

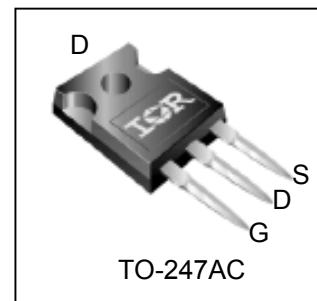
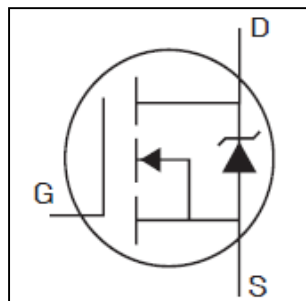
V_{DSS}	300V
$R_{DS(on)}$ typ.	25.5mΩ
max.	32mΩ
I_D	70A

Applications

- High Efficiency Synchronous Rectification in SMPS
- Uninterruptible Power Supply
- High Speed Power Switching
- Hard Switched and High Frequency Circuits

Benefits

- Improved Gate, Avalanche and Dynamic dV/dt Ruggedness
- Fully Characterized Capacitance and Avalanche SOA
- Enhanced body diode dV/dt and dI/dt Capability
- Lead-Free



G	D	S
Gate	Drain	Source

Base Part Number	Package Type	Standard Pack		Orderable Part Number
		Form	Quantity	
IRFP4868PbF	TO-247AC	Tube	25	IRFP4868PbF

Absolute Maximum Ratings

Symbol	Parameter	Max.	Units
$I_D @ T_C = 25^\circ\text{C}$	Continuous Drain Current, $V_{GS} @ 10\text{V}$	70	A
$I_D @ T_C = 100^\circ\text{C}$	Continuous Drain Current, $V_{GS} @ 10\text{V}$	49	
I_{DM}	Pulsed Drain Current ①	280	
$P_D @ T_C = 25^\circ\text{C}$	Maximum Power Dissipation	517	W
	Linear Derating Factor	3.4	W/°C
V_{GS}	Gate-to-Source Voltage	± 20	V
T_J	Operating Junction and	-55 to + 175	°C
T_{STG}	Storage Temperature Range		
	Soldering Temperature, for 10 seconds (1.6mm from case)	300	
	Mounting torque, 6-32 or M3 screw	10lbf.in (1.1N-m)	

Avalanche Characteristics

E_{AS} (Thermally limited)	Single Pulse Avalanche Energy ②	1093	mJ
I_{AR}	Avalanche Current ①	See Fig. 14, 15, 22a, 22b	A
E_{AR}	Repetitive Avalanche Energy ①		mJ

Thermal Resistance

Symbol	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case ⑦⑧	—	0.29	
$R_{\theta CS}$	Case-to-Sink, Flat Greased Surface	0.24	—	°C/W
$R_{\theta JA}$	Junction-to-Ambient	—	40	

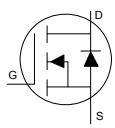
Static @ $T_J = 25^\circ\text{C}$ (unless otherwise specified)

Symbol	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(BR)DSS}$	Drain-to-Source Breakdown Voltage	300	—	—	V	$V_{GS} = 0V, I_D = 250\mu A$
$\Delta V_{(BR)DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	—	0.29	—	V/ $^\circ\text{C}$	Reference to 25°C , $I_D = 5mA$ ①
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	—	25.5	32	m Ω	$V_{GS} = 10V, I_D = 42A$ 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	—	—	20	μA	$V_{DS} = 300V, V_{GS} = 0V$
		—	—	250		$V_{DS} = 300V, V_{GS} = 0V, T_J = 125^\circ\text{C}$
I_{GSS}	Gate-to-Source Forward Leakage	—	—	100	nA	$V_{GS} = 20V$
	Gate-to-Source Reverse Leakage	—	—	-100		$V_{GS} = -20V$
R_G	Internal Gate Resistance	—	1.1	—	Ω	

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

Symbol	Parameter	Min.	Typ.	Max.	Units	Conditions
gfs	Forward Transconductance	80	—	—	S	$V_{DS} = 50V, I_D = 42A$
Q_g	Total Gate Charge	—	180	270	nC	$I_D = 42A$
Q_{gs}	Gate-to-Source Charge	—	60	—		$V_{DS} = 150V$
Q_{gd}	Gate-to-Drain ("Miller") Charge	—	57	—		$V_{GS} = 10V$ ④
Q_{sync}	Total Gate Charge Sync. ($Q_g - Q_{gd}$)	—	123	—		$I_D = 42A, V_{DS} = 0V, V_{GS} = 10V$
$t_{d(on)}$	Turn-On Delay Time	—	24	—	ns	$V_{DD} = 195V$
t_r	Rise Time	—	16	—		$I_D = 42A$
$t_{d(off)}$	Turn-Off Delay Time	—	62	—		$R_G = 1.0\Omega$
t_f	Fall Time	—	45	—		$V_{GS} = 10V$ ④
C_{iss}	Input Capacitance	—	10774	—	pF	$V_{GS} = 0V$
C_{oss}	Output Capacitance	—	612	—		$V_{DS} = 50V$
C_{rss}	Reverse Transfer Capacitance	—	193	—		$f = 1.0\text{ MHz}$, See Fig. 5
$C_{oss\text{ eff. (ER)}}$	Effective Output Capacitance (Energy Related) ⑥	—	406	—		$V_{GS} = 0V, V_{DS} = 0V$ to $240V$ ⑥, See Fig. 11
$C_{oss\text{ eff. (TR)}}$	Effective Output Capacitance (Time Related) ⑤	—	710	—		$V_{GS} = 0V, V_{DS} = 0V$ to $240V$ ⑤

