

Boost chopper Super Junction MOSFET Power Module

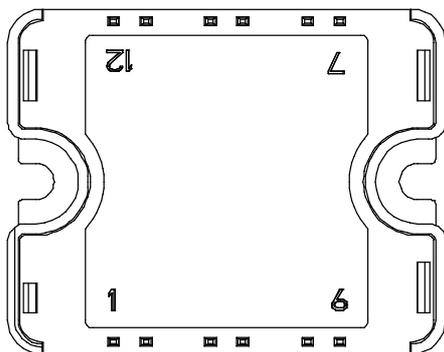
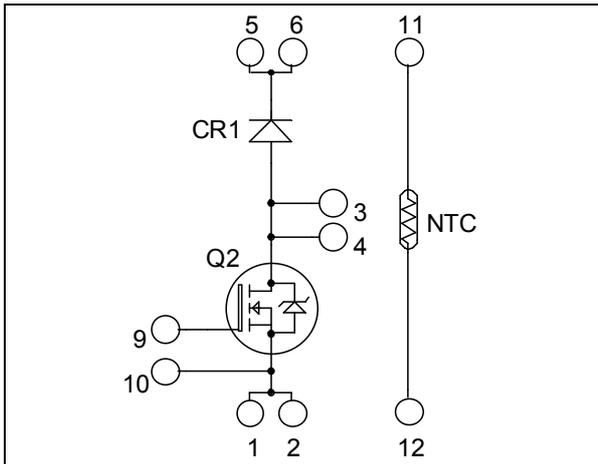
$V_{DSS} = 900V$
 $R_{DSon} = 60m\Omega \text{ max @ } T_j = 25^\circ C$
 $I_D = 59A \text{ @ } T_c = 25^\circ C$

Application

- AC and DC motor control
- Switched Mode Power Supplies
- Power Factor Correction

Features

- **COOLMOS** Power Semiconductors
 - Ultra low R_{DSon}
 - Low Miller capacitance
 - Ultra low gate charge
 - Avalanche energy rated
 - Very rugged
- **CR1 SiC Schottky Diode**
 - Zero reverse recovery
 - Zero forward recovery
 - Temperature Independent switching behavior
 - Positive temperature coefficient on VF
- Very low stray inductance
- Internal thermistor for temperature monitoring
- High level of integration



Pins 1/2 ; 3/4 ; 5/6 must be shorted together

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
- RoHS Compliant

Absolute maximum ratings

| Symbol | Parameter | Max ratings | Unit |
|------------|---|--------------------|------------|
| V_{DSS} | Drain - Source Breakdown Voltage | 900 | V |
| I_D | Continuous Drain Current | $T_c = 25^\circ C$ | 59 |
| | | $T_c = 80^\circ C$ | 44 |
| I_{DM} | Pulsed Drain current | 150 | A |
| V_{GS} | Gate - Source Voltage | ± 20 | V |
| R_{DSon} | Drain - Source ON Resistance | 60 | m Ω |
| P_D | Maximum Power Dissipation | $T_c = 25^\circ C$ | 462 |
| I_{AR} | Avalanche current (repetitive and non repetitive) | 8.8 | A |
| E_{AR} | Repetitive Avalanche Energy | 2.9 | mJ |
| E_{AS} | Single Pulse Avalanche Energy | 1940 | |

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

All ratings @ $T_j = 25^\circ\text{C}$ unless otherwise specified

Electrical Characteristics

| Symbol | Characteristic | Test Conditions | Min | Typ | Max | Unit |
|--------------|---------------------------------|-------------------------------------|-----|------|-----|------------------|
| I_{DSS} | Zero Gate Voltage Drain Current | $V_{GS} = 0V, V_{DS} = 900V$ | | | 200 | μA |
| | | $T_j = 25^\circ\text{C}$ | | 1000 | | |
| $R_{DS(on)}$ | Drain – Source on Resistance | $V_{GS} = 10V, I_D = 52A$ | | 50 | 60 | $\text{m}\Omega$ |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{GS} = V_{DS}, I_D = 6\text{mA}$ | 2.5 | 3 | 3.5 | V |
| I_{GSS} | Gate – Source Leakage Current | $V_{GS} = \pm 20V, V_{DS} = 0V$ | | | 200 | nA |

