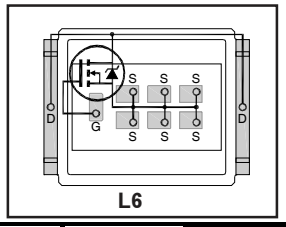
International
IOR Rectifier

IRF7737L2TRPbF
IRF7737L2TR1PbF

DirectFET® Power MOSFET ②

- Advanced Process Technology
- Optimized for Industrial Motor Drive, DC-DC and other Heavy Load Applications
- Exceptionally Small Footprint and Low Profile
- High Power Density
- Low Parasitic Parameters
- Dual Sided Cooling
- Repetitive Avalanche Capability for Robustness and Reliability
- Lead Free, RoHS Compliant and Halogen Free

$V_{(BR)DSS}$	40V
$R_{DS(on)}$ typ.	1.5mΩ
max.	1.9mΩ
$I_{D\ (Silicon\ Limited)}$	156A
Q_g	89nC



L6


DirectFET® ISOMETRIC

Applicable DirectFET® Outline and Substrate Outline ①

SB	SC			M2	M4		L4	L6	L8	

Description

The IRF7737L2PbF combines the latest HEXFET® Power MOSFET Silicon technology with the advanced DirectFET® packaging technology to achieve exceptional performance in a package that has the footprint of a DPak (TO-252AA) 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.

This HEXFET® Power MOSFET is designed for applications where efficiency and power density are of value. The advanced DirectFET® packaging platform coupled with the latest silicon technology allows the IRF7737L2PbF to offer substantial system level savings and performance improvement specifically in motor drive, high frequency DC-DC and other heavy load applications. This MOSFET utilizes the latest processing techniques to achieve low on-resistance and low Qg per silicon area. Additional features of this MOSFET are 175°C operating junction temperature and high repetitive peak current capability. These features combine to make this MOSFET a highly efficient, robust and reliable device for high current applications.

Absolute Maximum Ratings

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only; and functional operation of the device at these or any other condition beyond those indicated in the specifications is not implied.Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability. The thermal resistance and power dissipation ratings are measured under board mounted and still air conditions. Ambient temperature (T_A) is 25°C, unless otherwise specified.

	Parameter	Max.	Units
V_{DS}	Drain-to-Source Voltage	40	V
V_{GS}	Gate-to-Source Voltage	± 20	
I_D @ T_C = 25°C	Continuous Drain Current, V_{GS} @ 10V (Silicon Limited)④	156	A
I_D @ T_C = 100°C	Continuous Drain Current, V_{GS} @ 10V (Silicon Limited)④	110	
I_D @ T_A = 25°C	Continuous Drain Current, V_{GS} @ 10V (Silicon Limited)③	31	
I_D @ T_C = 25°C	Continuous Drain Current, V_{GS} @ 10V (Package Limited)	315	
I_{DM}	Pulsed Drain Current ⑤	624	
P_D @T_C = 25°C	Power Dissipation ④	83	W
P_D @T_A = 25°C	Power Dissipation ③	3.3	
E_{AS}	Single Pulse Avalanche Energy (Thermally Limited) ⑥	104	mJ
E_{AS} (tested)	Single Pulse Avalanche Energy Tested Value ⑥	386	
I_{AR}	Avalanche Current ⑤	See Fig.18a, 18b, 16, 17	A
E_{AR}	Repetitive Avalanche Energy ⑤		mJ
T_P	Peak Soldering Temperature	270	°C
T_J	Operating Junction and	-55 to + 175	
T_{STG}	Storage Temperature Range		

Thermal Resistance

	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	—	
$R_{\theta JCan}$	Junction-to-Can ④⑩	—	1.8	
$R_{\theta J\text{-}PCB}$	Junction-to-PCB Mounted	—	0.5	
	Linear Derating Factor ④	0.56		W/°C

HEXFET® is a registered trademark of International Rectifier.

Static Characteristics @ T_J = 25°C (unless otherwise stated)

	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(BR)DSS}$	Drain-to-Source Breakdown Voltage	40	—	—	V	V_{GS} = 0V, I_D = 250µA
$\Delta V_{(BR)DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	—	0.03	—	V/°C	Reference to 25°C, I_D = 1mA
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	—	1.5	1.9	mΩ	V_{GS} = 10V, I_D = 94A ⑦
$V_{GS(th)}$	Gate Threshold Voltage	2.0	3.0	4.0	V	V_{DS} = V_{GS}, I_D = 150µA
$\Delta V_{GS(th)}/\Delta T_J$	Gate Threshold Voltage Coefficient	—	-10	—	mV/°C	
gfs	Forward Transconductance	100	—	—	S	V_{DS} = 10V, I_D = 94A
R_G	Gate Resistance	—	0.6	—	Ω	
I_{DSS}	Drain-to-Source Leakage Current	—	—	5	µA	V_{DS} = 40V, V_{GS} = 0V
		—	—	250		V_{DS} = 40V, 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

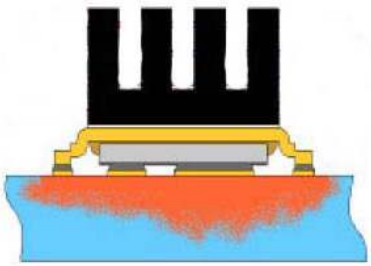
Dynamic Characteristics @ T_J = 25°C (unless otherwise stated)

