International
IOR Rectifier

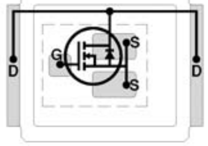
PD - 95842

IRF6612/IRF6612TR1

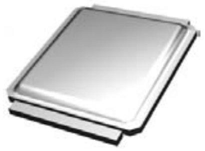
HEXFET® Power MOSFET

V_{DSS}	$R_{DS(on)}$ max	Qg(typ.)
30V	3.3mΩ@V_{GS} = 10V 4.4mΩ@V_{GS} = 4.5V	30nC

- Application Specific MOSFETs
- Ideal for CPU Core DC-DC Converters
- Low Conduction Losses
- Low Switching Losses
- Low Profile (<0.7 mm)
- Dual Sided Cooling Compatible
- Compatible with existing Surface Mount Techniques



MX


DirectFET™ ISOMETRIC

Applicable DirectFET Package/Layout Pad (see p.8,9 for details)

SQ	SX	ST		MQ	**MX**	MT				

Description

The IRF6612 combines the latest HEXFET® Power MOSFET Silicon technology with the advanced DirectFET™ packaging to achieve the lowest on-state resistance in a package that has the footprint of a SO-8 and only 0.7 mm profile. The DirectFET package is compatible with existing layout geometries used in power applications, PCB assembly equipment and vapor phase, infra-red or convection soldering techniques, when application note AN-1035 is followed regarding the manufacturing methods and processes. The DirectFET package allows dual sided cooling to maximize thermal transfer in power systems, IMPROVING previous best thermal resistance by 80%.

The IRF6612 balances both low resistance and low charge along with ultra low package inductance to reduce both conduction and switching losses. The reduced total losses make this product ideal for high efficiency DC-DC converters that power the latest generation of processors operating at higher frequencies. The IRF6612 has been optimized for parameters that are critical in synchronous buck converters including Rds(on), gate charge and Cdv/dt-induced turn on immunity to minimize losses in the synchronous FET socket.

Absolute Maximum Ratings

	Parameter	Max.	Units
V_{DS}	Drain-to-Source Voltage	30	V
V_{GS}	Gate-to-Source Voltage	±20	
I_D @ T_C = 25°C	Continuous Drain Current, V_{GS} @ 10V	136	A
I_D @ T_A = 25°C	Continuous Drain Current, V_{GS} @ 10V	24	
I_D @ T_A = 70°C	Continuous Drain Current, V_{GS} @ 10V	19	
I_{DM}	Pulsed Drain Current ①	190	
P_D @T_A = 25°C	Power Dissipation ⑤	2.8	W
P_D @T_A = 70°C	Power Dissipation ⑤	1.8	
P_D @T_C = 25°C	Power Dissipation	89	
	Linear Derating Factor	0.022	W/°C
T_J T_{STG}	Operating Junction and Storage Temperature Range	-40 to + 150	°C

Thermal Resistance

	Parameter	Typ.	Max.	Units
$R_{\theta JA}$	Junction-to-Ambient ④⑧	——	45	°C/W
$R_{\theta JA}$	Junction-to-Ambient ⑤⑧	12.5	——	
$R_{\theta JA}$	Junction-to-Ambient ⑥⑧	20	——	
$R_{\theta JC}$	Junction-to-Case ⑦⑧	——	1.4	
$R_{\theta J\text{-}PCB}$	Junction-to-PCB Mounted	1.0	——	

Notes ① through ⑧ are on page 10

02/02/04

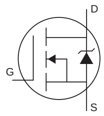
Static @ T_J = 25°C (unless otherwise specified)

