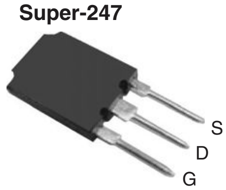
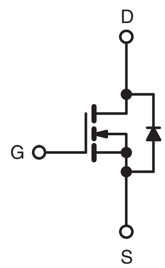
Power MOSFET

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

Pb Available

RoHS*
COMPLIANT

APPLICATIONS

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

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

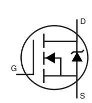
ABSOLUTE MAXIMUM RATINGS (T_C = 25 °C, unless otherwise noted)

PARAMETER			SYMBOL	LIMIT	UNIT
Drain-Source Voltage			V_{DS}	600	V
Gate-Source Voltage			V_{GS}	± 30	
Continuous Drain Current	V_{GS} at 10 V	T_C = 25 °C	I_D	38	A
		T_C = 100 °C		24	
Pulsed Drain Current[a]			I_{DM}	150	
Linear Derating Factor				4.3	W/°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	T_C = 25 °C		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	°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
a. Repetitive rating; pulse width limited by maximum junction temperature (see fig. 12).
b. Starting T_J = 25 °C, L = 0.91 mH, R_g = 25 Ω, I_{AS} = 38 A, dV/dt = 13 V/ns (see fig. 14a).
c. $I_{SD} \le 38$ A, dI/dt ≤ 630 A/µs, $V_{DD} \le V_{DS}$, $T_J \le 150$ °C.
d. 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 °C, unless otherwise noted)						
PARAMETER	**SYMBOL**	**TEST CONDITIONS**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
Static						
Drain-Source Breakdown Voltage	V_{DS}	V_{GS} = 0 V, I_D = 250 µA	600	-	-	V
V_{DS} Temperature Coefficient	$\Delta V_{DS}/T_J$	Reference to 25 °C, I_D = 1 mA	-	410	-	mV/°C
Gate-Source Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}$, I_D = 250 µA	3.0	-	5.0	V
Gate-Source Leakage	I_{GSS}	V_{GS} = ± 30 V	-	-	± 100	nA
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS} = 600 V, V_{GS} = 0 V	-	-	50	µA
		V_{DS} = 480 V, V_{GS} = 0 V, T_J = 125 °C	-	-	2.0	mA
Drain-Source On-State Resistance	$R_{DS(on)}$	V_{GS} = 10 V; I_D = 23 A[b]	-	0.12	0.15	Ω
Forward Transconductance	g_{fs}	V_{DS} = 50 V, I_D = 23 A[b]	20	-	-	S
Dynamic						
Input Capacitance	C_{iss}	V_{GS} = 0 V, V_{DS} = 25 V, f = 1.0 MHz, see fig. 5	-	7990	-	pF
Output Capacitance	C_{oss}		-	740	-	
Reverse Transfer Capacitance	C_{rss}		-	72	-	
Effective Output Capacitance	C_{oss} eff.	V_{GS} = 0 V, V_{DS} = 0 V to 480 V[c]	-	350	-	
Effective Output Capacitance (Energy Related)	C_{oss} eff. (ER)		-	260	-	
Total Gate Charge	Q_g	V_{GS} = 10 V; I_D = 38 A, V_{DS} = 480 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 MHz, open drain	-	1.2	-	Ω
Turn-On Delay Time	$t_{d(on)}$	V_{DD} = 300 V, I_D = 38 A, R_G = 4.3 Ω, V_{GS} = 10 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 °C, I_S = 38 A, V_{GS} = 0 V[b]	-	-	1.5	V
Body Diode Reverse Recovery Time	t_{rr}	T_J = 25 °C, I_F = 38 A	-	170	250	ns
		T_J = 125 °C, dI/dt = 100 A/µs[b]	-	420	630	
Body Diode Reverse Recovery Charge	Q_{rr}	T_J = 25 °C, I_F = 38 A, V_{GS} = 0 V[b]	-	830	1240	nC
		T_J = 125 °C, dI/dt = 100 A/µs[b]	-	2600	3900	
Reverse Recovery Time	I_{RRM}	T_J = 25 °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 ≤ 300 µs; duty cycle ≤ 2 %.

