

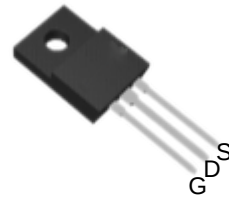
Features

- 650V/4A,
 $R_{DS(ON)} = 2.4\Omega(\text{typ.}) @ V_{GS} = 10V$
 $V_{DS@Tj, \text{max}} = 750V(\text{typ.})$
- 100% UIS + R_g Tested
- Reliable and Rugged
- Avalanche Rated
- Lead Free and Green Devices Available
(RoHS Compliant)

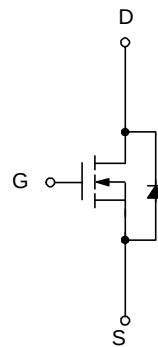
Applications

- AC/DC Power Conversion in Switched Mode Power Supplies (SMPS).
- Uninterruptible Power Supply (UPS),
- Adapter.

Pin Description



TO-220FP



N-Channel MOSFET

Absolute Maximum Ratings (T_A = 25°C Unless Otherwise Noted)

Symbol	Parameter		Rating	Unit
Common Ratings				
V _{DSS}	Drain-Source Voltage		650	V
V _{GSS}	Gate-Source Voltage		±30	
T _J	Maximum Junction Temperature		150	°C
T _{STG}	Storage Temperature Range		-55 to 150	
I _S	Diode Continuous Forward Current		4 ^a	A
I _{DP}	Pulse Drain Current Tested	T _C =25°C	10 ^b	
I _D	Continuous Drain Current	T _C =25°C	4 ^a	
		T _C =100°C	2.54 ^a	
P _D	Maximum Power Dissipation for TO-220/TO-252-2/TO-251	T _C =25°C	69	W
		T _C =100°C	27.7	
P _D	Maximum Power Dissipation for TO-220FP	T _C =25°C	20.8	
		T _C =100°C	8.3	
R _{θJC}	Thermal Resistance-Junction to Case for TO-220/TO-252-2/TO-251		1.8	°C/W
R _{θJC}	Thermal Resistance-Junction to Case for TO-220FP		6	
R _{θJA}	Thermal Resistance-Junction to Ambient		62.5	
Drain-Source Avalanche Ratings				
dv/dt ^c	MOSFET dv/dt ruggedness		50	V/ns
E _{AS} ^d	Avalanche Energy, Single Pulsed		17.5	mJ
I _{AR} ^e	Avalanche Current		0.5	A
E _{AR} ^e	Repetitive Avalanche Energy		0.06	mJ

Note a : limited by maximum junction temperature.

Note b : Bond wire current limit.

Note c : V_{DS}=520V, I_D=4A.

Note d : I_D=0.5A, V_{DD}=50V, T_J=25°C.

Note e : Repetitive Rating : Pulse width limited by maximum junction temperature.

