

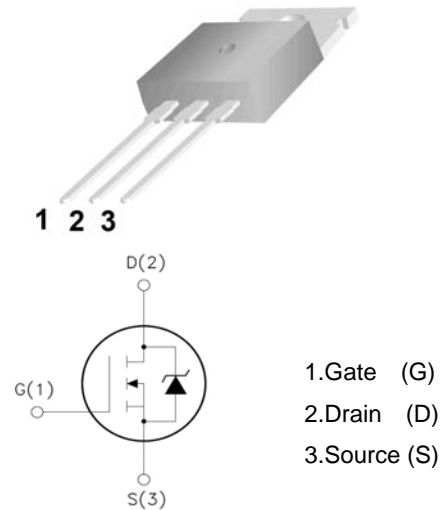
TO-220



60V N-Channel MOSFET

**Features:**

- Low Intrinsic Capacitances.
- Excellent Switching Characteristics.
- Extended Safe Operating Area.
- Unrivalled Gate Charge :Qg= 130nC (Typ.).
- BVDSS=60V, I<sub>D</sub>=200A
- R<sub>DS(on)</sub> : 3.4mΩ(Max) @V<sub>G</sub>=10V
- 100% Avalanche Tested


**Absolute Maximum Ratings** (T<sub>A</sub>=25°C unless otherwise noted)

Symbol	Parameter	Maximum	Unit
V <sub>DSS</sub>	Drain-to-Source Voltage	60	V
V <sub>GSS</sub>	Gate-to-Source Voltage	±20	V
I <sub>D</sub> <sup>3</sup>	Continuous Drain Current	T <sub>C</sub> =25°C	180
		T <sub>C</sub> =100°C	116
I <sub>DP</sub> <sup>4</sup>	Pulsed Drain Current	T <sub>C</sub> =25°C	720
I <sub>AS</sub> <sup>5</sup>	Avalanche Current	28	A
E <sub>AS</sub> <sup>5</sup>	Avalanche energy	870	mJ
PD	Maximum Power Dissipation	T <sub>C</sub> =25°C	1.96
		T <sub>C</sub> =100°C	245
T <sub>J</sub> , T <sub>STG</sub>	Junction & Storage Temperature Range	-55~150	°C

**Thermal Characteristics**

Symbol	Parameter	Typical	Unit
Rθ <sub>jc</sub>	Thermal Resistance-Junction to Case	0.51	°C/W
Rθ <sub>ja</sub>	Thermal Resistance-Junction to Ambient	62.5	

(TA=25°C unless otherwise noted)

