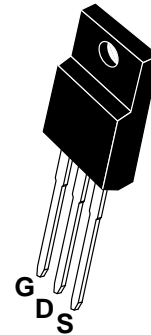




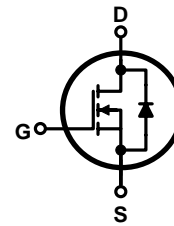
PIN Connection TO-220F

FEATURE

- 10A,650V, $R_{DS(ON)MAX}=1.0\ \Omega$ @ $V_{GS}=10V/5A$
- Low gate charge
- Low C_{iss}
- Fast switching
- 100% avalanche tested
- Improved dv/dt capability
- Halogen free



Schematic diagram



Marking Diagram



- Y = Year
- A = Assembly Location
- WW = Work Week
- VT = Version & Thickness
- FIR10N65F = Specific Device Code

Absolute Maximum Ratings($T_c=25^\circ C$, unless otherwise noted)

Parameter	Symbol		UNIT
Drain-Source Voltage	V_{DSS}	650	V
Gate-Source Voltage	V_{GSS}	± 30	
Continuous Drain Current	I_D	10	A
Pulsed Drain Current(Note1)	I_{DM}	40	
Single Pulse Avalanche Energy (Note 2)	E_{AS}	500	mJ
Reverse Diode dV/dt (Note 3)	dv/dt	5	V/ns
Operating Junction and Storage Temperature Range	T_J, T_{STG}	-55to+150	$^\circ C$
Maximum lead temperature for soldering purposes, 1/8" from case for 5 seconds	T_L	260	$^\circ C$

Parameter	Symbol		Units
Thermal resistance , Channel to Case	$R_{th(ch-c)}$	3.13	$^\circ C/W$
Thermal resistance , Channel to Ambient	$R_{th(ch-a)}$	62.5	$^\circ C/W$
Maximum Power Dissipation $T_c=25^\circ C$	P_D	40	W

