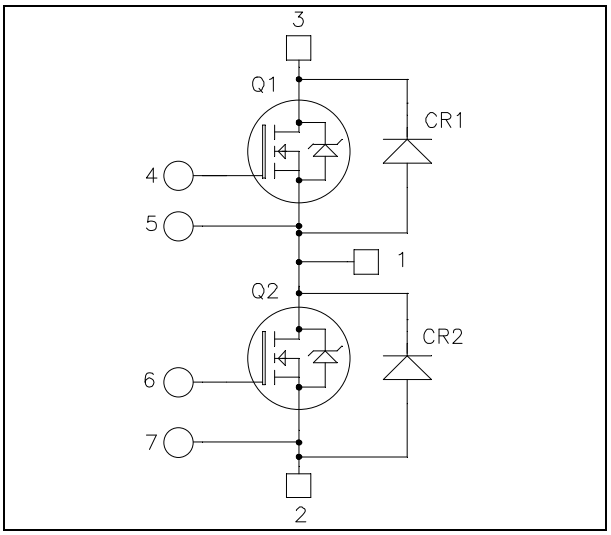
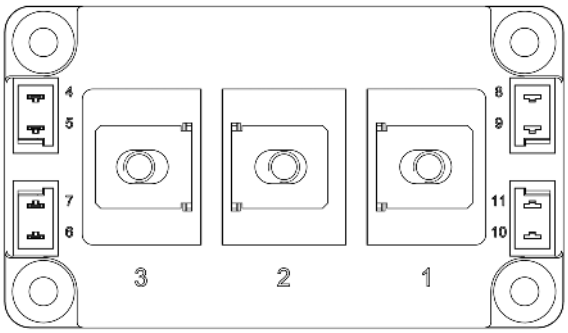
# APTMC120AM16CD3AG

## *Phase leg*
## *SiC MOSFET Power Module*

**$V_{DSS}$ = 1200V**
**$R_{DSon}$ = 16mΩ typ @ Tj = 25°C**
**$I_D$ = 98A @ Tc = 25°C**




**Application**

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

**Features**

- ***SiC Power MOSFET***
  - High speed switching
  - Low $R_{DS(on)}$
  - Ultra low loss
- ***SiC Schottky Diode***
  - Zero reverse recovery
  - Zero forward recovery
  - Temperature Independent switching behavior
  - Positive temperature coefficient on VF
- Kelvin emitter for easy drive
- High level of integration
- AlN substrate for improved thermal performance
- M6 power connectors

**Benefits**

- Stable temperature behavior
- Direct mounting to heatsink (isolated package)
- Low junction to case thermal resistance
- RoHS Compliant

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

**Absolute maximum ratings** (per SiC MOSFET)

| *Symbol* | *Parameter* | | *Max ratings* | *Unit* |
|---|---|---|---|---|
| $V_{DSS}$ | Drain - Source Voltage | | 1200 | V |
| $I_D$ | Continuous Drain Current | $T_c$ = 25°C | 131 | A |
| | | $T_c$ = 80°C | 98 | |
| $I_{DM}$ | Pulsed Drain current | | 262 | |
| $V_{GS}$ | Gate - Source Voltage | | -10/25V | V |
| $R_{DSon}$ | Drain - Source ON Resistance | | 20 | mΩ |
| $P_D$ | Maximum Power Dissipation | $T_c$ = 25°C | 625 | W |

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

## Electrical Characteristics (per SiC MOSFET)

| Symbol | Characteristic | Test Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| $I_{DSS}$ | Zero Gate Voltage Drain Current | $V_{GS}$ = 0V , $V_{DS}$ = 1200V | | | | 500 | µA |
| $R_{DS(on)}$ | Drain – Source on Resistance | $V_{GS}$ = 20V, $I_D$ = 100A | $T_j$ = 25°C | | 16 | 20 | mΩ |
| | | | $T_j$ = 150°C | | 30 | 42 | |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{GS}$ = $V_{DS}$, $I_D$ = 5mA | | 1.7 | 2.2 | | V |
| $I_{GSS}$ | Gate – Source Leakage Current | $V_{GS}$ = 20 V, $V_{DS}$ = 0V | | | | 1.25 | µA |

