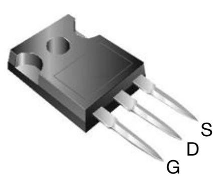
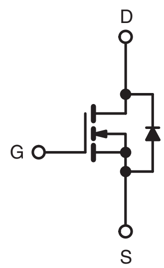
Power MOSFET

PRODUCT SUMMARY		
V_{DS} (V)	600	
$R_{DS(on)}$ (Ω)	V_{GS} = 10 V	0.24
Q_g (Max.) (nC)	150	
Q_{gs} (nC)	45	
Q_{gd} (nC)	76	
Configuration	Single	

TO-247AC





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

BENEFITS

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

ORDERING INFORMATION	
Package	TO-247AC
Lead (Pb)-free	IRFP22N60KPbF
	SiHFP22N60K-E3
SnPb	IRFP22N60K
	SiHFP22N60K

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

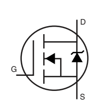
PARAMETER			SYMBOL	LIMIT	UNIT
Drain-Source Voltage			V_{DS}	600	V
Gate-Source Voltage			V_{GS}	± 30	
Continuous Drain Current	V_{GS} at 10 V	T_C = 25 °C	I_D	22	A
		T_C = 100 °C		14	
Pulsed Drain Current[a]			I_{DM}	88	
Linear Derating Factor				2.9	W/°C
Single Pulse Avalanche Energy[b]			E_{AS}	380	mJ
Repetitive Avalanche Current[a]			I_{AR}	22	A
Repetitive Avalanche Energy[a]			E_{AR}	37	mJ
Maximum Power Dissipation	T_C = 25 °C		P_D	370	W
Peak Diode Recovery dV/dt[c]			dV/dt	15	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 = 1.5 mH, R_g = 25 Ω, I_{AS} = 22 A (see fig. 12).
c. $I_{SD} \leq 22$ A, dI/dt ≤ 360 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	
Case-to-Sink, Flat, Greased Surface	R_{thCS}	0.24	-	°C/W
Maximum Junction-to-Case (Drain)	R_{thJC}	-	0.34	

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[d]	-	0.30	-	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 = 13 A[b]	-	0.240	0.280	Ω
Forward Transconductance	g_{fs}	V_{DS} = 50 V, I_D = 13 A[b]	11	-	-	S
Dynamic						
Input Capacitance	C_{iss}	V_{GS} = 0 V, V_{DS} = 25 V, f = 1.0 MHz, see fig. 5	-	3570	-	pF
Output Capacitance	C_{oss}		-	350	-	
Reverse Transfer Capacitance	C_{rss}		-	36	-	
Output Capacitance	C_{oss}	V_{GS} = 0 V; V_{DS} = 1.0 V , f = 1.0 MHz	-	4710	-	
		V_{GS} = 0 V; V_{DS} = 480 V , f = 1.0 MHz	-	92	-	
Effective Output Capacitance	C_{oss} eff.	V_{GS} = 0 V; V_{DS} = 0 V to 480 V	-	180	-	
Total Gate Charge	Q_g	V_{GS} = 10 V; I_D = 22 A, V_{DS} = 480 V see fig. 6 and 13[b]	-	-	150	nC
Gate-Source Charge	Q_{gs}		-	-	45	
Gate-Drain Charge	Q_{gd}		-	-	76	
Turn-On Delay Time	$t_{d(on)}$	V_{DD} = 300 V, I_D = 22 A, R_g = 6.2, V_{GS} = 10 V, see fig. 10[b]	-	26	-	ns
Rise Time	t_r		-	99	-	
Turn-Off Delay Time	$t_{d(off)}$		-	48	-	
Fall Time	t_f		-	37	-	
Drain-Source Body Diode Characteristics						
Continuous Source-Drain Diode Current	I_S	MOSFET symbol showing the integral reverse p - n junction diode 	-	-	22	A
Pulsed Diode Forward Current[a]	I_{SM}		-	-	88	
Body Diode Voltage	V_{SD}	T_J = 25 °C, I_S = 22 A, V_{GS} = 0 V[b]	-	-	1.5	V
Body Diode Reverse Recovery Time	t_{rr}	T_J = 25 °C; I_F = 22 A, dI/dt = 100 A/µs[b]	-	590	890	ns
		T_J = 125 °C	-	670	1010	
Body Diode Reverse Recovery Charge	Q_{rr}	T_J = 25 °C	-	7.2	11	µC
		T_J =1 25 °C	-	8.5	13	
Reverse Recovery Current	I_{RRM}	T_J = 25 °C	-	26	39	
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}.

TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)

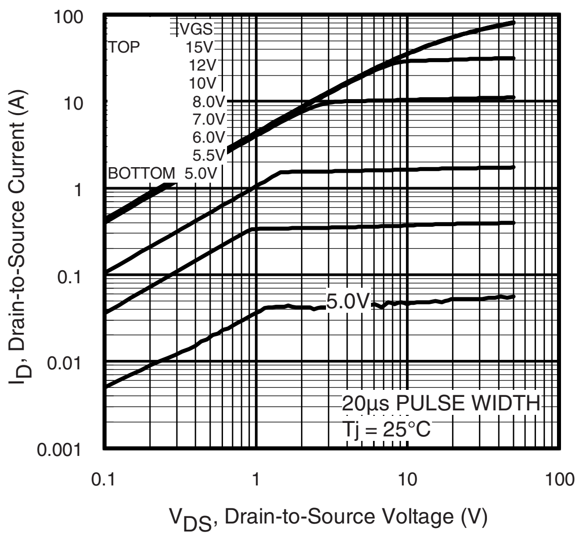


Fig. 1 - Typical Output Characteristics

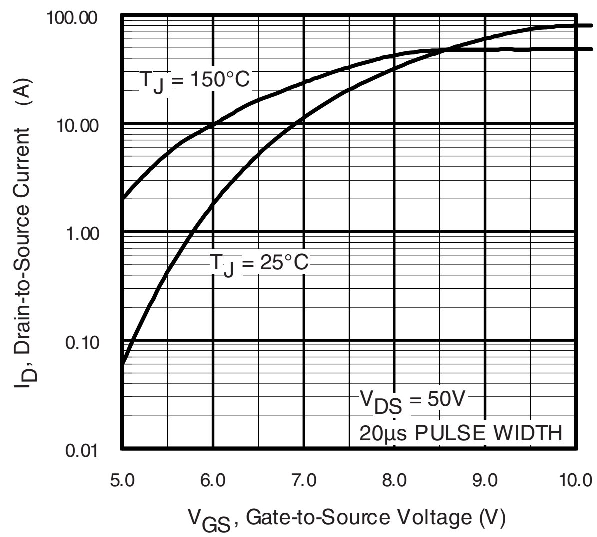


Fig. 3 - Typical Transfer Characteristics

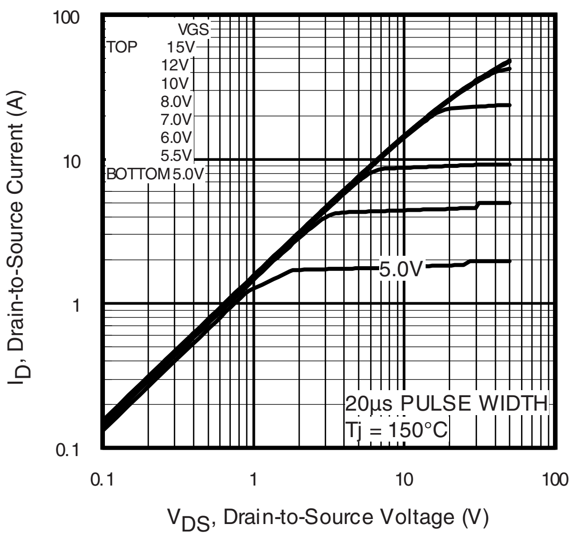


Fig. 2 - Typical Output Characteristics

