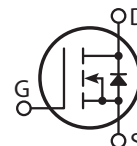
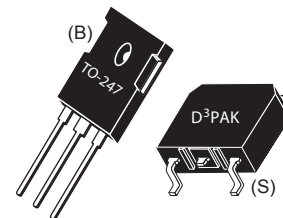




## Super Junction MOSFET



- Ultra Low  $R_{DS(ON)}$
- Low Miller Capacitance
- Ultra Low Gate Charge,  $Q_g$
- Avalanche Energy Rated
- Extreme  $dv/dt$  Rated
- Popular TO-247 or Surface Mount D<sup>3</sup> Package

### MAXIMUM RATINGS

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

| Symbol         | Parameter  | APT60N60B_SCS(G) | UNIT                |
|----------------|--|------------------|---------------------|
| $V_{DSS}$      | Drain-Source Voltage                                 | 600              | Volts               |
| $I_D$          | Continuous Drain Current @ $T_C = 25^\circ\text{C}$  | 60               | Amps                |
|                | Continuous Drain Current @ $T_C = 100^\circ\text{C}$ | 38               |                     |
| $I_{DM}$       | Pulsed Drain Current <sup>①</sup>                    | 230              |                     |
| $V_{GS}$       | Gate-Source Voltage Continuous                       | $\pm 30$         | Volts               |
| $P_D$          | Total Power Dissipation @ $T_C = 25^\circ\text{C}$   | 431              | Watts               |
|                | Linear Derating Factor                               | 3.45             | 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.       | 260              |                     |
| $dv/dt$        | MOSFET $dv/dt$ Ruggedness ( $V_{DS} = 480\text{V}$ ) | 50               | V/ns                |
| $I_{AR}$       | Avalanche Current <sup>②</sup>                       | 11               | Amps                |
| $E_{AR}$       | Repetitive Avalanche Energy <sup>②</sup>             | 3                | mJ                  |
| $E_{AS}$       | Single Pulse Avalanche Energy <sup>③</sup>           | 1950             |                     |

### STATIC ELECTRICAL CHARACTERISTICS

| Symbol        | Characteristic / Test Conditions  | MIN | TYP | MAX       | UNIT          |
|---------------|---|-----|-----|-----------|---------------|
| $V_{(BR)DSS}$ | Drain-Source Breakdown Voltage ( $V_{GS} = 0\text{V}, I_D = 250\mu\text{A}$ )                           | 600 |     |           | Volts         |
| $R_{DS(on)}$  | Drain-Source On-State Resistance <sup>④</sup> ( $V_{GS} = 10\text{V}, I_D = 44\text{A}$ )               |     |     | 0.045     | Ohms          |
| $I_{DSS}$     | Zero Gate Voltage Drain Current ( $V_{DS} = 600\text{V}, V_{GS} = 0\text{V}$ )                          |     |     | 25        | $\mu\text{A}$ |
|               | Zero Gate Voltage Drain Current ( $V_{DS} = 600\text{V}, V_{GS} = 0\text{V}, T_C = 150^\circ\text{C}$ ) |     |     | 250       |               |
| $I_{GSS}$     | Gate-Source Leakage Current ( $V_{GS} = \pm 20\text{V}, V_{DS} = 0\text{V}$ )                           |     |     | $\pm 100$ | nA            |
| $V_{GS(th)}$  | Gate Threshold Voltage ( $V_{DS} = V_{GS}, I_D = 3\text{mA}$ )  | 2.1 | 3   | 3.9       | Volts         |

