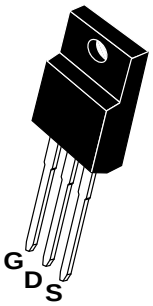
First Semiconductor

FIR10N65AFG

650V N-Channel MOSFET-T

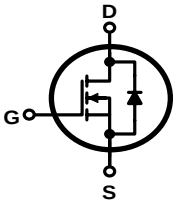
PIN Connection TO-220F



Features:

- ☐ Low Intrinsic Capacitances
- ☐ Excellent Switching Characteristics
- ☐ Extended Safe Operating Area
- ☐ Unrivalled Gate Charge :Qg= 44nC (Typ.)
- ☐ BVDSS=650V,ID=10A
- ☐ $R_{DS(on)}$:0.80 Ω (Max) @VG=10V
- ☐ 100% Avalanche Tested

Schematic diagram



Marking Diagram

Y = Year

A = Assembly Location

WW = Work Week

FIR10N65AF= Specific Device Code

Absolute Maximum Ratings (Ta=25℃ unless otherwise noted)

Symbol	Parameter		Value	Unit
V_{DSS}	Drain-Source Voltage		650	V
I_D	Drain Current	T_j=25℃	10	A
		T_j=100℃	6.6	
$V_{GS(TH)}$	Gate Threshold Voltage		±30	V
E_{AS}	Single Pulse Avalanche Energy (note1)		580	mJ
I_{AR}	Avalanche Current (note2)		9.5	A
P_D	Power Dissipation (Tj=25℃)		60	W
T_j	Junction Temperature(Max)		150	℃
T_{stg}	Storage Temperature		-55~+150	℃
TL	Maximum lead temperature for soldering purpose,1/8" from case for 5 seconds		300	℃

Thermal Characteristics

Symbol	Parameter	Typ.	Max.	Unit
$R_{\theta JC}$	Thermal Resistance,Junction to Case	-	2.08	℃/W
$R_{\theta JA}$	Thermal Resistance,Junction to Ambient	-	120	℃/W

Electrical Characteristics (Ta=25℃ unless otherwise noted)

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
Off Characteristics						
BV_{DSS}	Drain-Source Breakdown Voltage	I_D=250μA，V_{GS}=0	650	-	-	V
△BVDSS/△TJ	Breakdown Voltage Temperature Coefficient	I_D=250μA ,Reference to 25℃	-	0.7	-	V/℃
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS}=650V, V_{GS}=0V	-	-	1	μA
		V_{DS}=520V, Tj=125℃			10	
I_{GSSF}	Gate-body leakage Current, Forward	V_{GS}=+30V, V_{DS}=0V	-	-	100	nA
I_{GSSR}	Gate-body leakage Current, Reverse	V_{GS}=-30V, V_{DS}=0V	-	-	-100	
On Characteristics						
$V_{GS(TH)}$	Date Threshold Voltage	I_D=250μA,V_{DS}=V_{GS}	2	-	4	V
$R_{DS(ON)}$	Static Drain-Source On-Resistance	I_D=5.0A,V_{GS}=10V	-	-	0.80	Ω
Dynamic Characteristics						
Ciss	Input Capacitance	V_{DS}=25V，V_{GS}=0，f=1.0MHz	-	1890	-	pF
Coss	Output Capacitance		-	166	-	
Crss	Reverse Transfer Capacitance		-	18	-	
Switching Characteristics						
Td(on)	Turn-On Delay Time	V_{DD}=300V，I_D=10A R_G=25Ω (Note 3,4)	-	23	55	ns
Tr	Turn-On Rise Time		-	66	150	
Td(off)	Turn-Off Delay Time		-	144	300	
Tf	Turn-Off Rise Time		-	77	165	
Qg	Total Gate Charge	V_{DS}=480V,V_{GS}=10V，I_D=10A (Note 3,4)	-	44	57	nC
Qgs	Gate-Source Charge		-	6.7	-	
Qgd	Gate-Drain Charge		-	18.5	-	
Drain-Source Diode Characteristics and Maximum Ratings						
Is	Max. Diode Forward Current	-	-	-	9.5	A
I_{SM}	Max. Pulsed Forward Current	-	-	-	38	
V_{SD}	Diode Forward Voltage	I_D=10A	-	-	1.4	V
Trr	Reverse Recovery Time	I_S=10A,V_{GS} =0V diF/dt=100A/μs (Note3)	-	340	-	nS
Qrr	Reverse Recovery Charge		-	3.2	-	μC

