MOSFET – Power, N-Channel, UltraFET

55 V, 75 A, 7 m Ω

HUF75345G3, HUF75345P3, HUF75345S3S

Description

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.

Features

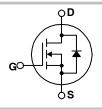
- 75 A, 55 V
- Simulation Models
 - Temperature Compensated PSPICE™ and SABER® Models
 - Thermal Impedance SPICE and SABER Models
- Peak Current vs Pulse Width Curve
- UIS Rating Curve
- These Devices are Pb-Free

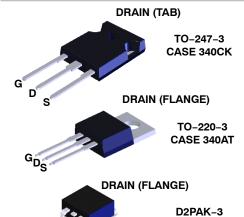


ON Semiconductor®

www.onsemi.com

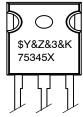
V _{DSS}	R _{DS(ON)} MAX	I _D MAX
55 V	7 m Ω	75 A





MARKING DIAGRAM

CASE 418AJ



\$Y = ON Semiconductor Logo &Z = Assembly Plant Code &3 = Data Code (Year & Week)

&K = I ot

75345X = Specific Device Code

X = G/P/S

ORDERING INFORMATION

See detailed ordering and shipping information on page 2 of this data sheet.

PACKAGE MARKING AND ORDERING INFORMATION

Part Number	Package	Brand
HUF75345G3	TO-247-3	75345G
HUF75345P3	TO-220-3	75345P
HUF75345S3ST	D2PAK-3	75345S

MOSFET MAXIMUM RATINGS ($T_C = 25^{\circ}C$, Unless otherwise noted)

Symbol		Value	Unit	
V _{DSS}	Drain to Source Voltage (Note 1)		55	V
V_{DGR}	Drain to Gate Voltage (R _{GS} =	20 kΩ) (Note 1)	55	V
V_{GS}	Gate to Source Voltage		±20	V
I _D	Drain Current	- Continuous (Figure 2)	75	Α
I _{DM}	Drain Current	- Pulsed	Figure 4	
E _{AS}	Pulsed Avalanche Rating		Figure 6	
P_{D}	Power Dissipation	(T _C = 25°C)	325	W
		– Derate Above 25°C	2.17	W/°C
T _J , T _{STG}	Operating and Storage Temperature		-55 to +175	°C
TL	Maximum Temperature for Soldering Leads at 0.063 in (1.6 mm) from Case for 10 s		300	°C
T _{pkg}	Maximum Temperature for Soldering Leads Package Body for 10 s		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.} $T_J = 25^{\circ}C$ to $150^{\circ}C$

ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise noted)