	Parameter	Min.	Typ.	Max.	Units	Conditions
Q_g	Total Gate Charge	—	89	134	nC	V_{DS} = 20V, V_{GS} = 10V
Q_{gs1}	Pre-Vth Gate-to-Source Charge	—	18	—		I_D = 94A
Q_{gs2}	Post-Vth Gate-to-Source Charge	—	8	—		See Fig.11
Q_{gd}	Gate-to-Drain ("Miller") Charge	—	34	—		
Q_{godr}	Gate Charge Overdrive	—	29	—		
Q_{sw}	Switch Charge (Q_{gs2} + Q_{gd})	—	42	—		
Q_{oss}	Output Charge	—	39	—	nC	V_{DS} = 16V, V_{GS} = 0V
$t_{d(on)}$	Turn-On Delay Time	—	12	—	ns	V_{DD} = 20V, V_{GS} = 10V ⑦
t_r	Rise Time	—	19	—		I_D = 94A
$t_{d(off)}$	Turn-Off Delay Time	—	22	—		R_G = 1.8Ω
t_f	Fall Time	—	14	—		
C_{iss}	Input Capacitance	—	5469	—	pF	V_{GS} = 0V
C_{oss}	Output Capacitance	—	1193	—		V_{DS} = 25V
C_{rss}	Reverse Transfer Capacitance	—	534	—		f = 1.0MHz
C_{oss}	Output Capacitance	—	4296	—		V_{GS} = 0V, V_{DS} = 1.0V, f=1.0MHz
C_{oss}	Output Capacitance	—	1066	—		V_{GS} = 0V, V_{DS} = 32V, f=1.0MHz
C_{oss} eff.	Effective Output Capacitance	—	1615	—		V_{GS} = 0V, V_{DS} = 0V to 32V

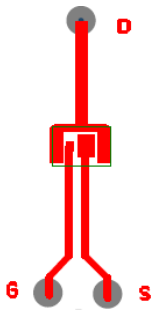
Diode Characteristics @ T_J = 25°C (unless otherwise stated)

	Parameter	Min.	Typ.	Max.	Units	Conditions
I_S	Continuous Source Current (Body Diode)	—	—	156	A	MOSFET symbol showing the integral reverse p-n junction diode.
I_{SM}	Pulsed Source Current (Body Diode) ⑤	—	—	624		
V_{SD}	Diode Forward Voltage	—	—	1.3	V	I_S = 94A, V_{GS} = 0V ⑦
t_{rr}	Reverse Recovery Time	—	35	53	ns	I_F = 94A, V_{DD} = 20V
Q_{rr}	Reverse Recovery Charge	—	32	48	nC	di/dt = 100A/µs ⑦

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



⑨ Mounted to a PCB with small clip heatsink (still air)



