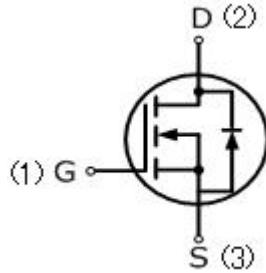


## 4N60TF

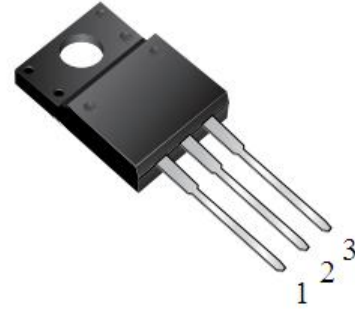
### 4 Amps,600 Volts N-CHANNEL Power MOSFET

#### FEATURE

- 4A,600V, $R_{DS(ON)MAX}=2.5\ \Omega$  @ $V_{GS}=10V/2A$
- Low gate charge
- Low  $C_{iss}$
- Fast switching
- 100% avalanche tested
- Improved dv/dt capability
- Halogen free



#### TO-220TF



#### Absolute Maximum Ratings ( $T_C=25^\circ\text{C}$ , unless otherwise noted)

Parameter	Symbol	4N60TF	UNIT
Drain-Source Voltage	$V_{DSS}$	600	V
Gate-Source Voltage	$V_{GSS}$	$\pm 30$	
Continuous Drain Current	$I_D$	4	A
Pulsed Drain Current(Note 1)	$I_{DM}$	16	
Single Pulse Avalanche Energy (Note 2)	$E_{AS}$	250	mJ
Reverse Diode dV/dt (Note 3)	dv/dt	5	V/ns
Operating Junction and Storage Temperature Range	$T_J, T_{STG}$	-55to+150	$^\circ\text{C}$
Maximum lead temperature for soldering purposes, 1/8" from case for 5 seconds	$T_L$	260	$^\circ\text{C}$
Mounting Torque	6-32 or M3 screw	10	lbf • in
		1.1	N • m

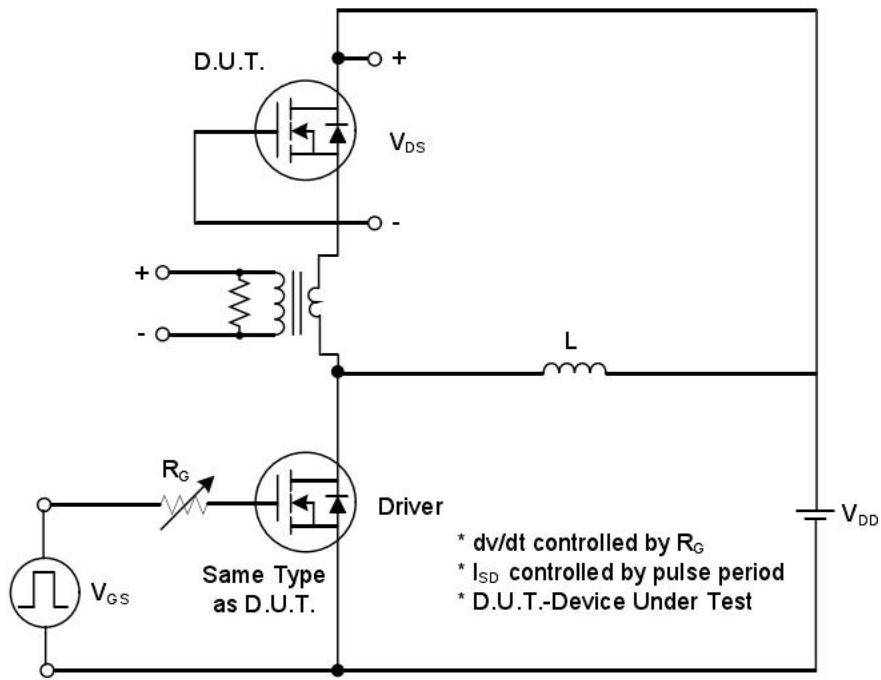
Parameter	Symbol	4N60TF	Units
Thermal resistance , Channel to Case	$R_{th(ch-c)}$	4.17	$^\circ\text{C}/\text{W}$
Thermal resistance , Channel to Ambient	$R_{th(ch-a)}$	62.5	$^\circ\text{C}/\text{W}$
Maximum Power Dissipation	$T_C=25^\circ\text{C}$ $P_D$	30	W

