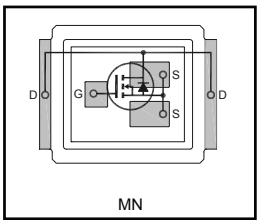
DirectFET® Power MOSFET②

Typical values (unless otherwise specified)

V_{DSS}	V_{GS}	$R_{DS(on)}$
100V min	±20V max	5.3mΩ @ 10V
$Q_{g\ tot}$	Q_{gd}	$V_{gs(th)}$
36nC	13nC	2.9V

Applications and Benefits

- Ideal for High Performance Isolated Converter Primary Switch
- Optimized for Synchronous Rectification
- RoHS Compliant, Halogen Free ②
- Lead-Free (Qualified up to 260°C Reflow) ①
- Low Conduction Losses
- High Cdv/dt Immunity
- Low Profile (<0.7mm)
- Dual Sided Cooling Compatible ①
- Compatible with existing Surface Mount Techniques ①
- Industrial Qualified



MN


DirectFET™ ISOMETRIC

Applicable DirectFET® Outline and Substrate Outline ①

				MN						

Description

The IRF7171MTRPbF 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 a footprint smaller than a D2PAK 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.
The IRF7171MTRPbF is optimized for high frequency switching and synchronous rectification applications. The reduced total losses in the device coupled with the high level of thermal performance enables high efficiency and low temperatures, which are key for system reliability improvements, and makes this device ideal for high performance power converters.

Ordering Information

Base part number	Package Type	Standard Pack		Orderable Part Number
		Form	Quantity	
IRF7171MTRPbF	DirectFET® Medium Can	Tape and Reel	4800	IRF7171MTRPbF

Absolute Maximum Ratings

	Parameter	Max.	Units
V_{GS}	Gate-to-Source Voltage	±20	V
I_D @ T_C = 25°C	Continuous Drain Current, V_{GS} @ 10V (Silicon Limited)④	93	A
I_D @ T_C = 100°C	Continuous Drain Current, V_{GS} @ 10V (Silicon Limited)④	59	
I_D @ T_A = 25°C	Continuous Drain Current, V_{GS} @ 10V (Silicon Limited)③	15	
I_{DM}	Pulsed Drain Current⑤	330	
E_{AS}	Single Pulse Avalanche Energy ⑥	86	mJ
I_{AR}	Avalanche Current ⑥	56	A

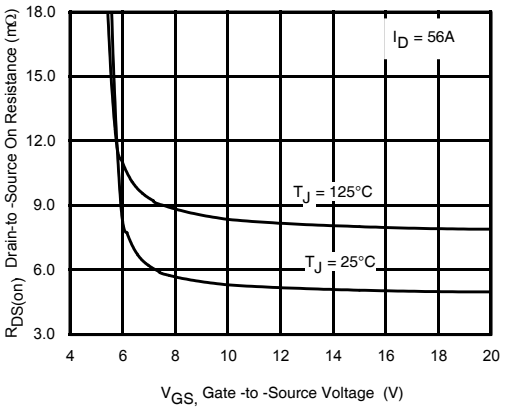


Fig 1. Typical On-Resistance vs. Gate Voltage

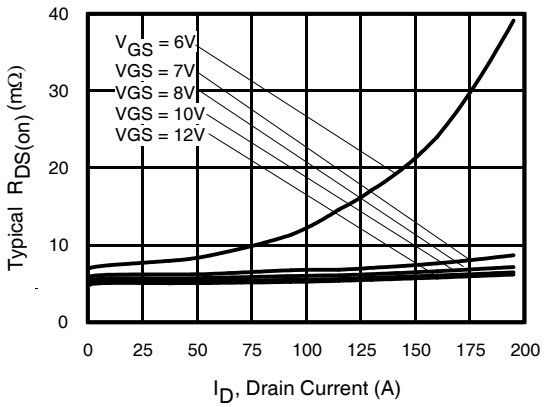


Fig 2. Typical On-Resistance vs. Drain Current

Notes
① Click on this section to link to the appropriate technical paper.
② Click on this section to link to the DirectFET® Website.
③ Surface mounted on 1 in. square Cu board, steady state.
④ TC measured with thermocouple mounted to top (Drain) of part.
⑤ Repetitive rating; pulse width limited by max. junction temperature.
⑥ Starting T_J = 25°C, L = 55µH, R_G = 50Ω, I_{AS} = 56A.