Symbol	Parameter	Test Conditions	Min.	Тур.	Max.	Unit
OFF STATE CH	HARACTERISTICS					
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	μΑ
		V _{DS} = 45 V, V _{GS} = 0 V, T _C = 150°C	250		250	
I _{GSS}	Gate to Source Leakage Current	V _{GS} = ±20 V			±100	nA
ON STATE CH	ARACTERISTICS					1
V _{GS(TH)}	Gate to Source Threshold Voltage	$V_{GS} = V_{DS}$, $I_D = 250 \mu A$ (Figure 10)	2		4.0	V
R _{DS(ON)}	Drain to Source On Resistance	I _D = 75 A, V _{GS} = 10 V (Figure 9)		0.006	0.007	Ω
THERMAL CHA	ARACTERISTICS				•	•
$R_{ heta JC}$	Thermal Resistance Junction to Case	(Figure 3)			0.46	°C/W
$R_{\theta JA}$	Thermal Resistance Junction to Ambient	TO-247			30	°C/W
	Thermal Resistance Junction to Ambient	TO-220, D2PAK			62	°C/W
SWITCHING C	HARACTERISTICS (V _{GS} = 10 V)			-	<u>-</u>	-
t _{ON}	Turn-On Time	$V_{DD} = 30 \text{ V}, I_D = 75 \text{ A},$			195	ns
t _{d(ON)}	Turn-On Delay Time	$R_L = 0.4 \Omega$, $V_{GS} = 10 V$, $R_{GS} = 2.5 \Omega$		14		ns
t _r	Rise Time			118		ns
t _{d(OFF)}	Turn-Off Delay Time			42		ns
t _f	Fall Time			26		ns
t _{OFF}	Turn-Off Time				98	ns
GATE CHARG	E CHARACTERISTICS			•		•
Q _{g(tot)}	Total Gate Charge	$V_{GS} = 0 \text{ V to } 20 \text{ V},$ $V_{DD} = 30 \text{ V}, I_D = 75 \text{ A}, R_L = 0.4 \Omega,$ $I_{q(REF)} = 1.0 \text{ mA (Figure 13)}$		220	275	nC
0	Coto Charge et 10 V	O()		105	165	nC
Q _{g(10)}	Gate Charge at 10 V	$ \begin{array}{c} V_{GS} = 0 \text{ V to 10 V,} \\ V_{DD} = 30 \text{ V, } I_{D} = 75 \text{ A, } R_{L} = 0.4 \Omega, \\ I_{g(REF)} = 1.0 \text{ mA (Figure 13)} \\ \end{array} $		125	105	IIC
Q _{g(th)}	Threshold Gate Charge	$\begin{aligned} &V_{GS} = 0 \text{ V to 2 V,} \\ &V_{DD} = 30 \text{ V, I}_{D} = 75 \text{ A, R}_{L} = 0.4 \Omega, \\ &I_{g(REF)} = 1.0 \text{ mA (Figure 13)} \end{aligned}$		6.8	10	nC
Q _{gs}	Gate to Source Gate Charge	$V_{DD} = 30 \text{ V}, I_D = 75 \text{ A}, R_L = 0.4 \Omega,$		14		nC
Q_{gd}	Gate to Drain "Miller" Charge	$I_{g(REF)} = 1.0 \text{ mA (Figure 13)}$		58		nC
CAPACITANCE	E CHARACTERISTICS					
C _{iss}	Input Capacitance	$V_{DS} = 25 \text{ V}, V_{GS} = 0 \text{ V}, f = 1 \text{ Mhz}$		4000		pF
C _{oss}	Output Capacitance	(Figure 12)		1450		pF
C _{rss}	Reverse Transfer Capacitance			450		pF
SOURCE TO D	PRAIN DIODE CHARACTERISTICS					
V _{SD}	Source to Drain Diode Voltage	I _{SD} = 75 A			1.25	V
t _{rr}	Reverse Recovery Time	I _{SD} = 75 A, dl _{SD} /dt = 100 A/μs			55	ns
Q _{RR}	Reverse Recovered Charge	I _{SD} = 75 A, dI _{SD} /dt = 100 A/μs			80	nC

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

TYPICAL PERFORMANCE CURVES

 $T_C = 25^{\circ}C$ unless otherwise noted

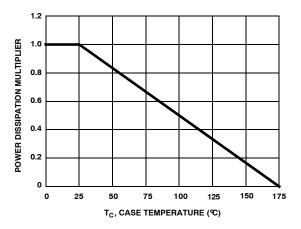


Figure 1. Normalized Power Dissipation vs. Case Temperature

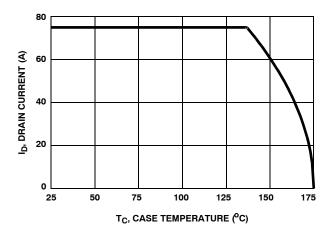


Figure 2. Maximum Continuous Drain Current vs Case Temperature

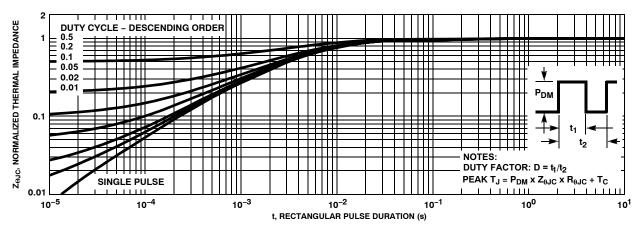


Figure 3. Normalized Maximum Transient Thermal Impedance

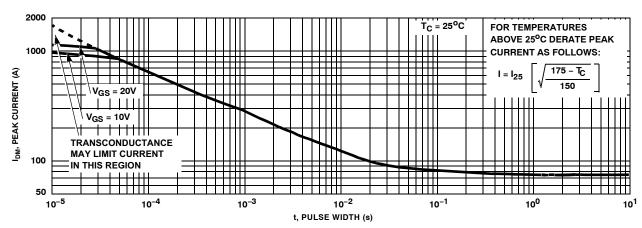


Figure 4. Peak Current Capability

TYPICAL CHARACTERISTICS (Continued)