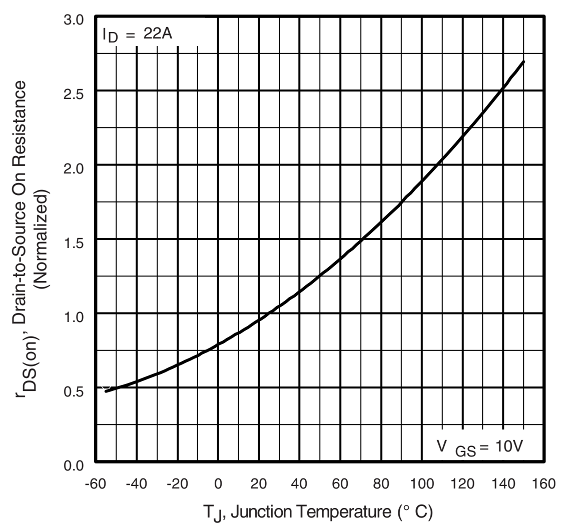


Fig. 4 - Normalized On-Resistance vs. Temperature

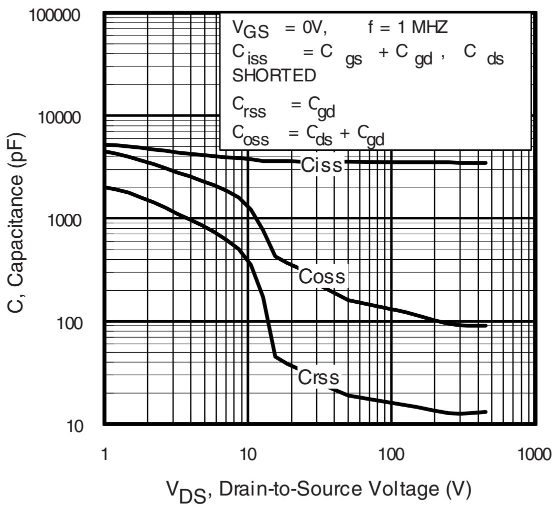


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

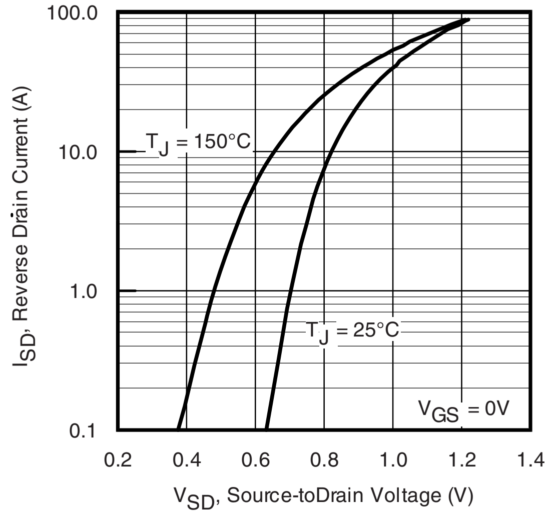


Fig. 7 - Typical Source-Drain Diode Forward Voltage

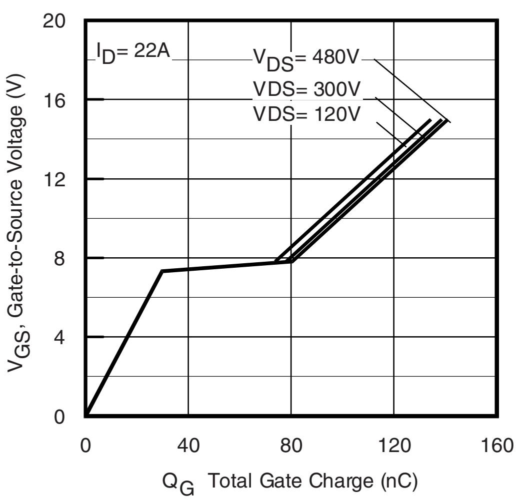


Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage

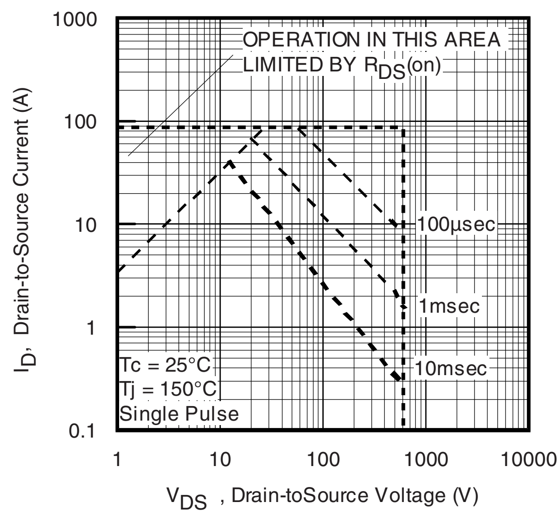


Fig. 8 - Maximum Safe Operating Area

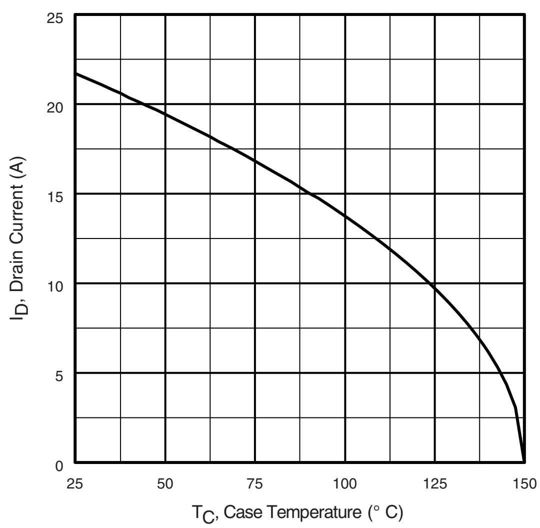


Fig. 9 - Maximum Drain Current vs. Case Temperature

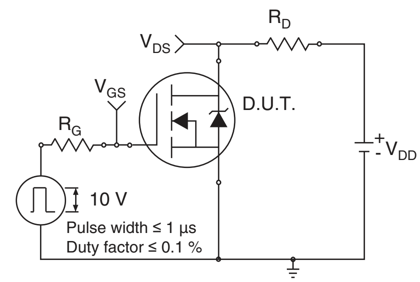


Fig. 10a - Switching Time Test Circuit

