

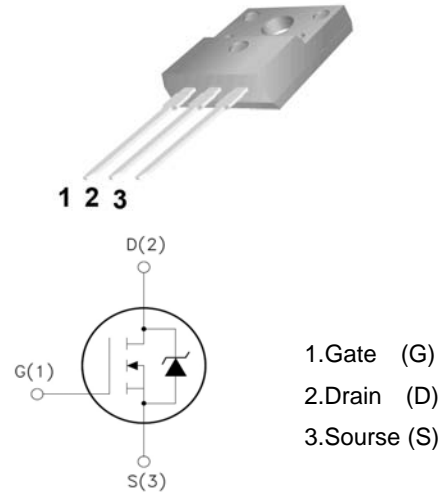
TO-220F 

## F10N70

700V N-Channel MOSFET

### Features:

- Low Intrinsic Capacitances.
- Excellent Switching Characteristics.
- Extended Safe Operating Area.
- Unrivalled Gate Charge : $Q_g = 40\text{nC}$  (Typ.).
- $BV_{DSS} = 700\text{V}, I_D = 10\text{A}$
- $R_{DS(on)} : 0.9\Omega$  (Max) @  $V_G = 10\text{V}$
- 100% Avalanche Tested



### Absolute Maximum Ratings\* ( $T_c = 25^\circ\text{C}$ Unless otherwise noted)

Symbol	PARAMETER	Value	Unit
$V_{DSS}$	Drain-Source Voltage	700	V
$I_D$	Drain Current	$T_c = 25^\circ\text{C}$	10
		$T_c = 100^\circ\text{C}$	5.6
$V_{GSS}$	Gate Threshold Voltage	$\pm 30$	V
$E_{AS}$	Single Pulse Avalanche Energy (note1)	420	mJ
$I_{AR}$	Avalanche Current (note2)	10	A
$P_D$	Power Dissipation ( $T_c = 25^\circ\text{C}$ )	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** (Tc=25°C unless other wise noted)

Symbol	Parameter	Test Condition	MIN.	Typ.	MAX.	Unit
<b>Off Characteristics</b>						
BV <sub>DSS</sub>	Drain-Source Breakdown Voltage	I <sub>D</sub> =250μA, V <sub>GS</sub> =0	700	-	-	V
ΔBV <sub>DSS</sub> /ΔT <sub>J</sub>	Breakdown Voltage Temperature Coefficient	I <sub>D</sub> =250μA, Reference to 25°C	-	0.67	-	V/°C
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> =700V, V <sub>GS</sub> =0V	-	-	10	μA
		V <sub>DS</sub> =560V, Tc=125°C			100	
I <sub>GSSF</sub>	Gate-body leakage Current, Forward	V <sub>GS</sub> =+30V, V <sub>DS</sub> =0V	-	-	100	nA
I <sub>GSSR</sub>	Gate-body leakage Current, Reverse	V <sub>GS</sub> =-30V, V <sub>DS</sub> =0V	-	-	-100	nA
<b>On Characteristics</b>						
V <sub>GS(TH)</sub>	Gate Threshold Voltage	I <sub>D</sub> =250μA, V <sub>DS</sub> =V <sub>GS</sub>	2	-	4	V
R <sub>DS(ON)</sub>	Static Drain-Source On-Resistance	I <sub>D</sub> =5A, V <sub>GS</sub> =10V	-	0.8	0.9	Ω
<b>Dynamic Characteristics</b>						
C <sub>iss</sub>	Input Capacitance	V <sub>DS</sub> =25V, V <sub>GS</sub> =0, f=1.0MHz	-	1420	-	pF
C <sub>oss</sub>	Output Capacitance		-	175	-	pF
C <sub>rss</sub>	Reverse Transfer Capacitance		-	40	-	pF
<b>Switching Characteristics</b>						
T <sub>d(on)</sub>	Turn-On Delay Time	V <sub>DD</sub> =350V, I <sub>D</sub> =10A R <sub>G</sub> =25Ω (Note 3,4)	-	50	-	ns
T <sub>r</sub>	Turn-On Rise Time		-	140	-	ns
T <sub>d(off)</sub>	Turn-Off Delay Time		-	110	-	ns
T <sub>f</sub>	Turn-Off Rise Time		-	120	-	ns
Q <sub>g</sub>	Total Gate Charge	V <sub>DS</sub> =560, V <sub>GS</sub> =10V, I <sub>D</sub> =10A (Note 3,4)	-	40	57	nC
Q <sub>gs</sub>	Gate-Source Charge		-	7	-	nC
Q <sub>gd</sub>	Gate-Drain Charge		-	15	-	nC
<b>Drain-Source Diode Characteristics and Maximum Ratings</b>						
I <sub>S</sub>	Max. Diode Forward Current	-	-	-	10	A
I <sub>SM</sub>	Max. Pulsed Forward Current	-	-	-	30	A
V <sub>SD</sub>	Diode Forward Voltage	I <sub>D</sub> =10A	-	-	1.5	V
T <sub>rr</sub>	Reverse Recovery Time	I <sub>S</sub> =10A, V <sub>GS</sub> =0V diF/dt=100A/μs (Note3)	-	320	-	nS
Q <sub>rr</sub>	Reverse Recovery Charge		-	2.4	-	μC

