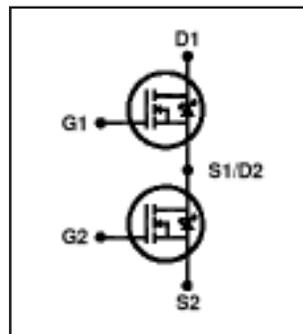


# IRFI4212H-117P

## Features

- Integrated half-bridge package
- Reduces the part count by half
- Facilitates better PCB layout
- Key parameters optimized for Class-D audio amplifier applications
- Low  $R_{DS(ON)}$  for improved efficiency
- Low  $Q_g$  and  $Q_{sw}$  for better THD and improved efficiency
- Low  $Q_{rr}$  for better THD and lower EMI
- Can delivery up to 150W per channel into 4Ω load in half-bridge configuration amplifier
- Lead-free package

Key Parameters ⑤		
$V_{DS}$	100	V
$R_{DS(ON)}$ typ. @ 10V	58	mΩ
$Q_g$ typ.	12	nC
$Q_{sw}$ typ.	6.9	nC
$R_{G(int)}$ typ.	3.4	Ω
$T_J$ max	150	°C



G1, G2	D1, D2	S1, S2
Gate	Drain	Source

## Description

This Digital Audio MosFET Half-Bridge is specifically designed for Class D audio amplifier applications. It consists of two power MosFET switches connected in half-bridge configuration. The latest process is used to achieve low on-resistance per silicon area. Furthermore, Gate charge, body-diode reverse recovery, and internal Gate resistance are optimized to improve key Class D audio amplifier performance factors such as efficiency, THD and EMI. These combine to make this Half-Bridge a highly efficient, robust and reliable device for Class D audio amplifier applications.

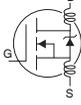
## Absolute Maximum Ratings ⑤

	Parameter	Max.	Units
$V_{DS}$	Drain-to-Source Voltage	100	V
$V_{GS}$	Gate-to-Source Voltage	±20	
$I_D$ @ $T_C = 25^\circ\text{C}$	Continuous Drain Current, $V_{GS}$ @ 10V	11	A
$I_D$ @ $T_C = 100^\circ\text{C}$	Continuous Drain Current, $V_{GS}$ @ 10V	6.8	
$I_{DM}$	Pulsed Drain Current ①	44	
$P_D$ @ $T_C = 25^\circ\text{C}$	Power Dissipation ④	18	W
$P_D$ @ $T_C = 100^\circ\text{C}$	Power Dissipation ④	7.0	
	Linear Derating Factor	0.14	W/°C
$E_{AS}$	Single Pulse Avalanche Energy②	41	mJ
$T_J$	Operating Junction and	-55 to + 150	°C
$T_{STG}$	Storage Temperature Range		
	Soldering Temperature, for 10 seconds (1.6mm from case)	300	
	Mounting torque, 6-32 or M3 screw	10lb·in (1.1N·m)	

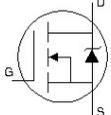
## Thermal Resistance ⑤

	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case ④	—	7.1	°C/W
$R_{\theta JA}$	Junction-to-Ambient (free air)	—	65	