	Parameter	Min.	Typ.	Max.	Units	Conditions
BV_{DSS}	Drain-to-Source Breakdown Voltage	30	—	—	V	V_{GS} = 0V, I_D = 250µA
$\Delta BV_{DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	—	24	—	mV/°C	Reference to 25°C, I_D = 1mA
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	—	2.5	3.3	mΩ	V_{GS} = 10V, I_D = 24A ③
		—	3.4	4.4		V_{GS} = 4.5V, I_D = 19A ③
$V_{GS(th)}$	Gate Threshold Voltage	1.35	—	2.25	V	V_{DS} = V_{GS}, I_D = 250µA
$\Delta V_{GS(th)}/\Delta T_J$	Gate Threshold Voltage Coefficient	—	-5.6	—	mV/°C	
I_{DSS}	Drain-to-Source Leakage Current	—	—	1.0	µA	V_{DS} = 24V, V_{GS} = 0V
		—	—	100		V_{DS} = 24V, V_{GS} = 0V, T_J = 125°C
I_{GSS}	Gate-to-Source Forward Leakage	—	—	100	nA	V_{GS} = 20V
	Gate-to-Source Reverse Leakage	—	—	-100		V_{GS} = -20V
gfs	Forward Transconductance	96	—	—	S	V_{DS} = 15V, I_D = 19A
Q_g	Total Gate Charge	—	30	45	nC	V_{DS} = 15V V_{GS} = 4.5V I_D = 19A
Q_{gs1}	Pre-Vth Gate-to-Source Charge	—	8.5	—		
Q_{gs2}	Post-Vth Gate-to-Source Charge	—	2.9	—		
Q_{gd}	Gate-to-Drain Charge	—	10	—		
Q_{godr}	Gate Charge Overdrive	—	8.6	—		
Q_{sw}	Switch Charge (Q_{gs2} + Q_{gd})	—	13	—		
Q_{oss}	Output Charge	—	18	—	nC	V_{DS} = 16V, V_{GS} = 0V
$t_{d(on)}$	Turn-On Delay Time	—	15	—	ns	V_{DD} = 16V, V_{GS} = 4.5V ③ I_D = 19A Clamped Inductive Load
t_r	Rise Time	—	52	—		
$t_{d(off)}$	Turn-Off Delay Time	—	21	—		
t_f	Fall Time	—	4.8	—		
C_{iss}	Input Capacitance	—	3970	—	pF	V_{GS} = 0V V_{DS} = 15V ƒ = 1.0MHz
C_{oss}	Output Capacitance	—	780	—		
C_{rss}	Reverse Transfer Capacitance	—	360	—		

Avalanche Characteristics

	Parameter	Typ.	Max.	Units
E_{AS}	Single Pulse Avalanche Energy②	—	37	mJ
I_{AR}	Avalanche Current ①	—	19	A

Diode Characteristics

	Parameter	Min.	Typ.	Max.	Units	Conditions
I_S	Continuous Source Current (Body Diode)	—	—	24	A	MOSFET symbol showing the integral reverse p-n junction diode. 
I_{SM}	Pulsed Source Current (Body Diode) ①	—	—	190		
V_{SD}	Diode Forward Voltage	—	—	1.0	V	T_J = 25°C, I_S = 19A, V_{GS} = 0V ③
t_{rr}	Reverse Recovery Time	—	19	29	ns	T_J = 25°C, I_F = 19A di/dt = 100A/µs ③
Q_{rr}	Reverse Recovery Charge	—	8.1	12	nC	