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

	Parameter	Min.	Typ.	Max.	Units	Conditions
BV_{DSS}	Drain-to-Source Breakdown Voltage	100	—	—	V	V_{GS} = 0V, I_D = 250µA
$\Delta BV_{DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	—	40	—	mV/°C	Reference to 25°C, I_D = 1mA
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	—	5.3	6.5	mΩ	V_{GS} = 10V, I_D = 56A ⑦
$V_{GS(th)}$	Gate Threshold Voltage	2.0	—	3.6	V	V_{DS} = V_{GS}, I_D = 150µA
$\Delta V_{GS(th)}/\Delta T_J$	Gate Threshold Voltage Temp. Coefficient	—	-6.2	—	mV/°C	
I_{DSS}	Drain-to-Source Leakage Current	—	—	1	µA	V_{DS} = 80 V, V_{GS} = 0V
I_{GSS}	Gate-to-Source Forward Leakage	—	—	100	nA	V_{GS} = 20V
	Gate-to-Source Reverse Leakage	—	—	-100		V_{GS} = -20V
gfs	Forward Transconductance	80	—	—	S	V_{DS} = 10V, I_D =56A
Q_g	Total Gate Charge	—	36	54	nC	V_{DS} = 50V V_{GS} = 10V I_D = 56A See Fig.8
Q_{gs1}	Pre– Vth Gate-to-Source Charge	—	6.9	—		
Q_{gs2}	Post– Vth Gate-to-Source Charge	—	2.4	—		
Q_{gd}	Gate-to-Drain Charge	—	13	—		
Q_{godr}	Gate Charge Overdrive	—	13.7	—		
Q_{sw}	Switch Charge (Q_{gs2} + Q_{gd})	—	15.4	—		
Q_{oss}	Output Charge	—	120	—	nC	V_{DS} = 50V, V_{GS} = 0V
R_G	Gate Resistance	—	1.0	—	Ω	
$t_{d(on)}$	Turn-On Delay Time	—	9.3	—	ns	V_{DD} = 50V, V_{GS} = 10V⑦ I_D = 56A R_G= 1.8Ω
t_r	Rise Time	—	27	—		
$t_{d(off)}$	Turn-Off Delay Time	—	15	—		
t_f	Fall Time	—	20	—		
C_{iss}	Input Capacitance	—	2160	—	pF	V_{GS} = 0V V_{DS} = 50V f = 1.0MHz
C_{oss}	Output Capacitance	—	970	—		
C_{rss}	Reverse Transfer Capacitance	—	60	—		
C_{oss}	Output Capacitance	—	4660	—		V_{GS} = 0V, V_{DS} = 1.0V, f =1.0MHz
C_{oss}	Output Capacitance	—	580	—		V_{GS} = 0V, V_{DS} = 80V, f =1.0MHz

Diode Characteristics

	Parameter	Min.	Typ.	Max.	Units	Conditions
I_S	Continuous Source Current (Body Diode)	—	—	95	A	MOSFET symbol showing the integral reverse p-n junction diode. 
I_{SM}	Pulsed Source Current (Body Diode) ⑤	—	—	330		
V_{SD}	Diode Forward Voltage	—	—	1.3	V	T_J = 25°C, I_S = 56A, V_{GS} = 0V ⑦
t_{rr}	Reverse Recovery Time	—	66	—	ns	T_J = 25°C, I_F = 56A, V_{DD} = 50V
Q_{rr}	Reverse Recovery Charge	—	126	—	nC	di/dt = 100A/µs ⑦

Notes:
⑤ Repetitive rating; pulse width limited by max. junction temperature.
⑦ Pulse width ≤ 400µs; duty cycle ≤ 2%

Absolute Maximum Ratings

Symbol	Parameter	Max.	Units
P_D @T_C = 25°C	Power Dissipation ④	104	W
P_D @T_C = 100°C	Power Dissipation ④	42	
P_D @T_A = 25°C	Power Dissipation ③	2.8	
T_P	Peak Soldering Temperature	270	°C
T_J T_{STG}	Operating Junction and Storage Temperature Range	-55 to + 150	

Thermal Resistance

Symbol	Parameter	Typ.	Max.	Units
$R_{\theta JA}$	Junction-to-Ambient ③	–––	45	°C/W
$R_{\theta JA}$	Junction-to-Ambient ⑧	12.5	–––	
$R_{\theta JA}$	Junction-to-Ambient ⑨	20	–––	
$R_{\theta JC}$	Junction-to-Can ④⑩	–––	1.2	
$R_{\theta JA\text{-}PCB}$	Junction-to-PCB Mounted	1.0	–––	

Notes:

③ Surface mounted on 1 in. square Cu board, steady state.
④ T_C measured with thermocouple in contact with top (Drain) of part.
⑧ Used double sided cooling, mounting pad with large heat sink.
⑨ Mounted on minimum footprint full size board with metalized back and with small clip heat sink.
⑩ R_θ is measured at T_J of approximately 90°C.