<b>Electrical Characteristics (T<sub>c</sub>=25°C, unless otherwise noted)</b>						
Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
<b>Off Characteristics</b>						
Drain-Source Breakdown Voltage	BV <sub>DSS</sub>	V <sub>GS</sub> =0V, I <sub>D</sub> =250uA	600	—	—	V
Breakdown Temperature Coefficient	ΔBV <sub>DSS</sub> /ΔT <sub>J</sub>	Reference to 25°C , I <sub>D</sub> =250uA	—	0.67	—	V/°C
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>DS</sub> =600V, V <sub>GS</sub> =0V	—	—	1	uA
Gate-Body Leakage Current, Forward	I <sub>GSSF</sub>	V <sub>GS</sub> =30V, V <sub>DS</sub> =0V	—	—	100	nA
Gate-Body Leakage Current, Reverse	I <sub>GSSR</sub>	V <sub>GS</sub> =-30V, V <sub>DS</sub> =0V	—	—	-100	nA
<b>On Characteristics</b>						
Gate-Source Threshold Voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250uA	2	—	4	V
Drain-Source On-State Resistance	R <sub>DS(on)</sub>	V <sub>GS</sub> =10V, I <sub>D</sub> =2A	—	2.1	2.5	Ω
<b>Dynamic Characteristics</b>						
Input Capacitance	C <sub>iss</sub>	V <sub>DS</sub> =25V, V <sub>GS</sub> =0V, f=1.0MHZ	—	590	—	pF
Output Capacitance	C <sub>oss</sub>		—	55	—	pF
Reverse Transfer Capacitance	C <sub>rss</sub>		—	4	—	pF
<b>Switching Characteristics</b>						
Turn-On Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> =300V, I <sub>D</sub> =4A, R <sub>G</sub> =10Ω (Note3,4)	—	14	—	ns
Turn-On Rise Time	t <sub>r</sub>		—	15	—	ns
Turn-Off Delay Time	t <sub>d(off)</sub>		—	34	—	ns
Turn-Off Fall Time	t <sub>f</sub>		—	13	—	ns
Total Gate Charge	Q <sub>g</sub>	V <sub>DS</sub> =480V, I <sub>D</sub> =4A, V <sub>GS</sub> =10V, (Note3,4)	—	14.5	—	nC
Gate-Source Charge	Q <sub>gs</sub>		—	2.6	—	nC
Gate-Drain Charge	Q <sub>gd</sub>		—	6.5	—	nC
<b>Drain-Source Body Diode Characteristics and Maximum Ratings</b>						
Continuous Diode Forward Current	I <sub>S</sub>		—	—	4	A
Pulsed Diode Forward Current	I <sub>SM</sub>		—	—	16	A
Diode Forward Voltage	V <sub>SD</sub>	I <sub>S</sub> =4A, V <sub>GS</sub> =0V	—	—	1.5	V
Reverse Recovery Time	t <sub>rr</sub>	V <sub>GS</sub> =0V, I <sub>S</sub> =4A,	—	250	—	ns
Reverse Recovery Charge	Q <sub>rr</sub>	dI <sub>F</sub> /dt=100A/us, (Note4)	—	1	—	uC

