

## DirectFET® N-Channel Power MOSFET ②

### Applications

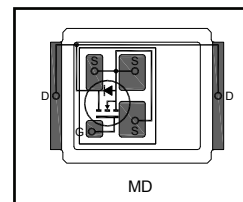
- ORing, eFuse, and high current load switch
- Load switch for battery application
- Inverter switches for DC motor application

Typical values (unless otherwise specified)

V <sub>DSS</sub>	V <sub>GS</sub>	V <sub>GS(th)</sub>	R <sub>DS(on)</sub>	R <sub>DS(on)</sub>	R <sub>DS(on)</sub>
20V max	±12V max	0.8V	0.50mΩ@10V	0.65mΩ@4.5V	1.1mΩ@2.5V

### Features and Benefits

- Environmentally Friendly Product
- RoHs compliant containing no Lead, no Bromide and no Halogen
- Very Low R<sub>DS(on)</sub>



Applicable DirectFET Outline and Substrate Outline (see p.7,8 for details) ①

SQ	SX	ST		MQ	<b>MD</b>	MT	MP	MC		
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### Description

The IRL6283MTRPbF combines the latest HEXFET® N-Channel 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 0.6 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%.

Base part number	Package Type	Standard Pack		Orderable Part Number
		Form	Quantity	
IRL6283MTRPbF	DirectFET Medium Can	Tape and Reel	4800	IRL6283MTRPbF

### Absolute Maximum Ratings

	Parameter	Max.	Units
V <sub>GS</sub>	Gate-to-Source Voltage	±12	V
I <sub>D</sub> @ T <sub>A</sub> = 25°C	Continuous Drain Current, V <sub>GS</sub> @ 4.5V ③	38	A
I <sub>D</sub> @ T <sub>A</sub> = 70°C	Continuous Drain Current, V <sub>GS</sub> @ 4.5V ③	30	
I <sub>D</sub> @ T <sub>C</sub> = 25°C	Continuous Drain Current, V <sub>GS</sub> @ 4.5V ④	211	
I <sub>DM</sub>	Pulsed Drain Current ⑤	305	
E <sub>AS</sub>	Single Pulse Avalanche Energy ⑥	406	mJ
I <sub>AR</sub>	Avalanche Current ⑤	30	A

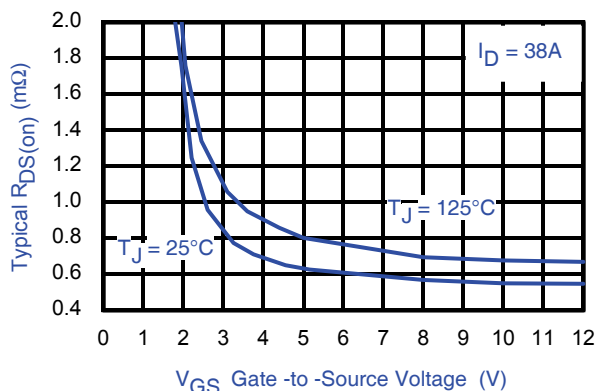


Fig 1. Typical On-Resistance vs. Gate Voltage

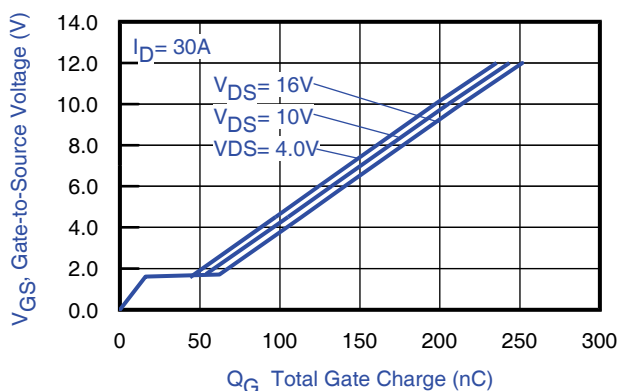


Fig 2. Typical Total Gate Charge vs. Gate-to-Source Voltage

### Notes:

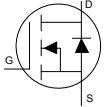
- ① Click on this section to link to the appropriate technical paper.
- ② Click on this section to link to the DirectFET Website.
- ③ Surface mounted on 1 in. square Cu board, steady state.

- ④ T<sub>c</sub> measured with thermocouple mounted to top (Drain) of part.
- ⑤ Repetitive rating; pulse width limited by max. junction temperature.
- ⑥ Starting T<sub>J</sub> = 25°C, L = 0.88mH, R<sub>G</sub> = 50Ω, I<sub>AS</sub> = 30A.

