

Features

- Low drain-source on-resistance: $R_{DS(ON)}=0.145\Omega$ (typ)
- Easy to control gate switching
- Enhancement mode: $V_{th} = 2.0$ to $4.0V$
- 100% avalanche tested
- RoHS compliant

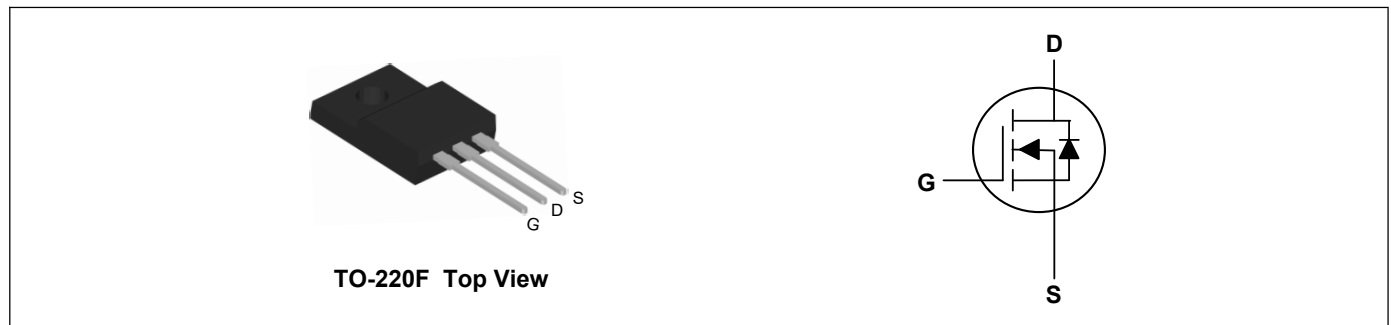
Key Performance Parameters



Parameter	Value	Unit
$V_{DS} @ T_{j,max}$	700	V
$R_{DS(ON),max}$	180	m Ω
I_D	28	A
$Q_{g,typ}$	48	nC
I_{DM}	84	A

Applications

- Switch Mode Power Supply (SMPS)
- Uninterruptible Power Supply (UPS)
- Power Factor Correction (PFC)
- Charger, Lighting



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

Parameter	Symbol	Rating	Units
Drain-Source Voltage	V_{DS}	700	V
Gate-Source Voltage	V_{GS}	± 30	V
Continuous Drain Current ¹	I_D	28	A
Pulsed Drain Current ²	I_{DM}	84	A
Single Pulse Avalanche Energy ³	E_{AS}	980	mJ
Total Power Dissipation ⁴	P_D	34	W
Storage Temperature Range	T_{STG}	-55 to 150	$^\circ C$
Operating Junction Temperature Range	T_J	-55 to 150	$^\circ C$

Thermal Characteristics

Parameter	Symbol	Value	Unit
Thermal Resistance Junction-Ambient (Max)	$R_{\theta JA}$	80	$^\circ C/W$
Thermal Resistance Junction-Case (Max)	$R_{\theta JC}$	3.65	$^\circ C/W$

