Chipsmall Limited consists of a professional team with an average of over 10 year of expertise in the distribution of electronic components. Based in Hongkong, we have already established firm and mutual-benefit business relationships with customers from,Europe,America and south Asia,supplying obsolete and hard-to-find components to meet their specific needs.

With the principle of “Quality Parts,Customers Priority,Honest Operation,and Considerate Service”,our business mainly focus on the distribution of electronic components. Line cards we deal with include Microchip,ALPS,ROHM,Xilinx,Pulse,ON,Everlight and Freescale. Main products comprise IC,Modules,Potentiometer,IC Socket,Relay,Connector.Our parts cover such applications as commercial,industrial, and automotives areas.

We are looking forward to setting up business relationship with you and hope to provide you with the best service and solution. Let us make a better world for our industry!


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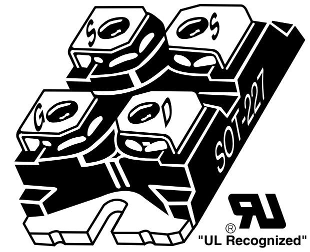
Microsemi
POWER PRODUCTS GROUP

# APT31N80JC3

**800V 31A 0.145Ω**

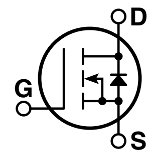
## Super Junction MOSFET




ISOTOP®

COOLMOS Power Semiconductors

- **Ultra low $R_{DS(ON)}$**
- **Ultra Low Gate Charge, $Q_g$**
- **Popular SOT-227 Package**
- **Low Miller Capacitance**
- **Avalanche Energy Rated**
- **N-Channel Enhancement Mode**




Unless stated otherwise, Microsemi discrete MOSFETs contain a single MOSFET die. This device is made with two parallel MOSFET die. It is intended for switch-mode operation. It is not suitable for linear mode operation.

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

| Symbol | Parameter | APT31N80JC3 | UNIT |
|---|---|---|---|
| $V_{DSS}$ | Drain-Source Voltage | 800 | Volts |
| $I_D$ | Continuous Drain Current @ $T_C$ = 25°C | 31 | Amps |
| $I_{DM}$ | Pulsed Drain Current ① | 93 | |
| $V_{GS}$ | Gate-Source Voltage Continuous | ±20 | Volts |
| $V_{GSM}$ | Gate-Source Voltage Transient | ±30 | |
| $P_D$ | Total Power Dissipation @ $T_C$ = 25°C | 833 | Watts |
| | Linear Derating Factor | 6.67 | 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. | 300 | |
| $^{dv}/_{dt}$ | Drain-Source Voltage slope ($V_{DS}$ = 640V, $I_D$ = 31A, $T_J$ = 125°C) | 50 | V/ns |
| $I_{AR}$ | Repetitive Avalanche Current ⑦ | 17 | Amps |
| $E_{AR}$ | Repetitive Avalanche Energy ⑦ | 0.5 | mJ |
| $E_{AS}$ | Single Pulse Avalanche Energy ④ | 670 | |

**STATIC ELECTRICAL CHARACTERISTICS**

| Symbol | Characteristic / Test Conditions | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|
| $BV_{DSS}$ | Drain-Source Breakdown Voltage ($V_{GS}$ = 0V, $I_D$ = 500μA) | 800 | | | Volts |
| $R_{DS(on)}$ | Drain-Source On-State Resistance ② ($V_{GS}$ = 10V, $I_D$ = 22A) | | 0.125 | 0.145 | Ohms |
| $I_{DSS}$ | Zero Gate Voltage Drain Current ($V_{DS}$ = 800V, $V_{GS}$ = 0V) | | 0.5 | 25 | μA |
| | Zero Gate Voltage Drain Current ($V_{DS}$ = 800V, $V_{GS}$ = 0V, $T_J$ = 150°C) | | | 250 | |
| $I_{GSS}$ | Gate-Source Leakage Current ($V_{GS}$ = ±20V, $V_{DS}$ = 0V) | | | ±200 | nA |
| $V_{GS(th)}$ | Gate Threshold Voltage ($V_{DS}$ = $V_{GS}$, $I_D$ = 2mA) | 2.10 | 3 | 3.9 | Volts |

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

*Microsemi Website - http://www.microsemi.com*

**"COOLMOS™ comprise a new family of transistors developed by Infineon Technologies AG. "COOLMOS" is a trademark of Infineon Technologies AG"**

