

**ADVANCED  
POWER  
TECHNOLOGY®**  
**2N7228 500 Volt 0.415Ω**  
**JX2N7228\***  
**JV2N7228\***

## POWER MOS IV™

\*QUALIFIED TO MIL-S-19500/592 31/7/92

### JEDEC REGISTERED N - CHANNEL HIGH VOLTAGE POWER MOSFETS

#### MAXIMUM RATINGS

All Ratings:  $T_C = 25^\circ\text{C}$  unless otherwise specified.

Symbol	Parameter	2N7228	UNIT
$V_{DSS}$	Drain-Source Voltage	500	Volts
$V_{GS}$	Gate-Source Voltage	$\pm 20$	
$I_D$	Continuous Drain Current @ $T_C = 25^\circ\text{C}$	12	Amps
	Continuous Drain Current @ $T_C = 100^\circ\text{C}$	8	
$I_{DM}$	Pulsed Drain Current <sup>①</sup>	48	
$I_{AR}$	Avalanche Current <sup>①</sup>	12	
$P_D$	Total Power Dissipation @ $T_C = 25^\circ\text{C}$	150	Watts
	Total Power Dissipation @ $T_C = 100^\circ\text{C}$	60	
	Linear Derating Factor	1.2	W/K
$E_{AS}$	Single Pulse Avalanche Energy	750	mJ
$E_{AR}$	Repetitive Avalanche Energy	15	
$T_J, T_{STG}$	Operating and Storage Junction Temperature Range	-55 to 150	$^\circ\text{C}$
$T_L$	Max. Lead Temp. for Soldering Conditions; 0.063" from Case for 10 Sec.	300	

#### STATIC ELECTRICAL CHARACTERISTICS

Symbol	Characteristic / Test Conditions	MIN	TYP	MAX	UNIT
$BV_{DSS}$	Drain-Source Breakdown Voltage ( $V_{GS} = 0V, I_D = 250\mu\text{A}$ )	500			Volts
$V_{GS(TH)}$	Gate Threshold Voltage ( $V_{DS} = V_{GS}, I_D = 250\mu\text{A}$ )	2		4	
$I_{DSS}$	Zero Gate Voltage Drain Current ( $V_{DS} = 0.8 V_{DSS}, V_{GS} = 0V$ )			25	$\mu\text{A}$
	Zero Gate Voltage Drain Current ( $V_{DS} = 0.8 V_{DSS}, V_{GS} = 0V, T_C = 125^\circ\text{C}$ )			250	
$I_{GSS}$	Gate-Source Leakage Current ( $V_{GS} = \pm 20V, V_{DS} = 0V$ )			$\pm 100$	nA
$I_{D(ON)}$	On State Drain Current <sup>②</sup> ( $V_{DS} > I_{D(ON)} \times R_{DS(ON)}$ Max, $V_{GS} = 10V$ )	12			Amps
$R_{DS(ON)}$	Drain-Source On-State Resistance <sup>②</sup> ( $V_{GS} = 10V, I_D = 8.0A$ )			0.415	Ohms
	Drain-Source On-State Resistance <sup>②</sup> ( $V_{GS} = 10V, I_D = 8.0A, T_C = 125^\circ\text{C}$ )			0.900	
	Drain-Source On-State Resistance <sup>②</sup> ( $V_{GS} = 10V, I_D = 12.0A$ )			0.515	