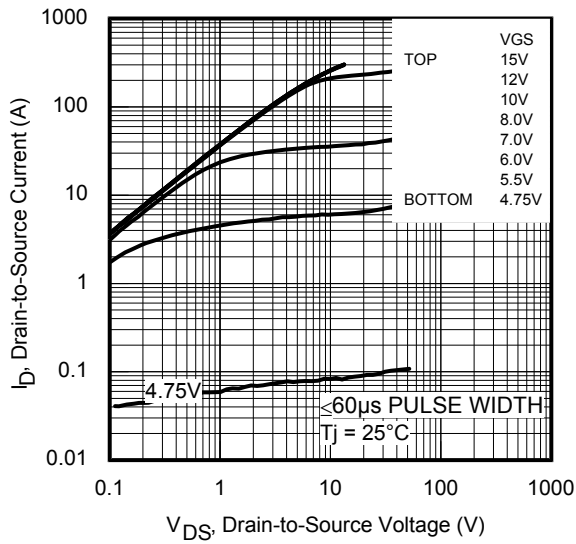
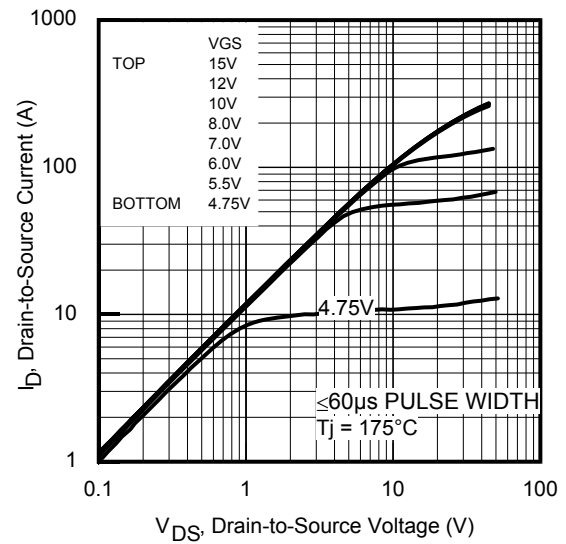
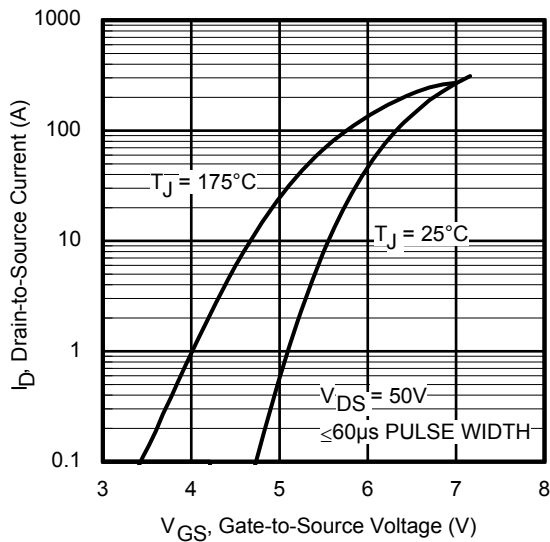
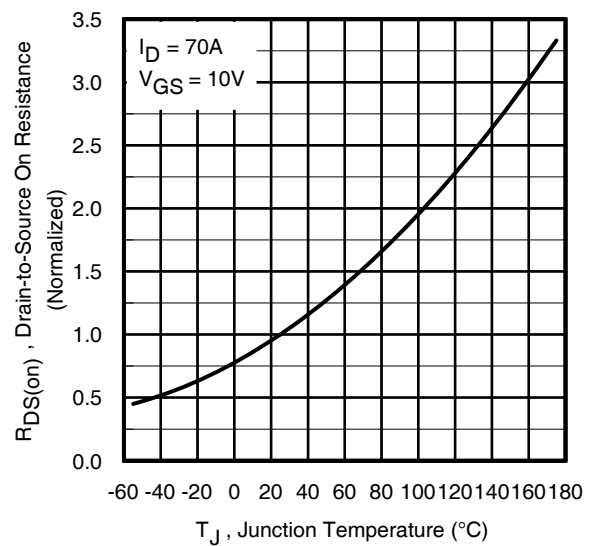
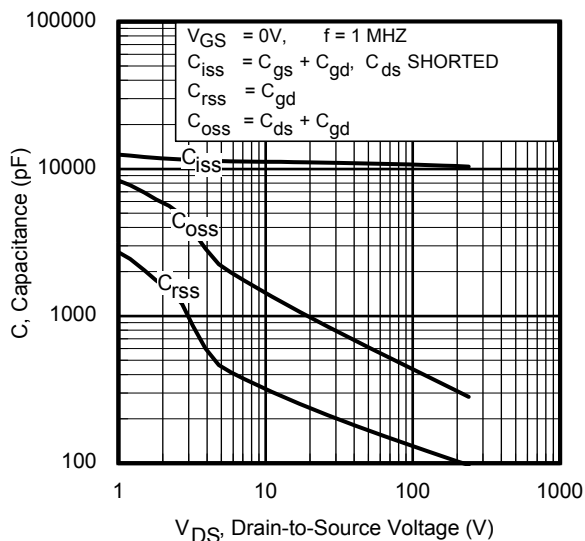
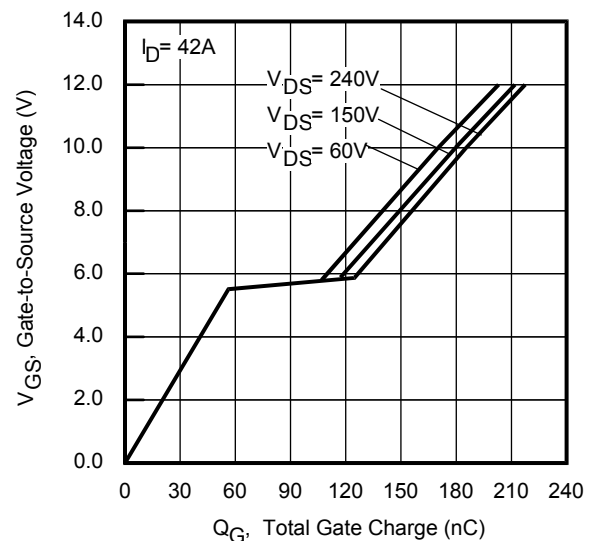
Diode Characteristics

