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Please note: As part of the Fairchild Semiconductor integration, some of the Fairchild orderable part numbers will need to change in order to meet ON Semiconductor's system requirements. Since the ON Semiconductor product management systems do not have the ability to manage part nomenclature that utilizes an underscore (_), the underscore (_) in the Fairchild part numbers will be changed to a dash (-). This document may contain device numbers with an underscore (_). Please check the ON Semiconductor website to verify the updated device numbers. The most current and up-to-date ordering information can be found at www.onsemi.com. Please email any questions regarding the system integration to Fairchild_questions@onsemi.com.

Data Sheet September 2013

N-Channel Power MOSFET
50V, 14A, 100 mΩ

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.

Formerly developmental type TA09770.

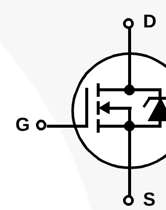
Ordering Information

PART NUMBER	PACKAGE	BRAND
RFD14N05SM9A	TO-252AA	F14N05

Features

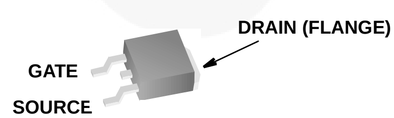
- 14A, 50V
- $r_{DS(ON)}$ = 0.100Ω
- Temperature Compensating PSPICE® Model
- Peak Current vs Pulse Width Curve
- UIS Rating Curve
- 175^{o}C Operating Temperature
- Related Literature
  - TB334 “Guidelines for Soldering Surface Mount Components to PC Boards”

Symbol



Packaging

JEDEC TO-252AA



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

		RFD14N05SM9A	UNITS
Drain to Source Voltage (Note 1)	V_{DSS}	50	V
Drain to Gate Voltage (R_{GS} = 20kΩ) (Note 1)	V_{DGR}	50	V
Gate to Source Voltage	V_{GS}	±20	V
Continuous Drain Current	I_D	14	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	48	W
Derate above 25^oC		0.32	$W/^oC$
Operating and Storage Temperature	T_J, T_{STG}	-55 to 175	^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 150^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 9)	50	-	-	V
Gate Threshold Voltage	$V_{GS(TH)}$	$V_{GS} = V_{DS}$, I_D = 250μA	2	-	4	V
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS} = Rated BV_{DSS}, V_{GS} = 0V	-	-	25	μA
		V_{DS} = 0.8 x Rated BV_{DSS}, V_{GS} = 0V, $T_C = 150^oC$	-	-	250	μA
Gate to Source Leakage Current	I_{GSS}	V_{GS} = ±20V	-	-	±100	nA
Drain to Source On Resistance (Note 2)	$r_{DS(ON)}$	I_D = 14A, V_{GS} = 10V, (Figure 11)	-	-	0.100	Ω
Turn-On Time	t_{ON}	V_{DD} = 25V, $I_D \approx$ 14A, V_{GS} = 10V, R_{GS} = 25Ω, R_L = 1.7Ω (Figure 13)	-	-	60	ns
Turn-On Delay Time	$t_{d(ON)}$		-	14	-	ns
Rise Time	t_r		-	26	-	ns
Turn-Off Delay Time	$t_{d(OFF)}$		-	45	-	ns
Fall Time	t_f		-	17	-	ns
Turn-Off Time	t_{OFF}		-	-	100	ns
Total Gate Charge	$Q_{g(TOT)}$	V_{GS} = 0V to 20V; V_{DD} = 40V, I_D = 14A, R_L = 2.86Ω, $I_{g(REF)}$ = 0.4mA (Figure 13)	-	-	40	nC
Gate Charge at 5V	$Q_{g(10)}$	V_{GS} = 0V to 10V	-	-	25	nC
Threshold Gate Charge	$Q_{g(TH)}$	V_{GS} = 0V to 2V	-	-	1.5	nC
Input Capacitance	C_{ISS}	V_{DS} = 25V, V_{GS} = 0V, f = 1MHz (Figure 12)	-	570	-	pF
Output Capacitance	C_{OSS}		-	185	-	pF
Reverse Transfer Capacitance	C_{RSS}		-	50	-	pF
Thermal Resistance Junction to Case	$R_{\theta JC}$		-	-	3.125	$^oC/W$
Thermal Resistance Junction to Ambient	$R_{\theta JA}$		-	-	100	$^oC/W$

