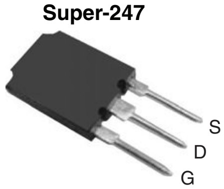
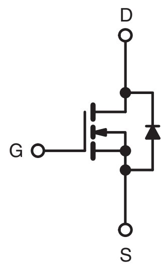
Power MOSFET

PRODUCT SUMMARY		
V_{DS} (V)	600	
$R_{DS(on)}$ (Ω)	V_{GS} = 10 V	0.110
Q_g (Max.) (nC)	330	
Q_{gs} (nC)	84	
Q_{gd} (nC)	150	
Configuration	Single	

Super-247





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
- Enhanced Body Diode dV/dt Capability
- Compliant to RoHS Directive 2002/95/EC

Pb Available

RoHS* COMPLIANT

APPLICATIONS

- Hard Switching Primary or PFC Switch
- Switch Mode Power Supply (SMPS)
- Uninterruptible Power Supply
- High Speed Power Switching
- Motor Drive

ORDERING INFORMATION	
Package	Super-247
Lead (Pb)-free	IRFPS40N60KPbF
	SiHFPS40N60K-E3
SnPb	IRFPS40N60K
	SiHFPS40N60K

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

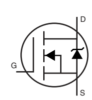
PARAMETER			SYMBOL	LIMIT	UNIT
Drain-Source Voltage			V_{DS}	600	V
Gate-Source Voltage			V_{GS}	± 30	
Continuous Drain Current	V_{GS} at 10 V	T_C = 25 °C	I_D	40	A
		T_C = 100 °C		24	
Pulsed Drain Current[a]			I_{DM}	160	
Linear Derating Factor				4.5	W/°C
Single Pulse Avalanche Energy[b]			E_{AS}	600	mJ
Repetitive Avalanche Current[a]			I_{AR}	40	A
Repetitive Avalanche Energy[a]			E_{AR}	57	mJ
Maximum Power Dissipation	T_C = 25 °C		P_D	570	W
Peak Diode Recovery dV/dt[c]			dV/dt	7.5	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]	

Notes

a. Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).
b. Starting T_J = 25 °C, L = 0.84 mH, R_g = 25 Ω, I_{AS} = 38 A, dV/dt = 5.5 V/ns (see fig. 12a).
c. $I_{SD} \leq$ 38 A, dI/dt ≤ 150 A/μs, $V_{DD} \leq V_{DS}$, $T_J \leq$ 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	-	0.63	-	V/°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	-	-	250	
Drain-Source On-State Resistance	$R_{DS(on)}$	V_{GS} = 10 V, I_D = 24 A[b]	-	0.110	0.130	Ω
Forward Transconductance	g_{fs}	V_{DS} = 50 V, I_D = 24 A[b]	21	-	-	S
Dynamic						
Input Capacitance	C_{iss}	V_{GS} = 0 V, V_{DS} = 25 V, f = 1.0 MHz, see fig. 5	-	7970	-	pF
Output Capacitance	C_{oss}		-	750	-	
Reverse Transfer Capacitance	C_{rss}		-	75	-	
Output Capacitance	C_{oss}	V_{GS} = 0 V, V_{DS} = 1.0 V , f = 1.0 MHz	-	9440	-	
		V_{GS} = 0 V, V_{DS} = 480 V , f = 1.0 MHz	-	200	-	
Effective Output Capacitance	C_{oss} eff.	V_{GS} = 0 V, V_{DS} = 0 V to 480 V[c]	-	260	-	
Total Gate Charge	Q_g	V_{GS} = 10 V, I_D = 38 A, V_{DS} = 480 V, see fig. 6 and 13[b]	-	-	330	nC
Gate-Source Charge	Q_{gs}		-	-	84	
Gate-Drain Charge	Q_{gd}		-	-	150	
Turn-On Delay Time	$t_{d(on)}$	V_{GS} = 10 V, V_{DD} = 300 V, I_D = 38 A, R_G = 4.3 Ω, see fig. 10[b]	-	47	-	ns
Rise Time	t_r		-	110	-	
Turn-Off Delay Time	$t_{d(off)}$		-	97	-	
Fall Time	t_f		-	60	-	
Drain-Source Body Diode Characteristics						
Continuous Source-Drain Diode Current	I_S	MOSFET symbol showing the integral reverse p - n junction diode 	-	-	40	A
Pulsed Diode Forward Current[a]	I_{SM}		-	-	160	
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, dI/dt = 100 A/μs	-	630	950	ns
		T_J = 125 °C, I_F = 38 A, dI/dt = 100 A/μs	-	730	1090	
Body Diode Reverse Recovery Charge	Q_{rr}	T_J = 25 °C, I_F = 38 A, dI/dt = 100 A/μs	-	14	20	μC
		T_J = 125 °C, I_F = 38 A, dI/dt = 100 A/μs	-	17	25	
Body Diode Recovery Current	I_{RRM}	T_J = 25 °C	-	39	58	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. 11).
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 from 0 % to 80 % V_{DS}.

