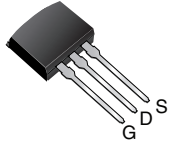
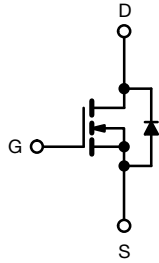
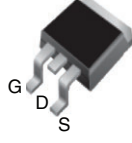


## Power MOSFET

**I<sup>2</sup>PAK (TO-262)**

**D<sup>2</sup>PAK (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](http://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

### PRODUCT SUMMARY

$V_{DS}$ (V)	400	
$R_{DS(on)}$ ( $\Omega$ )	$V_{GS} = 10$ V	0.55
$Q_g$ (Max.) (nC)	36	
$Q_{gs}$ (nC)	9.9	
$Q_{gd}$ (nC)	16	
Configuration	Single	

### APPLICATIONS

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

### TYPICAL SMPS TOPOLOGIES

- Single transistor flyback Xfmr. reset
- Single transistor forward Xfmr. reset (both for US line input only)

### ORDERING INFORMATION

Package	D <sup>2</sup> PAK (TO-263)	D <sup>2</sup> PAK (TO-263)	D <sup>2</sup> PAK (TO-263)	I <sup>2</sup> PAK (TO-262)
Lead (Pb)-free and Halogen-free	SiHF740AS-GE3	SiHF740ASTRL-GE3 <sup>a</sup>	SiHF740ASTRR-GE3 <sup>a</sup>	SiHF740AL-GE3
Lead (Pb)-free	IRF740ASPbF	IRF740ASTRLPbF <sup>a</sup>	IRF740ASTRRPbF <sup>a</sup>	IRF740ALPbF

### Note

a. See device orientation.

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

PARAMETER	SYMBOL	LIMIT	UNIT
Drain-Source Voltage	$V_{DS}$	400	V
Gate-Source Voltage	$V_{GS}$	$\pm 30$	
Continuous Drain Current <sup>e</sup>	$V_{GS}$ at 10 V	$T_C = 25$ °C	10
		$T_C = 100$ °C	6.3
Pulsed Drain Current <sup>a, e</sup>	$I_{DM}$	40	A
Linear Derating Factor		1.0	W/°C
Single Pulse Avalanche Energy <sup>b, e</sup>	$E_{AS}$	630	mJ
Avalanche Current <sup>a</sup>	$I_{AR}$	10	A
Repetitive Avalanche Energy <sup>a</sup>	$E_{AR}$	$T_A = 25$ °C	12.5
		$T_C = 25$ °C	3.1
Maximum Power Dissipation	$P_D$	125	W
Peak Diode Recovery $dV/dt$ <sup>c, e</sup>	$dV/dt$	5.9	V/ns
Operating Junction and Storage Temperature Range	$T_J, T_{stg}$	- 55 to + 150	°C
Soldering Recommendations (Peak Temperature)	for 10 s	300 <sup>d</sup>	

### Notes


- Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11)
- Starting  $T_J = 25$  °C,  $L = 12.6$  mH,  $R_g = 25$   $\Omega$ ,  $I_{AS} = 10$  A (see fig. 12)
- $I_{SD} \leq 10$  A,  $dI/dt \leq 330$  A/ $\mu$ s,  $V_{DD} \leq V_{DS}$ ,  $T_J \leq 150$  °C
- 1.6 mm from case
- Uses IRF740A, SiHF740A data and test conditions



THERMAL RESISTANCE RATINGS				
PARAMETER	SYMBOL	TYP.	MAX.	UNIT
Maximum Junction-to-Ambient (PCB Mounted, Steady-State) <sup>a</sup>	R <sub>thJA</sub>	-	40	°C/W
Maximum Junction-to-Case (Drain)	R <sub>thJC</sub>	-	1.0	