Symbol	Parameter	Min.	Typ.	Max.	Units	Conditions
I_S	Continuous Source Current (Body Diode)	—	—	70	A	MOSFET symbol showing the integral reverse p-n junction diode. 
I_{SM}	Pulsed Source Current (Body Diode) ①	—	—	280	A	
V_{SD}	Diode Forward Voltage	—	—	1.3	V	$T_J = 25^\circ\text{C}, I_S = 42A, V_{GS} = 0V$ ④
dv/dt	Peak Diode Recovery ③	—	7.3	—	V/ns	$T_J = 25^\circ\text{C}, I_S = 42A, V_{DS} = 300V$
t_{rr}	Reverse Recovery Time	—	351	—	ns	$T_J = 25^\circ\text{C}$
		—	454	—		$T_J = 125^\circ\text{C}$
Q_{rr}	Reverse Recovery Charge	—	2520	—	nC	$T_J = 25^\circ\text{C}$
		—	3686	—		$T_J = 125^\circ\text{C}$
I_{RRM}	Reverse Recovery Current	—	16	—	A	$T_J = 25^\circ\text{C}$
t_{on}	Forward Turn-On Time	Intrinsic turn-on time is negligible (turn-on is dominated by $LS+LD$)				

Notes:

- ① Repetitive rating; pulse width limited by max. junction temperature.
- ② Limited by T_{Jmax} , starting $T_J = 25^\circ\text{C}$, $L = 1.2mH$, $R_G = 50\Omega$, $I_{AS} = 42A$, $V_{GS} = 10V$. Part not recommended for use above this value.
- ③ $ISD \leq 42A$, $di/dt \leq 1706A/\mu s$, $V_{DD} \leq V_{(BR)DSS}$, $T_J \leq 175^\circ\text{C}$.
- ④ Pulse width $\leq 400\mu s$; duty cycle $\leq 2\%$.

- ⑤ $C_{oss\text{ eff. (TR)}}$ is a fixed capacitance that gives the same charging time as C_{oss} while V_{DS} is rising from 0 to $80\% V_{DSS}$.
- ⑥ $C_{oss\text{ eff. (ER)}}$ is a fixed capacitance that gives the same energy as C_{oss} while V_{DS} is rising from 0 to $80\% V_{DSS}$.
- ⑦ R_θ is measured at T_J approximately 90°C .
- ⑧ $R_{\theta JC}$ value shown is at time zero.


