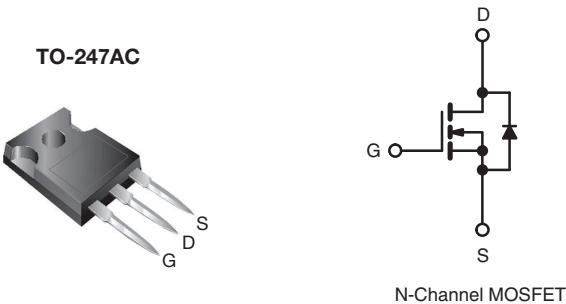


Power MOSFET

PRODUCT SUMMARY		
V_{DS} (V)	60	
$R_{DS(on)}$ (Ω)	$V_{GS} = 10$ V	0.018
Q_g (Max.) (nC)	110	
Q_{gs} (nC)	29	
Q_{gd} (nC)	38	
Configuration	Single	



FEATURES

- Dynamic dV/dt Rating
- Isolated Central Mounting Hole
- 175 °C Operating Temperature
- Ease of Parallelizing
- Simple Drive Requirements
- Compliant to RoHS Directive 2002/95/EC


RoHS*
COMPLIANT

DESCRIPTION

Third generation Power MOSFETs from Vishay provide the designer with the best combination of fast switching, ruggedized device design, low on-resistance and cost-effectiveness.

The TO-247AC package is preferred for commercial-industrial applications where higher power levels preclude the use of TO-220AB devices. The TO-247AC is similar but superior to the earlier TO-218 package because its isolated mounting hole. It also provides greater creepage distances between pins to meet the requirements of most safety specifications.

ORDERING INFORMATION	
Package	TO-247AC
Lead (Pb)-free	IRFP048RPbF SiHFP048R-E3
SnPb	IRFP048R SiHFP048R

ABSOLUTE MAXIMUM RATINGS ($T_C = 25$ °C, unless otherwise noted)				
PARAMETER		SYMBOL	LIMIT	UNIT
Drain-Source Voltage		V_{DS}	60	
Gate-Source Voltage		V_{GS}	± 20	V
Continuous Drain Current ^e	V_{GS} at 10 V	$T_C = 25$ °C	I_D	70
Continuous Drain Current				52
Pulsed Drain Current ^a		I_{DM}	290	
Linear Derating Factor			1.3	W/°C
Single Pulse Avalanche Energy ^b		E_{AS}	200	mJ
Maximum Power Dissipation	$T_C = 25$ °C	P_D	190	W
Peak Diode Recovery dV/dt ^c		dV/dt	4.5	V/ns
Operating Junction and Storage Temperature Range		T_J, T_{stg}	- 55 to + 175	°C
Soldering Recommendations (Peak Temperature) ^d	for 10 s		300	
Mounting Torque	6-32 or M3 screw		10	lbf · in
			1.1	N · m

Notes

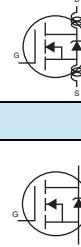
- Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).
- $V_{DD} = 25$ V, starting $T_J = 25$ °C, $L = 43$ μ H, $R_g = 25$ Ω , $I_{AS} = 73$ A (see fig. 12).
- $I_{SD} \leq 72$ A, $dI/dt \leq 200$ A/ μ s, $V_{DD} \leq V_{DS}$, $T_J \leq 175$ °C.
- 1.6 mm from case.
- Current limited by the package (die current = 73 A)

* 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}	-	0.80	

SPECIFICATIONS ($T_J = 25$ °C, unless otherwise noted)

