

75A, 55V, 0.008 Ohm, N-Channel UltraFET Power MOSFETs



These N-Channel power MOSFETs are manufactured using the innovative UltraFET® process. This advanced process technology

achieves the lowest possible on-resistance per silicon area, resulting in outstanding performance. This device is capable of withstanding high energy in the avalanche mode and the diode exhibits very low reverse recovery time and stored charge. It was designed for use in applications where power efficiency is important, such as switching regulators, switching converters, motor drivers, relay drivers, low-voltage bus switches, and power management in portable and battery-operated products.

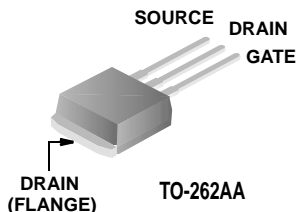
Formerly developmental type TA75344.

Ordering Information

PART NUMBER	PACKAGE	BRAND
HUFA75344S3	TO-262AA	75344S

NOTE: When ordering, use the entire part number. Add the suffix T to obtain the TO-262AA variant in tape and reel, e.g., HUFA75344S3T.

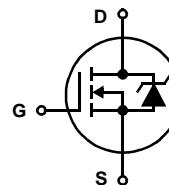
Packaging



Features

- 75A, 55V
- Simulation Models
 - Temperature Compensated PSPICE® and SABER™ Models
 - Thermal Impedance PSPICE and SABER Models Available on the web at: www.fairchildsemi.com
- Peak Current vs Pulse Width Curve
- UIS Rating Curve
- Related Literature
 - TB334, "Guidelines for Soldering Surface Mount Components to PC Boards"

Symbol



This product has been designed to meet the extreme test conditions and environment demanded by the automotive industry. For a copy of the requirements, see AEC Q101 at: <http://www.aecouncil.com/>

Reliability data can be found at: <http://www.fairchildsemi.com>

All Fairchild semiconductor products are manufactured, assembled and tested under ISO9000 and QS9000 quality systems certification.

HUFA75344S3

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

			UNITS
Drain to Source Voltage (Note 1)	V_{DSS}	55	V
Drain to Gate Voltage ($R_{GS} = 20k\Omega$) (Note 1)	V_{DGR}	55	V
Gate to Source Voltage	V_{GS}	± 20	V
Drain Current			
Continuous (Figure 2)	I_D	75	A
Pulsed Drain Current	I_{DM}	Figure 4	
Pulsed Avalanche Rating	E_{AS}	Figure 6	
Power Dissipation	P_D	285	W
Derate Above 25°C		1.90	W/ $^\circ\text{C}$
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_{pkg}	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:

- $T_J = 25^\circ\text{C}$ to 150°C .

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

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNITS	
OFF STATE SPECIFICATIONS							
Drain to Source Breakdown Voltage	BV_{DSS}	$I_D = 250\mu\text{A}, V_{GS} = 0\text{V}$ (Figure 11)	55	-	-	V	
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS} = 50\text{V}, V_{GS} = 0\text{V}$	-	-	1	μA	
		$V_{DS} = 45\text{V}, V_{GS} = 0\text{V}, T_C = 150^\circ\text{C}$	-	-	250	μA	
Gate to Source Leakage Current	I_{GSS}	$V_{GS} = \pm 20\text{V}$	-	-	± 100	nA	
ON STATE SPECIFICATIONS							
Gate to Source Threshold Voltage	$V_{GS(TH)}$	$V_{GS} = V_{DS}, I_D = 250\mu\text{A}$ (Figure 10)	2	-	4	V	
Drain to Source On Resistance	$r_{DS(ON)}$	$I_D = 75\text{A}, V_{GS} = 10\text{V}$ (Figure 9)	-	6.5	8.0	m Ω	
THERMAL SPECIFICATIONS							
Thermal Resistance Junction to Case	$R_{\theta JC}$	(Figure 3)	-	-	0.52	$^\circ\text{C}/\text{W}$	
Thermal Resistance Junction to Ambient	$R_{\theta JA}$	TO-262	-	-	62	$^\circ\text{C}/\text{W}$	
SWITCHING SPECIFICATIONS ($V_{GS} = 10\text{V}$)							
Turn-On Time	t_{ON}	$V_{DD} = 30\text{V}, I_D \cong 75\text{A},$ $R_L = 0.4\Omega, V_{GS} = 10\text{V},$ $R_{GS} = 3.0\Omega$	-	-	187	ns	
Turn-On Delay Time	$t_{d(ON)}$		-	13	-	ns	
Rise Time	t_r		-	125	-	ns	
Turn-Off Delay Time	$t_{d(OFF)}$		-	46	-	ns	
Fall Time	t_f		-	57	-	ns	
Turn-Off Time	t_{OFF}		-	-	147	ns	
GATE CHARGE SPECIFICATIONS							
Total Gate Charge	$Q_{g(TOT)}$	$V_{GS} = 0\text{V}$ to 20V	$V_{DD} = 30\text{V},$ $I_D \cong 75\text{A},$ $R_L = 0.4\Omega$ $I_{g(REF)} = 1.0\text{mA}$ (Figure 13)	-	175	210	nC
Gate Charge at 10V	$Q_{g(10)}$	$V_{GS} = 0\text{V}$ to 10V		-	90	108	nC
Threshold Gate Charge	$Q_{g(TH)}$	$V_{GS} = 0\text{V}$ to 2V		-	5.9	7.0	nC
Gate to Source Gate Charge	Q_{gs}			-	14	-	nC
Reverse Transfer Capacitance	Q_{gd}			-	39	-	nC
CAPACITANCE SPECIFICATIONS							
Input Capacitance	C_{ISS}	$V_{DS} = 25\text{V}, V_{GS} = 0\text{V},$ $f = 1\text{MHz}$ (Figure 12)	-	3200	-	pF	
Output Capacitance	C_{OSS}		-	1170	-	pF	
Reverse Transfer Capacitance	C_{RSS}		-	310	-	pF	