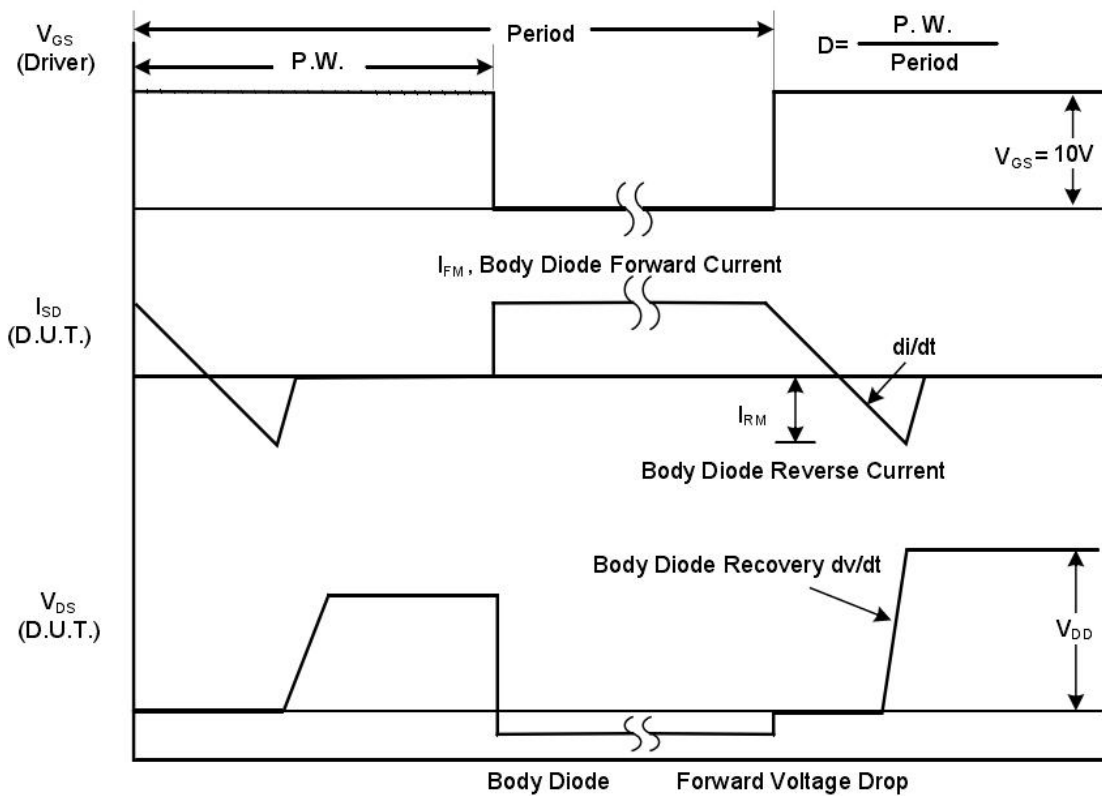
#### Notes

1. Repetitive Rating: pulse width limited by maximum junction temperature.
2. L=10mH, R<sub>g</sub>=25 Ω, I<sub>AS</sub>=7.1A, starting T<sub>J</sub>=25°C.
3. I<sub>SD</sub>=4A, dI/dt ≤ 100A/us, V<sub>DD</sub> ≤ BV<sub>DSS</sub>, starting T<sub>J</sub>=25°C, Pulse width ≤ 300us; duty cycle ≤ 2%.
4. Repetitive rating; pulse width limited by maximum junction temperature.

**TEST CIRCUIT AND WAVEFORM**



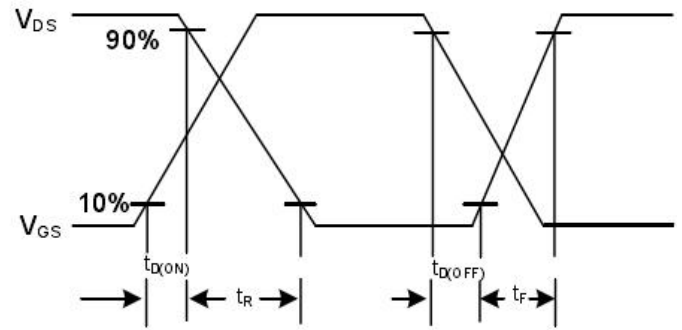
**Peak Diode Recovery dv/dt Test Circuit**



