

### DirectFET® Dual N-Channel Power MOSFET ②

#### Applications

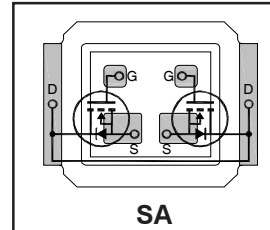
- Charge and Discharge Switch for Battery Application
- Isolation Switch for Input Power or Battery Application

#### Features and Benefits

- Environmentally Friendly Product
- RoHs Compliant, Halogen Free
- Dual Common-Drain N-Channel MOSFETs Provides High Level of Integration and Very Low RDS(on)

Typical values (unless otherwise specified)

<b>V<sub>DSS</sub></b>	<b>V<sub>GS</sub></b>	<b>R<sub>DS(on)</sub></b>	<b>R<sub>DS(on)</sub></b>		
20V max	±12V max	3.8mΩ @ 4.5V	5.4mΩ @ 2.5V		
<b>Q<sub>g tot</sub></b>	<b>Q<sub>gd</sub></b>	<b>Q<sub>gs2</sub></b>	<b>Q<sub>rr</sub></b>	<b>Q<sub>oss</sub></b>	<b>V<sub>gs(th)</sub></b>
27nC	9.5nC	1.4nC	21nC	15nC	0.80V



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

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

The IRL6297SDPbF 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 smaller than an 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	
IRL6297SDPbF	DirectFET Small Can	Tape and Reel	4800	IRL6297SDTRPbF

#### Absolute Maximum Ratings

	Parameter	Max.	Units
V <sub>DS</sub>	Drain-to-Source Voltage	20	V
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> @ 10V ③	15	A
I <sub>D</sub> @ T <sub>A</sub> = 70°C	Continuous Drain Current, V <sub>GS</sub> @ 10V ③	12	
I <sub>D</sub> @ T <sub>C</sub> = 25°C	Continuous Drain Current, V <sub>GS</sub> @ 10V ④	58	
I <sub>DM</sub>	Pulsed Drain Current ⑤	140	

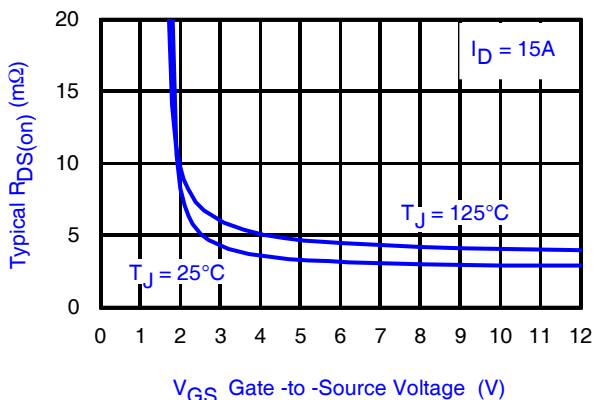


Fig 1. Typical On-Resistance vs. Gate Voltage

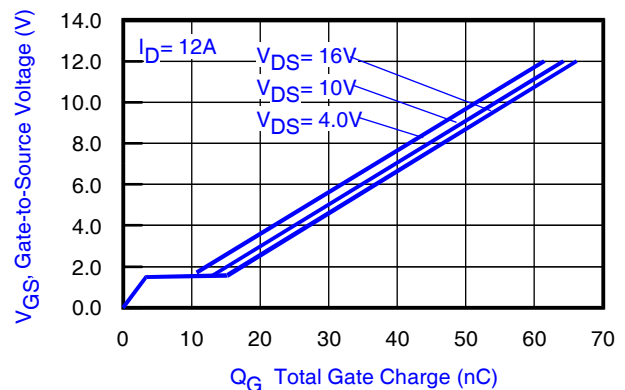


Fig 2. Typical Total Gate Charge vs. Gate-to-Source Voltage

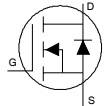
#### Notes:

- 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.

