

Applications

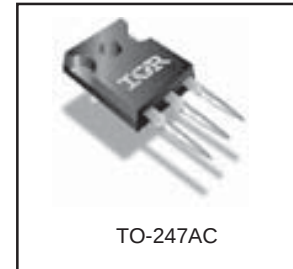
- Zero Voltage Switching SMPS
- Telecom and Server Power Supplies
- Uninterruptible Power Supplies
- Motor Control applications

HEXFET® Power MOSFET

V_{DSS}	$R_{DS(on)}$ typ.	T_{rr} typ.	I_D
500V	0.190 Ω	170ns	23A

Features and Benefits

- SuperFast body diode eliminates the need for external diodes in ZVS applications.
- Lower Gate charge results in simpler drive requirements.
- Enhanced dv/dt capabilities offer improved ruggedness.
- Higher Gate voltage threshold offers improved noise immunity.



Absolute Maximum Ratings

	Parameter	Max.	Units
I_D @ $T_C = 25^\circ\text{C}$	Continuous Drain Current, V_{GS} @ 10V	23	A
I_D @ $T_C = 100^\circ\text{C}$	Continuous Drain Current, V_{GS} @ 10V	15	
I_{DM}	Pulsed Drain Current ①	92	
P_D @ $T_C = 25^\circ\text{C}$	Power Dissipation	370	W
	Linear Derating Factor	2.9	W/ $^\circ\text{C}$
V_{GS}	Gate-to-Source Voltage	± 30	V
dv/dt	Peak Diode Recovery dv/dt ③	14	V/ns
T_J	Operating Junction and	-55 to + 150	$^\circ\text{C}$
T_{STG}	Storage Temperature Range		
	Soldering Temperature, for 10 seconds	300 (1.6mm from case)	
	Mounting torque, 6-32 or M3 screw	10lb·in (1.1N·m)	

Diode Characteristics

Symbol	Parameter	Min.	Typ.	Max.	Units	Conditions
I_S	Continuous Source Current (Body Diode)	—	—	23	A	MOSFET symbol showing the integral reverse p-n junction diode.
I_{SM}	Pulsed Source Current (Body Diode) ①	—	—	92		
V_{SD}	Diode Forward Voltage	—	—	1.5	V	$T_J = 25^\circ\text{C}$, $I_S = 14\text{A}$, $V_{GS} = 0\text{V}$ ④
t_{rr}	Reverse Recovery Time	—	170	250	ns	$T_J = 25^\circ\text{C}$, $I_F = 23\text{A}$
		—	220	330		$T_J = 125^\circ\text{C}$, $di/dt = 100\text{A}/\mu\text{s}$ ④
Q_{rr}	Reverse Recovery Charge	—	560	840	nC	$T_J = 25^\circ\text{C}$, $I_S = 23\text{A}$, $V_{GS} = 0\text{V}$ ④
		—	980	1500		$T_J = 125^\circ\text{C}$, $di/dt = 100\text{A}/\mu\text{s}$ ④
I_{RRM}	Reverse Recovery Current	—	7.6	11	A	$T_J = 25^\circ\text{C}$
t_{on}	Forward Turn-On Time	Intrinsic turn-on time is negligible (turn-on is dominated by LS+LD)				

IRFP23N50L

International
IR Rectifier

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

Symbol	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(BR)DSS}$	Drain-to-Source Breakdown Voltage	500	—	—	V	$V_{GS} = 0V, I_D = 250\mu A$
$\Delta V_{(BR)DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	—	0.27	—	V/ $^\circ\text{C}$	Reference to 25°C , $I_D = 1mA$
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	—	0.190	0.235	Ω	$V_{GS} = 10V, I_D = 14A$ ④
$V_{GS(th)}$	Gate Threshold Voltage	3.0	—	5.0	V	$V_{DS} = V_{GS}, I_D = 250\mu A$
I_{DSS}	Drain-to-Source Leakage Current	—	—	50	μA	$V_{DS} = 500V, V_{GS} = 0V$
		—	—	2.0	mA	$V_{DS} = 400V, V_{GS} = 0V, T_J = 125^\circ\text{C}$
I_{GSS}	Gate-to-Source Forward Leakage	—	—	100	nA	$V_{GS} = 30V$
	Gate-to-Source Reverse Leakage	—	—	-100	nA	$V_{GS} = -30V$
R_G	Internal Gate Resistance	—	1.2	—	Ω	$f = 1MHz$, open drain

