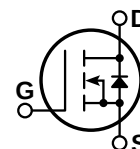


### POWER MOS 7® MOSFET

Power MOS 7® is a new generation of low loss, high voltage, N-Channel enhancement mode power MOSFETS. Both conduction and switching losses are addressed with Power MOS 7® by significantly lowering  $R_{DS(ON)}$  and  $Q_g$ . Power MOS 7® combines lower conduction and switching losses along with exceptionally fast switching speeds inherent with APT's patented metal gate structure.



- Lower Input Capacitance
- Lower Miller Capacitance
- Lower Gate Charge,  $Q_g$
- Increased Power Dissipation
- Easier To Drive
- Popular SOT-227 Package



#### MAXIMUM RATINGS

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

| Symbol         | Parameter                                                      | APT60M60JLL | UNIT                |
|----------------|----------------------------------------------------------------|-------------|---------------------|
| $V_{DSS}$      | Drain-Source Voltage                                           | 600         | Volts               |
| $I_D$          | Continuous Drain Current @ $T_C = 25^\circ\text{C}$            | 70          | Amps                |
| $I_{DM}$       | Pulsed Drain Current <sup>①</sup>                              | 280         |                     |
| $V_{GS}$       | Gate-Source Voltage Continuous                                 | $\pm 30$    | Volts               |
| $V_{GSM}$      | Gate-Source Voltage Transient                                  | $\pm 40$    |                     |
| $P_D$          | Total Power Dissipation @ $T_C = 25^\circ\text{C}$             | 694         | Watts               |
|                | Linear Derating Factor                                         | 5.56        | W/ $^\circ\text{C}$ |
| $T_J, T_{STG}$ | Operating and Storage Junction Temperature Range               | -55 to 150  | $^\circ\text{C}$    |
| $T_L$          | Lead Temperature: 0.063" from Case for 10 Sec.                 | 300         |                     |
| $I_{AR}$       | Avalanche Current <sup>①</sup> (Repetitive and Non-Repetitive) | 70          | Amps                |
| $E_{AR}$       | Repetitive Avalanche Energy <sup>①</sup>                       | 50          | mJ                  |
| $E_{AS}$       | Single Pulse Avalanche Energy <sup>④</sup>                     | 3600        |                     |

#### STATIC ELECTRICAL CHARACTERISTICS

| Symbol       | Characteristic / Test Conditions                                                          | MIN | TYP | MAX       | UNIT    |
|--------------|-------------------------------------------------------------------------------------------|-----|-----|-----------|---------|
| $BV_{DSS}$   | Drain-Source Breakdown Voltage ( $V_{GS} = 0V, I_D = 250\mu A$ )                          | 600 |     |           | Volts   |
| $R_{DS(on)}$ | Drain-Source On-State Resistance <sup>②</sup> ( $V_{GS} = 10V, 35A$ )                     |     |     | 0.060     | Ohms    |
| $I_{DSS}$    | Zero Gate Voltage Drain Current ( $V_{DS} = 600V, V_{GS} = 0V$ )                          |     |     | 100       | $\mu A$ |
|              | Zero Gate Voltage Drain Current ( $V_{DS} = 480V, V_{GS} = 0V, T_C = 125^\circ\text{C}$ ) |     |     | 500       |         |
| $I_{GSS}$    | Gate-Source Leakage Current ( $V_{GS} = \pm 30V, V_{DS} = 0V$ )                           |     |     | $\pm 100$ | nA      |
| $V_{GS(th)}$ | Gate Threshold Voltage ( $V_{DS} = V_{GS}, I_D = 5mA$ )                                   | 3   |     | 5         | Volts   |



