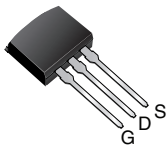


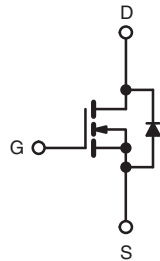
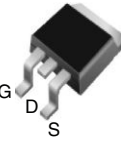
## Power MOSFET

PRODUCT SUMMARY	
$V_{DS}$ (V)	500
$R_{DS(on)}$ ( $\Omega$ )	$V_{GS} = 10\text{ V}$ 0.85
$Q_g$ (Max.) (nC)	38
$Q_{gs}$ (nC)	9.0
$Q_{gd}$ (nC)	18
Configuration	Single

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



D<sup>2</sup>PAK (TO-263)



N-Channel MOSFET

### FEATURES

- Halogen-free According to IEC 61249-2-21 Definition
- 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
- Compliant to RoHS Directive 2002/95/EC



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

### APPLICATIONS

- Switch Mode Power Supply (SMPS)
- Uninterruptible Power Supply
- High Speed Power Switching

### TYPICAL SMPS TOPOLOGIES

- Two Transistor Forward
- Half Bridge
- Full Bridge

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	SiHF840AS-GE3	SiHF840ASTRL-GE3 <sup>a</sup>	SiHF840ASTRR-GE3 <sup>a</sup>	SiHF840AL-GE3 <sup>a</sup>
Lead (Pb)-free	IRF840ASPbF	IRF840ASTRLPbF <sup>a</sup>	IRF840ASTRRPbF <sup>a</sup>	IRF840ALPbF
	SiHF840AS-E3	SiHF840ASTL-E3 <sup>a</sup>	SiHF840ASTR-E3 <sup>a</sup>	SiHF840AL-E3

**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	$V_{DS}$	500	V
Gate-Source Voltage	$V_{GS}$	$\pm 30$	
Continuous Drain Current	$V_{GS}$ at 10 V	$T_C = 25\text{ }^\circ\text{C}$	8.0
		$T_C = 100\text{ }^\circ\text{C}$	5.1
Pulsed Drain Current <sup>a</sup>	$I_{DM}$	32	A
Linear Derating Factor		1.0	W/ $^\circ\text{C}$
Single Pulse Avalanche Energy <sup>b</sup>	$E_{AS}$	510	mJ
Repetitive Avalanche Current <sup>a</sup>	$I_{AR}$	8.0	A
Repetitive Avalanche Energy <sup>a</sup>	$E_{AR}$	13	mJ
Maximum Power Dissipation	$P_D$	$T_C = 25\text{ }^\circ\text{C}$	125
		$T_A = 25\text{ }^\circ\text{C}$	3.1
Peak Diode Recovery $dV/dt$ <sup>c</sup>	$dV/dt$	5.0	V/ns
Operating Junction and Storage Temperature Range	$T_J, T_{stg}$	- 55 to + 150	$^\circ\text{C}$
Soldering Temperature	for 10 s	300 <sup>d</sup>	

**Notes**


- Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).
- Starting  $T_J = 25\text{ }^\circ\text{C}$ ,  $L = 16\text{ mH}$ ,  $R_g = 25\text{ }^\circ\Omega$ ,  $I_{AS} = 8.0\text{ A}$  (see fig. 12).
- $I_{SD} \leq 8.0\text{ A}$ ,  $dI/dt \leq 100\text{ A}/\mu\text{s}$ ,  $V_{DD} \leq V_{DS}$ ,  $T_J \leq 150\text{ }^\circ\text{C}$ .
- 1.6 mm from case.
- Uses IRF840A, SiHF840A data and test conditions.

\* Pb containing terminations are not RoHS compliant, exemptions may apply

THERMAL RESISTANCE RATINGS					
PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT
Maximum Junction-to-Ambient (PCB Mount) <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).