## Dynamic Characteristics (per SiC MOSFET)

| Symbol | Characteristic | Test Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| $C_{iss}$ | Input Capacitance | $V_{GS}$ = 0V<br>$V_{DS}$ = 1000V<br>f = 1MHz | | | 4.75 | | nF |
| $C_{oss}$ | Output Capacitance | | | | 0.4 | | |
| $C_{rss}$ | Reverse Transfer Capacitance | | | | 0.033 | | |
| $Q_g$ | Total gate Charge | $V_{GS}$ = 0/+20V<br>$V_{Bus}$ = 800V<br>$I_D$ = 100A | | | 246 | | nC |
| $Q_{gs}$ | Gate – Source Charge | | | | 54 | | |
| $Q_{gd}$ | Gate – Drain Charge | | | | 90 | | |
| $T_{d(on)}$ | Turn-on Delay Time | $V_{GS}$ = -5/+20V<br>$V_{Bus}$ = 800V<br>$I_D$ =100A ; $T_J$ =150°C<br>$R_L$ = 8Ω ; $R_{Gext}$ = 10Ω | | | 20 | | ns |
| $T_r$ | Rise Time | | | | 20 | | |
| $T_{d(off)}$ | Turn-off Delay Time | | | | 75 | | |
| $T_f$ | Fall Time | | | | 35 | | |
| $E_{on}$ | Turn on Energy | Inductive Switching<br>$V_{GS}$ = -5/+20V<br>$V_{Bus}$ = 600V<br>$I_D$ = 100A<br>$R_{Gext}$ = 10Ω | $T_j$ = 150°C | | 2.2 | | mJ |
| $E_{off}$ | Turn off Energy | | $T_j$ = 150°C | | 1.25 | | |
| $R_{Gint}$ | Internal gate resistance | | | | 1.9 | | Ω |
| $R_{thJC}$ | Junction to Case Thermal Resistance | | | | | 0.20 | °C/W |

## Source - Drain diode ratings and characteristics (per SiC MOSFET)

| Symbol | Characteristic | Test Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $V_{SD}$ | Diode Forward Voltage | $V_{GS}$ = -5V, $I_{SD}$ = 50A | | 3.3 | | V |
| | | $V_{GS}$ = -2V, $I_{SD}$ = 50A | | 3.1 | | |
| $t_{rr}$ | Reverse Recovery Time | $I_{SD}$ = 100A ; $V_{GS}$ = -5V<br>$V_R$ = 800V ; $di_F/dt$ = 1750A/µs | | 40 | | ns |
| $Q_{rr}$ | Reverse Recovery Charge | | | 825 | | nC |
| $I_{rr}$ | Reverse Recovery Current | | | 32 | | A |

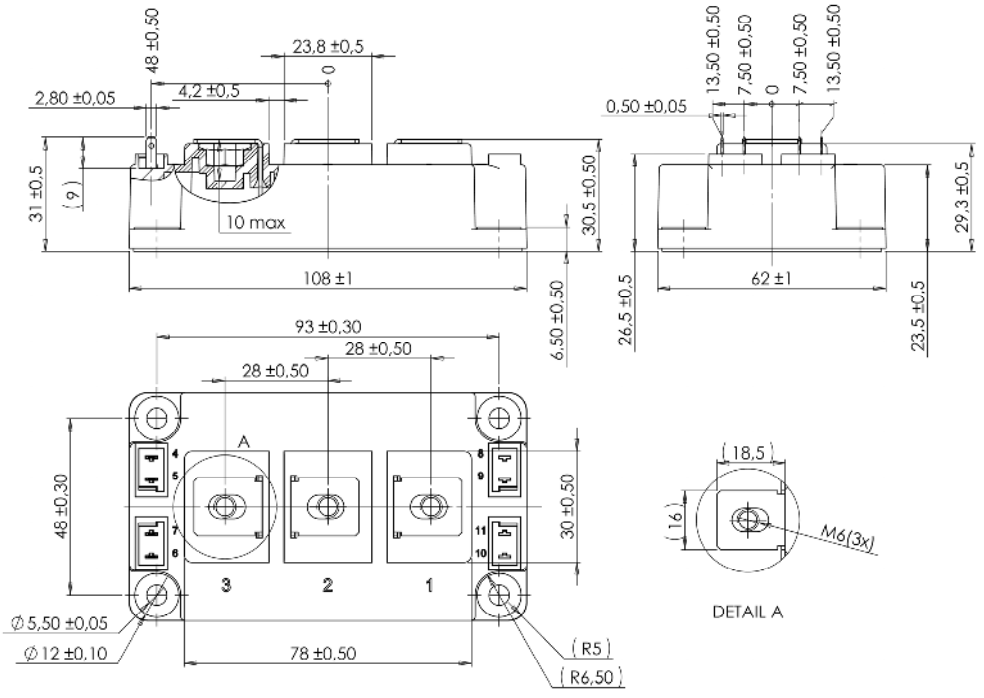
## SiC schottky diode ratings and characteristics (per SiC diode)