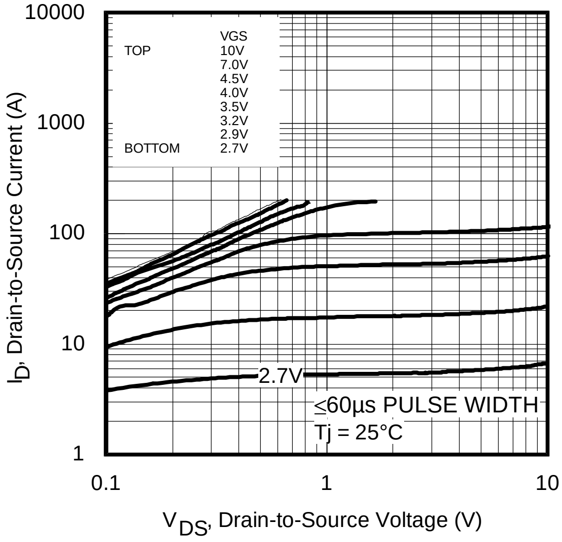


Fig 1. Typical Output Characteristics

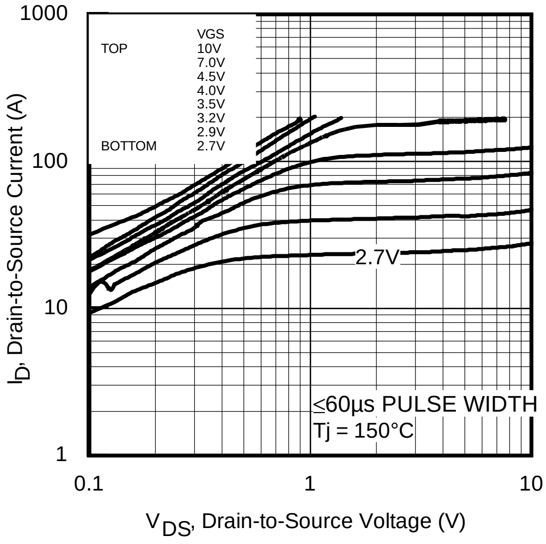


Fig 2. Typical Output Characteristics

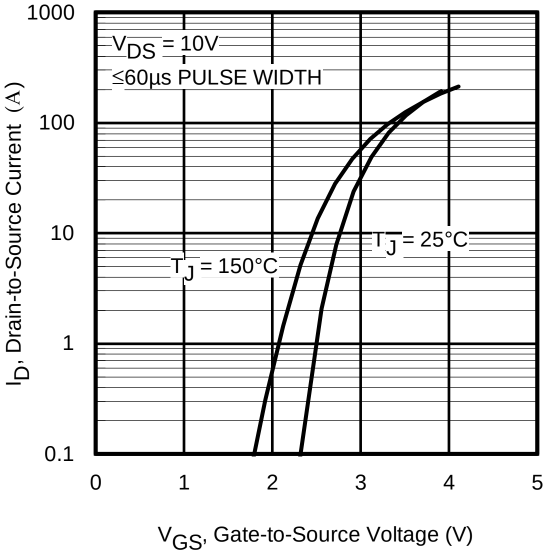


Fig 3. Typical Transfer Characteristics