 $T_C = 25^{\circ}C$ unless otherwise noted

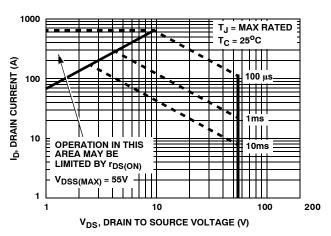


Figure 5. Forward Bias Safe Operating Area

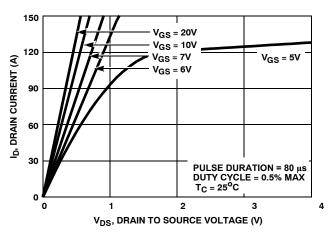


Figure 7. Saturation Characteristics

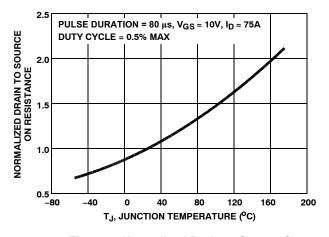


Figure 9. Normalized Drain to Source On Resistance vs Junction Temperature



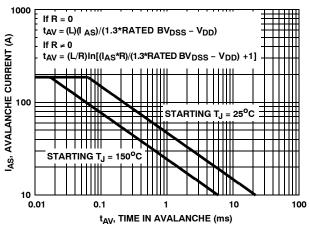


Figure 6. Unclamped Inductive Switching Capability

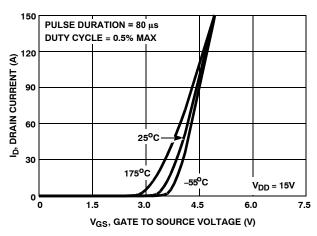


Figure 8. Transfer Characteristics

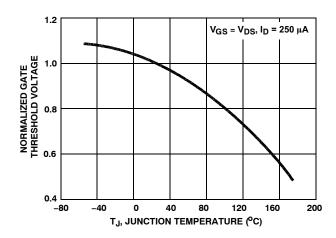


Figure 10. Normalized Gate Threshold Voltage vs Junction Temperature

TYPICAL CHARACTERISTICS (Continued)

