

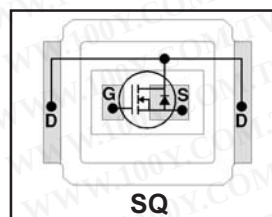
IRF6631PbF

IRF6631TRPbF

DirectFET™ Power MOSFET ②

Typical values (unless otherwise specified)

V_{DSS}	V_{GS}	$R_{DS(on)}$	$R_{DS(on)}$		
30V max	±20V max	6.0mΩ @ 10V	8.3mΩ @ 4.5V		
$Q_g \text{ tot}$	Q_{gd}	Q_{gs2}	Q_{rr}	Q_{oss}	$V_{gs(th)}$
12nC	4.4nC	1.1nC	10nC	7.3nC	1.8V



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

SQ	SX	ST		MQ	MX	MT	MP			
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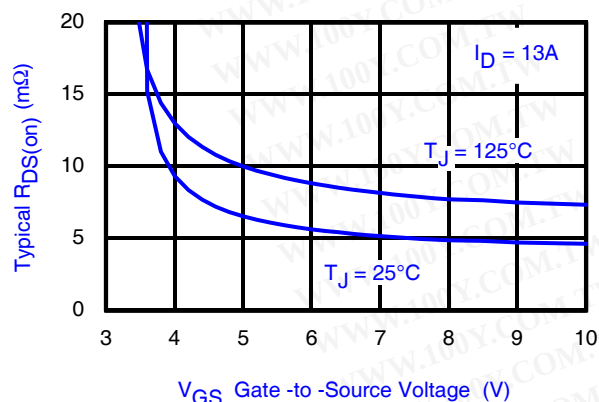
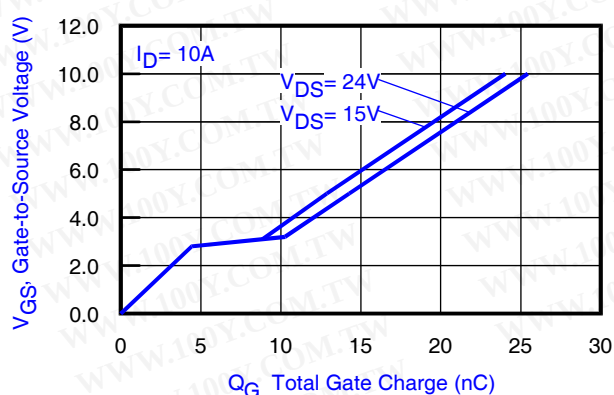
Description

The IRF6631PbF 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 Micro-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. 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 IRF6631PbF balances industry leading on-state resistance while minimizing gate charge along with ultra low package inductance to reduce both conduction and switching losses. The reduced losses make this product ideal for high frequency/high efficiency DC-DC converters that power high current loads such as the latest generation of microprocessors. The IRF6631PbF has been optimized for parameters that are critical in synchronous buck converter's CtrlFET sockets.

Absolute Maximum Ratings

	Parameter	Max.	Units
V_{DS}	Drain-to-Source Voltage	30	V
V_{GS}	Gate-to-Source Voltage	±20	
I_D @ $T_A = 25^\circ\text{C}$	Continuous Drain Current, V_{GS} @ 10V ③	13	A
I_D @ $T_A = 70^\circ\text{C}$	Continuous Drain Current, V_{GS} @ 10V ③	10	
I_D @ $T_C = 25^\circ\text{C}$	Continuous Drain Current, V_{GS} @ 10V ④	57	
I_{DM}	Pulsed Drain Current ⑤	100	
E_{AS}	Single Pulse Avalanche Energy ⑥	13	mJ
I_{AR}	Avalanche Current ⑤	10	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_C measured with thermocouple mounted to top (Drain) of part.
 ⑤ Repetitive rating; pulse width limited by max. junction temperature.
 ⑥ Starting $T_J = 25^\circ\text{C}$, $L = 0.24\text{mH}$, $R_G = 25\Omega$, $I_{AS} = 10\text{A}$.

Static @ $T_J = 25^\circ\text{C}$ (unless otherwise specified)