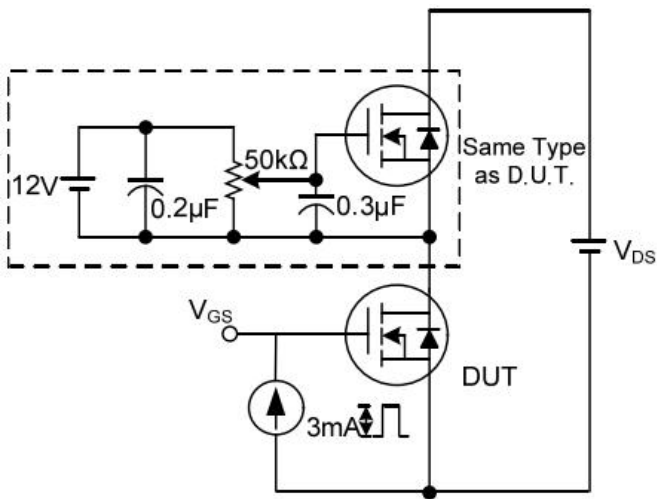
**Peak Diode Recovery dv/dt Waveforms**



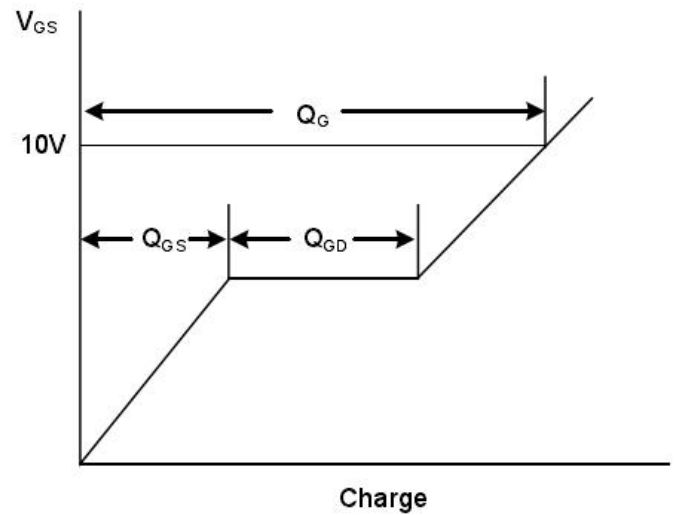
**Switching Test Circuit**



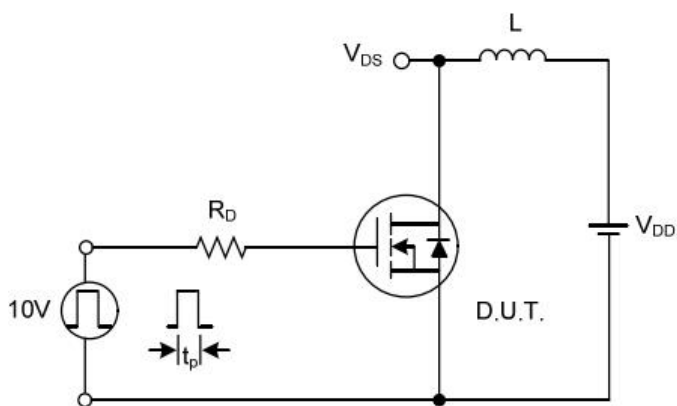
**Switching Waveforms**



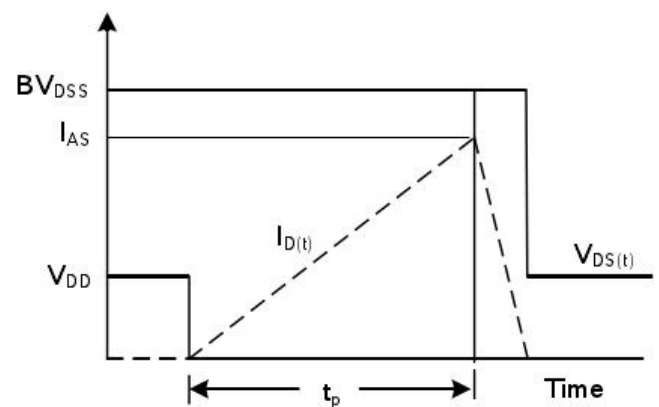
