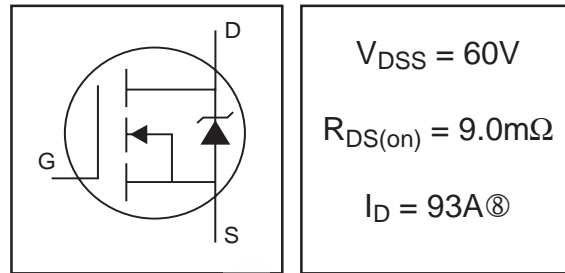


# IRFP054VPbF

HEXFET<sup>®</sup> Power MOSFET

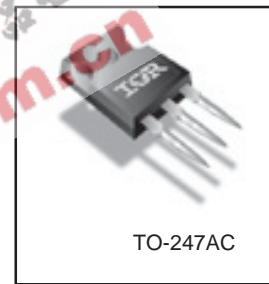
- Advanced Process Technology
- Ultra Low On-Resistance
- Dynamic dv/dt Rating
- 175°C Operating Temperature
- Fast Switching
- Fully Avalanche Rated
- Optimized for SMPS Applications
- Lead-Free



## Description

Advanced HEXFET<sup>®</sup> 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.



## Absolute Maximum Ratings

	Parameter	Max.	Units
$I_D @ T_C = 25^\circ\text{C}$	Continuous Drain Current, $V_{GS} @ 10\text{V}$	93 <sup>⑧</sup>	A
$I_D @ T_C = 100^\circ\text{C}$	Continuous Drain Current, $V_{GS} @ 10\text{V}$	66	
$I_{DM}$	Pulsed Drain Current ①②	360	
$P_D @ T_C = 25^\circ\text{C}$	Power Dissipation	180	W
	Linear Derating Factor	1.2	W/°C
$V_{GS}$	Gate-to-Source Voltage	$\pm 20$	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
$T_J$	Operating Junction and	-55 to + 175	°C
$T_{STG}$	Storage Temperature Range		
	Soldering Temperature, for 10 seconds		
	Mounting torque, 6-32 or M3 screw	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	

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## Electrical Characteristics @ $T_J = 25^\circ\text{C}$ (unless otherwise specified)

	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(BR)DSS}$	Drain-to-Source Breakdown Voltage	60	—	—	V	$V_{GS} = 0V, I_D = 250\mu A$
$\Delta V_{(BR)DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	—	0.066	—	V/ $^\circ\text{C}$	Reference to $25^\circ\text{C}, I_D = 1\text{mA}$
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	—	—	9.0	$m\Omega$	$V_{GS} = 10V, I_D = 54A$ ④ ⑦
$V_{GS(th)}$	Gate Threshold Voltage	2.0	—	4.0	V	$V_{DS} = V_{GS}, I_D = 250\mu A$
$g_{fs}$	Forward Transconductance	61	—	—	S	$V_{DS} = 25V, I_D = 54A$ ④ ⑦
$I_{DSS}$	Drain-to-Source Leakage Current	—	—	25	$\mu A$	$V_{DS} = 60V, V_{GS} = 0V$
		—	—	250		$V_{DS} = 48V, V_{GS} = 0V, T_J = 150^\circ\text{C}$
$I_{GSS}$	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 13 ⑦
$t_{d(on)}$	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	—		$R_G = 6.2\Omega$
$t_f$	Fall Time	—	110	—		$V_{GS} = 10V$ , See Fig. 10 ④ ⑦
$L_D$	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	—		$f = 1.0\text{MHz}$ , See Fig. 5 ⑦
$E_{AS}$	Single Pulse Avalanche Energy ②	—	1080 ③	220 ⑥		mJ

## Source-Drain Ratings and Characteristics

	Parameter	Min.	Typ.	Max.	Units	Conditions
$I_S$	Continuous Source Current (Body Diode)	—	—	93 ⑧	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	$T_J = 25^\circ\text{C}, I_S = 90A, V_{GS} = 0V$ ④ ⑦
$t_{rr}$	Reverse Recovery Time	—	78	120	ns	$T_J = 25^\circ\text{C}, I_F = 64A$
$Q_{rr}$	Reverse Recovery Charge	—	250	380	nC	$di/dt = 100A/\mu s$ ④ ⑦
$t_{on}$	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  $T_J = 25^\circ\text{C}$ ,  $L = 54\mu H$   
 $R_G = 25\Omega, I_{AS} = 90A, V_{GS} = 10V$  (See Figure 12)
- ③  $I_{SD} \leq 90A, di/dt \leq 250A/\mu s, V_{DD} \leq V_{(BR)DSS}, T_J \leq 175^\circ\text{C}$

- ④ Pulse width  $\leq 400\mu s$ ; duty cycle  $\leq 2\%$ .
- ⑤ This is a typical value at device destruction and represents operation outside rated limits.
- ⑥ This is a calculated value limited to  $T_J = 175^\circ\text{C}$ .
- 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.

