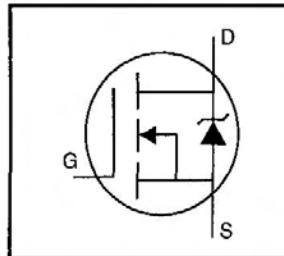


# IRFP354PbF

HEXFET® Power MOSFET

- Dynamic dv/dt Rating
- Repetitive Avalanche Rated
- Isolated Central Mounting Hole
- Fast Switching
- Ease of Paralleling
- Simple Drive Requirements
- Lead-Free

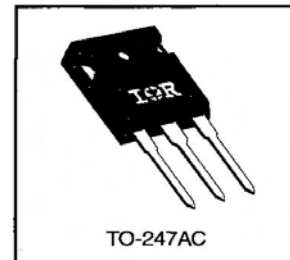


$V_{DSS} = 450V$   
 $R_{DS(on)} = 0.35\Omega$   
 $I_D = 14A$

### Description

Third Generation HEXFETs from International Rectifier provide the designer with the best combination of fast switching, ruggedized device design, low on-resistance and cost-effectiveness.

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. It also provides greater creepage distance between pins to meet the requirements of most safety specifications.



### Absolute Maximum Ratings

	Parameter	Max.	Units
$I_D @ T_C = 25^\circ C$	Continuous Drain Current, $V_{GS} @ 10 V$	14	A
$I_D @ T_C = 100^\circ C$	Continuous Drain Current, $V_{GS} @ 10 V$	9.1	
$I_{DM}$	Pulsed Drain Current ①	56	
$P_D @ T_C = 25^\circ C$	Power Dissipation	190	W
	Linear Derating Factor	1.5	W/°C
$V_{GS}$	Gate-to-Source Voltage	$\pm 20$	V
$E_{AS}$	Single Pulse Avalanche Energy ②	740	mJ
$I_{AR}$	Avalanche Current ①	14	A
$E_{AR}$	Repetitive Avalanche Energy ①	19	mJ
dv/dt	Peak Diode Recovery dv/dt ③	3.5	V/ns
$T_J$ $T_{STG}$	Operating Junction and Storage Temperature Range	-55 to +150	°C
	Soldering Temperature, for 10 seconds	300 (1.6mm from case)	
	Mounting Torque, 6-32 or M3 screw	10 lbf·in (1.1 N·m)	

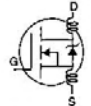
### Thermal Resistance

	Parameter	Min.	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case	—	—	0.65	°C/W
$R_{\theta CS}$	Case-to-Sink, Flat, Greased Surface	—	0.24	—	
$R_{\theta JA}$	Junction-to-Ambient	—	—	40	

