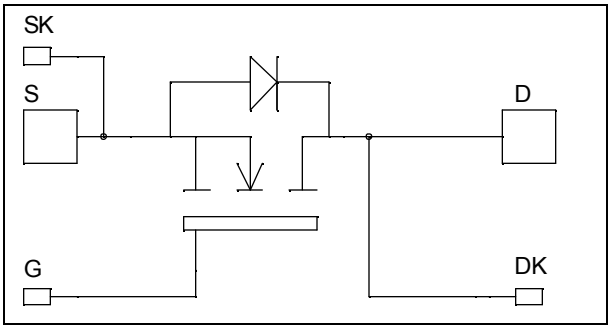
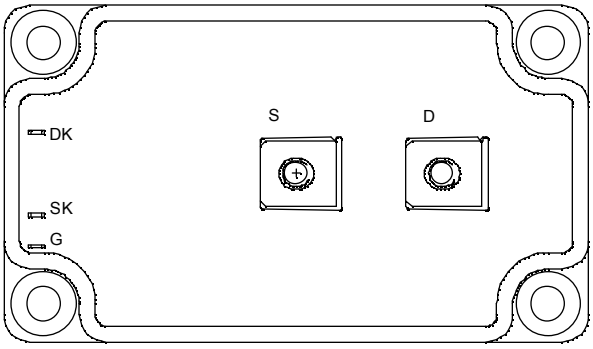
# APTM100UM45F-AIN

## *Single Switch MOSFET Power Module*

$V_{DSS}$ = 1000V
$R_{DSon}$ = 45mΩ typ @ Tj = 25°C
$I_D$ = 215A @ Tc = 25°C




**Application**

- Welding converters
- Switched Mode Power Supplies
- Uninterruptible Power Supplies
- Motor control

**Features**

- Power MOS 7® FREDFETs
  - Low $R_{DSon}$
  - Low input and Miller capacitance
  - Low gate charge
  - Fast intrinsic reverse diode
  - Avalanche energy rated
  - Very rugged
- Kelvin source for easy drive
- Very low stray inductance
  - Symmetrical design
  - M5 power connectors
- High level of integration
- AlN substrate for improved thermal performance

**Benefits**

- Outstanding performance at high frequency operation
- Direct mounting to heatsink (isolated package)
- Low junction to case thermal resistance
- Low profile

## Absolute maximum ratings

| *Symbol* | *Parameter* | | *Max ratings* | *Unit* |
|---|---|---|---|---|
| $V_{DSS}$ | Drain - Source Breakdown Voltage | | 1000 | V |
| $I_D$ | Continuous Drain Current | $T_c$ = 25°C | 215 | A |
| | | $T_c$ = 80°C | 160 | |
| $I_{DM}$ | Pulsed Drain current | | 860 | |
| $V_{GS}$ | Gate - Source Voltage | | ±30 | V |
| $R_{DSon}$ | Drain - Source ON Resistance | | 55 | mΩ |
| $P_D$ | Maximum Power Dissipation | $T_c$ = 25°C | 5000 | W |
| $I_{AR}$ | Avalanche current (repetitive and non repetitive) | | 30 | A |
| $E_{AR}$ | Repetitive Avalanche Energy | | 50 | mJ |
| $E_{AS}$ | Single Pulse Avalanche Energy | | 3200 | |

CAUTION: These Devices are sensitive to Electrostatic Discharge. Proper Handing Procedures Should Be Followed.

**All ratings @ $T_j$ = 25°C unless otherwise specified**

## Electrical Characteristics

| *Symbol* | *Characteristic* | *Test Conditions* | | *Min* | *Typ* | *Max* | *Unit* |
|---|---|---|---|---|---|---|---|
| $I_{DSS}$ | Zero Gate Voltage Drain Current | $V_{GS}$ = 0V, $V_{DS}$= 1000V | $T_j$ = 25°C | | | 600 | µA |
| | | $V_{GS}$ = 0V, $V_{DS}$= 800V | $T_j$ = 125°C | | | 3 | mA |
| $R_{DS(on)}$ | Drain – Source on Resistance | $V_{GS}$ = 10V, $I_D$ = 107.5A | | | 45 | 55 | mΩ |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{GS}$ = $V_{DS}$, $I_D$ = 30mA | | 3 | | 5 | V |
| $I_{GSS}$ | Gate – Source Leakage Current | $V_{GS}$ = ±30 V, $V_{DS}$ = 0V | | | | ±600 | nA |