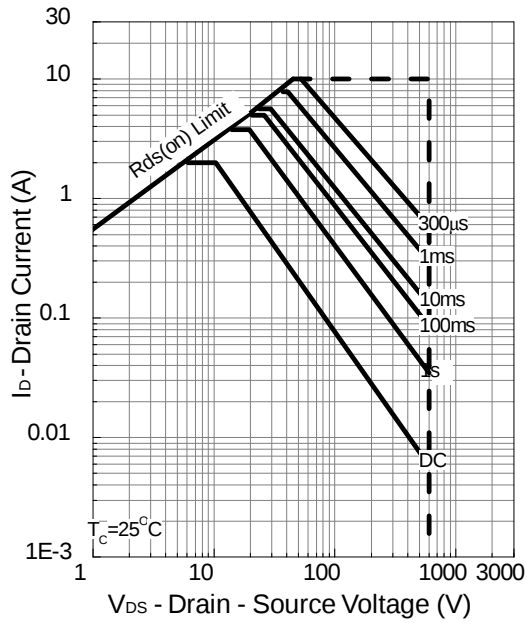
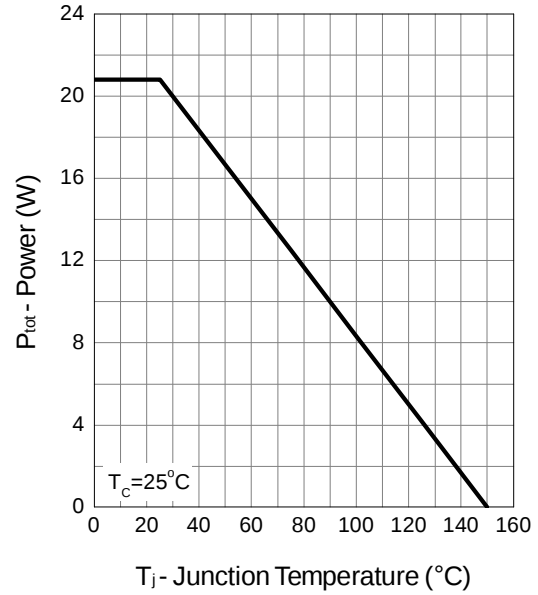
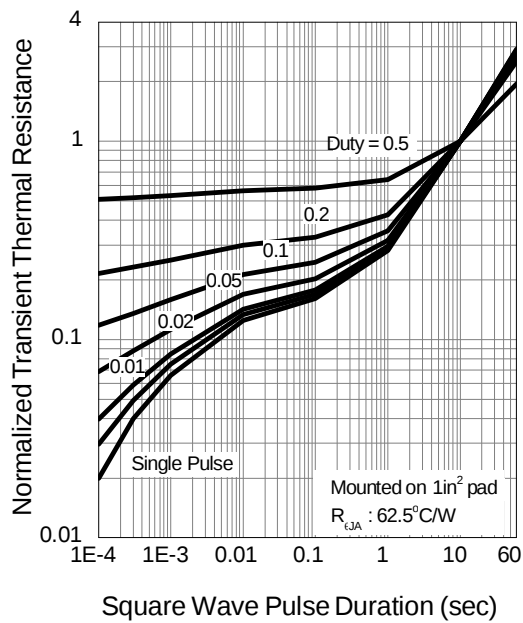
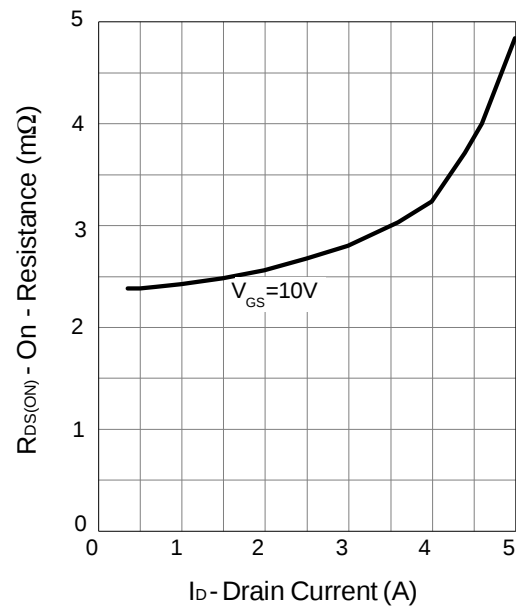
Electrical Characteristics (T_A = 25°C Unless Otherwise Noted)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
Static Characteristics						
BV _{DSS}	Drain-Source Breakdown Voltage	V _{GS} =0V, I _{DS} =250μA	650	-	-	V
		T _J =150°C	-	750	-	
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} =520V, V _{GS} =0V	-	-	1	μA
		T _J =150°C	-	-	200	
V _{GS(th)}	Gate Threshold Voltage	V _{DS} =V _{GS} , I _{DS} =250μA	2.5	3.5	4.5	V
I _{GSS}	Gate Leakage Current	V _{GS} =±30V, V _{DS} =0V	-	-	±100	nA
R _{DS(ON)} ^f	Drain-Source On-state Resistance	V _{GS} =10V, I _{DS} =2A	-	2.4	2.9	Ω
Diode Characteristics						
V _{SD} ^f	Diode Forward Voltage	I _{SD} =4A, V _{GS} =0V	-	0.95	1.3	V
