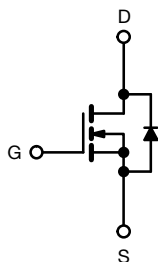
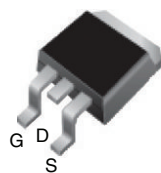


Power MOSFET

D²PAK (TO-263)


N-Channel MOSFET

FEATURES

- Low gate charge Q_g results in simple drive requirement
- Improved gate, avalanche and dynamic dV/dt ruggedness
- Fully characterized capacitance and avalanche voltage and current
- Effective C_{oss} specified
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912



RoHS*
Available
HALOGEN
FREE
Available

Note

* This datasheet provides information about parts that are RoHS-compliant and / or parts that are non RoHS-compliant. For example, parts with lead (Pb) terminations are not RoHS-compliant. Please see the information / tables in this datasheet for details

APPLICATIONS

- Switch mode power supply (SMPS)
- Uninterruptible power supply
- High speed power switching

TYPICAL SMPS TOPOLOGIES

- Single transistor forward

PRODUCT SUMMARY

V_{DS} (V)	600	
$R_{DS(on)}$ (Ω)	$V_{GS} = 10\text{ V}$	1.2
Q_g max. (nC)	42	
Q_{gs} (nC)	10	
Q_{gd} (nC)	20	
Configuration	Single	

ORDERING INFORMATION

Package	D ² PAK (TO-263)	D ² PAK (TO-263)	D ² PAK (TO-263)
Lead (Pb)-free and halogen-free	SiHFBC40AS-GE3	SiHFBC40ASTRL-GE3 ^a	SiHFBC40ASTRR-GE3 ^a
Lead (Pb)-free	IRFBC40ASPbF	IRFBC40ASTRLPbF ^a	IRFBC40ASTRRPbF ^a

Note

a. See device orientation.

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

PARAMETER				SYMBOL	LIMIT	UNIT
Drain-source voltage				V_{DS}	600	V
Gate-source voltage				V_{GS}	± 30	
Continuous drain current ^e	V_{GS} at 10 V	$T_C = 25\text{ }^{\circ}\text{C}$	I_D	6.2	A	
		$T_C = 100\text{ }^{\circ}\text{C}$		3.9		
Pulsed drain current ^{a, e}				I_{DM}	25	
Linear derating factor					1.0	W/ $^{\circ}\text{C}$
Single pulse avalanche energy ^b				E_{AS}	570	mJ
Repetitive avalanche current ^a				I_{AR}	6.2	A
Repetitive avalanche energy ^a				E_{AR}	13	mJ
Maximum power dissipation		$T_C = 25\text{ }^{\circ}\text{C}$		P_D	125	W
Peak diode recovery dV/dt ^{c, e}				dV/dt	6.0	V/ns
Operating junction and storage temperature range				T_J, T_{stg}	-55 to +150	$^{\circ}\text{C}$
Soldering recommendations (peak temperature) ^d		for 10 s			300	

Notes

- Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11)
- Starting $T_J = 25\text{ }^\circ\text{C}$, $L = 29.6\text{ mH}$, $R_g = 25\text{ }\Omega$, $I_{AS} = 6.2\text{ A}$ (see fig. 12)
- $I_{SD} \leq 6.2\text{ A}$, $dI/dt \leq 88\text{ A}/\mu\text{s}$, $V_{DD} \leq V_{DS}$, $T_J \leq 150\text{ }^\circ\text{C}$
- 1.6 mm from case
- Uses IRFBC40A, SiHFBC40A data and test conditions

**THERMAL RESISTANCE RATINGS**

PARAMETER	SYMBOL	TYP.	MAX.	UNIT
Maximum junction-to-ambient	R_{thJA}	-	40	°C/W
Maximum junction-to-case (drain)	R_{thJC}	-	1.0	

