

## E Series Power MOSFET



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

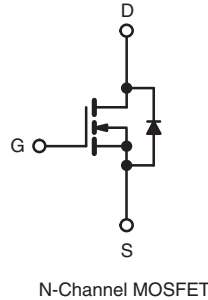
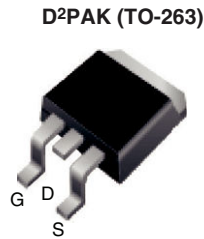
PRODUCT SUMMARY		
$V_{DS}$ (V) at $T_J$ max.	650	
$R_{DS(on)}$ max. at 25 °C ( $\Omega$ )	$V_{GS} = 10$ V	0.099
$Q_g$ (Max.) (nC)	150	
$Q_{gs}$ (nC)	24	
$Q_{gd}$ (nC)	42	
Configuration	Single	

### 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)

### 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
- Industrial
  - Welding
  - Induction Heating
  - Motor Drives
  - Battery Chargers
  - Renewable Energy
  - Solar (PV Inverters)



ORDERING INFORMATION	
Package	D <sup>2</sup> PAK (TO-263)
Lead (Pb)-free and Halogen-free	SiHB33N60E-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	$V_{GS}$		$\pm 20$	
Gate-Source Voltage AC ( $f > 1$ Hz)			30	
Continuous Drain Current ( $T_J = 150$ °C)	$V_{GS}$ at 10 V	$T_C = 25$ °C	33	A
		$T_C = 100$ °C	21	
Pulsed Drain Current <sup>a</sup>	$I_{DM}$		88	
Linear Derating Factor			2.2	W/°C
Single Pulse Avalanche Energy <sup>b</sup>	$E_{AS}$		793	mJ
Maximum Power Dissipation	$P_D$		278	W
Operating Junction and Storage Temperature Range		$T_J, T_{stg}$	- 55 to + 150	°C
Drain-Source Voltage Slope	$T_J = 125$ °C		37	V/ns
Reverse Diode $dV/dt$ <sup>d</sup>			12	
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,  $R_g = 25$   $\Omega$ ,  $I_{AS} = 7.5$  A.
- 1.6 mm from case.
- $I_{SD} \leq I_D$ ,  $dI/dt = 100$  A/ $\mu$ s, starting  $T_J = 25$  °C.



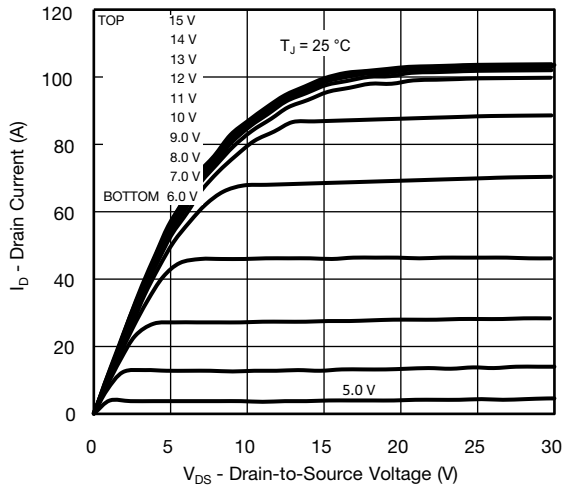
THERMAL RESISTANCE RATINGS				
PARAMETER	SYMBOL	TYP.	MAX.	UNIT
Maximum Junction-to-Ambient	$R_{thJA}$	-	62	°C/W
Maximum Junction-to-Case (Drain)	$R_{thJC}$	-	0.45	