## Electrical Characteristics @ $T_J = 25^\circ\text{C}$ (unless otherwise specified) ⑤

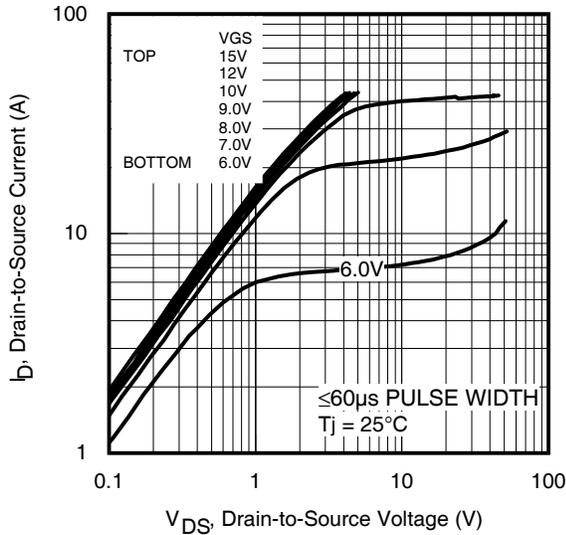
	Parameter	Min.	Typ.	Max.	Units	Conditions
$BV_{DSS}$	Drain-to-Source Breakdown Voltage	100	—	—	V	$V_{GS} = 0V, I_D = 250\mu A$
$\Delta BV_{DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	—	0.09	—	V/ $^\circ\text{C}$	Reference to $25^\circ\text{C}, I_D = 1\text{mA}$
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	—	58	72.5	m $\Omega$	$V_{GS} = 10V, I_D = 6.6A$ ③
$V_{GS(th)}$	Gate Threshold Voltage	3.0	—	5.0	V	$V_{DS} = V_{GS}, I_D = 250\mu A$
$\Delta V_{GS(th)}/\Delta T_J$	Gate Threshold Voltage Coefficient	—	-11	—	mV/ $^\circ\text{C}$	
$I_{DSS}$	Drain-to-Source Leakage Current	—	—	20	$\mu A$	$V_{DS} = 100V, V_{GS} = 0V$
		—	—	250		$V_{DS} = 100V, V_{GS} = 0V, T_J = 125^\circ\text{C}$
$I_{GSS}$	Gate-to-Source Forward Leakage	—	—	200	nA	$V_{GS} = 20V$
	Gate-to-Source Reverse Leakage	—	—	-200		$V_{GS} = -20V$
$g_{fs}$	Forward Transconductance	11	—	—	S	$V_{DS} = 50V, I_D = 6.6A$
$Q_g$	Total Gate Charge	—	12	18		
$Q_{gs1}$	Pre-V <sub>th</sub> Gate-to-Source Charge	—	1.6	—		$V_{DS} = 80V$
$Q_{gs2}$	Post-V <sub>th</sub> Gate-to-Source Charge	—	0.71	—	nC	$V_{GS} = 10V$
$Q_{gd}$	Gate-to-Drain Charge	—	6.2	—		$I_D = 6.6A$
$Q_{godr}$	Gate Charge Overdrive	—	3.5	—		See Fig. 6 and 15
$Q_{sw}$	Switch Charge ( $Q_{gs2} + Q_{gd}$ )	—	6.9	—		
$R_{G(int)}$	Internal Gate Resistance	—	3.4	—	$\Omega$	
$t_{d(on)}$	Turn-On Delay Time	—	4.7	—		$V_{DD} = 50V, V_{GS} = 10V$ ③
$t_r$	Rise Time	—	8.3	—		$I_D = 6.6A$
$t_{d(off)}$	Turn-Off Delay Time	—	9.5	—	ns	$R_G = 2.5\Omega$
$t_f$	Fall Time	—	4.3	—		
$C_{iss}$	Input Capacitance	—	490	—		$V_{GS} = 0V$
$C_{oss}$	Output Capacitance	—	64	—	pF	$V_{DS} = 50V$
$C_{rss}$	Reverse Transfer Capacitance	—	34	—		$f = 1.0\text{MHz}$ , See Fig.5
$C_{oss\ eff.}$	Effective Output Capacitance	—	110	—		$V_{GS} = 0V, V_{DS} = 0V\ \text{to}\ 80V$
$L_D$	Internal Drain Inductance	—	4.5	—		Between lead, 6mm (0.25in.) from package and center of die contact
$L_S$	Internal Source Inductance	—	7.5	—	nH	