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

Symbol	Parameter	Min.	Typ.	Max.	Units	Conditions
g_{fs}	Forward Transconductance	12	—	—	S	$V_{DS} = 50V, I_D = 14A$
Q_g	Total Gate Charge	—	—	150	nC	$I_D = 23A$
Q_{gs}	Gate-to-Source Charge	—	—	44	nC	$V_{DS} = 400V$
Q_{gd}	Gate-to-Drain ("Miller") Charge	—	—	72	nC	$V_{GS} = 10V$, See Fig. 7 & 15 ④
$t_{d(on)}$	Turn-On Delay Time	—	26	—	ns	$V_{DD} = 250V$
t_r	Rise Time	—	94	—	ns	$I_D = 23A$
$t_{d(off)}$	Turn-Off Delay Time	—	53	—	ns	$R_G = 6.0\Omega$
t_f	Fall Time	—	45	—	ns	$V_{GS} = 10V$, See Fig. 11a & 11b ④
C_{iss}	Input Capacitance	—	3600	—	pF	$V_{GS} = 0V$
C_{oss}	Output Capacitance	—	380	—	pF	$V_{DS} = 25V$
C_{rss}	Reverse Transfer Capacitance	—	37	—	pF	$f = 1.0MHz$, See Fig. 5
C_{oss}	Output Capacitance	—	4800	—	pF	$V_{GS} = 0V, V_{DS} = 1.0V, f = 1.0MHz$
C_{oss}	Output Capacitance	—	100	—	pF	$V_{GS} = 0V, V_{DS} = 400V, f = 1.0MHz$
$C_{oss \text{ eff.}}$	Effective Output Capacitance	—	220	—	pF	$V_{GS} = 0V, V_{DS} = 0V \text{ to } 400V$ ⑤
$C_{oss \text{ eff. (ER)}}$	Effective Output Capacitance (Energy Related)	—	160	—	pF	

Avalanche Characteristics

Symbol	Parameter	Typ.	Max.	Units
E_{AS}	Single Pulse Avalanche Energy ②	—	410	mJ
I_{AR}	Avalanche Current ①	—	23	A
E_{AR}	Repetitive Avalanche Energy ①	—	37	mJ

Thermal Resistance

Symbol	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case	—	0.34	$^\circ\text{C/W}$
$R_{\theta CS}$	Case-to-Sink, Flat, Greased Surface	0.24	—	
$R_{\theta JA}$	Junction-to-Ambient	—	40	

Notes:

- ① Repetitive rating; pulse width limited by max. junction temperature. (See Fig. 11).
- ② Starting $T_J = 25^\circ\text{C}$, $L = 1.5mH$, $R_G = 25\Omega$, $I_{AS} = 23A$, $dv/dt = 14V/ns$. (See Figure 12).
- ③ $I_{SD} \leq 23A$, $di/dt \leq 430A/\mu s$, $V_{DD} \leq V_{(BR)DSS}$, $T_J \leq 150^\circ\text{C}$.

④ Pulse width $\leq 300\mu s$; duty cycle $\leq 2\%$.

⑤ $C_{oss \text{ eff.}}$ is a fixed capacitance that gives the same charging time as C_{oss} while V_{DS} is rising from 0 to 80% V_{DSS} .
 $C_{oss \text{ eff. (ER)}}$ is a fixed capacitance that stores the same energy as C_{oss} while V_{DS} is rising from 0 to 80% V_{DSS} .

