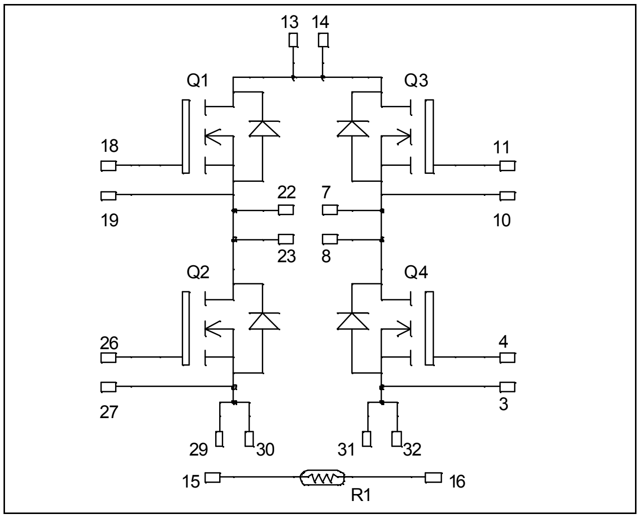
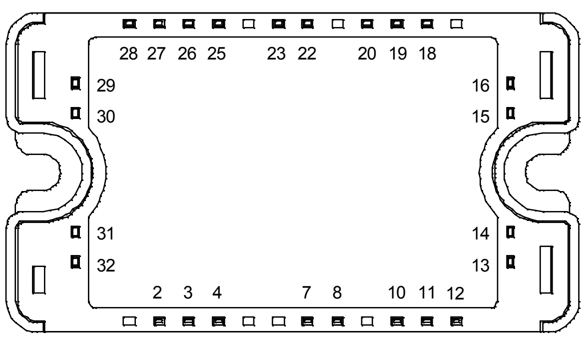
# APTM100H35FT3

## *Full - Bridge MOSFET Power Module*

**$V_{DSS}$ = 1000V**
**$R_{DSon}$ = 350mΩ typ @ Tj = 25°C**
**$I_D$ = 22A @ Tc = 25°C**




All multiple inputs and outputs must be shorted together
Example: 13/14 ; 29/30 ; 22/23 …

**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
- Internal thermistor for temperature monitoring
- High level of integration

**Benefits**
- Outstanding performance at high frequency operation
- Direct mounting to heatsink (isolated package)
- Low junction to case thermal resistance
- Solderable terminals both for power and signal for easy PCB mounting
- Low profile
- Each leg can be easily paralleled to achieve a phase leg of twice the current capability

## 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 | 22 | A |
| | | $T_c$ = 80°C | 17 | |
| $I_{DM}$ | Pulsed Drain current | | 88 | |
| $V_{GS}$ | Gate - Source Voltage | | ±30 | V |
| $R_{DSon}$ | Drain - Source ON Resistance | | 420 | mΩ |
| $P_D$ | Maximum Power Dissipation | $T_c$ = 25°C | 390 | W |
| $I_{AR}$ | Avalanche current (repetitive and non repetitive) | | 25 | A |
| $E_{AR}$ | Repetitive Avalanche Energy | | 50 | mJ |
| $E_{AS}$ | Single Pulse Avalanche Energy | | 3000 | |