	Parameter	Min.	Typ.	Max.	Units	Conditions
BV_{DSS}	Drain-to-Source Breakdown Voltage	30	—	—	V	$V_{GS} = 0V, I_D = 250\mu A$
$\Delta BV_{DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	—	23	—	mV/°C	Reference to 25°C , $I_D = 1mA$
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	—	6.0	7.8	m Ω	$V_{GS} = 10V, I_D = 13A$ ⑦
		—	8.3	10.8		$V_{GS} = 4.5V, I_D = 10A$ ⑦
$V_{GS(th)}$	Gate Threshold Voltage	1.35	1.8	2.35	V	$V_{DS} = V_{GS}, I_D = 25\mu A$
$\Delta V_{GS(th)}/\Delta T_J$	Gate Threshold Voltage Coefficient	—	-5.2	—	mV/°C	
I_{DSS}	Drain-to-Source Leakage Current	—	—	1.0	μA	$V_{DS} = 24V, V_{GS} = 0V$
		—	—	150		$V_{DS} = 24V, V_{GS} = 0V, T_J = 125^\circ\text{C}$
I_{GSS}	Gate-to-Source Forward Leakage	—	—	100	nA	$V_{GS} = 20V$
	Gate-to-Source Reverse Leakage	—	—	-100		$V_{GS} = -20V$
g_{fs}	Forward Transconductance	32	—	—	S	$V_{DS} = 15V, I_D = 10A$
Q_g	Total Gate Charge	—	12	18	nC	$V_{DS} = 15V$ $V_{GS} = 4.5V$ $I_D = 10A$ See Fig. 15
Q_{gs1}	Pre-Vth Gate-to-Source Charge	—	3.4	—		
Q_{gs2}	Post-Vth Gate-to-Source Charge	—	1.1	—		
Q_{gd}	Gate-to-Drain Charge	—	4.4	—		
Q_{godr}	Gate Charge Overdrive	—	3.1	—		
Q_{sw}	Switch Charge ($Q_{gs2} + Q_{gd}$)	—	5.5	—		
Q_{oss}	Output Charge	—	7.3	—	nC	$V_{DS} = 16V, V_{GS} = 0V$
R_G	Gate Resistance	—	1.6	3.0	Ω	
$t_{d(on)}$	Turn-On Delay Time	—	15	—	ns	$V_{DD} = 16V, V_{GS} = 4.5V$ ⑦ $I_D = 10A$ Clamped Inductive Load See Fig. 16 & 17
t_r	Rise Time	—	18	—		
$t_{d(off)}$	Turn-Off Delay Time	—	18	—		
t_f	Fall Time	—	4.9	—		
C_{iss}	Input Capacitance	—	1450	—	pF	$V_{GS} = 0V$ $V_{DS} = 15V$ $f = 1.0MHz$
C_{oss}	Output Capacitance	—	310	—		
C_{rss}	Reverse Transfer Capacitance	—	170	—		

Diode Characteristics

	Parameter	Min.	Typ.	Max.	Units	Conditions
I_S	Continuous Source Current (Body Diode)	—	—	42	A	MOSFET symbol showing the integral reverse p-n junction diode.
I_{SM}	Pulsed Source Current (Body Diode) ②	—	—	100		
V_{SD}	Diode Forward Voltage	—	—	1.2	V	$T_J = 25^\circ\text{C}, I_S = 10A, V_{GS} = 0V$ ⑦
t_{rr}	Reverse Recovery Time	—	11	17	ns	$T_J = 25^\circ\text{C}, I_F = 10A$
Q_{rr}	Reverse Recovery Charge	—	10	15	nC	$di/dt = 500A/\mu s$ ⑦ See Fig. 18

Notes:

- ⑤ Repetitive rating; pulse width limited by max. junction temperature.
⑦ Pulse width $\leq 400\mu s$; duty cycle $\leq 2\%$.

Absolute Maximum Ratings

	Parameter	Max.	Units
P _D @ T _A = 25°C	Power Dissipation ③	2.2	W
P _D @ T _A = 70°C	Power Dissipation ③	1.4	
P _D @ T _C = 25°C	Power Dissipation ④	42	
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 ①	—	58	$^\circ\text{C/W}$
$R_{\theta JA}$	Junction-to-Ambient ⑨ ①	12.5	—	
$R_{\theta JA}$	Junction-to-Ambient ⑩ ①	20	—	
$R_{\theta JC}$	Junction-to-Case ④ ①	—	3.0	
$R_{\theta J-PCB}$	Junction-to-PCB Mounted	1.4	—	
	Linear Derating Factor ③	0.017		$\text{W}/^\circ\text{C}$