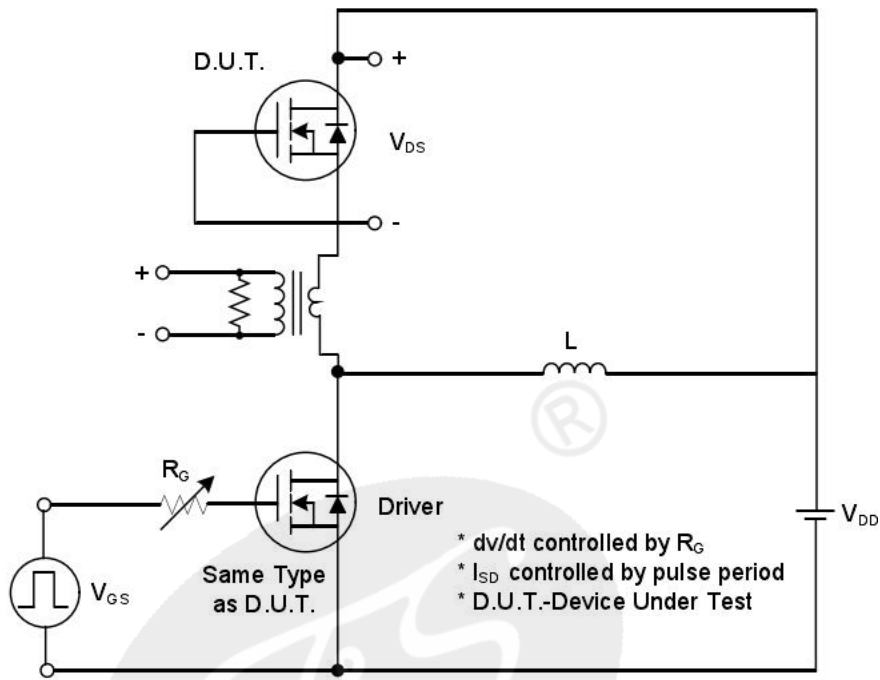


Electrical Characteristics (T _c =25°C, unless otherwise noted)						
Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Off Characteristics						
Drain-Source Breakdown Voltage	BV _{DSS}	V _{GS} =0V, I _D =250uA	650	—	—	V
Breakdown Temperature Coefficient	ΔBV _{DSS} / ΔT _J	Reference to 25°C , I _D =250uA	—	0.7	—	V/°C
Zero Gate Voltage Drain Current	I _{DSS}	V _{DS} =650V, V _{GS} =0V	—	—	1	uA
Gate-Body Leakage Current, Forward	I _{GSSF}	V _{GS} =30V, V _{DS} =0V	—	—	100	nA
Gate-Body Leakage Current, Reverse	I _{GSSR}	V _{GS} =-30V, V _{DS} =0V	—	—	-100	nA
On Characteristics						
Gate-Source Threshold Voltage	V _{GS(th)}	V _{DS} =V _{GS} , I _D =250uA	2	—	4	V
Drain-Source On-State Resistance	R _{DS(on)}	V _{GS} =10V, I _D =5A	—	0.86	1.0	Ω
Dynamic Characteristics						
Input Capacitance	C _{iss}	V _{DS} =25V, V _{GS} =0V, f=1.0MHZ	—	1642	—	pF
Output Capacitance	C _{oss}		—	128	—	pF
Reverse Transfer Capacitance	C _{rss}		—	7	—	pF
Switching Characteristics						
Turn-On Delay Time	t _{d(on)}	V _{DD} =325V, I _D =10A, R _G =10Ω (Note3,4)	—	27	—	ns
Turn-On Rise Time	t _r		—	22	—	ns
Turn-Off Delay Time	t _{d(off)}		—	53	—	ns
Turn-Off Fall Time	t _f		—	24	—	ns
Total Gate Charge	Q _g	V _{DS} =520V, I _D =10A, V _{GS} =10V, (Note3,4)	—	32	—	nC
Gate-Source Charge	Q _{gs}		—	8	—	nC
Gate-Drain Charge	Q _{gd}		—	12	—	nC
Drain-Source Body Diode Characteristics and Maximum Ratings						
Continuous Diode Forward Current	I _S		—	—	10	A
Pulsed Diode Forward Current	I _{SM}		—	—	40	A
Diode Forward Voltage	V _{SD}	I _S =10A, V _{GS} =0V	—	—	1.5	V
Reverse Recovery Time	t _{rr}	V _{GS} =0V, I _S =10A, dI _F /dt=100A/us, (Note4)	—	528	—	ns
Reverse Recovery Charge	Q _{rr}		—	3.22	—	uC