**Static @ T<sub>J</sub> = 25°C (unless otherwise specified)**

	Parameter	Min.	Typ.	Max.	Units	Conditions
BV <sub>DSS</sub>	Drain-to-Source Breakdown Voltage	20	—	—	V	V <sub>GS</sub> = 0V, I <sub>D</sub> = 250μA
ΔBV <sub>DSS</sub> /ΔT <sub>J</sub>	Breakdown Voltage Temp. Coefficient	—	4.8	—	mV/°C	Reference to 25°C, I <sub>D</sub> = 1.0mA
R <sub>DS(on)</sub>	Static Drain-to-Source On-Resistance	—	0.50	0.75	mΩ	V <sub>GS</sub> = 10V, I <sub>D</sub> = 50A ⑦
		—	0.65	0.87		V <sub>GS</sub> = 4.5V, I <sub>D</sub> = 50A ⑦
		—	1.1	1.5		V <sub>GS</sub> = 2.5V, I <sub>D</sub> = 50A ⑦
V <sub>GS(th)</sub>	Gate Threshold Voltage	0.5	0.8	1.1	V	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 100μA
ΔV <sub>GS(th)</sub>	Gate Threshold Voltage Coefficient	—	-3.9	—	mV/°C	
I <sub>DSS</sub>	Drain-to-Source Leakage Current	—	—	1.0	μA	V <sub>DS</sub> = 16V, V <sub>GS</sub> = 0V
		—	—	150		V <sub>DS</sub> = 16V, V <sub>GS</sub> = 0V, T <sub>J</sub> = 125°C
I <sub>GSS</sub>	Gate-to-Source Forward Leakage	—	—	100	nA	V <sub>GS</sub> = 12V
	Gate-to-Source Reverse Leakage	—	—	-100		V <sub>GS</sub> = -12V
g <sub>fs</sub>	Forward Transconductance	320	—	—	S	V <sub>DS</sub> = 10V, I <sub>D</sub> = 30A
Q <sub>g</sub>	Total Gate Charge	—	105	158	nC	V <sub>DS</sub> = 10V V <sub>GS</sub> = 4.5V I <sub>D</sub> = 30A
Q <sub>gs1</sub>	Pre-V <sub>th</sub> Gate-to-Source Charge	—	9.7	—		
Q <sub>gs2</sub>	Post-V <sub>th</sub> Gate-to-Source Charge	—	8.9	—		
Q <sub>gd</sub>	Gate-to-Drain Charge	—	35	—		
Q <sub>odr</sub>	Gate Charge Overdrive	—	51	—		
Q <sub>sw</sub>	Switch Charge (Q <sub>gs2</sub> + Q <sub>gd</sub> )	—	44	—		
Q <sub>oss</sub>	Output Charge	—	50	—	nC	V <sub>DS</sub> = 16V, V <sub>GS</sub> = 0V
R <sub>G</sub>	Gate Resistance	—	1.1	—	Ω	
t <sub>d(on)</sub>	Turn-On Delay Time	—	23	—	ns	V <sub>DD</sub> = 20V, V <sub>GS</sub> = 4.5V ⑦ I <sub>D</sub> = 30A R <sub>G</sub> = 1.8Ω
t <sub>r</sub>	Rise Time	—	160	—		
t <sub>d(off)</sub>	Turn-Off Delay Time	—	116	—		
t <sub>f</sub>	Fall Time	—	192	—		
C <sub>iss</sub>	Input Capacitance	—	8292	—	pF	V <sub>GS</sub> = 0V V <sub>DS</sub> = 10V f = 1.0MHz
C <sub>oss</sub>	Output Capacitance	—	2012	—		
C <sub>rss</sub>	Reverse Transfer Capacitance	—	1526	—		

**Diode Characteristics**

	Parameter	Min.	Typ.	Max.	Units	Conditions
I <sub>S</sub>	Continuous Source Current (Body Diode)	—	—	211	A	MOSFET symbol showing the integral reverse p-n junction diode. 
I <sub>SM</sub>	Pulsed Source Current (Body Diode) ⑤	—	—	305		
V <sub>SD</sub>	Diode Forward Voltage	—	—	1.2	V	T <sub>J</sub> = 25°C, I <sub>S</sub> = 30A, V <sub>GS</sub> = 0V ⑦
t <sub>rr</sub>	Reverse Recovery Time	—	48	72	ns	T <sub>J</sub> = 25°C, I <sub>F</sub> = 30A, V <sub>DD</sub> = 10V
Q <sub>rr</sub>	Reverse Recovery Charge	—	84	126	nC	di/dt = 200A/μs ⑦