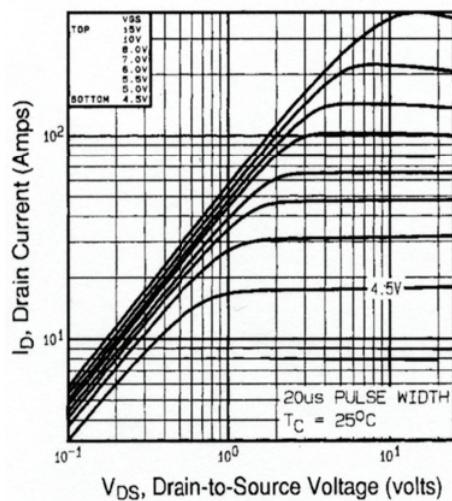
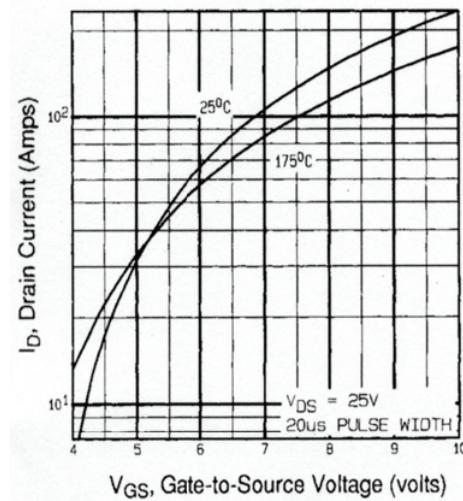
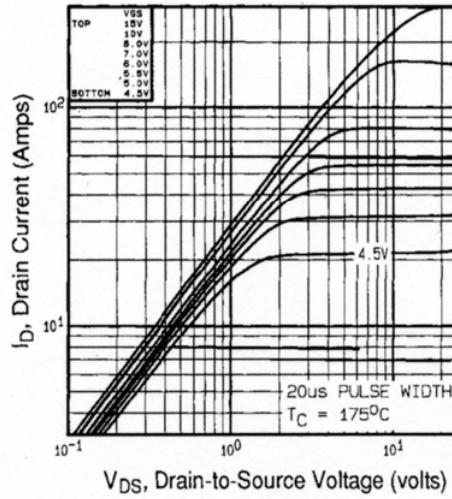
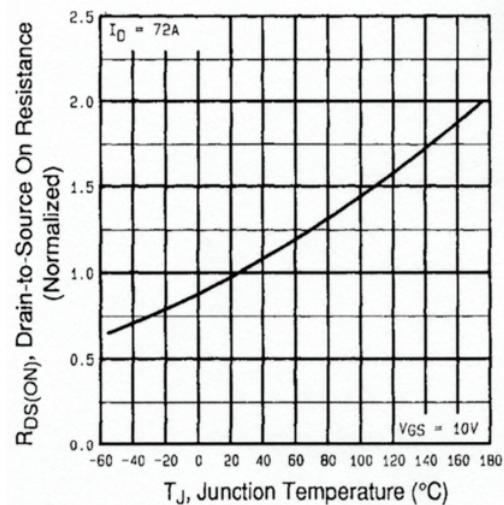
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT		
Static								
Drain-Source Breakdown Voltage	V_{DS}	$V_{GS} = 0$ V, $I_D = 250$ μ A	60	-	-	V		
V_{DS} Temperature Coefficient	$\Delta V_{DS}/T_J$	Reference to 25 °C, $I_D = 1$ mA	-	0.060	-	V/°C		
Gate-Source Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}$, $I_D = 250$ μ A	2.0	-	4.0	V		
Gate-Source Leakage	I_{GSS}	$V_{GS} = \pm 20$ V	-	-	± 100	nA		
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS} = 60$ V, $V_{GS} = 0$ V	-	-	25	μ A		
		$V_{DS} = 48$ V, $V_{GS} = 0$ V, $T_J = 150$ °C	-	-	250	μ A		
Drain-Source On-State Resistance	$R_{DS(on)}$	$V_{GS} = 10$ V	$I_D = 44$ A ^b	-	-	0.018		
Forward Transconductance	g_{fs}	$V_{DS} = 25$ V	$I_D = 44$ A ^b	20	-	-		
Dynamic								
Input Capacitance	C_{iss}	$V_{GS} = 0$ V, $V_{DS} = 25$ V, $f = 1.0$ MHz, see fig. 5	-	2400	-	pF		
Output Capacitance	C_{oss}		-	1300	-			
Reverse Transfer Capacitance	C_{rss}		-	190	-			
Total Gate Charge	Q_g	$V_{GS} = 10$ V	$I_D = 72$ A, $V_{DS} = 48$ V see fig. 6 and 13 ^b	-	-	110		
Gate-Source Charge	Q_{gs}			-	-	29		
Gate-Drain Charge	Q_{gd}			-	-	38		
Turn-On Delay Time	$t_{d(on)}$			-	8.1	-		
Rise Time	t_r	$V_{DD} = 30$ V, $I_D = 72$ A, $R_g = 9.1$ Ω , $R_D = 0.34$ Ω , see fig. 10 ^b	$I_D = 72$ A, $V_{DS} = 48$ V see fig. 6 and 13 ^b	-	250	-		
Turn-Off Delay Time	$t_{d(off)}$			-	210	-		
Fall Time	t_f			-	250	-		
Internal Drain Inductance	L_D			-	5.0	-		
Internal Source Inductance	L_S	Between lead, 6 mm (0.25") from package and center of die contact			-	13	-	
Drain-Source Body Diode Characteristics								
Continuous Source-Drain Diode Current	I_S	MOSFET symbol showing the integral reverse p - n junction diode		-	-	70 ^c		
Pulsed Diode Forward Current ^a	I_{SM}			-	-	290		
Body Diode Voltage	V_{SD}	$T_J = 25$ °C, $I_S = 73$ A, $V_{GS} = 0$ V ^b	-	-	2.0	V		
Body Diode Reverse Recovery Time	t_{rr}	$T_J = 25$ °C, $I_F = 72$ A, $dI/dt = 100$ A/ μ s ^b		-	120	180		
Body Diode Reverse Recovery Charge	Q_{rr}			-	0.50	0.80		
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 μ s; duty cycle ≤ 2 %.