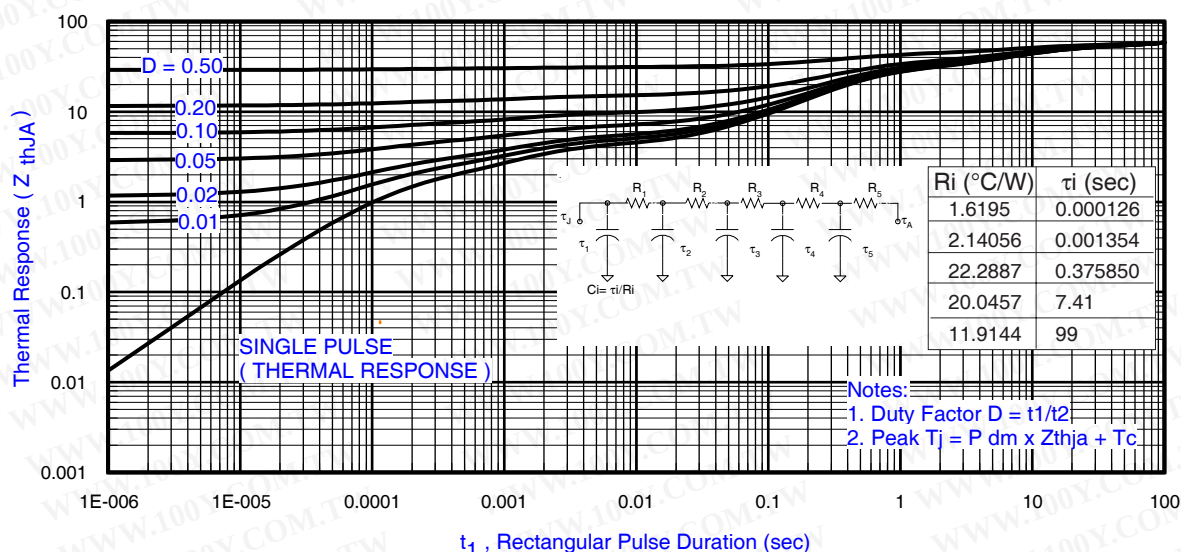


Fig 3. Maximum Effective Transient Thermal Impedance, Junction-to-Ambient ①

Notes:

- ③ Used double sided cooling, mounting pad.
- ⑩ Mounted on minimum footprint full size board with metalized back and with small clip heatsink.

① R_{θ} is measured at T_J of approximately 90°C .