Notes : 1, L=8.4mH, I<sub>AS</sub>=10A, V<sub>DD</sub>=50V, R<sub>G</sub>=25Ω, Starting T<sub>J</sub>=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

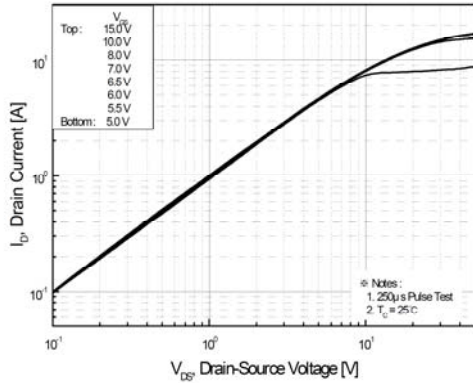


Figure 1. On-Region Characteristics

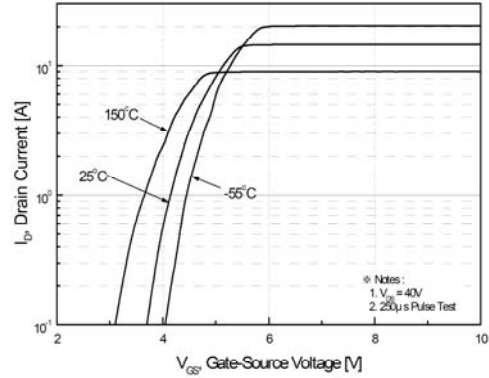


Figure 2. Transfer Characteristics

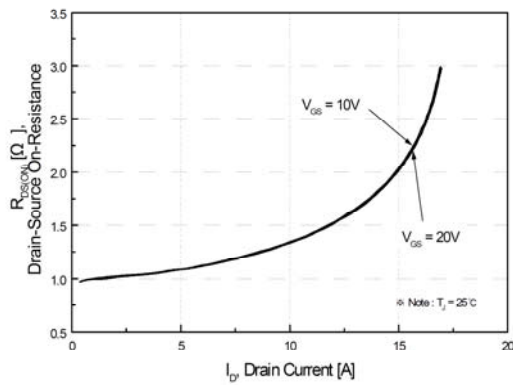


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

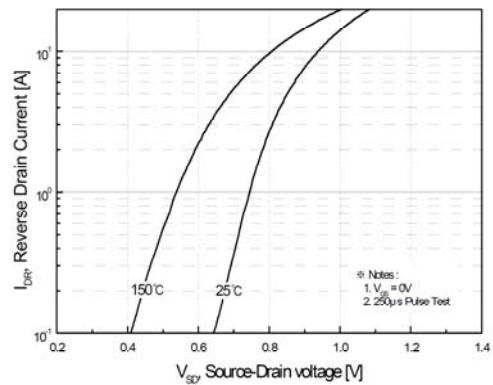


Figure 4. Body Diode Forward Voltage Variation with Source Current and Temperature

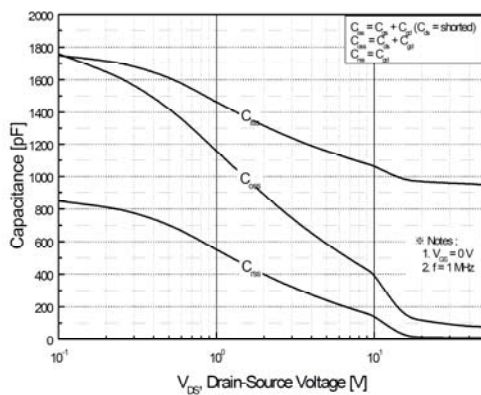


Figure 5. Capacitance Characteristics

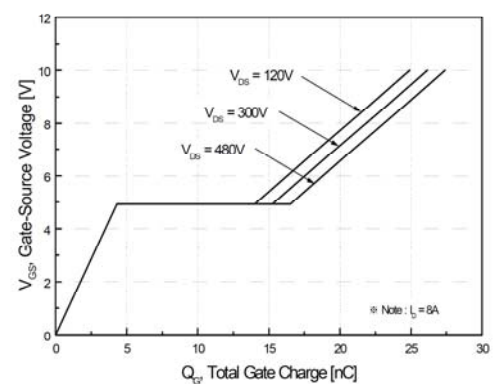


Figure 6. Gate Charge Characteristics

Typical Characteristics (Continued)

