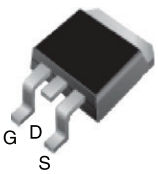
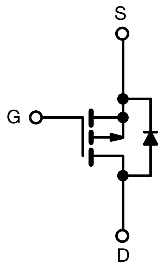
Power MOSFET

D^2PAK (TO-263)





P-Channel MOSFET

PRODUCT SUMMARY		
V_{DS} (V)	-200	
$R_{DS(on)}$ (Ω)	V_{GS} = -10 V	3
Q_g max. (nC)	11	
Q_{gs} (nC)	7	
Q_{gd} (nC)	4	
Configuration	Single	

FEATURES

- Surface-mount
- Available in tape and reel
- Dynamic dV/dt rating
- P-channel
- Fast switching
- Ease of paralleling
- Simple drive requirements
- 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 D^2PAK (TO-263) 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 D^2PAK (TO-263) is suitable for high current applications because of its low internal connection resistance and can dissipate up to 2 W in a typical surface mount application.

ORDERING INFORMATION	
Package	D^2PAK (TO-263)
Lead (Pb)-free and Halogen-free	SiHF9610S-GE3
	SiHF9610STRR-GE3
	SiHF9610STRL-GE3
Lead (Pb)-free	IRF9610SPbF
	IRF9610STRRPbF
	IRF9610STRLPbF

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

PARAMETER			SYMBOL	LIMIT	UNIT
Drain-Source Voltage			V_{DS}	-200	V
Gate-Source Voltage			V_{GS}	± 20	
Continuous Drain Current	V_{GS} at -10 V	T_C = 25 °C	I_D	-1.8	A
		T_C = 100 °C		-1	
Pulsed Drain Current[a]			I_{DM}	-7	
Linear Derating Factor				0.16	W/°C
Linear Derating Factor (PCB mount) [d]				0.025	
Maximum Power Dissipation	T_C = 25 °C		P_D	20	W
Maximum Power Dissipation (PCB mount) [d]	T_A = 25 °C			3	
Peak Diode Recovery dV/dt [b]			dV/dt	-5	V/ns
Operating Junction and Storage Temperature Range			T_J, T_{stg}	-55 to +150	°C
Soldering Recommendations (Peak temperature) [c]	For 10 s			300	

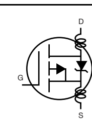
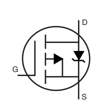
Notes

a. Repetitive rating; pulse width limited by maximum junction temperature (see fig. 5)
b. $I_{SD} \leq$ -1.8 A, dI/dt $\leq$ 70 A/μs, $V_{DD} \leq V_{DS}$, $T_J \leq$ 150 °C
c. 1.6 mm from case
d. When mounted on 1" square PCB (FR-4 or G-10 material)

THERMAL RESISTANCE RATINGS				
PARAMETER	SYMBOL	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}	-	6.4	

Note

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

SPECIFICATIONS (T_J = 25 °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 μA	-200	-	-	V
V_{DS} Temperature Coefficient	$\Delta V_{DS}/T_J$	Reference to 25 °C, I_D = -1 mA	-	-0.23	-	V/°C
Gate-Source Threshold Voltage	$V_{GS(th)}$	V_{DS} = V_{GS}, I_D = -250 μA	-2	-	-4	V
Gate-Source Leakage	I_{GSS}	V_{GS} = ± 20 V	-	-	± 100	nA
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS} = -200 V, V_{GS} = 0 V	-	-	-100	μA
		V_{DS} = -160 V, V_{GS} = 0 V, T_J = 125 °C	-	-	-500	
Drain-Source On-State Resistance	$R_{DS(on)}$	V_{GS} = -10 V, I_D = -0.90 A [b]	-	-	3	Ω
Forward Transconductance	g_{fs}	V_{DS} = -50 V, I_D = -0.90 A [b]	0.90	-	-	S
Dynamic						
Input Capacitance	C_{iss}	V_{GS} = 0 V, V_{DS} = -25 V, f = 1 MHz, see fig. 10	-	170	-	pF
Output Capacitance	C_{oss}		-	50	-	
Reverse Transfer Capacitance	C_{rss}		-	15	-	
Total Gate Charge	Q_g	V_{GS} = -10 V, I_D = -3.5 A, V_{DS} = -160 V, see fig. 11 and 18 [b]	-	-	11	nC
Gate-Source Charge	Q_{gs}		-	-	7	
Gate-Drain Charge	Q_{gd}		-	-	4	
Turn-On Delay Time	$t_{d(on)}$	V_{DD} = -100 V, I_D = -0.90 A, R_G = 50 Ω, R_D = 110 Ω, see fig. 17 [b]	-	8	-	ns
Rise Time	t_r		-	15	-	
Turn-Off Delay Time	$t_{d(off)}$		-	1	-	
Fall Time	t_f		-	8	-	
Gate Input Resistance	R_g	f = 1 MHz, open drain	2.5	-	14.3	Ω
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	-	
Drain-Source Body Diode Characteristics						
Continuous Source-Drain Diode Current	I_S	MOSFET symbol showing the integral reverse p - n junction diode 	-	-	-1.8	A
Pulsed Diode Forward Current [a]	I_{SM}		-	-	-7	
Body Diode Voltage	V_{SD}	T_J = 25 °C, I_S = -1.8 A, V_{GS} = 0 V [b]	-	-	-5.8	V
Body Diode Reverse Recovery Time	t_{rr}	T_J = 25 °C, I_F = -1.8 A, dI/dt = 100 A/μs [b]	-	240	360	ns
Body Diode Reverse Recovery Charge	Q_{rr}		-	1.7	2.6	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. 5)