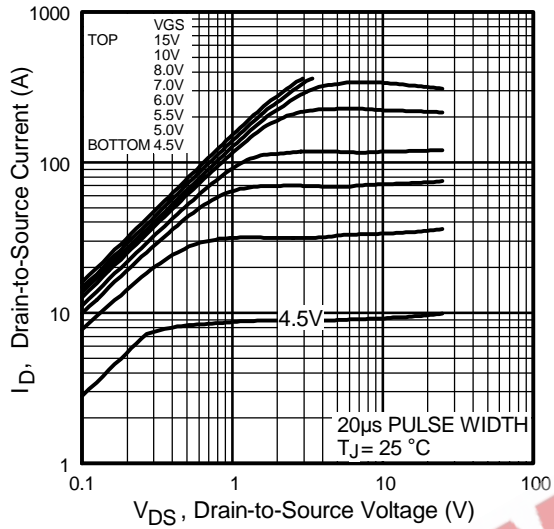


Fig 1. Typical Output Characteristics

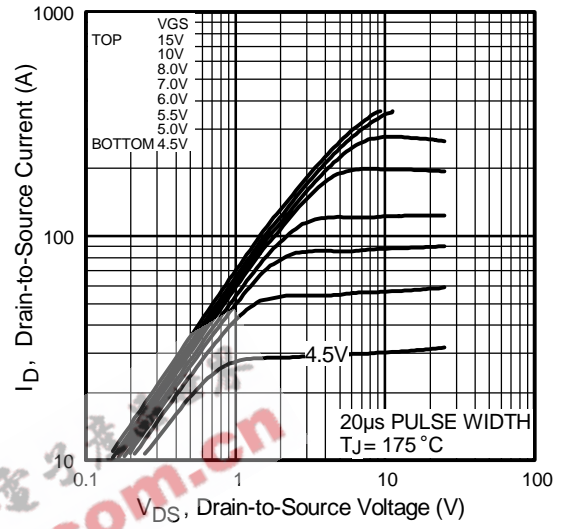


Fig 2. Typical Output Characteristics

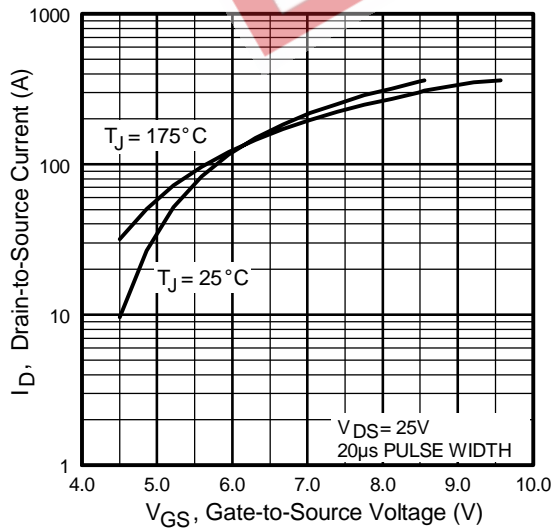


Fig 3. Typical Transfer Characteristics

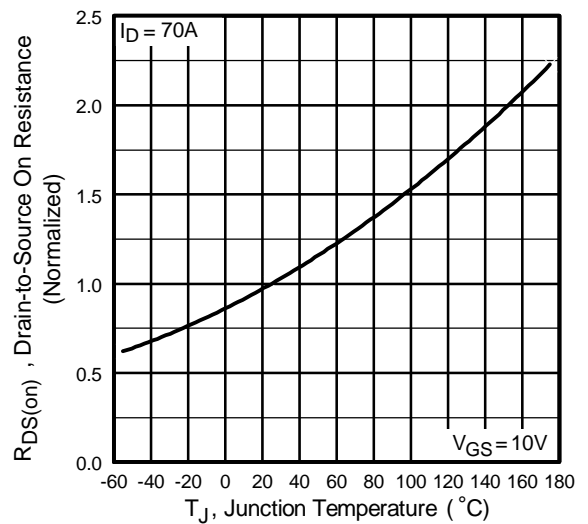
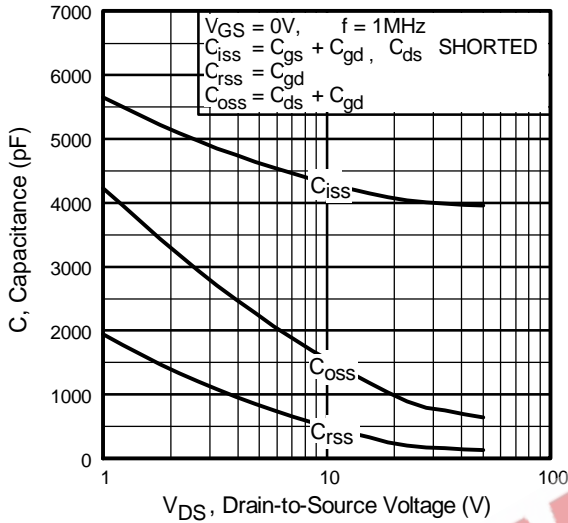


