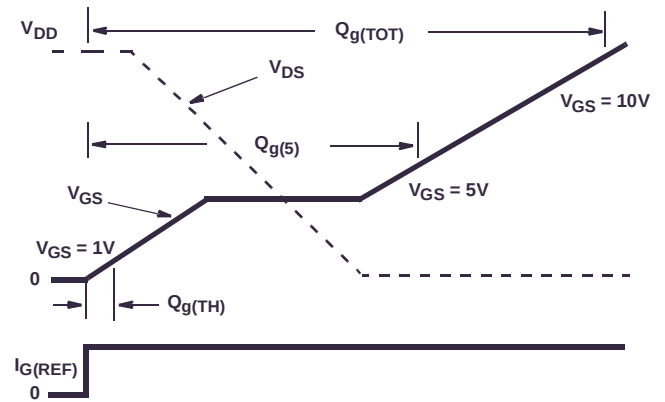


FIGURE 19. GATE CHARGE WAVEFORMS

PSPICE Electrical Model

SUBCKT RFP30N06LE 2 1 3; rev 6/2/93
 CA 12 8 1 3.34e-9
 CB 15 14 3.44e-9
 CIN 6 8 0 1.343e-9

DBODY 7 5 DBDMOD
 DBREAK 5 11 DBKMOD
 DESD1 91 9 DESD1MOD
 DESD2 91 7 DESD2MOD
 DPLCAP 10 5 DPLCAPMOD

EBREAK 11 7 17 18 75.39
 EDS 14 8 5 8 1
 EGS 13 8 6 8 1
 ESG 6 10 6 8 1
 EVTO 20 6 18 8 1

IT 8 17 1

LDRAIN 2 5 1e-9
 LGATE 1 9 7.22e-9
 LSOURCE 3 7 6.31e-9

MOS1 16 6 8 8 MOSMOD M = 0.99
 MOS2 16 21 8 8 MOSMOD M = 0.01

RBREAK 17 18 RBKMOD 1
 RDRAIN 50 16 RDSMOD 11.86e-3
 RGATE 9 20 2.52
 RIN 6 8 1e9
 RSCL1 5 51 RSLVCMOD 1e-6
 RSCL2 5 50 1e3
 RSOURCE 8 7 RDSMOD 26.6e-3
 RVTO 18 19 RVTOMOD 1

