



## Description

The IRFR9020TRPBF uses advanced trench technology to provide excellent  $R_{DS(ON)}$ , low gate charge and operation with gate voltages as low as 4.5V. This device is suitable for use as a Battery protection or in other Switching application.



TO-252-2L

## General Features

$V_{DS} = -60V$   $I_D = -10A$

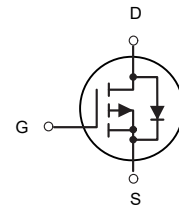
$R_{DS(ON)} < 140m\Omega$  @  $V_{GS}=10V$

## Application

Brushless motor

Load switch

Uninterruptible power supply



P-Channel MOSFET

## Package Marking and Ordering Information

Product ID	Pack	Brand	Qty(PCS)
IRFR9020TRPBF	TO-252-2L	HXY MOSFET	2500

## Absolute Maximum Ratings ( $T_C=25^\circ C$ unless otherwise noted)

Symbol	Parameter	Rating	Units
$V_{DS}$	Drain-Source Voltage	-60	V
$V_{GS}$	Gate-Source Voltage	$\pm 20$	V
$I_D@T_C=25^\circ C$	Continuous Drain Current, $V_{GS} @ -10V^1$	-10	A
$I_D@T_C=100^\circ C$	Continuous Drain Current, $V_{GS} @ -10V^1$	-8.3	A
$I_{DM}$	Pulsed Drain Current <sup>2</sup>	-26	A
EAS	Single Pulse Avalanche Energy <sup>3</sup>	29.8	mJ
$I_{AS}$	Avalanche Current	-24.4	A
$P_D@T_C=25^\circ C$	Total Power Dissipation <sup>4</sup>	31.3	W
$T_{STG}$	Storage Temperature Range	-55 to 150	$^\circ C$
$T_J$	Operating Junction Temperature Range	-55 to 150	$^\circ C$
$R_{\theta JA}$	Thermal Resistance Junction-Ambient <sup>1</sup>	62	$^\circ C/W$
$R_{\theta JC}$	Thermal Resistance Junction-Case <sup>1</sup>	4.0	$^\circ C/W$



**Electrical Characteristics (T<sub>J</sub>=25 °C, unless otherwise noted)**

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
BV <sub>DSS</sub>	Drain-Source Breakdown Voltage	V <sub>GS</sub> =0V, I <sub>D</sub> =-250uA	-60	---	---	V
ΔBV <sub>DSS</sub> /ΔT	BV <sub>DSS</sub> Temperature Coefficient	Reference to 25°C, I <sub>D</sub> =-1mA	---	-0.049	---	V/°C
R <sub>DS(ON)</sub>	Static Drain-Source On-Resistance <sup>2</sup>	V <sub>GS</sub> =-10V, I <sub>D</sub> =-8A	---	125	140	mΩ
		V <sub>GS</sub> =-4.5V, I <sub>D</sub> =-6A	---	168	210	
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>GS</sub> =V <sub>DS</sub> , I <sub>D</sub> =-250uA	-1.0	---	-2.5	V
ΔV <sub>GS(th)</sub>	V <sub>GS(th)</sub> Temperature Coefficient		---	5.42	---	mV/°C
I <sub>DSS</sub>	Drain-Source Leakage Current	V <sub>DS</sub> =-48V, V <sub>GS</sub> =0V, T <sub>J</sub> =25°C	---	---	1	uA
		V <sub>DS</sub> =-48V, V <sub>GS</sub> =0V, T <sub>J</sub> =150°C	---	---	5	
I <sub>GSS</sub>	Gate-Source Leakage Current	V <sub>GS</sub> =±20V, V <sub>DS</sub> =0V	---	---	±100	nA
g <sub>fs</sub>	Forward Transconductance	V <sub>DS</sub> =-5V, I <sub>D</sub> =-5A	---	5.8	---	S
Q <sub>g</sub>	Total Gate Charge (-4.5V)	V <sub>DS</sub> =-20V, V <sub>GS</sub> =-4.5V, I <sub>D</sub> =-5A	---	5.85	---	nC
Q <sub>gs</sub>	Gate-Source Charge		---	2.9	---	
Q <sub>gd</sub>	Gate-Drain Charge		---	1.8	---	
T <sub>d(on)</sub>	Turn-On Delay Time	V <sub>DD</sub> =-12V, V <sub>GS</sub> =-10V, R <sub>G</sub> =3.3Ω, I <sub>D</sub> =-5A	---	10	---	ns
T <sub>r</sub>	Rise Time		---	17	---	
T <sub>d(off)</sub>	Turn-Off Delay Time		---	22	---	
T <sub>f</sub>	Fall Time		---	21	---	
C <sub>iss</sub>	Input Capacitance	V <sub>DS</sub> =-15V, V <sub>GS</sub> =0V, F=1MHz	---	715	---	pF
C <sub>oss</sub>	Output Capacitance		---	51	---	
C <sub>rss</sub>	Reverse Transfer Capacitance		---	34	---	
I <sub>S</sub>	Continuous Source Current <sup>1,5</sup>	V <sub>G</sub> =V <sub>D</sub> =0V, Force Current	---	---	-9.5	A
I <sub>SM</sub>	Pulsed Source Current <sup>2,5</sup>		---	---	-24	A
V <sub>SD</sub>	Diode Forward Voltage <sup>2</sup>	V <sub>GS</sub> =0V, I <sub>S</sub> =-1A, T <sub>J</sub> =25°C	---	---	-1.2	V
t <sub>rr</sub>	Reverse Recovery Time	I <sub>F</sub> =-8A, dI/dt=100A/μs, T <sub>J</sub> =25°C	---	10.2	---	nS
Q <sub>rr</sub>	Reverse Recovery Charge		---	5.4	---	nC

