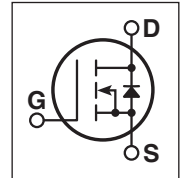
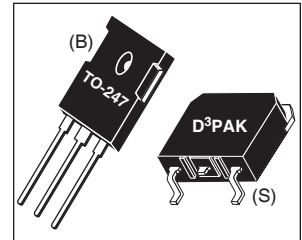




## Super Junction FREDFET

- Ultra Low  $R_{DS(ON)}$
- Low Miller Capacitance
- Ultra Low Gate Charge,  $Q_g$
- Avalanche Energy Rated
- Extreme  $dv/dt$  Rated
- Intrinsic Fast-Recovery Body Diode
- Extreme Low Reverse Recovery Charge
- Ideal For ZVS Applications
- 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                                                                                              | APT47N60B_SCF(G) | UNIT                |
|----------------|--------------------------------------------------------------------------------------------------------|------------------|---------------------|
| $V_{DSS}$      | Drain-Source Voltage                                                                                   | 600              | Volts               |
| $I_D$          | Continuous Drain Current @ $T_C = 25^\circ\text{C}$                                                    | 46               | Amps                |
|                | Continuous Drain Current @ $T_C = 100^\circ\text{C}$                                                   | 29               |                     |
| $I_{DM}$       | Pulsed Drain Current <sup>①</sup>                                                                      | 115              |                     |
| $V_{GS}$       | Gate-Source Voltage Continuous                                                                         | $\pm 30$         | Volts               |
| $P_D$          | Total Power Dissipation @ $T_C = 25^\circ\text{C}$                                                     | 417              | Watts               |
|                | Linear Derating Factor                                                                                 | 1.67             | 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              |                     |
| $dv/dt$        | Drain-Source Voltage slope ( $V_{DS} = 480\text{V}$ , $I_D = 46\text{A}$ , $T_J = 125^\circ\text{C}$ ) | 80               | V/ns                |
| $I_{AR}$       | Avalanche Current <sup>②</sup>                                                                         | 20               | Amps                |
| $E_{AR}$       | Repetitive Avalanche Energy <sup>②</sup>                                                               | 1                | mJ                  |
| $E_{AS}$       | Single Pulse Avalanche Energy <sup>③</sup>                                                             | 1800             |                     |

### STATIC ELECTRICAL CHARACTERISTICS

| Symbol       | Characteristic / Test Conditions                                                                              | MIN | TYP | MAX       | UNIT          |
|--------------|---------------------------------------------------------------------------------------------------------------|-----|-----|-----------|---------------|
| $B_{(VR)DS}$ | 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> ( $V_{GS} = 10\text{V}$ , $I_D = 29\text{A}$ )                  |     |     | 0.083     | Ohms          |
| $I_{DSS}$    | Zero Gate Voltage Drain Current ( $V_{DS} = 600\text{V}$ , $V_{GS} = 0\text{V}$ )                             |     |     | 6         | $\mu\text{A}$ |
|              | Zero Gate Voltage Drain Current ( $V_{DS} = 600\text{V}$ , $V_{GS} = 0\text{V}$ , $T_C = 150^\circ\text{C}$ ) |     |     | 5000      |               |
| $I_{GSS}$    | Gate-Source Leakage Current ( $V_{GS} = \pm 20\text{V}$ , $V_{DS} = 0\text{V}$ )                              |     |     | $\pm 100$ | nA            |
| $V_{GS(th)}$ | Gate Threshold Voltage ( $V_{DS} = V_{GS}$ , $I_D = 2.9\text{mA}$ )                                           | 3   | 4   | 5         | Volts         |