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S11-0112-Rev. B, 31-Jan-11

TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)

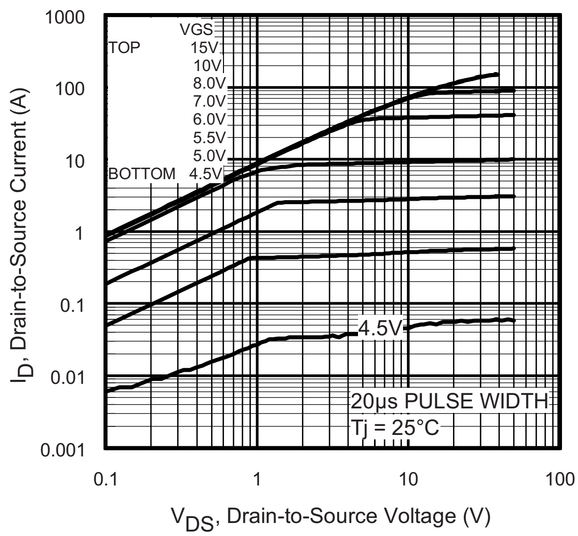


Fig. 1 - Typical Output Characteristics

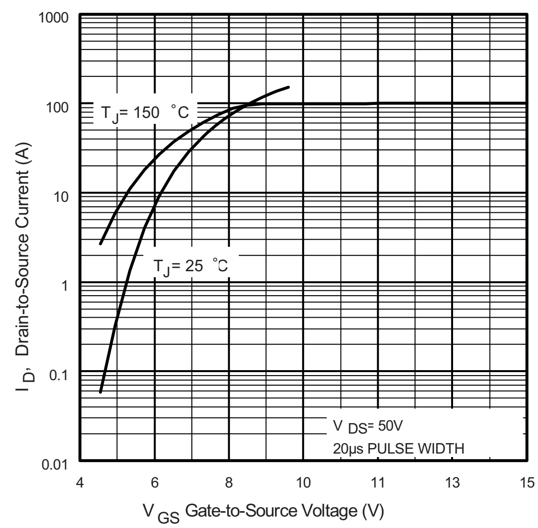


Fig. 3 - Typical Transfer Characteristics

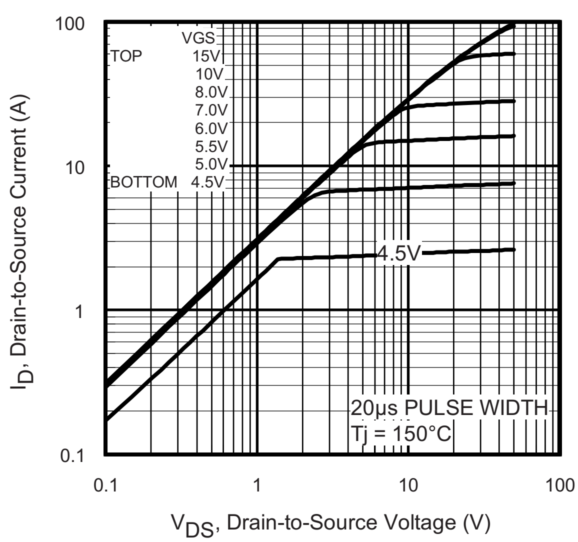