**Gate Charge Test Circuit**



**Gate Charge Waveform**

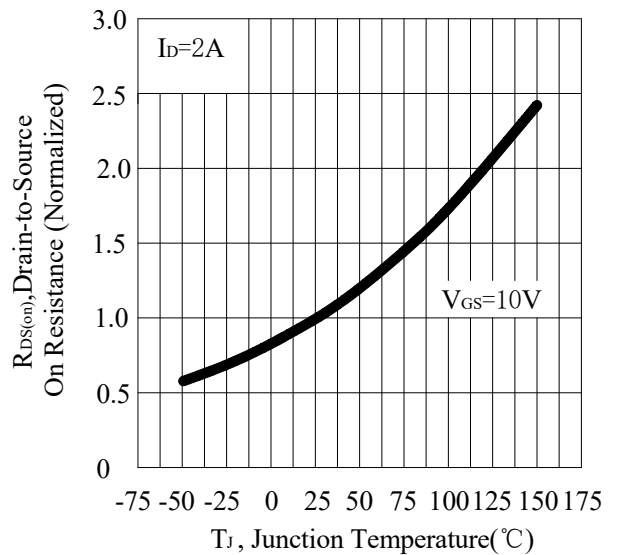
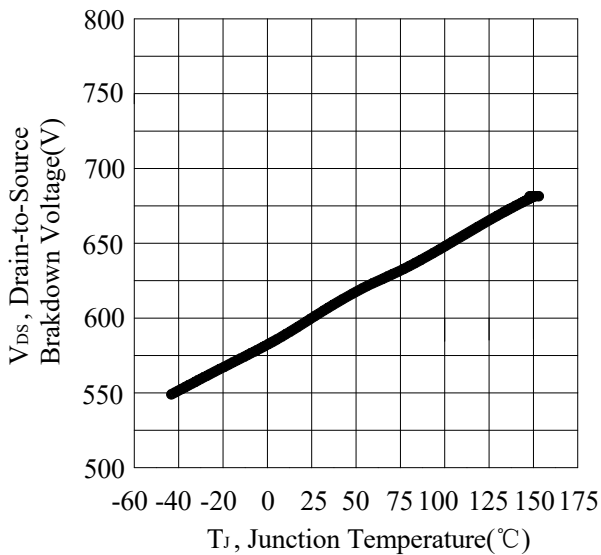
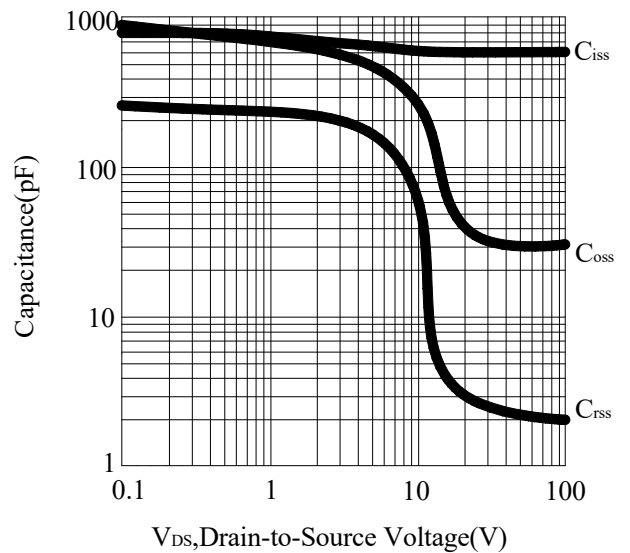
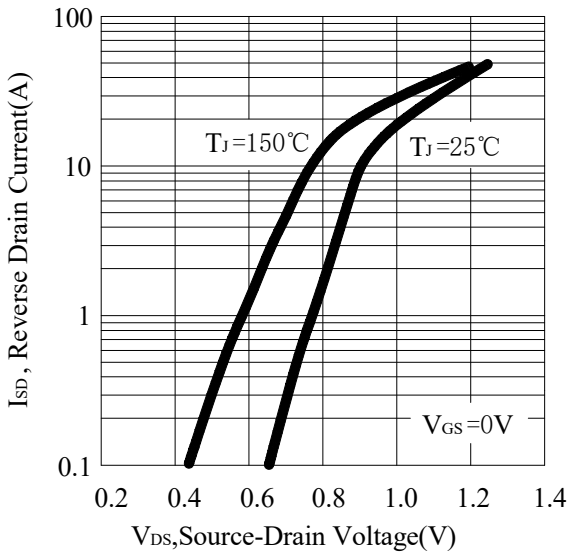
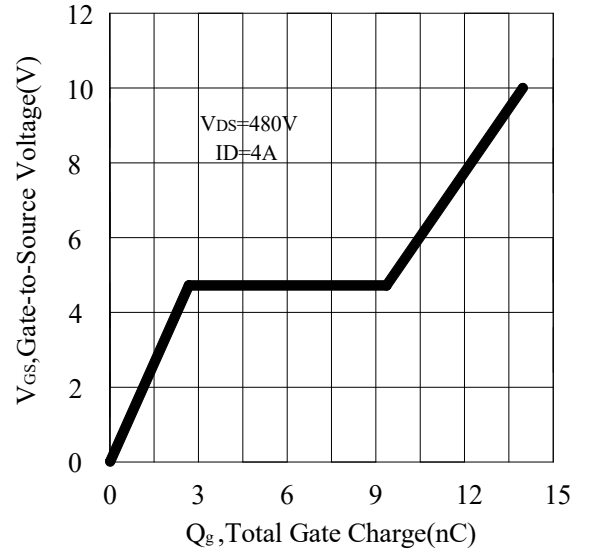
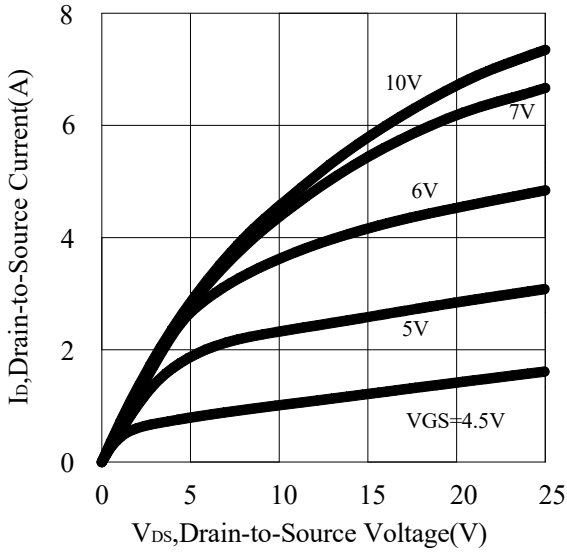


