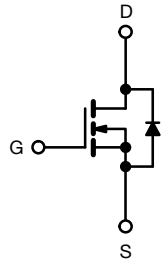
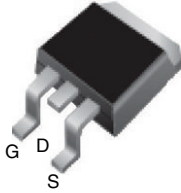


## E Series Power MOSFET

**D<sup>2</sup>PAK (TO-263)**


N-Channel MOSFET

### PRODUCT SUMMARY

$V_{DS}$ (V) at $T_J$ max.	650	
$R_{DS(on)}$ max. ( $\Omega$ ) at 25 °C	$V_{GS} = 10$ V	0.125
$Q_g$ max. (nC)	130	
$Q_{gs}$ (nC)	15	
$Q_{gd}$ (nC)	39	
Configuration	Single	

### FEATURES

- Low figure-of-merit (FOM)  $R_{on} \times Q_g$
- Low input capacitance ( $C_{iss}$ )
- Reduced switching and conduction losses
- Ultra low gate charge ( $Q_g$ )
- Avalanche energy rated (UIS)
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)


**RoHS**  
 COMPLIANT  
 HALOGEN  
**FREE**

### APPLICATIONS

- Server and telecom power supplies
- Switch mode power supplies (SMPS)
- Power factor correction power supplies (PFC)
- Lighting
  - High-intensity discharge (HID)
  - Fluorescent ballast lighting
  - LED lighting
- Industrial
  - Welding
  - Induction heating
  - Motor drives
- Battery chargers
- Renewable energy
  - Solar (PV inverters)

### ORDERING INFORMATION

Package	D <sup>2</sup> PAK (TO-263)
	SiHB30N60E-GE3
Lead (Pb)-free and halogen-free	SiHB30N60ET1-GE3
	SiHB30N60ET5-GE3

### ABSOLUTE MAXIMUM RATINGS ( $T_C = 25$ °C, unless otherwise noted)


PARAMETER	SYMBOL	LIMIT	UNIT	
Drain-source voltage	$V_{DS}$	600	V	
Gate-source voltage	$V_{GS}$	$\pm 30$		
Continuous drain current ( $T_J = 150$ °C)	$V_{GS}$ at 10 V	$T_C = 25$ °C	29	A
		$T_C = 100$ °C	18	
Pulsed drain current <sup>a</sup>	$I_{DM}$	76		
Linear derating factor		2	W/°C	
Single pulse avalanche energy <sup>b</sup>	$E_{AS}$	690	mJ	
Maximum power dissipation	$P_D$	250	W	
Operating junction and storage temperature range	$T_J, T_{stg}$	-55 to +150	°C	
Drain-source voltage slope	$dV/dt$	$V_{DS} = 0$ V to 80 % $V_{DS}$	70	V/ns
Reverse diode $dV/dt$ <sup>d</sup>		18		
Soldering recommendations (peak temperature) <sup>c</sup>	for 10 s	300	°C	

#### Notes

- Repetitive rating; pulse width limited by maximum junction temperature
- $V_{DD} = 50$  V, starting  $T_J = 25$  °C,  $L = 28.2$  mH,  $R_g = 25$   $\Omega$ ,  $I_{AS} = 7$  A
- 1.6 mm from case
- $I_{SD} \leq I_D$ ,  $dI/dt = 100$  A/ $\mu$ s, starting  $T_J = 25$  °C



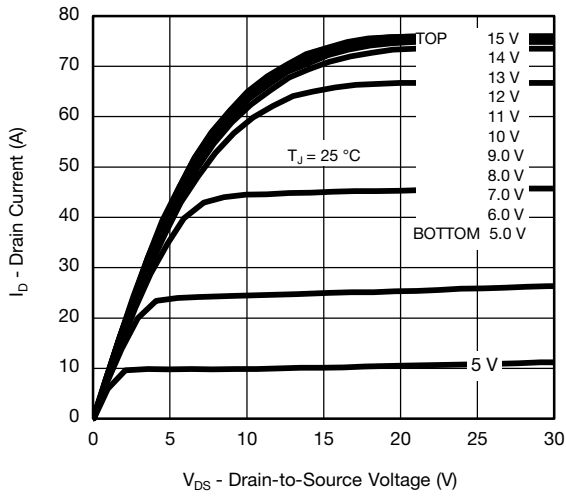
THERMAL RESISTANCE RATINGS				
PARAMETER	SYMBOL	TYP.	MAX.	UNIT
Maximum junction-to-ambient	$R_{thJA}$	-	62	°C/W
Maximum junction-to-case (drain)	$R_{thJC}$	-	0.5	

