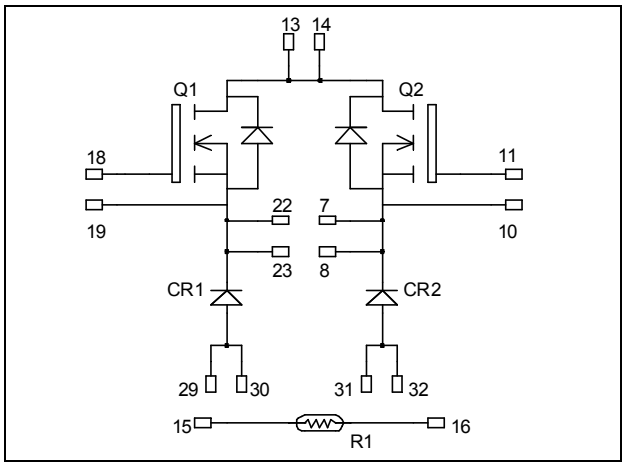
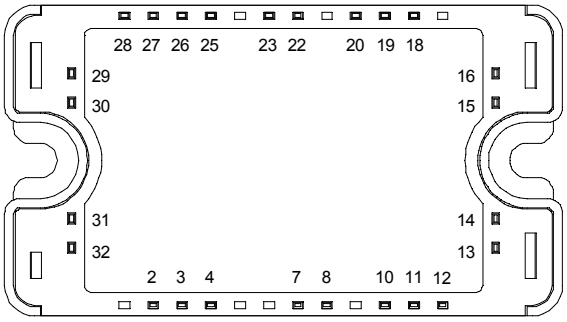
# APTC60DSKM24T3G

## *Dual buck chopper Super Junction MOSFET Power Module*

**$V_{DSS}$ = 600V**
**$R_{DSon}$ = 24mΩ max @ Tj = 25°C**
**$I_D$ = 95A @ Tc = 25°C**




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

**Application**

- AC and DC motor control
- Switched Mode Power Supplies

**Features**

- COOLMOS Power Semiconductors
  - Ultra low $R_{DSon}$
  - Low Miller capacitance
  - Ultra low gate charge
  - 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 single buck of twice the current capability
- RoHS Compliant

## Absolute maximum ratings

| *Symbol* | *Parameter* | | *Max ratings* | *Unit* |
|---|---|---|---|---|
| $V_{DSS}$ | Drain - Source Breakdown Voltage | | 600 | V |
| $I_D$ | Continuous Drain Current | $T_c$ = 25°C | 95 | A |
| | | $T_c$ = 80°C | 70 | |
| $I_{DM}$ | Pulsed Drain current | | 260 | |
| $V_{GS}$ | Gate - Source Voltage | | ±20 | V |
| $R_{DSon}$ | Drain - Source ON Resistance | | 24 | mΩ |
| $P_D$ | Maximum Power Dissipation | $T_c$ = 25°C | 462 | W |
| $I_{AR}$ | Avalanche current (repetitive and non repetitive) | | 15 | A |
| $E_{AR}$ | Repetitive Avalanche Energy | | 3 | mJ |
| $E_{AS}$ | Single Pulse Avalanche Energy | | 1900 | |

**CAUTION:** These Devices are sensitive to Electrostatic Discharge. Proper Handling Procedures Should Be Followed. See application note APT0502 on www.microsemi.com

**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,$V_{DS}$ = 600V | $T_j$ = 25°C | | | 350 | µA |
| | | $V_{GS}$ = 0V,$V_{DS}$ = 600V | $T_j$ = 125°C | | | 600 | |
| $R_{DS(on)}$ | Drain – Source on Resistance | $V_{GS}$ = 10V, $I_D$ = 47.5A | | | | 24 | mΩ |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{GS}$ = $V_{DS}$, $I_D$ = 5mA | | 2.1 | 3 | 3.9 | V |
| $I_{GSS}$ | Gate – Source Leakage Current | $V_{GS}$ = ±20 V, $V_{DS}$ = 0V | | | | 200 | nA |

