

Applications

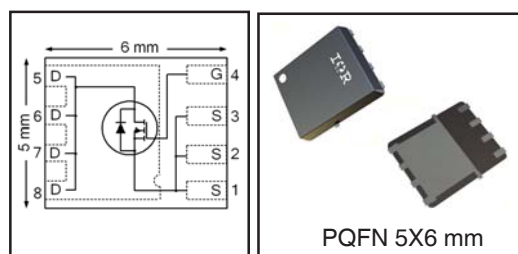
- High Frequency Point-of-Load Synchronous Buck Converter for Applications in Networking & Computing Systems
- Optimized for Control FET Applications

HEXFET® Power MOSFET

V_{DS}	$R_{DS(on)}$ max	Q_g
30V	$8.5m\Omega @ V_{GS} = 10V$	9.3nC

Benefits

- Very low $R_{DS(ON)}$ at 4.5V V_{GS}
- Low Gate Charge
- Fully Characterized Avalanche Voltage and Current
- 100% Tested for R_G
- Lead-Free (Qualified up to 260°C Reflow)
- RoHS compliant (Halogen Free)
- Low Thermal Resistance
- Large Source Lead for more reliable Soldering



Absolute Maximum Ratings

	Parameter	Max.	Units
V_{DS}	Drain-to-Source Voltage	30	V
V_{GS}	Gate-to-Source Voltage	± 20	
$I_D @ T_A = 25^\circ C$	Continuous Drain Current, $V_{GS} @ 10V$	15	A
$I_D @ T_A = 70^\circ C$	Continuous Drain Current, $V_{GS} @ 10V$	12	
$I_D @ T_C = 25^\circ C$	Continuous Drain Current, $V_{GS} @ 10V$	34	
I_{DM}	Pulsed Drain Current ①	120	
$P_D @ T_A = 25^\circ C$	Power Dissipation ⑤	3.1	W
$P_D @ T_A = 70^\circ C$	Power Dissipation ⑤	2.0	
	Linear Derating Factor ⑤	0.025	W/°C
T_J T_{STG}	Operating Junction and Storage Temperature Range	-55 to + 150	°C

Thermal Resistance

	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case ④	—	7.9	°C/W
$R_{\theta JA}$	Junction-to-Ambient ⑤	—	40	