SPECIFICATIONS ($T_J = 25\text{ }^{\circ}\text{C}$, unless otherwise noted)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Static						
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 $25\text{ }^{\circ}\text{C}$, $I_D = 1\text{ mA}$ ^d	-	0.66	-	V/°C
Gate-source threshold voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}$, $I_D = 250\text{ }\mu\text{A}$	2.0	-	4.0	V
Gate-source leakage	I_{GSS}	$V_{GS} = \pm 30\text{ V}$	-	-	± 100	nA
Zero gate voltage drain current	I_{DSS}	$V_{DS} = 600\text{ V}$, $V_{GS} = 0\text{ V}$	-	-	25	μA
		$V_{DS} = 480\text{ V}$, $V_{GS} = 0\text{ V}$, $T_J = 125\text{ }^{\circ}\text{C}$	-	-	250	
Drain-source on-state resistance	$R_{DS(on)}$	$V_{GS} = 10\text{ V}$, $I_D = 3.7\text{ A}$ ^b	-	-	1.2	Ω
Forward transconductance	g_{fs}	$V_{DS} = 50\text{ V}$, $I_D = 3.7\text{ A}$	3.4	-	-	S
Dynamic						
Input capacitance	C_{iss}	$V_{GS} = 0\text{ V}$, $V_{DS} = 25\text{ V}$, $f = 1.0\text{ MHz}$, see fig. 5	-	1036	-	pF
Output capacitance	C_{oss}		-	136	-	
Reverse transfer capacitance	C_{rss}		-	7.0	-	
Output capacitance	C_{oss}	$V_{GS} = 0\text{ V}$ $V_{DS} = 1.0\text{ V}$, $f = 1.0\text{ MHz}$ $V_{DS} = 480\text{ V}$, $f = 1.0\text{ MHz}$ $V_{DS} = 0\text{ V}$ to 480 V ^c	-	1487	-	
Output capacitance effective	$C_{oss\text{ eff.}}$		-	36	-	nC
Total gate charge	Q_g		-	48	-	
Gate-source charge	Q_{gs}	$V_{GS} = 10\text{ V}$ $I_D = 6.2\text{ A}$, $V_{DS} = 480\text{ V}$, see fig. 6 and 13 ^b	-	-	10	
Gate-drain charge	Q_{gd}		-	-	20	ns
Turn-on delay time	$t_{d(on)}$	$V_{DD} = 300\text{ V}$, $I_D = 6.2\text{ A}$, $R_g = 9.1\text{ }\Omega$, $R_D = 47\text{ }\Omega$, see fig. 10 ^b	-	13	-	
Rise time	t_r		-	23	-	
Turn-off delay time	$t_{d(off)}$		-	31	-	
Fall time	t_f		-	18	-	
Gate input resistance	R_g	$f = 1\text{ MHz}$, open drain	0.6	-	3.9	Ω
Drain-Source Body Diode Characteristics						
Continuous source-drain diode current	I_S	MOSFET symbol showing the integral reverse p - n junction diode 	-	-	6.2	A
Pulsed diode forward current ^a	I_{SM}		-	-	25	
Body diode voltage	V_{SD}	$T_J = 25\text{ }^{\circ}\text{C}$, $I_S = 6.2\text{ A}$, $V_{GS} = 0\text{ V}$ ^b	-	-	1.5	V
Body diode reverse recovery time	t_{rr}	$T_J = 25\text{ }^{\circ}\text{C}$, $I_F = 6.2\text{ A}$, $dI/dt = 100\text{ A}/\mu\text{s}$ ^b	-	431	647	ns
Body diode reverse recovery charge	Q_{rr}		-	1.8	2.8	μC
Forward turn-on time	t_{on}	Intrinsic turn-on time is negligible (turn-on is dominated by L_S and L_D)				

Notes

- a. Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11)
b. Pulse width $\leq 300\text{ }\mu\text{s}$; duty cycle $\leq 2\%$
c. $C_{oss\text{ eff.}}$ is a fixed capacitance that gives the same charging time as C_{oss} while V_{DS} is rising from 0 % to 80 % V_{DS}
d. Uses IRHFBC40A, SiHFBC40A data and test conditions



TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)

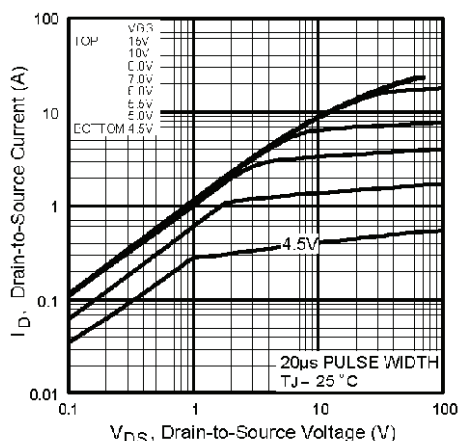


Fig. 1 - Typical Output Characteristics

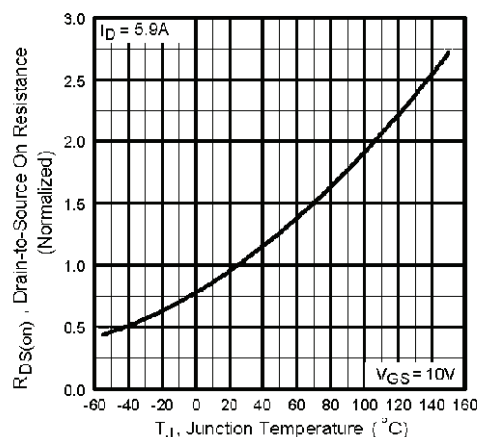


Fig. 4 - Normalized On-Resistance vs. Temperature

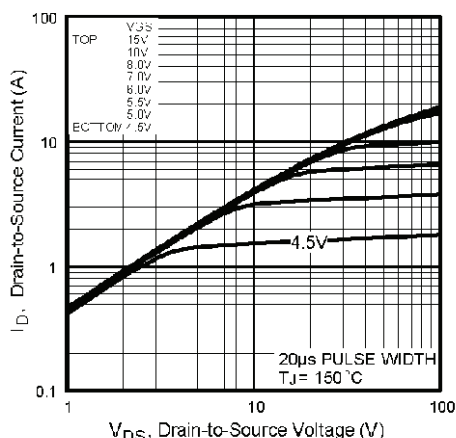


Fig. 2 - Typical Output Characteristics

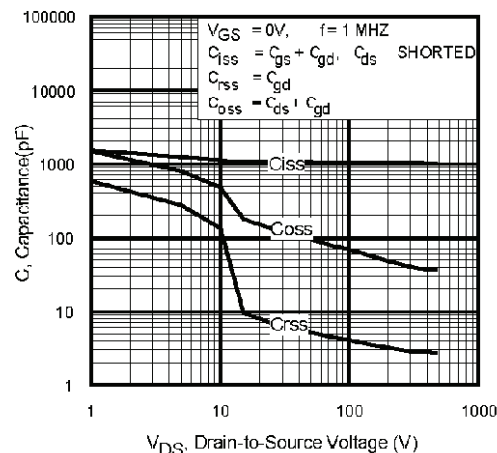


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