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

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

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

# DYNAMIC CHARACTERISTICS

APT47N60BCF\_SCF(G)

| Symbol       | Characteristic                        | Test Conditions                                                                                                  | MIN | TYP  | MAX | UNIT |
|--------------|---------------------------------------|------------------------------------------------------------------------------------------------------------------|-----|------|-----|------|
| $C_{iss}$    | Input Capacitance                     | $V_{GS} = 0V$<br>$V_{DS} = 25V$<br>$f = 1 \text{ MHz}$                                                           |     | 7290 |     | pF   |
| $C_{oss}$    | Output Capacitance                    |                                                                                                                  |     | 1735 |     |      |
| $C_{rss}$    | Reverse Transfer Capacitance          |                                                                                                                  |     | 41   |     |      |
| $Q_g$        | Total Gate Charge <sup>⑤</sup>        | $V_{GS} = 10V$<br>$V_{DD} = 300V$<br>$I_D = 46A @ 25^\circ C$                                                    |     | 255  |     | nC   |
| $Q_{gs}$     | Gate-Source Charge                    |                                                                                                                  |     | 43   |     |      |
| $Q_{gd}$     | Gate-Drain ("Miller") Charge          |                                                                                                                  |     | 135  |     |      |
| $t_{d(on)}$  | Turn-on Delay Time                    | <b>RESISTIVE SWITCHING</b><br>$V_{GS} = 15V$<br>$V_{DD} = 380V$<br>$I_D = 46A @ 25^\circ C$<br>$R_G = 3.6\Omega$ |     | 30   |     | ns   |
| $t_r$        | Rise Time                             |                                                                                                                  |     | 30   |     |      |
| $t_{d(off)}$ | Turn-off Delay Time                   |                                                                                                                  |     | 100  |     |      |
| $t_f$        | Fall Time                             |                                                                                                                  |     | 15   |     |      |
| $E_{on}$     | Turn-on Switching Energy <sup>⑥</sup> | <b>INDUCTIVE SWITCHING @ 25°C</b><br>$V_{DD} = 400V, V_{GS} = 15V$<br>$I_D = 46A, R_G = 4.3\Omega$               |     | 885  |     | μJ   |
| $E_{off}$    | Turn-off Switching Energy             |                                                                                                                  |     | 590  |     |      |
| $E_{on}$     | Turn-on Switching Energy <sup>⑥</sup> | <b>INDUCTIVE SWITCHING @ 125°C</b><br>$V_{DD} = 400V, V_{GS} = 15V$<br>$I_D = 46A, R_G = 4.3\Omega$              |     | 1270 |     |      |
| $E_{off}$    | Turn-off Switching Energy             |                                                                                                                  |     | 725  |     |      |

# SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS

| Symbol    | Characteristic / Test Conditions                                 | MIN                 | TYP | MAX | UNIT  |
|-----------|------------------------------------------------------------------|---------------------|-----|-----|-------|
| $I_S$     | Continuous Source Current (Body Diode)                           |                     |     | 46  | Amps  |
| $I_{SM}$  | Pulsed Source Current <sup>①</sup> (Body Diode)                  |                     |     | 115 |       |
| $V_{SD}$  | Diode Forward Voltage <sup>④</sup> ( $V_{GS} = 0V, I_S = -46A$ ) |                     |     | 1.2 | Volts |
| $dv/dt$   | Peak Diode Recovery $dv/dt$ <sup>⑦</sup>                         |                     |     | 40  | V/ns  |
| $t_{rr}$  | Reverse Recovery Time<br>( $I_S = -46A, di/dt = 100A/\mu s$ )    | $T_J = 25^\circ C$  | 210 |     | ns    |
|           |                                                                  | $T_J = 125^\circ C$ | 350 |     |       |
| $Q_{rr}$  | Reverse Recovery Charge<br>( $I_S = -46A, di/dt = 100A/\mu s$ )  | $T_J = 25^\circ C$  | 2.0 |     | μC    |
|           |                                                                  | $T_J = 125^\circ C$ | 5.4 |     |       |
| $I_{RRM}$ | Peak Recovery Current<br>( $I_S = -46A, di/dt = 100A/\mu s$ )    | $T_J = 25^\circ C$  | 18  |     | Amps  |
|           |                                                                  | $T_J = 125^\circ C$ | 28  |     |       |

# THERMAL CHARACTERISTICS

| Symbol          | Characteristic      | MIN | TYP | MAX  | UNIT |
|-----------------|---------------------|-----|-----|------|------|
| $R_{\theta JC}$ | Junction to Case    |     |     | 0.30 | °C/W |
| $R_{\theta JA}$ | Junction to Ambient |     |     | 62   |      |

