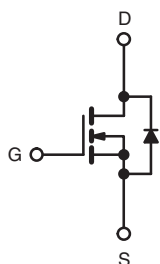
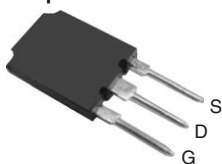


Power MOSFET

PRODUCT SUMMARY

V_{DS} (V)	600	
$R_{DS(on)}$ (Ω)	$V_{GS} = 10$ V	0.12
Q_g (Max.) (nC)	320	
Q_{gs} (nC)	85	
Q_{gd} (nC)	160	
Configuration	Single	

Super-247



N-Channel MOSFET

FEATURES

- Superfast Body Diode Eliminates the Need for External Diodes in ZVS Applications
- Lower Gate Charge Results in Simple Drive Requirements
- Enhanced dV/dt Capabilities Offer Improved Ruggedness
- Higher Gate Voltage Threshold Offers Improved Noise Immunity
- Compliant to RoHS Directive 2002/95/EC



RoHS*
COMPLIANT

APPLICATIONS

- Zero Voltage Switching SMPS
- Telecom and Server Power Supplies
- Uninterruptible Power Supplies
- Motor Control applications

ORDERING INFORMATION

Package	Super-247
Lead (Pb)-free	IRFPS38N60LPbF
	SiHFPS38N60L-E3
SnPb	IRFPS38N60L
	SiHFPS38N60L

ABSOLUTE MAXIMUM RATINGS ($T_C = 25^\circ\text{C}$, unless otherwise noted)

PARAMETER	SYMBOL	LIMIT	UNIT
Drain-Source Voltage	V_{DS}	600	V
Gate-Source Voltage	V_{GS}	± 30	
Continuous Drain Current	I_D	$T_C = 25^\circ\text{C}$	A
		$T_C = 100^\circ\text{C}$	
Pulsed Drain Current ^a	I_{DM}	150	
Linear Derating Factor		4.3	W/ $^\circ\text{C}$
Single Pulse Avalanche Energy ^b	E_{AS}	680	mJ
Repetitive Avalanche Current ^a	I_{AR}	38	A
Repetitive Avalanche Energy ^a	E_{AR}	54	mJ
Maximum Power Dissipation	P_D	540	W
Peak Diode Recovery dV/dt ^c	dV/dt	19	V/ns
Operating Junction and Storage Temperature Range	T_J, T_{stg}	- 55 to + 150	$^\circ\text{C}$
Soldering Recommendations (Peak Temperature)	for 10 s	300 ^d	
Mounting Torque	6-32 or M3 screw	10	lbf · in
		1.1	N · m

Notes

- Repetitive rating; pulse width limited by maximum junction temperature (see fig. 12).
- Starting $T_J = 25^\circ\text{C}$, $L = 0.91$ mH, $R_g = 25\ \Omega$, $I_{AS} = 38$ A, $dV/dt = 13$ V/ns (see fig. 14a).
- $I_{SD} \leq 38$ A, $dI/dt \leq 630$ A/ μs , $V_{DD} \leq V_{DS}$, $T_J \leq 150^\circ\text{C}$.
- 1.6 mm from case.

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

THERMAL RESISTANCE RATINGS

PARAMETER	SYMBOL	TYP.	MAX.	UNIT
Maximum Junction-to-Ambient	R_{thJA}	-	40	°C/W
Case-to-Sink, Flat, Greased Surface	R_{thCS}	0.24	-	
Maximum Junction-to-Case (Drain)	R_{thJC}	-	0.22	