Notes ① through ⑤ are on page 9

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

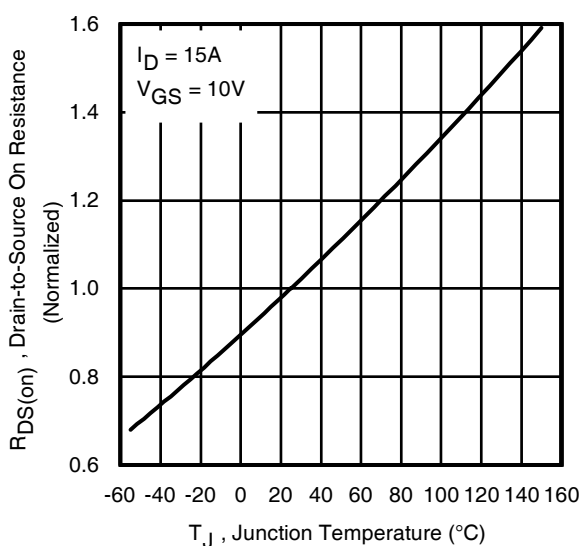
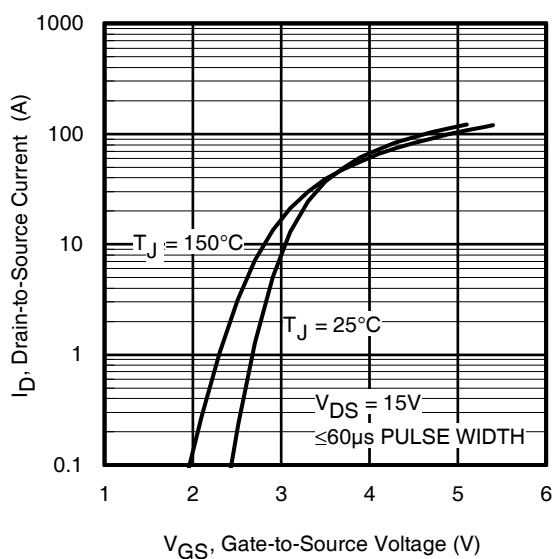
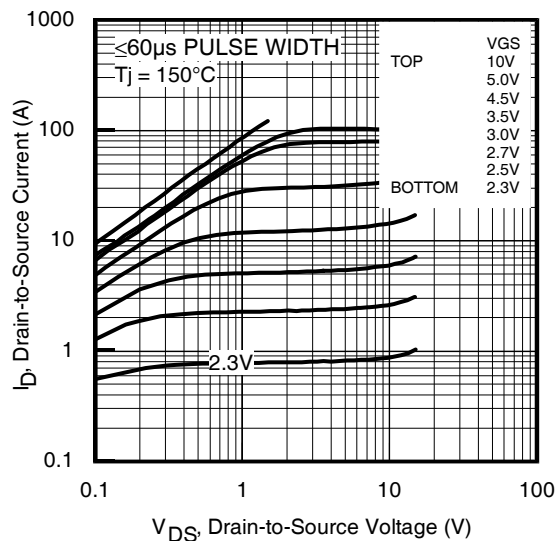
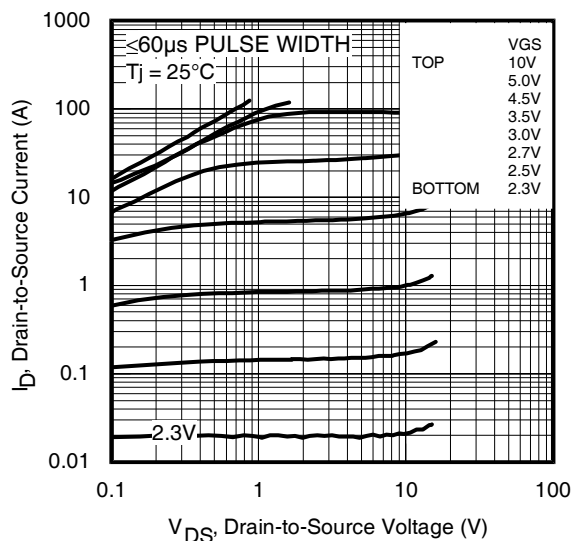
	Parameter	Min.	Typ.	Max.	Units	Conditions
BV_{DSS}	Drain-to-Source Breakdown Voltage	30	—	—	V	$V_{GS} = 0V, I_D = 250\mu A$
$\Delta BV_{DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	—	0.02	—	V/°C	Reference to 25°C , $I_D = 1mA$
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	—	7.1	8.5	mΩ	$V_{GS} = 10V, I_D = 15A$ ③
		—	10.4	12.5		$V_{GS} = 4.5V, I_D = 12A$ ③
$V_{GS(th)}$	Gate Threshold Voltage	1.35	1.8	2.35	V	$V_{DS} = V_{GS}, I_D = 25\mu A$
$\Delta V_{GS(th)}$	Gate Threshold Voltage Coefficient	—	-6.2	—	mV/°C	
I_{DSS}	Drain-to-Source Leakage Current	—	—	1.0	μA	$V_{DS} = 24V, V_{GS} = 0V$
		—	—	150		$V_{DS} = 24V, V_{GS} = 0V, T_J = 125^\circ\text{C}$
I_{GSS}	Gate-to-Source Forward Leakage	—	—	100	nA	$V_{GS} = 20V$
	Gate-to-Source Reverse Leakage	—	—	-100		$V_{GS} = -20V$
g_{fs}	Forward Transconductance	27	—	—	S	$V_{DS} = 15V, I_D = 12A$
Q_g	Total Gate Charge	—	9.3	14	nC	$V_{DS} = 15V$ $V_{GS} = 4.5V$ $I_D = 12A$ See Fig.17 & 18
Q_{gs1}	Pre-V _{th} Gate-to-Source Charge	—	2.2	—		
Q_{gs2}	Post-V _{th} Gate-to-Source Charge	—	1.2	—		
Q_{gd}	Gate-to-Drain Charge	—	3.2	—		
Q_{godr}	Gate Charge Overdrive	—	2.7	—		
Q_{sw}	Switch Charge ($Q_{gs2} + Q_{gd}$)	—	4.4	—		
Q_{oss}	Output Charge	—	5.0	—	nC	$V_{DS} = 16V, V_{GS} = 0V$
R_G	Gate Resistance	—	1.4	2.4	Ω	
$t_{d(on)}$	Turn-On Delay Time	—	12	—	ns	$V_{DD} = 15V, V_{GS} = 4.5V$ $I_D = 12A$ $R_G = 1.8\Omega$ See Fig.15
t_r	Rise Time	—	7.6	—		
$t_{d(off)}$	Turn-Off Delay Time	—	14	—		
t_f	Fall Time	—	4.7	—		
C_{iss}	Input Capacitance	—	1210	—	pF	$V_{GS} = 0V$
C_{oss}	Output Capacitance	—	240	—		$V_{DS} = 15V$
C_{rss}	Reverse Transfer Capacitance	—	120	—		$f = 1.0MHz$

