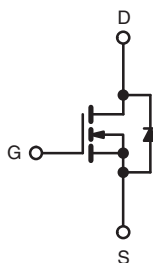
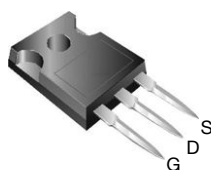


## Power MOSFET

### PRODUCT SUMMARY

$V_{DS}$ (V)	500	
$R_{DS(on)}$ ( $\Omega$ )	$V_{GS} = 10\text{ V}$	0.135
$Q_g$ (Max.) (nC)	190	
$Q_{gs}$ (nC)	59	
$Q_{gd}$ (nC)	84	
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
- Low  $R_{DS(on)}$
- Compliant to RoHS Directive 2002/95/EC



**RoHS\***  
COMPLIANT

### APPLICATIONS

- Switch Mode Power Supply (SMPS)
- Uninterruptible Power Supply
- High Speed Power Switching
- Hard Switching and High Frequency Circuits

### ORDERING INFORMATION

Package	TO-247AC
Lead (Pb)-free	IRFP32N50KPbF
	SiHFP32N50K-E3
SnPb	IRFP32N50K
	SiHFP32N50K

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

PARAMETER	SYMBOL	LIMIT	UNIT
Drain-Source Voltage	$V_{DS}$	500	V
Gate-Source Voltage	$V_{GS}$	$\pm 30$	
Continuous Drain Current	$V_{GS} \text{ at } 10\text{ V}$	$T_C = 25^\circ\text{C}$	A
		$T_C = 100^\circ\text{C}$	
Pulsed Drain Current <sup>a</sup>	$I_{DM}$	130	
Linear Derating Factor		3.7	W/ $^\circ\text{C}$
Single Pulse Avalanche Energy <sup>b</sup>	$E_{AS}$	450	mJ
Repetitive Avalanche Current <sup>a</sup>	$I_{AR}$	32	A
Repetitive Avalanche Energy <sup>a</sup>	$E_{AR}$	46	mJ
Maximum Power Dissipation	$T_C = 25^\circ\text{C}$	$P_D$	460
Peak Diode Recovery $dV/dt^c$	$dV/dt$	13	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 <sup>d</sup>	
Mounting Torque	6-32 or M3 screw	10	lbf · in
		1.1	N · m

#### Notes


- Repetitive rating; pulse width limited by maximum junction temperature.
- Starting  $T_J = 25^\circ\text{C}$ ,  $L = 0.87\text{ mH}$ ,  $R_g = 25\ \Omega$ ,  $I_{AS} = 32\text{ A}$ .
- $I_{SD} \leq 32\text{ A}$ ,  $dI/dt \leq 197\text{ A}/\mu\text{s}$ ,  $V_{DD} \leq V_{DS}$ ,  $T_J \leq 150^\circ\text{C}$ .
- 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)	$R_{thJC}$	-	0.26	