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

Notes ① through ⑩ are on page 10

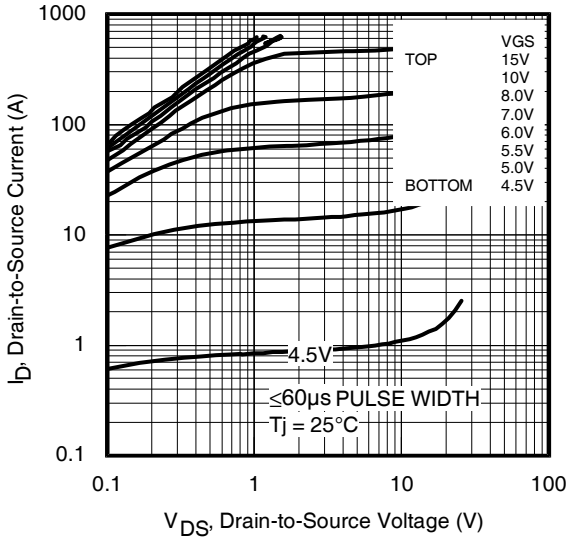


Fig 1. Typical Output Characteristics

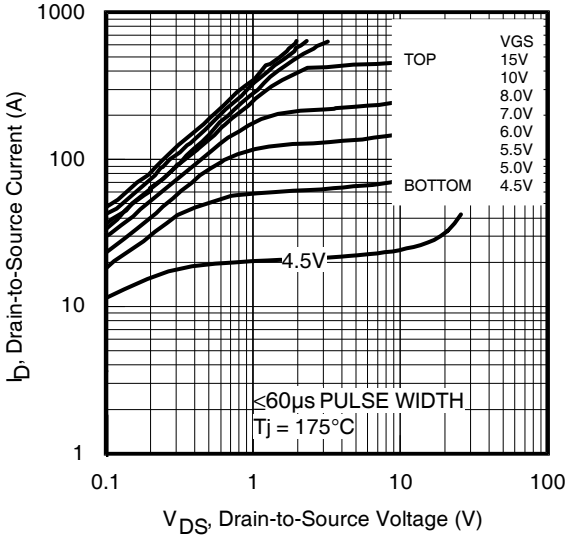


Fig 2. Typical Output Characteristics

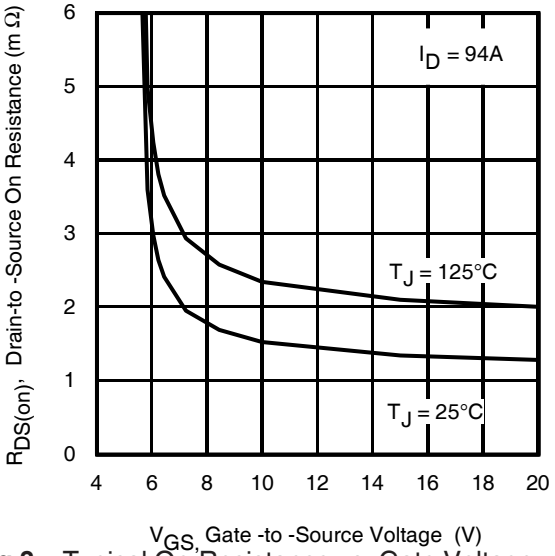


Fig 3. Typical On-Resistance vs. Gate Voltage

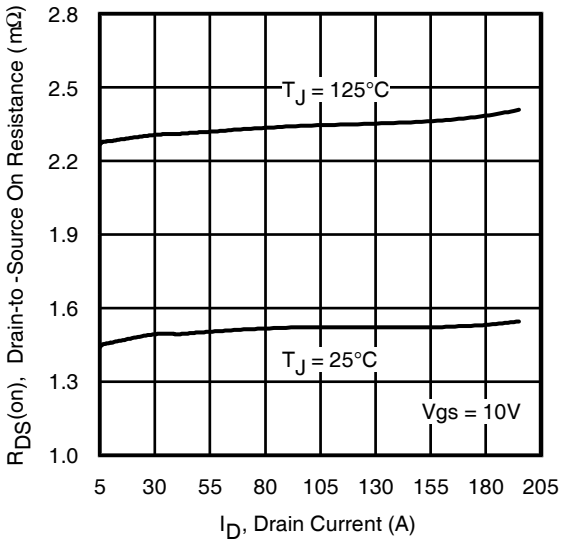


Fig 4. Typical On-Resistance vs. Drain Current

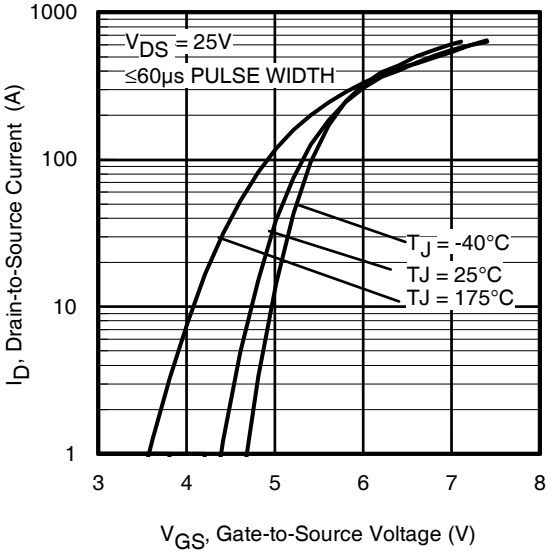


Fig 5. Typical Transfer Characteristics

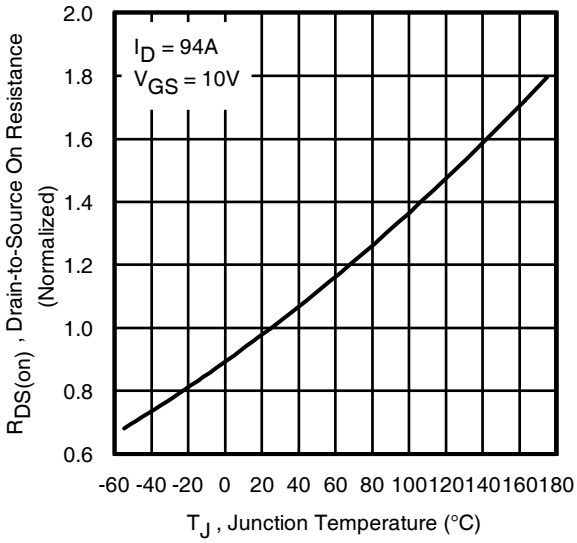


