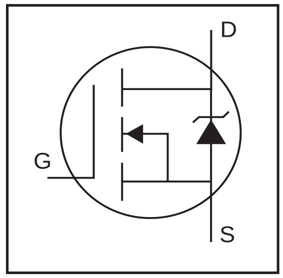
International
IOR Rectifier

IRFP054V

HEXFET® Power MOSFET

- Advanced Process Technology
- Ultra Low On-Resistance
- Dynamic dv/dt Rating
- 175°C Operating Temperature
- Fast Switching
- Fully Avalanche Rated
- Optimized for SMPS Applications



V_{DSS} = 60V

$R_{DS(on)}$ = 9.0mΩ

I_D = 93A⑧

Description

Advanced HEXFET® Power MOSFETs from International Rectifier utilize advanced processing techniques to achieve extremely low on-resistance per silicon area. This benefit, combined with the fast switching speed and ruggedized device design that HEXFET power MOSFETs are well known for, provides the designer with an extremely efficient and reliable device for use in a wide variety of applications.

The TO-247 package is preferred for commercial-industrial applications where higher power levels preclude the use of TO-220 devices. The TO-247 is similar but superior to the earlier TO-218 package because of its isolated mounting hole.

TO-247AC

Absolute Maximum Ratings

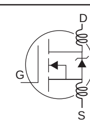
	Parameter	Max.	Units
I_D @ T_C = 25°C	Continuous Drain Current, V_{GS} @ 10V	93⑧	A
I_D @ T_C = 100°C	Continuous Drain Current, V_{GS} @ 10V	66	
I_{DM}	Pulsed Drain Current ①⑦	360	
P_D @T_C = 25°C	Power Dissipation	180	W
	Linear Derating Factor	1.2	W/°C
V_{GS}	Gate-to-Source Voltage	± 20	V
I_{AR}	Avalanche Current①	90	A
E_{AR}	Repetitive Avalanche Energy①	18	mJ
dv/dt	Peak Diode Recovery dv/dt ③⑦	4.7	V/ns
T_J T_{STG}	Operating Junction and Storage Temperature Range	-55 to + 175	°C
	Soldering Temperature, for 10 seconds	300 (1.6mm from case)	
	Mounting torque, 6-32 or M3 srew	10 lbf•in (1.1N•m)	

Thermal Resistance

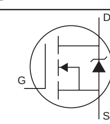
	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case	——	0.85	°C/W
$R_{\theta CS}$	Case-to-Sink, Flat, Greased Surface	0.24	——	
$R_{\theta JA}$	Junction-to-Ambient	——	40	

3/30/01

Electrical Characteristics @ T_J = 25°C (unless otherwise specified)

	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(BR)DSS}$	Drain-to-Source Breakdown Voltage	60	——	——	V	V_{GS} = 0V, I_D = 250µA
$\Delta V_{(BR)DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	——	0.066	——	V/°C	Reference to 25°C, I_D = 1mA
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	——	——	9.0	mΩ	V_{GS} = 10V, I_D = 54A ④⑦
$V_{GS(th)}$	Gate Threshold Voltage	2.0	——	4.0	V	V_{DS} = V_{GS}, I_D = 250µA
g_{fs}	Forward Transconductance	61	——	——	S	V_{DS} = 25V, I_D = 54A④⑦
I_{DSS}	Drain-to-Source Leakage Current	——	——	25	µA	V_{DS} = 60V, V_{GS} = 0V
		——	——	250		V_{DS} = 48V, V_{GS} = 0V, T_J = 150°C
I_{GSS}	Gate-to-Source Forward Leakage	——	——	100	nA	V_{GS} = 20V
	Gate-to-Source Reverse Leakage	——	——	-100		V_{GS} = -20V
Q_g	Total Gate Charge	——	——	170	nC	I_D = 64A
Q_{gs}	Gate-to-Source Charge	——	——	39		V_{DS} = 48V
Q_{gd}	Gate-to-Drain ("Miller") Charge	——	——	59		V_{GS} = 10V, See Fig. 6 and 13⑦
$t_{d(on)}$	Turn-On Delay Time	——	22	——	ns	V_{DD} = 30V
t_r	Rise Time	——	160	——		I_D = 64A
$t_{d(off)}$	Turn-Off Delay Time	——	77	——		R_G = 6.2Ω
t_f	Fall Time	——	110	——		V_{GS} = 10V, See Fig. 10 ④⑦
L_D	Internal Drain Inductance	——	4.5	——	nH	Between lead, 6mm (0.25in.) from package and center of die contact 
L_S	Internal Source Inductance	——	7.5	——		
C_{iss}	Input Capacitance	——	4080	——	pF	V_{GS} = 0V
C_{oss}	Output Capacitance	——	840	——		V_{DS} = 25V
C_{rss}	Reverse Transfer Capacitance	——	180	——		f = 1.0MHz, See Fig. 5⑦
E_{AS}	Single Pulse Avalanche Energy②	——	1080⑤	220⑥	mJ	I_{AS} = 90A, L = 54µH⑦