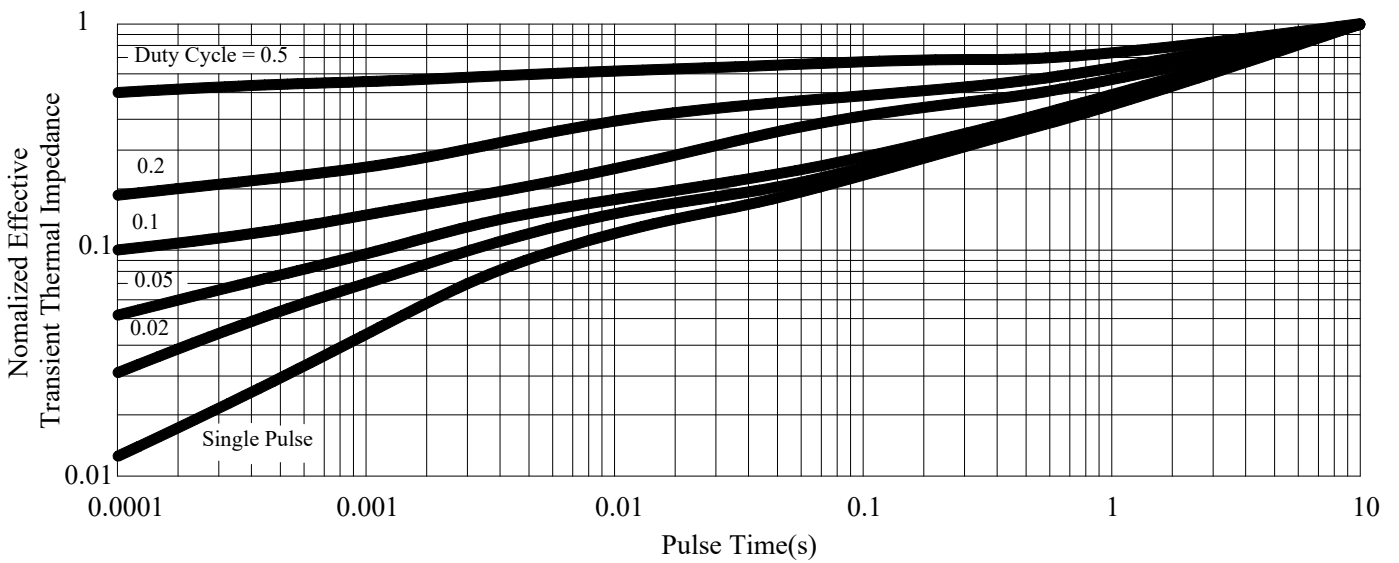
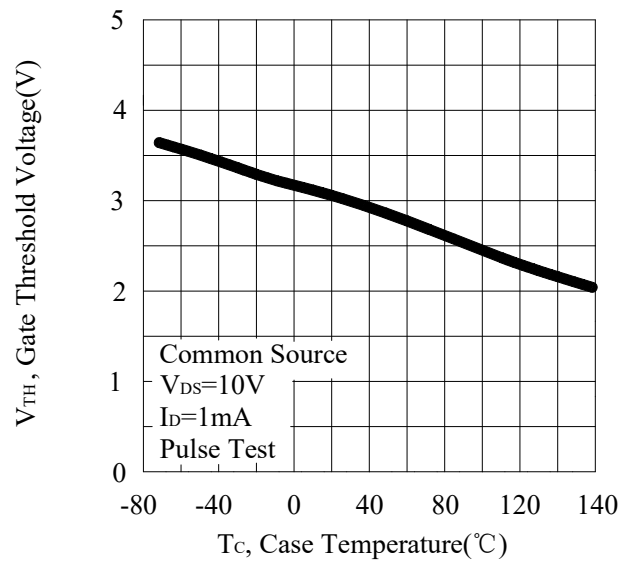
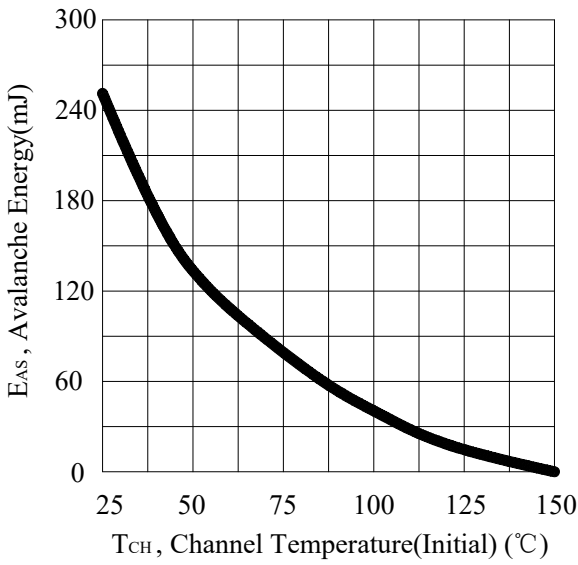