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

# DYNAMIC CHARACTERISTICS

APT60M60JLL

| Symbol       | Characteristic               | Test Conditions                                                                                                  | MIN | TYP   | MAX | UNIT    |
|--------------|------------------------------|------------------------------------------------------------------------------------------------------------------|-----|-------|-----|---------|
| $C_{iss}$    | Input Capacitance            | $V_{GS} = 0V$<br>$V_{DS} = 25V$<br>$f = 1\text{ MHz}$                                                            |     | 12630 |     | pF      |
| $C_{oss}$    | Output Capacitance           |                                                                                                                  |     | 2202  |     |         |
| $C_{rss}$    | Reverse Transfer Capacitance |                                                                                                                  |     | 157   |     |         |
| $Q_g$        | Total Gate Charge ③          | $V_{GS} = 10V$<br>$V_{DD} = 300V$<br>$I_D = 70A @ 25^\circ C$                                                    |     | 289   |     | nC      |
| $Q_{gs}$     | Gate-Source Charge           |                                                                                                                  |     | 74    |     |         |
| $Q_{gd}$     | Gate-Drain ("Miller") Charge |                                                                                                                  |     | 146   |     |         |
| $t_{d(on)}$  | Turn-on Delay Time           | <b>RESISTIVE SWITCHING</b><br>$V_{GS} = 15V$<br>$V_{DD} = 300V$<br>$I_D = 70A @ 25^\circ C$<br>$R_G = 0.6\Omega$ |     | 21    |     | ns      |
| $t_r$        | Rise Time                    |                                                                                                                  |     | 16    |     |         |
| $t_{d(off)}$ | Turn-off Delay Time          |                                                                                                                  |     | 51    |     |         |
| $t_f$        | Fall Time                    |                                                                                                                  |     | 12    |     |         |
| $E_{on}$     | Turn-on Switching Energy ⑥   | <b>INDUCTIVE SWITCHING @ 25°C</b><br>$V_{DD} = 400V, V_{GS} = 15V$<br>$I_D = 70A, R_G = 5\Omega$                 |     | 1428  |     | $\mu J$ |
| $E_{off}$    | Turn-off Switching Energy    |                                                                                                                  |     | 1386  |     |         |
| $E_{on}$     | Turn-on Switching Energy ⑥   | <b>INDUCTIVE SWITCHING @ 125°C</b><br>$V_{DD} = 400V, V_{GS} = 15V$<br>$I_D = 70A, R_G = 5\Omega$                |     | 2058  |     |         |
| $E_{off}$    | Turn-off Switching Energy    |                                                                                                                  |     | 1691  |     |         |

## SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS

| Symbol   | Characteristic / Test Conditions                               | MIN | TYP  | MAX | UNIT    |
|----------|----------------------------------------------------------------|-----|------|-----|---------|
| $I_S$    | Continuous Source Current (Body Diode)                         |     |      | 70  | Amps    |
| $I_{SM}$ | Pulsed Source Current ① (Body Diode)                           |     |      | 280 |         |
| $V_{SD}$ | Diode Forward Voltage ② ( $V_{GS} = 0V, I_S = -70A$ )          |     |      | 1.3 | Volts   |
| $t_{rr}$ | Reverse Recovery Time ( $I_S = -70A, di_S/dt = 100A/\mu s$ )   |     | 950  |     | ns      |
| $Q_{rr}$ | Reverse Recovery Charge ( $I_S = -70A, di_S/dt = 100A/\mu s$ ) |     | 33.0 |     | $\mu C$ |
| $dv/dt$  | Peak Diode Recovery $dv/dt$ ⑤                                  |     |      | 8   | V/ns    |

## THERMAL CHARACTERISTICS

| Symbol          | Characteristic      | MIN | TYP | MAX  | UNIT         |
|-----------------|---------------------|-----|-----|------|--------------|
| $R_{\theta JC}$ | Junction to Case    |     |     | 0.18 | $^\circ C/W$ |
| $R_{\theta JA}$ | Junction to Ambient |     |     | 40   |              |

① Repetitive Rating: Pulse width limited by maximum junction temperature

② Pulse Test: Pulse width < 380  $\mu s$ , Duty Cycle < 2%

③ See MIL-STD-750 Method 3471

④ Starting  $T_J = +25^\circ C$ ,  $L = 1.47mH$ ,  $R_G = 25\Omega$ , Peak  $I_L = 70A$

⑤  $dv/dt$  numbers reflect the limitations of the test circuit rather than the device itself.  $I_S \leq -70A$   $di/dt \leq 700A/\mu s$   $V_R \leq 600V$   $T_J \leq 150^\circ C$

⑥  $E_{on}$  includes diode reverse recovery. See figures 18, 20.