Source-Drain Ratings and Characteristics

	Parameter	Min.	Typ.	Max.	Units	Conditions
I_S	Continuous Source Current (Body Diode)	——	——	93⑧	A	MOSFET symbol showing the integral reverse p-n junction diode. 
I_{SM}	Pulsed Source Current (Body Diode)①	——	——	360		
V_{SD}	Diode Forward Voltage	——	——	1.2	V	T_J = 25°C, I_S = 90A, V_{GS} = 0V ④⑦
t_{rr}	Reverse Recovery Time	——	78	120	ns	T_J = 25°C, I_F = 64A
Q_{rr}	Reverse Recovery Charge	——	250	380	nC	di/dt = 100A/µs ④⑦
t_{on}	Forward Turn-On Time	Intrinsic turn-on time is negligible (turn-on is dominated by L_S+L_D)				

Notes:

① Repetitive rating; pulse width limited by max. junction temperature. (See fig. 11)

② Starting T_J = 25°C, L = 54µH R_G = 25Ω, I_{AS} = 90A, V_{GS}=10V (See Figure 12)

③ $I_{SD} \leq$ 90A, di/dt ≤ 250A/µs, $V_{DD} \leq V_{(BR)DSS}$, $T_J \leq$ 175°C

④ Pulse width ≤ 400µs; duty cycle ≤ 2%.

⑤ This is a typical value at device destruction and represents operation outside rated limits.

⑥ This is a calculated value limited to T_J = 175°C .

⑦ This is tested with same test conditions as the existing data sheet

⑧ Calculated continuous current based on maximum allowable junction temperature. Package limitation current is 90A.

