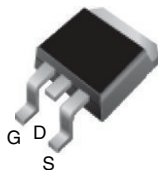


Power MOSFET

D²PAK (TO-263)


N-Channel MOSFET

PRODUCT SUMMARY

V_{DS} (V)	200	
$R_{DS(on)}$ (Ω)	$V_{GS} = 5\text{ V}$	0.18
Q_g max. (nC)	66	
Q_{gs} (nC)	9.0	
Q_{gd} (nC)	38	
Configuration	Single	

FEATURES

- Surface-mount
- Available in tape and reel
- Dynamic dV/dt rating
- Repetitive avalanche rated
- Logic-level gate drive
- $R_{DS(on)}$ specified at $V_{GS} = 4\text{ V}$ and 5 V
- Fast switching
- 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

DESCRIPTION

Third generation power MOSFETs from Vishay provide the designer with the best combination of fast switching, ruggedized device design, low on-resistance and cost-effectiveness.

The D²PAK is a surface-mount power package capable of accommodating die sizes up to HEX-4. It provides the highest power capability and the lowest possible on-resistance in any existing surface-mount package. The D²PAK is suitable for high current applications because of its low internal connection resistance and can dissipate up to 2.0 W in a typical surface mount application.

ORDERING INFORMATION

Package	D ² PAK (TO-263)	D ² PAK (TO-263)	D ² PAK (TO-263)
Lead (Pb)-free and Halogen-free	SiHL640S-GE3	SiHL640STRL-GE3 ^a	SiHL640STRR-GE3 ^a
Lead (Pb)-free	IRL640SPbF	IRL640STRLPbF ^a	IRL640STRRPbF ^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}	200	V
Gate-Source Voltage	V_{GS}	± 10	
Continuous Drain Current	I_D	$T_C = 25\text{ }^{\circ}\text{C}$	A
		$T_C = 100\text{ }^{\circ}\text{C}$	
Pulsed Drain Current ^a	I_{DM}	68	W/ $^{\circ}\text{C}$
Linear Derating Factor		1.0	
Linear Derating Factor (PCB mount) ^e		0.025	
Single Pulse Avalanche Energy ^b	E_{AS}	580	mJ
Repetitive Avalanche Current ^a	I_{AR}	10	A
Repetitive Avalanche Energy ^a	E_{AR}	13	mJ
Maximum Power Dissipation	P_D	$T_C = 25\text{ }^{\circ}\text{C}$	W
Maximum Power Dissipation (PCB mount) ^e		$T_A = 25\text{ }^{\circ}\text{C}$	
Peak Diode Recovery dV/dt ^c	dV/dt	5.0	V/ns
Operating Junction and Storage Temperature Range	T_J, T_{stg}	-55 to +150	$^{\circ}\text{C}$
Soldering Temperature ^d	For 10 s	300	

Notes

- Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11)
- $V_{DD} = 50\text{ V}$, starting $T_J = 25\text{ }^{\circ}\text{C}$, $L = 3.0\text{ mH}$, $R_g = 25\text{ }\Omega$, $I_{AS} = 17\text{ A}$ (see fig. 12)
- $I_{SD} \leq 17\text{ A}$, $dI/dt \leq 150\text{ A}/\mu\text{s}$, $V_{DD} \leq V_{DS}$, $T_J \leq 150\text{ }^{\circ}\text{C}$
- 1.6 mm from case
- When mounted on 1" square PCB (FR-4 or G-10 material)

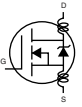

**THERMAL RESISTANCE RATINGS**

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT
Maximum Junction-to-Ambient	R_{thJA}	-	-	62	°C/W
Maximum Junction-to-Ambient (PCB mount) ^a	R_{thJA}	-	-	40	
Maximum Junction-to-Case (Drain)	R_{thJC}	-	-	1.0	

Note

a. When mounted on 1" square PCB (FR-4 or G-10 material)