050-7143 Rev E 6-2006

## DYNAMIC CHARACTERISTICS

| Symbol | Characteristic | Test Conditions | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|
| $C_{iss}$ | Input Capacitance | $V_{GS} = 0V$<br>$V_{DS} = 25V$<br>f = 1 MHz | | 4510 | | pF |
| $C_{oss}$ | Output Capacitance | | | 2050 | | |
| $C_{rss}$ | Reverse Transfer Capacitance | | | 110 | | |
| $Q_g$ | Total Gate Charge ③ | $V_{GS} = 10V$<br>$V_{DD} = 400V$<br>$I_D = 31A$ @ 25°C | | 180 | 355 | nC |
| $Q_{gs}$ | Gate-Source Charge | | | 22 | | |
| $Q_{gd}$ | Gate-Drain ("Miller") Charge | | | 90 | | |
| $t_{d(on)}$ | Turn-on Delay Time | **RESISTIVE SWITCHING**<br>$V_{GS} = 10V$<br>$V_{DD} = 400V$<br>$I_D = 31A$ @ 125°C<br>$R_G = 2.5\Omega$ | | 25 | | ns |
| $t_r$ | Rise Time | | | 15 | | |
| $t_{d(off)}$ | Turn-off Delay Time | | | 70 | 80 | |
| $t_f$ | Fall Time | | | 6 | 9 | |
| $E_{on}$ | Turn-on Switching Energy ⑥ | **INDUCTIVE SWITCHING @ 25°C**<br>$V_{DD} = 533V$, $V_{GS} = 15V$<br>$I_D = 31A$, $R_G = 5\Omega$ | | 615 | | µJ |
| $E_{off}$ | Turn-off Switching Energy | | | 530 | | |
| $E_{on}$ | Turn-on Switching Energy ⑥ | **INDUCTIVE SWITCHING @ 125°C**<br>$V_{DD} = 533V$, $V_{GS} = 15V$<br>$I_D = 31A$, $R_G = 5\Omega$ | | 1025 | | |
| $E_{off}$ | Turn-off Switching Energy | | | 580 | | |

## SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS

| Symbol | Characteristic / Test Conditions | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|
| $I_S$ | Continuous Source Current (Body Diode) | | | 31 | Amps |
| $I_{SM}$ | Pulsed Source Current ① (Body Diode) | | | 93 | |
| $V_{SD}$ | Diode Forward Voltage ② ($V_{GS} = 0V$, $I_S = -31A$) | | 1 | 1.2 | Volts |
| $t_{rr}$ | Reverse Recovery Time ($I_S = -31A$, $dI_S/dt = 100A/\mu s$, $V_R = 400V$) | | 855 | | ns |
| $Q_{rr}$ | Reverse Recovery Charge ($I_S = -31A$, $dI_S/dt = 100A/\mu s$, $V_R = 400V$) | | 30 | | 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 | | | 0.37 | °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 = 115.92mH, $R_G = 25\Omega$, Peak $I_L = 3.4A$
⑤ $I_S = -31A$ $di/dt = 100A/\mu s$ $V_R = 480V$ $T_J = 125°C$
⑥ Eon includes diode reverse recovery. See figures 18, 20.
⑦ Repetitve avalanche causes additional power losses that can be calculated as $P_{AV}=E_{AR}*f$