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

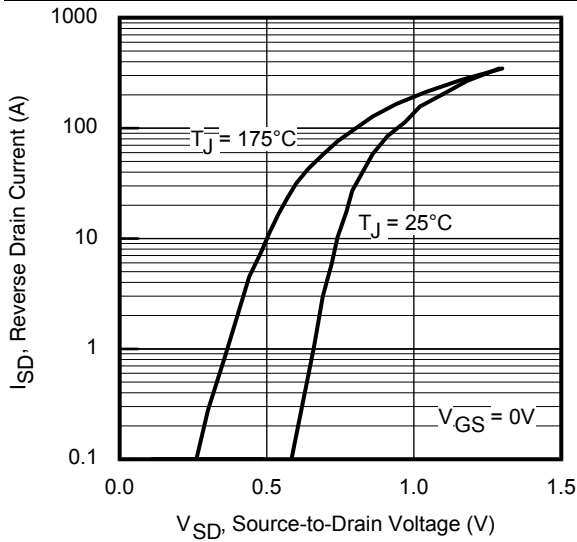


Fig 7. Typical Source-to-Drain Diode Forward Voltage

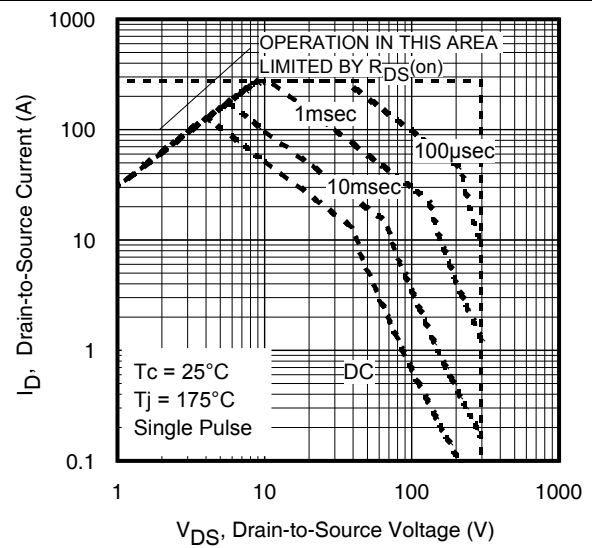


Fig 8. Maximum Safe Operating Area

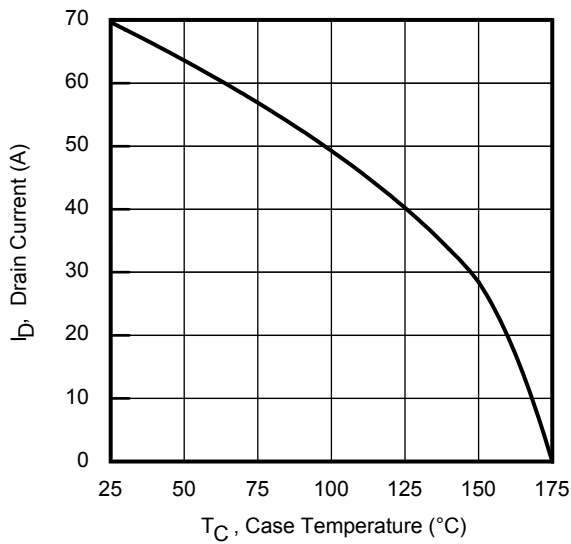


Fig 9. Maximum Drain Current vs. Case Temperature

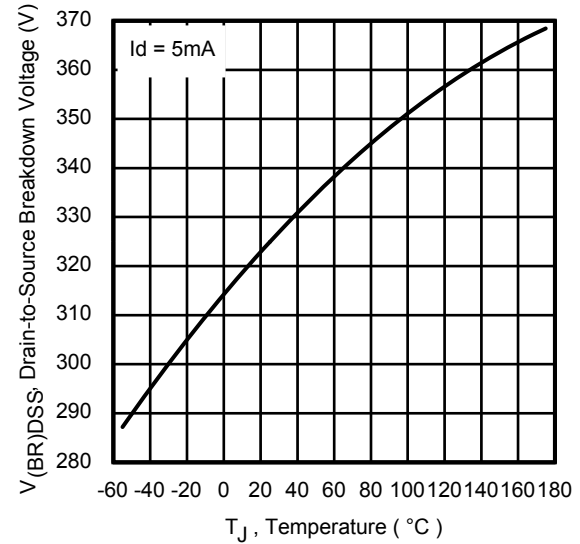


Fig 10. Drain-to-Source Breakdown Voltage