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

PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
Static							
Drain-Source Breakdown Voltage	V <sub>DS</sub>	V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250 μA		500	-	-	V
V <sub>DS</sub> Temperature Coefficient	ΔV <sub>DS</sub> /T <sub>J</sub>	Reference to 25 °C, I <sub>D</sub> = 1 mA		-	0.54	-	V/°C
Gate-Source Threshold Voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 μA		3.0	-	5.0	V
Gate-Source Leakage	I <sub>GSS</sub>	V <sub>GS</sub> = ± 30 V		-	-	± 100	nA
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>DS</sub> = 500 V, V <sub>GS</sub> = 0 V		-	-	50	μA
		V <sub>DS</sub> = 400 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 150 °C		-	-	250	
Drain-Source On-State Resistance	R <sub>DS(on)</sub>	V <sub>GS</sub> = 10 V	I <sub>D</sub> = 32 A <sup>b</sup>	-	0.135	0.16	Ω
Forward Transconductance	g <sub>fs</sub>	V <sub>DS</sub> = 50 V, I <sub>D</sub> = 32 A		14	-	-	S
Dynamic							
Input Capacitance	C <sub>iss</sub>	V <sub>GS</sub> = 0 V, V <sub>DS</sub> = 25 V, f = 1.0 MHz, see fig. 5		-	5280	-	pF
Output Capacitance	C <sub>oss</sub>			-	550	-	
Reverse Transfer Capacitance	C <sub>rss</sub>			-	45	-	
Output Capacitance	C <sub>oss</sub>	V <sub>GS</sub> = 0 V	V <sub>DS</sub> = 1.0 V, f = 1.0 MHz	-	5630	-	pF
			V <sub>DS</sub> = 400 V, f = 1.0 MHz	-	155	-	
Effective Output Capacitance	C <sub>oss eff.</sub>		V <sub>DS</sub> = 0 V to 400 V <sup>c</sup>	-	265	-	
Total Gate Charge	Q <sub>g</sub>	V <sub>GS</sub> = 10 V	I <sub>D</sub> = 32 A, V <sub>DS</sub> = 400 V <sup>b</sup>	-	-	190	nC
Gate-Source Charge	Q <sub>gs</sub>			-	-	59	
Gate-Drain Charge	Q <sub>gd</sub>			-	-	84	
Turn-On Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> = 250 V, I <sub>D</sub> = 32 A, R <sub>g</sub> = 4.3 Ω, V <sub>GS</sub> = 10 V <sup>b</sup>		-	28	-	ns
Rise Time	t <sub>r</sub>			-	120	-	
Turn-Off Delay Time	t <sub>d(off)</sub>			-	48	-	
Fall Time	t <sub>f</sub>			-	54	-	
Drain-Source Body Diode Characteristics							
Continuous Source-Drain Diode Current	I <sub>S</sub>	MOSFET symbol showing the integral reverse p - n junction diode 		-	-	32	A
Pulsed Diode Forward Current <sup>a</sup>	I <sub>SM</sub>			-	-	130	
Body Diode Voltage	V <sub>SD</sub>	T <sub>J</sub> = 25 °C, I <sub>S</sub> = 32 A, V <sub>GS</sub> = 0 V <sup>b</sup>		-	-	1.5	V
Body Diode Reverse Recovery Time	t <sub>rr</sub>	T <sub>J</sub> = 25 °C, I <sub>F</sub> = 32 A, dI/dt = 100 A/μs <sup>b</sup>		-	530	800	ns
Body Diode Reverse Recovery Charge	Q <sub>rr</sub>			-	9.0	13.5	μC
Body Diode Reverse Recovery Current	I <sub>RRM</sub>			-	30	-	A
Forward Turn-On Time	t <sub>on</sub>	Intrinsic turn-on time is negligible (turn-on is dominated by L <sub>S</sub> and L <sub>D</sub> )					

**Notes**

- a. Repetitive rating; pulse width limited by maximum junction temperature.  
b. Pulse width  $\leq 400\text{ }\mu\text{s}$ ; 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)