S1A 6 12 13 8 S1AMOD
 S1B 13 12 13 8 S1BMOD
 S2A 6 15 14 13 S2AMOD
 S2B 13 15 14 13 S2BMOD

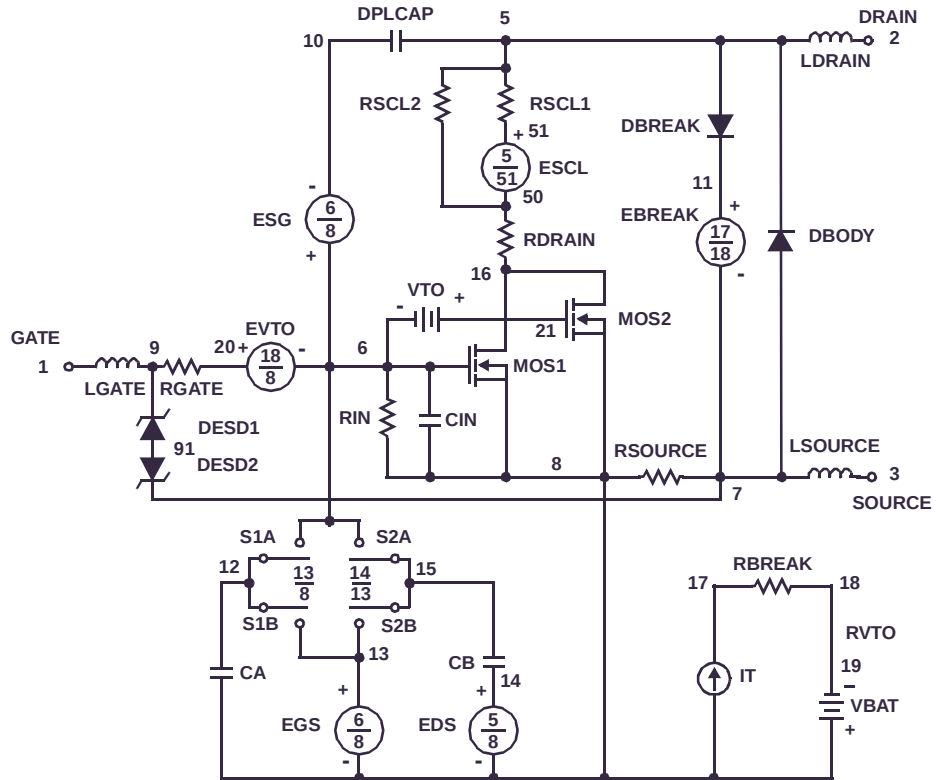
VBAT 8 19 DC 1
 VTO 21 6 0.5

ESCL 51 50 VALUE = {(V(5,51)/ABS(V(5,51)))*(PWR(V(5,51)*1e6/89,7))}

.MODEL DBDMOD D (IS = 3.80e-13 RS = 1.12e-2 TRS1 = 1.61e-3 TRS2 = 6.08e-6 CJO = 1.05e-9 TT = 3.84e-8)
 .MODEL DBKMOD D (RS = 1.82e-1 TRS1 = 7.50e-3 TRS2 = -4.0e-5)
 .MODEL DESD1MOD D (BV = 13.54 TBV1 = 0 TBV2 = 0 RS = 45.5 TRS1 = 0 TRS2 = 0)
 .MODEL DESD2MOD D (BV = 11.46 TBV1 = -7.576e-4 TBV2 = -3.0e-6 RS = 0 TRS1 = 0 TRS2 = 0)
 .MODEL DPLCAPMOD D (CJO = 0.591e-9 IS = 1e-30 N = 10)
 .MODEL MOSMOD NMOS (VTO = 1.94 KP = 139.2 IS = 1e-30 N = 10 TOX = 1 L = 1u W = 1u)
 .MODEL RBKMOD RES (TC1 = 1.07e-3 TC2 = -3.03e-7)
 .MODEL RDSMOD RES (TC1 = 5.38e-3 TC2 = 1.64e-5)
 .MODEL RSLVCMOD RES (TC1 = 1.75e-3 TC2 = 3.90e-6)
 .MODEL RVTOMOD RES (TC1 = -2.15e-3 TC2 = -5.43e-6)
 .MODEL S1AMOD VSWITCH (RON = 1e-5 ROFF = 0.1 VON = -4.05 VOFF = -1.5)
 .MODEL S1BMOD VSWITCH (RON = 1e-5 ROFF = 0.1 VON = -1.5 VOFF = -4.05)
 .MODEL S2AMOD VSWITCH (RON = 1e-5 ROFF = 0.1 VON = -2.2 VOFF = 2.8)
 .MODEL S2BMOD VSWITCH (RON = 1e-5 ROFF = 0.1 VON = 2.8 VOFF = -2.2)

.ENDS

NOTE: For further discussion of the PSPICE model, consult **A New PSPICE Sub-Circuit for the Power MOSFET Featuring Global Temperature Options**; IEEE Power Electronics Specialist Conference Records 1991.



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

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.

ON Semiconductor and  are trademarks of Semiconductor Components Industries, LLC dba ON Semiconductor or its subsidiaries in the United States and/or other countries. ON Semiconductor owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of ON Semiconductor's product/patent coverage may be accessed at www.onsemi.com/site/pdf/Patent-Marking.pdf. ON Semiconductor reserves the right to make changes without further notice to any products herein. ON Semiconductor makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does ON Semiconductor assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using ON Semiconductor products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by ON Semiconductor. "Typical" parameters which may be provided in ON Semiconductor data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. ON Semiconductor does not convey any license under its patent rights nor the rights of others. ON Semiconductor products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use ON Semiconductor products for any such unintended or unauthorized application, Buyer shall indemnify and hold ON Semiconductor and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that ON Semiconductor was negligent regarding the design or manufacture of the part. ON Semiconductor is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:

Literature Distribution Center for ON Semiconductor
19521 E. 32nd Pkwy, Aurora, Colorado 80011 USA
Phone: 303-675-2175 or 800-344-3860 Toll Free USA/Canada
Fax: 303-675-2176 or 800-344-3867 Toll Free USA/Canada
Email: orderlit@onsemi.com

N. American Technical Support: 800-282-9855 Toll Free
USA/Canada

Europe, Middle East and Africa Technical Support:
Phone: 421 33 790 2910

Japan Customer Focus Center
Phone: 81-3-5817-1050

ON Semiconductor Website: www.onsemi.com

Order Literature: <http://www.onsemi.com/orderlit>

For additional information, please contact your local
Sales Representative