**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 | | | 250 | µA |
| | | $V_{GS}$ = 0V, $V_{DS}$ = 800V | $T_j$ = 125°C | | | 1000 | |
| $R_{DS(on)}$ | Drain – Source on Resistance | $V_{GS}$ = 10V, $I_D$ = 11A | | | 350 | 420 | mΩ |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{GS}$ = $V_{DS}$, $I_D$ = 2.5mA | | 3 | | 5 | V |
| $I_{GSS}$ | Gate – Source Leakage Current | $V_{GS}$ = ±30V, $V_{DS}$ = 0V | | | | ±100 | 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 | | 5.2 | | nF |
| $C_{oss}$ | Output Capacitance | | | 0.88 | | |
| $C_{rss}$ | Reverse Transfer Capacitance | | | 0.16 | | |
| $Q_g$ | Total gate Charge | $V_{GS}$ = 10V<br>$V_{Bus}$ = 500V<br>$I_D$ = 22A | | 186 | | nC |
| $Q_{gs}$ | Gate – Source Charge | | | 24 | | |
| $Q_{gd}$ | Gate – Drain Charge | | | 122 | | |
| $T_{d(on)}$ | Turn-on Delay Time | **Inductive switching @ 125°C**<br>$V_{GS}$ = 15V<br>$V_{Bus}$ = 670V<br>$I_D$ = 22A<br>$R_G$ = 5Ω | | 18 | | ns |
| $T_r$ | Rise Time | | | 12 | | |
| $T_{d(off)}$ | Turn-off Delay Time | | | 155 | | |
| $T_f$ | Fall Time | | | 40 | | |
| $E_{on}$ | Turn-on Switching Energy ❶ | **Inductive switching @ 25°C**<br>$V_{GS}$ = 15V, $V_{Bus}$ = 670V<br>$I_D$ = 22A, $R_G$ = 5Ω | | 900 | | µJ |
| $E_{off}$ | Turn-off Switching Energy ❷ | | | 623 | | |
| $E_{on}$ | Turn-on Switching Energy ❶ | **Inductive switching @ 125°C**<br>$V_{GS}$ = 15V, $V_{Bus}$ = 670V<br>$I_D$ = 22A, $R_G$ = 5Ω | | 1423 | | µJ |
| $E_{off}$ | Turn-off Switching Energy ❷ | | | 779 | | |

## Source - Drain diode ratings and characteristics

| *Symbol* | *Characteristic* | *Test Conditions* | | *Min* | *Typ* | *Max* | *Unit* |
|---|---|---|---|---|---|---|---|
| $I_S$ | Continuous Source current (Body diode) | | Tc = 25°C | | | 22 | A |
| | | | Tc = 80°C | | | 17 | |
| $V_{SD}$ | Diode Forward Voltage | $V_{GS}$ = 0V, $I_S$ = - 22A | | | | 1.3 | V |
| dv/dt | Peak Diode Recovery ❸ | | | | | 18 | V/ns |
| $t_{rr}$ | Reverse Recovery Time | $I_S$ = - 22A<br>$V_R$ = 500V<br>$di_S/dt$ = 100A/µs | $T_j$ = 25°C | | | 320 | ns |
| | | | $T_j$ = 125°C | | | 650 | |
| $Q_{rr}$ | Reverse Recovery Charge | $I_S$ = - 22A<br>$V_R$ = 500V<br>$di_S/dt$ = 100A/µs | $T_j$ = 25°C | | 3.6 | | µC |
| | | | $T_j$ = 125°C | | 9.72 | | |

❶ $E_{on}$ includes diode reverse recovery.
❷ In accordance with JEDEC standard JESD24-1.
❸ dv/dt numbers reflect the limitations of the circuit rather than the device itself.
$I_S \leq$ - 22A    di/dt ≤ 700A/µs    $V_R \leq V_{DSS}$    $T_j \leq$ 150°C

## Thermal and package characteristics

| *Symbol* | *Characteristic* | | | *Min* | *Typ* | *Max* | *Unit* |
|---|---|---|---|---|---|---|---|
| $R_{thJC}$ | Junction to Case | | | | | 0.32 | °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 | M4 | 1.5 | | 4.7 | N.m |
| Wt | Package Weight | | | | | 110 | g |