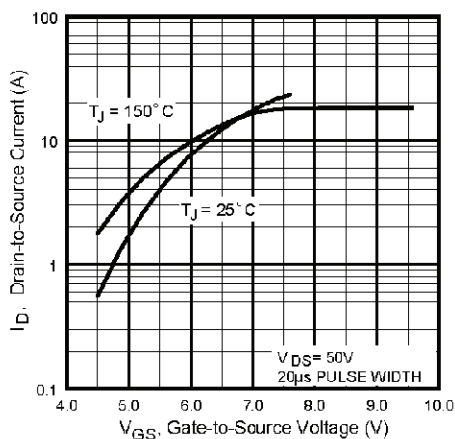


Fig. 3 - Typical Transfer Characteristics

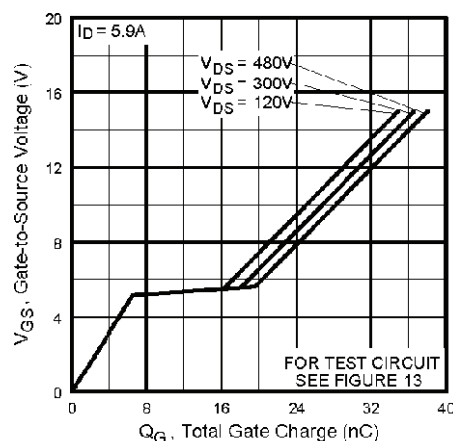
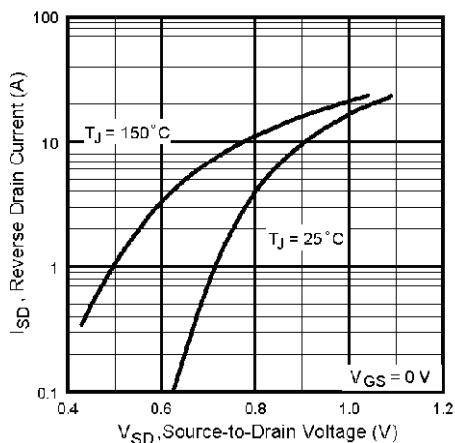
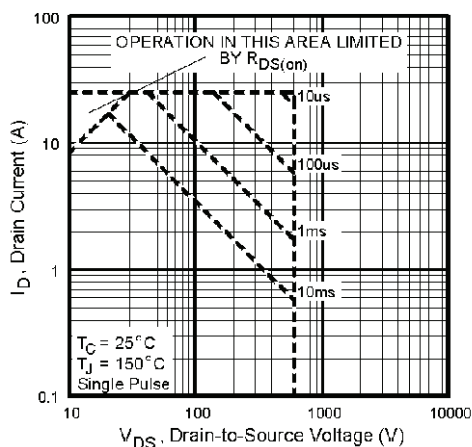
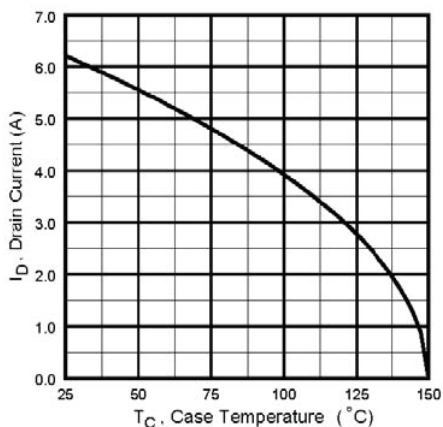
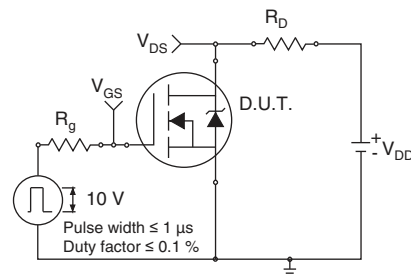
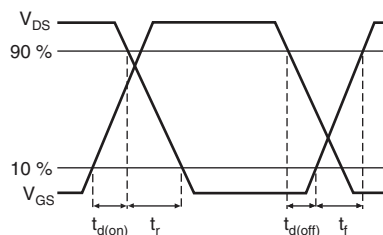


Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage

TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)