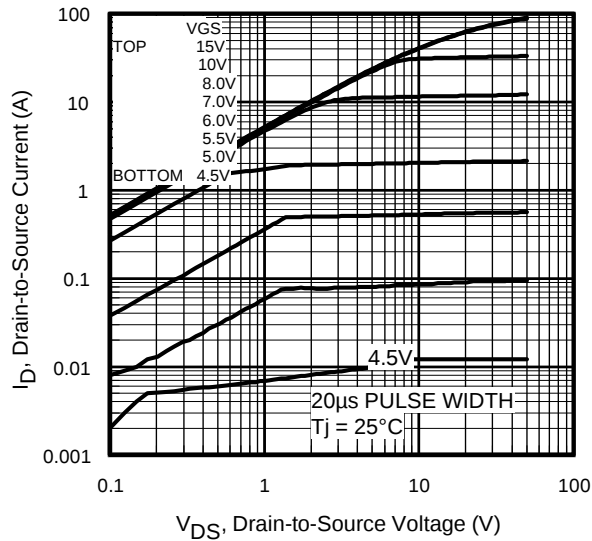


Fig 1. Typical Output Characteristics

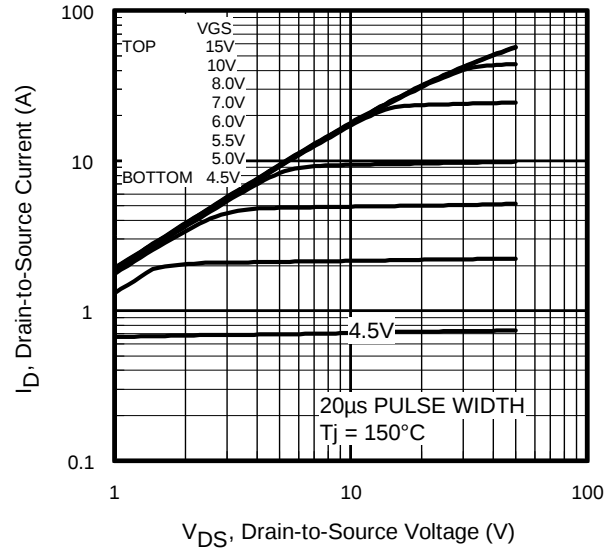


Fig 2. Typical Output Characteristics

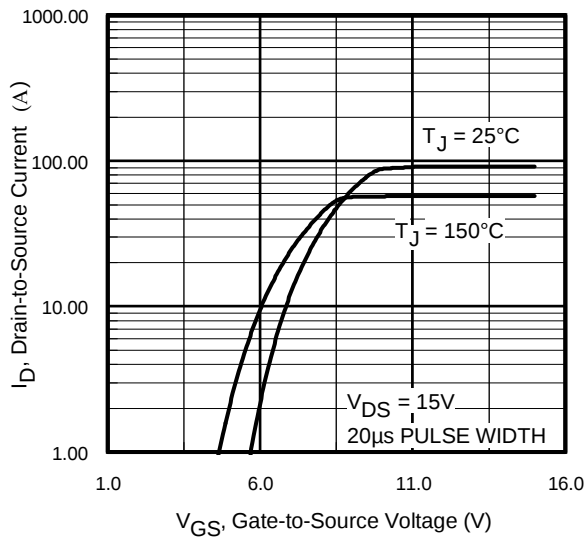