APT Reserves the right to change, without notice, the specifications and information contained herein.

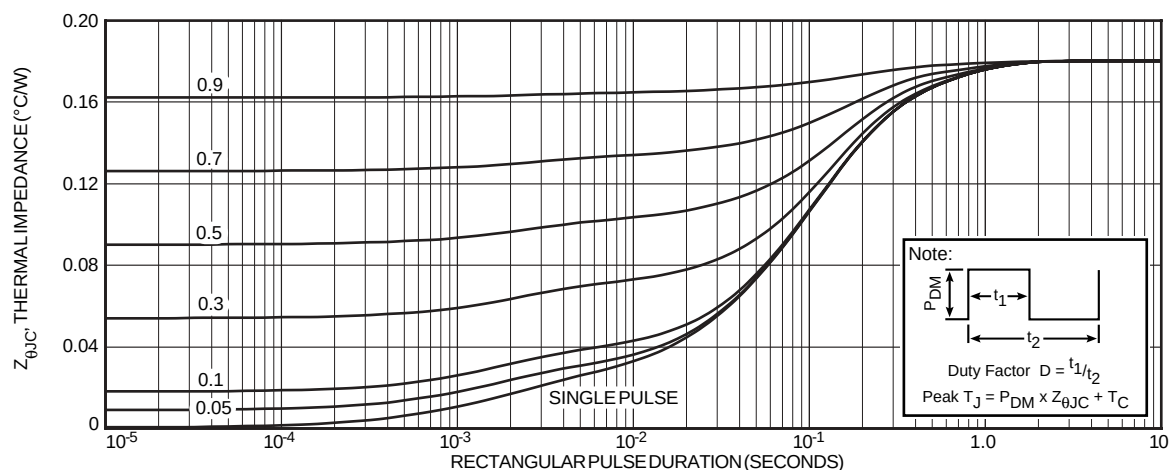


FIGURE 1, MAXIMUM EFFECTIVE TRANSIENT THERMAL IMPEDANCE, JUNCTION-TO-CASE vs PULSE DURATION

## Typical Performance Curves

APT60M60JLL

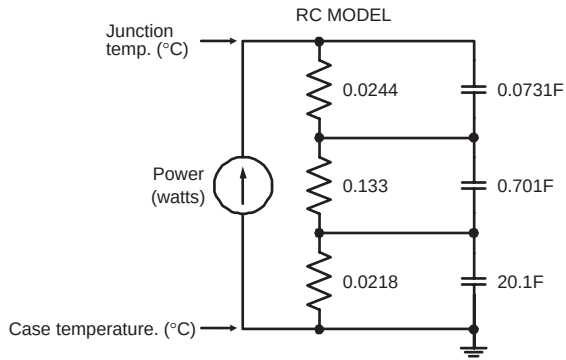


FIGURE 2, TRANSIENT THERMAL IMPEDANCE MODEL

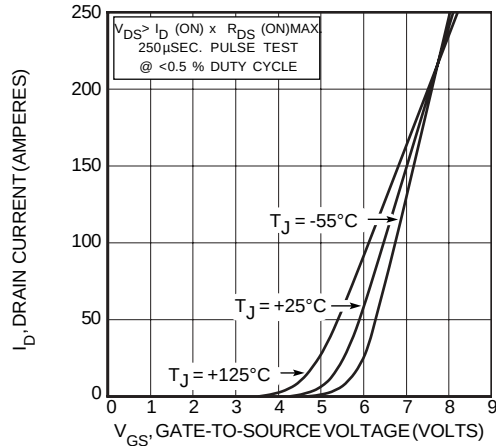