## Dynamic Characteristics

| *Symbol* | *Characteristic* | *Test Conditions* | *Min* | *Typ* | *Max* | *Unit* |
|---|---|---|---|---|---|---|
| $C_{iss}$ | Input Capacitance | $V_{GS}$ = 0V<br>$V_{DS}$ = 25V<br>f = 1MHz | | 42.7 | | nF |
| $C_{oss}$ | Output Capacitance | | | 7.6 | | |
| $C_{rss}$ | Reverse Transfer Capacitance | | | 1.3 | | |
| $Q_g$ | Total gate Charge | $V_{GS}$ = 10V<br>$V_{Bus}$ = 500V<br>$I_D$ = 215A | | 1602 | | nC |
| $Q_{gs}$ | Gate – Source Charge | | | 204 | | |
| $Q_{gd}$ | Gate – Drain Charge | | | 1038 | | |
| $T_{d(on)}$ | Turn-on Delay Time | **Inductive switching @ 125°C**<br>$V_{GS}$ = 15V<br>$V_{Bus}$ = 670V<br>$I_D$ = 215A<br>$R_G$ = 0.5Ω | | 18 | | ns |
| $T_r$ | Rise Time | | | 14 | | |
| $T_{d(off)}$ | Turn-off Delay Time | | | 140 | | |
| $T_f$ | Fall Time | | | 55 | | |
| $E_{on}$ | Turn-on Switching Energy | **Inductive switching @ 25°C**<br>$V_{GS}$ = 15V, $V_{Bus}$ = 670V<br>$I_D$ = 215A, $R_G$ = 0.5Ω | | 7.2 | | mJ |
| $E_{off}$ | Turn-off Switching Energy | | | 4.3 | | |
| $E_{on}$ | Turn-on Switching Energy | **Inductive switching @ 125°C**<br>$V_{GS}$ = 15V, $V_{Bus}$ = 670V<br>$I_D$ = 215A, $R_G$ = 0.5Ω | | 12 | | mJ |
| $E_{off}$ | Turn-off Switching Energy | | | 5.8 | | |

