

## E Series Power MOSFET

### PRODUCT SUMMARY

$V_{DS}$ (V) at $T_J$ max.	550	
$R_{DS(on)}$ max. at 25 °C ( $\Omega$ )	$V_{GS} = 10$ V	0.380
$Q_g$ max. (nC)	50	
$Q_{gs}$ (nC)	6	
$Q_{gd}$ (nC)	10	
Configuration	Single	

### FEATURES

- Low figure-of-merit (FOM)  $R_{DS(on)} \times Q_g$
- Low input capacitance ( $C_{iss}$ )
- Reduced switching and conduction losses
- 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)

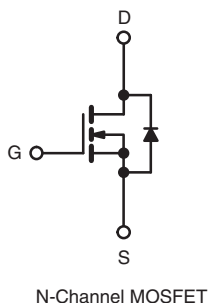
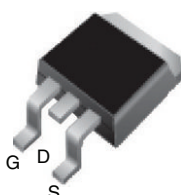


**RoHS**  
COMPLIANT  
HALOGEN  
FREE

### APPLICATIONS

- Computing
  - PC silver box / ATX power supplies
- Lighting
  - Two stage LED lighting
- Consumer electronics
- Applications using hard switched topologies
  - Power factor correction (PFC)
  - Two switch forward converter
  - Flyback converter
- Switch mode power supplies (SMPS)

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



### ORDERING INFORMATION

Package	D <sup>2</sup> PAK (TO-263)
Lead (Pb)-free and Halogen-free	SiHB12N50E-GE3

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

PARAMETER	SYMBOL	LIMIT	UNIT
Drain-Source Voltage	$V_{DS}$	500	V
Gate-Source Voltage	$V_{GS}$	$\pm 30$	
Continuous Drain Current ( $T_J = 150$ °C)	$V_{GS}$ at 10 V	$T_C = 25$ °C	A
		$T_C = 100$ °C	
Pulsed Drain Current <sup>a</sup>	$I_{DM}$	21	
Linear Derating Factor		0.91	W/°C
Single Pulse Avalanche Energy <sup>b</sup>	$E_{AS}$	103	mJ
Maximum Power Dissipation	$P_D$	114	W
Operating Junction and Storage Temperature Range	$T_J, T_{stg}$	-55 to +150	°C
Drain-Source Voltage Slope	$dV/dt$	70	V/ns
Reverse Diode $dV/dt$ <sup>d</sup>		27	
Soldering Recommendations (Peak Temperature) <sup>c</sup>		300	


#### Notes

- Repetitive rating; pulse width limited by maximum junction temperature.
- $V_{DD} = 50$  V, starting  $T_J = 25$  °C,  $L = 28.2$  mH,  $R_g = 25$   $\Omega$ ,  $I_{AS} = 2.7$  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)	$R_{thJC}$	-	1.1	