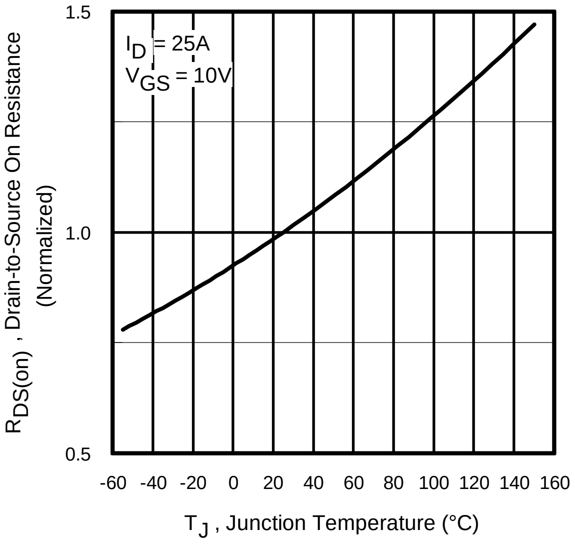
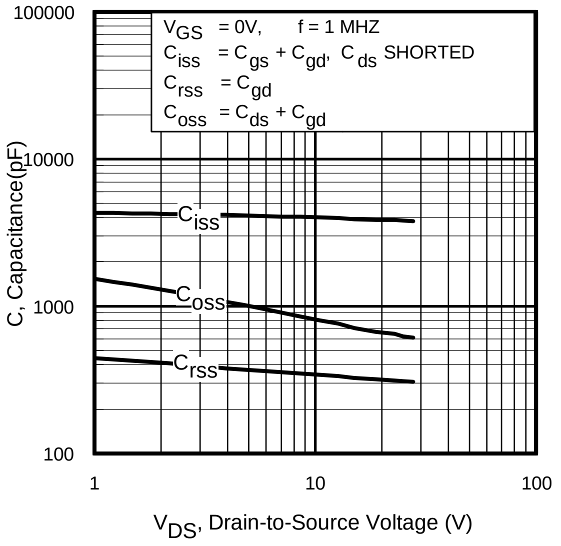


Fig 4. Normalized On-Resistance vs. Temperature



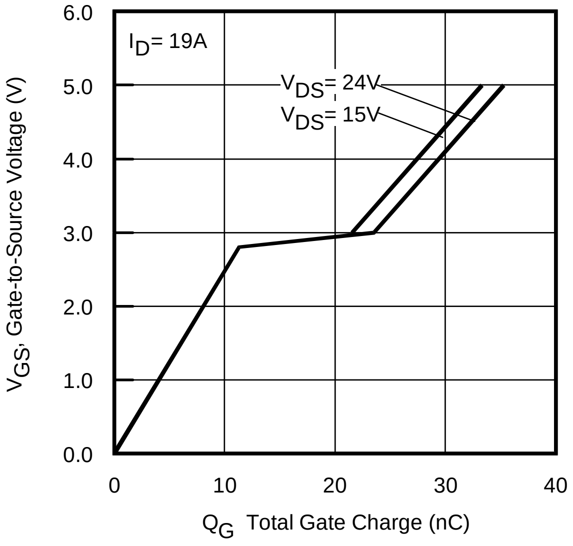
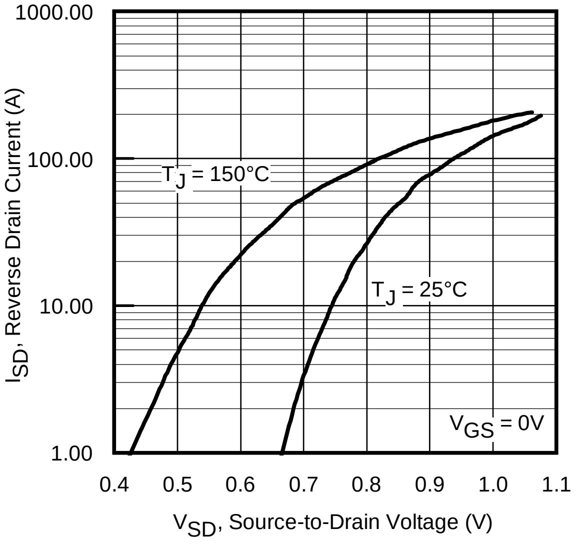