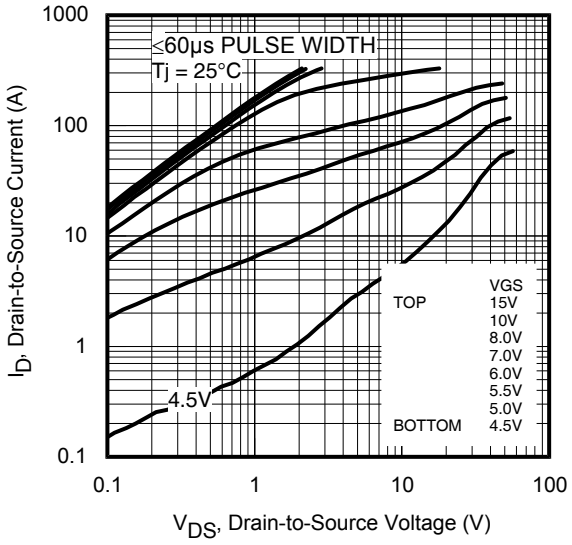


Fig 3. Typical Output Characteristics

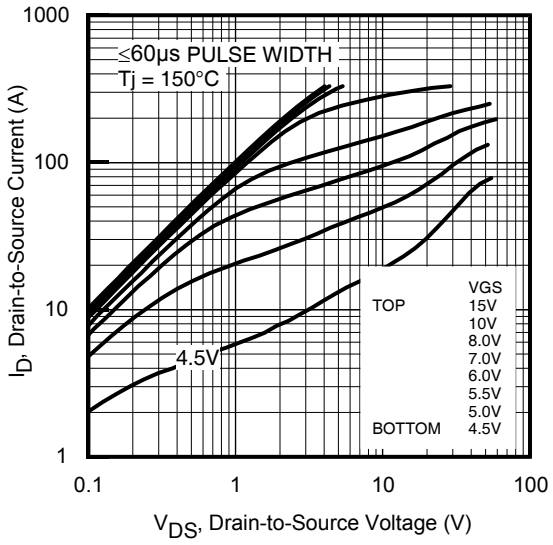


Fig 4. Typical Output Characteristics

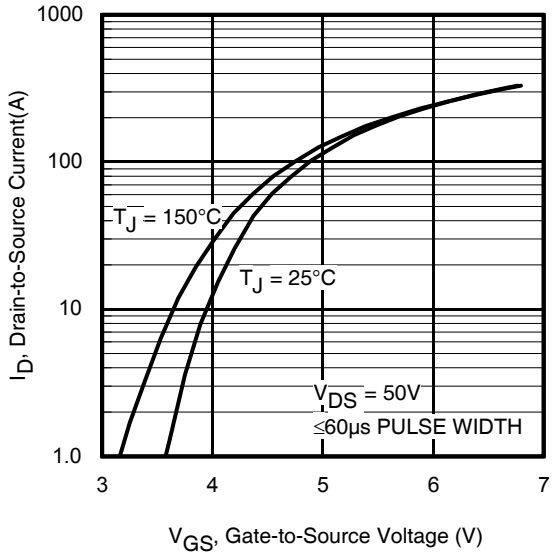


Fig 5. Typical Transfer Characteristics

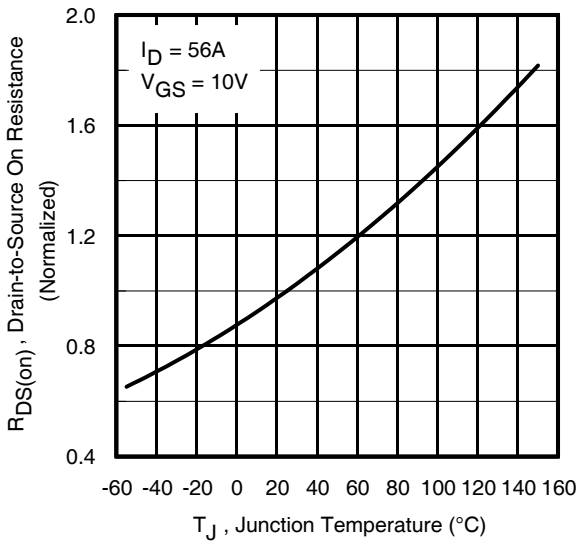


Fig 6. Normalized On-Resistance vs. Temperature

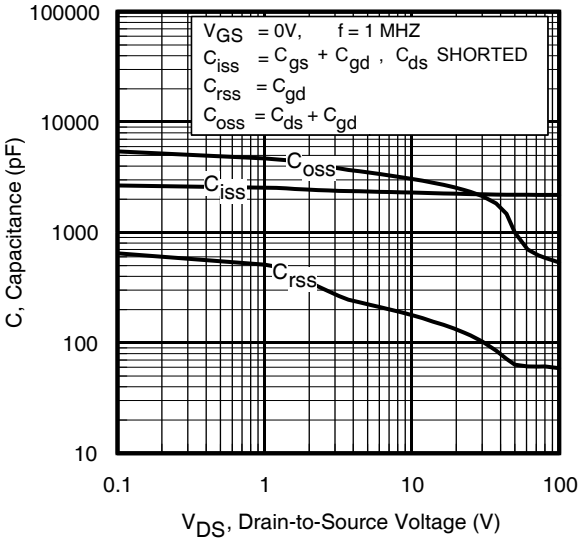


Fig 7. Typical Capacitance vs. Drain-to-Source Voltage

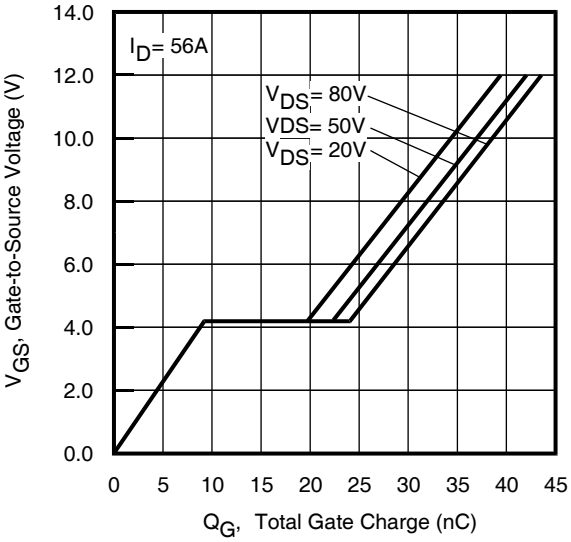


Fig 8. Typical Gate Charge vs. Gate-to-Source Voltage

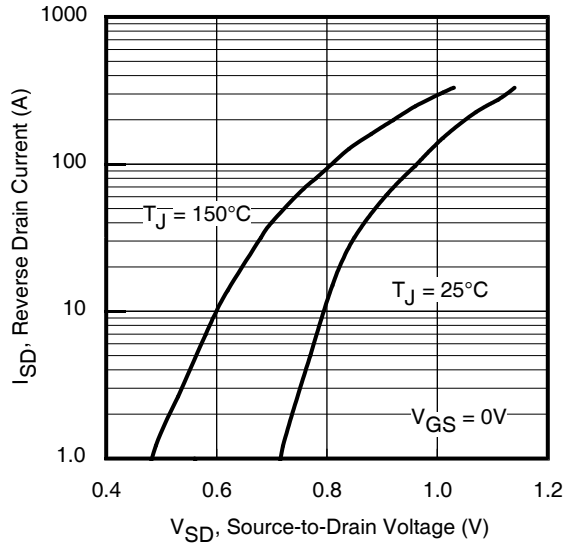