b. Pulse width ≤ 300 μs; duty cycle ≤ 2 %

TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)

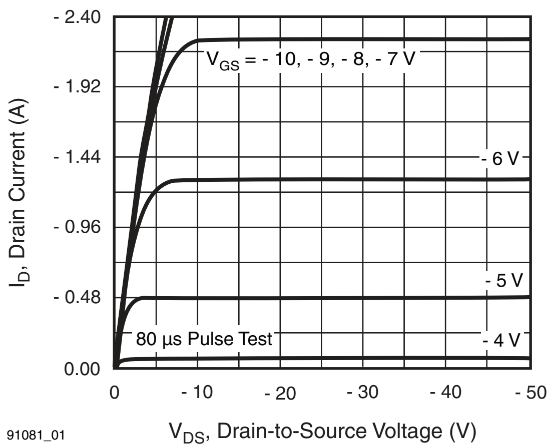


Fig. 1 - Typical Output Characteristics

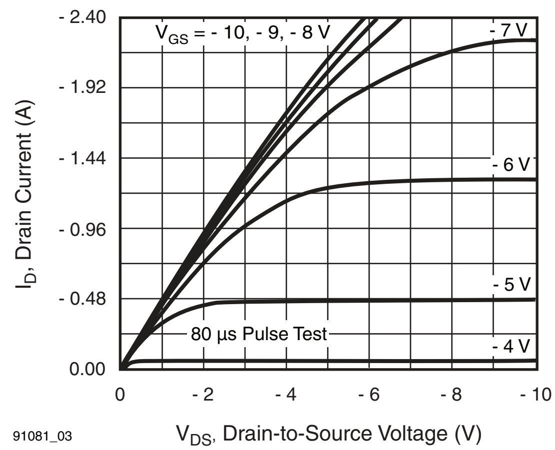


Fig. 3 - Typical Saturation Characteristics

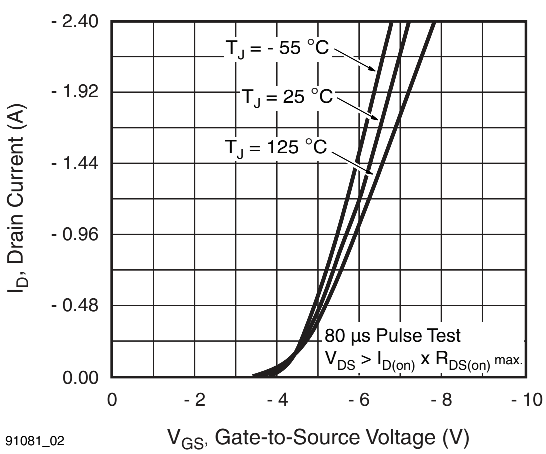


Fig. 2 - Typical Transfer Characteristics

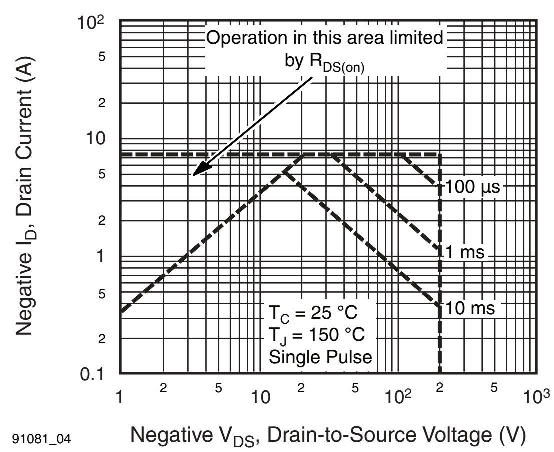


Fig. 4 - Maximum Safe Operating Area

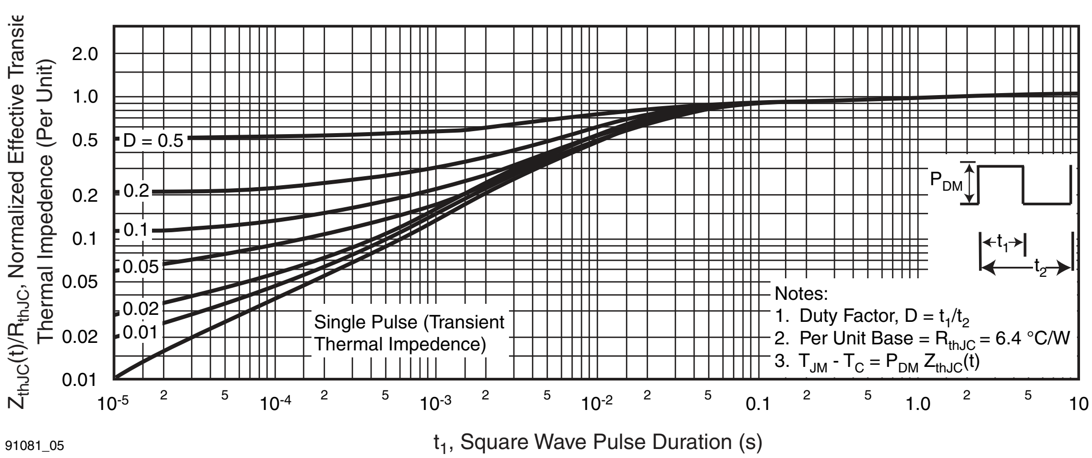


Fig. 5 - Maximum Effective Transient Thermal Impedance, Junction-to.Case vs. Pulse Duration