**CAUTION:** These Devices are Sensitive to Electrostatic Discharge. Proper Handling Procedures Should Be Followed.

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Symbol	Characteristic	Test Conditions	MIN	TYP	MAX	UNIT
C <sub>DC</sub>	Drain-to-Case Capacitance	f = 1 MHz		12	24	pF
C <sub>ISS</sub>	Input Capacitance	V <sub>GS</sub> = 0V		2410	2900	
C <sub>OSS</sub>	Output Capacitance	V <sub>DS</sub> = 25V		356	530	
C <sub>RSS</sub>	Reverse Transfer Capacitance	f = 1 MHz		125	235	
Q <sub>g</sub>	Total Gate Charge	V <sub>GS</sub> = 10V		103	150	nC
Q <sub>gs</sub>	Gate-Source Charge	V <sub>DD</sub> = 0.5 V <sub>DSS</sub>		14	21	
Q <sub>gd</sub>	Gate-Drain ("Miller") Charge	I <sub>D</sub> = I <sub>D</sub> [Cont.] @ 25°C		42	70	
t <sub>d(on)</sub>	Turn-on Delay Time	V <sub>GS</sub> = 10V		14	35	ns
t <sub>r</sub>	Rise Time	V <sub>DD</sub> = 0.5 V <sub>DSS</sub>		21	190	
t <sub>d(off)</sub>	Turn-off Delay Time	I <sub>D</sub> = I <sub>D</sub> [Cont.] @ 25°C		38	170	
t <sub>f</sub>	Fall Time	R <sub>G</sub> = 2.35Ω		12	130	

SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS

Symbol	Characteristic / Test Conditions	MIN	TYP	MAX	UNIT
I <sub>S</sub>	Continuous Source Current (Body Diode)			12	Amps
I <sub>SM</sub>	Pulsed Source Current <sup>①</sup> (Body Diode)			48	
V <sub>SD</sub>	Diode Forward Voltage <sup>②</sup> (V <sub>GS</sub> = 0V, I <sub>S</sub> = -I <sub>D</sub> [Cont.])			1.7	Volts
t <sub>rr</sub>	Reverse Recovery Time (I <sub>S</sub> = -I <sub>D</sub> [Cont.], dI <sub>S</sub> /dt = 100A/μs)		296	1600	ns
Q <sub>rr</sub>	Reverse Recovery Charge (I <sub>S</sub> = -I <sub>D</sub> [Cont.], dI <sub>S</sub> /dt = 100A/μs)		3.5	8.8	μC

THERMAL CHARACTERISTICS

Symbol	Characteristic	MIN	TYP	MAX	UNIT
R <sub>θJC</sub>	Junction to Case			0.83	K/W <sup>③</sup>
R <sub>θJA</sub>	Junction to Ambient			31	

① Repetitive Rating: Pulse width limited by maximum junction temperature. See Transient Thermal Impedance Curve. (Fig.1)

② Pulse Test: Pulse width < 380 μs, Duty Cycle < 2%

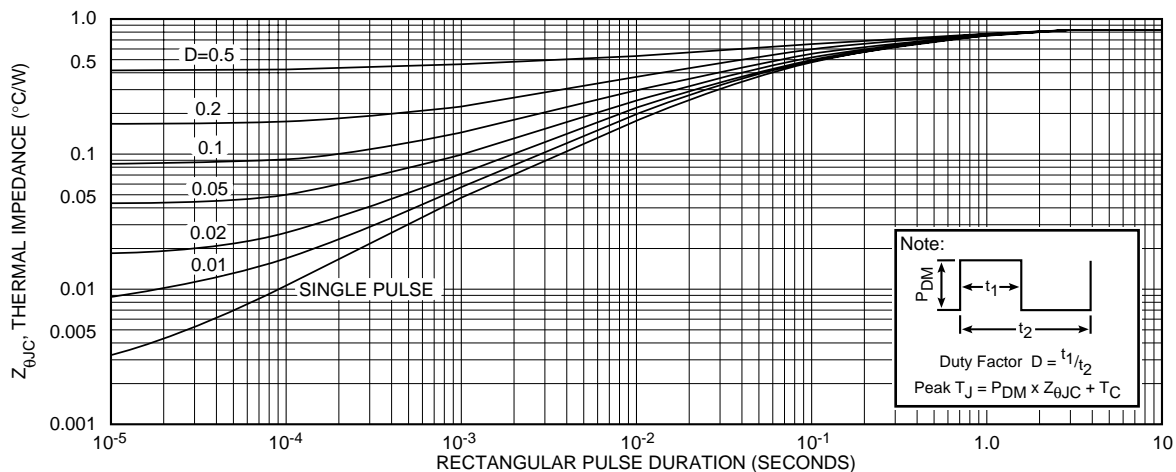
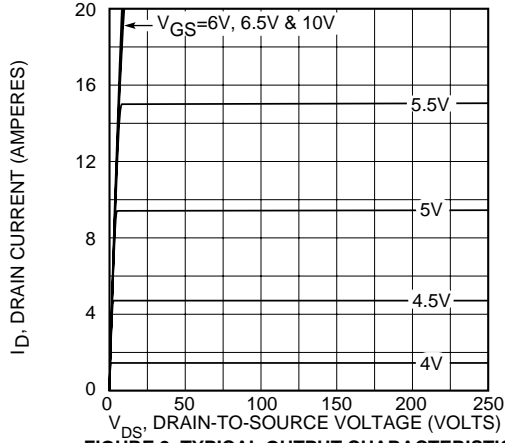
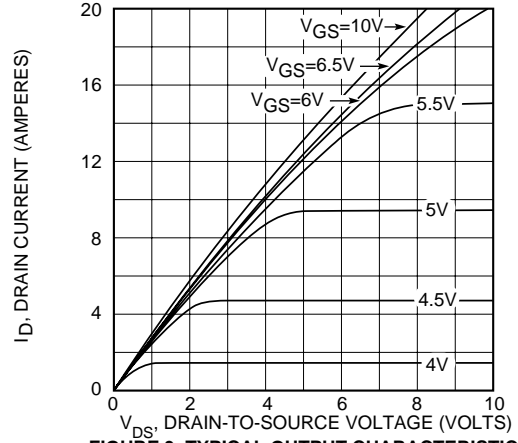