## Temperature sensor NTC (see application note APT0406 on www.advancedpower.com for more information).

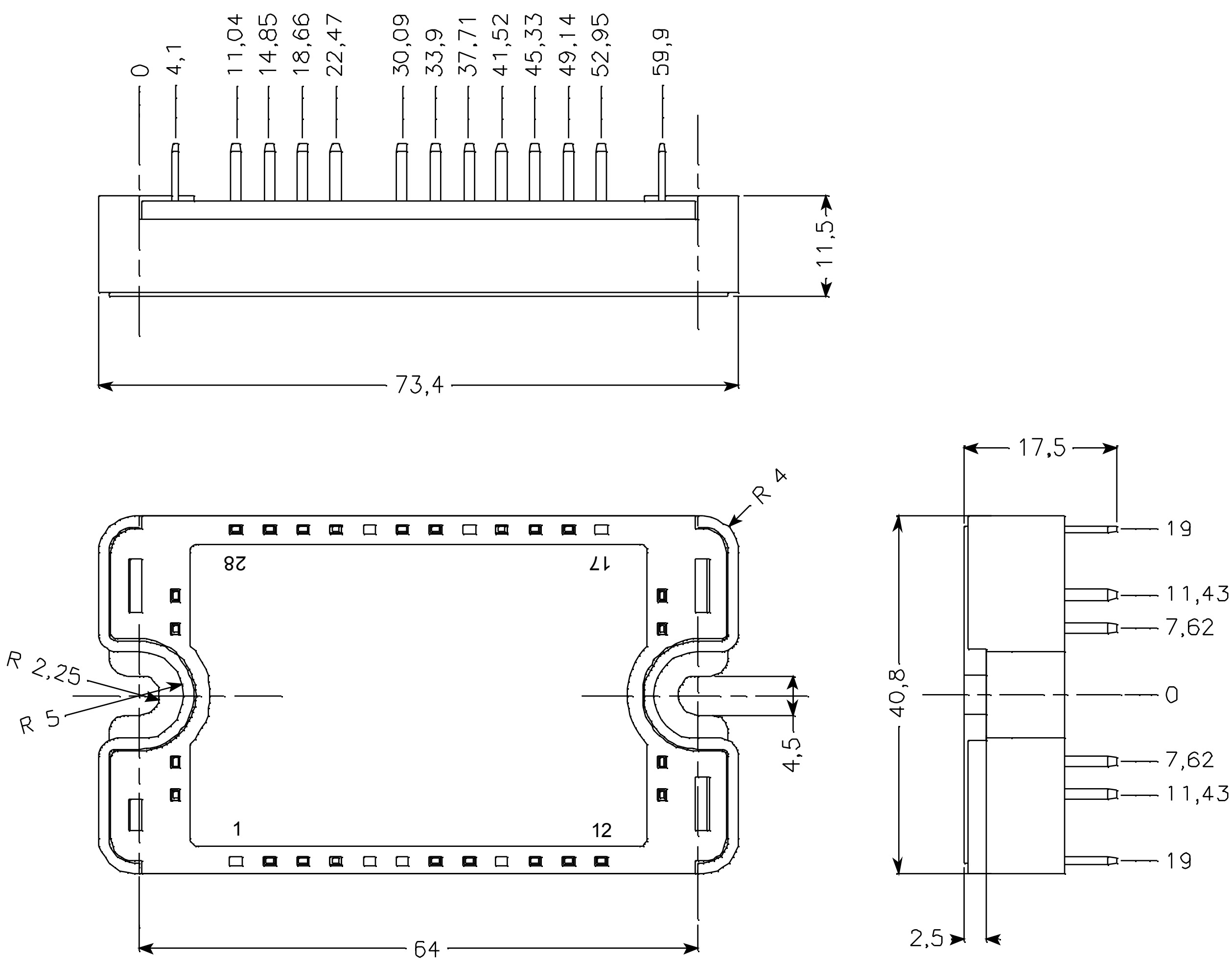
| *Symbol* | *Characteristic* | *Min* | *Typ* | *Max* | *Unit* |
|---|---|---|---|---|---|
| $R_{25}$ | Resistance @ 25°C | | 50 | | kΩ |
| $B_{25/85}$ | $T_{25}$ = 298.15 K | | 3952 | | K |

$$R_T = \frac{R_{25}}{\exp\left[B_{25/85}\left(\frac{1}{T_{25}} - \frac{1}{T}\right)\right]}$$

