

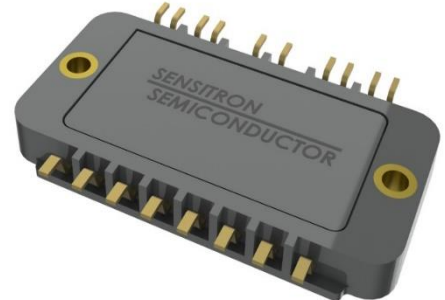
**TECHNICAL DATA**

DATASHEET 6177, Preliminary

**1200 VOLT, 40 AMP MOSFET FULL-BRIDGE MODULE**

**Features:**

- Electrically isolated, base-less construction
- Light weight low profile standard package
- Aluminum Nitride substrate
- High temperature engineering plastic shell construction



**ELECTRICAL CHARACTERISTICS PER MOSFET LEG**

(T<sub>J</sub>=25°C UNLESS OTHERWISE SPECIFIED)

| SYMBOL   | PARAMETER   | MIN      | TYP        | MAX             | UNIT |
|--|---|----------|------------|-----------------|------|
| <b>MOSFET SPECIFICATIONS</b>   |   |          |            |                 |      |
| BV <sub>DSS</sub>  | Drain to Source Breakdown Voltage<br>I <sub>D</sub> = 100 μA, V <sub>GS</sub> = 0V  | 1200     | -          | -               | V    |
| I <sub>D</sub>   | Continuous Drain Current<br>T <sub>C</sub> = 25°C<br>T <sub>C</sub> = 100°C   | -        | -          | 60<br>40        | A    |
| I <sub>D(pulse)</sub>  | Pulsed Drain Current, pulse width t <sub>p</sub> limited by t <sub>max</sub>  | -        | -          | 120             | A    |
| V <sub>GS</sub>  | Gate to Source Voltage<br>static<br>dynamic   | -        | -          | -4/+15<br>8/+19 | V    |
| I <sub>GSS</sub>   | Gate-Source Leakage Current, V <sub>GS</sub> = +15V / -4V, V <sub>DS</sub> = 0V   | -        | 10         | 250             | nA   |
| V <sub>GS(th)</sub>  | Gate Threshold Voltage,<br>I <sub>D</sub> = 10mA, V <sub>DS</sub> = V <sub>GS</sub>   | 1.8<br>- | 2.5<br>2.1 | 3.6<br>-        | V    |
| I <sub>DSS</sub>   | Zero Gate Voltage Drain Current<br>V <sub>DS</sub> = 1200 V, V <sub>GS</sub> = 0V   | -        | 1          | 50              | μA   |
| R <sub>DS(on)</sub>  | Drain-Source On-State Resistance<br>I <sub>D</sub> = 40A, V <sub>GS</sub> = 15V   | 22<br>-  | 32<br>58   | 43<br>-         | mΩ   |
| C <sub>iSS</sub>   | Input Capacitance   | -        | 3357       | -               | pF   |
| C <sub>oss</sub>   | Output Capacitance  | -        | 250        | -               |      |
| C <sub>rSS</sub>   | Reverse Transfer Cap.<br>V <sub>DS</sub> = 200 V, V <sub>GS</sub> = 0 V, f = 100 kHz, V <sub>AC</sub> = 25 mV                     | -        | 12         | -               |      |
| t <sub>D(on)</sub>   | Turn On Delay Time  | -        | 15         | -               | ns   |
| t <sub>r</sub>   | Rise Time   | -        | 52         | -               |      |
| t <sub>D(off)</sub>  | Turn Off Delay Time   | -        | 26         | -               |      |
| t <sub>f</sub>   | Fall Time   | -        | 34         | -               |      |
| V <sub>DS</sub> = 800 V, I <sub>D</sub> = 20A, V <sub>GS</sub> = -4/+15V, R <sub>G</sub> = 2.5Ω<br>Timing relative to V <sub>DS</sub> , inductive load |   |          |            |                 |      |
| E <sub>ON</sub>  | Turn on Energy Loss   | -        | 325        | -               | μJ   |
| E <sub>OFF</sub>   | Turn off Energy Loss<br>V <sub>DS</sub> = 600 V, I <sub>D</sub> = 40A, V <sub>GS</sub> = -4/+15V, R <sub>G</sub> = 2.5Ω, L=65.7μH | -        | 50         | -               |      |
| R <sub>G(int)</sub>  | Internal Gate Resistance<br>f = 1MHz, V <sub>AC</sub> = 25mV  | -        | 1.7        | -               | Ω    |
| Q <sub>GS</sub>  | Gate to Source Charge   | -        | 40         | -               | nC   |
| Q <sub>GD</sub>  | Gate to Drain Charge  | -        | 34         | -               |      |
| Q <sub>G</sub>   | Total Gate Charge<br>V <sub>DS</sub> = 800 V, I <sub>D</sub> = 40A, V <sub>GS</sub> = -4/+15V                                     | -        | 118        | -               |      |

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**REVERSE DIODE CHARACTERISTICS**