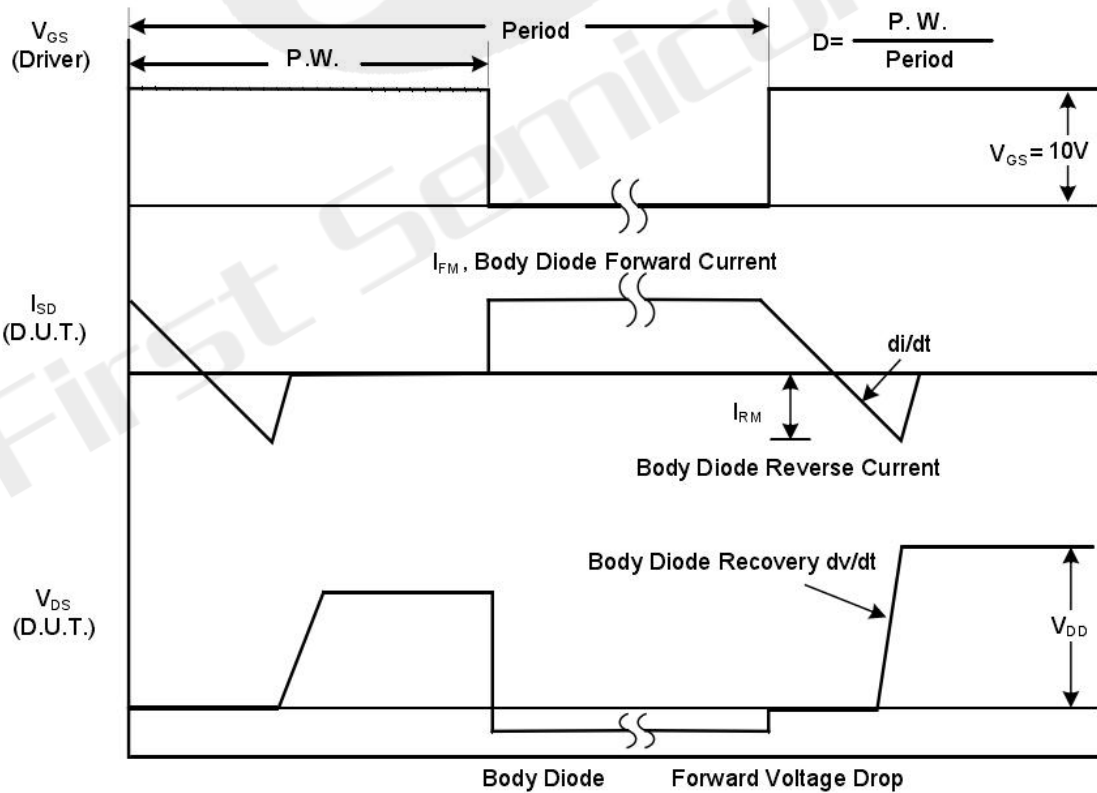
Notes

1. Repetitive Rating; pulse width limited by maximum junction temperature.
2. L=10mH, I_{AS}=10A , starting T_J=25°C .
3. I_{SD}=10A, dI/dt ≤ 100A/us, V_{DD} ≤ BV_{DSS}, starting T_J=25°C, Pulse width ≤ 300us; duty cycle ≤ 2%.
4. Repetitive rating; pulse width limited by maximum junction temperature.