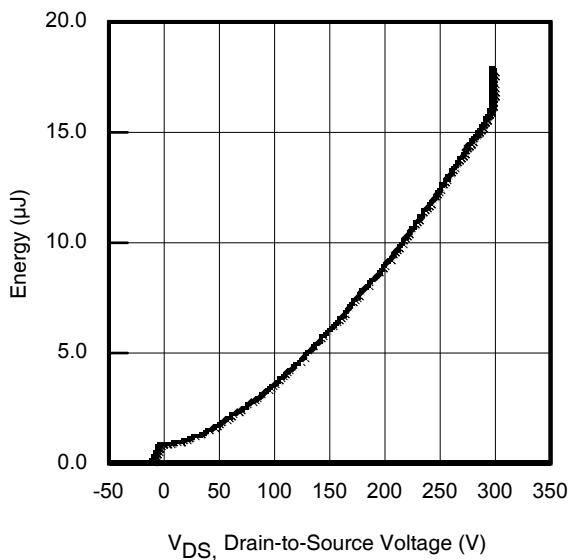


Fig 11. Typical Coss Stored Energy

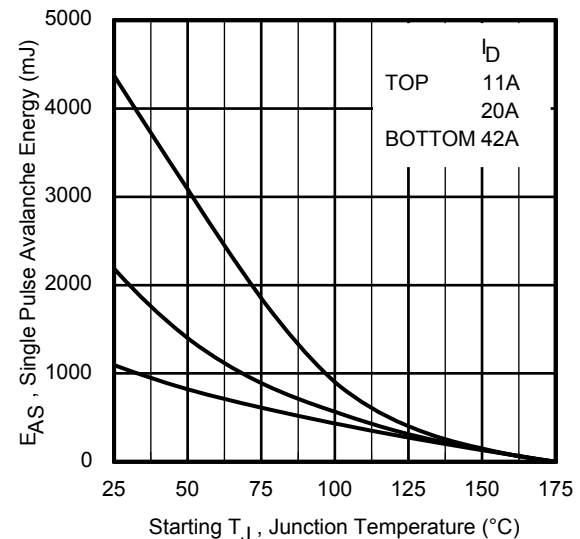


Fig 12. Maximum Avalanche Energy vs. Drain Current

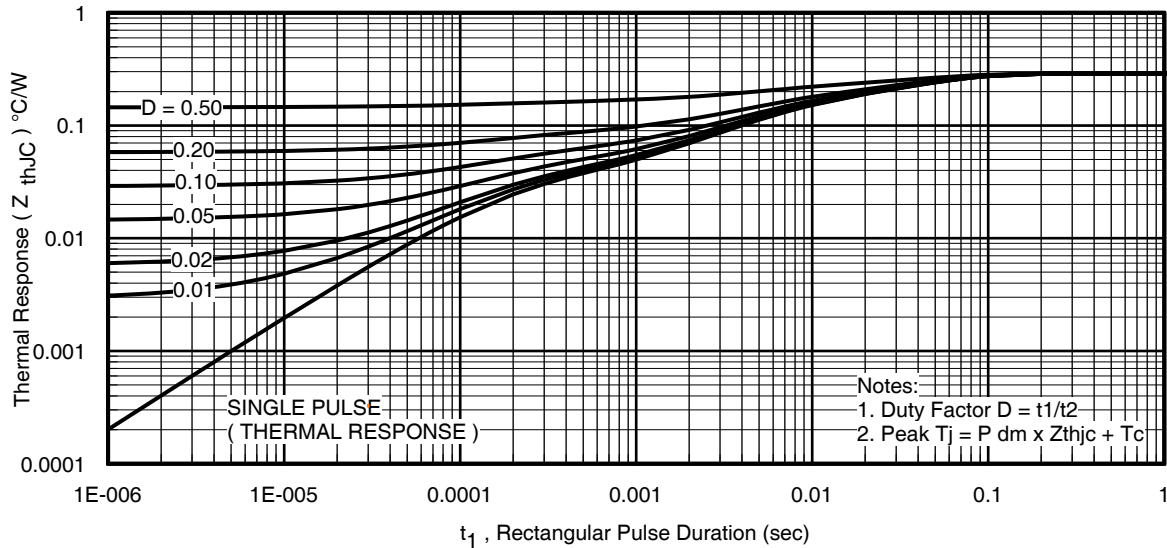


Fig 13. Maximum Effective Transient Thermal Impedance, Junction-to-Case

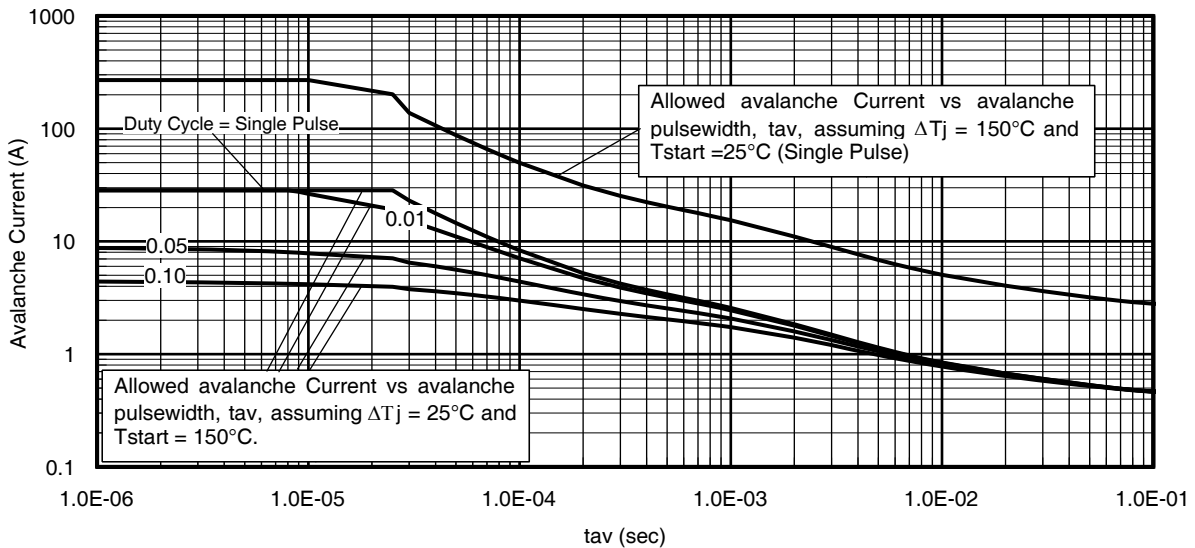


Fig 14. Typical Avalanche Current vs. Pulsewidth