(T<sub>J</sub>=25 °C UNLESS OTHERWISE SPECIFIED)

| SYMBOL                      | PARAMETER  | MIN | TYP   | MAX | UNIT |
|-----------------------------|--|-----|---|-----|------|
| <b>DIODE SPECIFICATIONS</b> |  |     |   |     |      |
| V <sub>SD</sub>             | Diode Forward Voltage<br>V <sub>GS</sub> = -4V, I <sub>SD</sub> = 20A  |     | T <sub>J</sub> = 25°C<br>4.6<br>T <sub>J</sub> = 150°C<br>4.2 |     | V    |
| I <sub>S</sub>              | Continuous Forward Current   |     | T <sub>J</sub> = 25°C<br>60                                   |     | A    |
| t <sub>rr</sub>             | Reverse Recovery Time<br>V <sub>GS</sub> = -4V, I <sub>SD</sub> = 40A, V <sub>R</sub> = 800V, di/dt = 2250A/μs         |     | 27  |     | ns   |
| Q <sub>rr</sub>             | Reverse Recovery Charge<br>V <sub>GS</sub> = -4V, I <sub>SD</sub> = 40A, V <sub>R</sub> = 800V, di/dt = 2250A/μs       |     | 478   |     | nC   |
| I <sub>rrm</sub>            | Peak Reverse Recovery Current<br>V <sub>GS</sub> = -4V, I <sub>SD</sub> = 40A, V <sub>R</sub> = 800V, di/dt = 2250A/μs |     | 27  |     | A    |

**ZVS SiC DIODE CHARACTERISTICS**

(T<sub>J</sub>=25 °C UNLESS OTHERWISE SPECIFIED)

| SYMBOL                      | PARAMETER  | MIN  | TYP             | MAX        | UNIT |
|-----------------------------|--|------|-----------------|------------|------|
| <b>DIODE SPECIFICATIONS</b> |  |      |                 |            |      |
| V <sub>RRM</sub>            | Repetitive Peak Reverse Voltage  | 1200 | -               | -          | V    |
| V <sub>RSM</sub>            | Surge Peak Reverse Voltage   | 1300 | -               | -          | V    |
| V <sub>R</sub>              | DC Peak Blocking Voltage   | 1200 | -               | -          | V    |
| I <sub>F</sub>              | Continuous Forward Current,<br>T <sub>J</sub> = 150°C  | -    | -               | 5          | A    |
| I <sub>FRM</sub>            | Repetitive Peak Forward Surge Current<br>t <sub>P</sub> = 10ms, Half Sine Pulse<br>T <sub>C</sub> = 25°C<br>T <sub>C</sub> = 110°C   | -    | -               | 26<br>18   | A    |
| I <sub>FSM</sub>            | Non-Repetitive Forward Surge Current<br>t <sub>P</sub> = 10ms, Half Sine Pulse<br>T <sub>C</sub> = 25°C<br>T <sub>C</sub> = 110°C  | -    | -               | 46<br>36   | A    |
| V <sub>F</sub>              | Forward Voltage<br>I <sub>F</sub> = 5A<br>T <sub>J</sub> = 25°C<br>T <sub>J</sub> = 150°C  | -    | 1.4<br>1.9      | 1.8<br>3.0 | V    |
| I <sub>R</sub>              | Reverse Current<br>V <sub>R</sub> = 1200V<br>T <sub>J</sub> = 25°C<br>T <sub>J</sub> = 150°C   | -    | 20<br>40        | 150<br>300 | μA   |
| Q <sub>C</sub>              | Total Capacitive Charge<br>V <sub>R</sub> = 800V, I <sub>F</sub> = 5A, di/dt = 200A/μs, T <sub>J</sub> = 25 °C   | -    | 27              | -          | nC   |
| C                           | Total Capacitance<br>V <sub>R</sub> = 0V, T <sub>J</sub> = 25 °C, f = 1MHz<br>V <sub>R</sub> = 400V, T <sub>J</sub> = 25 °C, f = 1MHz<br>V <sub>R</sub> = 800V, T <sub>J</sub> = 25 °C, f = 1MHz | -    | 390<br>27<br>20 | -          | pF   |

Note: Production units are only tested at room temperature. Low/High temperature operation is guaranteed by design.

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**NTC-THERMISTOR CHARACTERISTICS**

(T<sub>J</sub>=25°C UNLESS OTHERWISE SPECIFIED)

| SYMBOL                    | PARAMETER  | MIN | TYP  | MAX | UNIT  |
|---------------------------|--|-----|------|-----|-------|
| <b>NTC SPECIFICATIONS</b> |  |     |      |     |       |
| R <sub>25</sub>           | Resistance<br>T <sub>C</sub> = 25°C  | -   | 4.7  | -   | K Ohm |
| R <sub>TOL</sub>          | Resistance Tolerance   | -   | -    | 1   | %     |
| P                         | Maximum Power Dissipation  | -   | -    | 50  | mW    |
| B <sub>25/85</sub>        | NTC Thermistor Beta Value<br>$R = R_{25} e^{B_{25/85} (\frac{1}{T} - \frac{1}{298.15})}$ |     | 3435 |     | K     |