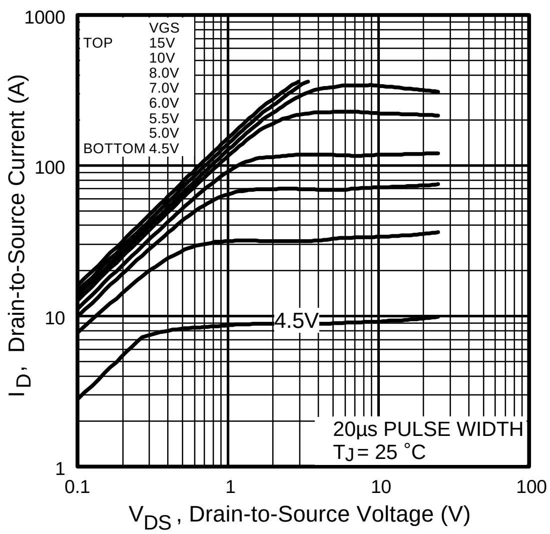


Fig 1. Typical Output Characteristics

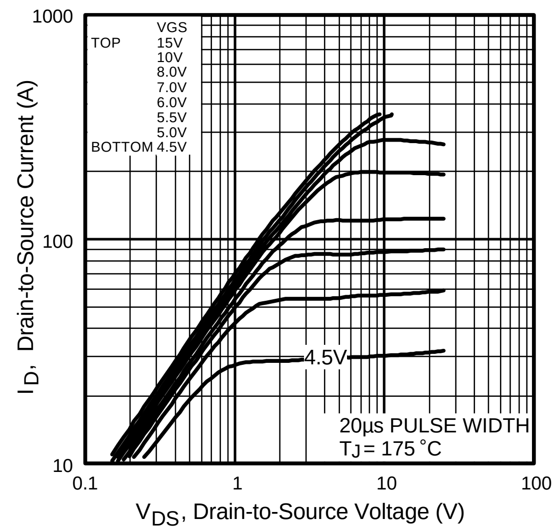


Fig 2. Typical Output Characteristics

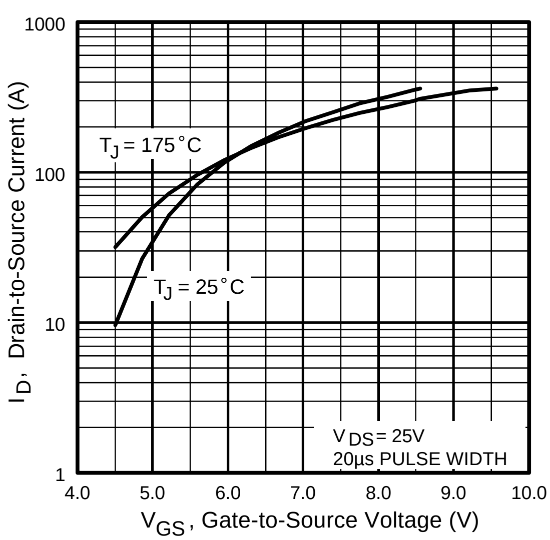


Fig 3. Typical Transfer Characteristics

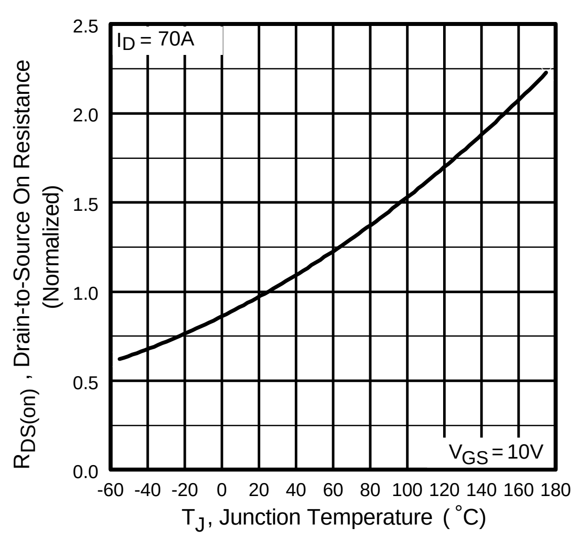


Fig 4. Normalized On-Resistance
Vs. Temperature

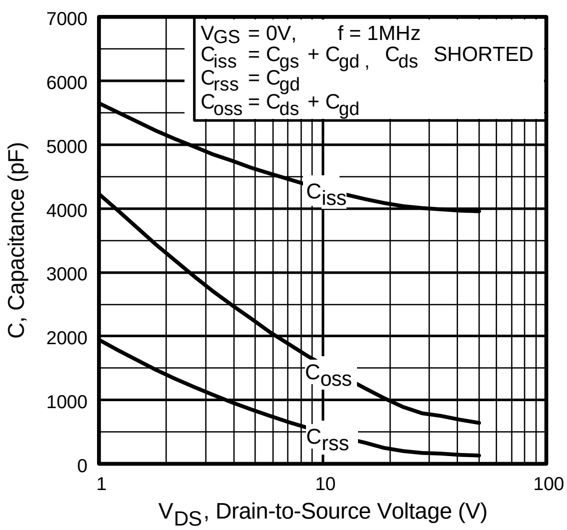