Source to Drain Diode Specifications

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNITS
Source to Drain Diode Voltage (Note 2)	V_{SD}	I_{SD} = 14A	-	-	1.5	V
Diode Reverse Recovery Time	t_{rr}	I_{SD} = 14A, dI_{SD}/dt = 100A/μs	-	-	125	ns

NOTES:

2. Pulse Test: Pulse Width ≤300ms, Duty Cycle ≤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

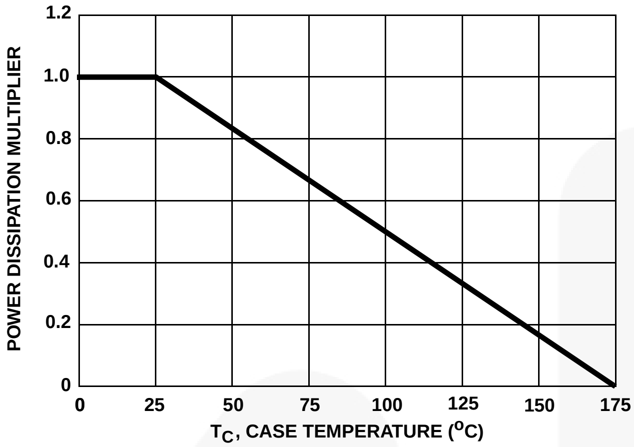


FIGURE 1. NORMALIZED POWER DISSIPATION vs CASE TEMPERATURE

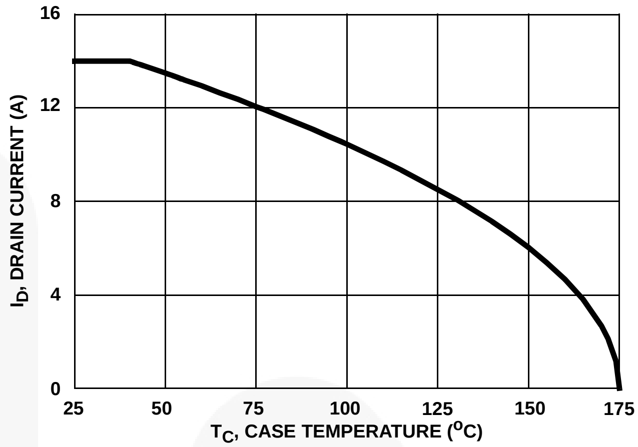


