

# MOSFET – Power, N-Channel, Ultrafet

150 V, 75 A, 16 mΩ

## HUF75852G3

### Features

- Ultra Low On-Resistance
  - ◆  $r_{DS(ON)} = 0.016 \Omega$ ,  $V_{GS} = 10 \text{ V}$
- Simulation Models
  - ◆ Temperature Compensated PSPICE™ and SABER™ Electrical Models
  - ◆ Spice and SABER Thermal Impedance Models
  - ◆ [www.onsemi.com](http://www.onsemi.com)
- Peak Current vs Pulse Width Curve
- UIS Rating Curve
- This Device is Pb-Free, Halogen Free/BFR Free and is RoHS Compliant

### Packing

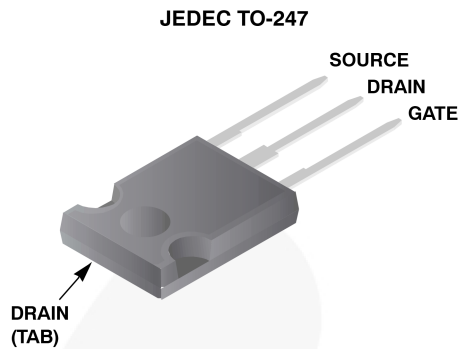
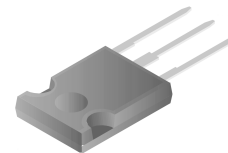
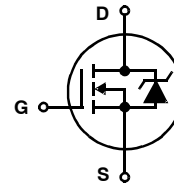


Figure 1.



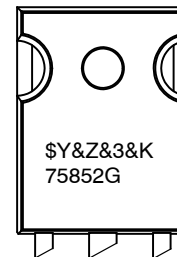
ON Semiconductor®

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TO-247-3LD  
CASE 340CK

### MARKING DIAGRAMS



\$Y = ON Semiconductor Logo  
 &Z = Assembly Plant Code  
 &3 = Data Code (Year & Week)  
 &K = Lot  
 75852G = Specific Device Code

### ORDERING INFORMATION

Part Number	Package	Brand
HUF75852G3	TO-247-3LD	75852G

# HUF75852G3

## ABSOLUTE MAXIMUM RATINGS $T_C = 25^\circ\text{C}$ unless otherwise noted

Description	Symbol	Ratings	Units
Drain to Source Voltage (Note 1)	$V_{DSS}$	150	V
Drain to Gate Voltage ( $R_{GS} = 20\text{ k}\Omega$ ) (Note 1)	$V_{DGR}$	150	V
Gate to Source Voltage	$V_{GS}$	+20	V
Drain Current – Continuous ( $T_C = 25^\circ\text{C}$ , $V_{GS} = 10\text{ V}$ ) (Figure 2) – Continuous ( $T_C = 100^\circ\text{C}$ , $V_{GS} = 10\text{ V}$ ) (Figure 2) – Pulsed Drain Current	$I_D$ $I_D$ $I_{DM}$	75 75 Figure 4	A A
Pulsed Avalanche Rating	UIS	Figures 6, 14, 15	
Power Dissipation – Derate Above $25^\circ\text{C}$	$P_D$	500 3.33	W W/ $^\circ\text{C}$
Operating and Storage Temperature	$T_J$ , $T_{STG}$	-55 to 175	$^\circ\text{C}$
Maximum Temperature for Soldering – Leads at 0.063 in (1.6 mm) from Case for 10 s – Package Body for 10 s, See Techbrief TB334	$T_L$ $T_{pkg}$	300 260	$^\circ\text{C}$ $^\circ\text{C}$

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

1.  $T_J = 25^\circ\text{C}$  to  $150^\circ\text{C}$ .

# HUF75852G3

ELECTRICAL SPECIFICATIONS  $T_J = 25^\circ\text{C}$  unless otherwise noted

SYMBOL	PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNITS
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## OFF STATE SPECIFICATIONS

$BV_{DSS}$	Drain to Source Breakdown Voltage	$I_D = 250 \mu\text{A}$ , $V_{GS} = 0 \text{ V}$ (Figure 11)	150	-	-	V
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 140 \text{ V}$ , $V_{GS} = 0 \text{ V}$	-	-	1	$\mu\text{A}$
		$V_{DS} = 135 \text{ V}$ , $V_{GS} = 0 \text{ V}$ , $T_C = 150^\circ\text{C}$	-	-	250	$\mu\text{A}$
$I_{GSS}$	Gate to Source Leakage Current	$V_{GS} = \pm 20 \text{ V}$	-	-	$\pm 100$	nA

## ON STATE SPECIFICATIONS

$V_{GS(TH)}$	Gate to Source Threshold Voltage	$V_{GS} = V_{DS}$ , $I_D = 250 \mu\text{A}$ (Figure 10)	2	-	4	V
$r_{DS(ON)}$	Drain to Source On Resistance	$I_D = 75 \text{ A}$ , $V_{GS} = 10 \text{ V}$ (Figure 9)	-	0.013	0.016	m $\Omega$

## THERMAL SPECIFICATIONS

$R_{\theta JC}$	Thermal Resistance Junction to Case	TO-247	-	-	0.30	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance Junction to Ambient		-	-	30	$^\circ\text{C/W}$