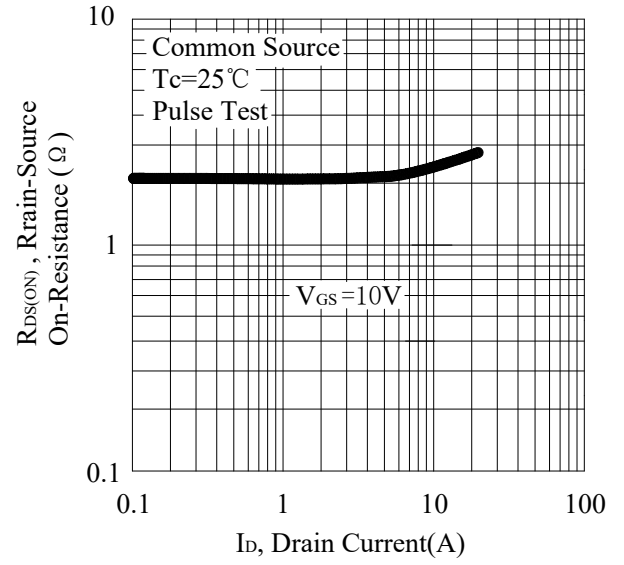
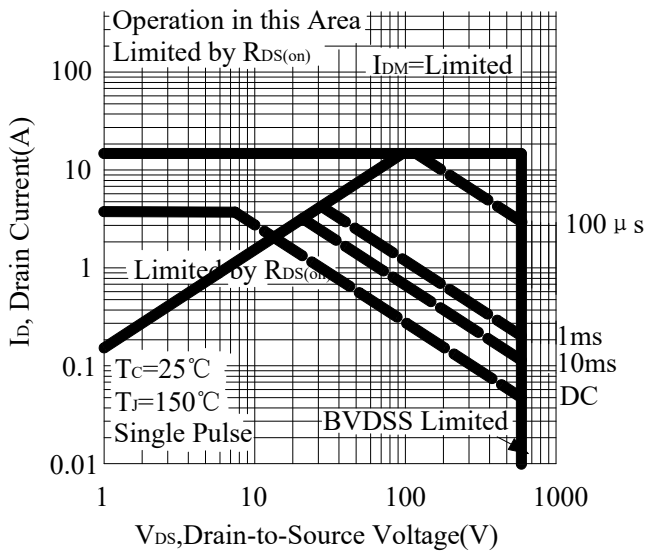
**Unclamped Inductive Switching Test Circuit**