SPECIFICATIONS ( $T_J = 25\text{ }^\circ\text{C}$ , unless otherwise noted)							
PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
<b>Static</b>							
Drain-source breakdown voltage	$V_{DS}$	$V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$		600	-	-	V
$V_{DS}$ temperature coefficient	$\Delta V_{DS}/T_J$	Reference to $25\text{ }^\circ\text{C}, I_D = 250\text{ }\mu\text{A}$		-	0.64	-	V/°C
Gate-source threshold voltage (N)	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$		2	2.8	4	V
Gate-source leakage	$I_{GSS}$	$V_{GS} = \pm 20\text{ V}$		-	-	$\pm 100$	nA
		$V_{GS} = \pm 30\text{ V}$		-	-	$\pm 1$	$\mu\text{A}$
Zero gate voltage drain current	$I_{DSS}$	$V_{DS} = 600\text{ V}, V_{GS} = 0\text{ V}$		-	-	1	$\mu\text{A}$
		$V_{DS} = 600\text{ V}, V_{GS} = 0\text{ V}, T_J = 150\text{ }^\circ\text{C}$		-	-	100	
Drain-source on-state resistance	$R_{DS(on)}$	$V_{GS} = 10\text{ V}$	$I_D = 15\text{ A}$	-	0.104	0.125	$\Omega$
Forward transconductance	$g_{fs}$	$V_{DS} = 8\text{ V}, I_D = 3\text{ A}$		-	5.4	-	S
<b>Dynamic</b>							
Input capacitance	$C_{iss}$	$V_{GS} = 0\text{ V},$ $V_{DS} = 100\text{ V},$ $f = 1\text{ MHz}$		-	2600	-	pF
Output capacitance	$C_{oss}$			-	138	-	
Reverse transfer capacitance	$C_{rss}$			-	3	-	
Effective output capacitance, energy related <sup>a</sup>	$C_{o(er)}$	$V_{DS} = 0\text{ V to } 480\text{ V}, V_{GS} = 0\text{ V}$		-	98	-	pF
Effective output capacitance, time related <sup>b</sup>	$C_{o(tr)}$			-	346	-	
Total gate charge	$Q_g$	$V_{GS} = 10\text{ V}$	$I_D = 15\text{ A}, V_{DS} = 480\text{ V}$	-	85	130	nC
Gate-source charge	$Q_{gs}$			-	15	-	
Gate-drain charge	$Q_{gd}$			-	39	-	
Turn-on delay time	$t_{d(on)}$	$V_{DD} = 380\text{ V}, I_D = 15\text{ A},$ $V_{GS} = 10\text{ V}, R_g = 4.7\text{ }\Omega$		-	19	40	ns
Rise time	$t_r$			-	32	65	
Turn-off delay time	$t_{d(off)}$			-	63	95	
Fall time	$t_f$			-	36	75	
Gate input resistance	$R_g$			$f = 1\text{ MHz}, \text{ open drain}$		-	
<b>Drain-Source Body Diode Characteristics</b>							
Continuous source-drain diode current	$I_S$	MOSFET symbol showing the integral reverse p - n junction diode 		-	-	29	A
Pulsed diode forward current	$I_{SM}$			-	-	65	
Diode forward voltage	$V_{SD}$	$T_J = 25\text{ }^\circ\text{C}, I_S = 15\text{ A}, V_{GS} = 0\text{ V}$		-	-	1.3	V
Body diode reverse recovery time	$t_{rr}$	$T_J = 25\text{ }^\circ\text{C}, I_F = I_S = 15\text{ A},$ $di/dt = 100\text{ A}/\mu\text{s}, V_R = 20\text{ V}$		-	402	605	ns
Body diode reverse recovery charge	$Q_{rr}$			-	7	15	$\mu\text{C}$
Reverse recovery current	$I_{RRM}$			-	32	65	A