FIGURE 2. MAXIMUM CONTINUOUS DRAIN CURRENT vs CASE TEMPERATURE

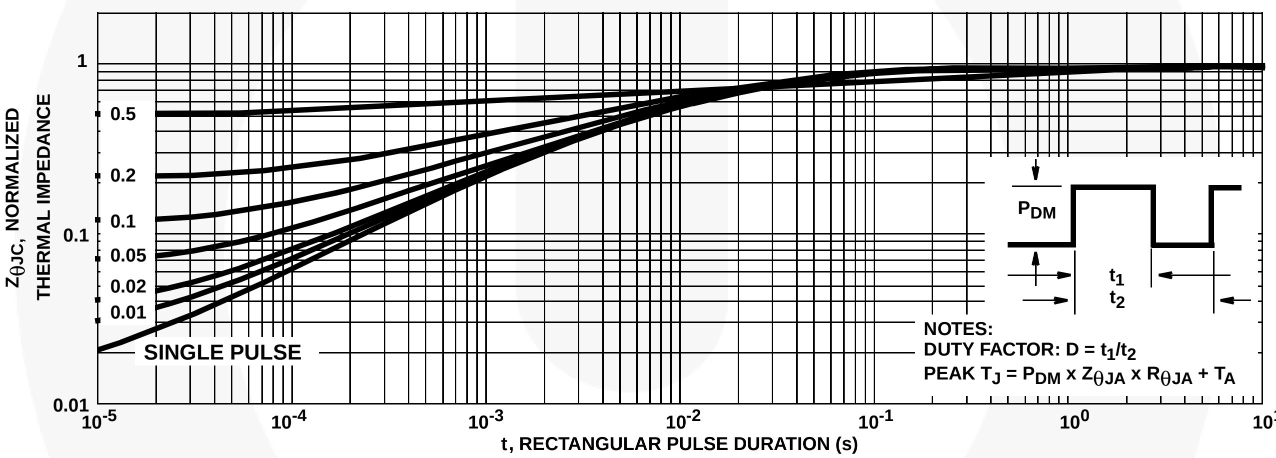


FIGURE 3. NORMALIZED MAXIMUM TRANSIENT THERMAL IMPEDANCE

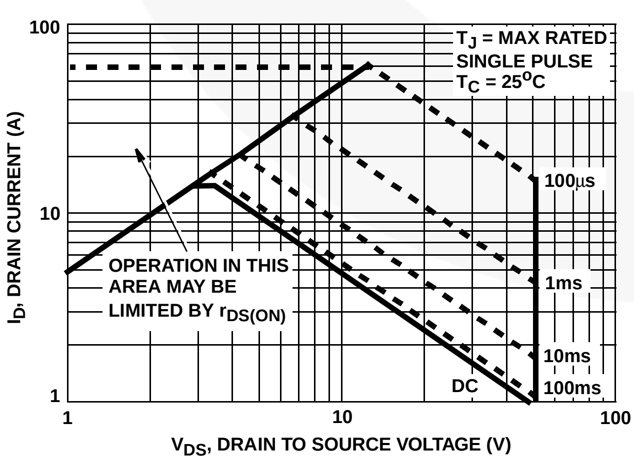


FIGURE 4. FORWARD BIAS SAFE OPERATING AREA

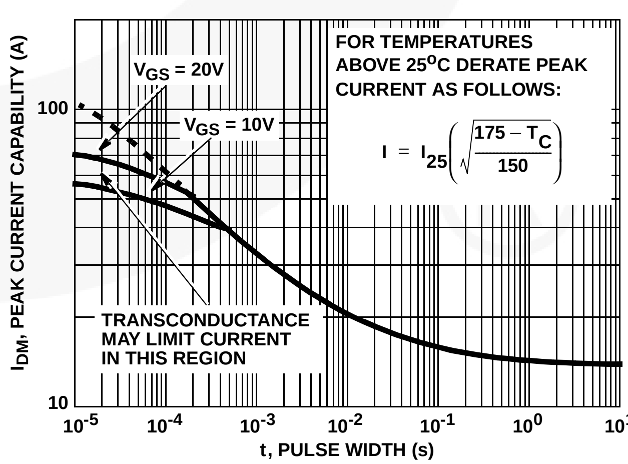
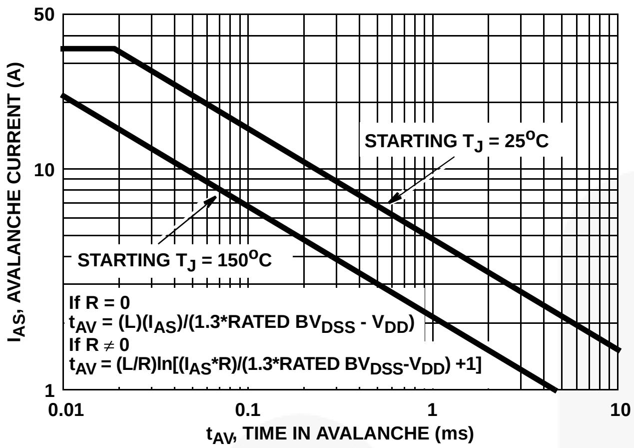


FIGURE 5. PEAK CURRENT CAPABILITY

Typical Performance Curves Unless Otherwise Specified **(Continued)**



NOTE: Refer to Fairchild Application Notes AN9321 and AN9322.

