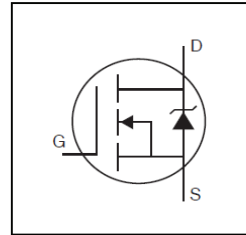


HEXFET® Power MOSFET
Applications

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



V_{DSS}	100V
R_{DS(on)} typ.	3.7mΩ
R_{DS(on)} max.	4.5mΩ
I_D	72A

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
- Halogen-Free


TO-220 Full-Pak

G	D	S
Gate	Drain	Source

Base Part Number	Package Type	Standard Pack		Orderable Part Number
		Form	Quantity	
IRFI4110GPbF	TO-220 Full-Pak	Tube	50	IRFI4110GPbF

Absolute Maximum Ratings

Symbol	Parameter	Max.	Units
I _D @ T _C = 25°C	Continuous Drain Current, V _{GS} @ 10V	72	A
I _D @ T _C = 100°C	Continuous Drain Current, V _{GS} @ 10V	51	
I _{DM}	Pulsed Drain Current ①	290	
P _D @ T _C = 25°C	Maximum Power Dissipation	61	W
	Linear Derating Factor	0.41	W/°C
V _{GS}	Gate-to-Source Voltage	± 20	V
dv/dt	Peak Diode Recovery dv/dt③	27	V/ns
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	10 lbf•in (1.1N•m)	

Avalanche Characteristics

E _{AS}	Single Pulse Avalanche Energy (Thermally Limited) ②	71	mJ
I _{AR}	Avalanche Current ①	43	A
E _{AR}	Repetitive Avalanche Energy ①	6.1	mJ

Thermal Resistance

Symbol	Parameter	Typ.	Max.	Units
R _{θJC}	Junction-to-Case ③	—	2.46	°C/W
R _{θJA}	Junction-to-Ambient (PCB Mount)②	—	65	

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	100	—	—	V	$V_{GS} = 0V, I_D = 250\mu A$
$\Delta V_{(BR)DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	—	0.11	—	V/ $^\circ\text{C}$	Reference to 25°C , $I_D = 5mA$ ①
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	—	3.7	4.5	m Ω	$V_{GS} = 10V, I_D = 43A$
$V_{GS(th)}$	Gate Threshold Voltage	2.0	—	4.0	V	$V_{DS} = V_{GS}, I_D = 250\mu A$
I_{DSS}	Drain-to-Source Leakage Current	—	—	20	μA	$V_{DS} = 100V, V_{GS} = 0V$
		—	—	250		$V_{DS} = 100V, V_{GS} = 0V, T_J = 125^\circ\text{C}$
I_{GSS}	Gate-to-Source Forward Leakage	—	—	100	nA	$V_{GS} = 20V$
	Gate-to-Source Reverse Leakage	—	—	-100		$V_{GS} = -20V$