Fig. 2 - Typical Output Characteristics

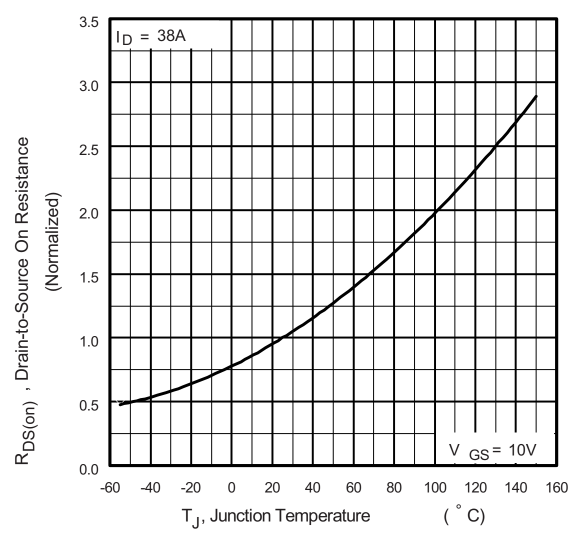


Fig. 4 - Normalized On-Resistance vs. Temperature

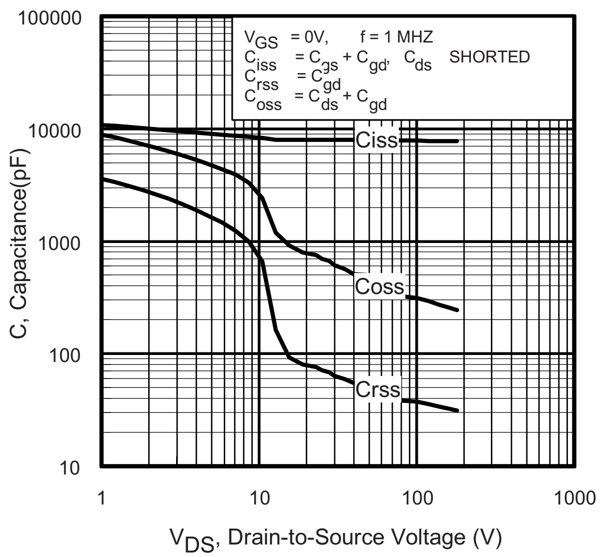


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

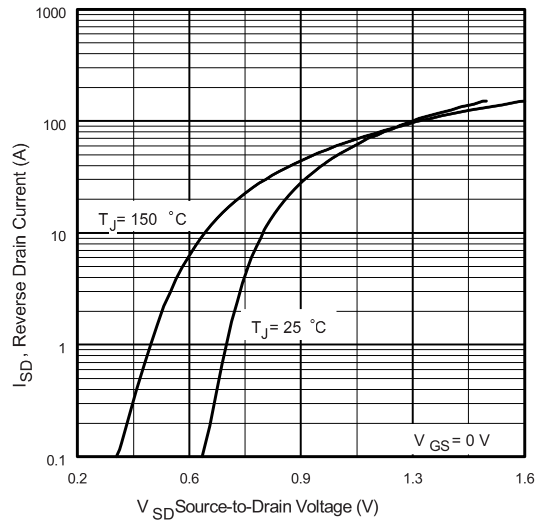


Fig. 7 - Typical Source-Drain Diode Forward Voltage