| Symbol | Characteristic | Test Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| $V_{RRM}$ | Peak Repetitive Reverse Voltage | | | | | 1200 | V |
| $I_{RRM}$ | Reverse Leakage Current | $V_R$=1200V | $T_j$ = 25°C | | 192 | 1200 | µA |
| | | | $T_j$ = 175°C | | 336 | 6000 | |
| $I_F$ | DC Forward Current | | Tc = 125°C | | 60 | | A |
| $V_F$ | Diode Forward Voltage | $I_F$ = 60A | $T_j$ = 25°C | | 1.6 | 1.8 | V |
| | | | $T_j$ = 175°C | | 2.3 | 3 | |
| $Q_C$ | Total Capacitive Charge | $I_F$ = 60A, $V_R$ = 1200V<br>di/dt =2400A/µs | | | 480 | | nC |
| C | Total Capacitance | f = 1MHz, $V_R$ = 200V | | | 576 | | pF |
| | | f = 1MHz, $V_R$ = 800V | | | 414 | | |
| $R_{thJC}$ | Junction to Case Thermal Resistance | | | | | 0.19 | °C/W |

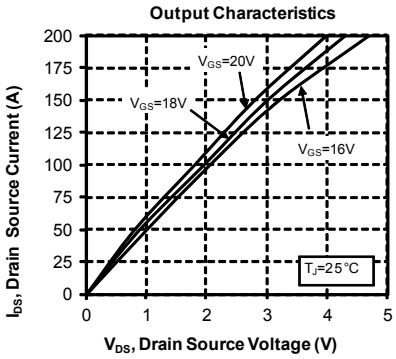
## Thermal and package characteristics

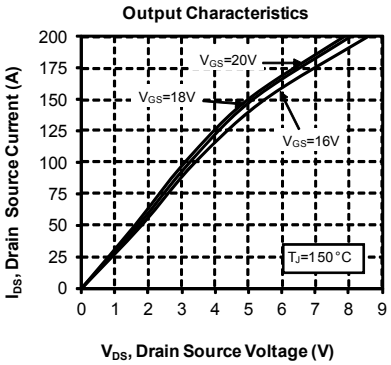
| Symbol | Characteristic | | | Min | Max | Unit |
|---|---|---|---|---|---|---|
| $V_{ISOL}$ | RMS Isolation Voltage, any terminal to case t =1 min, 50/60Hz | | | 4000 | | V |
| $T_J$ | Operating junction temperature range | SiC MOSFET | | -40 | 150 | °C |
| | | SiC diode | | -40 | 175 | |
| $T_{JOP}$ | Recommended junction temperature under switching conditions | | | -40 | $T_J$max -25 | |
| $T_{STG}$ | Storage Temperature Range | | | -40 | 125 | |
| $T_C$ | Operating Case Temperature | | | -40 | 100 | |
| Torque | Mounting torque | For terminals | M6 | 3 | 5 | N.m |
| | | To Heatsink | M6 | 3 | 5 | |
| Wt | Package Weight | | | | 350 | g |

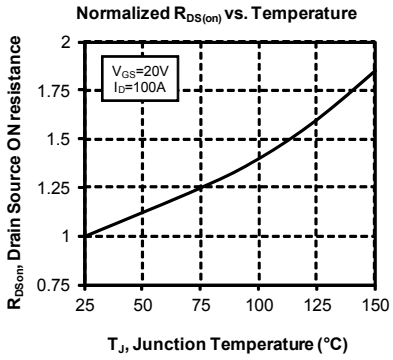
## D3 Package outline (dimensions in mm)

