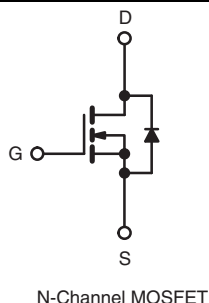
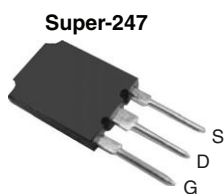


Power MOSFET

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	



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



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 ($T_C = 25^\circ\text{C}$, 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}	160	
Linear Derating Factor		4.5	W/ $^\circ\text{C}$
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	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	$^\circ\text{C}$
Soldering Recommendations (Peak Temperature)	for 10 s	300 ^d	

Notes

- Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).
- Starting $T_J = 25^\circ\text{C}$, $L = 0.84$ mH, $R_g = 25\ \Omega$, $I_{AS} = 38$ A, $dV/dt = 5.5$ V/ns (see fig. 12a).
- $I_{SD} \leq 38$ A, $dI/dt \leq 150$ 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 ($T_J = 25\text{ }^{\circ}\text{C}$, 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	ΔV _{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	-	pF
			V _{DS} = 480 V , f = 1.0 MHz	-	200	-	
Effective Output Capacitance	C _{oss eff.}		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	-
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		-	730	1090	
Body Diode Reverse Recovery Charge	Q _{rr}	T _J = 25 °C		-	14	20	μC
		T _J = 125 °C		-	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 $\leq 300\text{ }\mu\text{s}$; 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} .

TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)

