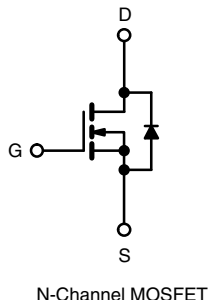
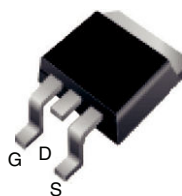


Power MOSFET

PRODUCT SUMMARY

V_{DS} (V)	500	
$R_{DS(on)}$ (Ω)	$V_{GS} = 10\text{ V}$	0.52
Q_g (Max.) (nC)	52	
Q_{gs} (nC)	13	
Q_{gd} (nC)	18	
Configuration	Single	

D²PAK (TO-263)


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



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.

APPLICATIONS

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

TYPICAL SMPS TOPOLOGIES

- Two Transistor Forward
- Half and Full Bridge
- Power Factor Correction Boost

ORDERING INFORMATION

Package	D ² PAK (TO-263)	D ² PAK (TO-263)	D ² PAK (TO-263)
Lead (Pb)-free and Halogen-free	SiHFS11N50A-GE3	SiHFS11N50ATTR-GE3 ^a	SiHFS11N50ATRL-GE3 ^a
Lead (Pb)-free	IRFS11N50APbF	IRFS11N50ATTRP ^a	IRFS11N50ATRLP ^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}	500	V
Gate-Source Voltage	V_{GS}	± 30	
Continuous Drain Current	V_{GS} at 10 V	$T_C = 25\text{ }^{\circ}\text{C}$	A
		$T_C = 100\text{ }^{\circ}\text{C}$	
Pulsed Drain Current ^a	I_{DM}	44	
Linear Derating Factor		1.3	W/ $^{\circ}\text{C}$
Single Pulse Avalanche Energy ^b	E_{AS}	275	mJ
Repetitive Avalanche Current ^a	I_{AR}	11	A
Repetitive Avalanche Energy ^a	E_{AR}	17	mJ
Maximum Power Dissipation	P_D	170	W
Peak Diode Recovery dV/dt ^c	dV/dt	6.9	V/ns
Operating Junction and Storage Temperature Range	T_J, T_{stg}	- 55 to + 150	$^{\circ}\text{C}$
Soldering Recommendations (Peak Temperature) ^d	for 10 s	300	

Notes

- Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).
- Starting $T_J = 25\text{ }^{\circ}\text{C}$, $L = 4.5\text{ mH}$, $R_g = 25\text{ }\Omega$, $I_{AS} = 11\text{ A}$ (see fig. 12).
- $I_{SD} \leq 11\text{ A}$, $dI/dt \leq 140\text{ A}/\mu\text{s}$, $V_{DD} \leq V_{DS}$, $T_J \leq 150\text{ }^{\circ}\text{C}$.
- 1.6 mm from case.

**THERMAL RESISTANCE RATINGS**

PARAMETER	SYMBOL	TYP.	MAX.	UNIT
Maximum Junction-to-Case (Drain)	R_{thJC}	-	0.75	°C/W
Case-to-Sink, Flat, Greased Surface	R_{thCS}	0.50	-	
Maximum Junction-to-Ambient	R_{thJA}	-	62	

SPECIFICATIONS ($T_J = 25^\circ\text{C}$, unless otherwise noted)

PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
Static							
Drain-Source Breakdown Voltage	V_{DS}	$V_{GS} = 0$, $I_D = 250\ \mu\text{A}$		500	-	-	V
V_{DS} Temperature Coefficient	$\Delta V_{DS}/T_J$	Reference to $25\ ^\circ\text{C}$, $I_D = 1\ \text{mA}$		-	0.060	-	V/ $^\circ\text{C}$
Gate-Source Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}$, $I_D = 250\ \mu\text{A}$		2.0	-	4.0	V
Gate-Source Leakage	I_{GSS}	$V_{GS} = \pm 30\ \text{V}$		-	-	± 100	nA
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS} = 500\ \text{V}$, $V_{GS} = 0\ \text{V}$		-	-	25	μA
		$V_{DS} = 400\ \text{V}$, $V_{GS} = 0\ \text{V}$, $T_J = 125\ ^\circ\text{C}$		-	-	250	
Drain-Source On-State Resistance	$R_{DS(on)}$	$V_{GS} = 10\ \text{V}$	$I_D = 6.6\ \text{A}^b$	-	-	0.52	Ω
Forward Transconductance	g_{fs}	$V_{DS} = 50\ \text{V}$, $I_D = 6.6\ \text{A}$		6.1	-	-	S
Dynamic							
Input Capacitance	C_{iss}	$V_{GS} = 0\ \text{V}$, $V_{DS} = 25\ \text{V}$, $f = 1.0\ \text{MHz}$, see fig. 5		-	1423	-	pF
Output Capacitance	C_{oss}			-	208	-	
Reverse Transfer Capacitance	C_{rss}			-	8.1	-	
Output Capacitance	C_{oss}	$V_{GS} = 0\ \text{V}$	$V_{DS} = 1.0\ \text{V}$, $f = 1.0\ \text{MHz}$	-	2000	-	
Effective Output Capacitance	$C_{oss\ eff.}$		$V_{DS} = 400\ \text{V}$, $f = 1.0\ \text{MHz}$	-	55	-	
			$V_{DS} = 0\ \text{V}$ to $400\ \text{V}^c$	-	97	-	
Total Gate Charge	Q_g	$V_{GS} = 10\ \text{V}$	$I_D = 11\ \text{A}$, $V_{DS} = 400\ \text{V}$ see fig. 6 and 13 ^b	-	-	52	nC
Gate-Source Charge	Q_{gs}			-	-	13	
Gate-Drain Charge	Q_{gd}			-	-	18	
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = 250\ \text{V}$, $I_D = 11\ \text{A}$ $R_g = 9.1\ \Omega$, $R_D = 22\ \Omega$, see fig. 10 ^b		-	14	-	ns
Rise Time	t_r			-	35	-	
Turn-Off Delay Time	$t_{d(off)}$			-	32	-	
Fall Time	t_f			-	28	-	
Drain-Source Body Diode Characteristics							
Continuous Source-Drain Diode Current	I_S	MOSFET symbol showing the integral reverse p - n junction diode 	-	-	11	A	
Pulsed Diode Forward Current ^a	I_{SM}		-	-	44		
Body Diode Voltage	V_{SD}	$T_J = 25\ ^\circ\text{C}$, $I_S = 11\ \text{A}$, $V_{GS} = 0\ \text{V}^b$		-	-	1.5	V
Body Diode Reverse Recovery Time	t_{rr}	$T_J = 25\ ^\circ\text{C}$, $I_F = 11\ \text{A}$, $dI/dt = 100\ \text{A}/\mu\text{s}^b$		-	510	770	ns
Body Diode Reverse Recovery Charge	Q_{rr}			-	3.4	5.1	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 $\leq 300\ \mu\text{s}$; duty cycle $\leq 2\ \%$.
c. $C_{oss\ eff.}$ is a fixed capacitance that gives the same charging time as C_{oss} while V_{DS} is rising from $0\ \%$ V_{DS} to $80\ \%$ V_{DS} .



TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)