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

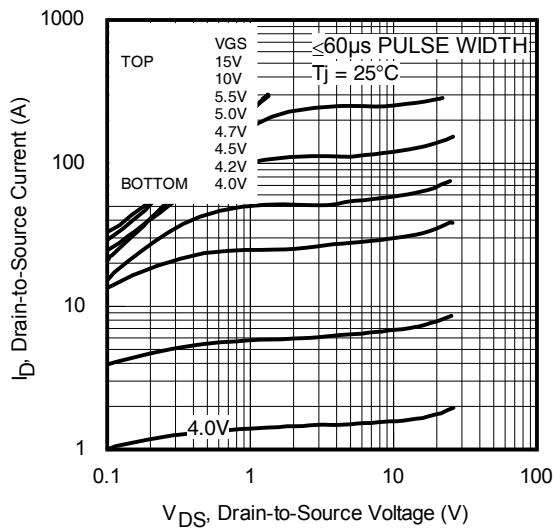
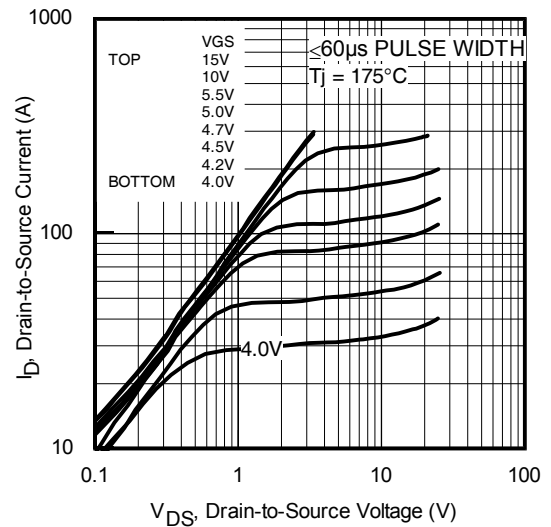
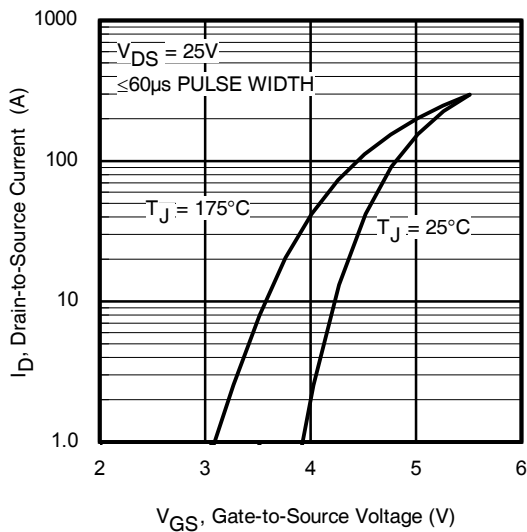
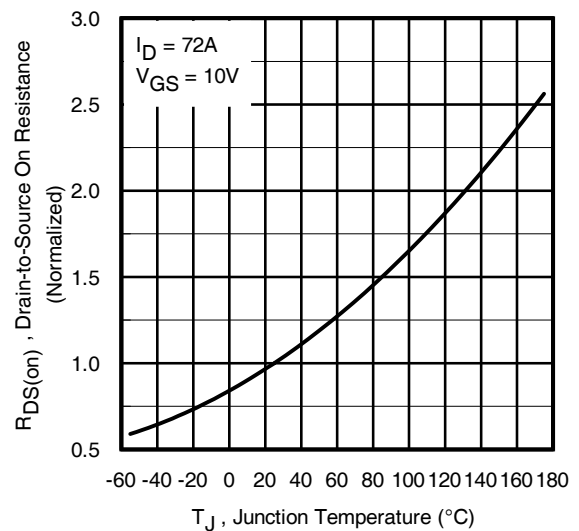
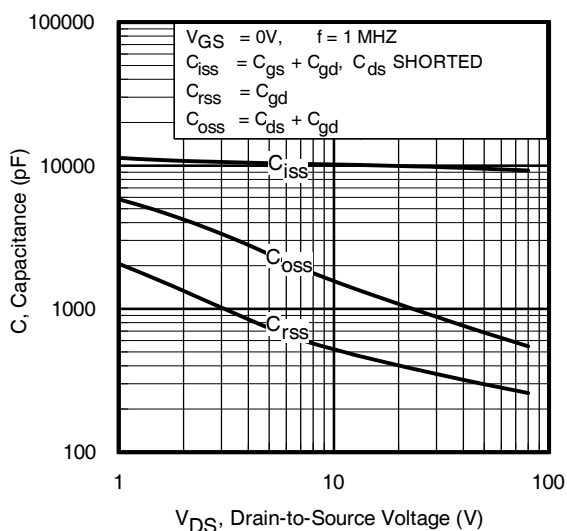
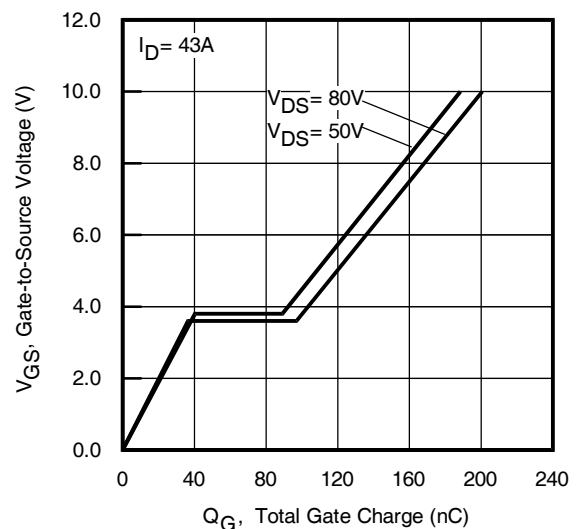
g_{fs}	Forward Trans conductance	260	—	—	S	$V_{DS} = 50V, I_D = 43A$
Q_g	Total Gate Charge	—	190	290	nC	$I_D = 43A$
Q_{gs}	Gate-to-Source Charge	—	40	—		$V_{DS} = 50V$
Q_{gd}	Gate-to-Drain Charge	—	49	—		$V_{GS} = 10V$ ④
R_G	Internal Gate Resistance	—	1.3	—	Ω	
$t_{d(on)}$	Turn-On Delay Time	—	24	—	ns	$V_{DD} = 65V$
t_r	Rise Time	—	58	—		$I_D = 43A$
$t_{d(off)}$	Turn-Off Delay Time	—	81	—		$R_G = 2.6\Omega$
t_f	Fall Time	—	71	—		$V_{GS} = 10V$ ④
C_{iss}	Input Capacitance	—	9540	—	pF	$V_{GS} = 0V$
C_{oss}	Output Capacitance	—	680	—		$V_{DS} = 50V$
C_{rss}	Reverse Transfer Capacitance	—	300	—		$f = 1.0MHz$
$C_{oss \text{ eff. (ER)}}$	Effective Output Capacitance (Energy Related)	—	760	—		$V_{GS}=0V, V_{DS}= 0V \text{ to } 80V$ ⑥
$C_{oss \text{ eff. (TR)}}$	Effective Output Capacitance (Time Related)	—	1120	—		$V_{GS} = 0V, V_{DS} = 0V \text{ to } 80V$ ⑤