## SWITCHING SPECIFICATIONS ( $V_{GS} = 10 \text{ V}$ )

$t_{ON}$	Turn-On Time	$V_{DD} = 75 \text{ V}$ , $I_D \cong 75 \text{ A}$ , $V_{GS} = 10 \text{ V}$ , $R_{GS} = 2.0 \Omega$ (Figures 18, 19)	-	-	260	ns
$t_{d(ON)}$	Turn-On Delay Time		-	22	-	ns
$t_r$	Rise Time		-	151	-	ns
$t_{d(OFF)}$	Turn-Off Delay Time		-	82	-	ns
$t_f$	Fall Time		-	107	-	ns
$t_{OFF}$	Turn-Off Time		-	-	285	ns

## GATE CHARGE SPECIFICATIONS

$Q_{g(TOT)}$	Total Gate Charge	$V_{GS} = 0 \text{ V to } 20 \text{ V}$	$V_{DD} = 75 \text{ V}$ , $I_D = 75 \text{ A}$ , $I_{g(REF)} = 1.0 \text{ mA}$ (Figures 13, 16, 17)	-	400	480	nC
$Q_{g(10)}$	Gate Charge at 10 V	$V_{GS} = 0 \text{ V to } 10 \text{ V}$		-	215	260	nC
$Q_{g(TH)}$	Threshold Gate Charge	$V_{GS} = 0 \text{ V to } 2 \text{ V}$		-	15	17.5	nC
$Q_{gs}$	Gate to Source Gate Charge			-	25	-	nC
$Q_{gd}$	Gate to Drain "Miller" Charge			-	66	-	nC

## CAPACITANCE SPECIFICATIONS

$C_{ISS}$	Input Capacitance	$V_{DS} = 25 \text{ V}$ , $V_{GS} = 0 \text{ V}$ , $f = 1 \text{ MHz}$ (Figure 12)	-	7690	-	pF
$C_{OSS}$	Output Capacitance		-	1650	-	pF
$C_{RSS}$	Reverse Transfer Capacitance		-	535	-	pF

## SOURCE TO DRAIN DIODE SPECIFICATIONS

SYMBOL	PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNITS
$V_{SD}$	Source to Drain Diode Voltage	$I_{SD} = 75 \text{ A}$	-	-	1.25	V
		$I_{SD} = 35 \text{ A}$	-	-	1.00	V
$t_{rr}$	Reverse Recovery Time	$I_{SD} = 75 \text{ A}$ , $dI_{SD}/dt = 100 \text{ A}/\mu\text{s}$	-	-	260	ns
$Q_{RR}$	Reverse Recovered Charge	$I_{SD} = 75 \text{ A}$ , $dI_{SD}/dt = 100 \text{ A}/\mu\text{s}$	-	-	183	nC