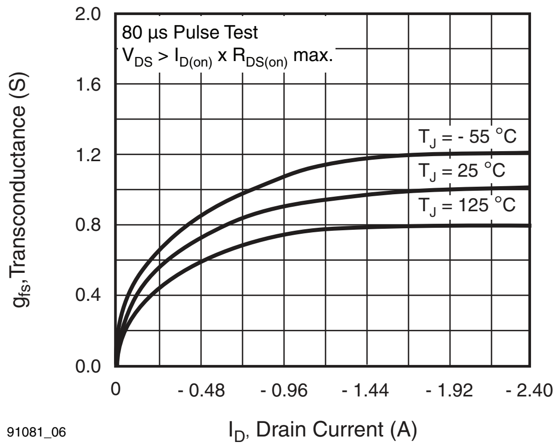


Fig. 6 - Typical Transconductance vs. Drain Current

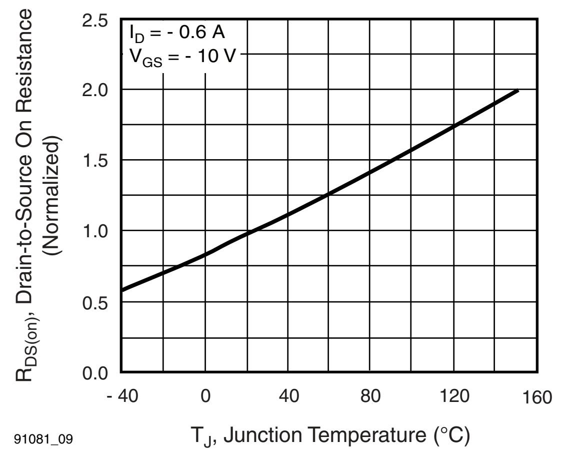


Fig. 9 - Normalized On-Resistance vs. Temperature

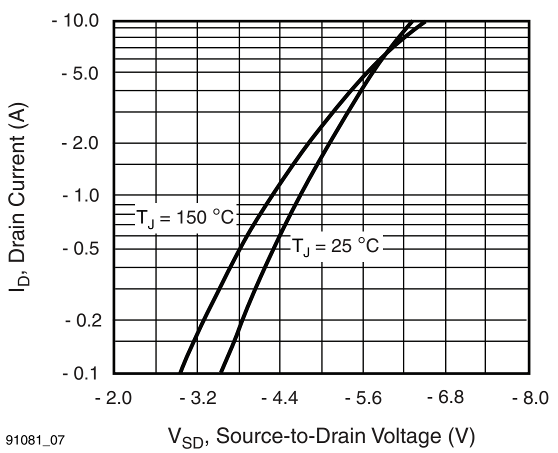


Fig. 7 - Typical Source-Drain Diode Forward Voltage

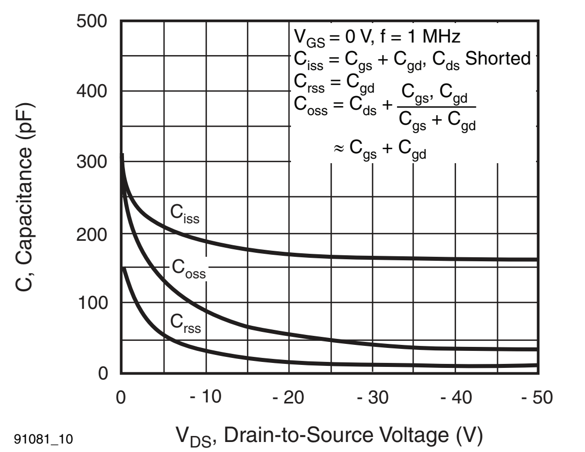


Fig. 10 - Typical Capacitance vs. Drain-to-Source Voltage

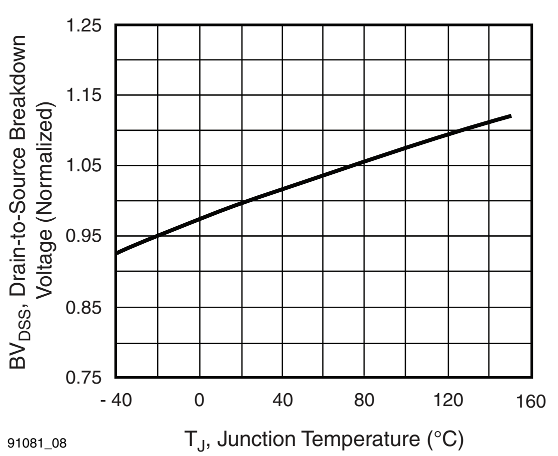