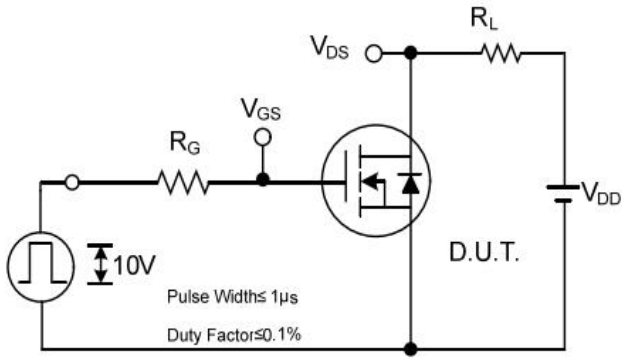
TEST CIRCUIT AND WAVEFORM



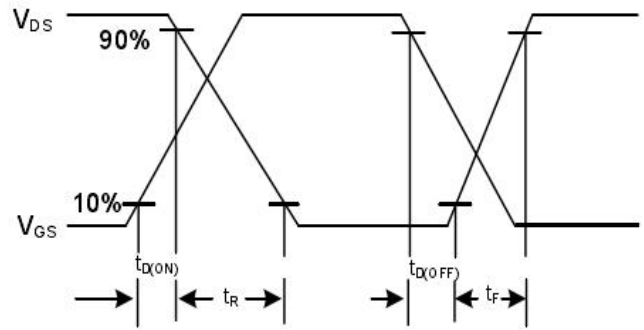
Peak Diode Recovery dv/dt Test Circuit



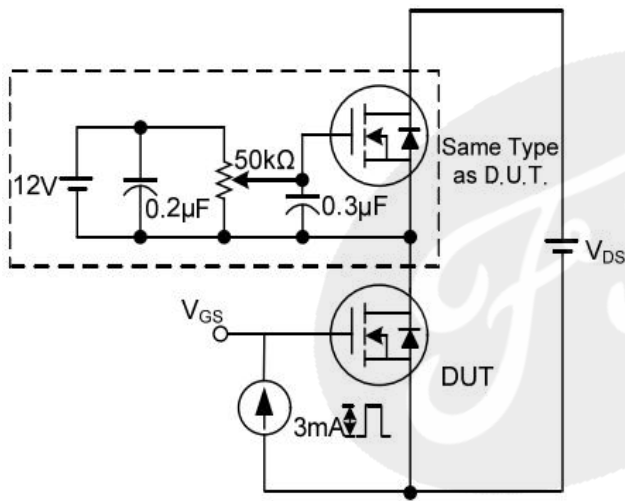
Peak Diode Recovery dv/dt Waveforms