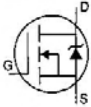
# IRFP354PbF

International  
IR Rectifier

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

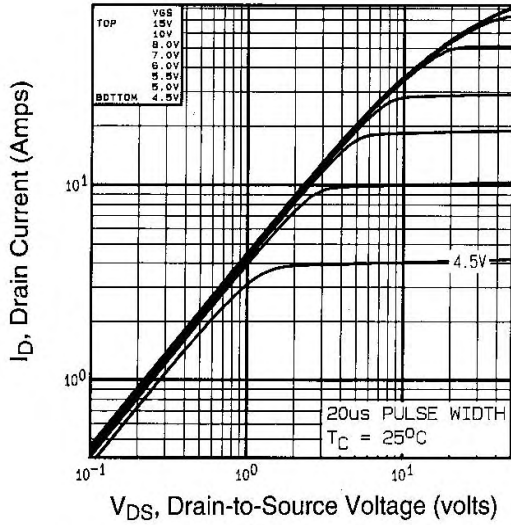
	Parameter	Min.	Typ.	Max.	Units	Test Conditions
$V_{(BR)DSS}$	Drain-to-Source Breakdown Voltage	450	—	—	V	$V_{GS}=0V, I_D=250\mu A$
$\Delta V_{(BR)DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	—	0.61	—	V/°C	Reference to $25^\circ\text{C}$ , $I_D=1\text{mA}$
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	—	—	0.35	$\Omega$	$V_{GS}=10V, I_D=8.4A$ ③
$V_{GS(th)}$	Gate Threshold Voltage	2.0	—	4.0	V	$V_{DS}=V_{GS}, I_D=250\mu A$
$g_{fs}$	Forward Transconductance	5.9	—	—	S	$V_{DS}=50V, I_D=8.4A$ ③
$I_{DSS}$	Drain-to-Source Leakage Current	—	—	25	$\mu A$	$V_{DS}=450V, V_{GS}=0V$
		—	—	250		$V_{DS}=360V, V_{GS}=0V, T_J=125^\circ\text{C}$
$I_{GSS}$	Gate-to-Source Forward Leakage	—	—	100	nA	$V_{GS}=20V$
	Gate-to-Source Reverse Leakage	—	—	-100		$V_{GS}=-20V$
$Q_g$	Total Gate Charge	—	—	160	nC	$I_D=14A$
$Q_{gs}$	Gate-to-Source Charge	—	—	21		$V_{DS}=360V$
$Q_{gd}$	Gate-to-Drain ("Miller") Charge	—	—	83		$V_{GS}=10V$ See Fig. 6 and 13 ④
$t_{d(on)}$	Turn-On Delay Time	—	14	—	ns	$V_{DD}=225V$
$t_r$	Rise Time	—	44	—		$I_D=14A$
$t_{d(off)}$	Turn-Off Delay Time	—	89	—		$R_G=6.2\Omega$
$t_f$	Fall Time	—	46	—		$R_D=16\Omega$ See Figure 10 ④
$L_D$	Internal Drain Inductance	—	5.0	—	nH	Between lead, 6 mm (0.25in.) from package and center of die contact
$L_S$	Internal Source Inductance	—	13	—		
$C_{iss}$	Input Capacitance	—	2700	—	pF	$V_{GS}=0V$
$C_{oss}$	Output Capacitance	—	720	—		$V_{DS}=25V$
$C_{rss}$	Reverse Transfer Capacitance	—	300	—		$f=1.0\text{MHz}$ See Figure 5

## Source-Drain Ratings and Characteristics

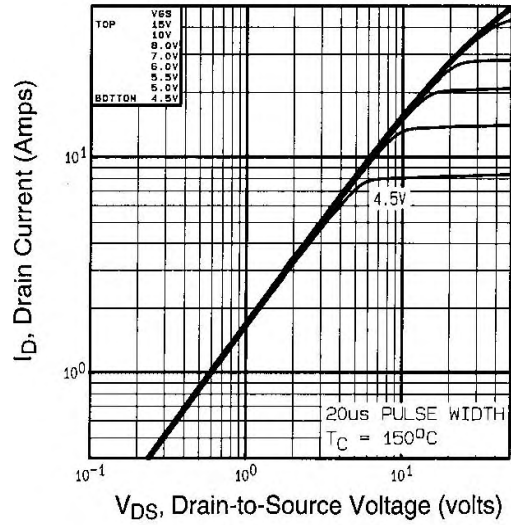
	Parameter	Min.	Typ.	Max.	Units	Test Conditions
$I_S$	Continuous Source Current (Body Diode)	—	—	14	A	MOSFET symbol showing the integral reverse p-n junction diode. 
$I_{SM}$	Pulsed Source Current (Body Diode) ①	—	—	56		
$V_{SD}$	Diode Forward Voltage	—	—	1.5	V	$T_J=25^\circ\text{C}, I_S=14A, V_{GS}=0V$ ④
$t_{rr}$	Reverse Recovery Time	—	580	870	ns	$T_J=25^\circ\text{C}, I_F=14A$
$Q_{rr}$	Reverse Recovery Charge	—	5.1	7.6	$\mu C$	$di/dt=100A/\mu s$ ④
$t_{on}$	Forward Turn-On Time	Intrinsic turn-on time is negligible (turn-on is dominated by $L_S+L_D$ )				