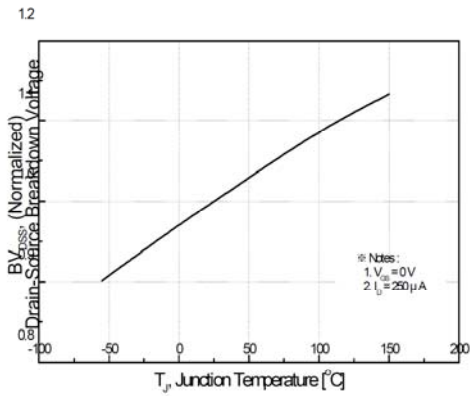


Figure 7. Breakdown Voltage Variation vs Temperature

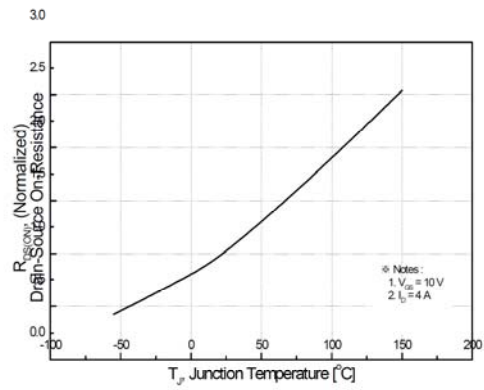


Figure 8. ON-Resistance variation vs Temperature

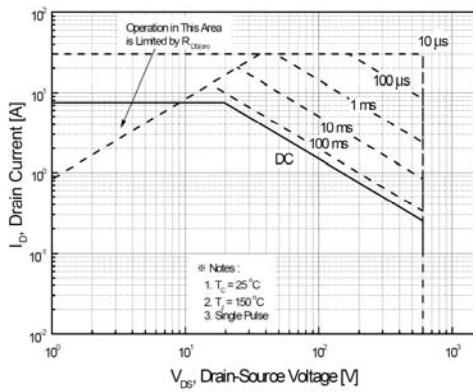


Figure 9-1. Maximum Safe Operating Area

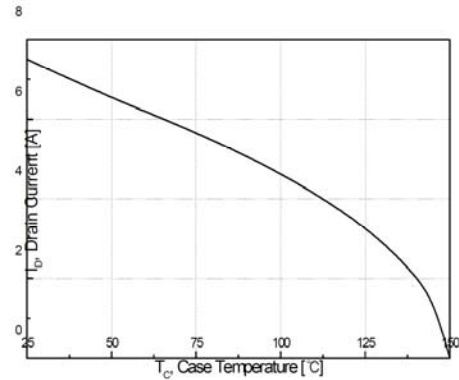


Figure 10. Maximum Drain Current vs Case Temperature