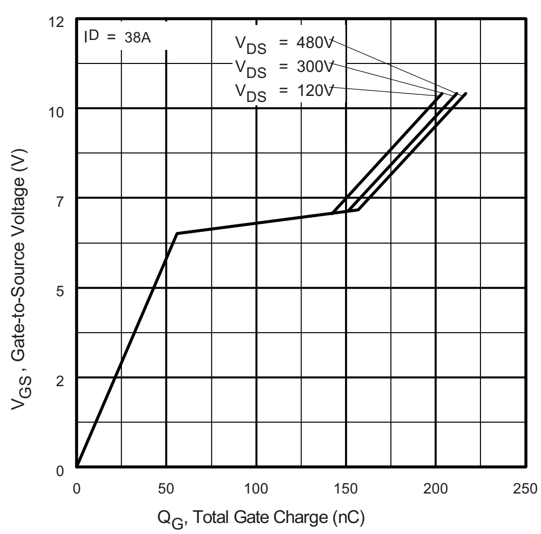


Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage

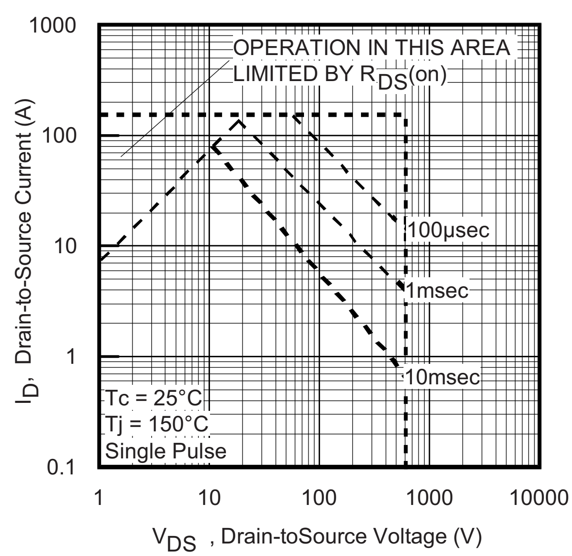


Fig. 8 - Maximum Safe Operating Area

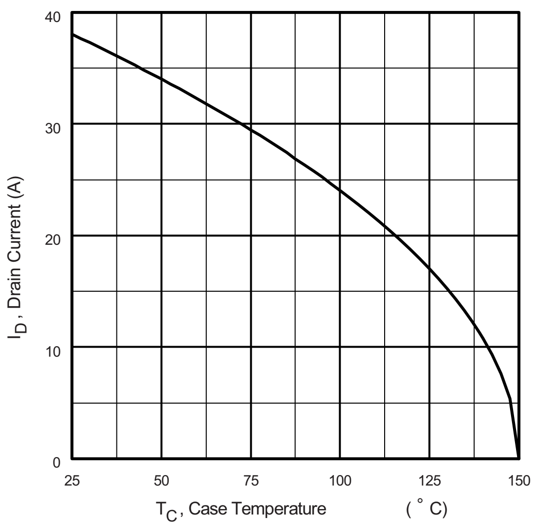


Fig. 9 - Maximum Drain Current vs. Case Temperature

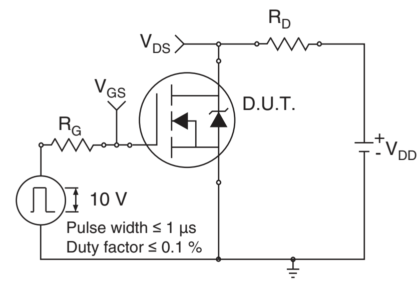


Fig. 10a - Switching Time Test Circuit