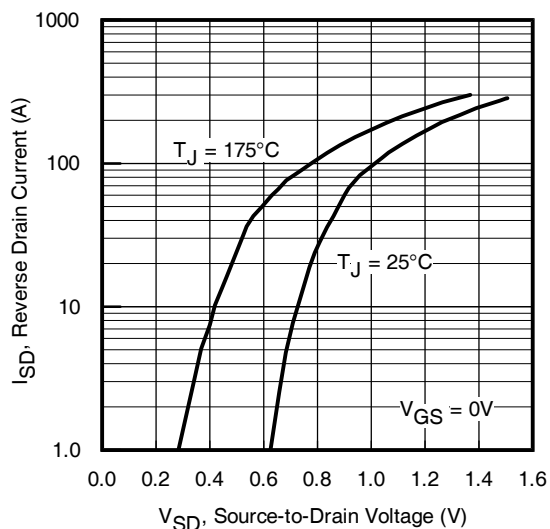
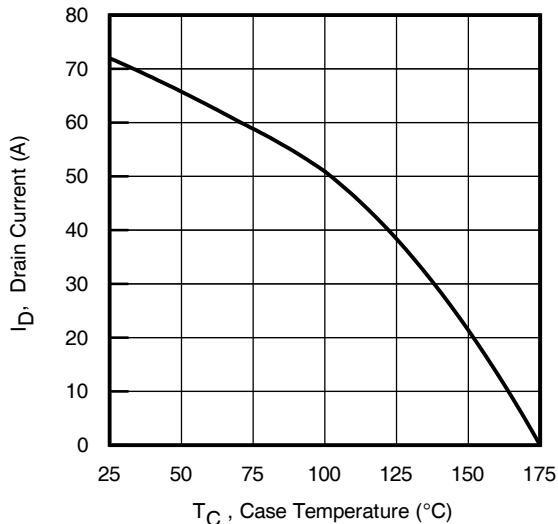
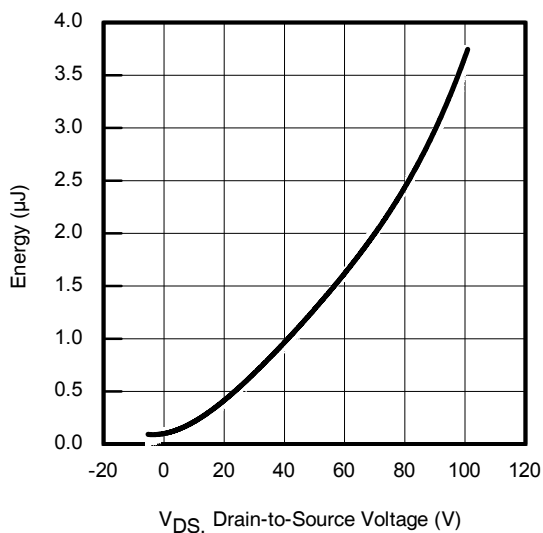
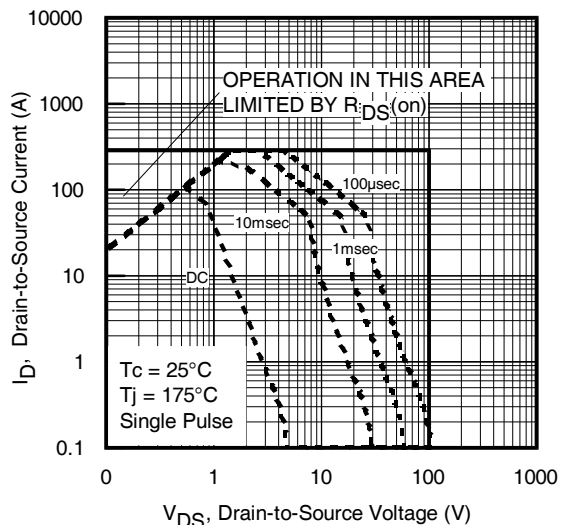
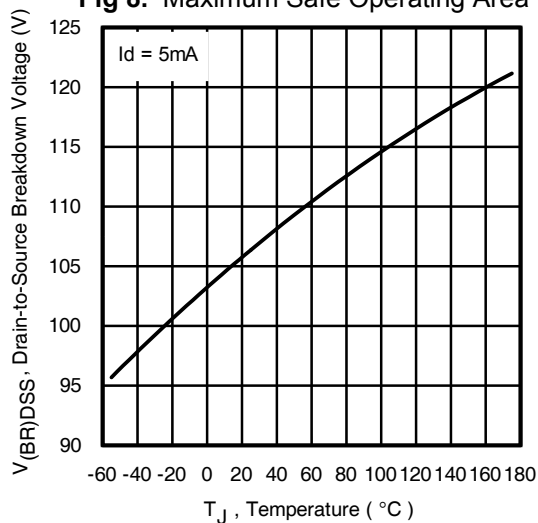
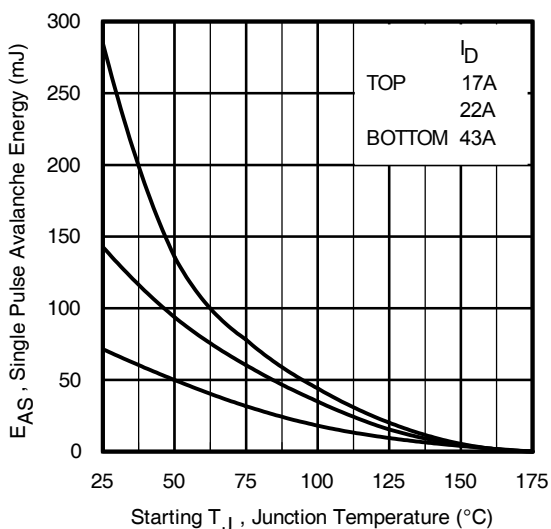
Source-Drain Ratings and Characteristics