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

PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
Static							
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 $25\text{ }^\circ\text{C}$, $I_D = 1\text{ mA}$		-	410	-	mV/ $^\circ\text{C}$
Gate-Source Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}$, $I_D = 250\text{ }\mu\text{A}$		3.0	-	5.0	V
Gate-Source Leakage	I_{GSS}	$V_{GS} = \pm 30\text{ V}$		-	-	± 100	nA
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS} = 600\text{ V}$, $V_{GS} = 0\text{ V}$		-	-	50	μA
		$V_{DS} = 480\text{ V}$, $V_{GS} = 0\text{ V}$, $T_J = 125\text{ }^\circ\text{C}$		-	-	2.0	mA
Drain-Source On-State Resistance	$R_{DS(on)}$	$V_{GS} = 10\text{ V}$	$I_D = 23\text{ A}^b$	-	0.12	0.15	Ω
Forward Transconductance	g_{fs}	$V_{DS} = 50\text{ V}$, $I_D = 23\text{ A}^b$		20	-	-	S
Dynamic							
Input Capacitance	C_{iss}	$V_{GS} = 0\text{ V}$, $V_{DS} = 25\text{ V}$, $f = 1.0\text{ MHz}$, see fig. 5		-	7990	-	pF
Output Capacitance	C_{oss}			-	740	-	
Reverse Transfer Capacitance	C_{rss}			-	72	-	
Effective Output Capacitance	$C_{oss\text{ eff.}}$	$V_{GS} = 0\text{ V}$ $V_{DS} = 0\text{ V to } 480\text{ V}^c$		-	350	-	
Effective Output Capacitance (Energy Related)	$C_{oss\text{ eff. (ER)}}$			-	260	-	
Total Gate Charge	Q_g	$V_{GS} = 10\text{ V}$	$I_D = 38\text{ A}$, $V_{DS} = 480\text{ V}$ see fig. 7 and 15 ^b	-	-	320	nC
Gate-Source Charge	Q_{gs}			-	-	85	
Gate-Drain Charge	Q_{gd}			-	-	160	
Gate Resistance	R_G	$f = 1\text{ MHz}$, open drain		-	1.2	-	Ω
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = 300\text{ V}$, $I_D = 38\text{ A}$, $R_G = 4.3\text{ }\Omega$, $V_{GS} = 10\text{ V}$, see fig. 11a and 11b ^b		-	44	-	ns
Rise Time	t_r			-	130	-	
Turn-Off Delay Time	$t_{d(off)}$			-	92	-	
Fall Time	t_f			-	69	-	
Drain-Source Body Diode Characteristics							
Continuous Source-Drain Diode Current	I_S	MOSFET symbol showing the integral reverse p - n junction diode 		-	-	38	A
Pulsed Diode Forward Current ^a	I_{SM}			-	-	150	
Body Diode Voltage	V_{SD}	$T_J = 25\text{ }^\circ\text{C}$, $I_S = 38\text{ A}$, $V_{GS} = 0\text{ V}^b$		-	-	1.5	V
Body Diode Reverse Recovery Time	t_{rr}	$T_J = 25\text{ }^\circ\text{C}$, $I_F = 38\text{ A}$		-	170	250	ns
		$T_J = 125\text{ }^\circ\text{C}$, $dI/dt = 100\text{ A}/\mu\text{s}^b$		-	420	630	
Body Diode Reverse Recovery Charge	Q_{rr}	$T_J = 25\text{ }^\circ\text{C}$, $I_F = 38\text{ A}$, $V_{GS} = 0\text{ V}^b$		-	830	1240	nC
		$T_J = 125\text{ }^\circ\text{C}$, $dI/dt = 100\text{ A}/\mu\text{s}^b$		-	2600	3900	
Reverse Recovery Time	I_{RRM}	$T_J = 25\text{ }^\circ\text{C}$		-	9.1	14	A
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. 12).
b. Pulse width $\leq 300\text{ }\mu\text{s}$; duty cycle $\leq 2\%$.
c. $C_{oss\text{ eff.}}$ is a fixed capacitance that gives the same charging time as C_{oss} while V_{DS} is rising from 0 % to 80 % V_{DS} .
 $C_{oss\text{ eff. (ER)}}$ is a fixed capacitance that stores the same energy as C_{oss} while V_{DS} is rising from 0 % to 80 % V_{DS} .

TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)

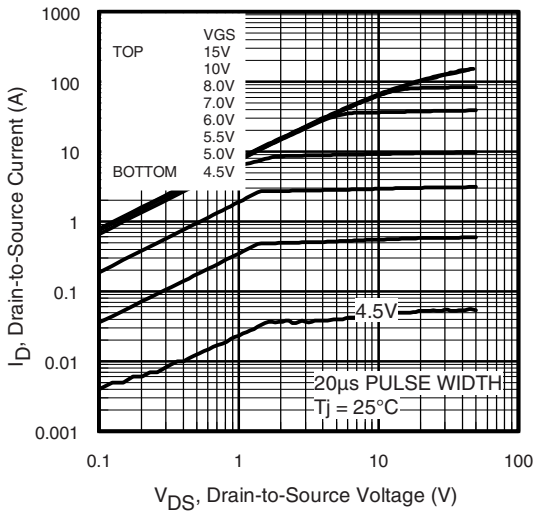


Fig. 1 - Typical Output Characteristics

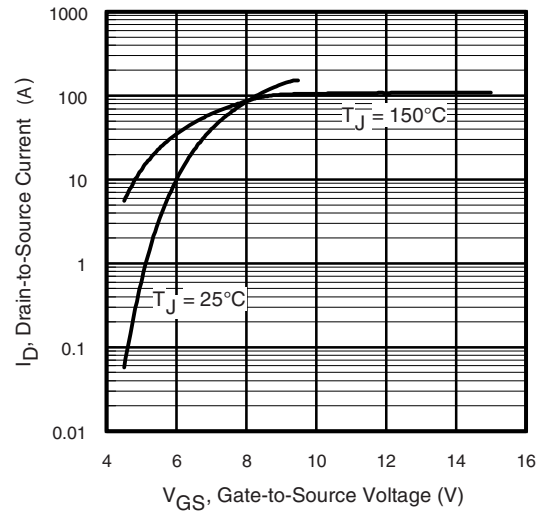


Fig. 3 - Typical Transfer Characteristics

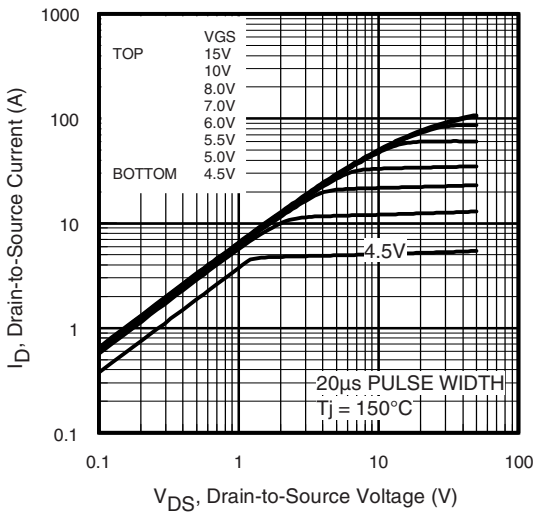


Fig. 2 - Typical Output Characteristics

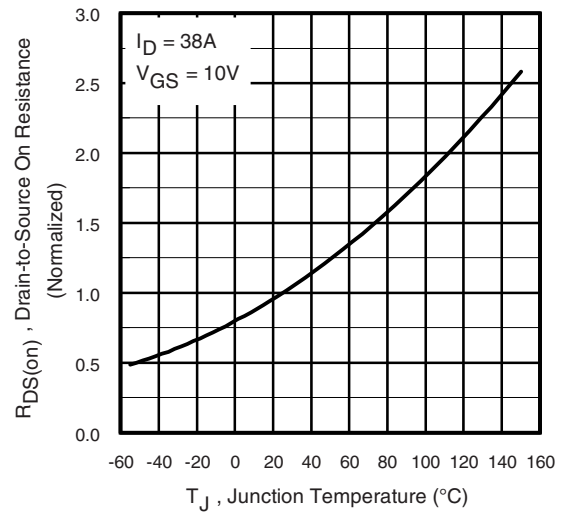