Avalanche Characteristics

	Parameter	Typ.	Max.	Units
E_{AS}	Single Pulse Avalanche Energy ②	—	29	mJ
I_{AR}	Avalanche Current ①	—	12	A

Diode Characteristics

	Parameter	Min.	Typ.	Max.	Units	Conditions
I_S	Continuous Source Current (Body Diode)	—	—	3.9	A	MOSFET symbol showing the integral reverse p-n junction diode.
I_{SM}	Pulsed Source Current (Body Diode) ①	—	—	120		
V_{SD}	Diode Forward Voltage	—	—	1.0	V	$T_J = 25^\circ\text{C}, I_S = 12A, V_{GS} = 0V$ ③
t_{rr}	Reverse Recovery Time	—	12	18	ns	$T_J = 25^\circ\text{C}, I_F = 12A, V_{DD} = 15V$
Q_{rr}	Reverse Recovery Charge	—	11	17	nC	$di/dt = 300A/\mu s$ ③
t_{on}	Forward Turn-On Time	Intrinsic turn-on time is negligible (turn-on is dominated by LS+LD)				



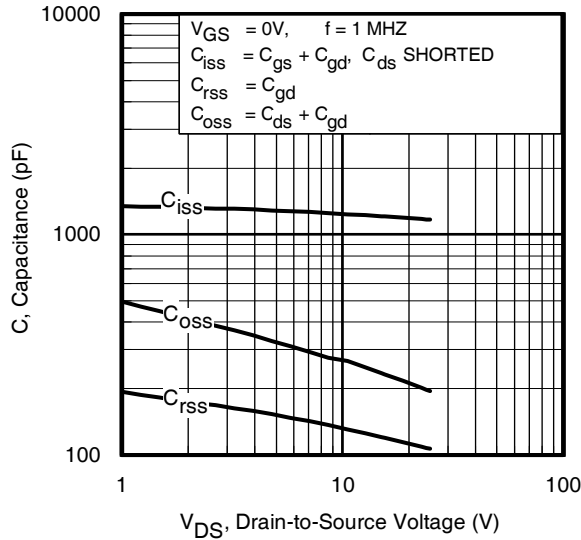


Fig 5. Typical Capacitance vs. Drain-to-Source Voltage

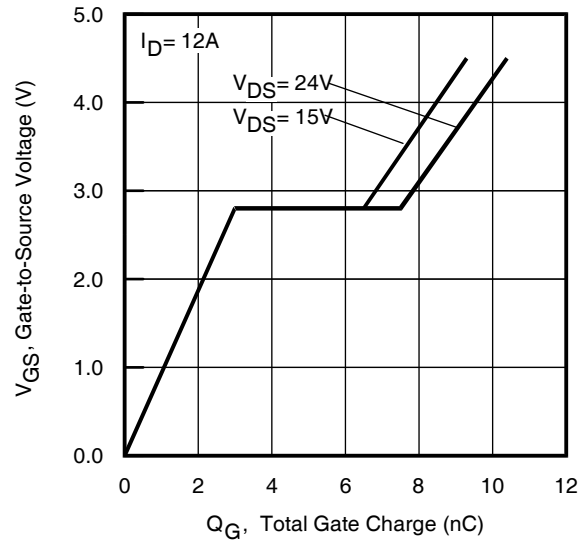


Fig 6. Typical Gate Charge vs. Gate-to-Source Voltage

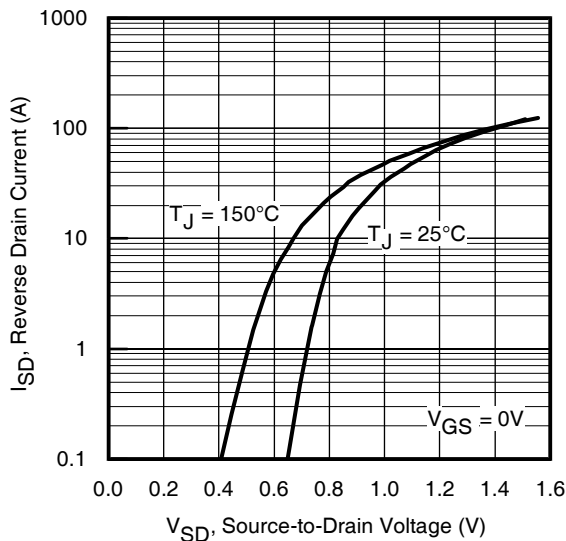


Fig 7. Typical Source-Drain Diode Forward Voltage

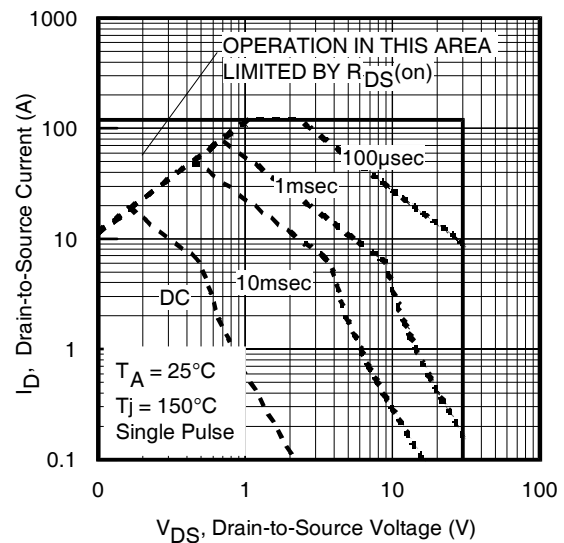