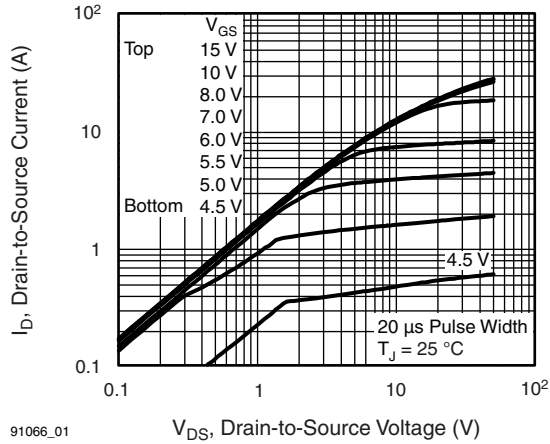
SPECIFICATIONS (T <sub>J</sub> = 25 °C, unless otherwise noted)							
PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
<b>Static</b>							
Drain-Source Breakdown Voltage	V <sub>DS</sub>	V <sub>GS</sub> = 0, I <sub>D</sub> = 250 μA		500	-	-	V
V <sub>DS</sub> Temperature Coefficient	ΔV <sub>DS</sub> /T <sub>J</sub>	Reference to 25 °C, I <sub>D</sub> = 1 mA <sup>d</sup>		-	0.58	-	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> = 500 V, V <sub>GS</sub> = 0 V		-	-	25	μA
		V <sub>DS</sub> = 400 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> = 4.8 A <sup>b</sup>	-	-	0.85	Ω
Forward Transconductance	g <sub>fs</sub>	V <sub>DS</sub> = 50 V, I <sub>D</sub> = 4.8 A		3.7	-	-	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		-	1018	-	pF
Output Capacitance	C <sub>oss</sub>			-	155	-	
Reverse Transfer Capacitance	C <sub>rss</sub>			-	8.0	-	
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
Output Capacitance	C <sub>oss</sub>		V <sub>DS</sub> = 400 V, f = 1.0 MHz	-	42	-	
Effective Output Capacitance	C <sub>oss eff.</sub>		V <sub>DS</sub> = 0 V to 480 V <sup>c, d</sup>	-	56	-	
Total Gate Charge	Q <sub>g</sub>	V <sub>GS</sub> = 10 V	I <sub>D</sub> = 8.0 A, V <sub>DS</sub> = 400 V, see fig. 6 and 13 <sup>b, d</sup>	-	-	38	nC
Gate-Source Charge	Q <sub>gs</sub>			-	-	9.0	
Gate-Drain Charge	Q <sub>gd</sub>			-	-	18	
Turn-On Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> = 250 V, I <sub>D</sub> = 8.0 A, R <sub>g</sub> = 9.1 Ω, R <sub>D</sub> = 31 Ω, see fig. 10 <sup>b, d</sup>		-	11	-	ns
Rise Time	t <sub>r</sub>			-	23	-	
Turn-Off Delay Time	t <sub>d(off)</sub>			-	26	-	
Fall Time	t <sub>f</sub>			-	19	-	
<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 		-	-	8.0	A
Pulsed Diode Forward Current <sup>a</sup>	I <sub>SM</sub>			-	-	32	
Body Diode Voltage	V <sub>SD</sub>	T <sub>J</sub> = 25 °C, I <sub>S</sub> = 8.0 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> = 8.0 A, di/dt = 100 A/μs <sup>b</sup>		-	422	633	ns
Body Diode Reverse Recovery Charge	Q <sub>rr</sub>			-	2.0	3.0	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

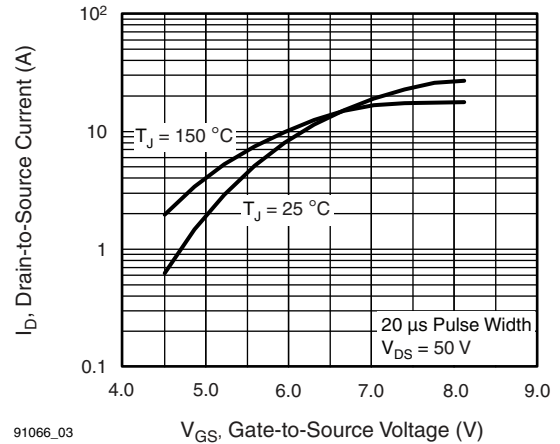
- Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).
- Pulse width ≤ 300 μs; duty cycle ≤ 2 %.
- C<sub>oss eff.</sub> is a fixed capacitance that gives the same charging time as C<sub>oss</sub> while V<sub>DS</sub> is rising from 0 % to 80 % V<sub>DS</sub>.
- Uses IRF840A, SiHF840A data and test conditions