c. C_{oss} eff. is a fixed capacitance that gives the same charging time as C_{oss} while V_{DS} is rising form 0 % to 80 % V_{DS}.
C_{oss} 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)

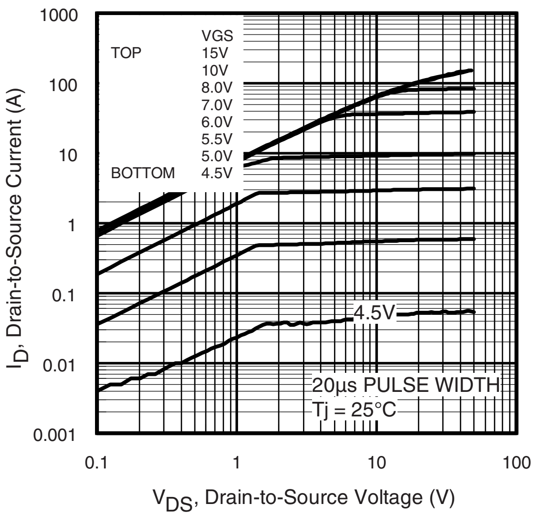


Fig. 1 - Typical Output Characteristics

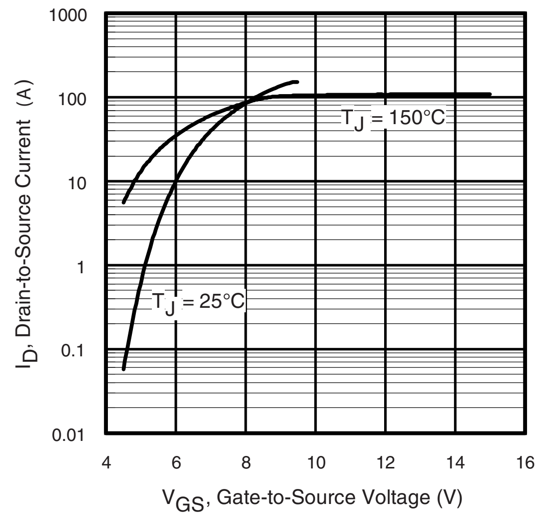


Fig. 3 - Typical Transfer Characteristics

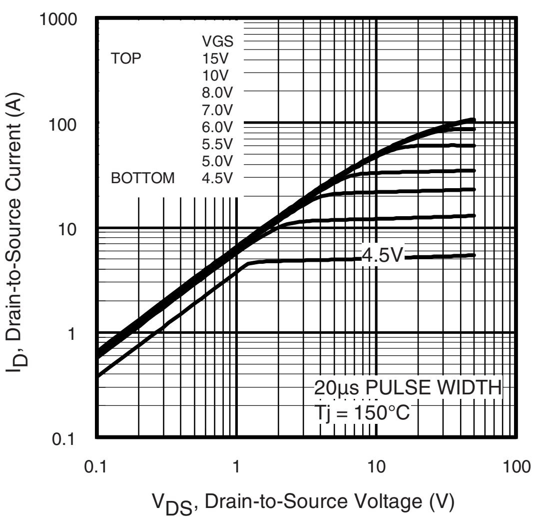


Fig. 2 - Typical Output Characteristics

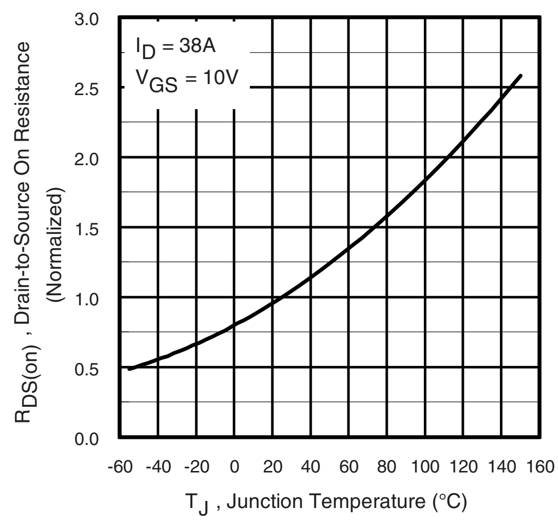


Fig. 4 - Normalized On-Resistance vs. Temperature

