

■ **Features**

- 650V,20A, $R_{DS(ON)}=0.35\Omega@V_{GS} = 10V$
- Improved dv/dt capability
- Fast switching
- 100% EAS Guaranteed
- Green Device Available

■ **Applications**

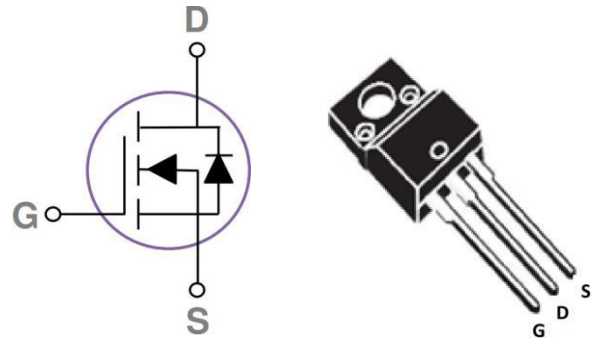
- Networking
- Load Switch
- LED applications
- Quick Charger

■ **General Description**

These N-Channel enhancement mode power field effect transistors are using trench DMOS technology. This advanced technology has been especially tailored to minimize on-state resistance, provide superior switching performance, and

withstand high energy pulse in the avalanche and commutation mode. These devices are well suited for high efficiency fast switching applications.

■ **Product Summary**



BV_{DSS}	$R_{DS(ON)}$	I_D
650V	0.35ohm	20A

■ **Absolute Maximum Ratings** $T_c=25^\circ C$ unless otherwise noted

Parameter	Symbol	Rating	Unit
Drain-Source Voltage	V_{DS}	650	V
Gate-Source Voltage	V_{GS}	± 30	V
Continuous Drain Current	$I_D@T_c=25^\circ C$	20	A
	$I_D@T_c=100^\circ C$	12.5	A
Pulsed Drain Current	I_{DM}	80	A
Single Pulse Avalanche Energy	EAS	1300	mJ
Single Pulse Avalanche Current	IAS	20	A
Power Dissipation-	Derate above $25^\circ C$	0.31	W/ $^\circ C$
Power Dissipation	$T_c=25^\circ C$	45	W
Operating Junction Temperature	T_J	-55 to 150	$^\circ C$
Storage Temperature	T_{STG}	-55 to 150	$^\circ C$

■ **Thermal Resistance**

Parameter	Symbol	Min.	Typ.	Max.	Unit
Thermal resistance, junction - case	R_{thJC}	---	---	2.6	$^\circ C/W$
Thermal Resistance Junction to ambient	R_{thJA}	---	---	65	$^\circ C/W$
Soldering temperature, wave soldering for 10s	T_{sold}	---	---	265	$^\circ C$

■ **Electronic Characteristics** $T_J = 25^\circ\text{C}$ unless otherwise noted

Off Characteristics

Parameter	Condition	Symbol	Min.	Typ.	Max.	Unit
Drain-Source Breakdown Voltage	$V_{GS} = 0V, I_D = 250\mu A$	BV_{DSS}	650	700	---	V
Drain-Source Leakage Current	$V_{DS} = 650V, V_{GS} = 0V$	I_{DSS}	---	---	1	μA
	$V_{DS} = 520V, V_{GS} = 0V$		---	---	10	
Gate- Source Leakage Current	$V_{GS} = \pm 30V, V_{DS} = 0V$	I_{GSS}	---	---	± 100	nA

On Characteristics

Parameter	Condition	Symbol	Min.	Typ.	Max.	Unit
Static Drain-source On Resistance	$V_{GS} = 10V, I_D = 5A$	$R_{DS(ON)}$	---	0.3	0.35	Ω
Gate Threshold Voltage	$V_{GS} = V_{DS}, I_D = 250\mu A$	$V_{GS(TH)}$	2.0	3.0	4.0	V
Forward Transconductance	$V_{DS} = 40V, I_D = 10A$	g_{FS}	---	3.4	---	S