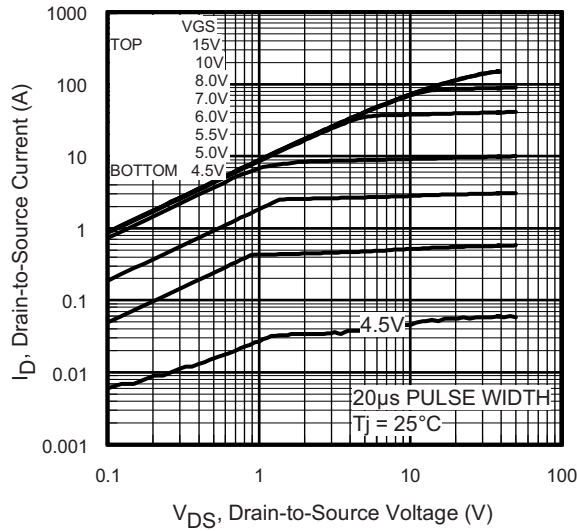


Fig. 1 - Typical Output Characteristics

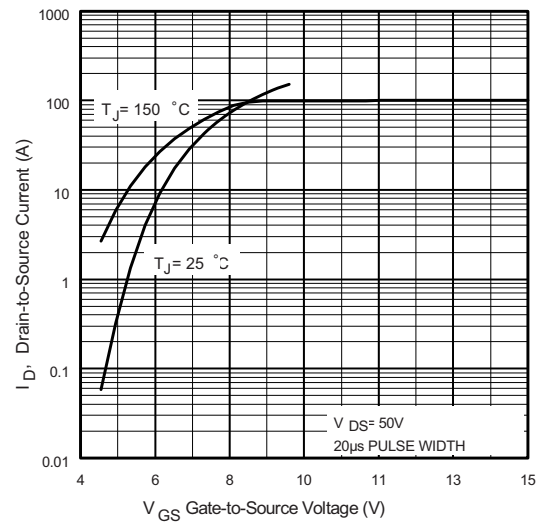


Fig. 3 - Typical Transfer Characteristics

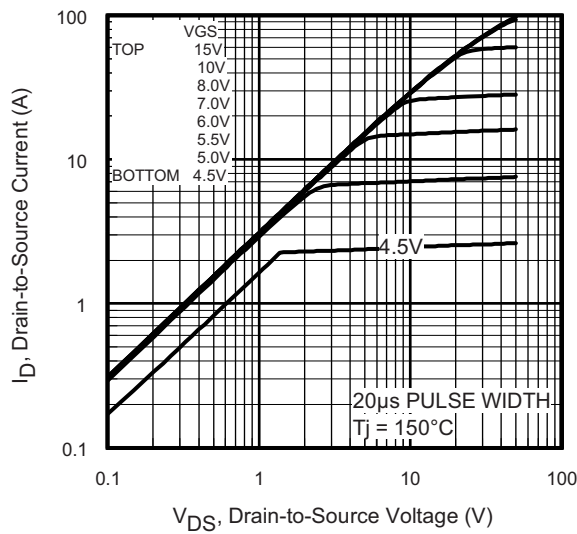


Fig. 2 - Typical Output Characteristics

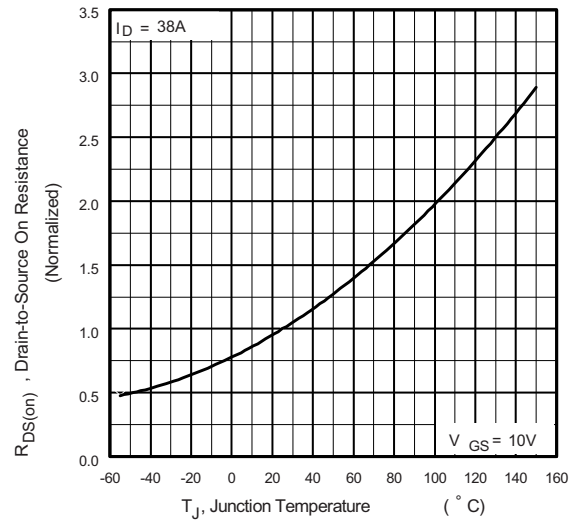


Fig. 4 - Normalized On-Resistance vs. Temperature

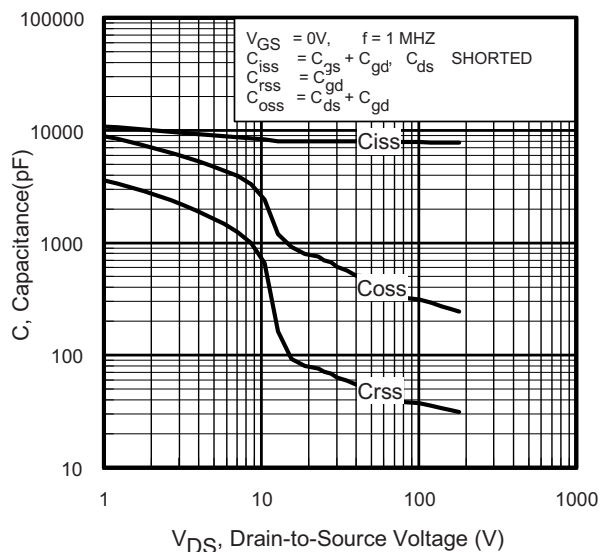