Fig 3. Typical Transfer Characteristics

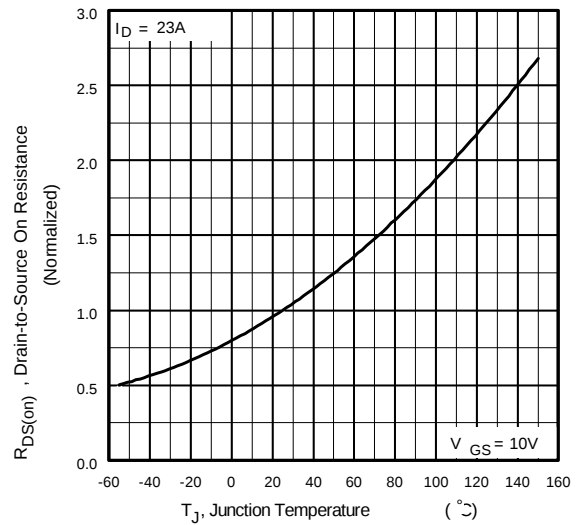
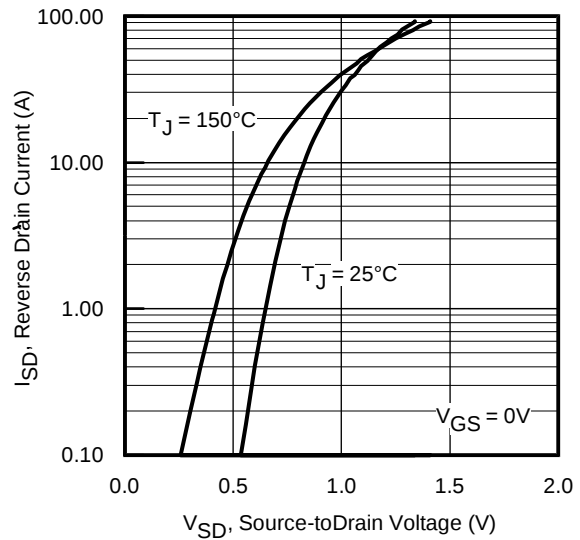
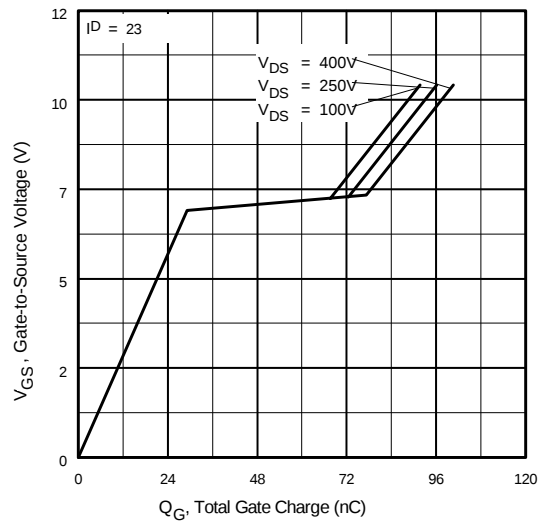
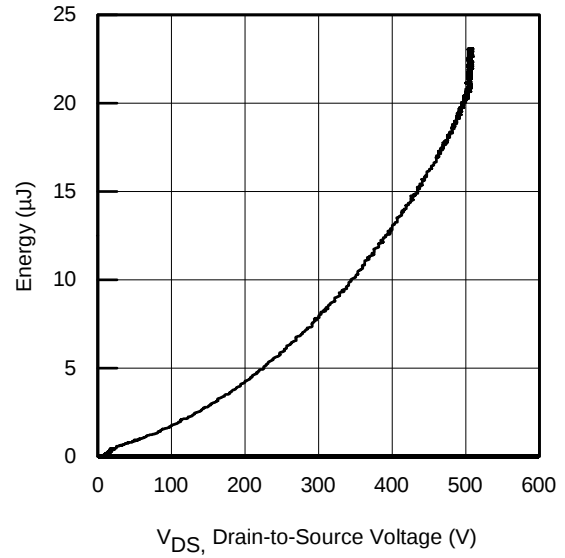
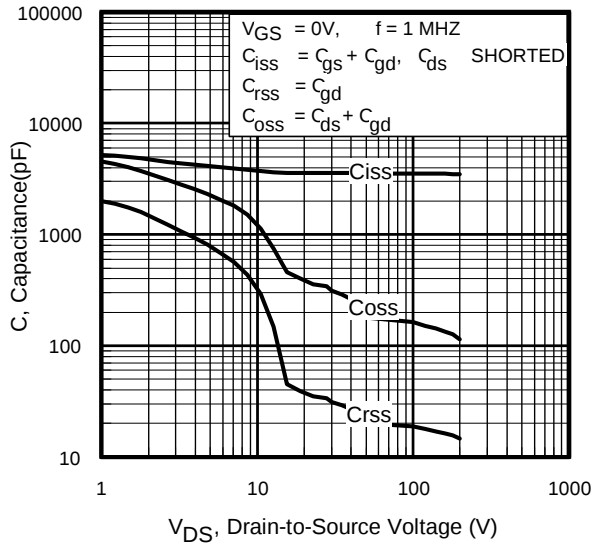