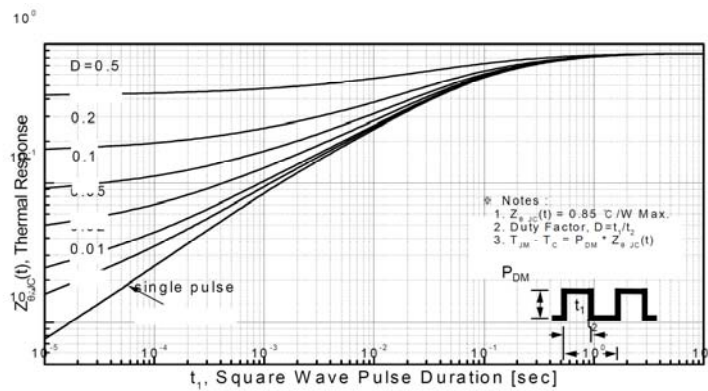
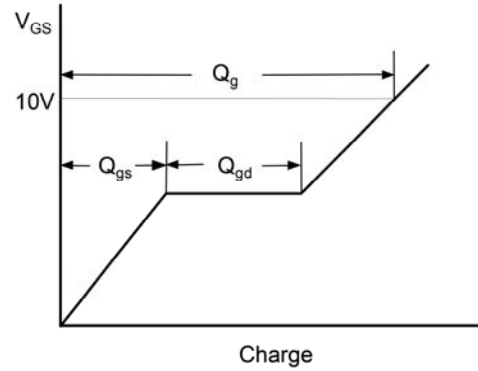
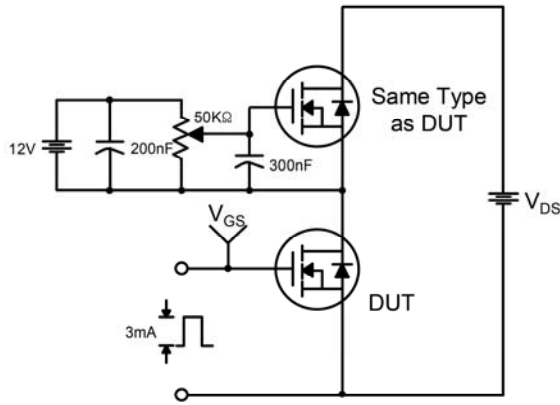
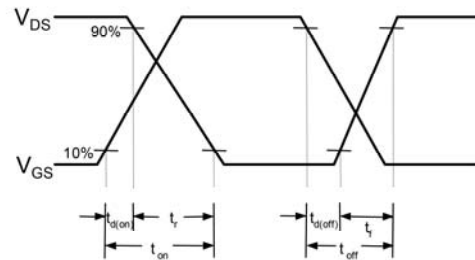
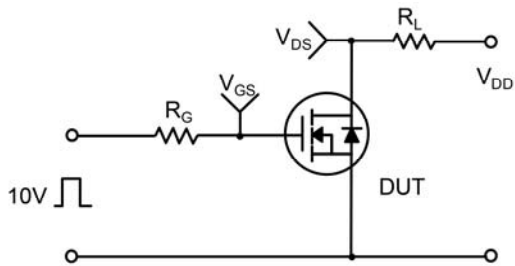


Figure 11-1. Transient Thermal Response Curve

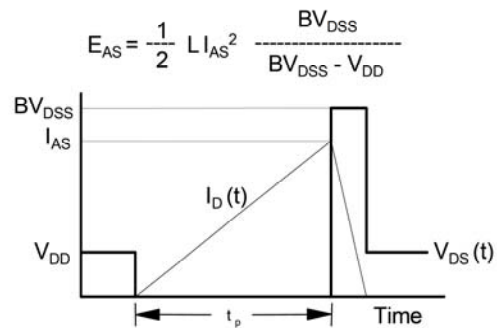
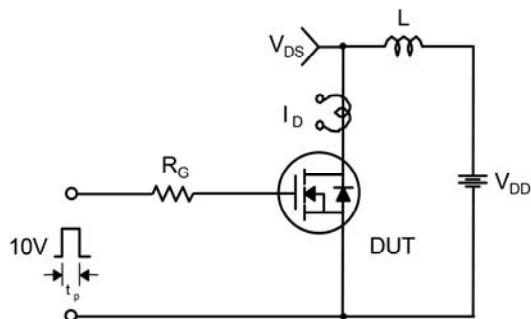
**Gate Charge Test Circuit & Waveform**