**Notes:**

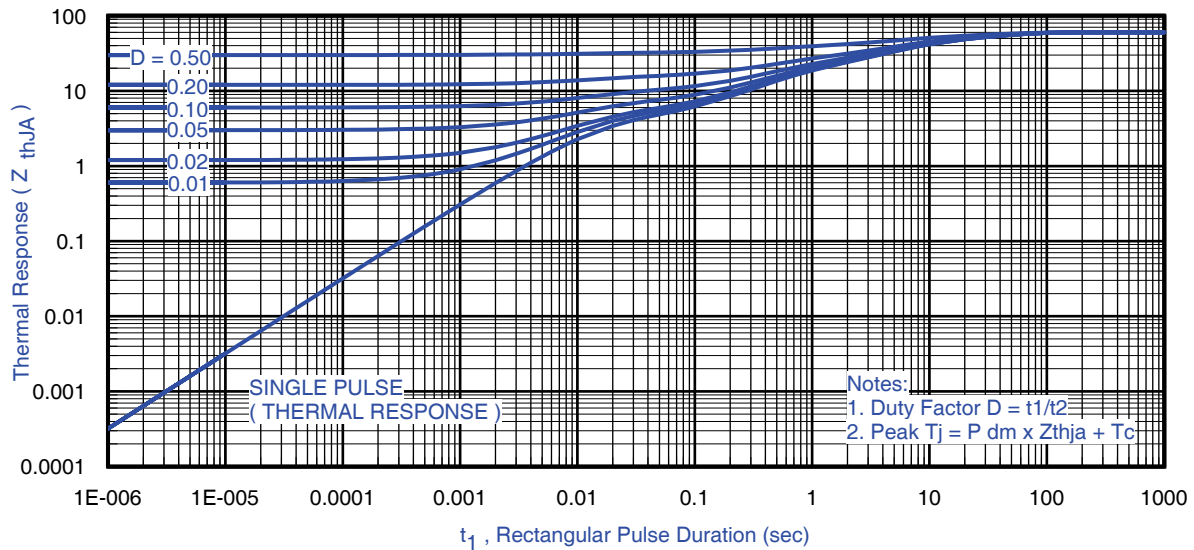
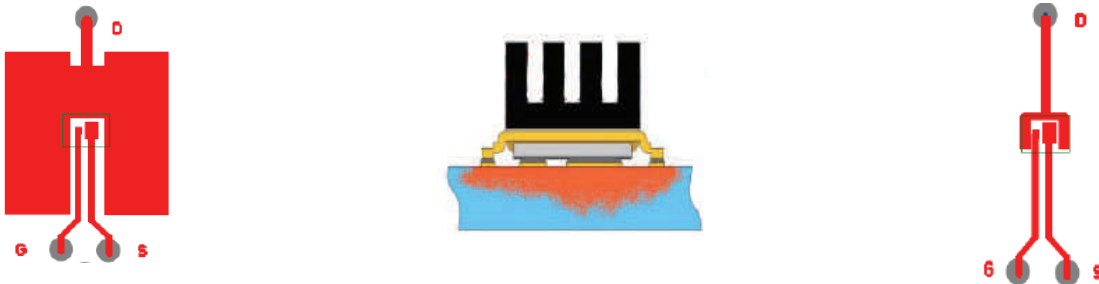
- ⑤ Repetitive rating; pulse width limited by max. junction temperature.
- ⑦ Pulse width ≤ 400μs; duty cycle ≤ 2%.

**Absolute Maximum Ratings**

	Parameter	Max.	Units
$P_D @ T_A = 25^\circ\text{C}$	Power Dissipation ③	2.1	W
$P_D @ T_A = 70^\circ\text{C}$	Power Dissipation ③	1.3	
$P_D @ T_C = 25^\circ\text{C}$	Power Dissipation ④	63	
$T_P$	Peak Soldering Temperature	270	°C
$T_J$	Operating Junction and	-40 to + 150	
$T_{STG}$	Storage Temperature Range		