Symbol	Parameter	Test Conditions	Min.	Typ	Max.	Unit
<b>Static Characteristics</b>						
BV <sub>DSS</sub>	Drain-Source Breakdown Voltage	V <sub>GS</sub> =0V, I <sub>D</sub> =250uA	60	—	—	V
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> =60V, V <sub>GS</sub> =0V	—	—	1	uA
		T <sub>J</sub> =100°C	—	—	100	
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250uA	2	—	4	V
I <sub>GSS</sub>	Gate Leakage Current	V <sub>GS</sub> =±25V, V <sub>DS</sub> =0V	—	—	±100	nA
R <sub>DS(on)</sub> <sup>1</sup>	Drain-Source On-Resistance	V <sub>GS</sub> =10V, I <sub>D</sub> =70A	—	2.6	3.4	mΩ
			—	—	—	
<b>Diode Characteristics</b>						
V <sub>SD</sub> <sup>1</sup>	Diode Forward Voltage	I <sub>SD</sub> 70A, V <sub>GS</sub> =0V	—	—	1.3	V
I <sub>S</sub> <sup>3</sup>	Diode Continuous Forward Current		—	—	140	A
t <sub>rr</sub>	Reverse Recovery Time	I <sub>F</sub> =70A, V <sub>DD</sub> =50V	—	48	—	nS
Q <sub>rr</sub>	Reverse Recovery Charge	di/dt=100A/us	—	69.6	—	nC
<b>Dynamic Characteristics<sup>2</sup></b>						
R <sub>G</sub>	Gate Resistance	V <sub>GS</sub> =0V, V <sub>DS</sub> =0V, Frequency=1MHz	—	9.0	—	Ω
C <sub>iss</sub>	Input Capacitance	V <sub>GS</sub> =0V, V <sub>DS</sub> =25V, Frequency=1MHz	—	4882	—	pF
C <sub>oss</sub>	Output Capacitance		—	635	—	
C <sub>rss</sub>	Reverse Transfer Capacitance		—	342	—	
t <sub>d(on)</sub>	Turn-On Delay Time	V <sub>DD</sub> =30V, I <sub>D</sub> =90A, V <sub>GS</sub> =10V, R <sub>G</sub> =6Ω	—	37.9	—	nS
t <sub>r</sub>	Rise Time		—	22.7	—	
t <sub>d(off)</sub>	Turn-Off Delay Time		—	68.8	—	
t <sub>f</sub>	Fall Time		—	23.5	—	
<b>Gate Charge Characteristics<sup>2</sup></b>						
Q <sub>g</sub>	Total Gate Charge	V <sub>DS</sub> =48V, V <sub>GS</sub> =10V, I <sub>D</sub> =90A	—	86.2	—	nC
Q <sub>gs</sub>	Gate-to-Source Charge		—	23.6	—	
Q <sub>gd</sub>	Gate-to-Drain Charge		—	29.4	—	

Note: 1: Pulse test; pulse width ≤ 300us, duty cycle ≤ 2%.

2: Guaranteed by design, not subject to production testing.

3: Package limitation current is 8A. Calculated continuous current based on maximum allowable junction temperature.

4: Repetitive rating, pulse width limited by max junction temperature.