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 $25\text{ }^\circ\text{C}, I_D = 1\text{ mA}$		-	0.71	-	V/°C
Gate-Source Threshold Voltage (N)	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$		2.0	-	4.0	V
Gate-Source Leakage	$I_{GSS}$	$V_{GS} = \pm 20\text{ V}$		-	-	$\pm 100$	nA
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = 600\text{ V}, V_{GS} = 0\text{ V}$		-	-	1	$\mu\text{A}$
		$V_{DS} = 480\text{ V}, V_{GS} = 0\text{ V}, T_J = 125\text{ }^\circ\text{C}$		-	-	10	
Drain-Source On-State Resistance	$R_{DS(on)}$	$V_{GS} = 10\text{ V}$	$I_D = 16.5\text{ A}$	-	0.083	0.099	$\Omega$
Forward Transconductance <sup>a</sup>	$g_{fs}$	$V_{DS} = 30\text{ V}, I_D = 16.5\text{ A}$		-	11	-	S
<b>Dynamic</b>							
Input Capacitance	$C_{iss}$	$V_{GS} = 0\text{ V},$ $V_{DS} = 100\text{ V},$ $f = 1\text{ MHz}$		-	3508	-	pF
Output Capacitance	$C_{oss}$			-	156	-	
Reverse Transfer Capacitance	$C_{rss}$			-	6	-	
Effective output capacitance, energy related <sup>b</sup>	$C_{o(er)}$			-	136	-	
Effective output capacitance, time related <sup>c</sup>	$C_{o(tr)}$	$V_{GS} = 0\text{ V}, V_{DS} = 0\text{ V to } 480\text{ V}$		-	468	-	
Total Gate Charge	$Q_g$	$V_{GS} = 10\text{ V}$	$I_D = 16.5\text{ A}, V_{DS} = 480\text{ V}$	-	100	150	nC
Gate-Source Charge	$Q_{gs}$			-	24	-	
Gate-Drain Charge	$Q_{gd}$			-	42	-	
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = 480\text{ V}, I_D = 16.5\text{ A}$ $R_g = 9.1\text{ }\Omega, V_{GS} = 10\text{ V}$		-	28	56	ns
Rise Time	$t_r$			-	60	90	
Turn-Off Delay Time	$t_{d(off)}$			-	99	150	
Fall Time	$t_f$			-	54	80	
Gate Input Resistance	$R_g$	$f = 1\text{ MHz}, \text{open drain}$		-	0.7	-	$\Omega$
<b>Drain-Source Body Diode Characteristics</b>							
Continuous Source-Drain Diode Current	$I_S$	MOSFET symbol showing the integral reverse p - n junction diode 		-	-	33	A
Pulsed Diode Forward Current	$I_{SM}$			-	-	88	
Diode Forward Voltage	$V_{SD}$	$T_J = 25\text{ }^\circ\text{C}, I_S = 8\text{ A}, V_{GS} = 0\text{ V}$		-	-	1.2	V
Reverse Recovery Time	$t_{rr}$	$T_J = 25\text{ }^\circ\text{C}, I_F = I_S,$ $dI/dt = 100\text{ A}/\mu\text{s}, V_R = 20\text{ V}$		-	503	-	ns
Reverse Recovery Charge	$Q_{rr}$			-	8.5	-	$\mu\text{C}$
Reverse Recovery Current	$I_{RRM}$			-	26	-	A

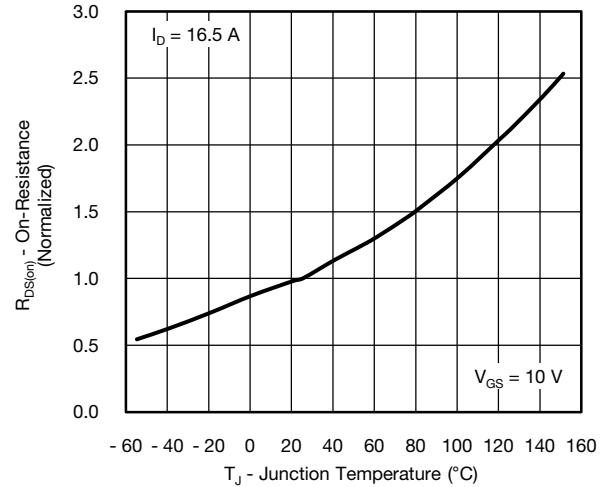
**Notes**

- a. Repetitive rating; pulse width limited by maximum junction temperature.
- b.  $C_{oss(er)}$  is a fixed capacitance that gives the same energy as  $C_{oss}$  while  $V_{DS}$  is rising from 0 % to 80 %  $V_{DSS}$ .
- c.  $C_{oss(tr)}$  is a fixed capacitance that gives the charging time as  $C_{oss}$  while  $V_{DS}$  is rising from 0 % to 80 %  $V_{DSS}$ .