FIGURE 6. UNCLAMPED INDUCTIVE SWITCHING

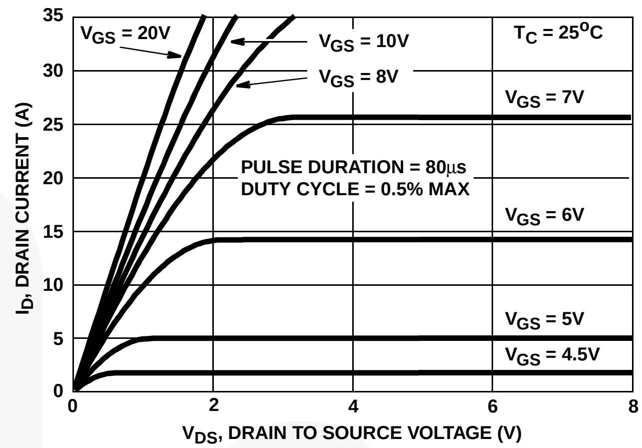


FIGURE 7. SATURATION CHARACTERISTICS

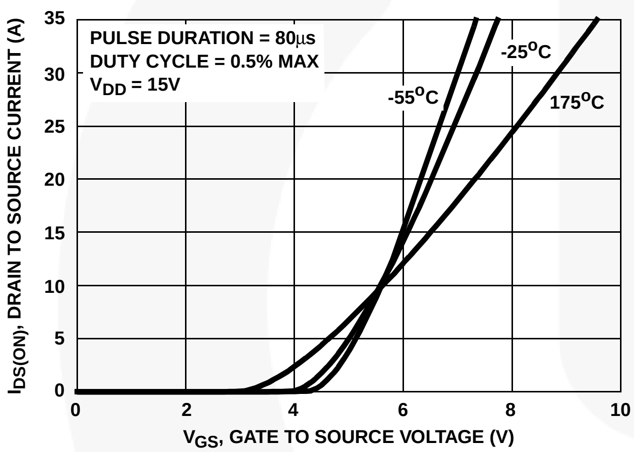


FIGURE 8. TRANSFER CHARACTERISTICS

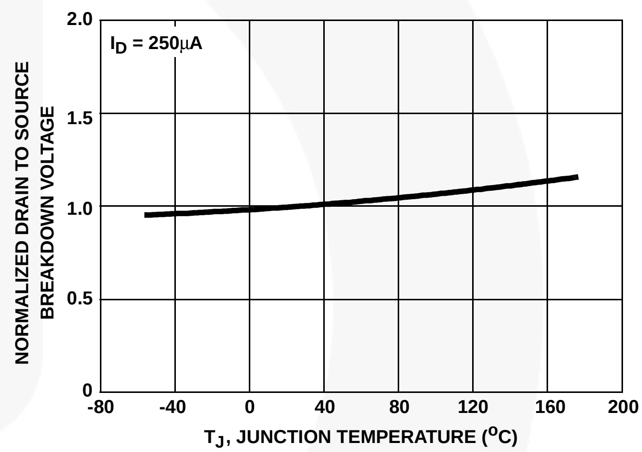


FIGURE 9. NORMALIZED DRAIN TO SOURCE BREAKDOWN VOLTAGE vs JUNCTION TEMPERATURE

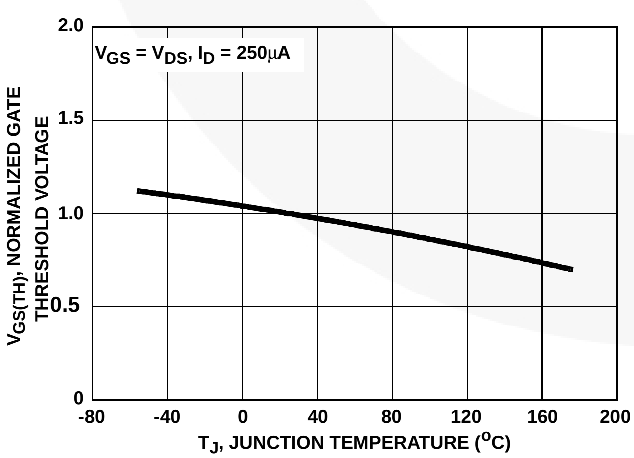


FIGURE 10. NORMALIZED GATE THRESHOLD VOLTAGE vs JUNCTION TEMPERATURE

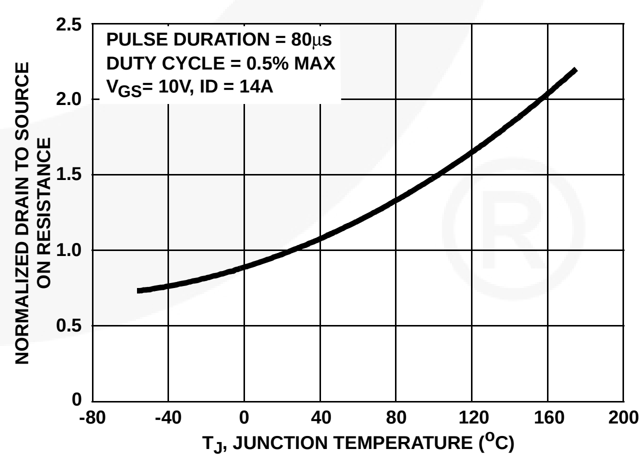


FIGURE 11. NORMALIZED DRAIN TO SOURCE ON RESISTANCE vs JUNCTION TEMPERATURE

Typical Performance Curves Unless Otherwise Specified **(Continued)**

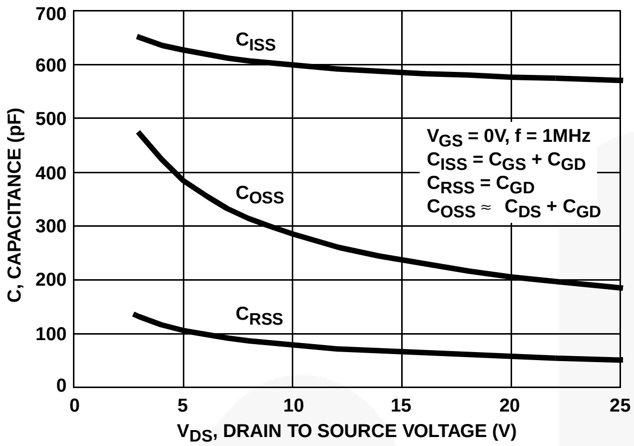
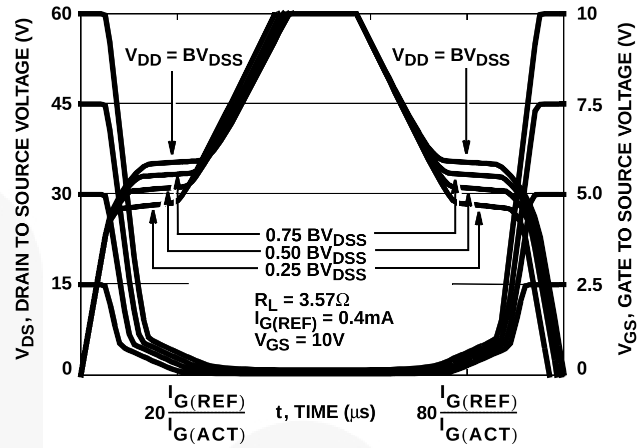