### Notes:

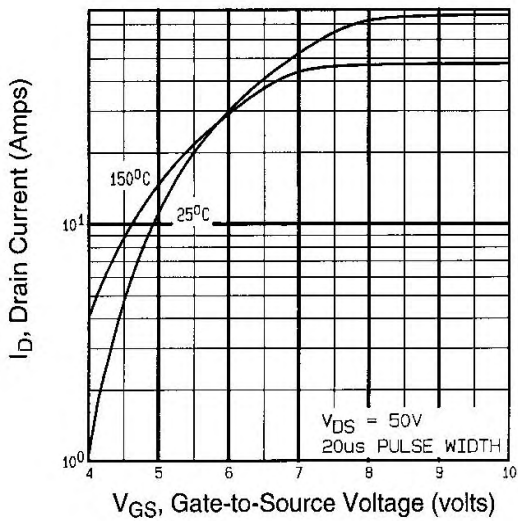
- ① Repetitive rating; pulse width limited by max. junction temperature (See Figure 11)
- ②  $V_{DD}=50V$ , starting  $T_J=25^\circ\text{C}$ ,  $L=6.7\text{mH}$ ,  $R_G=25\Omega$ ,  $I_{AS}=14A$  (See Figure 12)
- ③  $I_{SD}\leq 14A$ ,  $di/dt\leq 125A/\mu s$ ,  $V_{DD}\leq V_{(BR)DSS}$ ,  $T_J\leq 150^\circ\text{C}$
- ④ Pulse width  $\leq 300\mu s$ ; duty cycle  $\leq 2\%$ .



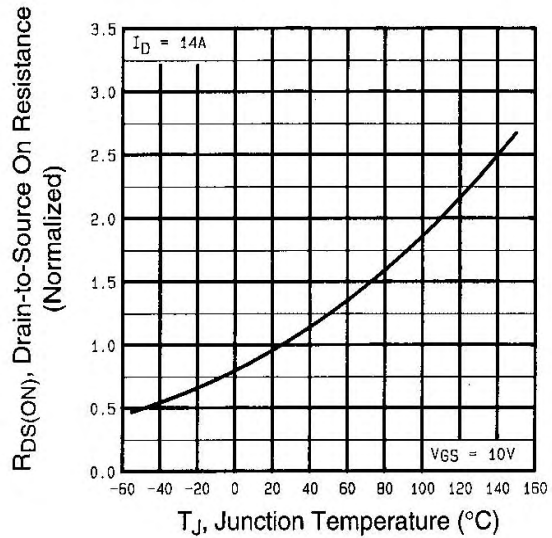
**Fig 1.** Typical Output Characteristics,  
 $T_C=25^\circ\text{C}$