FIGURE 4, TRANSFER CHARACTERISTICS

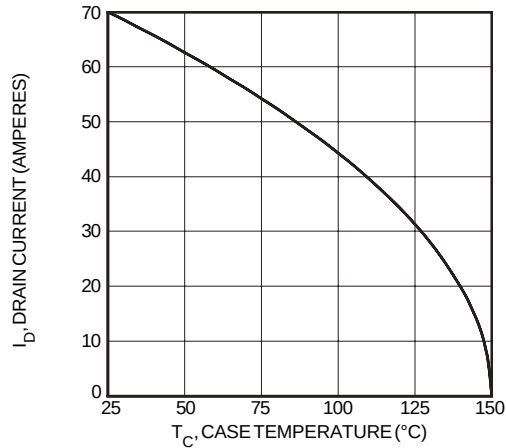


FIGURE 6, MAXIMUM DRAIN CURRENT vs CASE TEMPERATURE

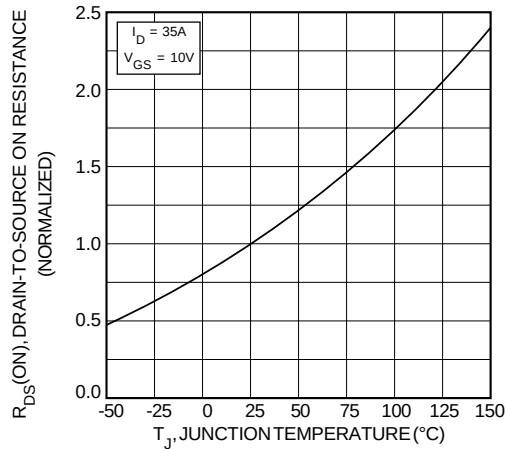


FIGURE 8, ON-RESISTANCE vs. TEMPERATURE

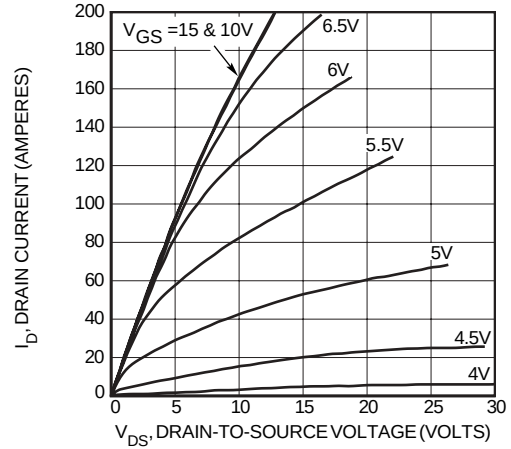


FIGURE 3, LOW VOLTAGE OUTPUT CHARACTERISTICS

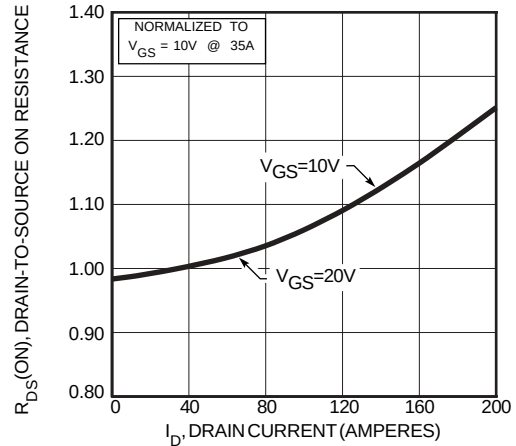


FIGURE 5,  $R_{DS(ON)}$  vs DRAIN CURRENT

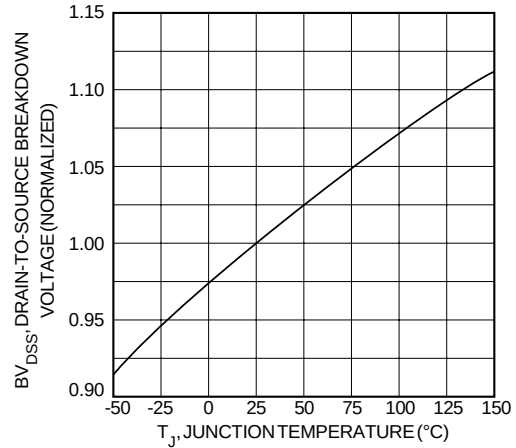