Notes : 1, L=10.6mH, IAS=10A, VDD=50V, RG=25 Ω, Starting TJ =25°C
2, Repetitive Rating : Pulse width limited by maximum junction temperature
3, Pulse Test : Pulse Width ≤ 300μs, Duty Cycle ≤ 2%
4, Essentially Independent of Operating Temperature

Typical Characteristics

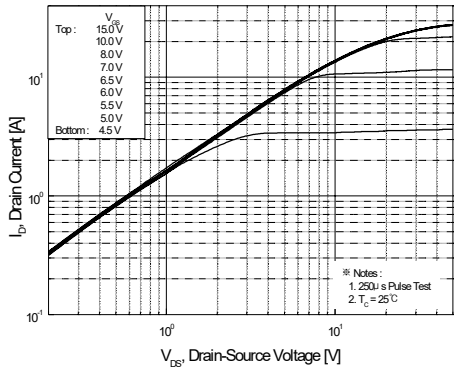


Figure 1. On-Region Characteristics

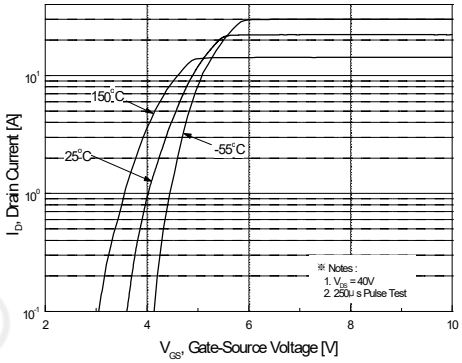


Figure 2. Transfer Characteristics

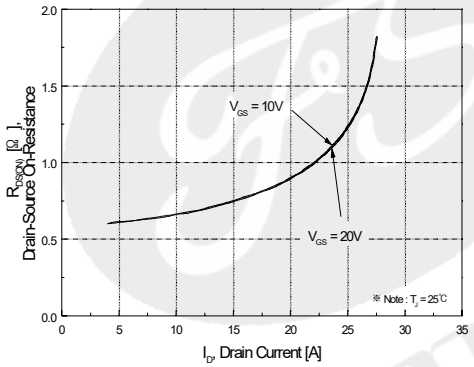


Figure 3. On-Resistance Variation vs Drain Current and Gate Voltage

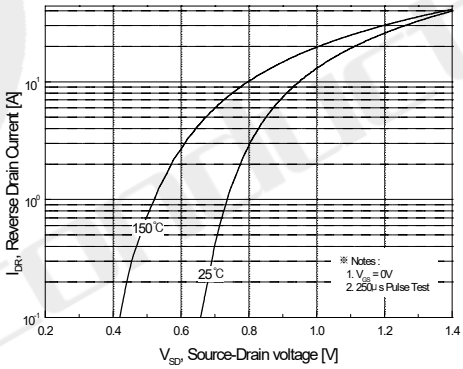


Figure 4. Body Diode Forward Voltage Variation with Source Current and Temperature

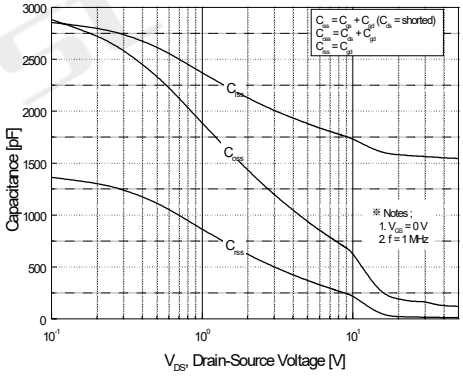


Figure 5. Capacitance Characteristics

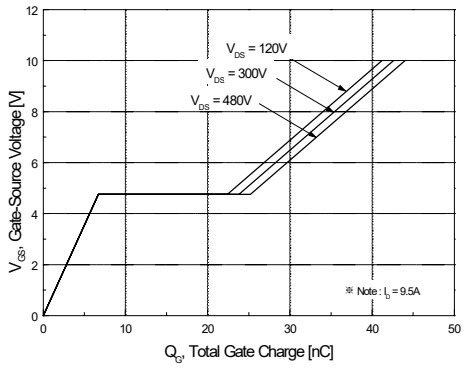


Figure 6. Gate Charge Characteristics

Typical Characteristics (Continued)