Fig. 4 - Normalized On-Resistance vs. Temperature

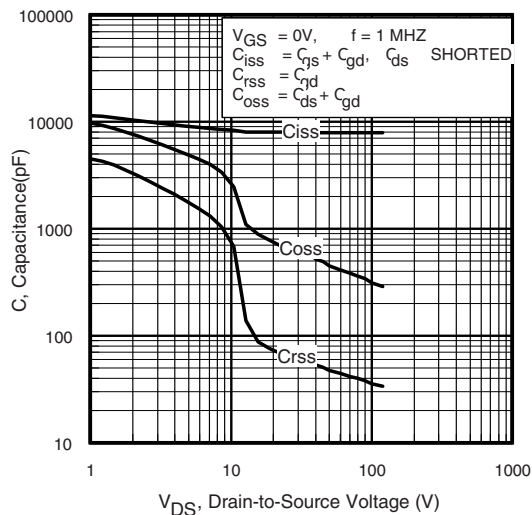


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

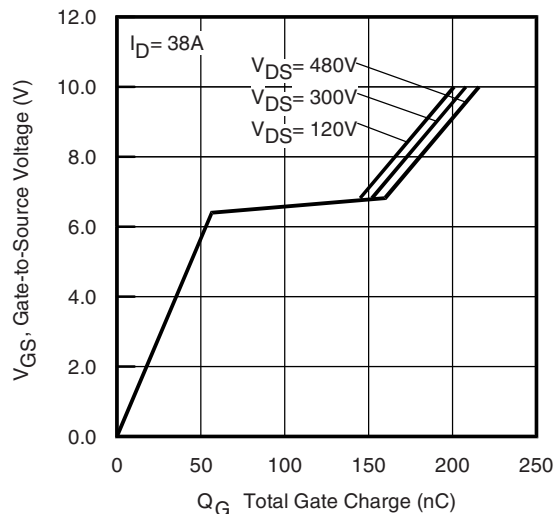


Fig. 7 - Typical Gate Charge vs. Gate-to-Source Voltage

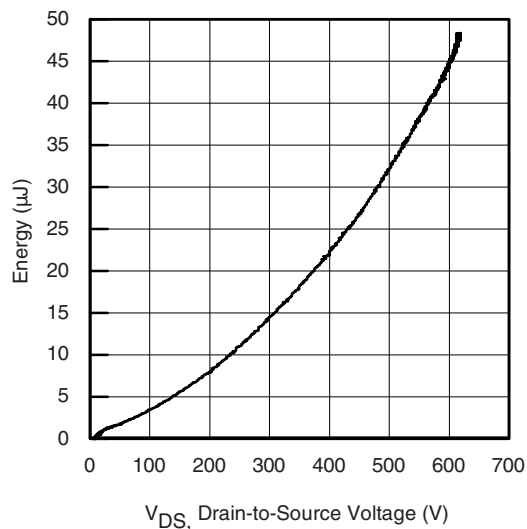


Fig. 6 - Typical Output Capacitance Stored Energy vs. V_{DS}