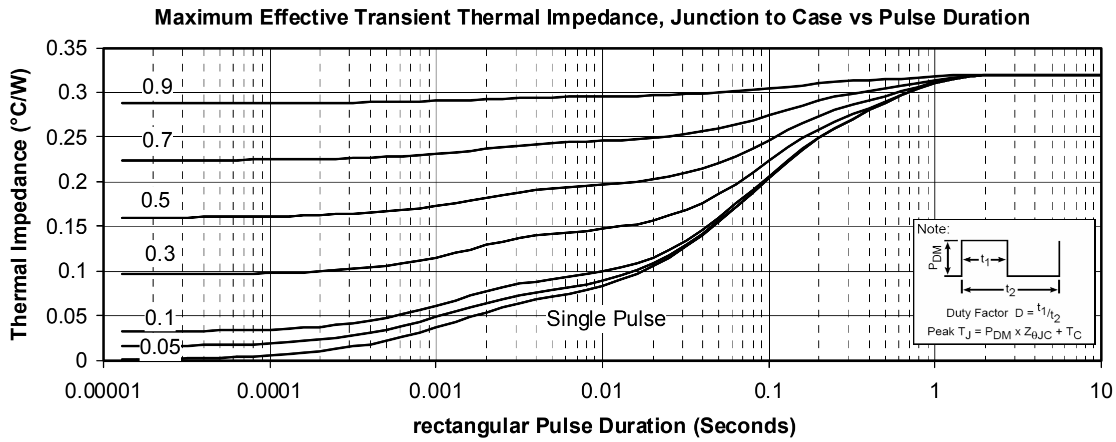
T: Thermistor temperature

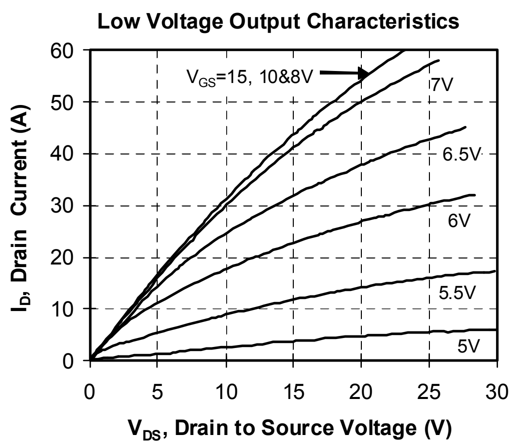
$R_T$: Thermistor value at T

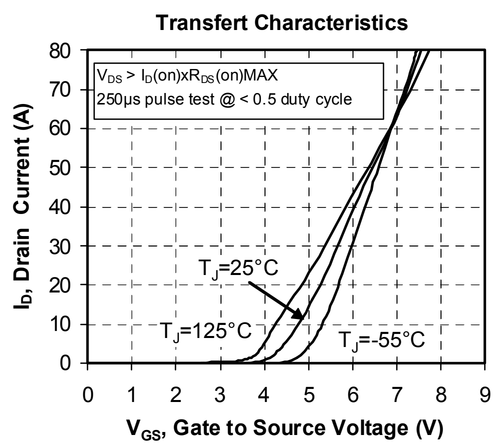
## Package outline (dimensions in mm)