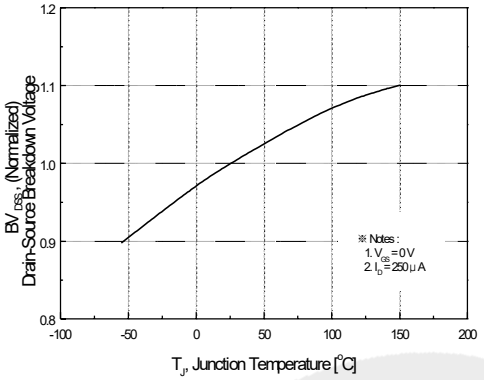


Figure 7. Breakdown Voltage Variation vs Temperature

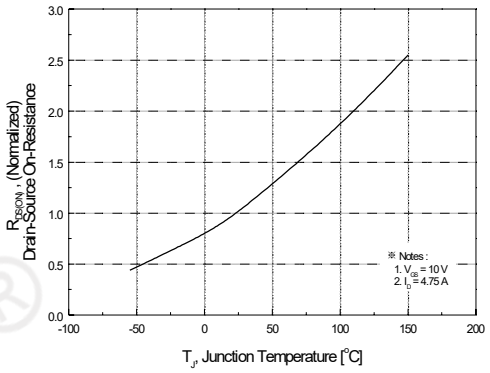


Figure 8. On-Resistance Variation vs Temperature

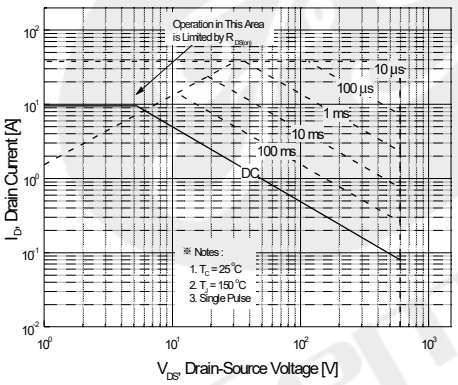


Figure 9-2. Maximum Safe Operating Area

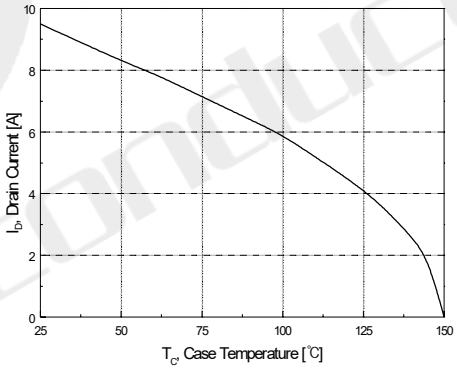


Figure 10. Maximum Drain Current vs Case Temperature

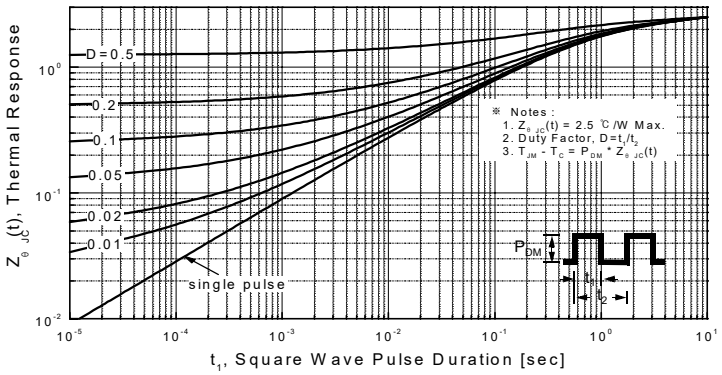
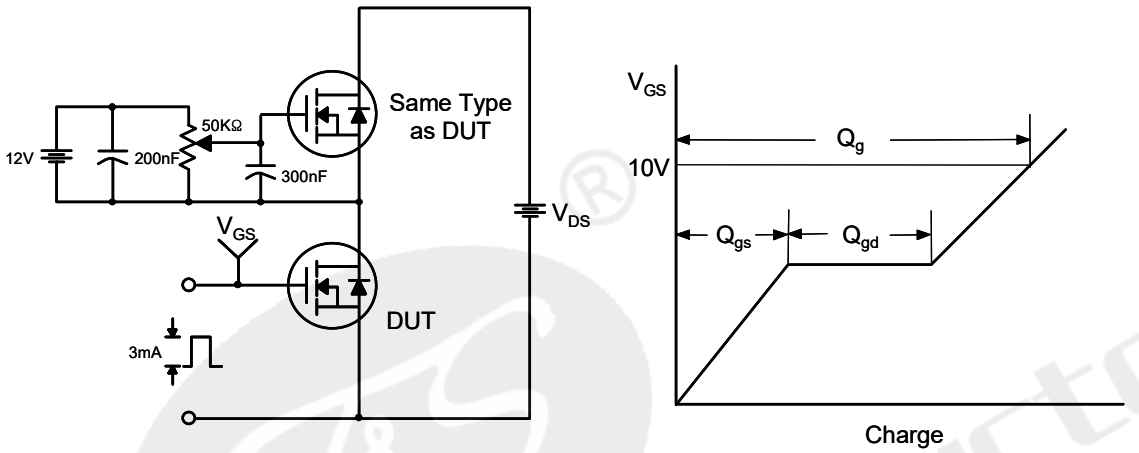
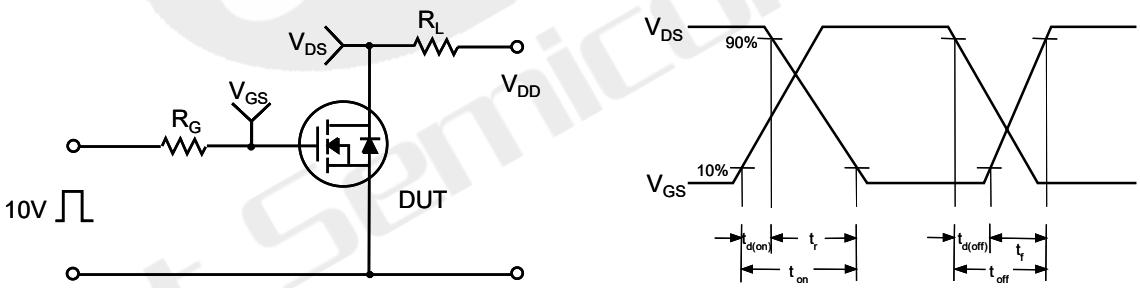


