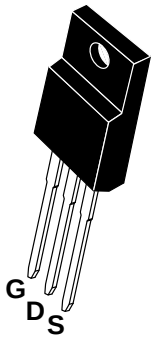
FIR20N65FG

N-Channel Power MOSFET

V_{DSS}	650	V
I_D	20	A
$P_D(T_C=25℃)$	85	W
$R_{DS(ON)Typ}$	0.37	Ω

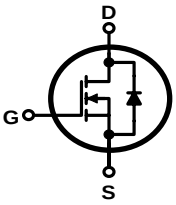
PIN Connection TO-220F



Features

- **Fast Switching**
- **Low ON Resistance(Rdson≤ 0.5)**
- **Low Gate Charge (Typical Data:65nC)**
- **Low Reverse transfer capacitances(Typical: 20p**
- **100% Single Pulse avalanche energy Test**

Schematic diagram



Applications

Power switch circuit of adaptor and charger.

Marking Diagram

Y = Year
A = Assembly Location
WW = Work Week
FIR20N65F = Specific Device Code

Absolute（Tc= 25℃ unless otherwise specified）

Symbol	Parameter	Rating	Units
V_{DSS}	Drain-to-Source Voltage	650	V
I_D	Continuous Drain Current	20	A
	Continuous Drain Current T_C = 100 °C	14	A
I_{DM} [a1]	Pulsed Drain Current	80	A
V_{GS}	Gate-to-Source Voltage	±30	V
E_{AS} [a2]	Single Pulse Avalanche Energy	550	mJ
E_{AR} [a1]	Avalanche Energy ,Repetitive	50	mJ
I_{AR} [a1]	Avalanche Current	3.2	A
dv/dt [a3]	Peak Diode Recovery dv/dt	5.0	V/ns
P_D	Power Dissipation	85	W
	Derating Factor above 25°C	0.68	W/℃
T_J， T_{stg}	Operating Junction and Storage Temperature Range	150，–55 to 150	℃
T_L	MaximumTemperature for Soldering	300	℃

Electrical Characteristics（Tc= 25 unless otherwise specified）：

OFF Characteristics						
Symbol	Parameter	Test Conditions	Rating			Units
			Min.	Typ.	Max.	
V_{DSS}	Drain to Source Breakdown Voltage	V_{GS}=0V, I_D=250μA	650	--	--	V
$\Delta BV_{DSS}/\Delta T_J$	Bvdss Temperature Coefficient	ID=250uA,Reference25℃	--	0.5	--	V/℃
I_{DSS}	Drain to Source Leakage Current	V_{DS} = 650V, V_{GS}= 0V, T_a = 25	--	--	1	μA
		V_{DS} =520V, V_{GS}= 0V, T_a = 125			100	
$I_{GSS(F)}$	Gate to Source Forward Leakage	V_{GS}= 30V	--	--	100	nA
$I_{GSS(R)}$	Gate to Source Reverse Leakage	V_{GS} =-30V	--	--	-100	nA

ON Characteristics						
Symbol	Parameter	Test Conditions	Rating			Units
			Min.	Typ.	Max.	
$R_{DS(ON)}$	Drain-to-Source On-Resistance	V_{GS}=10V,I_D=10A	--	0.37	0.5	Ω
$V_{GS(TH)}$	Gate Threshold Voltage	V_{DS} = V_{GS}, I_D = 250μA	2.0	--	4.0	V
Pulse width tp≤300μs,δ≤2%						

Dynamic Characteristics						
Symbol	Parameter	Test Conditions	Rating			Units
			Min.	Typ.	Max.	
g_{fs}	Forward Trans conductance	V_{DS}=15V, I_D =10A	--	17	--	S
C_{iss}	Input Capacitance	V_{GS} = 0V V_{DS} = 25V f = 1.0MHz	--	2400		pF
C_{oss}	Output Capacitance		--	225		
C_{rss}	Reverse Transfer Capacitance		--	20		

Resistive Switching Characteristics						
Symbol	Parameter	Test Conditions	Rating			Units
			Min.	Typ.	Max.	
$t_{d(ON)}$	Turn-on Delay Time	I_D =20A V_{DD} = 325V R_G = 25	--	35		ns
tr	Rise Time		--	82		
$t_{d(OFF)}$	Turn-Off Delay Time		--	180		
t_f	Fall Time		--	90		
Q_g	Total Gate Charge	I_D =20A V_{DD} =325V V_{GS} = 10V	--	65		nC
Q_{gs}	Gate to Source Charge		--	11	--	
Q_{gd}	Gate to Drain (“Miller”)Charge		--	26	--	