**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	—	6.1	—	mV/°C	Reference to 25°C, I <sub>D</sub> = 1.0mA
R <sub>DS(on)</sub>	Static Drain-to-Source On-Resistance	—	3.8	4.9	mΩ	V <sub>GS</sub> = 4.5V, I <sub>D</sub> = 15A ⑥
		—	5.4	6.9		V <sub>GS</sub> = 2.5V, I <sub>D</sub> = 12A ⑥
V <sub>GS(th)</sub>	Gate Threshold Voltage	0.50	0.80	1.10	V	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 35μA
ΔV <sub>GS(th)</sub> /ΔT <sub>J</sub>	Gate Threshold Voltage Coefficient	—	-4.1	—	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> = 150°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	60	—	—	S	V <sub>DS</sub> = 10V, I <sub>D</sub> = 12A
Q <sub>g</sub>	Total Gate Charge	—	54	—	nC	V <sub>DS</sub> = 10V, V <sub>GS</sub> = 10V, I <sub>D</sub> = 12A  V <sub>DS</sub> = 10V V <sub>GS</sub> = 4.5V I <sub>D</sub> = 12A See Fig.15
Q <sub>g</sub>	Total Gate Charge	—	27	—		
Q <sub>gs1</sub>	Pre- V <sub>th</sub> Gate-to-Source Charge	—	2.2	—		
Q <sub>gs2</sub>	Post -V <sub>th</sub> Gate-to-Source Charge	—	1.4	—		
Q <sub>gd</sub>	Gate-to-Drain Charge	—	9.5	—		
Q <sub>godr</sub>	Gate Charge Overdrive	—	13.9	—		
Q <sub>sw</sub>	Switch charge (Q <sub>gs2</sub> + Q <sub>gd</sub> )	—	10.9	—		
Q <sub>oss</sub>	Output Charge	—	15	—	nC	V <sub>DS</sub> = 16 V, V <sub>GS</sub> = 0V
R <sub>G</sub>	Gate Resistance	—	1.8	—	Ω	
t <sub>d(on)</sub>	Turn-On Delay Time	—	8.8	—	ns	V <sub>DD</sub> = 10V, V <sub>GS</sub> = 4.5V ⑥ I <sub>D</sub> = 12A R <sub>G</sub> = 2.0 Ω See Fig.17
t <sub>r</sub>	Rise Time	—	29	—		
t <sub>d(off)</sub>	Turn-Off Delay Time	—	41	—		
t <sub>f</sub>	Fall Time	—	41	—		
C <sub>iss</sub>	Input Capacitance	—	2245	—	pF	V <sub>GS</sub> = 0V V <sub>DS</sub> = 10V f = 1.0MHz
C <sub>oss</sub>	Output Capacitance	—	610	—		
C <sub>riss</sub>	Reverse Transfer Capacitance	—	395	—		

**Diode Characteristics**

	Parameter	Min.	Typ.	Max.	Units	Conditions
I <sub>S</sub>	Continuous Source Current (Body Diode)	—	—	25	A	MOSFET symbol showing the integral reverse p-n junction diode. 
I <sub>SM</sub>	Pulsed Source Current (Body Diode) ⑤	—	—	140		
V <sub>SD</sub>	Diode Forward Voltage	—	—	1.2	V	T <sub>J</sub> = 25°C, I <sub>S</sub> = 12A, V <sub>GS</sub> = 0V ⑥
t <sub>rr</sub>	Reverse Recovery Time	—	28	42	ns	T <sub>J</sub> = 25°C, I <sub>F</sub> = 12A, V <sub>DD</sub> = 10V
Q <sub>rr</sub>	Reverse Recovery Charge	—	21	32	nC	di/dt = 100 A/μs ⑥

**Notes:**

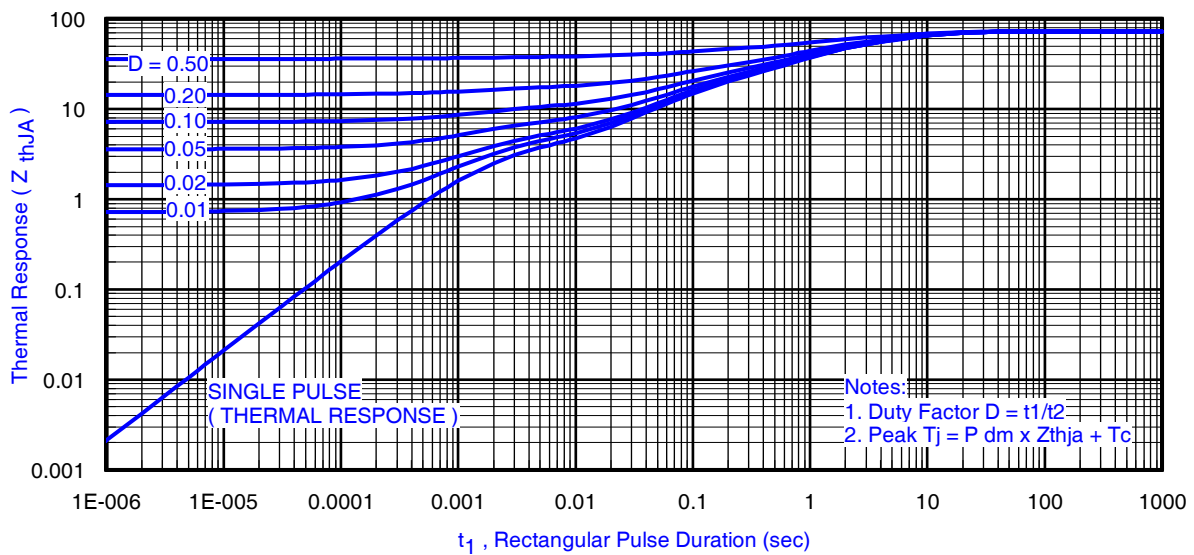
⑥ Pulse width ≤ 400μs; duty cycle ≤ 2%.