**Note**

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

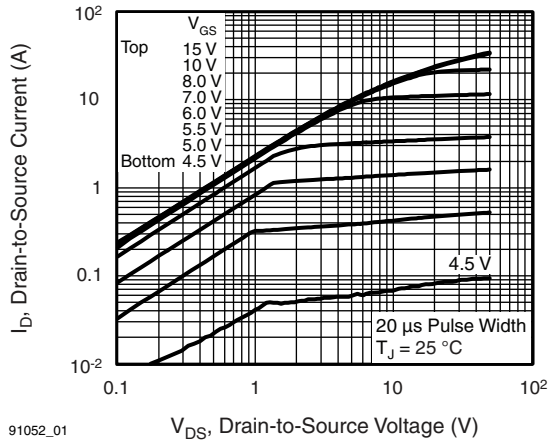
SPECIFICATIONS (T <sub>J</sub> = 25 °C, unless otherwise noted)							
PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
<b>Static</b>							
Drain-Source Breakdown Voltage	V <sub>DS</sub>	V <sub>GS</sub> = 0, I <sub>D</sub> = 250 μA		400	-	-	V
V <sub>DS</sub> Temperature Coefficient	ΔV <sub>DS</sub> /T <sub>J</sub>	Reference to 25 °C, I <sub>D</sub> = 1 mA <sup>d</sup>		-	0.48	-	V/°C
Gate-Source Threshold Voltage	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> = ± 30 V		-	-	± 100	nA
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>DS</sub> = 400 V, V <sub>GS</sub> = 0 V		-	-	25	μA
		V <sub>DS</sub> = 320 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 125 °C		-	-	250	
Drain-Source On-State Resistance	R <sub>DS(on)</sub>	V <sub>GS</sub> = 10 V	I <sub>D</sub> = 6.0 A <sup>b</sup>	-	-	0.55	Ω
Forward Transconductance	g <sub>fs</sub>	V <sub>DS</sub> = 50 V, I <sub>D</sub> = 6.0 A <sup>d</sup>		4.9	-	-	S
<b>Dynamic</b>							
Input Capacitance	C <sub>iss</sub>	V <sub>GS</sub> = 0 V, V <sub>DS</sub> = 25 V, f = 1.0 MHz, see fig. 5 <sup>d</sup>		-	1030	-	pF
Output Capacitance	C <sub>oss</sub>			-	170	-	
Reverse Transfer Capacitance	C <sub>rss</sub>			-	7.7	-	
Output Capacitance	C <sub>oss</sub>	V <sub>GS</sub> = 0 V	V <sub>DS</sub> = 1.0 V, f = 1.0 MHz	-	1490	-	pF
			V <sub>DS</sub> = 320 V, f = 1.0 MHz	-	52	-	
Effective Output Capacitance	C <sub>oss eff.</sub>	V <sub>DS</sub> = 0 V to 320 V <sup>c, d</sup>		-	61	-	pF
Total Gate Charge	Q <sub>g</sub>	V <sub>GS</sub> = 10 V	I <sub>D</sub> = 10 A, V <sub>DS</sub> = 320 V, see fig. 6 and 13 <sup>b, d</sup>	-	-	36	nC
Gate-Source Charge	Q <sub>gs</sub>			-	-	9.9	
Gate-Drain Charge	Q <sub>gd</sub>			-	-	16	
Turn-On Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> = 200 V, I <sub>D</sub> = 10 A, R <sub>g</sub> = 10 Ω, R <sub>D</sub> = 19.5 Ω, see fig. 10 <sup>b, d</sup>		-	10	-	ns
Rise Time	t <sub>r</sub>			-	35	-	
Turn-Off Delay Time	t <sub>d(off)</sub>			-	24	-	
Fall Time	t <sub>f</sub>			-	22	-	
<b>Drain-Source Body Diode Characteristics</b>							
Continuous Source-Drain Diode Current	I <sub>S</sub>	MOSFET symbol showing the integral reverse p - n junction diode		-	-	10	A
Pulsed Diode Forward Current <sup>a</sup>	I <sub>SM</sub>			-	-	40	
Body Diode Voltage	V <sub>SD</sub>	T <sub>J</sub> = 25 °C, I <sub>S</sub> = 10 A, V <sub>GS</sub> = 0 V <sup>b</sup>		-	-	2.0	V
Body Diode Reverse Recovery Time	t <sub>rr</sub>	T <sub>J</sub> = 25 °C, I <sub>F</sub> = 10 A, di/dt = 100 A/μs <sup>b, d</sup>		-	240	360	ns
Body Diode Reverse Recovery Charge	Q <sub>rr</sub>			-	1.9	2.9	μC
Forward Turn-On Time	t <sub>on</sub>	Intrinsic turn-on time is negligible (turn-on is dominated by L <sub>S</sub> and L <sub>D</sub> )					

**Notes**

- a. Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).
- b. Pulse width ≤ 300 μs; duty cycle ≤ 2 %.
- c. C<sub>oss eff.</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>DS</sub>.
- d. Uses IRF740A, SiHF740A data and test conditions.