Dynamic Characteristics

| Symbol | Characteristic | Test Conditions | Min | Typ | Max | Unit |
|--------------|---------------------------|---|-----|------|-----|------|
| C_{iss} | Input Capacitance | $V_{GS} = 0V ; V_{DS} = 100V$ $f = 1\text{MHz}$ | | 13.6 | | nF |
| C_{oss} | Output Capacitance | | | 0.66 | | |
| Q_g | Total gate Charge | $V_{GS} = 10V$ $V_{Bus} = 400V$ $I_D = 52A$ | | 540 | | nC |
| Q_{gs} | Gate – Source Charge | | | 64 | | |
| Q_{gd} | Gate – Drain Charge | | | 230 | | |
| $T_{d(on)}$ | Turn-on Delay Time | Inductive Switching (125°C) $V_{GS} = 10V$ $V_{Bus} = 600V$ $I_D = 52A$ $R_G = 3.8\Omega$ | | 70 | | ns |
| T_r | Rise Time | | | 20 | | |
| $T_{d(off)}$ | Turn-off Delay Time | | | 400 | | |
| T_f | Fall Time | | | 25 | | |
| E_{on} | Turn-on Switching Energy | Inductive switching @ 25°C $V_{GS} = 10V ; V_{Bus} = 600V$ $I_D = 52A ; R_G = 3.8\Omega$ | | 1.8 | | mJ |
| E_{off} | Turn-off Switching Energy | | | 1.5 | | |
| E_{on} | Turn-on Switching Energy | Inductive switching @ 125°C $V_{GS} = 10V ; V_{Bus} = 600V$ $I_D = 52A ; R_G = 3.8\Omega$ | | 2.52 | | mJ |
| E_{off} | Turn-off Switching Energy | | | 1.7 | | |

CR1 SiC diode ratings and characteristics

| Symbol | Characteristic | Test Conditions | Min | Typ | Max | Unit |
|-----------|---|--|---------------------------|-----|------|---------------|
| V_{RRM} | Maximum Peak Repetitive Reverse Voltage | | 1200 | | | V |
| I_{RM} | Maximum Reverse Leakage Current | $V_R = 1200V$ | $T_j = 25^\circ\text{C}$ | 96 | 600 | μA |
| | | | $T_j = 175^\circ\text{C}$ | 168 | 3000 | |
| I_F | DC Forward Current | | | 30 | | A |
| V_F | Diode Forward Voltage | $I_F = 30A$ | $T_j = 25^\circ\text{C}$ | 1.6 | 1.8 | V |
| | | | $T_j = 175^\circ\text{C}$ | 2.3 | 3 | |
| Q_C | Total Capacitive Charge | $I_F = 30A, V_R = 600V$ $di/dt = 1000A/\mu\text{s}$ | | 120 | | nC |
| C | Total Capacitance | $f = 1\text{MHz}, V_R = 200V$ | | 288 | | pF |
| | | $f = 1\text{MHz}, V_R = 400V$ | | 207 | | |

Thermal and package characteristics

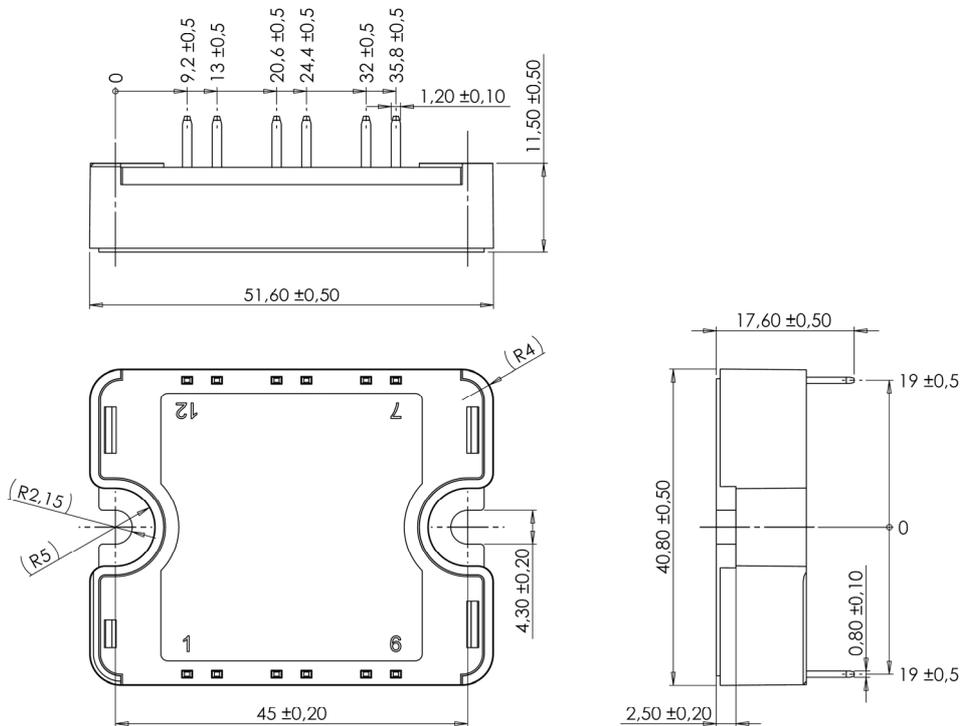
| Symbol | Characteristic | Min | Typ | Max | Unit | |
|-------------------|--|-------------|-----|------|------|-----|
| R _{thJC} | Junction to Case Thermal Resistance | CoolMOS | | 0.27 | °C/W | |
| | | SiC Diode | | 0.63 | | |
| V _{ISOL} | RMS Isolation Voltage, any terminal to case t=1 min, 50/60Hz | 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 | | | | 80 | 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 |
| ΔR ₂₅ /R ₂₅ | | | 5 | | % |
| B _{25/85} | T ₂₅ = 298.15 K | | 3952 | | K |
| ΔB/B | T _C = 100°C | | 4 | | % |