## Source - Drain diode ratings and characteristics

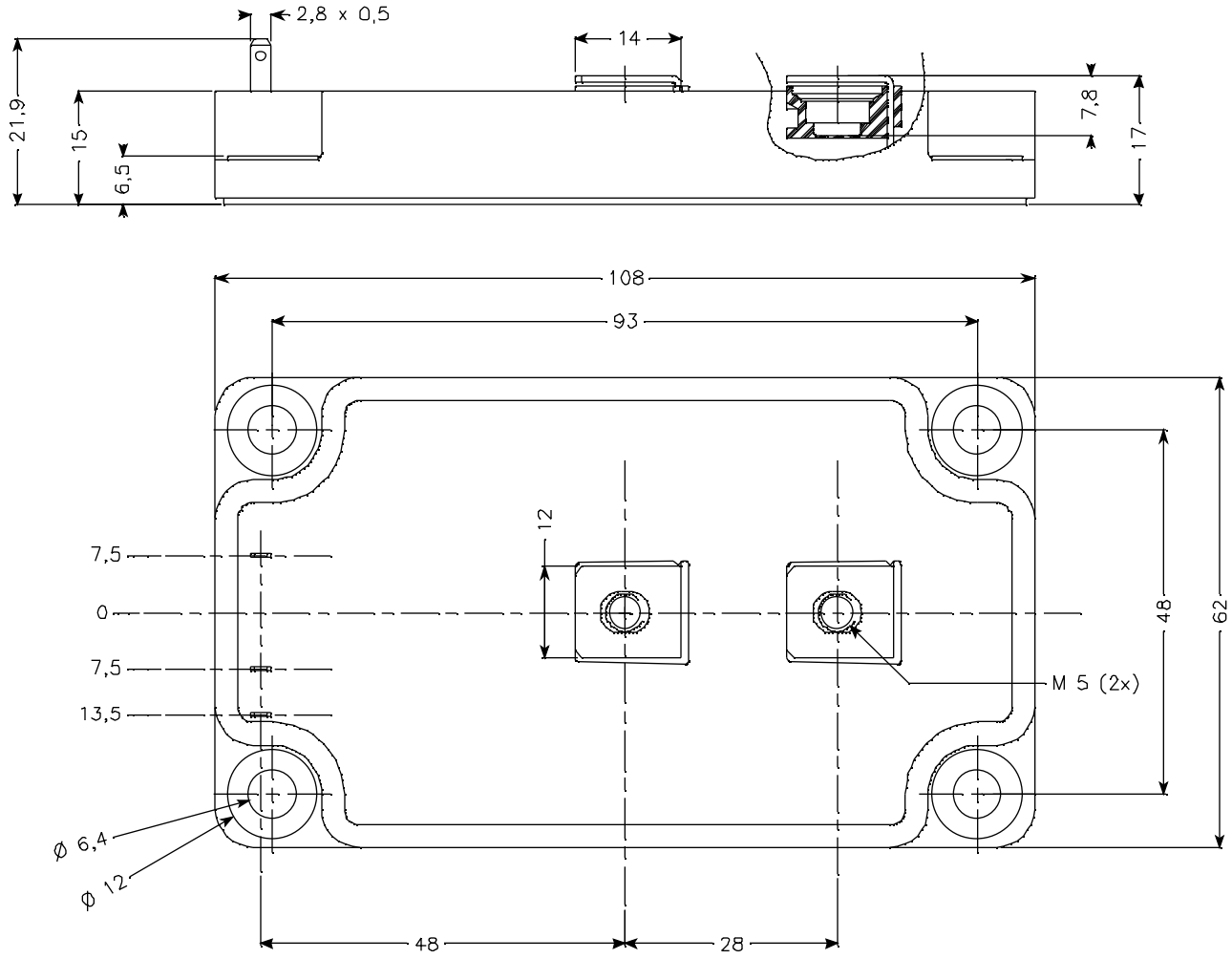
| *Symbol* | *Characteristic* | *Test Conditions* | | *Min* | *Typ* | *Max* | *Unit* |
|---|---|---|---|---|---|---|---|
| $I_S$ | Continuous Source current (Body diode) | | Tc = 25°C | | | 215 | A |
| | | | Tc = 80°C | | | 160 | |
| $V_{SD}$ | Diode Forward Voltage | $V_{GS}$ = 0V, $I_S$ = - 215A | | | | 1.3 | V |
| dv/dt | Peak Diode Recovery ❶ | | | | | 18 | V/ns |
| $t_{rr}$ | Reverse Recovery Time | $I_S$ = - 215A<br>$V_R$ = 500V<br>$di_S/dt$ = 600A/µs | $T_j$ = 25°C | | | 310 | ns |
| | | | $T_j$ = 125°C | | | 625 | |
| $Q_{rr}$ | Reverse Recovery Charge | | $T_j$ = 25°C | | 12 | | µC |
| | | | $T_j$ = 125°C | | 36 | | |

❶ dv/dt numbers reflect the limitations of the circuit rather than the device itself.
$I_S \le$ - 215A  di/dt ≤ 700A/µs  $V_R \le V_{DSS}$  $T_j \le$ 150°C