Figure 11-2. Transient Thermal Response Curve

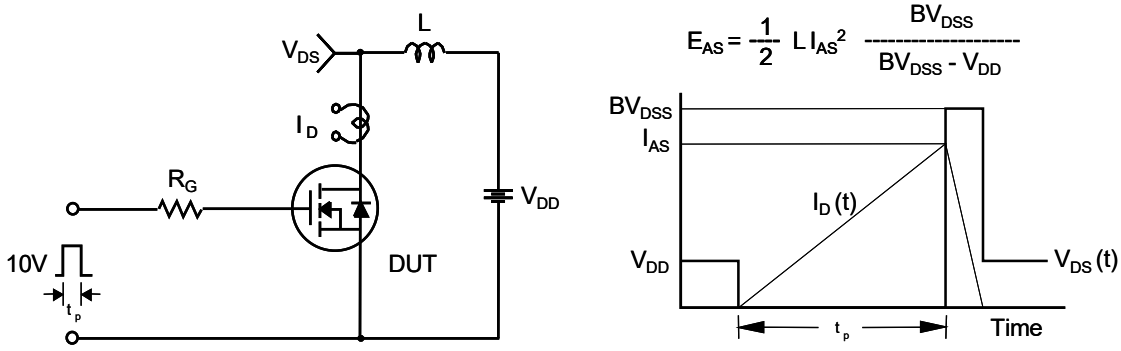
Gate Charge Test Circuit & Waveform



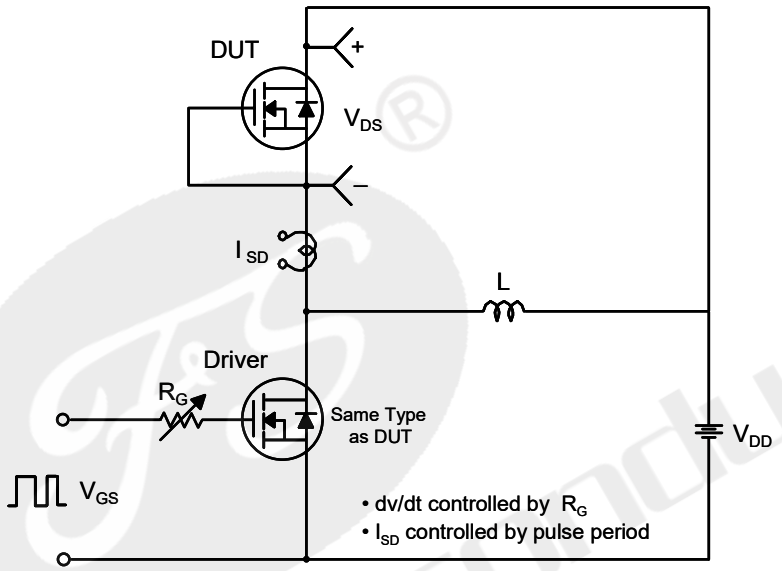
Resistive Switching Test Circuit & Waveforms

