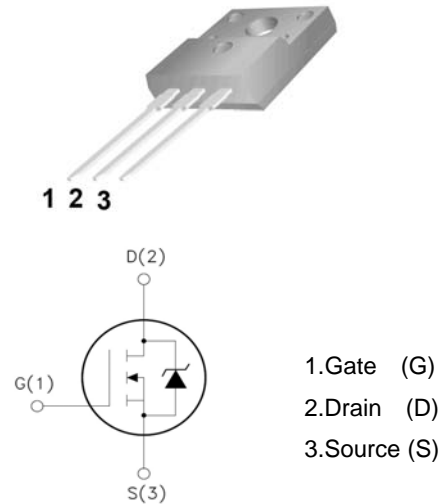


F10N20

Features

- Low Intrinsic Capacitances
- Excellent Switching Characteristics
- Extended Safe Operating Area
- Unrivalled Gate Charge : 22 nC (Typ.)
- BVDSS=200V, ID=10A
- Lower $R_{DS(on)}$: 0.4 Ω (Max) @VG=10V
- 100% Avalanche Tested

TO-220F 



Absolute Maximum Ratings (Ta=25°C unless otherwise noted)

Symbol	Parameter	Value	Unit
V_{DSS}	Drain-Source Voltage	200	V
I_D	Drain Current	$T_j=25^\circ\text{C}$	10.0
		$T_j=100^\circ\text{C}$	7.0
$V_{GS(TH)}$	Gate Threshold Voltage	± 30	V
E_{AS}	Single Pulse Avalanche Energy (note1)	160	mJ
I_{AR}	Avalanche Current (note2)	9.0	A
P_D	Power Dissipation ($T_j=25^\circ\text{C}$)	50	W
T_j	Junction Temperature(Max)	150	$^\circ\text{C}$
T_{stg}	Storage Temperature	-55~+150	$^\circ\text{C}$
TL	Maximum lead temperature for soldering purpose, 1/8" from case for 5 seconds	300	$^\circ\text{C}$

Thermal Characteristics

Symbol	Parameter	Typ.	Max.	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case	-	2.5	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	-	62.5	$^\circ\text{C}/\text{W}$

Electrical Characteristics (Ta=25°C unless otherwise noted)

Symbol	Parameter	Test Condition	Min.	Typ.	Max	Units
Off Characteristics						
BV _{DSS}	Drain-Source Breakdown Voltage	ID=250 μ A, VGS=0	200	--	--	V
ΔBV _{DSS} / ΔT _J	Breakdown Voltage Temperature Coefficient	ID=250 μ A, Reference to 25°C	--	0.55	--	V/°C
IDSS	Zero Gate Voltage Drain Current	Vds=200V, Vgs=0V	--	--	1	μ A
		Vds=160V, Tc=125°C			10	μ A
IGSSF	Gate-body leakage Current, Forward	Vgs=+30V, Vds=0V	--	--	100	nA
IGSSR	Gate-body leakage Current, Reverse	Vgs=-30V, Vds=0V	--	--	-100	nA
On Characteristics						
V _{GS(th)}	Gate Threshold Voltage	Id=250uA, Vds=Vgs	2	--	4	V
R _{DS(on)}	Static Drain-Source On-Resistance	Id=5A, Vgs=10V	--	--	0.4	Ω
Dynamic Characteristics						
Ciss	Input Capacitance	VDS=25V, VGS=0, f=1.0MHz	--	710	-	pF
Coss	Output Capacitance		--	85	-	pF
Crss	Reverse Transfer Capacitance		--	22	-	pF
Switching Characteristics						
Td(on)	Turn-On Delay Time	VDD=100V, ID=10A, RG=25 Ω (Note 3,4)	--	11	25	nS
Tr	Turn-On Rise Time		--	70	140	nS
Td(off)	Turn-Off Delay Time		--	60	120	nS
Tf	Turn-Off Fall Time		--	65	130	nS
Qg	Total Gate Charge	VDS=160, VGS=10V, ID=10A (Note 3,4)	--	22	30	nC
Qgs	Gate-Source Charge		--	4	--	nC
Qgd	Gate-Drain Charge		--	11	--	nC
Drain-Source Diode Characteristics and Maximum Ratings						
IS	Maximun Continuous Drain-Source Diode Forward Current		--	--	10	A
ISM	Maximun Plused Drain-Source Diode Forward Current		--	--	40	A
VSD	Drain-Source Diode Forward Voltage	Id=10A	--	--	1.45	V
trr	Reverse Recovery Time	IS=10A, VGS =0V diF/ dt=100A/ μ S (Note3)	--	140	--	nS
Qrr	Reverse Recovery Charge		--	2.2	--	μ C
*Notes 1, L=8mH, IAS=10A, VDD=50V, RG=25Ω, 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