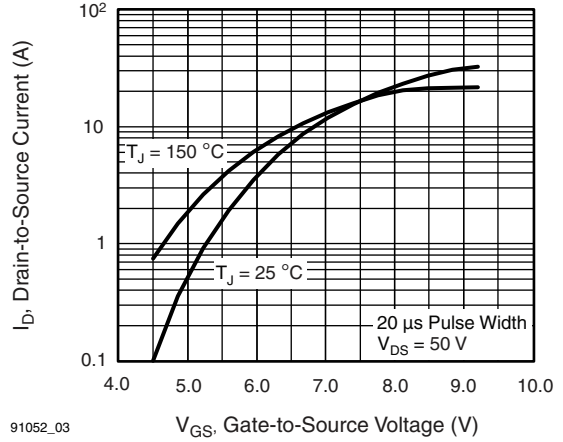


## TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



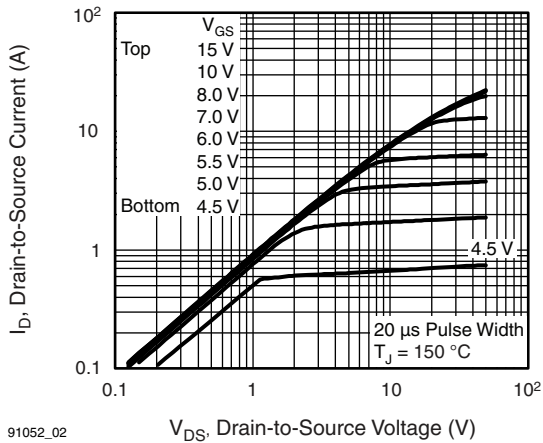
91052\_01

Fig. 1 - Typical Output Characteristics



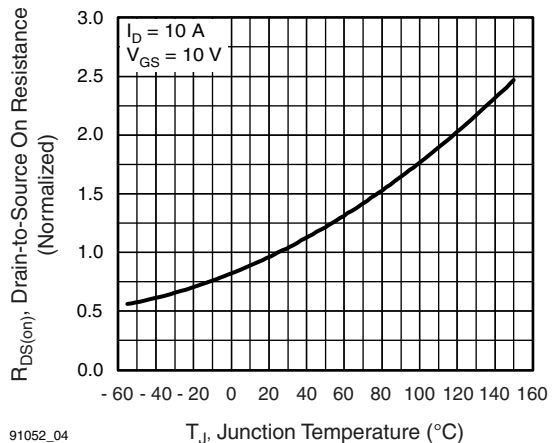
91052\_03

Fig. 2 - Typical Transfer Characteristics



91052\_02

Fig. 1 - Typical Output Characteristics



91052\_04

Fig. 3 - Normalized On-Resistance vs. Temperature