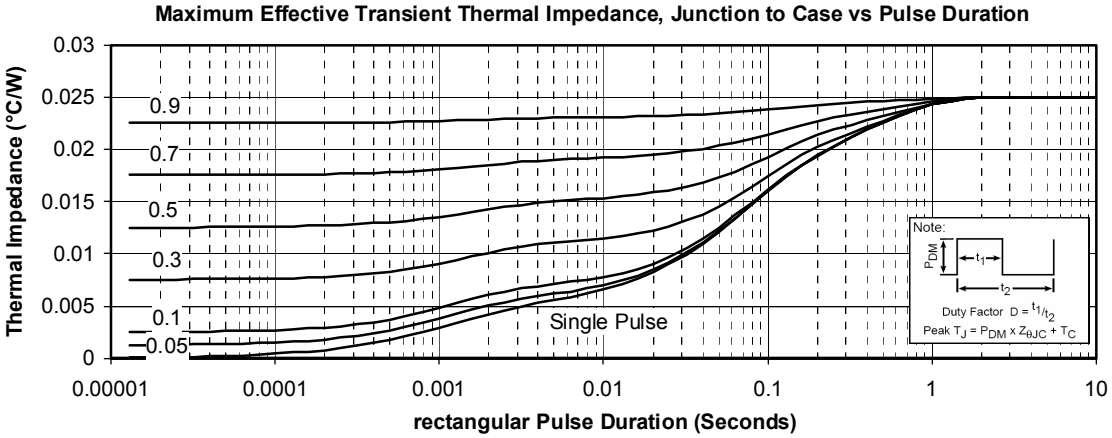
## Thermal and package characteristics

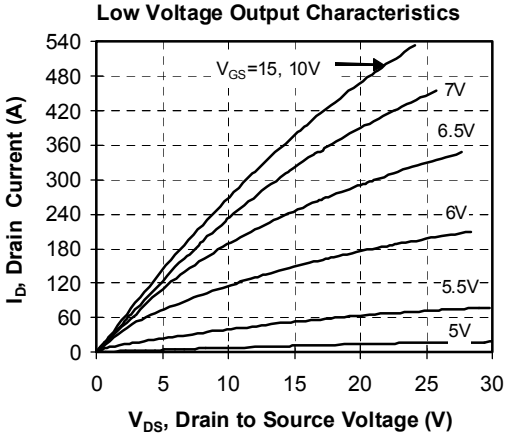
| *Symbol* | *Characteristic* | | | *Min* | *Typ* | *Max* | *Unit* |
|---|---|---|---|---|---|---|---|
| $R_{thJC}$ | Junction to Case | | Transistor | | | 0.025 | °C/W |
| $V_{ISOL}$ | RMS Isolation Voltage, any terminal to case t =1 min, I isol<1mA, 50/60Hz | | | 2500 | | | V |
| $T_J$ | Operating junction temperature range | | | -40 | | 150 | °C |
| $T_{STG}$ | Storage Temperature Range | | | -40 | | 125 | |
| $T_C$ | Operating Case Temperature | | | -40 | | 100 | |
| Torque | Mounting torque | To Heatsink | M6 | 3 | | 5 | N.m |
| | | For teminals | M5 | 2 | | 3.5 | |
| Wt | Package Weight | | | | | 280 | g |

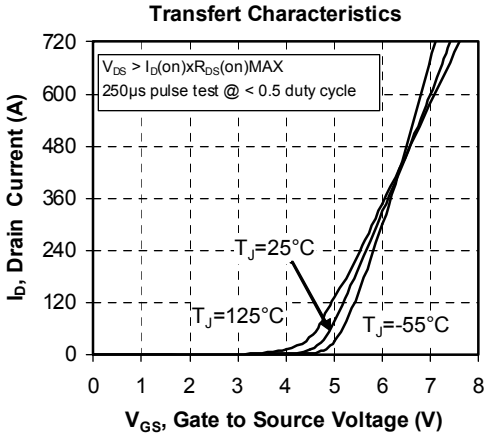
## SP6 Package outline (dimensions in mm)