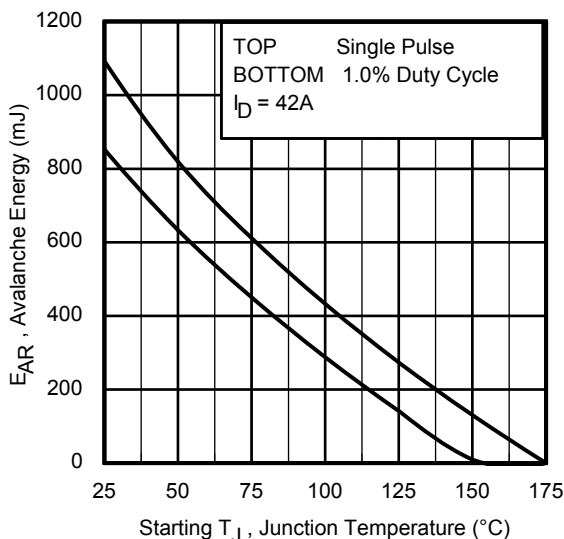


Fig 15. Maximum Avalanche Energy vs. Temperature

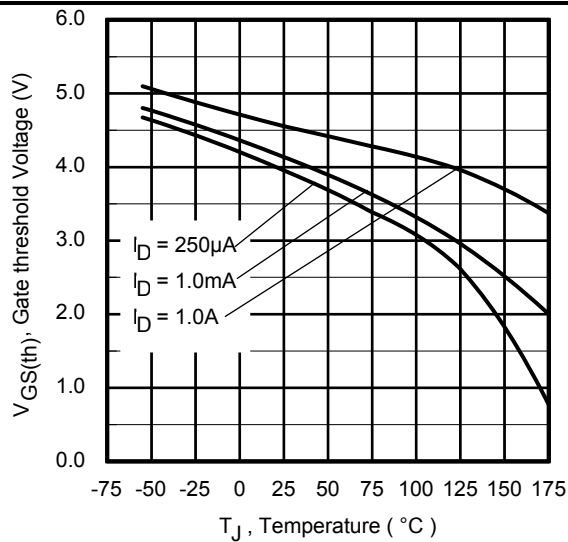
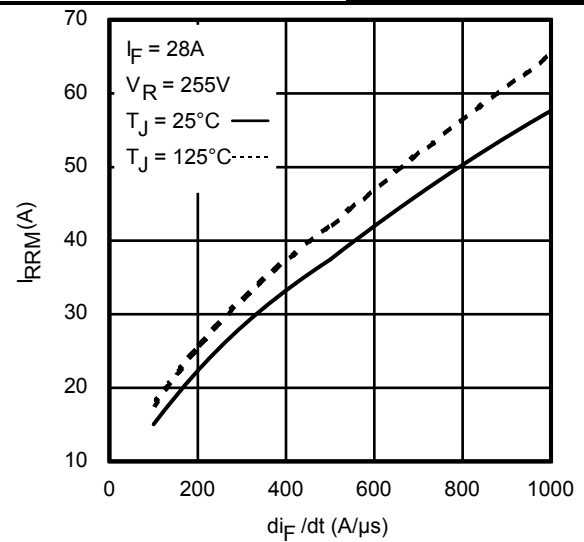
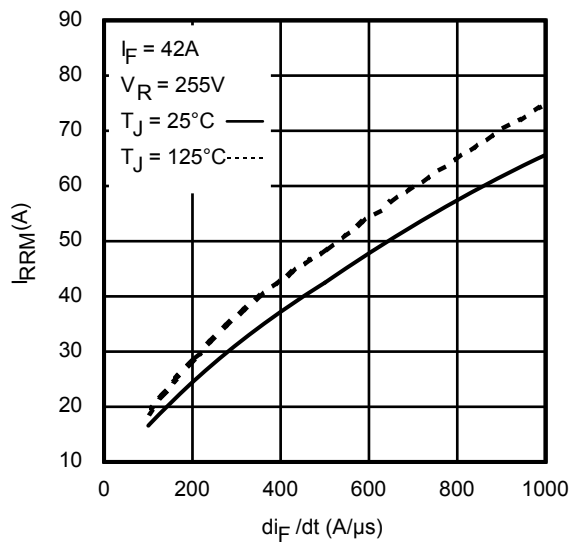
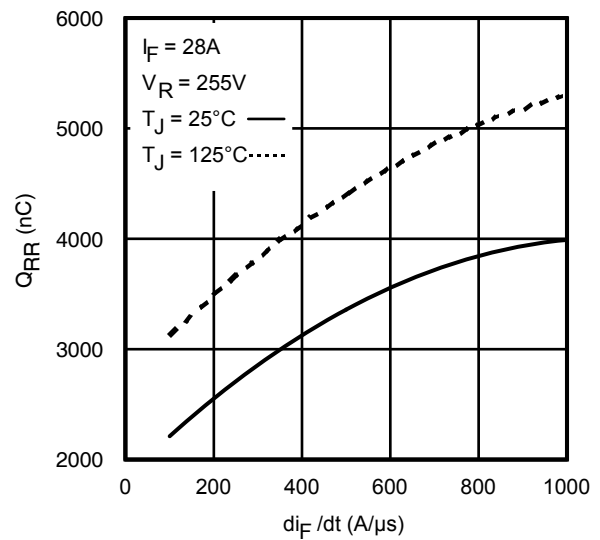
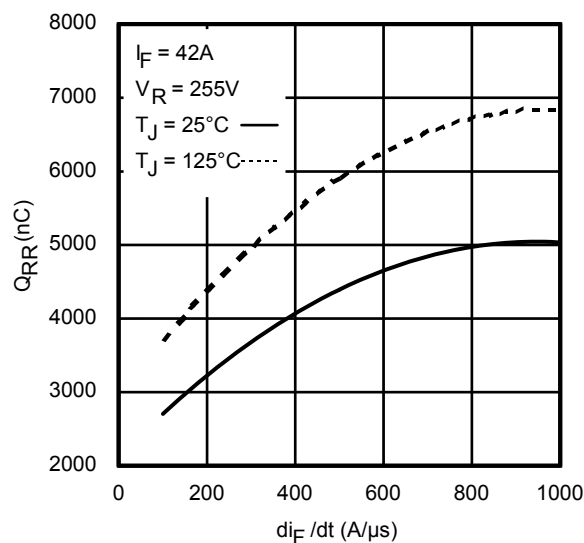
Notes on Repetitive Avalanche Curves , Figures 14, 15:
(For further info, see AN-1005 at www.irf.com)