	Parameter	Min.	Typ.	Max.	Units	Conditions
I_S	Continuous Source Current (Body Diode)	—	—	72	A	MOSFET symbol showing the integral reverse p-n junction diode. 
I_{SM}	Pulsed Source Current (Body Diode) ①	—	—	290		
V_{SD}	Diode Forward Voltage	—	—	1.3	V	$T_J = 25^\circ\text{C}, I_S = 43A, V_{GS} = 0V$ ④
t_{rr}	Reverse Recovery Time	—	50	75	ns	$T_J = 25^\circ\text{C}$
		—	60	90		$T_J = 125^\circ\text{C}$
Q_{rr}	Reverse Recovery Charge	—	100	150	nC	$T_J = 25^\circ\text{C}$
		—	140	210		$T_J = 125^\circ\text{C}$
I_{RRM}	Reverse Recovery Current	—	3.5	—	A	$T_J = 25^\circ\text{C}$
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 Limited by T_{Jmax} , starting $T_J = 25^\circ\text{C}$, $L = 0.077mH$, $R_G = 50\Omega$, $I_{AS} = 43A$, $V_{GS} = 10V$. Part not recommended for use above this value.
- ③ $I_{SD} \leq 43A$, $di/dt \leq 1600A/\mu s$, $V_{DD} \leq V_{(BR)DSS}$, $T_J \leq 175^\circ\text{C}$.
- 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 When mounted on 1" square PCB (FR-4 or G-10 Material). For recommended footprint and soldering techniques refer to application note #AN-994.
- ⑧ R_θ is measured at T_J approximately 90°C .


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. 9. Maximum Drain Current vs. Case Temperature