- 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  $T_J = +25^\circ C$ ,  $L = 36.0mH$ ,  $R_G = 25\Omega$ , Peak  $I_L = 10A$   
 ④ Pulse Test: Pulse width < 380 μs, Duty Cycle < 2%  
 ⑤ See MIL-STD-750 Method 3471  
 ⑥  $E_{on}$  includes diode reverse recovery. See figures 18, 20.  
 ⑦ Maximum 125°C diode commutation speed =  $di/dt$  600A/μs

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

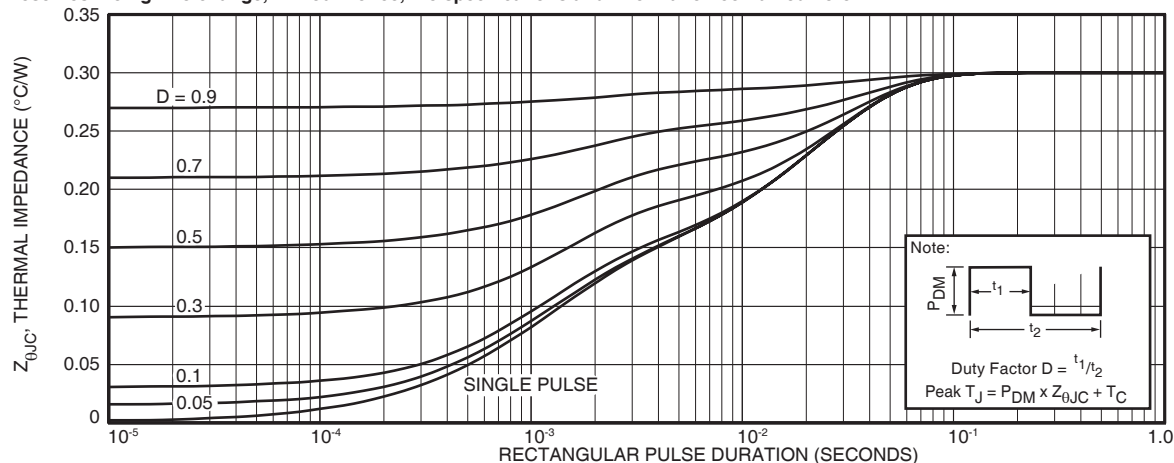


FIGURE 1, MAXIMUM EFFECTIVE TRANSIENT THERMAL IMPEDANCE, JUNCTION-TO-CASE vs PULSE DURATION