Dynamic and switching Characteristics

Parameter	Condition	Symbol	Min.	Typ.	Max.	Unit
Total Gate Charge	$V_{DS} = 400V$	Q_g	---	58	---	nC
Gate-Source Charge	$V_{GS} = 10V$	Q_{gs}	---	13	---	
Gate-Drain Charge	$I_D = 20A$	Q_{gd}	---	23	---	
Turn-On Delay Time	$V_{DD} = 250V$	$T_{d(on)}$	---	36	---	ns
Rise Time	$V_{GS} = 10V$	T_r	---	74	---	
Turn-Off Delay Time	$R_G = 10\Omega$	$T_{d(off)}$	---	78	---	
Fall Time	$I_D = 20A$	T_f	---	58	---	
Input capacitance	$V_{DS} = 25V$	C_{iss}	---	2900	---	pF
Output capacitance	$V_{GS} = 0V$	C_{oss}	---	310	---	
Reverse transfer capacitance	$F = 1MHz$	C_{rss}	---	20	---	
Gate resistance	$V_{DS} = 0V, V_{GS} = 0V, F = 1MHz$	R_g	---	2.5	---	Ω

Drain-Source Diode Characteristics and Maximum Ratings

Parameter	Condition	Symbol	Min.	Typ.	Max.	Unit
Diode Forward Voltage	$V_{GS} = 0V, I_S = 10A$	V_{SD}	---	0.7	1.4	V
Reverse Recovery Time	$I_F = 10A, di/dt = 40A/\mu s,$	t_{rr}	---	491	---	nS
Reverse Recovery Charge	$V_{DS} = 100V$	Q_{rr}	---	2296	---	nC

Note:

1. Repetitive Rating: Pulsed width limited by maximum junction temperature.
2. $V_{DD} = 650V, V_{GS} = 10V, L = 1mH, I_{AS} = 10A, R_G = 25\Omega$, Starting $T_J = 25^\circ\text{C}$.
3. The data tested by pulsed, pulse width $\leq 300\mu s$, duty cycle $\leq 2\%$.
4. Essentially independent of operating temperature.