FIGURE 1, MAXIMUM EFFECTIVE TRANSIENT THERMAL IMPEDANCE, JUNCTION-TO-CASE vs PULSE DURATION

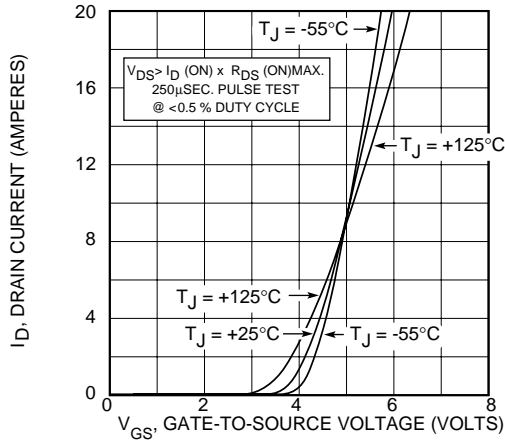
**2N7228**



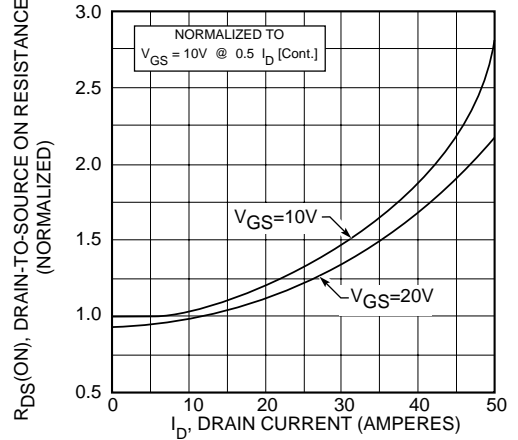
**FIGURE 2, TYPICAL OUTPUT CHARACTERISTICS**



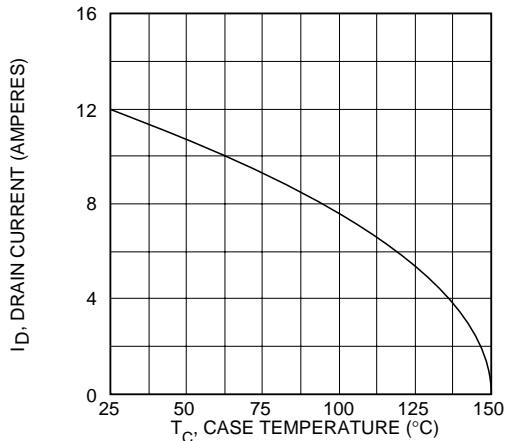
**FIGURE 3, TYPICAL OUTPUT CHARACTERISTICS**