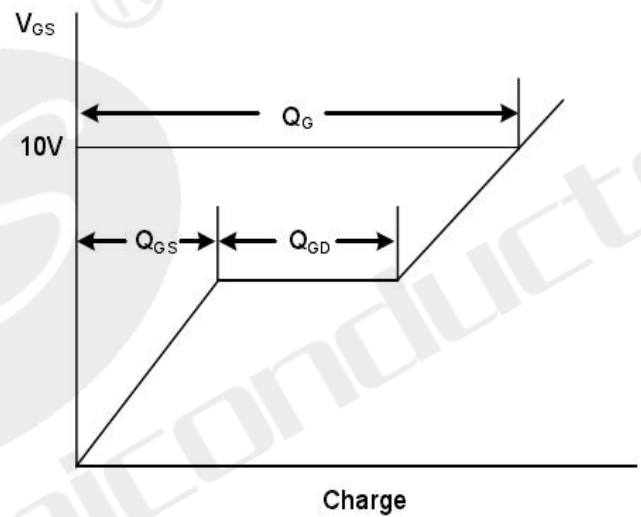
Switching Test Circuit



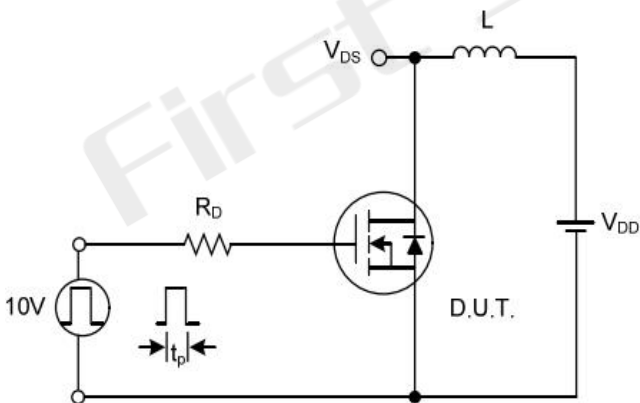
Switching Waveforms



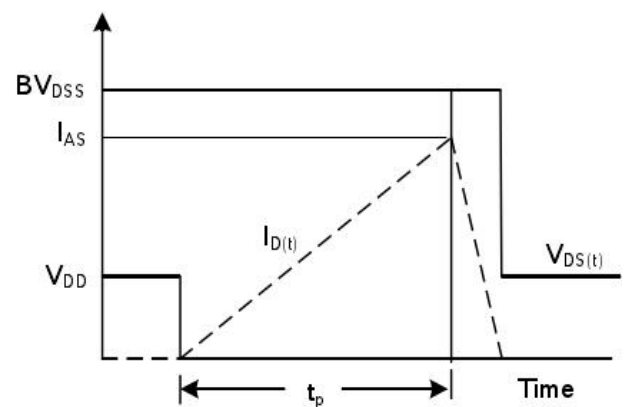
Gate Charge Test Circuit



Gate Charge Waveform



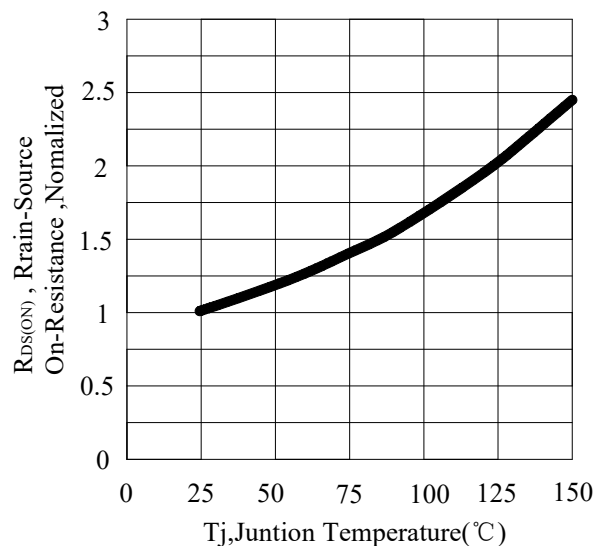