1. Avalanche failures assumption:
Purely a thermal phenomenon and failure occurs at a temperature far in excess of Tjmax. This is validated for every part type.
2. Safe operation in Avalanche is allowed as long as Tjmax is not exceeded.
3. Equation below based on circuit and waveforms shown in Figures 16a, 16b.
4. $P_{D(ave)}$ = Average power dissipation per single avalanche pulse.
5. BV = Rated breakdown voltage (1.3 factor accounts for voltage increase during avalanche).
6. I_{av} = Allowable avalanche current.
7. ΔT = Allowable rise in junction temperature, not to exceed Tjmax (assumed as 25°C in Figure 14, 15).
 t_{av} = Average time in avalanche.
 D = Duty cycle in avalanche = $tav \cdot f$
 $Z_{thJC}(D, t_{av})$ = Transient thermal resistance, see Figures 13)

$$P_{D(ave)} = 1/2 (1.3 \cdot BV \cdot I_{av}) = \Delta T / Z_{thJC}$$

$$I_{av} = 2\Delta T / [1.3 \cdot BV \cdot Z_{thJC}]$$

$$E_{AS(AR)} = P_{D(ave)} \cdot t_{av}$$


Fig. 16 Threshold Voltage vs. Temperature

Fig. 17 Typical Recovery Current vs. di_F/dt

Fig 18. Typical Recovery Current vs. di_F/dt

Fig 19. Typical Stored Charge vs. di_F/dt

Fig 20. Typical Stored Charge vs. di_F/dt

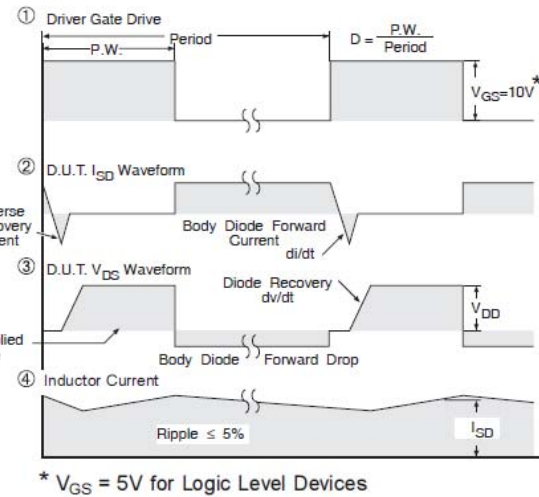
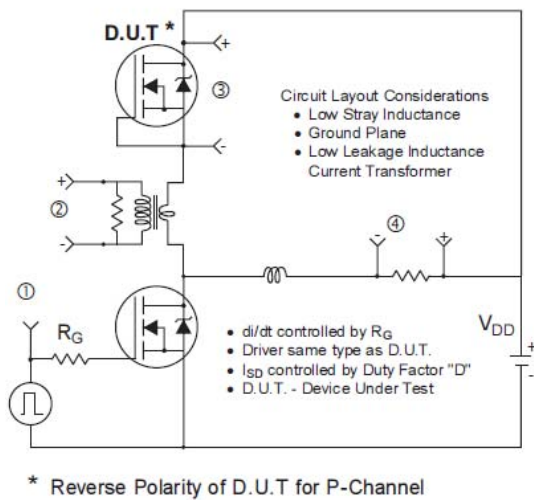


Fig 21. Peak Diode Recovery dv/dt Test Circuit for N-Channel HEXFET® Power MOSFETs

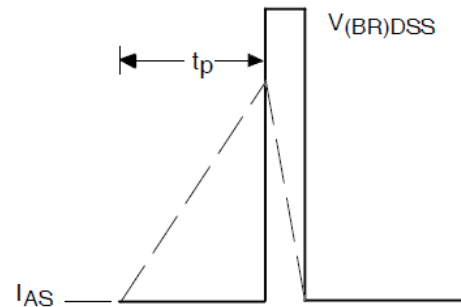
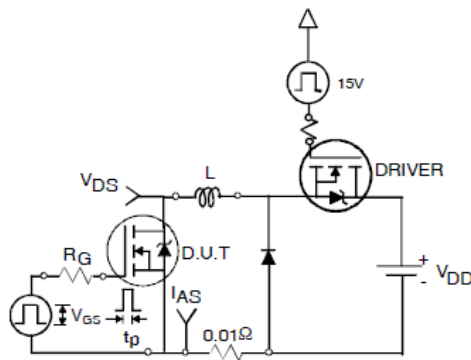


Fig 22a. Unclamped Inductive Test Circuit

Fig 22b. Unclamped Inductive Waveforms

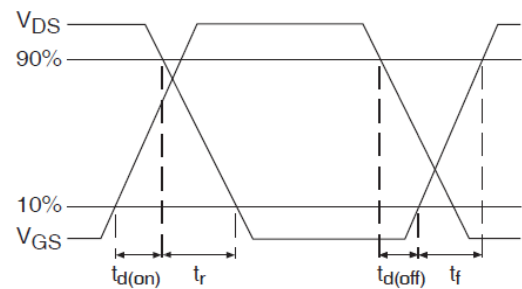
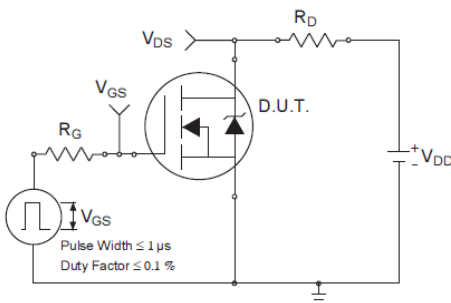