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

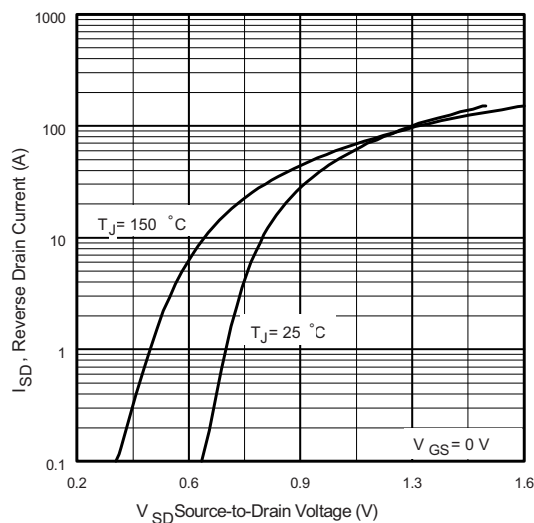


Fig. 7 - Typical Source-Drain Diode Forward Voltage

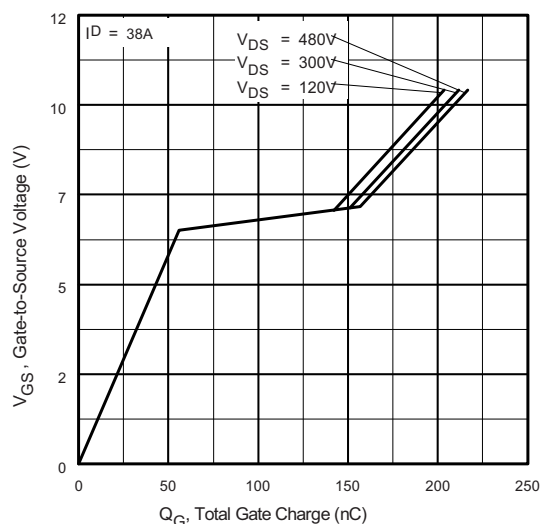


Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage

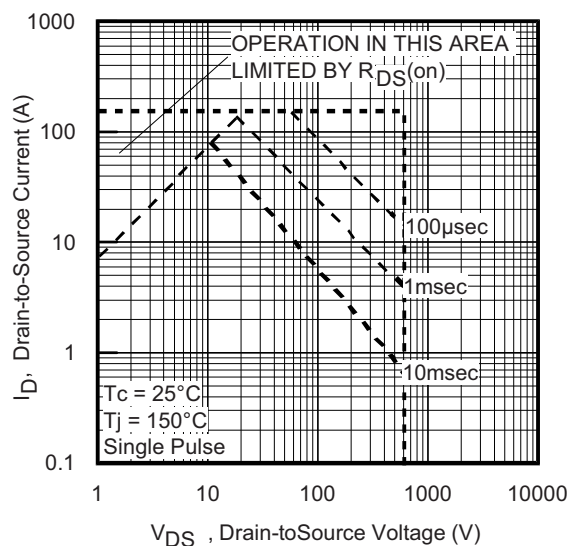


Fig. 8 - Maximum Safe Operating Area

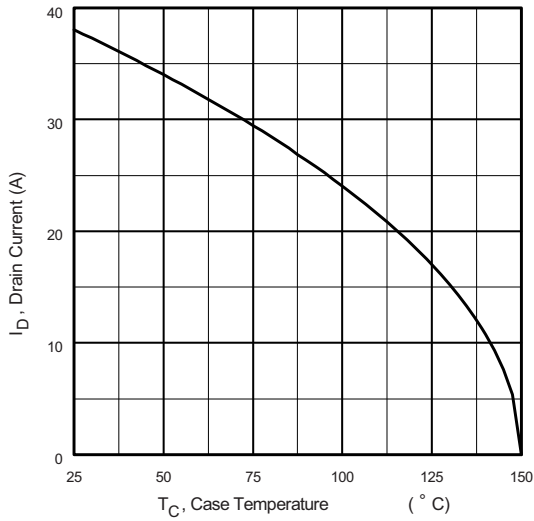


Fig. 9 - Maximum Drain Current vs. Case Temperature

