**APT20M120JCU2**

**ISOTOP® Boost chopper MOSFET + SiC chopper diode**

**Power module**

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Max ratings</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{DSS}$</td>
<td>Drain - Source Breakdown Voltage</td>
<td>1200</td>
<td>V</td>
</tr>
<tr>
<td>$I_D$</td>
<td>Continuous Drain Current</td>
<td>20</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td>$T_c = 25°C$</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>$T_c = 80°C$</td>
<td>15</td>
<td>A</td>
</tr>
<tr>
<td>$I_{DM}$</td>
<td>Pulsed Drain current</td>
<td>104</td>
<td></td>
</tr>
<tr>
<td>$V_{GS}$</td>
<td>Gate - Source Voltage</td>
<td>±30</td>
<td>V</td>
</tr>
<tr>
<td>$R_{DSon}$</td>
<td>Drain - Source ON Resistance</td>
<td>672</td>
<td>mΩ</td>
</tr>
<tr>
<td>$P_D$</td>
<td>Maximum Power Dissipation</td>
<td>543</td>
<td>W</td>
</tr>
<tr>
<td>$I_{AR}$</td>
<td>Avalanche current (repetitive and non repetitive)</td>
<td>14</td>
<td>A</td>
</tr>
</tbody>
</table>

**Application**
- AC and DC motor control
- Switched Mode Power Supplies
- Power Factor Correction
- Brake switch

**Features**
- **Power MOS 8™ MOSFET**
  - Low $R_{DSon}$
  - Low input and Miller capacitance
  - Low gate charge
  - Avalanche energy rated
- **SiC Schottky Diode**
  - Zero reverse recovery
  - Zero forward recovery
  - Temperature Independent switching behavior
  - Positive temperature coefficient on VF
- **ISOTOP® Package (SOT-227)**
- Very low stray inductance
- High level of integration

**Benefits**
- Outstanding performance at high frequency operation
- Stable temperature behavior
- Very rugged
- Direct mounting to heatsink (isolated package)
- Low junction to case thermal resistance
- Easy paralleling due to positive TC of VCEsat
- RoHS Compliant

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

$V_{DSS} = 1200V$

$R_{DSon} = 560mΩ \text{ typ @ } T_j = 25°C$

$I_D = 20A \text{ @ } T_c = 25°C$
# Electrical Characteristics

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Characteristic</th>
<th>Test Conditions</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>$I_{DSS}$</td>
<td>Zero Gate Voltage Drain Current</td>
<td>$V_{DS} = 1200V, T_j = 25^\circ C$</td>
<td>100</td>
<td>µA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$R_{DS(on)}$</td>
<td>Drain – Source on Resistance</td>
<td>$V_{GS} = 10V, I_D = 14A$</td>
<td>560</td>
<td>672</td>
<td>mΩ</td>
<td></td>
</tr>
<tr>
<td>$V_{GS(th)}$</td>
<td>Gate Threshold Voltage</td>
<td>$V_{GS} = V_{DS}, I_D = 2.5mA$</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>V</td>
</tr>
<tr>
<td>$I_{DSS}$</td>
<td>Gate – Source Leakage Current</td>
<td>$V_{GS} = \pm 30V$</td>
<td>±100</td>
<td>nA</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## Dynamic Characteristics

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Characteristic</th>
<th>Test Conditions</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>$C_{iss}$</td>
<td>Input Capacitance</td>
<td>$V_{GS} = 0V$</td>
<td>7736</td>
<td>pF</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$C_{oss}$</td>
<td>Output Capacitance</td>
<td>$V_{DS} = 25V$</td>
<td>715</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$C_{rss}$</td>
<td>Reverse Transfer Capacitance</td>
<td>$f = 1MHz$</td>
<td>92</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$Q_G$</td>
<td>Total gate Charge</td>
<td>$V_{GS} = 10V$</td>
<td>300</td>
<td>nC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$Q_{gs}$</td>
<td>Gate – Source Charge</td>
<td>$V_{bus} = 600V$</td>
<td>50</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$Q_{gd}$</td>
<td>Gate – Drain Charge</td>
<td>$I_D = 14A$</td>
<td>140</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$T_{j(on)}$</td>
<td>Turn-on Delay Time</td>
<td>Resitive switching @ 25°C</td>
<td>50</td>
<td>ns</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$T_r$</td>
<td>Rise Time</td>
<td>$V_{GS} = 15V$</td>
<td>31</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$T_{j(off)}$</td>
<td>Turn-off Delay Time</td>
<td>$V_{bus} = 800V$</td>
<td>170</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$T_T$</td>
<td>Fall Time</td>
<td>$R_G = 2.2\Omega$</td>
<td>48</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## SiC chopper diode ratings and characteristics