 5: Starting T<sub>J</sub> = 25°C, L = 0.5mH

Typical Characteristics

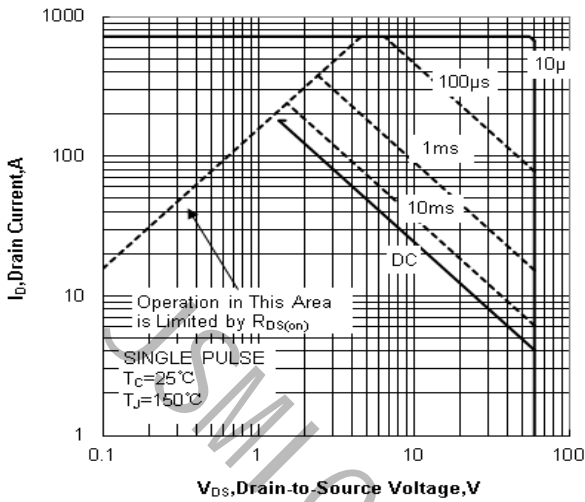


Figure 1 Maximum Forward Bias Safe Operating Area

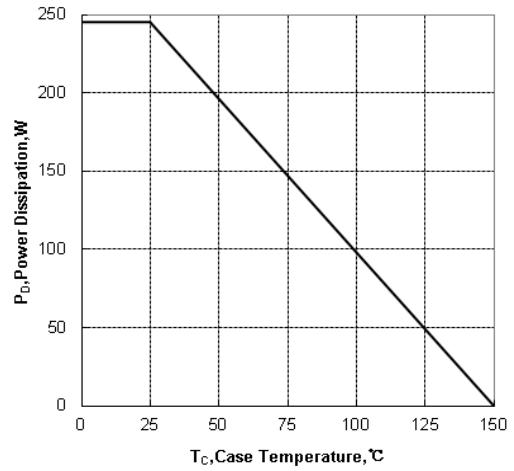


Figure 2 Maximum Power Dissipation vs Case Temperature

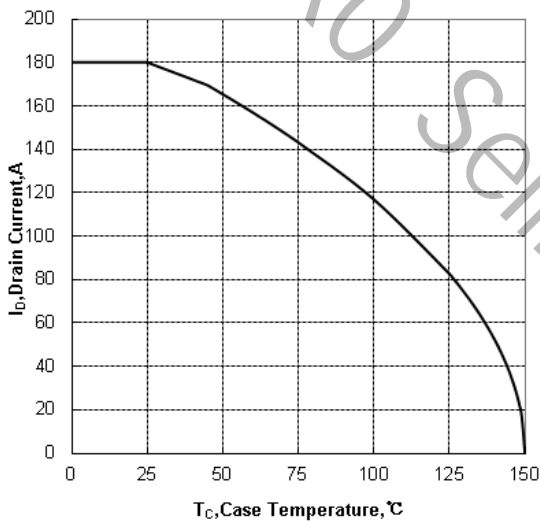


Figure 3 Maximum Continuous Drain Current vs Case Temperature

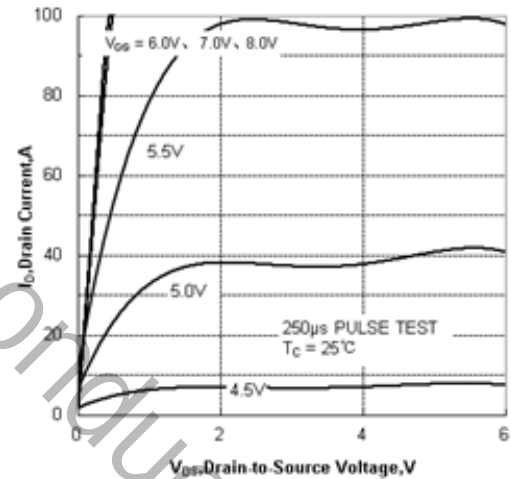


Figure 4 Typical Output Characteristics

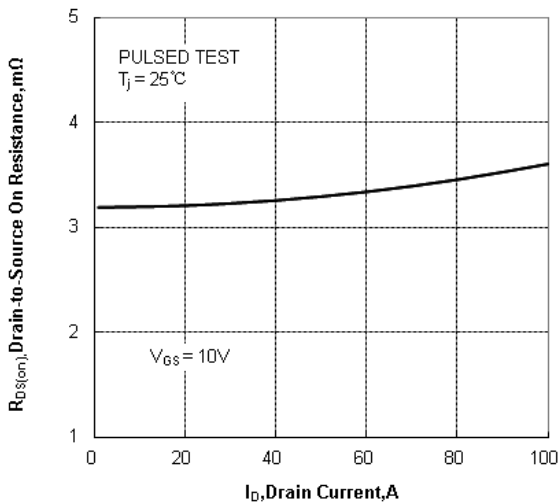


Figure 5 Drain-to-Source On Resistance vs Drain Current

