

**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 ( $V_{GS} = 0V, I_D = 250\mu A$ )                                         | 500 |     |           | Volts   |
| $V_{GS(TH)}$ | Gate Threshold Voltage ( $V_{DS} = V_{GS}, I_D = 250\mu A$ )                                             | 2   |     | 4         |         |
| $I_{DSS}$    | Zero Gate Voltage Drain Current ( $V_{DS} = 0.8 V_{DSS}, V_{GS} = 0V$ )                                  |     |     | 25        | $\mu A$ |
|              | 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> ( $V_{DS} > I_{D(ON)} \times R_{DS(ON)} \text{ Max}, V_{GS} = 10V$ ) | 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.

APT Website - <http://www.advancedpower.com>

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| Symbol       | Characteristic               | Test Conditions                                                                                                 | MIN | TYP  | MAX  | UNIT |
|--------------|------------------------------|-----------------------------------------------------------------------------------------------------------------|-----|------|------|------|
| $C_{DC}$     | Drain-to-Case Capacitance    | $f = 1 \text{ MHz}$                                                                                             |     | 12   | 24   | pF   |
| $C_{ISS}$    | Input Capacitance            | $V_{GS} = 0V$<br>$V_{DS} = 25V$<br>$f = 1 \text{ MHz}$                                                          |     | 2410 | 2900 |      |
| $C_{OSS}$    | Output Capacitance           |                                                                                                                 |     | 356  | 530  |      |
| $C_{RSS}$    | Reverse Transfer Capacitance |                                                                                                                 |     | 125  | 235  |      |
| $Q_g$        | Total Gate Charge            | $V_{GS} = 10V$<br>$V_{DD} = 0.5 V_{DSS}$<br>$I_D = I_D [\text{Cont.}] @ 25^\circ\text{C}$                       |     | 103  | 150  | nC   |
| $Q_{gs}$     | Gate-Source Charge           |                                                                                                                 |     | 14   | 21   |      |
| $Q_{gd}$     | Gate-Drain ("Miller") Charge |                                                                                                                 |     | 42   | 70   |      |
| $t_{d(on)}$  | Turn-on Delay Time           | $V_{GS} = 10V$<br>$V_{DD} = 0.5 V_{DSS}$<br>$I_D = I_D [\text{Cont.}] @ 25^\circ\text{C}$<br>$R_G = 2.35\Omega$ |     | 14   | 35   | ns   |
| $t_r$        | Rise Time                    |                                                                                                                 |     | 21   | 190  |      |
| $t_{d(off)}$ | Turn-off Delay Time          |                                                                                                                 |     | 38   | 170  |      |
| $t_f$        | Fall Time                    |                                                                                                                 |     | 12   | 130  |      |

## SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS

| Symbol   | Characteristic / Test Conditions                                                   | MIN | TYP | MAX  | UNIT    |
|----------|------------------------------------------------------------------------------------|-----|-----|------|---------|
| $I_S$    | Continuous Source Current (Body Diode)                                             |     |     | 12   | Amps    |
| $I_{SM}$ | Pulsed Source Current <sup>①</sup> (Body Diode)                                    |     |     | 48   |         |
| $V_{SD}$ | Diode Forward Voltage <sup>②</sup> ( $V_{GS} = 0V$ , $I_S = -I_D [\text{Cont.}]$ ) |     |     | 1.7  | Volts   |
| $t_{rr}$ | Reverse Recovery Time ( $I_S = -I_D [\text{Cont.}]$ , $dI_S/dt = 100A/\mu s$ )     |     | 296 | 1600 | ns      |
| $Q_{rr}$ | Reverse Recovery Charge ( $I_S = -I_D [\text{Cont.}]$ , $dI_S/dt = 100A/\mu s$ )   |     | 3.5 | 8.8  | $\mu C$ |

## THERMAL CHARACTERISTICS

| Symbol          | Characteristic      | MIN | TYP | MAX  | UNIT             |
|-----------------|---------------------|-----|-----|------|------------------|
| $R_{\theta JC}$ | Junction to Case    |     |     | 0.83 | K/W <sup>③</sup> |
| $R_{\theta JA}$ | 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  $\mu s$ , Duty Cycle < 2%

