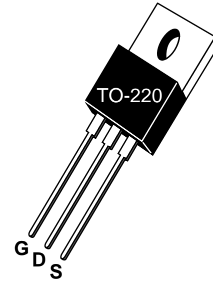
# APT11N80KC3

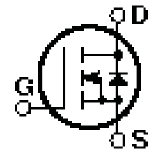
## 800V 11A 0.450Ω

Microsemi POWER PRODUCTS GROUP

## Super Junction MOSFET




- Ultra Low $R_{DS(ON)}$
- Low Miller Capacitance
- Ultra Low Gate Charge, $Q_g$
- Avalanche Energy Rated
- Extreme $^{dv}/_{dt}$ Rated




### MAXIMUM RATINGS

All Ratings: $T_C$ = 25°C unless otherwise specified.

| Symbol | Parameter | APT11N80KC3 | UNIT |
|---|---|---|---|
| $V_{DSS}$ | Drain-Source Voltage | 800 | Volts |
| $I_D$ | Continuous Drain Current @ $T_C$ = 25°C | 11 | Amps |
| $I_{DM}$ | Pulsed Drain Current ① | 33 | |
| $V_{GS}$ | Gate-Source Voltage Continuous | ±20 | Volts |
| $V_{GSM}$ | Gate-Source Voltage Transient | ±30 | |
| $P_D$ | Total Power Dissipation @ $T_C$ = 25°C | 156 | Watts |
| | Linear Derating Factor | 1.25 | W/°C |
| $T_J$,$T_{STG}$ | Operating and Storage Junction Temperature Range | -55 to 150 | °C |
| $T_L$ | Lead Temperature: 0.063" from Case for 10 Sec. | 260 | |
| $^{dv}/_{dt}$ | Drain-Source Voltage slope ($V_{DS}$ = 640V, $I_D$ = 11A, $T_J$ = 125°C) | 50 | V/ns |
| $I_{AR}$ | Repetitive Avalanche Current ⑦ | 11 | Amps |
| $E_{AR}$ | Repetitive Avalanche Energy ⑦ | 0.2 | mJ |
| $E_{AS}$ | Single Pulse Avalanche Energy ④ | 470 | |

### STATIC ELECTRICAL CHARACTERISTICS

| Symbol | Characteristic / Test Conditions | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|
| $BV_{DSS}$ | Drain-Source Breakdown Voltage ($V_{GS}$ = 0V, $I_D$ = 250µA) | 800 | | | Volts |
| $R_{DS(on)}$ | Drain-Source On-State Resistance ② ($V_{GS}$ = 10V, $I_D$ = 7.1A) | | 0.39 | 0.45 | Ohms |
| $I_{DSS}$ | Zero Gate Voltage Drain Current ($V_{DS}$ = 800, $V_{GS}$ = 0V) | | 0.5 | 20 | µA |
| | Zero Gate Voltage Drain Current ($V_{DS}$ = 800, $V_{GS}$ = 0V, $T_J$ = 150°C) | | | 200 | |
| $I_{GSS}$ | Gate-Source Leakage Current ($V_{GS}$ = ±20V, $V_{DS}$ = 0V) | | | ±100 | nA |
| $V_{GS(th)}$ | Gate Threshold Voltage ($V_{DS}$ = $V_{GS}$, $I_D$ = 680µA) | 2.1 | 3 | 3.9 | Volts |

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 |
|---|---|---|---|---|---|---|
| $C_{iss}$ | Input Capacitance | $V_{GS}$ = 0V<br>$V_{DS}$ = 25V<br>f = 1 MHz | | 1585 | | pF |
| $C_{oss}$ | Output Capacitance | | | 770 | | |
| $C_{rss}$ | Reverse Transfer Capacitance | | | 18 | | |
| $Q_g$ | Total Gate Charge ③ | $V_{GS}$ = 10V<br>$V_{DD}$ = 400V<br>$I_D$ = 11A @ 25°C | | 60 | | nC |
| $Q_{gs}$ | Gate-Source Charge | | | 8 | | |
| $Q_{gd}$ | Gate-Drain ("Miller") Charge | | | 30 | | |
| $t_{d(on)}$ | Turn-on Delay Time | **RESISTIVE SWITCHING**<br>$V_{GS}$ = 10V<br>$V_{DD}$ = 400V<br>$I_D$ = 11A @ 25°C<br>$R_G$ = 7.5Ω | | 25 | | ns |
| $t_r$ | Rise Time | | | 15 | | |
| $t_{d(off)}$ | Turn-off Delay Time | | | 70 | 80 | |
| $t_f$ | Fall Time | | | 7 | 10 | |
| $E_{on}$ | Turn-on Switching Energy ⑥ | **INDUCTIVE SWITCHING @ 25°C**<br>$V_{DD}$ = 533V, $V_{GS}$ = 15V<br>$I_D$ = 11A, $R_G$ = 5Ω | | 165 | | μJ |
| $E_{off}$ | Turn-off Switching Energy | | | 50 | | |
| $E_{on}$ | Turn-on Switching Energy ⑥ | **INDUCTIVE SWITCHING @ 125°C**<br>$V_{DD}$ = 533V $V_{GS}$ = 15V<br>$I_D$ = 11A, $R_G$ = 5Ω | | 305 | | |
| $E_{off}$ | Turn-off Switching Energy | | | 65 | | |

## SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS

| Symbol | Characteristic / Test Conditions | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|
| $I_S$ | Continuous Source Current (Body Diode) | | | 11 | Amps |
| $I_{SM}$ | Pulsed Source Current ① (Body Diode) | | | 33 | |
| $V_{SD}$ | Diode Forward Voltage ② ($V_{GS}$ = 0V, $I_S$ = -11A) | | 1 | 1.2 | Volts |
| $t_{rr}$ | Reverse Recovery Time ($I_S$ = 11A, $dI_S/dt$ = -100A/μs, $V_R$ = 640V) | | 550 | | ns |
| $Q_{rr}$ | Reverse Recovery Charge ($I_S$ = 11A, $dI_S/dt$ = -100A/μs, $V_R$ = 640V) | | 10 | | μC |
| $dv/dt$ | Peak Diode Recovery $dv/dt$ ⑤ | | | 6 | V/ns |

## THERMAL CHARACTERISTICS

| Symbol | Characteristic | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|
| $R_{\theta JC}$ | Junction to Case | | | 0.80 | °C/W |
| $R_{\theta JA}$ | Junction to Ambient | | | 62 | |

① Repetitive Rating: Pulse width limited by maximum junction temperature
② Pulse Test: Pulse width < 380 μs, Duty Cycle < 2%
③ See MIL-STD-750 Method 3471
④ Starting $T_j$ = +25°C, L = 194mH, $R_G$ = 25Ω, Peak $I_L$ = 2.2A
⑤ $dv/dt$ numbers reflect the limitations of the test circuit rather than the device itself. $I_S \leq -I_D$ 11A $di/dt \leq$ 700A/μs $V_R \leq V_{DSS}$ $T_J \leq$150°C
⑥ Eon includes diode reverse recovery. See figures 18, 20.
⑦ Repetitve avalanche causes additional power losses that can be calculated as $P_{AV} = E_{AR} * f$

Microsemi Reserves the right to change, without notice, the specifications and information contained

