

N2 Amps, 600Volts N-Channel MOSFET

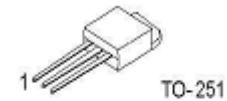
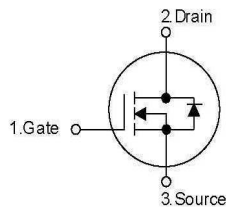
■ Description

The ET2N60 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

- $R_{DS(ON)} = 5.00\Omega @ V_{GS} = 10V$
- Low gate charge (typical 9nC)
- High ruggedness
- Fast switching capability
- Avalanche energy specified
- Improved dv/dt capability

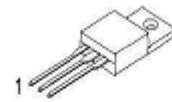
■ Symbol



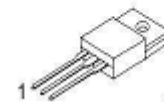
TO-251



TO-252



TO-220



TO-220F

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

Parameter		Symbol	Ratings				Units
			TO-220	TO-220F	TO-251	TO-252	
Drain-Source Voltage		V_{DSS}	600				V
Gate-Source Voltage		V_{GSS}	±30				V
Drain Current Continuous	$T_c=25^\circ\text{C}$	I_D	2.0	2.0*	1.9		A
	$T_c=100^\circ\text{C}$		1.35	1.35*	1.14		A
Drain Current Pulsed (Note 1)		I_{DP}	8	8*	7.6		A
Avalanche Energy	Repetitive (Note 1)	E_{AR}	5.55		4.4		mJ
	Single Pulse (Note 3)	E_{AS}	130		120		mJ
Peak Diode Recovery dv/dt (Note 3)		dv/dt	4.5				V/ns
Total Power Dissipation	$T_c=25^\circ\text{C}$	P_D	55.5	23.6	44		W

	Derate above 25°C		0.44	0.19	0.35	W/°C
Junction Temperature	T _J		+150			°C
Storage Temperature	T _{STG}		-55~+150			°C

* Drain current limited by maximum junction temperature.

■ Thermal Characteristics

Parameter	Symbol	Ratings				Units
		TO-220	TO-220F	TO-251	TO-252	
Thermal Resistance Junction-Ambient	R _{thJA}	62.5		50* (110)		°C/W
Thermal Resistance, Case-to-Sink Typ.	R _{thCS}	0.5	--	--		
Thermal Resistance Junction-Case	R _{thJC}	2.32	5.5	2.87		

■ Electrical Characteristics (T_J=25°C, unless Otherwise specified.)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Off Characteristics						
Drain-Source Breakdown Voltage	BV _{DSS}	V _{GS} =0V, I _D =250μA	600	--	--	V
Zero Gate Voltage Drain Current	I _{DSS}	V _{DS} =600V, V _{GS} =0V	--	--	1	μA
		V _{DS} =480V, T _C =125°C	--	--	10	μA
Gate-Body Leakage Current	Forward	I _{GSS}	V _{GS} =30V, V _{DS} =0V		100	nA
	Reverse		V _{GS} =-30V, V _{DS} =0V		-100	nA
Breakdown Voltage Temperature Coefficient	ΔBV _{DSS} /ΔT _J	I _D =250μA	--	0.7	--	V/°C
On Characteristics						
Gate Threshold Voltage	V _{GS(TH)}	V _{DS} =V _{GS} , I _D =250μA	2.0	--	4.0	V
Static Drain-Source On-Resistance	R _{DS(ON)}	V _{DS} =10V, I _D =1.0A(TO220, TO220F) I _D =0.95A(TO251, TO252)	--	4.1	5.0	Ω
Dynamic Characteristics						
Input Capacitance	C _{ISS}	V _{DS} =25V, V _{GS} =0V, f=1MHz	--	200	--	pF
Output Capacitance	C _{OSS}		--	20	--	pF
Reverse Transfer Capacitance	C _{RSS}		--	4	--	pF
Switching Characteristics						
Turn-On Delay Time	t _{D(ON)}	V _{DD} =300V, I _D =2.0A, R _G =25Ω (Note 4, 5)	--	10	--	ns
Rise Time	t _R		--	25	--	ns
Turn-Off Delay Time	t _{D(OFF)}		--	25	--	ns
Fall Time	t _F		--	30	--	ns
Total Gate Charge	Q _G	V _{DS} =480V, I _D =2.0A V _{GS} =10V (Note 4, 5)	--	9	--	nC
Gate-Source Charge	Q _{GS}		--	1.5	--	nC
Gate-Drain Charge	Q _{GD}		--	4.0	--	nC
Drain-Source Diode Characteristics						
Drain-Source Diode Forward Voltage	V _{SD}	V _{GS} =0V, I _{SD} =2.0A(TO220, TO220F) I _{SD} =0.95A(TO251, TO252)	--	--	1.4	V
Continuous Drain-Source Current	I _{SD}	TO-220, TO-220F	--	--	2.0	A
		TO-251, TO-252	--	--	1.9	A
Pulsed Drain-Source Current	I _{SM}	TO-220, TO-220F	--	--	8.0	A
		TO-251, TO-252	--	--	7.6	A
Reverse Recovery Time	t _{RR}	I _{SD} =2.0A, di _{SD} /dt=100A/μs (Note 4)	--	230	--	ns
Reverse Recovery Charge	Q _{RR}		--	1.0	--	μC