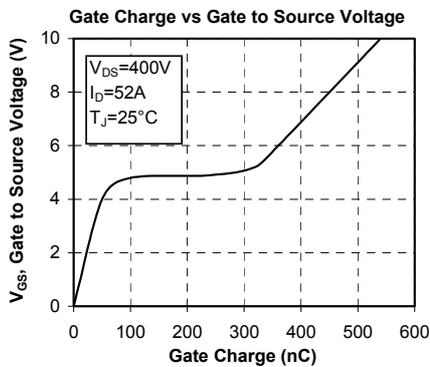
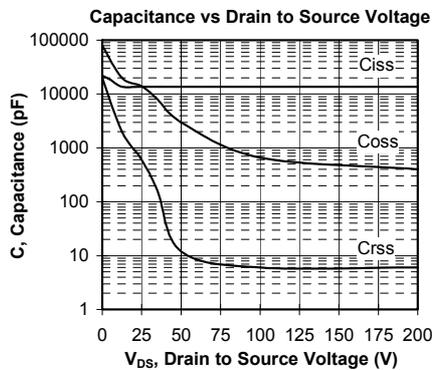
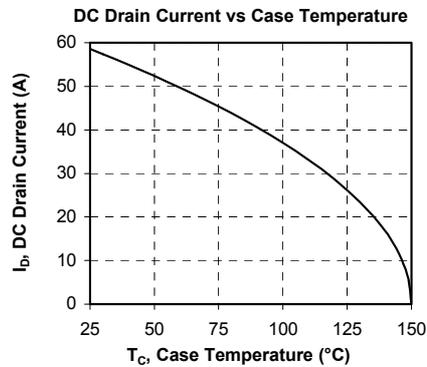
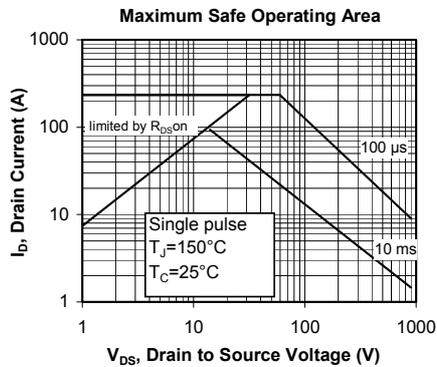
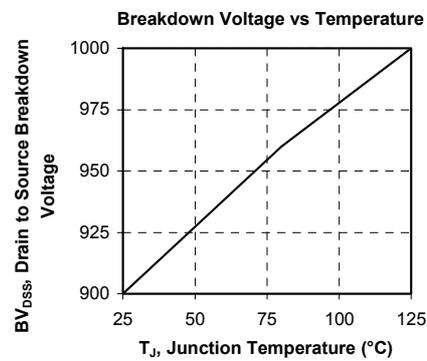
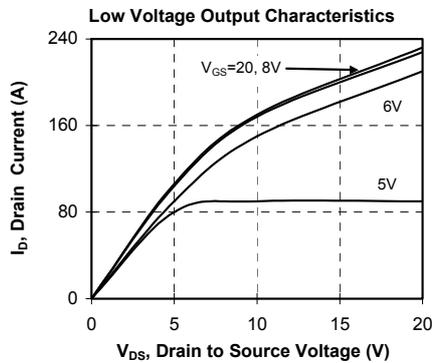
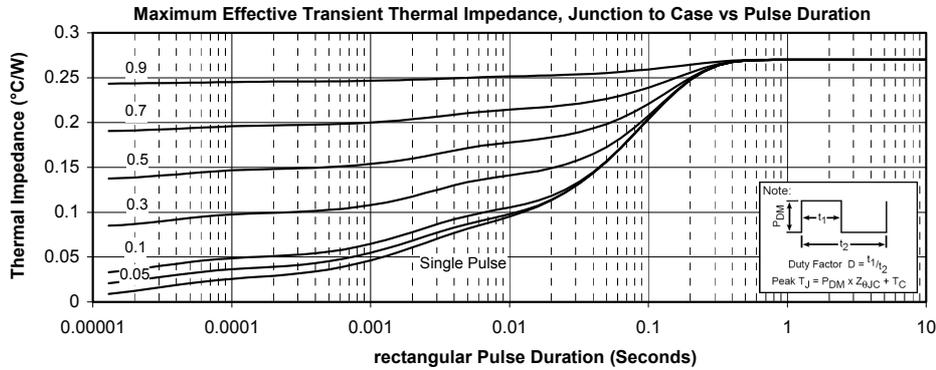
$$R_T = \frac{R_{25}}{\exp\left[B_{25/85}\left(\frac{1}{T_{25}} - \frac{1}{T}\right)\right]}$$