## Dynamic Characteristics

| *Symbol* | *Characteristic* | *Test Conditions* | *Min* | *Typ* | *Max* | *Unit* |
|---|---|---|---|---|---|---|
| $C_{iss}$ | Input Capacitance | $V_{GS}$ = 0V ; $V_{DS}$ = 25V<br>f = 1MHz | | 14.4 | | nF |
| $C_{oss}$ | Output Capacitance | | | 17 | | |
| $Q_g$ | Total gate Charge | $V_{GS}$ = 10V<br>$V_{Bus}$ = 300V<br>$I_D$ = 95A | | 300 | | nC |
| $Q_{gs}$ | Gate – Source Charge | | | 68 | | |
| $Q_{gd}$ | Gate – Drain Charge | | | 102 | | |
| $T_{d(on)}$ | Turn-on Delay Time | **Inductive Switching (125°C)**<br>$V_{GS}$ = 10V<br>$V_{Bus}$ = 400V<br>$I_D$ = 95A<br>$R_G$ = 2.5Ω | | 21 | | ns |
| $T_r$ | Rise Time | | | 30 | | |
| $T_{d(off)}$ | Turn-off Delay Time | | | 100 | | |
| $T_f$ | Fall Time | | | 45 | | |
| $E_{on}$ | Turn-on Switching Energy | **Inductive switching @ 25°C**<br>$V_{GS}$ = 10V ; $V_{Bus}$ = 400V<br>$I_D$ = 95A ; $R_G$ = 2.5Ω | | 1350 | | µJ |
| $E_{off}$ | Turn-off Switching Energy | | | 1040 | | |
| $E_{on}$ | Turn-on Switching Energy | **Inductive switching @ 125°C**<br>$V_{GS}$ = 10V ; $V_{Bus}$ = 400V<br>$I_D$ = 95A ; $R_G$ = 2.5Ω | | 2200 | | µJ |
| $E_{off}$ | Turn-off Switching Energy | | | 1270 | | |

## Chopper diode ratings and characteristics

| *Symbol* | *Characteristic* | *Test Conditions* | | *Min* | *Typ* | *Max* | *Unit* |
|---|---|---|---|---|---|---|---|
| $V_{RRM}$ | Maximum Peak Repetitive Reverse Voltage | | | 600 | | | V |
| $I_{RM}$ | Maximum Reverse Leakage Current | $V_R$=600V | $T_j$ = 25°C | | | 100 | µA |
| | | | $T_j$ = 125°C | | | 500 | |
| $I_F$ | DC Forward Current | | $T_c$ = 80°C | | 100 | | A |
| $V_F$ | Diode Forward Voltage | $I_F$ = 100A | | | 1.6 | 2 | V |
| | | $I_F$ = 200A | | | 2 | | |
| | | $I_F$ = 100A | $T_j$ = 125°C | | 1.3 | | |
| $t_{rr}$ | Reverse Recovery Time | $I_F$ = 100A<br>$V_R$ = 400V<br>di/dt=200A/µs | $T_j$ = 25°C | | 160 | | ns |
| | | | $T_j$ = 125°C | | 220 | | |
| $Q_{rr}$ | Reverse Recovery Charge | | $T_j$ = 25°C | | 290 | | nC |
| | | | $T_j$ = 125°C | | 1530 | | |

## Thermal and package characteristics

| Symbol | Characteristic | | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| $R_{thJC}$ | Junction to Case Thermal Resistance | | Transistor | | | 0.27 | °C/W |
| | | | Diode | | | 0.55 | |
| $V_{ISOL}$ | RMS Isolation Voltage, any terminal to case t =1 min, 50/60Hz | | | 4000 | | | 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 | 2 | | 3 | N.m |
| Wt | Package Weight | | | | | 110 | g |