FIGURE 12. CAPACITANCE vs DRAIN TO SOURCE VOLTAGE



NOTE: Refer to Fairchild Application Notes AN7254 and AN7260,

FIGURE 13. NORMALIZED SWITCHING WAVEFORMS FOR CONSTANT CURRENT GATE DRIVE

Test Circuits and Waveforms

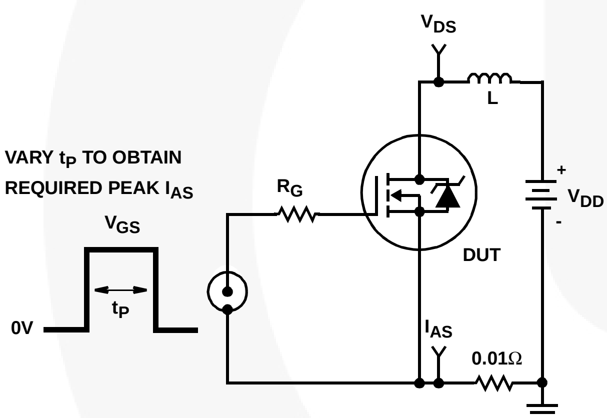


FIGURE 14. UNCLAMPED ENERGY TEST CIRCUIT

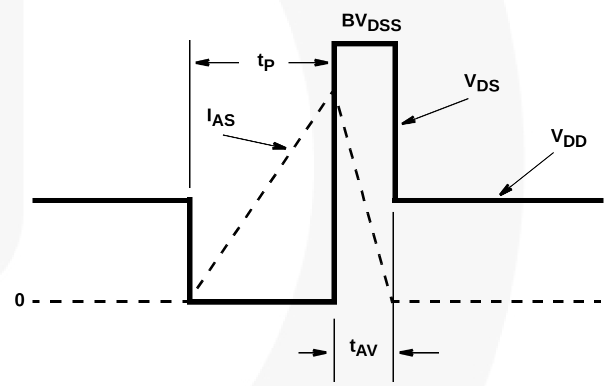


FIGURE 15. UNCLAMPED ENERGY WAVEFORMS