Fig. 8 - Breakdown Voltage vs. Temperature

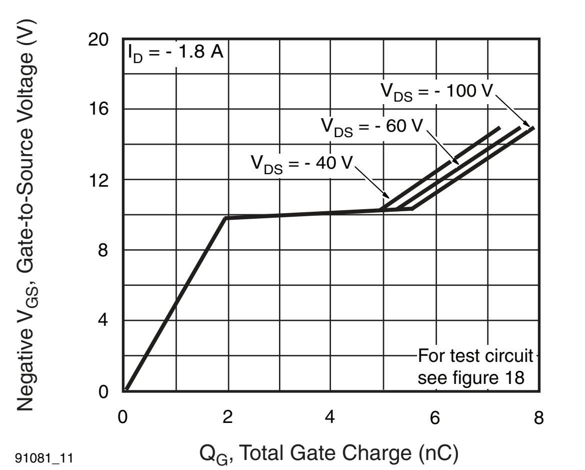


Fig. 11 - Typical Gate Charge vs. Gate-to-Source Voltage

For technical questions, contact: hvm@vishay.com

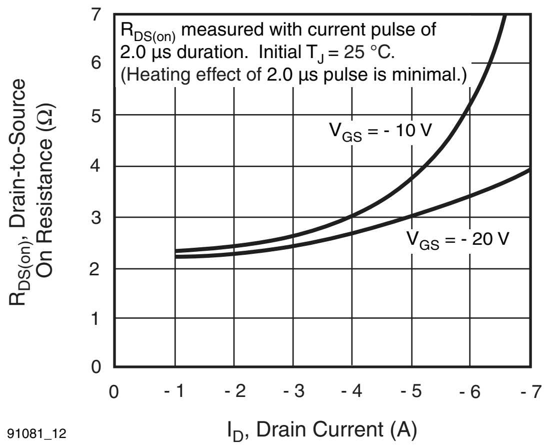


Fig. 12 - Typical On-Resistance vs. Drain Current

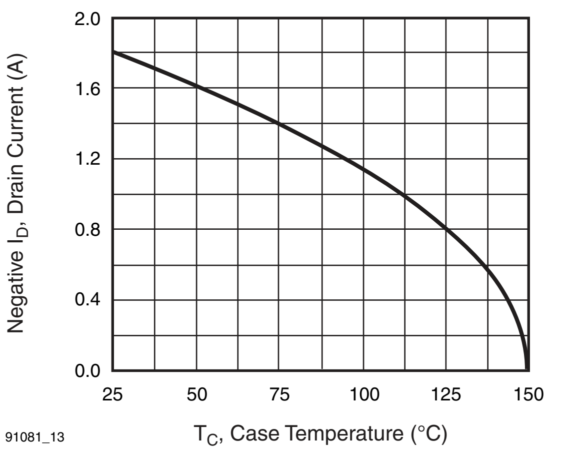


Fig. 13 - Maximum Drain Current vs. Case Temperature

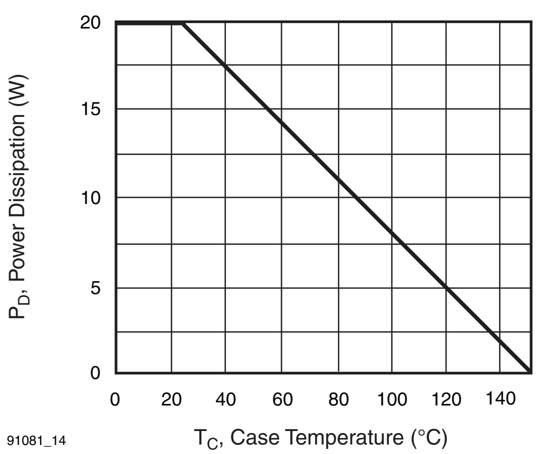


Fig. 14 - Power vs. Temperature Derating Curve