Fig 6. Normalized On-Resistance vs. Temperature

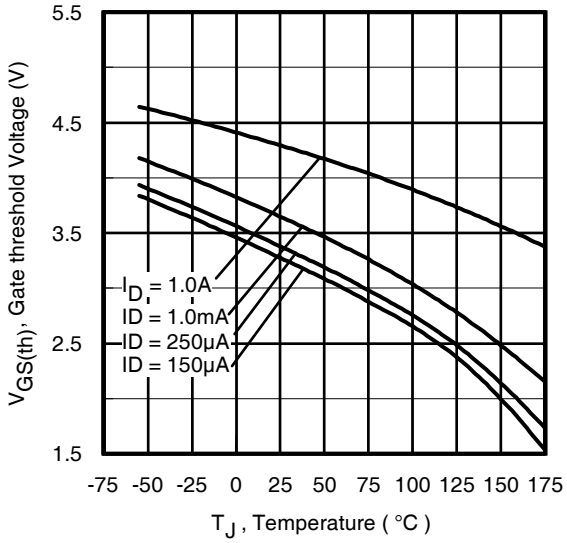


Fig 7. Typical Threshold Voltage vs. Junction Temperature

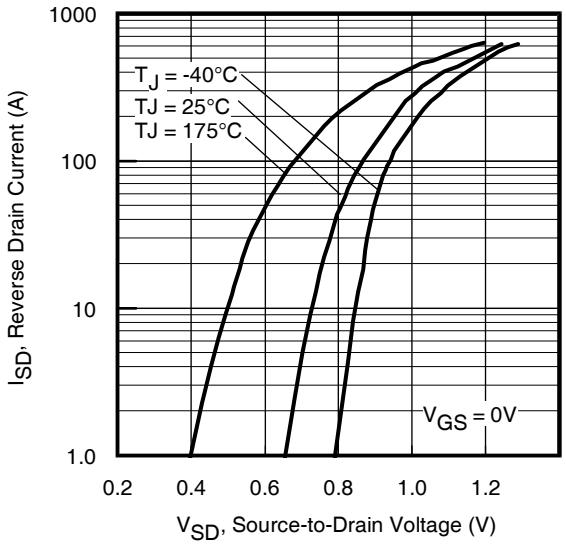


Fig 8. Typical Source-Drain Diode Forward Voltage

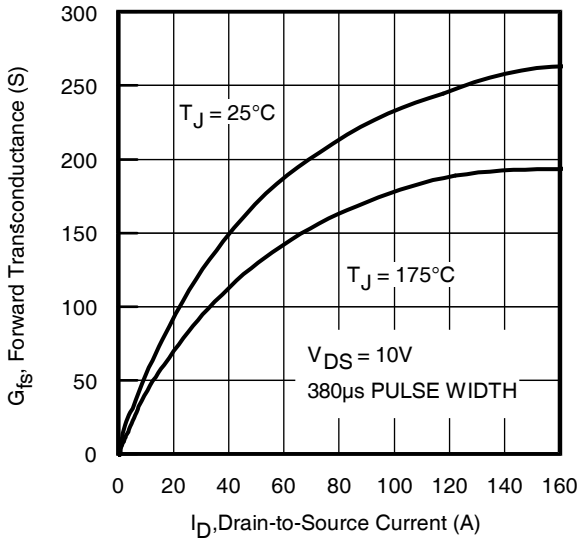


Fig 9. Typical Forward Transconductance Vs. Drain Current

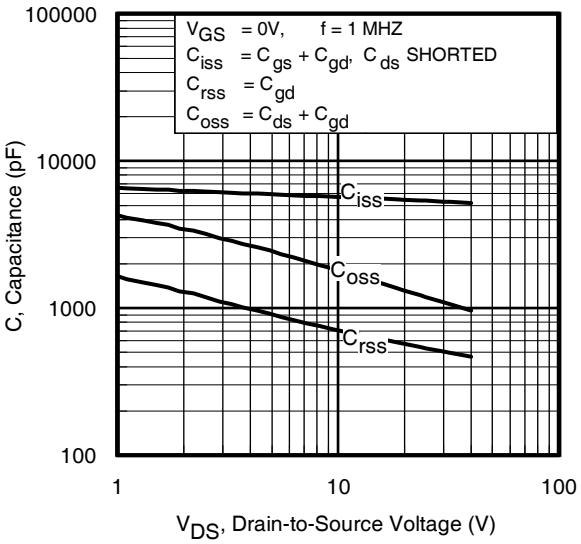


Fig 10. Typical Capacitance vs.Drain-to-Source Voltage

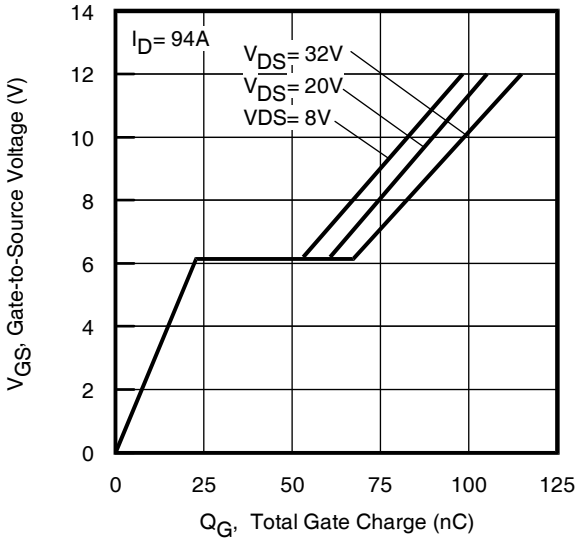


Fig.11 Typical Gate Charge vs.Gate-to-Source Voltage

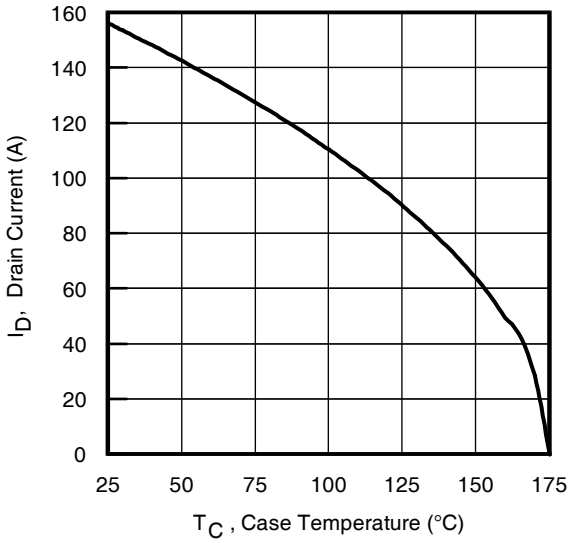