t _{rr}	Reverse Recovery Time	I _{SD} =4A, V _R =390V dI _{SD} /dt=100A/μs	-	138	-	ns
Q _{rr}	Reverse Recovery Charge		-	0.8	-	μC
I _{rm}	Peak Reverse Recovery Current		-	9.3	-	A
Dynamic Characteristics ^g						
R _G	Gate Resistance	V _{GS} =0V,V _{DS} =0V, F=1MHz	-	4	-	Ω
C _{iSS}	Input Capacitance	V _{GS} =0V, V _{DS} =25V, Frequency=1.0MHz	-	225	290	pF
C _{oSS}	Output Capacitance		-	200	-	
C _{rss}	Reverse Transfer Capacitance		-	1.5	-	
t _{d(ON)}	Turn-on Delay Time	V _{DD} =400V, R _L =100Ω I _{DS} =4A, V _{GEN} =10V, R _G =6Ω	-	10	-	ns
T _r	Turn-on Rise Time		-	22.5	-	
t _{d(OFF)}	Turn-off Delay Time		-	15	-	
T _f	Turn-off Fall Time		-	13	-	
Gate Charge Characteristics ^g						
Q _g	Total Gate Charge	V _{DS} =520V, V _{GS} =10V, I _{DS} =2A	-	12.8	16.6	nC
Q _{gs}	Gate-Source Charge		-	3	-	
Q _{gd}	Gate-Drain Charge		-	5.1	-	