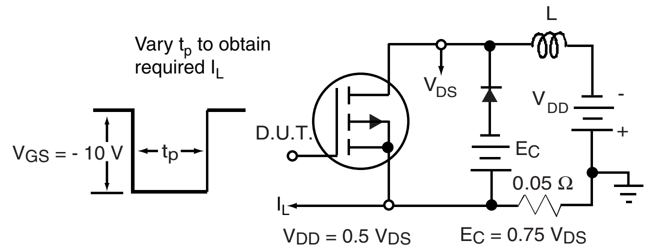


Fig. 15 - Clamped Inductive Test Circuit

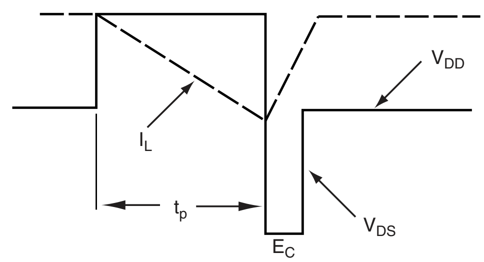


Fig. 16 - Clamped Inductive Waveforms

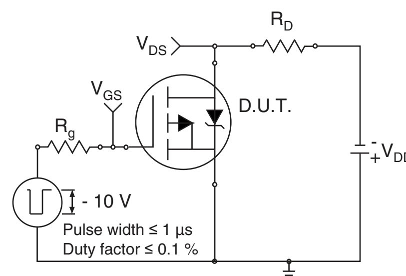


Fig. 17a - Switching Time Test Circuit

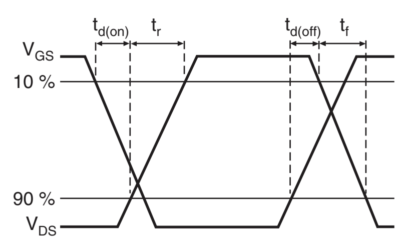


Fig. 17b - Switching Time Waveforms

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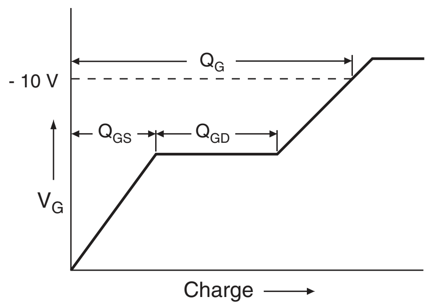