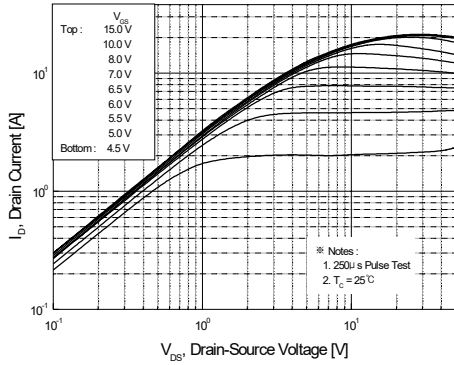


Figure 1. On-Region Characteristics

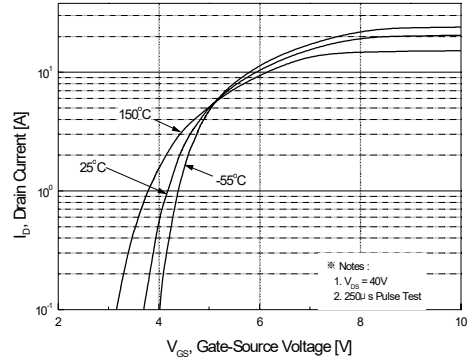


Figure 2. Transfer Characteristics

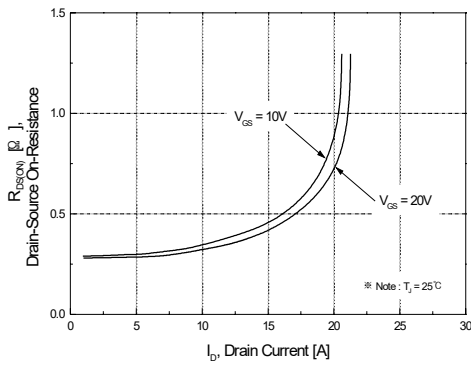


Figure 3. On-Resistance Variation vs Drain Current and Gate Voltage

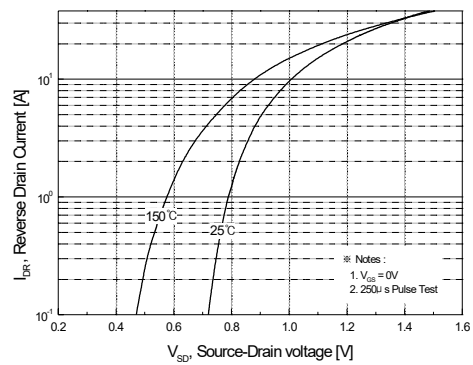


Figure 4. Body Diode Forward Voltage Variation with Source Current and Temperature