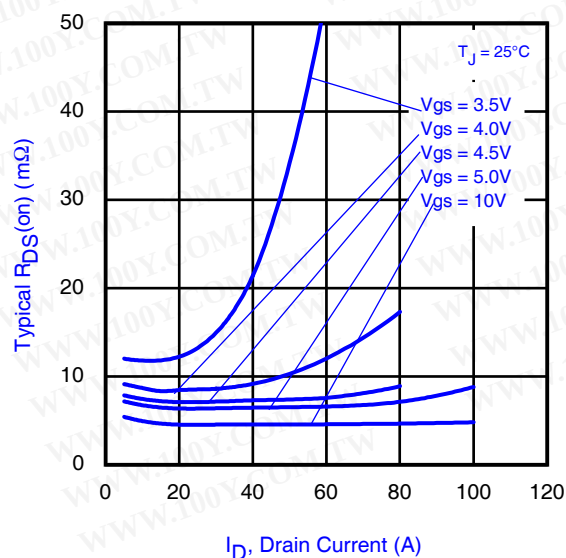
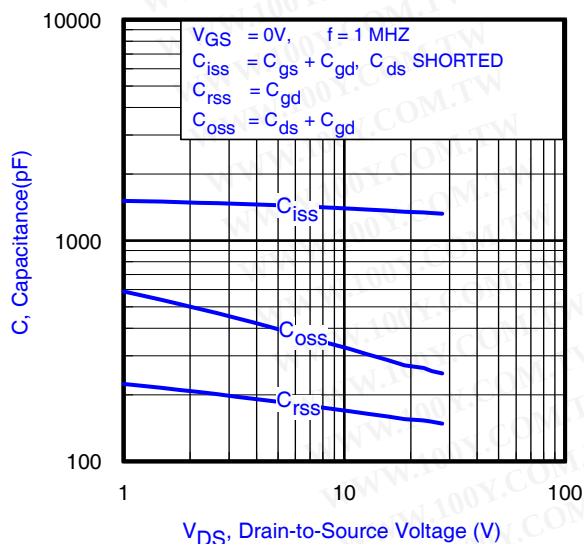
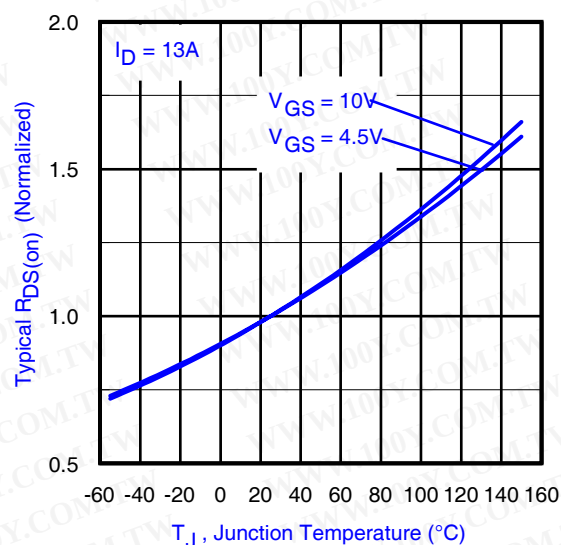
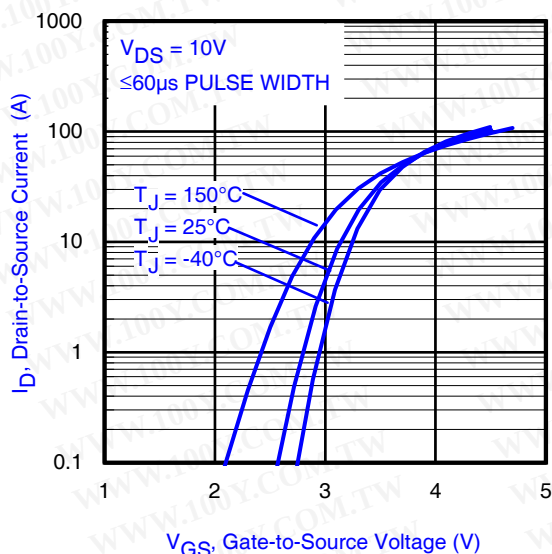
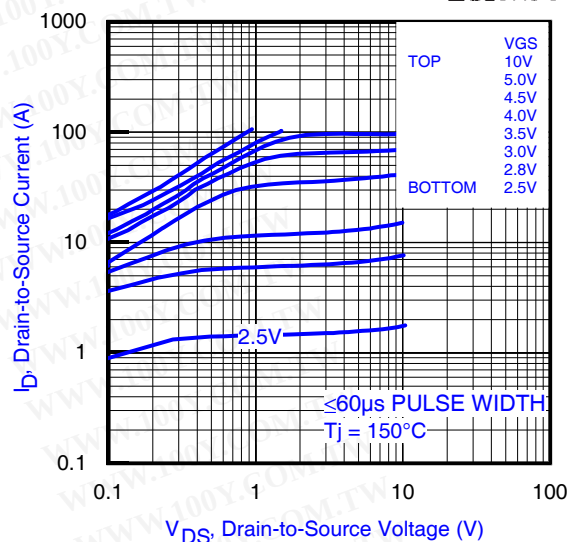
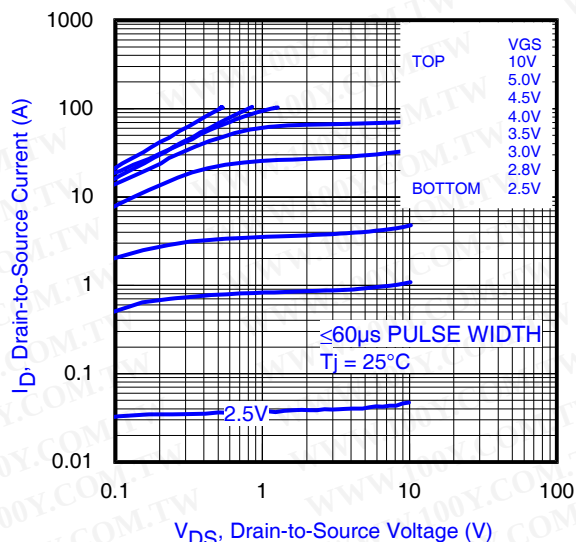
③ Surface mounted on 1 in. square Cu (still air).



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



⑩ Mounted on minimum footprint full size board with metalized back and with small clip heatsink (still air)