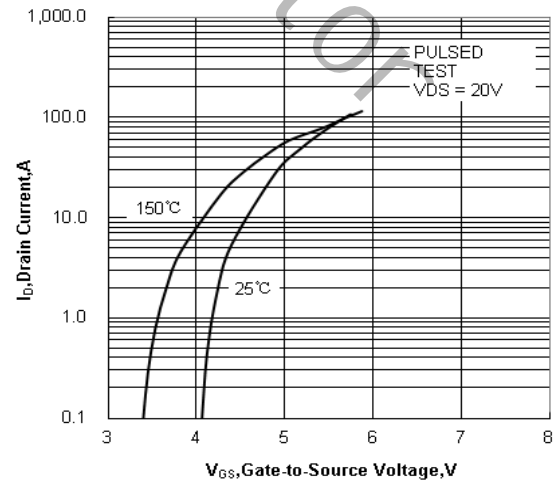


Figure 6 Typical Transfer Characteristics

## Typical Characteristics (Continued)

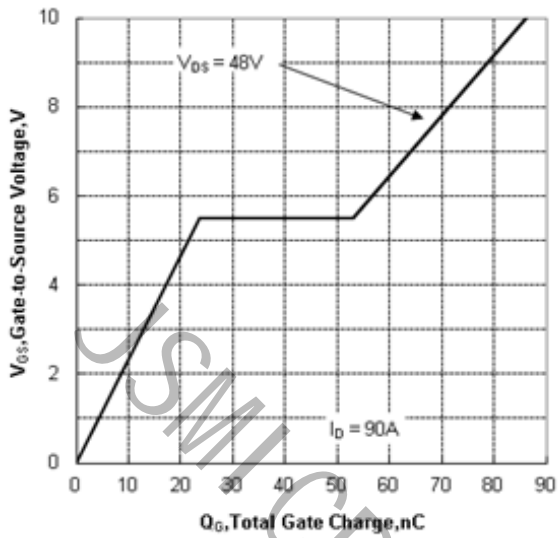


Figure 7 Typical Gate Charge vs Gate to Source Voltage

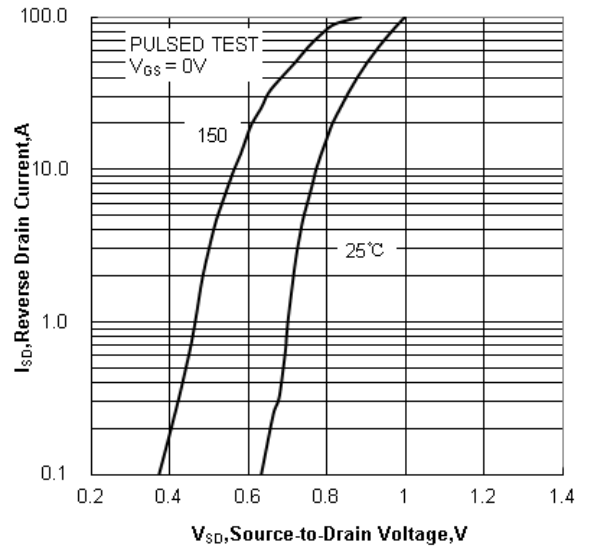


Figure 8 Typical Body Diode Transfer Characteristics

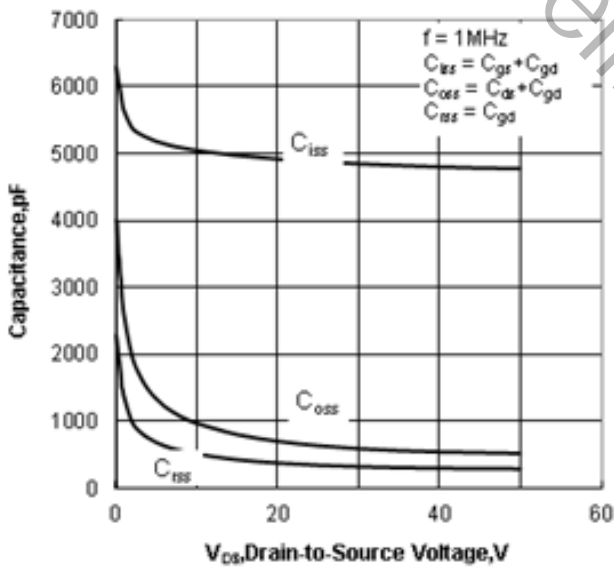


Figure 9 Typical Capacitance vs Drain to Source Voltage

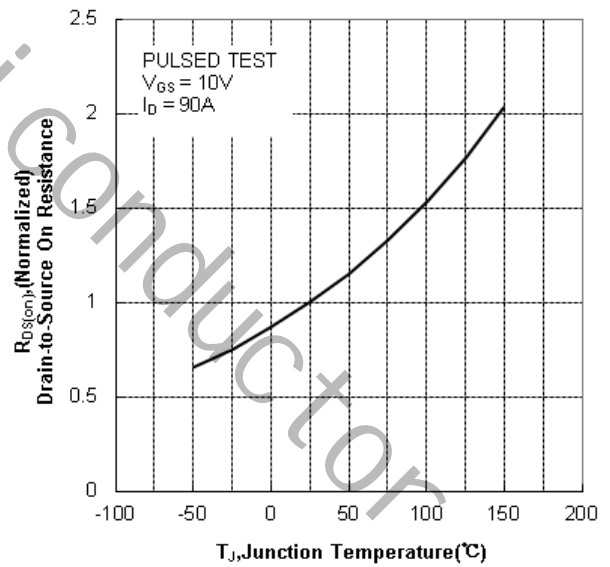


Figure 10 Typical Drain to Source on Resistance vs Junction Temperature

Typical Characteristics (Continued)