Fig. 7 - Typical Source-Drain Diode Forward Voltage

Fig. 8 - Maximum Safe Operating Area

Fig. 9 - Maximum Drain Current vs. Case Temperature

Fig. 10a - Switching Time Test Circuit

Fig. 10b - Switching Time Waveforms

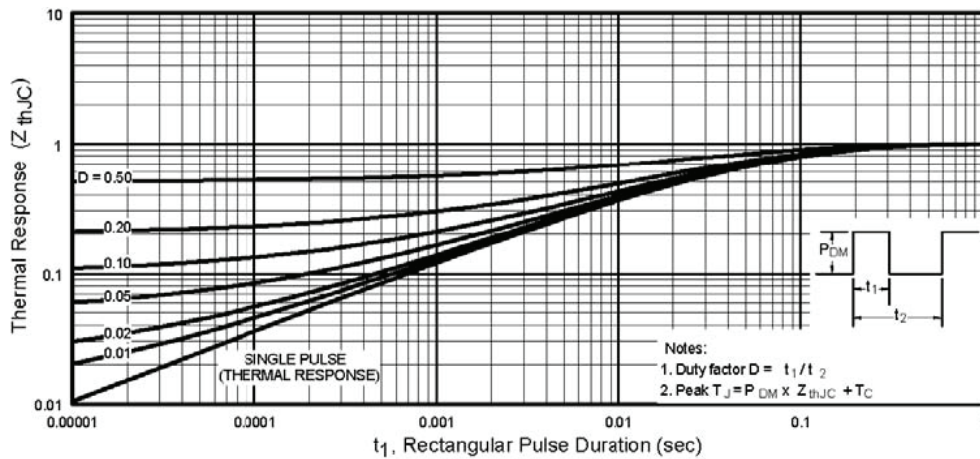
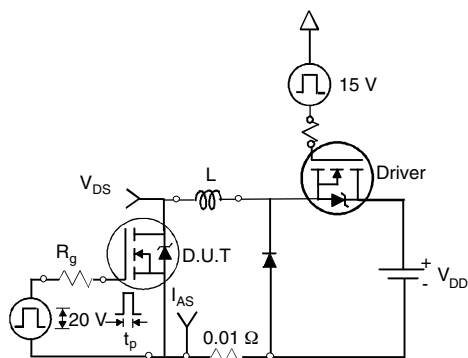
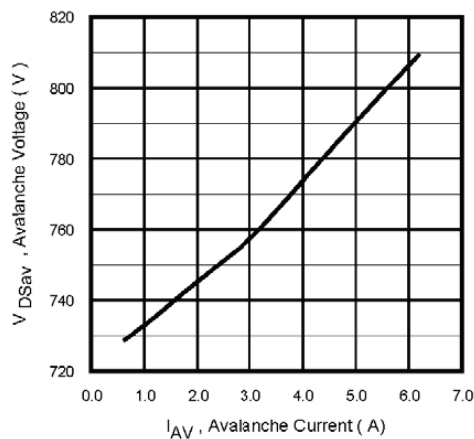
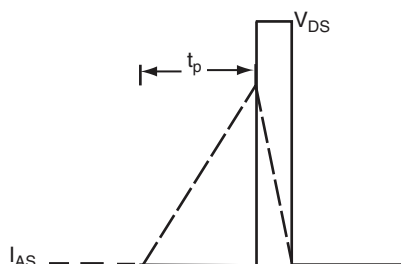
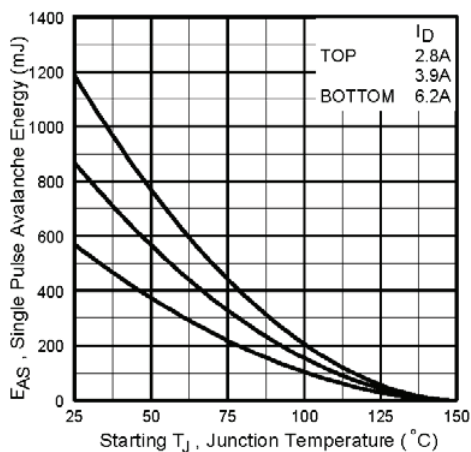
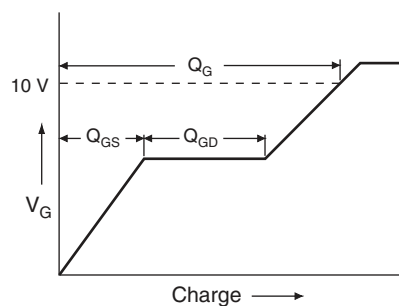
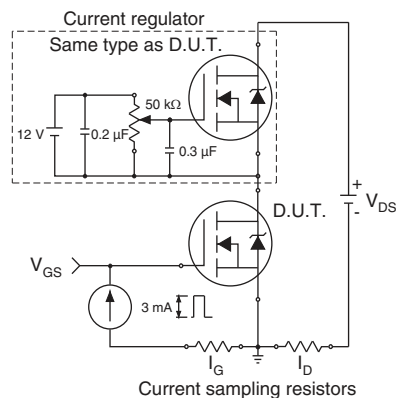
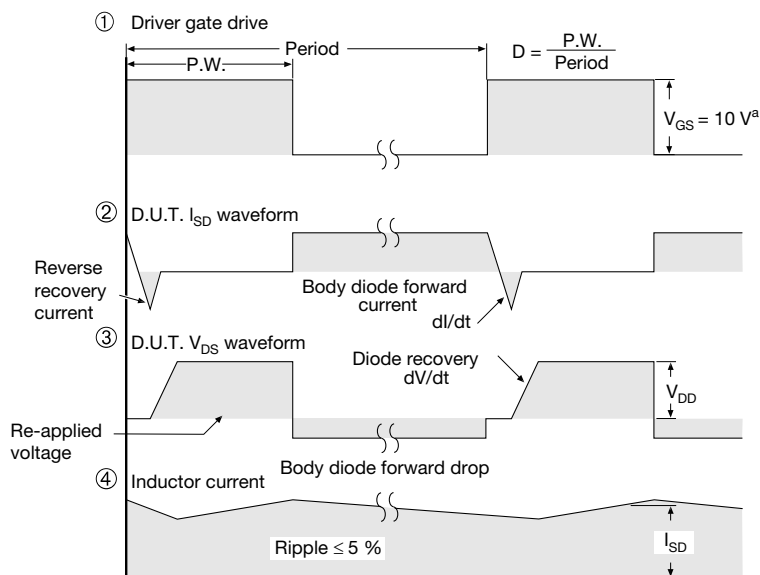
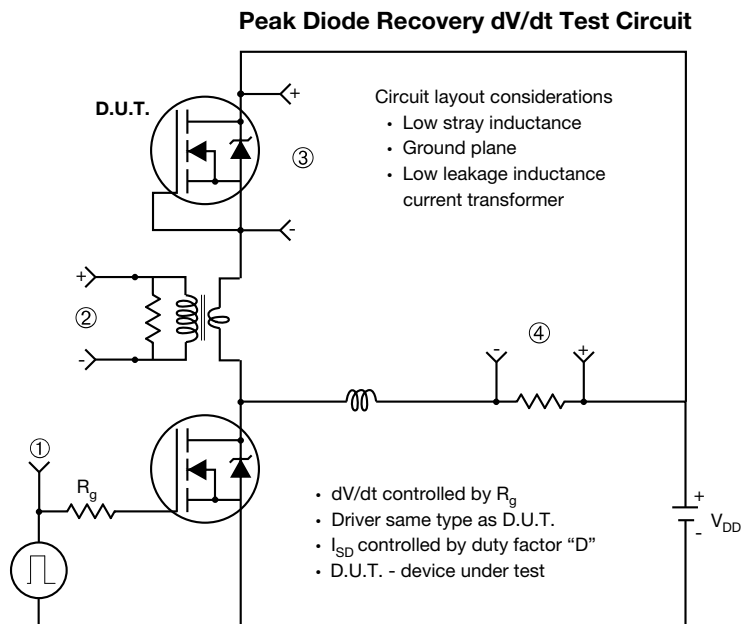


Fig. 11 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)

Fig. 12a - Unclamped Inductive Test Circuit

Fig. 12d - Maximum Avalanche Voltage vs. Drain Current

Fig. 12b - Unclamped Inductive Waveforms

Fig. 12c - Maximum Avalanche Energy vs. Drain Current

Fig. 13a - Basic Gate Charge Waveform

Fig. 13b - Gate Charge Test Circuit



Note

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

Fig. 14 - 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 D²PAK: 3-Lead



Recommended Minimum Pads
Dimensions in Inches/(mm)

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