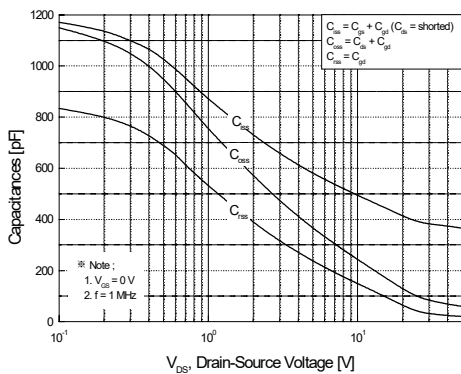


Figure 5. Capacitance Characteristics

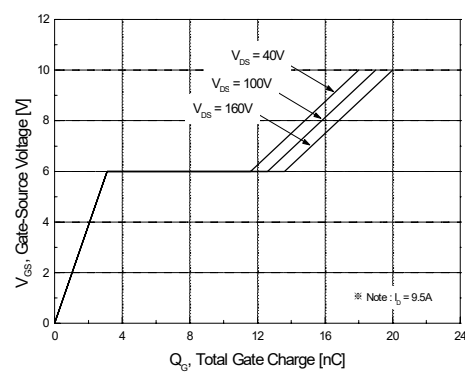
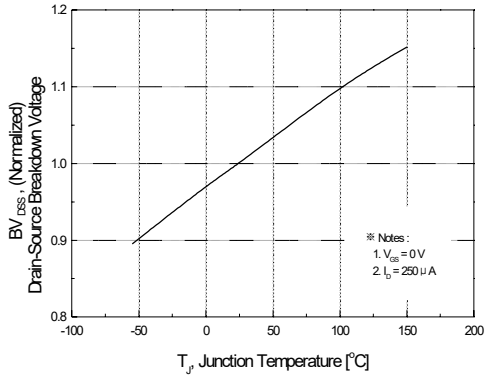
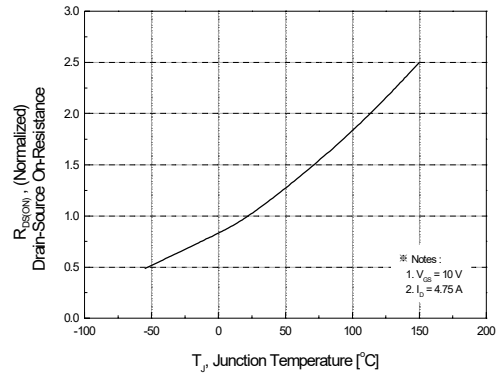
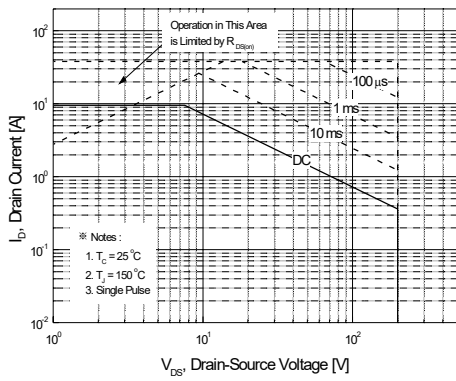
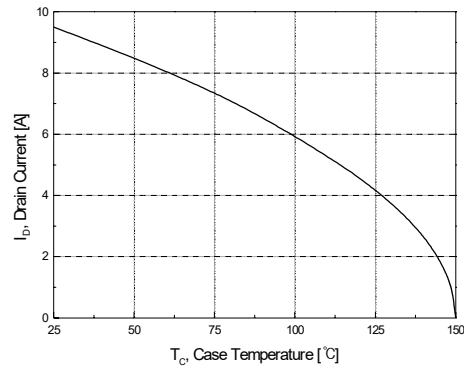
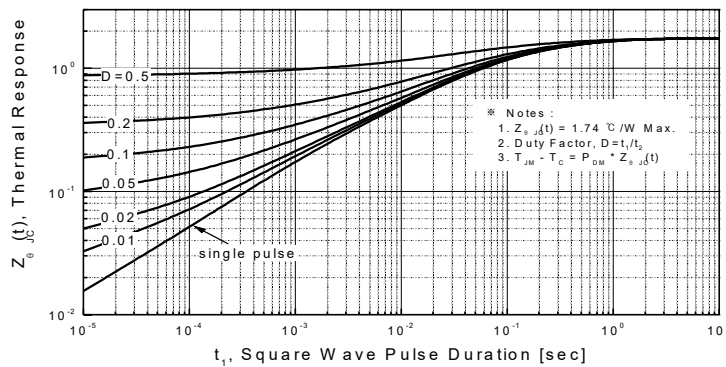
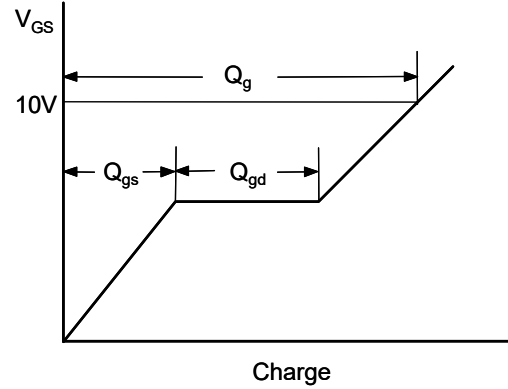
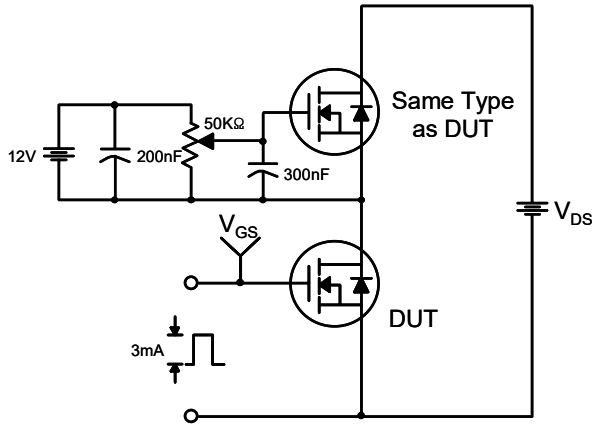