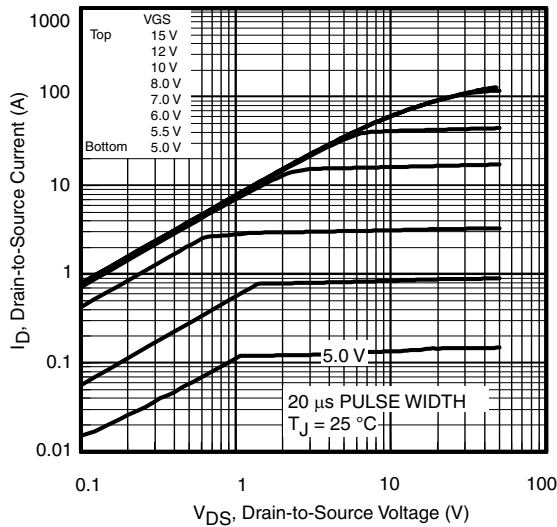


Fig. 1 - Typical Output Characteristics

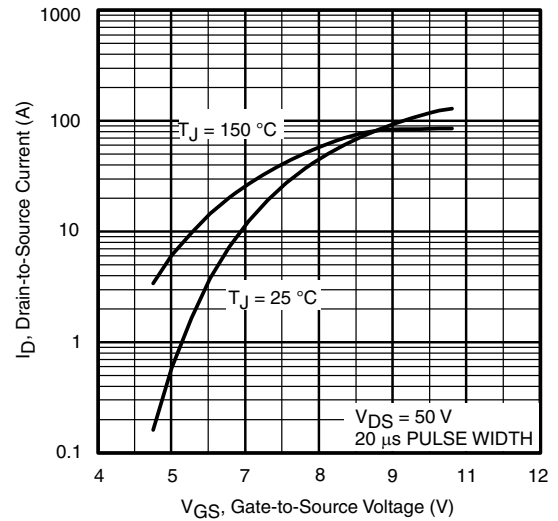


Fig. 3 - Typical Transfer Characteristics

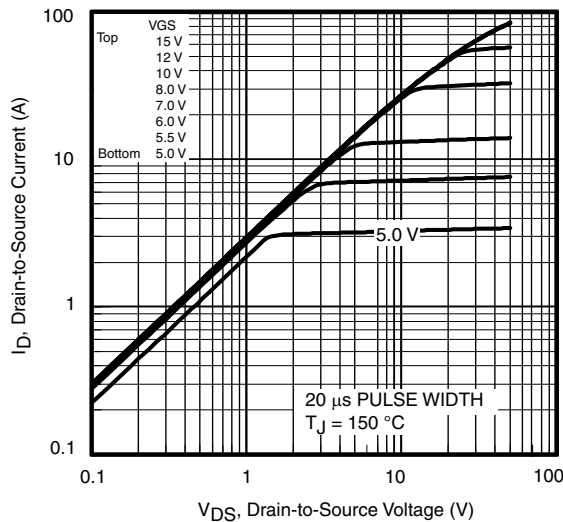


Fig. 2 - Typical Output Characteristics

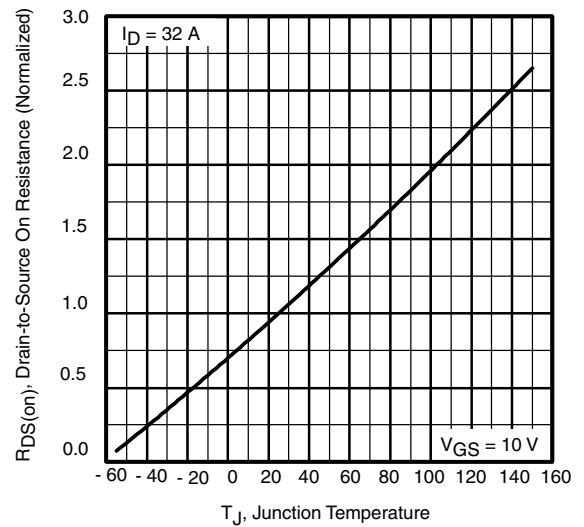


Fig. 4 - Normalized On-Resistance vs. Temperature

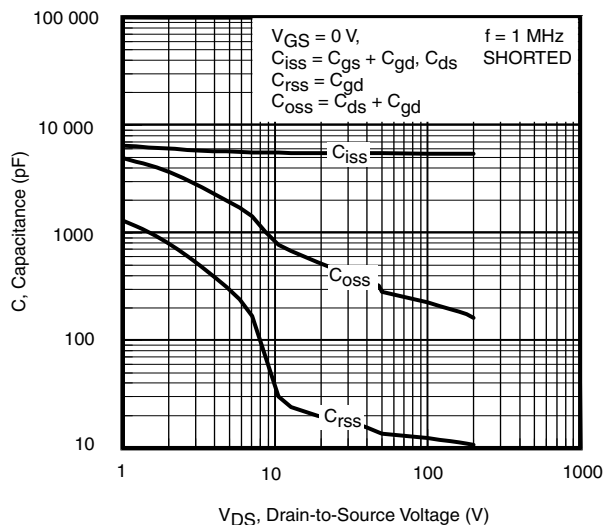