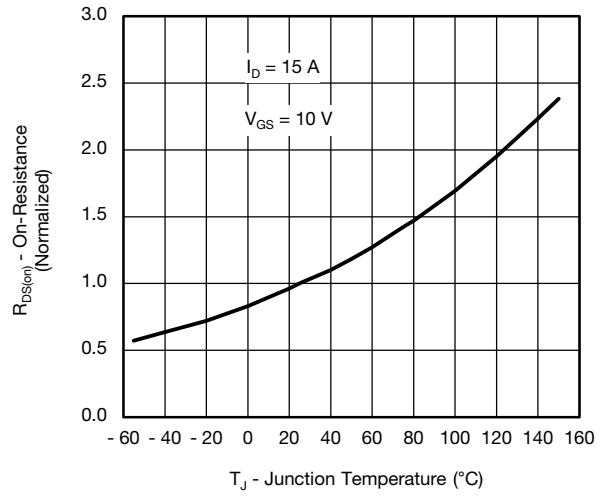
**Notes**

- a.  $C_{oss(er)}$  is a fixed capacitance that gives the same energy as  $C_{oss}$  while  $V_{DS}$  is rising from 0 % to 80 %  $V_{DSS}$
- b.  $C_{oss(tr)}$  is a fixed capacitance that gives the same charging time as  $C_{oss}$  while  $V_{DS}$  is rising from 0 % to 80 %  $V_{DSS}$

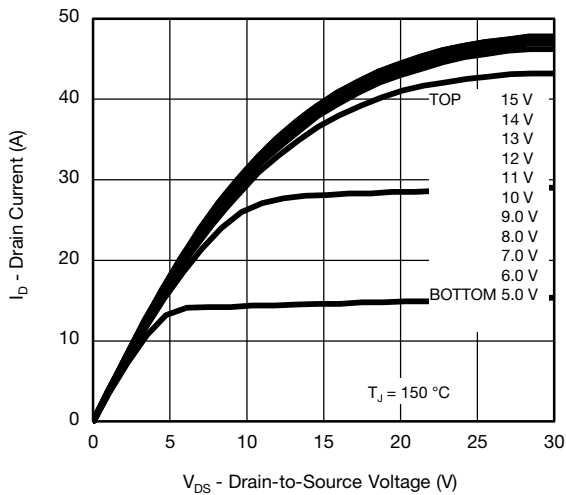
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



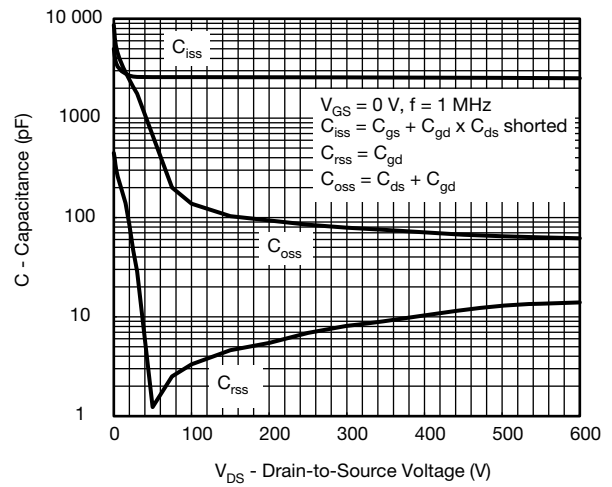
**Fig. 1 - Typical Output Characteristics,  $T_C = 25\text{ }^\circ\text{C}$**



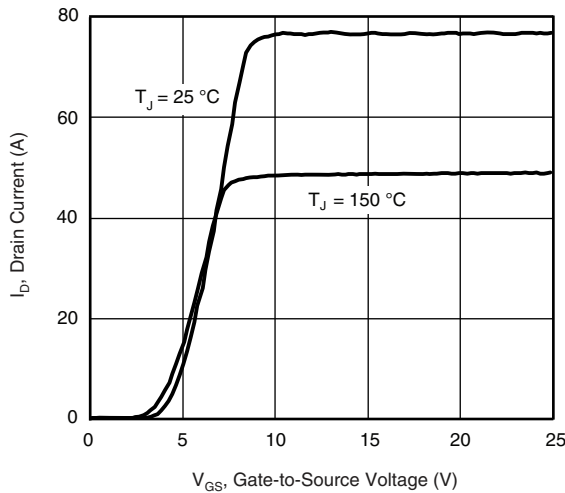
**Fig. 4 - Normalized On-Resistance vs. Temperature**