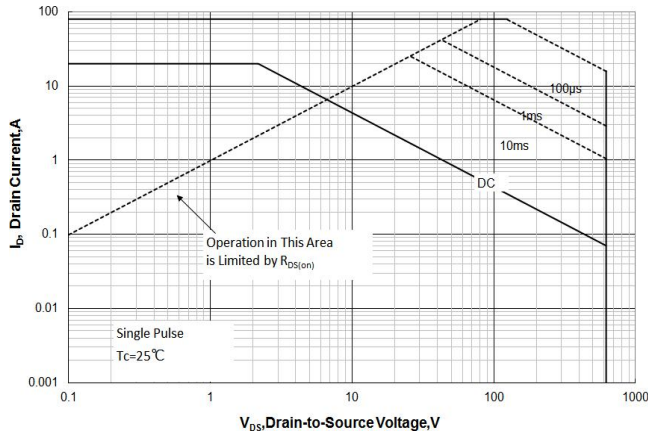


Figure 1 Maximum Forward Bias Safe Operating Area

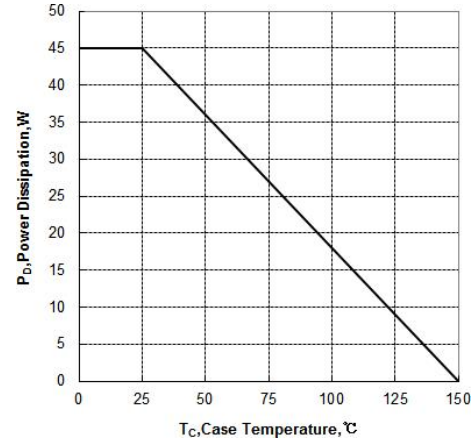


Figure 2 Maximum Power dissipation vs Case Temperature

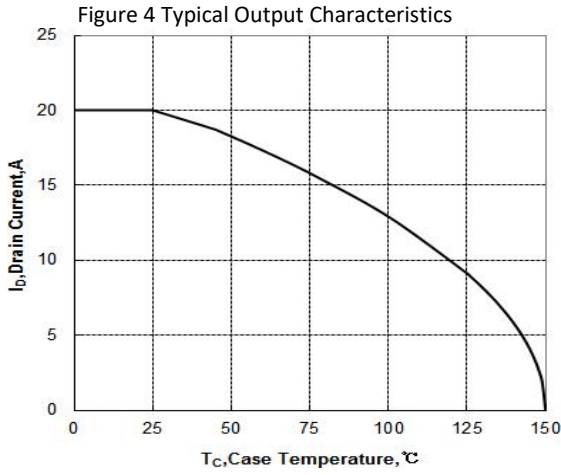


Figure 3 Maximum Continuous Drain Current vs Case Temperature

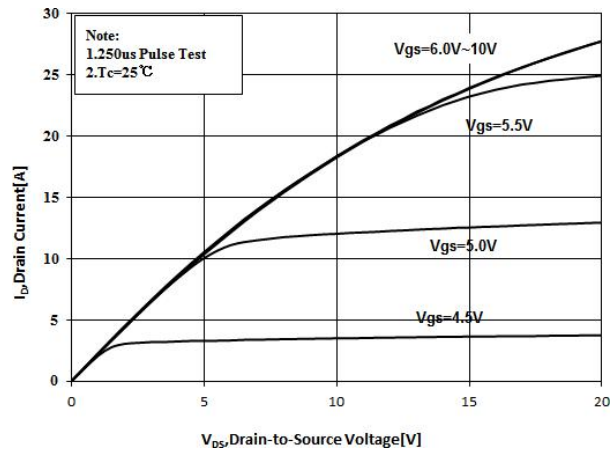


Figure 4 Typical Output Characteristics

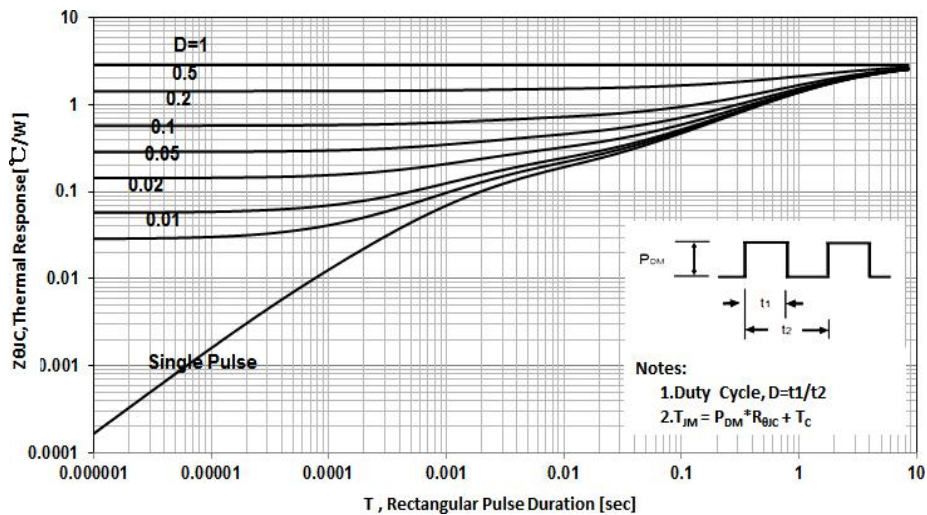


Figure 5 Maximum Effective Thermal Impedance , Junction to Case

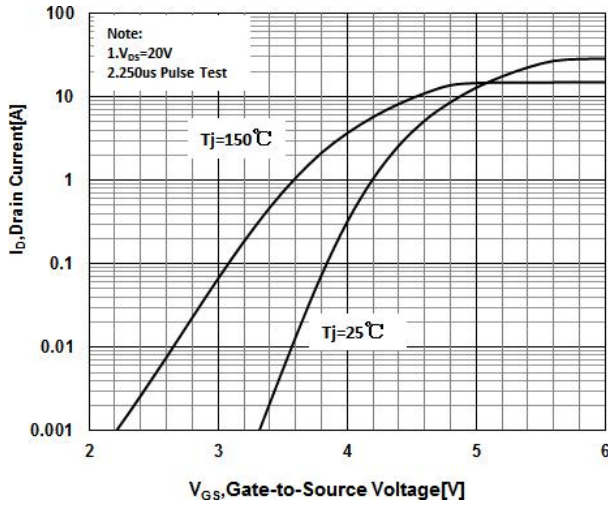


Figure 6 Typical Transfer Characteristics

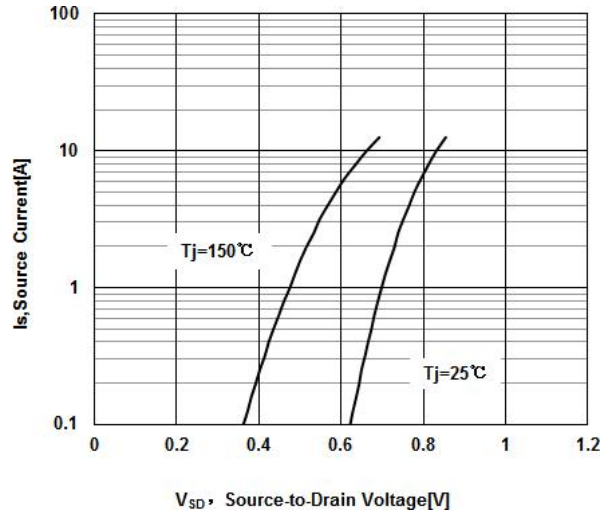


Figure 7 Typical Body Diode Transfer Characteristics

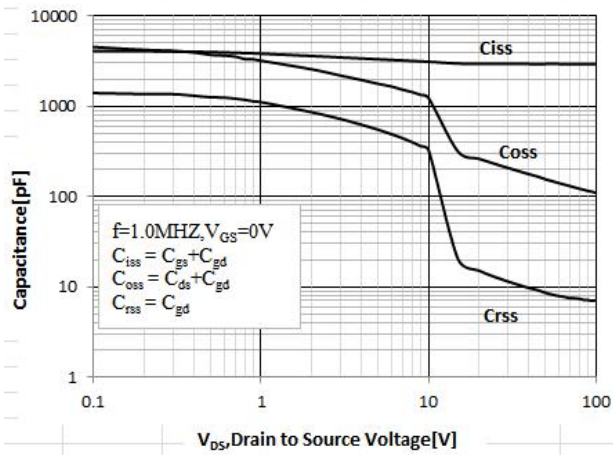


Figure 8 Typical Capacitance vs Drain to Source Voltage