1. Repetitive Rating : Pulse width limited by maximum junction temperature
2. L = 60 mH, I_{AS} = 2.0 A, V_{DD} = 50V, R_G = 25 Ω, Starting T_J = 25°C
3. I_{SD} ≤ 2.0 A, di/dt ≤ 200A/μs, V_{DD} ≤ BV_{DSS}, Starting T_J = 25°C

- 4. Pulse Test : Pulse width $\leq 300 \mu s$, Duty cycle $\leq 2\%$
- 5. Essentially independent of operating temperature

■ Typical Characteristics

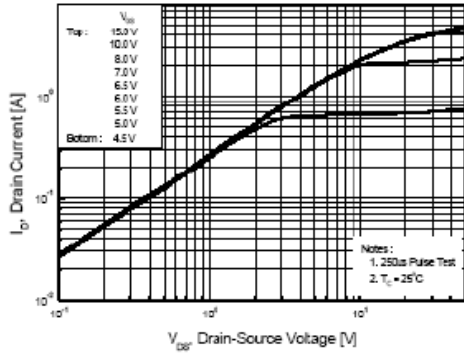


Figure 1. On-Region Characteristics

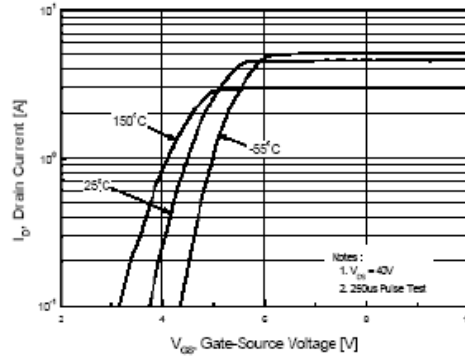


Figure 2. Transfer Characteristics

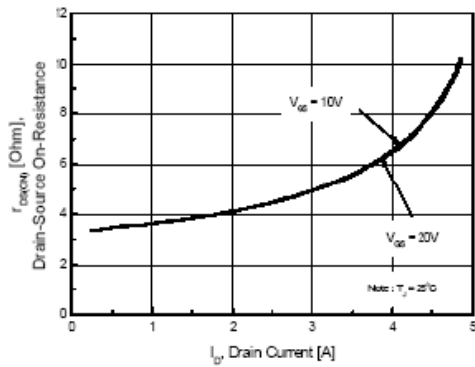


Figure 3. On-Resistance Variation vs Drain Current and Gate Voltage

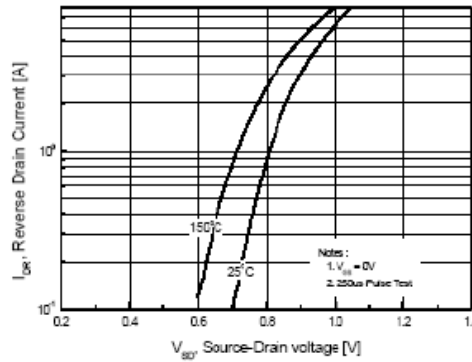


Figure 4. Body Diode Forward Voltage Variation with Source Current

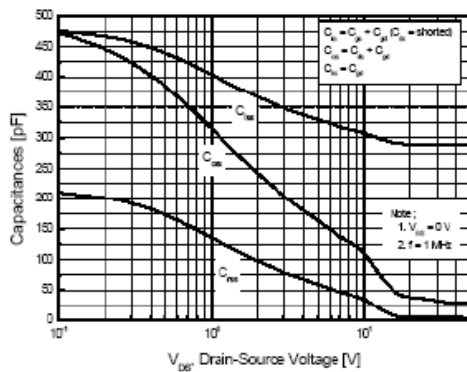


Figure 5. Capacitance Characteristics

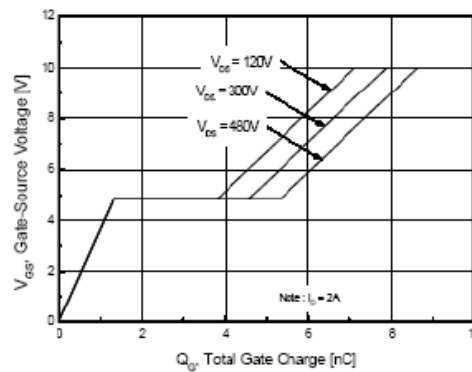


Figure 6. Gate Charge Characteristics

■ Typical Characteristics (Continued)