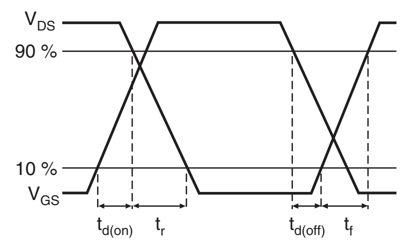


Fig. 10b - Switching Time Waveforms

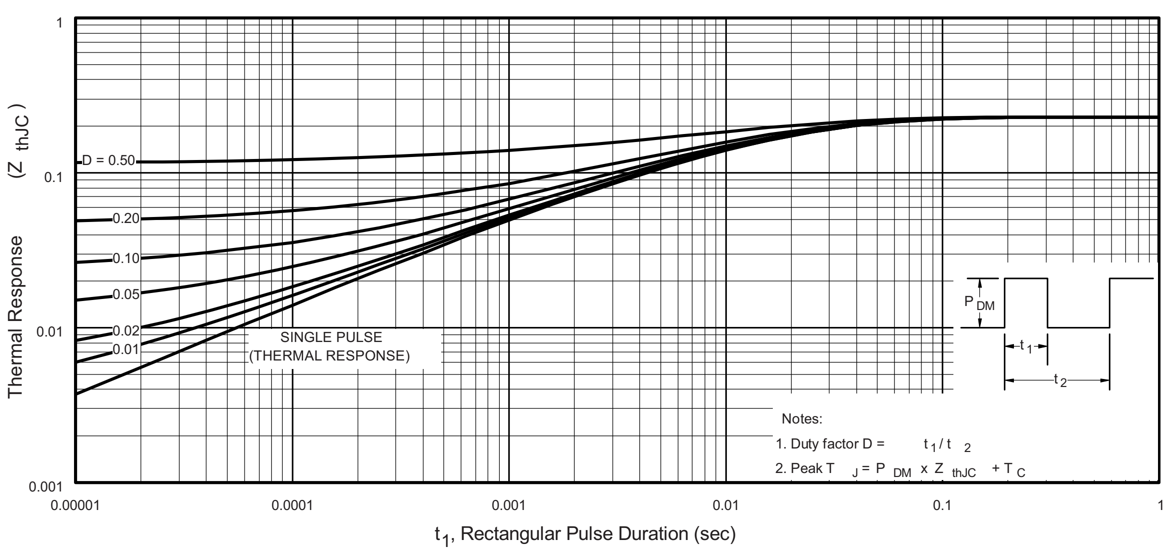


Fig. 11 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

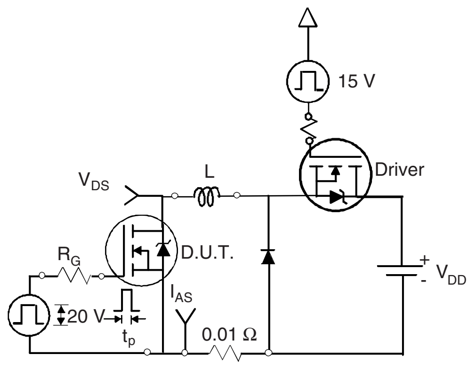


Fig. 12a - Unclamped Inductive Test Circuit

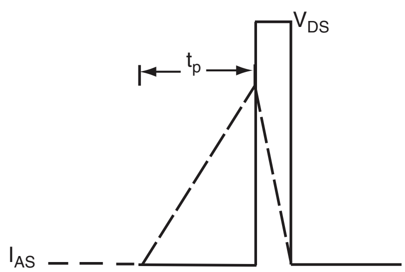


Fig. 12b - Unclamped Inductive Waveforms