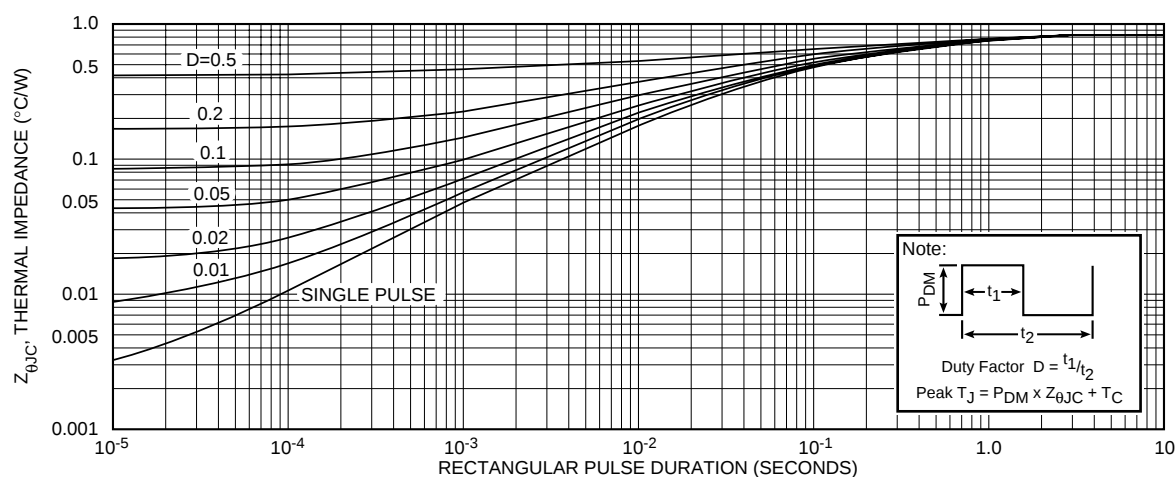


FIGURE 1, MAXIMUM EFFECTIVE TRANSIENT THERMAL IMPEDANCE, JUNCTION-TO-CASE vs PULSE DURATION

## 2N7228

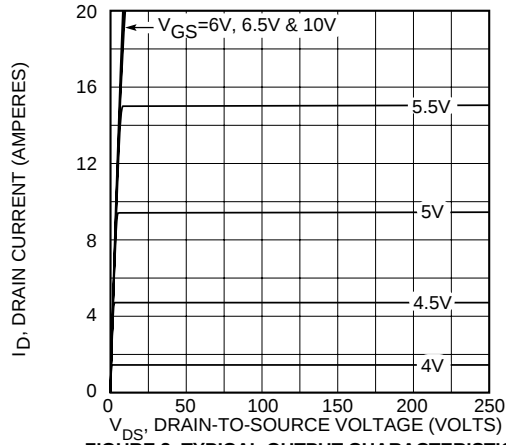


FIGURE 2, TYPICAL OUTPUT CHARACTERISTICS

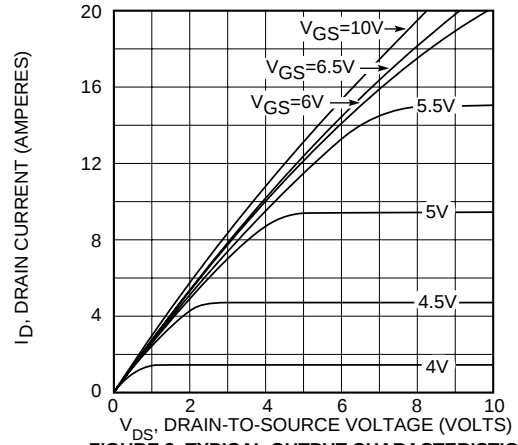


FIGURE 3, TYPICAL OUTPUT CHARACTERISTICS

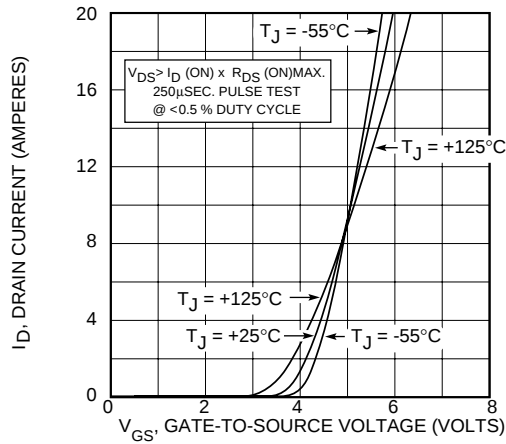