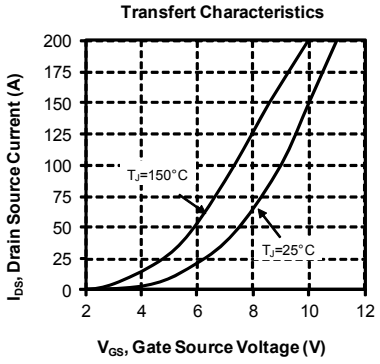


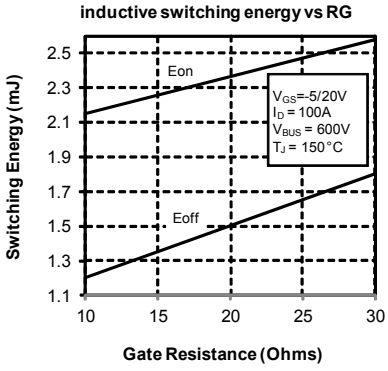
## Typical SiC MOSFET Performance Curve

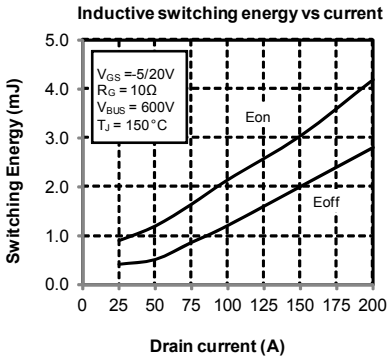


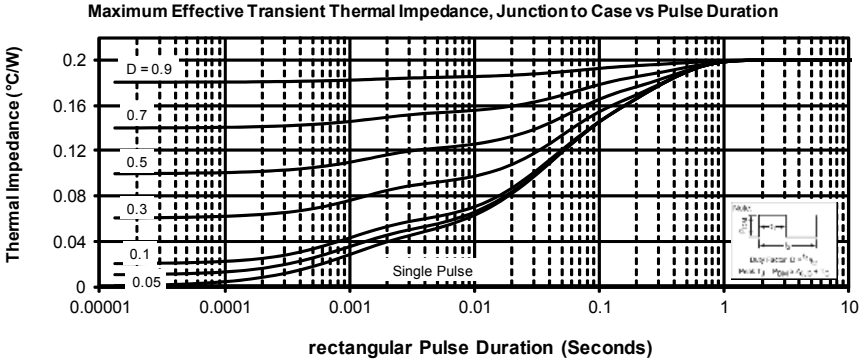



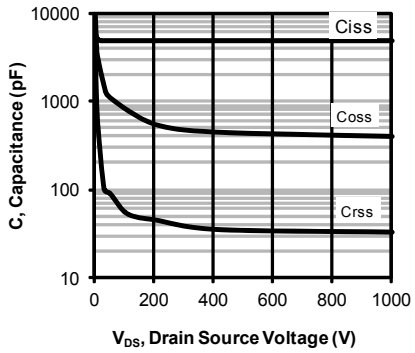



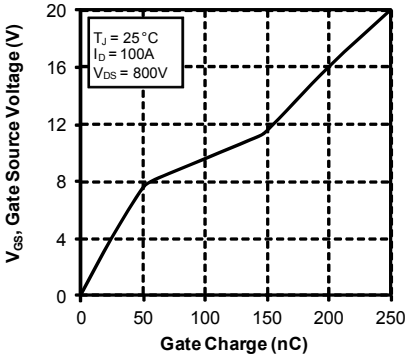



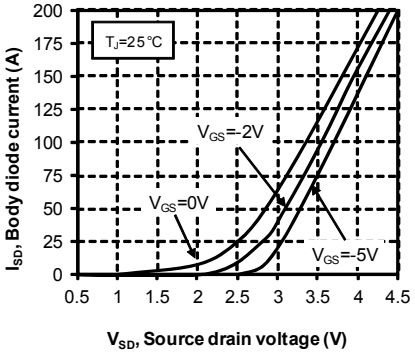
**Capacitance vs Drain Source Voltage**



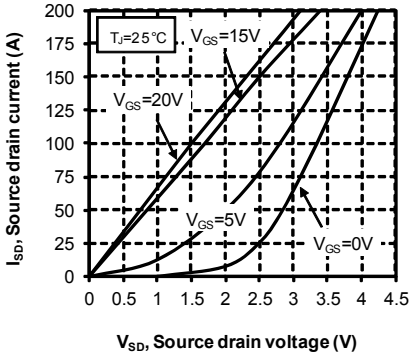

**Gate Charge vs Gate Source Voltage**



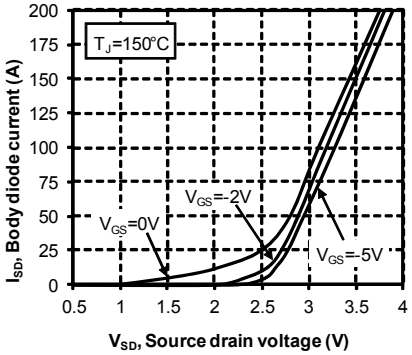