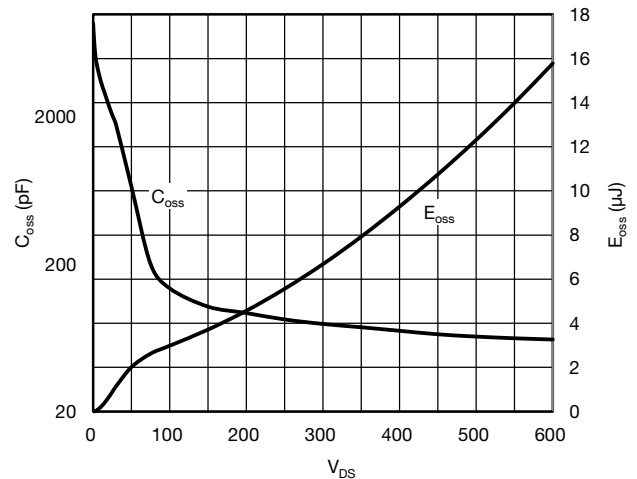
**Fig. 2 - Typical Output Characteristics,  $T_C = 150\text{ }^\circ\text{C}$**



**Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage**



**Fig. 3 - Typical Transfer Characteristics**



**Fig. 6 -  $C_{oss}$  and  $E_{oss}$  vs.  $V_{DS}$**

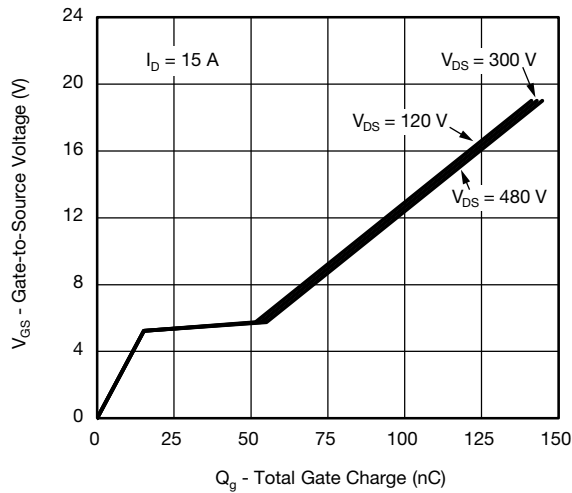


Fig. 7 - Typical Gate Charge vs. Gate-to-Source Voltage