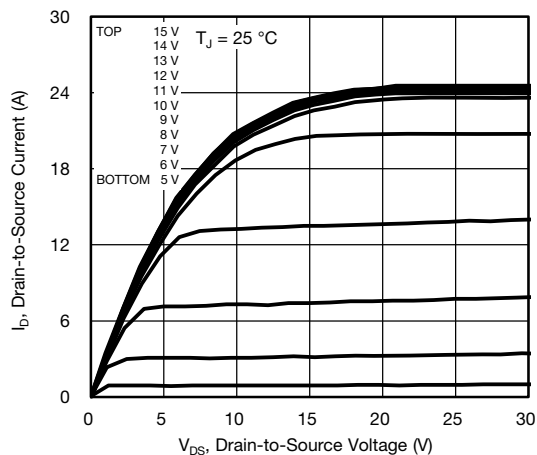
SPECIFICATIONS (T <sub>J</sub> = 25 °C, unless otherwise noted)							
PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
Static							
Drain-Source Breakdown Voltage	V <sub>DS</sub>	V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250 μA		500	-	-	V
V <sub>DS</sub> Temperature Coefficient	ΔV <sub>DS</sub> /T <sub>J</sub>	Reference to 25 °C, I <sub>D</sub> = 1 mA		-	0.60	-	V/°C
Gate-Source Threshold Voltage (N)	V <sub>GS(th)</sub>	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 μA		2.0	-	4.0	V
Gate-Source Leakage	I <sub>GSS</sub>	V <sub>GS</sub> = ± 20 V		-	-	± 100	nA
		V <sub>GS</sub> = ± 30 V		-	-	± 1	μA
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>DS</sub> = 500 V, V <sub>GS</sub> = 0 V		-	-	1	μA
		V <sub>DS</sub> = 400 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 125 °C		-	-	10	
Drain-Source On-State Resistance	R <sub>DS(on)</sub>	V <sub>GS</sub> = 10 V	I <sub>D</sub> = 6 A	-	0.330	0.380	Ω
Forward Transconductance	g <sub>fs</sub>	V <sub>DS</sub> = 30 V, I <sub>D</sub> = 6 A		-	3.1	-	S
Dynamic							
Input Capacitance	C <sub>iss</sub>	V <sub>GS</sub> = 0 V, V <sub>DS</sub> = 100 V, f = 1 MHz		-	886	-	pF
Output Capacitance	C <sub>oss</sub>			-	52	-	
Reverse Transfer Capacitance	C <sub>rss</sub>			-	6	-	
Effective Output Capacitance, Energy Related <sup>a</sup>	C <sub>o(er)</sub>	V <sub>DS</sub> = 0 V to 400 V, V <sub>GS</sub> = 0 V		-	45	-	
Effective Output Capacitance, Time Related <sup>b</sup>	C <sub>o(tr)</sub>			-	131	-	
Total Gate Charge	Q <sub>g</sub>	V <sub>GS</sub> = 10 V	I <sub>D</sub> = 6 A, V <sub>DS</sub> = 400 V	-	25	50	nC
Gate-Source Charge	Q <sub>gs</sub>			-	6	-	
Gate-Drain Charge	Q <sub>gd</sub>			-	10	-	
Turn-On Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> = 400 V, I <sub>D</sub> = 6 A, V <sub>GS</sub> = 10 V, R <sub>g</sub> = 9.1 Ω		-	13	26	ns
Rise Time	t <sub>r</sub>			-	16	32	
Turn-Off Delay Time	t <sub>d(off)</sub>			-	29	58	
Fall Time	t <sub>f</sub>			-	12	24	
Gate Input Resistance	R <sub>g</sub>	f = 1 MHz, open drain		-	0.92	-	Ω
Drain-Source Body Diode Characteristics							
Continuous Source-Drain Diode Current	I <sub>S</sub>	MOSFET symbol showing the integral reverse p - n junction diode 		-	-	10.5	A
Pulsed Diode Forward Current	I <sub>SM</sub>			-	-	21	
Diode Forward Voltage	V <sub>SD</sub>	T <sub>J</sub> = 25 °C, I <sub>S</sub> = 7.5 A, V <sub>GS</sub> = 0 V		-	-	1.2	V
Reverse Recovery Time	t <sub>rr</sub>	T <sub>J</sub> = 25 °C, I <sub>F</sub> = I <sub>S</sub> = 6 A, dI/dt = 100 A/μs, V <sub>R</sub> = 25 V		-	244	-	ns
Reverse Recovery Charge	Q <sub>rr</sub>			-	2.5	-	μC
Reverse Recovery Current	I <sub>RRM</sub>			-	19	-	A

**Notes**

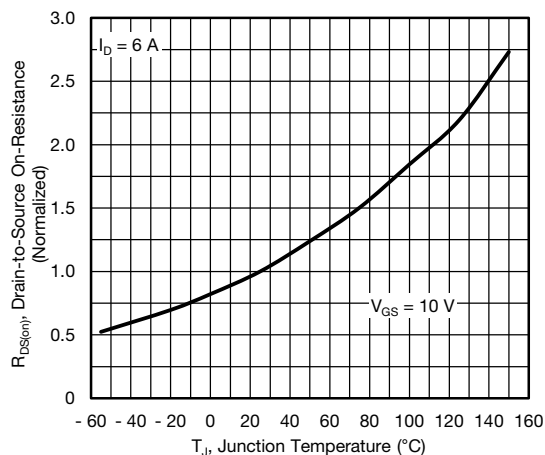
- a. C<sub>oss(er)</sub> is a fixed capacitance that gives the same energy as C<sub>oss</sub> while V<sub>DS</sub> is rising from 0 % to 80 % V<sub>DSS</sub>.  
b. C<sub>oss(tr)</sub> is a fixed capacitance that gives the same charging time as C<sub>oss</sub> while V<sub>DS</sub> is rising from 0 % to 80 % V<sub>DSS</sub>.