Source to Drain Diode Specifications

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNITS
Source to Drain Diode Voltage	V_{SD}	$I_{SD} = 75A$	-	-	1.25	V
Reverse Recovery Time	t_{rr}	$I_{SD} = 75A, di_{SD}/dt = 100A/\mu s$	-	-	105	ns
Reverse Recovered Charge	Q_{RR}	$I_{SD} = 75A, di_{SD}/dt = 100A/\mu s$	-	-	210	nC

Typical Performance Curves

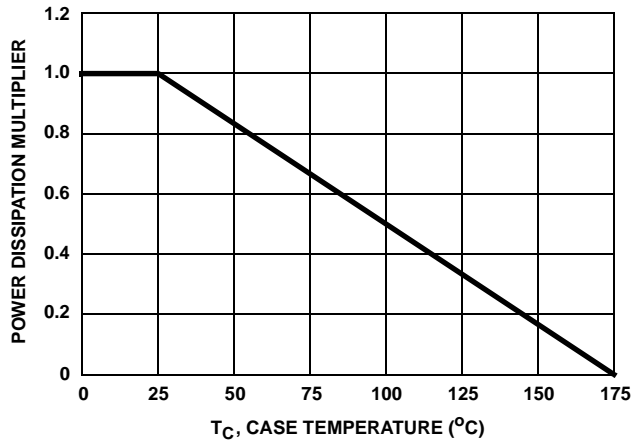


FIGURE 1. NORMALIZED POWER DISSIPATION vs CASE TEMPERATURE

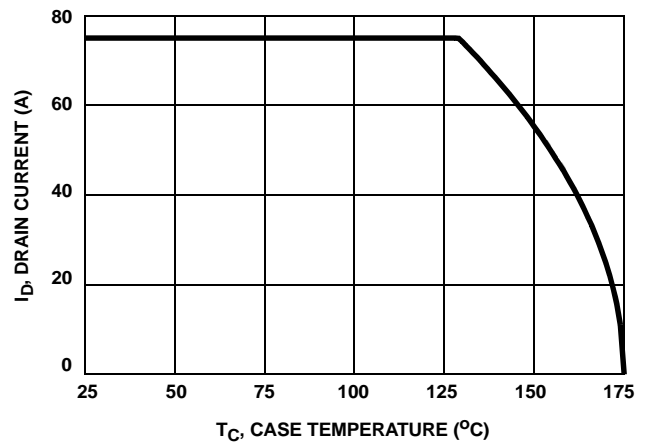


FIGURE 2. MAXIMUM CONTINUOUS DRAIN CURRENT vs CASE TEMPERATURE

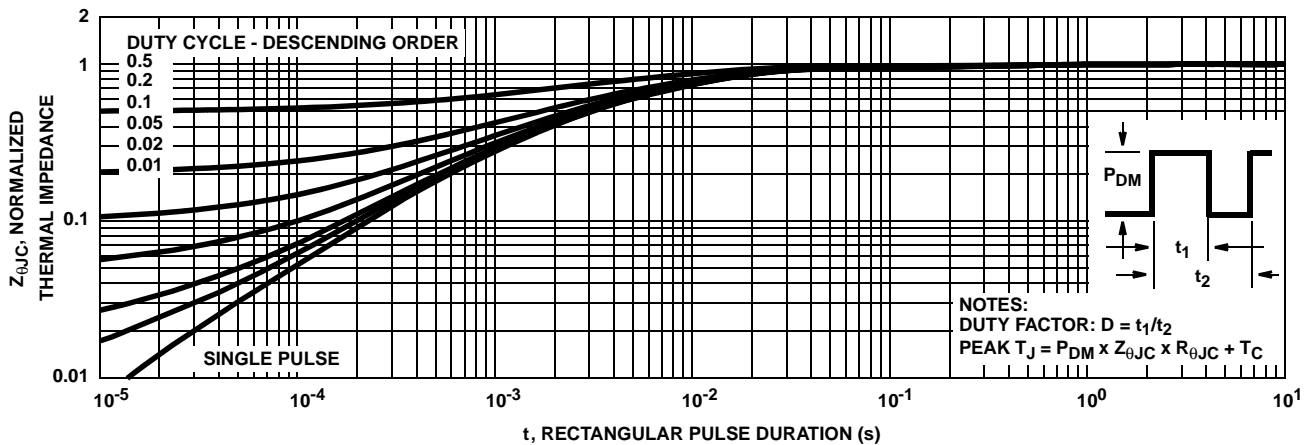


FIGURE 3. NORMALIZED MAXIMUM TRANSIENT THERMAL IMPEDANCE

Typical Performance Curves (Continued)