Fig 9. Typical Source-Drain Diode Forward Voltage

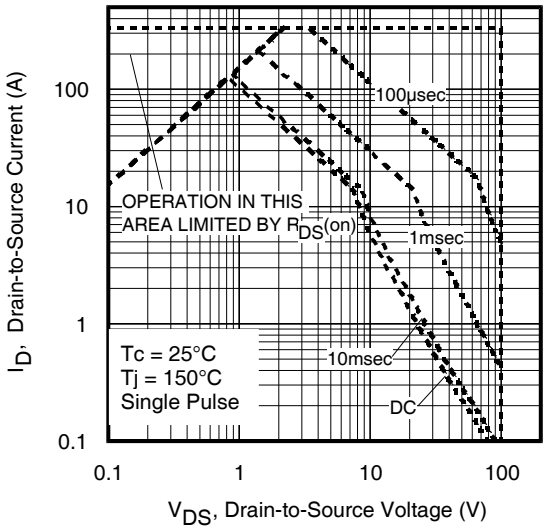


Fig 10. Maximum Safe Operating Area

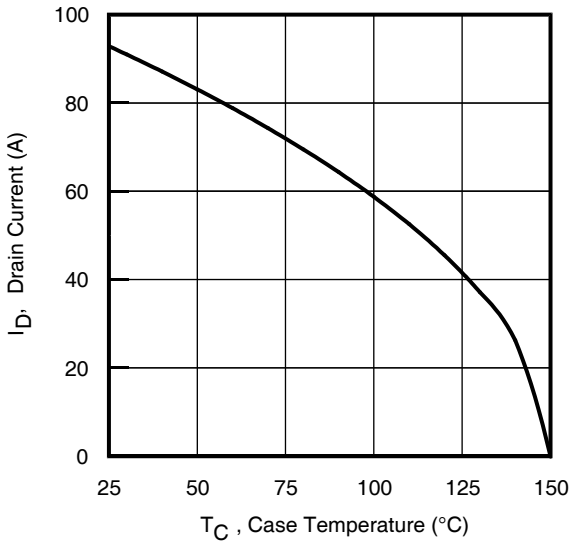


Fig 11. Maximum Drain Current vs. Case Temperature

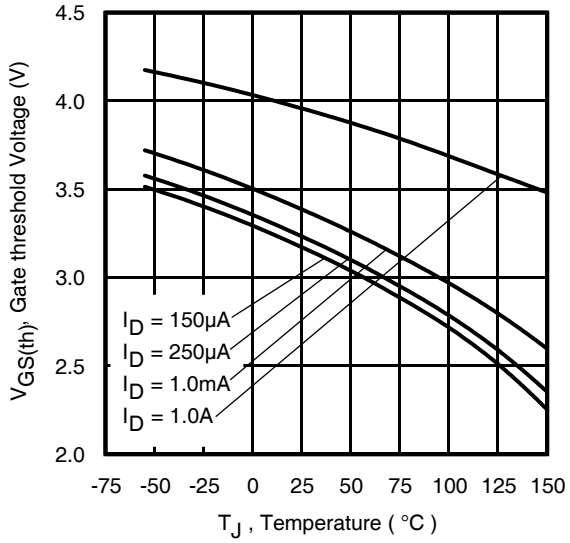


Fig 12. Typical Threshold Voltage vs. Junction Temperature

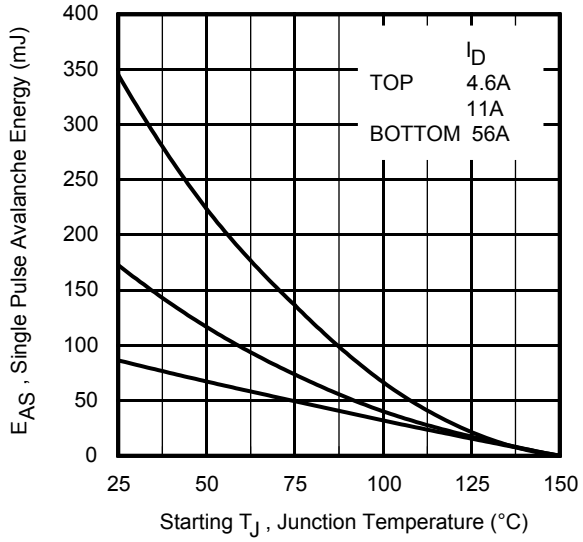


Fig 13. Maximum Avalanche Energy vs. Drain Current

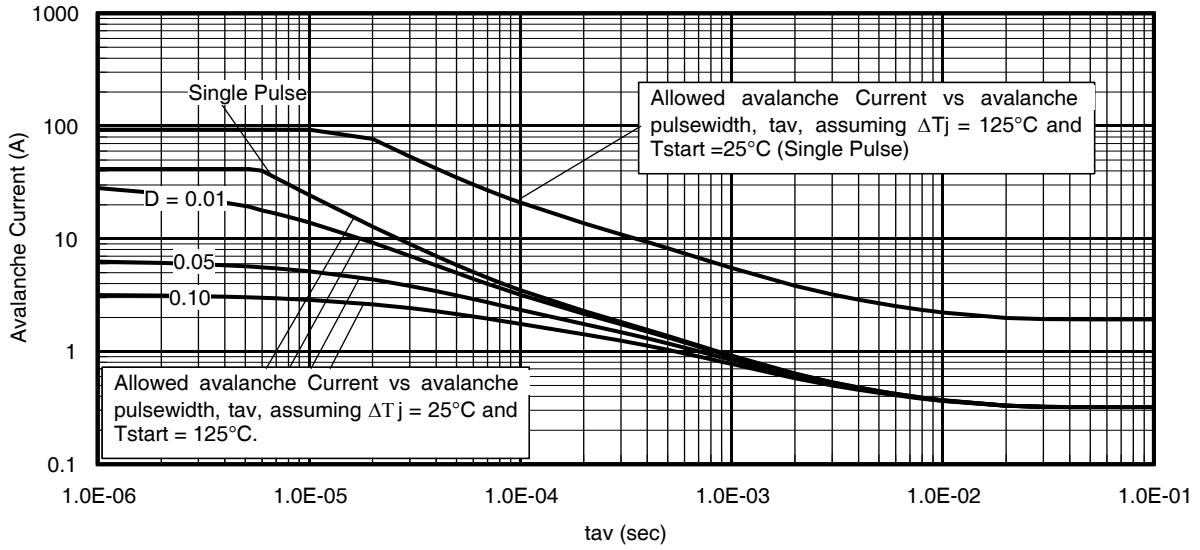


Fig 14. Typical Avalanche Current vs. Pulse Width

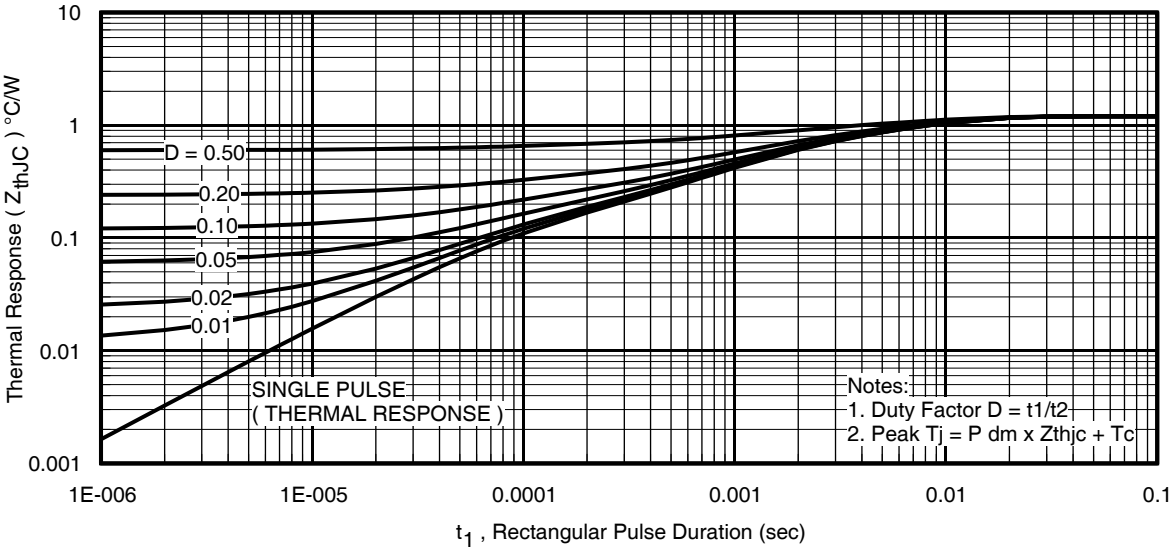
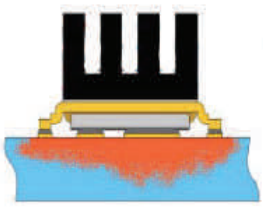
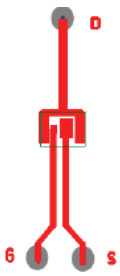


Fig 15. Maximum Effective Transient Thermal Impedance, Junction-to-Case

Notes:

③ Surface mounted on 1 in. square Cu board, steady state.
④ T_C measured with thermocouple incontact with top (Drain) of part.
⑤ Repetitive rating; pulse width limited by max. junction temperature.
⑧ Used double sided cooling, mounting pad with large heatsink.
⑨ Mounted on minimum footprint full size board with metalized back and with small clip heatsink.
⑩ R_θ is measured at T_J of approximately 90°C.





③ Surface mounted on 1 in. square Cu board (still air).