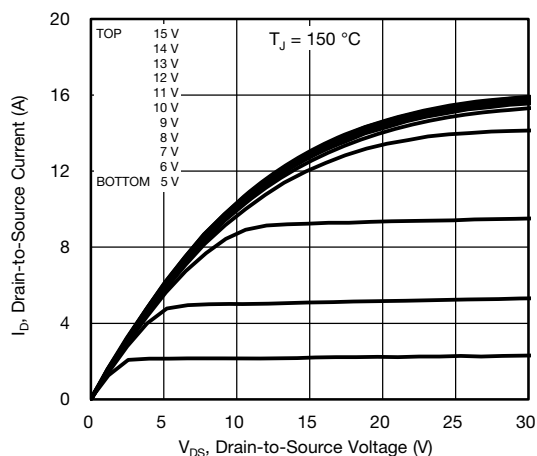
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



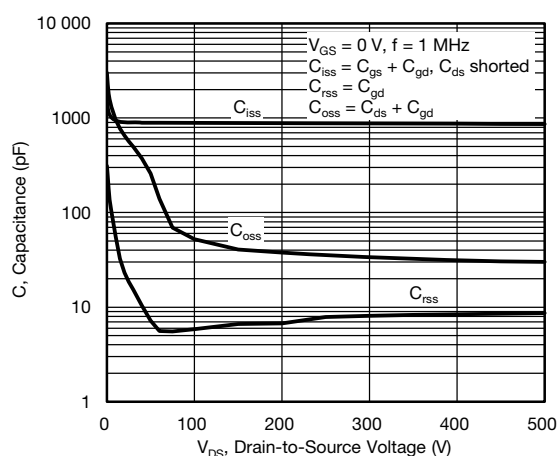
**Fig. 1 - Typical Output Characteristics**



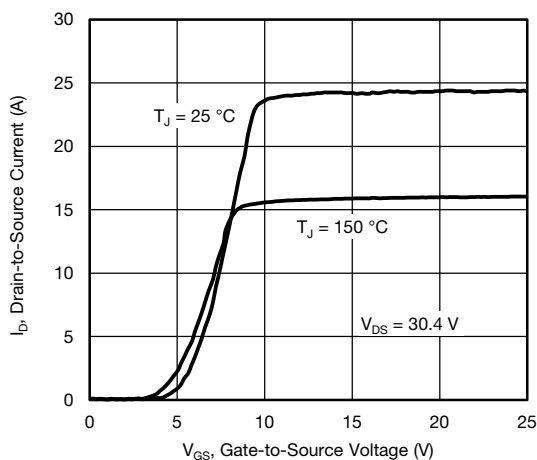
**Fig. 4 - Normalized On-Resistance vs. Temperature**



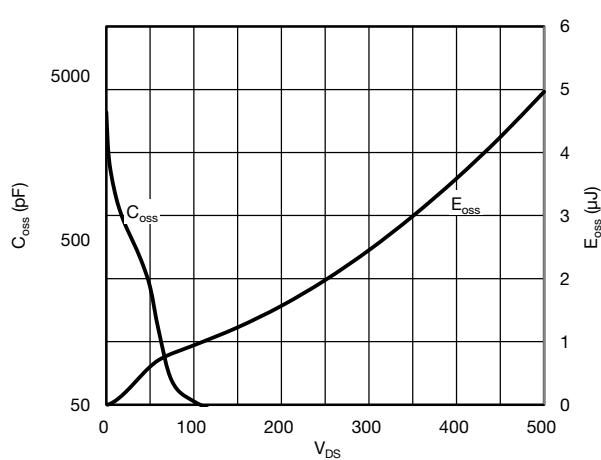
**Fig. 2 - Typical Output Characteristics**