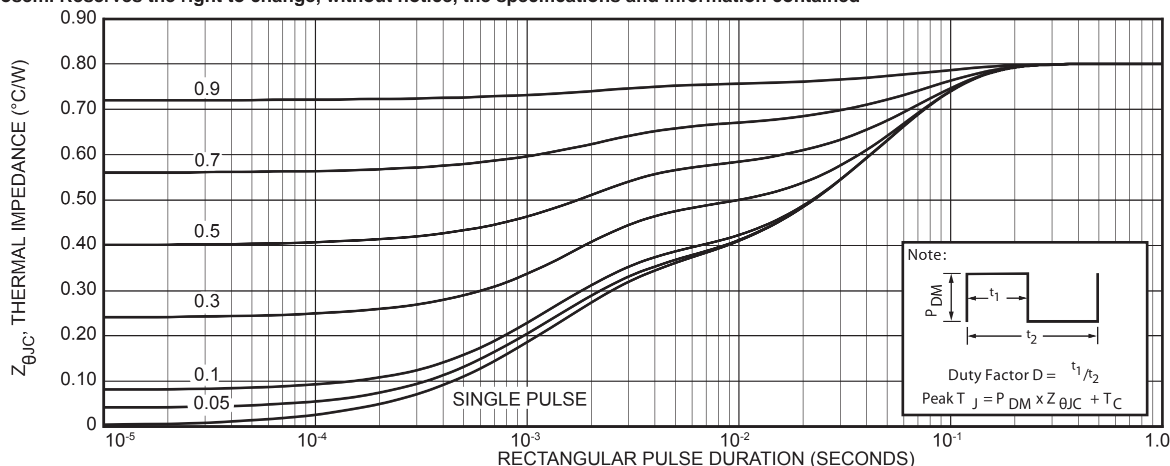



FIGURE 1, MAXIMUM EFFECTIVE TRANSIENT THERMAL IMPEDANCE, JUNCTION-TO-CASE vs PULSE DURATION

FIGURE 2, NOT USED

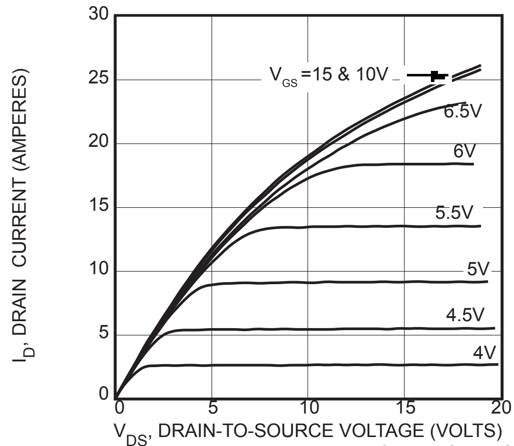



FIGURE 3, LOW VOLTAGE OUTPUT CHARACTERISTICS

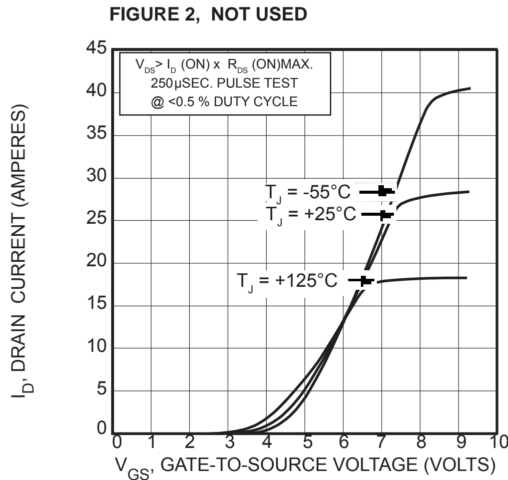



FIGURE 4, TRANSFER CHARACTERISTICS

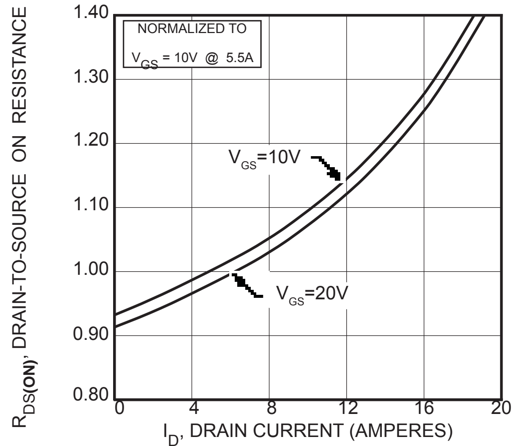



FIGURE 5, $R_{DS(ON)}$ vs DRAIN CURRENT

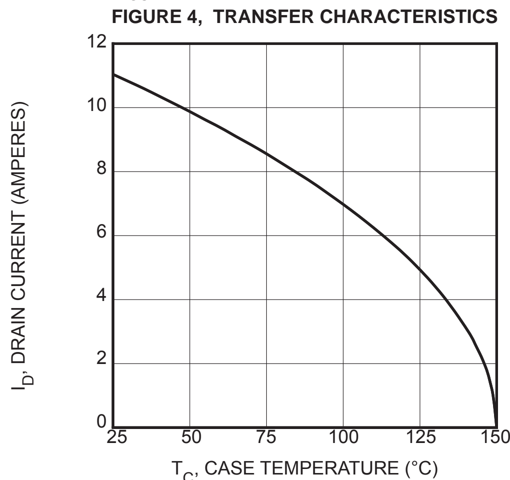