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}	$V_{GS} = 0$, $I_D = 250\text{ }\mu\text{A}$	200	-	-	V
V_{DS} Temperature Coefficient	$\Delta V_{DS}/T_J$	Reference to $25\text{ }^{\circ}\text{C}$, $I_D = 1\text{ mA}$	-	0.27	-	V/°C
Gate-Source Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}$, $I_D = 250\text{ }\mu\text{A}$	1.0	-	2.0	V
Gate-Source Leakage	I_{GSS}	$V_{GS} = \pm 10\text{ V}$	-	-	± 100	nA
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS} = 200\text{ V}$, $V_{GS} = 0\text{ V}$	-	-	25	μA
		$V_{DS} = 160\text{ V}$, $V_{GS} = 0\text{ V}$, $T_J = 125\text{ }^{\circ}\text{C}$	-	-	250	
Drain-Source On-State Resistance	$R_{DS(on)}$	$V_{GS} = 5.0\text{ V}$, $I_D = 10\text{ A}^b$	-	-	0.18	Ω
		$V_{GS} = 4.0\text{ V}$, $I_D = 8.5\text{ A}^b$	-	-	0.27	
Forward Transconductance	g_{fs}	$V_{DS} = 50\text{ V}$, $I_D = 10\text{ A}^b$	16	-	-	S
Dynamic						
Input Capacitance	C_{iss}	$V_{GS} = 0\text{ V}$, $V_{DS} = 25\text{ V}$, $f = 1.0\text{ MHz}$, see fig. 5	-	1800	-	pF
Output Capacitance	C_{oss}		-	400	-	
Reverse Transfer Capacitance	C_{rss}		-	120	-	
Total Gate Charge	Q_g	$V_{GS} = 5.0\text{ V}$, $I_D = 17\text{ A}$, $V_{DS} = 160\text{ V}$, see fig. 6 and 13 ^b	-	-	66	nC
Gate-Source Charge	Q_{gs}		-	-	9.0	
Gate-Drain Charge	Q_{gd}		-	-	38	
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = 100\text{ V}$, $I_D = 17\text{ A}$, $R_g = 4.6\text{ }\Omega$, $R_D = 5.7\text{ }\Omega$, see fig. 10 ^b	-	8.0	-	ns
Rise Time	t_r		-	83	-	
Turn-Off Delay Time	$t_{d(off)}$		-	44	-	
Fall Time	t_f		-	52	-	
Internal Drain Inductance	L_D	Between lead, 6 mm (0.25") from package and center of die contact 	-	4.5	-	nH
Internal Source Inductance	L_S		-	7.5	-	
Gate Input Resistance	R_g	$f = 1\text{ MHz}$, open drain	0.3	-	1.2	Ω
Drain-Source Body Diode Characteristics						
Continuous Source-Drain Diode Current	I_S	MOSFET symbol showing the integral reverse p - n junction diode 	-	-	17	A
Pulsed Diode Forward Current ^a	I_{SM}		-	-	68	
Body Diode Voltage	V_{SD}	$T_J = 25\text{ }^{\circ}\text{C}$, $I_S = 17\text{ A}$, $V_{GS} = 0\text{ V}^b$	-	-	2.0	V
Body Diode Reverse Recovery Time	t_{rr}	$T_J = 25\text{ }^{\circ}\text{C}$, $I_F = 17\text{ A}$, $dI/dt = 100\text{ A}/\mu\text{s}^b$	-	310	470	ns
Body Diode Reverse Recovery Charge	Q_{rr}		-	3.2	4.8	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 $\leq 2\%$



TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)