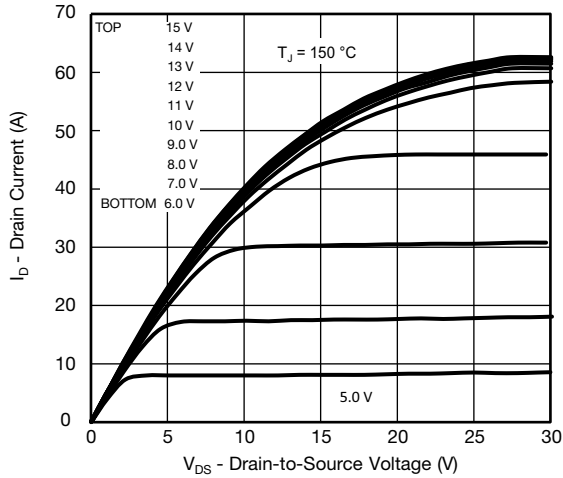
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



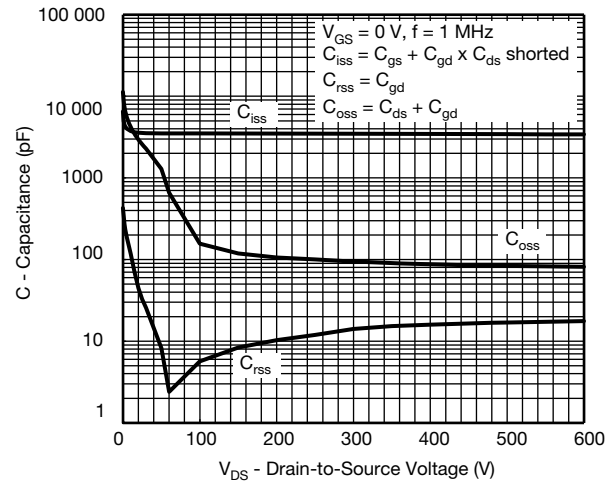
**Fig. 1 - Typical Output Characteristics,  $T_C = 150\text{ }^\circ\text{C}$**



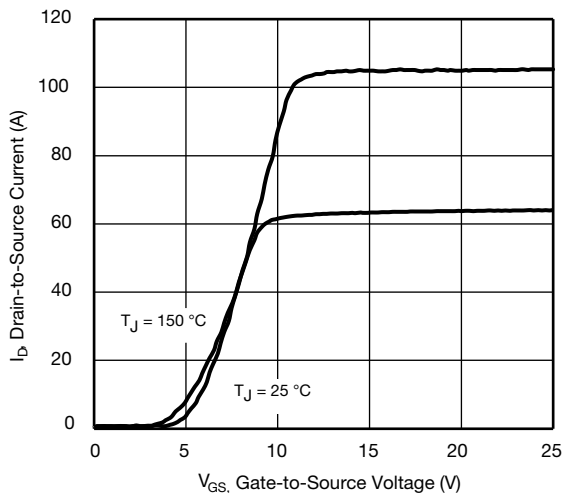
**Fig. 4 - Normalized On-Resistance vs. Temperature**



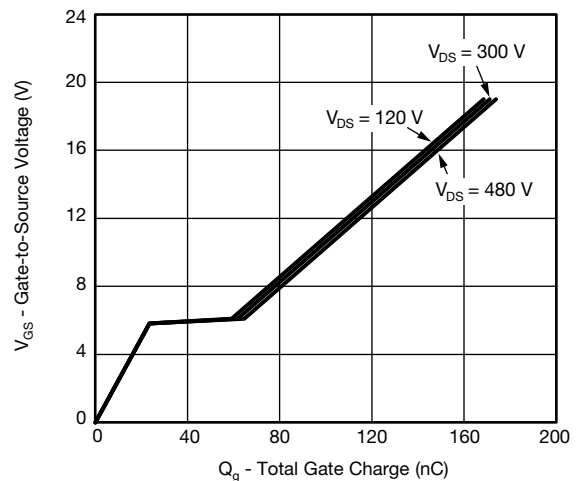
**Fig. 2 - Typical Output Characteristics,  $T_C = 150\text{ }^\circ\text{C}$**