Fig 5. Typical Capacitance Vs. Drain-to-Source Voltage

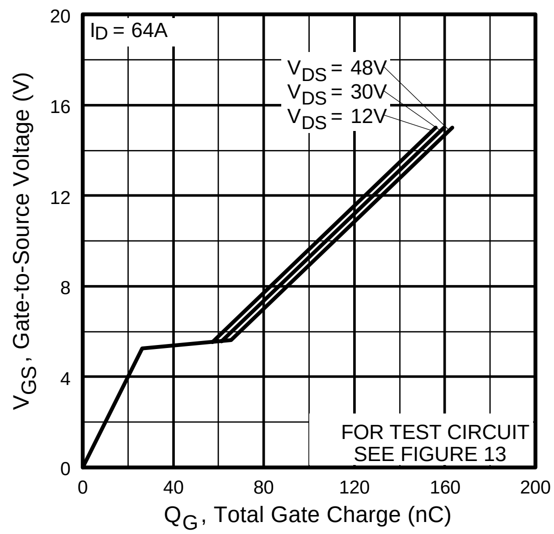


Fig 6. Typical Gate Charge Vs. Gate-to-Source Voltage

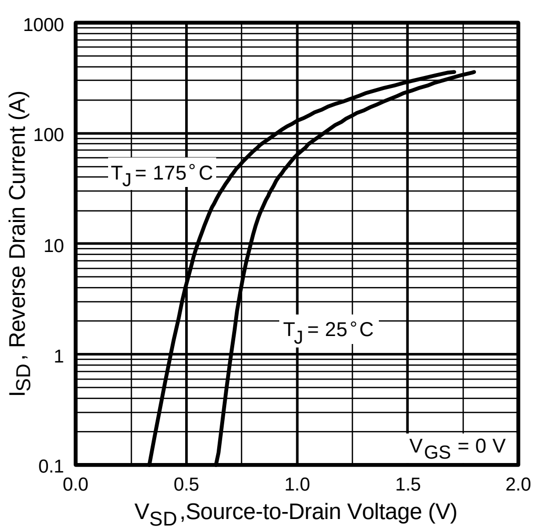


Fig 7. Typical Source-Drain Diode Forward Voltage

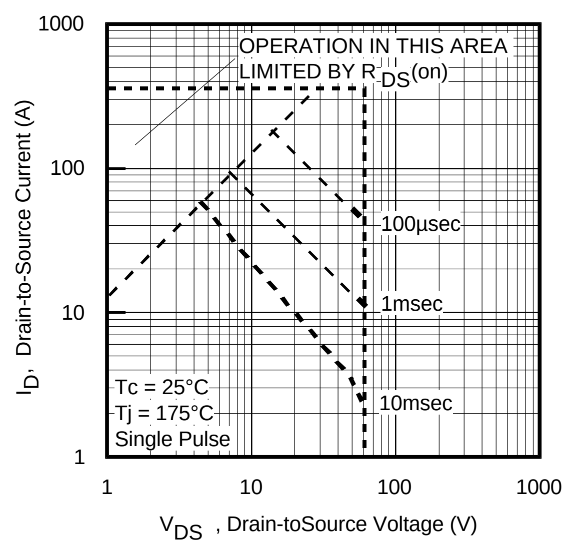


Fig 8. Maximum Safe Operating Area

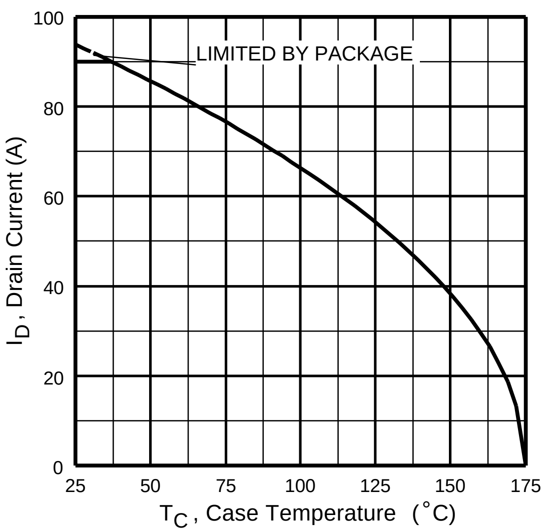