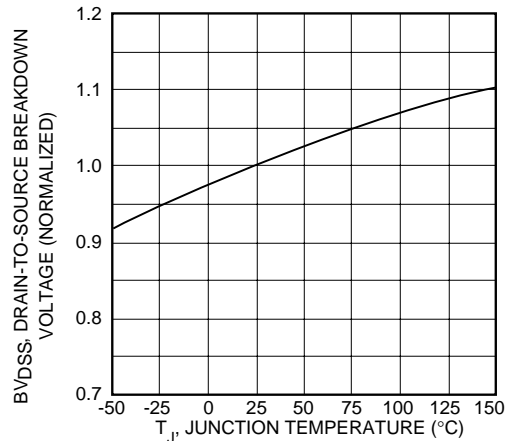
**FIGURE 4, TYPICAL TRANSFER CHARACTERISTICS**



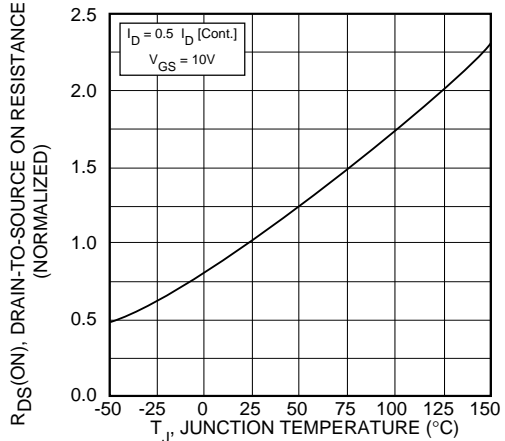
**FIGURE 5,  $R_{DS(ON)}$  vs DRAIN CURRENT**



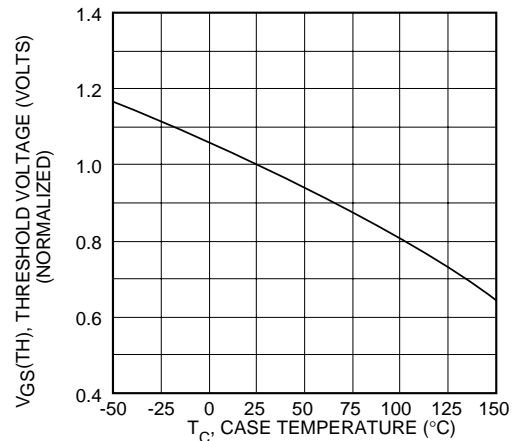
**FIGURE 6, MAXIMUM DRAIN CURRENT vs CASE TEMPERATURE**