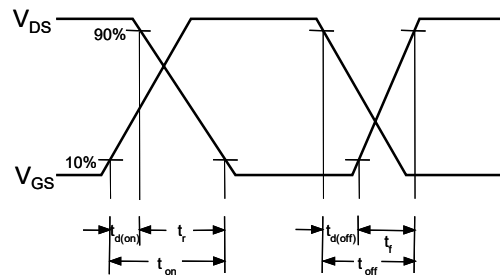
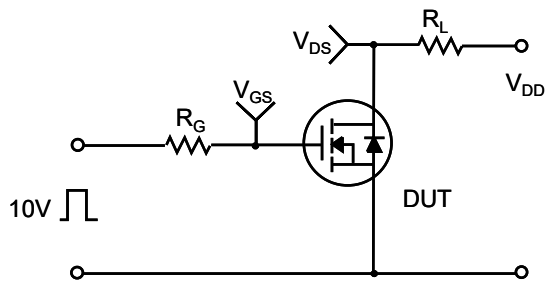
Figure 6. Gate Charge Characteristics

Typical Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs Temperature

Figure 8. On-Resistance Variation vs Temperature

Figure 9-1. Maximum Safe Operating Area

Figure 10. Maximum Drain Current vs Case Temperature

Figure 11-1. Transient Thermal Response Curve

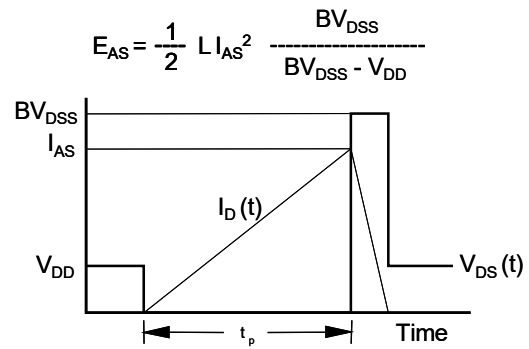
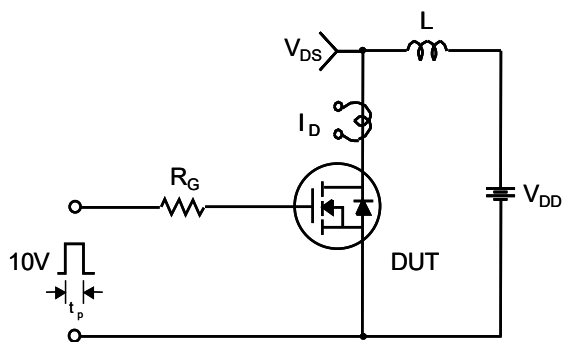
Gate Charge Test Circuit & Waveform