**Unclamped Inductive Switching Waveforms**

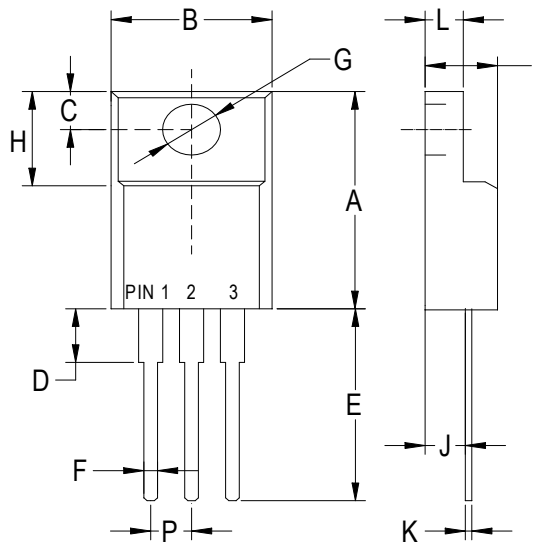
## RATING AND CHARACTERISTIC CURVES





## PACKAGE OUTLINE DIMENSIONS

### TO-220TF



TO-220TF		
Dim	Min	Max
A	.590 (15.0)	.650 (16.5)
B	.393 (10.0)	.414 (10.5)
C	.118 (3.00)	.138 (3.50)
D	.118 (3.00)	.146 (3.70)
E	.512 (13.0)	.551 (14.0)
F	.028 (0.70)	.035 (0.90)
G	.114 (2.90)	.138 (3.50)
H	.255 (6.50)	.280 (7.10)
I	.173 (4.40)	.197 (5.00)
J	.102 (2.60)	.110 (2.80)
K	.018 (0.45)	.026 (0.65)
L	.092 (2.35)	.109 (2.75)
P	.890 (2.25)	.113 (2.85)