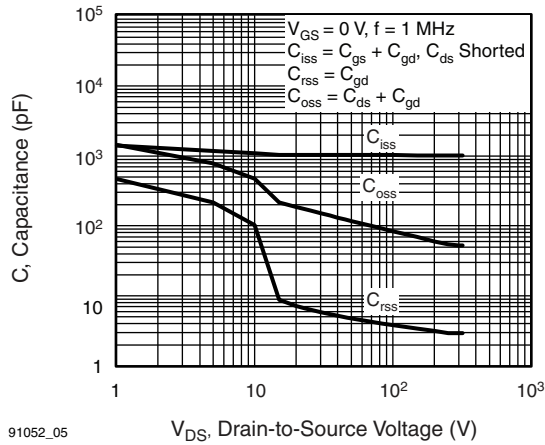


Fig. 4 - Typical Capacitance vs. Drain-to-Source Voltage

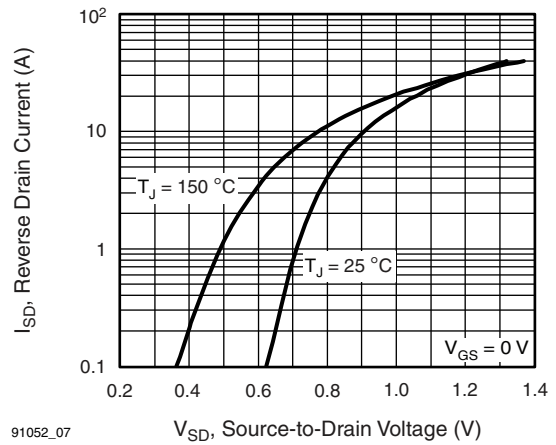


Fig. 6 - Typical Source-Drain Diode Forward Voltage

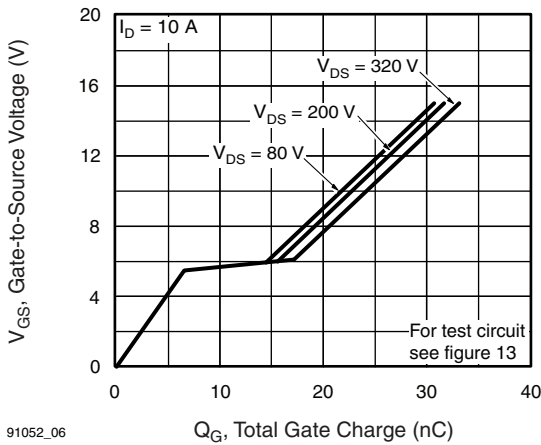


Fig. 5 - Typical Gate Charge vs. Gate-to-Source Voltage

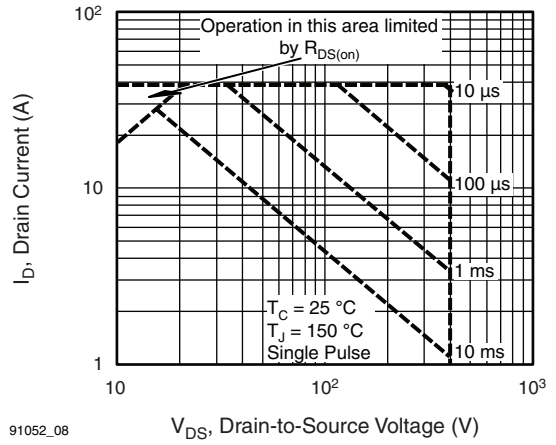
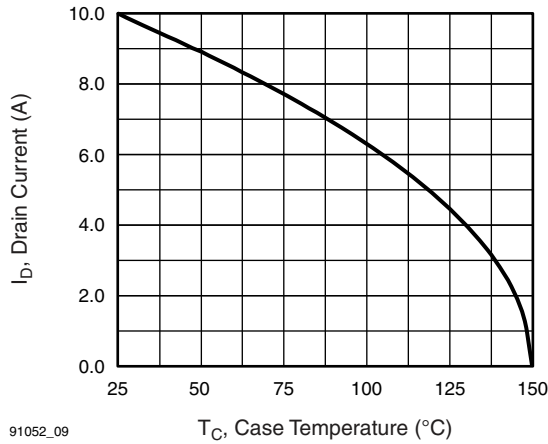
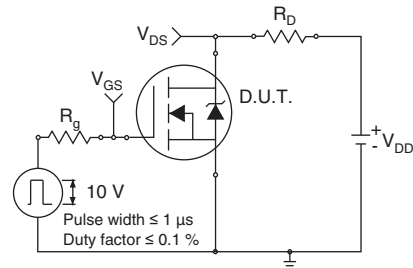