Fig 8. Maximum Safe Operating Area

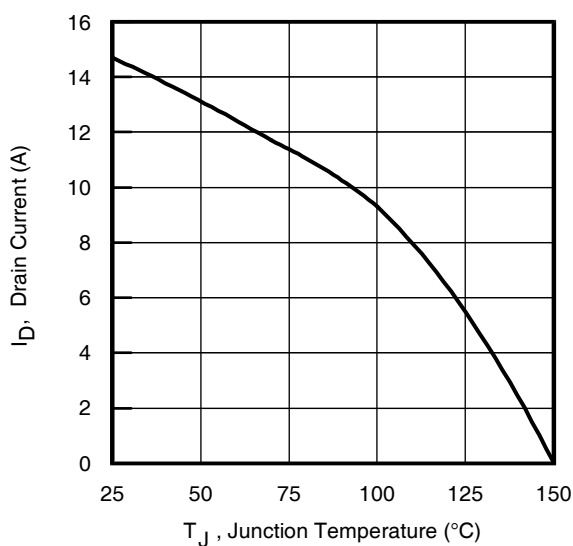


Fig 9. Maximum Drain Current vs. Ambient Temperature

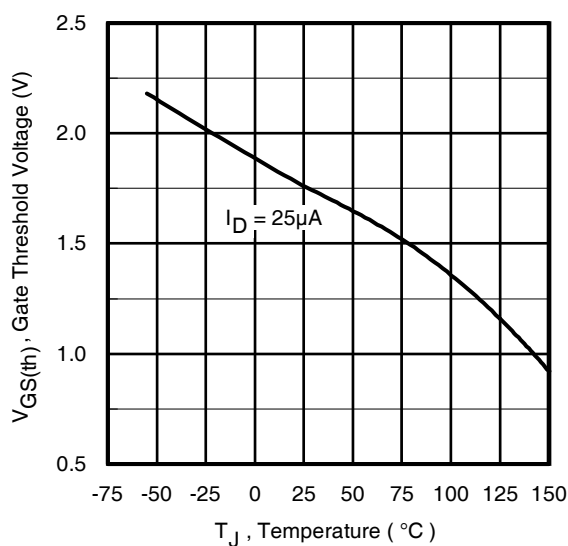


Fig 10. Threshold Voltage vs. Temperature

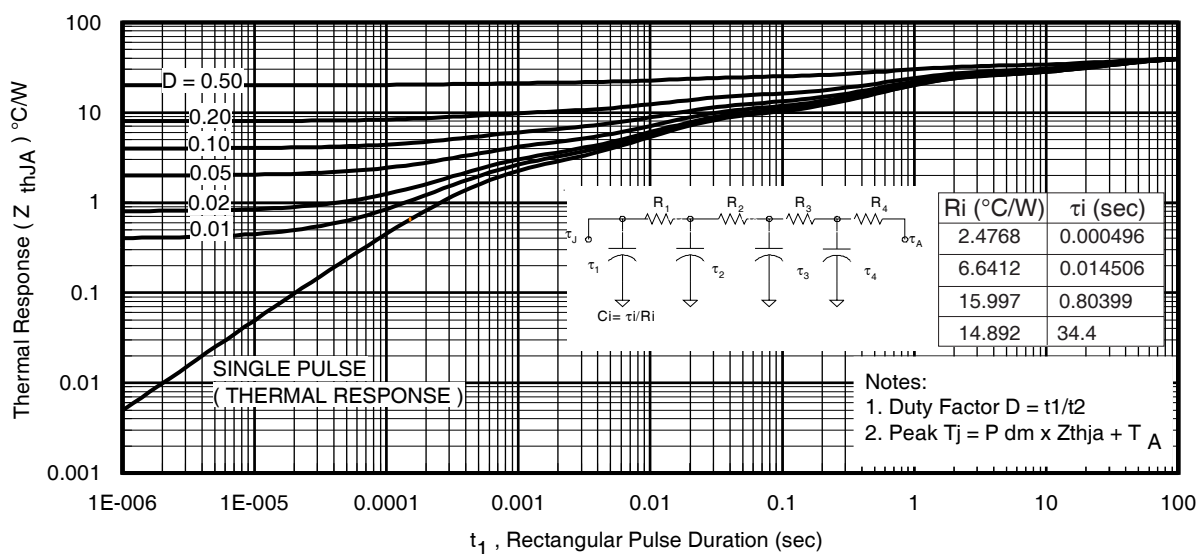
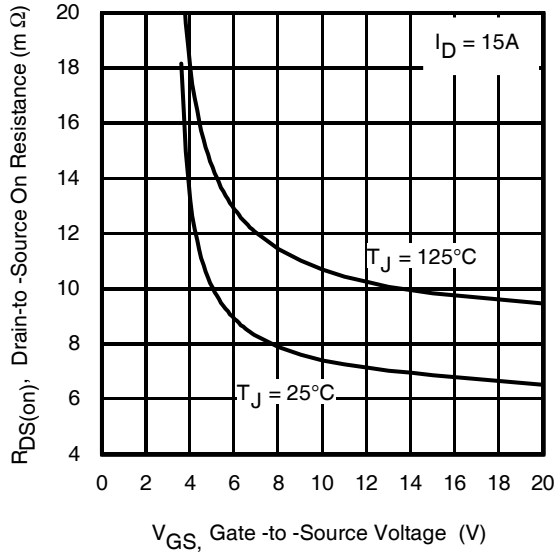
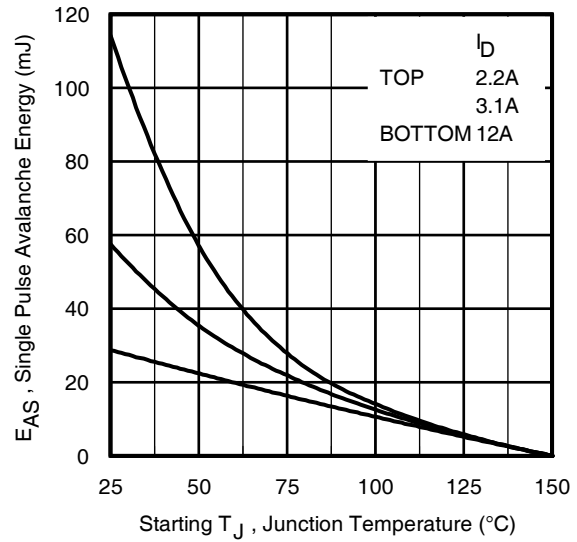
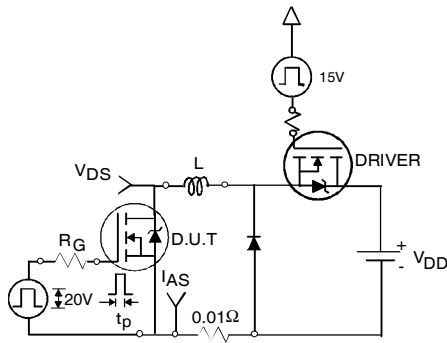
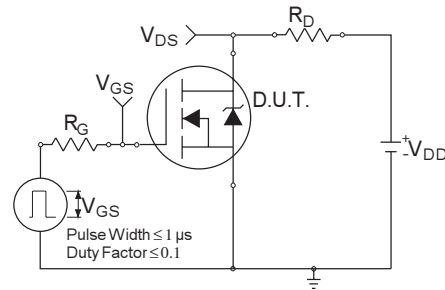
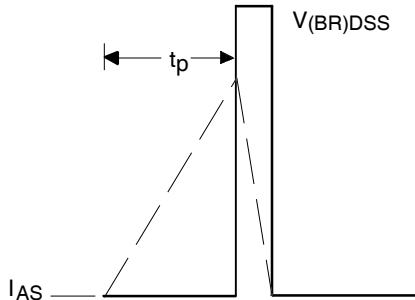
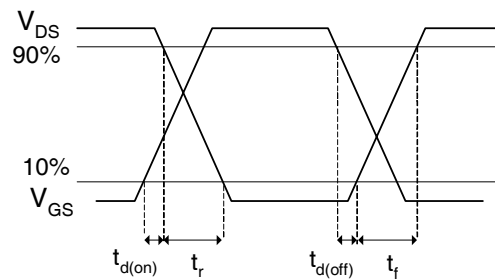