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

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

Microsemi Website - <http://www.microsemi.com>

### DYNAMIC CHARACTERISTICS

APT60N60B\_SCS(G)

| Symbol       | Characteristic                        | Test Conditions  | MIN | TYP  | MAX | UNIT    |
|--------------|---------------------------------------|--|-----|------|-----|---------|
| $C_{iss}$    | Input Capacitance                     | $V_{GS} = 0V$<br>$V_{DS} = 25V$<br>$f = 1\text{ MHz}$  |     | 7200 |     | pF      |
| $C_{oss}$    | Output Capacitance                    |  |     | 8500 |     |         |
| $C_{rss}$    | Reverse Transfer Capacitance          |  |     | 290  |     |         |
| $Q_g$        | Total Gate Charge <sup>⑤</sup>        | $V_{GS} = 10V$<br>$V_{DD} = 400V$<br>$I_D = 44A @ 25^\circ C$  |     | 150  | 190 | nC      |
| $Q_{gs}$     | Gate-Source Charge                    |  |     | 34   |     |         |
| $Q_{gd}$     | Gate-Drain ("Miller") Charge          |  |     | 50   |     |         |
| $t_{d(on)}$  | Turn-on Delay Time                    | <b>RESISTIVE SWITCHING</b><br>$V_{GS} = 15V$<br>$V_{DD} = 400V$<br>$I_D = 44A @ 25^\circ C$<br>$R_G = 4.3\Omega$ |     | 30   |     | ns      |
| $t_r$        | Rise Time                             |  |     | 20   |     |         |
| $t_{d(off)}$ | Turn-off Delay Time                   |  |     | 100  |     |         |
| $t_f$        | Fall Time                             |  |     | 10   |     |         |
| $E_{on}$     | Turn-on Switching Energy <sup>⑥</sup> | <b>INDUCTIVE SWITCHING @ 25°C</b><br>$V_{DD} = 400V, V_{GS} = 15V$<br>$I_D = 44A, R_G = 4.3\Omega$               |     | 675  |     | $\mu J$ |
| $E_{off}$    | Turn-off Switching Energy             |  |     | 520  |     |         |
| $E_{on}$     | Turn-on Switching Energy <sup>⑥</sup> | <b>INDUCTIVE SWITCHING @ 125°C</b><br>$V_{DD} = 400V, V_{GS} = 15V$<br>$I_D = 44A, R_G = 4.3\Omega$              |     | 1100 |     |         |
| $E_{off}$    | Turn-off Switching Energy             |  |     | 635  |     |         |

### SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS

| Symbol   | Characteristic / Test Conditions                                 | MIN | TYP | MAX | UNIT    |
|----------|--|-----|-----|-----|---------|
| $I_S$    | Continuous Source Current (Body Diode)                           |     |     | 44  | Amps    |
| $I_{SM}$ | Pulsed Source Current <sup>①</sup> (Body Diode)                  |     |     | 180 |         |
| $V_{SD}$ | Diode Forward Voltage <sup>④</sup> ( $V_{GS} = 0V, I_S = -44A$ ) |     |     | 1.2 | Volts   |
| $t_{rr}$ | Reverse Recovery Time ( $I_S = -44A, di_S/dt = 100A/\mu s$ )     |     | 600 |     | ns      |
| $Q_{rr}$ | Reverse Recovery Charge ( $I_S = -44A, di_S/dt = 100A/\mu s$ )   |     | 17  |     | $\mu C$ |
| $dv/dt$  | Peak Diode Recovery $dv/dt$ <sup>⑦</sup>                         |     |     | 4   | V/ns    |