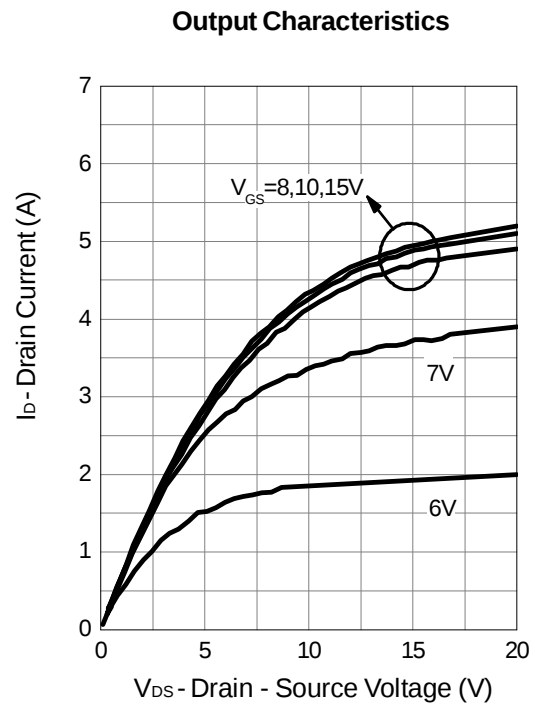
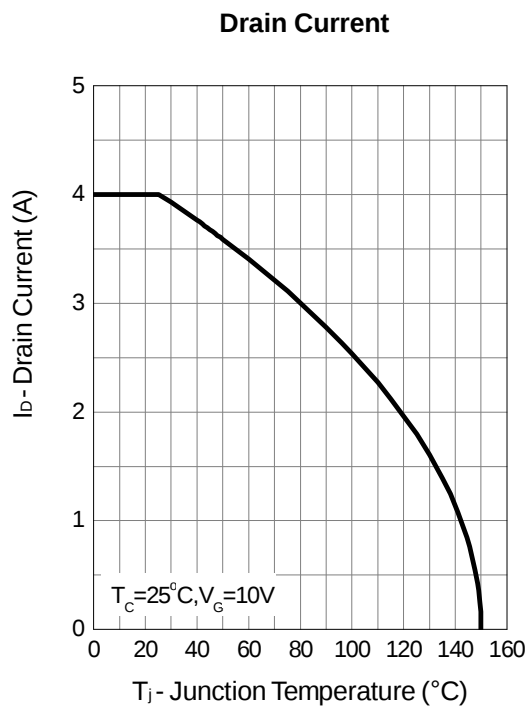
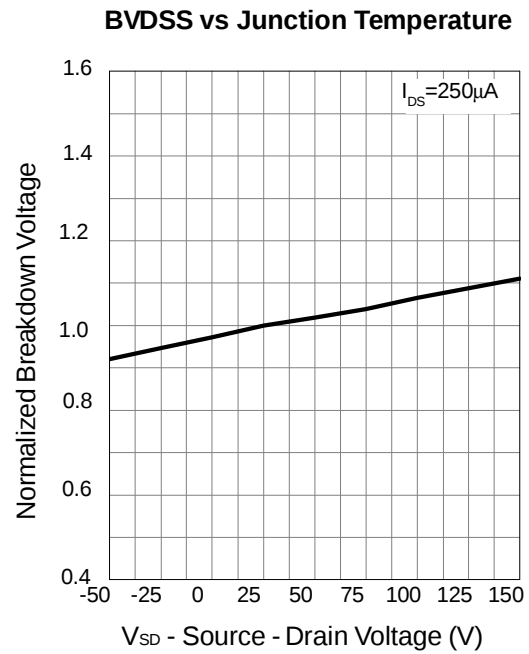
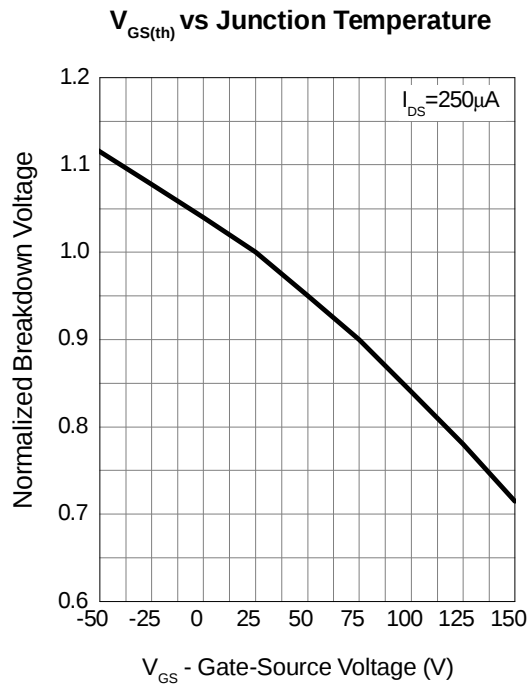
Note f : Pulse test ; pulse width≤300μs, duty cycle≤2%.