Fig 9. Maximum Drain Current Vs. Case Temperature

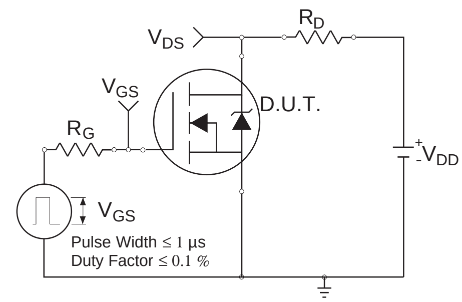


Fig 10a. Switching Time Test Circuit

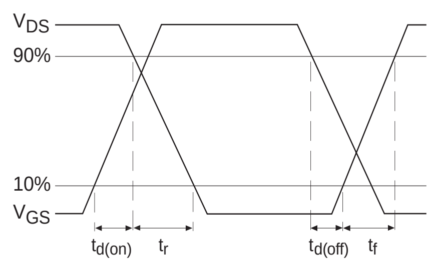


Fig 10b. Switching Time Waveforms

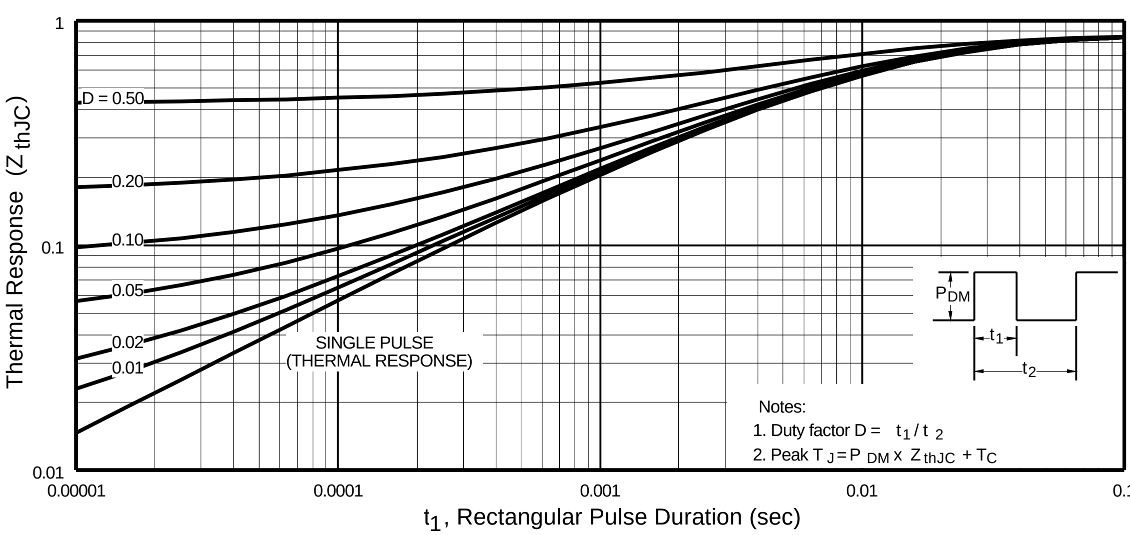


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Case

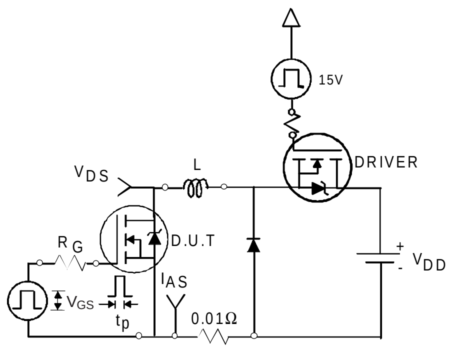


Fig 12a. Unclamped Inductive Test Circuit