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

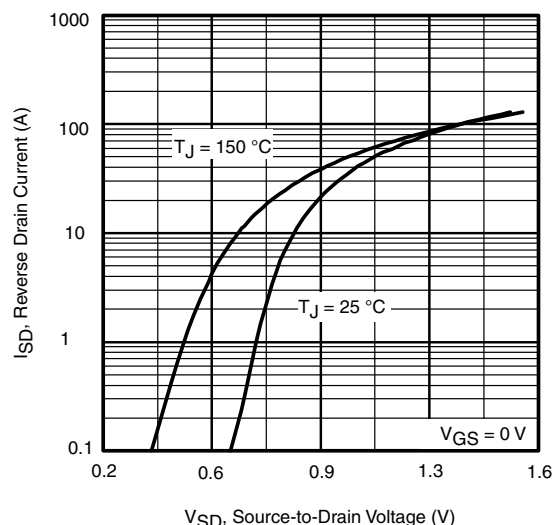


Fig. 7 - Typical Source-Drain Diode Forward Voltage

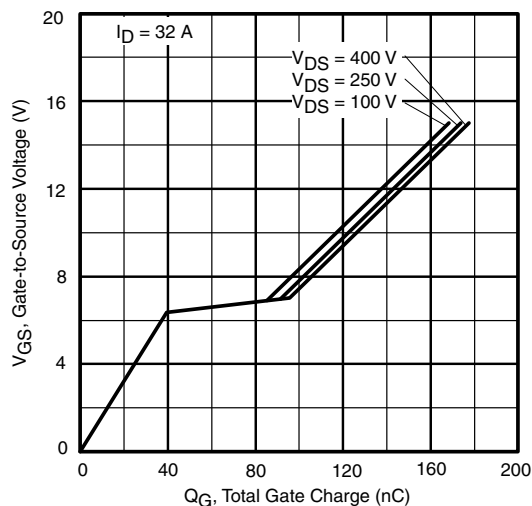


Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage

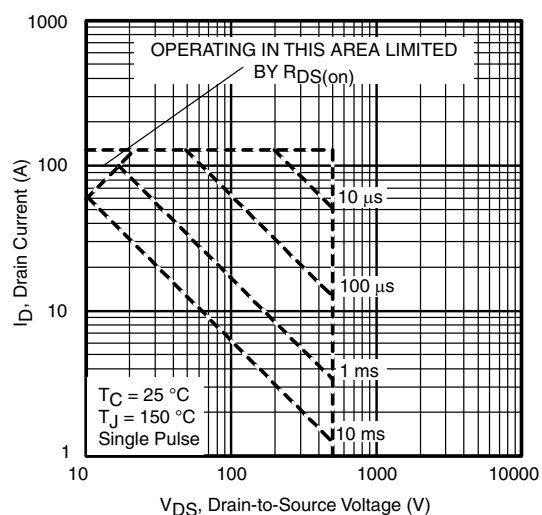


Fig. 8 - Maximum Safe Operating Area

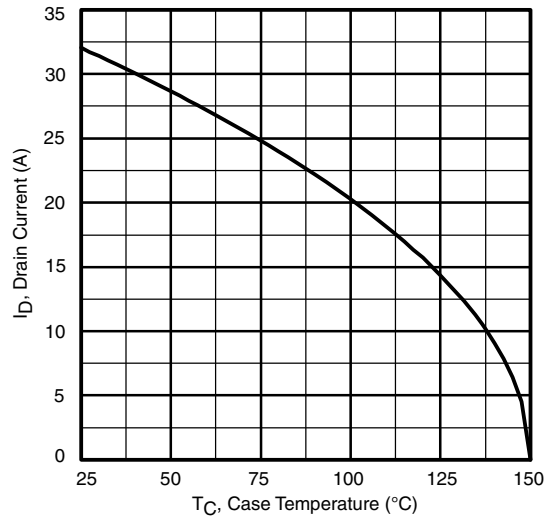