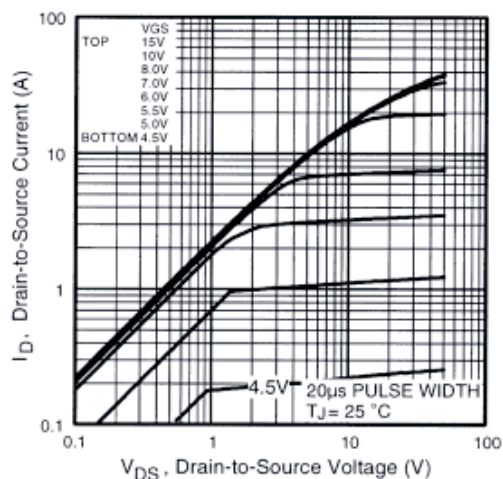


Fig. 1 - Typical Output Characteristics

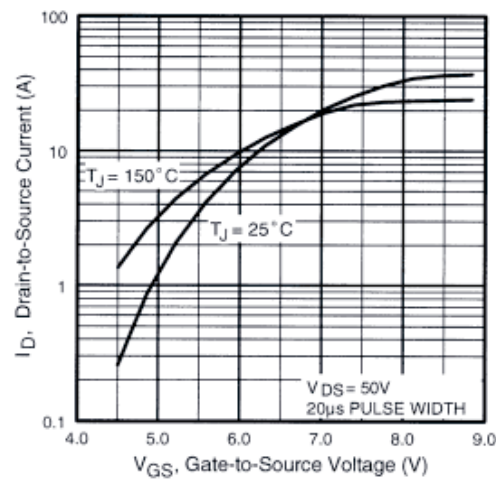


Fig. 3 - Typical Transfer Characteristics

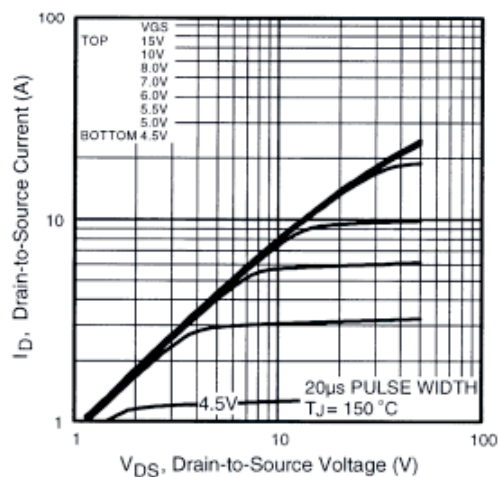


Fig. 2 - Typical Output Characteristics