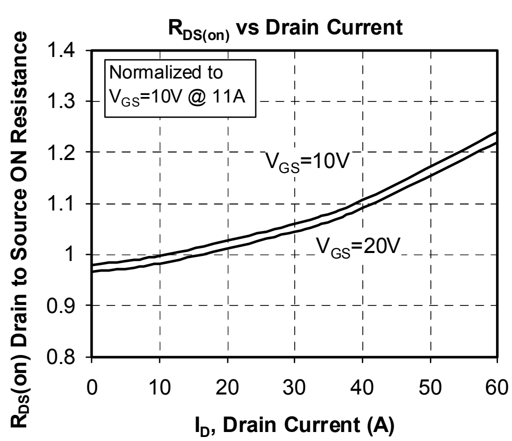


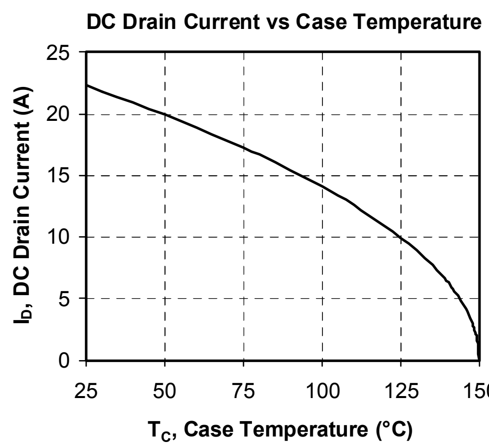
## Typical Performance Curve

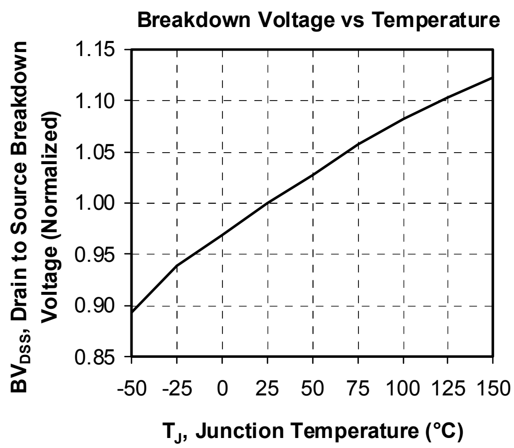


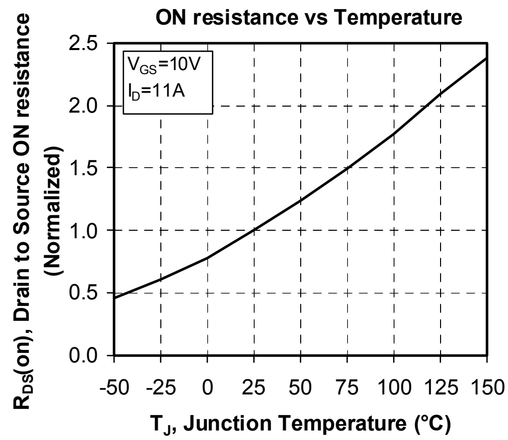



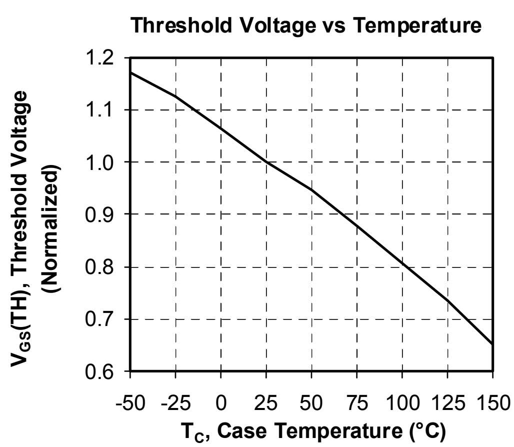



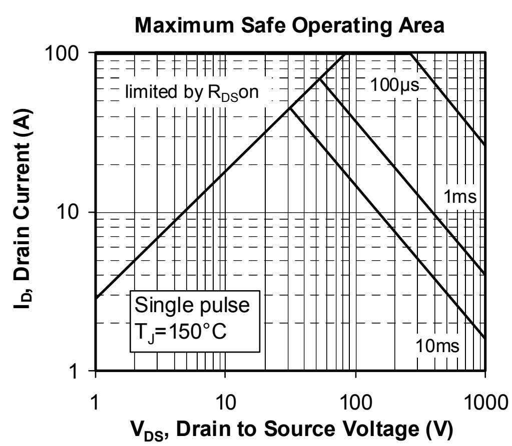



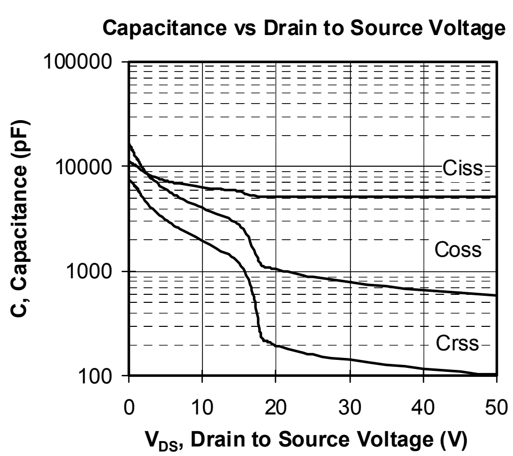



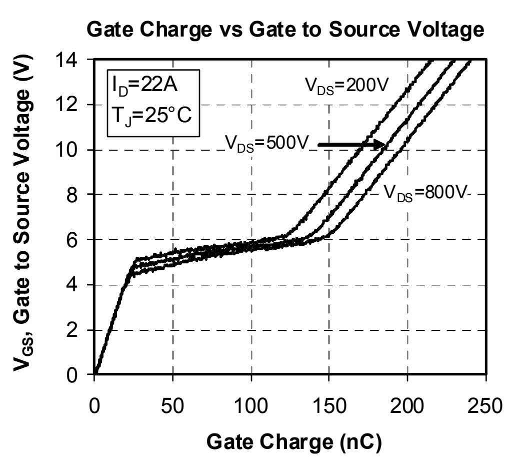

Breakdown Voltage vs Temperature
$BV_{DSS}$, Drain to Source Breakdown Voltage (Normalized)
1.15
1.10
1.05
1.00
0.95
0.90
0.85
-50 -25 0 25 50 75 100 125 150
$T_J$, Junction Temperature (°C)


ON resistance vs Temperature
$R_{DS}(on)$, Drain to Source ON resistance (Normalized)
$V_{GS}$=10V
$I_D$=11A