 $T_C = 25^{\circ}C$ unless otherwise noted

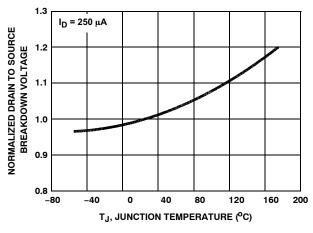


Figure 11. Normalized Drain to Source Breakdown vs. Junction Temperature

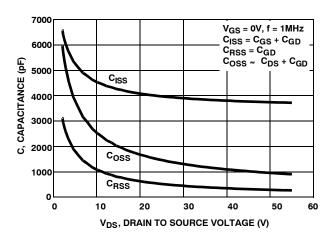


Figure 12. Capacitance vs. Drain to Source Voltage

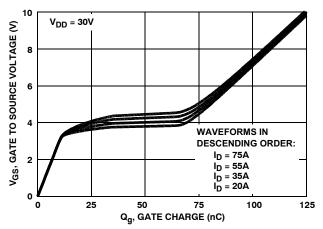


Figure 13. Gate Charge Waveforms for Constant Gate Currents

TEST CIRCUITS WAVEFORMS

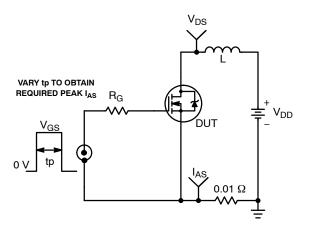


Figure 14. Unclamped Energy Test Circuit

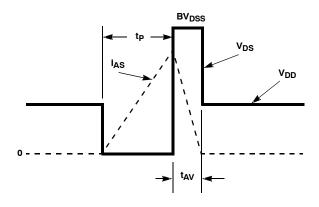


Figure 15. Unclamped Energy Waveforms

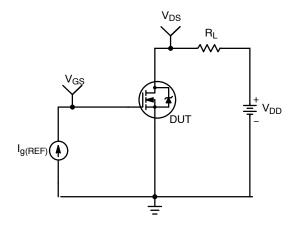


Figure 16. Gate Charge Test Circuit

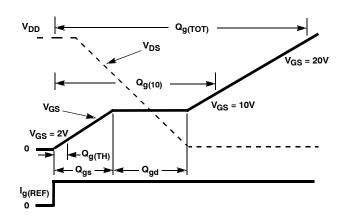


Figure 17. Gate Charge Waveforms

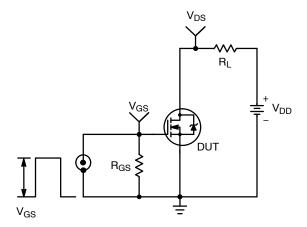


Figure 18. Switching Time Test Circuit

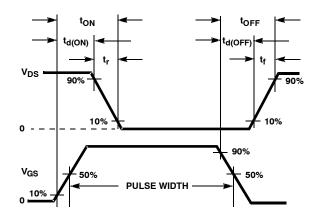


Figure 19. Resistive Switching Waveforms

PSPICE Electrical Model

.SUBCKT HUF75345 2 1 3; rev 3 Feb 99

CA 12 8 5.55e-9

CB 15 14 5.55e-9

CIN 6 8 3.45e-9

DBODY 7 5 DBODYMOD DBREAK 5 11 DBREAKMOD

DPLCAP 10 5 DPLCAPMOD

EBREAK 11 7 17 18 56.7

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 1e-4

RGATE 9 20 0.36

RLDRAIN 2510

RLGATE 1926

RLSOURCE 3 7 11

RSLC1 5 51 RSLCMOD 1e-6

RSLC2 5 50 1e3

RSOURCE 8 7 RSOURCEMOD 3.15e-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= $\{(V(5,51)/ABS(V(5,51)))*(PWR(V(5,51)/(1e-6*500),3.5))\}$

.MODEL DBODYMOD D (IS = 6e-12 RS = 1.4e-3 IKF = 20 XTI = 5 TRS1 = 2.75e-3 TRS2 = 5.0e-6 CJO = 5.5e-9 TT = 5.9e-8 M = 0.5 VJ = 0.75)

.MODEL DBREAKMOD D (RS = 2.8e-2 IKF = 30 TRS1 = -4.0e-3 TRS2 = 1.0e-6)

.MODEL DPLCAPMOD D (CJO = 6.75e-9 IS = 1e-30 M = 0.88 VJ = 1.45 FC = 0.5)

.MODEL MMEDMOD NMOS (VTO = 2.93 KP = 13.75 IS = 1e-30 N = 10 TOX = 1 L = 1u W = 1u RG = 0.36)

.MODEL MSTROMOD NMOS (VTO = 3.23 KP = 96 IS = 1e-30 N = 10 TOX = 1 L = 1u W = 1u Lambda = 0.06)

.MODEL MWEAKMOD NMOS (VTO = 2.35 KP = 0.02 IS = 1e-30 N = 10 TOX = 1 L = 1u W = 1u RG = 3.6)

.MODEL RBREAKMOD RES (TC1 = 8.0e-4 TC2 = 4.0e-6)

.MODEL RDRAINMOD RES (TC1 = 1.5e-1 TC2 = 6.5e-4)

```
.MODEL RSLCMOD RES (TC1 = 1.0e-4 TC2 = 1.05e-6)
.MODEL RSOURCEMOD RES (TC1 = 1.0e-3 TC2 = 0)
.MODEL RVTHRESMOD RES (TC1 = -1.5e-3 TC2 = -2.6e-5)
.MODEL RVTEMPMOD RES (TC1 = -2.75e-3 TC2 = 1.45e-6)
.MODEL S1AMOD VSWITCH (RON = 1e-5 ROFF = 0.1 VON = -9.00 VOFF = -4.00)
.MODEL S1BMOD VSWITCH (RON = 1e-5 ROFF = 0.1 VON = -4.00 VOFF = -9.00)
.MODEL S2AMOD VSWITCH (RON = 1e-5 ROFF = 0.1 VON = 0.00 VOFF = 0.50)
.MODEL S2BMOD VSWITCH (RON = 1e-5 ROFF = 0.1 VON = 0.50 VOFF = 0.50)
.ENDS
```

NOTE: For further discussion of the PSPICE model, consult <u>A New PSPICE Sub-Circuit for the Power MOSFET</u>

Featuring Global Temperature Options; IEEE Power Electronics Specialist Conference Records, 1991, written by William J. Hepp and C. Frank Wheatley.