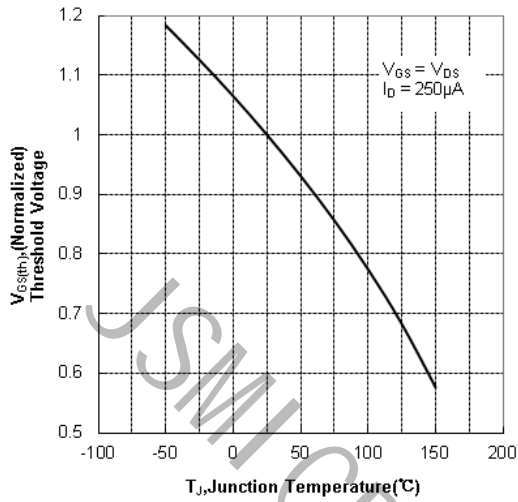


Figure 11 Typical Theshold Voltage vs Junction Temperature

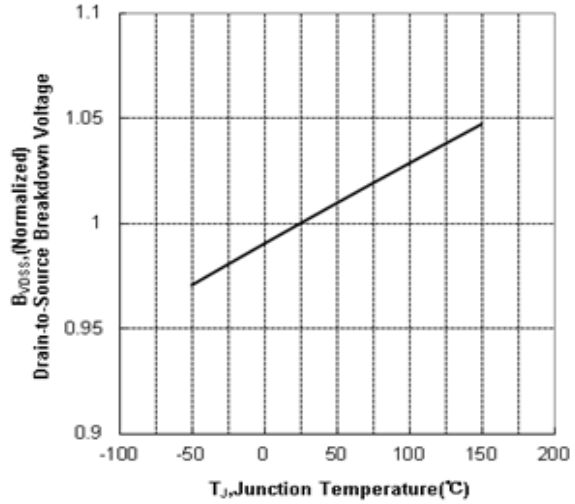


Figure 12 Typical Breakdown Voltage vs Junction Temperature

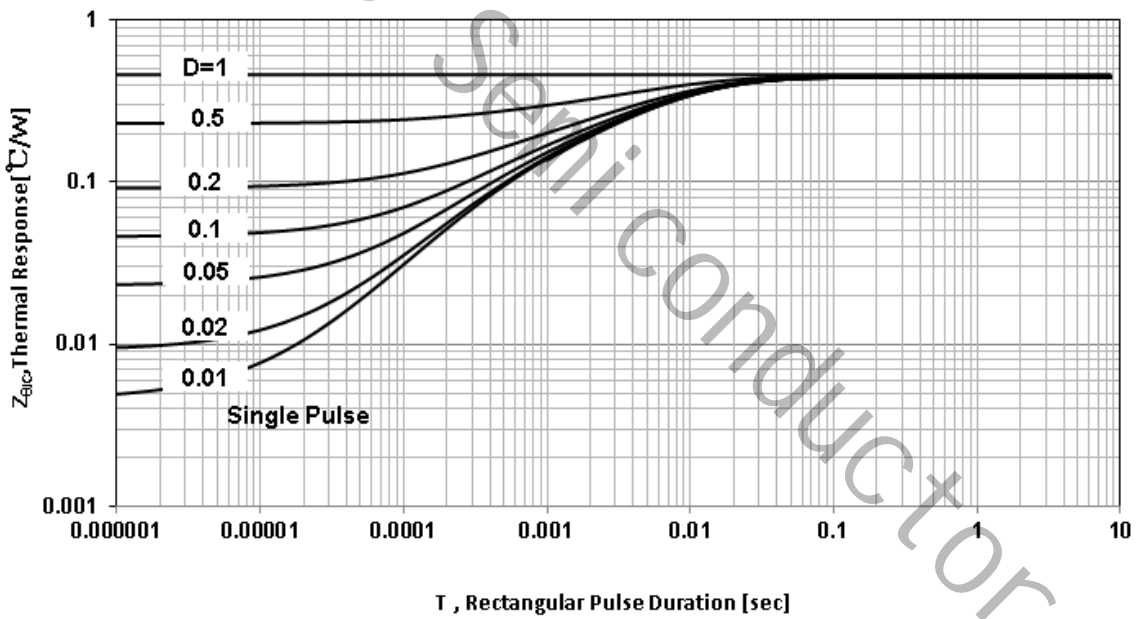
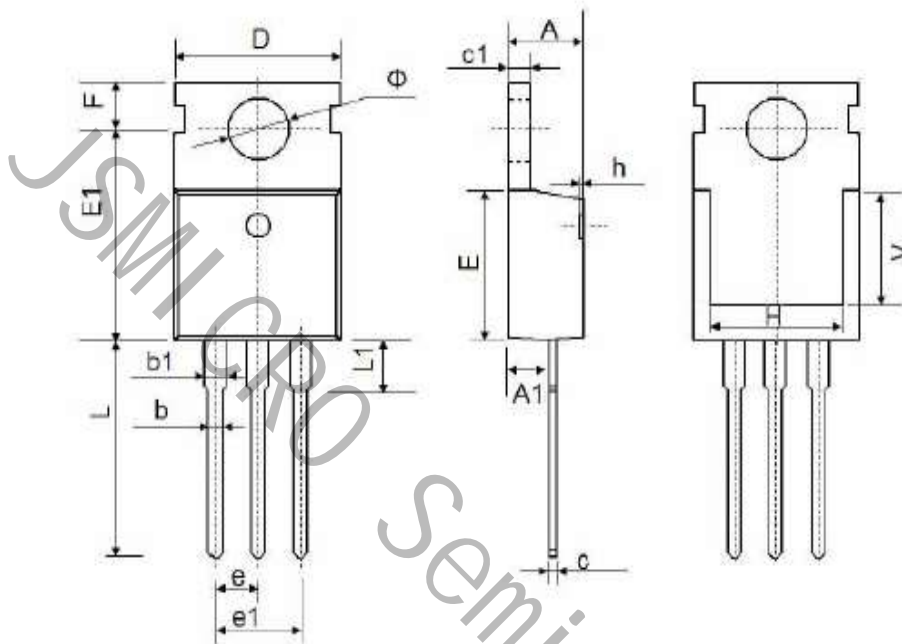


Figure 13 Maximum Effective Transient Thermal Impedance, Junction-to-Case

## Package Dimension

TO-220



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	4.30	4.80	0.169	0.189
A1	2.20	2.70	0.087	0.106
b	0.70	0.95	0.276	0.037
b1	1.10	1.50	0.043	0.059
c	0.40	0.65	0.016	0.026
c1	1.20	1.45	0.047	0.057
D	9.70	10.30	0.382	0.406
E	8.75	9.65	0.344	0.380
E1	12.50	13.10	0.492	0.516
e	2.540 Typ.		0.100 Typ.	
e1	4.98	5.18	0.196	0.204
F	2.60	3.00	0.102	0.118
H	7.00	8.40	0.276	0.331
h	0	0.3	0	0.012
L	12.75	13.90	0.502	0.547
L1	2.85	3.40	0.112	0.134
V	6.700Ref.		0.264Ref.	
φ	3.50	3.80	0.138	0.150