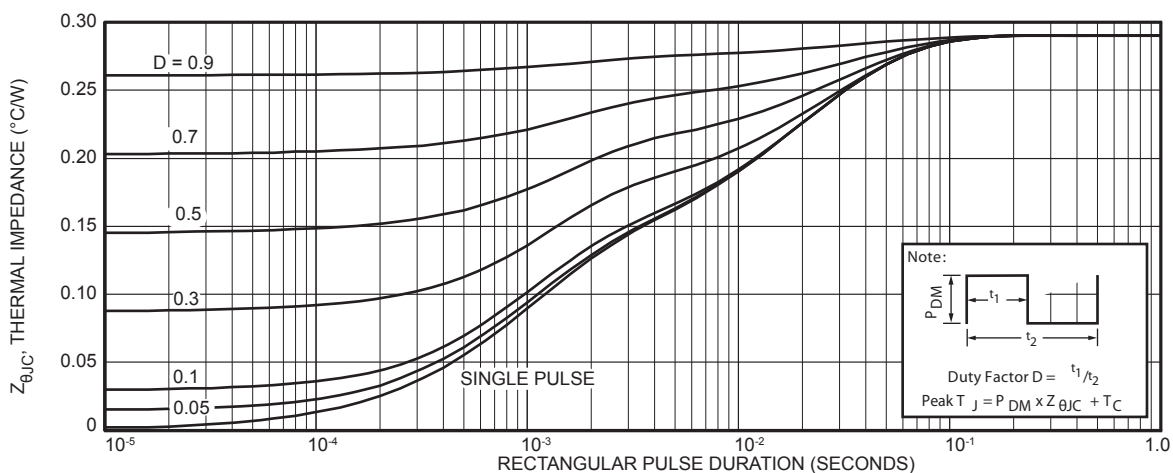
### THERMAL CHARACTERISTICS

| Symbol          | Characteristic      | MIN | TYP | MAX  | UNIT         |
|-----------------|---------------------|-----|-----|------|--------------|
| $R_{\theta JC}$ | Junction to Case    |     |     | 0.29 | $^\circ C/W$ |
| $R_{\theta JA}$ | Junction to Ambient |     |     | 40   |              |

- ① Repetitive Rating: Pulse width limited by maximum junction temperature
- ② Repetitive avalanche causes additional power losses that can be calculated as  $P_{AV} = E_{AR} \cdot f$
- ③ Starting  $T_j = +25^\circ C$ ,  $L = 33.23mH$ ,  $R_G = 25\Omega$ , Peak  $I_L = 11A$
- ④ Pulse Test: Pulse width < 380 $\mu s$ , Duty Cycle < 2%

- ⑤ See MIL-STD-750 Method 3471
- ⑥  $E_{on}$  includes diode reverse recovery. See figures 18, 20.
- ⑦ We do not recommend using this CoolMOS™ product in topologies that have free wheeling load current conducted in the body diode that is hard commutated. The current commutation is very "snappy", resulting in high  $di/dt$  at the completion of commutation, and the likelihood of severe over-voltage transients due to the resulting high  $dv/dt$ .

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



# Typical Performance Curves

APT60N60B\_SCS(G)