## Diode Characteristics ⑤

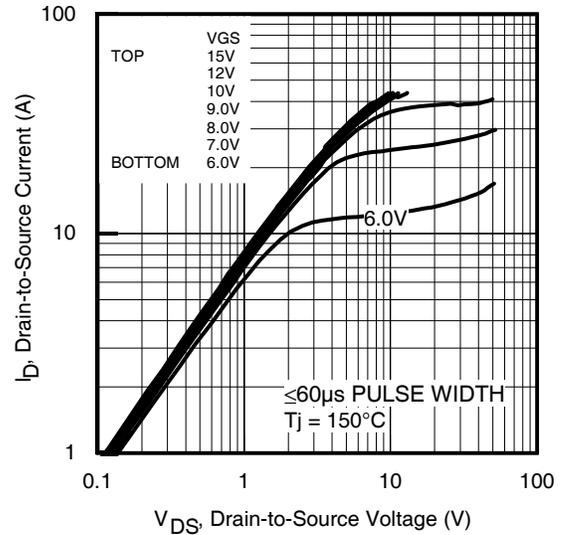
	Parameter	Min.	Typ.	Max.	Units	Conditions
$I_S @ T_C = 25^\circ\text{C}$	Continuous Source Current (Body Diode)	—	—	11	A	MOSFET symbol showing the integral reverse p-n junction diode. 
$I_{SM}$	Pulsed Source Current (Body Diode) ①	—	—	44		
$V_{SD}$	Diode Forward Voltage	—	—	1.3	V	$T_J = 25^\circ\text{C}, I_S = 6.6A, V_{GS} = 0V$ ③
$t_{rr}$	Reverse Recovery Time	—	36	54	ns	$T_J = 25^\circ\text{C}, I_F = 6.6A$
$Q_{rr}$	Reverse Recovery Charge	—	56	84	nC	$di/dt = 100A/\mu s$ ③

### Notes:

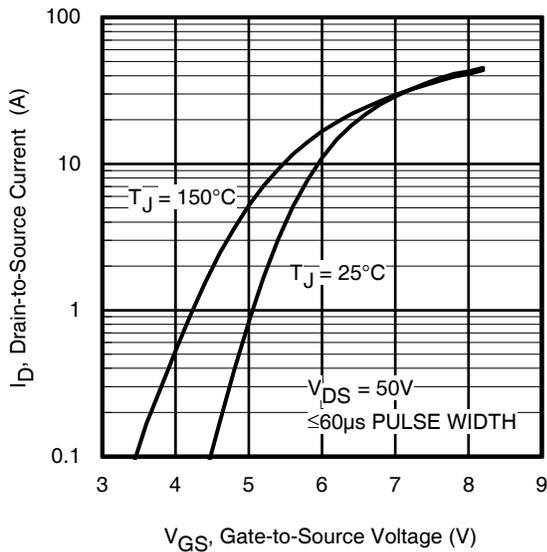
- ① Repetitive rating; pulse width limited by max. junction temperature.
- ② Starting  $T_J = 25^\circ\text{C}$ ,  $L = 1.9\text{mH}$ ,  $R_G = 25\Omega$ ,  $I_{AS} = 6.6A$ .
- ③ Pulse width  $\leq 400\mu s$ ; duty cycle  $\leq 2\%$ .
- ④  $R_{\theta}$  is measured at  $T_J$  of approximately  $90^\circ\text{C}$ .
- ⑤ Specifications refer to single MosFET.



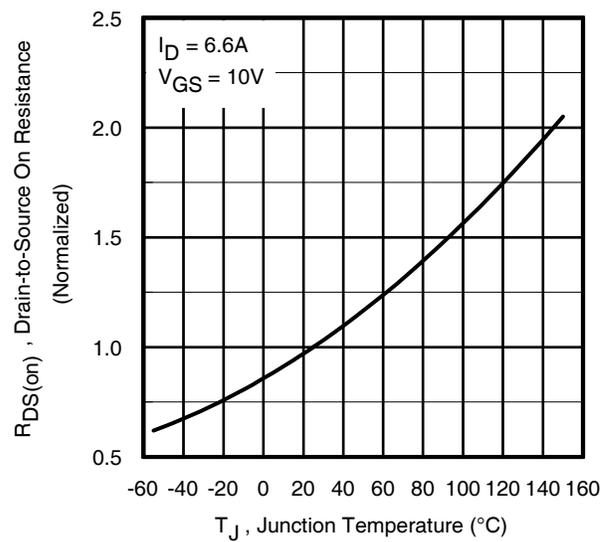
**Fig 1.** Typical Output Characteristics