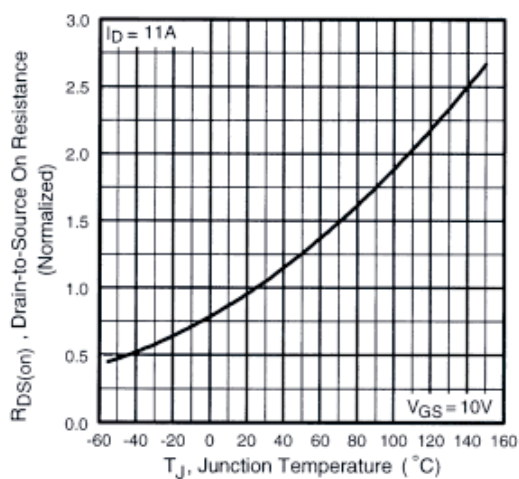
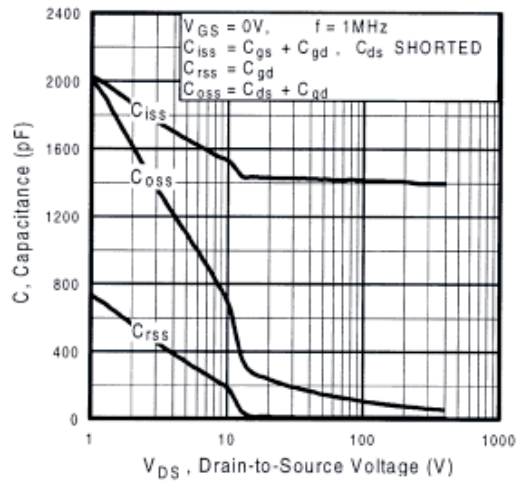
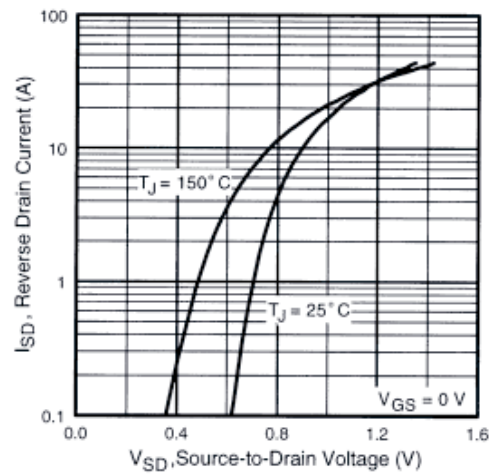
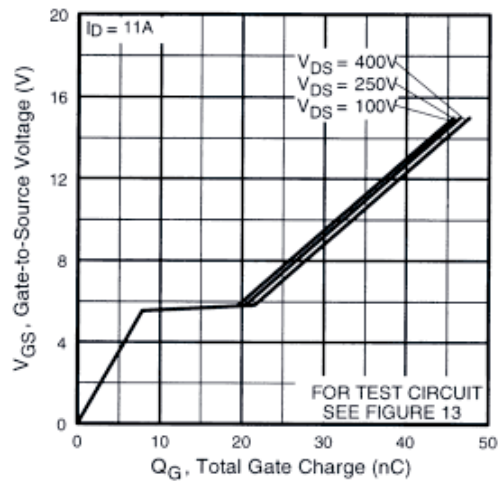
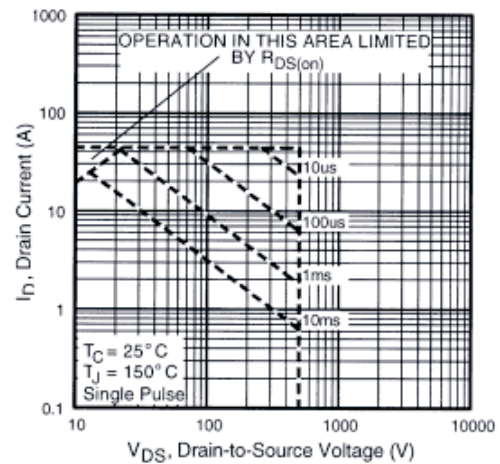