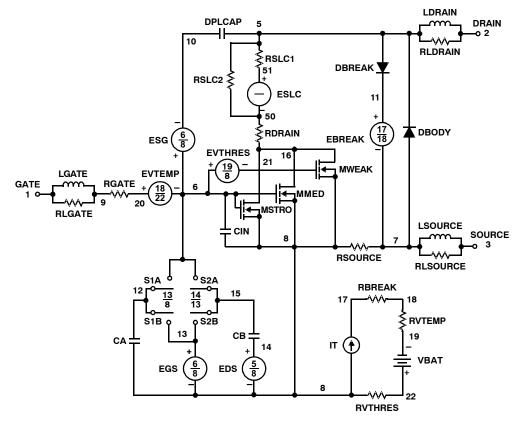


Figure 20. PSPICE Electrical Model

SABER Electrical Model

```
REV 3 February 1999
template huf75345 n2, n1, n3
electrical n2, n1, n3
{
var i iscl
d..model dbodymod = (is = 6e-12, xti = 5, cjo = 5.5e-9, tt = 5.9e-8, m=0.5, vj=0.75)
d..model dbreakmod = ()
d..model dplcapmod = (cjo = 6.75e-9, is = 1e-30, m = 0.88, vj = 1.45, fc=0.5)
m..model mmedmod = (type= n, vto = 2.93, kp = 13.75, is = 1e-30, tox = 1)
m..model mstrongmod = (type= n, vto = 3.23, kp = 96, is=1e-30,tox=1,
lambda = 0.06)
m..model mweakmod = (type= n, vto = 2.35, kp = 0.02, is = 1e-30, tox = 1)
sw vcsp..model s1amod = (ron = 1e-5, roff = 0.1, von = -9, voff = -4)
sw vcsp..model s1bmod = (ron = 1e-5, roff = 0.1, von = -4, voff = -9)
sw vcsp..model s2amod = (ron = 1e-5, roff = 0.1, von = 0, voff = 0.5)
sw vcsp..model s2bmod = (ron = 1e-5, roff = 0.1, von = 0.5, voff = 0)
c.ca n12 n8 = 5.55e-9
c.cb n15 \ n14 = 5.55e - 9
c.cin n6 n8 = 3.45e-9
d.dbody n7 n71 = model = dbodymod
d.dbreak n72 n11 = model=dbreakmod
d.dplcap n10 n5 = model = dplcap mod
i.it n8 n17 = 1
1.1 drain n2 n5 = 1e-9
1.1gate n1 n9 = 2.6e-9
1.1source n3 n7 = 1.1e-9
k.k1 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 = 8e-4, tc2 = 4e-6
res.rdbody n71 n5 = 1.4e-3, tc1 = 2.75e-3, tc2 = 5e-6
res.rdbreak n72 n5 = 2.8e-2, tc1 = -4e-3, tc2 = 1e-6
res.rdrain n50 n16 = 1e-4, tc1 = 1.5e-1, tc2 = 6.5e-4
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 = 1e-4, tc2 = 1.05e-6
res.rslc2 n5 n50 = 1e3
res.rsource n8 n7 = 3.15e-3, tc1 = 1e-3, tc2 = 0
res.rvtemp n18 n19 = 1, tc1 = -2.75e-3, tc2 = 1.45e-6
res.rvthres n22 n8 = 1, tc1 = -1.5e-3, tc2 = -2.6e-5
spe.ebreak n11 n7 n17 n18 = 56.7
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
```