2.5
2.0
1.5
1.0
0.5
0.0
-50 -25 0 25 50 75 100 125 150
$T_J$, Junction Temperature (°C)

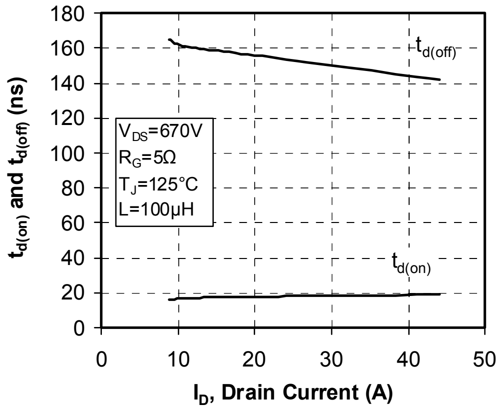

Threshold Voltage vs Temperature
$V_{GS}(TH)$, Threshold Voltage (Normalized)
1.2
1.1
1.0
0.9
0.8
0.7
0.6
-50 -25 0 25 50 75 100 125 150
$T_C$, Case Temperature (°C)


Maximum Safe Operating Area
$I_D$, Drain Current (A)
limited by $R_{DS}$on
100µs
1ms
10ms
Single pulse
$T_J$=150°C
100
10
1
1 10 100 1000
$V_{DS}$, Drain to Source Voltage (V)

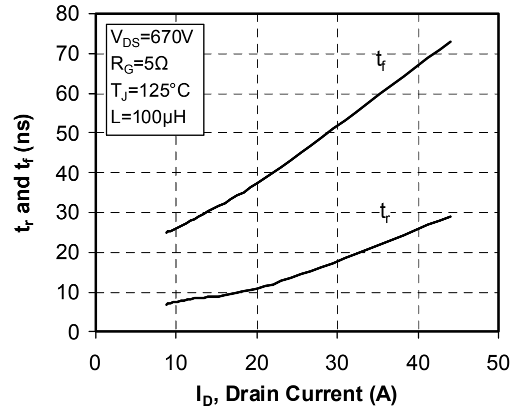

Capacitance vs Drain to Source Voltage
C, Capacitance (pF)
Ciss
Coss
Crss
100000
10000
1000
100
0 10 20 30 40 50
$V_{DS}$, Drain to Source Voltage (V)