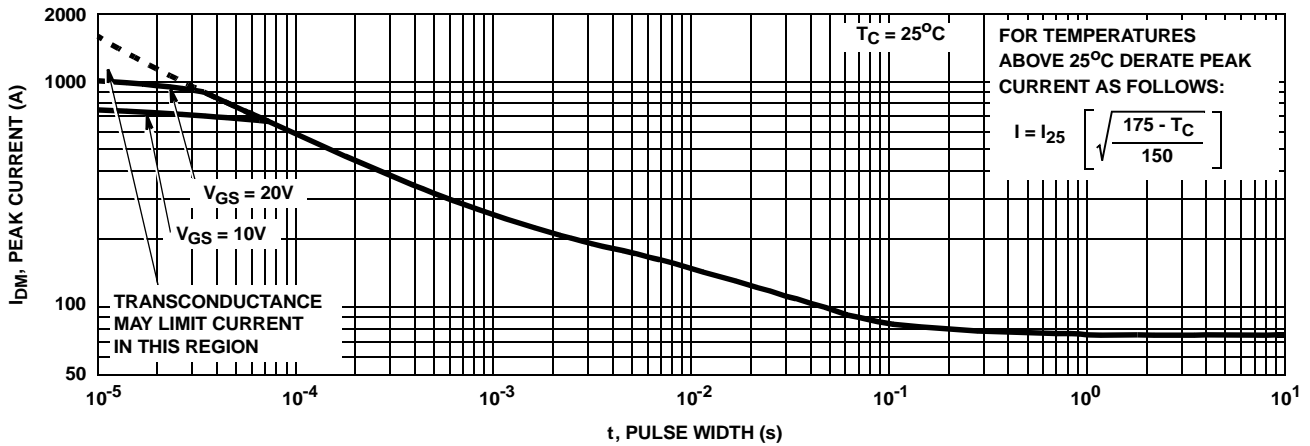


FIGURE 4. PEAK CURRENT CAPABILITY

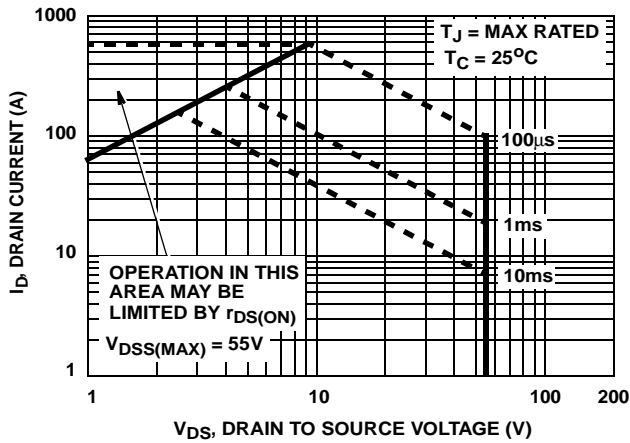
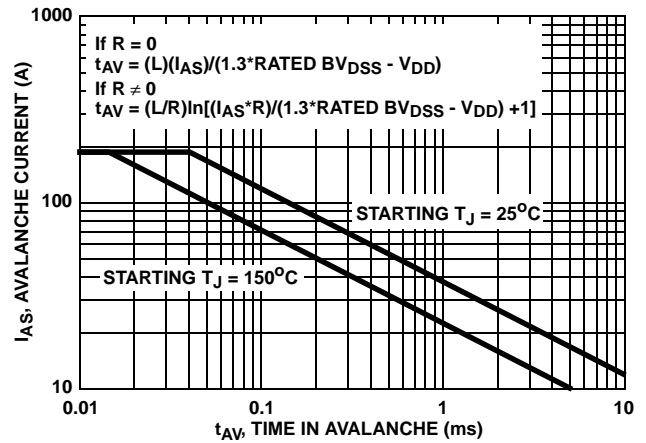


FIGURE 5. FORWARD BIAS SAFE OPERATING AREA



NOTE: Refer to Fairchild Application Notes AN9321 and AN9322.
FIGURE 6. UNCLAMPED INDUCTIVE SWITCHING CAPABILITY