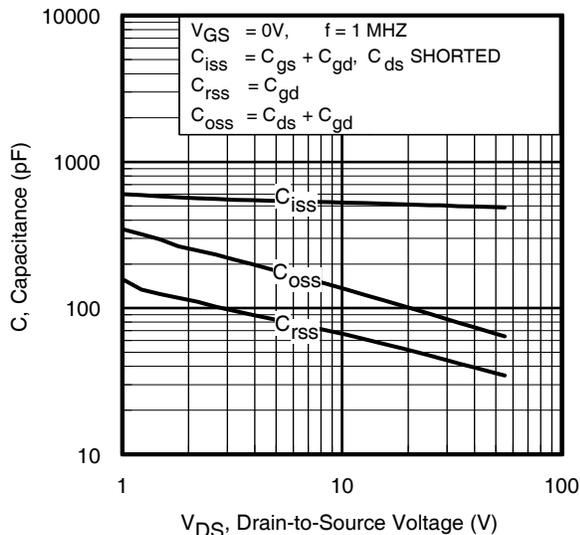
**Fig 2.** Typical Output Characteristics



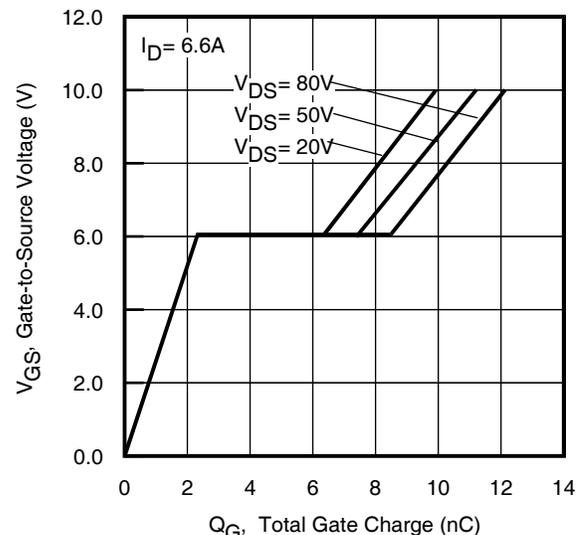
**Fig 3.** Typical Transfer Characteristics