Electrical Characteristics ($T_J=25^\circ\text{C}$, unless otherwise noted)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Drain-Source Breakdown Voltage	BV_{DSS}	$V_{GS}=0V, I_D=10mA$	700	---	---	V
Static Drain-Source On-Resistance	$R_{DS(ON)}$	$V_{GS}=10V, I_D=10A$	---	145	180	m Ω
Gate Threshold Voltage	$V_{GS(th)}$	$V_{GS}=V_{DS}, I_D=250\mu A$	2.0	---	4.0	V
Drain-Source Leakage Current	I_{DSS}	$V_{DS}=700V, V_{GS}=0V, T_J=25^\circ\text{C}$	---	---	1	μA
Gate-Source Leakage Current	I_{GSS}	$V_{GS}=\pm 30V, V_{DS}=0V$	---	---	± 100	nA
Gate Resistance	R_G	$f = 1.0MHz, \text{open drain}$	---	5.5	---	Ω
Total Gate Charge	Q_g	$V_{DD}=400V, V_{GS}=10V, I_D=11.3A$	---	48	---	nC
Gate-Source Charge	Q_{gs}		---	8.5	---	
Gate-Drain Charge	Q_{gd}		---	8.3	---	
Turn-On Delay Time	$T_{d(on)}$	$V_{DD}=400V, V_{GS}=10V, R_G=1.7\Omega, I_D=11.3A$	---	12.4	---	ns
Rise Time	T_r		---	21.6	---	
Turn-Off Delay Time	$T_{d(off)}$		---	50	---	
Fall Time	T_f		---	18.4	---	
Input Capacitance	C_{iss}	$V_{DS}=50V, V_{GS}=0V, f=10kHz$	---	2385	---	pF
Output Capacitance	C_{oss}		---	218	---	
Reverse Transfer Capacitance	C_{rss}		---	5.07	---	

Drain-Source Diode Characteristics

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Diode Forward Voltage ²	V_{SD}	$V_{GS}=0V, I_F=1A, T_J=25^\circ\text{C}$	---	0.8	---	V
Reverse recovery time	t_{rr}	$V_R=400V, I_F=11.3A, diF/dt=100A/\mu s$	---	288	---	ns
Reverse recovery charge	Q_{rr}		---	4.3	---	μC
Peak reverse recovery current	I_{rrm}		---	26.2	---	A

Note:

- Limited by $T_{J,max}$. Maximum Duty Cycle $D = 0.50$
- Pulse width t_p limited by $T_{J,max}$
- Identical low side and high side switch with identical R_G