Fig. 18a - Basic Gate Charge Waveform

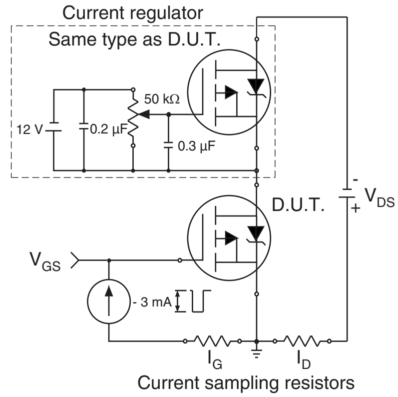
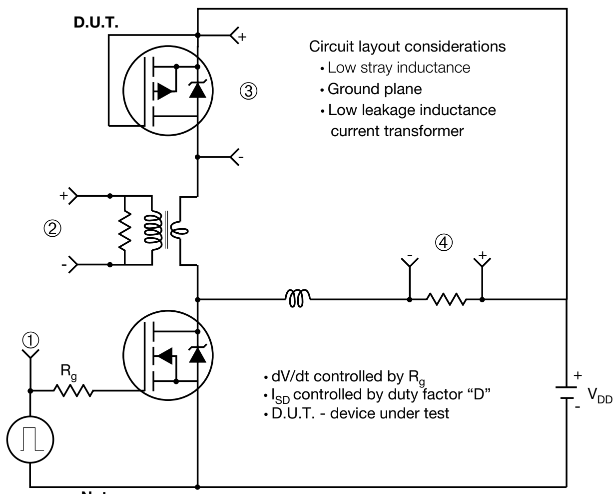
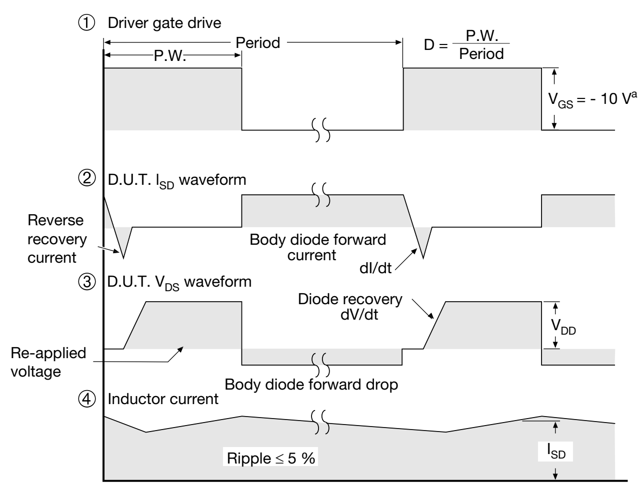


