

# 7 Amps, 600Volts N-Channel MOSFET

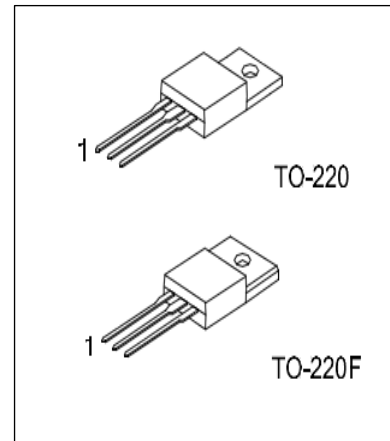
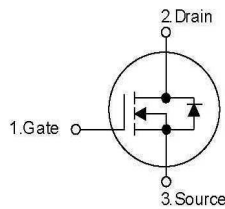
## ■ Description

The ET7N60 N-Channel enhancement mode silicon gate power MOSFET is designed for high voltage, high speed power switching applications such as switching regulators, switching converters, solenoid, motor drivers, relay drivers.

## ■ Features

- $R_{DS(ON)} = 1.20\Omega @ V_{GS} = 10V$
- Low gate charge ( typical 29nC)
- High ruggedness
- Fast switching capability
- Avalanche energy specified
- Improved dv/dt capability

## ■ Symbol



## ■ Absolute Maximum Ratings ( $T_c=25^\circ\text{C}$ , unless otherwise specified)

Parameter	Symbol	Ratings		Units	
		TO-220	TO-220F		
Drain-Source Voltage	$V_{DSS}$	600		V	
Gate-Source Voltage	$V_{GSS}$	$\pm 30$		V	
Drain Current Continuous	$I_D$	$T_c=25^\circ\text{C}$	7.0	7.0*	A
		$T_c=100^\circ\text{C}$	4.3	4.3*	A
Drain Current Pulsed (Note 1)	$I_{DP}$	28	28*	A	
Avalanche Energy	Repetitive (Note 1)	15.2		mJ	
	Single Pulse (Note 2)	267		mJ	
Peak Diode Recovery dv/dt (Note 3)	dv/dt	4.5		V/ns	
Total Power Dissipation	$P_D$	$T_c=25^\circ\text{C}$	152	50	W
		Derate above $25^\circ\text{C}$	1.21	0.40	W/ $^\circ\text{C}$
Junction Temperature	$T_J$	+150		$^\circ\text{C}$	
Storage Temperature	$T_{STG}$	-55~+150		$^\circ\text{C}$	

\*Drain current limited by maximum junction temperature.

**■ Thermal Characteristics**

Parameter	Symbol	Ratings		Units
		TO-220	TO-220F	
Thermal Resistance Junction-Ambient	$R_{thJA}$	62.5		°C/W
Thermal Resistance, Case-to-Sink Typ.	$R_{thCS}$	0.5	--	
Thermal Resistance Junction-Case	$R_{thJC}$	0.82	2.5	