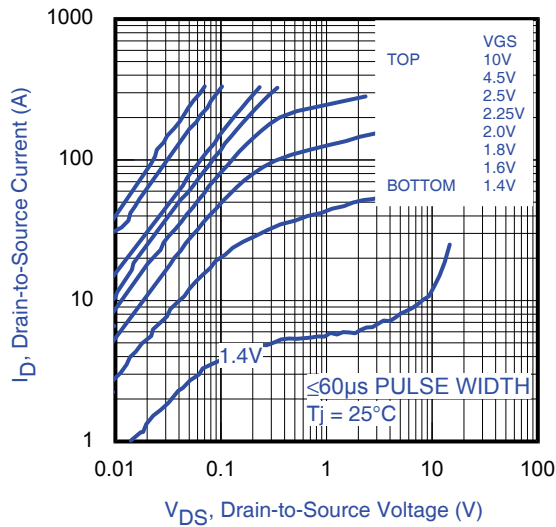
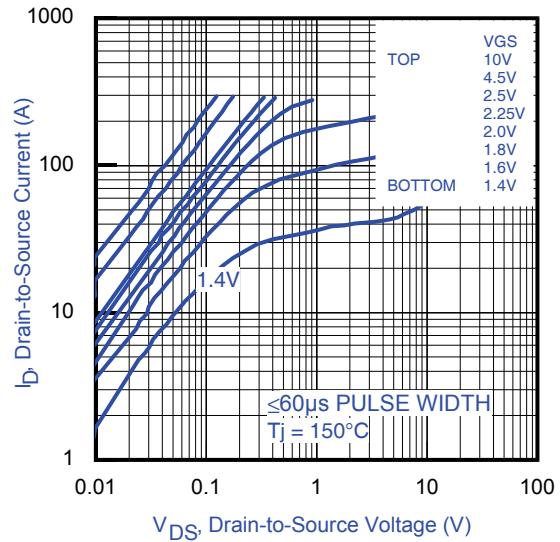
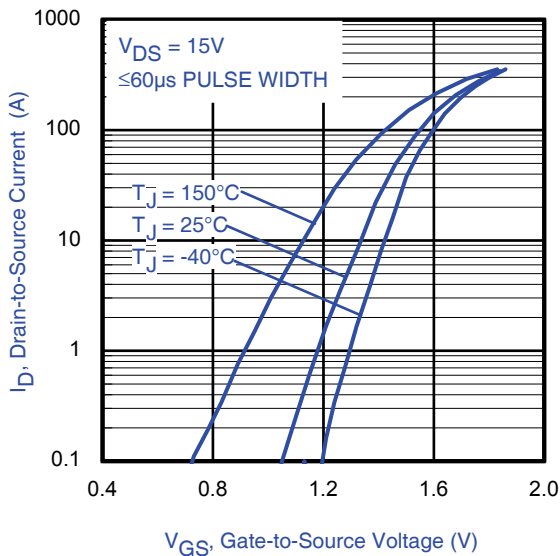
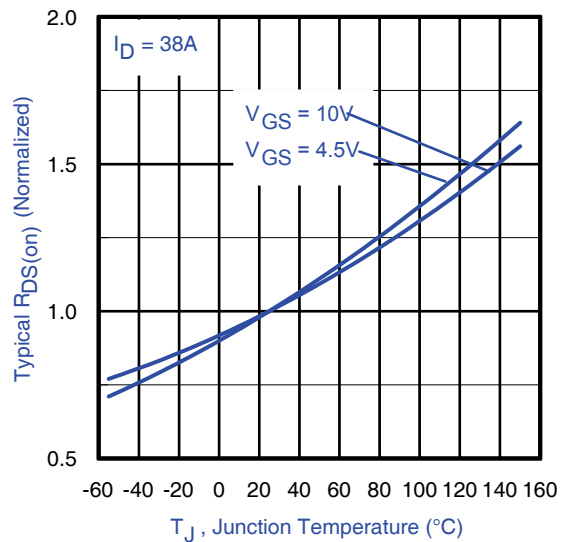
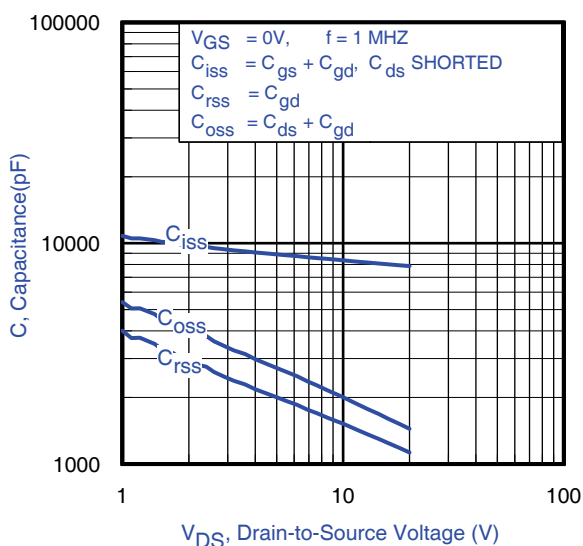
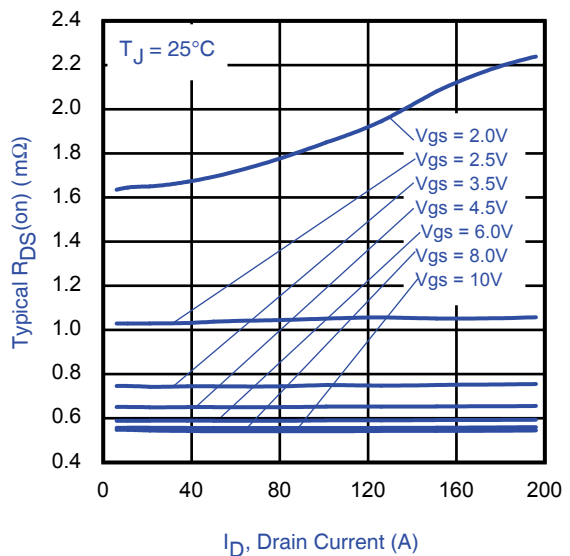
**Thermal Resistance**