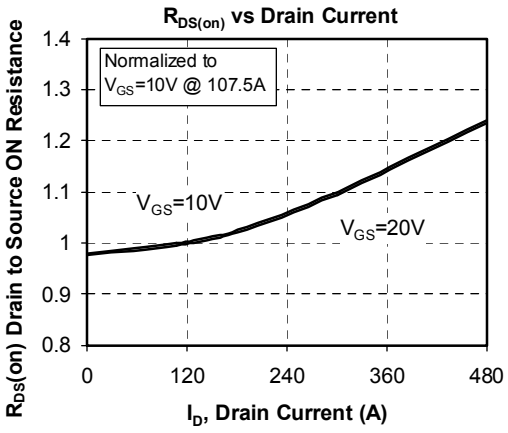


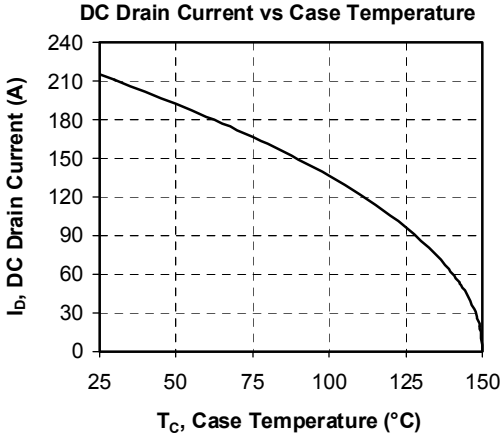
## Typical Performance Curve



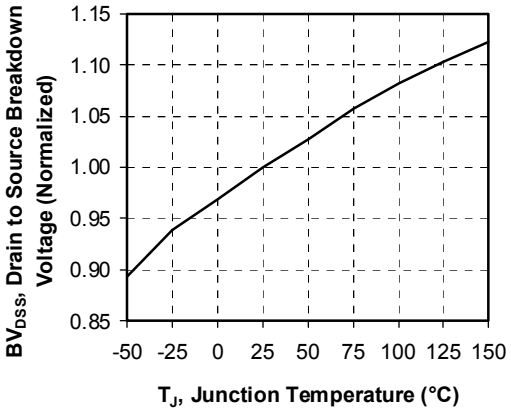



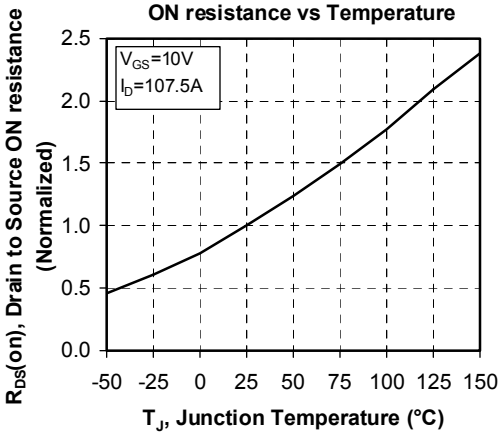



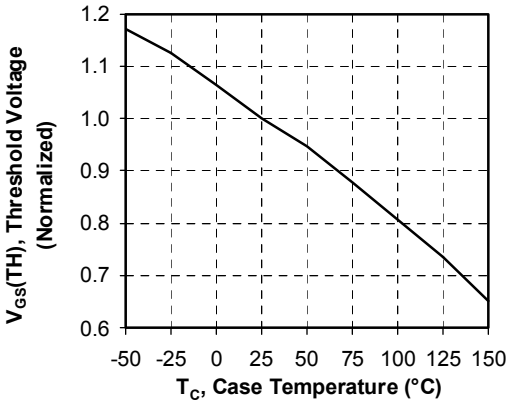
Breakdown Voltage vs Temperature



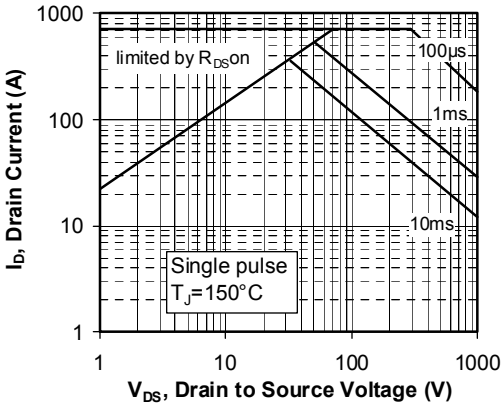

ON resistance vs Temperature



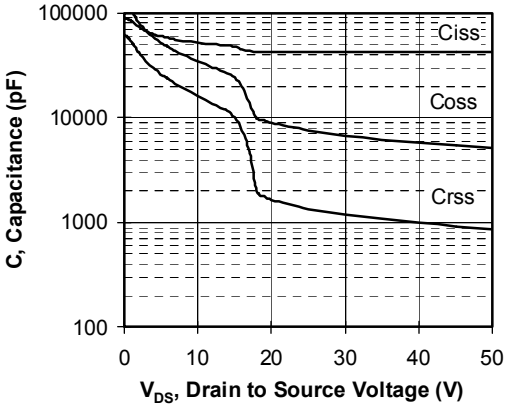

Threshold Voltage vs Temperature



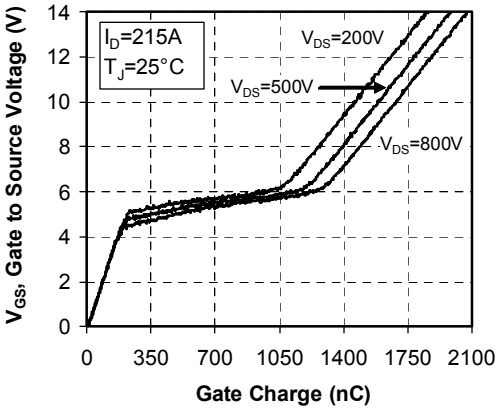

Maximum Safe Operating Area



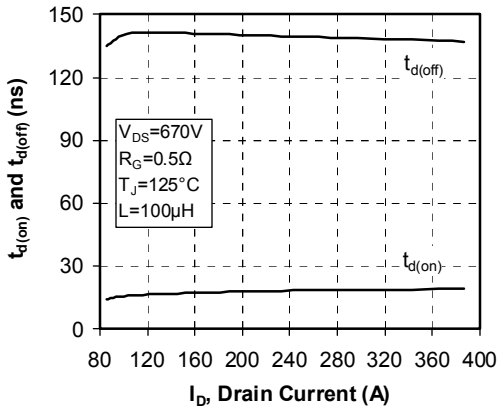