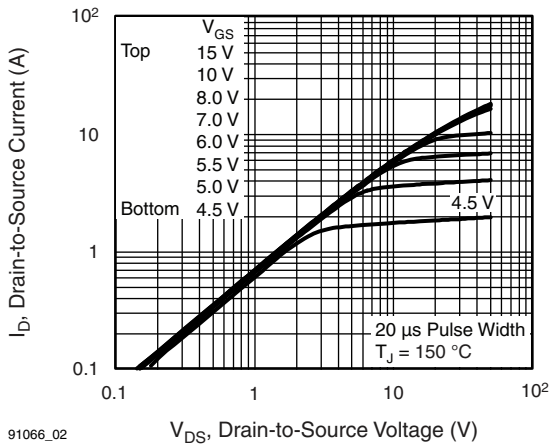
## TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



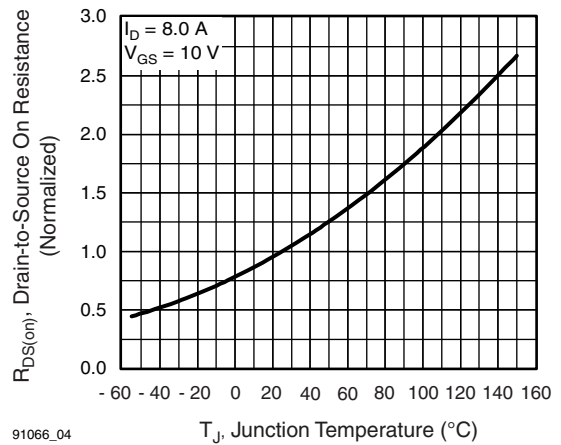
**Fig. 1 - Typical Output Characteristics**



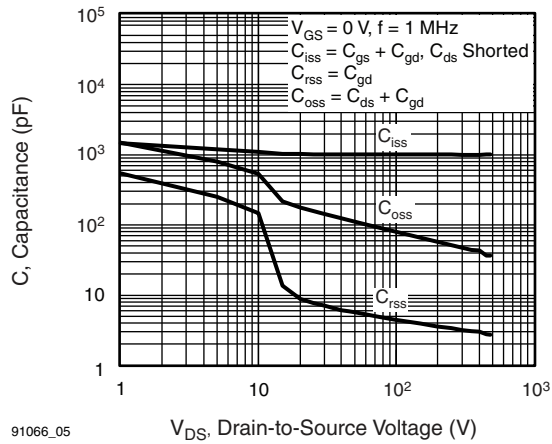
**Fig. 3 - Typical Transfer Characteristics**