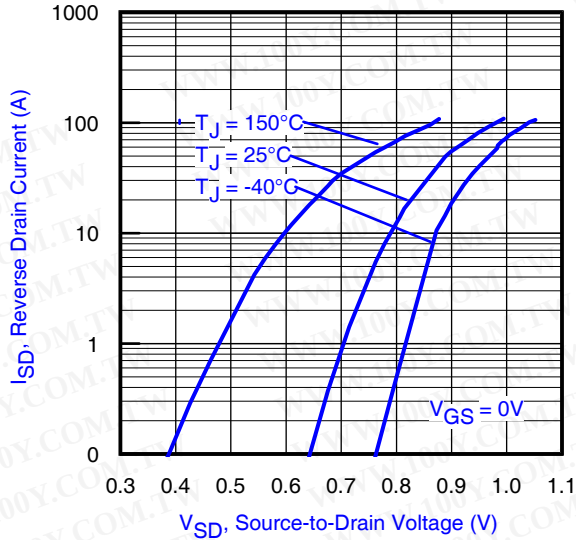


Fig 10. Typical Source-Drain Diode Forward Voltage

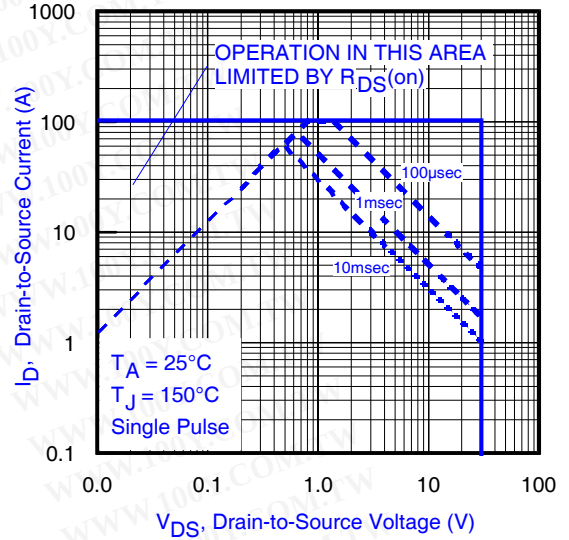


Fig 11. Maximum Safe Operating Area

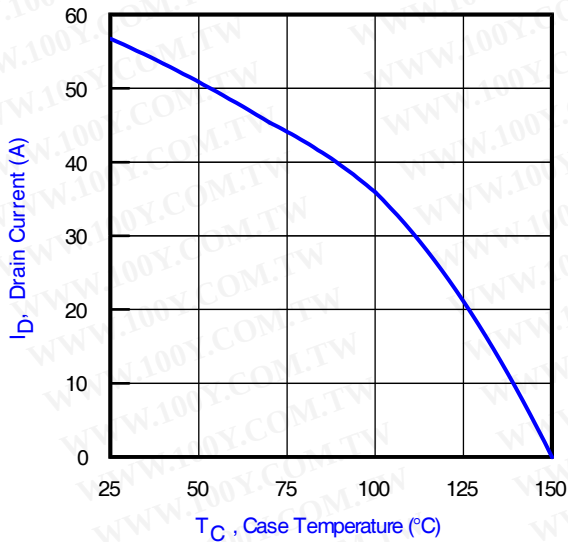


Fig 12. Maximum Drain Current vs. Case Temperature

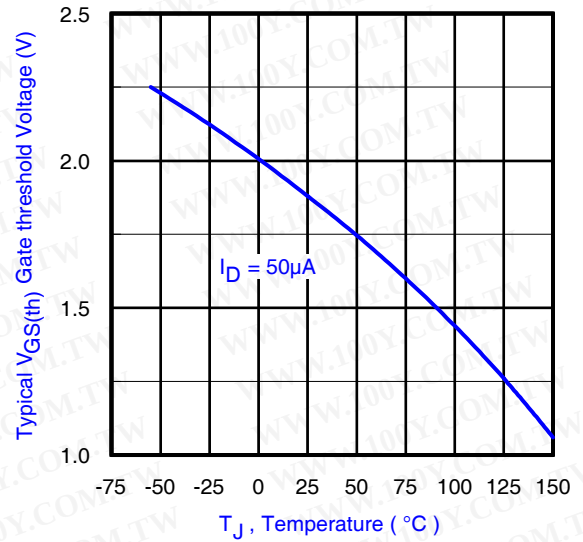


Fig 13. Typical Threshold Voltage vs. Junction Temperature

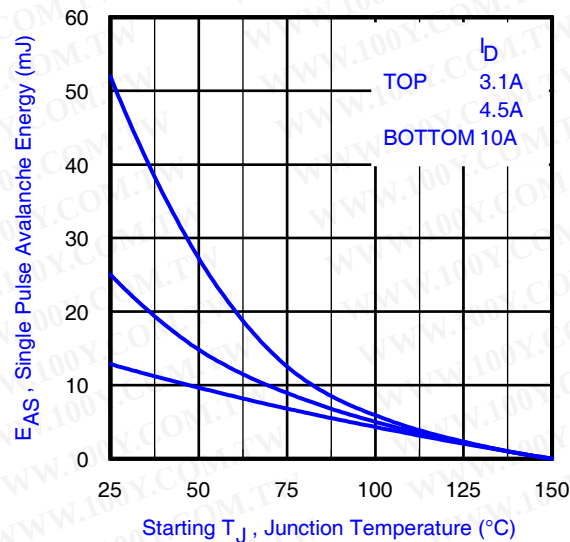