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Ambient


Fig 12. On-Resistance vs. Gate Voltage

Fig 13. Maximum Avalanche Energy vs. Drain Current

Fig 14a. Unclamped Inductive Test Circuit

Fig 15a. Switching Time Test Circuit

Fig 14b. Unclamped Inductive Waveforms

Fig 15b. Switching Time Waveforms

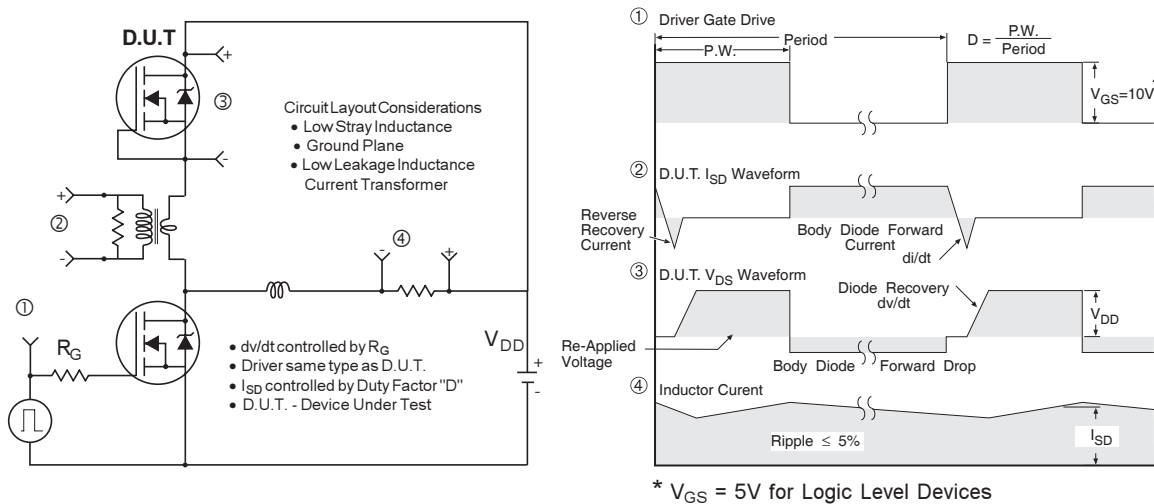


Fig 16. Peak Diode Recovery dv/dt Test Circuit for N-Channel HEXFET® Power MOSFETs