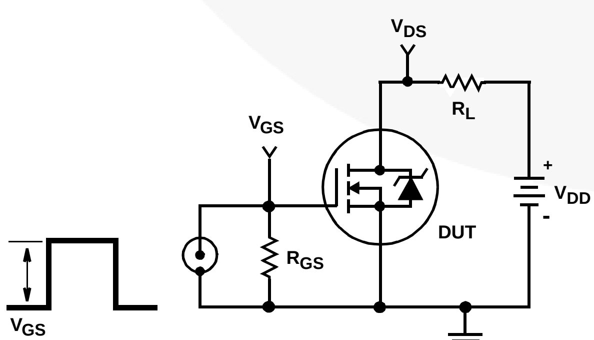


FIGURE 16. SWITCHING TIME TEST CIRCUIT

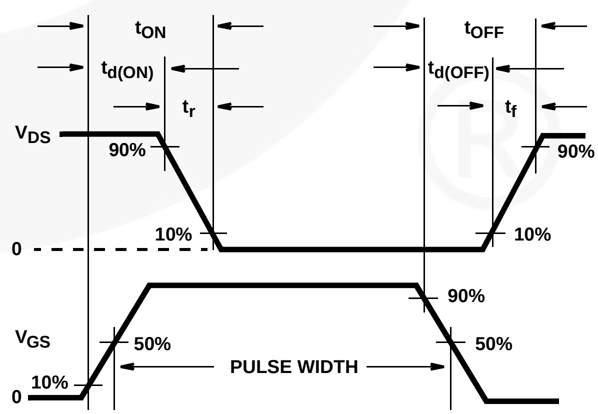


FIGURE 17. RESISTIVE SWITCHING WAVEFORMS

Test Circuits and Waveforms (Continued)

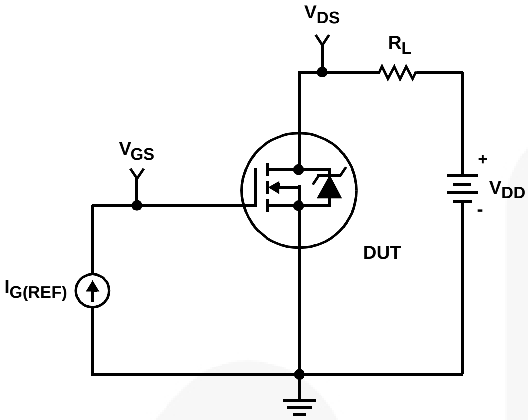


FIGURE 18. GATE CHARGE TEST CIRCUIT

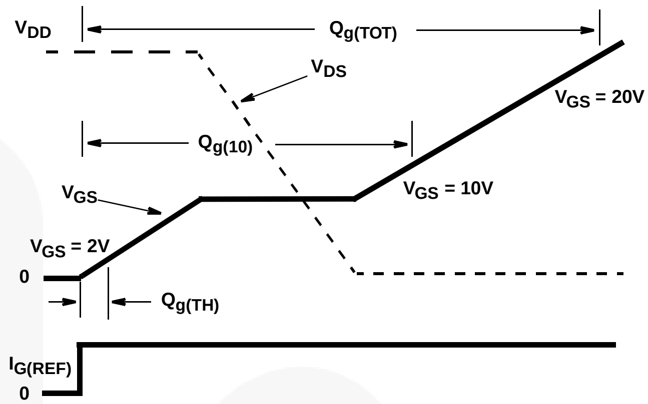
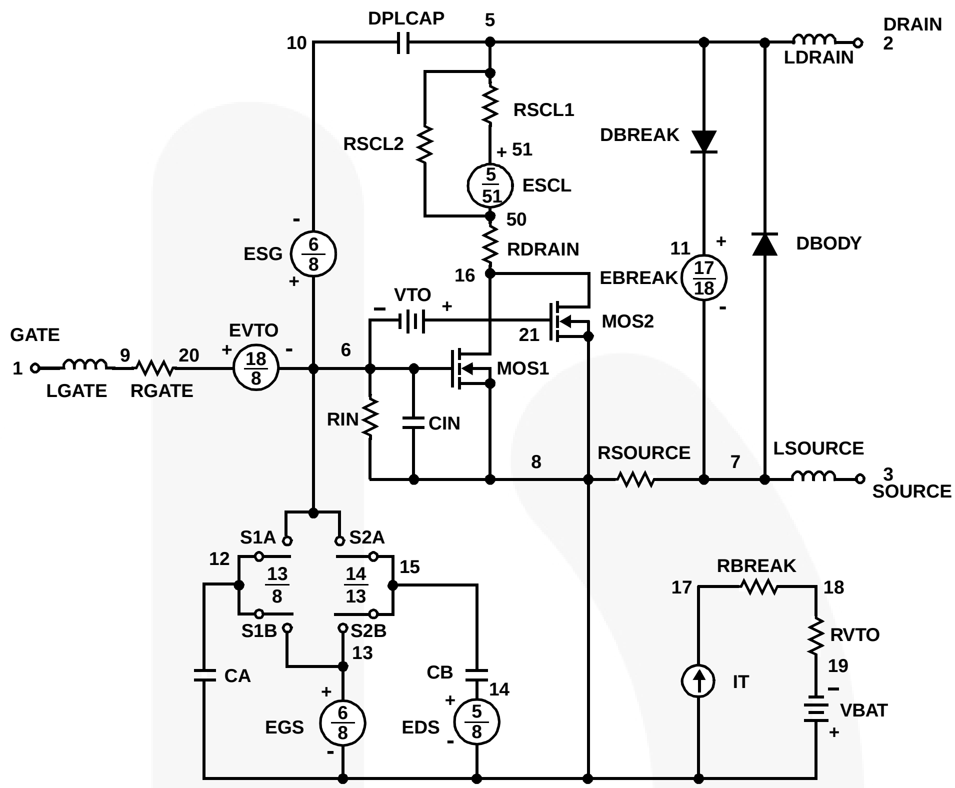