Fig 5. Typical Capacitance vs. Drain-to-Source Voltage

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



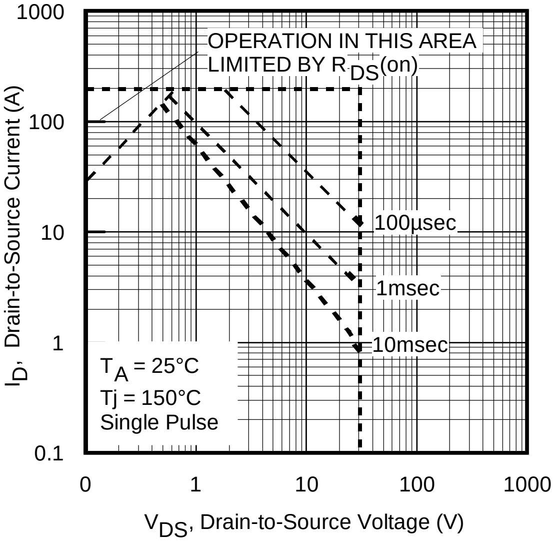
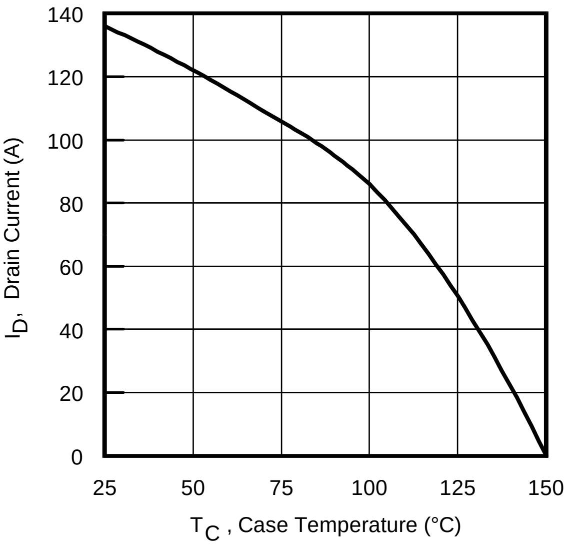


Fig 7. Typical Source-Drain Diode Forward Voltage

Fig 8. Maximum Safe Operating Area



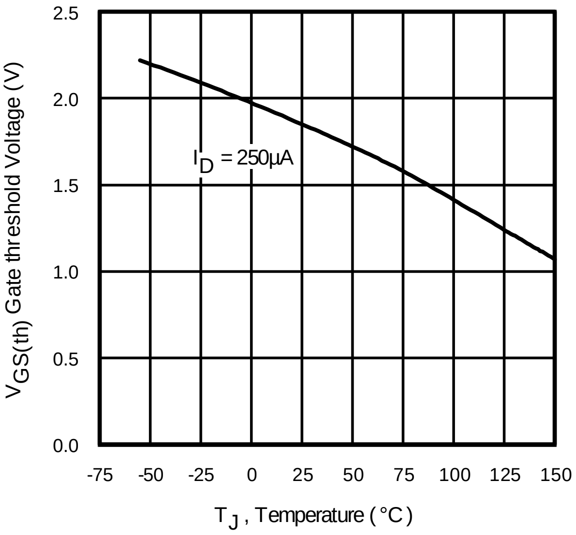
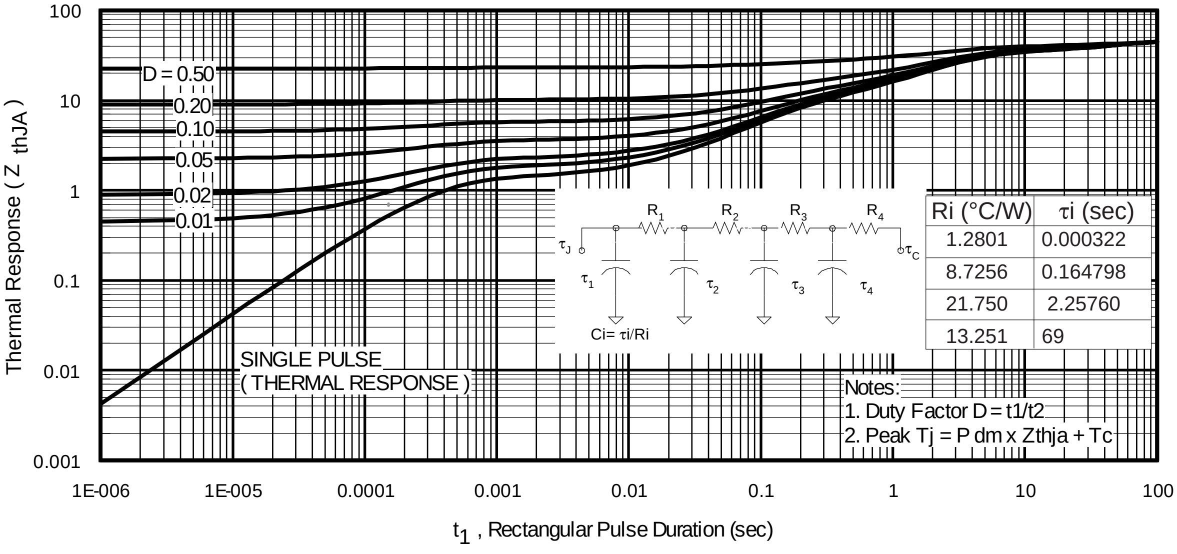


