ON Semiconductor

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MOSFET – Power, N-Channel, Ultrafet

55 V, 75 A, 8 mΩ

HUF75344G3, HUF75344P3

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.

Features

- 75 A, 55 V
- Simulation Models
  - Temperature Compensated PSPICE™ and SABER™ Models
  - Thermal Impedance PSPICE and SABER Models Available on the Web at: www.onsemi.com
- Peak Current vs Pulse Width Curve
- UIS Rating Curve
- Related Literature
  - TB334, “Guidelines for Soldering Surface Mount Components to PC Boards”
- These Devices are Pb−Free, Halogen Free/BFR Free and are RoHS Compliant

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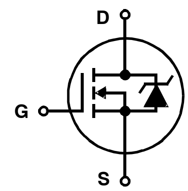
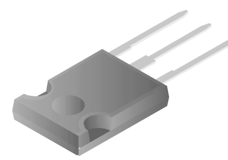
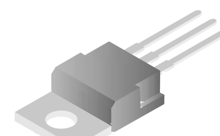


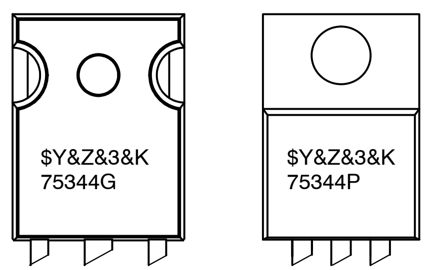


TO−247−3LD
CASE 340CK



TO−220−3LD
CASE 340AT

MARKING DIAGRAMS

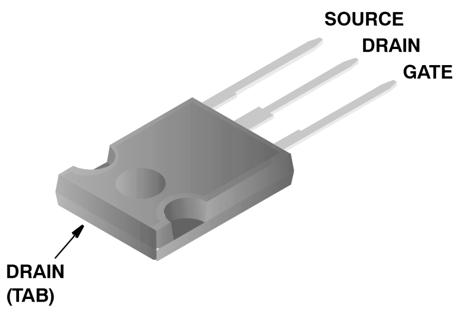


$Y = ON Semiconductor Logo
&Z = Assembly Plant Code
&3 = Data Code (Year & Week)
&K = Lot
75344G, 75344P = Specific Device Code

ORDERING INFORMATION

Part Number	Package	Brand
HUF75344G3	TO−247−3LD	75344G
HUF75344P3	TO−220−3LD	75344P

PACKING



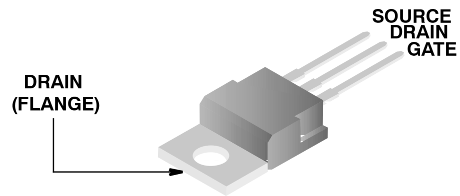


Figure 1.

ABSOLUTE MAXIMUM RATINGS T_C = 25°C unless otherwise noted

Description	Symbol	Ratings	Units
Drain to Source Voltage (Note 1)	V_{DSS}	55	V
Drain to Gate Voltage (R_{GS} = 20 kW) (Note 1)	V_{DGR}	55	V
Gate to Source Voltage	V_{GS}	+20	V
Drain Current – Continuous (Figure 2) – Pulsed Drain Current	I_D I_{DM}	75 Figure 4	A
Pulsed Avalanche Rating	E_{AS}	Figure 6	V
Power Dissipation – Derate Above 25°C	P_D	285 1.90	W/°C
Operating and Storage Temperature	T_J, T_{STG}	–55 to 175	°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 334	T_L T_{pkg}	300 260	°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. TJ = 25°C to 150°C.

ELECTRICAL CHARACTERISTICS OF THE IGBT T_J = 25 °C unless otherwise noted

SYMBOL	PARAMETER	TEST CONDITIONS		MIN	TYP	MAX	UNITS
OFF STATE SPECIFICATIONS							
BV_{DSS}	Drain to Source Breakdown Voltage	I_D = 250 μA, V_{GS} = 0 V (Figure 11)		55	–	–	V
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 50 V, V_{GS} = 0 V		–	–	1	μA
		V_{DS} = 45 V, V_{GS} = 0 V, T_C = 150°C		–	–	250	μA
I_{GSS}	Gate to Source Leakage Current	V_{GS} = ±20 V		–	–	±100	nA
ON STATE SPECIFICATIONS							
$V_{GS(TH)}$	Gate to Source Threshold Voltage	V_{GS} = V_{DS}, I_D = 250 μA (Figure 10)		2	–	4	V
$r_{DS(ON)}$	Drain to Source On Resistance	I_D = 75 A, V_{GS} = 10 V (Figure 9)		–	6.5	8.0	mΩ
THERMAL SPECIFICATIONS							
$R_{\theta JC}$	Thermal Resistance Junction to Case	(Figure 3)		–	–	0.52	°C/W
$R_{\theta JA}$	Thermal Resistance Junction to Ambient	TO−247		–	–	30	°C/W
		TO−220		–	–	62	°C/W
SWITCHING SPECIFICATIONS (V_{GS} = 10 V)							
t_{ON}	Turn−On Time	V_{DD} = 30 V, $I_D \cong$ 75 A, R_L = 0.4 Ω, V_{GS} = 10 V, R_{GS} = 3.0 Ω		–	–	187	ns
$t_{d(ON)}$	Turn−On Delay Time			–	13	–	ns
t_r	Rise Time			–	125	–	ns
$td_{(OFF)}$	Turn−Off Delay Time			–	46	–	ns
t_f	Fall Time			–	57	–	ns
t_{OFF}	Turn−Off Time			–	–	147	ns
GATE CHARGE SPECIFICATIONS							
$Q_{g(TOT)}$	Total Gate Charge	V_{GS} = 0 V to 20 V	V_{DD} = 30 V, $I_D \cong$ 75 A, R_L = 0.4 Ω, $I_{g(REF)}$ = 1.0 mA (Figure 13)	–	175	210	nC
$Q_{g(10)}$	Gate Charge at 10 V	V_{GS} = 0 V to 10 V		–	90	108	nC
$Q_{g(TH)}$	Threshold Gate Charge	V_{GS} = 0 V to 2 V		–	5.9	7.0	nC
Q_{gs}	Gate to Source Gate Charge			–	14	–	nC
Q_{gd}	Reverse Transfer Capacitance			–	39	–	nC
CAPACITANCE SPECIFICATIONS							
C_{ISS}	Input Capacitance	V_{DS} = 25 V, V_{GS} = 0 V, f = 1 MHz (Figure 12)		–	3200	–	pF
C_{OSS}	Output Capacitance			–	1170	–	pF
C_{RSS}	Reverse Transfer Capacitance			–	310	–	pF