Note :

1. The data tested by surface mounted on a 1 inch<sup>2</sup> FR-4 board with 20Z copper.
2. The data tested by pulsed, pulse width ≤ 300us, duty cycle ≤ 2%
3. The EAS data shows Max. rating. The test condition is V<sub>DD</sub>=-25V, V<sub>GS</sub>=-10V, L=0.1mH, I<sub>AS</sub>=-15A
4. The power dissipation is limited by 150°C junction temperature
5. The data is theoretically the same as I<sub>D</sub> and I<sub>DM</sub>, in real applications, should be limited by total power dissipation.



### Typical Characteristics

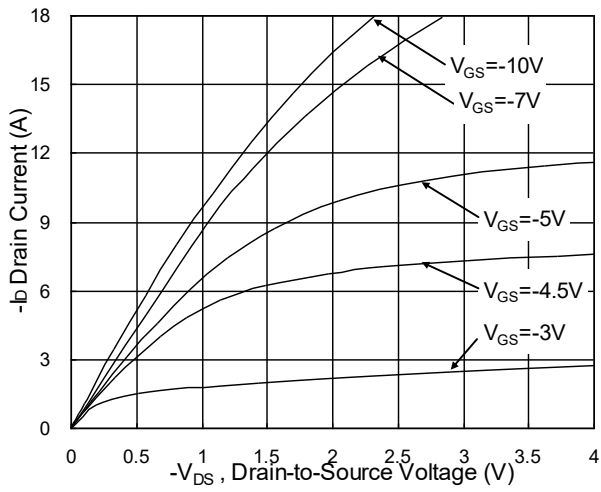


Fig.1 Typical Output Characteristics

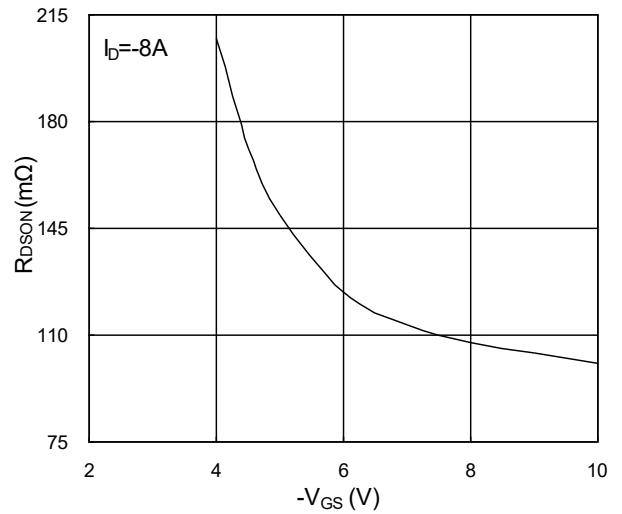


Fig.2 On-Resistance vs. G-S Voltage

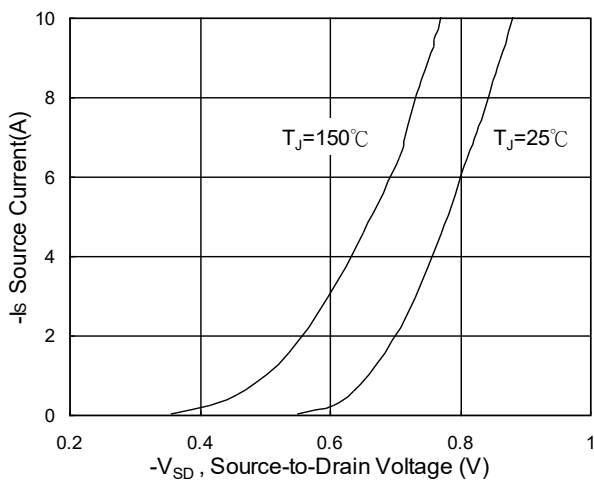


Fig.3 Forward Characteristics Of Reverse

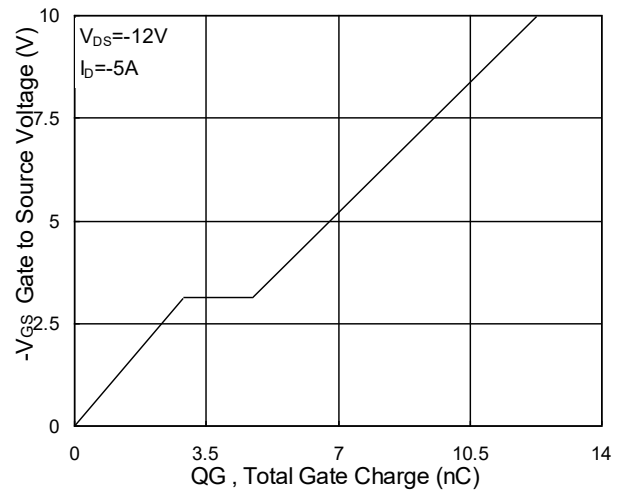


Fig.4 Gate-Charge Characteristics

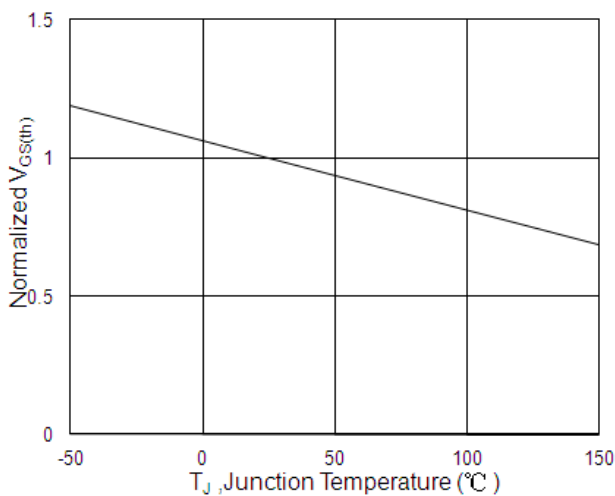


Fig.5 Normalized  $V_{GS(th)}$  vs.  $T_J$

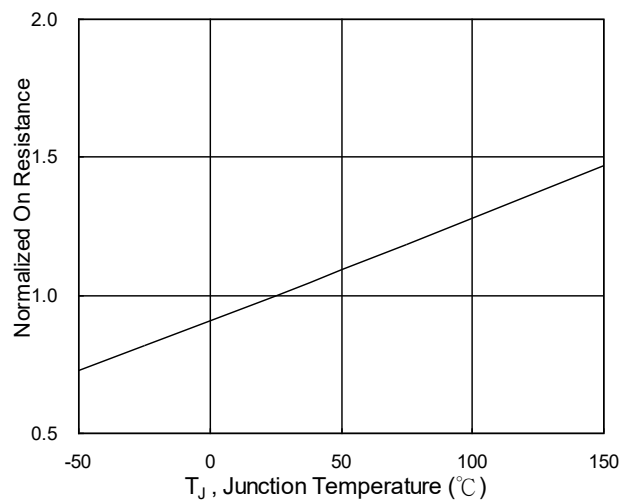


Fig.6 Normalized  $R_{DS(on)}$  vs.  $T_J$