# HUF75852G3

## TYPICAL PERFORMANCE CURVES

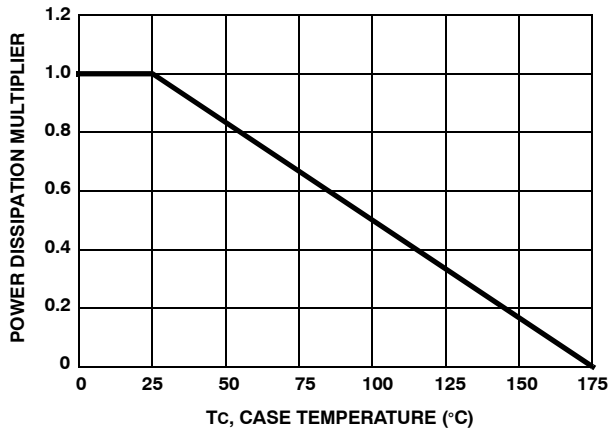


Figure 1. NORMALIZED POWER DISSIPATION vs CASE TEMPERATURE

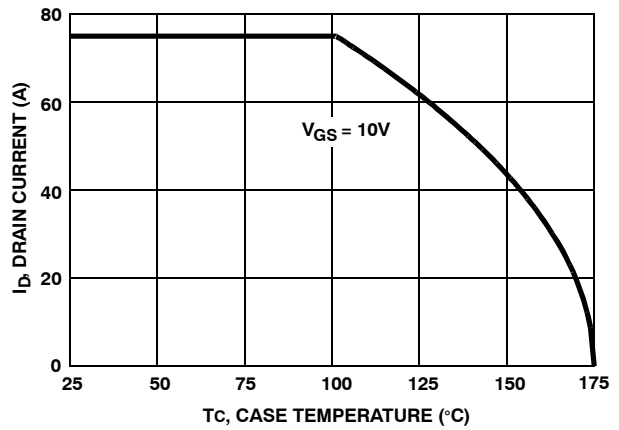


Figure 2. MAXIMUM CONTINUOUS DRAIN CURRENT vs CASE TEMPERATURE

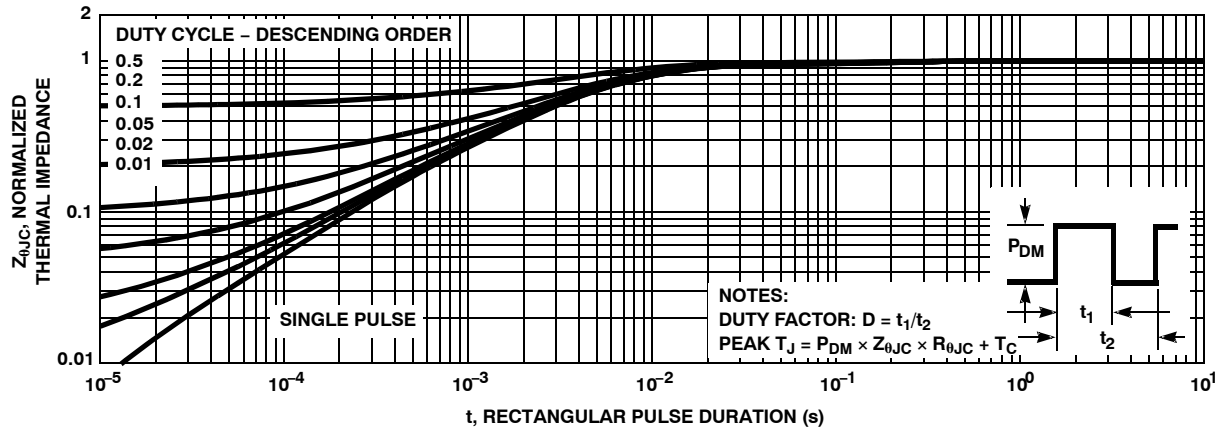


Figure 3. NORMALIZED MAXIMUM TRANSIENT THERMAL IMPEDANCE

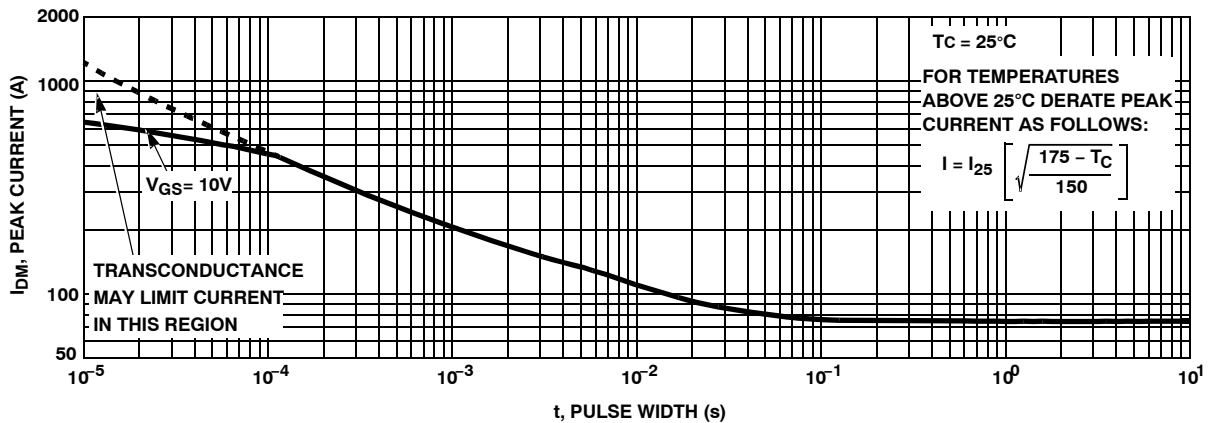


Figure 4. PEAK CURRENT CAPABILITY

TYPICAL PERFORMANCE CHARACTERISTICS (continued)

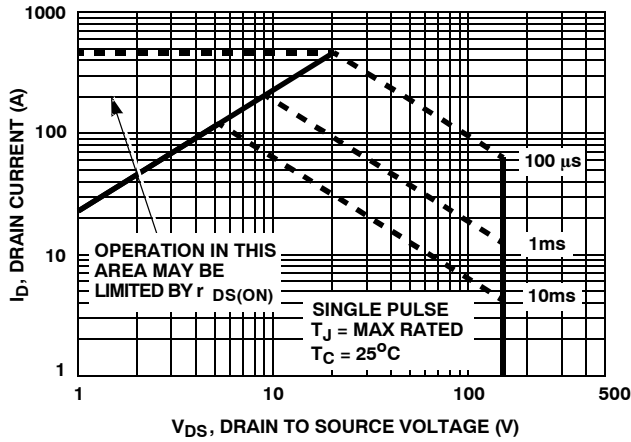
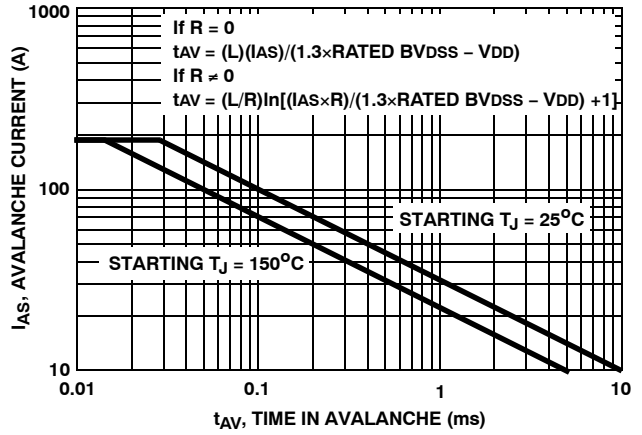


Figure 5. FORWARD BIAS SAFE OPERATING AREA



NOTE: Refer to Fairchild Application Notes AN9321 and AN9322.