Fig 9. Maximum Drain Current vs. Case Temperature

Fig 10. Threshold Voltage vs. Temperature



Ri (°C/W)	τi (sec)
1.2801	0.000322
8.7256	0.164798
21.750	2.25760
13.251	69

Notes:
1. Duty Factor D = t1/t2
2. Peak Tj = P dm x Zthja + Tc

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

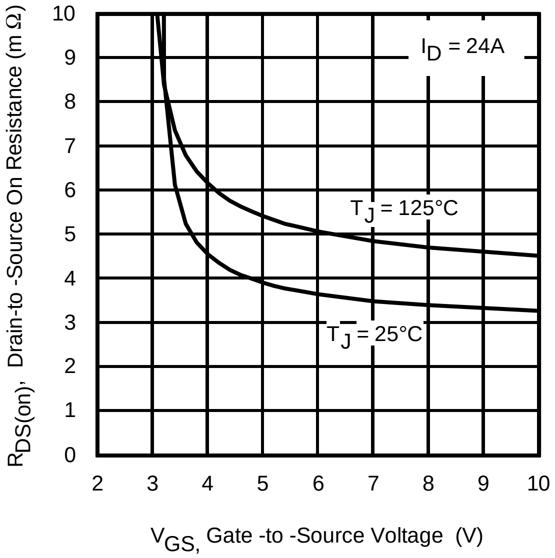


Fig 12. On-Resistance vs. Gate Voltage

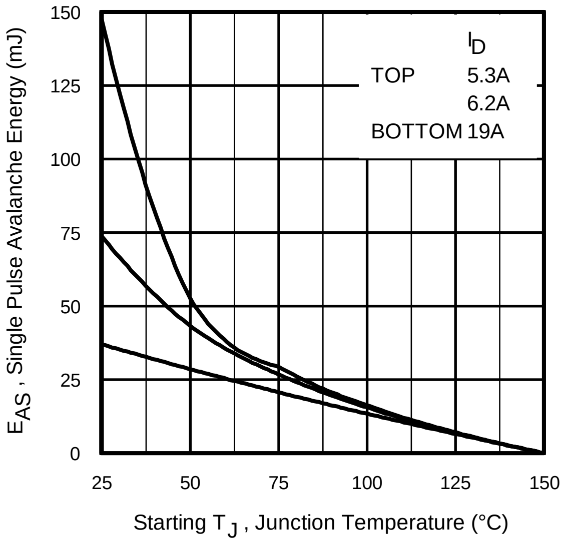


Fig 13. Maximum Avalanche Energy vs. Drain Current

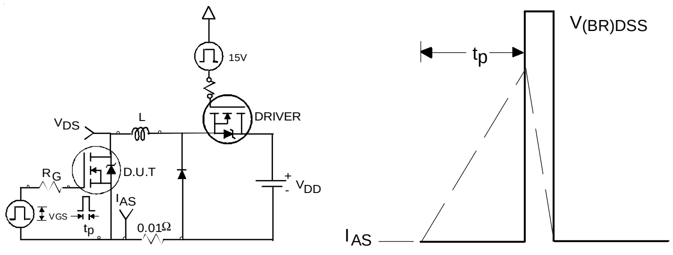


Fig 14. Unclamped Inductive Test Circuit and Waveform

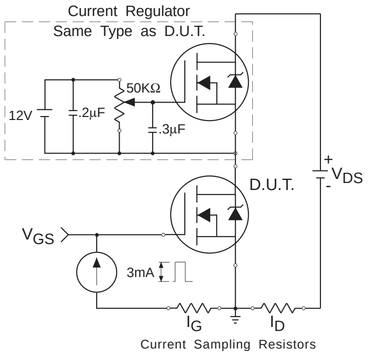


Fig 15. Gate Charge Test Circuit

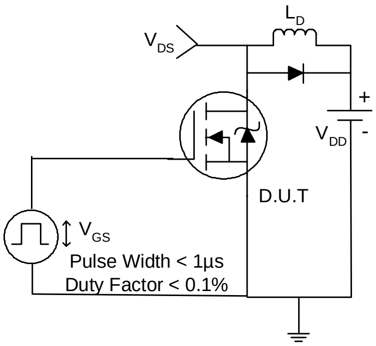


Fig 16. Switching Time Test Circuit

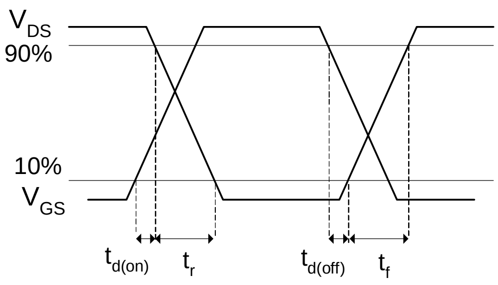
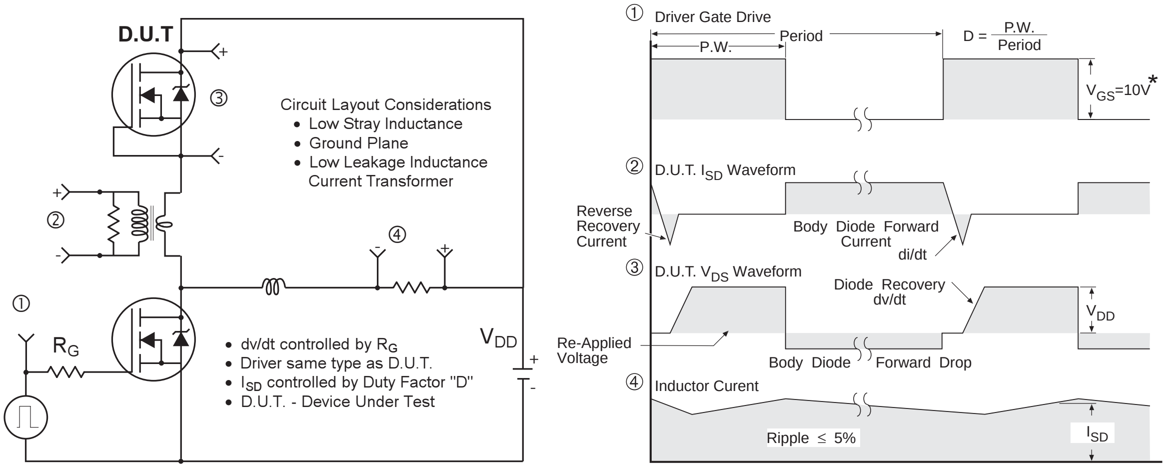


Fig 17. Switching Time Waveforms



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

Fig 15. Peak Diode Recovery dv/dt Test Circuit for N-Channel HEXFET® Power MOSFETs