Fig. 11. Typical C_{OSS} Stored Energy

Fig 8. Maximum Safe Operating Area

Fig 10. Drain-to-Source Breakdown Voltage

Fig 12. Maximum Avalanche Energy vs. Drain Current

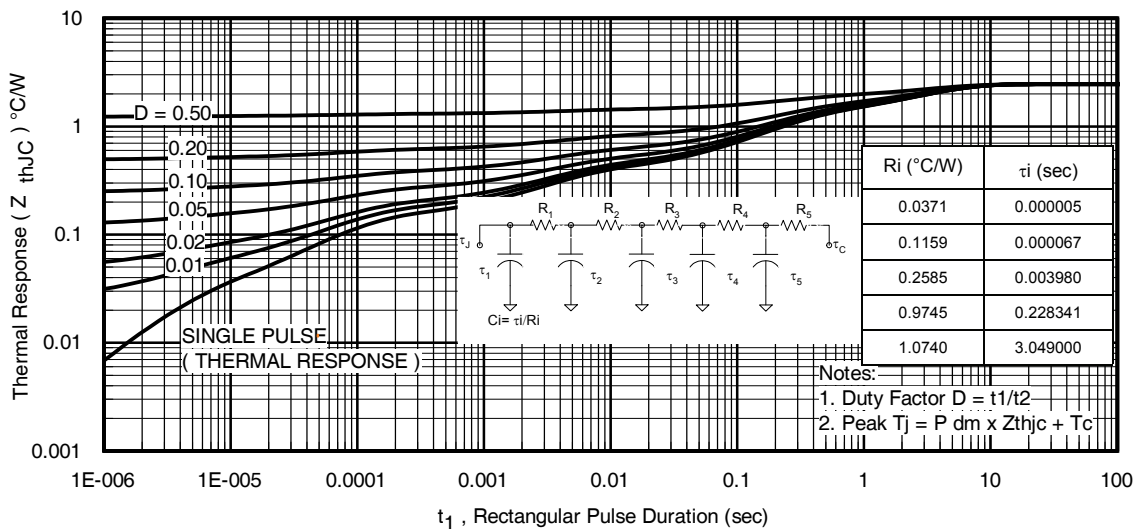


Fig 13. Maximum Effective Transient Thermal Impedance, Junction-to-Case

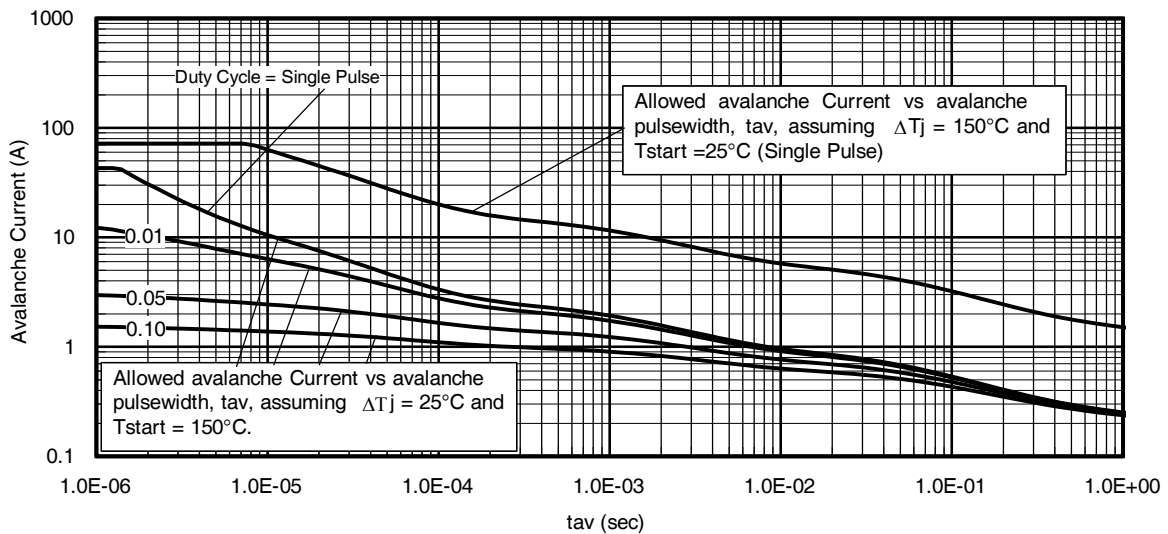


Fig 14. Single Avalanche Event: Pulse Current vs. Pulse Width

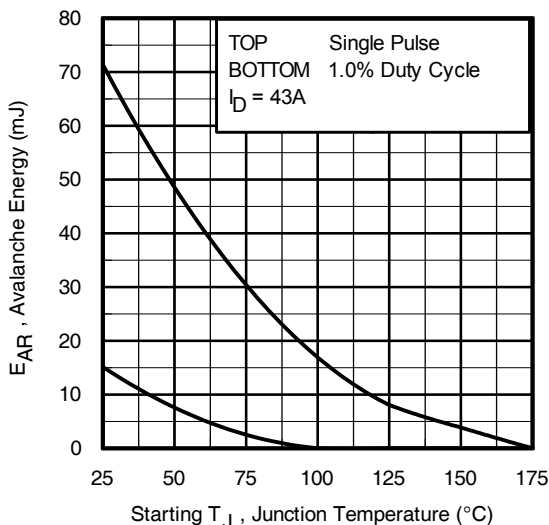


Fig 15. Maximum Avalanche Energy vs. Temperature

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

1. Avalanche failures assumption:

Purely a thermal phenomenon and failure occurs at a temperature far in excess of T_{jmax} . This is validated for every part type.

2. Safe operation in Avalanche is allowed as long as T_{jmax} 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 T_{jmax} (assumed as 25°C in Figure 14, 15).

t_{av} = Average time in avalanche.