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



**Fig 5.** Typical Capacitance vs. Drain-to-Source Voltage  
www.irf.com



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

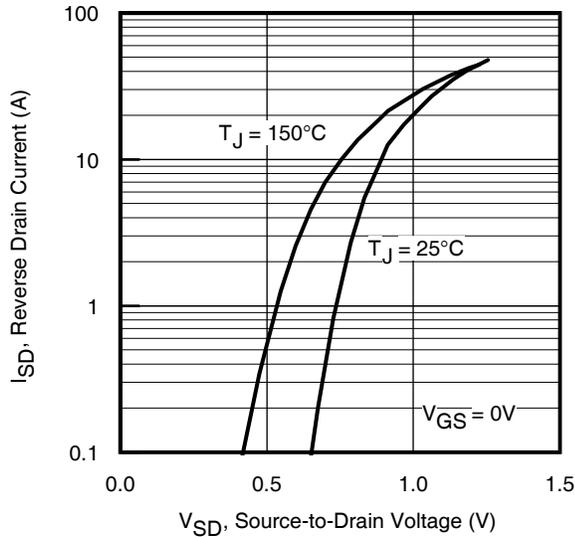


Fig 7. Typical Source-Drain Diode Forward Voltage

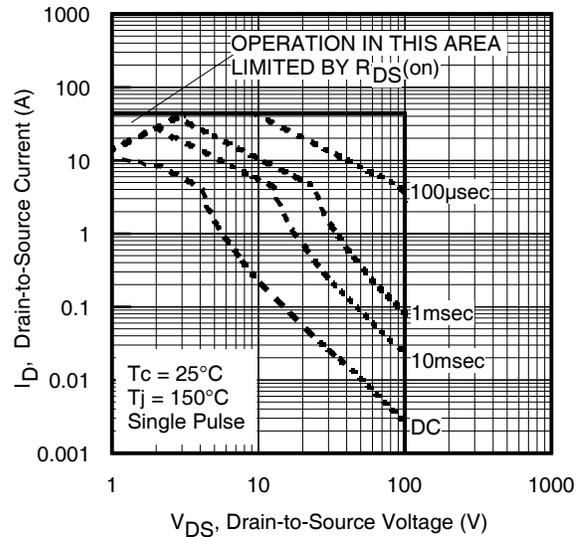


Fig 8. Maximum Safe Operating Area

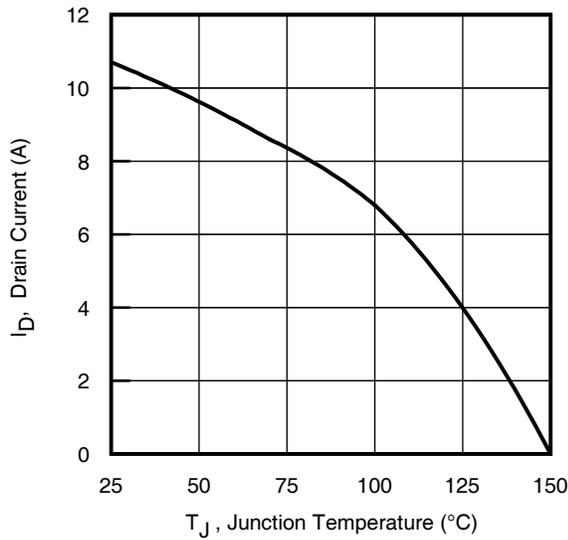