**Resistive Switching Test Circuit & Waveforms**

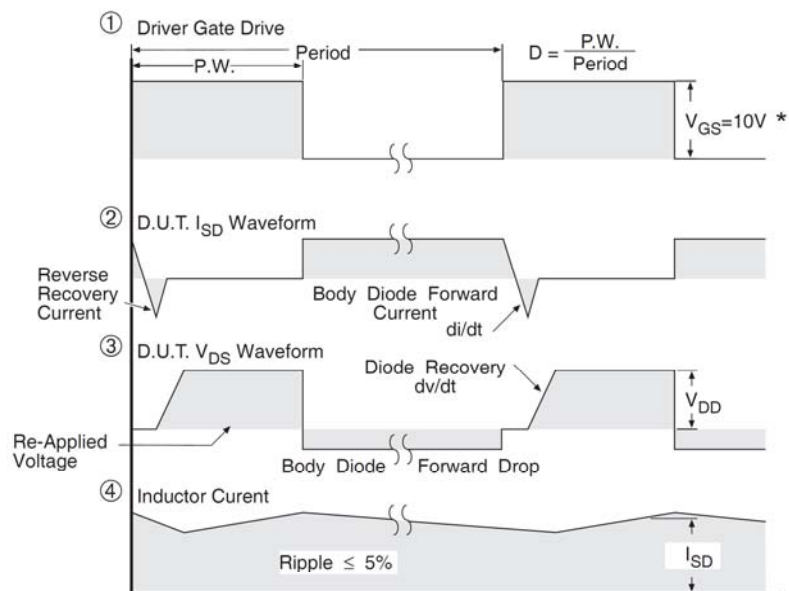
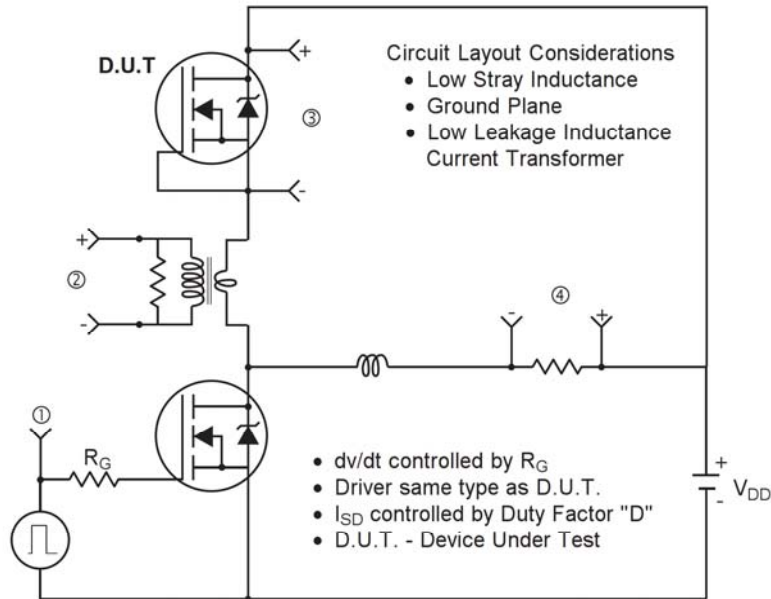


**Unclamped Inductive Switching Test Circuit & Waveforms**



**Peak Diode Recovery dv/dt Test Circuit & Waveform**

**Peak Diode Recovery dv/dt Test Circui**

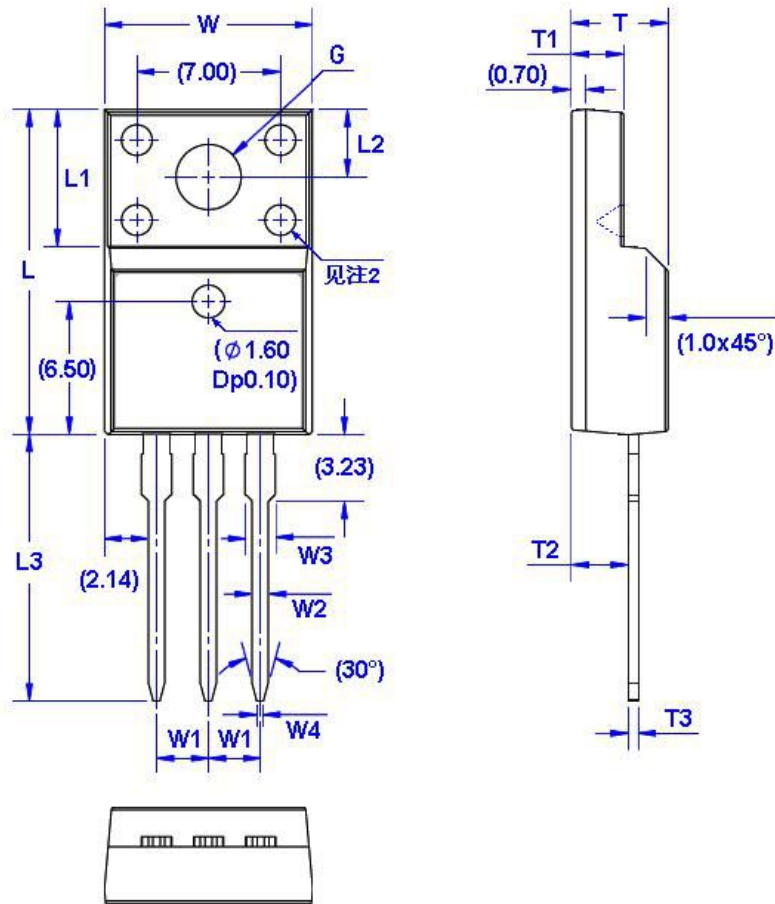


\*  $V_{GS} = 5V$  for Logic Level Devices

## 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( $\Phi$ )	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			