Fig 4. Normalized On-Resistance Vs. Temperature

IRFP23N50L

International
IR Rectifier



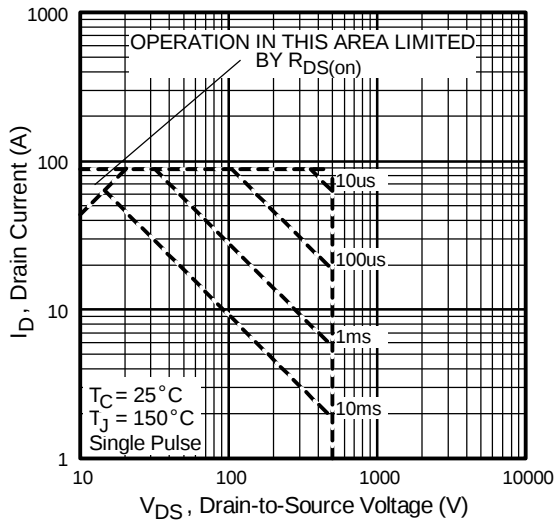


Fig 9. Maximum Safe Operating Area

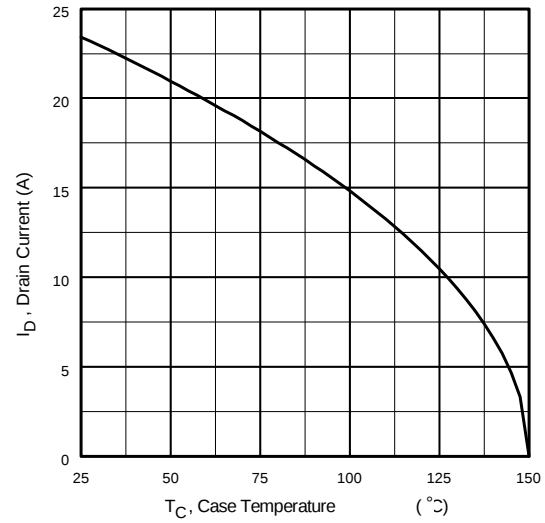


Fig 10. Maximum Drain Current vs. Case Temperature

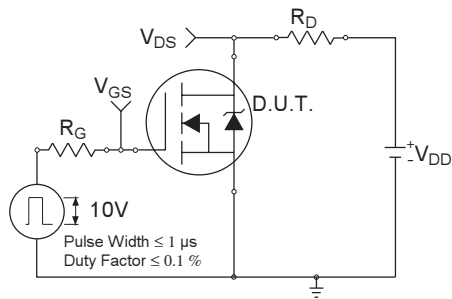


Fig 11a. Switching Time Test Circuit

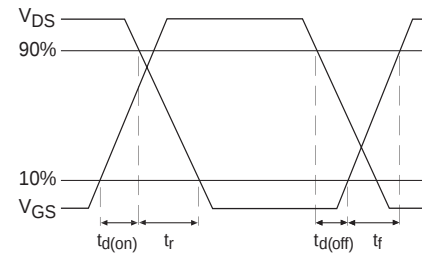