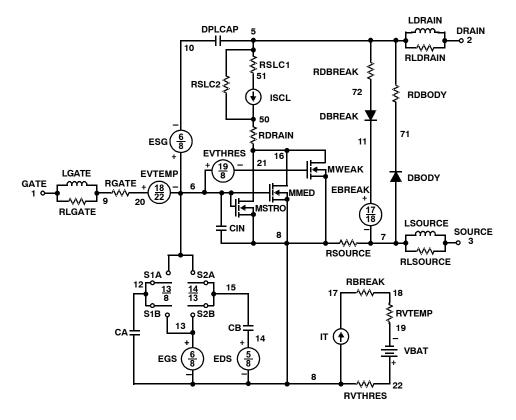


Figure 21. SABER Electrical Model

SPICE Thermal Model

REV 5 February 1999

HUF75345 CTHERM1 th 6 6.3e-3 CTHERM2 6 5 1.5e-2 CTHERM3 5 4 2.0e-2 CTHERM4 4 3 3.0e-2 CTHERM5 3 2 8.0e-2 CTHERM6 2 tl 1.5e-1 RTHERM1 th 6 5.0e-3 RTHERM2 6 5 1.8e-2 RTHERM3 5 4 5.0e-2 RTHERM4 4 3 8.5e-2 RTHERM5 3 2 1.0e-1

SABER Thermal Model

RTHERM6 2 tl 1.1e-1

SABER thermal model HUF75345

```
template thermal_model th tl
thermal_c th, tl
ctherm.ctherm1 th 6 = 6.3e-3
ctherm.ctherm2 65 = 1.5e-2
ctherm.ctherm3 5 4 = 2.0e-2
ctherm.ctherm4 4 3 = 3.0e-2
ctherm.ctherm5 3 2 = 8.0e-2
ctherm.ctherm6 2 tl = 1.5e-1
rtherm.rtherm1 th 6 = 5.0e-3
rtherm.rtherm2 6 5 = 1.8e-2
rtherm.rtherm3 5 4 = 5.0e-2
rtherm.rtherm4\ 4\ 3 = 8.5e-2
rtherm.rtherm5 3 2 = 1.0e-1
rtherm.rtherm6 2 tl = 1.1e-1
}
```

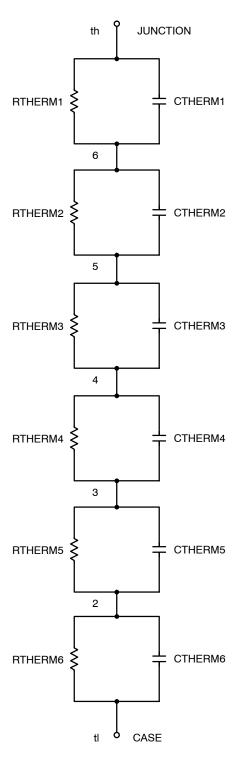
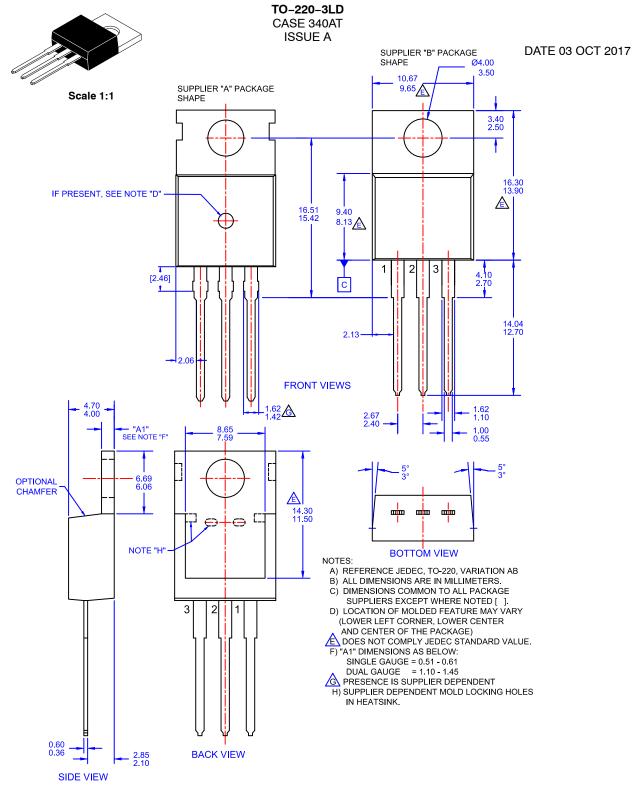