**Absolute Maximum Ratings**

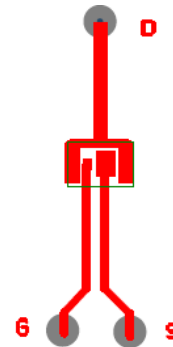
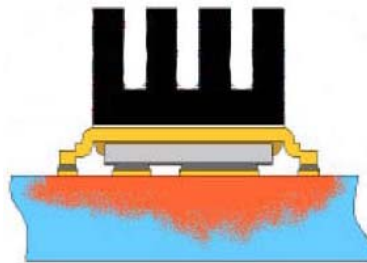
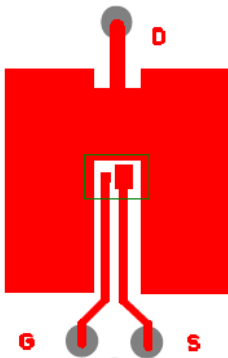
	Parameter	Max.	Units
$P_D @ T_A = 25^\circ\text{C}$	Power Dissipation ③	1.7	W
$P_D @ T_A = 70^\circ\text{C}$	Power Dissipation ③	1.1	
$P_D @ T_c = 25^\circ\text{C}$	Power Dissipation ④	25	
$T_P$	Peak Soldering Temperature	270	$^\circ\text{C}$
$T_J$	Operating Junction and	-40 to + 150	
$T_{STG}$	Storage Temperature Range		

**Thermal Resistance**

	Parameter	Typ.	Max.	Units
$R_{\theta JA}$	Junction-to-Ambient ③	—	72	$^\circ\text{C/W}$
$R_{\theta JA}$	Junction-to-Ambient ⑦	12.5	—	
$R_{\theta JA}$	Junction-to-Ambient ⑧	20	—	
$R_{\theta JC}$	Junction-to-Case ④, ⑨	—	5.1	
$R_{\theta J-PCB}$	Junction-to-PCB Mounted	1.0	—	
	Linear Derating Factor ③	0.014		$\text{W}/^\circ\text{C}$