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Characteristic</th>
<th>Test Conditions</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{RRM}$</td>
<td>Maximum Peak Repetitive Reverse Voltage</td>
<td>$V_R = 1200V, T_j = 25^\circ C$</td>
<td>1200</td>
<td>V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$I_{RM}$</td>
<td>Maximum Reverse Leakage Current</td>
<td>$V_R = 1200V, T_j = 175^\circ C$</td>
<td>56</td>
<td>1000</td>
<td>µA</td>
<td></td>
</tr>
<tr>
<td>$I_F$</td>
<td>DC Forward Current</td>
<td>$T_c = 100^\circ C$</td>
<td>10</td>
<td>A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$V_F$</td>
<td>Diode Forward Voltage</td>
<td>$I_F = 10A, V_R = 600V$</td>
<td>1.6</td>
<td>1.8</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>$Q_C$</td>
<td>Total Capacitive Charge</td>
<td>$I_F = 10A, V_R = 600V, di/dt = 500A/\mu s$</td>
<td>80</td>
<td>nC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$C$</td>
<td>Total Capacitance</td>
<td>$f = 1MHz, V_R = 200V$</td>
<td>96</td>
<td>pF</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## Thermal and package characteristics

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Characteristic</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>$R_{JAC}$</td>
<td>Junction to Case Thermal Resistance</td>
<td>SiC Diode</td>
<td>0.23</td>
<td>°C/W</td>
<td></td>
</tr>
<tr>
<td>$R_{JJA}$</td>
<td>Junction to Ambient (IGBT &amp; Diode)</td>
<td>Mosfet</td>
<td>1.65</td>
<td>°C/W</td>
<td></td>
</tr>
<tr>
<td>$V_{DSS}$</td>
<td>RMS Isolation Voltage, any terminal to case $t = 1 min, 50/60Hz$</td>
<td>2500</td>
<td>V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$T_J, T_{STG}$</td>
<td>Storage Temperature Range</td>
<td>-40</td>
<td>150</td>
<td>°C</td>
<td></td>
</tr>
<tr>
<td>$T_L$</td>
<td>Max Lead Temp for Soldering: 0.063” from case for 10 sec</td>
<td>300</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Torque</td>
<td>Mounting torque (Mounting = 8-32 or 4mm Machine and terminals = 4mm Machine)</td>
<td>1.5</td>
<td>N.m</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$W_t$</td>
<td>Package Weight</td>
<td>29.2</td>
<td>g</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
SOT-227 (ISOTOP®) Package Outline

Dimensions in Millimeters and (Inches)

11.8 (.463)
12.2 (.480)
8.9 (.350)
9.6 (.376)
Hex Nut M4
(4 places)

25.2 (0.992)
25.4 (1.000)

9.75 (.030)
12.6 (.496)
0.85 (.033)
12.8 (.504)

278x571
3.3 (.129)
W=4.1 (.161)
H=4.3 (.169)
H=4.8 (.187)
H=4.9 (.193)
(4 places)

r = 4.0 (.157)
(2 places)

1.95 (.077)
2.14 (.084)

H=4.0 (.157)
(2 places)

3.6 (.143)

14.9 (.587)
15.1 (.594)

31.5 (1.240)
31.7 (1.248)

7.8 (.307)
8.2 (.322)

30.1 (1.185)
30.3 (1.193)

38.0 (1.496)
38.2 (1.504)

11.8 (.460)
8.9 (.350)
9.6 (.376)

Source

Gate

Drain

Emitter terminals are shorted internally. Current handling capability is equal for either Emitter terminal.

Typical Mosfet Performance Curve

Maximum Effective Transient Thermal Impedance, Junction to Case vs Pulse Duration

rectangular Pulse Duration (Seconds)

Thermal Impedance (°C/W)

0.00001 0.0001 0.001 0.01 0.1 1 10

0.0 0.05 0.1 0.15 0.2 0.25

0.1

0.3

0.5

0.7

0.9

Single Pulse
Low Voltage Output Characteristics

Normalized $R_{\text{DS(on)}}$ vs. Temperature

Transfert Characteristics

Gate Charge vs Gate Source Voltage

Capacitance vs Drain to Source Voltage
Typical SiC Diode Performance Curve

Maximum Effective Transient Thermal Impedance, Junction to Case vs Pulse Duration

Rectangular Pulse Duration (Seconds)

Thermal Impedance (°C/W)

Forward Characteristics

TJ=25°C

TJ=75°C

TJ=125°C

TJ=175°C

VF Forward Voltage (V)

IF Forward Current (A)

Reverse Characteristics

VR Reverse Voltage (V)

IR Reverse Current (µA)

Capacitance vs. Reverse Voltage

C, Capacitance (pF)

VR Reverse Voltage

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