SOURCE TO DRAIN DIODE SPECIFICATIONS

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

TYPICAL PERFORMANCE CURVES

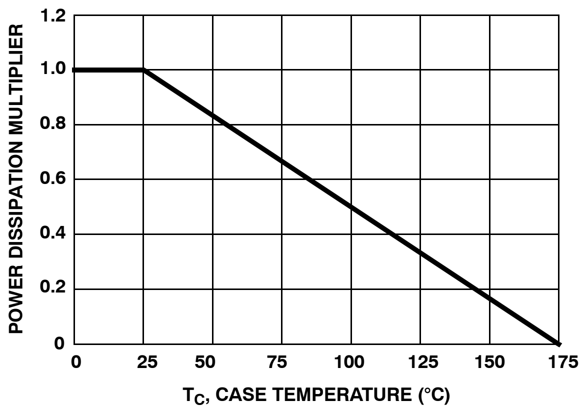


Figure 1. NORMALIZED POWER DISSIPATION vs CASE TEMPERATURE

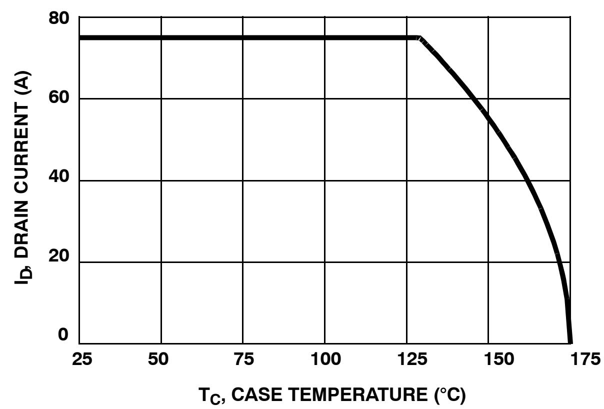


Figure 2. MAXIMUM CONTINUOUS DRAIN CURRENT vs CASE TEMPERATURE

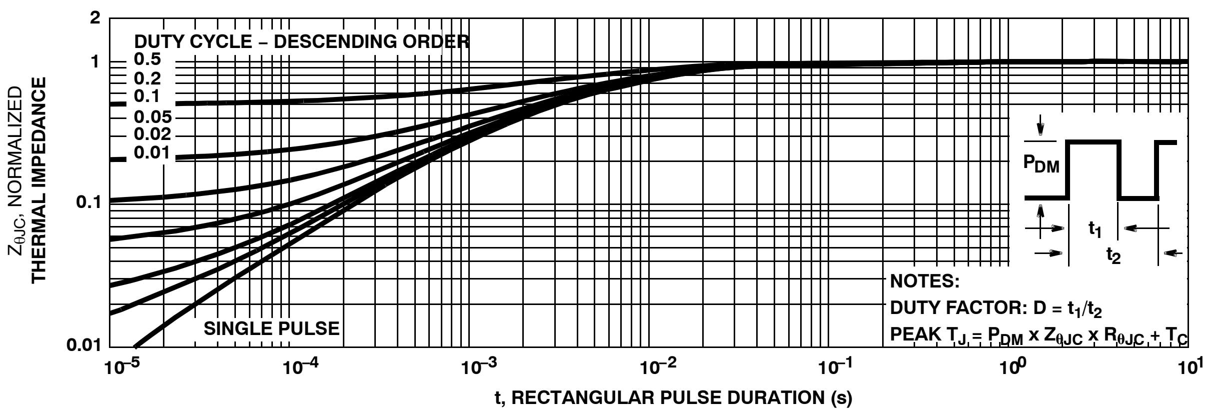


Figure 3. NORMALIZED MAXIMUM TRANSIENT THERMAL IMPEDANCE

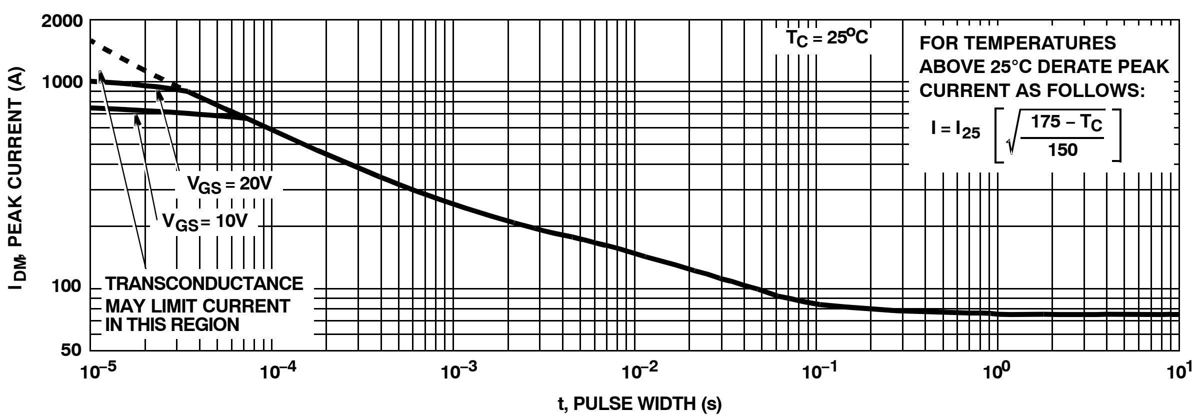


Figure 4. PEAK CURRENT CAPABILITY

TYPICAL PERFORMANCE CHARACTERISTICS (continued)