**Fig. 2 - Typical Output Characteristics**

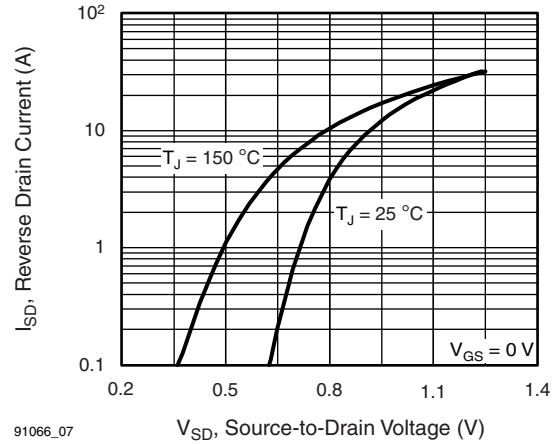


**Fig. 4 - Normalized On-Resistance vs. Temperature**



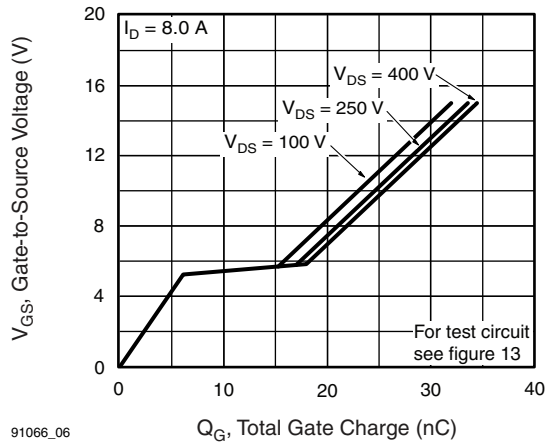
91066\_05

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



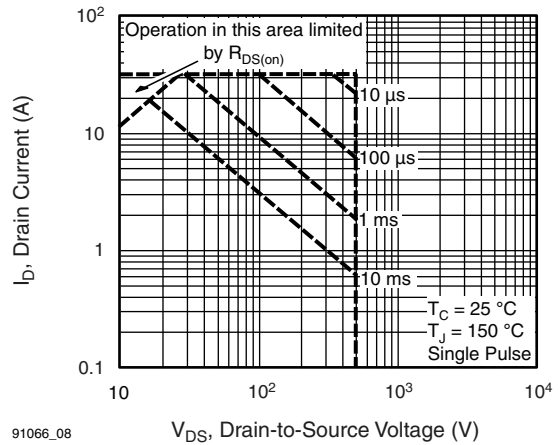
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**Fig. 7 - Typical Source-Drain Diode Forward Voltage**



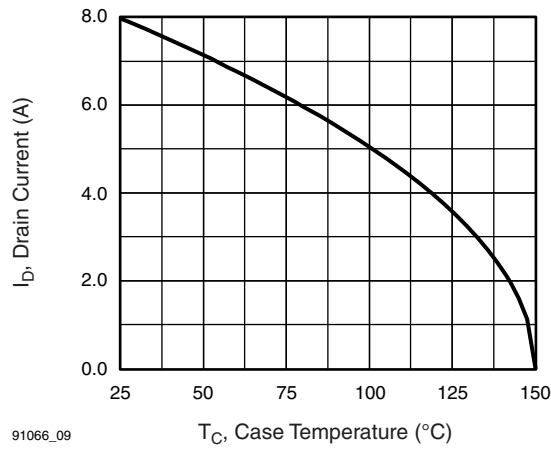
91066\_06

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



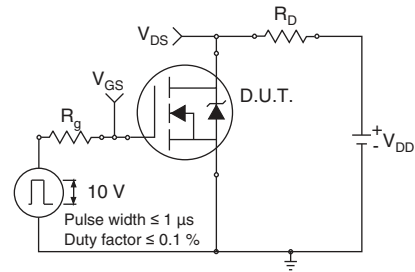
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**Fig. 8 - Maximum Safe Operating Area**