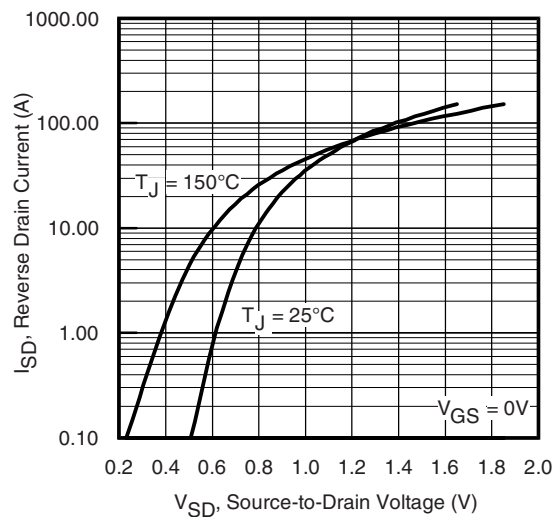


Fig. 8 - Typical Source-Drain Diode Forward Voltage

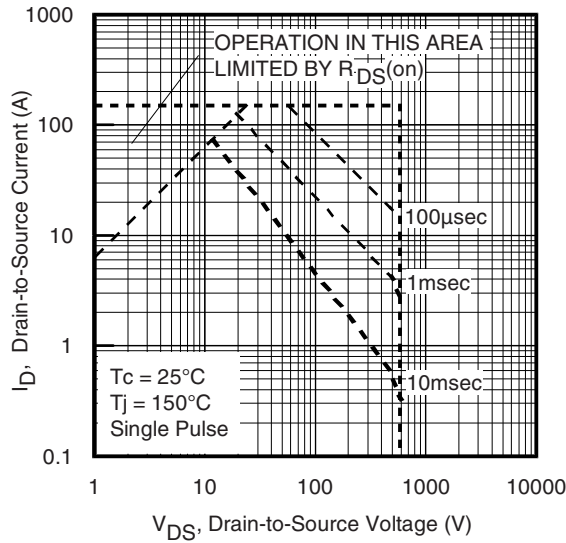


Fig. 9 - Maximum Safe Operating Area

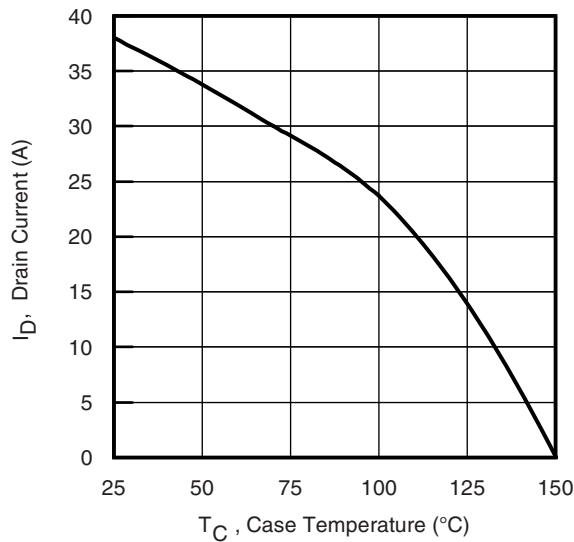


Fig. 10 - Maximum Drain Current vs. Case Temperature

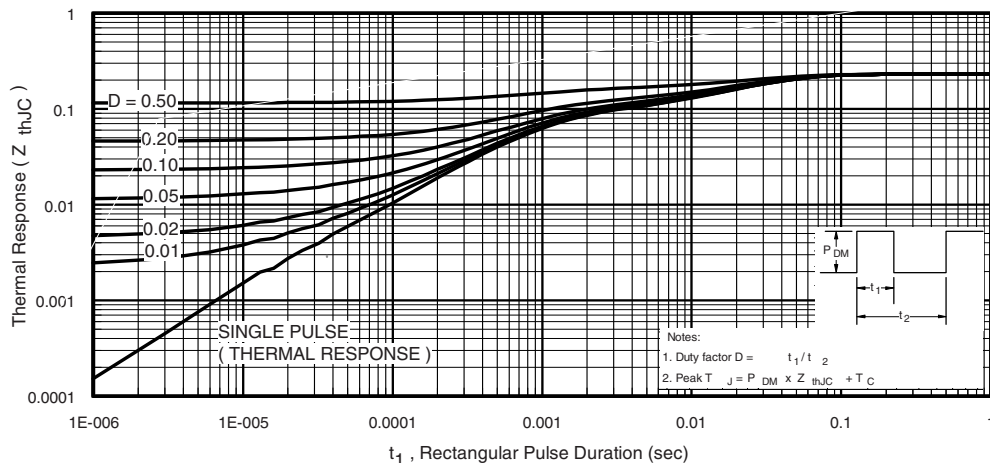


Fig. 12 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