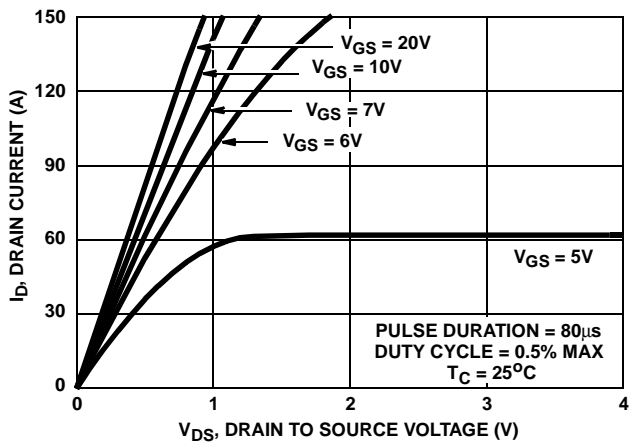


FIGURE 7. SATURATION CHARACTERISTICS

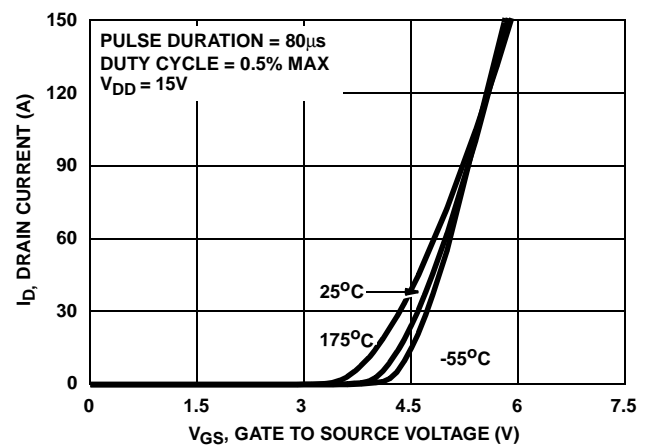


FIGURE 8. TRANSFER CHARACTERISTICS

Typical Performance Curves (Continued)

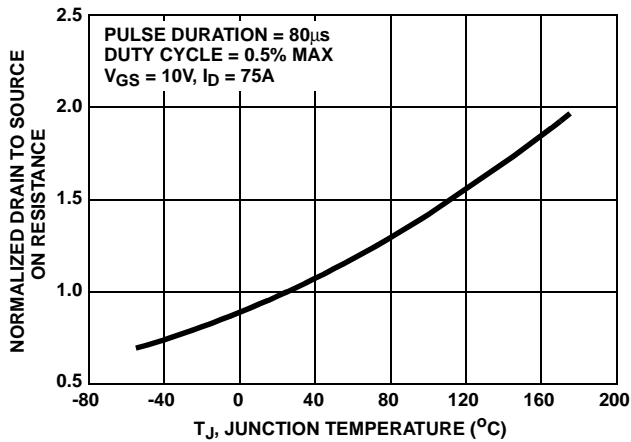


FIGURE 9. NORMALIZED DRAIN TO SOURCE ON RESISTANCE vs JUNCTION TEMPERATURE

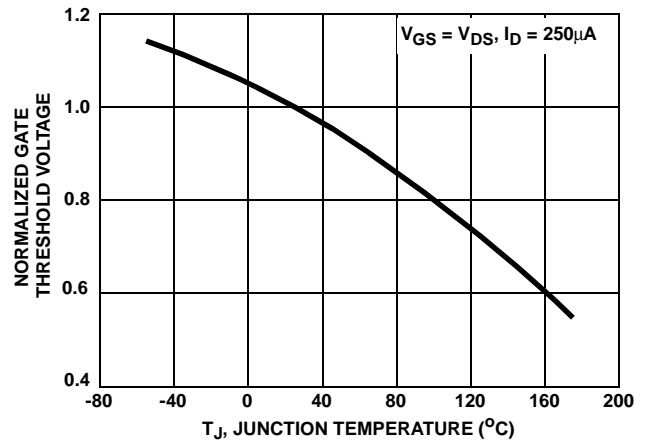


FIGURE 10. NORMALIZED GATE THRESHOLD VOLTAGE vs JUNCTION TEMPERATURE

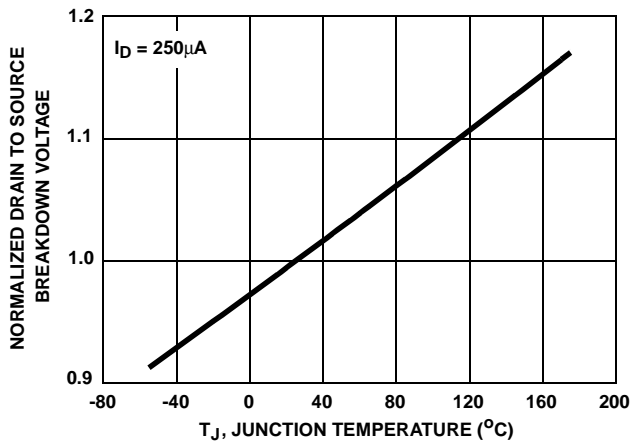


FIGURE 11. NORMALIZED DRAIN TO SOURCE BREAKDOWN VOLTAGE vs JUNCTION TEMPERATURE

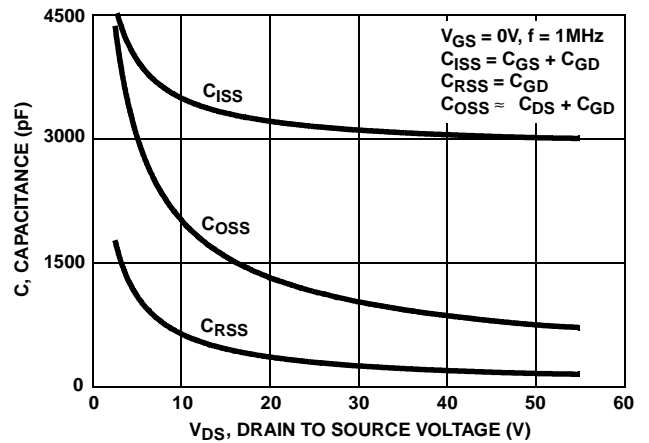
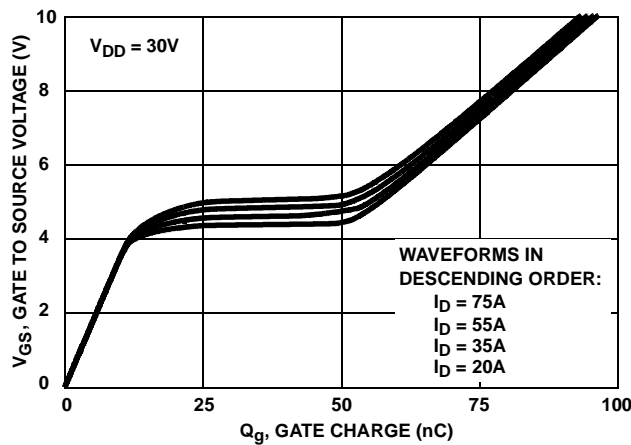