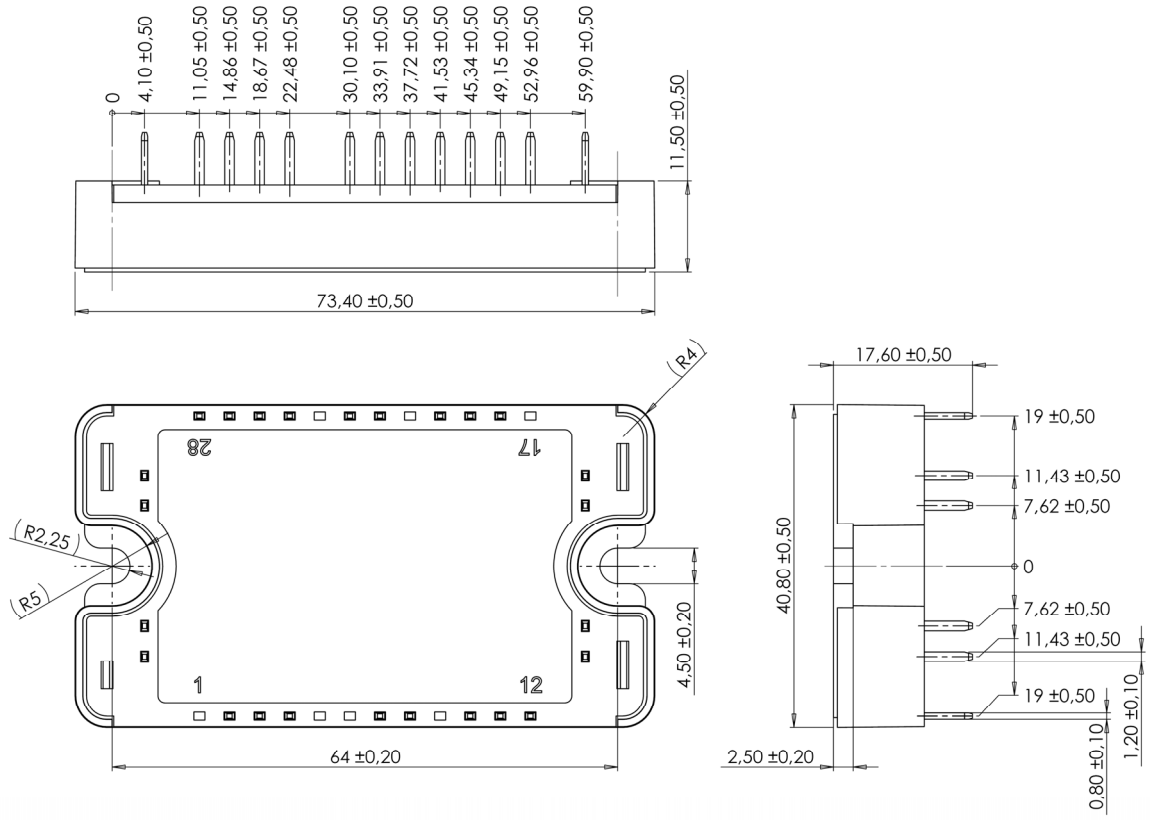
## Temperature sensor NTC (see application note APT0406 on www.microsemi.com for more information).

| Symbol | Characteristic | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $R_{25}$ | Resistance @ 25°C | | | 50 | | kΩ |
| $\Delta R_{25}/R_{25}$ | | | | 5 | | % |
| $B_{25/85}$ | $T_{25}$ = 298.15 K | | | 3952 | | K |
| $\Delta B/B$ | | $T_C$=100°C | | 4 | | % |