Fig 14. Maximum Avalanche Energy vs. Drain Current

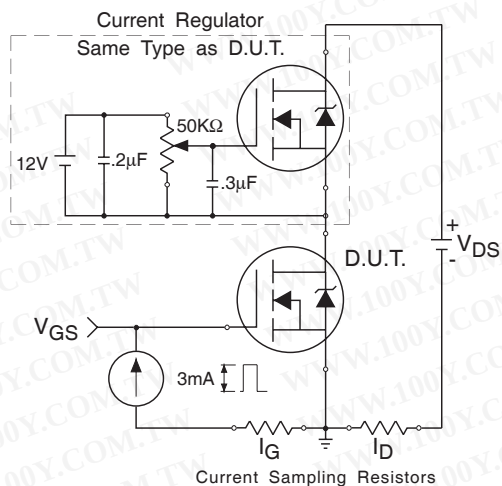


Fig 15a. Gate Charge Test Circuit

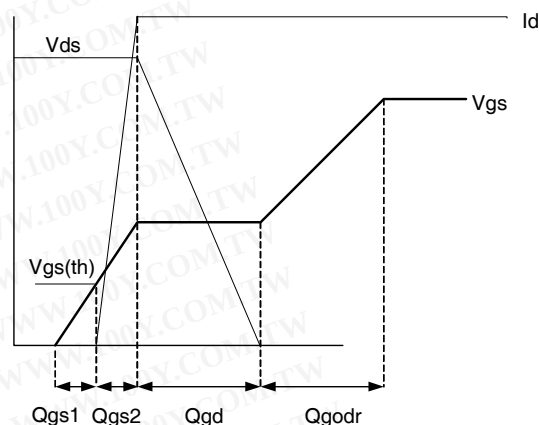


Fig 15b. Gate Charge Waveform

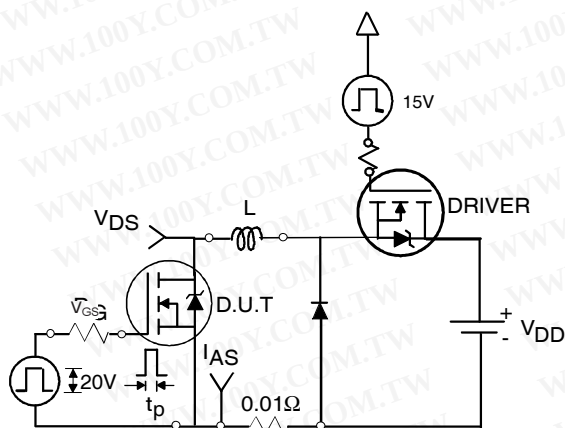


Fig 16a. Unclamped Inductive Test Circuit

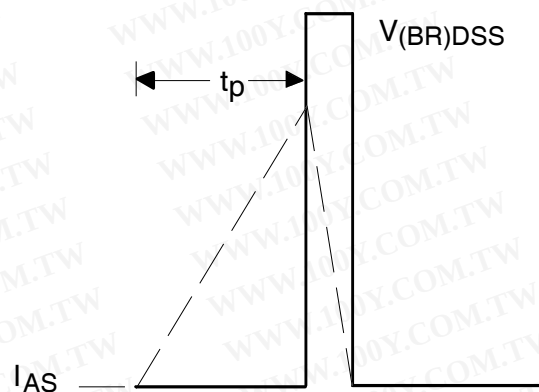


Fig 16b. Unclamped Inductive Waveforms

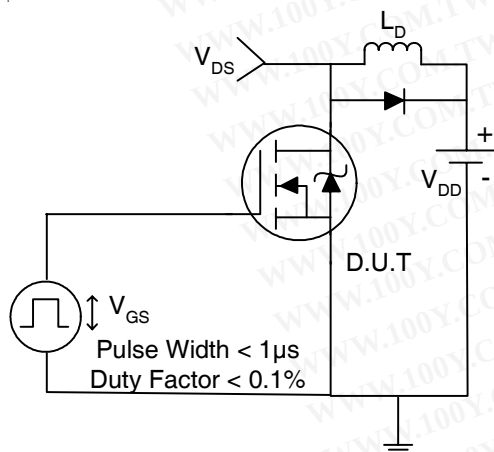


Fig 17a. Switching Time Test Circuit