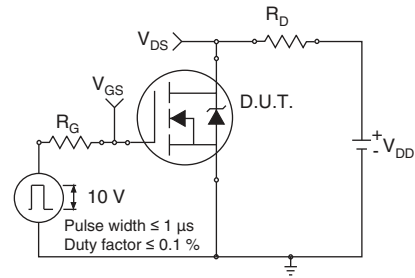


Fig. 10a - Switching Time Test Circuit

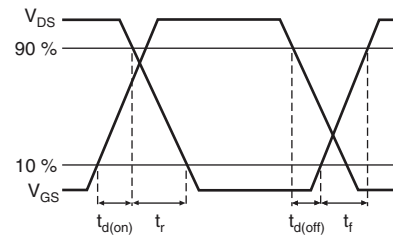


Fig. 10b - Switching Time Waveforms

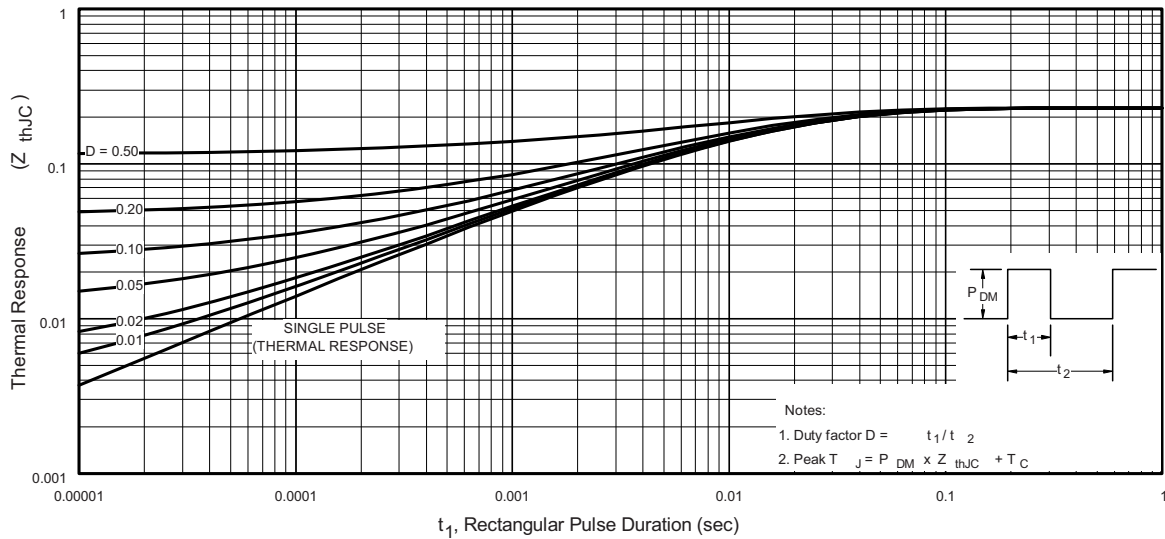


Fig. 11 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

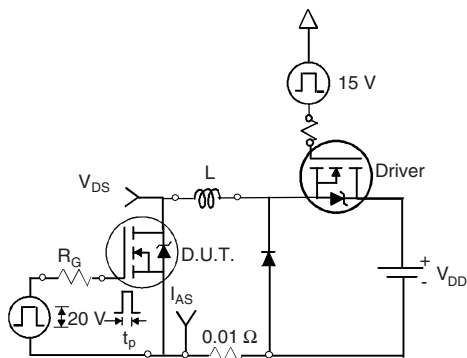


Fig. 12a - Unclamped Inductive Test Circuit

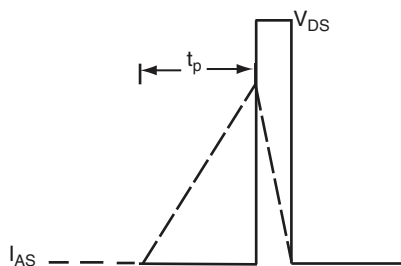


Fig. 12b - Unclamped Inductive Waveforms