Fig. 9 - Maximum Drain Current vs. Case Temperature

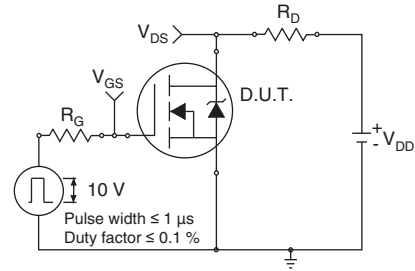


Fig. 10a - Switching Time Test Circuit

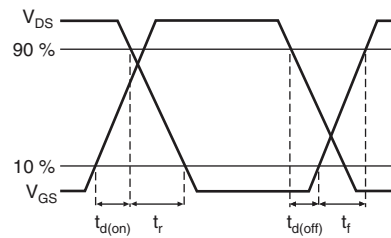


Fig. 10b - Switching Time Waveforms

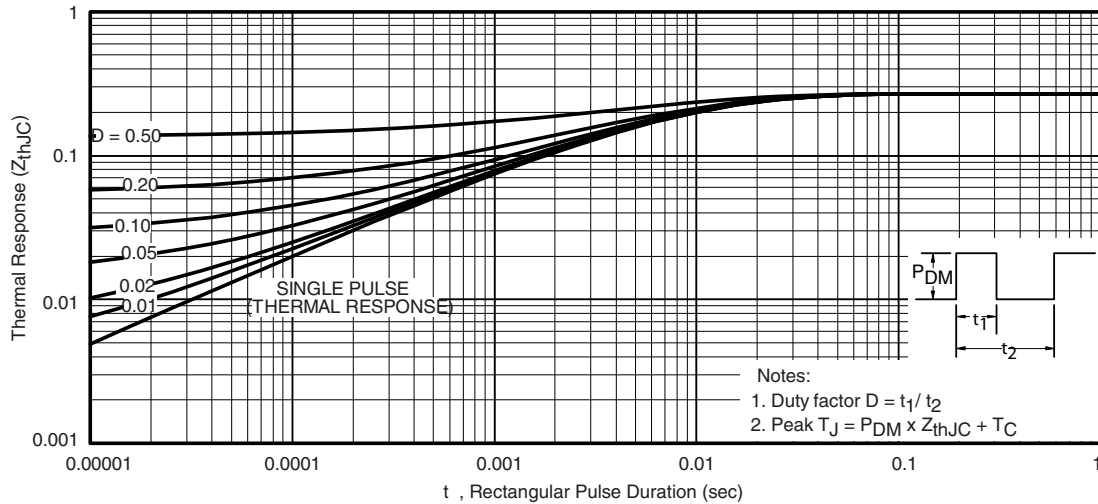


Fig. 11 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

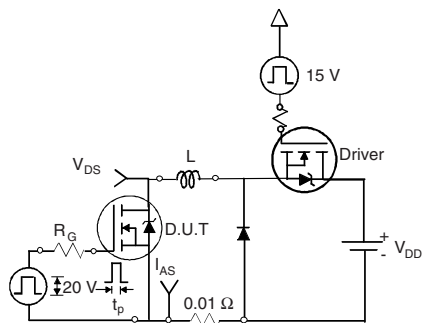


Fig. 12a - Unclamped Inductive Test Circuit