Source-Drain Diode Characteristics						
Symbol	Parameter	Test Conditions	Rating			Units
			Min.	Typ.	Max.	
I_S	Continuous Source Current (Body Diode)		--	--	20	A
I_{SM}	Maximum Pulsed Current (Body Diode)		--	--	80	A
V_{SD}	Diode Forward Voltage	I_S=20A,V_{GS}=0V	--	--	1.5	V
trr	Reverse Recovery Time	I_S=20A,T_j = 25°C	--	390	--	ns
Qrr	Reverse Recovery Charge	dI_F/dt=100A/us, V_{GS}=0V	--	3.4	--	μC
Pulse width tp≤300μs,δ≤2%						

Symbol	Parameter	Typ.	Units
$R_{\theta JC}$	Junction-to-Case	1.47	℃/W
$R_{\theta JA}$	Junction-to-Ambient	120	℃/W

[a1]: Repetitive rating; pulse width limited by maximum junction temperature
[a2]: L=10mH, I_D=10.5A, Start T_J=25
[a3]: I_{SD} =20A,di/dt ≤200A/us,V_{DD}≤$BV_{DSS,}$ Start T_J=25

Characteristics Curve:

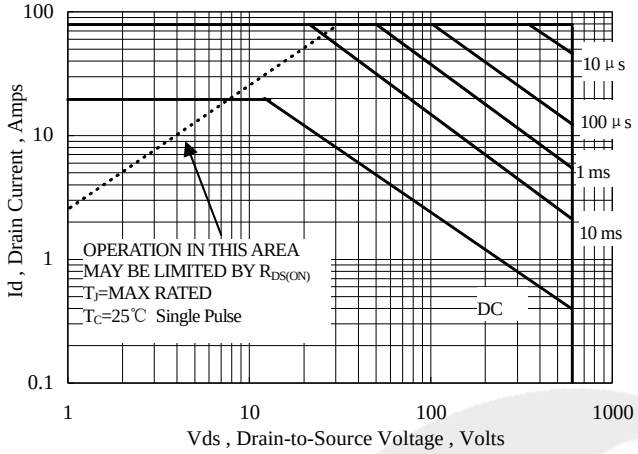


Figure 1 Maximum Forward Bias Safe Operating Area

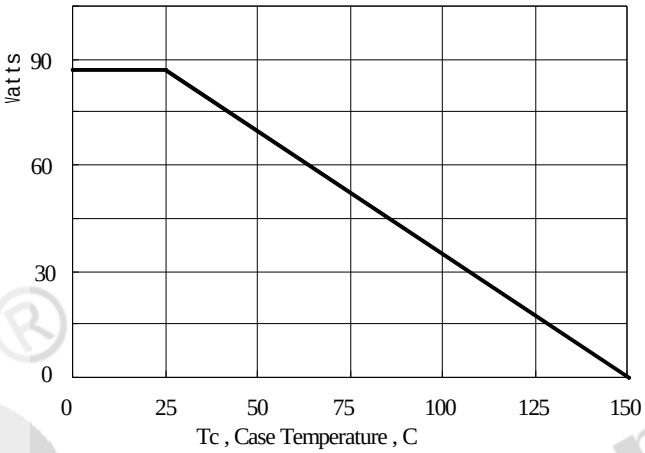


Figure 2 Maximum Power Dissipation vs Case Temperature

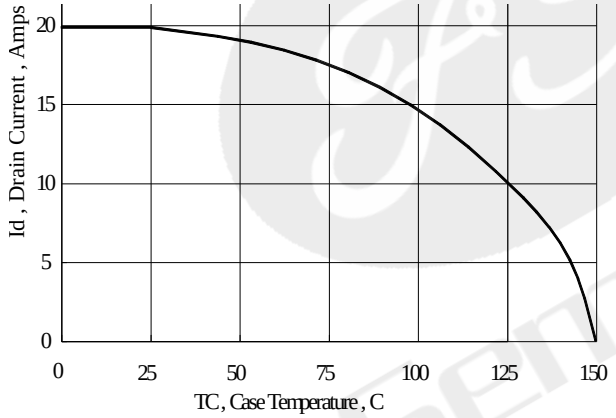


Figure 3 Maximum Continuous Drain Current vs Case Temperature