Capacitance vs Drain to Source Voltage



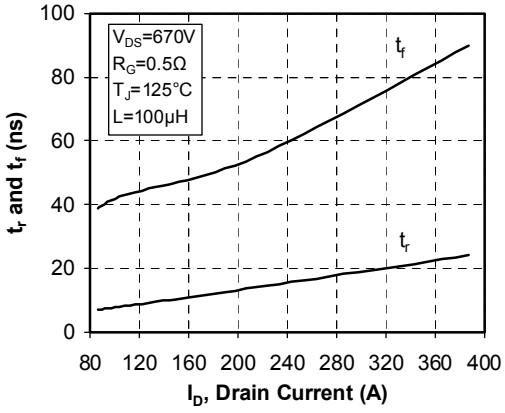

Gate Charge vs Gate to Source Voltage



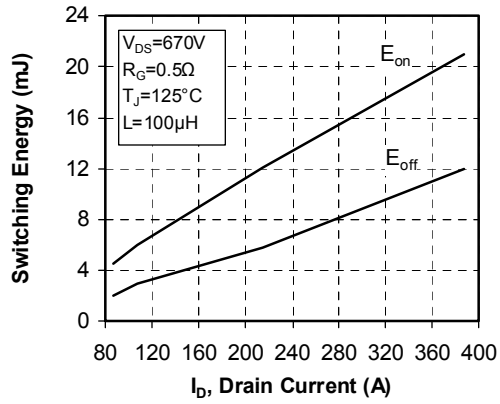
**Delay Times vs Current**



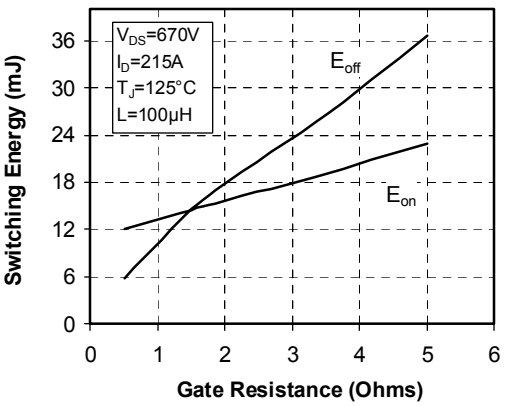

**Rise and Fall times vs Current**



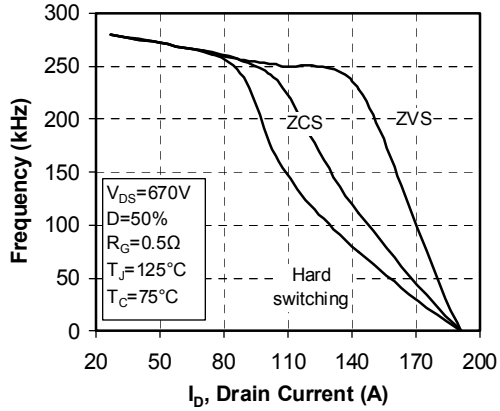

**Switching Energy vs Current**



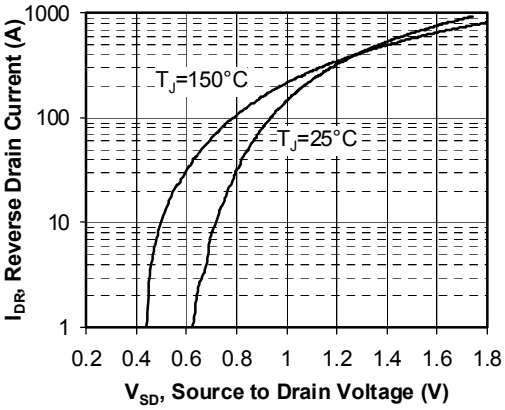

**Switching Energy vs Gate Resistance**




**Operating Frequency vs Drain Current**




**Source to Drain Diode Forward Voltage**

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