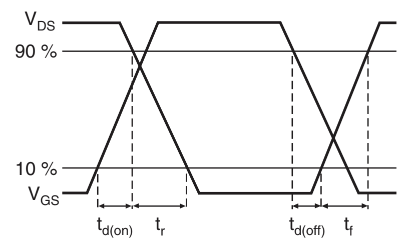


Fig. 10b - Switching Time Waveforms

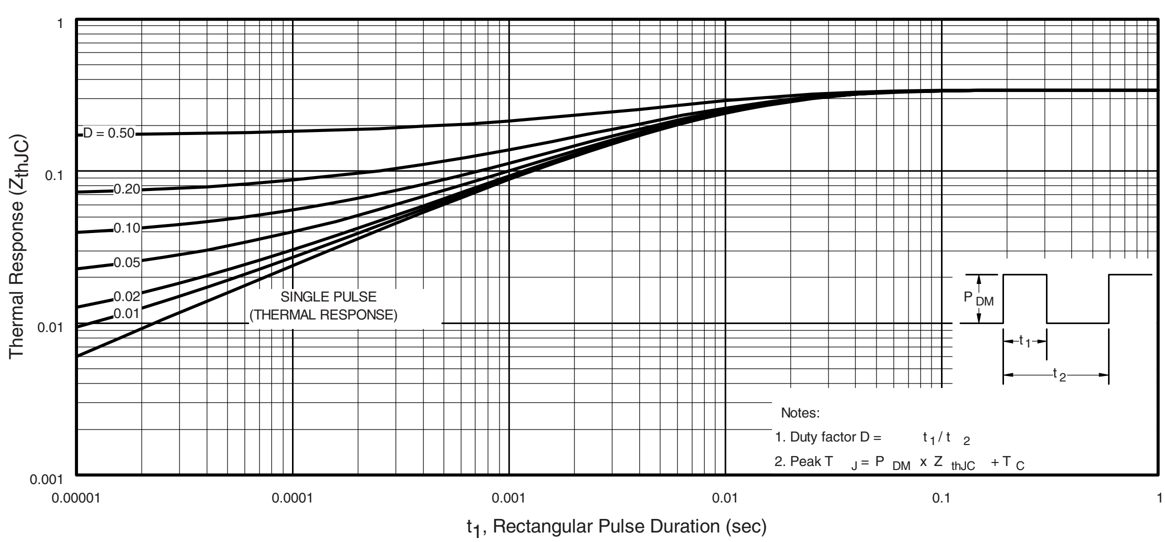


Fig. 11 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

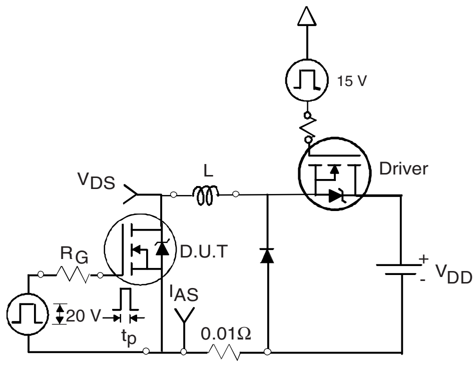


Fig. 12a - Unclamped Inductive Test Circuit

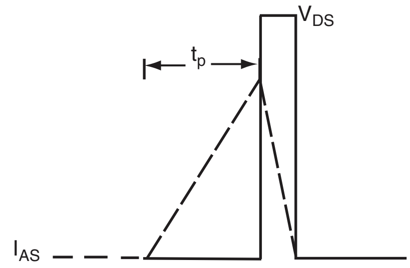


Fig. 12b - Unclamped Inductive Waveforms