FIGURE 12. CAPACITANCE vs DRAIN TO SOURCE VOLTAGE



NOTE: Refer to Fairchild Application Notes AN7254 and AN7260.

FIGURE 13. GATE CHARGE WAVEFORMS FOR CONSTANT GATE CURRENT

Test Circuits and Waveforms

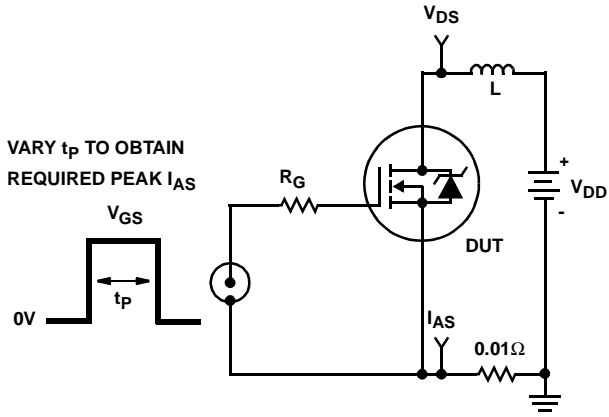


FIGURE 14. UNCLAMPED ENERGY TEST CIRCUIT

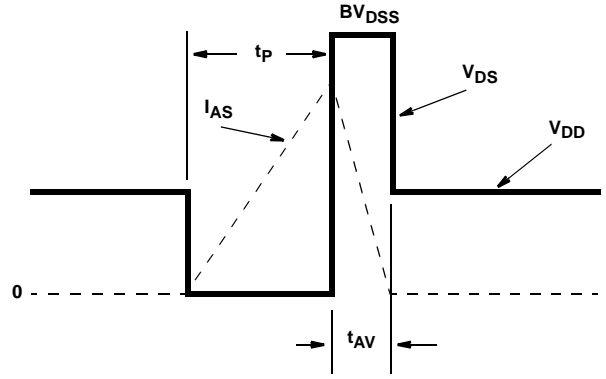


FIGURE 15. UNCLAMPED ENERGY WAVEFORMS

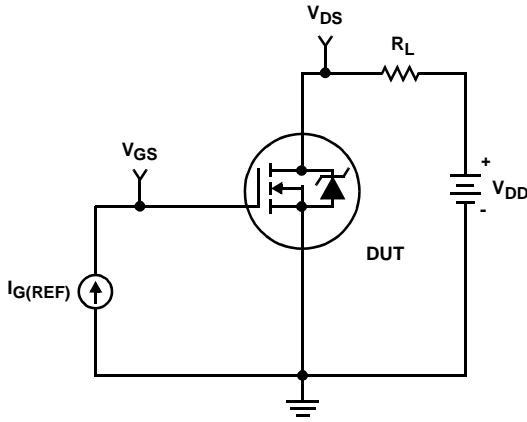


FIGURE 16. GATE CHARGE TEST CIRCUIT

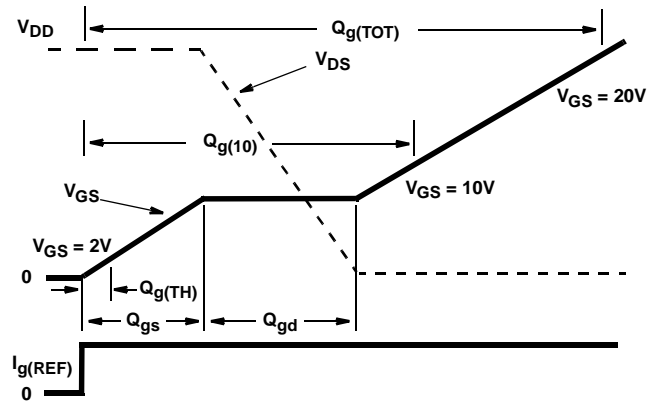


FIGURE 17. GATE CHARGE WAVEFORM

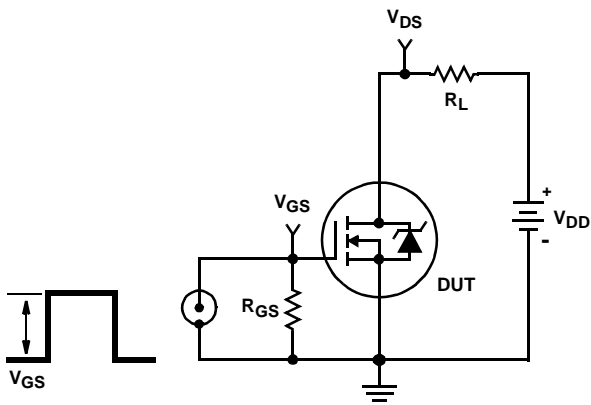


FIGURE 18. SWITCHING TIME TEST CIRCUIT

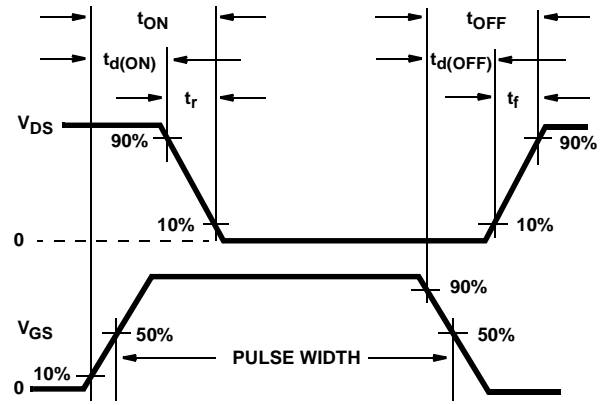


FIGURE 19. RESISTIVE SWITCHING WAVEFORMS

HUFA75344S3

PSPICE Electrical Model

.SUBCKT HUFA75337 2 1 3 ; rev 3 Feb 1999

CA 12 8 4.9e-9