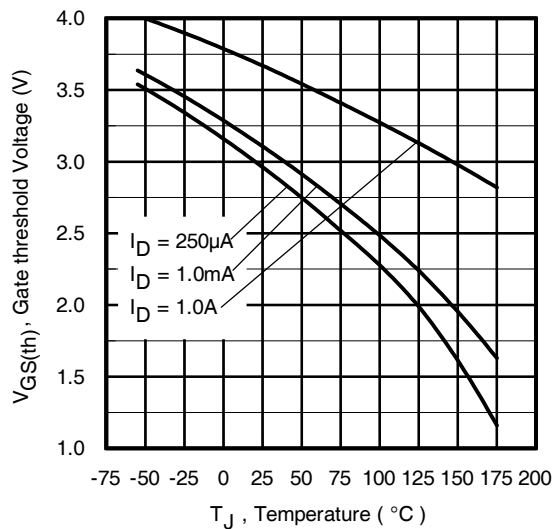
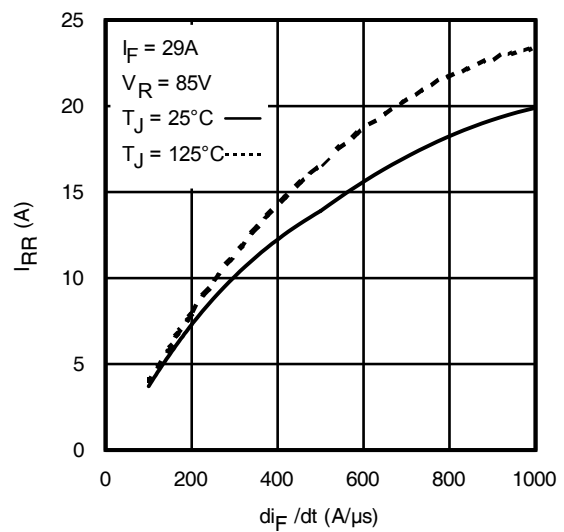
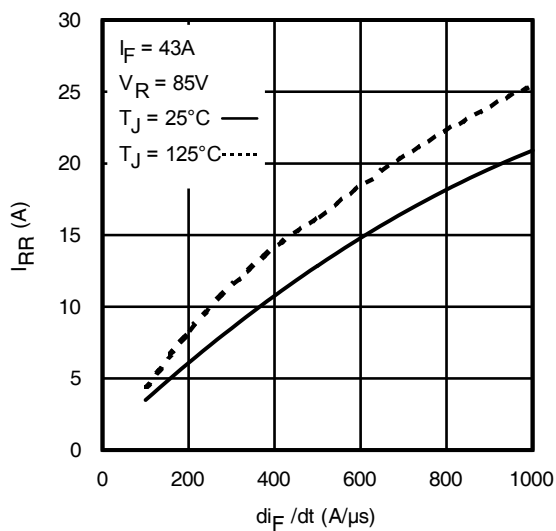
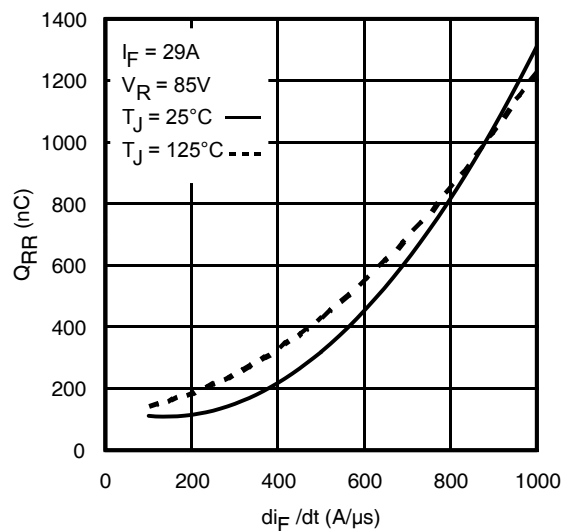
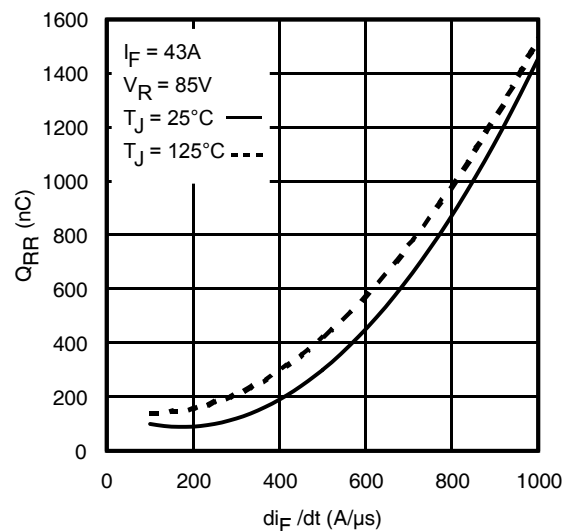
D = Duty cycle in avalanche = $t_{av} \cdot f$