c. Current limited by the package (die current = 73 A).

TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)

Fig. 1 - Typical Output Characteristics, $T_c = 25\text{ }^\circ\text{C}$

Fig. 3 - Typical Transfer Characteristics

Fig. 2 - Typical Output Characteristics, $T_c = 175\text{ }^\circ\text{C}$

Fig. 4 - Normalized On-Resistance vs. Temperature

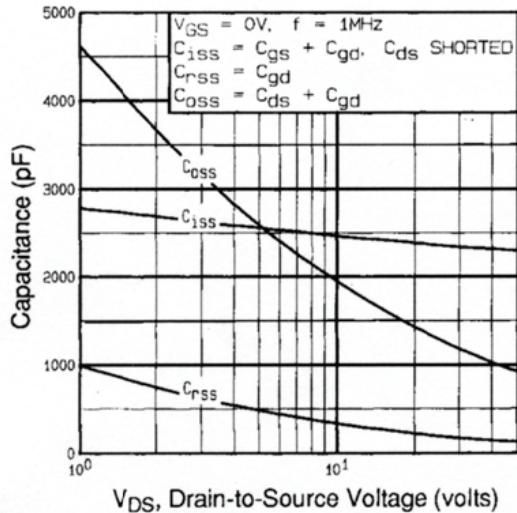


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

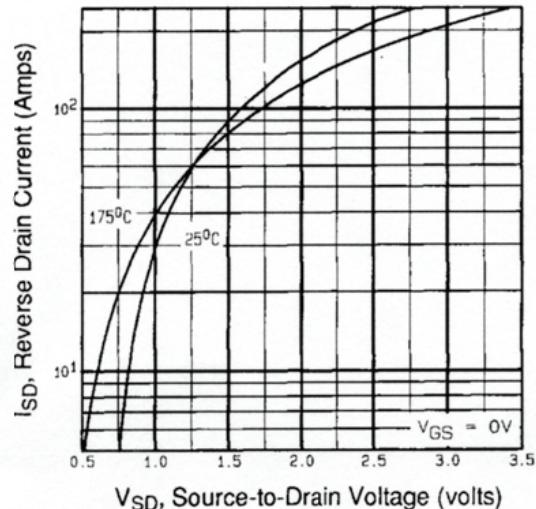