FIGURE 6, MAXIMUM DRAIN CURRENT vs CASE TEMPERATURE

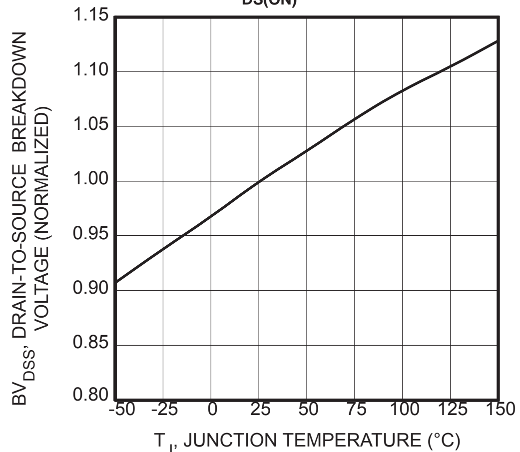



FIGURE 7, BREAKDOWN VOLTAGE vs TEMPERATURE

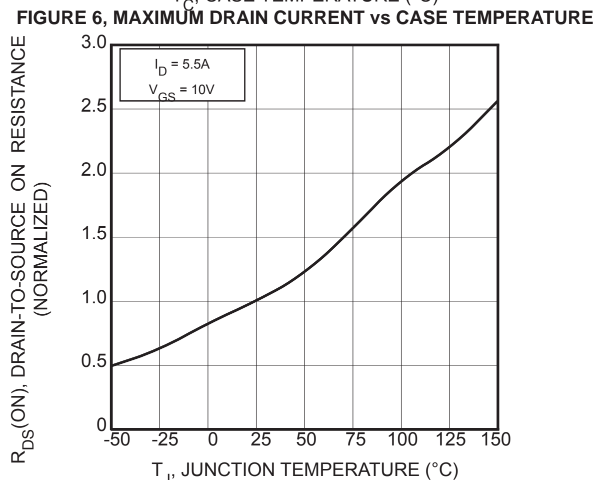



FIGURE 8, ON-RESISTANCE vs. TEMPERATURE

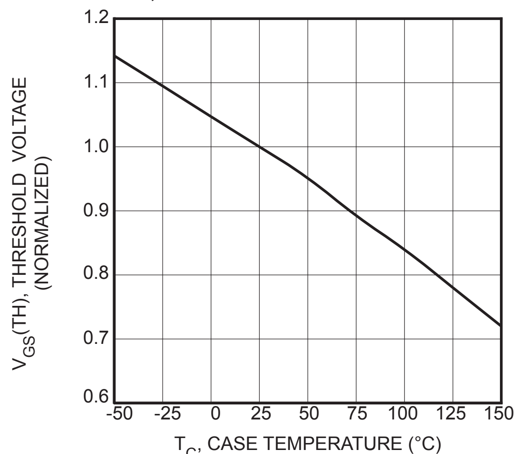



FIGURE 9, THRESHOLD VOLTAGE vs TEMPERATURE

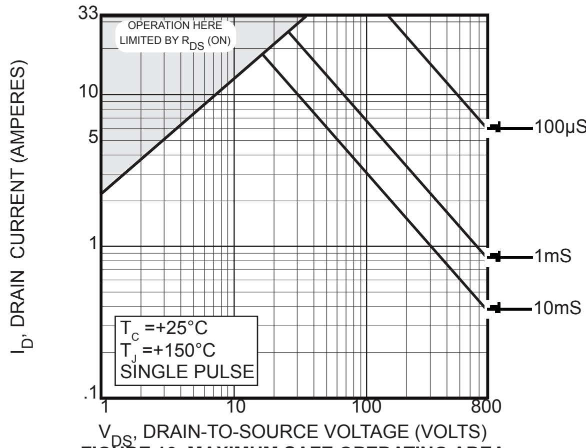



**FIGURE 10, MAXIMUM SAFE OPERATING AREA**

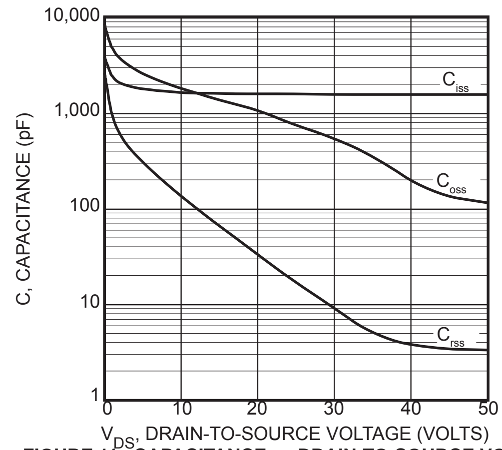