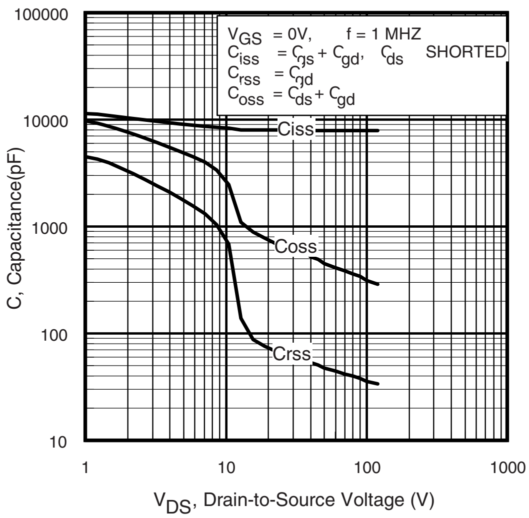


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

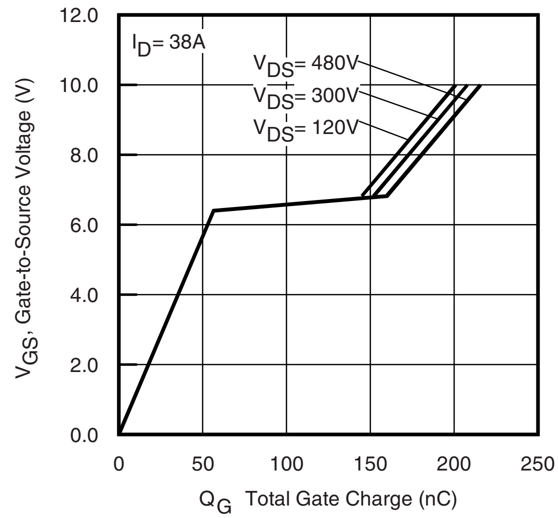


Fig. 7 - Typical Gate Charge vs. Gate-to-Source Voltage

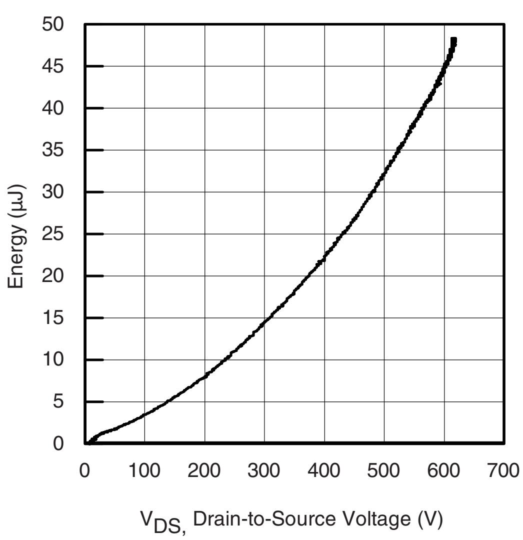


Fig. 6 - Typical Output Capacitance Stored Energy vs. V_{DS}

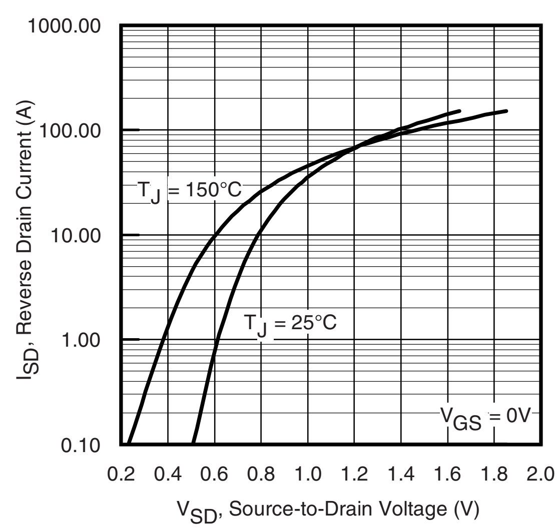


Fig. 8 - Typical Source-Drain Diode Forward Voltage

Document Number: 91259
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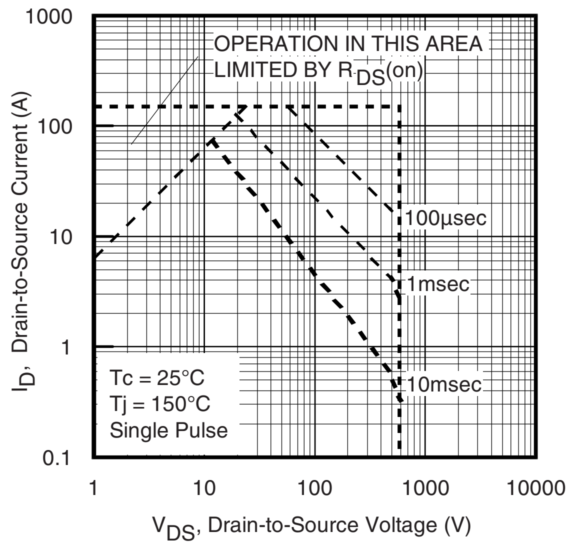