Fig. 7 - Typical Source-Drain Diode Forward Voltage

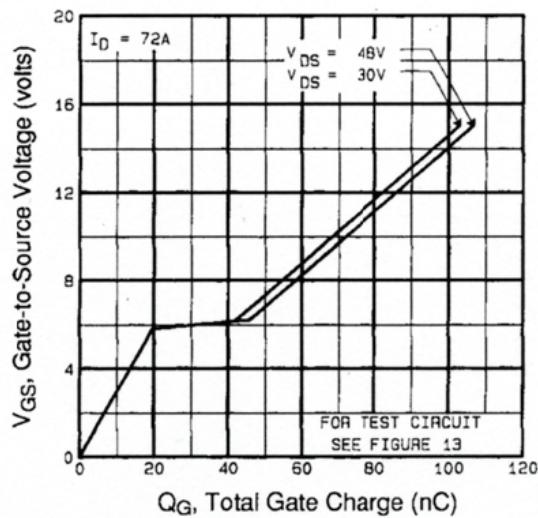


Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage

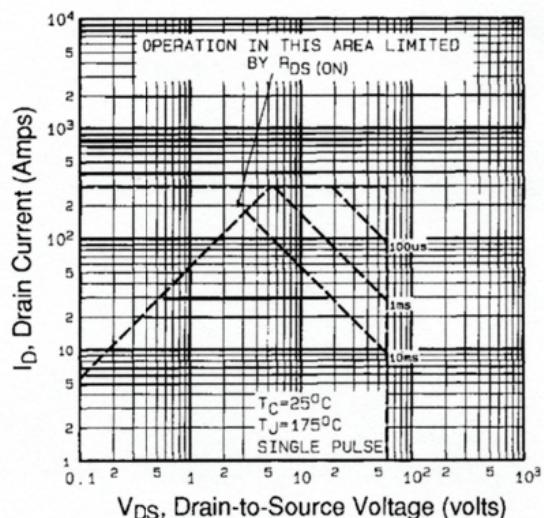


Fig. 8 - Maximum Safe Operating Area

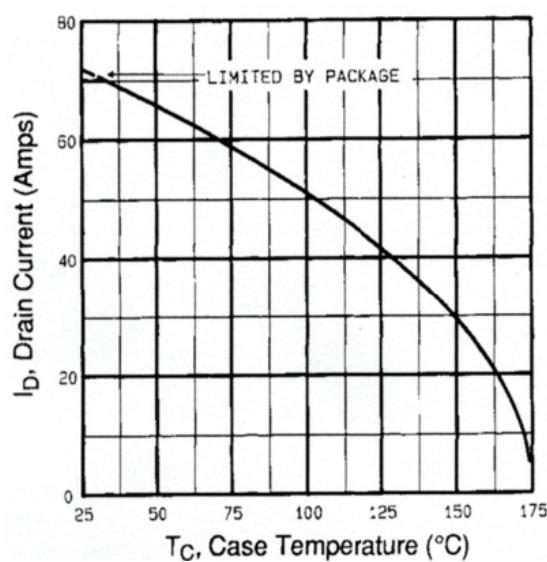


Fig. 9 - Maximum Drain Current vs. Case Temperature

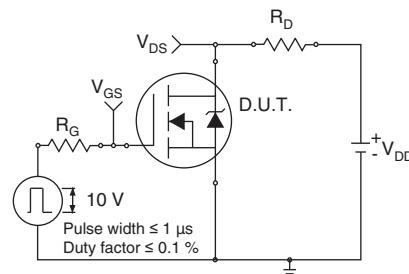


Fig. 10a - Switching Time Test Circuit

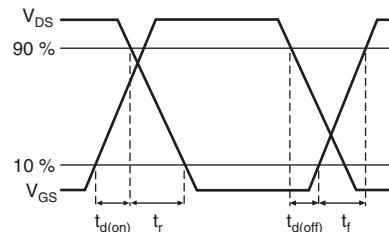


Fig. 10b - Switching Time Waveforms

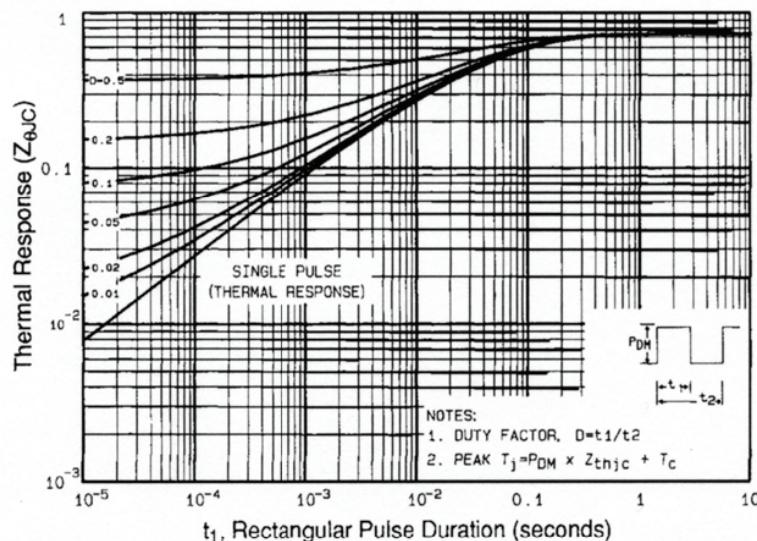