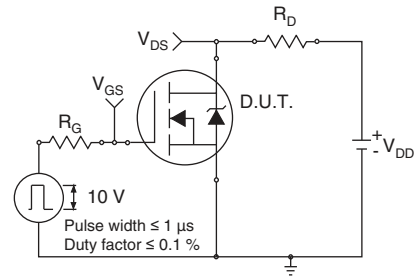


Fig. 11a - Switching Time Test Circuit

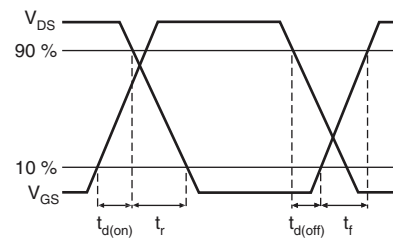


Fig. 11b - Switching Time Waveforms

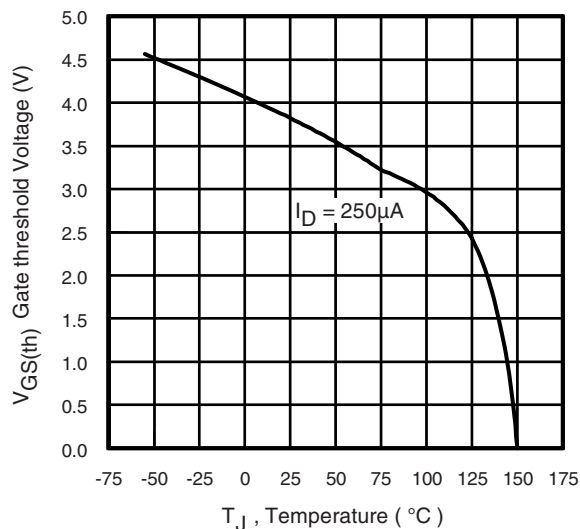


Fig. 13 - Threshold Voltage vs. Temperature

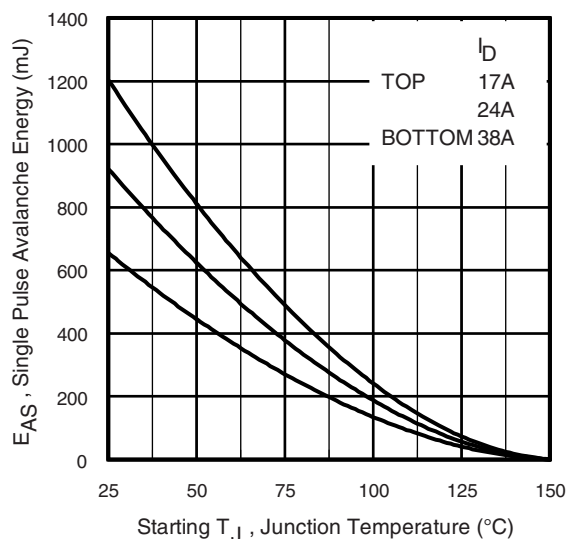


Fig. 14a - Maximum Avalanche Energy vs. Drain Current