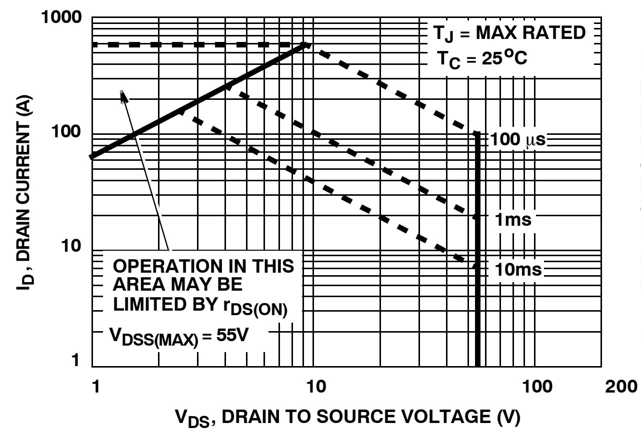
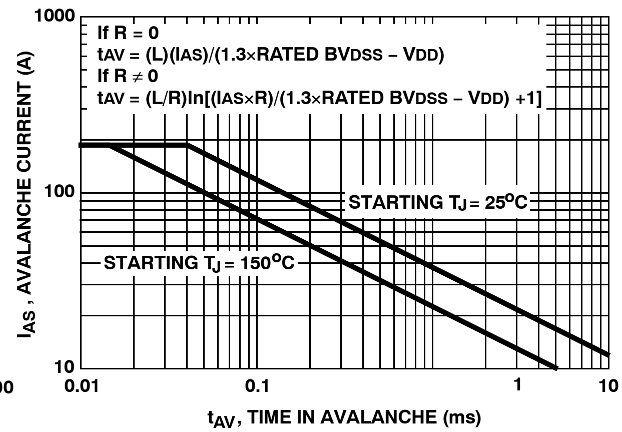


Figure 5. FORWARD BIAS SAFE OPERATING AREA



NOTE: Refer to ON Semiconductor Application Notes AN9321 and AN9322.

Figure 6. UNCLAMPED INDUCTIVE SWITCHING CAPABILITY

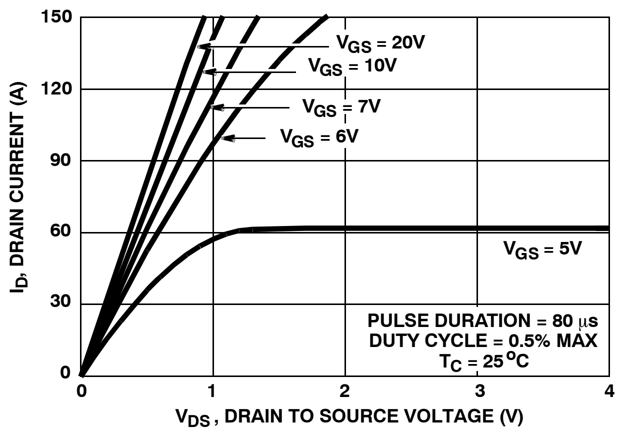


Figure 7. SATURATION CHARACTERISTICS

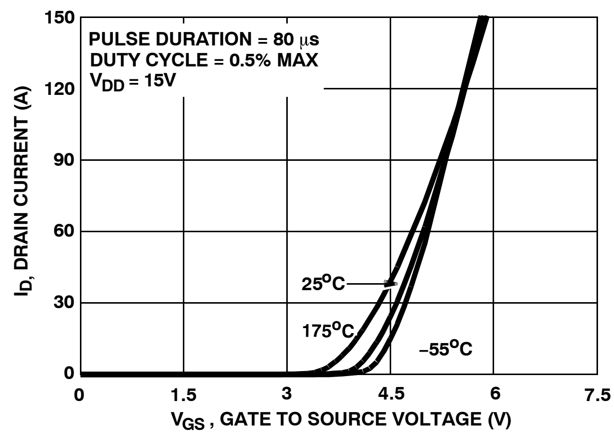


Figure 8. TRANSFER CHARACTERISTICS

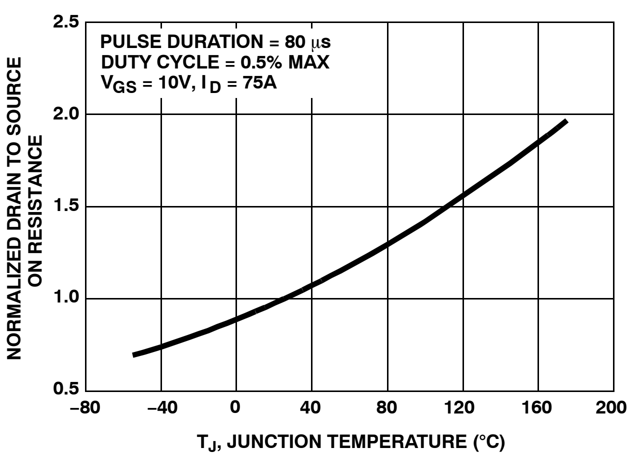


Figure 9. NORMALIZED DRAIN TO SOURCE ON RESISTANCE vs JUNCTION TEMPERATU

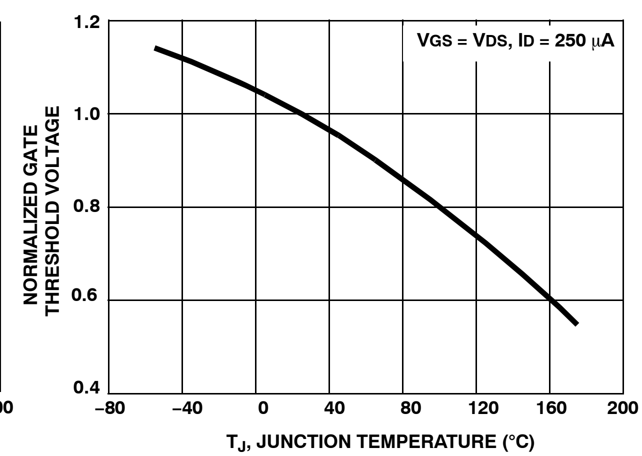


Figure 10. NORMALIZED GATE THRESHOLD VOLTAGE vs JUNCTION TEMPERATURE

TYPICAL PERFORMANCE CHARACTERISTICS (continued)