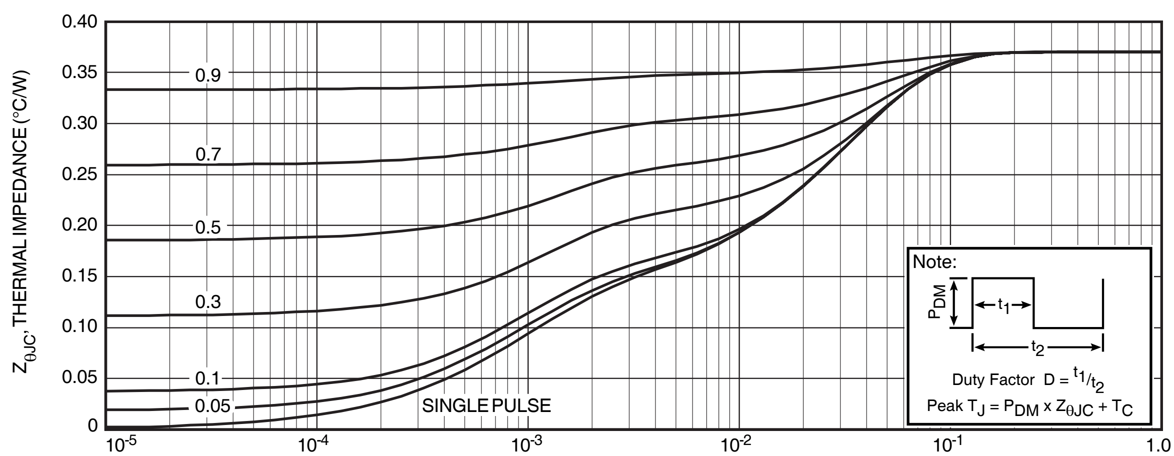



**FIGURE 1, MAXIMUM EFFECTIVE TRANSIENT THERMAL IMPEDANCE, JUNCTION-TO-CASE vs PULSE DURATION**

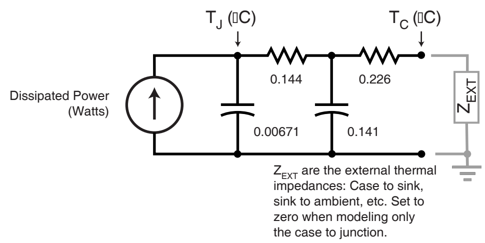



**FIGURE 2, TRANSIENT THERMAL IMPEDANCE MODEL**

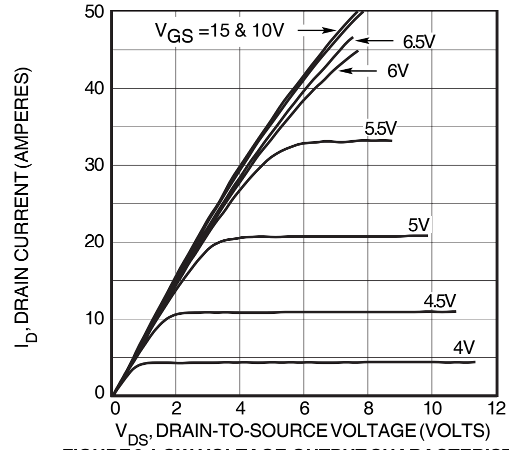



**FIGURE 3, LOW VOLTAGE OUTPUT CHARACTERISTICS**

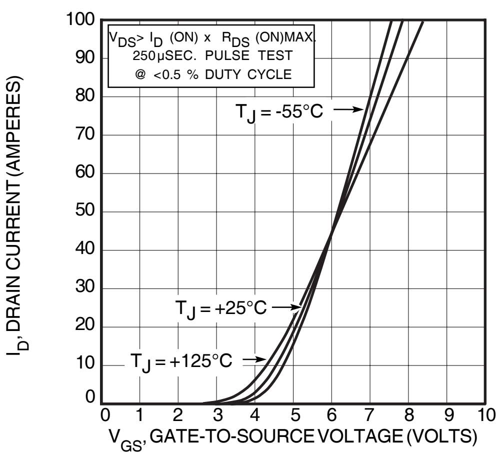



**FIGURE 4, TRANSFER CHARACTERISTICS**

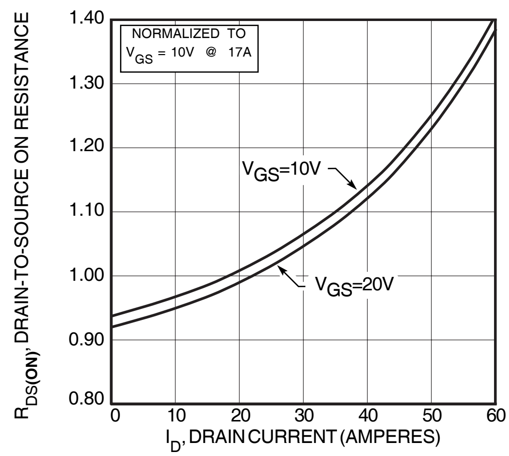