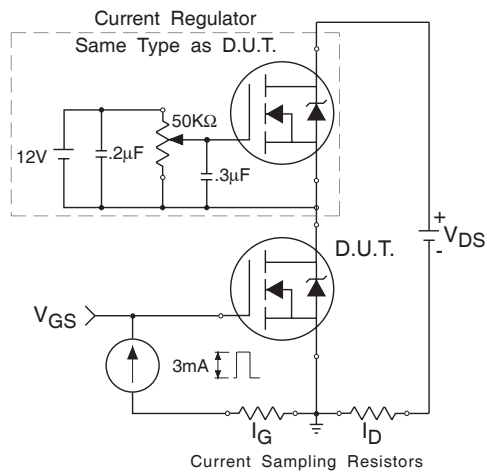


Fig 17. Gate Charge Test Circuit

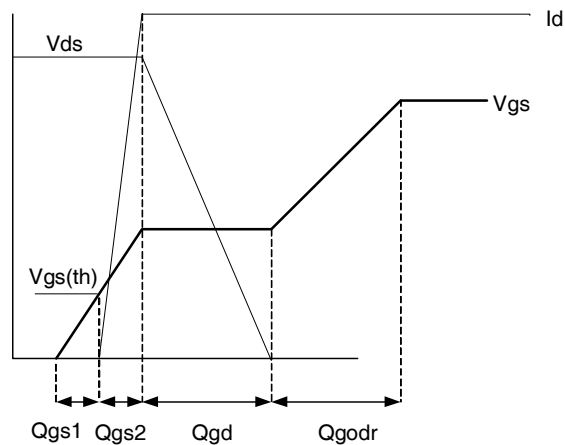
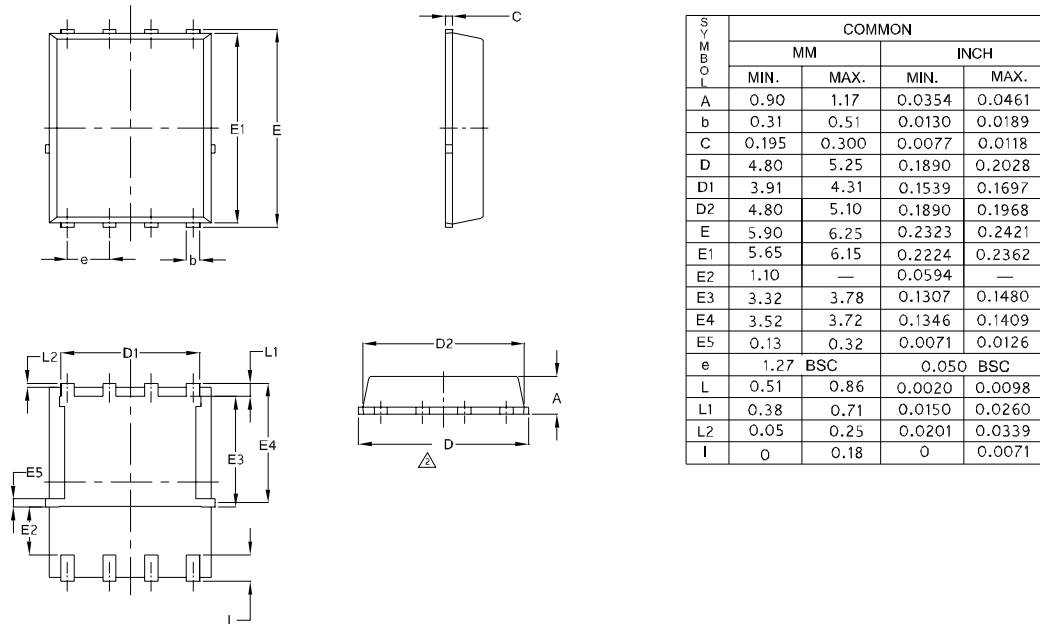
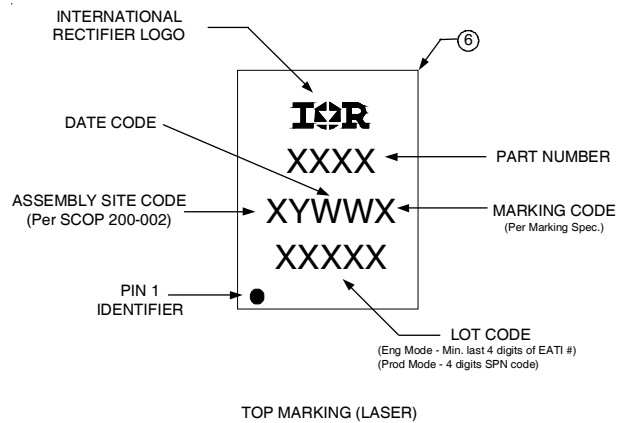