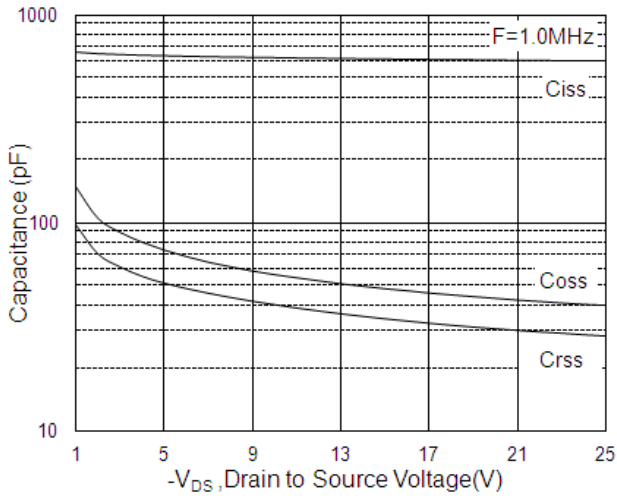


Fig.7 Capacitance

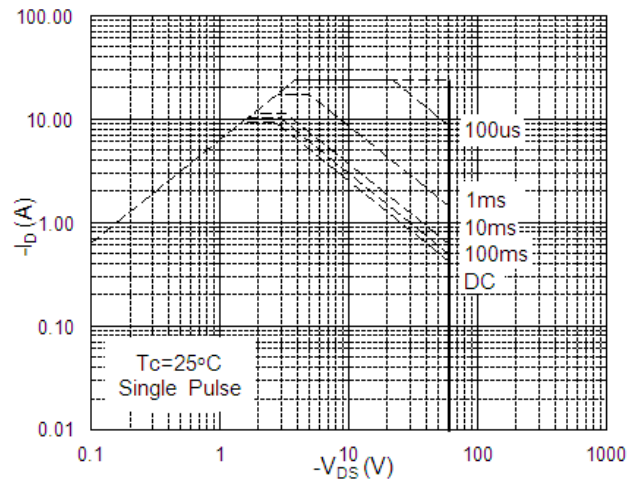


Fig.8 Safe Operating Area

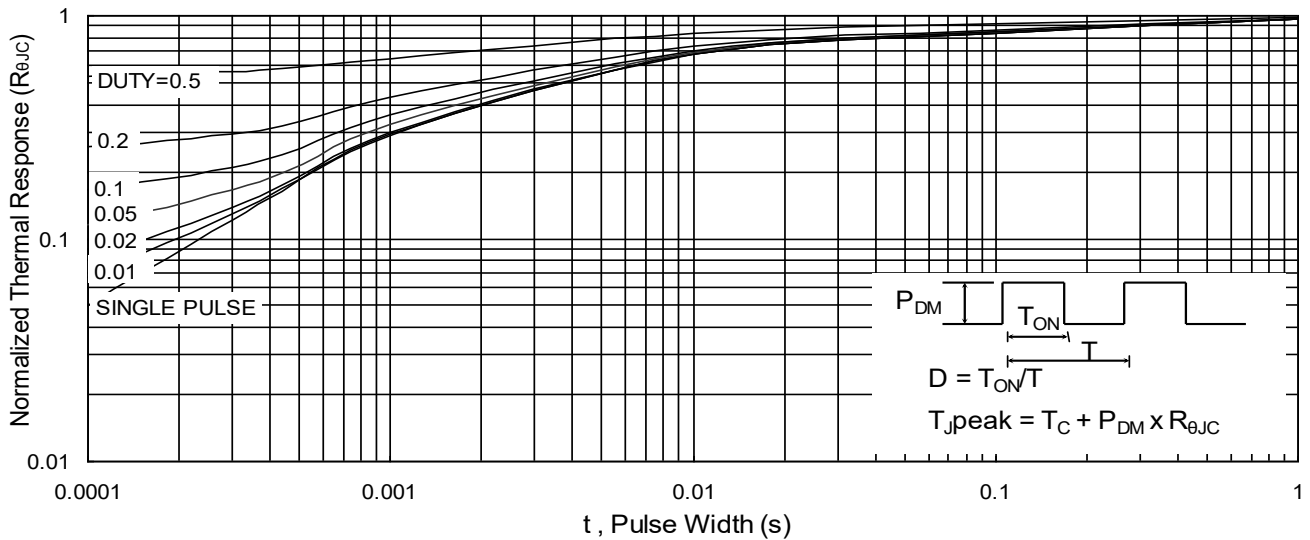


Fig.9 Normalized Maximum Transient Thermal Impedance

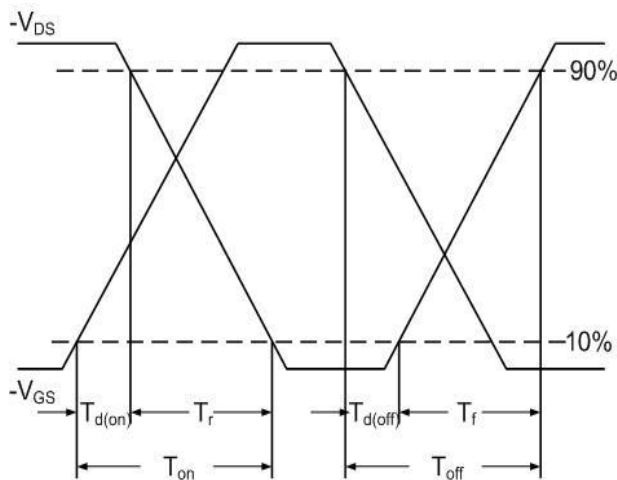


Fig.10 Switching Time Waveform

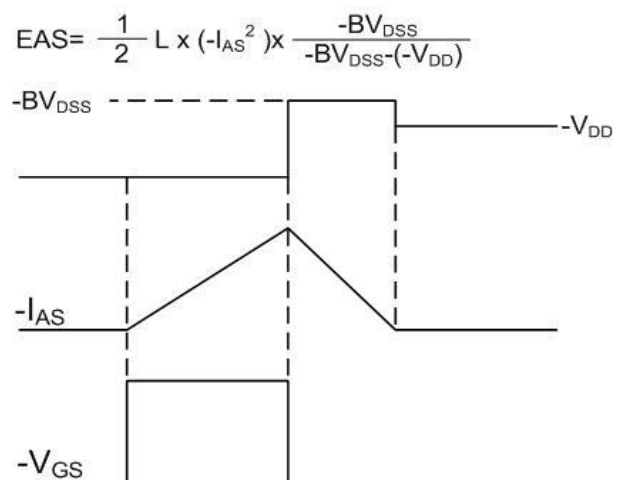
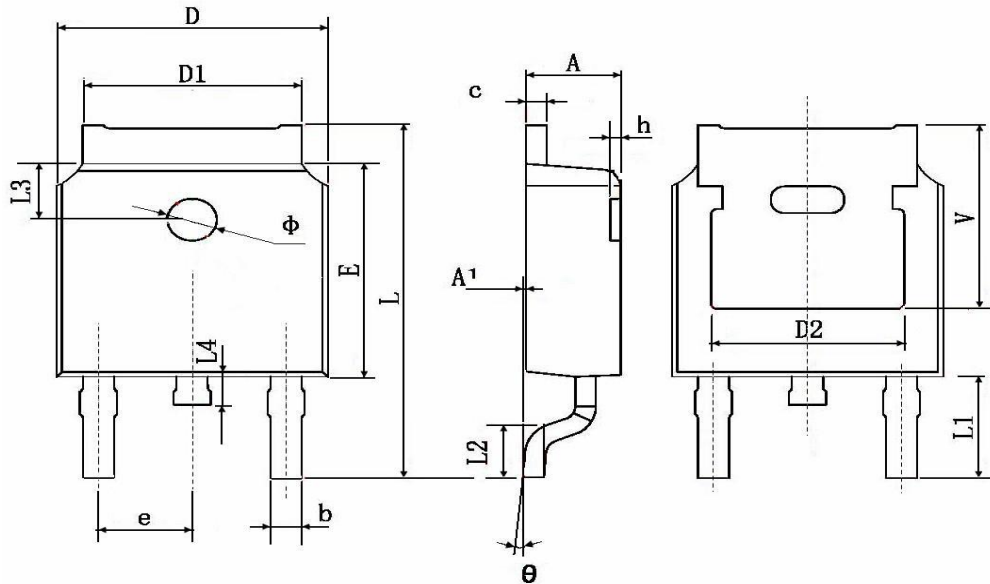


Fig.11 Unclamped Inductive Switching Waveform



### TO-252-2L Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	2.200	2.400	0.087	0.094
A1	0.000	0.127	0.000	0.005
b	0.660	0.860	0.026	0.034
c	0.460	0.580	0.018	0.023
D	6.500	6.700	0.256	0.264
D1	5.100	5.460	0.201	0.215
D2	4.830 TYP.		0.190 TYP.	
E	6.000	6.200	0.236	0.244
e	2.186	2.386	0.086	0.094
L	9.800	10.400	0.386	0.409
L1	2.900 TYP.		0.114 TYP.	
L2	1.400	1.700	0.055	0.067
L3	1.600 TYP.		0.063 TYP.	
L4	0.600	1.000	0.024	0.039
Φ	1.100	1.300	0.043	0.051
θ	0°	8°	0°	8°
h	0.000	0.300	0.000	0.012
V	5.350 TYP.		0.211 TYP.	



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