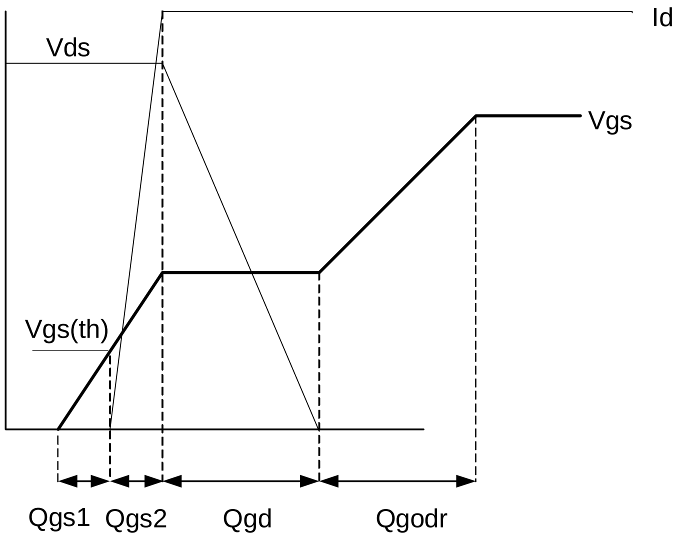
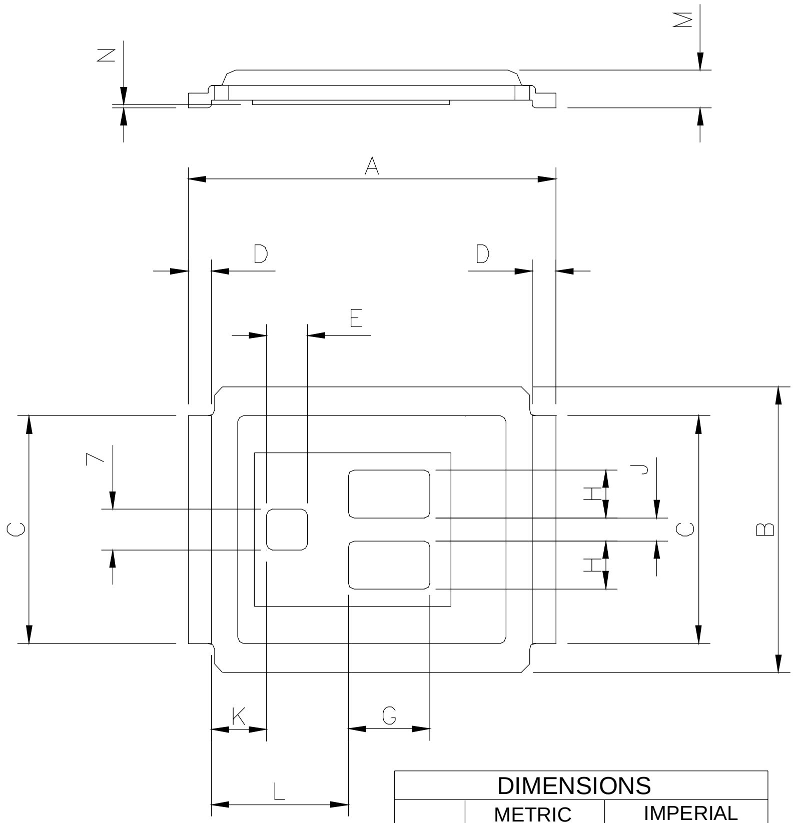


Fig 16. Gate Charge Waveform

DirectFET™ Outline Dimension, MX Outline (Medium Size Can, X-Designation).

Please see DirectFET application note AN-1035 for all details regarding the assembly of DirectFET. This includes all recommendations for stencil and substrate designs.



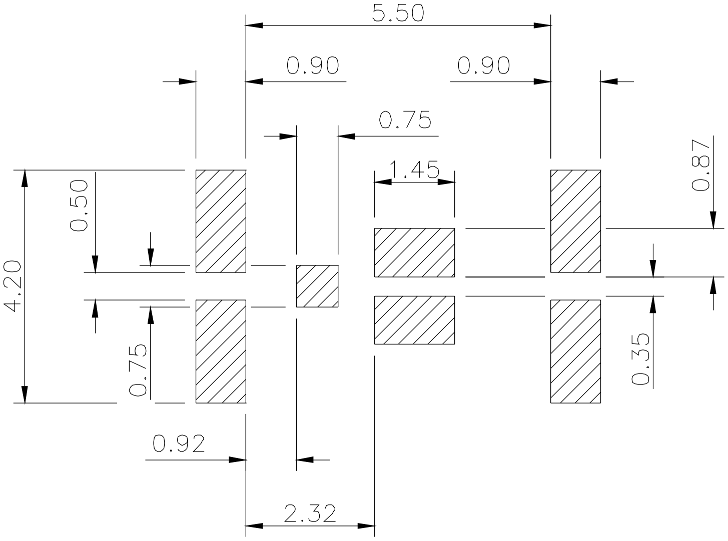
DIMENSIONS				
	METRIC		IMPERIAL	
CODE	MIN	MAX	MIN	MAX
A	6.25	6.35	0.246	0.250
B	4.80	5.05	0.189	0.201
C	3.85	3.95	0.152	0.156
D	0.35	0.45	0.014	0.018
E	0.68	0.72	0.027	0.028
F	0.68	0.72	0.027	0.028
G	1.38	1.42	0.054	0.056
H	0.80	0.84	0.032	0.033
J	0.38	0.42	0.015	0.017
K	0.88	1.01	0.035	0.039
L	2.28	2.41	0.090	0.095
M	0.59	0.70	0.023	0.028
N	0.03	0.08	0.001	0.003

Note: Controlling dimensions are in mm

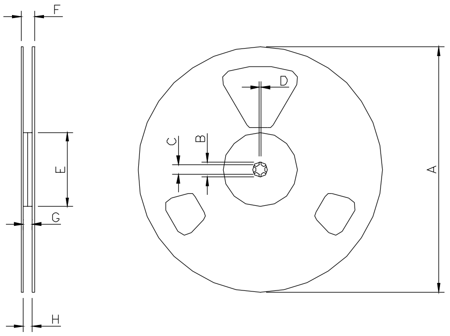
DirectFET™ Board Footprint, MX Outline (Medium Size Can, X-Designation).