Fig 11b. Switching Time Waveforms

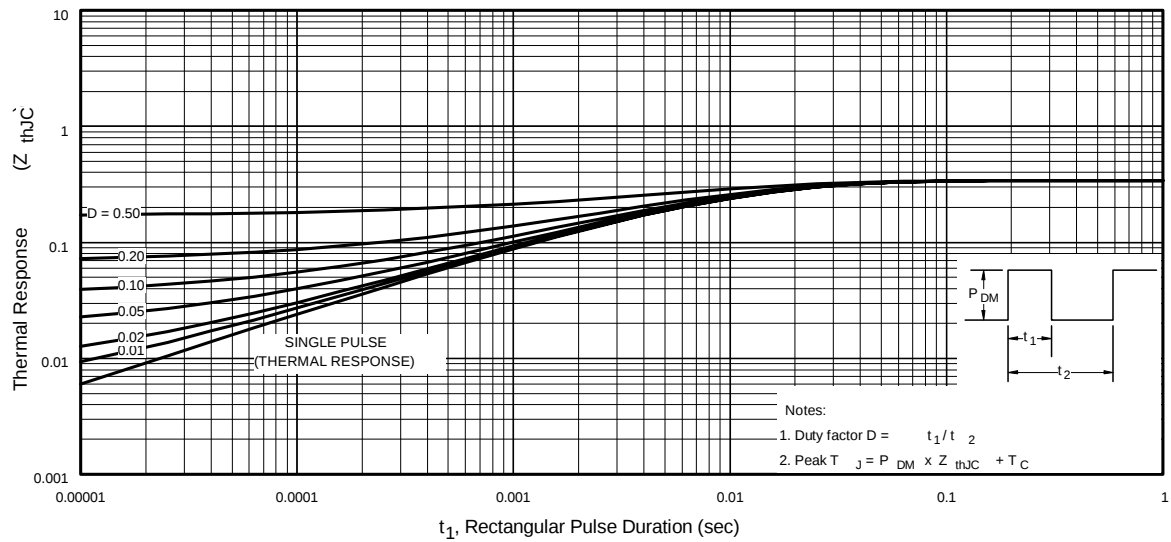


Fig 12. Maximum Effective Transient Thermal Impedance, Junction-to-Case

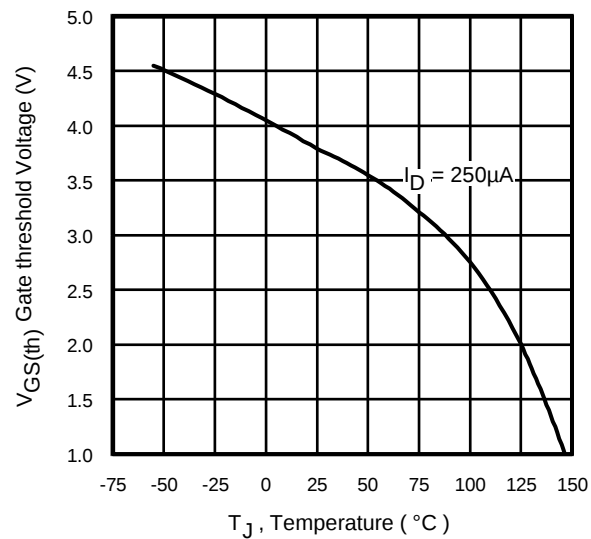


Fig 13. Threshold Voltage vs. Temperature

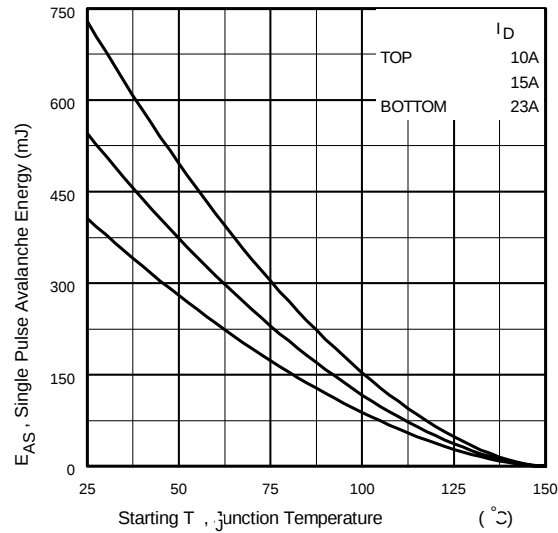


Fig 14. Maximum Avalanche Energy Vs. Drain Current