**Fig 3. Maximum Effective Transient Thermal Impedance, Junction-to-Ambient ①**
**Notes:**

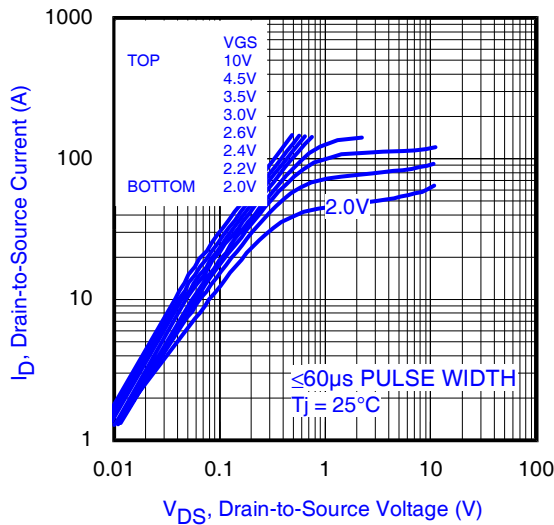
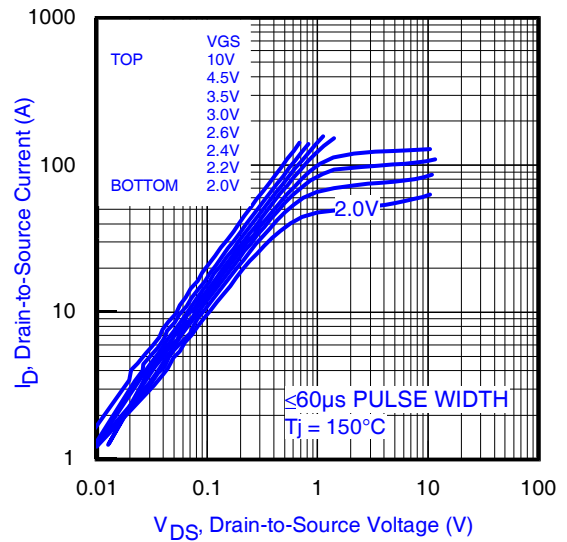
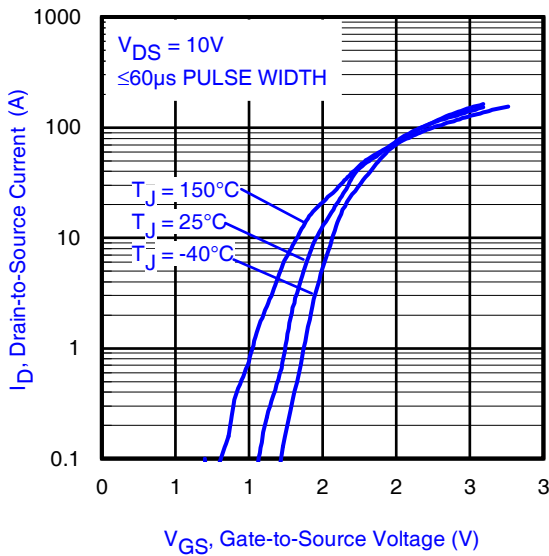
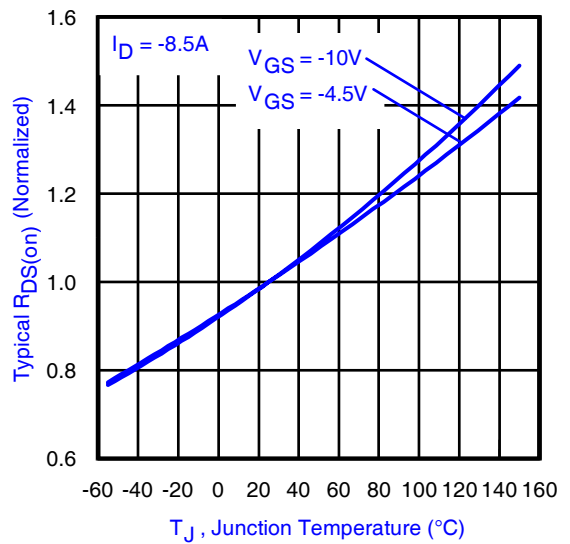
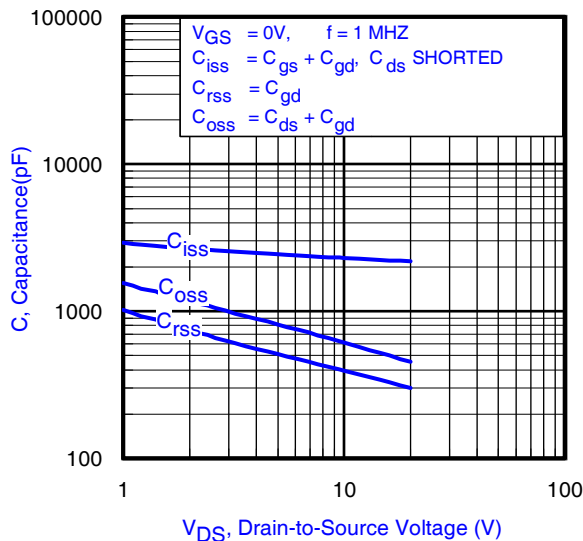
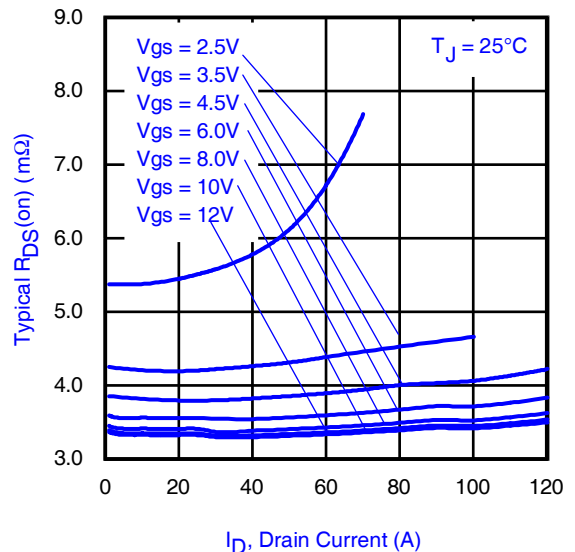
- ⑦ Used double sided cooling, mounting pad with large heatsink.
- ⑧ Mounted on minimum footprint full size board with metalized back and with small clip heatsink.
- ⑨  $R_\theta$  is measured at  $T_J$  of approximately  $90^\circ\text{C}$ .