**Body diode Characteristics**



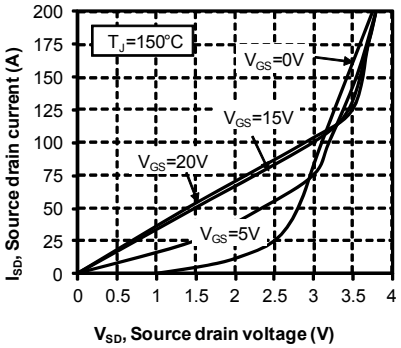

**Output Characteristics**



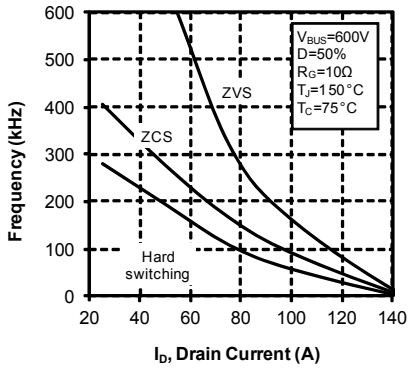

**Body diode Characteristics**



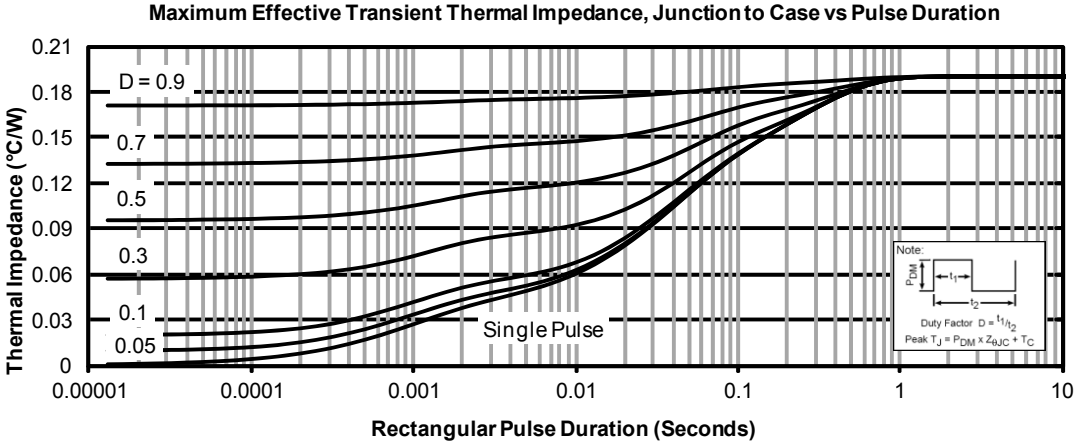

**Output Characteristics**

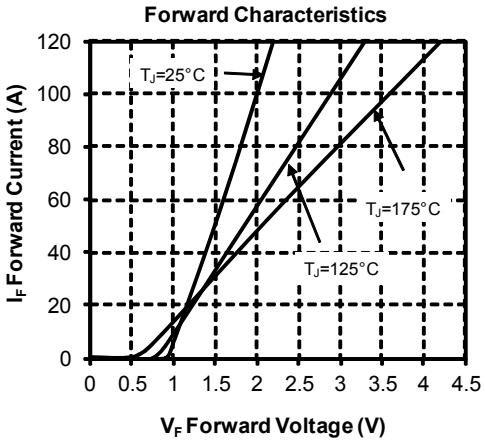


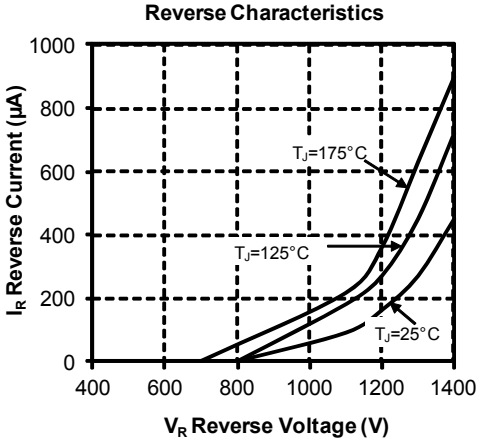

**Operating Frequency vs Drain Current**

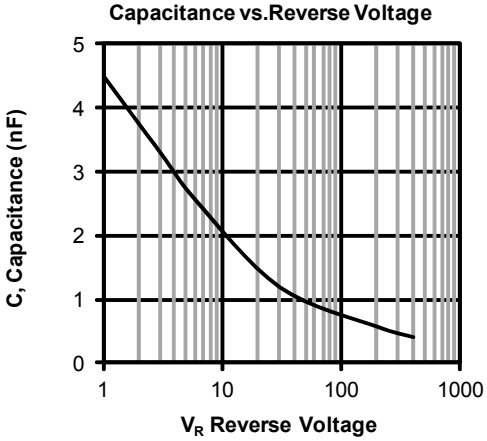


## Typical SiC diode Performance Curve



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