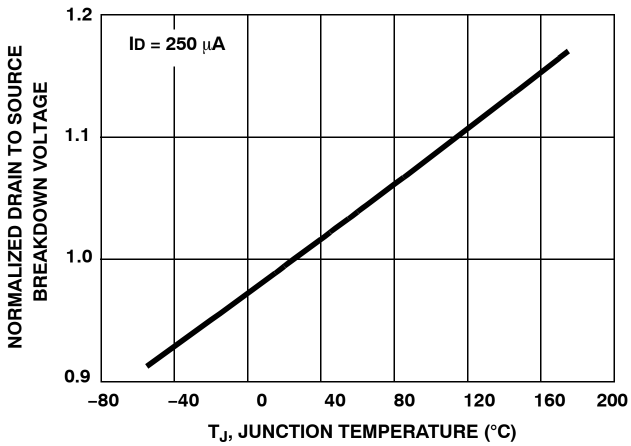


Figure 11. NORMALIZED DRAIN TO SOURCE BREAKDOWN VOLTAGE vs JUNCTION TEMPERATURE

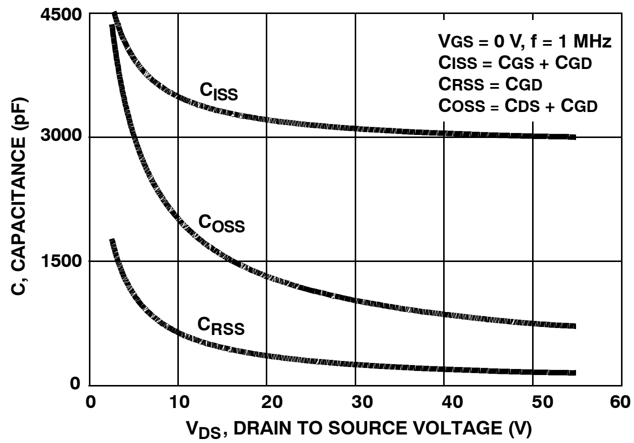
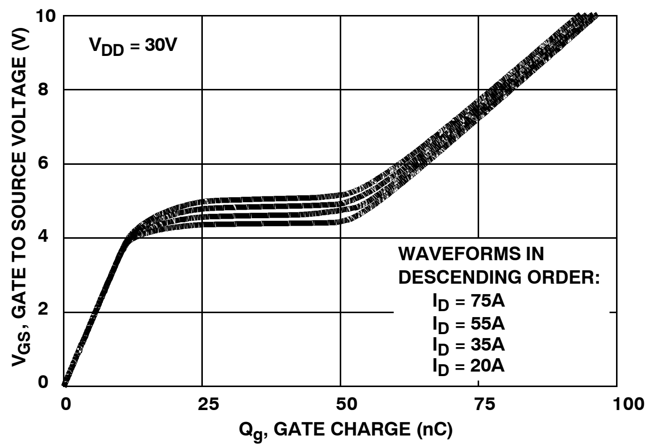


Figure 12. CAPACITANCE vs DRAIN TO SOURCE VOLTAGE



NOTE: Refer to ON Semiconductor Application Notes AN7254 and AN7260.