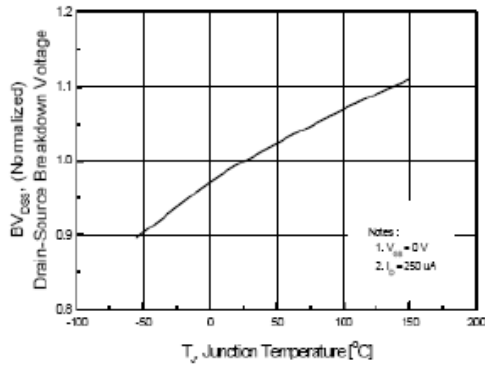


Figure 7. Breakdown Voltage Variation vs Temperature

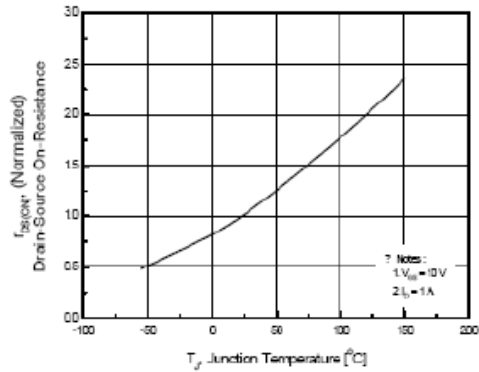


Figure 8. On-Resistance Variation vs Temperature

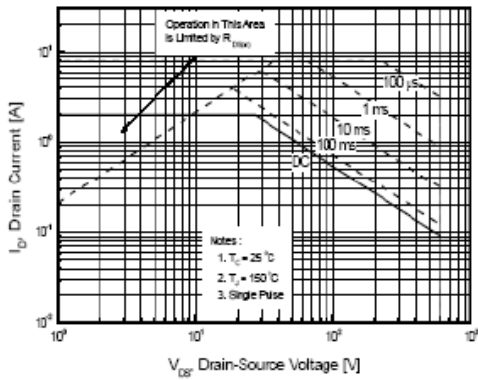


Figure 9-1. Maximum Safe Operating Area for TO220

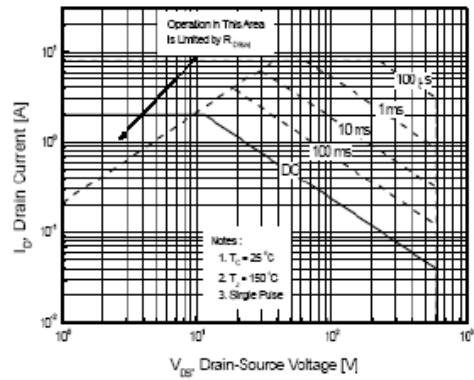


Figure 9-2. Maximum Safe Operating Area for TO220F

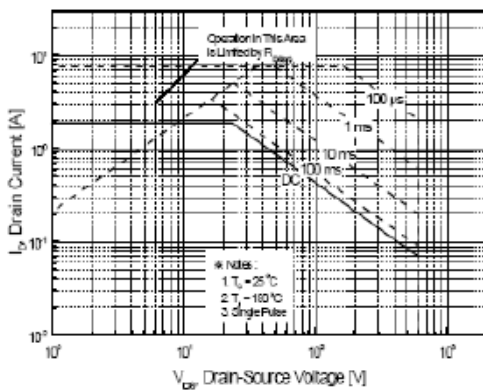


Figure 9-3. Maximum Safe Operating Area for TO251, TO252

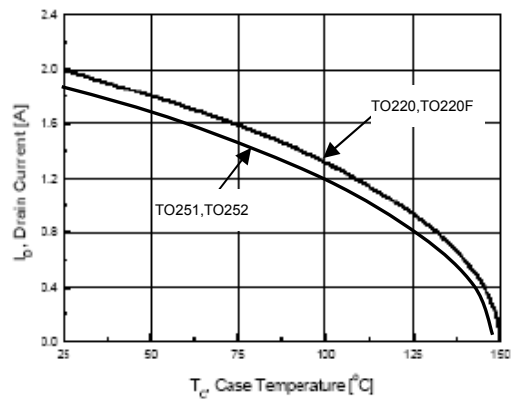


Figure 10. Maximum Drain Current vs Case Temperature

■ Typical Characteristics (Continued)