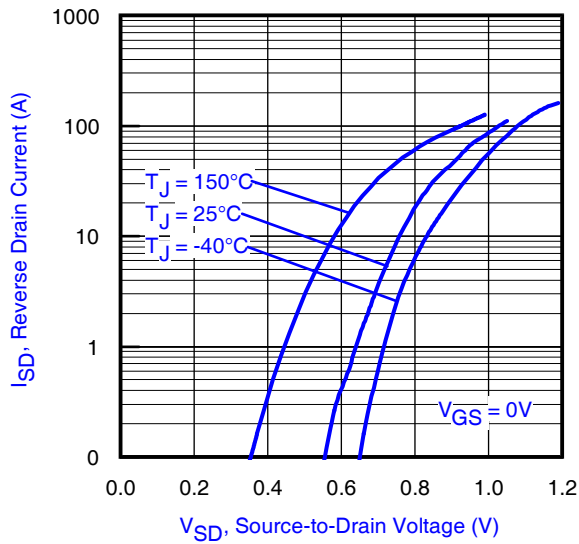
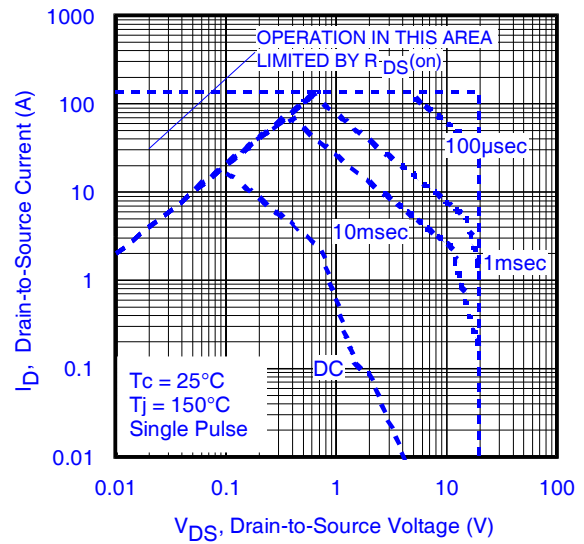
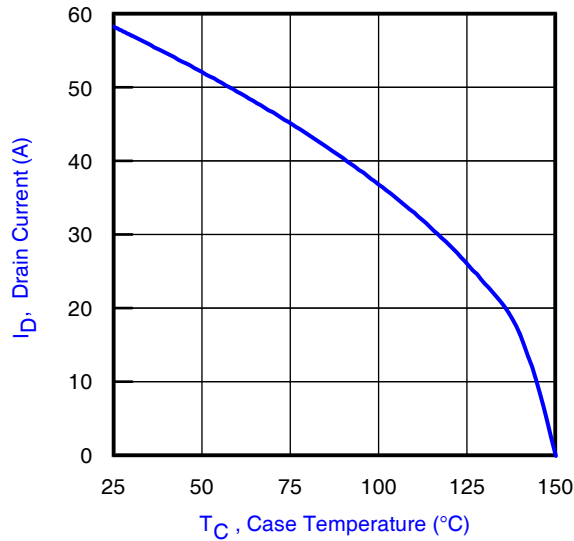
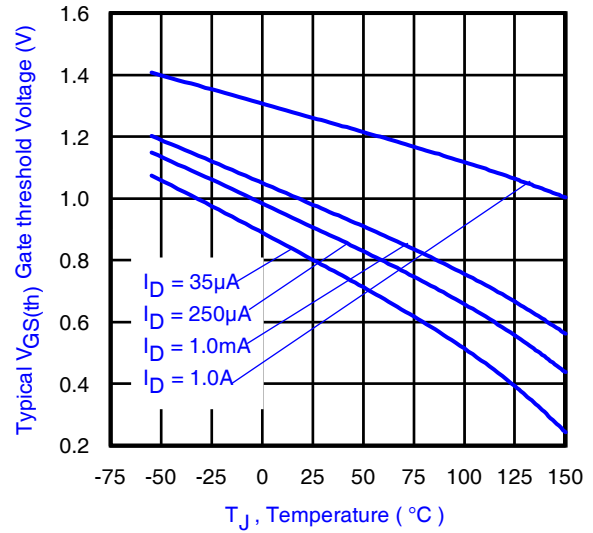
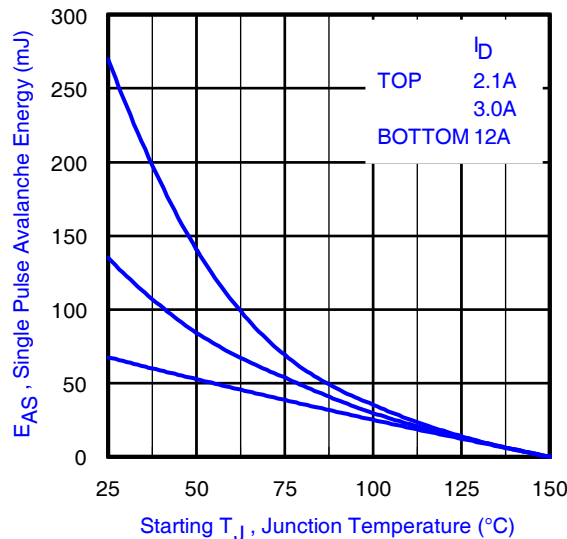