Figure 13. GATE CHARGE WAVEFORMS FOR CONSTANT GATE CURRENT

TEST CIRCUITS AND WAVEFORMS

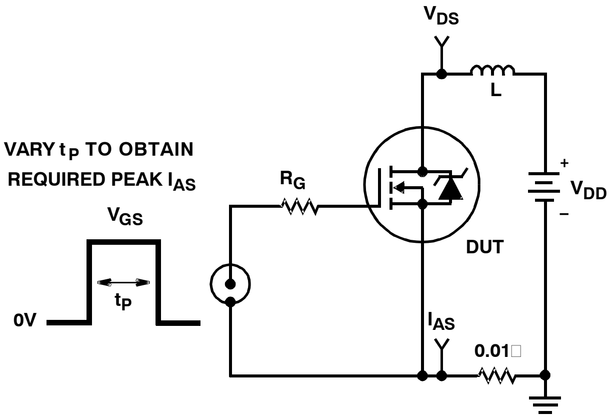


Figure 14. UNCLAMPED ENERGY TEST CIRCUIT

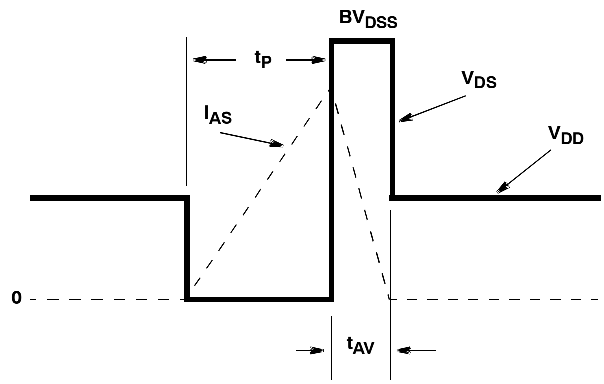


Figure 15. UNCLAMPED ENERGY WAVEFORMS

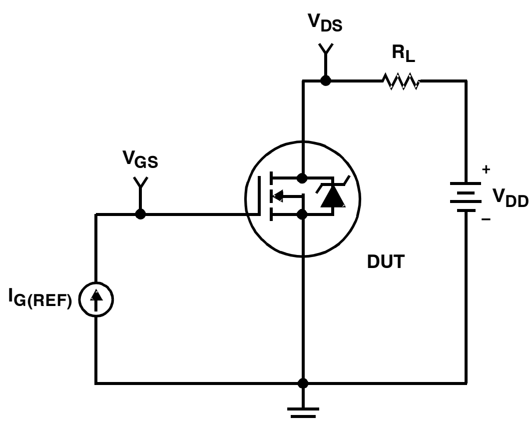


Figure 16. GATE CHARGE TEST CIRCUIT

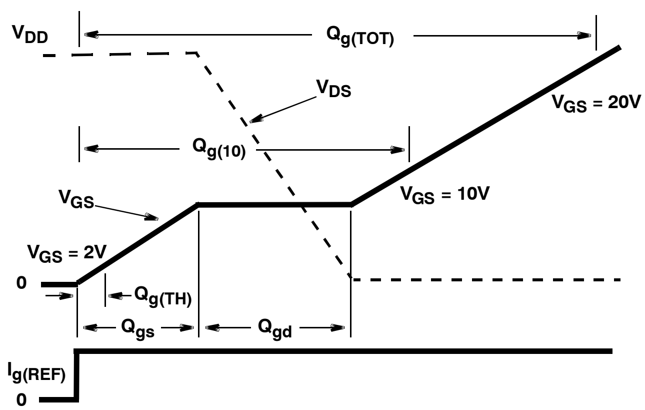


Figure 17. GATE CHARGE WAVEFORM

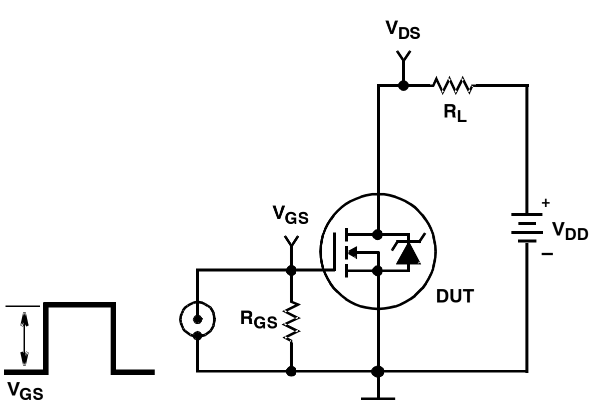


Figure 18. SWITCHING TIME TEST CIRCUIT

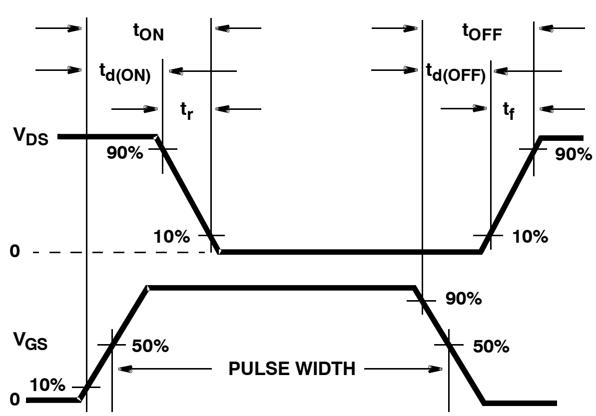
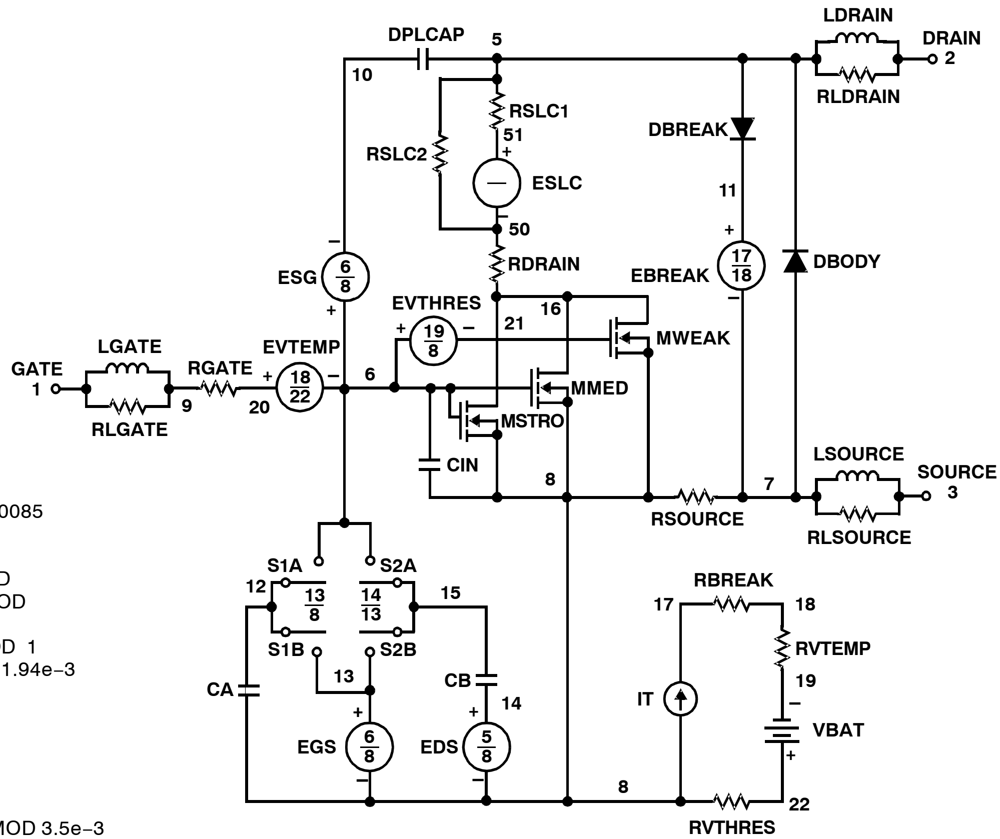