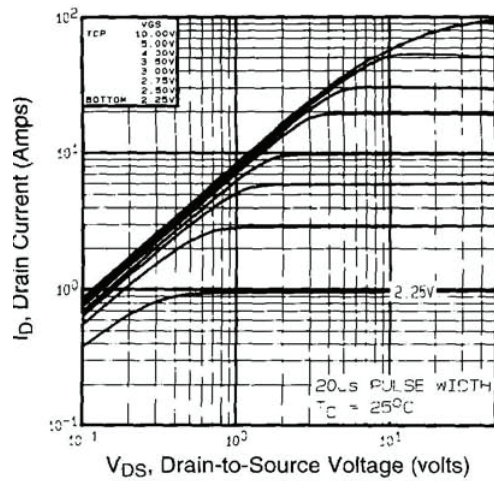


Fig. 1 - Typical Output Characteristics, $T_C = 25\text{ }^{\circ}\text{C}$

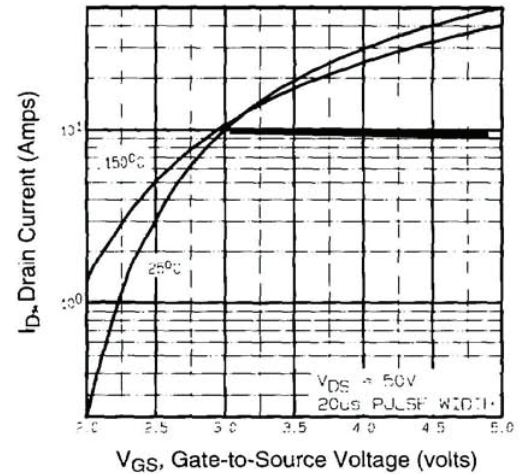


Fig. 3 - Typical Transfer Characteristics

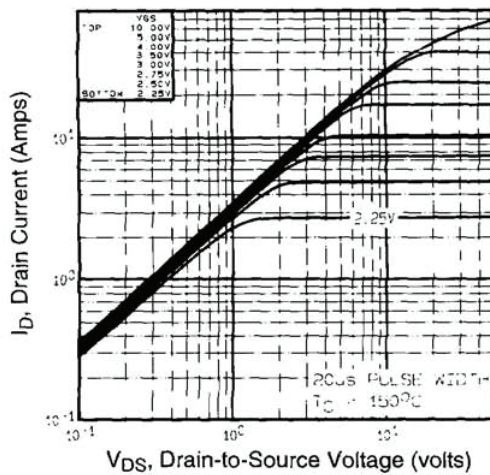


Fig. 2 - Typical Output Characteristics, $T_C = 150\text{ }^{\circ}\text{C}$