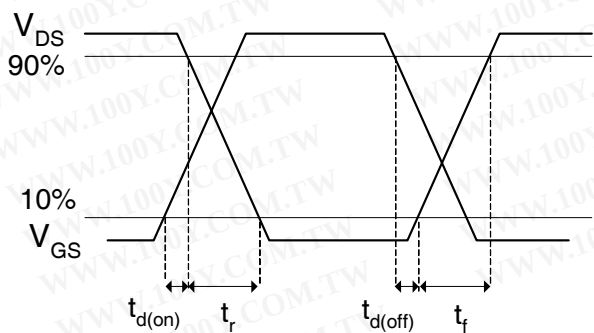
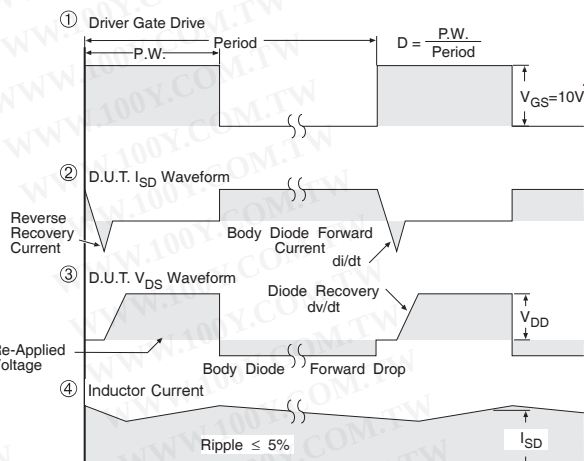
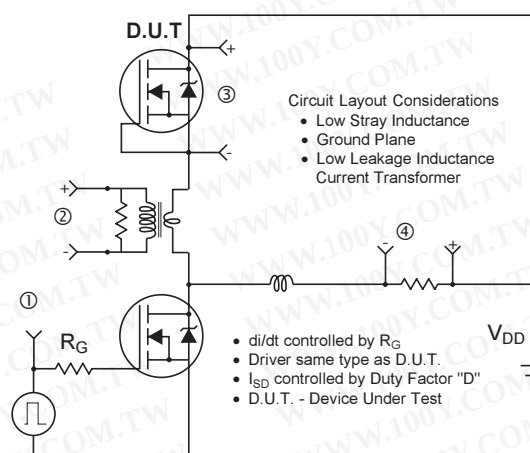


Fig 17b. Switching Time Waveforms

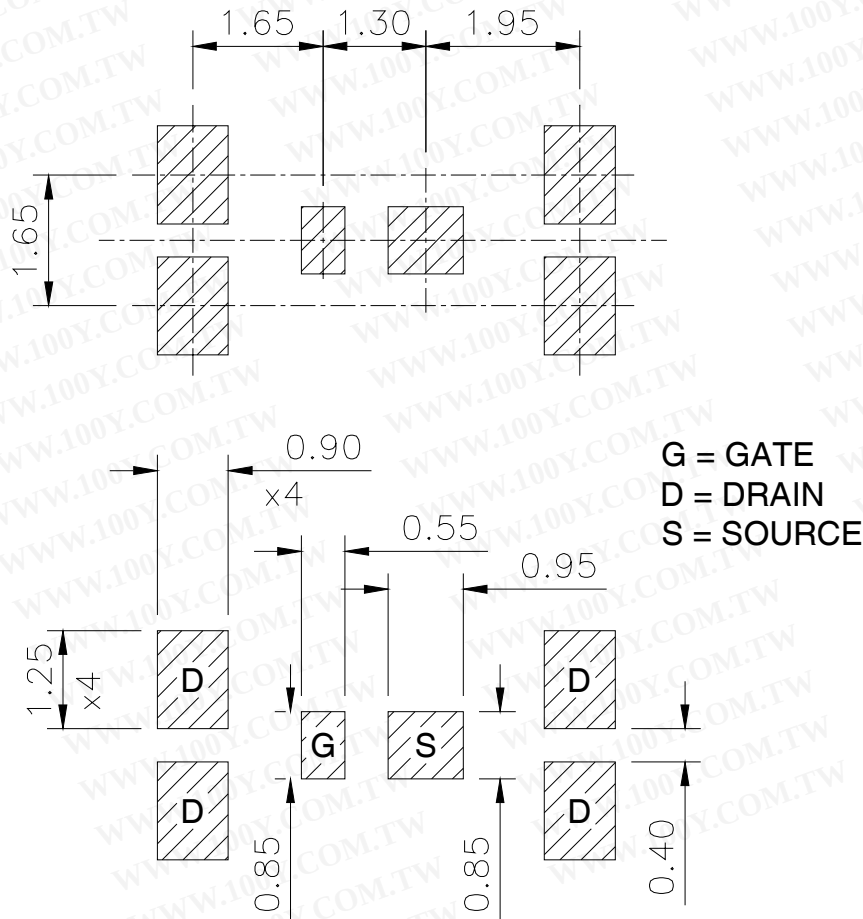


* $V_{GS} = 5V$ for Logic Level Devices

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

DirectFET™ Substrate and PCB Layout, SQ Outline ③ (Small Size Can, Q-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.