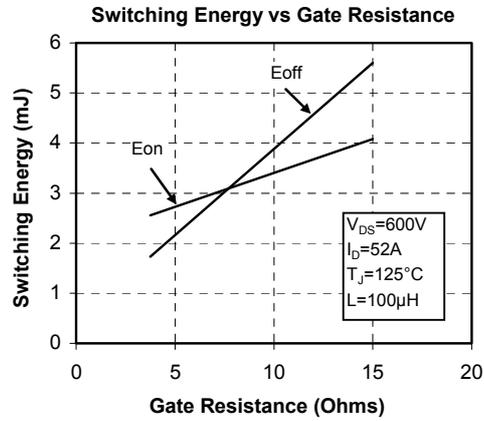
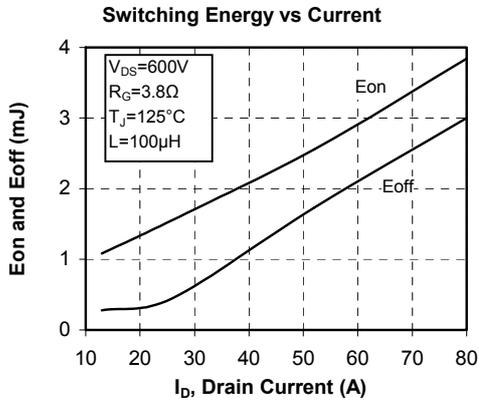
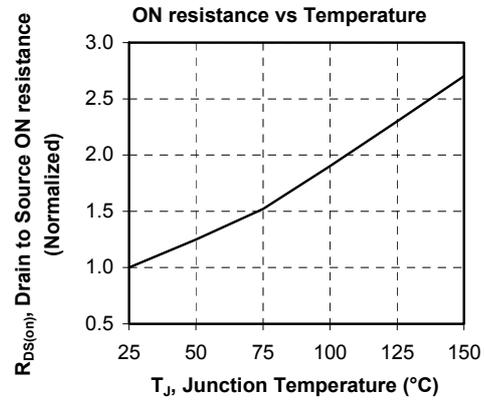
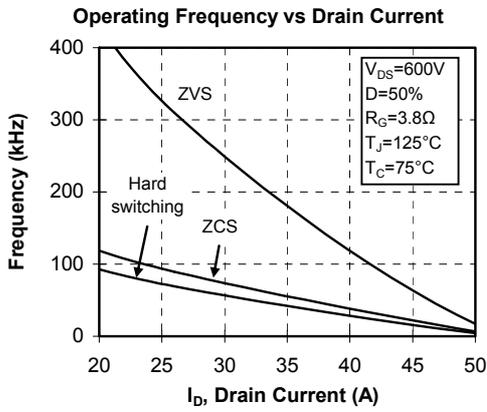
T: Thermistor temperature
 R_T: Thermistor value at T