Fig. 7 - Maximum Safe Operating Area

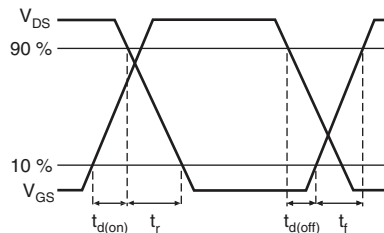


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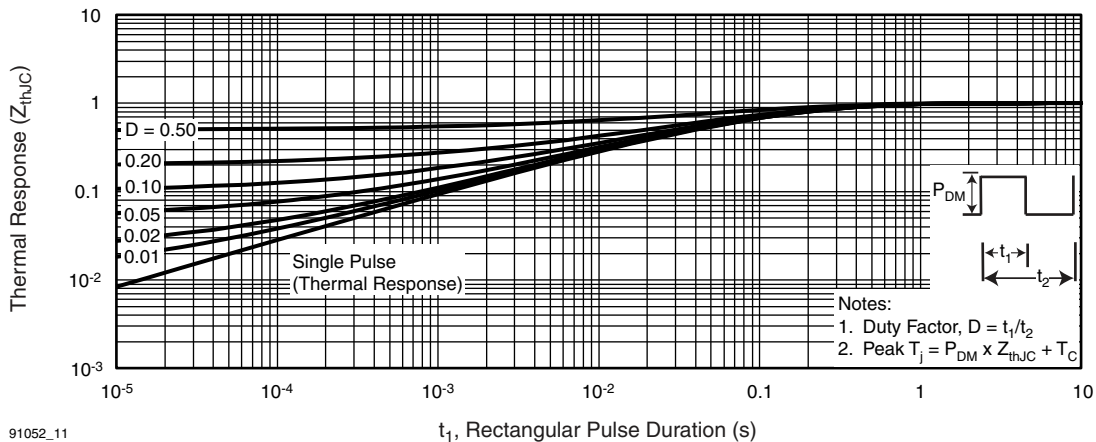
**Fig. 8 - Maximum Drain Current vs. Case Temperature**



**Fig. 10a - Switching Time Test Circuit**

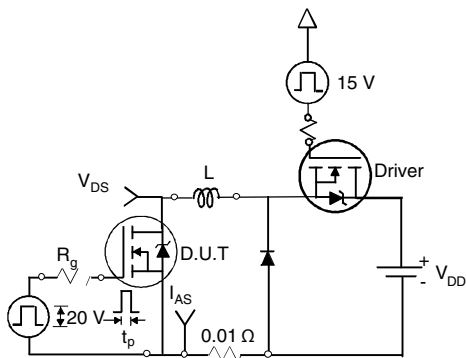


**Fig. 10b - Switching Time Waveforms**

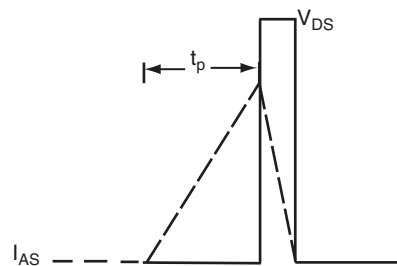


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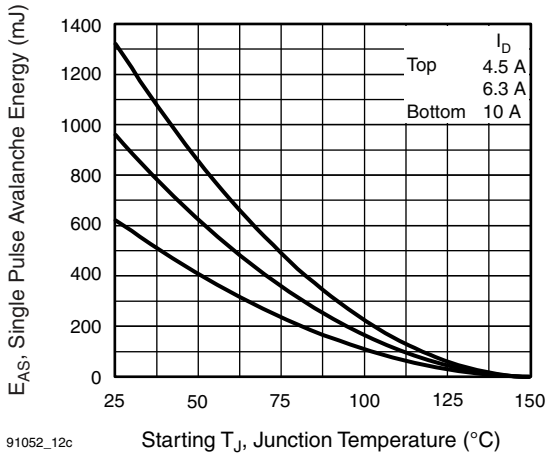
**Fig. 9 - Maximum Effective Transient Thermal Impedance, Junction-to-Case**