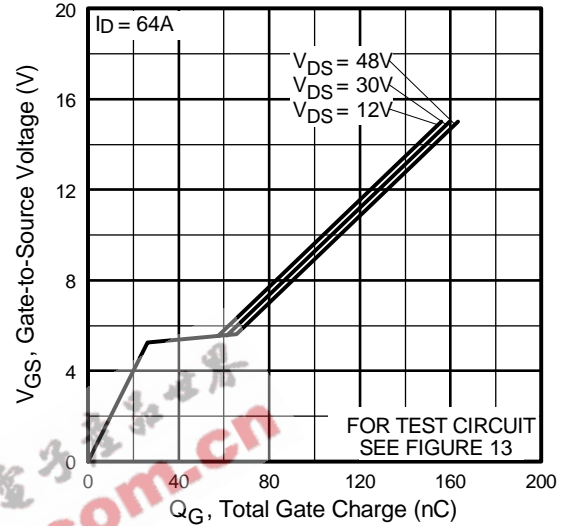
Fig 4. Normalized On-Resistance Vs. Temperature

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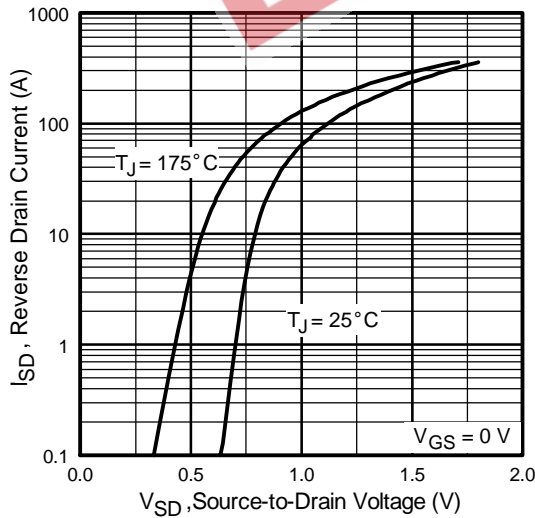
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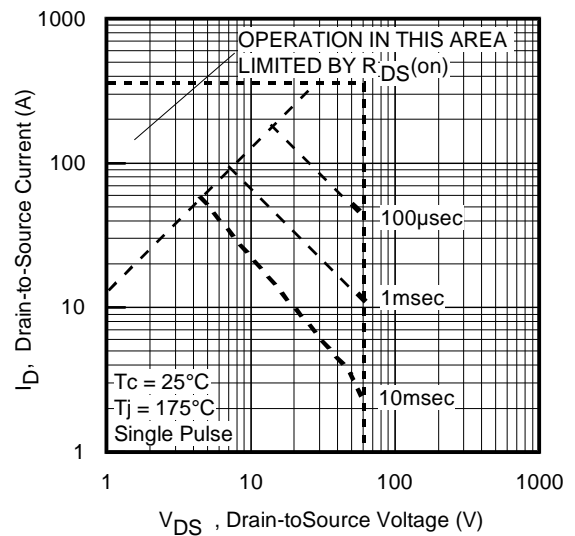
**Fig 5.** Typical Capacitance Vs. Drain-to-Source Voltage