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

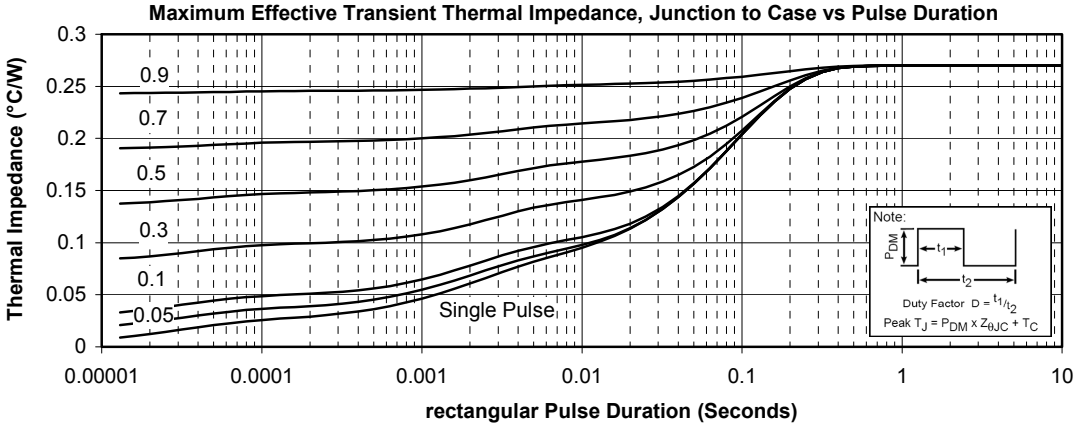
T: Thermistor temperature
$R_T$: Thermistor value at T

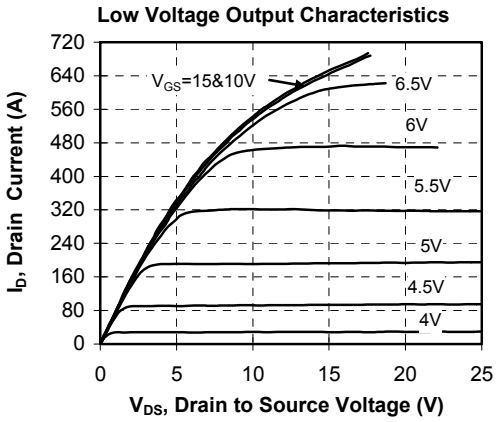
## SP3 Package outline (dimensions in mm)

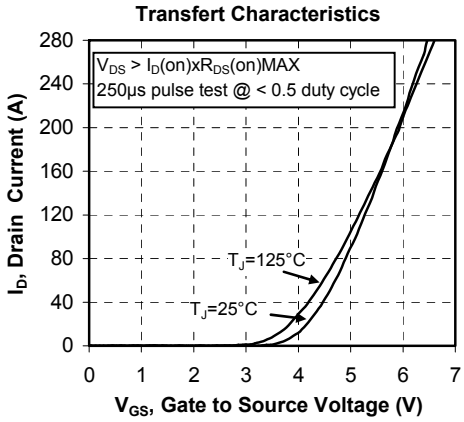


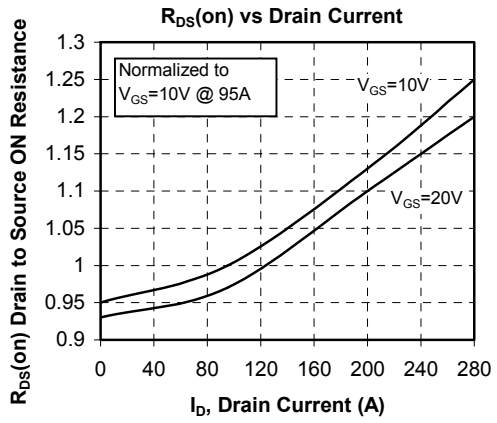

See application note 1901 - Mounting Instructions for SP3 Power Modules on www.microsemi.com