Fig 9. Maximum Drain Current vs. Junction Temperature

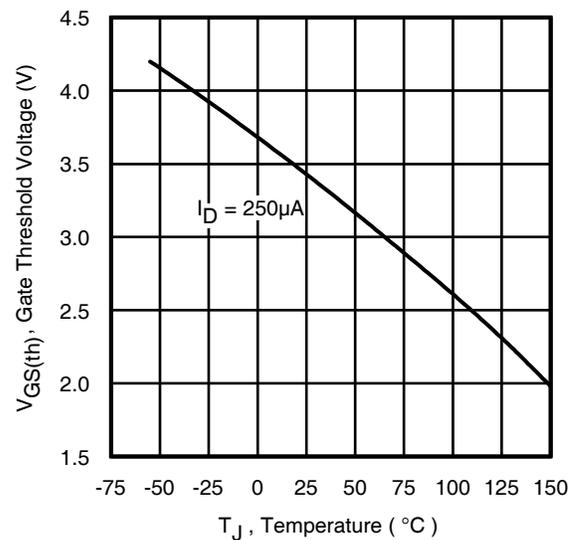


Fig 10. Threshold Voltage vs. Temperature

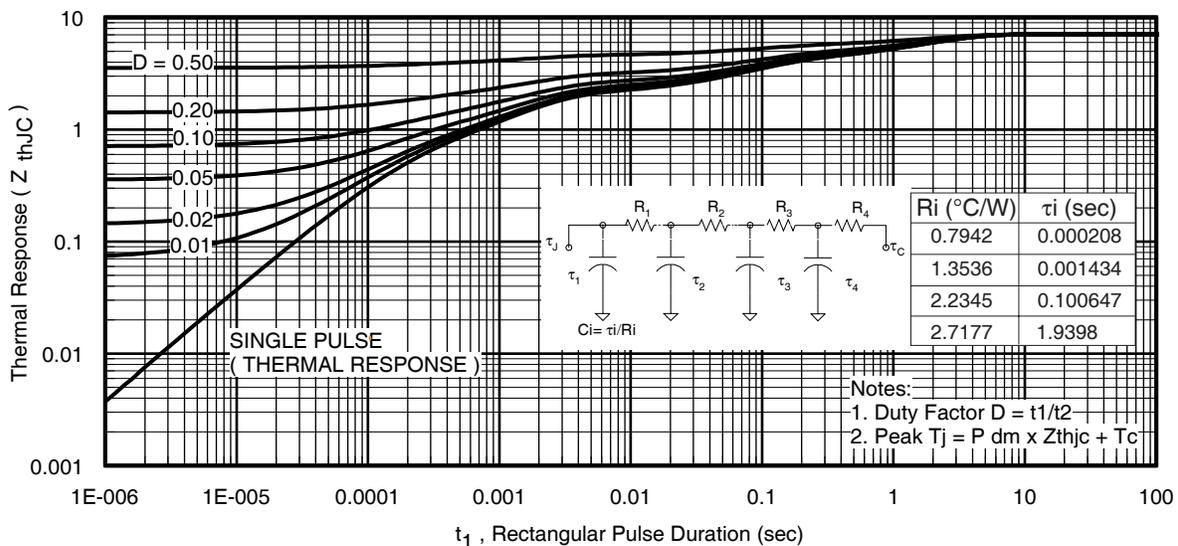
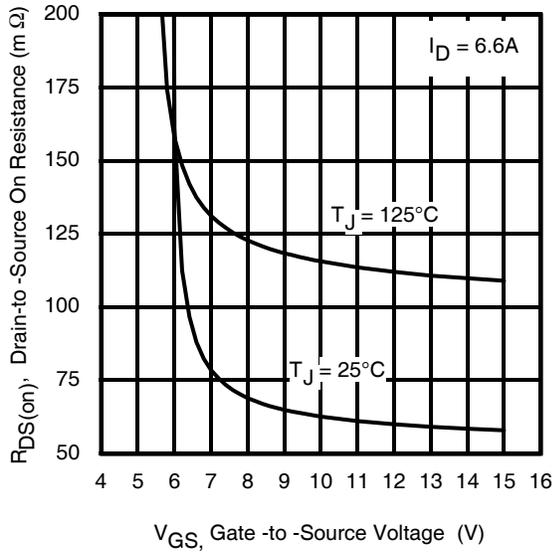
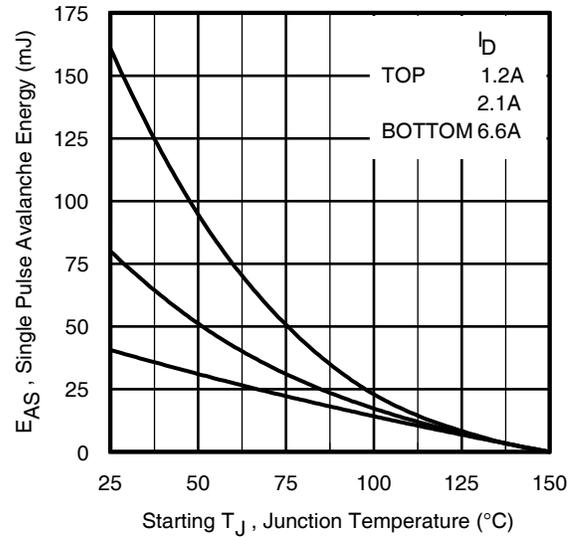


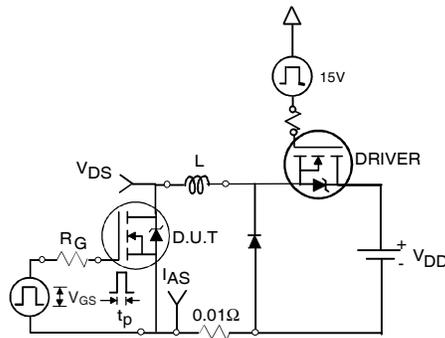
Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Case



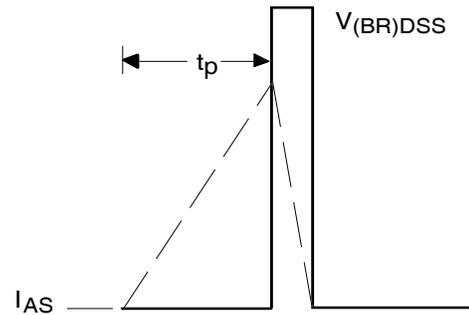
**Fig 12.** On-Resistance vs. Gate Voltage