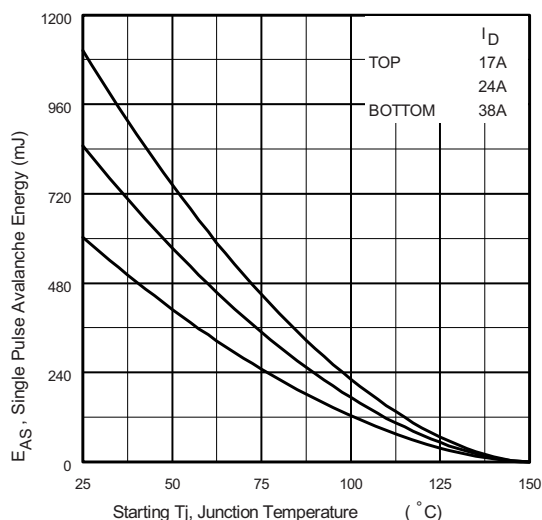


Fig. 12c - Maximum Avalanche Energy vs. Drain Current

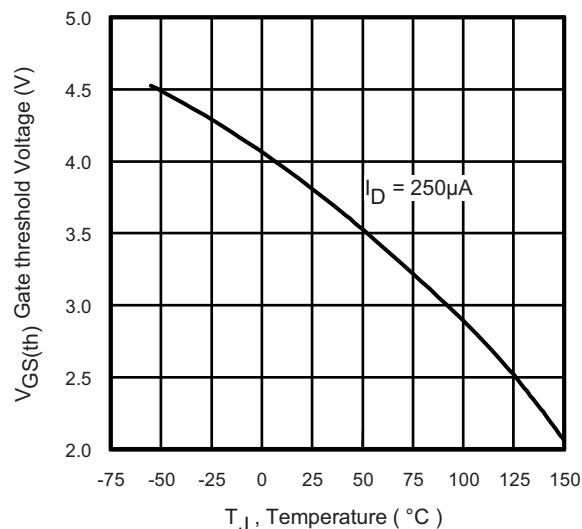


Fig. 12d - Threshold Voltage vs. Temperature

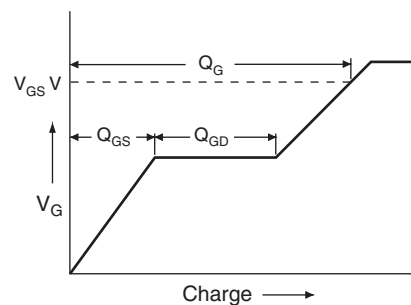


Fig. 13a - Basic Gate Charge Waveform

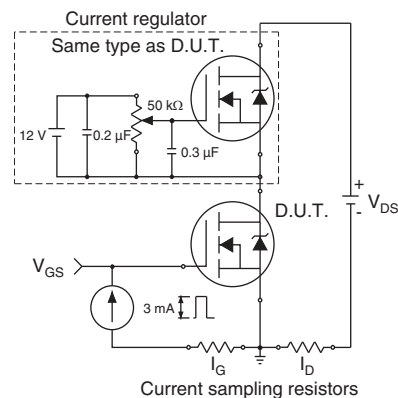
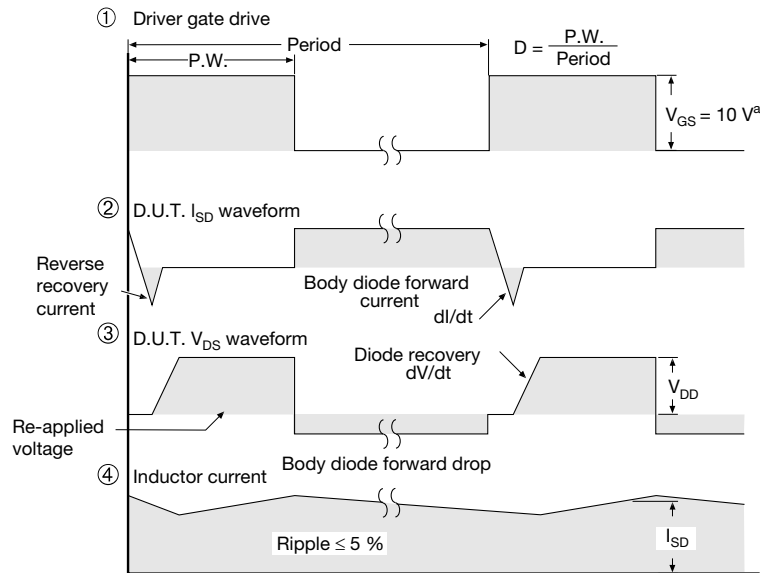
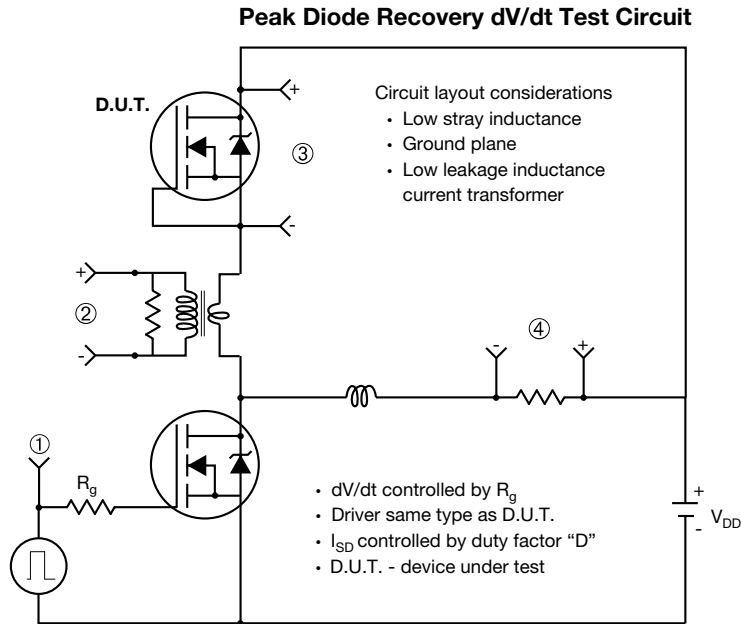