Note g : Guaranteed by design, not subject to production testing.

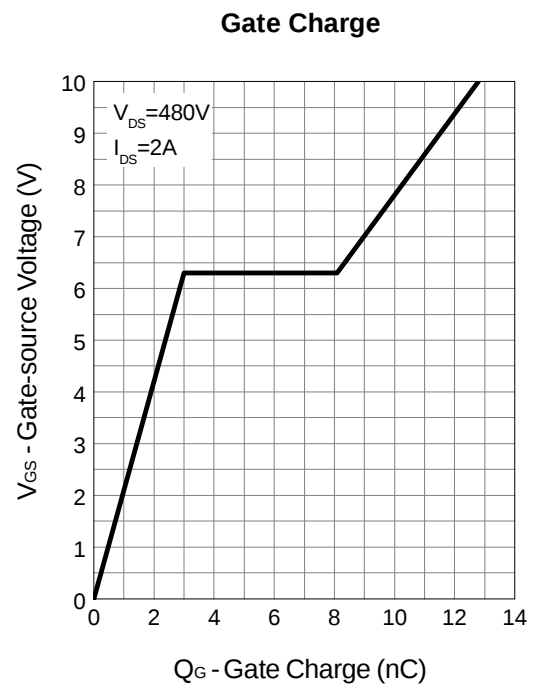
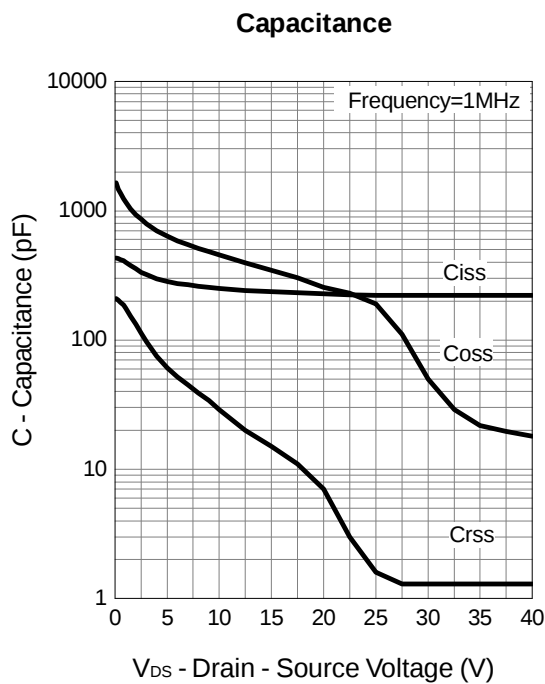
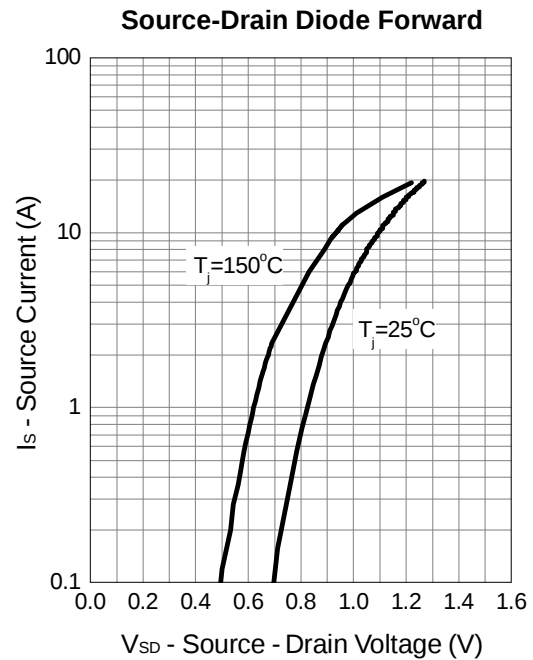
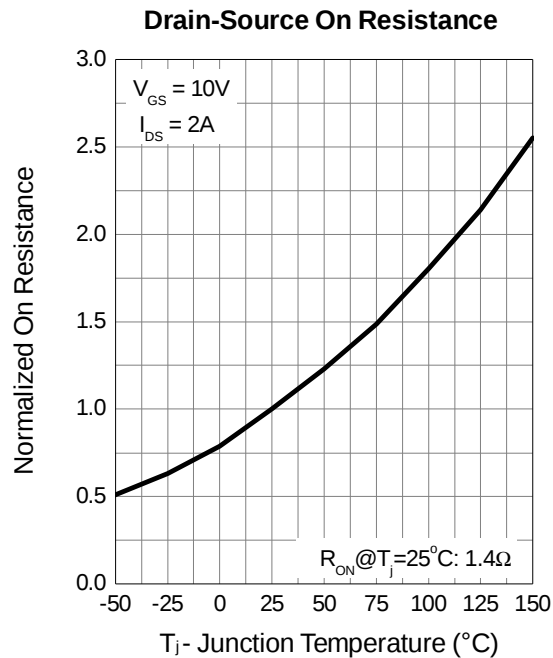
Typical Operating Characteristics

Safe Operation Area

Power Dissipation

Thermal Transient Impedance

Drain-Source On Resistance


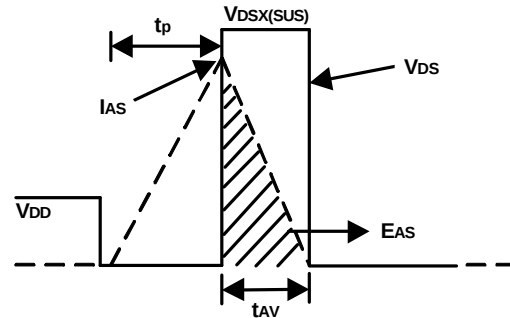
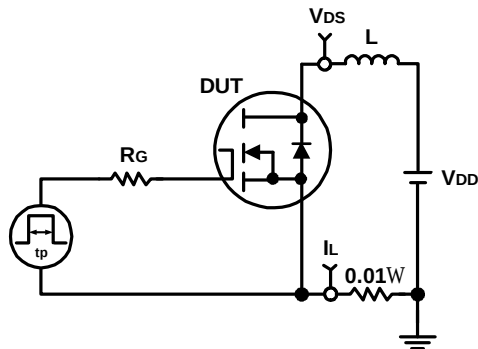
Typical Operating Characteristics (Cont.)