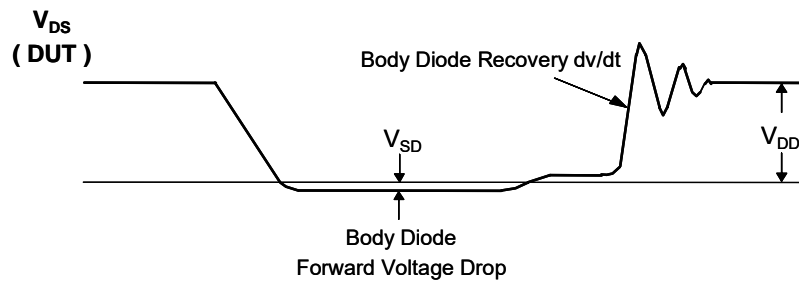
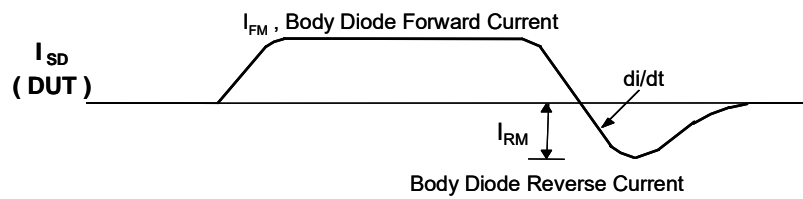
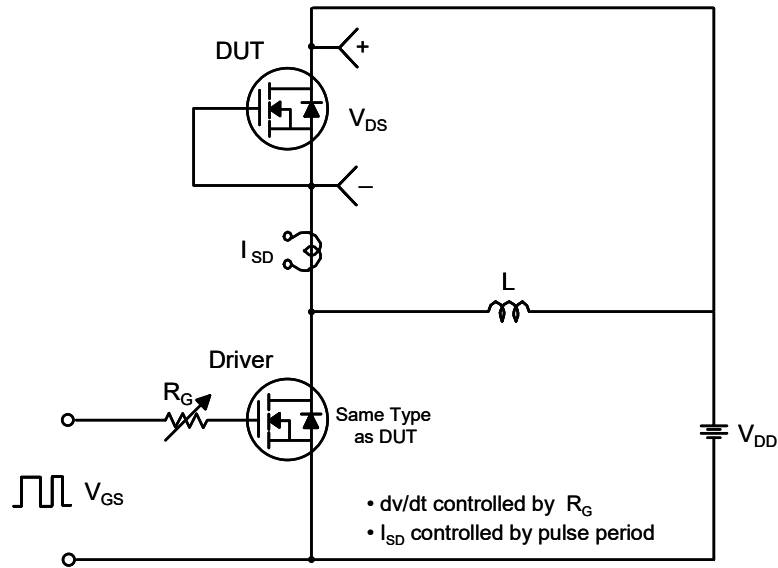
Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching Test Circuit & Waveforms



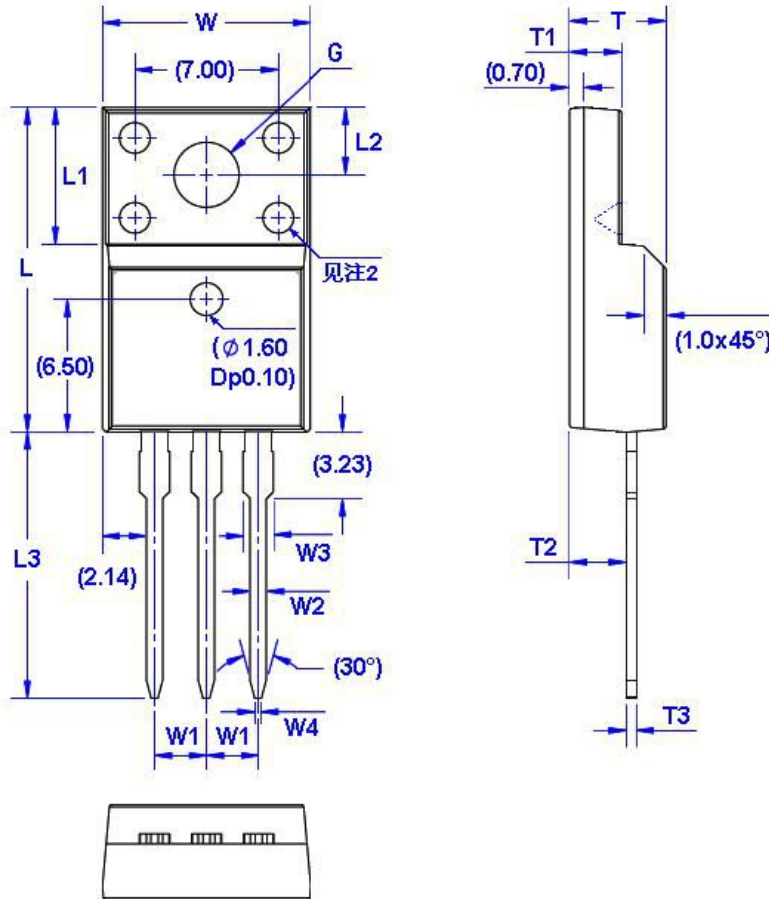
Peak Diode Recovery dv/dt Test Circuit & Waveforms



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			