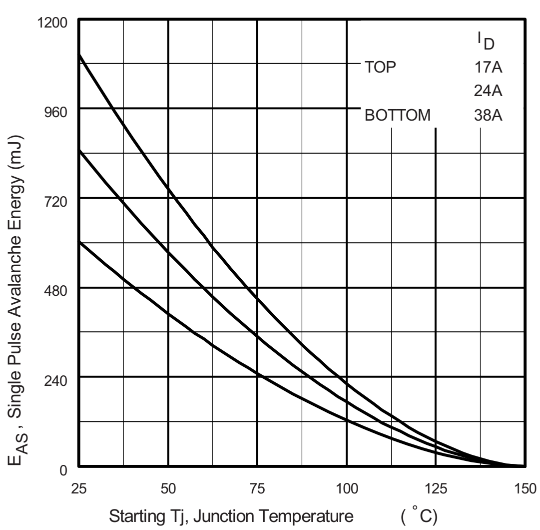


Fig. 12c - Maximum Avalanche Energy vs. Drain Current

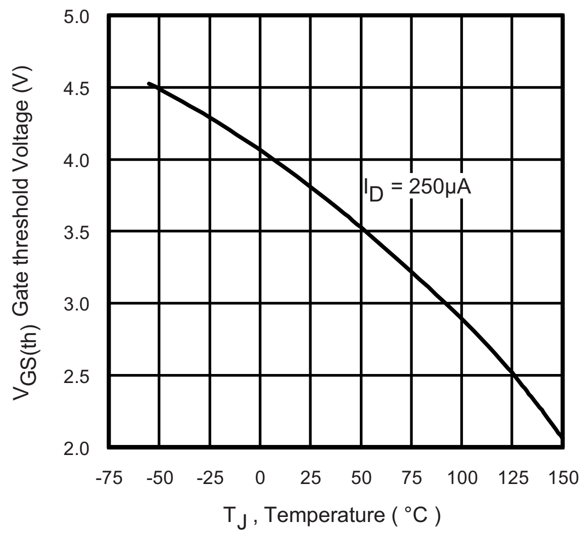


Fig. 12d - Threshold Voltage vs. Temperature

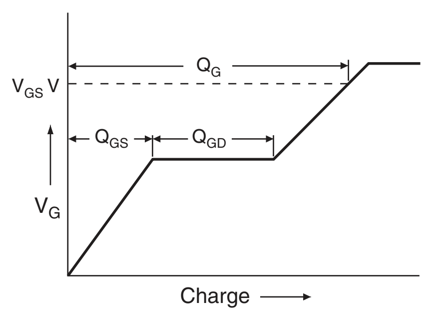


Fig. 13a - Basic Gate Charge Waveform

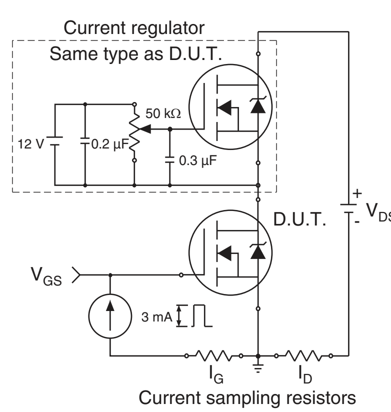
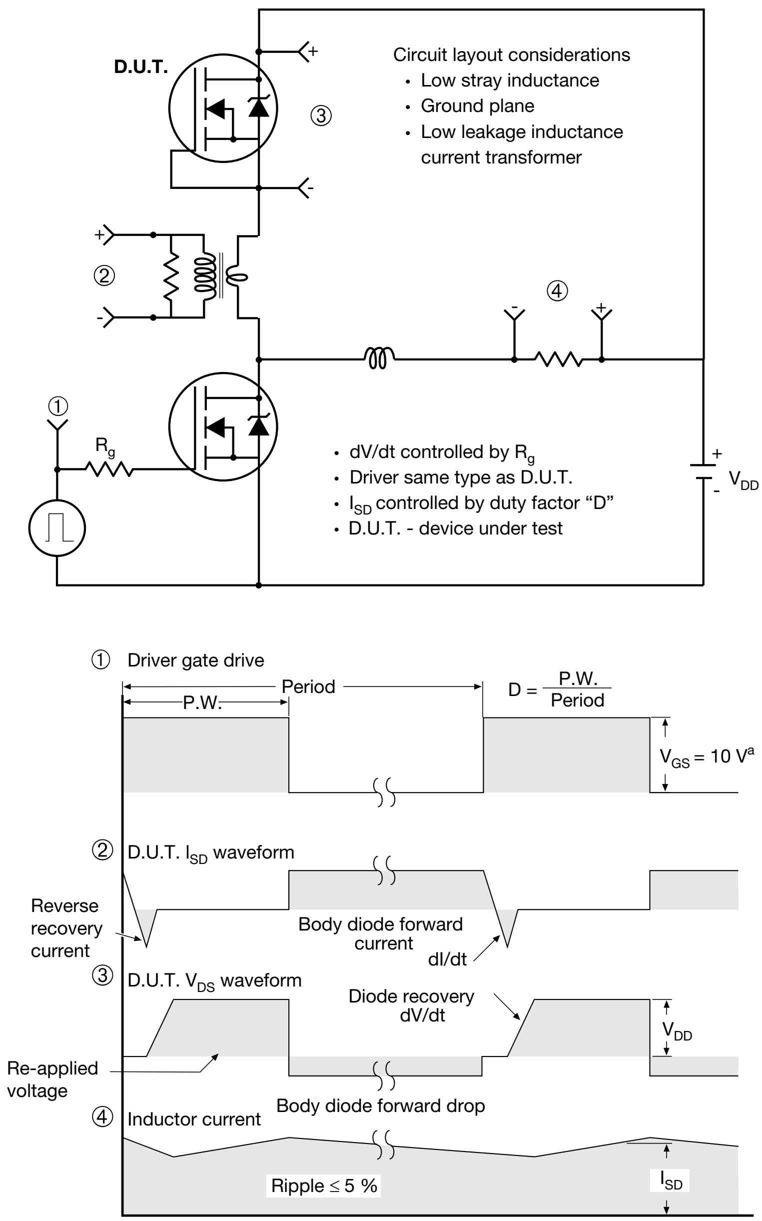