Fig 12. Maximum Drain Current vs. Case Temperature

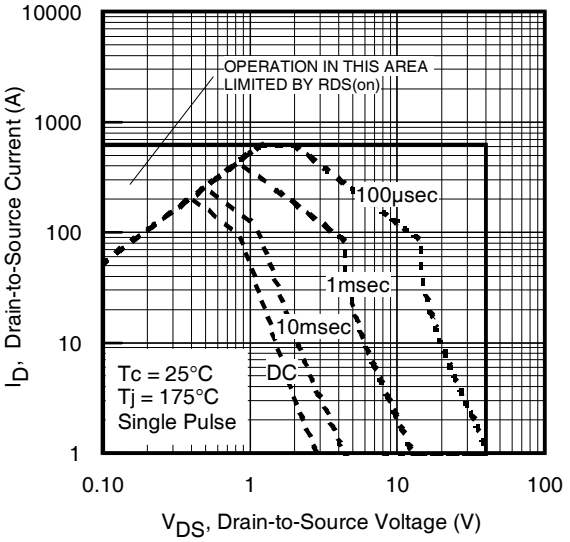


Fig 13. Maximum Safe Operating Area

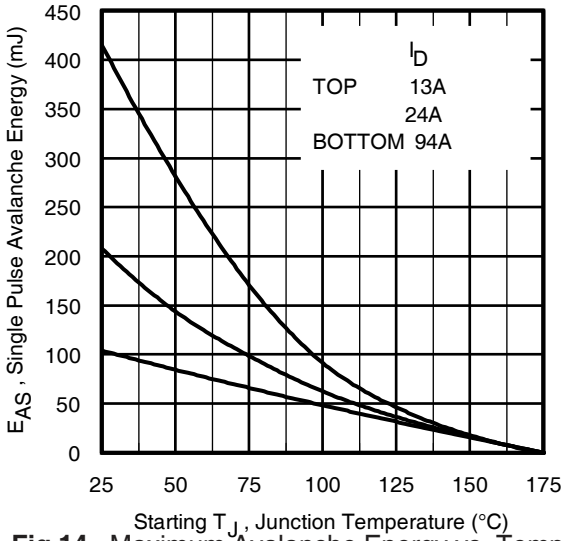


Fig 14. Maximum Avalanche Energy vs. Temperature

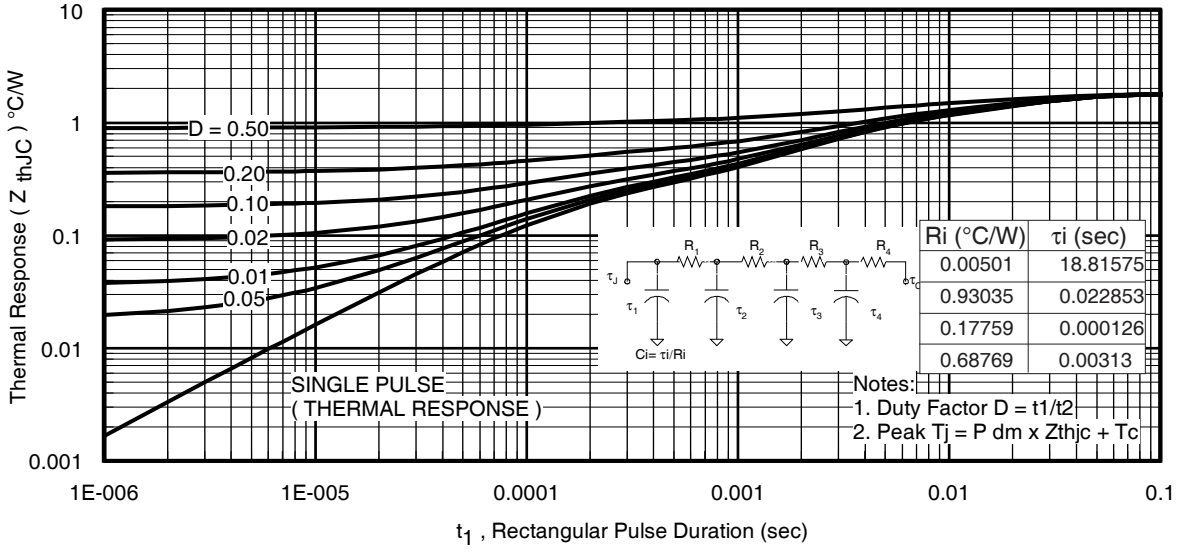


Fig 15. Maximum Effective Transient Thermal Impedance, Junction-to-Case

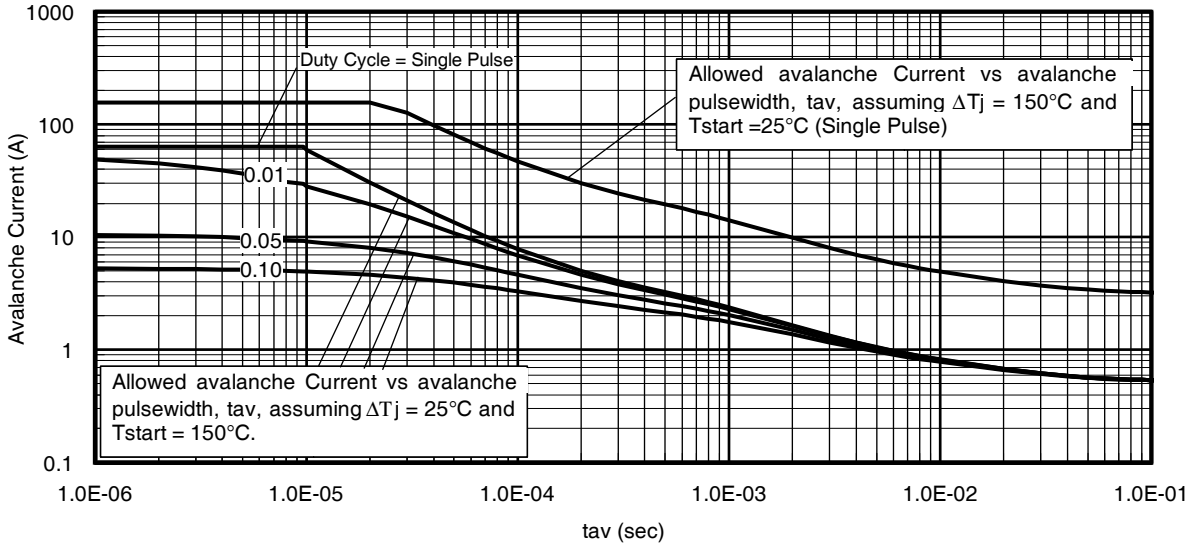


Fig 16. Typical Avalanche Current Vs.Pulsewidth

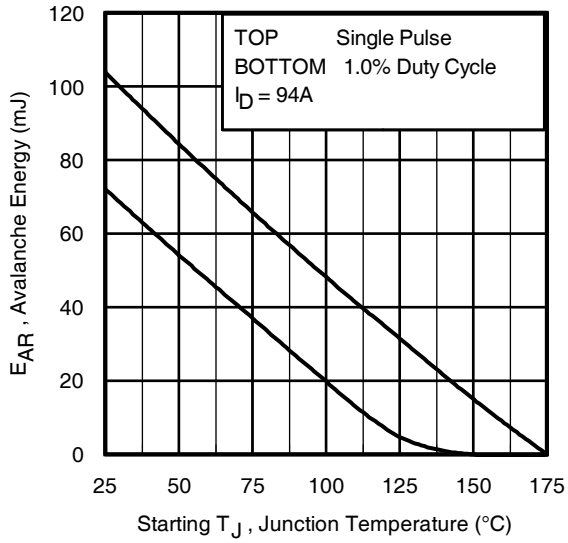


Fig 17. Maximum Avalanche Energy Vs. Temperature

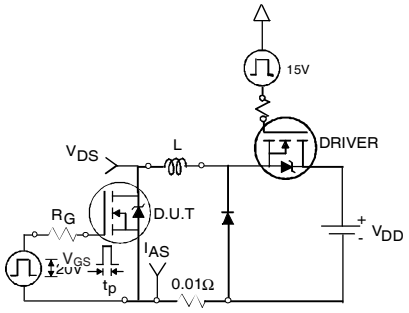