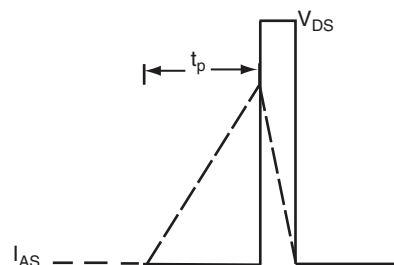


Fig. 12b - Unclamped Inductive Waveforms

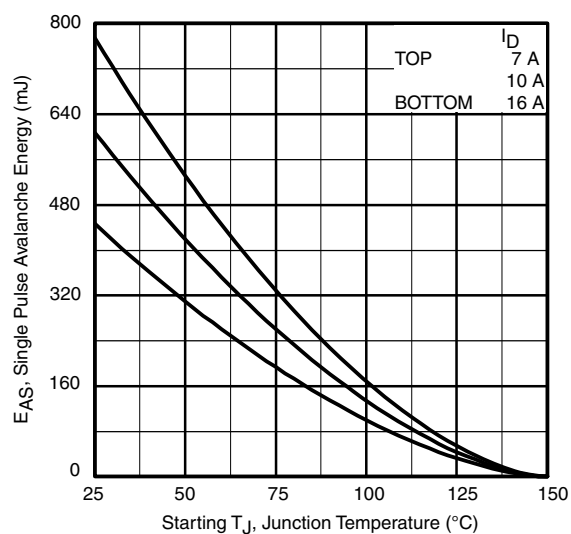


Fig. 12c - Maximum Avalanche Energy vs. Drain Current

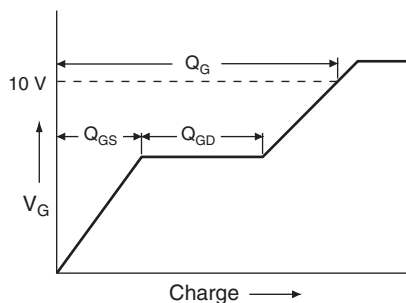


Fig. 13a - Basic Gate Charge Waveform

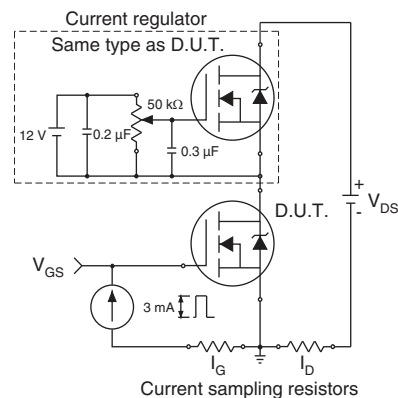
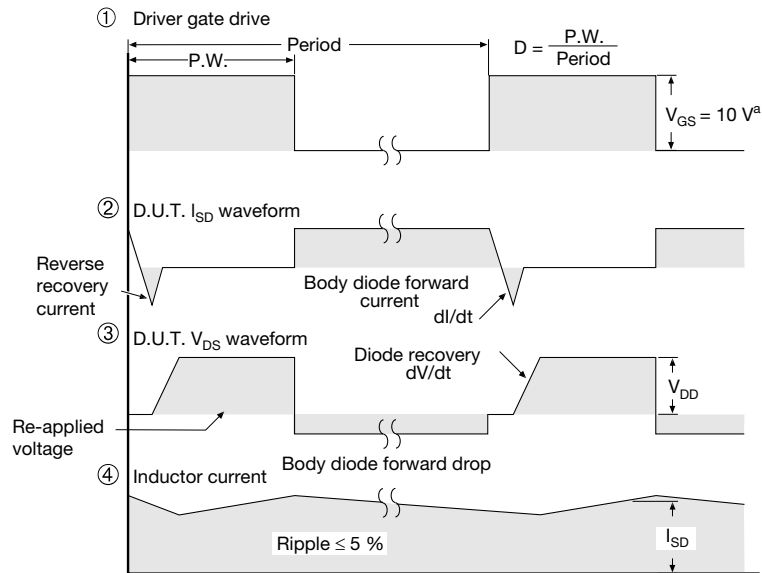
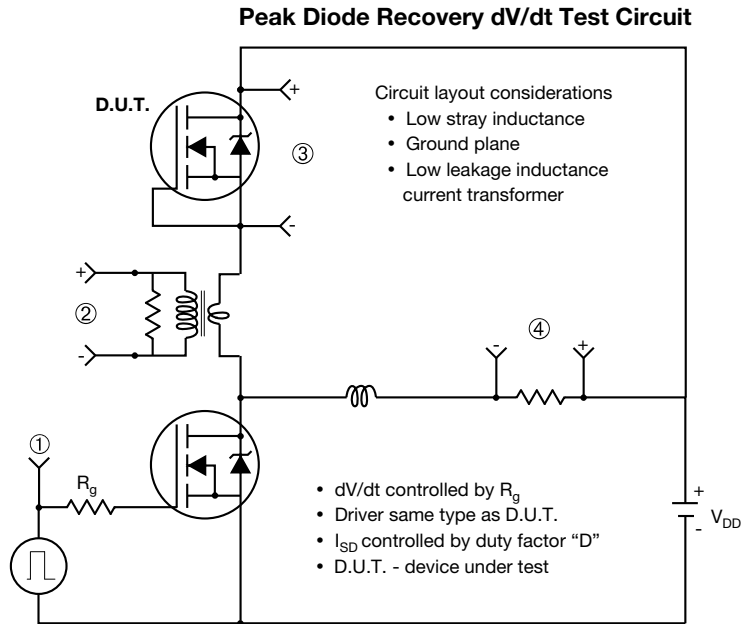