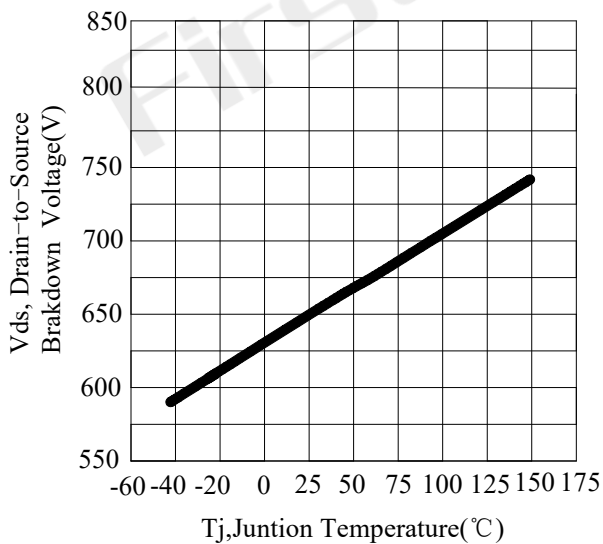
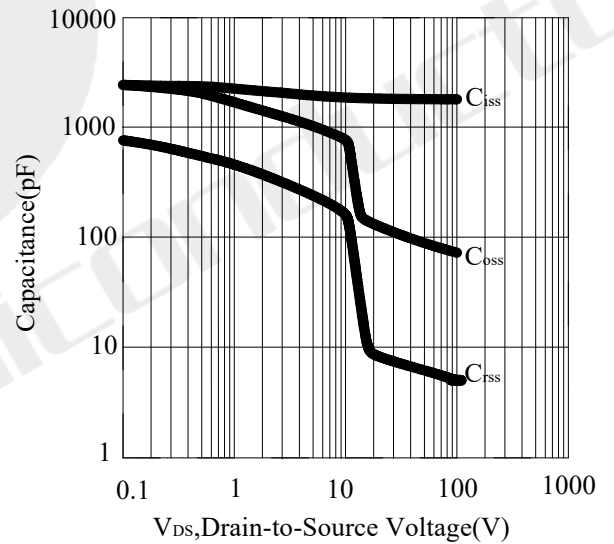
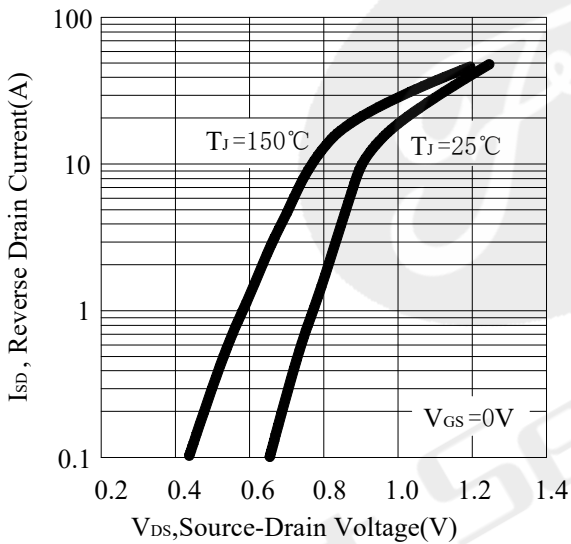
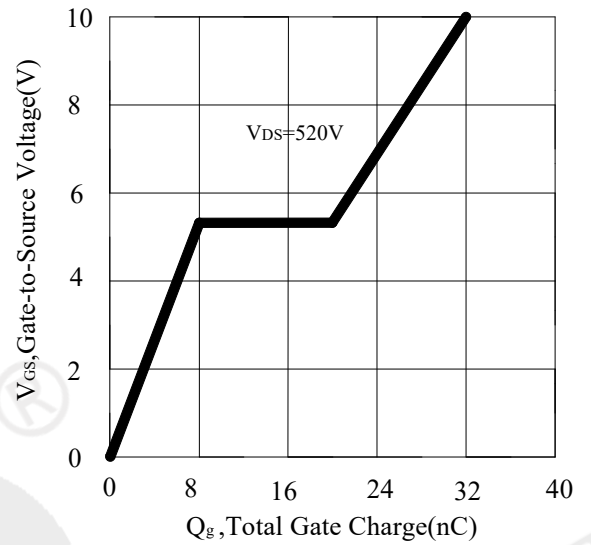
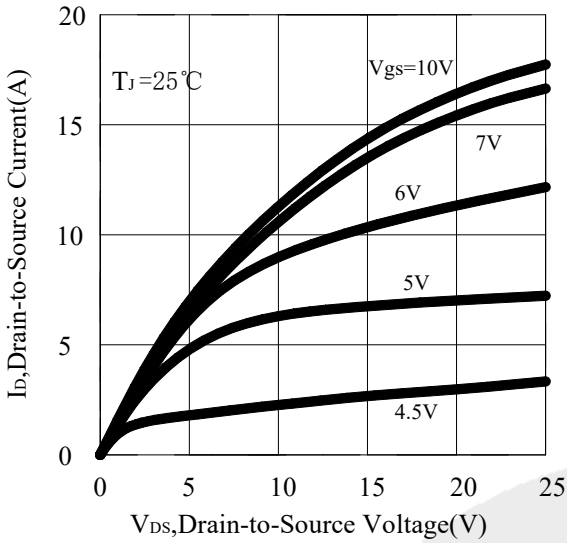
Unclamped Inductive Switching Test Circuit