**FIGURE 5, $R_{DS(ON)}$ vs DRAIN CURRENT**

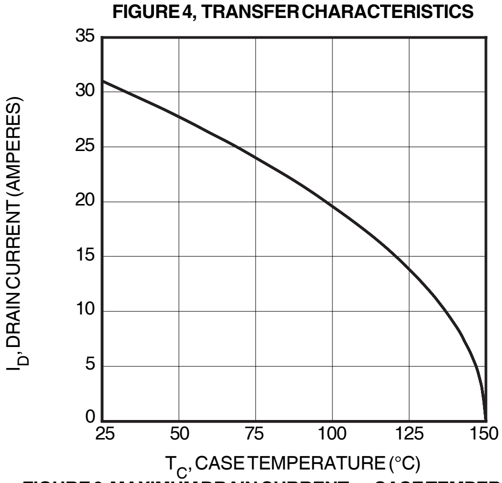



**FIGURE 6, MAXIMUM DRAIN CURRENT vs CASE TEMPERATURE**

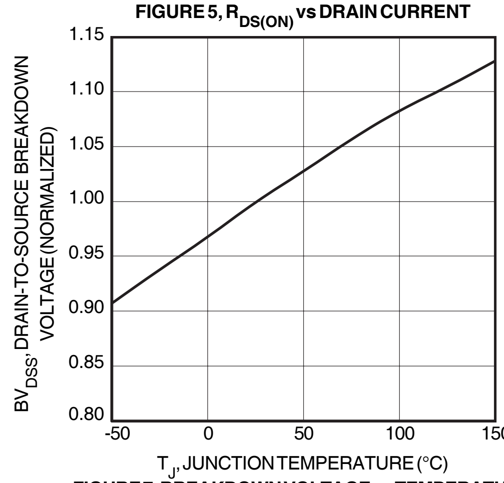



**FIGURE 7, BREAKDOWN VOLTAGE vs TEMPERATURE**

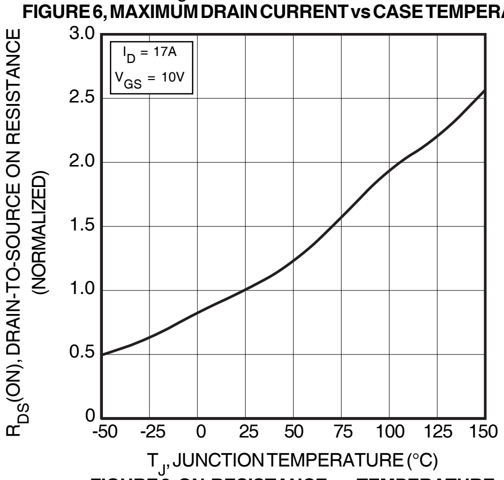



**FIGURE 8, ON-RESISTANCE vs. TEMPERATURE**

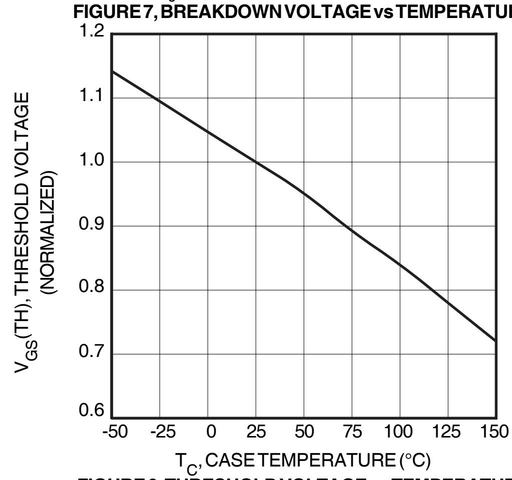



**FIGURE 9, THRESHOLD VOLTAGE vs TEMPERATURE**

$I_D$, DRAIN CURRENT (AMPERES)

Graph removed

$V_{DS}$, DRAIN-TO-SOURCE VOLTAGE (VOLTS)