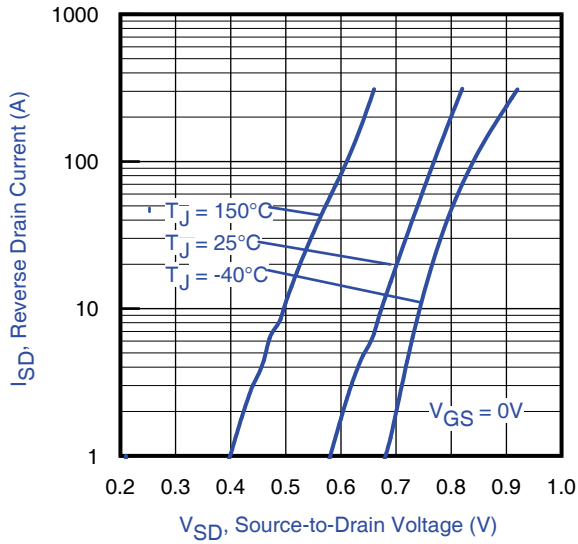
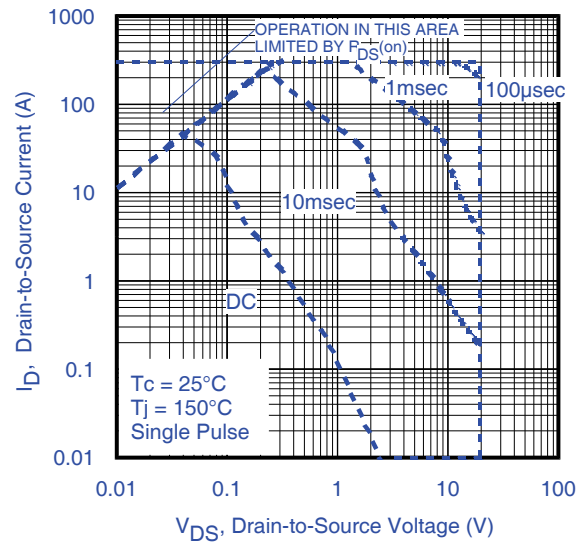
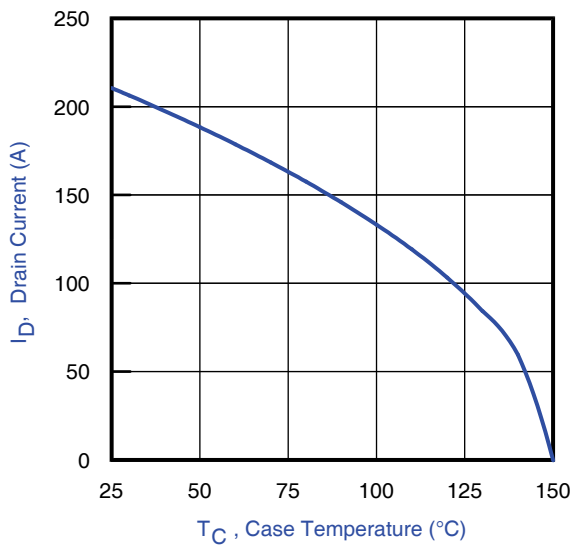
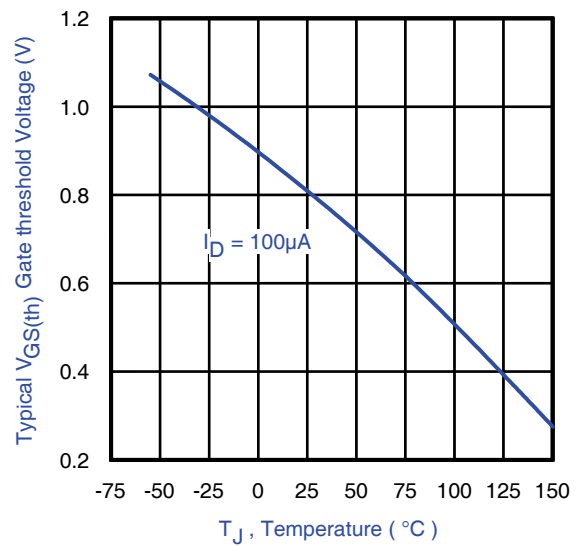
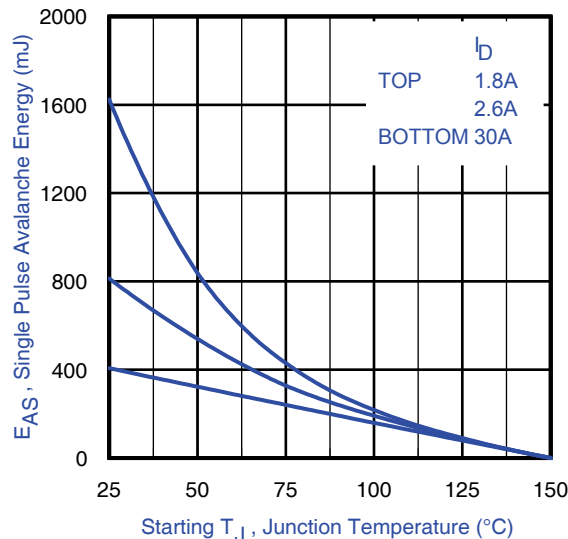
	Parameter	Typ.	Max.	Units
$R_{\theta JA}$	Junction-to-Ambient ③	—	60	°C/W
$R_{\theta JA}$	Junction-to-Ambient ⑧	12.5	—	
$R_{\theta JA}$	Junction-to-Ambient ⑨	20	—	
$R_{\theta JC}$	Junction-to-Case ④⑩	—	1.97	
$R_{\theta J-PCB}$	Junction-to-PCB Mounted	1.0	—	
	Linear Derating Factor ③	0.02		W/°C