Typical Characteristics

Diagram 1: Typ. output characteristics

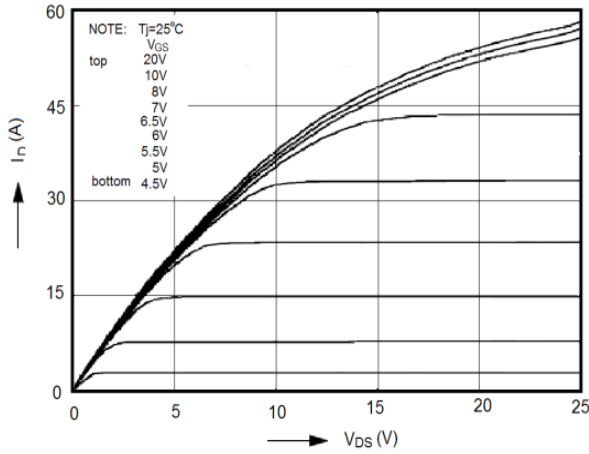


Diagram 2: Typ. Coss stored energy

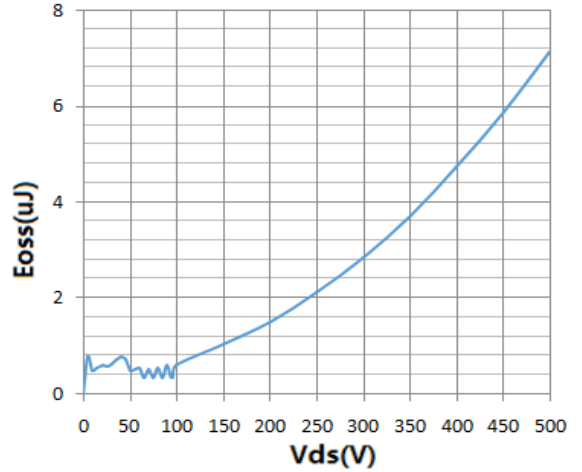


Diagram 3: Typ. transfer characteristics

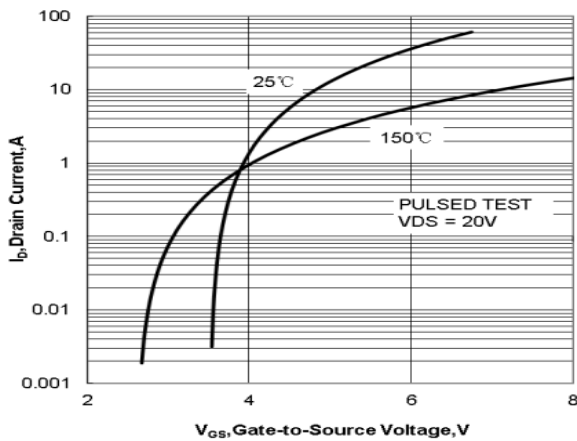


Diagram 4: Typ. gate charge

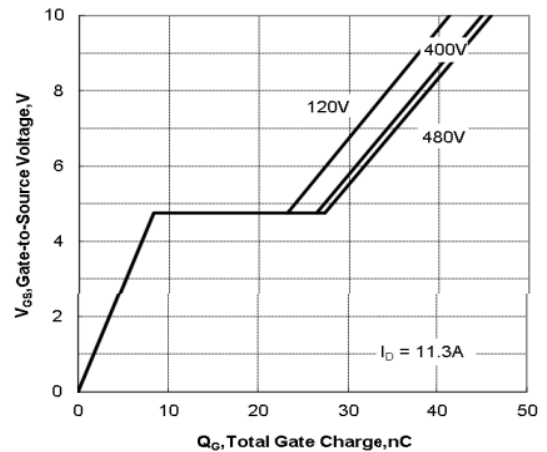


Diagram 5: Drain-source breakdown voltage

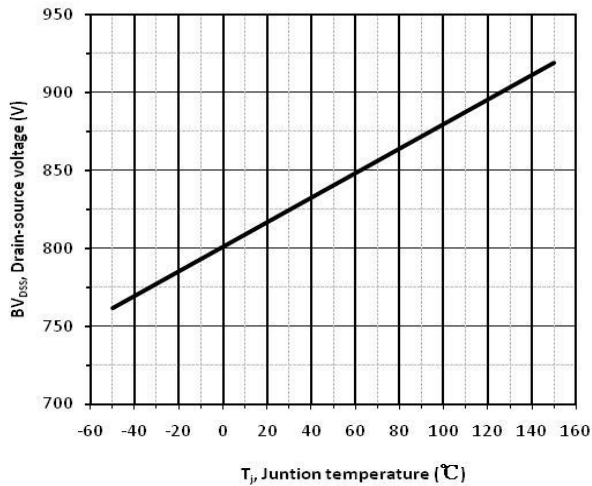


Diagram 6: Typ. capacitances

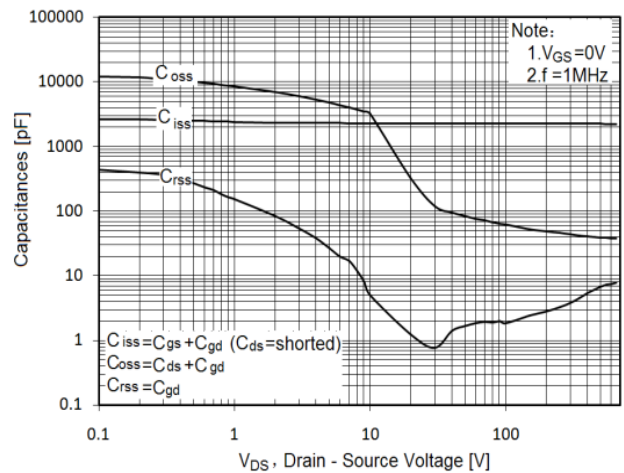


Diagram 7: Power Dissipation

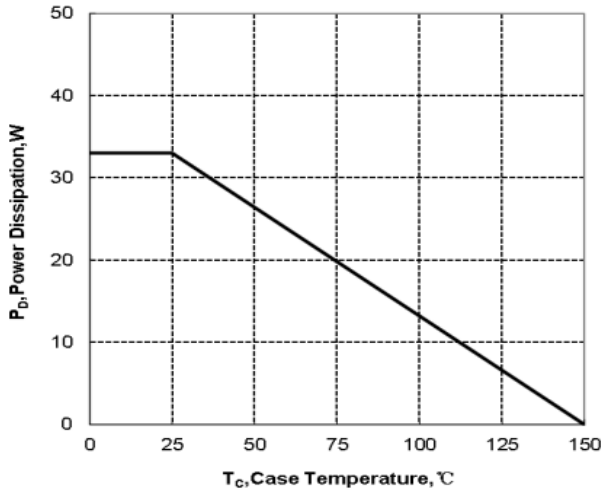


Diagram 8: Safe operating area $T_C=25^\circ\text{C}$,

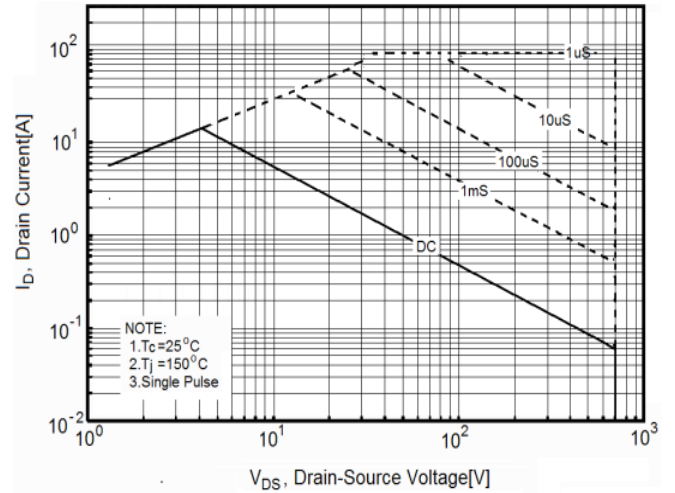


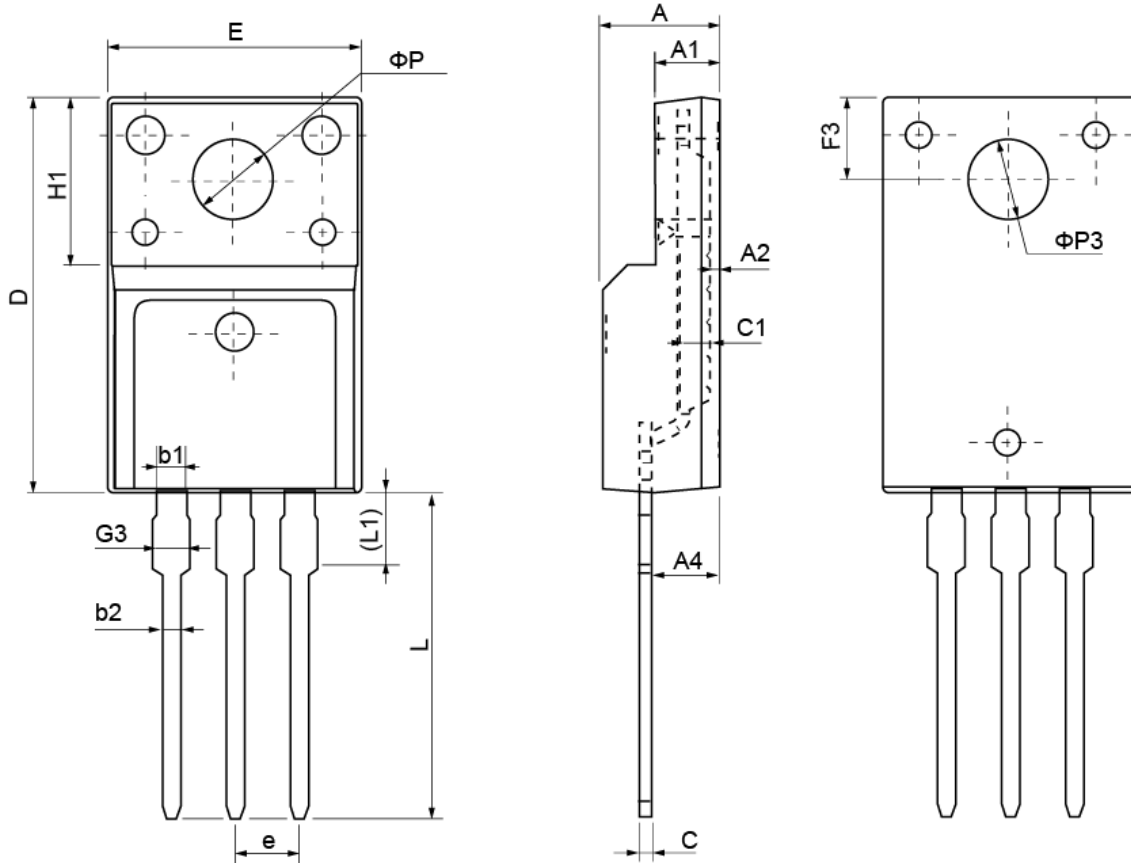
Table 9 Diode characteristics

Test circuit for diode characteristics	Diode recovery waveform
<p>Circuit diagram for diode characteristics test. It shows a MOSFET switching an inductive load. The gate is driven by a pulse source through a resistor R_{G2}. The drain is connected to the load and a diode. The diode current is I_D and the drain-source voltage is V_{DS}. Gate resistors are R_{G1} and R_{G2}, with $R_{G1} = R_{G2}$.