FIGURE 7, BREAKDOWN VOLTAGE vs TEMPERATURE

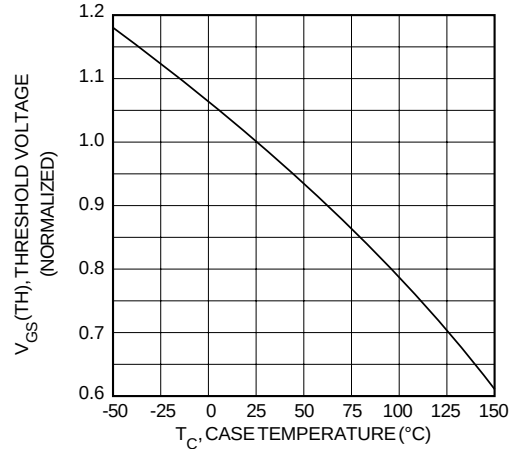


FIGURE 9, THRESHOLD VOLTAGE vs TEMPERATURE

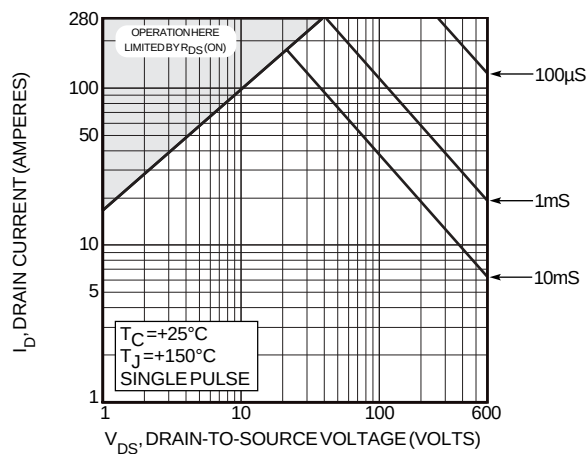


FIGURE 10, MAXIMUM SAFE OPERATING AREA

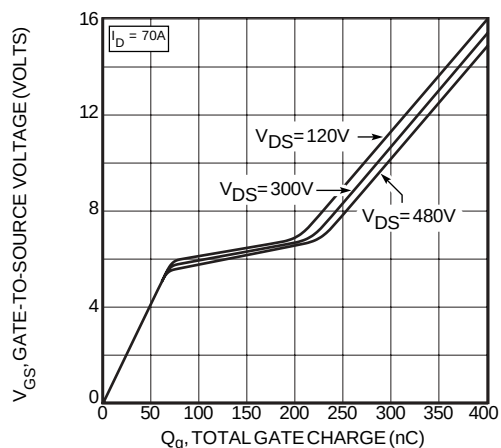


FIGURE 12, GATE CHARGES vs GATE-TO-SOURCE VOLTAGE

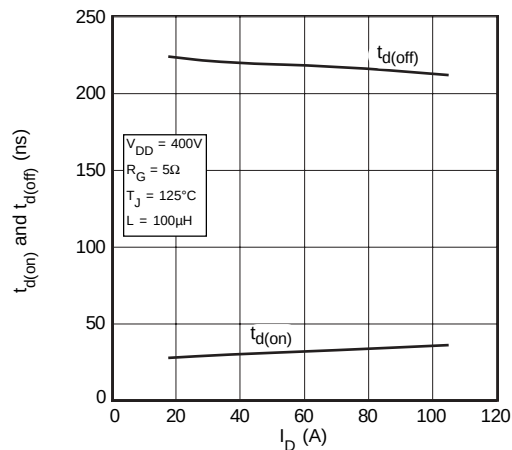


FIGURE 14, DELAY TIMES vs CURRENT

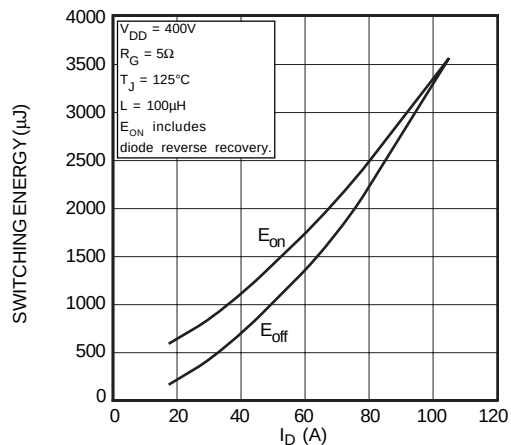