**Fig 2.** Typical Output Characteristics,  
 $T_C=150^\circ\text{C}$



**Fig 3.** Typical Transfer Characteristics

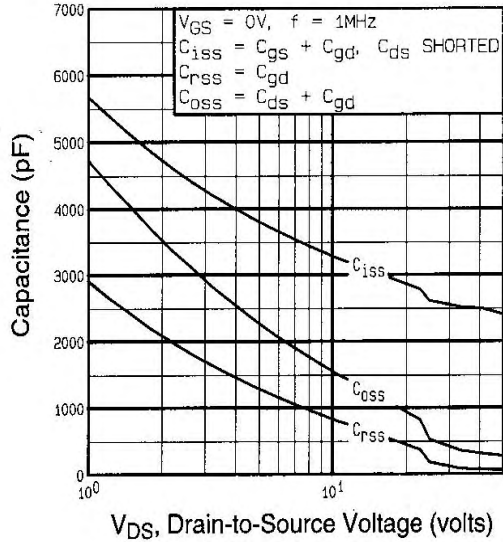


**Fig 4.** Normalized On-Resistance  
Vs. Temperature

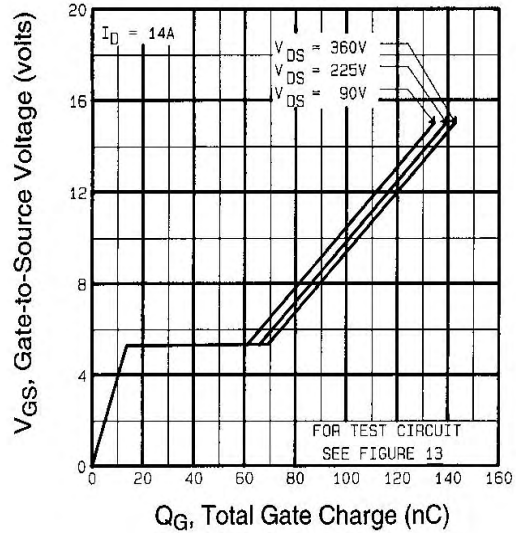


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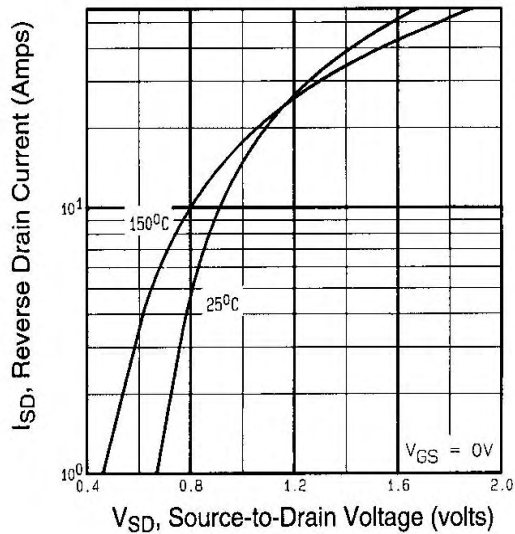
International  
**IR** Rectifier



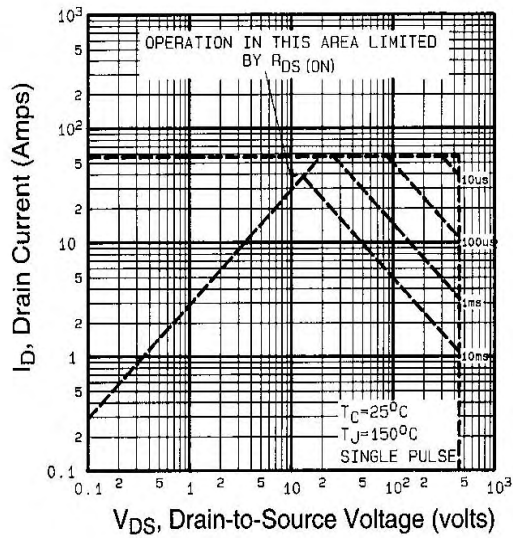
**Fig 5.** Typical Capacitance Vs. Drain-to-Source Voltage