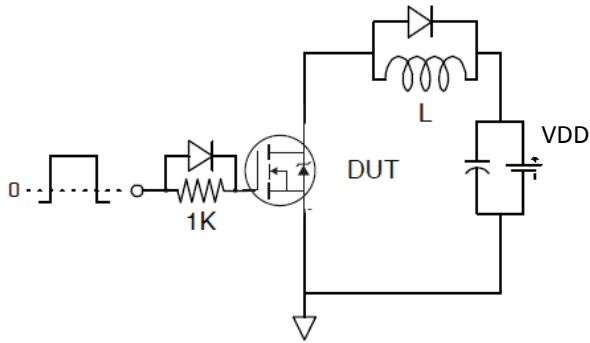
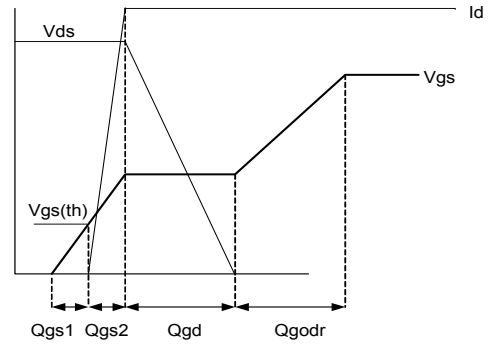
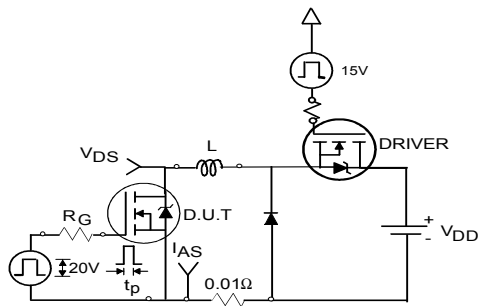
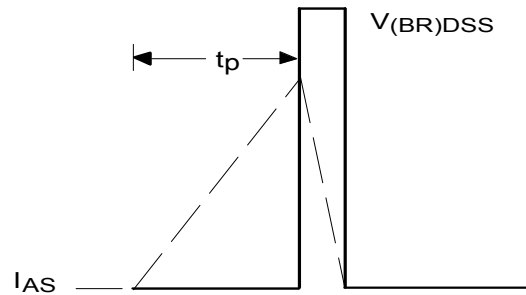
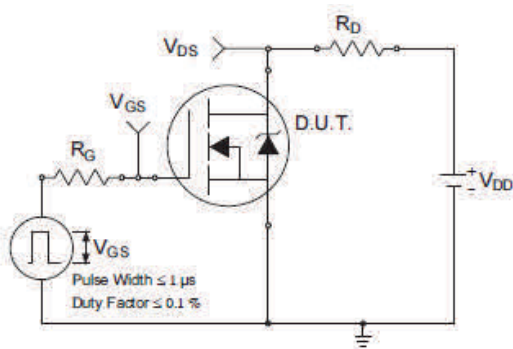
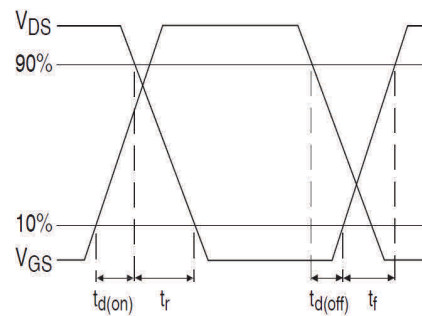

**Fig 3. Maximum Effective Transient Thermal Impedance, Junction-to-Ambient ③**


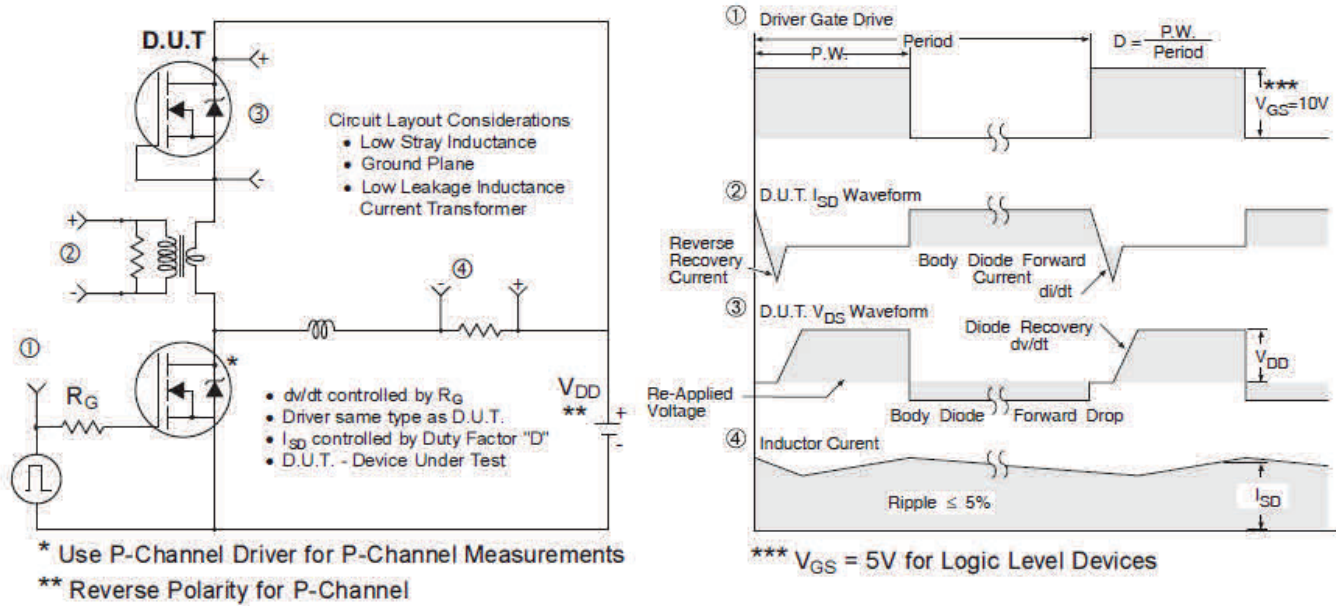
- ③ Surface mounted on 1 in. square Cu board, steady state.
- ④  $T_c$  measured with thermocouple mounted to top (Drain) of part.
- ⑧ Used double sided cooling, mounting pad with large heat sink.

- ⑨ Mounted on minimum footprint full size board with metalized back and with small clip heat sink.
- ⑩  $R_{\theta}$  is measured at  $T_J$  of approximately  $90^\circ\text{C}$ .