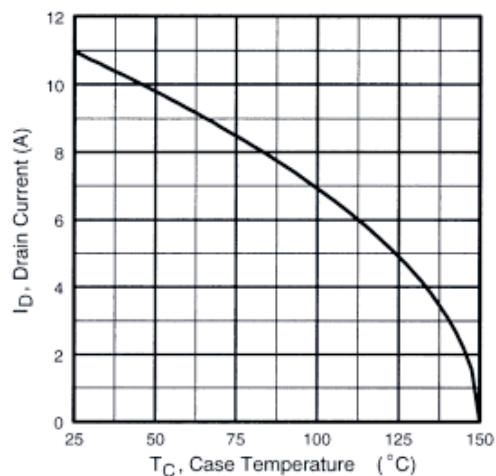
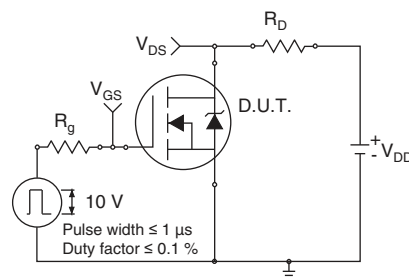
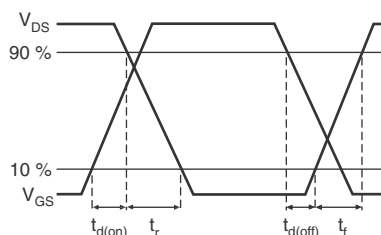
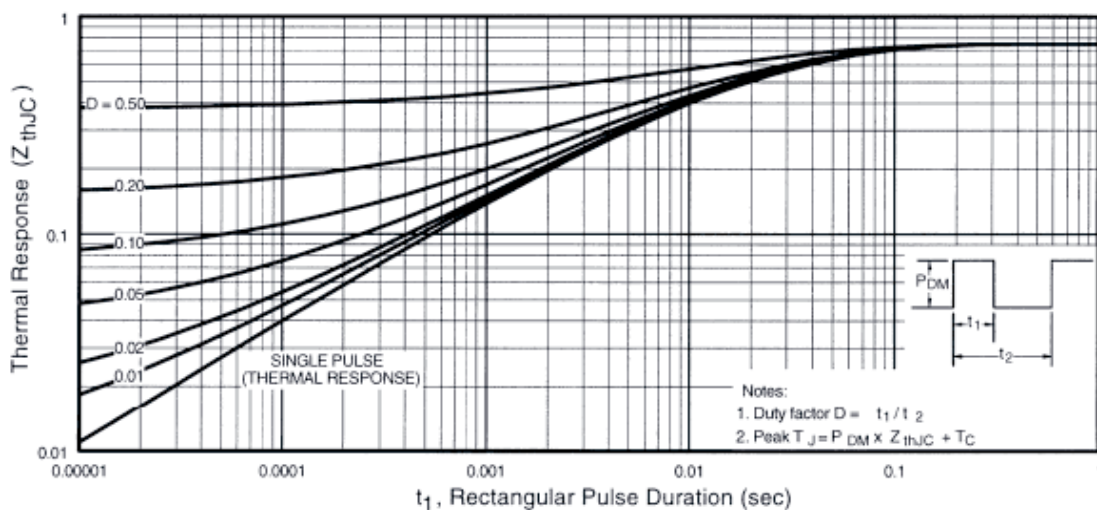
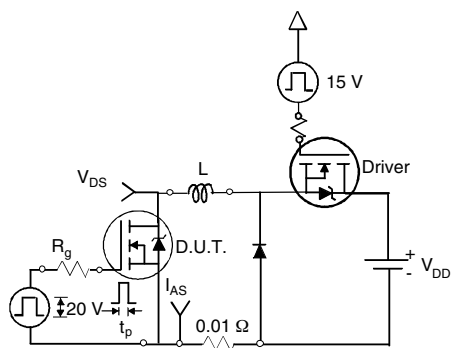
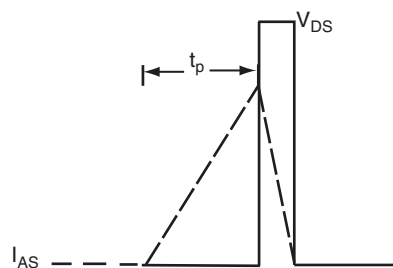