## Typical Performance Curves

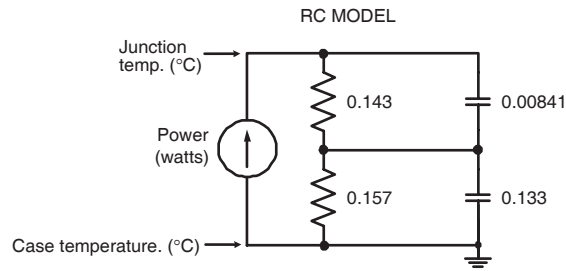


FIGURE 2, TRANSIENT THERMAL IMPEDANCE MODEL

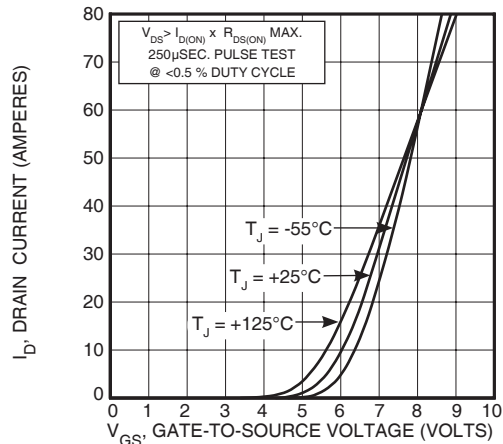


FIGURE 4, TRANSFER CHARACTERISTICS

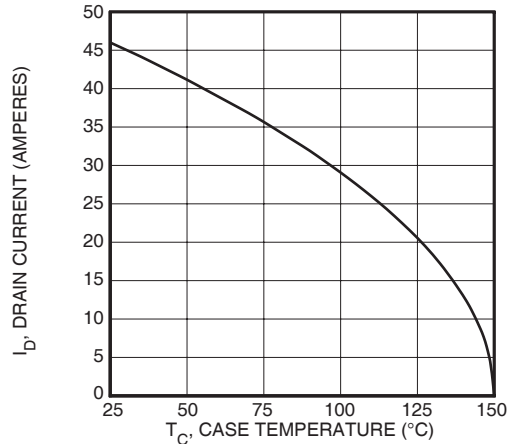


FIGURE 6, MAXIMUM DRAIN CURRENT vs. CASE TEMPERATURE

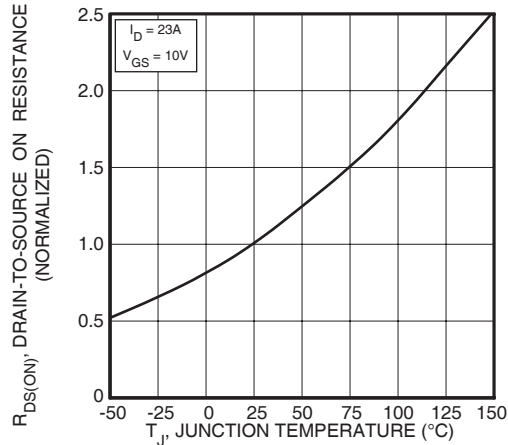


FIGURE 8, ON-RESISTANCE vs. TEMPERATURE

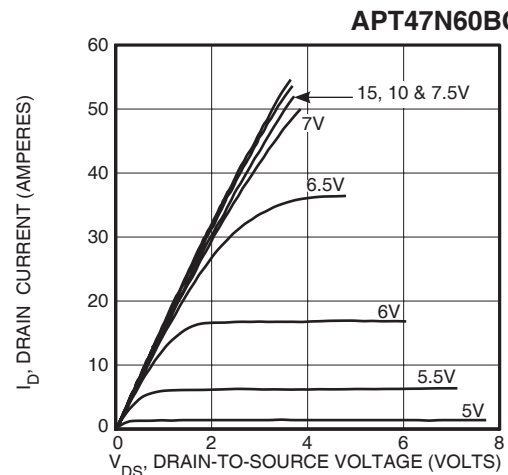


FIGURE 3, LOW VOLTAGE OUTPUT CHARACTERISTICS

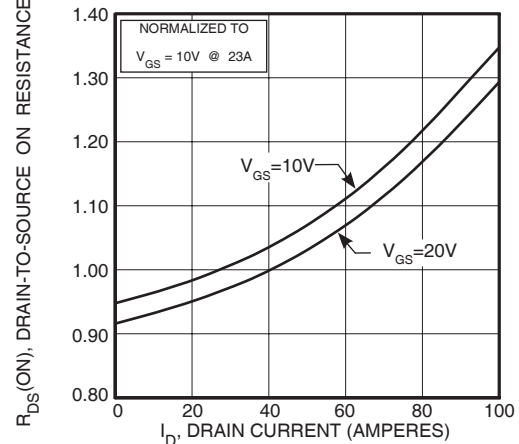