Figure 6. UNCLAMPED INDUCTIVE SWITCHING CAPABILITY

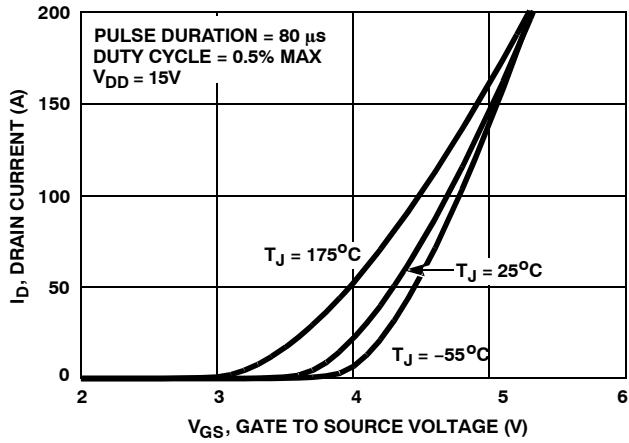


Figure 7. TRANSFER CHARACTERISTICS

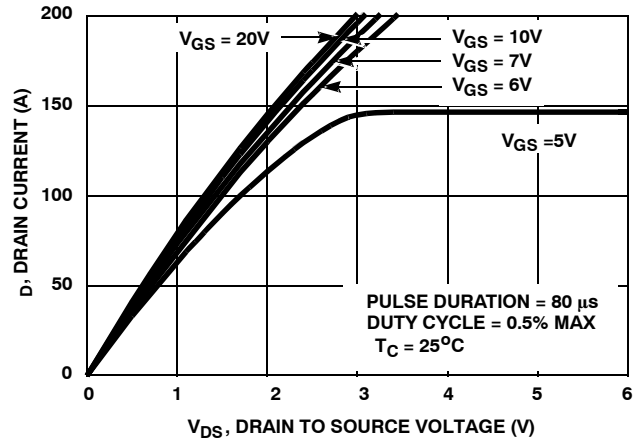


Figure 8. SATURATION CHARACTERISTICS

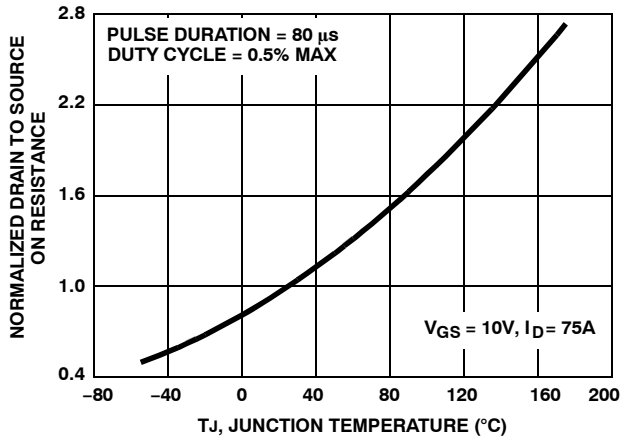


Figure 9. NORMALIZED DRAIN TO SOURCE ON RESISTANCE vs JUNCTION TEMPERATURE

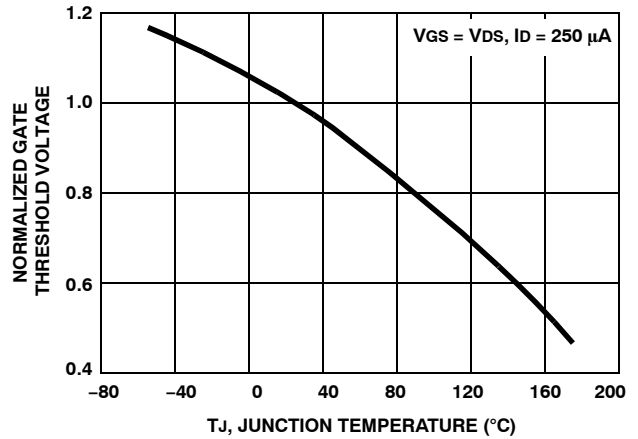


Figure 10. NORMALIZED GATE THRESHOLD VOLTAGE vs JUNCTION TEMPERATURE

# HUF75852G3

## TYPICAL PERFORMANCE CHARACTERISTICS (continued)

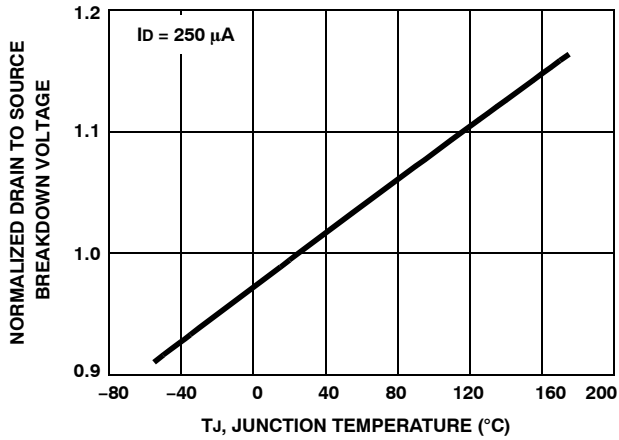


Figure 11. NORMALIZED DRAIN TO SOURCE BREAKDOWN VOLTAGE vs JUNCTION TEMPERATURE

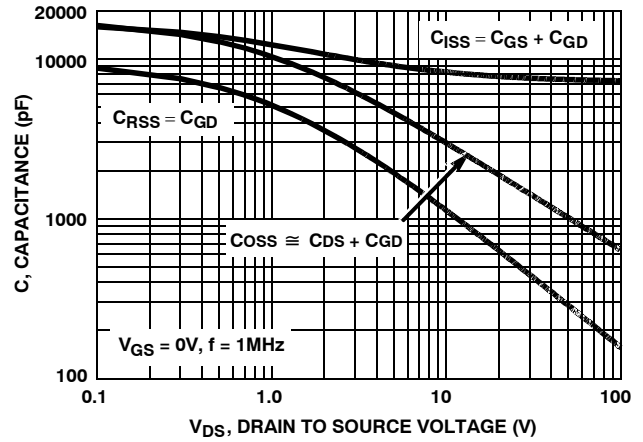
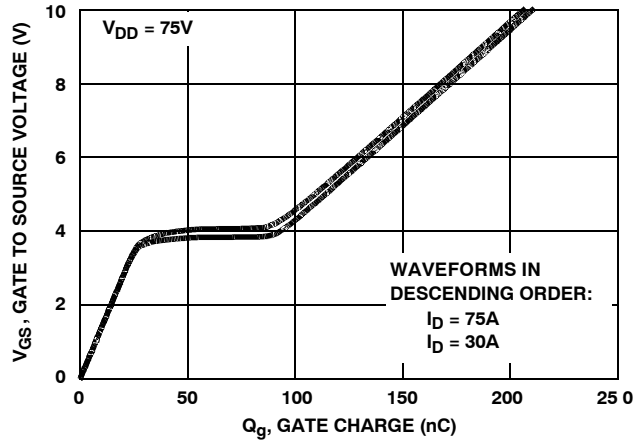


Figure 12. CAPACITANCE vs DRAIN TO SOURCE VOLTAGE



NOTE: Refer to Fairchild Application Notes AN7254 and AN7260.