**Fig 4. Typical Output Characteristics**

**Fig 5. Typical Output Characteristics**

**Fig 6. Typical Transfer Characteristics**

**Fig 7. Normalized On-Resistance vs. Temperature**

**Fig 8. Typical Capacitance vs. Drain-to-Source Voltage**

**Fig 9. Typical On-Resistance vs. Drain Current and Voltage**


**Fig 10. Typical Source-Drain Diode Forward Voltage**

**Fig 11. Maximum Safe Operating Area**

**Fig 12. Maximum Drain Current vs. Case Temperature**

**Fig 13. Typical Threshold Voltage vs. Junction Temperature**

**Fig 14. Maximum Avalanche Energy vs. Drain Current**

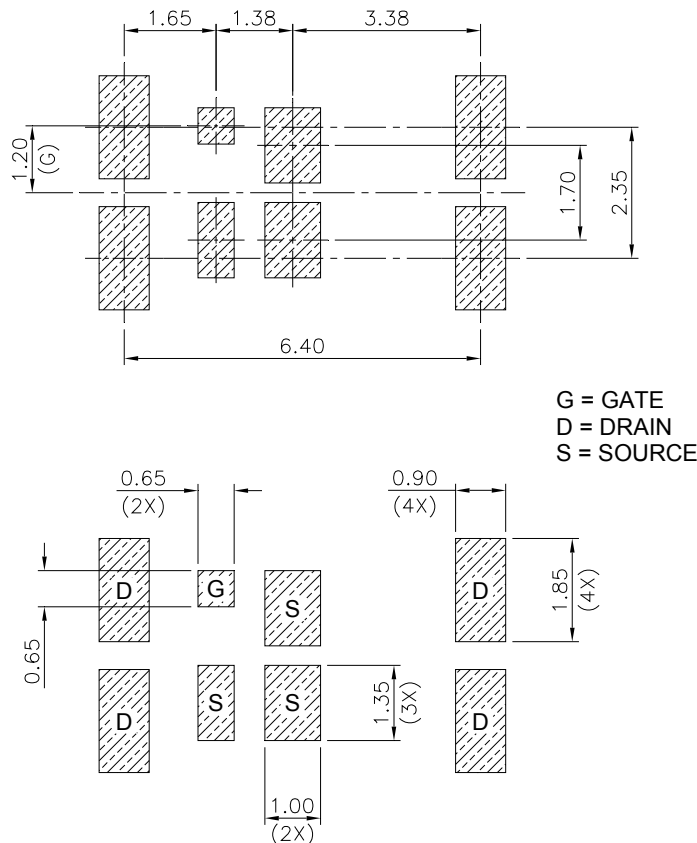

**Fig 15a. Gate Charge Test Circuit**

**Fig 15b. Gate Charge Waveform**

**Fig 16a. Unclamped Inductive Test Circuit**

**Fig 16b. Unclamped Inductive Waveforms**

**Fig 17a. Switching Time Test Circuit**

**Fig 17b. Switching Time Waveforms**



**Fig 18. Peak Diode Recovery  $dv/dt$  Test Circuit for N-Channel HEXFET<sup>®</sup> Power MOSFETs**

**DirectFET<sup>®</sup> Board Footprint, MD Outline (Medium Size Can, D-Designation).**

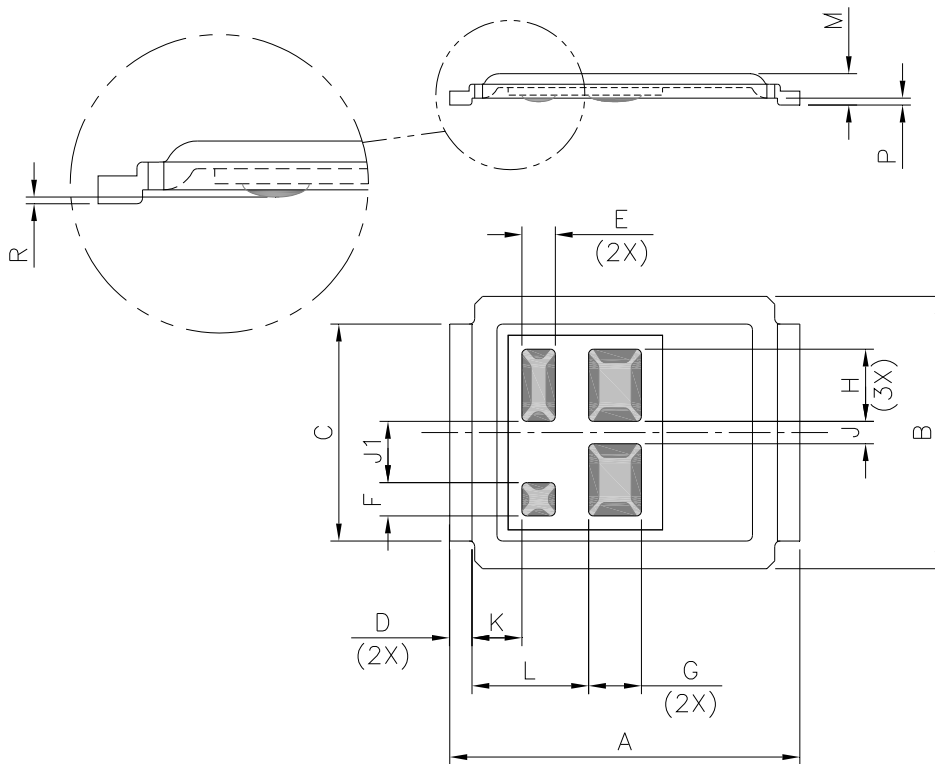
Please see DirectFET application note AN-1035 for all details regarding the assembly of DirectFET. This includes all recommendations for stencil and substrate designs.