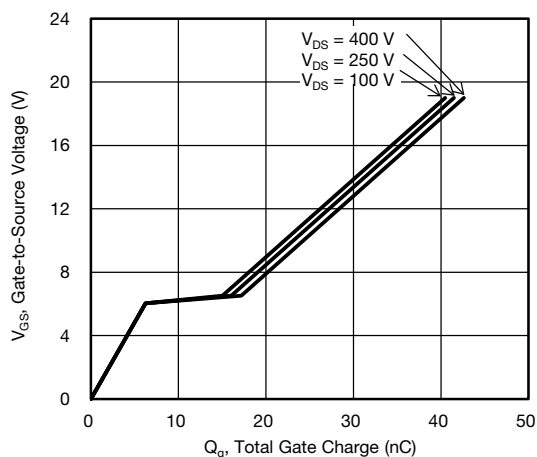
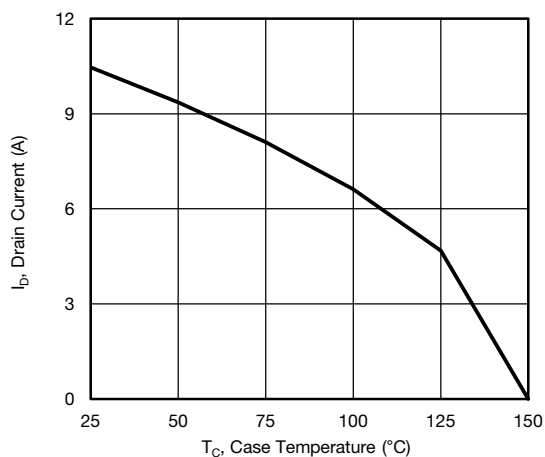
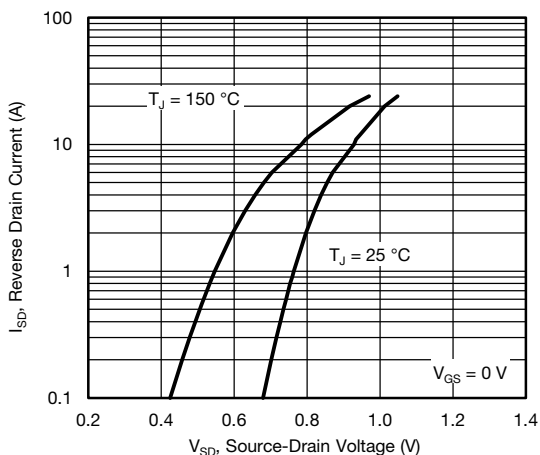
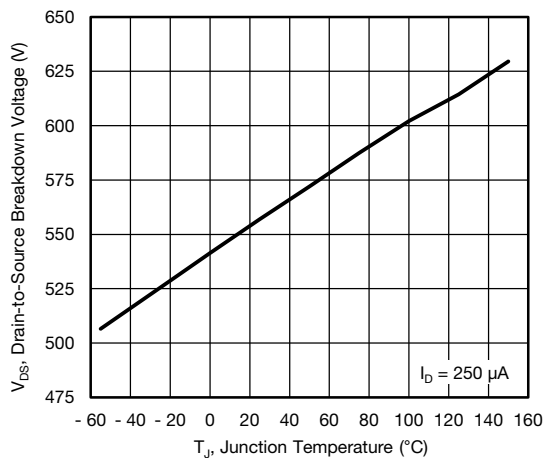
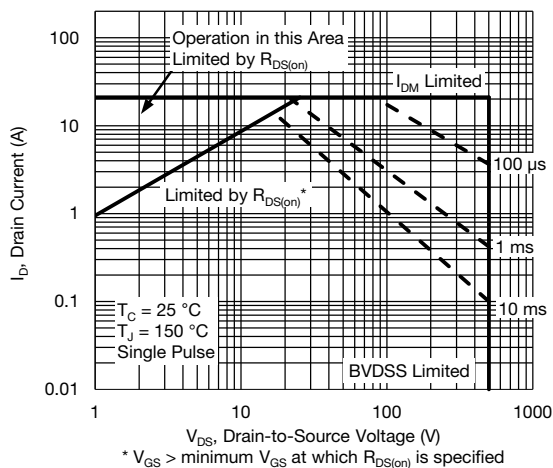
**Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage**