Figure 22. Thermal Model

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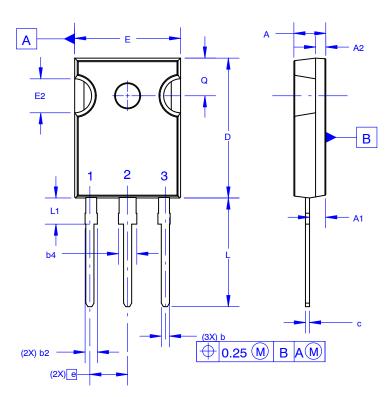


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DESCRIPTION:	TO-220-3LD		PAGE 1 OF 1

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TO-247-3LD SHORT LEAD

CASE 340CK ISSUE A





- 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

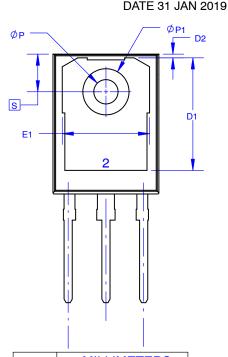
A = Assembly Location

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			
DIIVI	MIN	NOM	MAX	
Α	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	
С	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	
е	~	5.56	~	
L	15.75	16.00	16.25	
L1	3.69	3.81	3.93	
ØΡ	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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DESCRIPTION:	TO-247-3LD SHORT LEAD		PAGE 1 OF 1

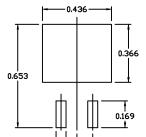
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2x 0.063

D²PAK-3 (TO-263, 3-LEAD) CASE 418AJ ISSUE F

DATE 11 MAR 2021



RECOMMENDED MOUNTING FOOTPRINT

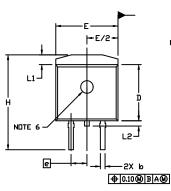
0.100 PITCH

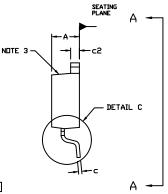
For additional information on our Pb-Free strategy and soldering details, please download the IN Seniconductor Soldering and Mounting Techniques Reference Manual, SILIERRM/D.

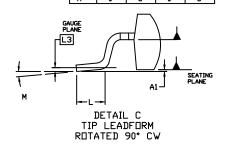
NOTES

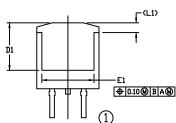
- DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2009.
- 2. CONTROLLING DIMENSION: INCHES
- 3. CHAMFER OPTIONAL.
- 4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED 0.005 PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY AT DATUM H.
- THERMAL PAD CONTOUR IS OPTIONAL WITHIN DIMENSIONS E, L1, D1, AND E1.
- 6. OPTIONAL MOLD FEATURE.
- 7. ①,② ... DPTIONAL CONSTRUCTION FEATURE CALL DUTS.

	INCHES		MILLIN	ETERS
DIM	MIN.	MAX.	MIN.	MAX.
Α	0.160	0.190	4.06	4.83
A1	0.000	0.010	0.00	0.25
b	0.020	0.039	0.51	0.99
С	0.012	0.029	0.30	0.74
c2	0.045	0.065	1.14	1.65
D	0.330	0.380	8.38	9.65
D1	0.260		6.60	
E	0.380	0.420	9.65	10.67
E1	0.245		6.22	
e	0.100 BSC		2.54	BSC
Н	0.575	0.625	14.60	15.88
L	0.070	0.110	1.78	2.79
L1		0.066		1.68
L5		0.070		1.78
L3	0.010 BSC		0.25	BSC
м	0+	8*	n•	8.

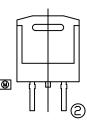


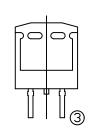


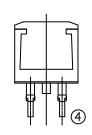




VIEW A-A







VIEW A-A

OPTIONAL CONSTRUCTIONS

GENERIC MARKING DIAGRAMS*

XX
XX
XXXXXXXX
AWLYWWG
AYWW
AYWW
AKA

IC Standard Rectifier SSG

XXXXXX = Specific Device Code A = Assembly Location

 WL
 = Wafer Lot

 Y
 = Year

 WW
 = Work Week

 W
 = Week Code (SSG)

 M
 = Month Code (SSG)

 G
 = Pb-Free Package

 AKA
 = Polarity Indicator

*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.

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DESCRIPTION:

D²PAK-3 (TO-263, 3-LEAD)

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