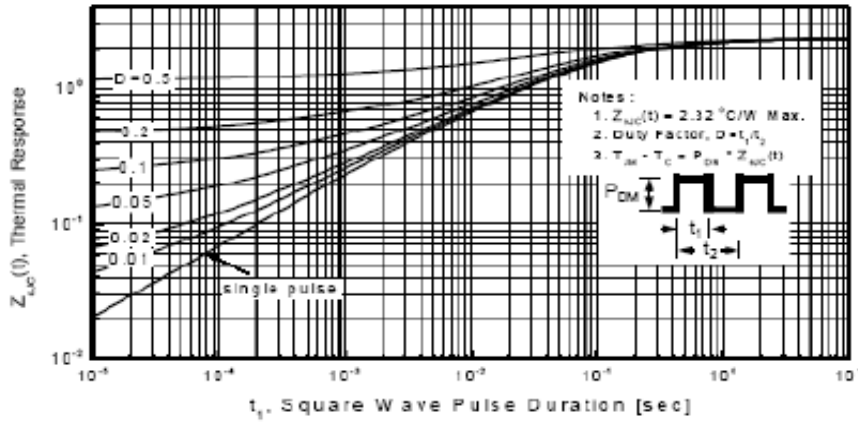


Figure 11-1. Transient Thermal Response Curve TO220

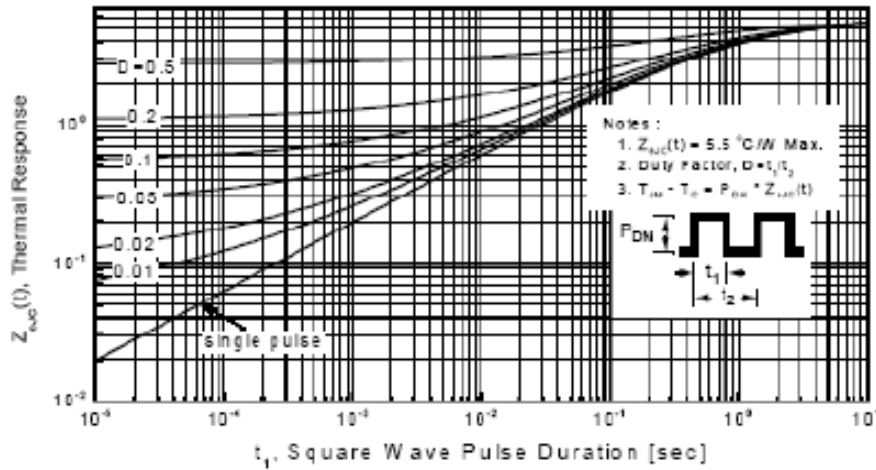


Figure 11-2. Transient Thermal Response Curve for TO220F

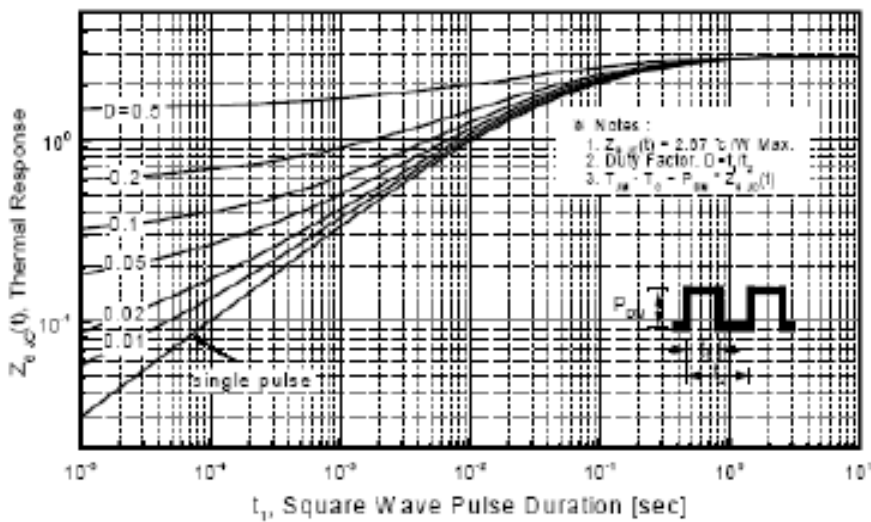


Figure 11-3. Transient Thermal Response Curve for TO251/ TO252