Fig 18. Gate Charge Waveform

PQFN 5x6 Option "E" Package Details

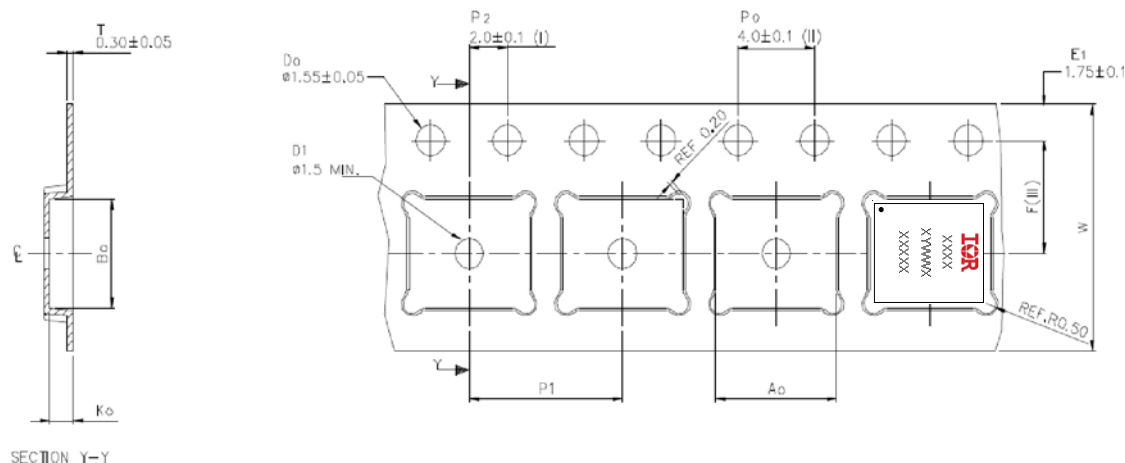


PQFN Part Marking



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

PQFN Tape and Reel



A_0	6.30 ± 0.1
B_0	5.30 ± 0.1
K_0	1.20 ± 0.1
F	5.50 ± 0.1
P_1	8.00 ± 0.1
W	12.00 ± 0.3

- (I) Measured from centreline of sprocket hole to centreline of pocket.
 (II) Cumulative tolerance of 10 sprocket holes is ± 0.20 .
 (III) Measured from centreline of sprocket hole to centreline of pocket.
 (IV) Other material available.
 (V) Typical SR of form tape Max 10^9 OHM/SQ

ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE STATED.

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

Notes:

- ① Repetitive rating; pulse width limited by max. junction temperature.
- ② Starting $T_J = 25^\circ\text{C}$, $L = 0.39\text{mH}$, $R_G = 25\Omega$, $I_{AS} = 12\text{A}$.
- ③ Pulse width $\leq 400\mu\text{s}$; duty cycle $\leq 2\%$.
- ④ R_{thjc} is guaranteed by design
- ⑤ When mounted on 1 inch square 2 oz copper pad on 1.5x1.5 in. board of FR-4 material.

Revision History

Date	Comments
08/05/2013	• Updated the package drawing, on page 1. • Updated the package outline drawing, on page 8. • This drawing change is related to PCN "Hana-GTBF-GEM 5x6 PQFN Public."

International
 Rectifier

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