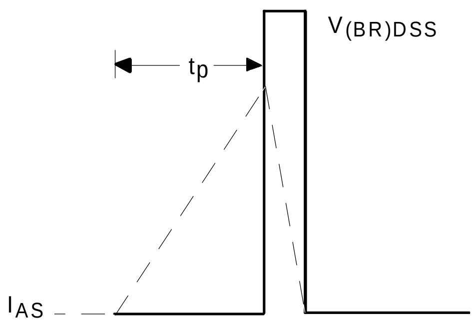


Fig 12b. Unclamped Inductive Waveforms

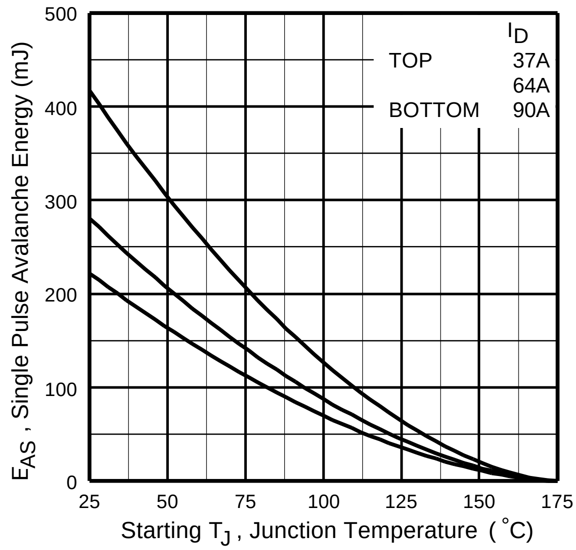


Fig 12c. Maximum Avalanche Energy Vs. Drain Current

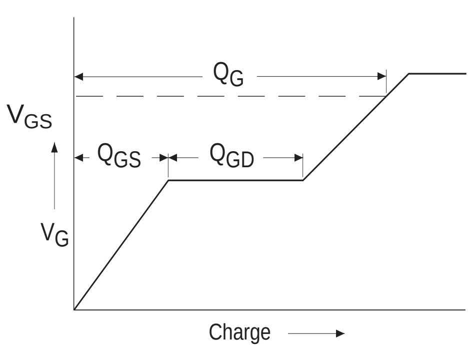


Fig 13a. Basic Gate Charge Waveform

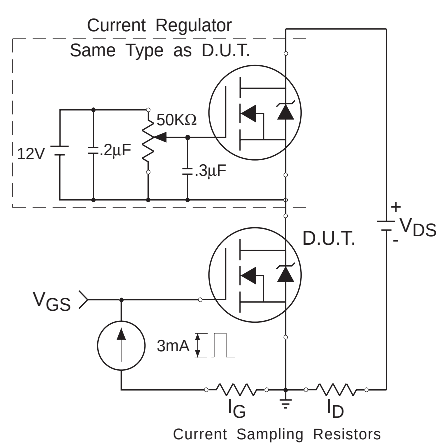
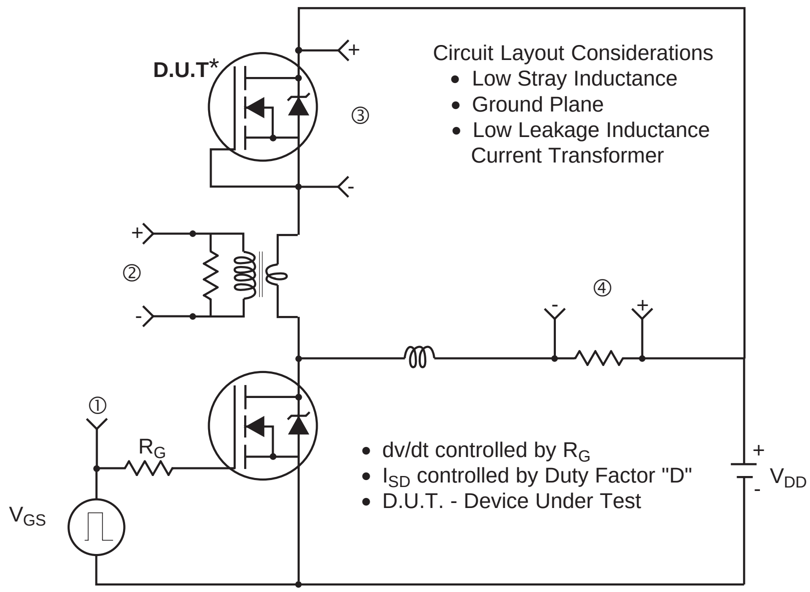
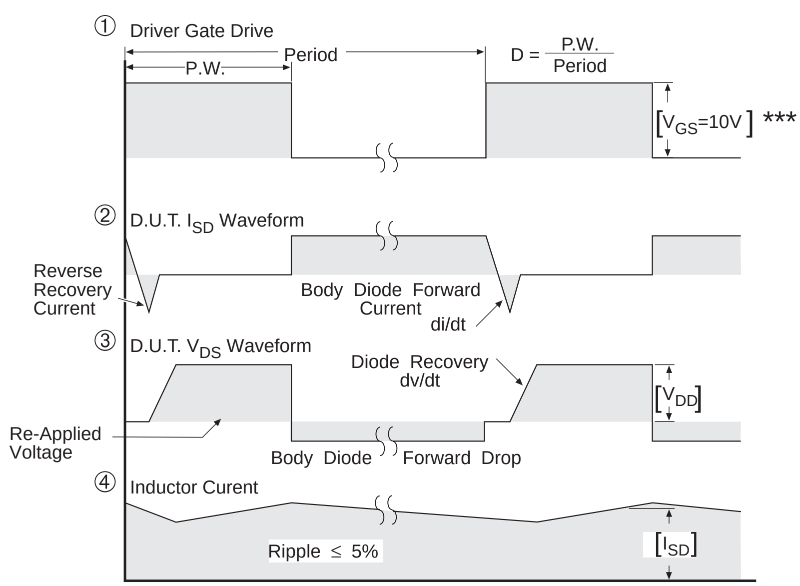