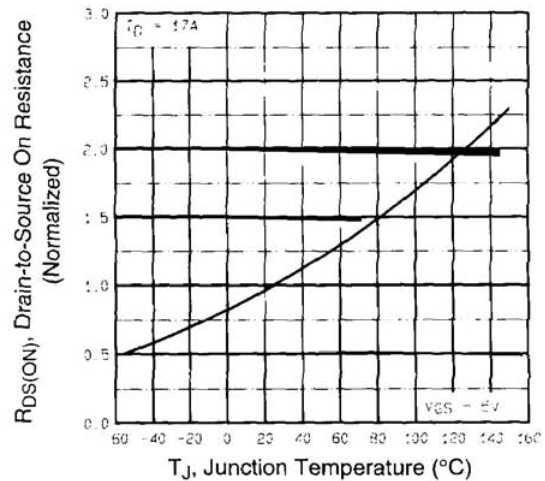
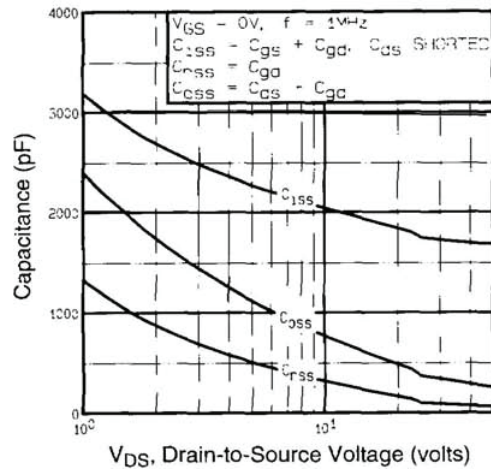
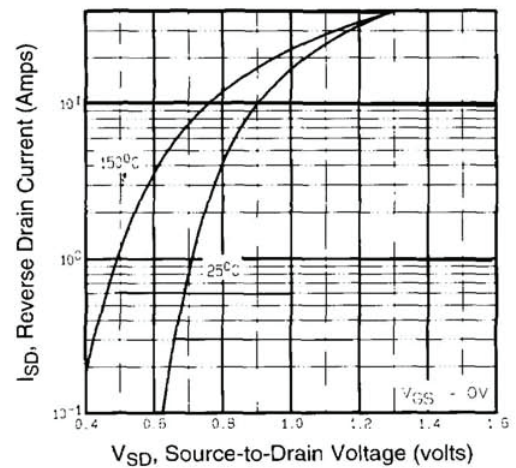
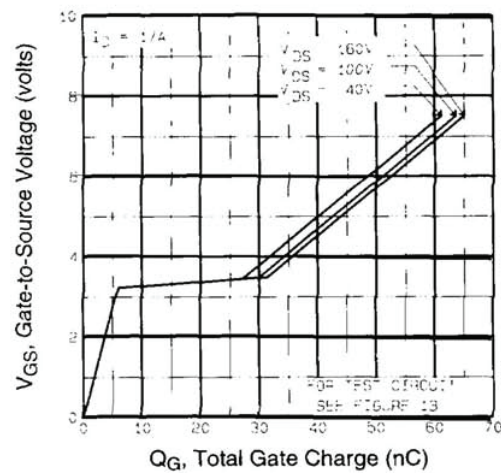
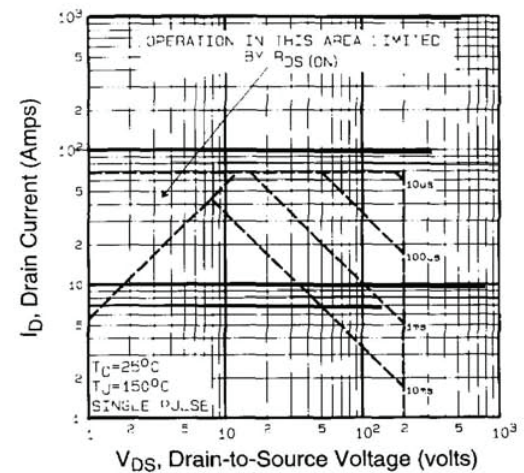
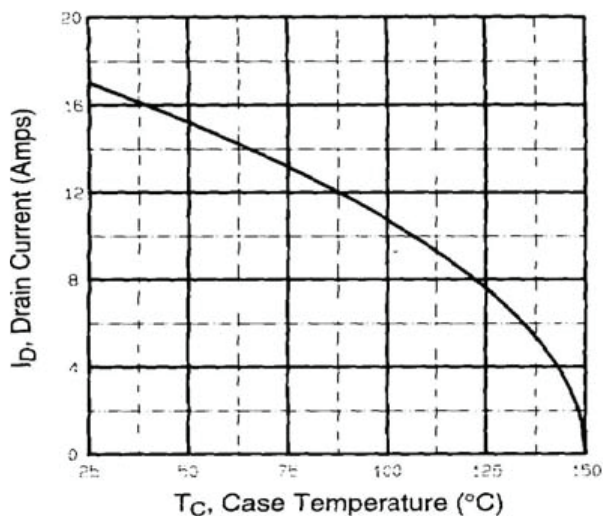
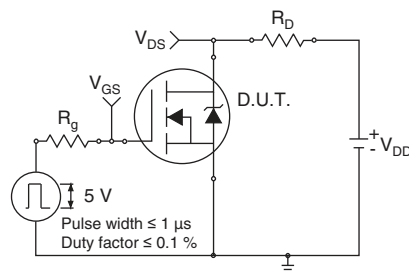