Gate Charge vs Gate to Source Voltage
$V_{GS}$, Gate to Source Voltage (V)
$I_D$=22A
$T_J$=25°C
$V_{DS}$=200V
$V_{DS}$=500V
$V_{DS}$=800V
14
12
10
8
6
4
2
0
0 50 100 150 200 250
Gate Charge (nC)

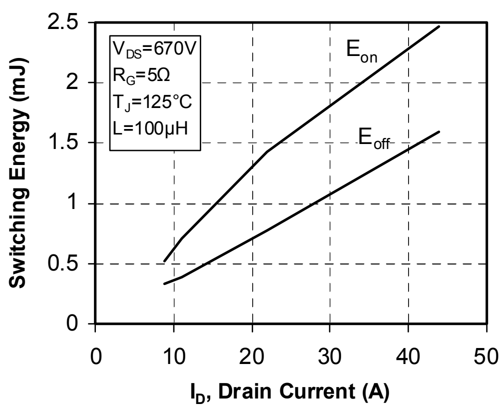
Delay Times vs Current



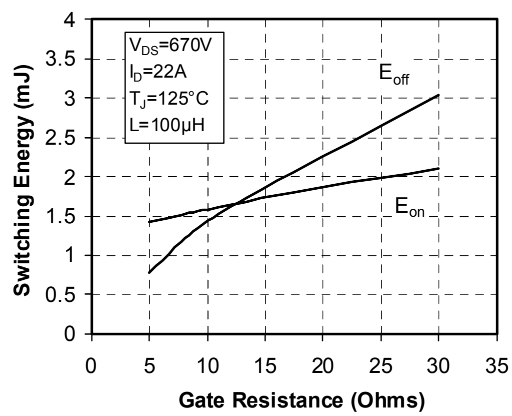

Rise and Fall times vs Current



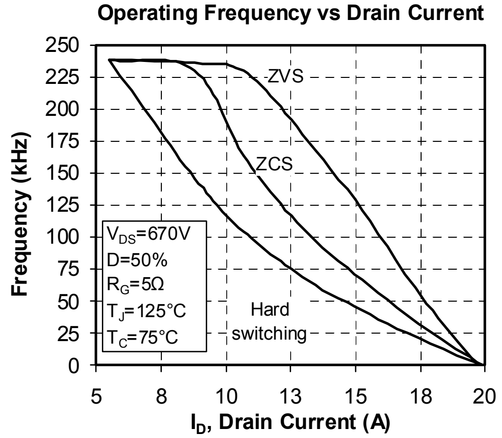

Switching Energy vs Current



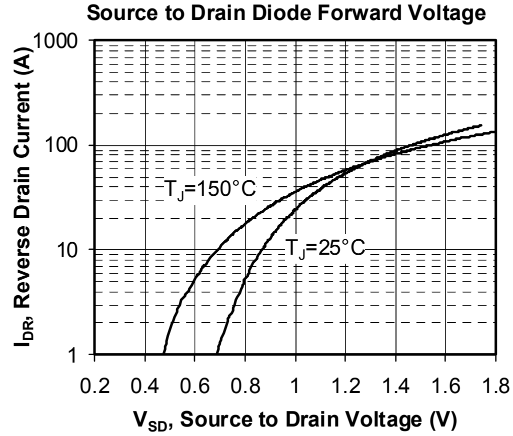

Switching Energy vs Gate Resistance




Operating Frequency vs Drain Current




Source to Drain Diode Forward Voltage




**APT reserves the right to change, without notice, the specifications and information contained herein**