⑨ Mounted on minimum footprint full size board with metalized back and with small clip heatsink (still air)

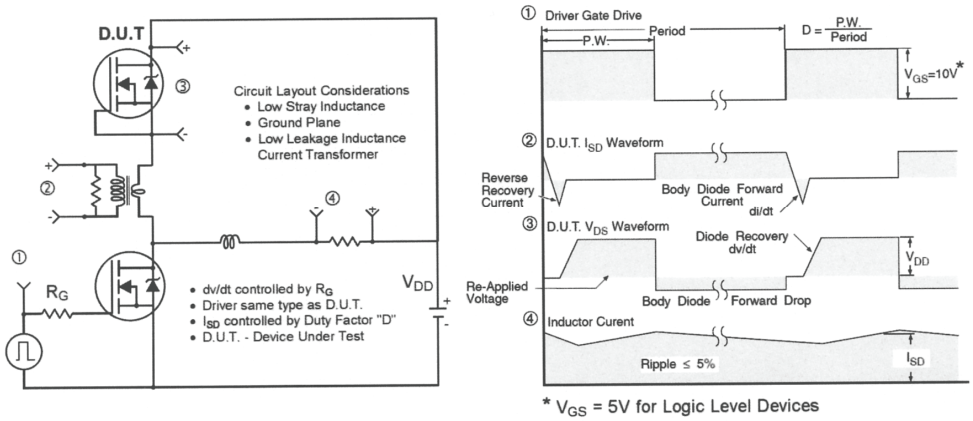


Fig 16. Peak Diode Recovery dv/dt Test Circuit for N-Channel HEXFET® Power MOSFETs