SP1 Package outline (dimensions in mm)


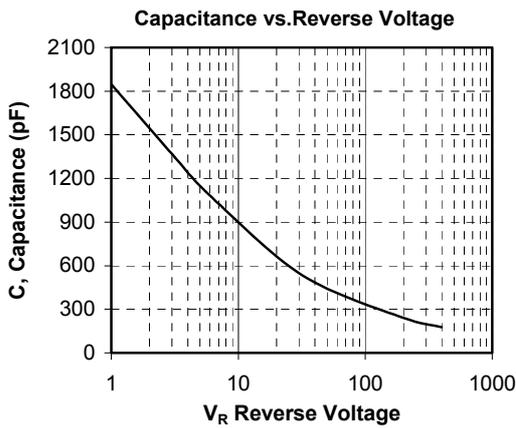
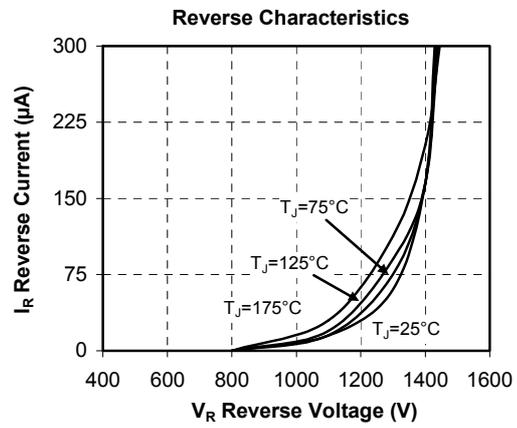
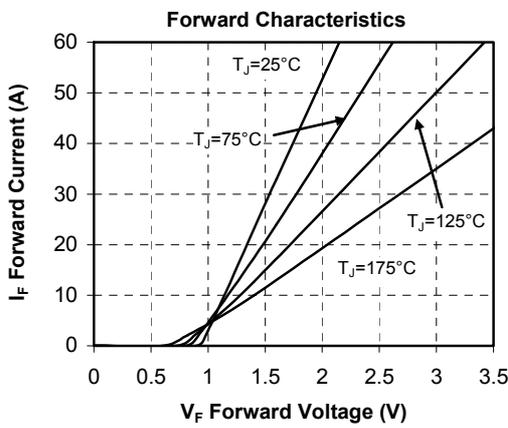
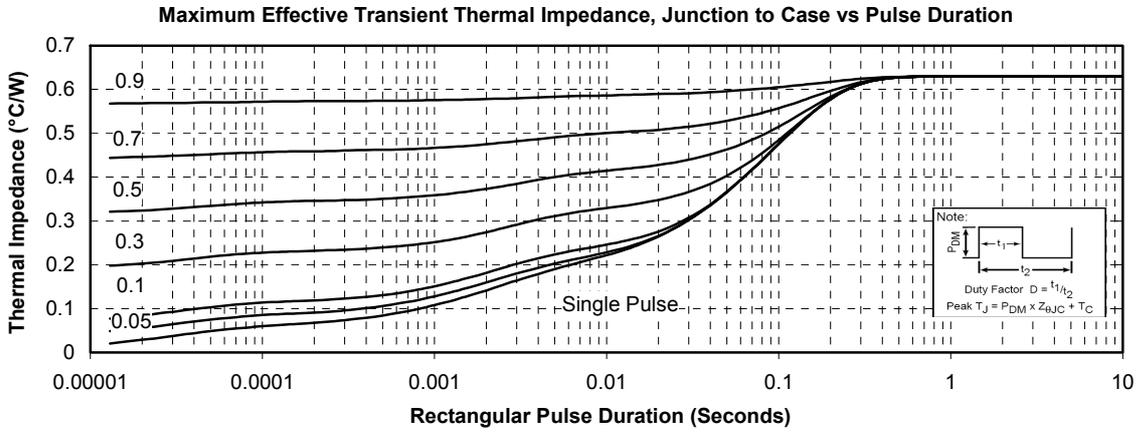
See application note 1904 - Mounting Instructions for SP1 Power Modules on www.microsemi.com

Typical CoolMOS Performance Curve





Typical CR1 SiC Diode Performance Curve



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