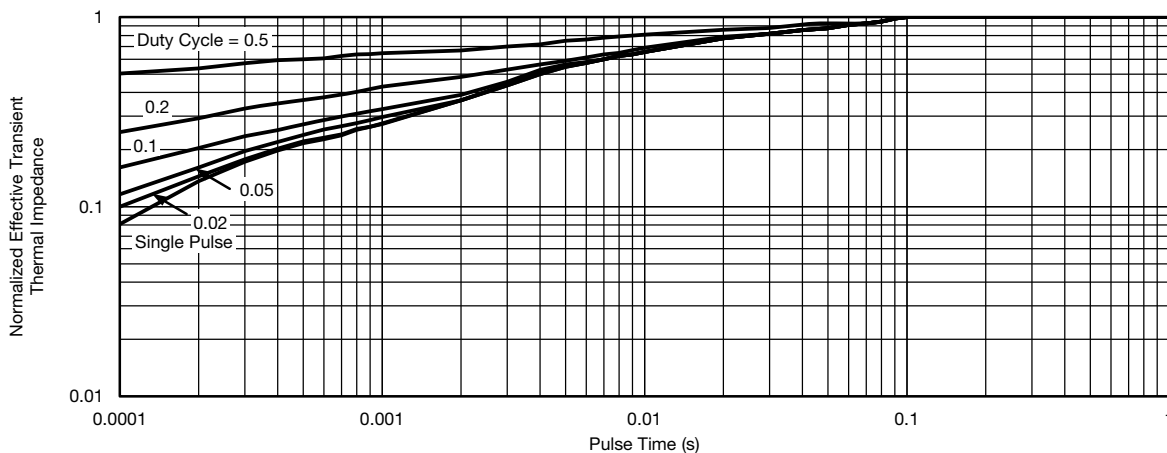
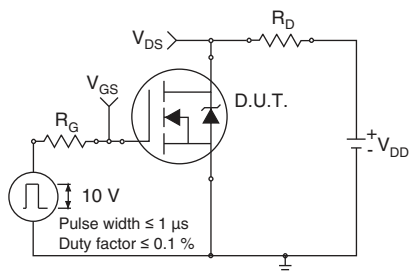
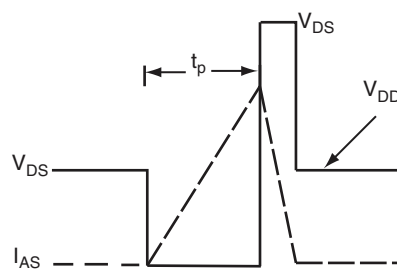
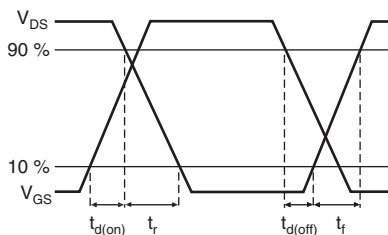
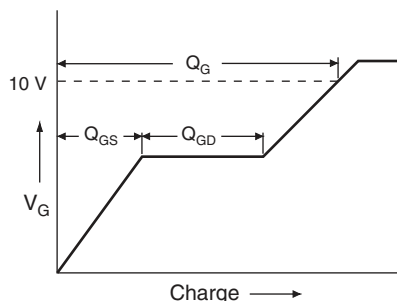
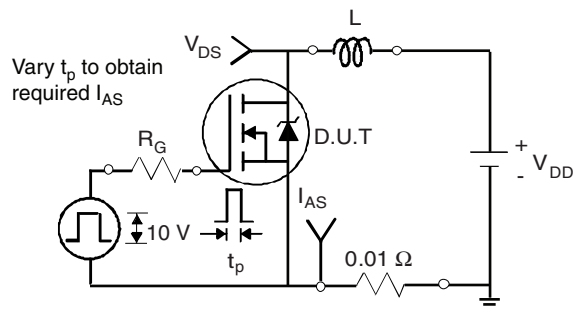
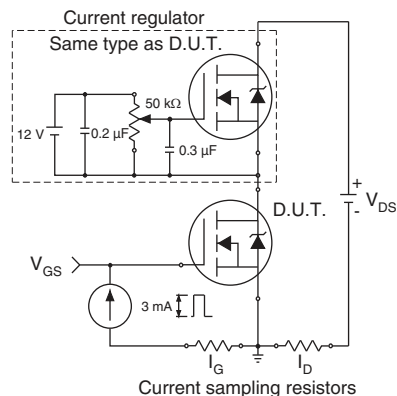


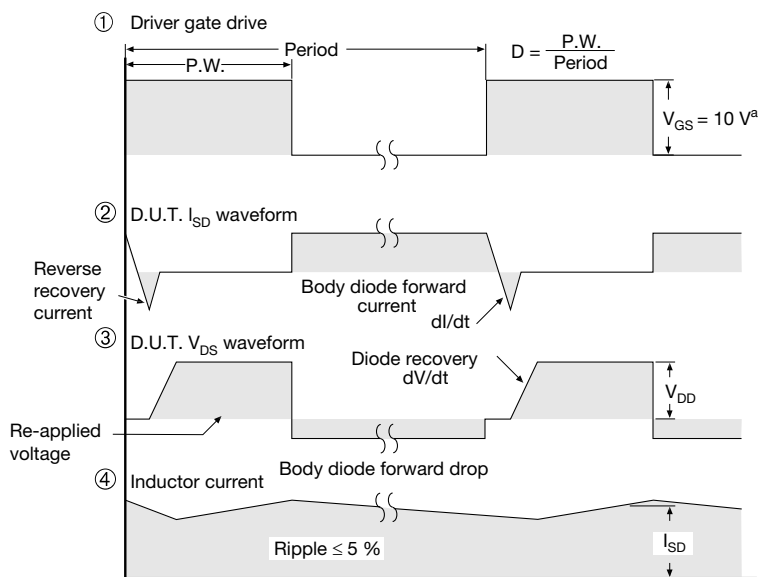
**Fig. 3 - Typical Transfer Characteristics**



**Fig. 6 - C<sub>oss</sub> and E<sub>oss</sub> vs. V<sub>DS</sub>**


**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**



**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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