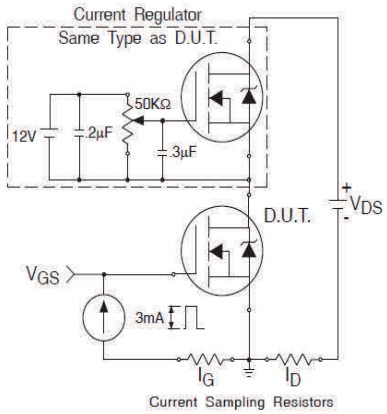


Fig 17a. Gate Charge Test Circuit

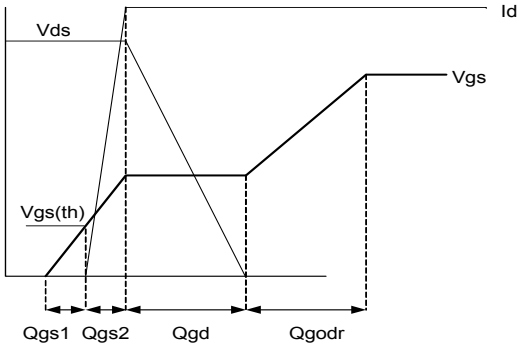


Fig 17b. Gate Charge Waveform

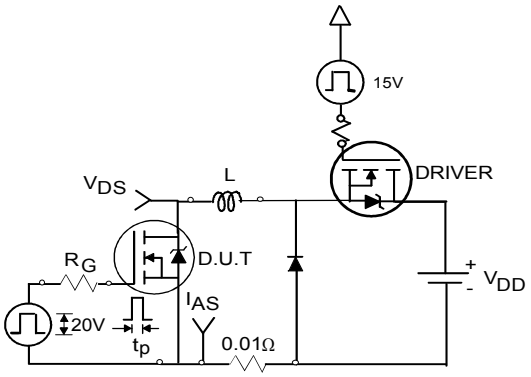


Fig 18a. Unclamped Inductive Test Circuit

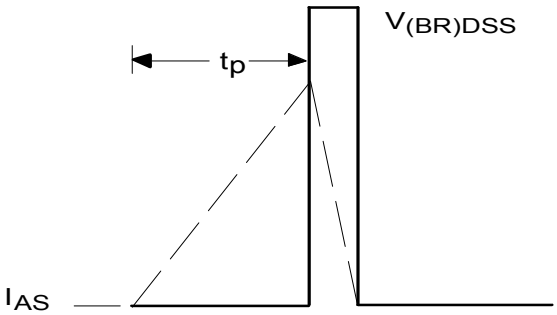


Fig 18b. Unclamped Inductive Waveforms

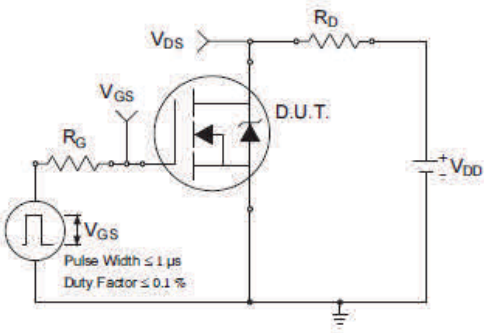


Fig 19a. Switching Time Test Circuit

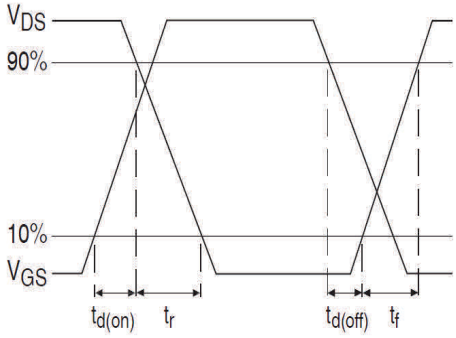
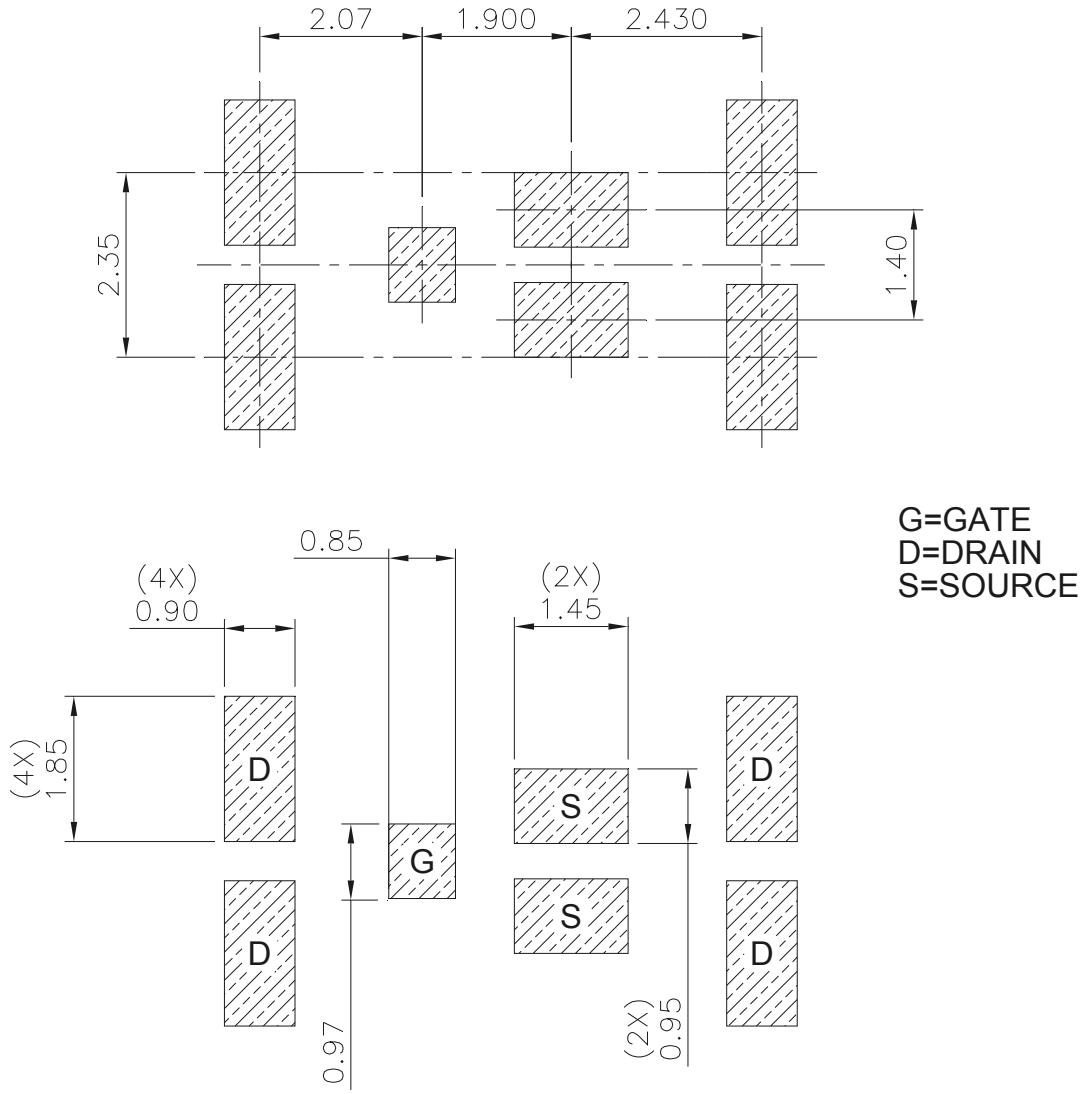


Fig 19b. Switching Time Waveforms

DirectFET®Board Footprint, MN Outline

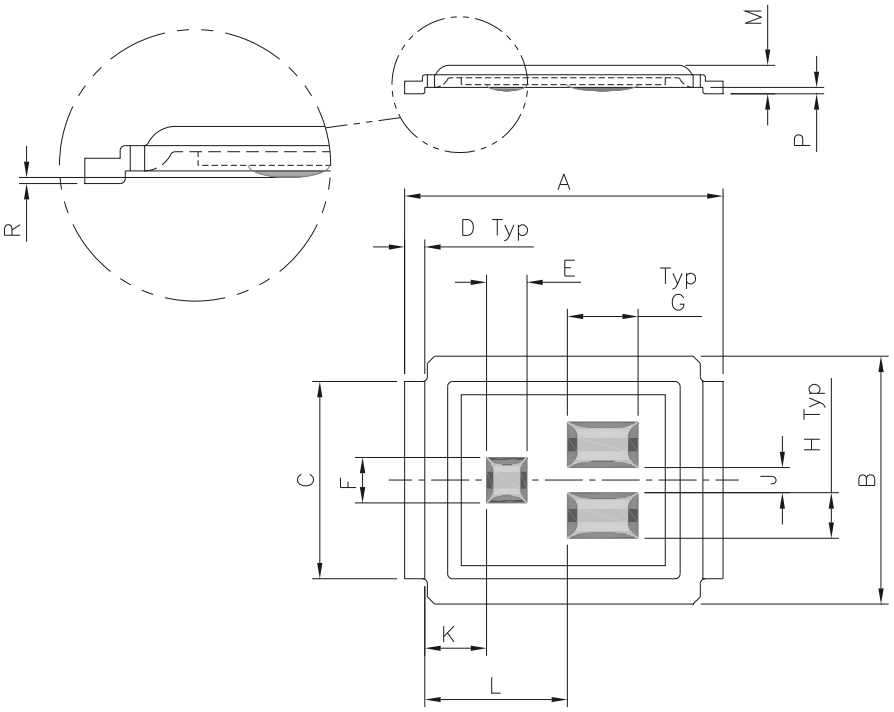
Please see DirectFET® application note AN-1035 for all details regarding the assembly of DirectFET®.
This includes all recommendations for stencil and substrate designs.



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

DirectFET® Outline Dimension, MN Outline
(Medium Size Can, N-Designation).