Fig. 9 - Maximum Safe Operating Area

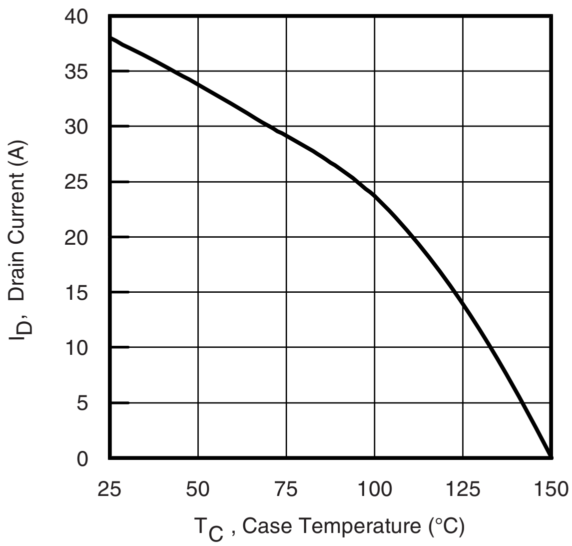


Fig. 10 - Maximum Drain Current vs. Case Temperature

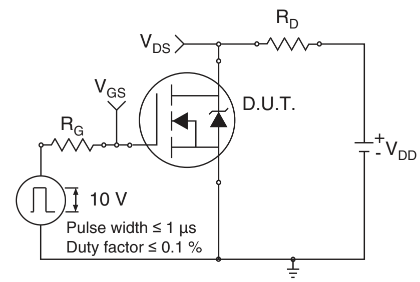


Fig. 11a - Switching Time Test Circuit

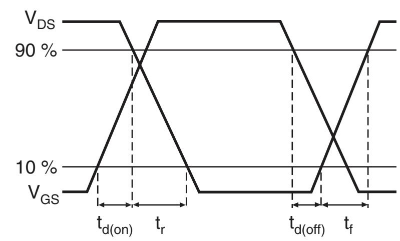


Fig. 11b - Switching Time Waveforms

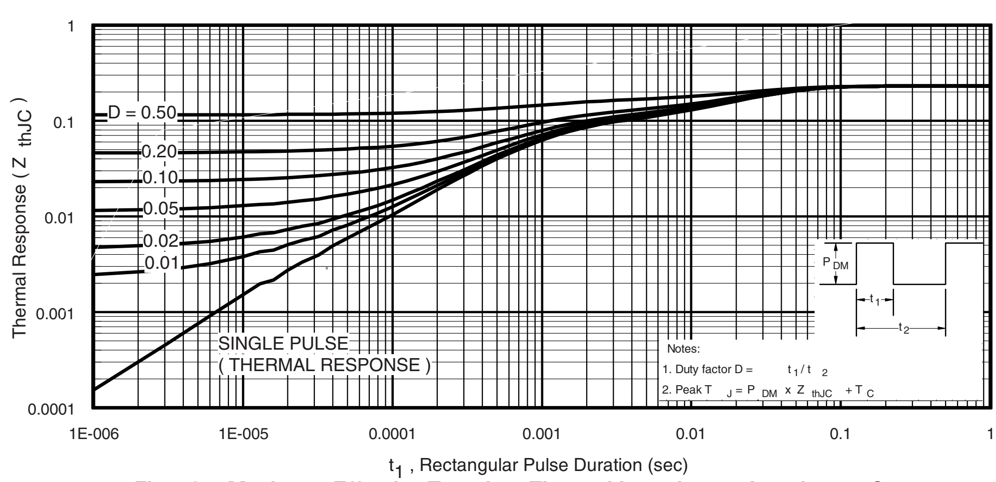