 CB 15 14 4.75e-9
 CIN 6 8 2.85e-9

DBODY 7 5 DBODYMOD
 DBREAK 5 11 DBREAKMOD
 DPLCAP 10 5 DPLCAPMOD

EBREAK 11 7 17 18 59.7
 EDS 14 8 5 8 1
 EGS 13 8 6 8 1
 ESG 6 10 6 8 1
 EVTHRES 6 21 19 8 1
 EVTEMP 20 6 18 22 1

IT 8 17 1

LDRAIN 2 5 1e-9
 LGATE 1 9 2.6e-9
 LSOURCE 3 7 1.1e-9
 KGATE LSOURCE LGATE 0.0085

MMED 16 6 8 8 MMEDMOD
 MSTRO 16 6 8 8 MSTROMOD
 MWEAK 16 21 8 8 MWEAKMOD

RBREAK 17 18 RBREAKMOD 1
 RDRAIN 50 16 RDRAINMOD 1.94e-3
 RGATE 9 20 0.36
 RLDRAIN 2 5 10
 RLGATE 1 9 26
 RLSOURCE 3 7 11
 RSLC1 5 51 RSLCMOD 1e-6
 RSLC2 5 50 1e3
 RSOURCE 8 7 RSOURCEMOD 3.5e-3
 RVTHRES 22 8 RVTHRESMOD 1
 RVTEMP 18 19 RVTEMPMOD 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 22 19 DC 1

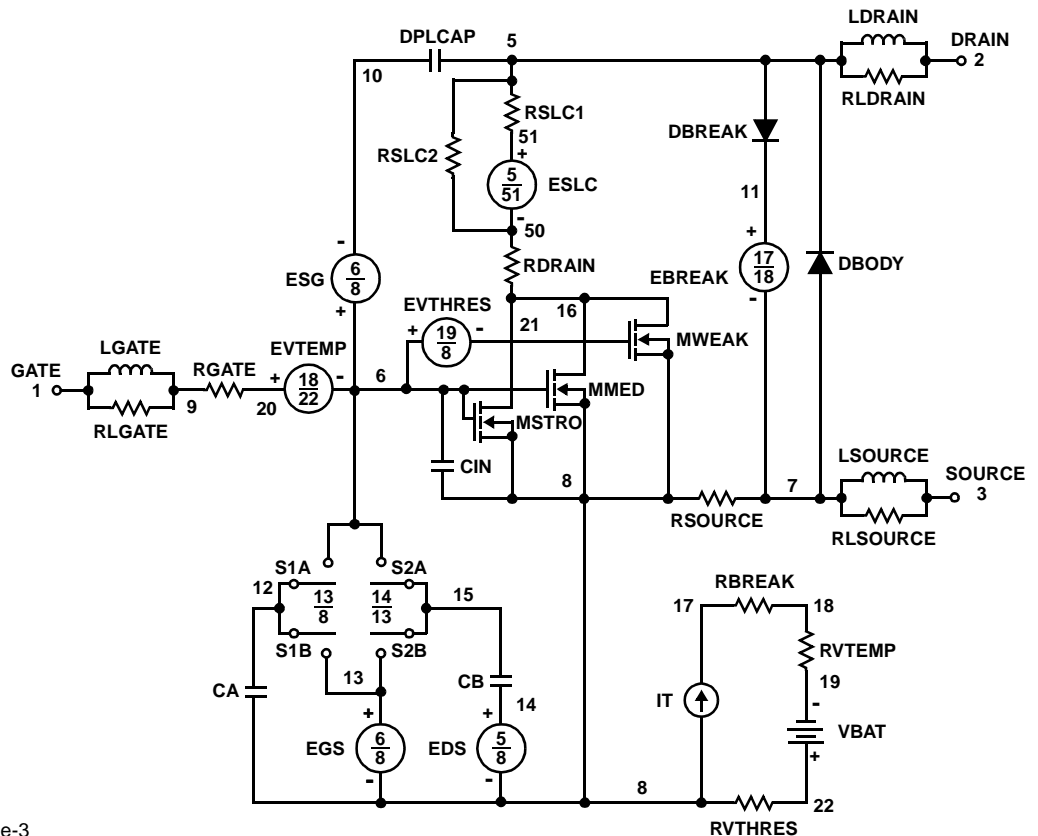
ESLC 51 50 VALUE={(V(5,51)/ABS(V(5,51)))*(PWR(V(5,51))/(1e-6*400),3))}