**■ Electrical Characteristics** ( $T_J=25^{\circ}\text{C}$ , unless Otherwise specified.)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units	
<b>Off Characteristics</b>							
Drain-Source Breakdown Voltage	$BV_{DSS}$	$V_{GS}=0V, I_D=250\mu A$	600	--	--	V	
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS}=600V, V_{GS}=0V$	--	--	1	$\mu A$	
		$V_{DS}=480V, T_C=125^{\circ}\text{C}$	--	--	10	$\mu A$	
Gate-Body Leakage Current	Forward	$I_{GSS}$	$V_{GS}=30V, V_{DS}=0V$	--	--	100	nA
	Reverse			--	--	-100	nA
Breakdown Voltage Temperature Coefficient	$\Delta BV_{DSS}/\Delta T_J$	$I_D=250\mu A$	--	0.7	--	V/°C	
<b>On Characteristics</b>							
Gate Threshold Voltage	$V_{GS(TH)}$	$V_{DS}=V_{GS}, I_D=250\mu A$	2.0	--	4.0	V	
Static Drain-Source On-Resistance	$R_{DS(ON)}$	$V_{DS}=10V, I_D=3.5A$	--	0.98	1.20	$\Omega$	
<b>Dynamic Characteristics</b>							
Input Capacitance	$C_{ISS}$	$V_{DS}=25V, V_{GS}=0V, f=1\text{MHz}$	--	1000	--	pF	
Output Capacitance	$C_{OSS}$		--	110	--	pF	
Reverse Transfer Capacitance	$C_{RSS}$		--	12.6	--	pF	
<b>Switching Characteristics</b>							
Turn-On Delay Time	$t_{D(ON)}$	$V_{DD}=300V, I_D=7.0A, R_G=25\Omega$ (Note 4, 5)	--	20	--	ns	
Rise Time	$t_R$		--	50	--	ns	
Turn-Off Delay Time	$t_{D(OFF)}$		--	80	--	ns	
Fall Time	$t_F$		--	70	--	ns	
Total Gate Charge	$Q_G$	$V_{DS}=480V, I_D=7.0A, V_{GS}=10V$ (Note 4, 5)	--	29	--	nC	
Gate-Source Charge	$Q_{GS}$		--	4.7	--	nC	
Gate-Drain Charge	$Q_{GD}$		--	12.5	--	nC	
<b>Drain-Source Diode Characteristics</b>							
Drain-Source Diode Forward Voltage	$V_{SD}$	$V_{GS}=0V, I_{SD}=7.0A$	--	--	1.4	V	
Continuous Drain-Source Current	$I_{SD}$		--	--	7.0	A	
Pulsed Drain-Source Current	$I_{SM}$		--	--	28.0	A	
Reverse Recovery Time	$t_{RR}$	$I_{SD}=7.0A, dI_{SD}/dt=100A/\mu s$ (Note 4)	--	350	--	ns	
Reverse Recovery Charge	$Q_{RR}$		--	3.3	--	$\mu C$	

1. Repetitive Rating : Pulse width limited by maximum junction temperature
2.  $L=10\text{ mH}, I_{AS}=7.0\text{ A}, V_{DD}=50\text{ V}, R_G=25\ \Omega, \text{ Starting } T_J=25^{\circ}\text{C}$
3.  $I_{SD}\leq 7.0\text{ A}, di/dt\leq 200\text{ A}/\mu\text{ s}, V_{DD}\leq BV_{DSS}, \text{ Starting } T_J=25^{\circ}\text{C}$
4. Pulse Test : Pulse width  $\leq 300\ \mu\text{ s}, \text{ Duty cycle}\leq 2\%$
5. Essentially independent of operating temperature

■ Typical Characteristics

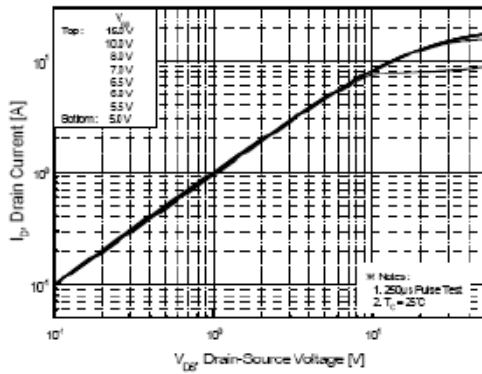


Figure 1. On-Region Characteristics

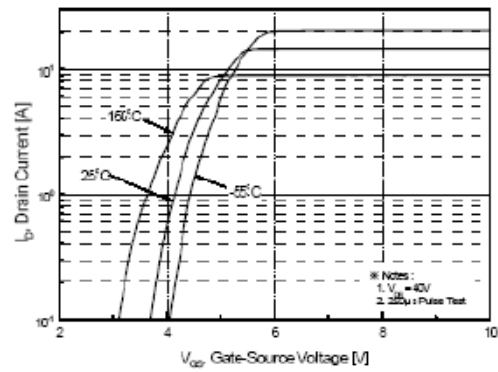


Figure 2. Transfer Characteristics

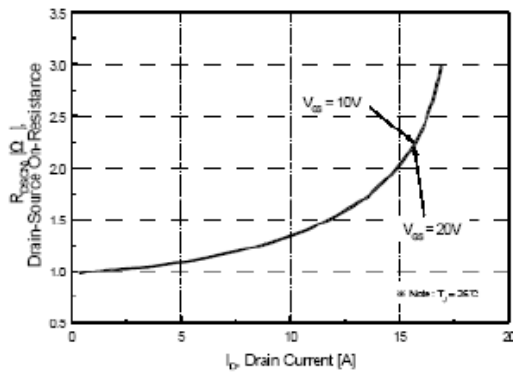


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

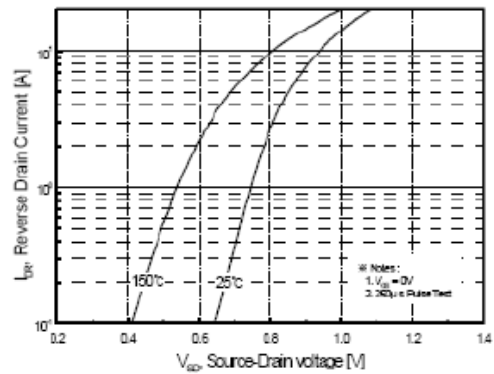


Figure 4. Body Diode Forward Voltage Variation with Source Current and Temperature