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

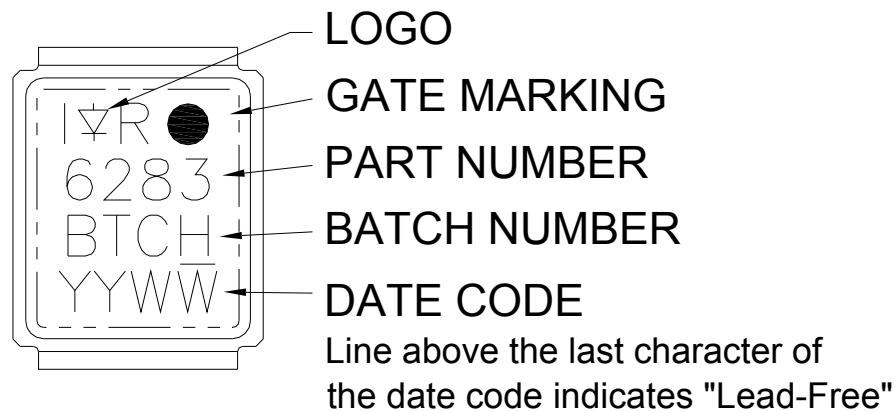
**DirectFET® Outline Dimension, MD Outline  
(Medium Size Can, D-Designation).**

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



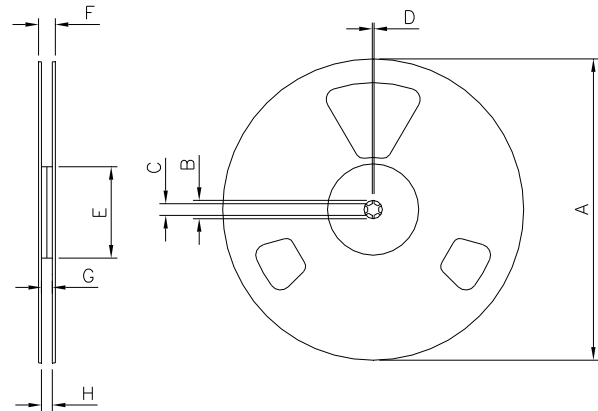
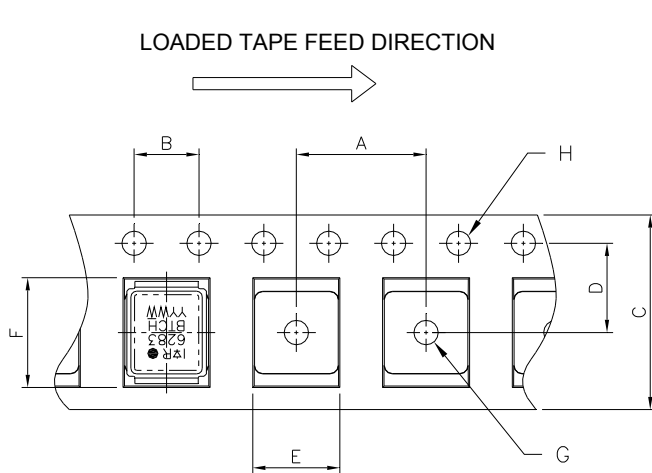
CODE	METRIC		IMPERIAL	
	MIN	MAX	MIN	MAX
A	6.25	6.35	0.246	0.250
B	4.80	5.05	0.189	0.199
C	3.85	3.95	0.152	0.156
D	0.35	0.45	0.014	0.018
E	0.58	0.62	0.023	0.024
F	0.58	0.62	0.023	0.024
G	0.93	0.97	0.037	0.038
H	1.28	1.32	0.050	0.052
J	0.38	0.42	0.015	0.017
J1	1.08	1.12	0.043	0.044
K	0.88	0.92	0.035	0.036
L	2.08	2.12	0.082	0.083
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 IRL6283MTRPbF). For 1000 parts on 7" reel, order IRL6283MTR1PbF

NOTE: CONTROLLING DIMENSIONS IN MM

CODE	DIMENSIONS		DIMENSIONS	
	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

REEL DIMENSIONS								
CODE	STANDARD OPTION (QTY 4800)				TR1 OPTION (QTY 1000)			
	METRIC		IMPERIAL		METRIC		IMPERIAL	
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: For the most current drawing please refer to IR website at <http://www.irf.com/package/>

**Qualification Information†**

<b>Moisture Sensitivity Level</b>	DirectFET	MSL1 (per JEDEC J-STD-020D††)
<b>RoHS Compliant</b>	Yes	

† Qualification standards can be found at International Rectifier's web site <http://www.irf.com/product-info/reliability/>

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

**Revision History**

Date	Comments
2/4/2014	<ul style="list-style-type: none"> <li>Converted the data sheet to StrongIRFET template.</li> <li>Updated the schematic drawing, on page 1.</li> </ul>
9/24/2014	<ul style="list-style-type: none"> <li>Updated notes on page 2 &amp; page 3</li> </ul>