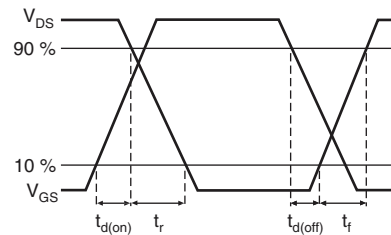


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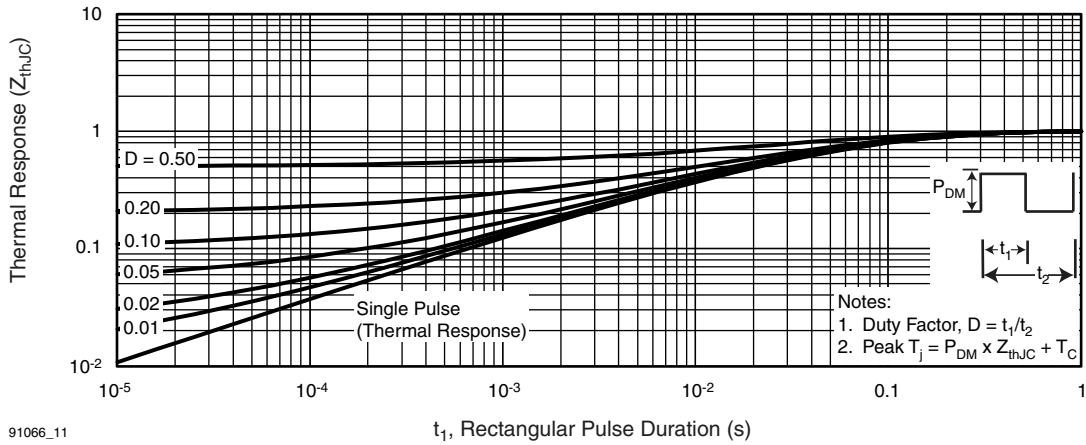
**Fig. 9 - Maximum Drain Current vs. Case Temperature**