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

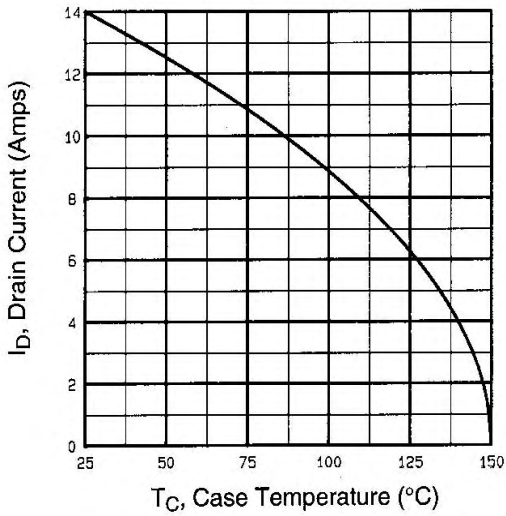


**Fig 7.** Typical Source-Drain Diode Forward Voltage

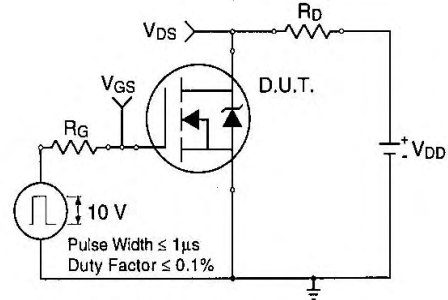


**Fig 8.** Maximum Safe Operating Area

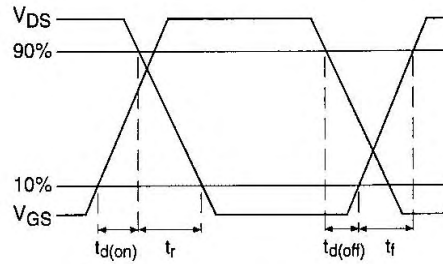
# IRFP354PbF



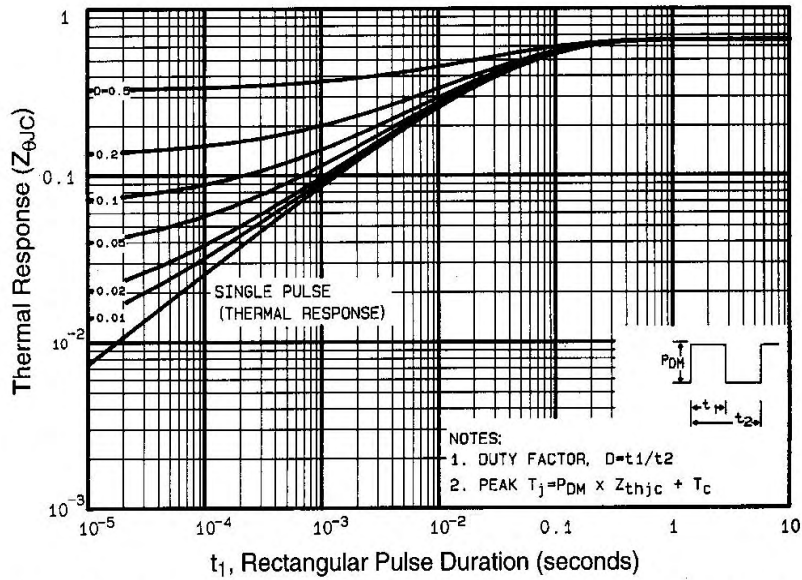
**Fig 9.** Maximum Drain Current Vs. Case Temperature



**Fig 10a.** Switching Time Test Circuit

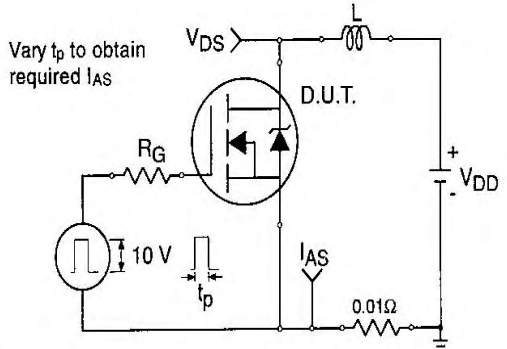


**Fig 10b.** Switching Time Waveforms

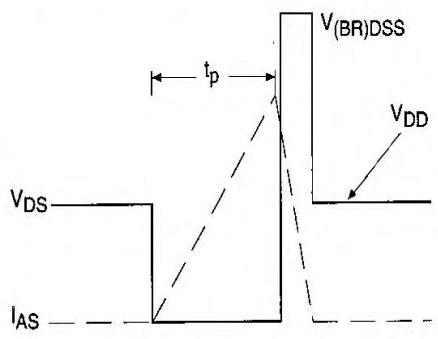


**Fig 11.** Maximum Effective Transient Thermal Impedance, Junction-to-Case

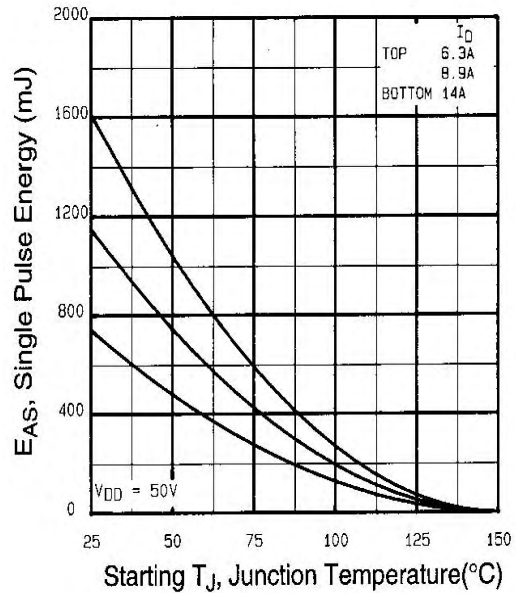
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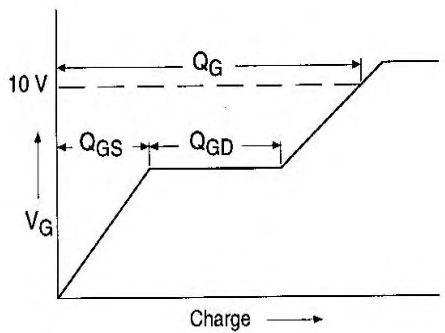
**Fig 12a.** Unclamped Inductive Test Circuit