Figure 19. RESISTIVE SWITCHING WAVEFORMS

PSPICE Electrical Model

.SUBCKT HUF75337 2 1 3 ;   rev 3 Feb 1999



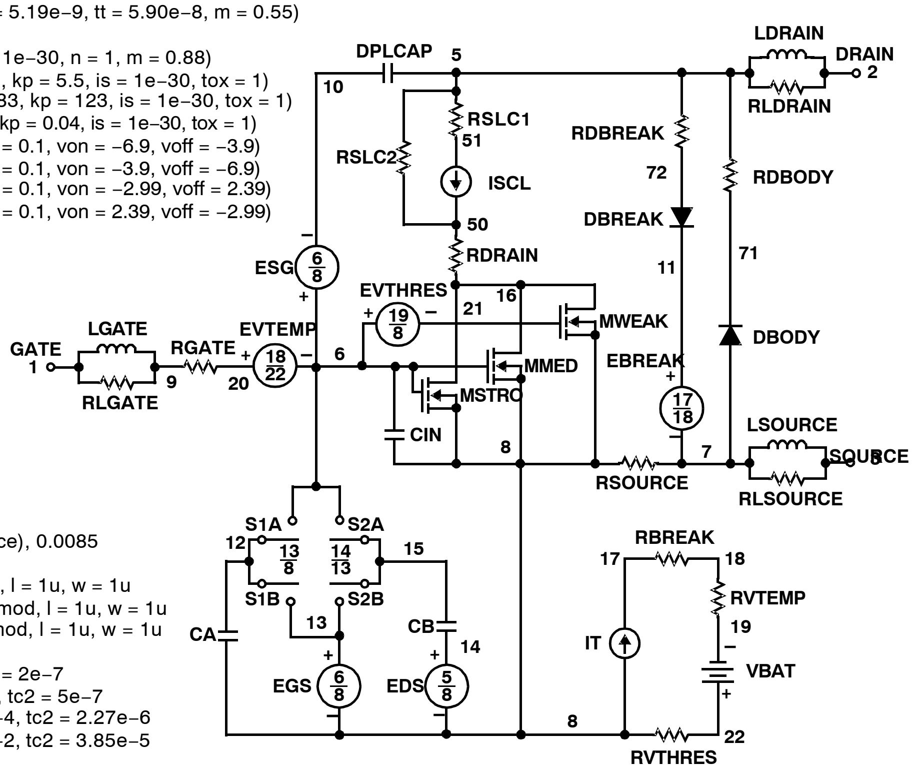

```
CA  12  8 4.9e-9
CB  15  14 4.75e-9
CIN  6  8 2.85e-9

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.

SABER Electrical Model

REV 3 February 1999

```
template huf75344 n2, n1, n3
electrical n2, n1, n3
{
var i iscl
d..model dbodymod = (is = 2.95e−12, cjo = 5.19e−9, tt = 5.90e−8, m = 0.55)
d..model dbreakmod = ()
d..model dplcapmod = (cjo = 5.40e−9, is = 1e−30, n = 1, m = 0.88)
m..model mmedmod = (type=_n, vto = 3.29, kp = 5.5, is = 1e−30, tox = 1)
m..model mstrongmod = (type=_n, vto = 3.83, kp = 123, is = 1e−30, tox = 1)
m..model mweakmod = (type=_n, vto = 2.90, kp = 0.04, is = 1e−30, tox = 1)
sw_vcsp..model s1amod = (ron = 1e−5, roff = 0.1, von = −6.9, voff = −3.9)
sw_vcsp..model s1bmod = (ron = 1e−5, roff = 0.1, von = −3.9, voff = −6.9)
sw_vcsp..model s2amod = (ron = 1e−5, roff = 0.1, von = −2.99, voff = 2.39)
sw_vcsp..model s2bmod = (ron = 1e−5, roff = 0.1, von = 2.39, voff = −2.99)

c.ca n12 n8 = 4.9e−9
c.cb n15 n14 = 4.75e−9
c.cin n6 n8 = 2.85e−9

d.dbody n7 n71 = model=dbodymod
d.dbreak n72 n11 = model=dbreakmod
d.dplcap n10 n5 = model=dplcapmod

i.it n8 n17 = 1

l.ldrain n2 n5 = 1e−9
l.lgate n1 n9 = 2.6e−9
l.lsource n3 n7 = 1.1e−9
k.kl i(l.lgate) i(l.lsource) = l(l.lgate), l(l.lsource), 0.0085

m.mmed n16 n6 n8 n8 = model=mmedmod, l = 1u, w = 1u
m.mstrong n16 n6 n8 n8 = model=mstrongmod, l = 1u, w = 1u
m.mweak n16 n21 n8 n8 = model=mweakmod, l = 1u, w = 1u

res.rbreak n17 n18 = 1, tc1 = 1.15e−3, tc2 = 2e−7
res.rdbody n71 n5 = 2.6e−3, tc1 = 1.05e−3, tc2 = 5e−7
res.rdbreak n72 n5 = 1.65e−1, tc1 = 1.15e−4, tc2 = 2.27e−6
res.rdrain n50 n16 = 1.94e−3, tc1 = 1.37e−2, tc2 = 3.85e−5
res.rgate n9 n20 = 0.36
res.rldrain n2 n5 = 10
res.rlgate n1 n9 = 26
res.rlsource n3 n7 = 11
res.rslc1 n5 n51 = 1e−6, tc1 = 1.45e−4, tc2 = 2.11e−6
res.rslc2 n5 n50 = 1e3
res.rsource n8 n7 = 3.5e−3, tc1 = 0, tc2 = 0
res.rvtemp n18 n19 = 1, tc1 = −2.4e−3, tc2 = 7e−7
res.rvthres n22 n8 = 1, tc1 = −3.7e−3, tc2 = −1.6e−5