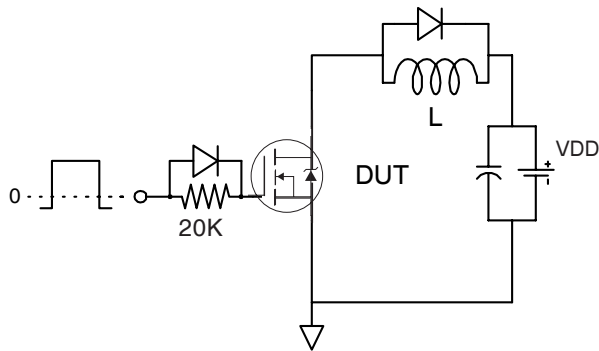
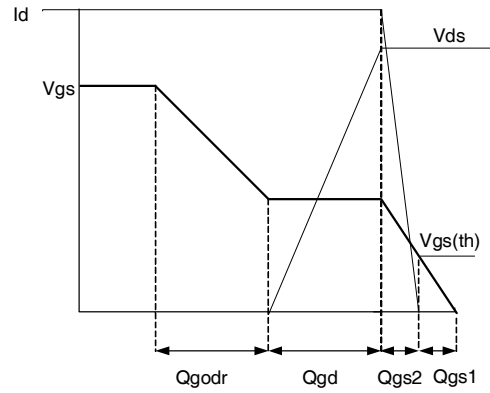
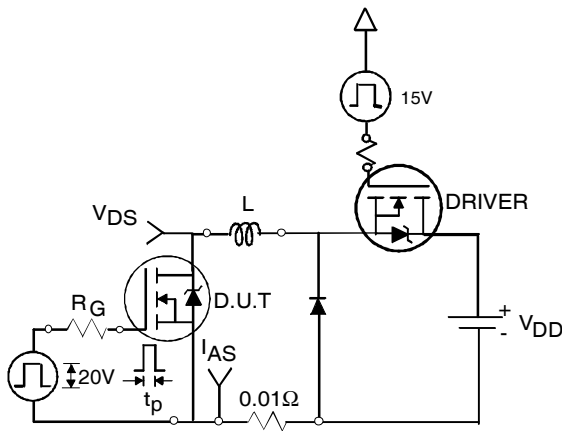
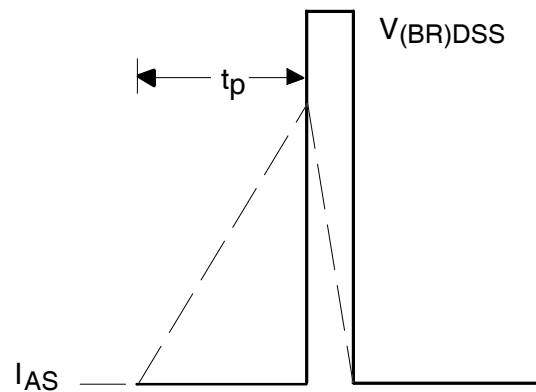
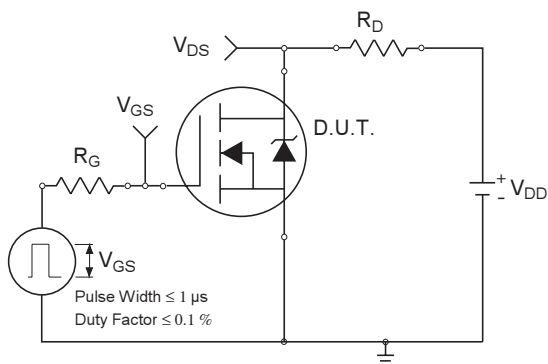
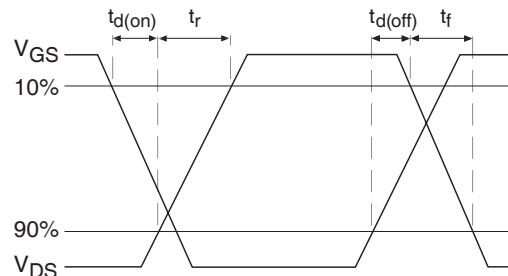
③ Surface mounted on 1 in. square Cu board (still air).

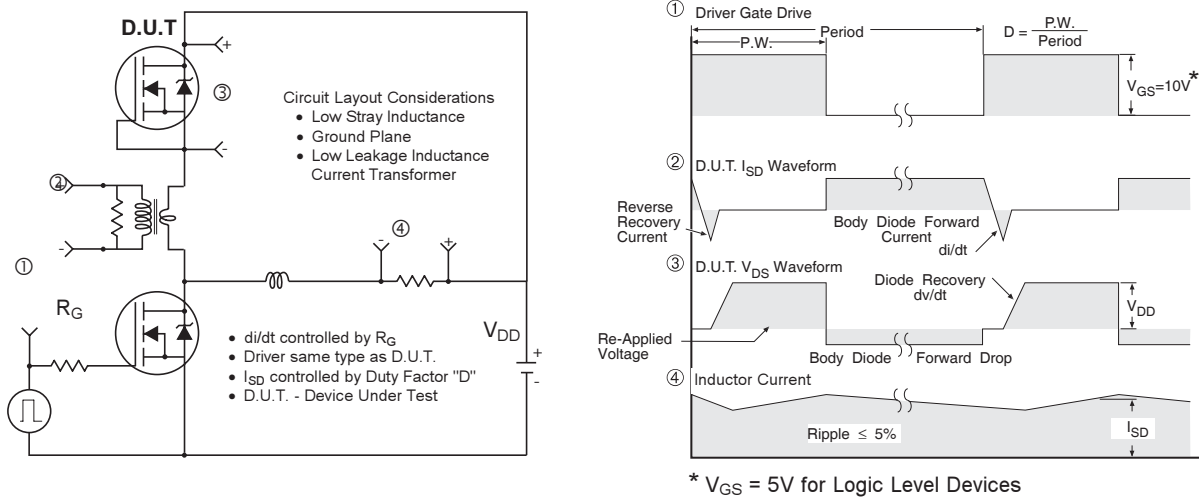
⑧ Mounted to a PCB with small clip heatsink (still air)