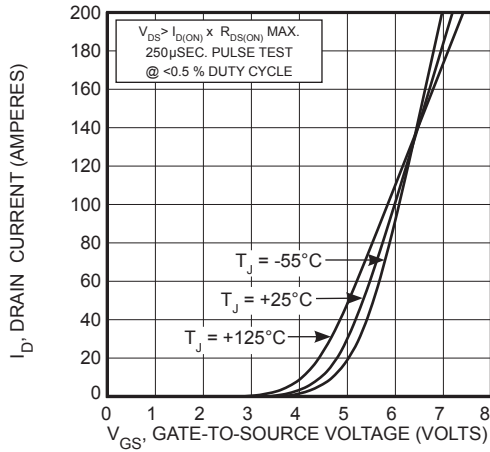


FIGURE 3, TRANSFER CHARACTERISTICS

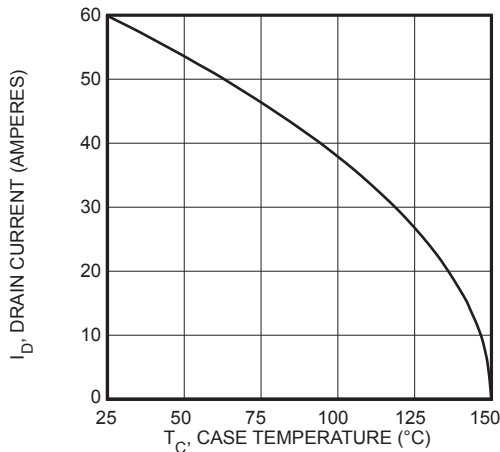


FIGURE 5, MAXIMUM DRAIN CURRENT vs CASE TEMPERATURE

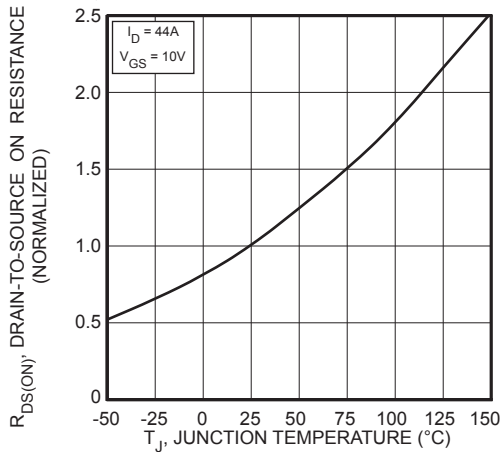


FIGURE 7, ON-RESISTANCE vs. TEMPERATURE

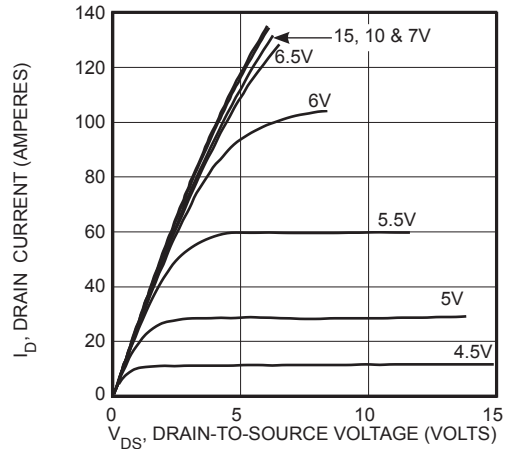


FIGURE 2, LOW VOLTAGE OUTPUT CHARACTERISTICS

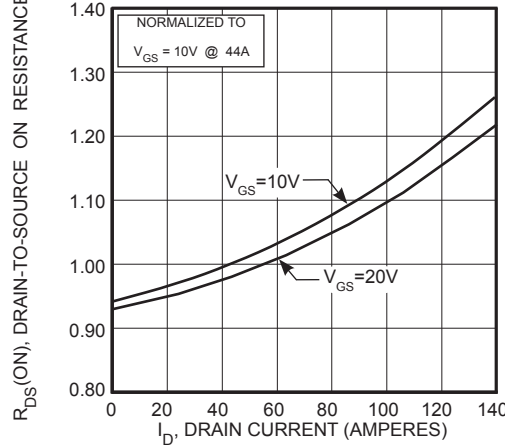


FIGURE 4,  $R_{DS(ON)}$  vs DRAIN CURRENT