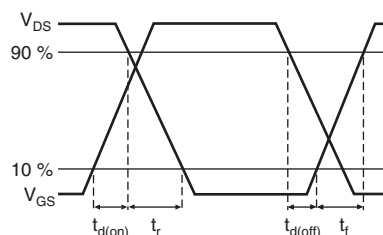
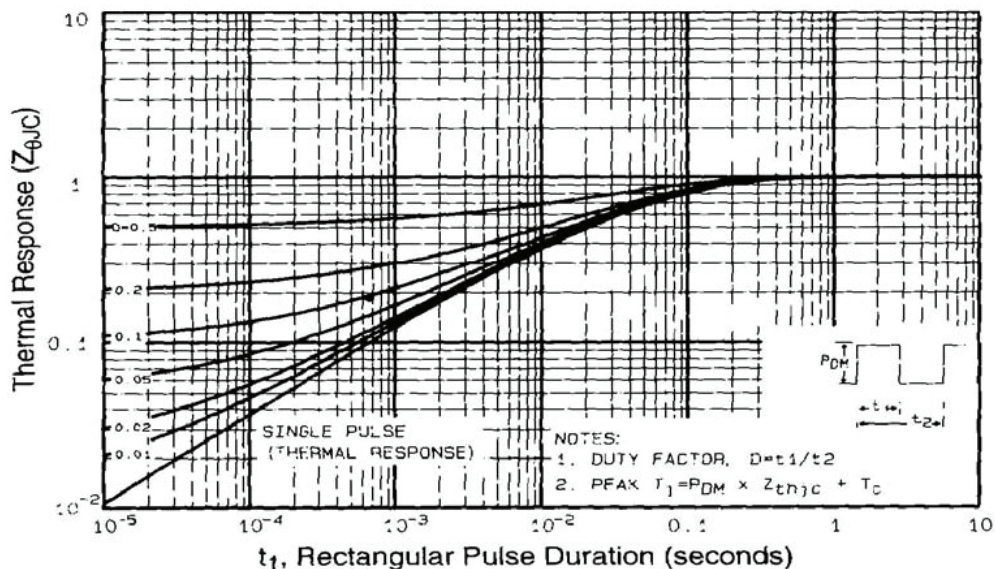
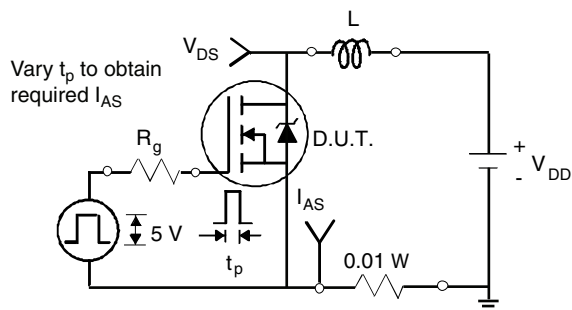
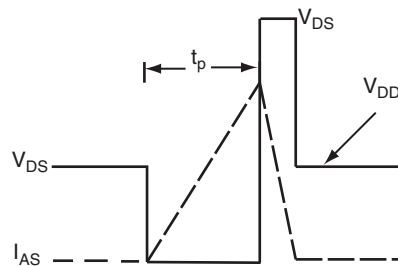
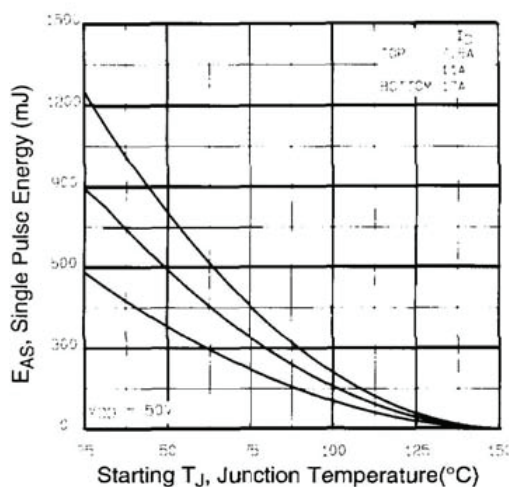
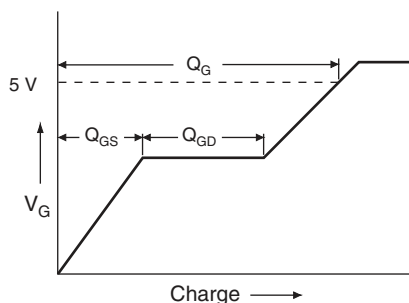
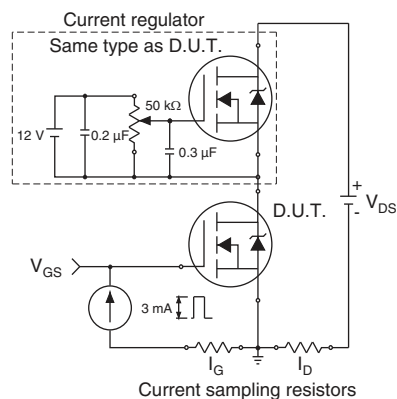