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



**Fig 7.** Typical Source-Drain Diode Forward Voltage



**Fig 8.** Maximum Safe Operating Area

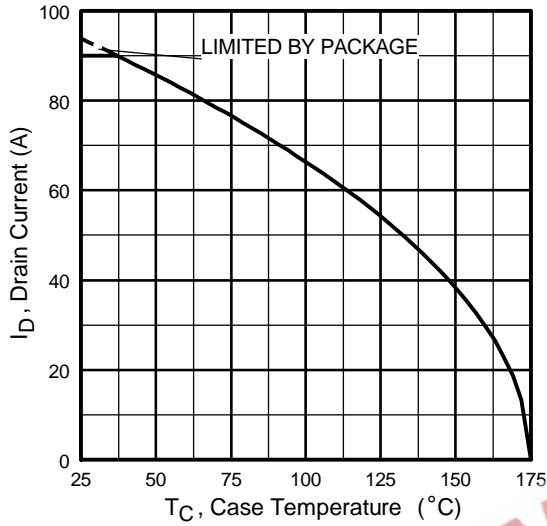


Fig 9. Maximum Drain Current Vs. Case Temperature

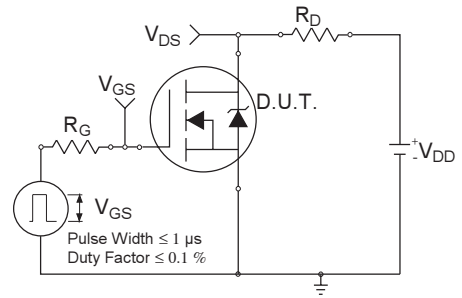


Fig 10a. Switching Time Test Circuit

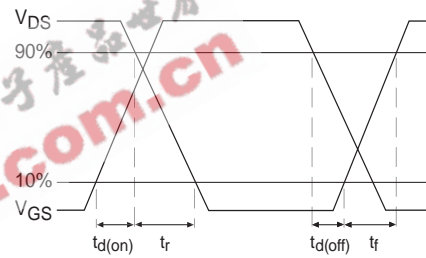


Fig 10b. Switching Time Waveforms

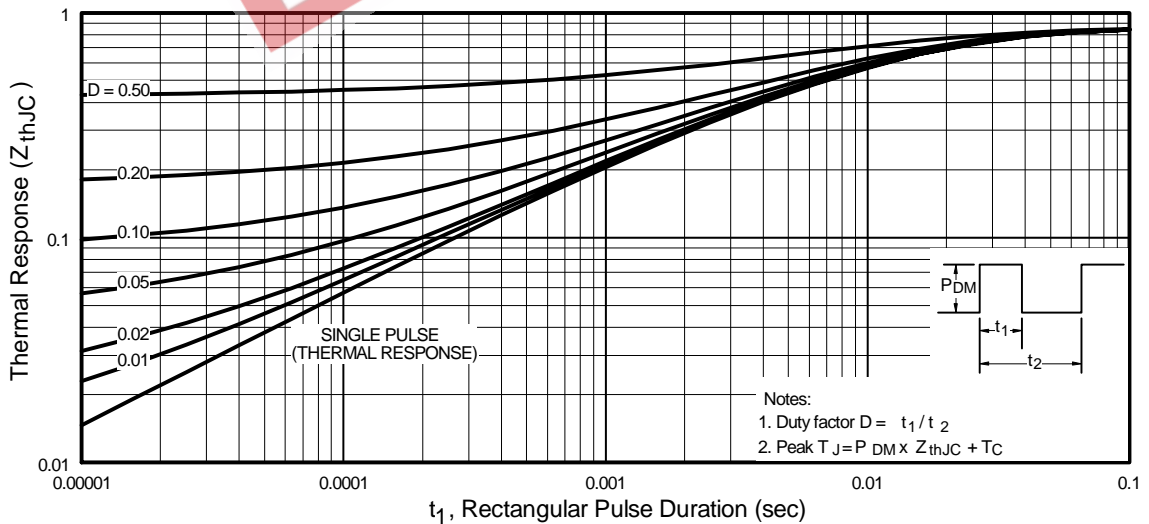


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Case

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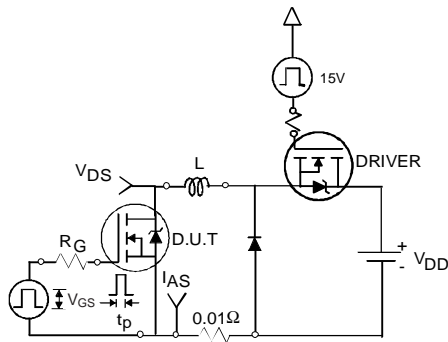