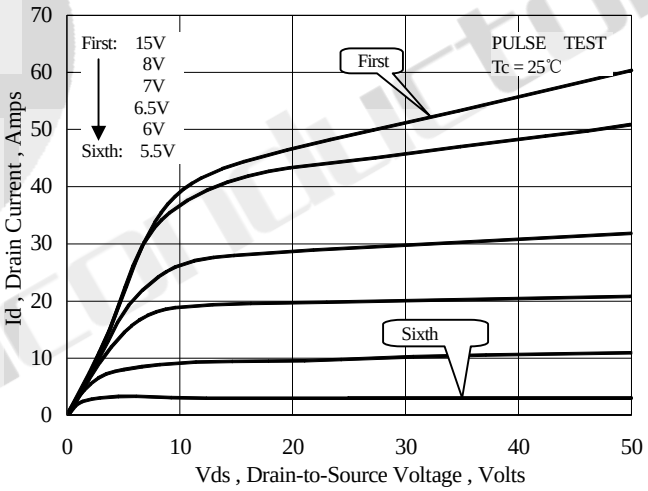


Figure 4 Typical Output Characteristics

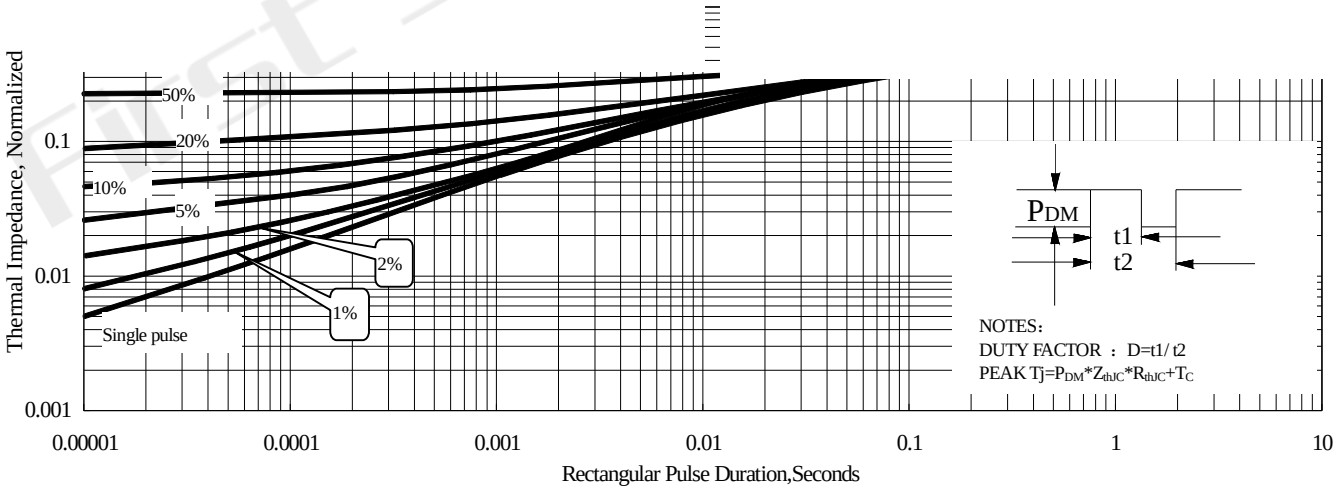


Figure 5 Maximum Effective Thermal Impendance , Junction to Case

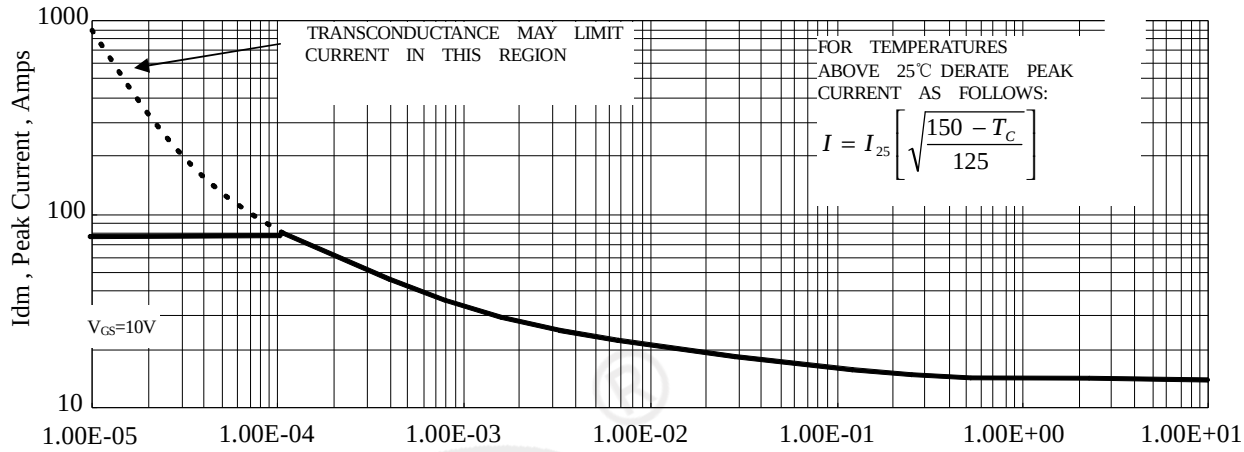


Figure 6 MaximumPeak Current Capability

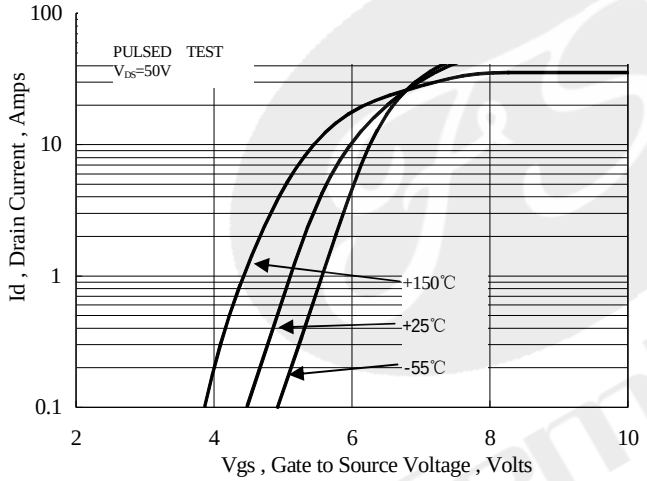


Figure 7 Typical Transfer Characteristics

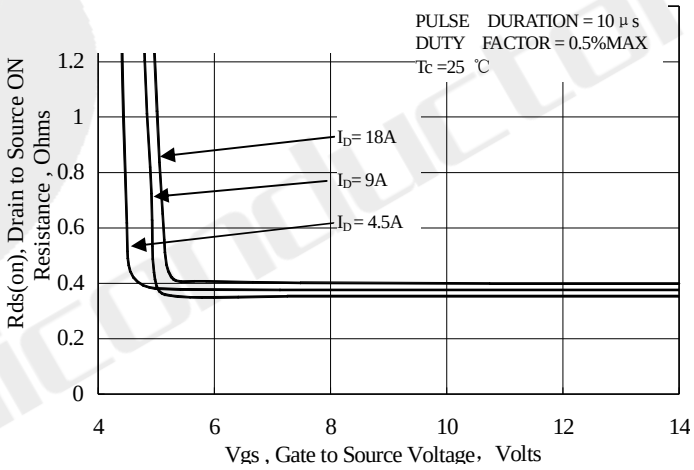


Figure 8 Typical Drain to Source ON Resistance vs Gate Voltage and Drain Current