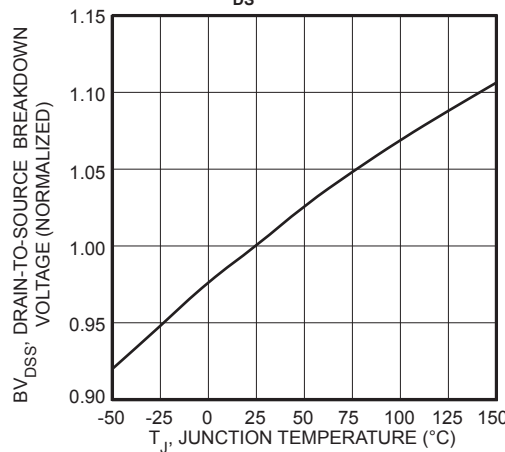


FIGURE 6, BREAKDOWN VOLTAGE vs TEMPERATURE

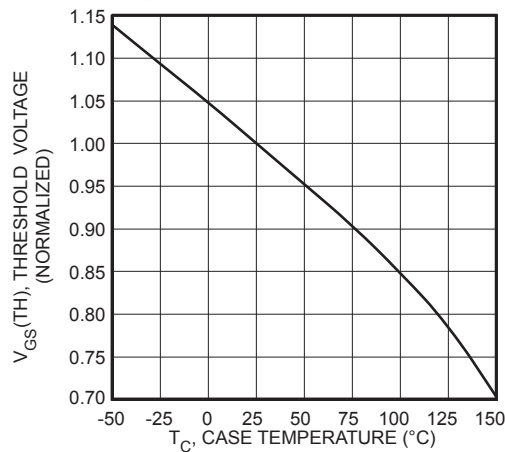


FIGURE 8, THRESHOLD VOLTAGE vs TEMPERATURE

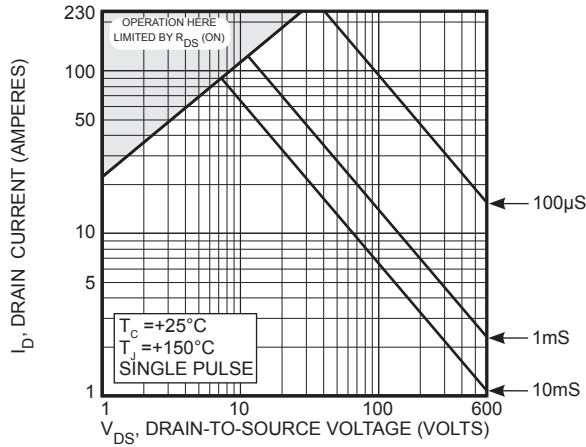


FIGURE 9, MAXIMUM SAFE OPERATING AREA

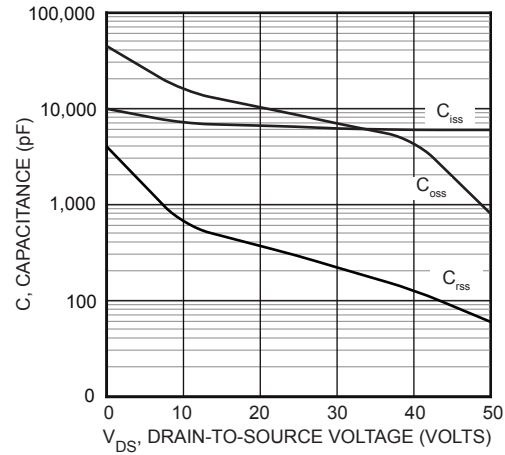


FIGURE 10, CAPACITANCE vs DRAIN-TO-SOURCE VOLTAGE

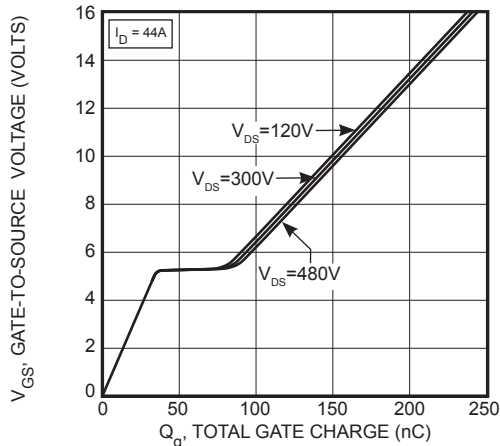


FIGURE 11, GATE CHARGE vs GATE-TO-SOURCE VOLTAGE