**FIGURE 11, CAPACITANCE vs DRAIN-TO-SOURCE VOLTAGE**

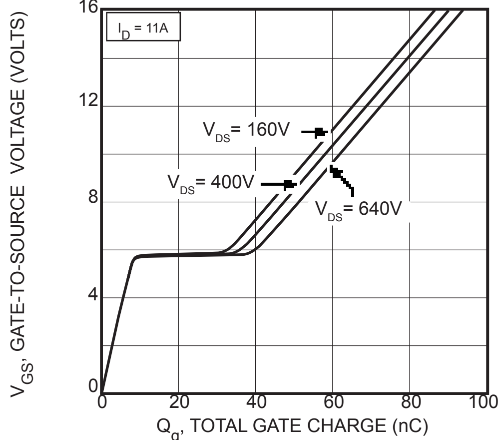



**FIGURE 12, GATE CHARGES vs GATE-TO-SOURCE VOLTAGE**

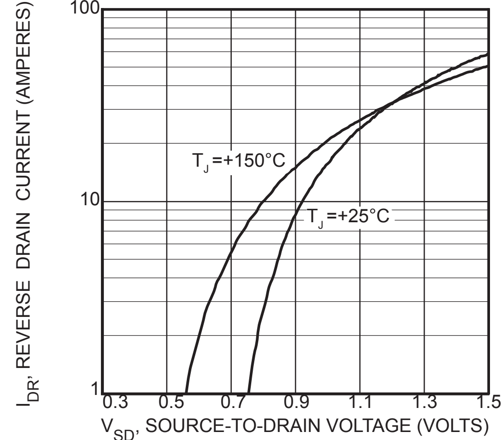



**FIGURE 13, SOURCE-DRAIN DIODE FORWARD VOLTAGE**

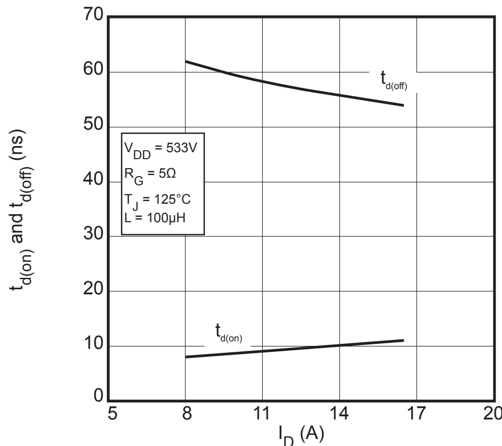



**FIGURE 14, DELAY TIMES vs CURRENT**

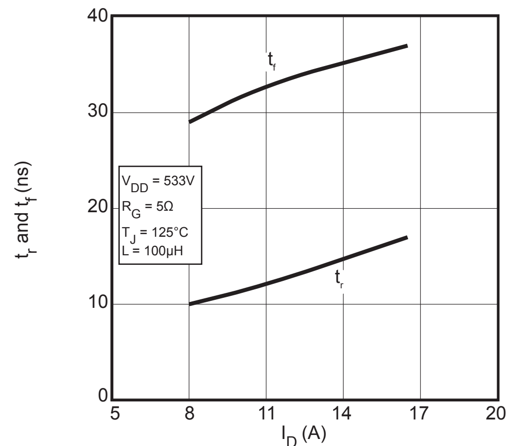



**FIGURE 15, RISE AND FALL TIMES vs CURRENT**

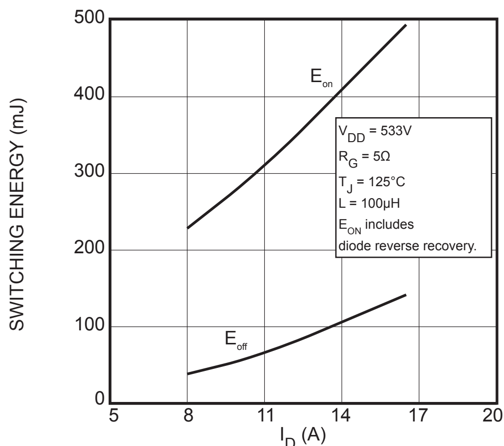