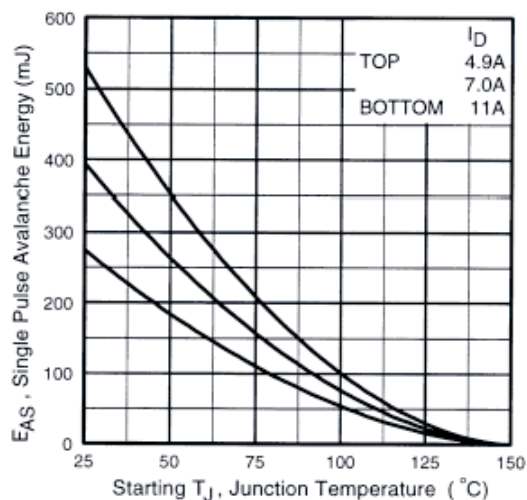
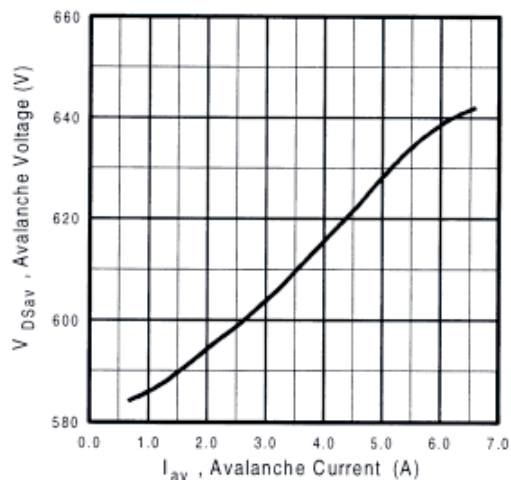
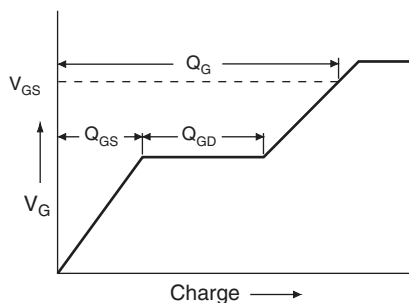
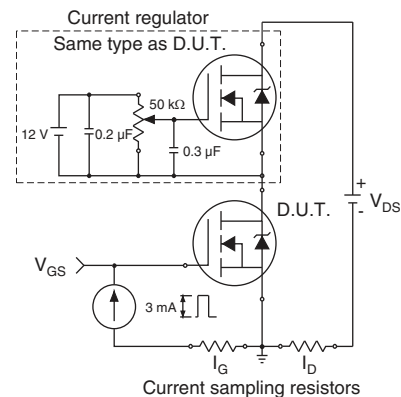
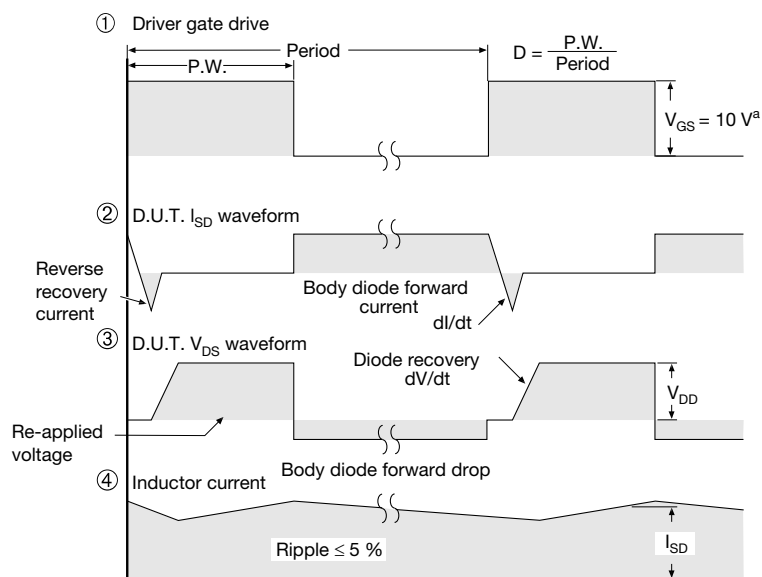
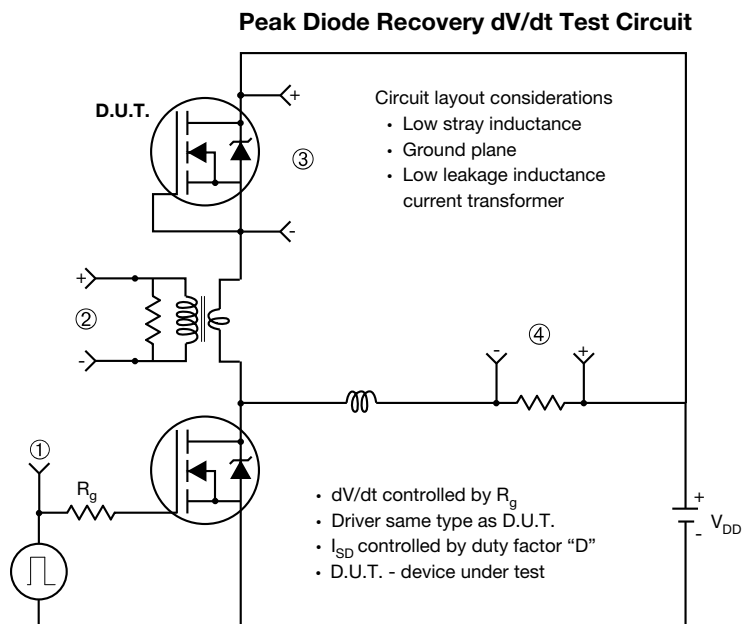