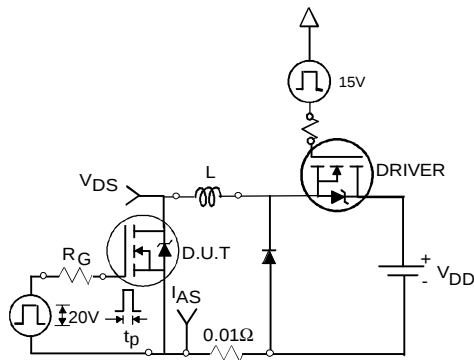


Fig 15a. Unclamped Inductive Test Circuit

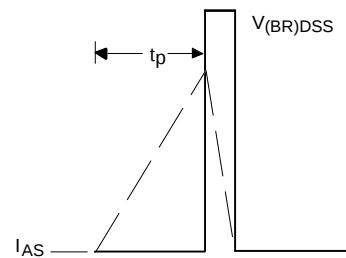


Fig 15b. Unclamped Inductive Waveforms

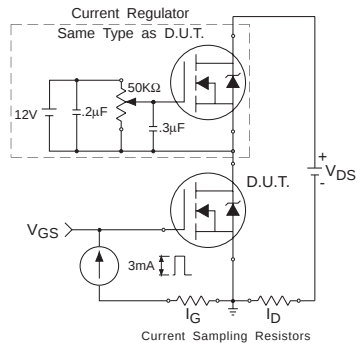


Fig 16a. Gate Charge Test Circuit
www.irf.com

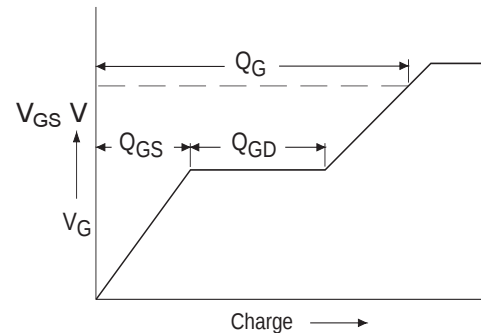
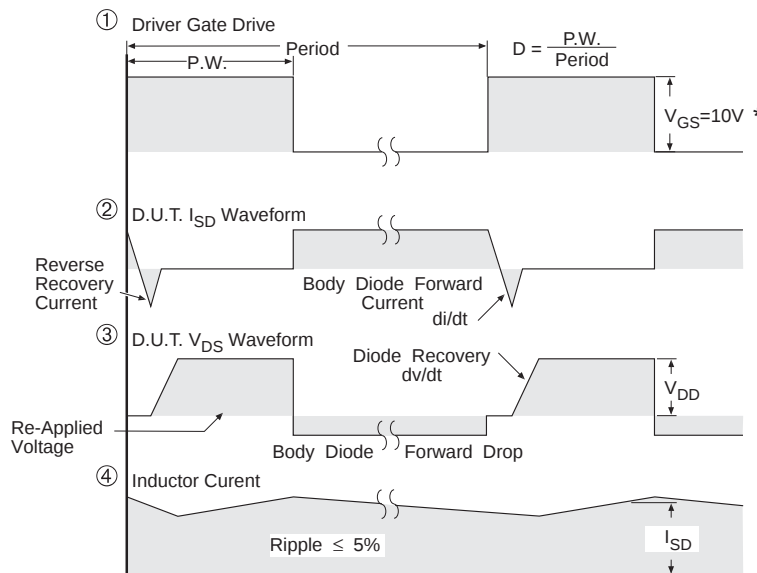
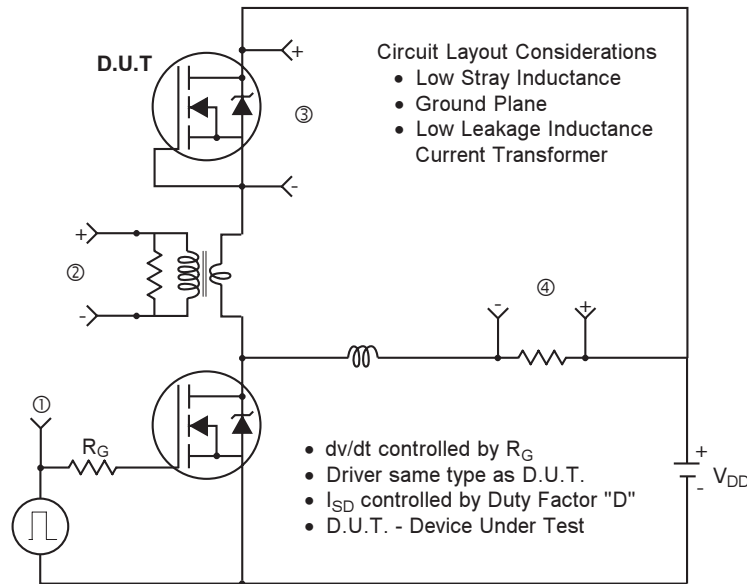