Fig. 11 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

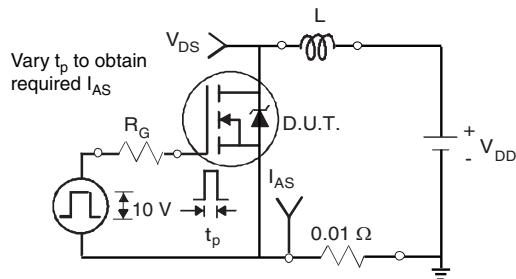


Fig. 12a - Unclamped Inductive Test Circuit

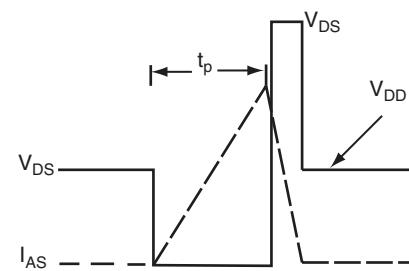


Fig. 12b - Unclamped Inductive Waveforms

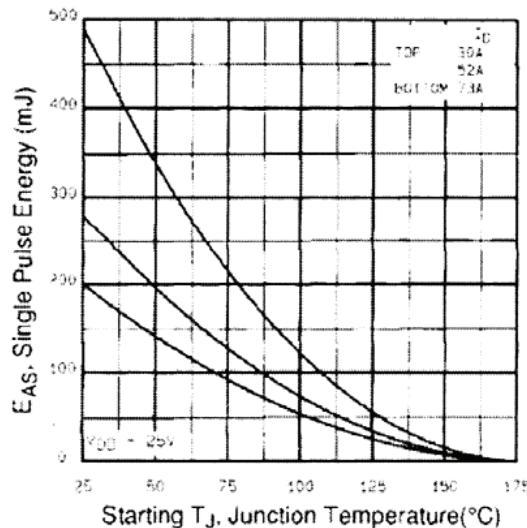


Fig. 12c - Maximum Avalanche Energy vs. Drain Current

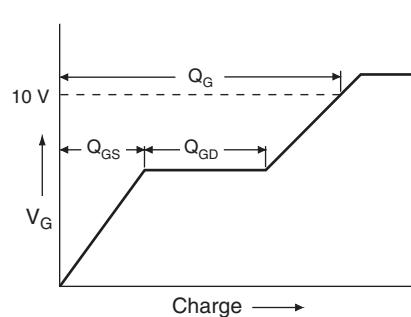


Fig. 13a - Basic Gate Charge Waveform

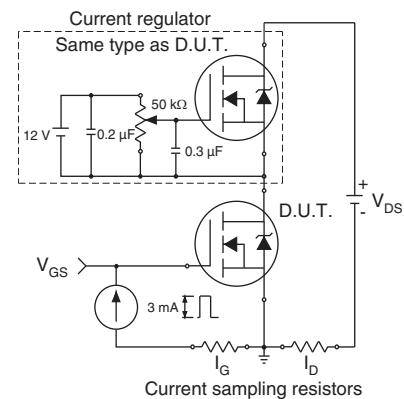
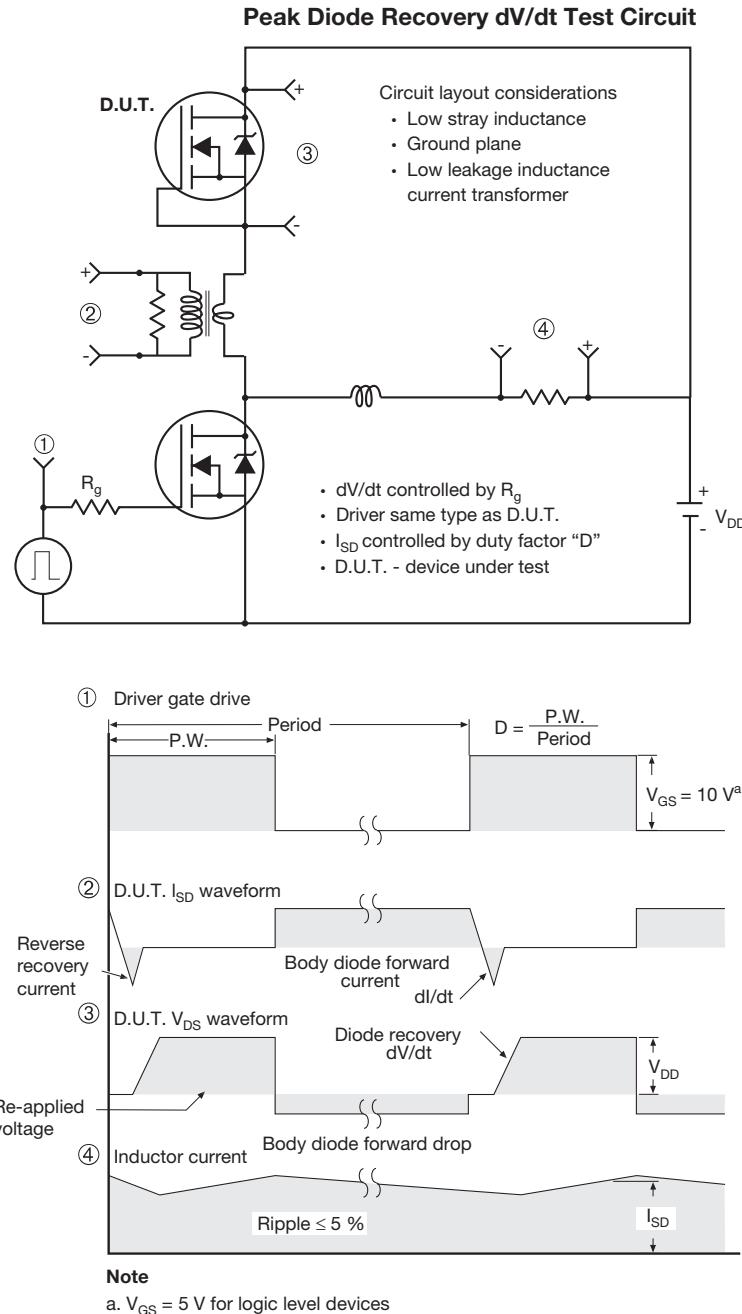