Fig. 4 - Normalized On-Resistance vs. Temperature


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

Fig. 13a - Basic Gate Charge Waveform

Fig. 13b - Gate Charge Test Circuit



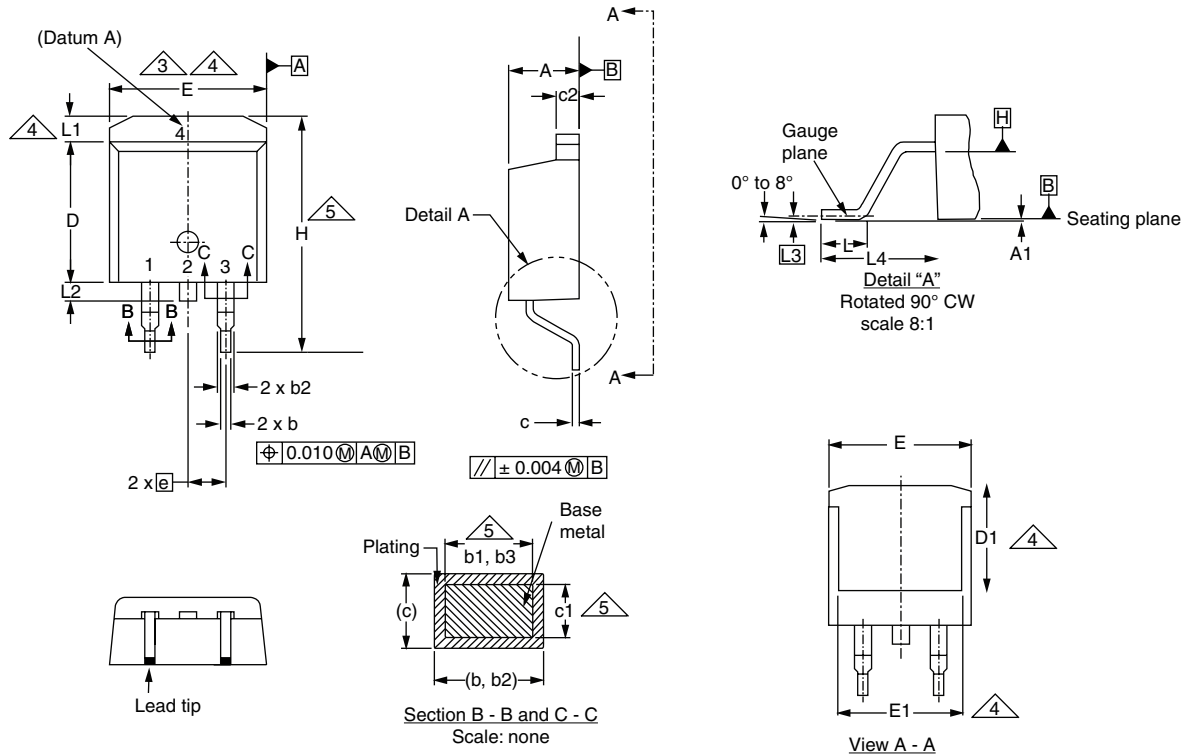
Note

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

Fig. 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

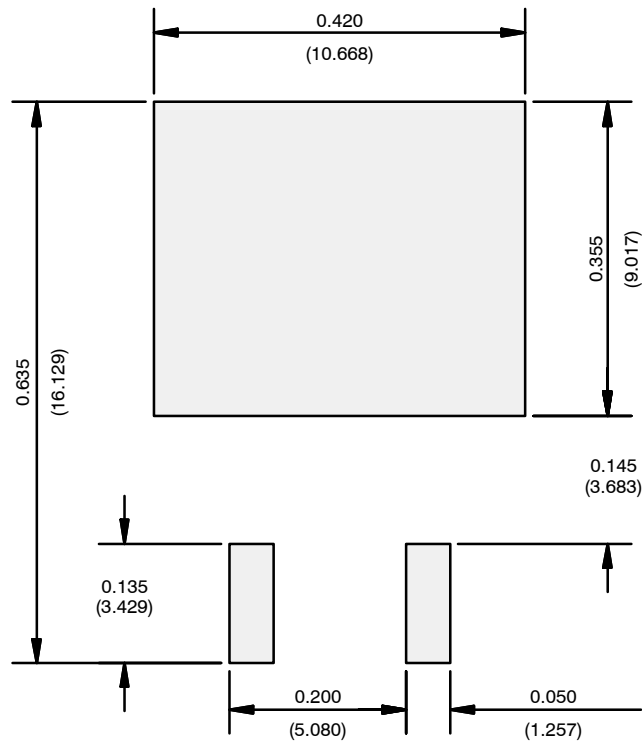
DIM.	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
D1	6.86	-	0.270	-
E	9.65	10.67	0.380	0.420
E1	6.22	-	0.245	-
e	2.54 BSC		0.100 BSC	
H	14.61	15.88	0.575	0.625
L	1.78	2.79	0.070	0.110
L1	-	1.65	-	0.066
L2	-	1.78	-	0.070
L3	0.25 BSC		0.010 BSC	
L4	4.78	5.28	0.188	0.208

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.

RECOMMENDED MINIMUM PADS FOR D²PAK: 3-Lead



Recommended Minimum Pads
Dimensions in Inches/(mm)

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