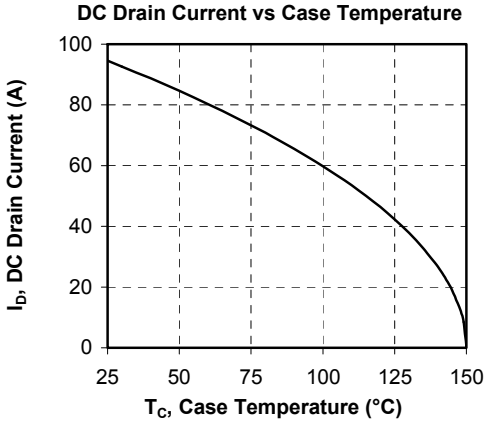
## Typical CoolMOS Performance Curve



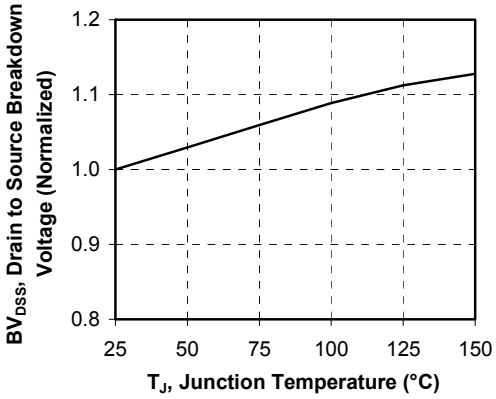



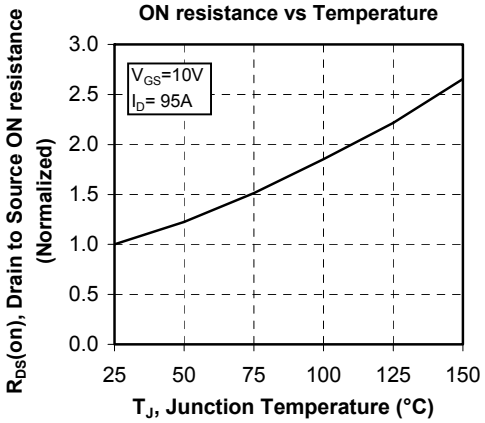



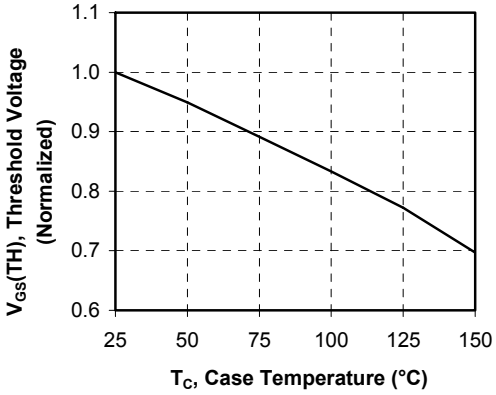
**Breakdown Voltage vs Temperature**



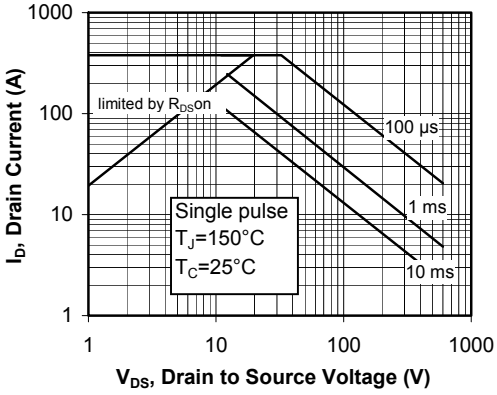

**ON resistance vs Temperature**



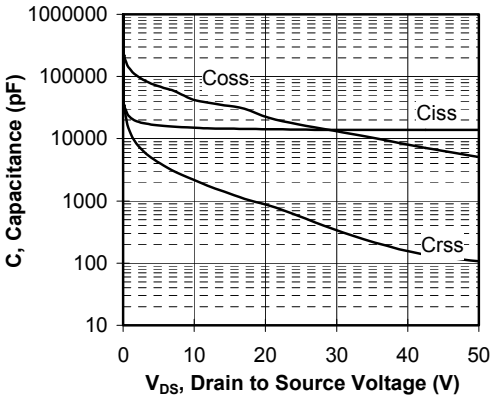

**Threshold Voltage vs Temperature**



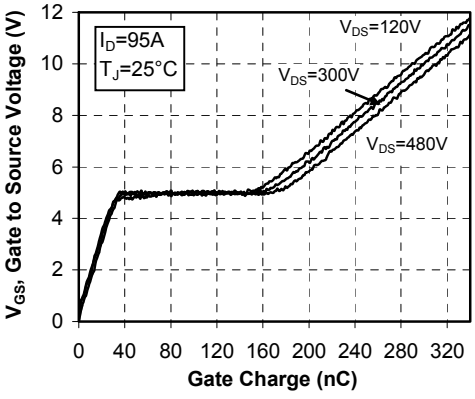