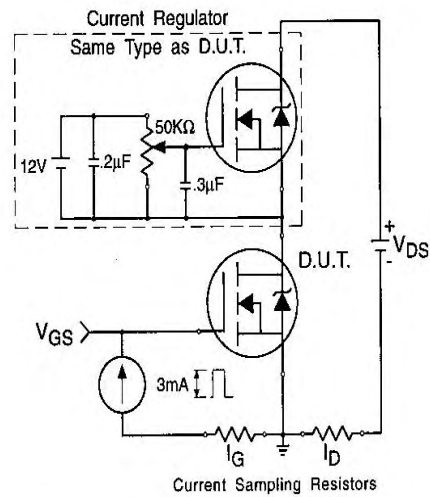
**Fig 12b.** Unclamped Inductive Waveforms



**Fig 12c.** Maximum Avalanche Energy Vs. Drain Current



**Fig 13a.** Basic Gate Charge Waveform

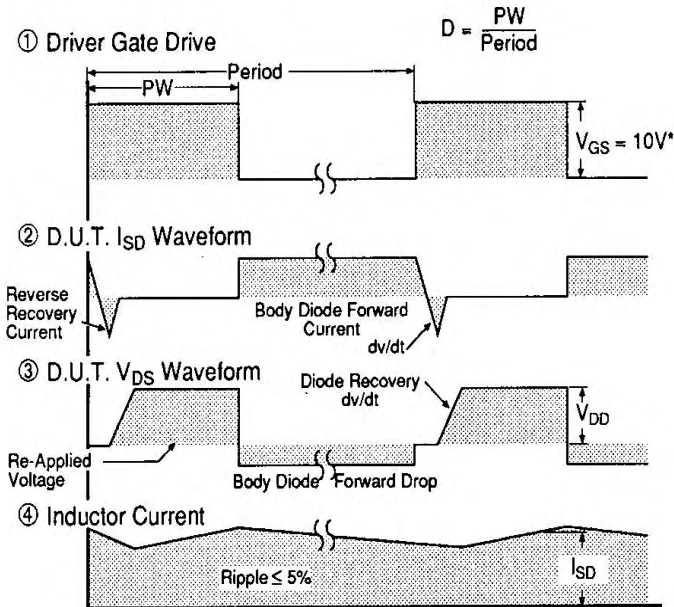
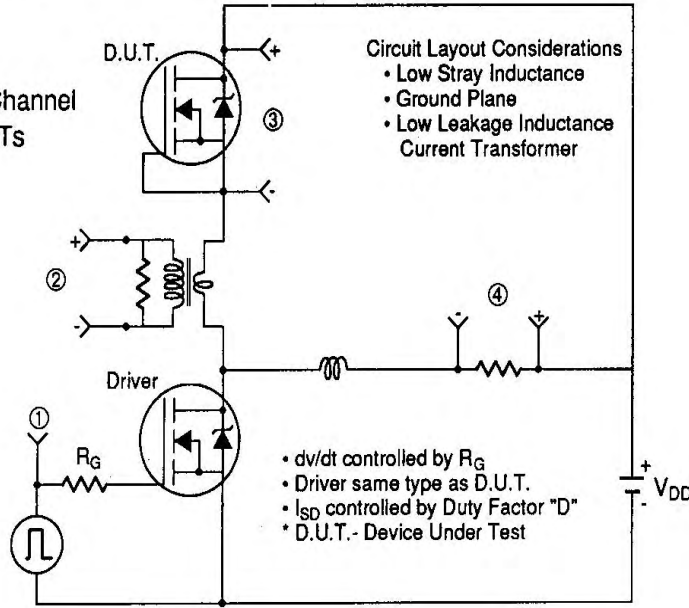