Fig 18a. Unclamped Inductive Test Circuit

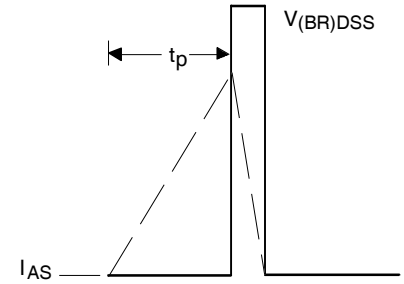


Fig 18b. Unclamped Inductive Waveforms

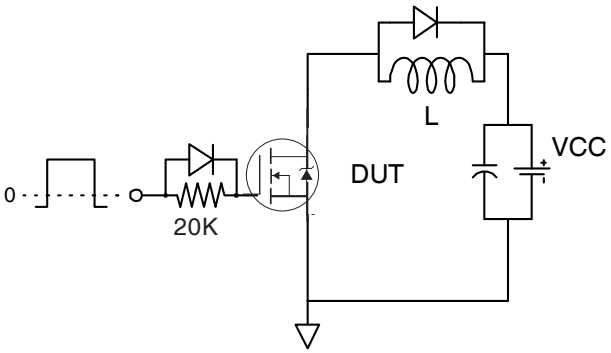


Fig 19a. Gate Charge Test Circuit

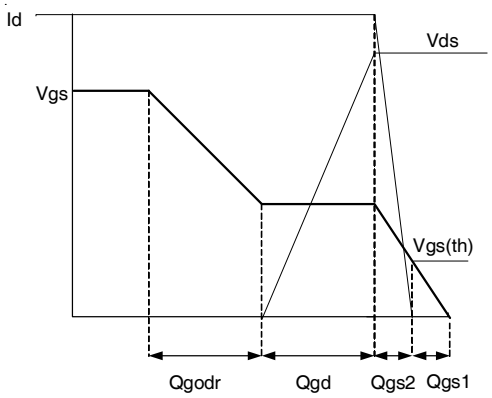


Fig 19b. Gate Charge Waveform

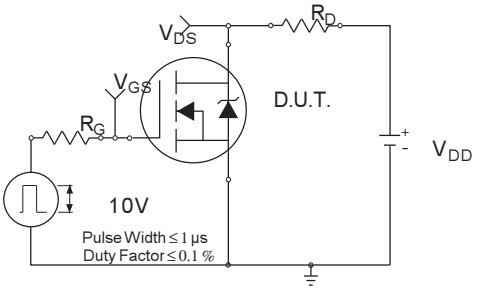


Fig 20a. Switching Time Test Circuit

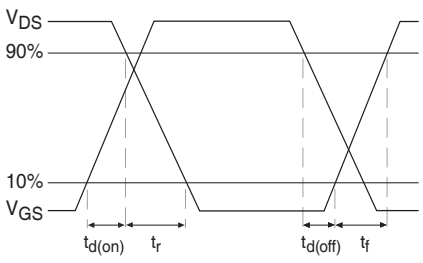


Fig 20b. Switching Time Waveforms

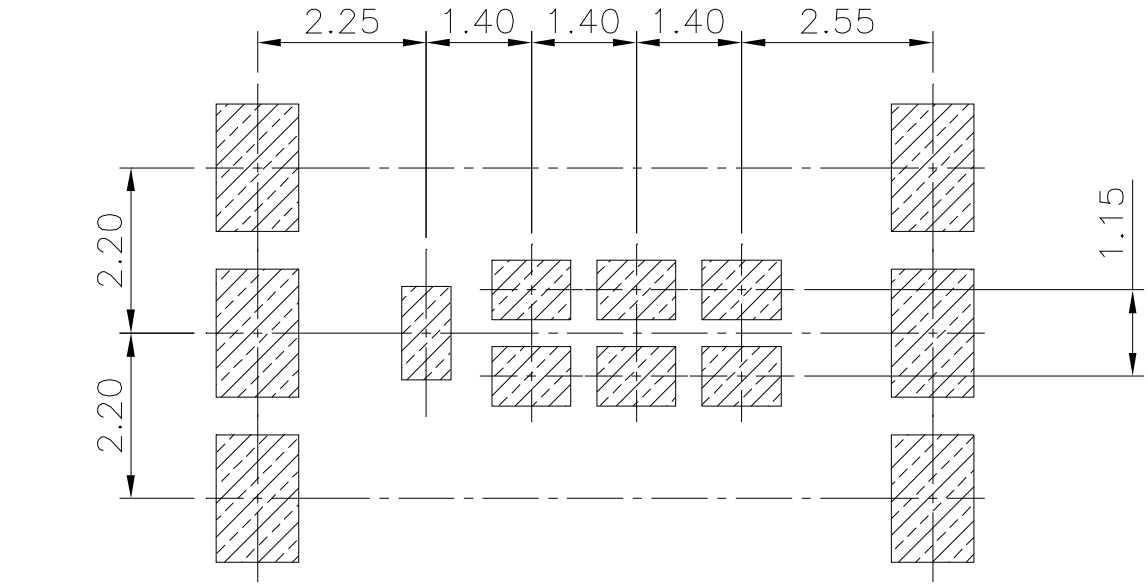
Notes on Repetitive Avalanche Curves , Figures 16, 17:
(For further info, see AN-1005 at www.irf.com)