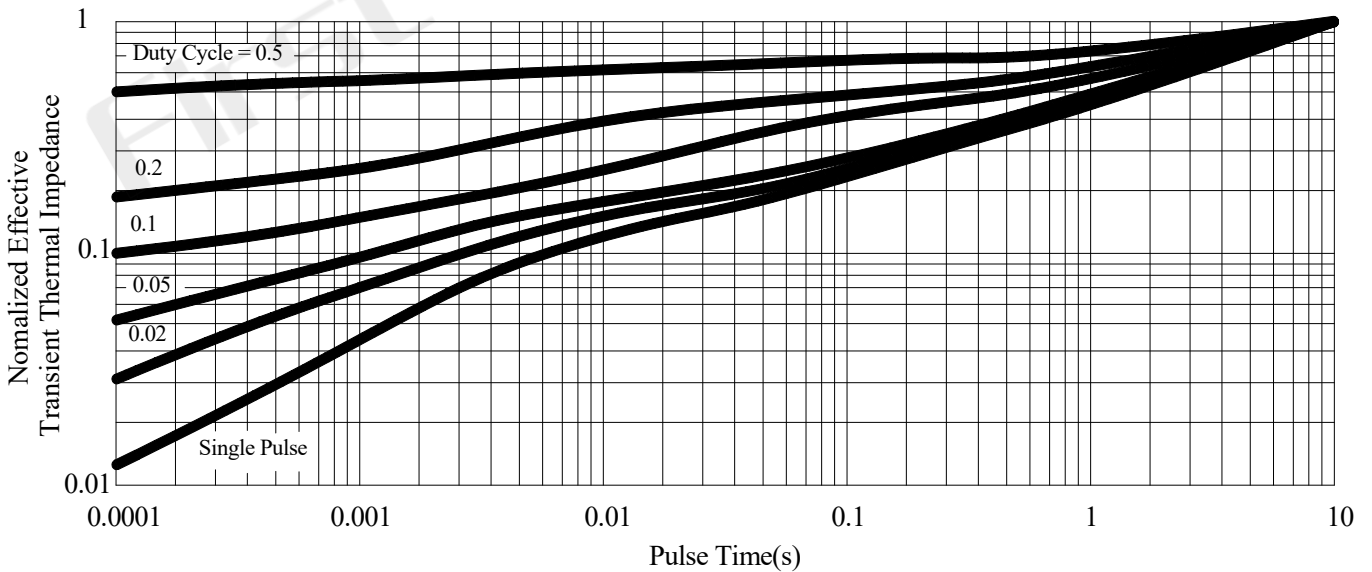
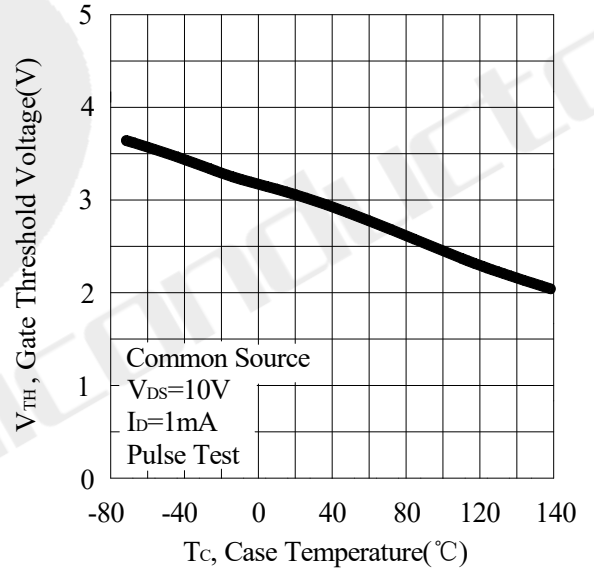
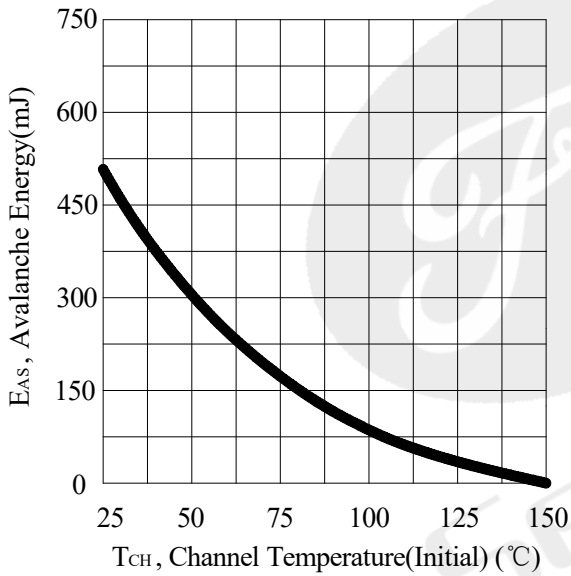
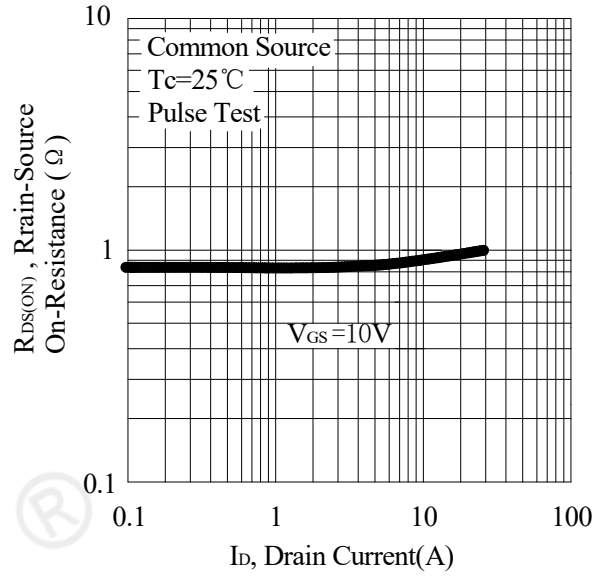
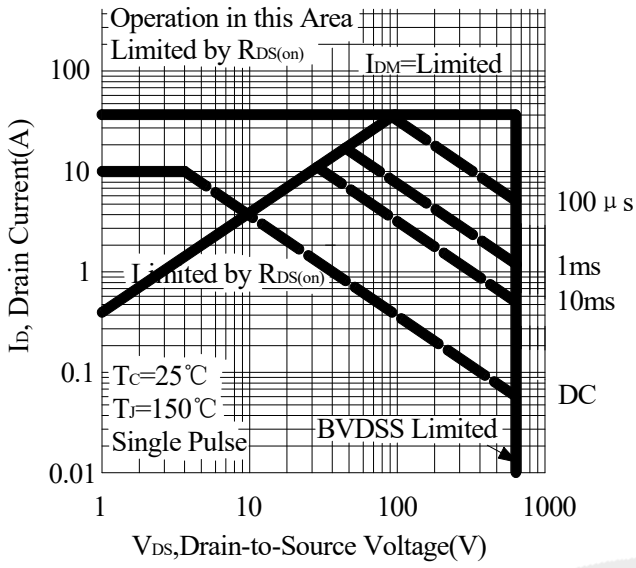