FIGURE 16, SWITCHING ENERGY vs CURRENT

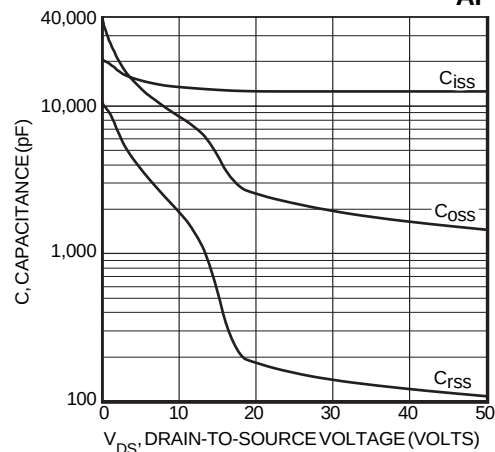


FIGURE 11, CAPACITANCE vs DRAIN-TO-SOURCE VOLTAGE

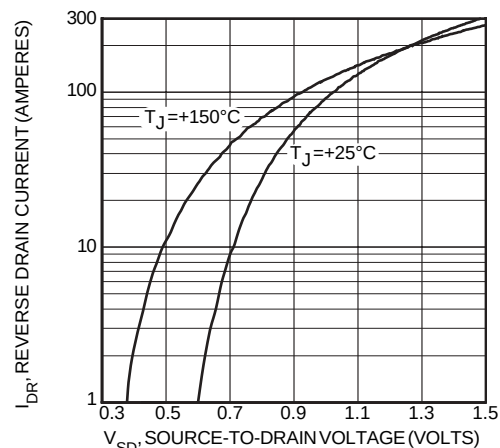


FIGURE 13, SOURCE-DRAIN DIODE FORWARD VOLTAGE

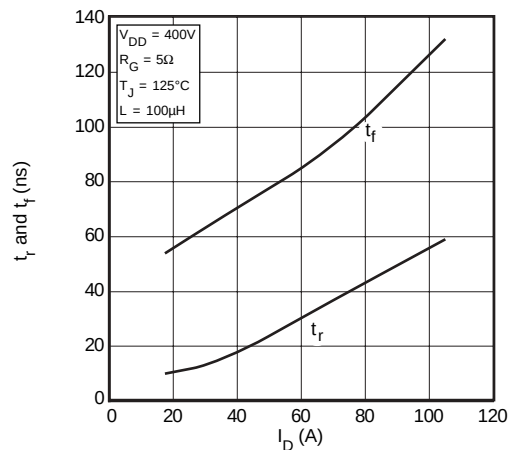


FIGURE 15, RISE AND FALL TIMES vs CURRENT

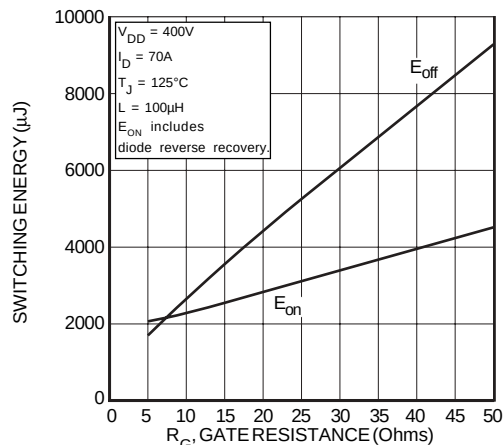


FIGURE 17, SWITCHING ENERGY vs. GATE RESISTANCE

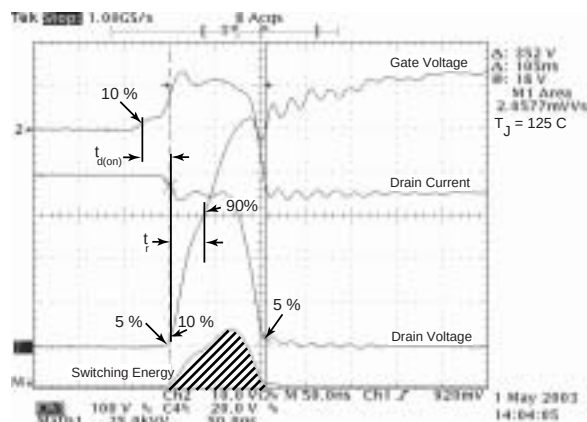