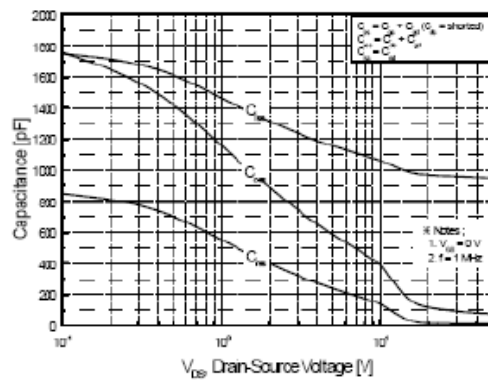


Figure 5. Capacitance Characteristics

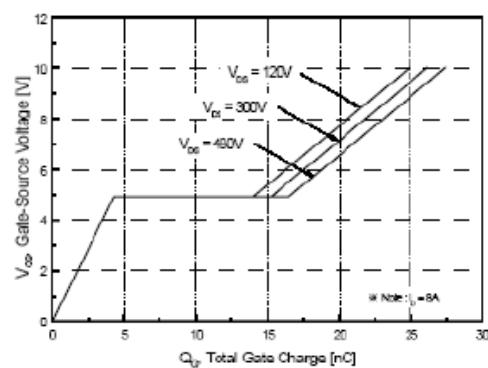


Figure 6. Gate Charge Characteristics

■ Typical Characteristics (Continued)