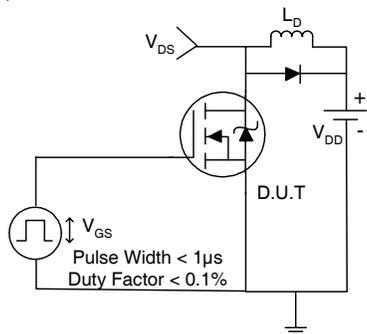
**Fig 13a.** Maximum Avalanche Energy vs. Drain Current



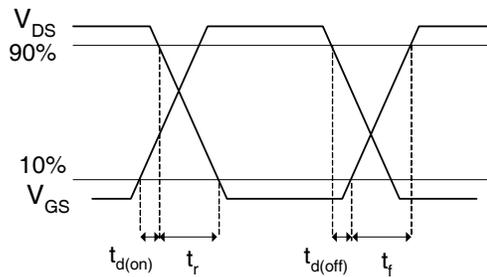
**Fig 13b.** Unclamped Inductive Test Circuit



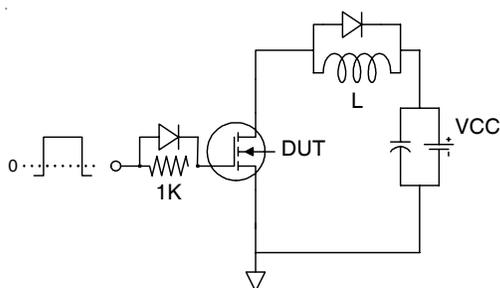
**Fig 13c.** Unclamped Inductive Waveforms



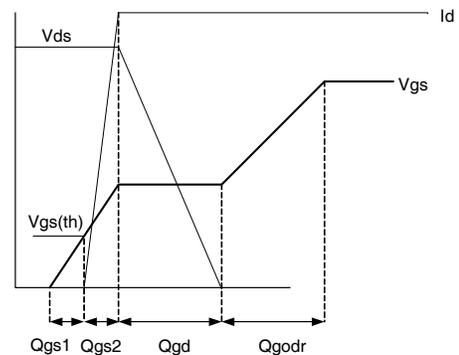
**Fig 14a.** Switching Time Test Circuit



**Fig 14b.** Switching Time Waveforms



**Fig 15a.** Gate Charge Test Circuit

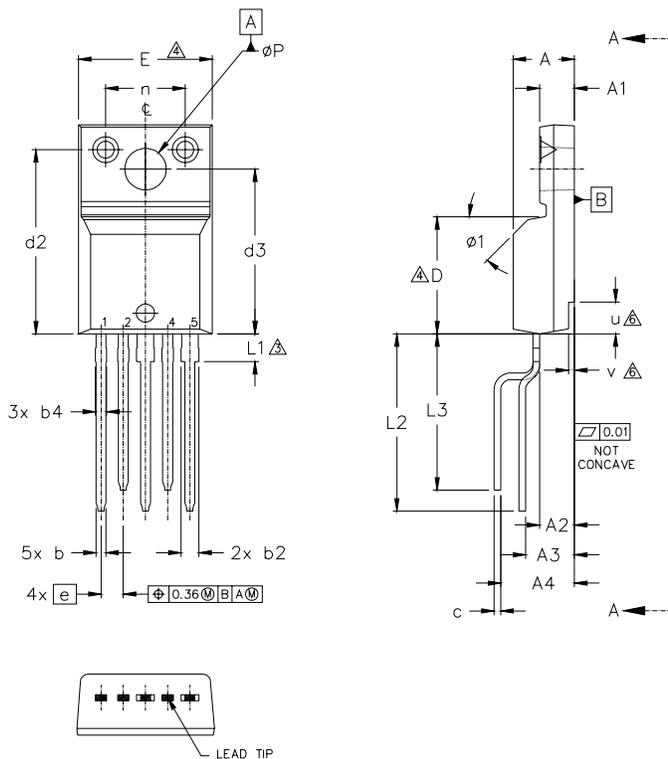


**Fig 15b** Gate Charge Waveform

# IRFI4212H-117P

## TO-220 Full-Pak 5-Pin Package Outline, Lead-Form Option 117

(Dimensions are shown in millimeters (inches))