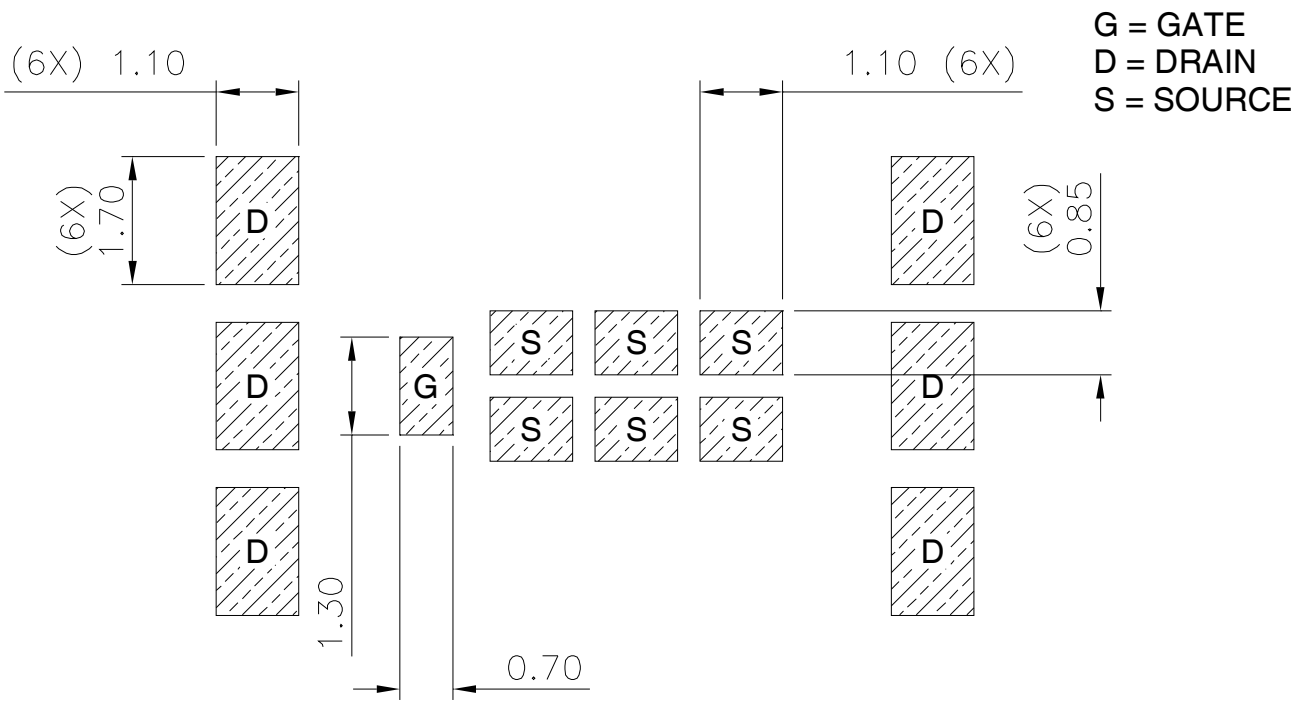
1. Avalanche failures assumption:
   Purely a thermal phenomenon and failure occurs at a temperature far in excess of T_{jmax}. This is validated for every part type.
2. Safe operation in Avalanche is allowed as long asT_{jmax} is not exceeded.
3. Equation below based on circuit and waveforms shown in Figures 18a, 18b.
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 16, 17).
   t_{av} = Average time in avalanche.
   D = Duty cycle in avalanche = $t_{av} \cdot f$
   $Z_{thJC}(D, t_{av})$ = Transient thermal resistance, see figure 15)

$$P_{D\ (ave)} = 1/2\ (\ 1.3 \cdot BV \cdot I_{av}) = \Delta T / Z_{thJC}$$
$$I_{av} = 2\Delta T / [1.3 \cdot BV \cdot Z_{th}]$$
$$E_{AS\ (AR)} = P_{D\ (ave)} \cdot t_{av}$$

DirectFET® Board Footprint, L6 (Large Size Can).

Please see AN-1035 for DirectFET® assembly details and stencil and substrate design recommendations

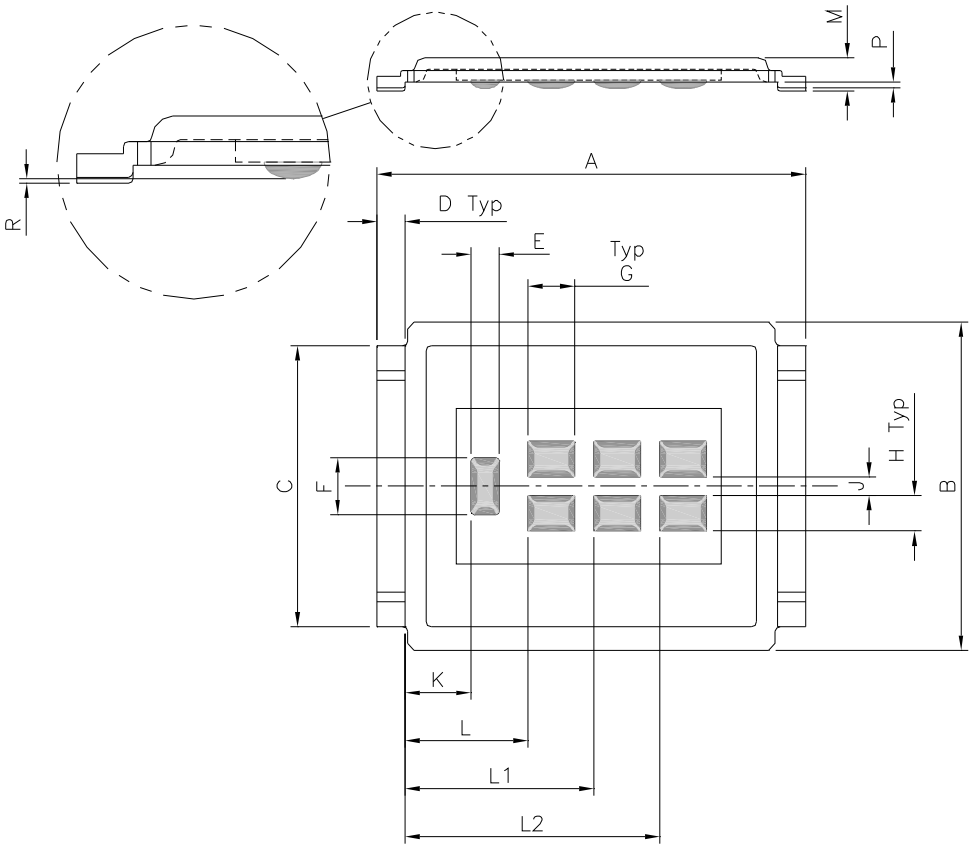




G = GATE
D = DRAIN
S = SOURCE

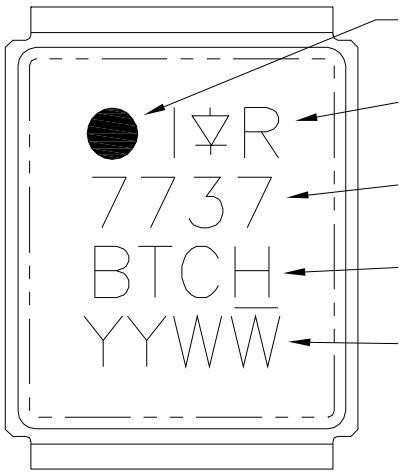
DirectFET™ Outline Dimension, L6 Outline (LargeSize Can).