Fig 16b. Basic Gate Charge Waveform

Peak Diode Recovery dv/dt Test Circuit

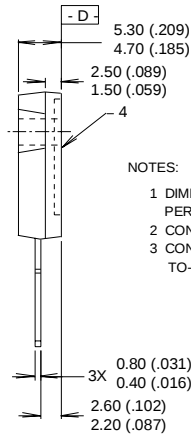
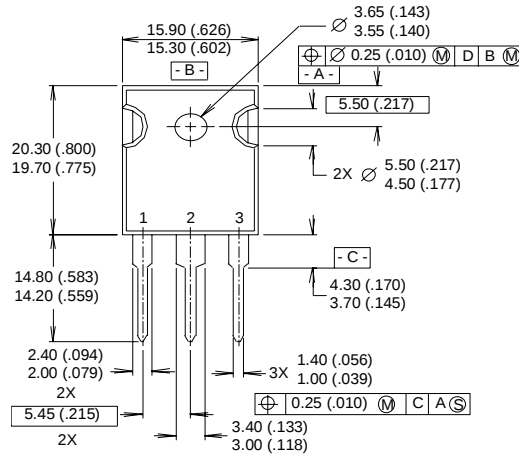


* $V_{GS} = 5V$ for Logic Level Devices

Fig 17. For N-Channel HEXFET® Power MOSFETs

TO-247AC Package Outline

Dimensions are shown in millimeters (inches)



NOTES:

- 1 DIMENSIONING & TOLERANCING PER ANSI Y14.5M, 1982.
- 2 CONTROLLING DIMENSION : INCH.
- 3 CONFORMS TO JEDEC OUTLINE TO-247-AC.

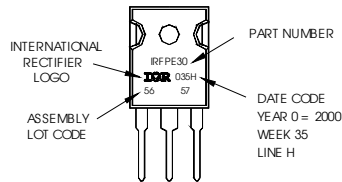
LEAD ASSIGNMENTS

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

TO-247AC Part Marking Information

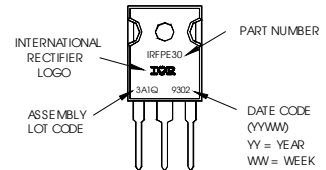
Notes: This part marking information applies to devices produced after 02/26/2001

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



Notes: This part marking information applies to devices produced before 02/26/2001 or for parts manufactured in GB.

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



TO-247AC package is not recommended for Surface Mount Application.

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

International
IR 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.07/03