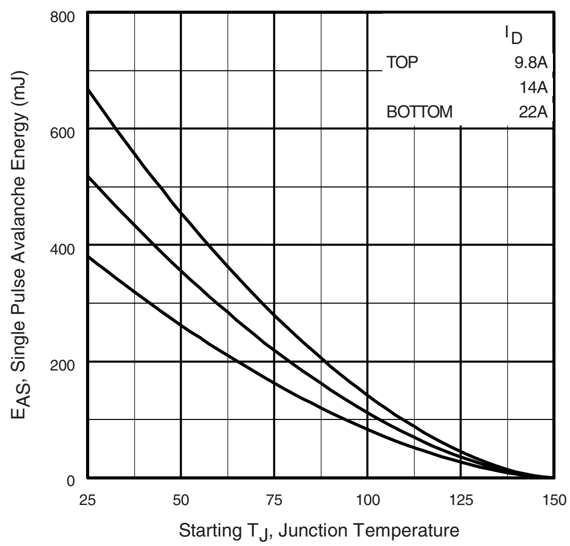


Fig. 12c - Maximum Avalanche Energy vs. Drain Current

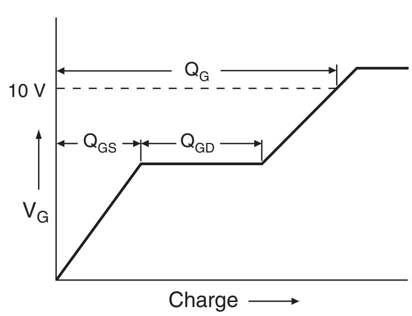


Fig. 13a - Basic Gate Charge Waveform

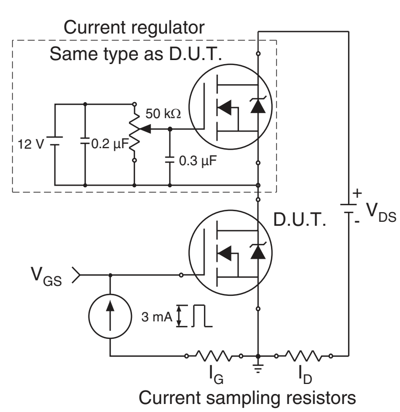
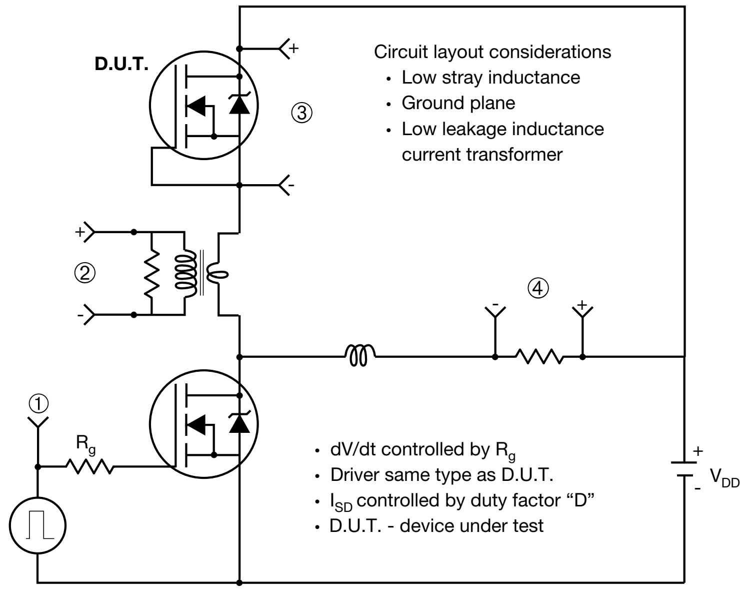
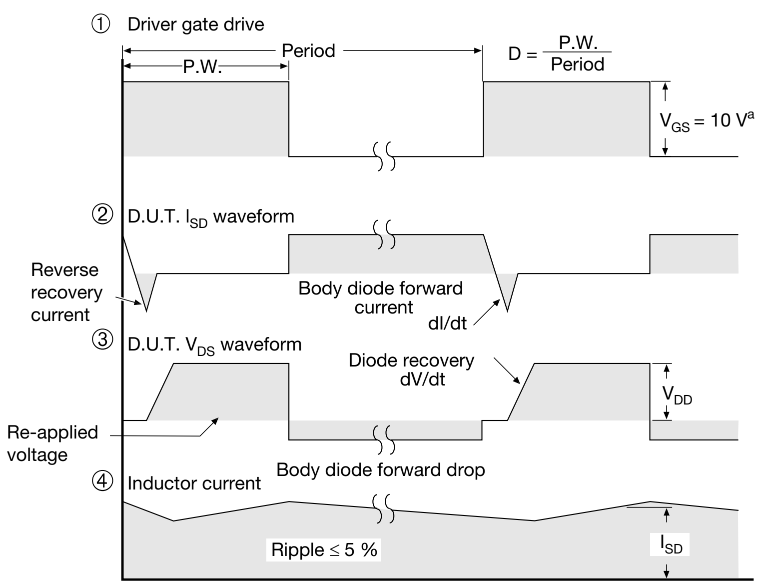