Please see AN-1035 for DirectFET assembly details and stencil and substrate design recommendations



DIMENSIONS				
	METRIC		IMPERIAL	
CODE	MIN	MAX	MIN	MAX
A	9.05	9.15	0.356	0.360
B	6.85	7.10	0.270	0.280
C	5.90	6.00	0.232	0.236
D	0.55	0.65	0.022	0.026
E	0.58	0.62	0.023	0.024
F	1.18	1.22	0.046	0.048
G	0.98	1.02	0.039	0.040
H	0.73	0.77	0.029	0.030
J	0.38	0.42	0.015	0.017
K	1.35	1.45	0.053	0.057
L	2.55	2.65	0.100	0.104
L1	3.95	4.05	0.155	0.159
L2	5.35	5.45	0.210	0.214
M	0.68	0.74	0.027	0.029
P	0.09	0.17	0.003	0.007
R	0.02	0.08	0.001	0.003

DirectFET™ Part Marking



GATE MARKING

LOGO

PART NUMBER

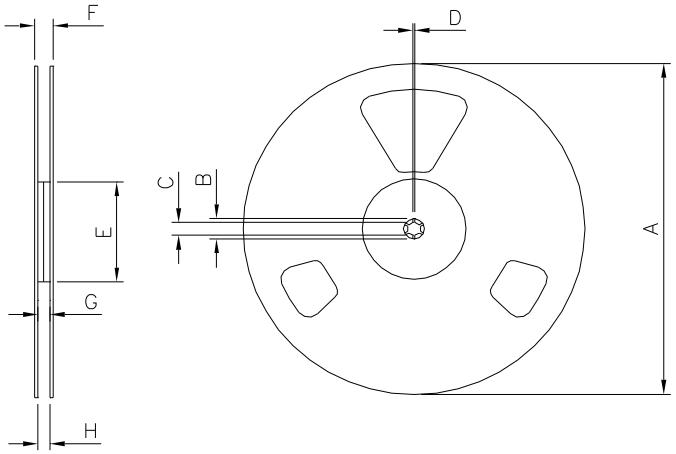
BATCH NUMBER

DATE CODE

Line above the last character of
the date code indicates "Lead-Free"

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

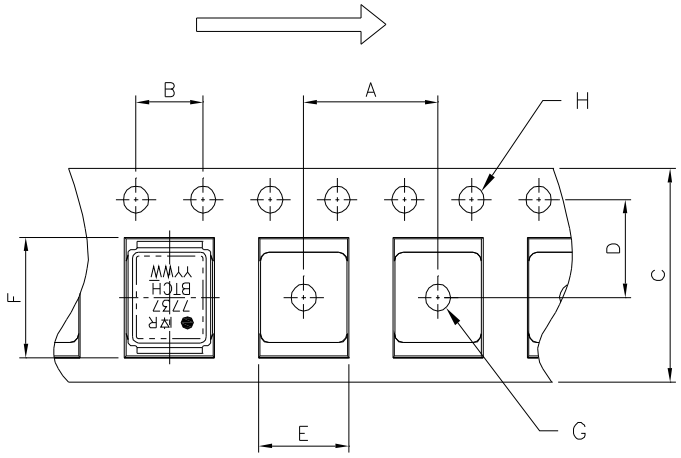
DirectFET® Tape & Reel Dimension (Showing component orientation).



NOTE: Controlling dimensions in mm
Std reel quantity is 4000 parts. (ordered as IRF7737L2TR). For 1000 parts on 7" reel, order IRF7737L2TR1

REEL DIMENSIONS								
STANDARD OPTION **(QTY 4000)**					TR1 OPTION **(QTY 1000)**			
	METRIC		IMPERIAL		METRIC		IMPERIAL	
CODE	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX
A	330.00	N.C	12.992	N.C	177.80	N.C	7.000	N.C
B	20.20	N.C	0.795	N.C	20.20	N.C	0.795	N.C
C	12.80	13.20	0.504	0.520	12.98	13.50	0.331	0.50
D	1.50	N.C	0.059	N.C	1.50	2.50	0.059	N.C
E	99.00	100.00	3.900	3.940	62.48	N.C	2.460	N.C
F	N.C	22.40	N.C	0.880	N.C	N.C	N.C	0.53
G	16.40	18.40	0.650	0.720	N.C	N.C	N.C	N.C
H	15.90	19.40	0.630	0.760	16.00	N.C	0.630	N.C

LOADED TAPE FEED DIRECTION



NOTE: CONTROLLING DIMENSIONS IN MM

DIMENSIONS				
	METRIC		IMPERIAL	
CODE	MIN	MAX	MIN	MAX
A	11.90	12.10	4.69	0.476
B	3.90	4.10	0.154	0.161
C	15.90	16.30	0.623	0.642
D	7.40	7.60	0.291	0.299
E	7.20	7.40	0.283	0.291
F	9.90	10.10	0.390	0.398
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/

Part number	Package Type	Standard Pack		Note
		Form	Quantity	
IRF7737L2TRPbF	DirectFET2 Large Can	Tape and Reel	4000	"TR" suffix
IRF7737L2TR1PbF	DirectFET2 Large Can	Tape and Reel	1000	"TR1" suffix

Qualification Information†

Qualification level	Industrial ††	
	(per JEDEC JESD47F††† guidelines)	
	Comments: This family of products has passed JEDEC's Industrial qualification. IR's Consumer qualification level is granted by extension of the higher Industrial level.	
Moisture Sensitivity Level	DFET2	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.

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_C 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 = 0.024mH, R_G = 50Ω, I_{AS} = 94A.
⑦ Pulse width ≤ 400µs; duty cycle ≤ 2%.
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.

Data and specifications subject to change without notice.
This product has been designed and qualified for the Industrial market.
Qualification Standards can be found on IR's Web site.

International
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