Fig. 13b - Gate Charge Test Circuit



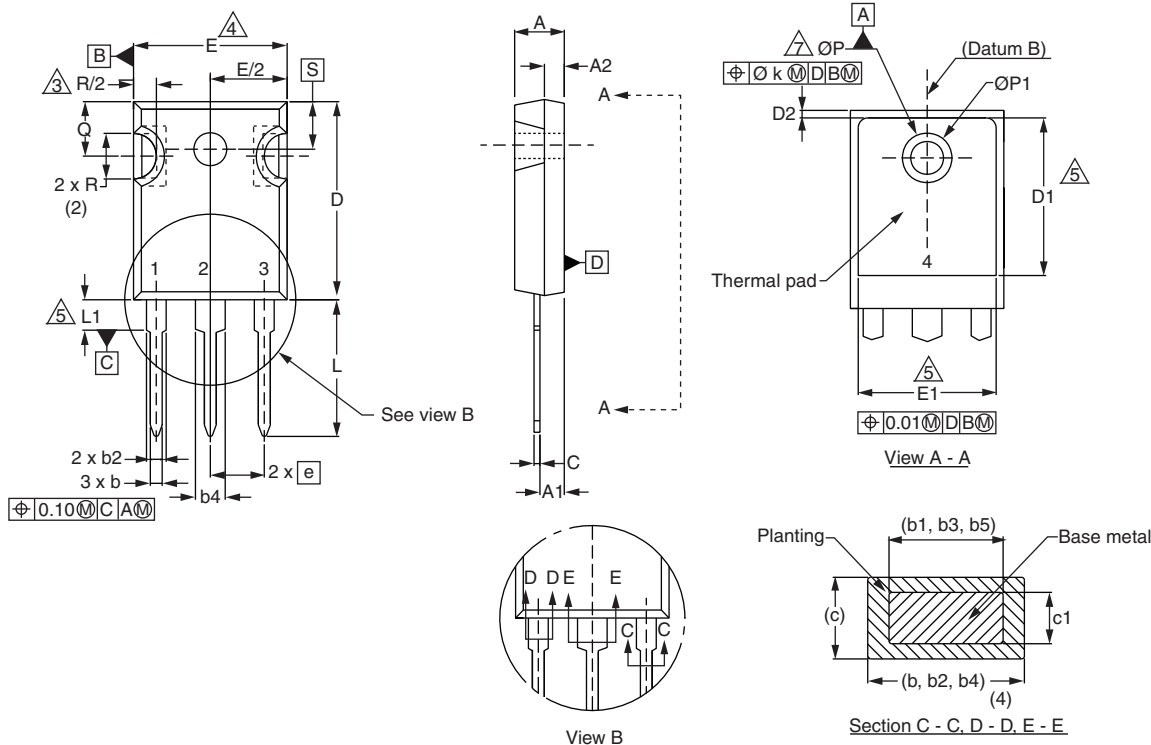
**Note**

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

**Fig. 14 - For N-Channel**

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## TO-247AC (High Voltage)



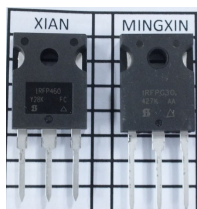
DIM.	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	4.58	5.31	0.180	0.209
A1	2.21	2.59	0.087	0.102
A2	1.17	2.49	0.046	0.098
b	0.99	1.40	0.039	0.055
b1	0.99	1.35	0.039	0.053
b2	1.53	2.39	0.060	0.094
b3	1.65	2.37	0.065	0.093
b4	2.42	3.43	0.095	0.135
b5	2.59	3.38	0.102	0.133
c	0.38	0.86	0.015	0.034
c1	0.38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

DIM.	MILLIMETERS		INCHES	
	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: X13-0045-Rev. C, 18-Mar-13  
DWG: 5971

### Notes

- Dimensioning and tolerancing per ASME Y14.5M-1994.
- Contour of slot optional.
- 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.
- Thermal pad contour optional with dimensions D1 and E1.
- Lead finish uncontrolled in L1.
- 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").
- Outline conforms to JEDEC outline TO-247 with exception of dimension c.
- Xian and Mingxin actually photo.







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**Please note that some Vishay documentation may still make reference to RoHS Directive 2002/95/EC. We confirm that all the products identified as being compliant to Directive 2002/95/EC conform to Directive 2011/65/EU.**

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