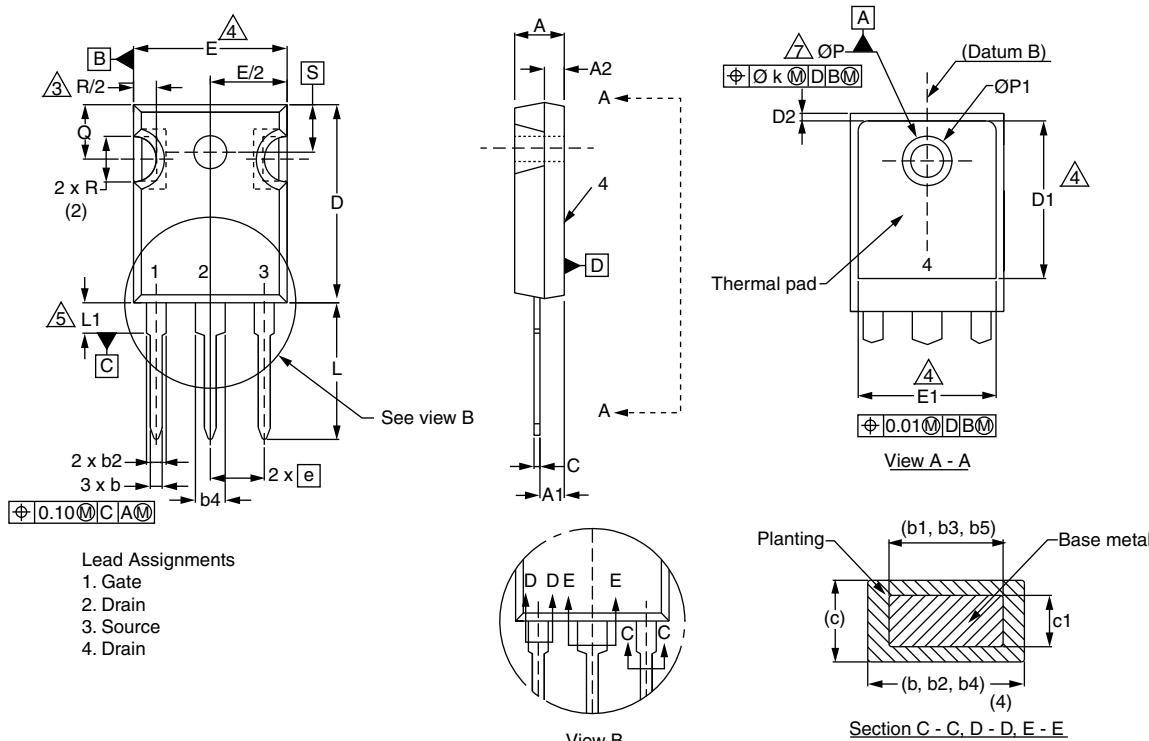


Fig. 13b - Gate Charge Test Circuit


Fig. 14 - For N-Channel

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TO-247AC (High Voltage)



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

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	-

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

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	

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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