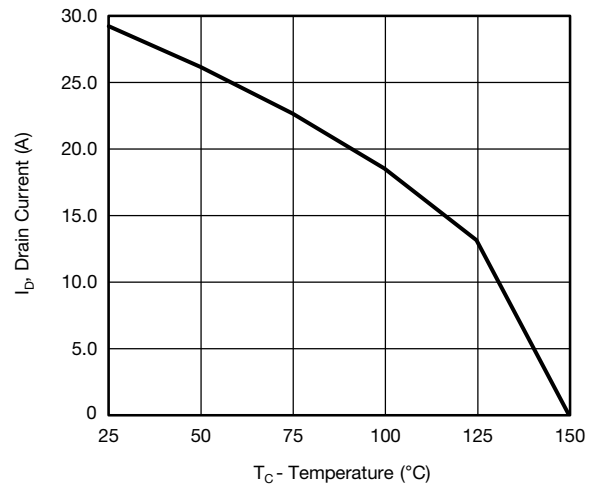


Fig. 10 - Maximum Drain Current vs. Case Temperature

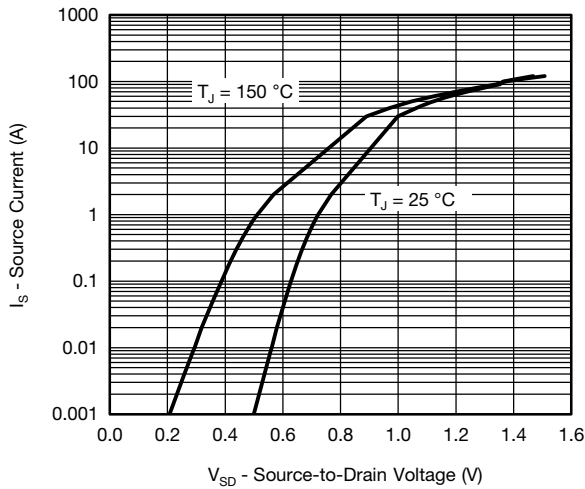


Fig. 8 - Typical Source-Drain Diode Forward Voltage

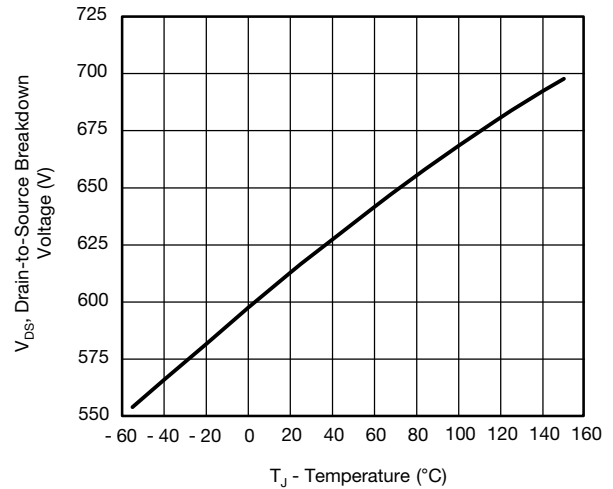


Fig. 11 - Temperature vs. Drain-to-Source Voltage

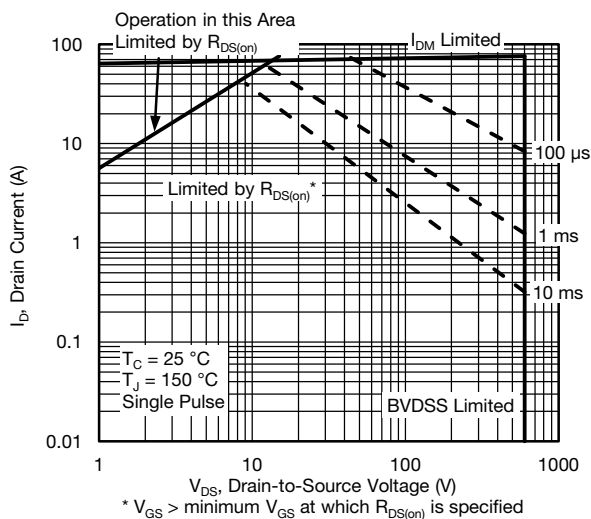
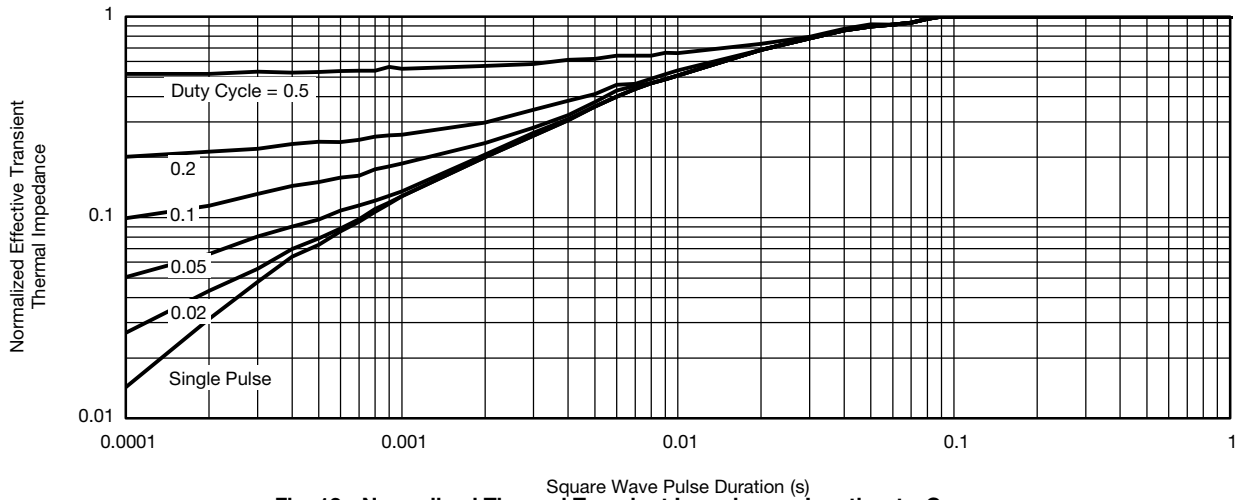
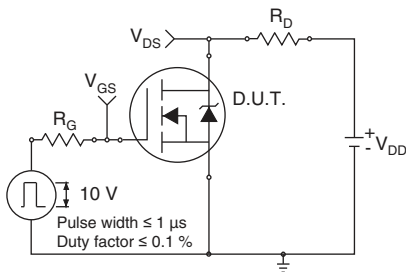