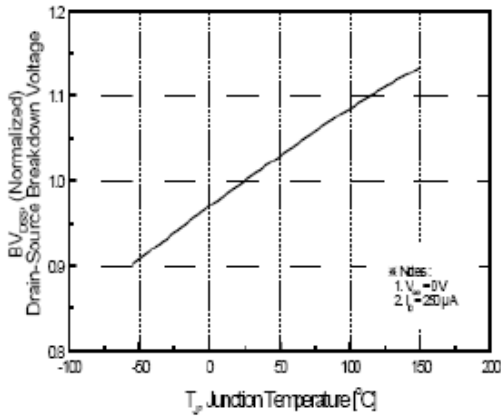


Figure 7. Breakdown Voltage Variation

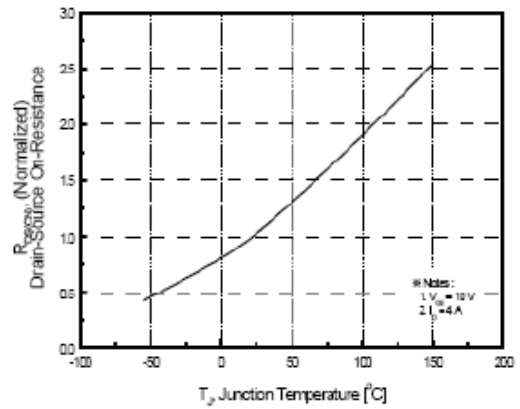


Figure 8. On-Resistance Variation vs Temperature

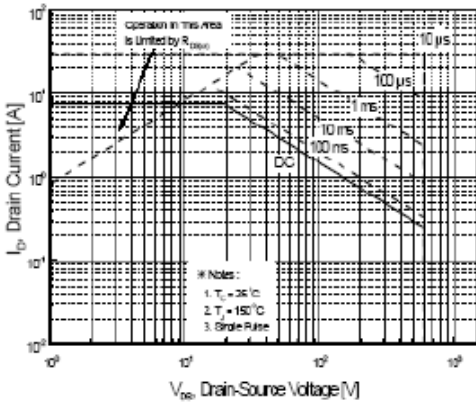


Figure 9-1. Maximum Safe Operating Area for TO220

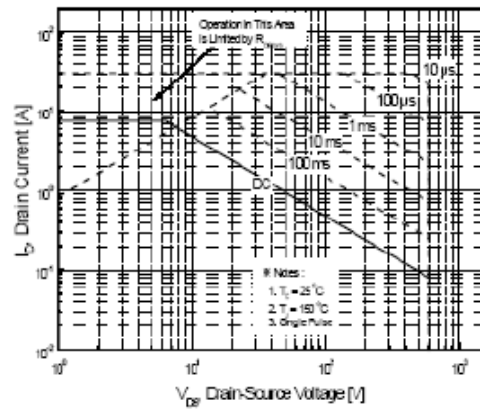


Figure 9-2. Maximum Safe Operating Area for TO220F

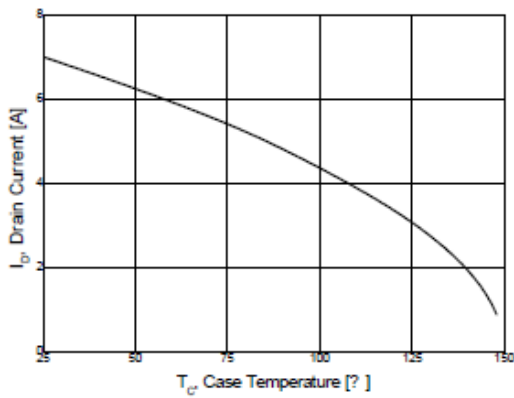
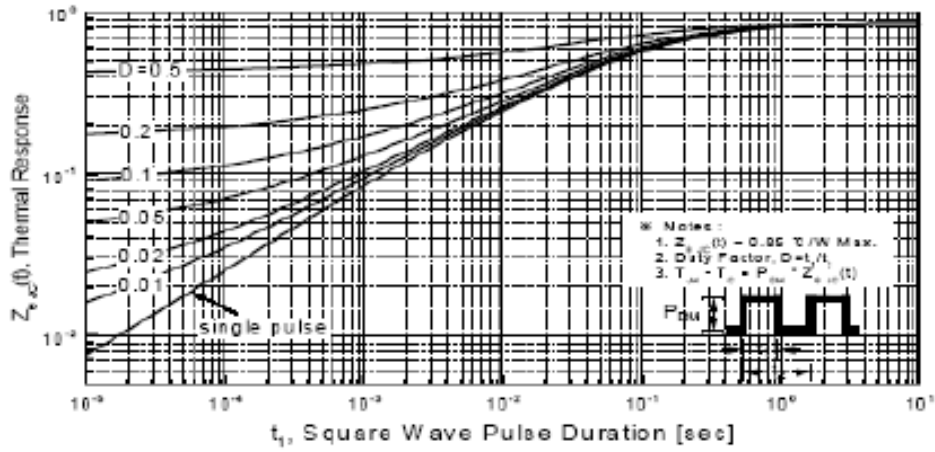
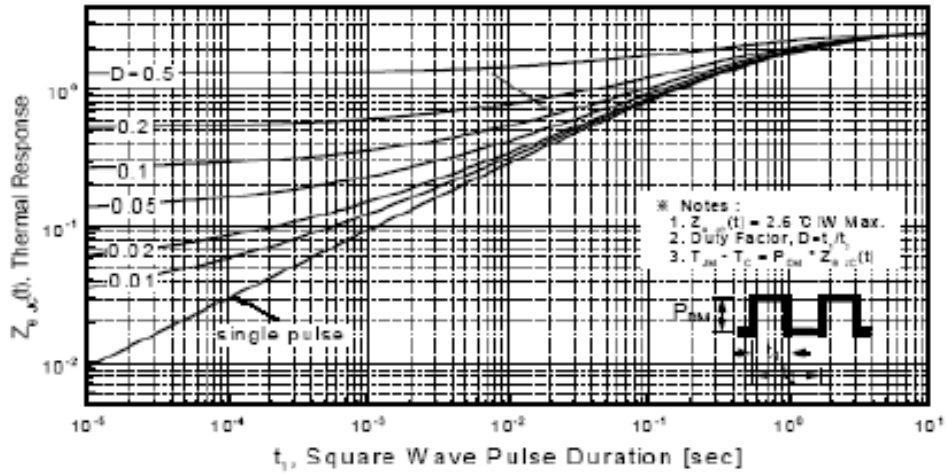


Figure 10. Maximum Drain Current vs Case Temperature

**Typical Characteristics (Continued)**

**Figure 11-1. Transient Thermal Response Curve**

**Figure 11-2. Transient Thermal Response Curve for TO220F**