FIGURE 4, TYPICAL TRANSFER CHARACTERISTICS

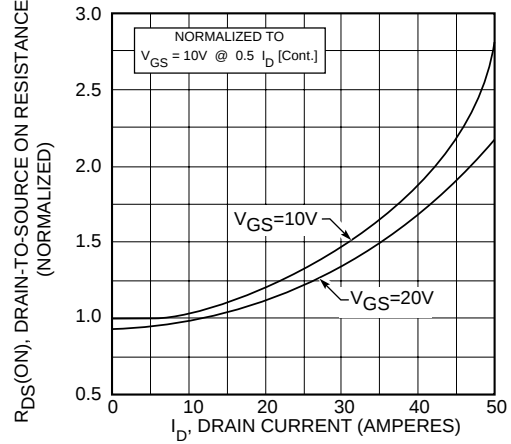


FIGURE 5,  $R_{DS(ON)}$  vs DRAIN CURRENT

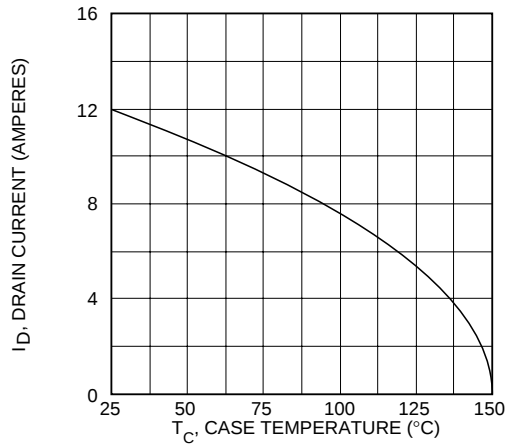


FIGURE 6, MAXIMUM DRAIN CURRENT vs CASE TEMPERATURE

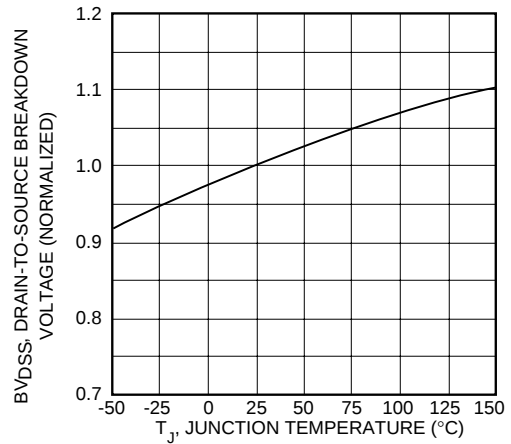


FIGURE 7, BREAKDOWN VOLTAGE vs TEMPERATURE

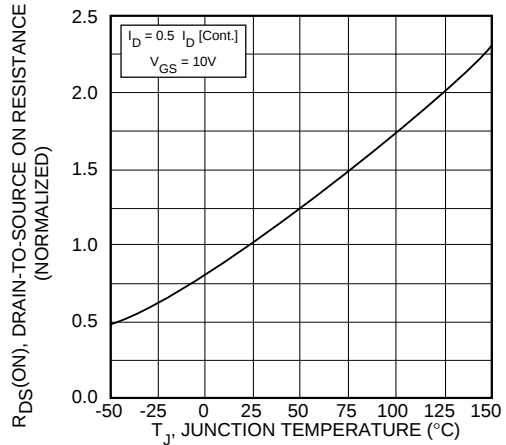