Please see DirectFET application note AN-1035 for all details regarding the assembly of DirectFET.

This includes all recommendations for stencil and substrate designs.

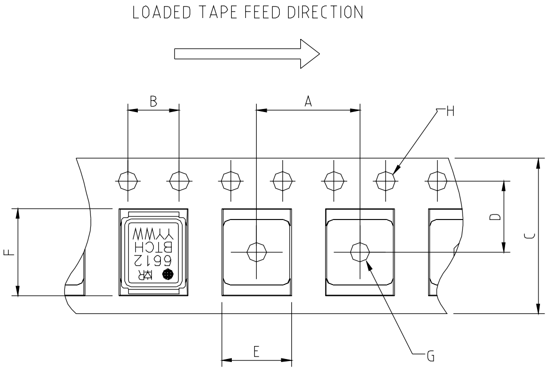


DirectFET™ Tape & Reel Dimension (Showing component orientation).



NOTE: Controlling dimensions in mm
Std reel quantity is 4800 parts. (ordered as IRF6618). For 1000 parts on 7" reel, order IRF6618TR1

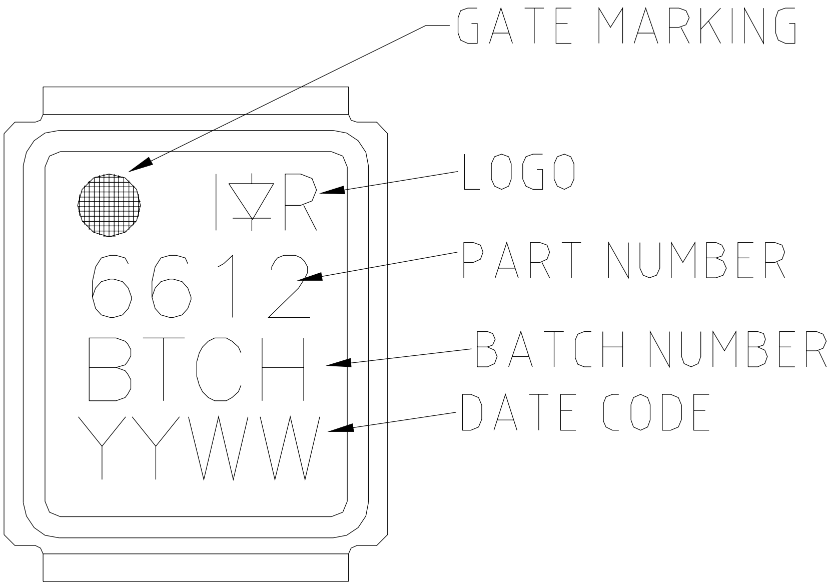
REEL DIMENSIONS								
	STANDARD OPTION **(QTY 4800)**				TR1 OPTION **(QTY 1000)**			
	METRIC		IMPERIAL		METRIC		IMPERIAL	
CODE	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX
A	330.0	N.C	12.992	N.C	177.77	N.C	6.9	N.C
B	20.2	N.C	0.795	N.C	19.06	N.C	0.75	N.C
C	12.8	13.2	0.504	0.520	13.5	12.8	0.53	0.50
D	1.5	N.C	0.059	N.C	1.5	N.C	0.059	N.C
E	100.0	N.C	3.937	N.C	58.72	N.C	2.31	N.C
F	N.C	18.4	N.C	0.724	N.C	13.50	N.C	0.53
G	12.4	14.4	0.488	0.567	11.9	12.01	0.47	N.C
H	11.9	15.4	0.469	0.606	11.9	12.01	0.47	N.C



NOTE: CONTROLLING DIMENSIONS IN MM

DIMENSIONS				
	METRIC		IMPERIAL	
CODE	MIN	MAX	MIN	MAX
A	7.90	8.10	0.311	0.319
B	3.90	4.10	0.154	0.161
C	11.90	12.30	0.469	0.484
D	5.45	5.55	0.215	0.219
E	5.10	5.30	0.201	0.209
F	6.50	6.70	0.256	0.264
G	1.50	N.C	0.059	N.C
H	1.50	1.60	0.059	0.063

DirectFET™ Part Marking



Notes:

① Repetitive rating; pulse width limited by max. junction temperature.

② Starting $T_J = 25°C$, $L = 0.20mH$, $R_G = 25\Omega$, $I_{AS} = 19A$.

③ Pulse width ≤ 400µs; duty cycle ≤ 2%.

④ Surface mounted on 1 in. square Cu board.

⑤ Used double sided cooling , mounting pad.

⑥ Mounted on minimum footprint full size board with metalized back and with small clip heatsink.

⑦ T_C measured with thermal couple mounted to top (Drain) of part.

⑧ R_θ is measured at T_J of approximately 90°C.

International
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