Figure 13. GATE CHARGE WAVEFORMS FOR CONSTANT GATE CURRENT

TEST CIRCUITS AND WAVEFORMS

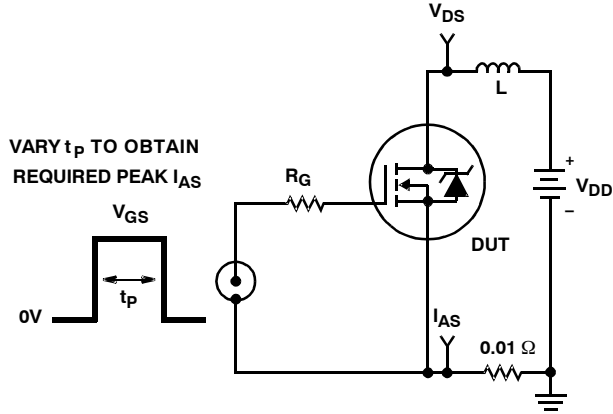


Figure 14. UNCLAMPED ENERGY TEST CIRCUIT

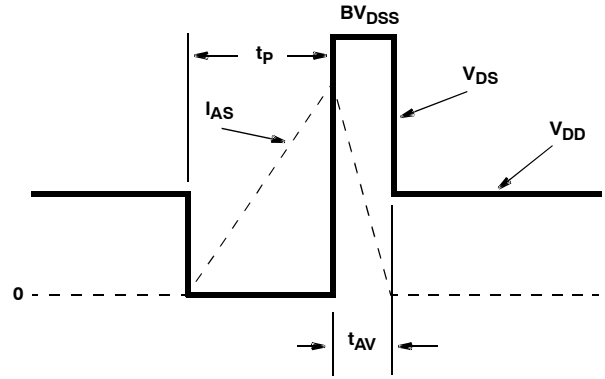


Figure 15. UNCLAMPED ENERGY WAVEFORMS

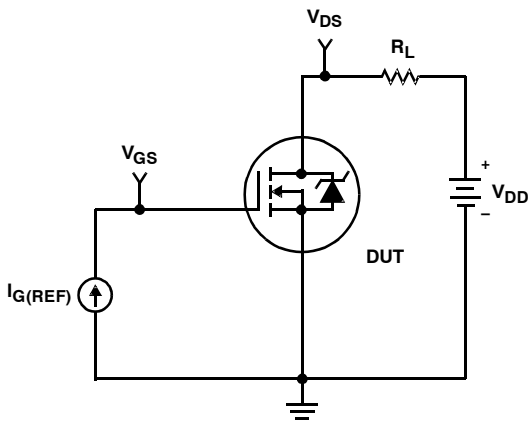


Figure 16. GATE CHARGE TEST CIRCUIT

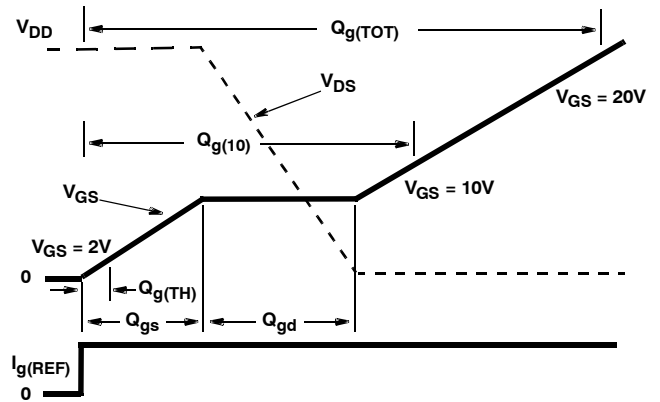


Figure 17. GATE CHARGE WAVEFORM

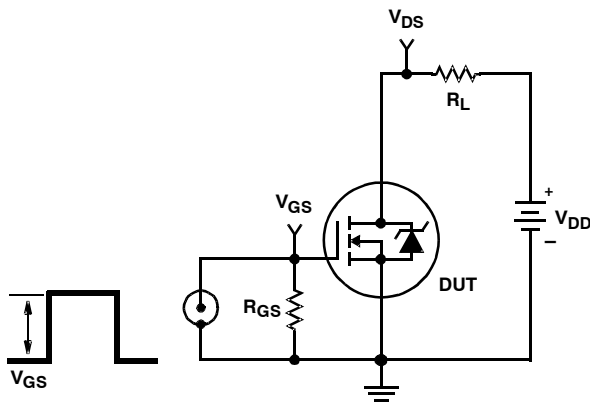


Figure 18. SWITCHING TIME TEST CIRCUIT

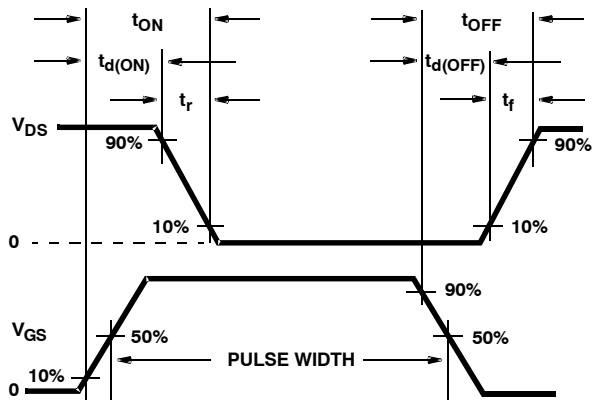


Figure 19. SWITCHING TIME WAVEFORM

# HUF75852G3

## PSPICE Electrical Model

.SUBCKT HUF75852 2 1 3 ; rev 26 Oct 1999