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

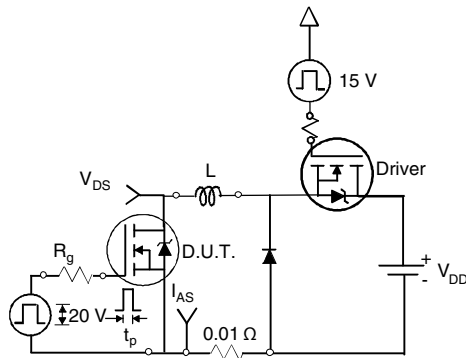


**Fig. 10b - Switching Time Waveforms**

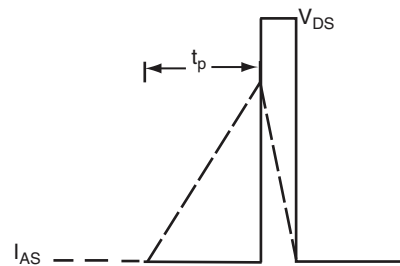


91066\_11

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



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



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

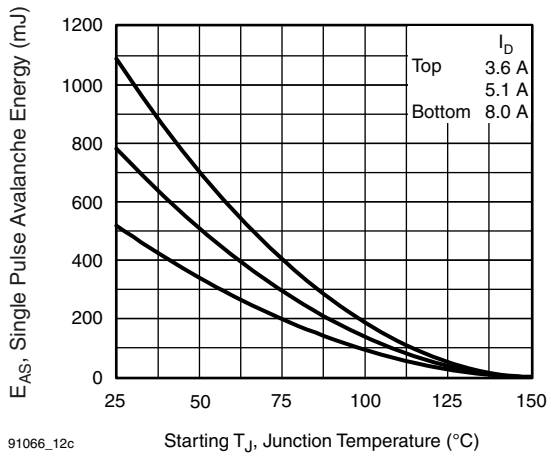


Fig. 12c - Maximum Avalanche Energy vs. Drain Current

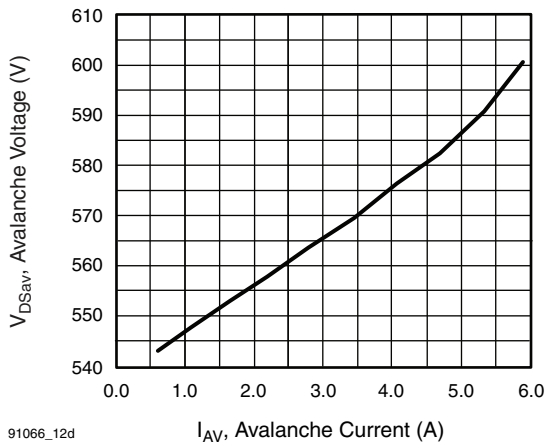


Fig. 12d - Typical Drain-to-Source Voltage vs. Avalanche Current

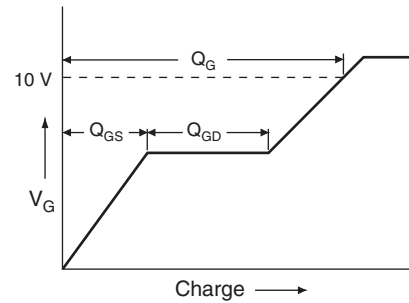


Fig. 13a - Basic Gate Charge Waveform

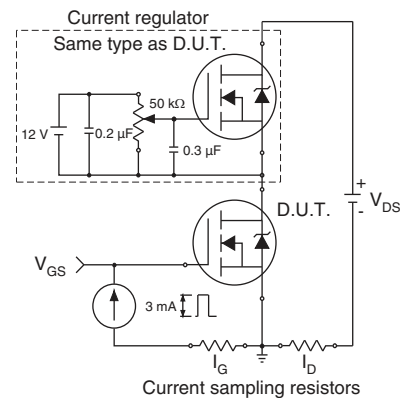
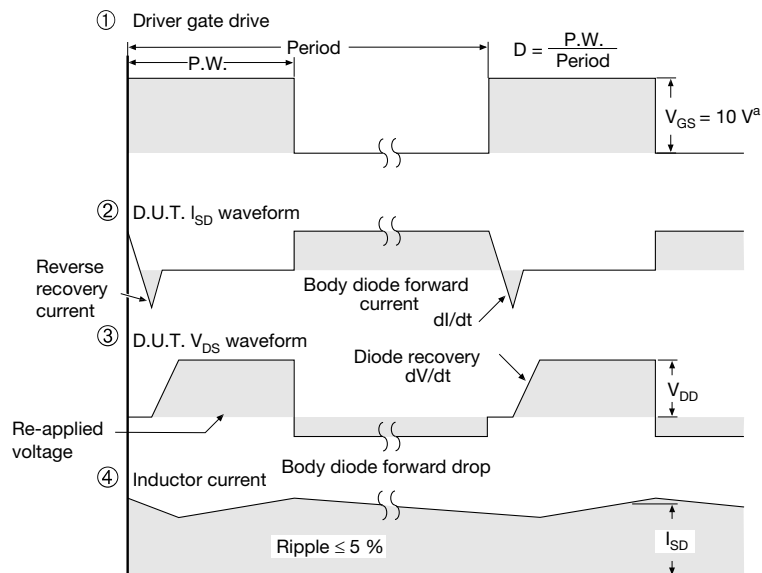
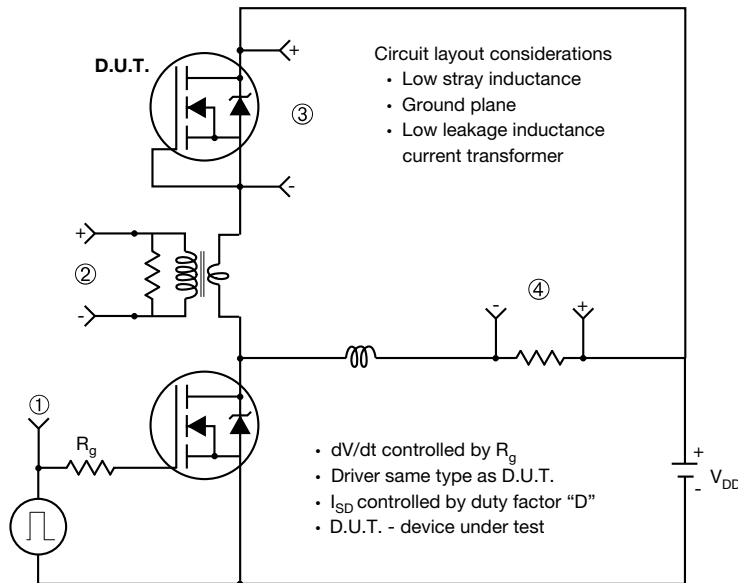


Fig. 13b - Gate Charge Test Circuit

### Peak Diode Recovery dV/dt Test Circuit



**Note**

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

**Fig. 14 - For N-Channel**

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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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