**FIGURE 10, MAXIMUM SAFE OPERATING AREA**

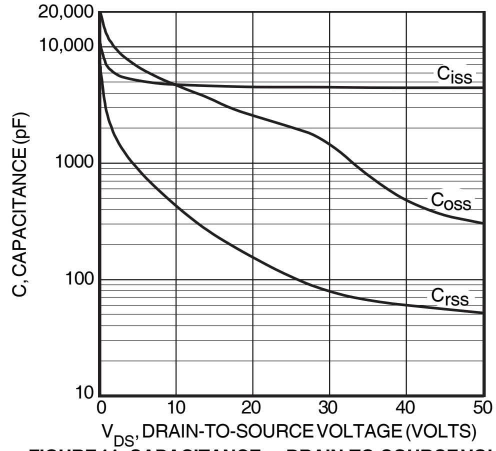



**FIGURE 11, CAPACITANCE vs DRAIN-TO-SOURCE VOLTAGE**

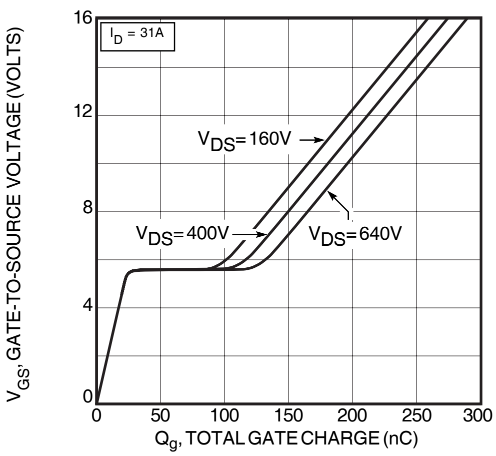



**FIGURE 12, GATE CHARGES vs GATE-TO-SOURCE VOLTAGE**

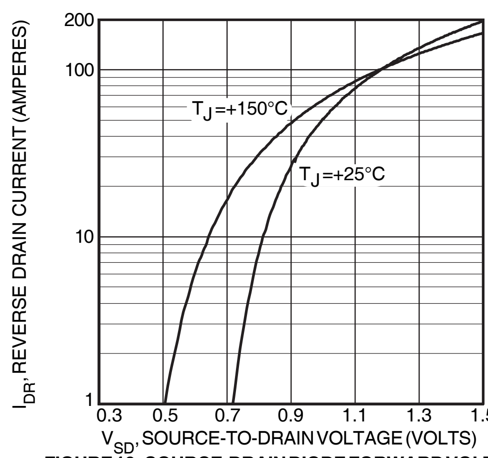



**FIGURE 13, SOURCE-DRAIN DIODE FORWARD VOLTAGE**

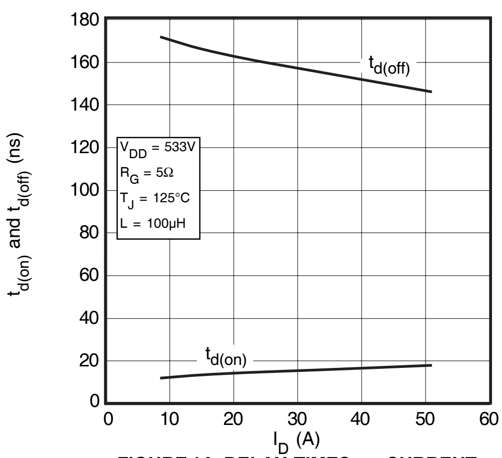



**FIGURE 14, DELAY TIMES vs CURRENT**

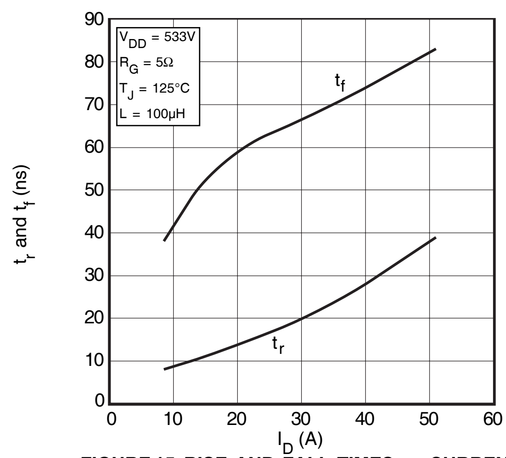



**FIGURE 15, RISE AND FALL TIMES vs CURRENT**

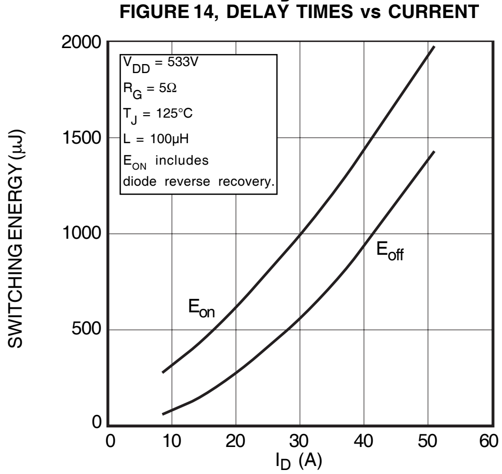