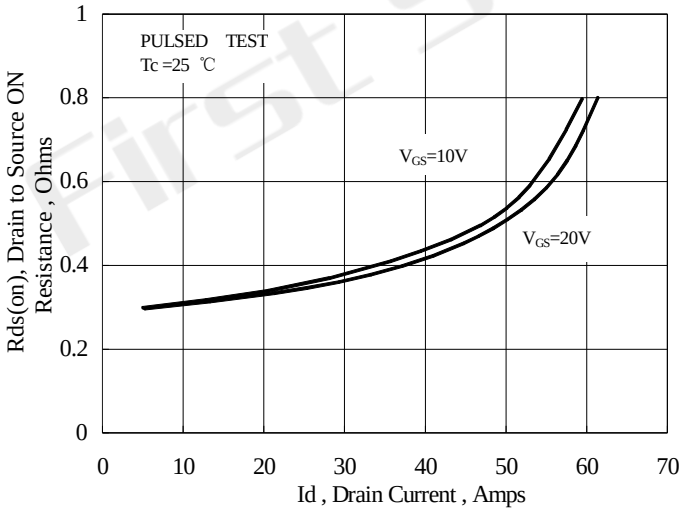


Figure 9 Typical Drain to Source ON Resistance vs Drain Current

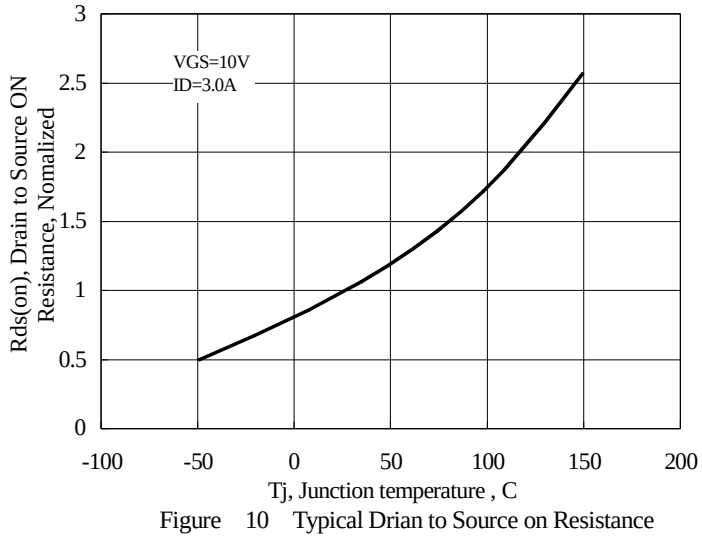


Figure 10 Typical Drian to Source on Resistance vs Junction Temperature

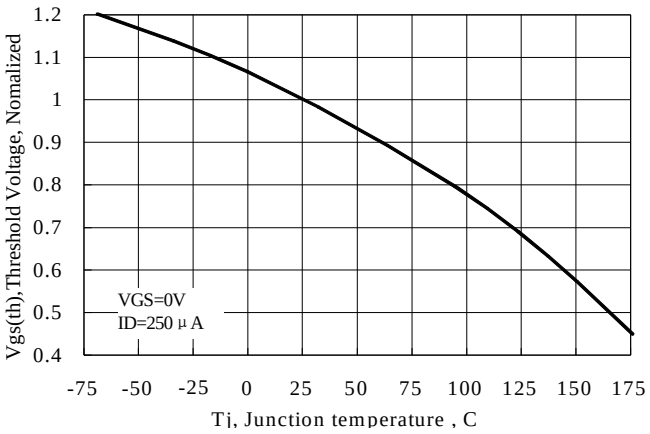


Figure 11 Typical Theshold Voltage vs Junction Temperature

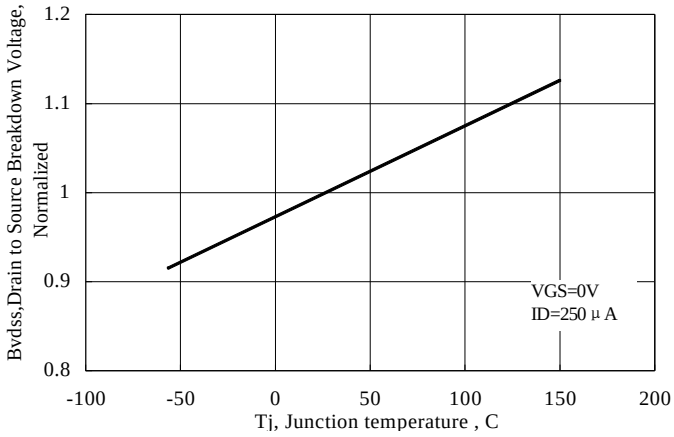


Figure 12 Typical Breakdown Voltage vs Junction Temperature

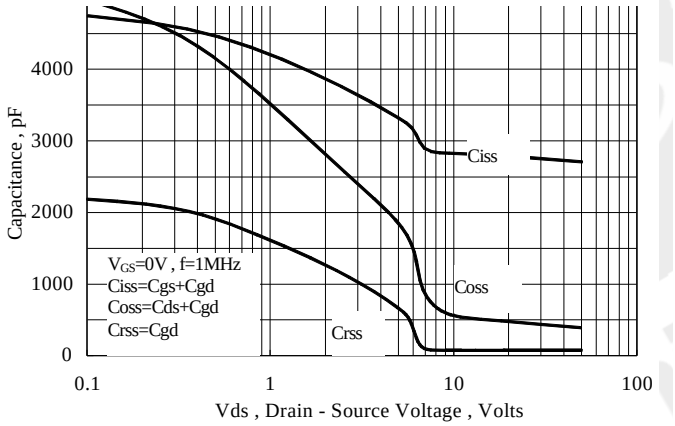
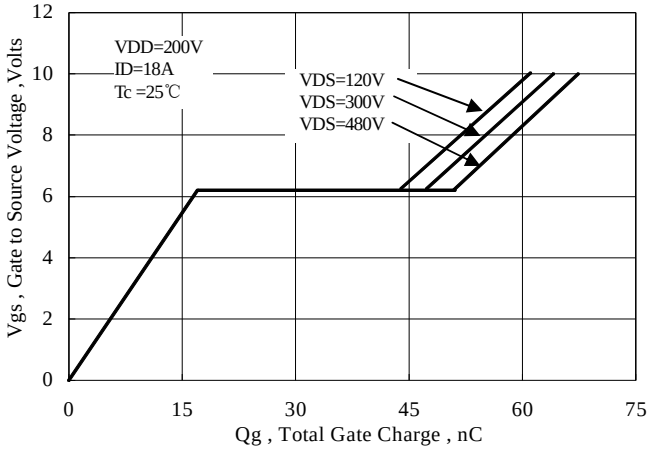