Fig 12a. Unclamped Inductive Test Circuit

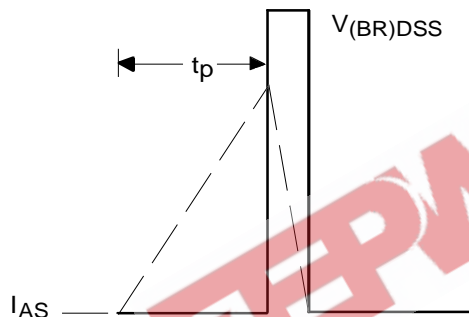


Fig 12b. Unclamped Inductive Waveforms

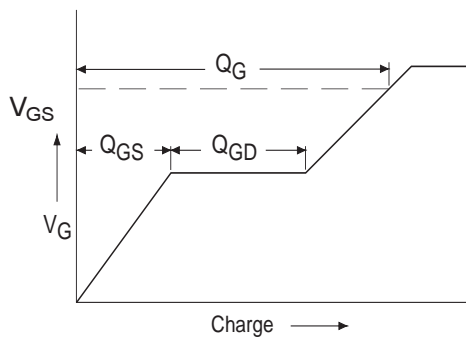


Fig 13a. Basic Gate Charge Waveform

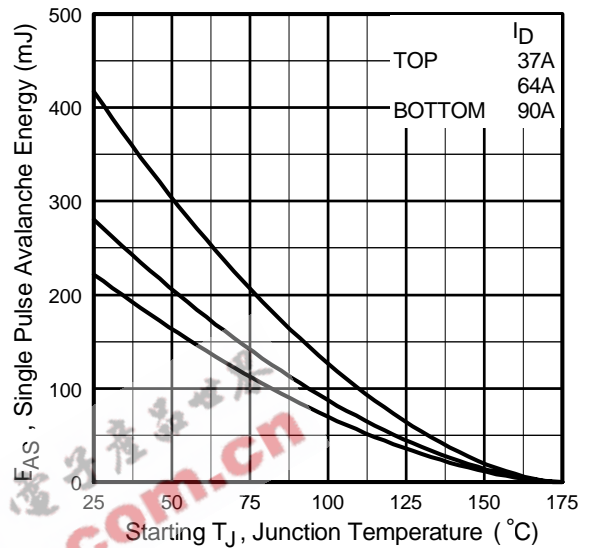


Fig 12c. Maximum Avalanche Energy Vs. Drain Current

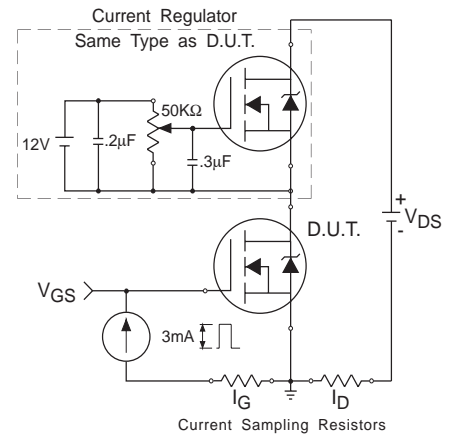
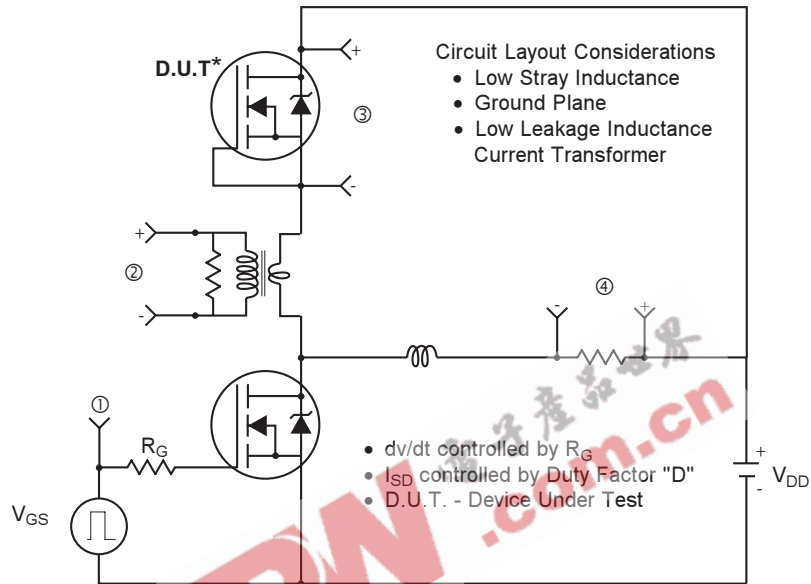
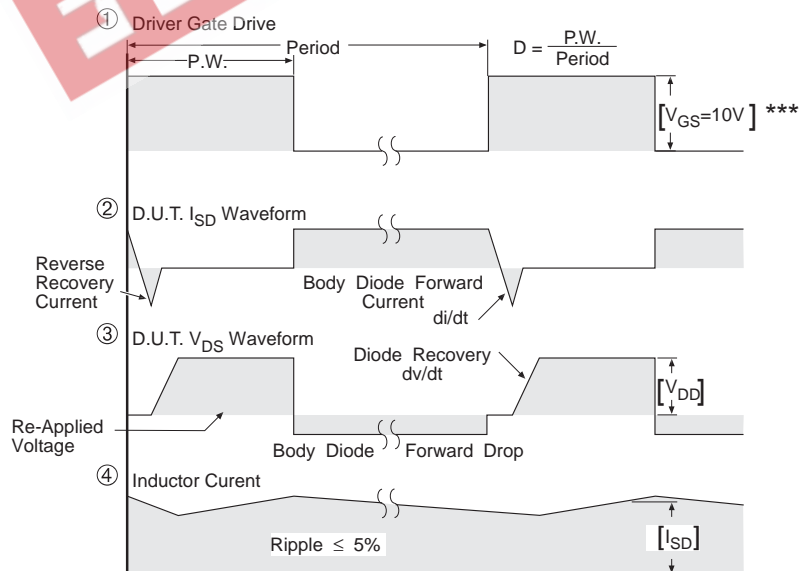