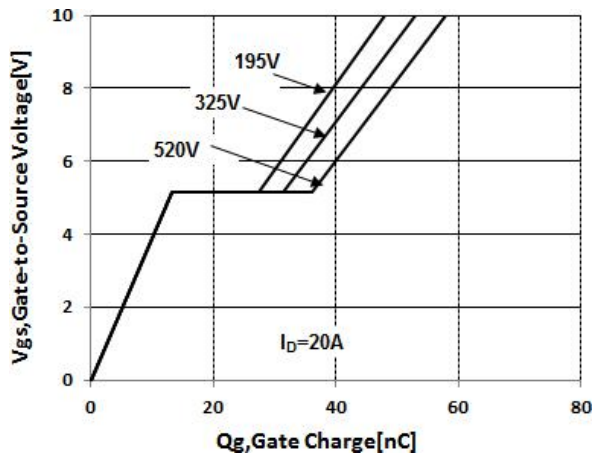
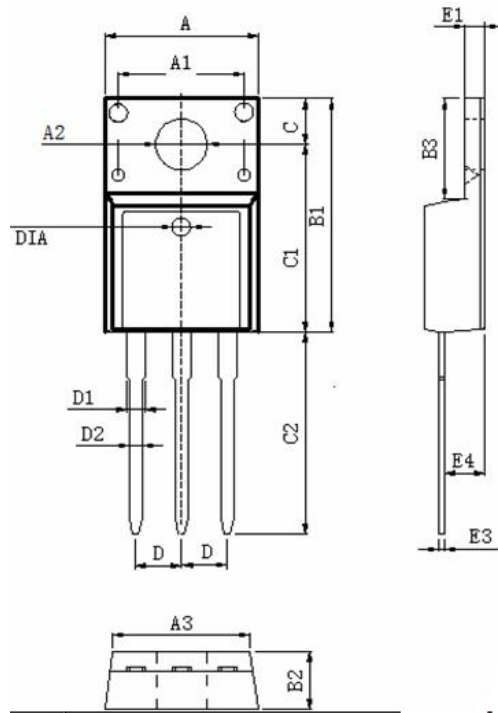


Figure 9 Typical Gate Charge vs Gate to Source Voltage

TO-220F PACKAGE INFORMATION



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MAX	MIN	MAX	MIN
A	10.460	9.860	0.412	0.388
A1	7.100	6.900	0.280	0.272
A2	3.500	3.100	0.138	0.122
A3	9.900	9.500	0.390	0.374
B1	16.170	15.570	0.637	0.613
B2	4.900	4.500	0.193	0.177
B3	6.880	6.480	0.271	0.255
C	3.500	3.100	0.138	0.122
C1	12.870	12.270	0.507	0.483
C2	13.380	12.580	0.527	0.495
D	2.590	2.490	0.102	0.098
D1	1.470	1.070	0.058	0.042
D2	0.900	0.700	0.035	0.028
E1	2.740	2.340	0.108	0.092
E3	0.600	0.400	0.024	0.016
E4	2.960	2.560	0.117	0.101
DIA	Φ1.5 TYP.	deep0.1 TYP.	Φ0.059 TYP.	deep0.004 TYP.