Unclamped Inductive Switching Waveforms



RATING AND CHARACTERISTIC CURVES

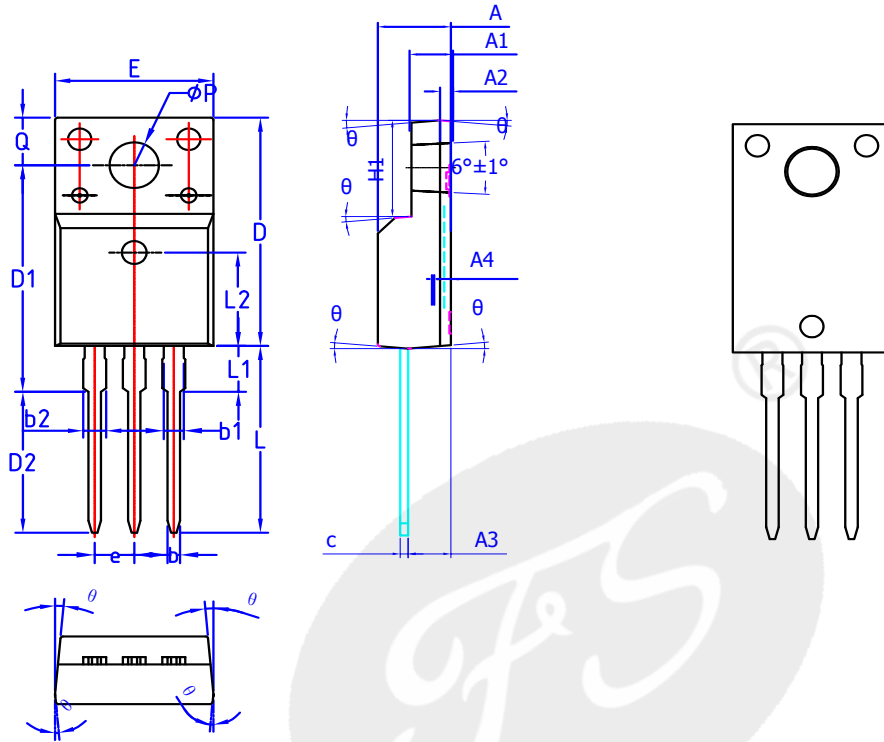






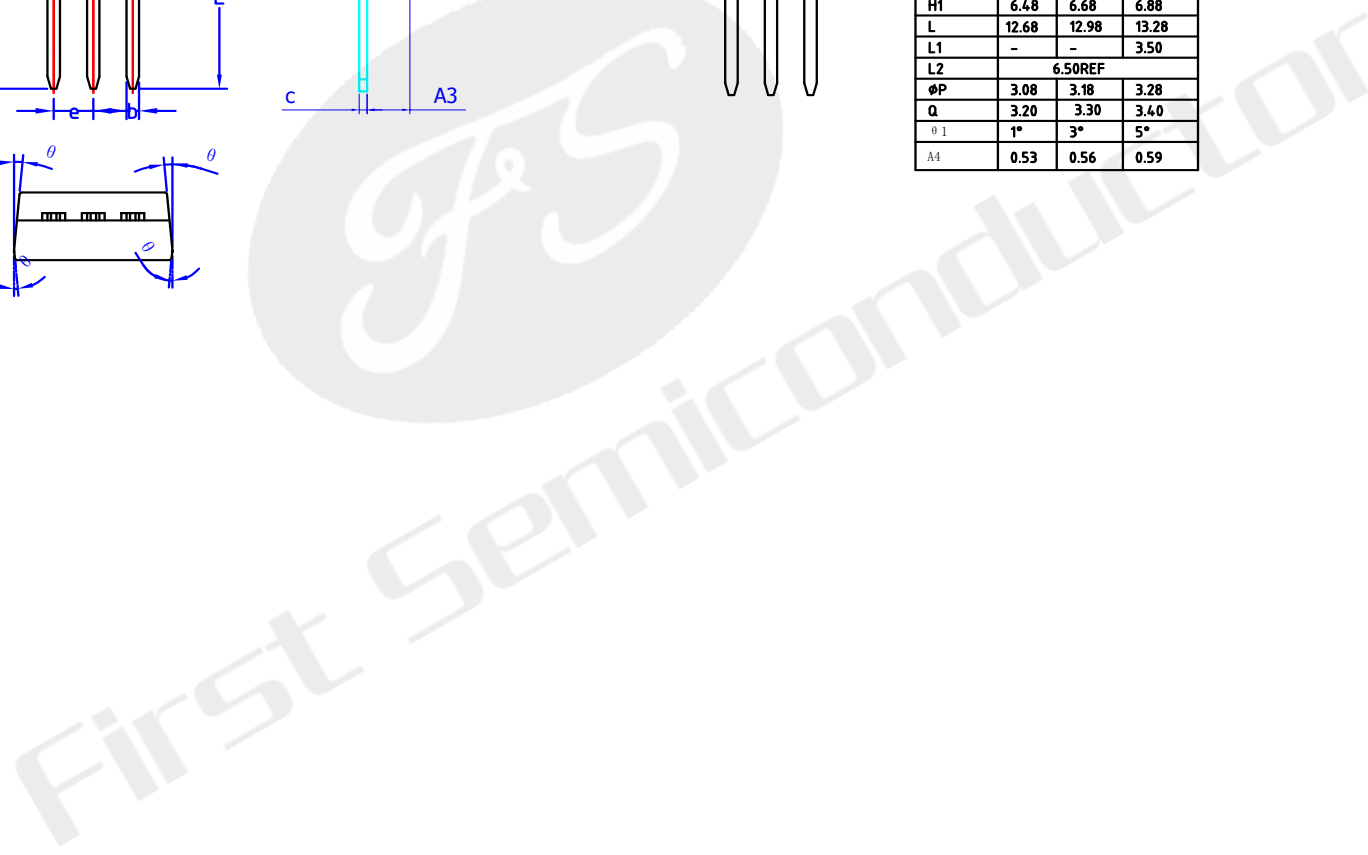
Package Information

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
φ 1	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
2021.01.01	1.0	Initial release	