FIGURE 5,  $R_{DS(ON)}$  vs. DRAIN CURRENT

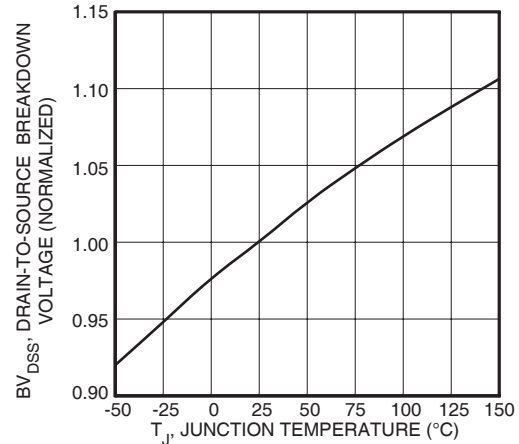


FIGURE 7, BREAKDOWN VOLTAGE vs. TEMPERATURE

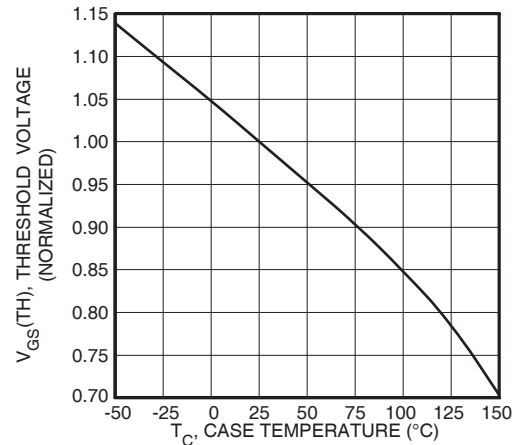


FIGURE 9, THRESHOLD VOLTAGE vs. TEMPERATURE

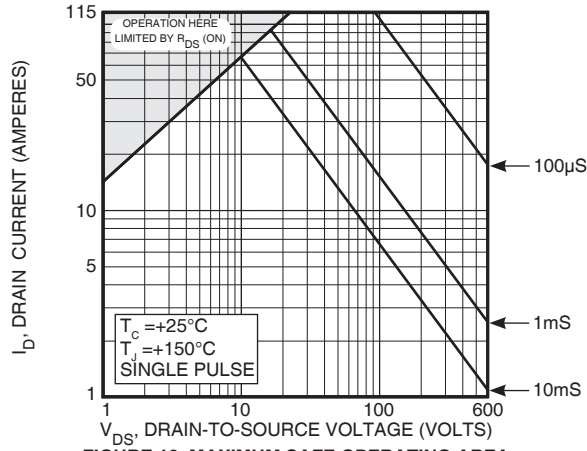


FIGURE 10, MAXIMUM SAFE OPERATING AREA

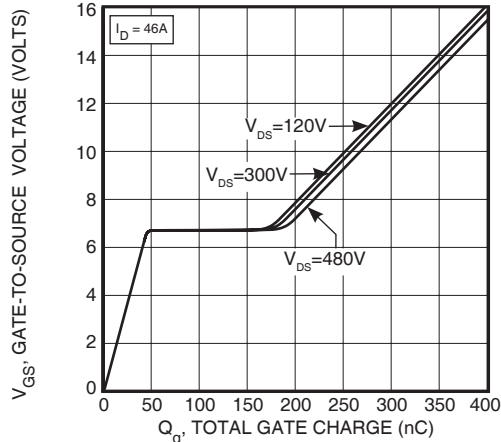


FIGURE 12, GATE CHARGE vs GATE-TO-SOURCE VOLTAGE

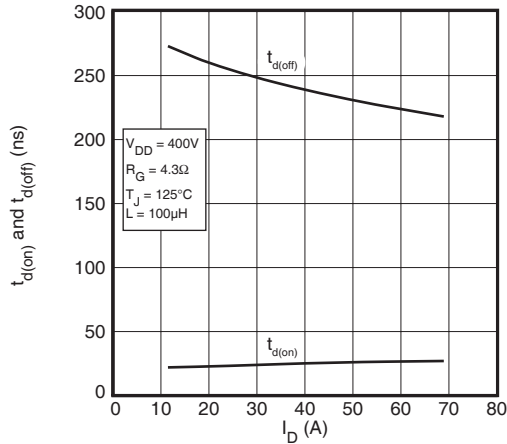


FIGURE 14, DELAY TIMES vs CURRENT

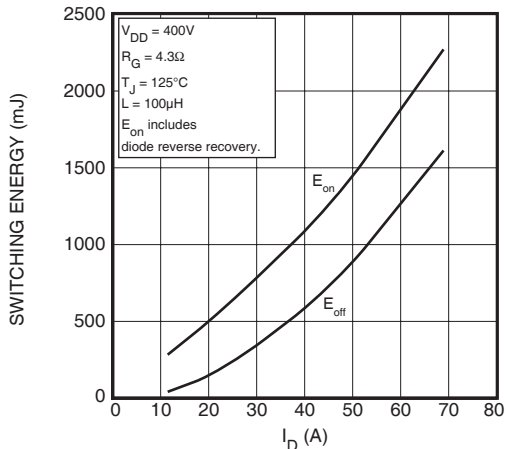


FIGURE 16, SWITCHING ENERGY vs CURRENT