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



**Fig. 3 - Typical Transfer Characteristics**



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

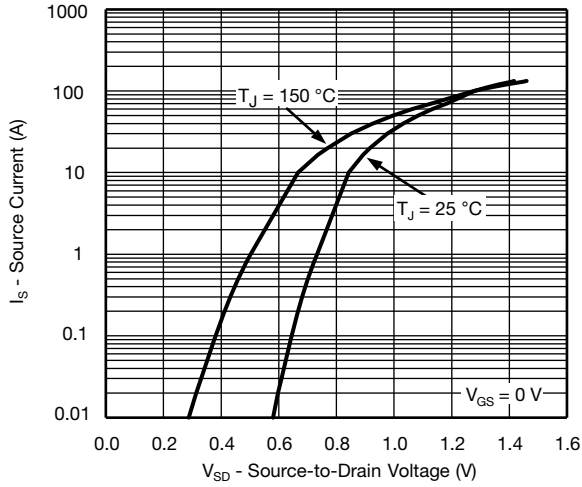


Fig. 7 - Typical Source-Drain Diode Forward Voltage

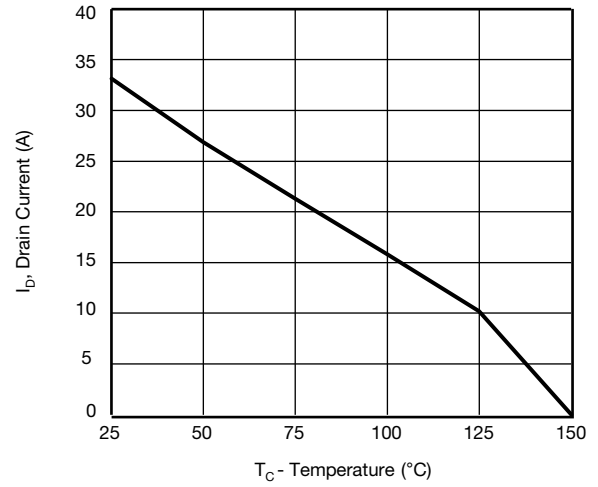


Fig. 9 - Maximum Drain Current vs. Case Temperature

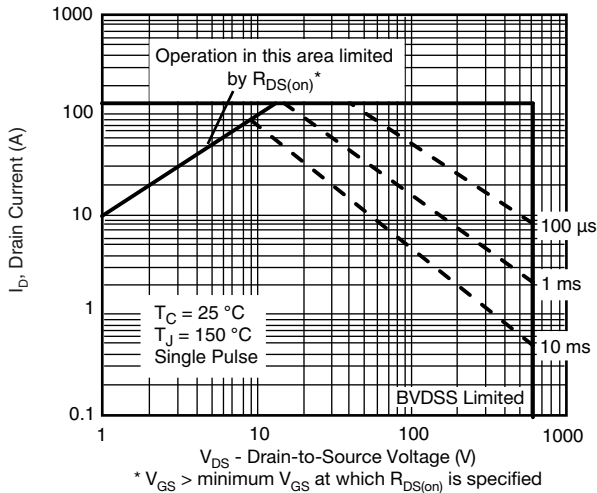


Fig. 8 - Maximum Safe Operating Area

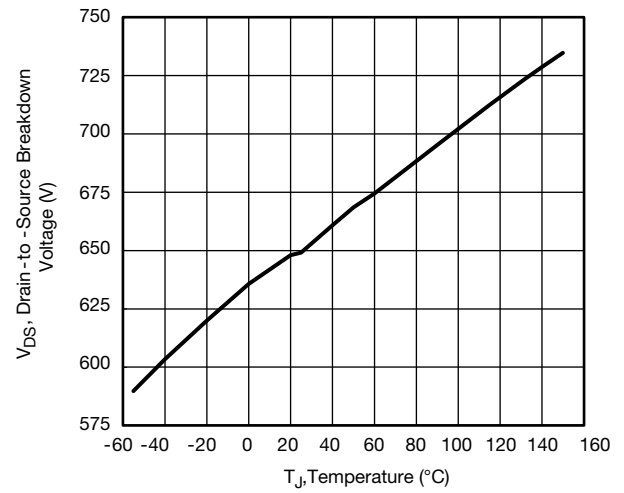


Fig. 10 - Typical Drain-to-Source Voltage vs. Temperature

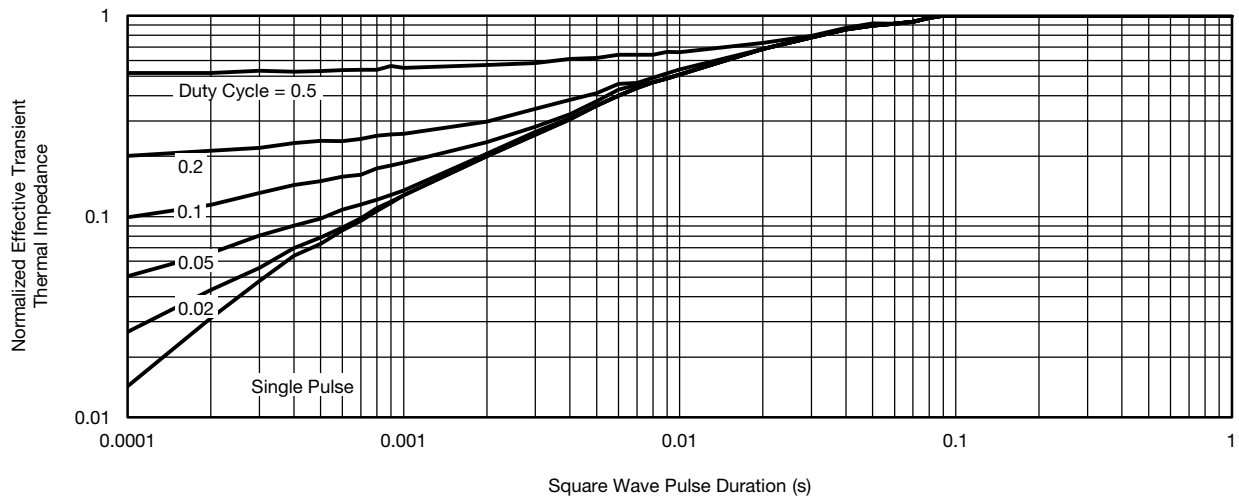


Fig. 11 - Normalized Thermal Transient Impedance, Junction-to-Case



Fig. 12 - Switching Time Test Circuit

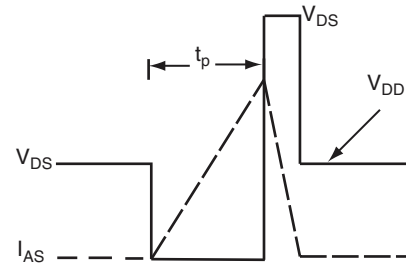


Fig. 15 - Unclamped Inductive Waveforms

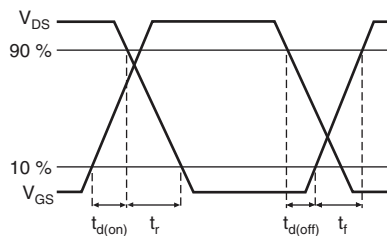


Fig. 13 - Switching Time Waveforms

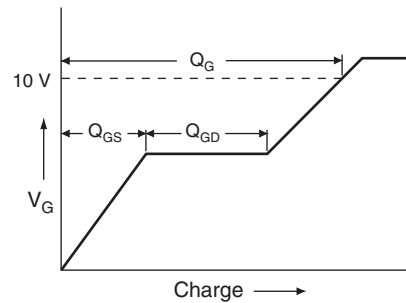


Fig. 16 - Basic Gate Charge Waveform



Fig. 14 - Unclamped Inductive Test Circuit