.MODEL DBODYMOD D (IS = 2.95e-12 RS = 2.6e-3 TRS1 = 1.05e-3 TRS2 = 5.0e-7 CJO = 5.19e-9 TT = 5.9e-8 M = 0.55)
 .MODEL DBREAKMOD D (RS = 1.65e-1 IKF = 30 TRS1 = 1.15e-4 TRS2 = 2.27e-6)
 .MODEL DPLCAPMOD D (CJO = 5.40e-9 IS = 1e-30 N=1 M = 0.88)
 .MODEL MMEDMOD NMOS (VTO = 3.29 KP = 5.5 IS = 1e-30 N = 10 TOX = 1 L = 1u W = 1u RG = 0.36)
 .MODEL MSTROMOD NMOS (VTO = 3.83 KP = 123 IS = 1e-30 N = 10 TOX = 1 L = 1u W = 1u)
 .MODEL MWEAKMOD NMOS (VTO = 2.90 KP = 0.04 IS = 1e-30 N = 10 TOX = 1 L = 1u W = 1u RG = 3.6)
 .MODEL RBREAKMOD RES (TC1 = 1.15e-3 TC2 = 2.0e-7)
 .MODEL RDRAINMOD RES (TC1 = 1.37e-2 TC2 = 3.85e-5)
 .MODEL RSLCMOD RES (TC1 = 1.45e-4 TC2 = 2.11e-6)
 .MODEL RSOURCEMOD RES (TC1 = 0 TC2 = 0)
 .MODEL RVTHRESMOD RES (TC1 = -3.7e-3 TC2 = -1.6e-5)
 .MODEL RVTEMPMOD RES (TC1 = -2.4e-3 TC2 = 7e-7)

.MODEL S1AMOD VSWITCH (RON = 1e-5 ROFF = 0.1 VON = -6.9 VOFF= -3.9)
 .MODEL S1BMOD VSWITCH (RON = 1e-5 ROFF = 0.1 VON = -3.9 VOFF= -6.9)
 .MODEL S2AMOD VSWITCH (RON = 1e-5 ROFF = 0.1 VON = -2.99 VOFF= 2.39)
 .MODEL S2BMOD VSWITCH (RON = 1e-5 ROFF = 0.1 VON = 2.39 VOFF= -2.99)

.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, written by William J. Hepp and C. Frank Wheatley.



SPICE Thermal Model

REV 5 February 1999

HUFA75344

CTHERM1 th 6 5.0e-3
 CHERM2 6 5 1.0e-2
 CHERM3 5 4 1.3e-2
 CHERM4 4 3 1.5e-2
 CHERM5 3 2 2.2e-2
 CHERM6 2 tl 8.5e-2

RHERM1 th 6 6.0e-4
 RHERM2 6 5 3.5e-3
 RHERM3 5 4 2.5e-2
 RHERM4 4 3 4.8e-2
 RHERM5 3 2 1.6e-1
 RHERM6 2 tl 1.8e-1