$Z_{thJC}(D, t_{av})$ = 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

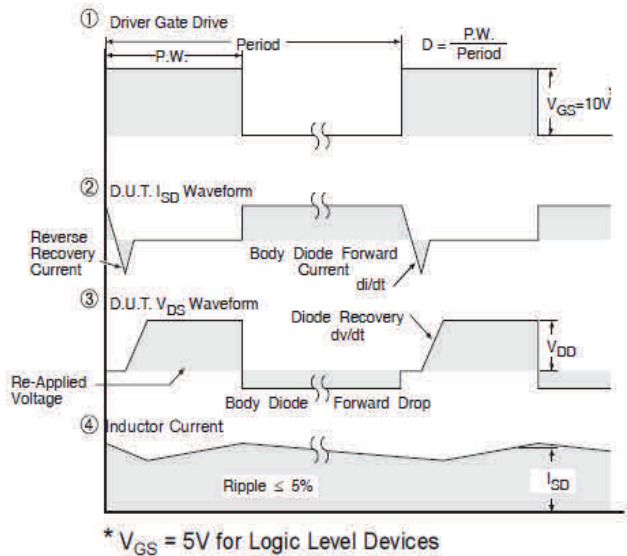
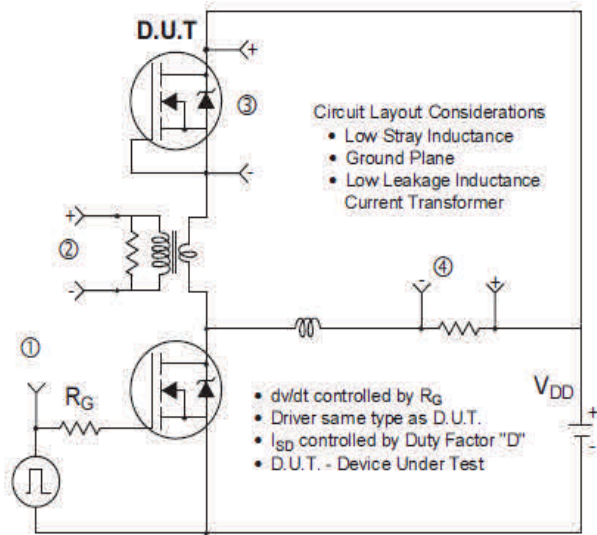


Fig 21. Peak Diode Recovery dv/dt Test Circuit for N-Channel HEXFET® Power MOSFETs