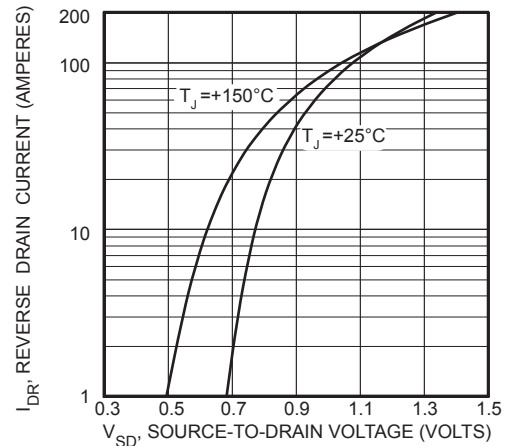


FIGURE 12, SOURCE-DRAIN DIODE FORWARD VOLTAGE

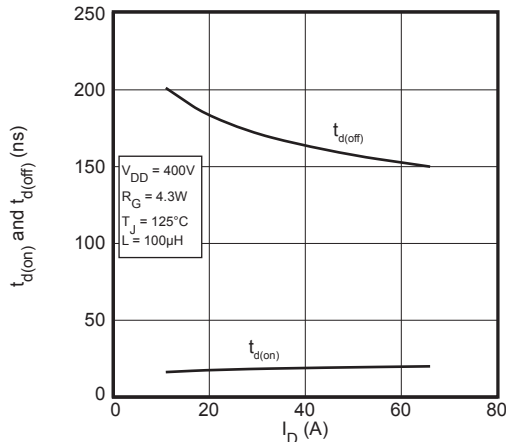


FIGURE 13, DELAY TIMES vs CURRENT

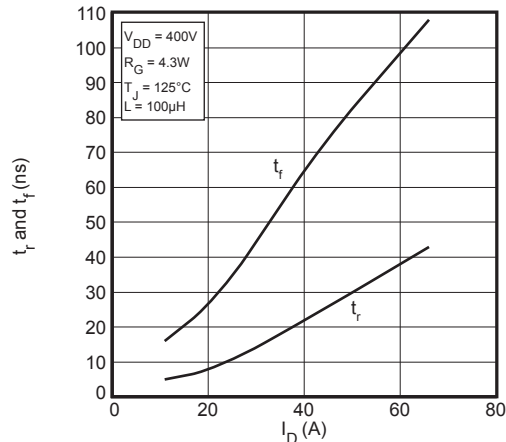


FIGURE 14, RISE AND FALL TIMES vs CURRENT

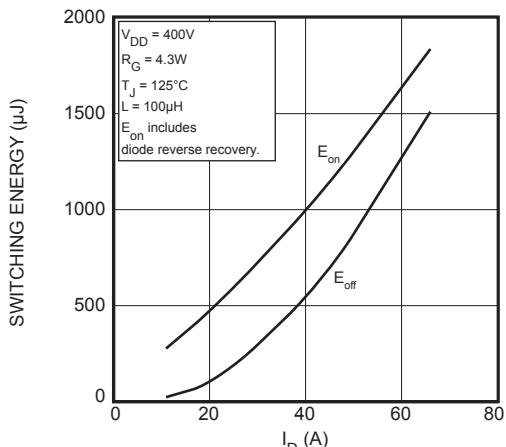


FIGURE 15, SWITCHING ENERGY vs CURRENT

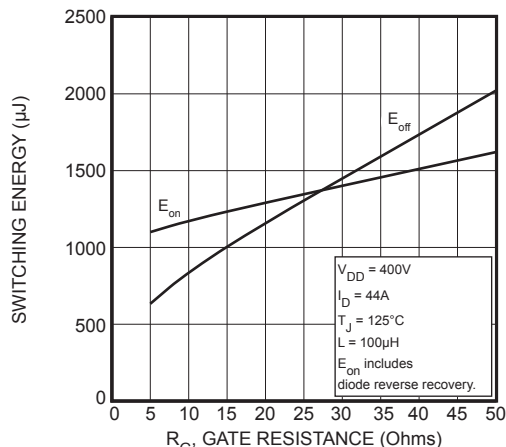


FIGURE 16, SWITCHING ENERGY vs. GATE RESISTANCE