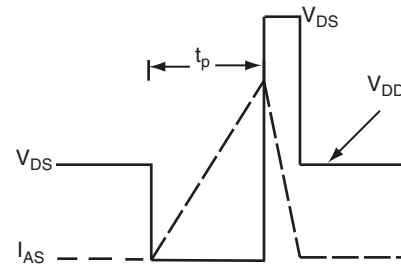
Fig. 9 - Maximum Safe Operating Area



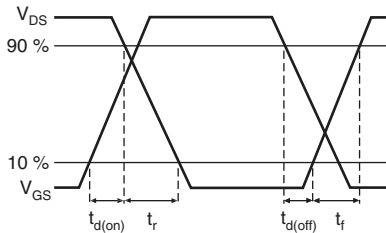
**Fig. 12 - Normalized Thermal Transient Impedance, Junction-to-Case**



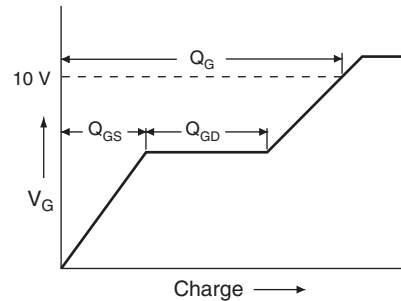
**Fig. 13 - Switching Time Test Circuit**



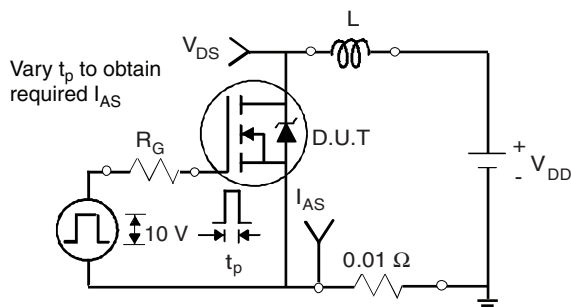
**Fig. 16 - Unclamped Inductive Waveforms**



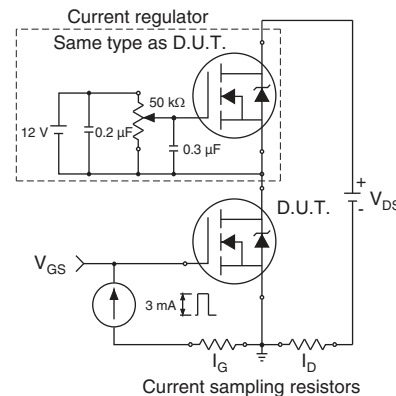
**Fig. 14 - Switching Time Waveforms**



**Fig. 17 - Basic Gate Charge Waveform**



**Fig. 15 - Unclamped Inductive Test Circuit**



**Fig. 18 - Gate Charge Test Circuit**



**Note**

a.  $V_{GS} = 5\text{ V}$  for logic level devices

**Fig. 19 - For N-Channel**

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### TO-263AB (HIGH VOLTAGE)



DIM.	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	4.06	4.83	0.160	0.190
A1	0.00	0.25	0.000	0.010
b	0.51	0.99	0.020	0.039
b1	0.51	0.89	0.020	0.035
b2	1.14	1.78	0.045	0.070
b3	1.14	1.73	0.045	0.068
c	0.38	0.74	0.015	0.029
c1	0.38	0.58	0.015	0.023
c2	1.14	1.65	0.045	0.065
D	8.38	9.65	0.330	0.380

DIM.	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
D1	6.86	-	0.270	-
E	9.65	10.67	0.380	0.420
E1	6.22	-	0.245	-
e	2.54 BSC		0.100 BSC	
H	14.61	15.88	0.575	0.625
L	1.78	2.79	0.070	0.110
L1	-	1.65	-	0.066
L2	-	1.78	-	0.070
L3	0.25 BSC		0.010 BSC	
L4	4.78	5.28	0.188	0.208

ECN: S-82110-Rev. A, 15-Sep-08  
DWG: 5970

#### Notes

1. Dimensioning and tolerancing per ASME Y14.5M-1994.
2. Dimensions are shown in millimeters (inches).
3. Dimension D and E do not include mold flash. Mold flash shall not exceed 0.127 mm (0.005") per side. These dimensions are measured at the outmost extremes of the plastic body at datum A.
4. Thermal PAD contour optional within dimension E, L1, D1 and E1.
5. Dimension b1 and c1 apply to base metal only.
6. Datum A and B to be determined at datum plane H.
7. Outline conforms to JEDEC outline to TO-263AB.

**RECOMMENDED MINIMUM PADS FOR D<sup>2</sup>PAK: 3-Lead**



Recommended Minimum Pads  
Dimensions in Inches/(mm)

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