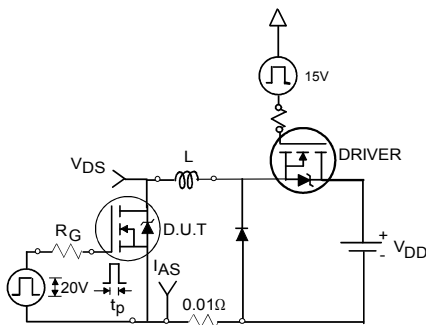


Fig 22a. Unclamped Inductive Test Circuit

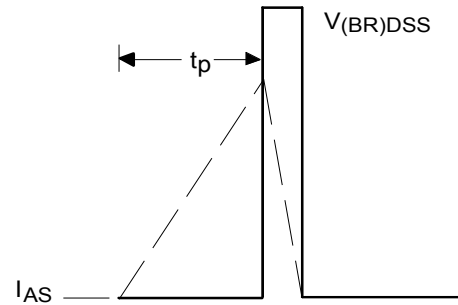


Fig 22b. Unclamped Inductive Waveforms

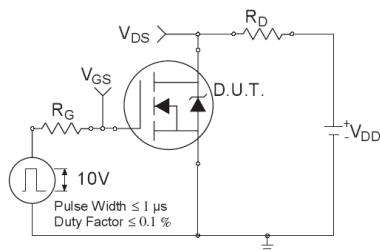


Fig 23a. Switching Time Test Circuit

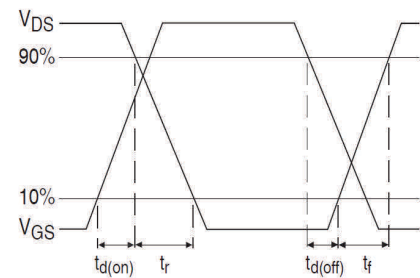


Fig 23b. Switching Time Waveforms

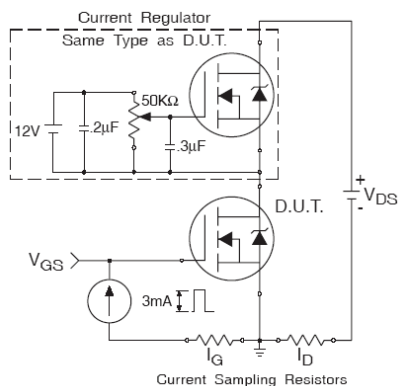


Fig 24a. Gate Charge Test Circuit

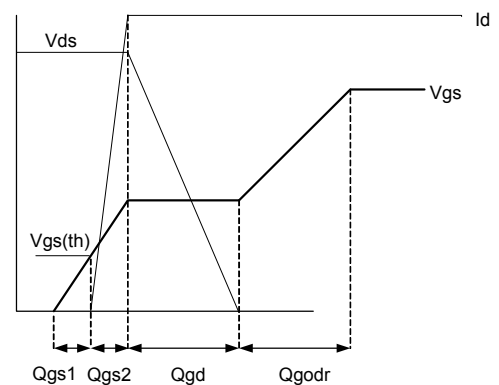
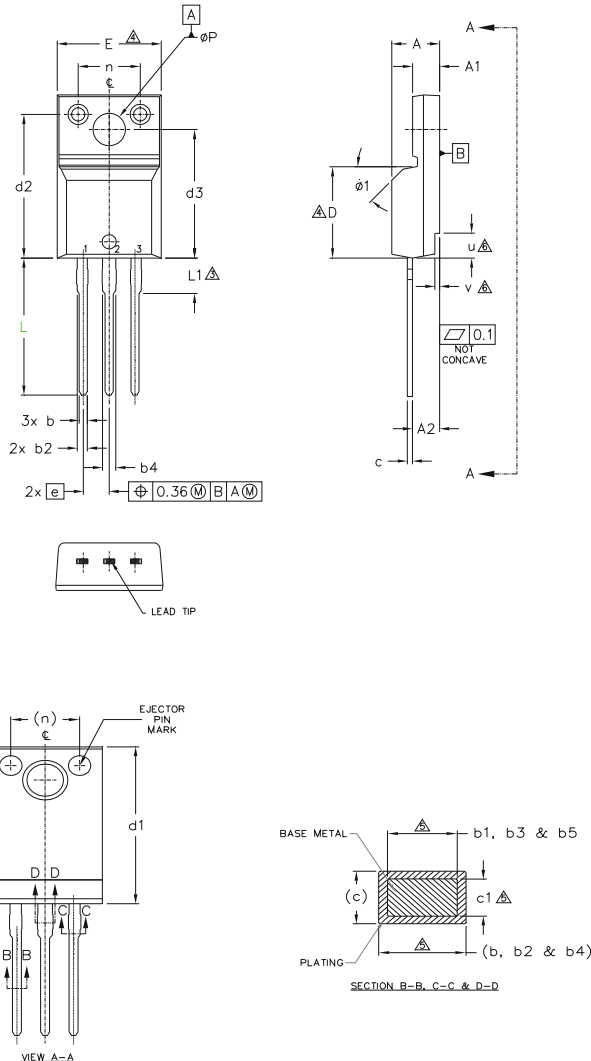


Fig 24b. Gate Charge Waveform

TO-220 Full-Pak Package Outline (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 L1.
- 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.

S Y M B O L	DIMENSIONS				N O T E S
	MILLIMETERS		INCHES		
	MIN.	MAX.	MIN.	MAX.	
A	4.57	4.83	.180	.190	
A1	2.57	2.82	.101	.111	
A2	2.51	2.92	.099	.115	
b	0.61	0.94	.024	.037	
b1	0.61	0.89	.024	.035	
b2	0.76	1.27	.030	.050	5
b3	0.76	1.22	.030	.048	5
b4	1.02	1.52	.040	.060	
b5	1.02	1.47	.040	.058	
c	0.33	0.63	.013	.025	
c1	0.33	0.58	.013	.023	5
D	8.66	9.80	.341	.386	
d1	15.80	16.13	.622	.635	
d2	13.97	14.22	.550	.560	
d3	12.29	12.93	.484	.509	
E	9.63	10.74	.379	.423	
e	2.54	BSC	.100	BSC	
L	13.21	13.72	.520	.540	
L1	3.10	3.68	.122	.145	
n	6.05	6.60	.238	.260	
øP	3.05	3.45	.120	.136	
u	2.39	2.49	.094	.098	6
v	0.41	0.51	.016	.020	6
ø1	—	45°	—	45°	

LEAD ASSIGNMENTS
HEXFET

- 1.— GATE
- 2.— DRAIN
- 3.— SOURCE

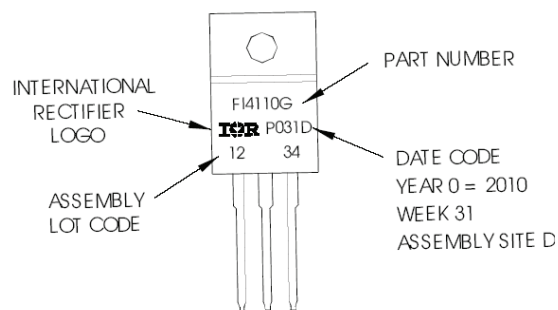
IGBTs, CoPACK

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

TO-220 Full-Pak Part Marking Information

EXAMPLE: THIS IS AN IRFI4110G
WITH ASSEMBLY
LOT CODE 1234
ASSEMBLED ON WW31, 2010

Notes: - "P" in assembly line position
indicates "Lead-Free"
- "G" suffix in part number
indicates "Halogen-Free"



TO-220AB Full-Pak packages are not recommended for Surface Mount Application.

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

Qualification Information

Qualification Level	Industrial (per JEDEC JESD47F) [†]	
Moisture Sensitivity Level	TO-220 Full-Pak	N/A
RoHS Compliant	Yes	

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

Revision History

Date	Comments
04/27/2017	- Changed datasheet with Infineon logo - all pages. - Corrected Package Outline on page 8. - Corrected fig 19 & 20 –Y axis title from “A” to “nC” on page 6. - Added disclaimer on last page.

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