**NOTES:**

- 1.0 DIMENSIONING AND TOLERANCING AS PER ASME Y14.5 M- 1994.
- 2.0 DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES].
- 3.0 LEAD DIMENSION AND FINISH UNCONTROLLED IN LT.
- 4.0 DIMENSION D & E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED .005" (0.127) PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTER MOST EXTREMES OF THE PLASTIC BODY.
- 5.0 DIMENSION b1, b3, b5 & c1 APPLY TO BASE METAL ONLY.
- 6.0 STEP OPTIONAL ON PLASTIC BODY DEFINED BY DIMENSIONS u & v.
- 7.0 CONTROLLING DIMENSION : INCHES.

SYMBOL	DIMENSIONS				NOTES
	MILLIMETERS		INCHES		
	MIN.	MAX.	MIN.	MAX.	
A	4.57	4.83	.180	.190	
A1	2.57	2.83	.101	.111	
A2	2.51	2.85	.099	.112	
A3	3.73	4.24	.147	.167	
A4	5.79	6.29	.228	.248	
b	0.61	0.95	0.24	.037	
b1	0.56	0.90	.022	0.35	5
b2	1.13	1.48	0.44	.058	
b3	1.08	1.43	0.42	.056	
b4	0.76	1.06	.030	.042	
b5	0.71	1.01	.028	.040	
c	0.33	0.63	.013	.025	
c1	0.28	0.58	.011	.023	
D	8.65	9.80	.341	.386	4
d1	15.80	16.12	.622	.635	
d2	13.97	14.22	.550	.560	
d3	12.30	12.92	.484	.509	
E	9.63	10.63	.379	.419	

SYMBOL	DIMENSIONS				NOTES
	MILLIMETERS		INCHES		
	MIN.	MAX.	MIN.	MAX.	
e	1.70	BSC	.067	BSC	3
L	13.20	13.73	.520	.541	
L1	1.91	2.31	.075	.091	
L2	12.7	13.46	.500	.530	
L3	10.92	11.68	.430	.460	
n	6.05	6.15	.238	.242	
øP	3.05	3.45	.120	.136	
u	2.40	2.50	.094	.098	
v	0.40	0.50	.016	.020	6
ø1	-	.45*	-	.45*	6

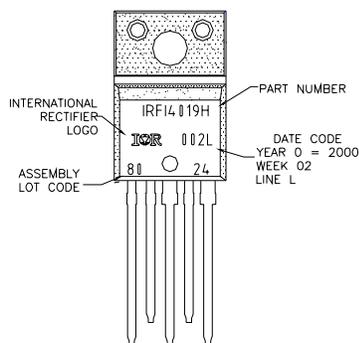
**LEAD ASSIGNMENTS**

- 1 - SOURCE 2
- 2 - GATE 2
- 3 - DRAIN 2 / SOURCE 1
- 4 - GATE 1
- 5 - DRAIN 1

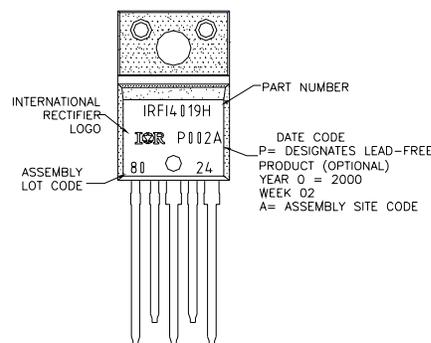
## TO-220 Full-Pak 5-Pin Part Marking Information

EXAMPLE: THIS IS AN IRFI4019H WITH  
LOT CODE 8024  
ASSEMBLED ON WW02,2000  
IN THE ASSEMBLY LINE "L"

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



OR



TO-220AB Full-Pak 5-Pin package is not recommended for Surface Mount Application.

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

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

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