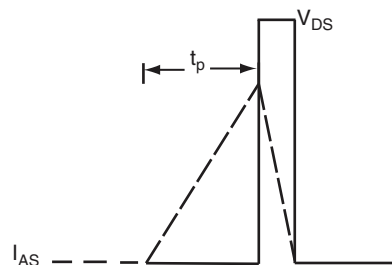


Fig. 14c - Unclamped Inductive Waveforms

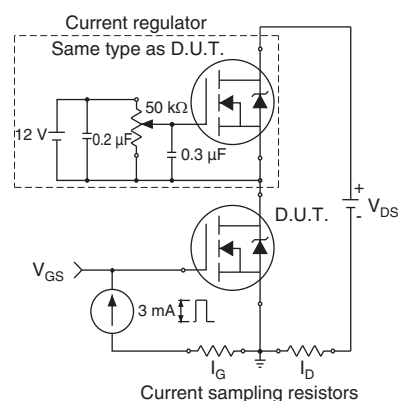


Fig. 15a - Basic Gate Charge Waveform

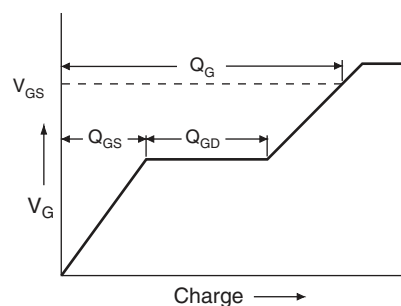


Fig. 15b - Gate Charge Test Circuit

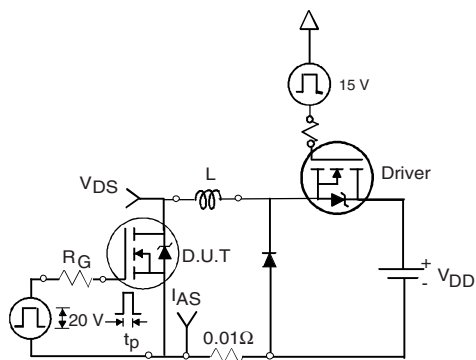
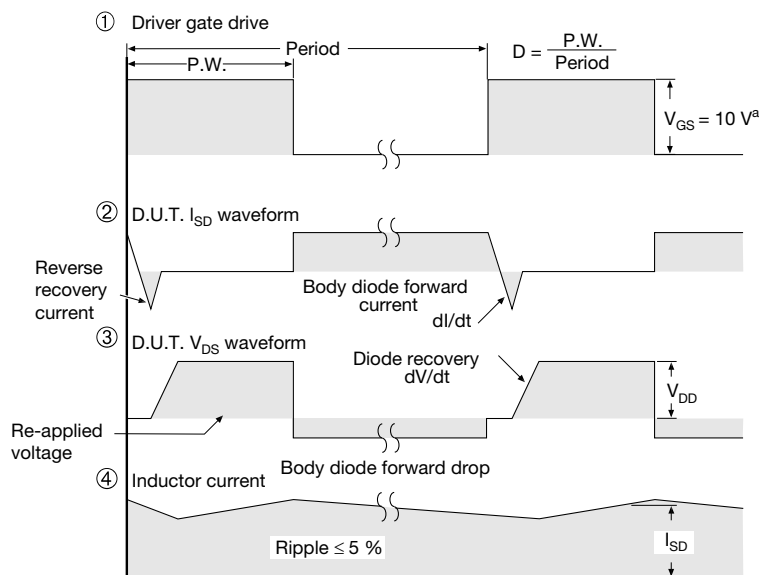
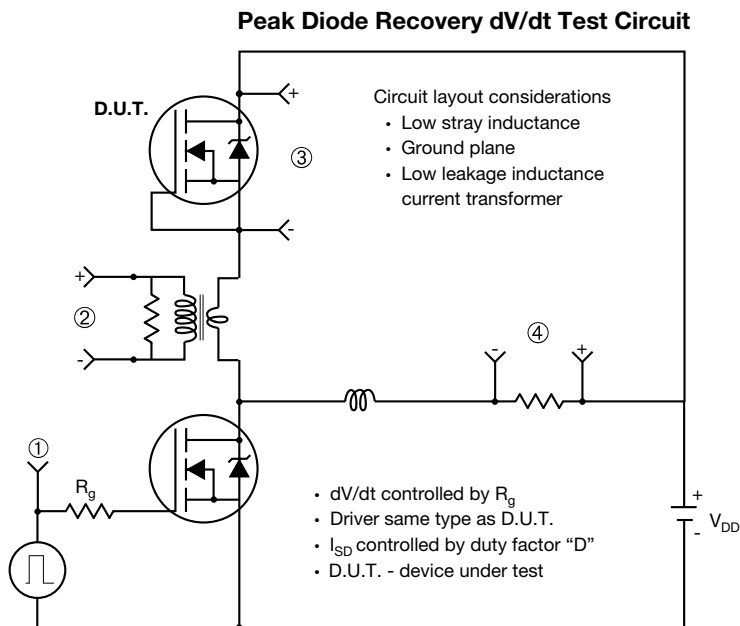