Fig. 12 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

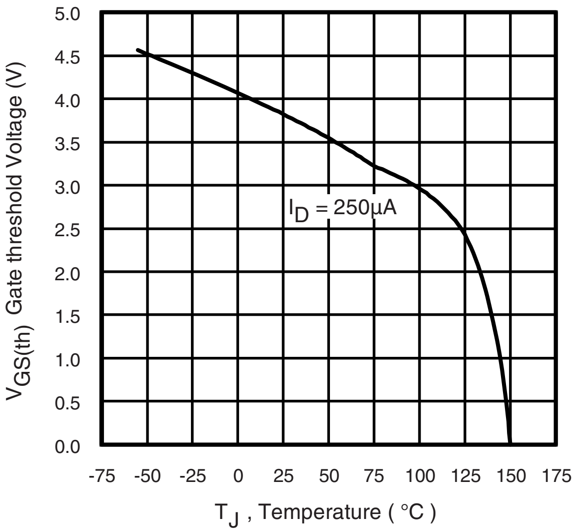


Fig. 13 - Threshold Voltage vs. Temperature

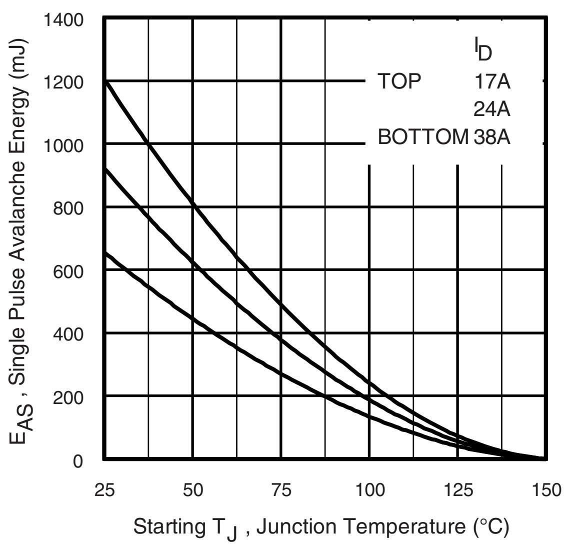


Fig. 14a - Maximum Avalanche Energy vs. Drain Current

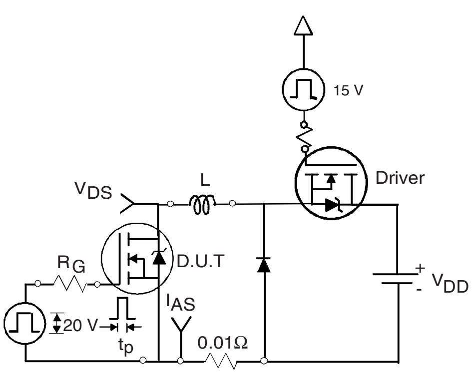