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


**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 Gate 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

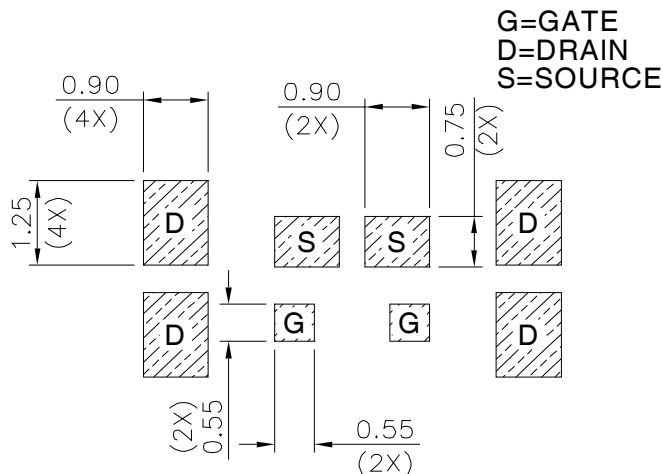
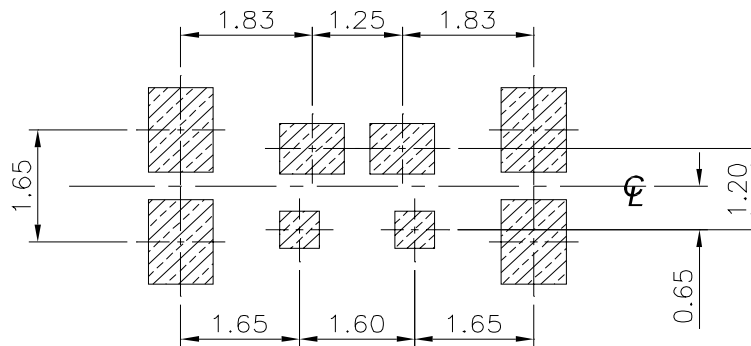


**Fig 18. Diode Reverse Recovery Test Circuit for N-Channel HEXFET® Power MOSFETs**

### DirectFET® Board Footprint, SA Outline (Small Size Can, A-Designation).

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

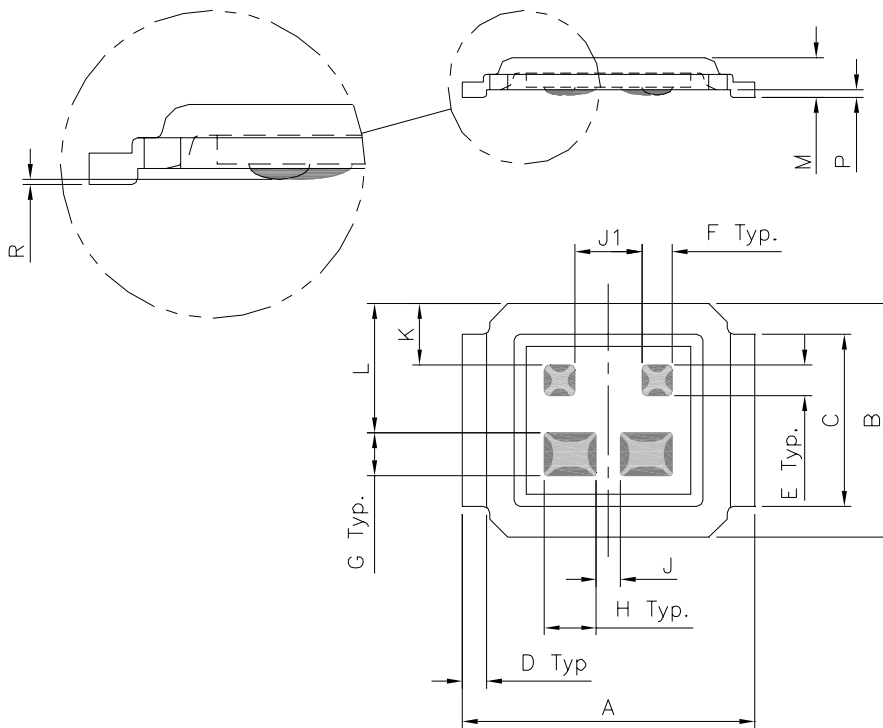
This includes all recommendations for stencil and substrate designs.