Fig. 14b - Unclamped Inductive Test Circuit



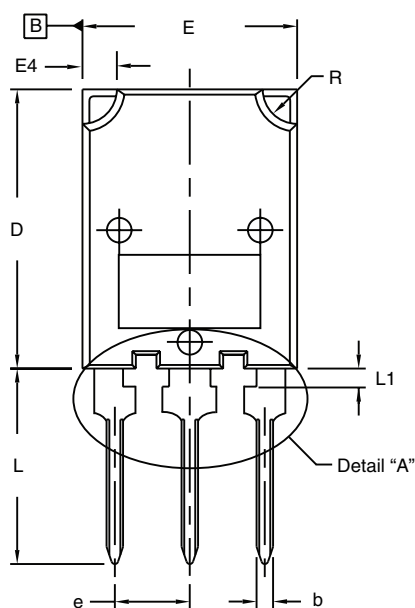
Note

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

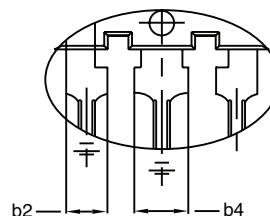
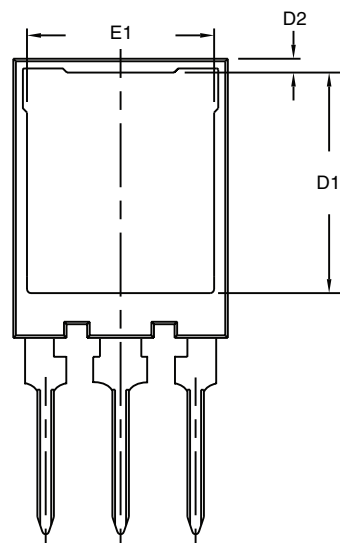
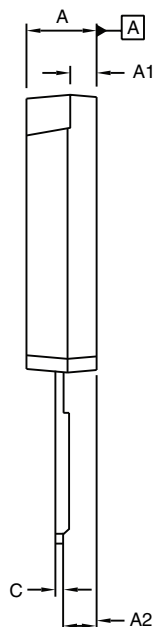
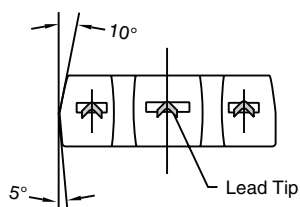
Fig. 16 - For N-Channel

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TO-274AA (HIGH VOLTAGE)



⊕ 0.10 (0.25) ⊕ B A ⊕



Detail "A"
Scale: 2:1

	MILLIMETERS		INCHES	
DIM.	MIN.	MAX.	MIN.	MAX.
A	4.70	5.30	0.185	0.209
A1	1.50	2.50	0.059	0.098
A2	2.25	2.65	0.089	0.104
b	1.30	1.60	0.051	0.063
b2	1.80	2.20	0.071	0.087
b4	3.00	3.25	0.118	0.128
c	0.80	1.20	0.031	0.047
D	19.80	20.80	0.780	0.819

	MILLIMETERS		INCHES	
DIM.	MIN.	MAX.	MIN.	MAX.
D1	15.50	16.10	0.610	0.634
D2	0.70	1.30	0.028	0.051
E	15.10	16.10	0.594	0.634
E1	13.30	13.90	0.524	0.547
e	5.45 BSC		0.215 BSC	
L	13.70	14.70	0.539	0.579
L1	1.00	1.60	0.039	0.063
R	2.00	3.00	0.079	0.118

ECN: S-82247-Rev. A, 06-Oct-08
DWG: 5975

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 (0.005") per side. These dimensions are measured at the outer extremes of the plastic body.
3. Outline conforms to JEDEC outline to TO-274AA.



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