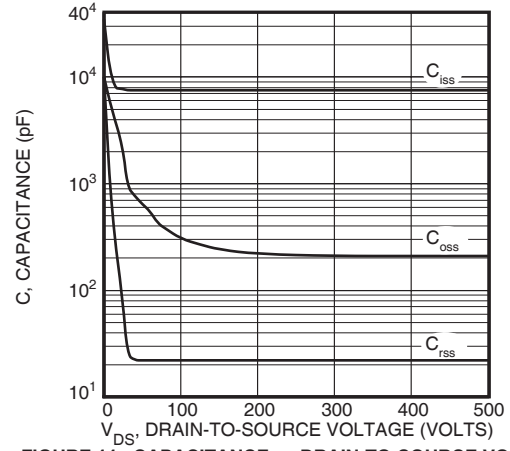


FIGURE 11, CAPACITANCE vs DRAIN-TO-SOURCE VOLTAGE

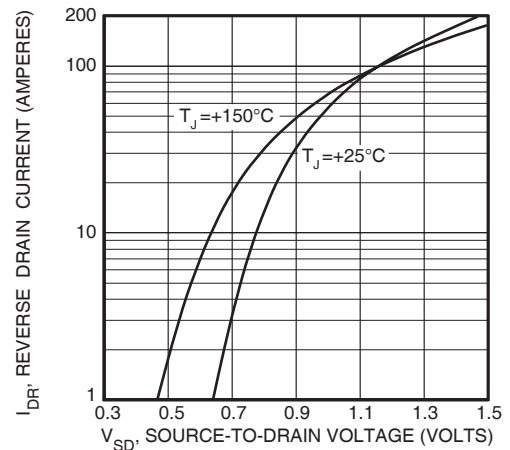


FIGURE 13, SOURCE-DRAIN DIODE FORWARD VOLTAGE

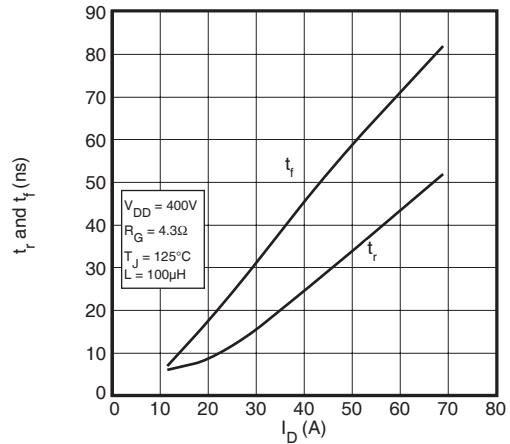


FIGURE 15, RISE AND FALL TIMES vs CURRENT

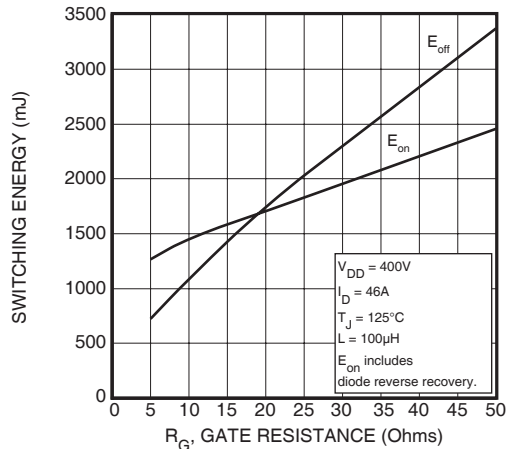


FIGURE 17, SWITCHING ENERGY VS. GATE RESISTANCE

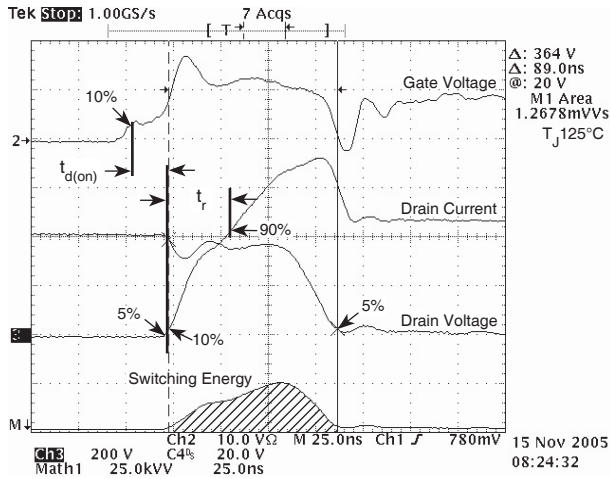


Figure 18, Turn-on Switching Waveforms and Definitions

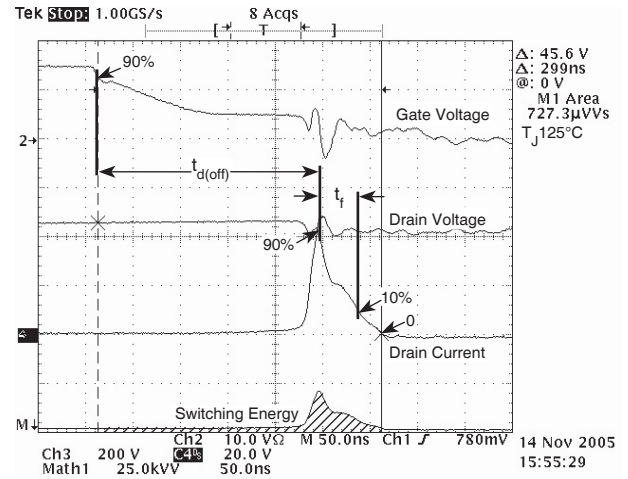


Figure 19, Turn-off Switching Waveforms and Definitions