**Fig 13b.** Gate Charge Test Circuit

Appendix A

Peak Diode Recovery dv/dt Test Circuit

Fig 14. For N-Channel HEXFETs

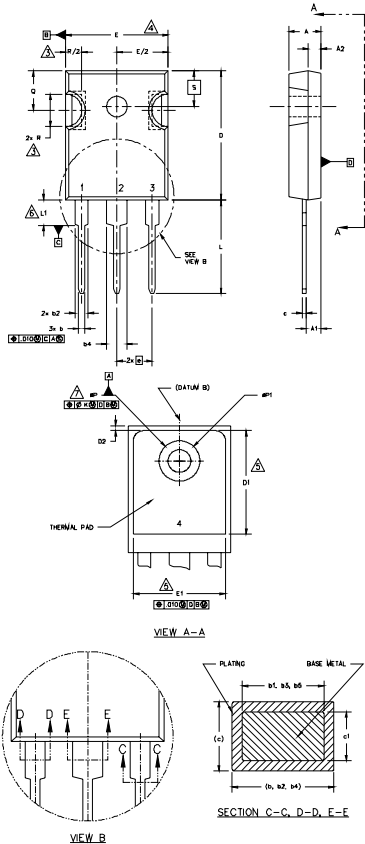


\*  $V_{GS} = 5V$  for Logic Level Devices

# IRFP354PbF



TO-247AC Package Outline Dimensions are shown in millimeters (inches)

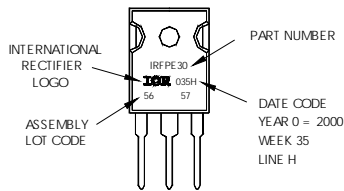


- NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M 1994.
  2. DIMENSIONS ARE SHOWN IN INCHES [MILLIMETERS]
  3. CONTOUR OF SLOT OPTIONAL.
  4. DIMENSION D & E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED .005" (0.127) PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY.
  5. THERMAL PAD CONTOUR OPTIONAL WITHIN DIMENSIONS D1 & E1.
  6. LEAD FINISH UNCONTROLLED IN L1.
  7. ØP TO HAVE A MAXIMUM DRAFT ANGLE OF 1.5 ° TO THE TOP OF THE PART WITH A MAXIMUM HOLE DIAMETER OF .154" [3.91]
8. OUTLINE CONFORMS TO JEDEC OUTLINE TO-247 WITH THE EXCEPTION OF DIMENSION c.

SYMBOL	DIMENSIONS				NOTES	
	INCHES		MILLIMETERS			
	MIN.	MAX.	MIN.	MAX.		
A	.183	.209	4.65	5.31		<b>LEAD ASSIGNMENTS</b>  <b>HEXFET</b> 1- GATE 2- DRAIN 3- SOURCE 4- DRAIN
A1	.087	.102	2.21	2.59		
A2	.059	.098	1.50	2.49		
b	.039	.055	0.99	1.40		
b1	.039	.053	0.99	1.35		
b2	.065	.094	1.65	2.39		
b3	.065	.092	1.65	2.37		
b4	.102	.135	2.59	3.43		
b5	.102	.133	2.59	3.38		
c	.015	.034	0.38	0.86		
c1	.015	.030	0.38	0.76		<b>IGBTs, CoPACK</b> 1- GATE 2- COLLECTOR 3- EMITTER 4- COLLECTOR
D	.776	.815	19.71	20.70	4	
D1	.515	-	13.08	-	5	
D2	.020	.030	0.51	0.76		
E	.602	.625	15.29	15.87	4	
E1	.540	-	15.72	-		
e	.215 BSC		5.46 BSC			
Øk	.010		2.54			
L	.559	.634	14.20	16.10		<b>DIODES</b> 1- ANODE/OPEN 2- CATHODE 3- ANODE
L1	.146	.169	3.71	4.29		
N	3		7.62 BSC			
ØP	.140	.144	3.56	3.66		
ØP1	-	.275	-	6.98		
Q	.209	.224	5.31	5.69		
R	.178	.216	4.52	5.49		
S	.217 BSC		5.51 BSC			

## TO-247AC Part Marking Information

EXAMPLE: THIS IS AN IRFPE30 WITH ASSEMBLY LOT CODE 5657 ASSEMBLED ON VW 35, 2000 IN THE ASSEMBLY LINE "H"  
**Note:** "P" in assembly line position indicates "Lead-Free"



Data and specifications subject to change without notice.



IR WORLD HEADQUARTERS: 233 Kansas St., El Segundo, California 90245, USA Tel: (310) 252-7105

TAC Fax: (310) 252-7903

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