**Maximum Safe Operating Area**



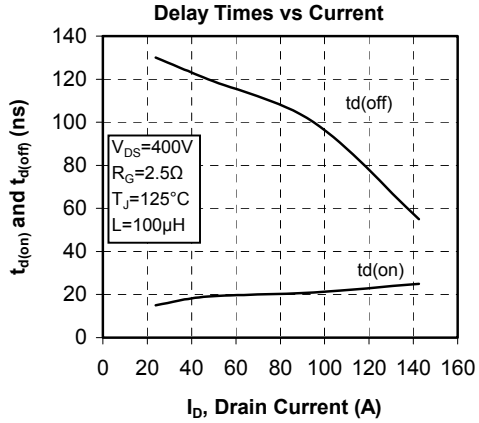

**Capacitance vs Drain to Source Voltage**



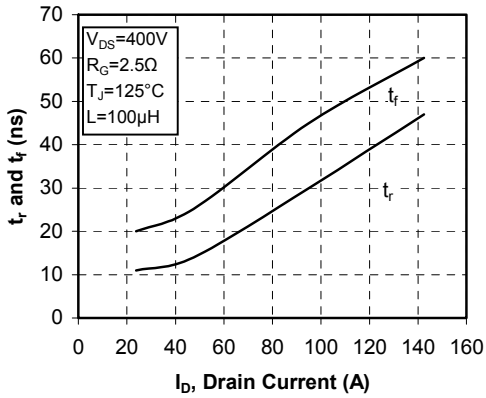

**Gate Charge vs Gate to Source Voltage**



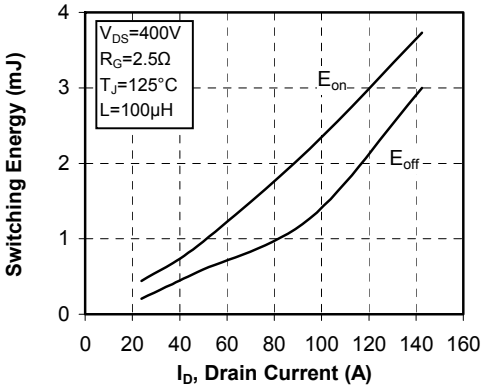
**Delay Times vs Current**



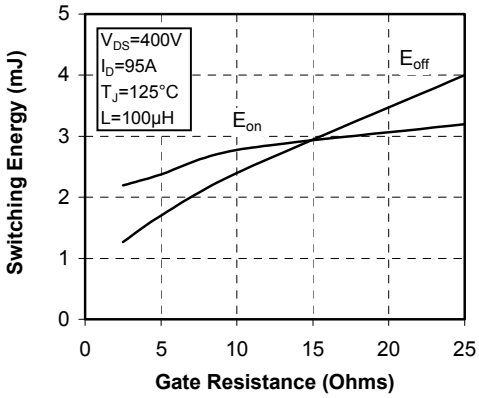

**Rise and Fall times vs Current**



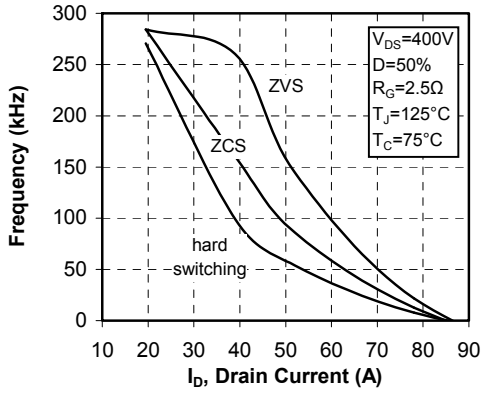

**Switching Energy vs Current**



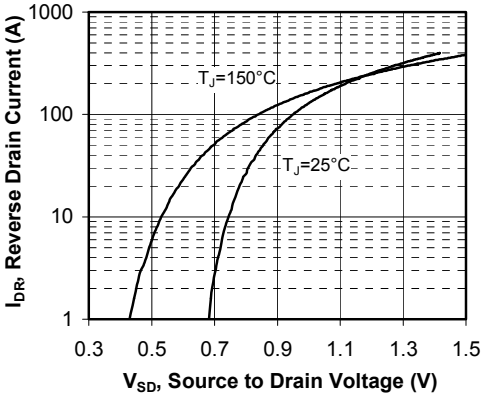