Fig. 13b - Gate Charge Test Circuit

Peak Diode Recovery dV/dt Test Circuit



Note

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

Fig. 14 - For N-Channel

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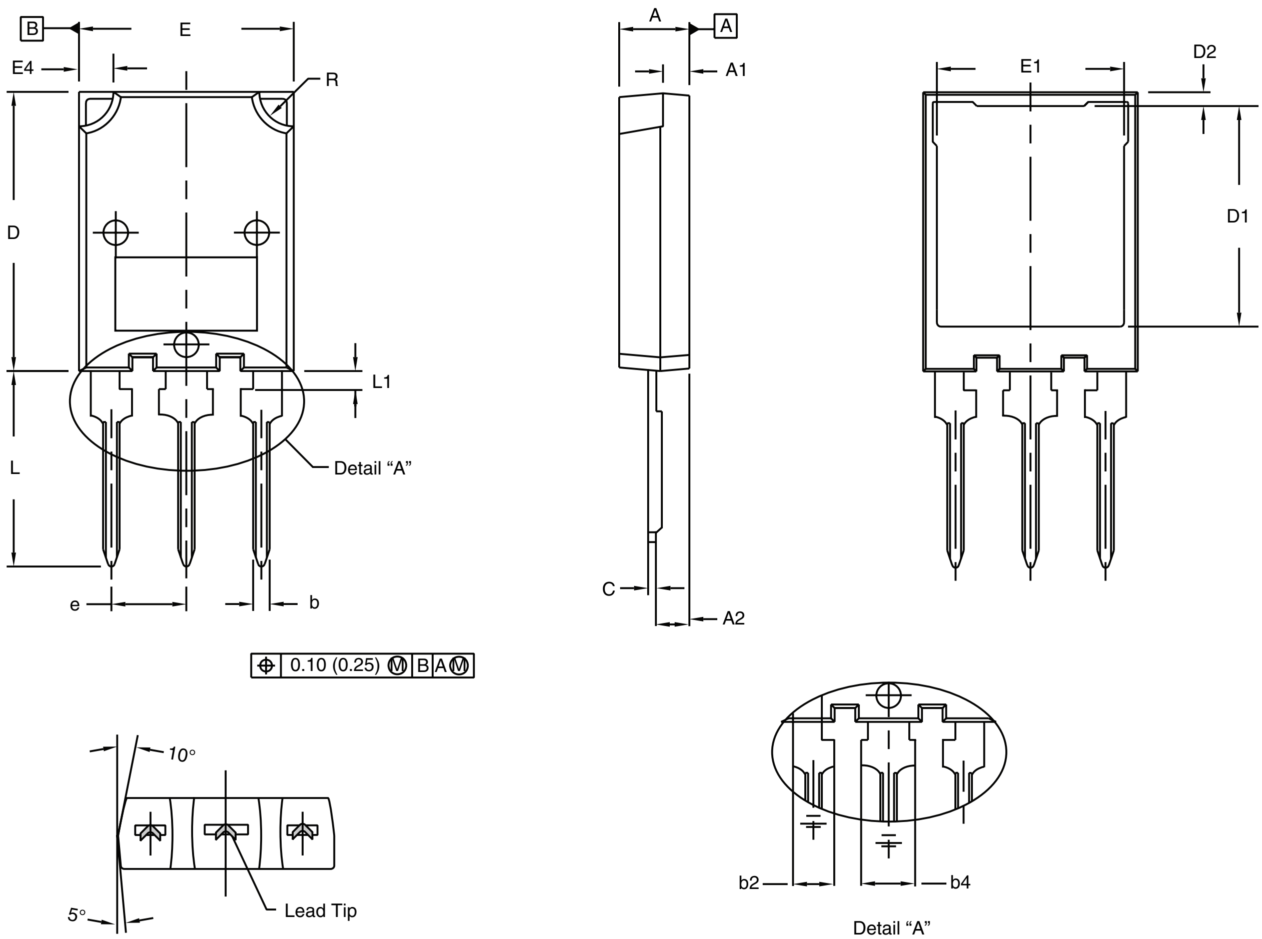
TO-274AA (HIGH VOLTAGE)



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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