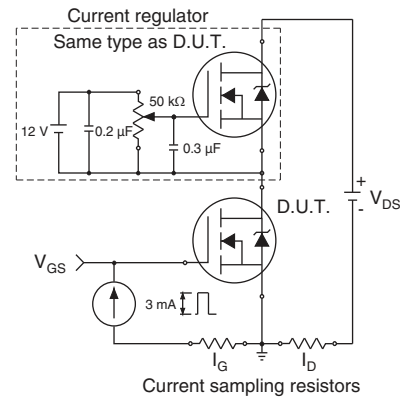
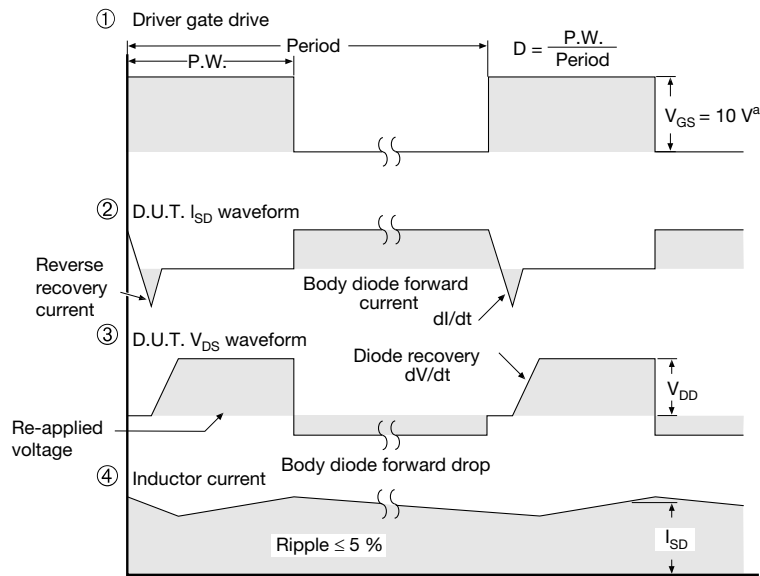
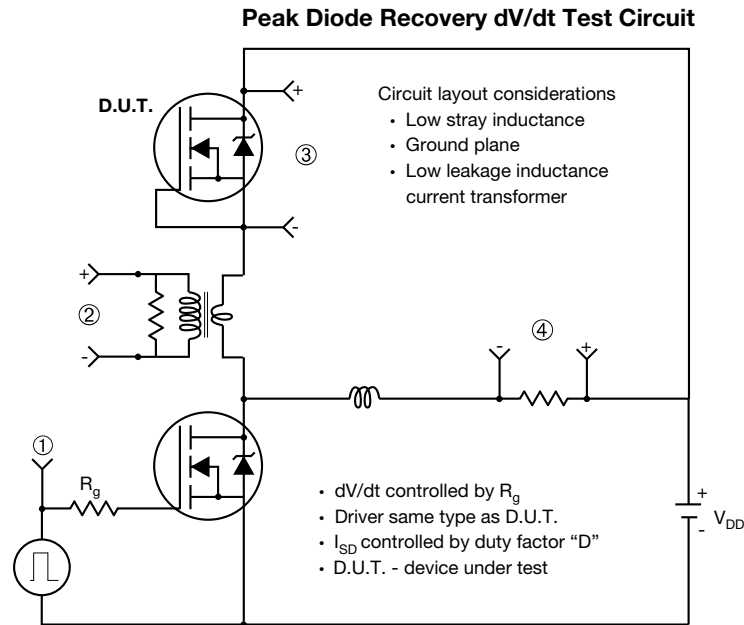


Fig. 17 - Gate Charge Test Circuit



**Note**

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

**Fig. 18 - For N-Channel**

Vishay Siliconix maintains worldwide manufacturing capability. Products may be manufactured at one of several qualified locations. Reliability data for Silicon 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?91524](http://www.vishay.com/ppg?91524).

### 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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**Please note that some Vishay documentation may still make reference to RoHS Directive 2002/95/EC. We confirm that all the products identified as being compliant to Directive 2002/95/EC conform to Directive 2011/65/EU.**

**Vishay Intertechnology, Inc. hereby certifies that all its products that are identified as Halogen-Free follow Halogen-Free requirements as per JEDEC JS709A standards. Please note that some Vishay documentation may still make reference to the IEC 61249-2-21 definition. We confirm that all the products identified as being compliant to IEC 61249-2-21 conform to JEDEC JS709A standards.**



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- Поставка более 17-ти миллионов наименований электронных компонентов;
- Поставка сложных, дефицитных, либо снятых с производства позиций;
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- Лицензия ФСБ на осуществление работ с использованием сведений, составляющих государственную тайну;
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- Подбор аналогов;
- Консультации по применению компонента;
- Поставка образцов и прототипов;
- Техническая поддержка проекта;
- Защита от снятия компонента с производства.



#### Как с нами связаться

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