**Switching Energy vs Gate Resistance**



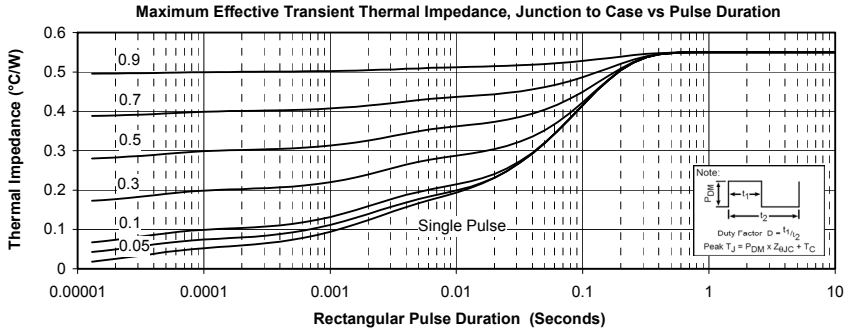

**Operating Frequency vs Drain Current**

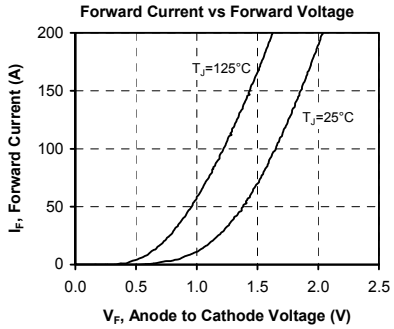


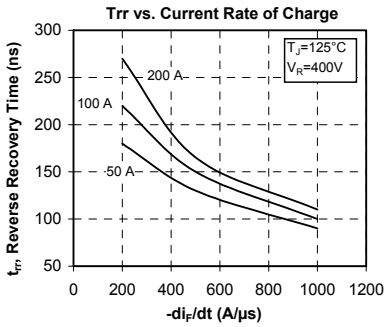

**Source to Drain Diode Forward Voltage**

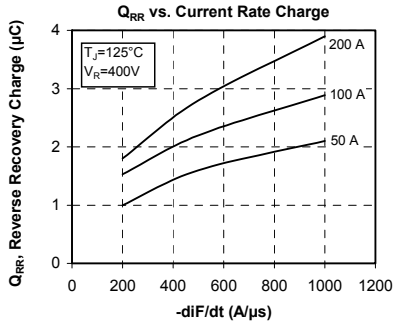


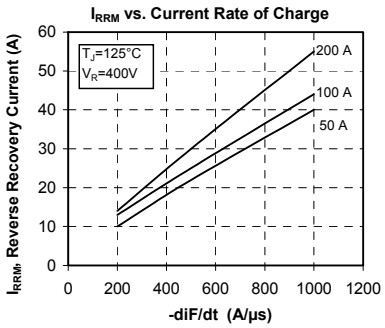
## Typical chopper diode performance curve

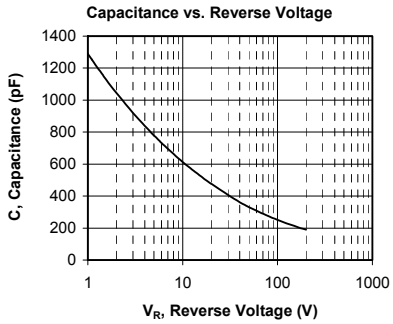


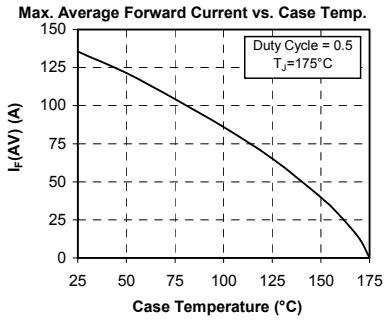

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