Fig 13b. Gate Charge Test Circuit

Peak Diode Recovery dv/dt Test Circuit



* Reverse Polarity of D.U.T for P-Channel

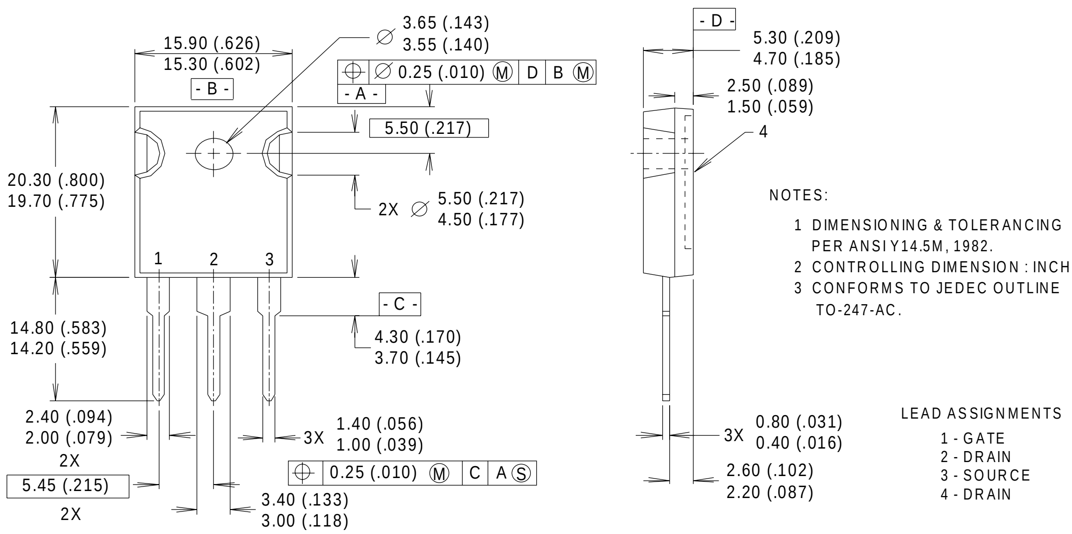


*** V_{GS} = 5.0V for Logic Level and 3V Drive Devices

Fig 14. For N-channel HEXFET® power MOSFETs

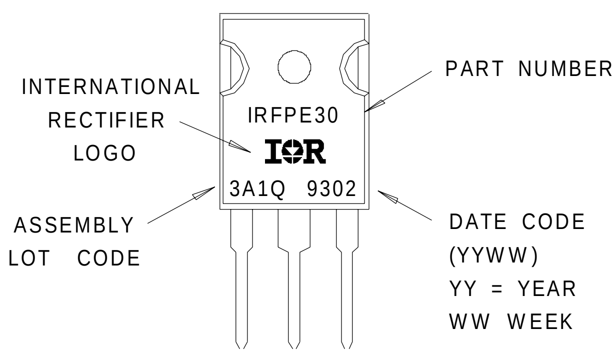
TO-247AC Package Outline

Dimensions are shown in millimeters (inches)



TO-247AC Part Marking Information

EXAMPLE : THIS IS AN IRFPE30
WITH ASSEMBLY
LOT CODE 3A1Q



Data and specifications subject to change without notice.
This product has been designed and qualified for the Automotive [Q101] market.
Qualification Standards can be found on IR's Web site.

International
IOR Rectifier

IR WORLD HEADQUARTERS: 233 Kansas St., El Segundo, California 90245, USA Tel: (310) 252-7105
TAC Fax: (310) 252-7903
Visit us at www.irf.com for sales contact information**.** 3/01