FIGURE 8, ON-RESISTANCE vs. TEMPERATURE

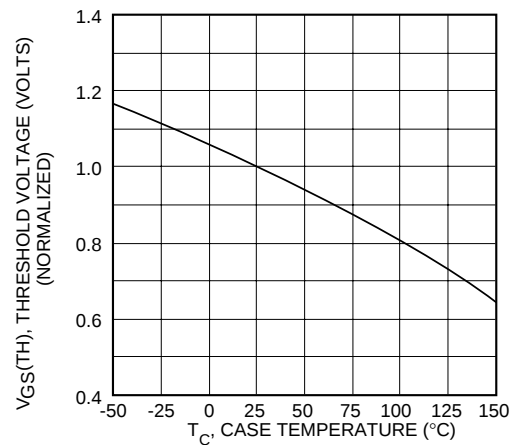
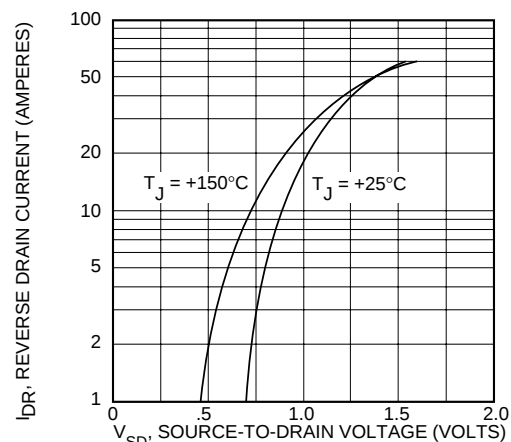
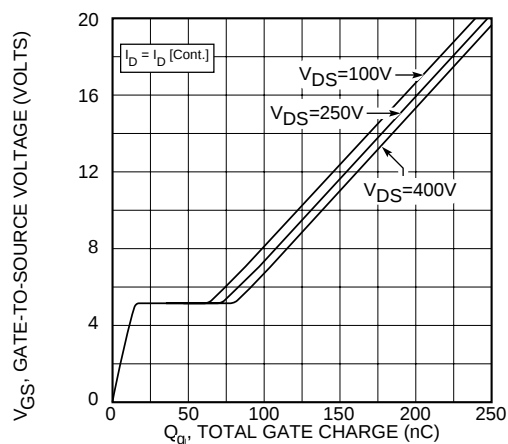
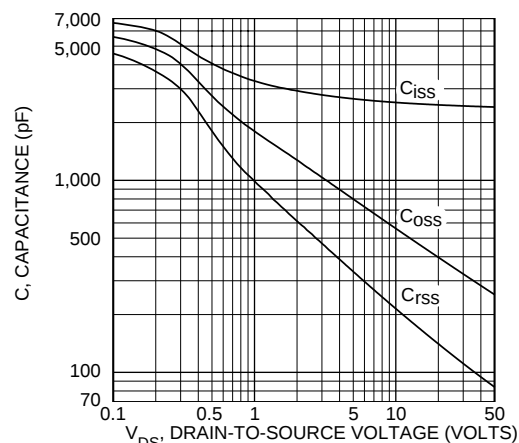
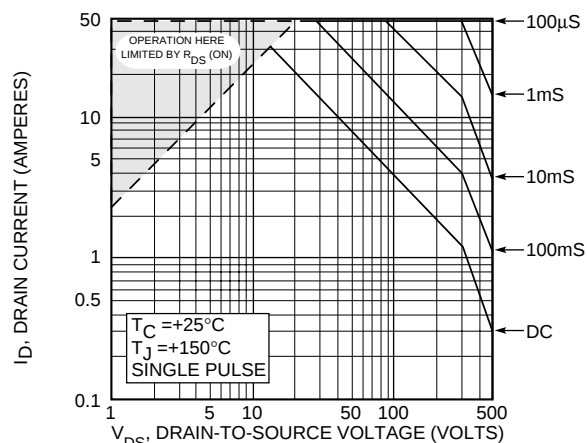


FIGURE 9, THRESHOLD VOLTAGE vs TEMPERATURE



Dimensions in Millimeters and (Inches)