CA 12 8 12.0e-9  
 CB 15 14 12.0e-9  
 CIN 6 8 7.15e-9

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

EBREAK 11 7 17 18 159.2  
 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 1.0e-9  
 LGATE 1 9 7.46e-9  
 LSOURCE 3 7 3.87e-9

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 9.50e-3  
 RGATE 9 20 0.80  
 RLDRAIN 2 5 10  
 RLGATE 1 9 74.6  
 RLSOURCE 3 7 38.7  
 RSLC1 5 51 RSLCMOD 1e-6  
 RSLC2 5 50 1e3  
 RSOURCE 8 7 RSOURCEMOD 2.37e-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

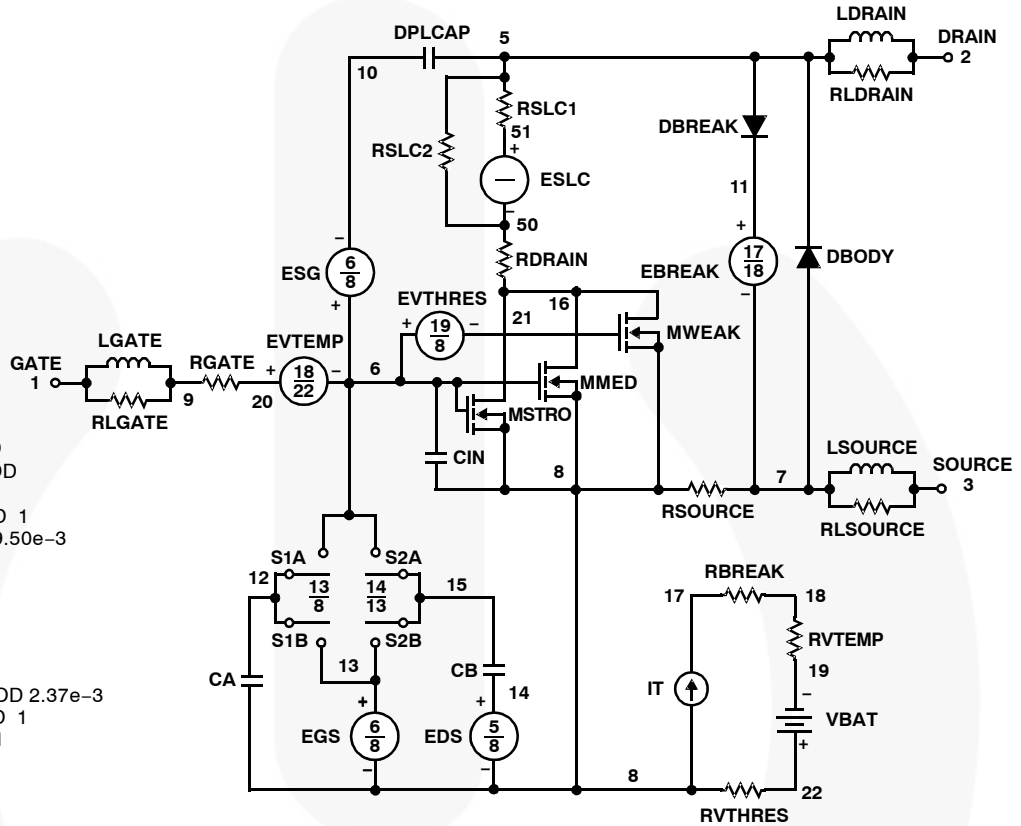
ESLC 51 50 VALUE={{(V(5,51) / ABS(V(5,51))) \* (PWR(V(5,51)) / (1e-6\*245), 2.5)}}