**FIGURE 7, BREAKDOWN VOLTAGE vs TEMPERATURE**



**FIGURE 8, ON-RESISTANCE vs. TEMPERATURE**



**FIGURE 9, THRESHOLD VOLTAGE vs TEMPERATURE**

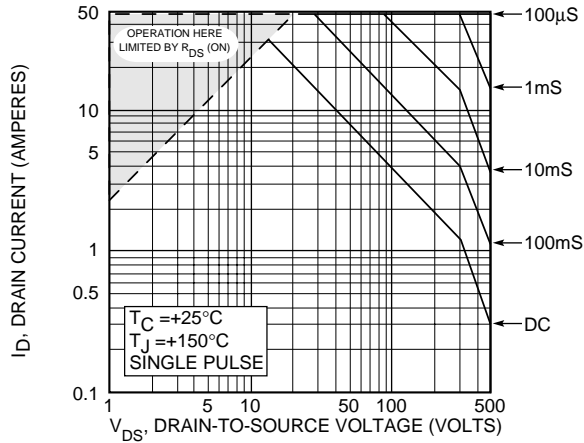


FIGURE 10, MAXIMUM SAFE OPERATING AREA

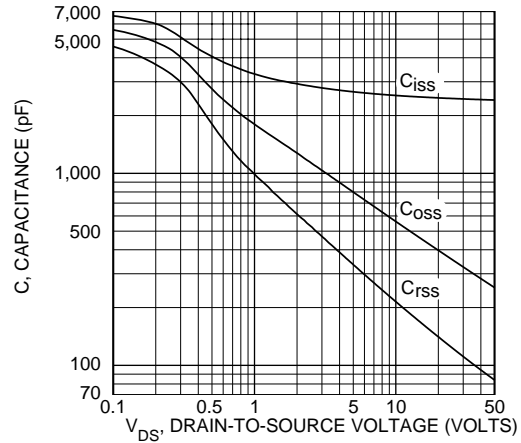


FIGURE 11, TYPICAL CAPACITANCE vs DRAIN-TO-SOURCE VOLTAGE

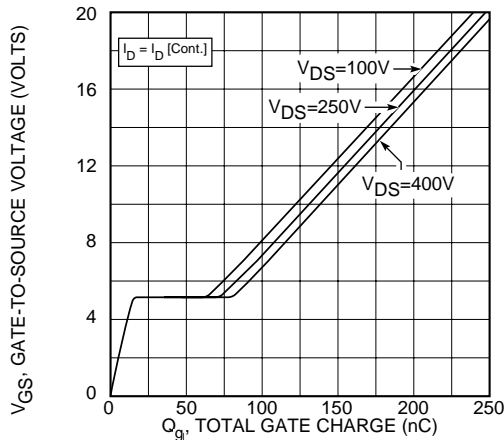


FIGURE 12, GATE CHARGES vs GATE-TO-SOURCE VOLTAGE

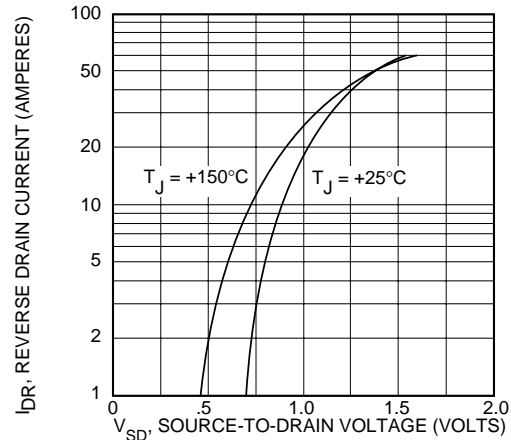
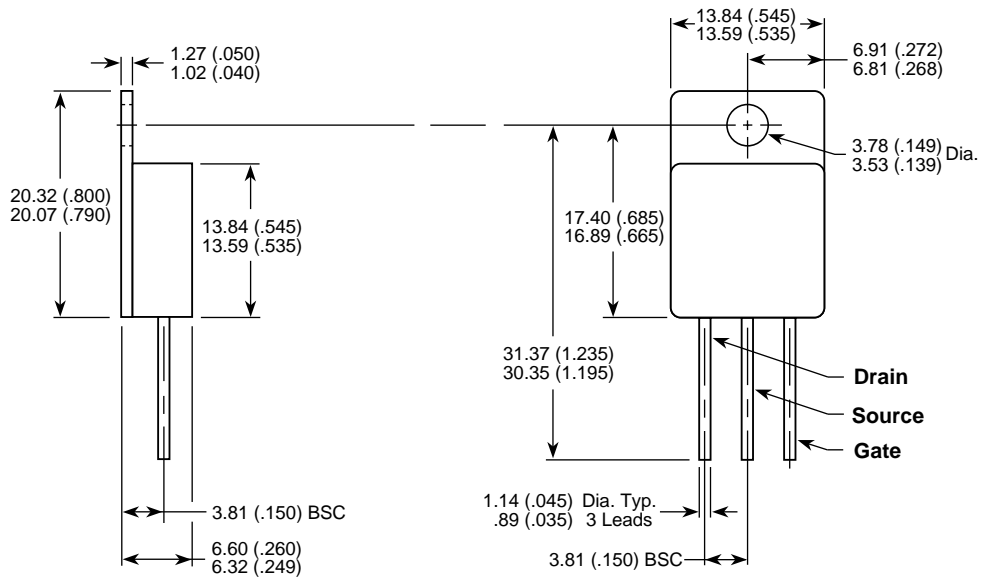


FIGURE 13, TYPICAL SOURCE-DRAIN DIODE FORWARD VOLTAGE

TO-254AA Package Outline



Dimensions in Millimeters and (Inches)