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

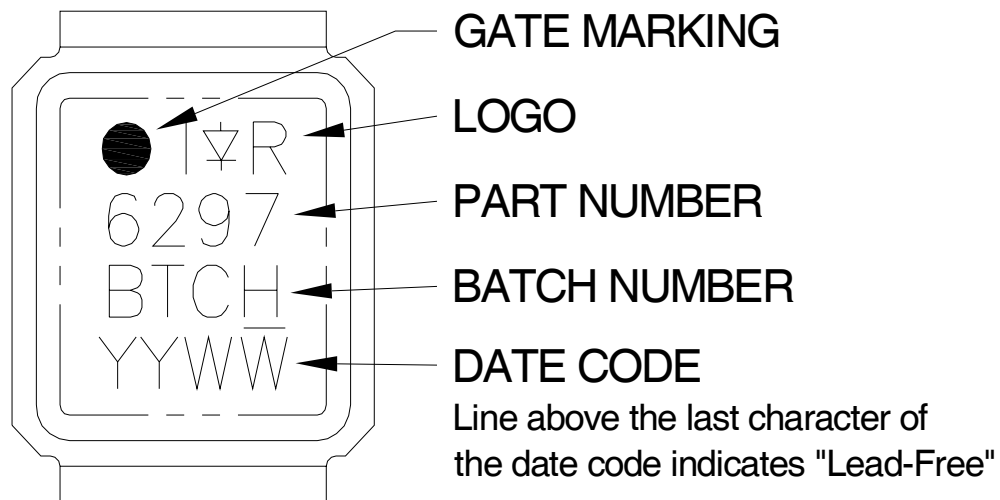
## DirectFET® Outline Dimension, SA Outline (Small Size Can, A-Designation).

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



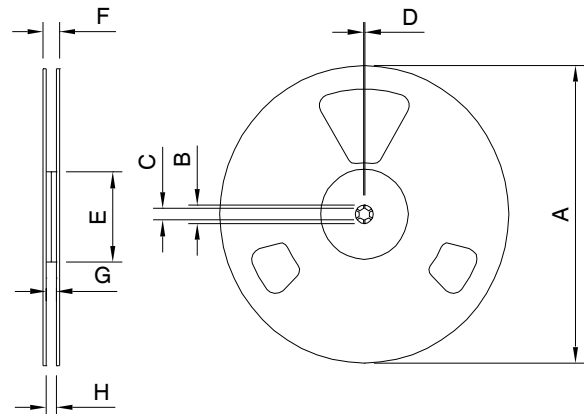
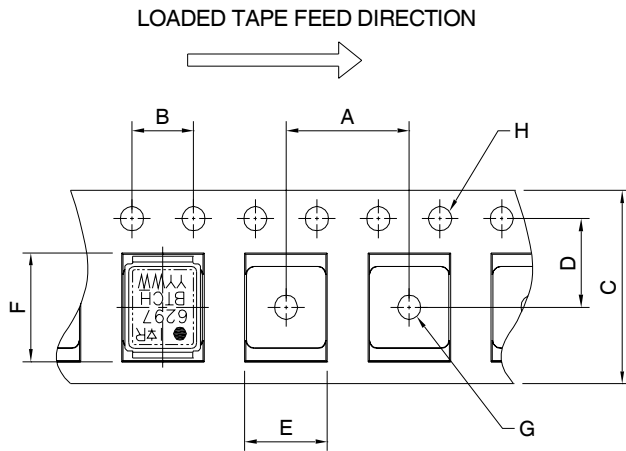
CODE	METRIC		IMPERIAL	
	MIN	MAX	MIN	MAX
A	4.75	4.85	0.187	0.191
B	3.70	3.95	0.146	0.156
C	2.75	2.85	0.108	0.112
D	0.35	0.45	0.014	0.018
E	0.48	0.52	0.019	0.020
F	0.48	0.52	0.019	0.020
G	0.68	0.72	0.027	0.028
H	0.83	0.87	0.033	0.034
J	0.38	0.42	0.015	0.016
J1	1.08	1.12	0.043	0.044
K	0.95	1.05	0.037	0.041
L	2.05	2.15	0.081	0.085
M	0.59	0.70	0.023	0.028
P	0.08	0.17	0.003	0.007
R	0.02	0.08	0.0008	0.0031

## 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 IRL6297SDTRPBF). For 1000 parts on 7" reel, order IRL6297SDTR1PBF

NOTE: CONTROLLING DIMENSIONS IN MM

CODE	METRIC		IMPERIAL	
	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	4.00	4.20	0.158	0.165
F	5.00	5.20	0.197	0.205
G	1.50	N.C	0.059	N.C
H	1.50	1.60	0.059	0.063

CODE	REEL DIMENSIONS							
	STANDARD OPTION (QTY 4800)				TR1 OPTION (QTY 1000)			
	METRIC		IMPERIAL		METRIC		IMPERIAL	
	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

**Qualification Information†**

Qualification level	Consumer ††	
	(per JEDEC JESD47F††† guidelines)	
Moisture Sensitivity Level	DirectFET Small 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.

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