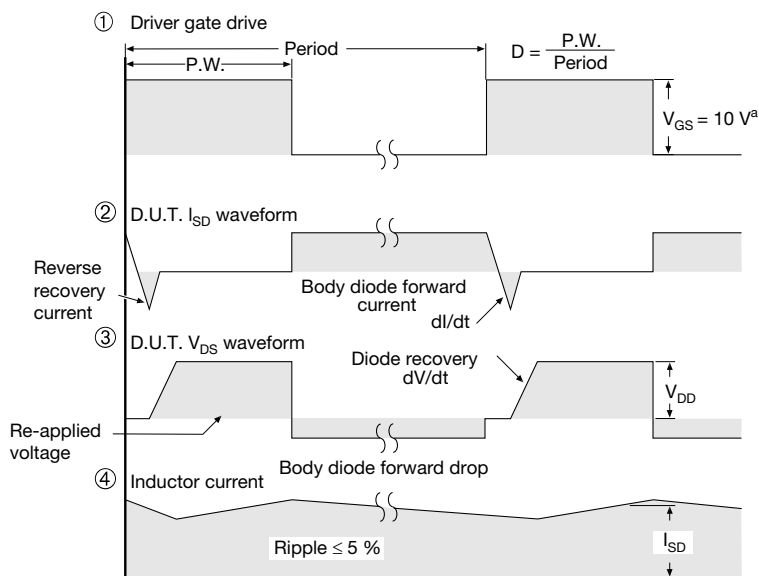
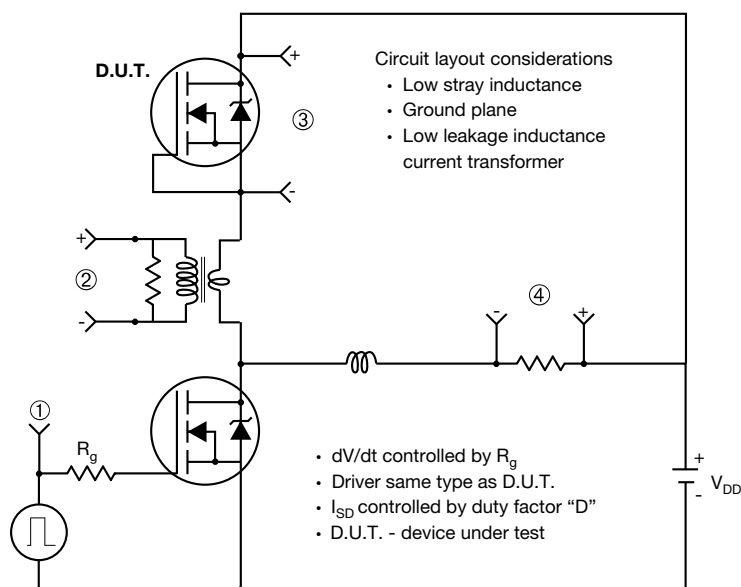
Fig. 4 - Normalized On-Resistance vs. Temperature