**Fig. 12a - Unclamped Inductive Test Circuit**

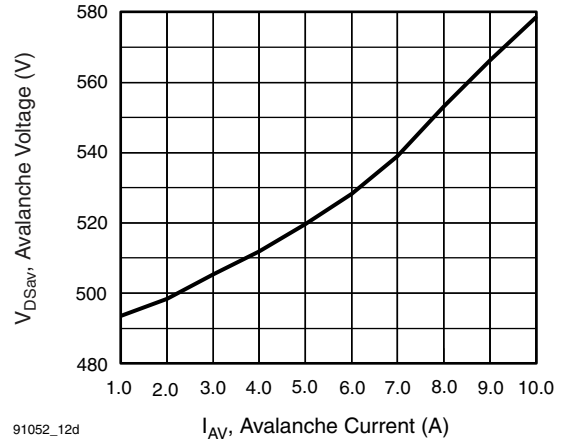


**Fig. 12b - Unclamped Inductive Waveforms**



91052\_12c

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



91052\_12d

Fig. 12d - Typical Drain-to-Source Voltage vs. Avalanche Current

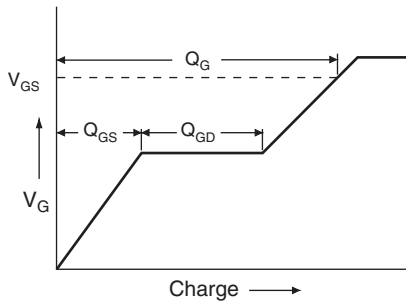


Fig. 13a - Basic Gate Charge Waveform

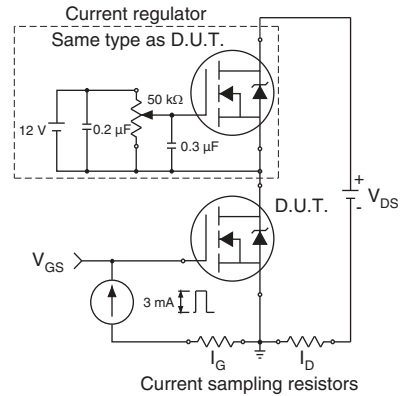
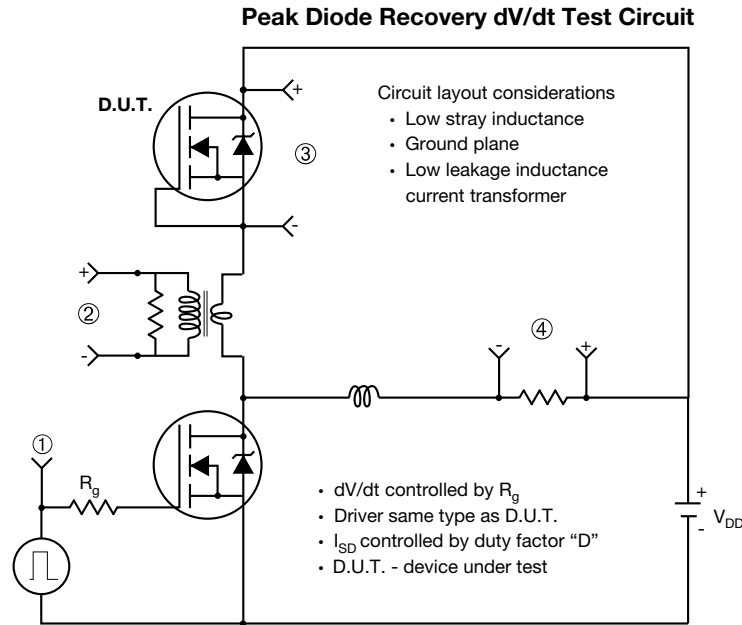


Fig. 13b - Gate Charge Test Circuit



**Note**

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

**Fig. 10 - 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.



### I<sup>2</sup>PAK (TO-262) (HIGH VOLTAGE)



DIM.	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	4.06	4.83	0.160	0.190
A1	2.03	3.02	0.080	0.119
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

DIM.	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
D	8.38	9.65	0.330	0.380
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	
L	13.46	14.10	0.530	0.555
L1	-	1.65	-	0.065
L2	3.56	3.71	0.140	0.146

ECN: S-82442-Rev. A, 27-Oct-08  
DWG: 5977

#### Notes

1. Dimensioning and tolerancing per ASME Y14.5M-1994.
2. Dimension D and E do not include mold flash. Mold flash shall not exceed 0.127 mm per side. These dimensions are measured at the outmost extremes of the plastic body.
3. Thermal pad contour optional within dimension E, L1, D1, and E1.
4. Dimension b1 and c1 apply to base metal only.

**RECOMMENDED MINIMUM PADS FOR D<sup>2</sup>PAK: 3-Lead**



Recommended Minimum Pads  
Dimensions in Inches/(mm)

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