spe.ebreak n11 n7 n17 n18 = 59.7
spe.eds n14 n8 n5 n8 = 1
spe.egs n13 n8 n6 n8 = 1
spe.esg n6 n10 n6 n8 = 1
spe.evtemp n20 n6 n18 n22 = 1
spe.evthres n6 n21 n19 n8 = 1

sw_vcsp.s1a n6 n12 n13 n8 = model=s1amod
sw_vcsp.s1b n13 n12 n13 n8 = model=s1bmod
sw_vcsp.s2a n6 n15 n14 n13 = model=s2amod
sw_vcsp.s2b n13 n15 n14 n13 = model=s2bmod

v.vbat n22 n19 = dc = 1

equations {
i (n51−>n50) + = iscl
iscl: v(n51,n50) = ((v(n5,n51)/(1e−9+abs(v(n5,n51))))*((abs(v(n5,n51)*1e6/400))** 3))
}
}
```



SPICE Thermal Model

REV 5 February 1999

HUF75344

CTHERM1 th 6 5.0e−3
CTHERM2 6 5 1.0e−2
CTHERM3 5 4 1.3e−2
CTHERM4 4 3 1.5e−2
CTHERM5 3 2 2.2e−2
CTHERM6 2 tl 8.5e−2

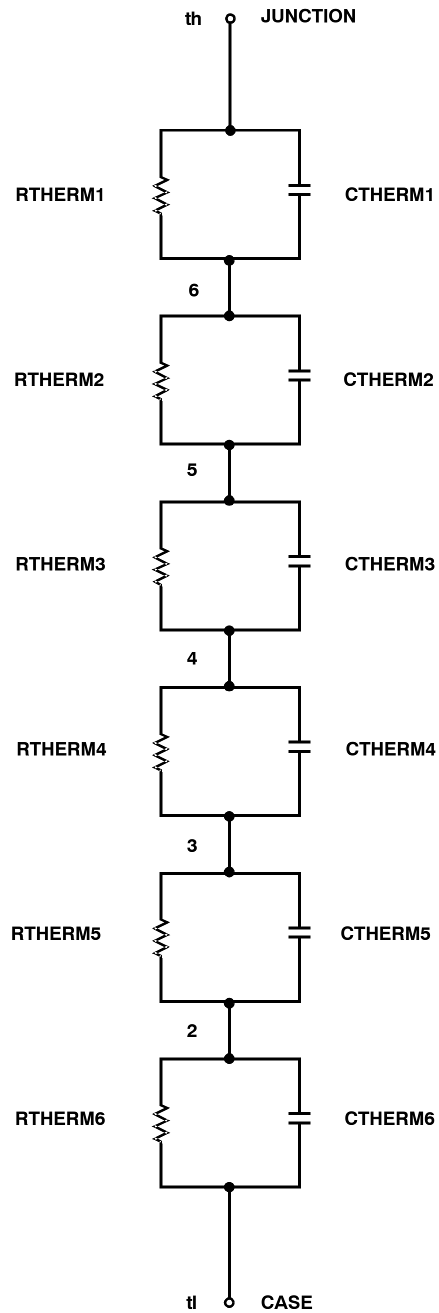
RTHERM1 th 6 6.0e−4
RTHERM2 6 5 3.5e−3
RTHERM3 5 4 2.5e−2
RTHERM4 4 3 4.8e−2
RTHERM5 3 2 1.6e−1
RTHERM6 2 tl 1.8e−1

SABER Thermal Model

SABER thermal model HUF75344

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
}

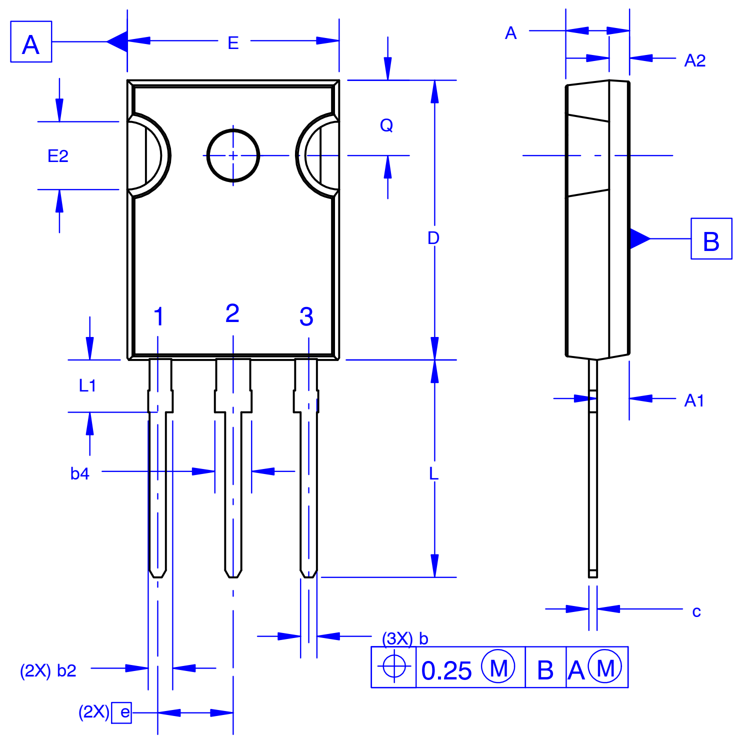


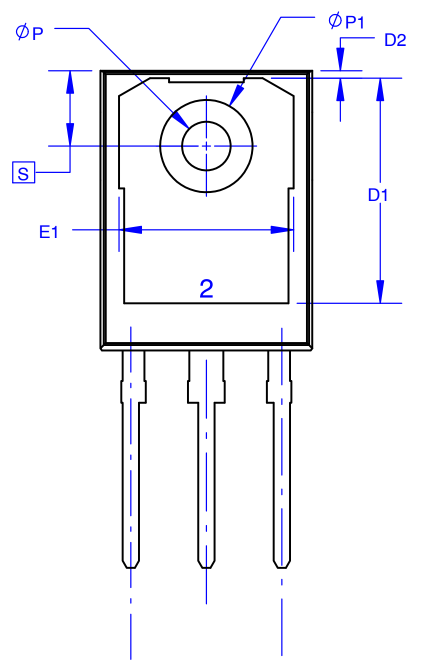
PSPICE is a trademark of MicroSim Corporation.
Saber is a registered trademark of Sabremark Limited Partnership.