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

Fig. 7 - Typical Source-Drain Diode Forward Voltage

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


Fig. 12a - Unclamped Inductive Test Circuit

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

Peak Diode Recovery dV/dt Test Circuit



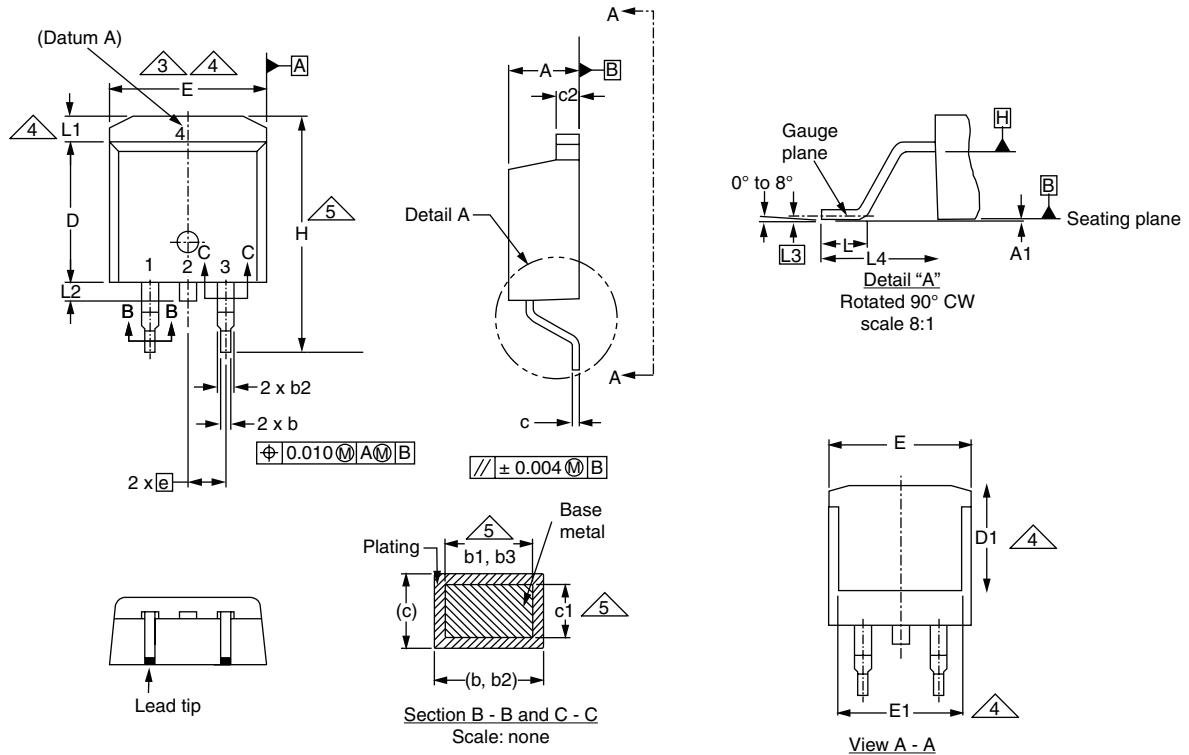
Note

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

Fig. 14 - For N-Channel

Vishay Silconix maintains worldwide manufacturing capability. Products may be manufactured at one of several qualified locations. Reliability data for Silcon Technology and Package Reliability represent a composite of all qualified locations. For related documents such as package/tape drawings, part marking, and reliability data, see www.vishay.com/ppg?91306.

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)

[Return to Index](#)



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