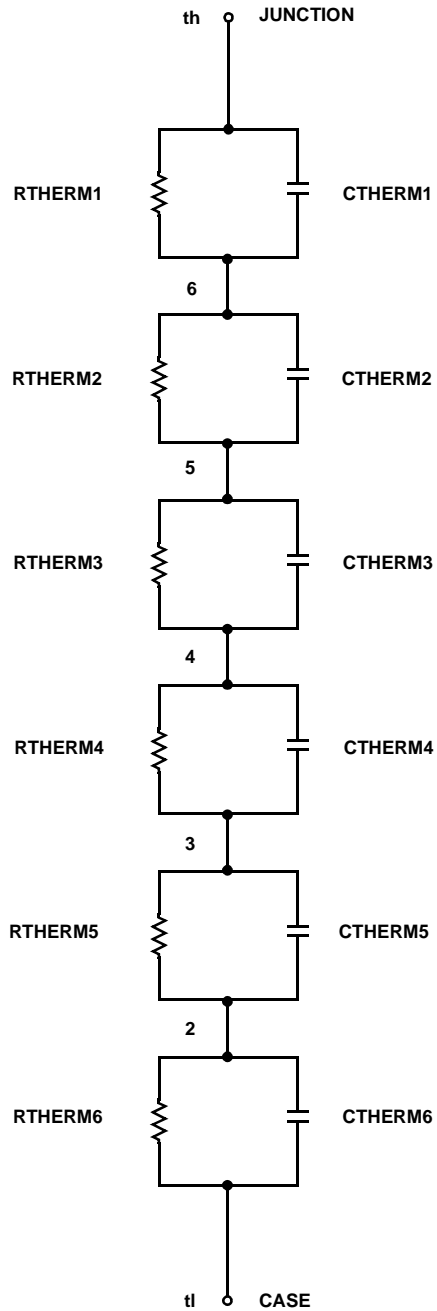
SABER Thermal Model

SABER thermal model HUFA75344

template thermal_model th tl
 thermal_c th, tl

```
{
ctherm.ctherm1 th 6 = 5.0e-3
ctherm.ctherm2 6 5 = 1.0e-2
ctherm.ctherm3 5 4 = 1.3e-2
ctherm.ctherm4 4 3 = 1.5e-2
ctherm.ctherm5 3 2 = 2.2e-2
ctherm.ctherm6 2 tl = 5.5e-2
```






```
rtherm.rtherm1 th 6 = 6.0e-4
rtherm.rtherm2 6 5 = 3.5e-3
rtherm.rtherm3 5 4 = 2.5e-2
rtherm.rtherm4 4 3 = 4.8e-2
rtherm.rtherm5 3 2 = 1.6e-1
rtherm.rtherm6 2 tl = 1.8e-1
}
```





TRADEMARKS

The following includes registered and unregistered trademarks and service marks, owned by Fairchild Semiconductor and/or its global subsidiaries, and is not intended to be an exhaustive list of all such trademarks.

- | | | | |
|---|---|---|---|
| 2Cool™ | FPST™ |  | Sync-Lock™ |
| AccuPower™ | F-PFST™ | PowerTrench® |  |
| AX-CAP®* | FRFET® | PowerXS™ | TinyBoost™ |
| BitSiC™ | Global Power Resource SM | Programmable Active Droop™ | TinyBuck™ |
| Build it Now™ | Green Bridge™ | QFET® | TinyCalc™ |
| CorePLUSTM | Green FPS™ | QS™ | TinyLogic® |
| CorePOWER™ | Green FPS™ e-Series™ | Quiet Series™ | TINYOPTO™ |
| CROSSVOLT™ | Gmax™ | RapidConfigure™ | TinyPower™ |
| CTL™ | GTO™ |  | TinyPWM™ |
| Current Transfer Logic™ | IntelliMAX™ | Saving our world, 1mW/W/kW at a time™ | TinyWire™ |
| DEUXPEED® | ISOPANAR™ | SignalWise™ | TranSiC® |
| Dual Cool™ | Marking Small Speakers Sound Louder and Better™ | SmartMax™ | TriFault Detect™ |
| EcoSPARK® | MegaBuck™ | SMART START™ | TRUECURRENT®* |
| EfficientMax™ | MICROCOUPLER™ | Solutions for Your Success™ | µSerDes™ |
| ESBC™ | MicroFET™ | SPM® |  |
|  | MicroPak™ | STEALTH™ | UHC® |
| Fairchild® | MicroPak2™ | SuperFET® | Ultra FRFET™ |
| Fairchild Semiconductor® | MillerDrive™ | SuperSOT™-3 | UniFET™ |
| FACT Quiet Series™ | MotionMax™ | SuperSOT™-6 | VCX™ |
| FACT® | mWSaver™ | SuperSOT™-8 | VisualMax™ |
| FAST® | OptoHiT™ | SupreMOS® | VoltagePlus™ |
| FastvCore™ | OPTOLOGIC® | SyncFET™ | XST™ |
| FETBench™ | OPTOPLANAR® | | |

*Trademarks of System General Corporation, used under license by Fairchild Semiconductor.

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. THESE SPECIFICATIONS DO NOT EXPAND THE TERMS OF FAIRCHILD'S WORLDWIDE TERMS AND CONDITIONS, SPECIFICALLY THE WARRANTY THEREIN, WHICH COVERS THESE PRODUCTS.

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 here in:

- 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, and (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 a significant injury of the user.
- A critical component in 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.

ANTI-COUNTERFEITING POLICY

Fairchild Semiconductor Corporation's Anti-Counterfeiting Policy. Fairchild's Anti-Counterfeiting Policy is also stated on our external website, www.Fairchildsemi.com, under Sales Support. Counterfeiting of semiconductor parts is a growing problem in the industry. All manufactures of semiconductor products are experiencing counterfeiting of their parts. Customers who inadvertently purchase counterfeit parts experience many problems such as loss of brand reputation, substandard performance, failed application, and increased cost of production and manufacturing delays. Fairchild is taking strong measures to protect ourselves and our customers from the proliferation of counterfeit parts. Fairchild strongly encourages customers to purchase Fairchild parts either directly from Fairchild or from Authorized Fairchild Distributors who are listed by country on our web page cited above. Products customers buy either from Fairchild directly or from Authorized Fairchild Distributors are genuine parts, have full traceability, meet Fairchild's quality standards for handling and storage and provide access to Fairchild's full range of up-to-date technical and product information. Fairchild and our Authorized Distributors will stand behind all warranties and will appropriately address and warranty issues that may arise. Fairchild will not provide any warranty coverage or other assistance for parts bought from Unauthorized Sources. Fairchild is committed to combat this global problem and encourage our customers to do their part in stopping this practice by buying direct or from authorized distributors.

PRODUCT STATUS DEFINITIONS

Definition of Terms

Datasheet Identification	Product Status	Definition
Advance Information	Formative / In Design	Datasheet contains the design specifications for product development. Specifications may change in any manner without notice.
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.