PACKAGE DIMENSIONS

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.

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

GENERIC
MARKING DIAGRAM*

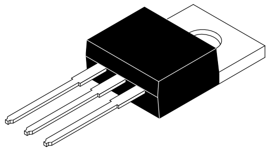
AYWWZZ
XXXXXXX
XXXXXXX

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

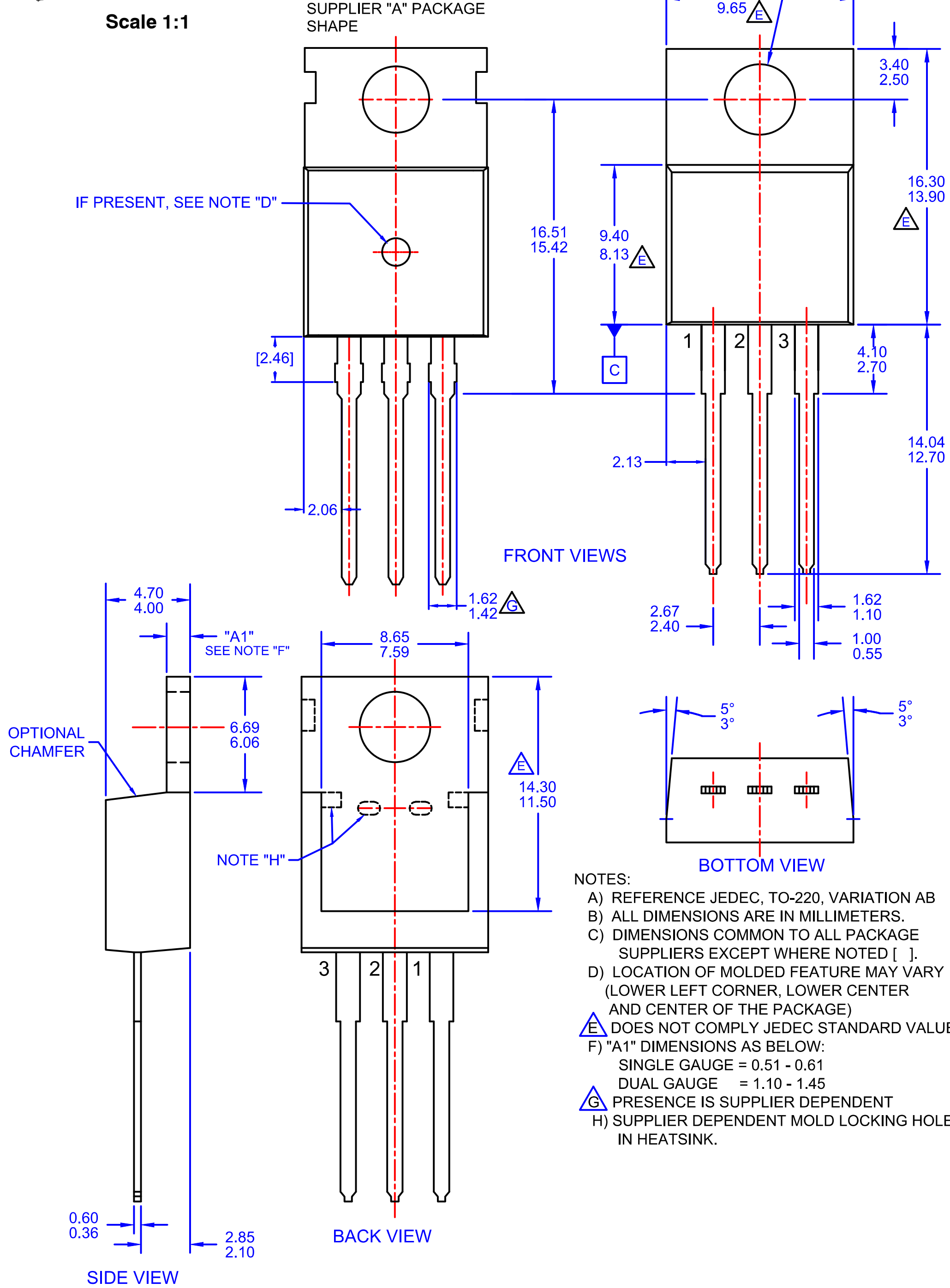
*This information is generic. Please refer to device data sheet for actual part marking. Pb−Free indicator, “G” or microdot “▪”, may or may not be present. Some products may not follow the Generic Marking.

TO−220−3LD
CASE 340AT
ISSUE A

DATE 03 OCT 2017



Scale 1:1



NOTES:
A) REFERENCE JEDEC, TO-220, VARIATION AB
B) ALL DIMENSIONS ARE IN MILLIMETERS.
C) DIMENSIONS COMMON TO ALL PACKAGE SUPPLIERS EXCEPT WHERE NOTED [ ].
D) LOCATION OF MOLDED FEATURE MAY VARY (LOWER LEFT CORNER, LOWER CENTER AND CENTER OF THE PACKAGE)
E) DOES NOT COMPLY JEDEC STANDARD VALUE.
F) "A1" DIMENSIONS AS BELOW:
SINGLE GAUGE = 0.51 - 0.61
DUAL GAUGE = 1.10 - 1.45
G) PRESENCE IS SUPPLIER DEPENDENT
H) SUPPLIER DEPENDENT MOLD LOCKING HOLES IN HEATSINK.

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