Fig 13b. Gate Charge Test Circuit

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

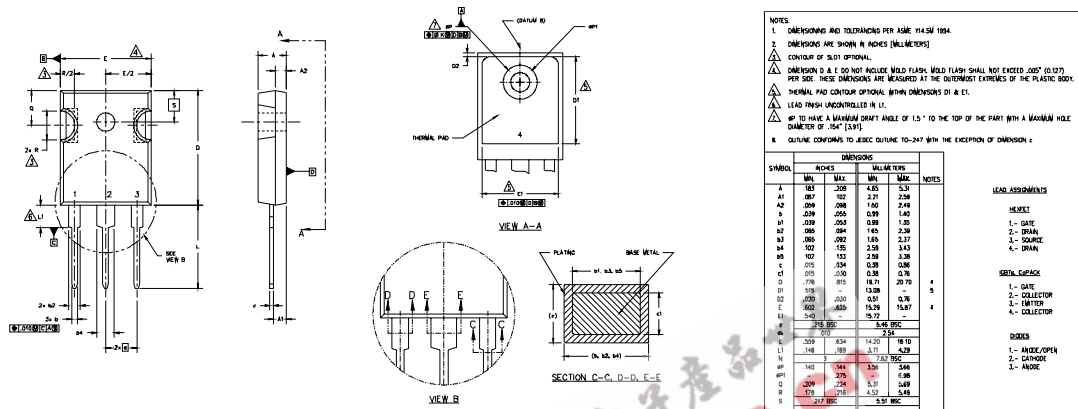
Fig 14. For N-channel HEXFET® power MOSFETs

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## TO-247AC Package Outline

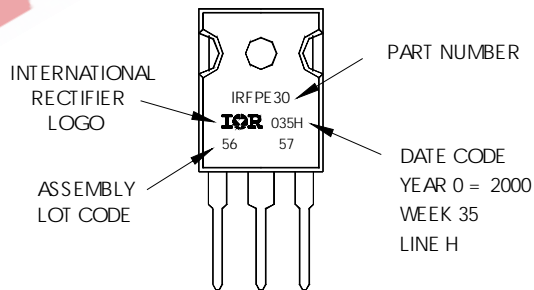
Dimensions are shown in millimeters (inches)



## TO-247AC Part Marking Information

EXAMPLE: THIS IS AN IRFPE30  
WITH ASSEMBLY  
LOT CODE 5657  
ASSEMBLED ON WW 35, 2000  
IN THE ASSEMBLY LINE "H"

**Note:** "P" in assembly line position indicates "Lead-Free"



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.

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**IR** Rectifier

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TAC Fax: (310) 252-7903

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Note: For the most current drawings please refer to the IR website at:  
<http://www.irf.com/package/>

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