Fig. 18b - Gate Charge Test Circuit

Peak Diode Recovery dV/dt Test Circuit



Note
• Compliment N-Channel of D.U.T. for driver



Note
a. V_{GS} = - 5 V for logic level and - 3 V drive devices

Fig. 19 - For P-Channel

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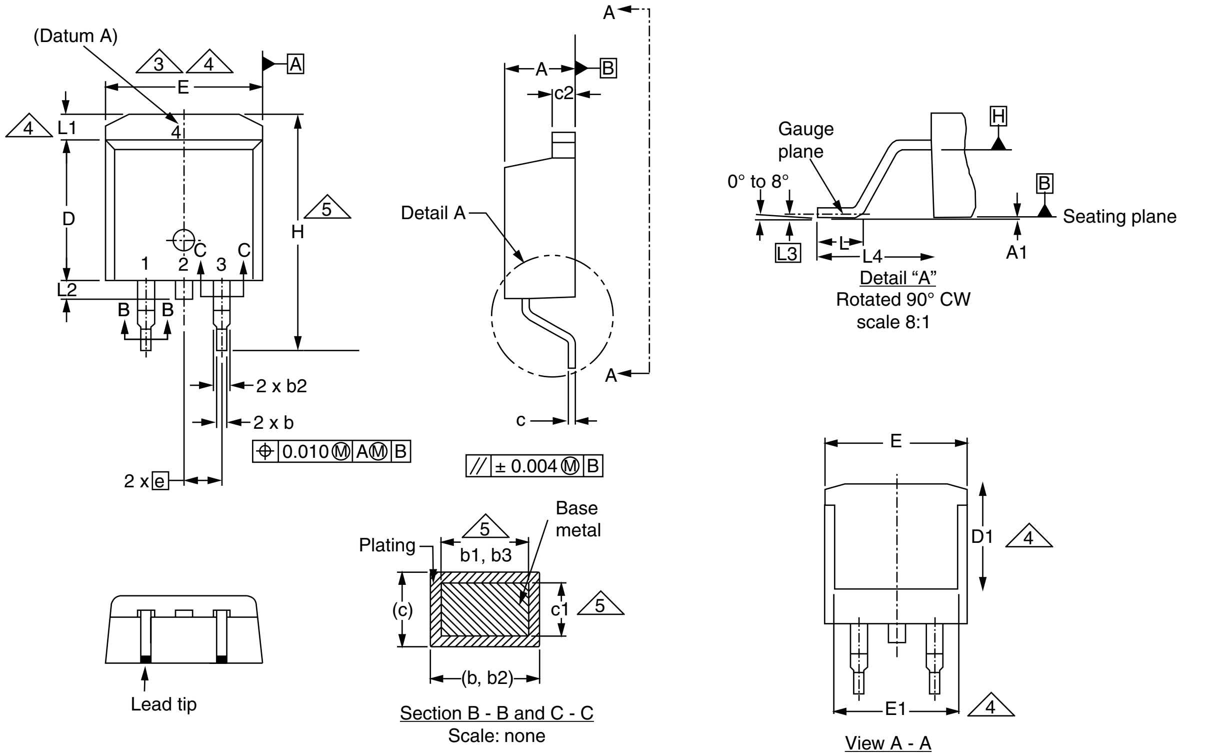
TO-263AB (HIGH VOLTAGE)



	MILLIMETERS		INCHES	
DIM.	**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

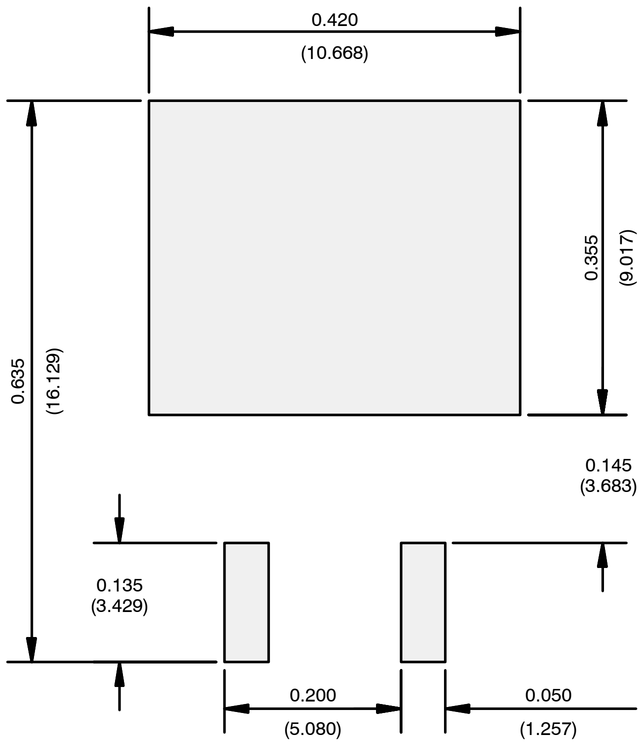
	MILLIMETERS		INCHES	
DIM.	**MIN.**	**MAX.**	**MIN.**	**MAX.**
D1	6.86	-	0.270	-
E	9.65	10.67	0.380	0.420
E1	6.22	-	0.245	-
e	2.54 BSC		0.100 BSC	
H	14.61	15.88	0.575	0.625
L	1.78	2.79	0.070	0.110
L1	-	1.65	-	0.066
L2	-	1.78	-	0.070
L3	0.25 BSC		0.010 BSC	
L4	4.78	5.28	0.188	0.208

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^{2}PAK: 3-Lead



Recommended Minimum Pads
Dimensions in Inches/(mm)

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