Fig. 13b - Gate Charge Test Circuit

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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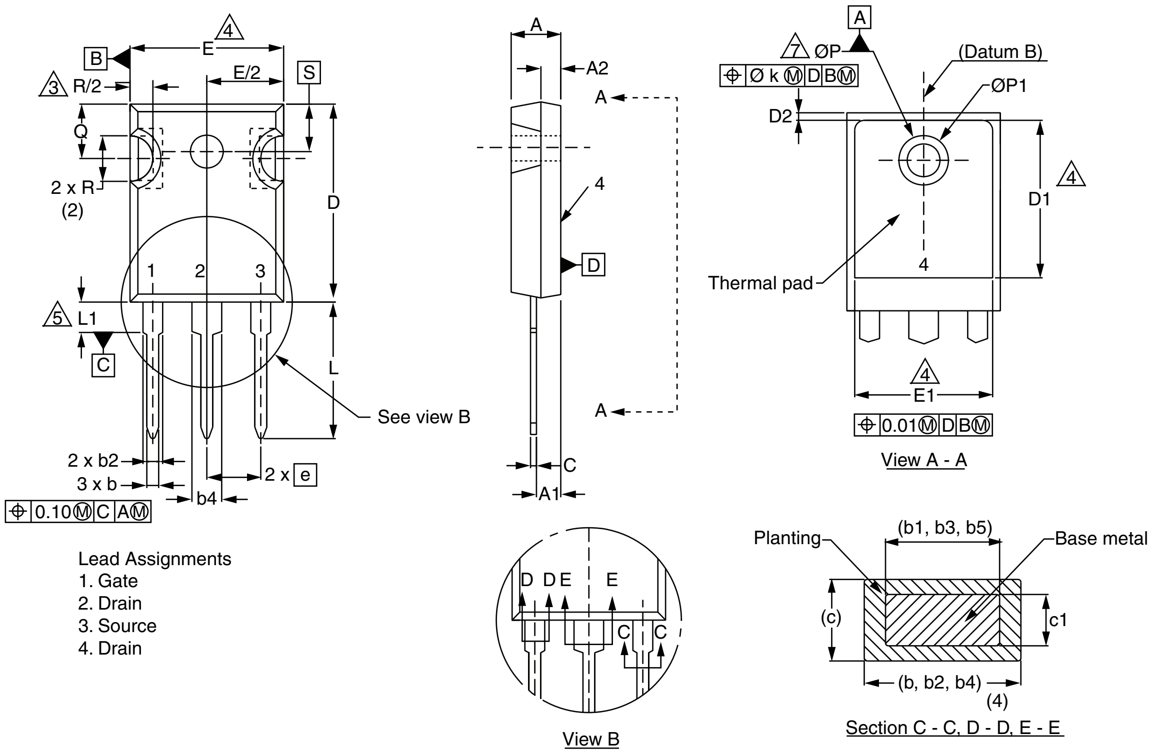
TO-247AC (High Voltage)



Lead Assignments
1. Gate
2. Drain
3. Source
4. Drain

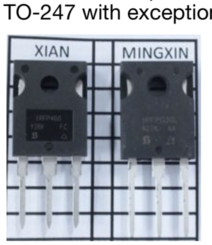
	MILLIMETERS		INCHES	
DIM.	MIN.	MAX.	MIN.	MAX.
A	4.58	5.31	0.180	0.209
A1	2.21	2.59	0.087	0.102
A2	1.17	2.49	0.046	0.098
b	0.99	1.40	0.039	0.055
b1	0.99	1.35	0.039	0.053
b2	1.53	2.39	0.060	0.094
b3	1.65	2.37	0.065	0.093
b4	2.42	3.43	0.095	0.135
b5	2.59	3.38	0.102	0.133
c	0.38	0.86	0.015	0.034
c1	0.38	0.76	0.015	0.030
D	19.71	20.82	0.776	0.820
D1	13.08	-	0.515	-

	MILLIMETERS		INCHES	
DIM.	MIN.	MAX.	MIN.	MAX.
D2	0.51	1.30	0.020	0.051
E	15.29	15.87	0.602	0.625
E1	13.72	-	0.540	-
e	5.46 BSC		0.215 BSC	
Ø k	0.254		0.010	
L	14.20	16.25	0.559	0.640
L1	3.71	4.29	0.146	0.169
N	7.62 BSC		0.300 BSC	
Ø P	3.51	3.66	0.138	0.144
Ø P1	-	7.39	-	0.291
Q	5.31	5.69	0.209	0.224
R	4.52	5.49	0.178	0.216
S	5.51 BSC		0.217 BSC	

ECN: X13-0103-Rev. D, 01-Jul-13
DWG: 5971

Notes

1. Dimensioning and tolerancing per ASME Y14.5M-1994.
2. Contour of slot optional.
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 outermost extremes of the plastic body.
4. Thermal pad contour optional with dimensions D1 and E1.
5. Lead finish uncontrolled in L1.
6. Ø P to have a maximum draft angle of 1.5 to the top of the part with a maximum hole diameter of 3.91 mm (0.154").
7. Outline conforms to JEDEC outline TO-247 with exception of dimension c.
8. Xian and Mingxin actually photo.



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