.MODEL DBODYMOD D (IS = 6.03e-12 RS = 2.17e-3 TRS1 = 1.97e-3 TRS2 = 1.03e-6 CJO = 7.91e-9 TT = 1.69e-7 M = 0.60)  
 .MODEL DBREAKMOD D (RS = 3.53e-1 TRS1 = 0 TRS2 = 0)  
 .MODEL DPLCAPMOD D (CJO = 9.52e-9 IS = 1e-3 0N = 1 M = 0.88)  
 .MODEL MMEDMOD NMOS (VTO = 3.05 KP = 8.50 IS = 1e-30 N = 10 TOX = 1 L = 1u W = 1u RG = 0.80)  
 .MODEL MSTROMOD NMOS (VTO = 3.53 KP = 215 IS = 1e-30 N = 10 TOX = 1 L = 1u W = 1u)  
 .MODEL MWEAKMOD NMOS (VTO = 2.63 KP = 0.075 IS = 1e-30 N = 10 TOX = 1 L = 1u W = 1u RG = 8.0)  
 .MODEL RBREAKMOD RES (TC1 = 1.12e-3 TC2 = -1.00e-7)  
 .MODEL RDRAINMOD RES (TC1 = 1.03e-2 TC2 = 3.04e-5)  
 .MODEL RSLCMOD RES (TC1 = 2.52e-3 TC2 = 0)  
 .MODEL RSOURCEMOD RES (TC1 = 1.01e-3 TC2 = 0)  
 .MODEL RVTHRESMOD RES (TC1 = -3.65e-3 TC2 = -1.55e-5)  
 .MODEL RVTEMPMOD RES (TC1 = -2.85e-3 TC2 = 0)

.MODEL S1AMOD VSWITCH (RON = 1e-5 ROFF = 0.1 VON = -3.5 VOFF = -3.0)  
 .MODEL S1BMOD VSWITCH (RON = 1e-5 ROFF = 0.1 VON = -3.0 VOFF = -3.5)  
 .MODEL S2AMOD VSWITCH (RON = 1e-5 ROFF = 0.1 VON = -2.5 VOFF = -0.5)  
 .MODEL S2BMOD VSWITCH (RON = 1e-5 ROFF = 0.1 VON = -0.5 VOFF = -2.5)

.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 W. Heatley.







**SPICE Thermal Model**

REV 19 Oct 1999

HUF75852T

CTHERM1 th 6 9.75e-3  
 CTHERM2 6 5 3.90e-2  
 CTHERM3 5 4 2.50e-2  
 CTHERM4 4 3 2.95e-2  
 CTHERM5 3 2 6.55e-2  
 CTHERM6 2 tl 12.55

RTHERM1 th 6 1.96e-3  
 RTHERM2 6 5 4.89e-3  
 RTHERM3 5 4 1.38e-2  
 RTHERM4 4 3 7.73e-2  
 RTHERM5 3 2 1.17e-1  
 RTHERM6 2 tl 1.55e-2