FIGURE 19. GATE CHARGE WAVEFORMS

PSPICE Electrical Model

```
.SUBCKT  RFD14N05  2 1 3 ;       rev 9/12/94

CA  12  8  8.84e-10
CB  15  14  9.34e-10
CIN  6  8  5.2e-10

DBODY  7  5  DBDMOD
DBREAK  5 11  DBKMOD
DPLCAP 10  5  DPLCAPMOD

EBREAK  11  7  17  18  62.87
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  4.34e-9
LSOURCE  3  7  3.79e-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  2.2e-3
RGATE  9  20  5.64
RIN  6  8  1e9
RSCL1  5  51  RSCLMOD 1e-6
RSCL2  5  50  1e3
RSOURCE  8  7  RDSMOD  42.3e-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   0.82

ESCL  51 50  VALUE = {(V(5,51)/ABS(V(5,51)))*(PWR(V(5,51)*1e6/50,6))}

.MODEL DBDMOD D (IS = 1.5e-13  RS = 10.9e-3  TRS1 = 2.3e-3  TRS2 = -1.75e-5  CJO = 6.84e-10  TT = 4.2e-8)
.MODEL DBKMOD D (RS = 4.15e-1  TRS1 = 3.73e-3  TRS2 = -3.21e-5)
.MODEL DPLCAPMOD D (CJO = 26.2e-11  IS = 1e-30  N = 10)
.MODEL MOSMOD NMOS (VTO = 3.91  KP = 12.68  IS = 1e-30  N = 10  TOX = 1  L = 1u  W = 1u)
.MODEL RBKMOD RES (TC1 = 7.73e-4  TC2 = 2.12e-6)
.MODEL RDSMOD RES (TC1 = 5.0e-3  TC2 = 2.53e-5)
.MODEL RSCLMOD RES (TC1 = 2.05e-3  TC2 = 1.35e-5)
.MODEL RVTOMOD RES (TC1 = -4.44e-3  TC2 = -6.45e-6)
.MODEL S1AMOD VSWITCH (RON = 1e-5  ROFF = 0.1  VON = -5.29  VOFF= -3.29)
.MODEL S1BMOD VSWITCH (RON = 1e-5  ROFF = 0.1  VON = -3.29  VOFF= -5.29)
.MODEL S2AMOD VSWITCH (RON = 1e-5  ROFF = 0.1  VON = -2.25  VOFF= 2.75)
.MODEL S2BMOD VSWITCH (RON = 1e-5  ROFF = 0.1  VON = 2.75  VOFF= -2.25)

.ENDS
```



NOTE: For further discussion of the PSPICE model, consult **A New PSPICE Sub-circuit for the Power MOSFET Featuring Global Temperature Options**; written by William J. Hepp and C. Frank Wheatley.

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Preliminary	First Production	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	Datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve the design.
Obsolete	Not In Production	Datasheet contains specifications on a product that is discontinued by Fairchild Semiconductor. The datasheet is for reference information only.

Rev. I66

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