</p>	<p>Diode recovery waveform diagram. It shows current i and voltage v versus time t. The forward current is I_F and the reverse current is I_{RRM}. The reverse recovery time is t_{rr}, which is the sum of storage time t_s and fall time t_f. The total reverse recovery charge is $Q_{rr} = Q_s + Q_f$. The diode voltage during reverse recovery is V_{RRM}. The diode current during reverse recovery is i_{rr}. The diode current during forward conduction is i_F. The diode current during reverse recovery is i_{rr}. The diode current during forward conduction is i_F. The diode current during reverse recovery is i_{rr}. The diode current during forward conduction is i_F.</p>

Table 10 Switching times

Switching times test circuit for inductive load	Switching times waveform
<p>Circuit diagram for switching times test. It shows a MOSFET switching an inductive load. The gate is driven by a pulse source through a resistor. The drain is connected to the load and a diode. The gate-source voltage is V_{GS} and the drain-source voltage is V_{DS}.</p>	<p>Switching times waveform diagram. It shows V_{DS} and V_{GS} versus time. The gate-source voltage V_{GS} transitions from 10% to 90% and back. The drain-source voltage V_{DS} transitions from 90% to 10% and back. The turn-on time is t_{on}, which includes delay time $t_{d(on)}$ and rise time t_r. The turn-off time is t_{off}, which includes fall time t_f and delay time $t_{d(off)}$.</p>

TO-220F Package Outline Dimensions



Symbol	Dimensions (unit:mm)			Symbol	Dimensions (unit:mm)		
	Min	Typ	Max		Min	Typ	Max
A	4.40	4.70	5.00	H1	6.70 REF		
A1	2.30	2.55	2.80	L	12.30	12.98	13.30
A2	0.30	0.50	0.70	L1	2.95	3.10	3.50
A4	2.45	2.80	3.05	φ P	3.03	3.20	3.50
c	0.30	0.50	0.70	φ P3	3.15	3.45	3.65
c1	1.20	1.30	1.40	b1	1.10	1.30	1.45
D	15.40	15.90	16.40	b2	0.60	0.80	1.00
E	9.86	10.16	10.46	F3	3.05	3.30	3.55
e	2.54 BSC			G3	1.15	1.35	1.55