**FIGURE 16, SWITCHING ENERGY vs CURRENT**

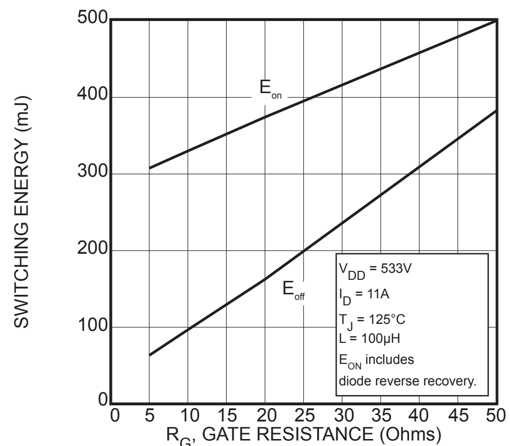
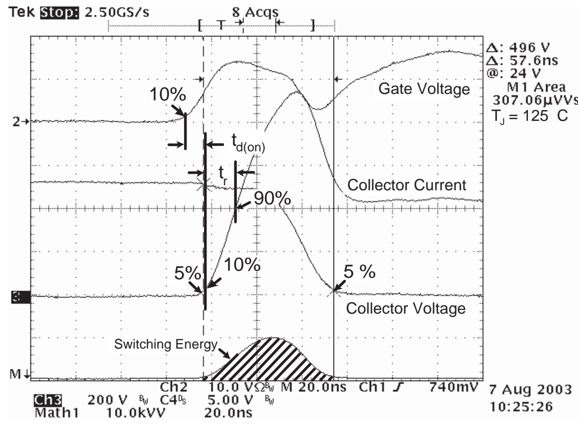
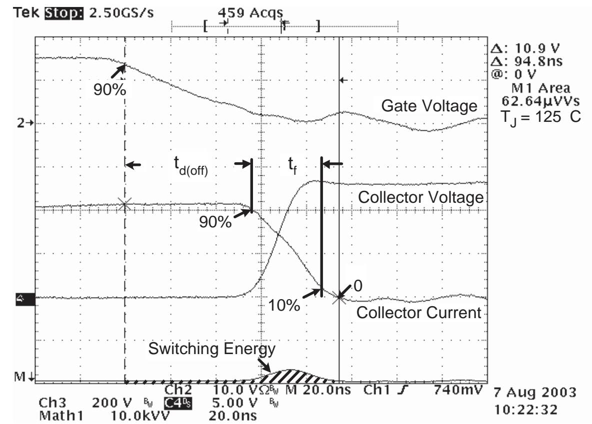



**FIGURE 17, SWITCHING ENERGY VS. GATE RESISTANCE**



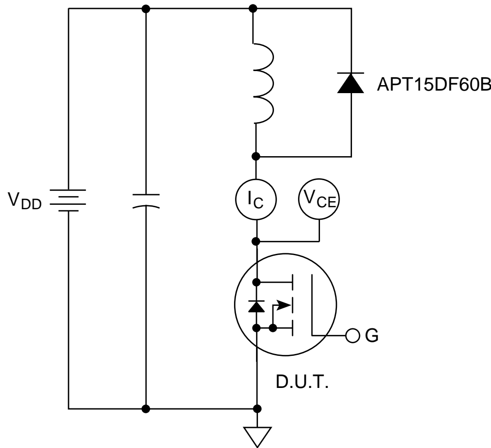
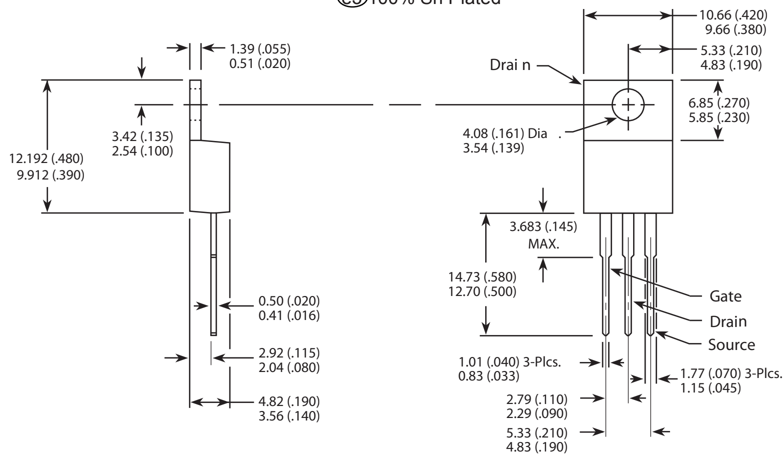




**Figure 20, Inductive Switching Test Circuit**

## TO-220 (K) Package Outline

e3 100% Sn Plated




Dimensions in Millimeters and (Inches)