Figure 18, Turn-on Switching Waveforms and Definitions

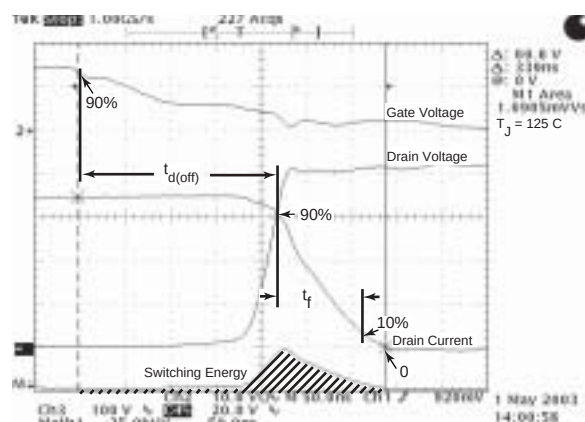


Figure 19, Turn-off Switching Waveforms and Definitions

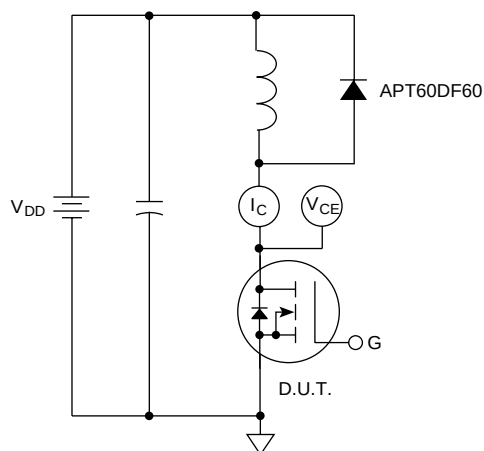
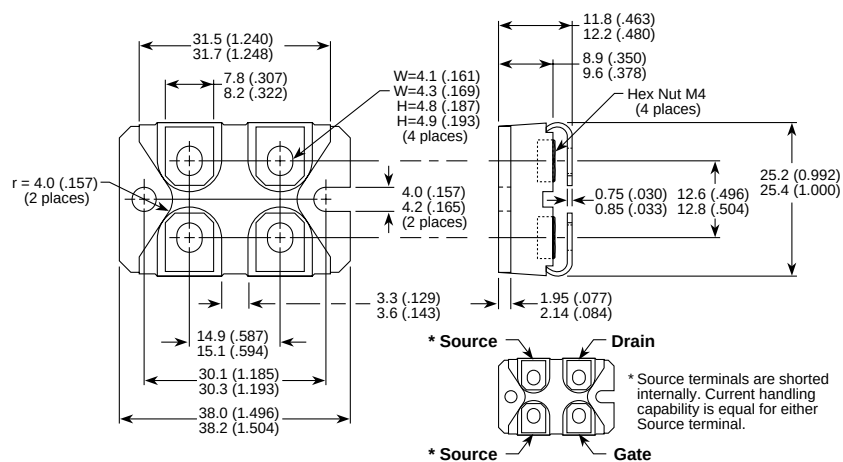


Figure 20, Inductive Switching Test Circuit

## SOT-227 (ISOTOP®) Package Outline



Dimensions in Millimeters and (Inches)

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