**FIGURE 16, SWITCHING ENERGY vs CURRENT**

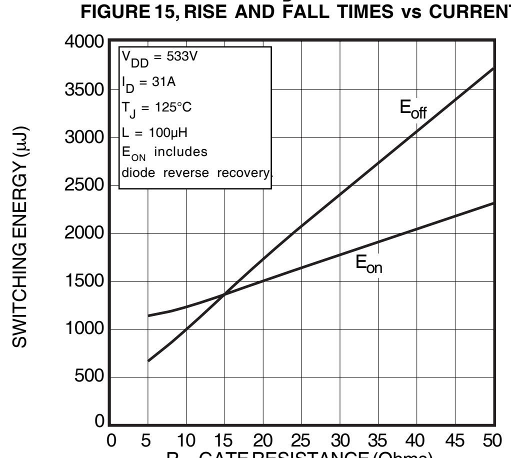



**FIGURE 17, SWITCHING ENERGY VS. GATE RESISTANCE**

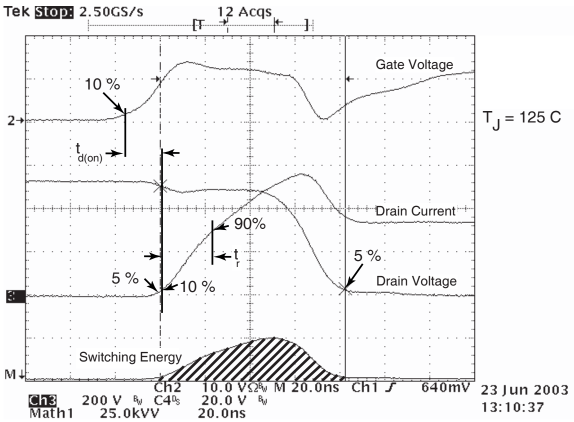



**Figure 18, Turn-on Switching Waveforms and Definitions**

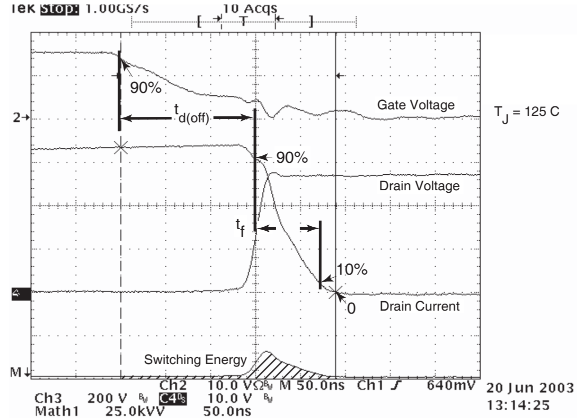



**Figure 19, Turn-off Switching Waveforms and Definitions**

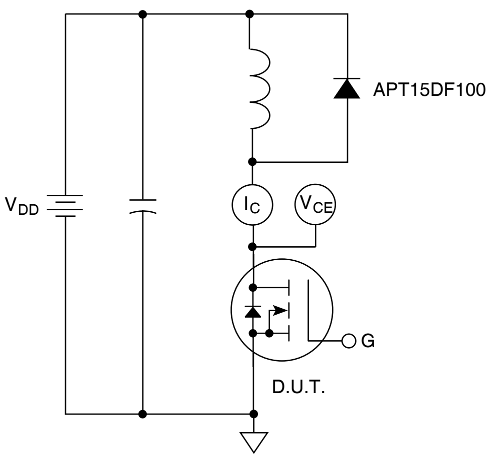
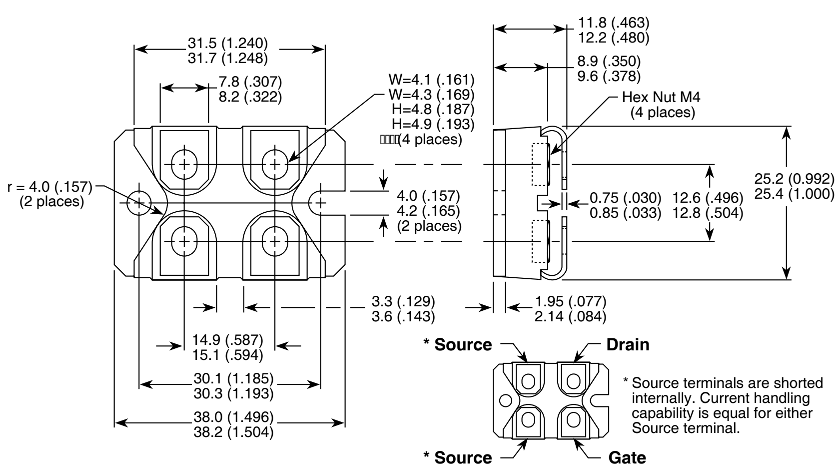



**Figure 20, Inductive Switching Test Circuit**

## SOT-227 (ISOTOP®) Package Outline




Dimensions in Millimeters and (Inches)

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