Figure 13 Typical Capacitance vs Drain to Source Voltage



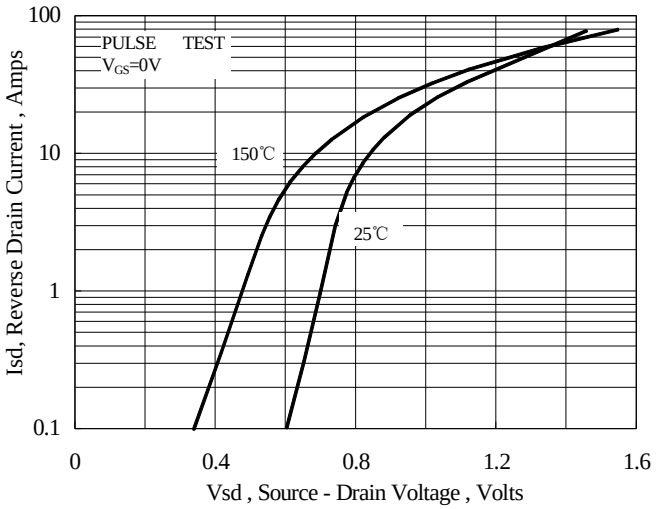


Figure 15 Typical Body Diode Transfer Characteristics

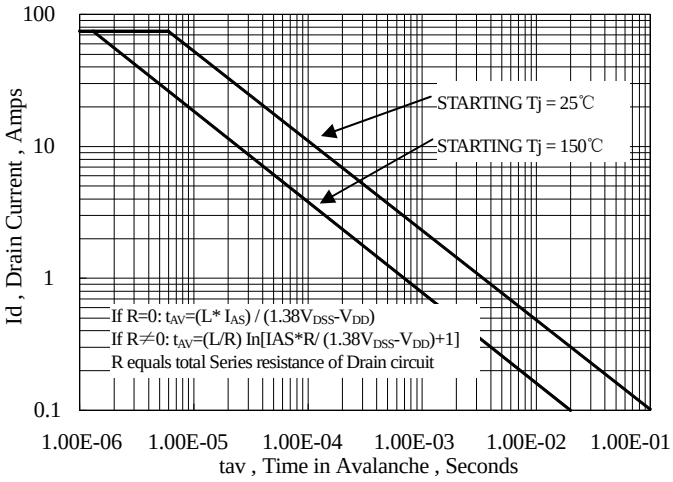


Figure 16 Unclamped Inductive Switching Capability

Test Circuit and Waveform

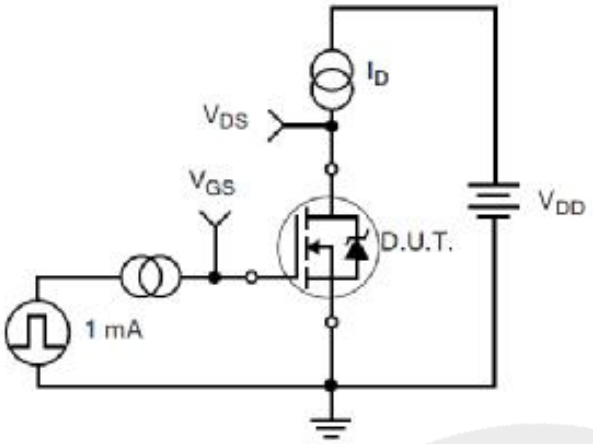


Figure 17. Gate Charge Test Circuit

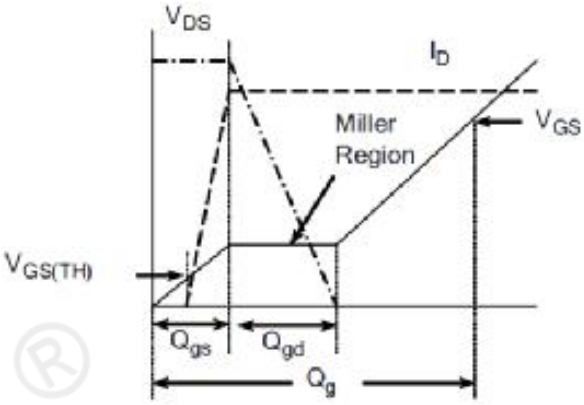


Figure 18. Gate Charge Waveform

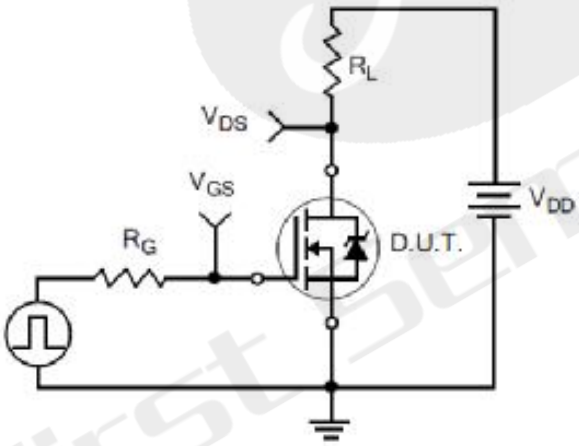


Figure 19. Resistive Switching Test Circuit

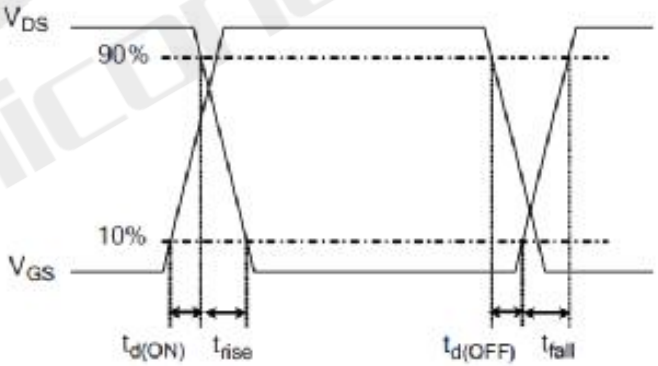


Figure 20. Resistive Switching Waveforms

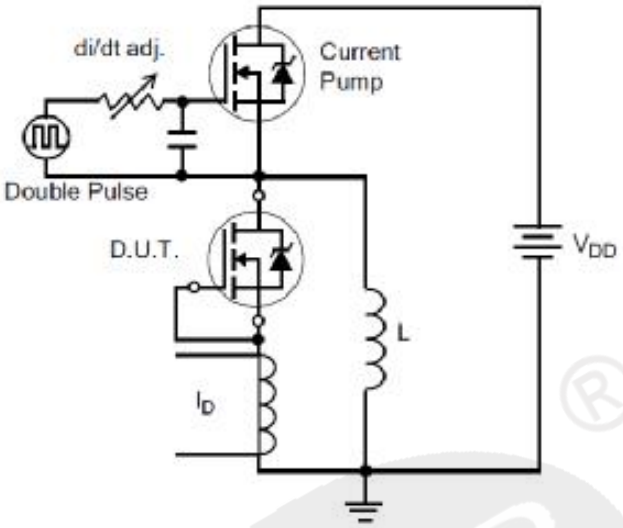


Figure 21. Diode Reverse Recovery Test Circuit

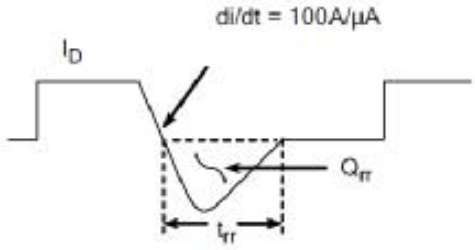


Figure 22. Diode Reverse Recovery Waveform

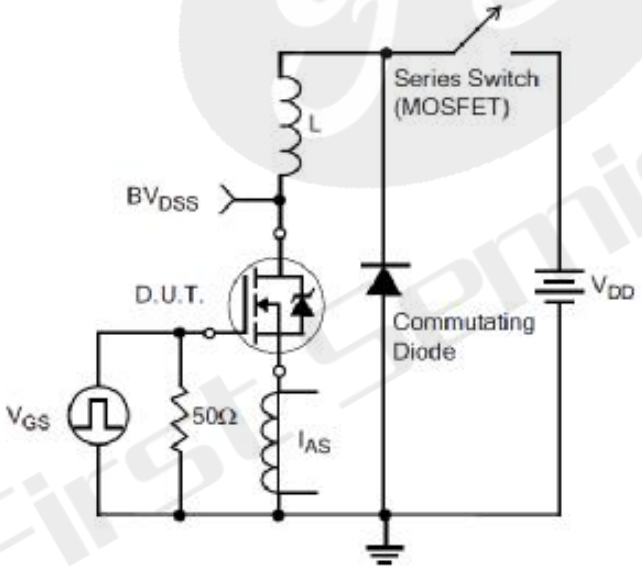