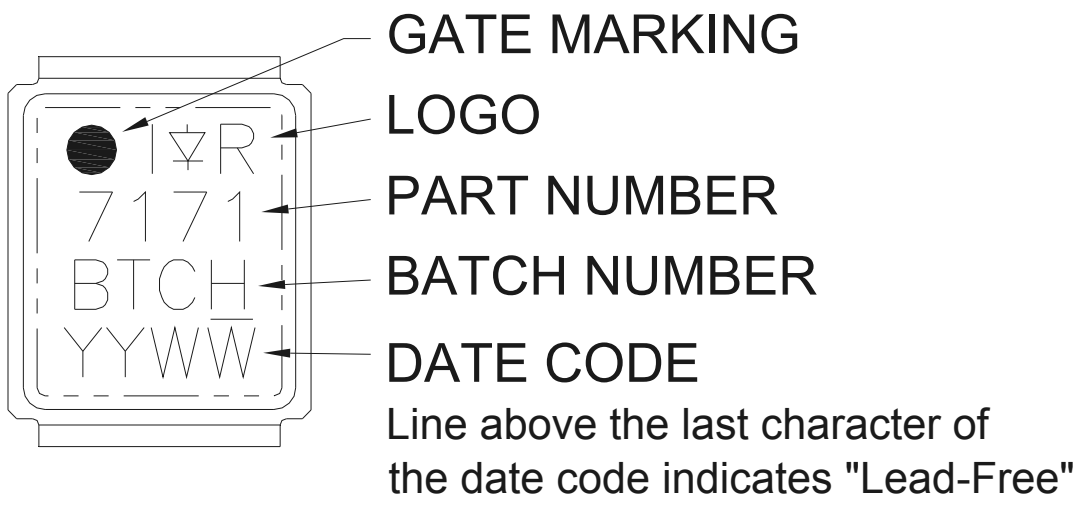
Please see DirectFET® application note AN-1035 for all details regarding the assembly of DirectFET®.
This includes all recommendations for stencil and substrate designs.



DIMENSIONS				
	METRIC		IMPERIAL	
CODE	MIN	MAX	MIN	MAX
A	6.25	6.35	0.246	0.250
B	4.80	5.05	0.189	0.199
C	3.85	3.95	0.152	0.156
D	0.35	0.45	0.014	0.018
E	0.78	0.82	0.031	0.032
F	0.88	0.92	0.035	0.036
G	1.38	1.42	0.054	0.056
H	0.88	0.92	0.035	0.036
J	0.48	0.52	0.019	0.020
K	1.17	1.27	0.046	0.050
L	2.77	2.87	0.109	0.113
M	0.535	0.595	0.021	0.023
R	0.02	0.08	0.0008	0.0031
P	0.08	0.17	0.003	0.007

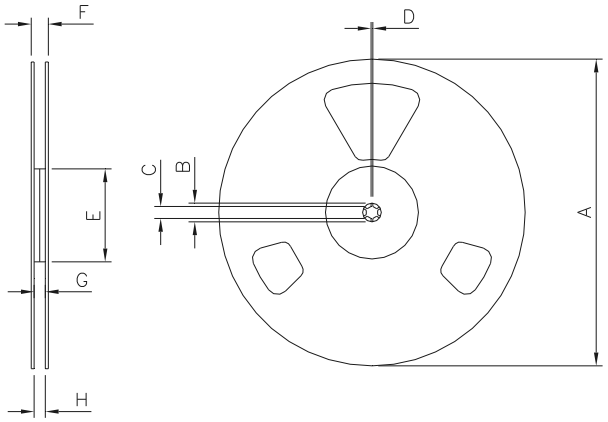
Dimensions are shown in
millimeters (inches)

DirectFET® Part Marking



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

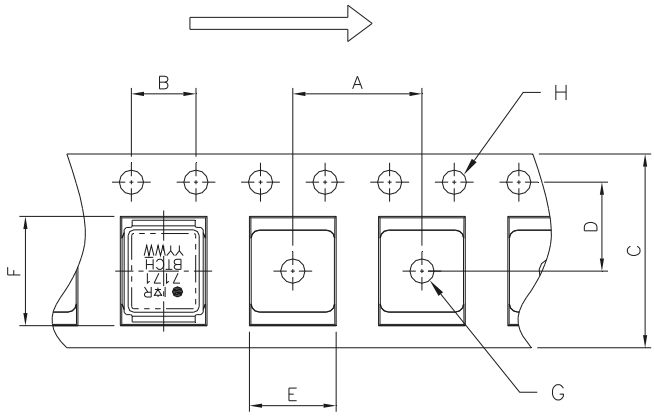
DirectFET® Tape & Reel Dimension (Showing component orientation).



NOTE: Controlling dimensions in mm
Std reel quantity is 4800 parts. (ordered as IRF7171MTRPBF). For 1000 parts on 7" reel, order IRF7171MTR1PBF

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

LOADED TAPE FEED DIRECTION



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

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

Qualification Information†

Qualification Level	Industrial†† *	
Moisture Sensitivity Level	DirectFET® Medium Can	MSL1 (per JEDEC J-STD-020D†††)
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.

* Industrial qualification standards except autoclave test conditions.

Revision History

Date	Comment
12/3/2014	• Updated $R_{\theta JA}$ from "60°C/W" to "45°C/W" on page 3. • Updated I_D @ T_A and P_D @T_A based on $R_{\theta JA}$ corrected on page 1 & page 3.
3/25/2015	• Added "FastIRFET" on page 1.

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