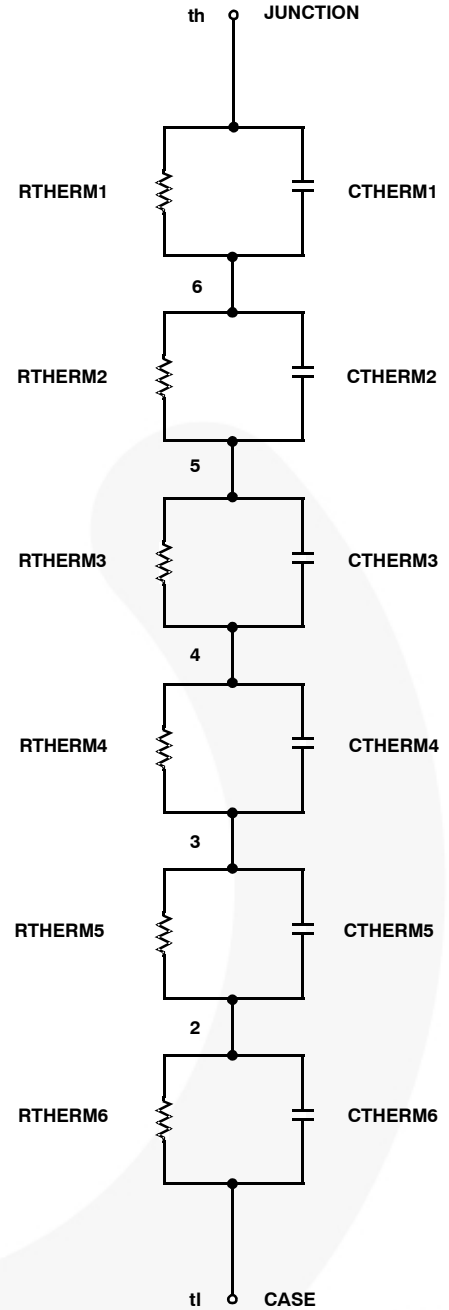
**SABER Thermal Model**

SABER thermal model HUF75852T

```

template thermal_model th tl
thermal_c th, tl
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  ctherm.ctherm1 th 6 = 9.75e-3
  ctherm.ctherm2 6 5 = 3.90e-2
  ctherm.ctherm3 5 4 = 2.50e-2
  ctherm.ctherm4 4 3 = 2.95e-2
  ctherm.ctherm5 3 2 = 6.55e-2
  ctherm.ctherm6 2 tl = 12.55

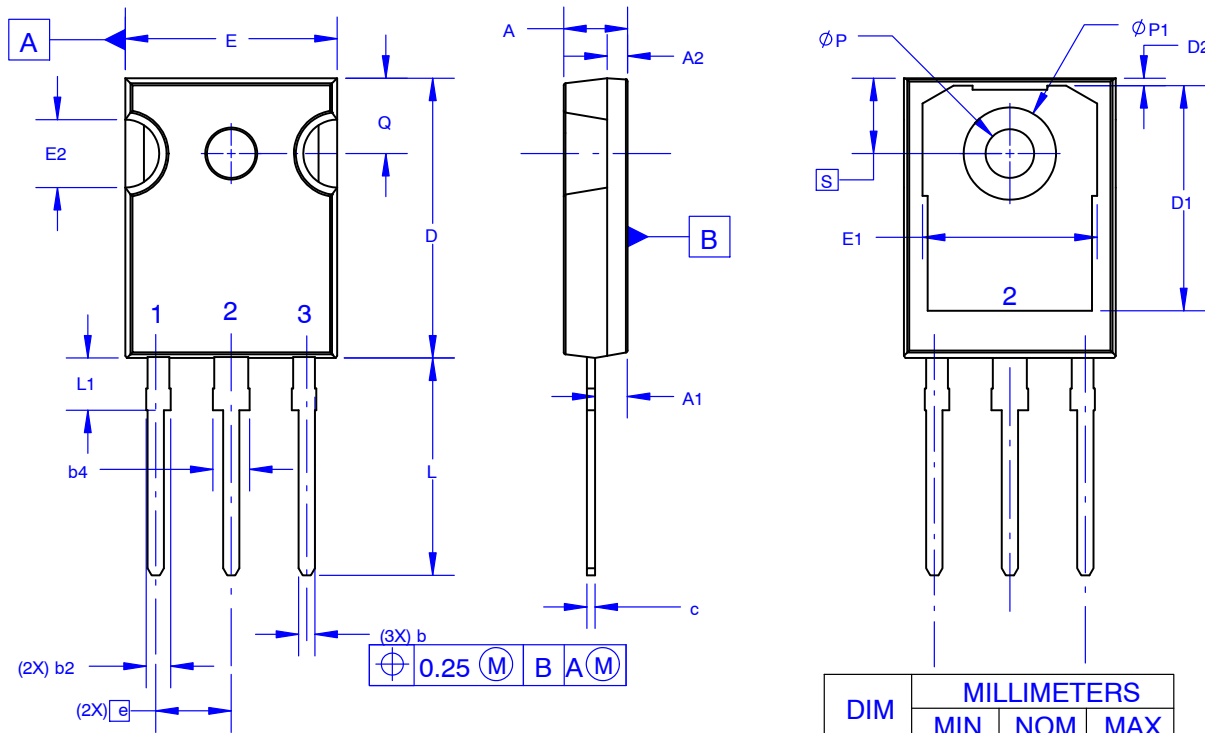
  rtherm.rtherm1 th 6 = 1.96e-3
  rtherm.rtherm2 6 5 = 4.89e-3
  rtherm.rtherm3 5 4 = 1.38e-2
  rtherm.rtherm4 4 3 = 7.73e-2
  rtherm.rtherm5 3 2 = 1.17e-1
  rtherm.rtherm6 2 tl = 1.55e-2
}
    
```



PSPICE is a trademark of MicroSim Corporation.  
 Saber is a registered trademark of Sabremark Limited Partnership.

**TO-247-3LD SHORT LEAD**  
**CASE 340CK**  
**ISSUE A**

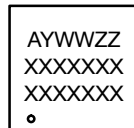
DATE 31 JAN 2019



NOTES: UNLESS OTHERWISE SPECIFIED.

- A. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.
- B. ALL DIMENSIONS ARE IN MILLIMETERS.
- C. DRAWING CONFORMS TO ASME Y14.5 - 2009.
- D. DIMENSION A1 TO BE MEASURED IN THE REGION DEFINED BY L1.
- E. LEAD FINISH IS UNCONTROLLED IN THE REGION DEFINED BY L1.

**GENERIC MARKING DIAGRAM\***



- XXXX = Specific Device Code
- A = Assembly Location
- Y = Year
- WW = Work Week
- ZZ = Assembly Lot Code

\*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "•", may or may not be present. Some products may not follow the Generic Marking.

DIM	MILLIMETERS		
	MIN	NOM	MAX
A	4.58	4.70	4.82
A1	2.20	2.40	2.60
A2	1.40	1.50	1.60
b	1.17	1.26	1.35
b2	1.53	1.65	1.77
b4	2.42	2.54	2.66
c	0.51	0.61	0.71
D	20.32	20.57	20.82
D1	13.08	~	~
D2	0.51	0.93	1.35
E	15.37	15.62	15.87
E1	12.81	~	~
E2	4.96	5.08	5.20
e	~	5.56	~
L	15.75	16.00	16.25
L1	3.69	3.81	3.93
ØP	3.51	3.58	3.65
ØP1	6.60	6.80	7.00
Q	5.34	5.46	5.58
S	5.34	5.46	5.58

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