Fig. 14b - Unclamped Inductive Test Circuit

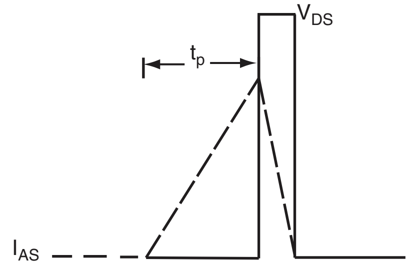


Fig. 14c - Unclamped Inductive Waveforms

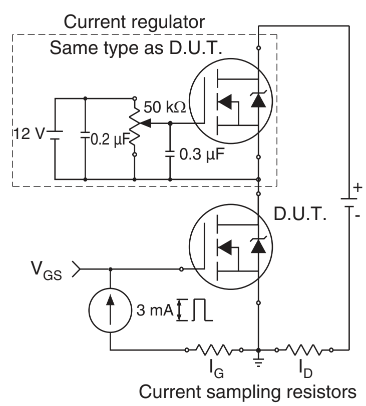


Fig. 15a - Basic Gate Charge Waveform

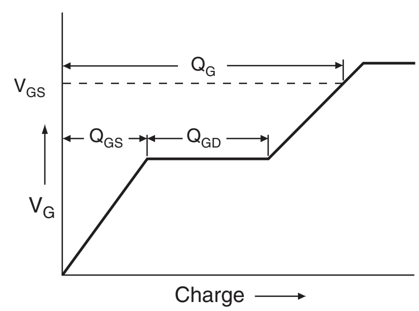
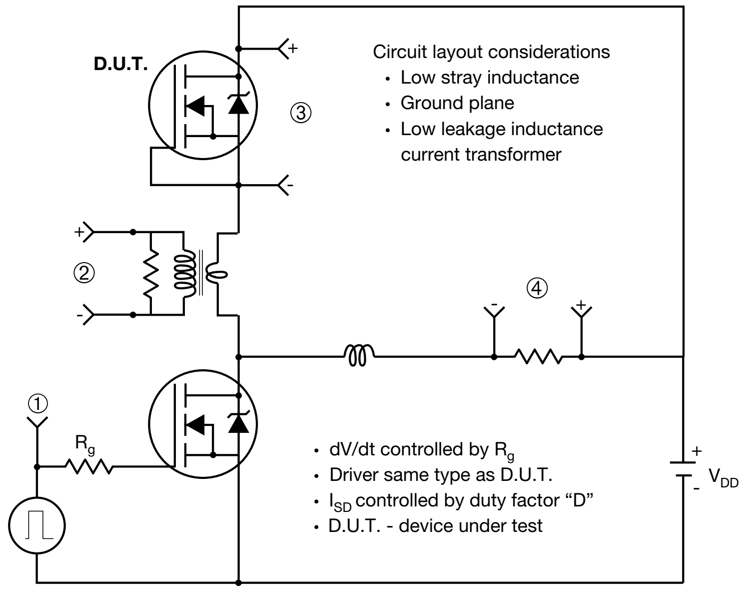
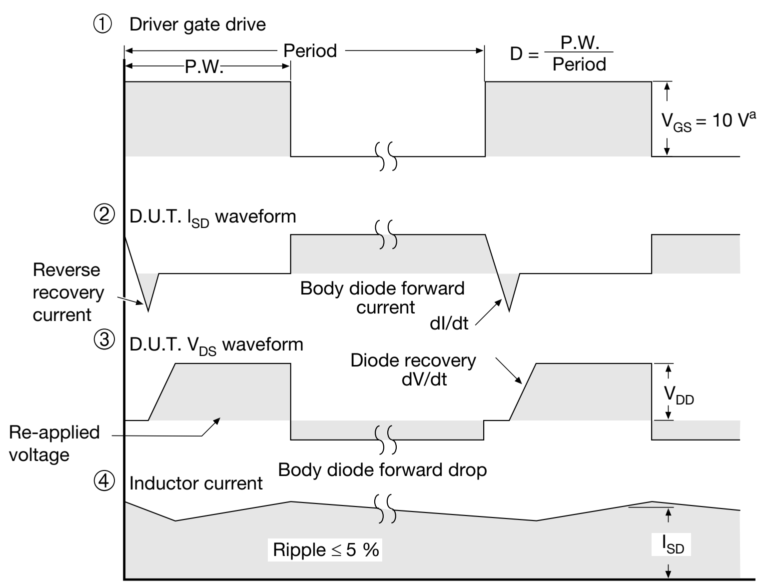