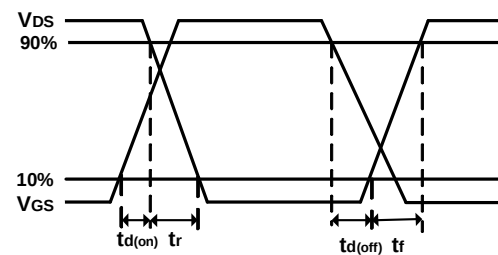
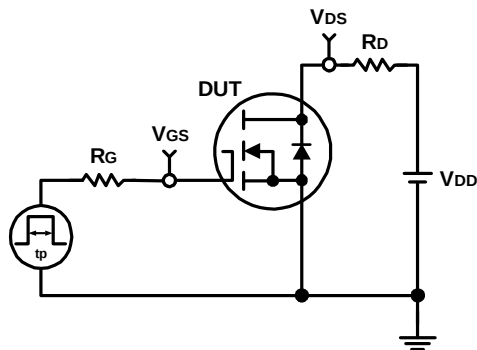
Typical Operating Characteristics (Cont.)



Avalanche Test Circuit and Waveforms

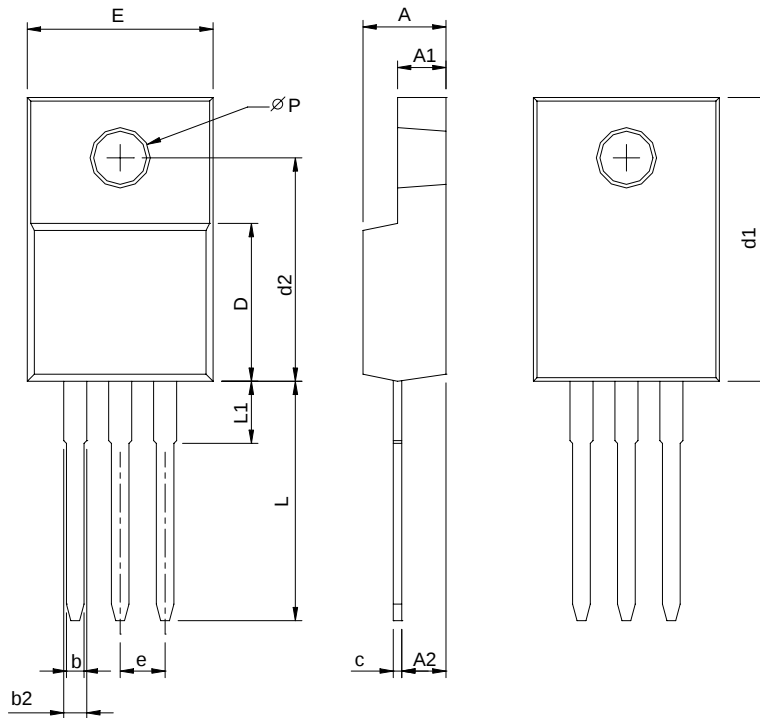


Switching Time Test Circuit and Waveforms



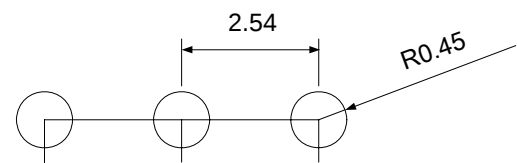
Package Information

TO-220F



SYMBOL	TO-220FP			
	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	4.20	4.80	0.165	0.189
A1	2.34	3.20	0.092	0.126
A2	2.10	2.90	0.083	0.114
b	0.50	0.90	0.020	0.035
b2	0.91	1.90	0.035	0.075
c	0.30	0.80	0.012	0.031
D	8.10	9.40	0.319	0.370
d1	14.50	16.50	0.571	0.650
d2	12.10	12.90	0.476	0.508
E	9.70	10.70	0.382	0.421
e	2.54 BSC		0.100 BSC	
L	13.00	14.50	0.512	0.570
L1	1.60	4.00	0.063	0.157
P	3.00	3.60	0.118	0.142

RECOMMENDED LAND PATTERN



UNIT: mm