Fig 23a. Switching Time Test Circuit

Fig 23b. Switching Time Waveforms

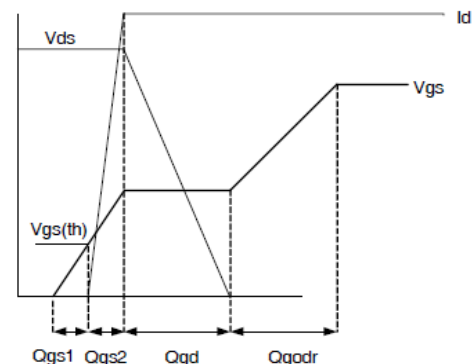
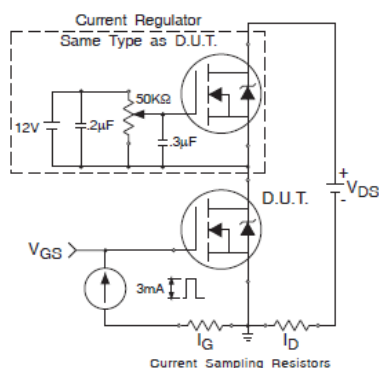
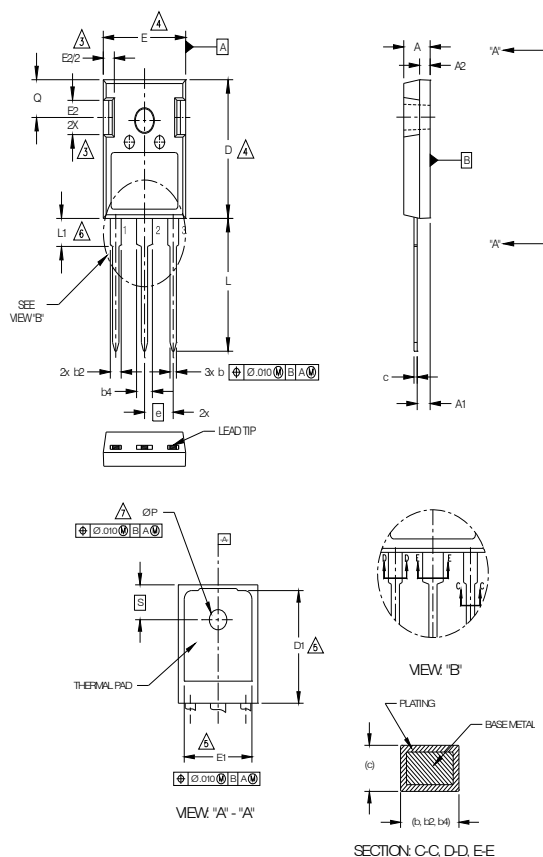


Fig 24a. Gate Charge Test Circuit

Fig 24b. Gate Charge Waveform

TO-247AC Package Outline

Dimensions are shown in millimeters (inches)



SYMBOL	D I M E N S I O N S				NOTES
	INCHES		MILLIMETERS		
	MIN.	MAX.	MIN.	MAX.	
A	.190	.204	4.83	5.20	4 5 4
A1	.090	.100	2.29	2.54	
A2	.075	.085	1.91	2.16	
b	.042	.052	1.07	1.33	
b2	.075	.094	1.91	2.41	
b4	.113	.133	2.87	3.38	
c	.022	.026	0.55	0.68	
D	.819	.830	20.80	21.10	
D1	.640	.694	16.25	17.65	
E	.620	.635	15.75	16.13	
E1	.512	.570	13.00	14.50	
E2	.145	.196	3.68	5.00	
e	.215 Typical		5.45 Typical		
L	.780	.800	19.80	20.32	
L1	.161	.173	4.10	4.40	
ø P	.138	.143	3.51	3.65	
Q	.216	.236	5.49	6.00	
S	.238	.248	6.04	6.30	

LEAD ASSIGNMENTS

HEXFET

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

IGBTs, CoPACK

- 1.- GATE
- 2.- COLLECTOR
- 3.- EMITTER
- 4.- COLLECTOR

DIODES

- 1.- ANODE/OPEN
- 2.- CATHODE
- 3.- ANODE

NOTES:

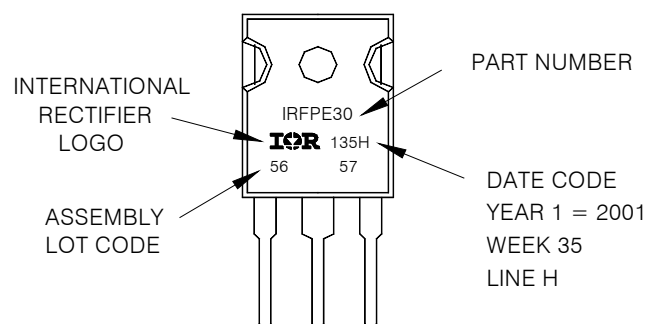
- 1 DIMENSIONING AND TOLERANCING AS PER ASME Y14.5M 1994.
- 2 DIMENSIONS ARE SHOWN IN INCHES AND MILLIMETERS.
- 3 CONTOUR OF SLOT OPTIONAL.
- 4 DIMENSION D & E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED .005" (0.127) PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTERMOST EXTREMES OF THE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

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, 2001
IN THE ASSEMBLY LINE "H"

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



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

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

Qualification information[†]

Qualification level	Industrial ^{††} (per JEDEC JESD47F ^{†††} guidelines)	
Moisture Sensitivity Level	TO-247AC	N/A
RoHS compliant	Yes	

† Qualification standards can be found at International Rectifier's web site

<http://www.irf.com/product-info/reliability>

†† Higher qualification ratings may be available should the user have such requirements.

Please contact your International Rectifier sales representative for further information:

<http://www.irf.com/whoto-call/salesrep/>

††† Applicable version of JEDEC standard at the time of product release.

Data and specifications subject to change without notice.

International
 Rectifier

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TAC Fax: (310) 252-7903

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