Fig. 15b - Gate Charge Test Circuit

Peak Diode Recovery dV/dt Test Circuit





Note

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

Fig. 16 - For N-Channel

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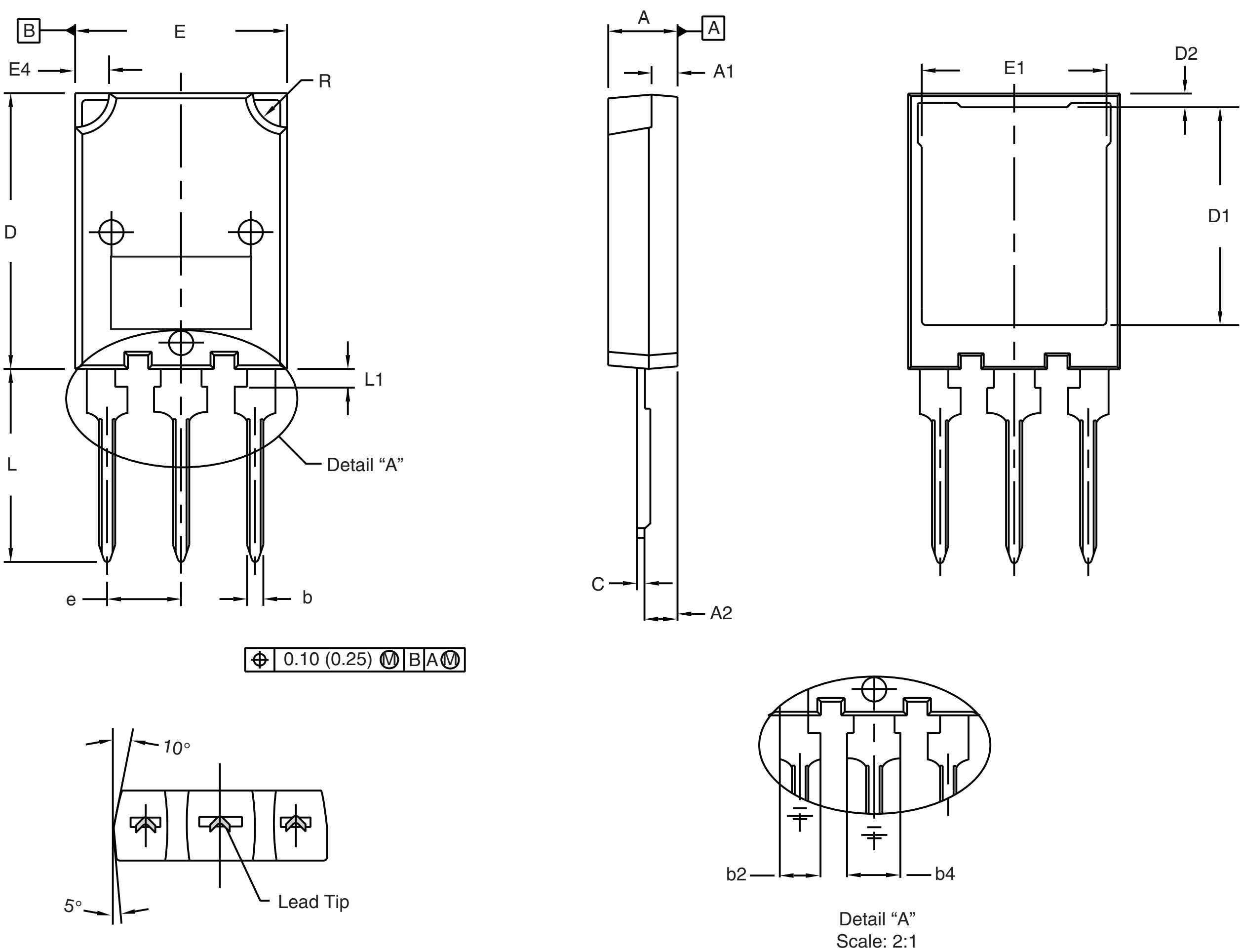
TO-274AA (High Voltage)



	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 [(1)]	0.38	0.89	0.015	0.035
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: X17-0056-Rev. B, 27-Mar-17
DWG: 5975

Notes

- Dimensioning and tolerancing per ASME Y14.5M-1994
- 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
- Outline conforms to JEDEC® outline to TO-274AA

[(1)] Dimension measured at tip of lead

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