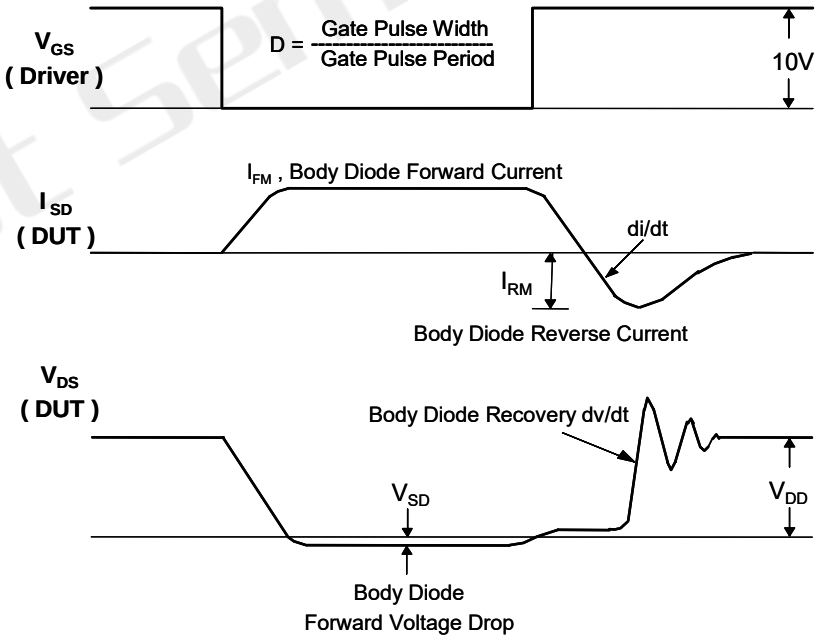


Unclamped Inductive Switching Test Circuit & Waveforms



Peak Diode Recovery dv/dt Test Circuit & Waveforms

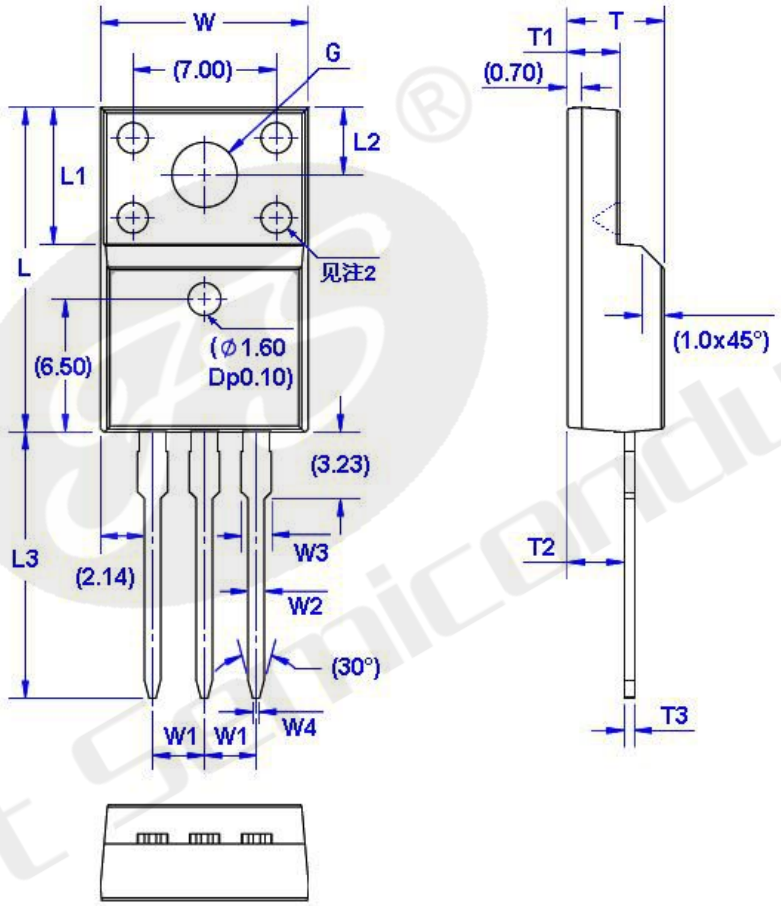




Package Dimension

TO-220F

Unit: mm



Symbol	Size		Symbol	Size		Symbol	Size		Symbol	Size	
	Min	Max		Min	Max		Min	Max		Min	Max
W	9.96	10.36	W4	0.25	0.45	L3	12.78	13.18	T3	0.45	0.60
W1	2.54 (TYP)		L	15.67	16.07	T	4.50	4.90	G(Φ)	3.08	3.28
W2	0.70	0.90	L1	6.48	6.88	T1	2.34	2.74			
W3	1.24	1.47	L2	3.20	3.40	T2	2.56	2.96			

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	