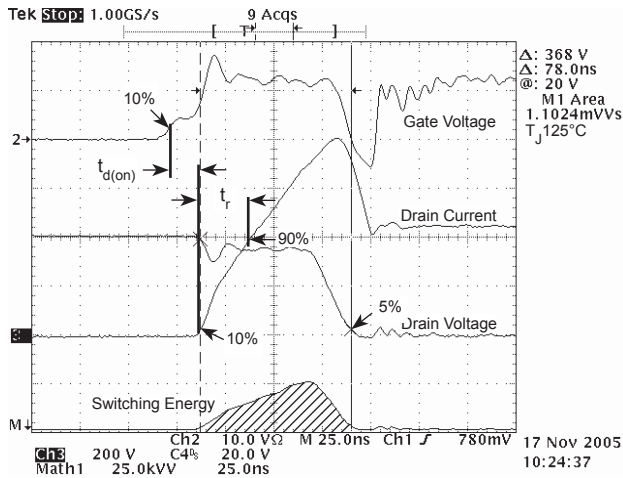


Figure 17, Turn-on Switching Waveforms and Definitions

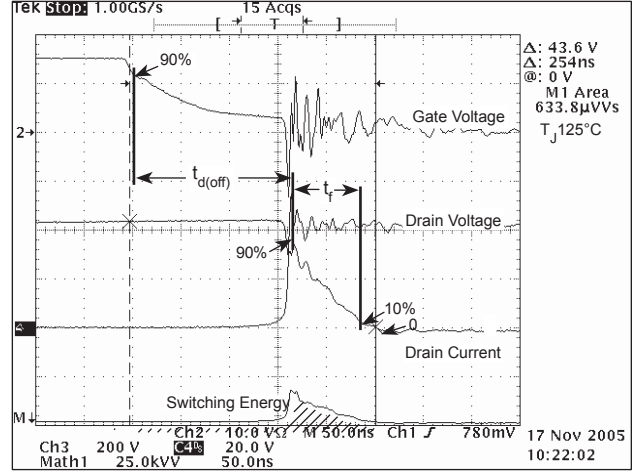


Figure 18, Turn-off Switching Waveforms and Definitions

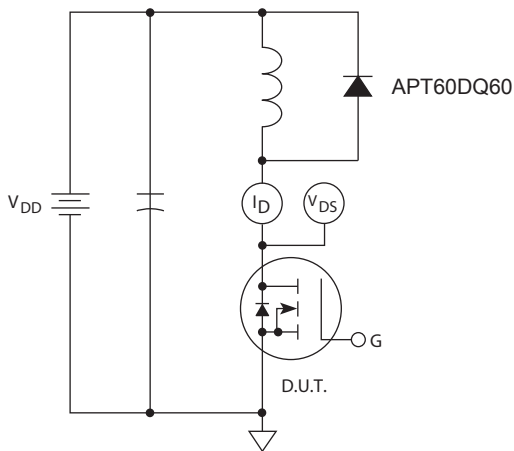
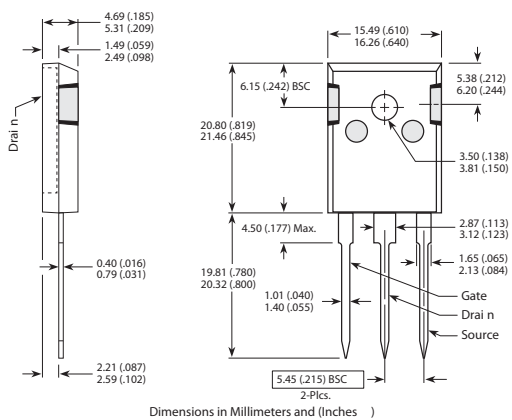


Figure 19, Inductive Switching Test Circuit

TO-247 Package Outline

① SAC: Tin, Silver, Copper



D<sup>3</sup>PAK Package Outline

③ 100% Sn