Fig. 13b - Gate Charge Test Circuit



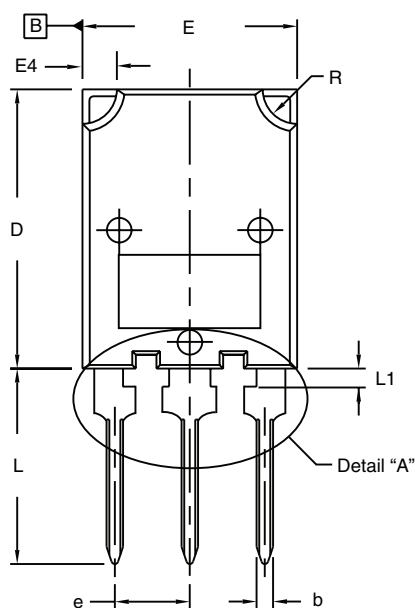
Note

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

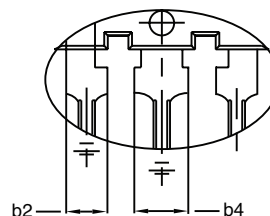
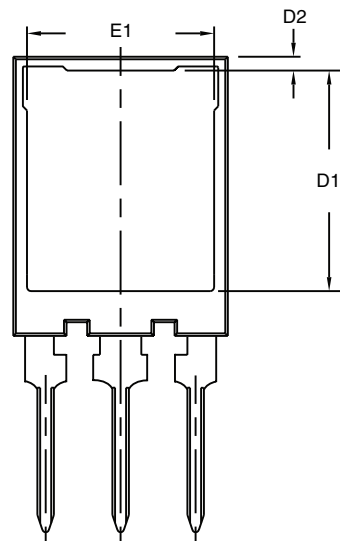
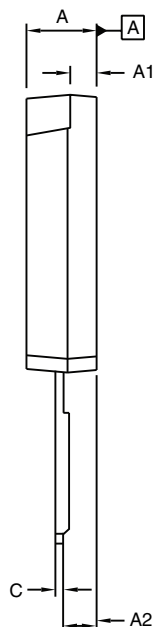
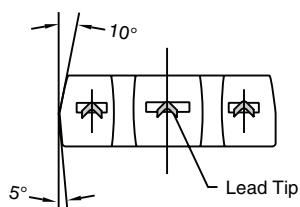
Fig. 14 - For N-Channel

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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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