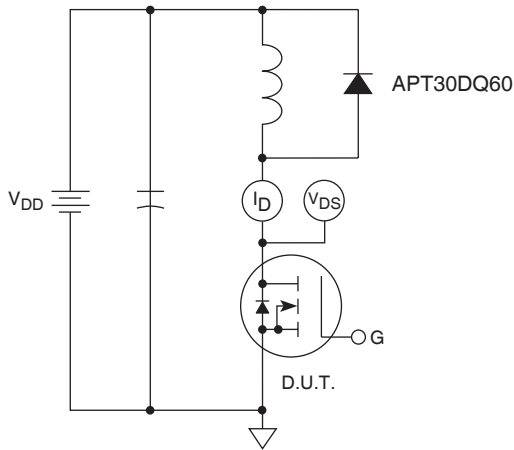
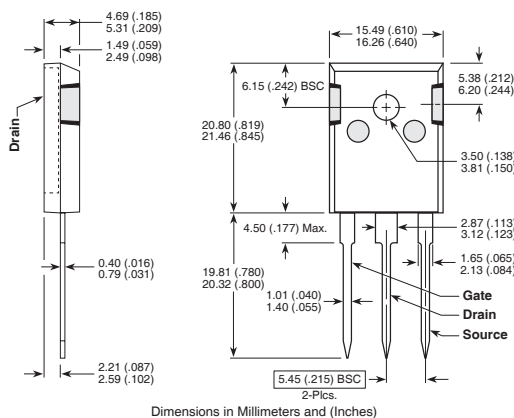


Figure 20, Inductive Switching Test Circuit

## TO-247 Package Outline

e1 SAC: Tin, Silver, Copper



APT's products are covered by one or more of U.S. patents 4,895,810 5,045,903 5,089,434 5,182,234 5,019,522

5,262,336 6,503,786 5,256,583 4,748,103 5,283,202 5,231,474 5,434,095 5,528,058 and foreign patents. US and Foreign patents pending. All Rights Reserved.

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

e3 100% Sn