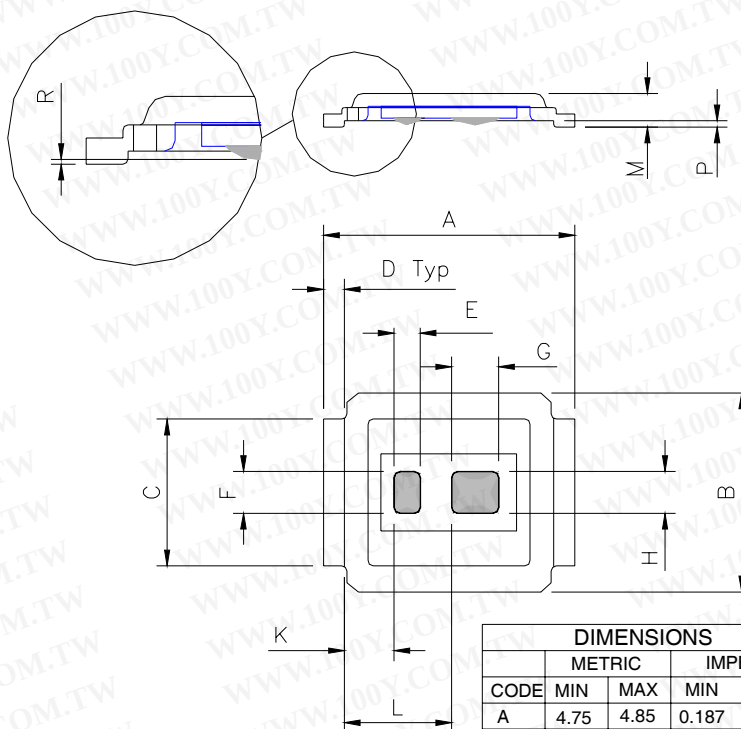


IRF6631PbF

International
IR Rectifier

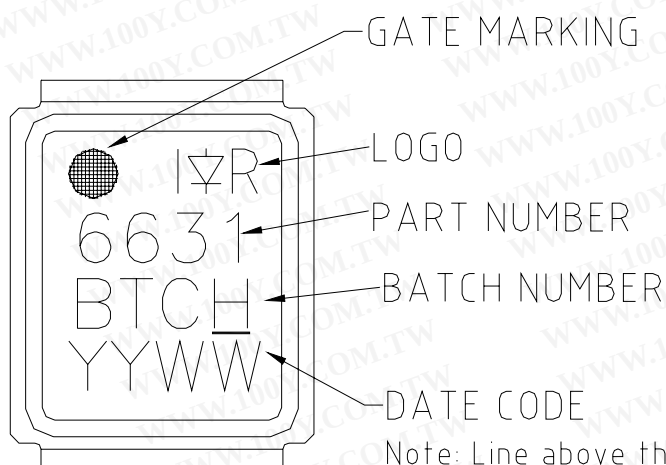
DirectFET™ Outline Dimension, SQ Outline (Small Size Can, Q-Designation).

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				
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	0.78	0.82	0.031	0.032
G	0.88	0.92	0.035	0.036
H	0.78	0.82	0.031	0.032
K	0.93	0.97	0.037	0.038
L	2.00	2.10	0.079	0.083
M	0.616	0.676	0.0235	0.0274
R	0.020	0.080	0.0008	0.0031
P	0.08	0.17	0.003	0.007

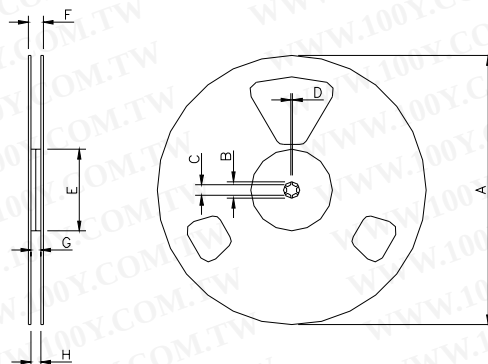
DirectFET™ Part Marking



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

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

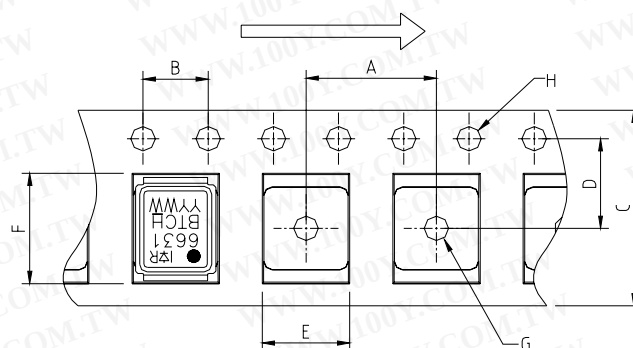
勝特力材料 886-3-5753170
 勝特力电子(上海) 86-21-34970699
 勝特力电子(深圳) 86-755-83298787
[Http://www.100y.com.tw](http://www.100y.com.tw)



NOTE: Controlling dimensions in mm
 Std reel quantity is 4800 parts. (ordered as IRF6631TRPBF). For 1000 parts on 7" reel, order IRF6631TR1PBF

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



DIMENSIONS				
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

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