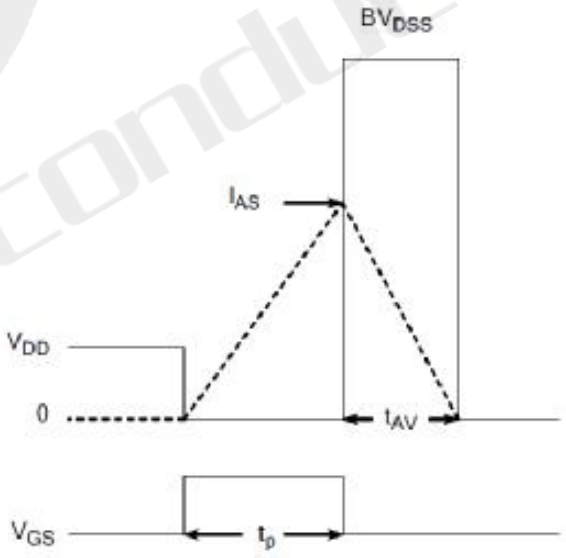


Figure 23. Unclamped Inductive Switching Test Circuit

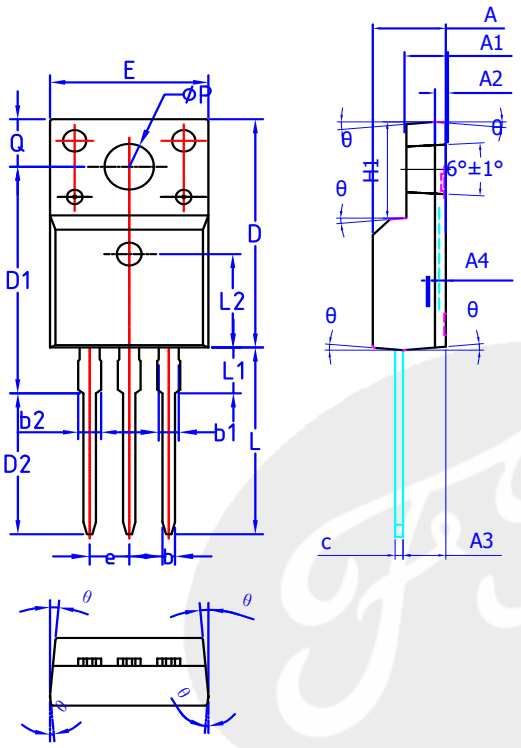


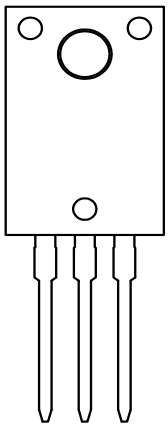
$$E_{AS} = \frac{I_{AS}^2 L}{2}$$

Figure 24. Unclamped Inductive Switching Waveforms

Package Dimensions

TO-220F





Units: mm

COMMON DIMENSIONS
(UNITS OF MEASURE=MILLIMETER)

SYMBOL	MIN	NOM	MAX
A	4.50	4.70	4.90
A1	2.34	2.54	2.74
A2		0.70 REF	
A3	2.56	2.76	2.96
b	0.70	0.80	0.90
b1	1.17	1.2	1.25
b2	1.17	1.2	1.25
c	0.45	0.50	0.60
D	15.67	15.87	16.07
D1	15.55	15.75	15.95
D2	10.0	10.2	10.4
E	9.96	10.16	10.36
e		2.54BSC	
H1	6.48	6.68	6.88
L	12.68	12.98	13.28
L1	-	-	3.50
L2		6.50REF	
ΦP	3.08	3.18	3.28
Q	3.20	3.30	3.40
θ1	1°	3°	5°
A4	0.53	0.56	0.59

Declaration

- FIRST reserves the right to change the specifications, the same specifications of products due to different packaging line mold, the size of the appearance will be slightly different, shipped in kind, without notice! Customers should obtain the latest version information before ordering, and verify whether the relevant information is complete and up-to-date.
- Any semiconductor product under certain conditions has the possibility of failure or failure,The buyer has the responsibility to comply with safety standards and take safety measures when using FIRST products for system design and manufacturing,To avoid To avoid potential failure risks, which may cause personal injury or property damage!
- Product promotion endless, our company will wholeheartedly provide customers with better products!

ATTACHMENT

Revision History

Date	REV	Description	Page
2018.01.01	1.0	Initial release	