**THERMAL AND MECHANICAL CHARACTERISTICS**

| SYMBOL             | PARAMETER  | MIN | TYP  | MAX  | UNIT    |
|--------------------|--|-----|------|------|---------|
| R <sub>θJB_M</sub> | MOSFET Junction-to-Base Plate Thermal Resistance Per Leg | -   | 0.45 | 0.60 | °C/W    |
| R <sub>θJB_D</sub> | Diode Junction-to-Base Plate Thermal Resistance Per Leg  | -   | 1.60 | 1.76 | °C/W    |
| V <sub>iso1</sub>  | All pins to Isolation to Base Plate/Screw mounting pads  | -   | -    | 2500 | VDC     |
| V <sub>iso2</sub>  | NTC1(Pin15&16) & NTC2(Pin13&14) to all other pins        | -   | -    | 2000 | Vrms    |
| T <sub>J</sub>     | Operating Junction Temperature                           | -55 | -    | 150  | °C      |
| T <sub>STG</sub>   | Storage Temperature                                      | -55 | -    | 150  | °C      |
|                    | Mounting Torque for Module Mounting                      | 3   | -    | 4    | in-lbs. |
|                    | Weight   | -   | 10   | -    | g       |

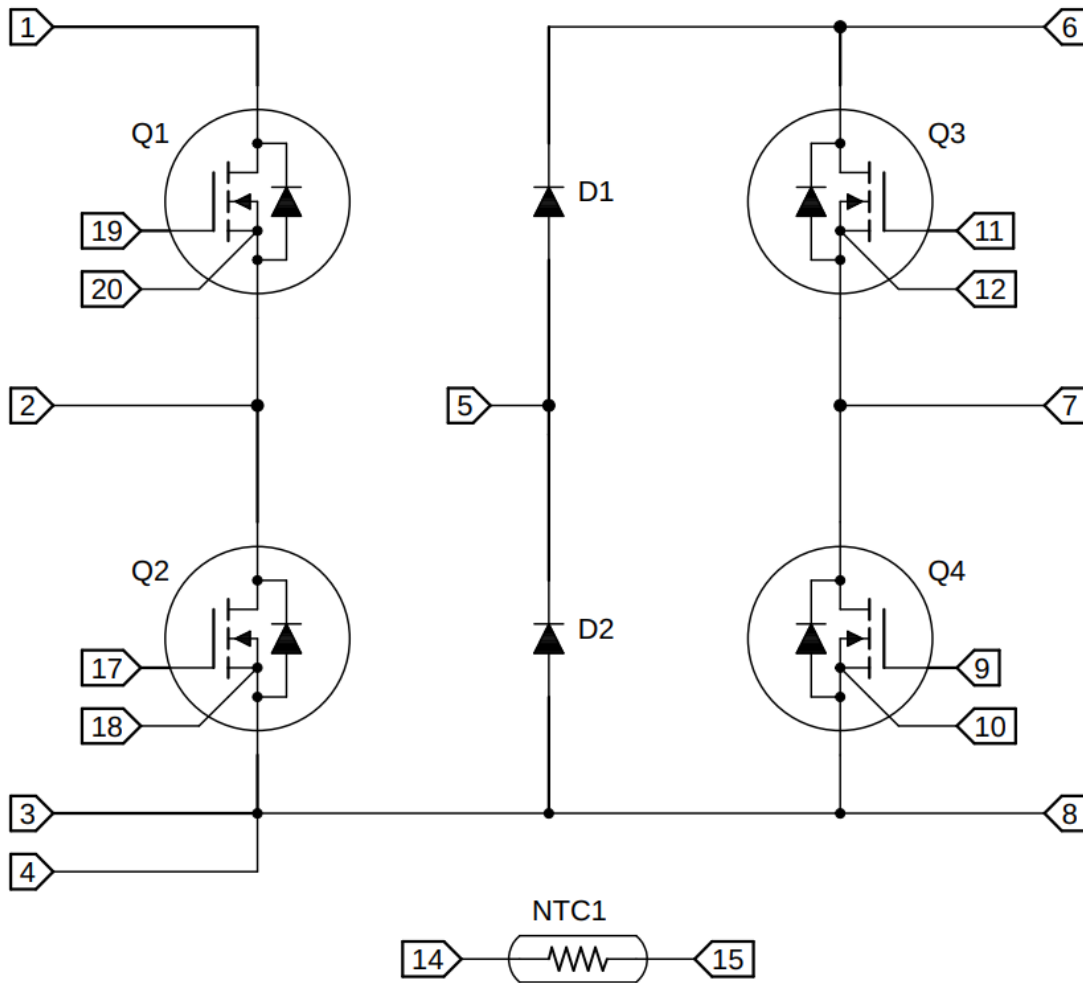
**INSTALLATION INSTRUCTIONS:**

Recommended thermal interface material = Laird Tgon 805 (5 mil thick graphite pad)

1. Fasten screws to 1 to 2 in-lb. of torque.
2. Fasten screws to final torque.

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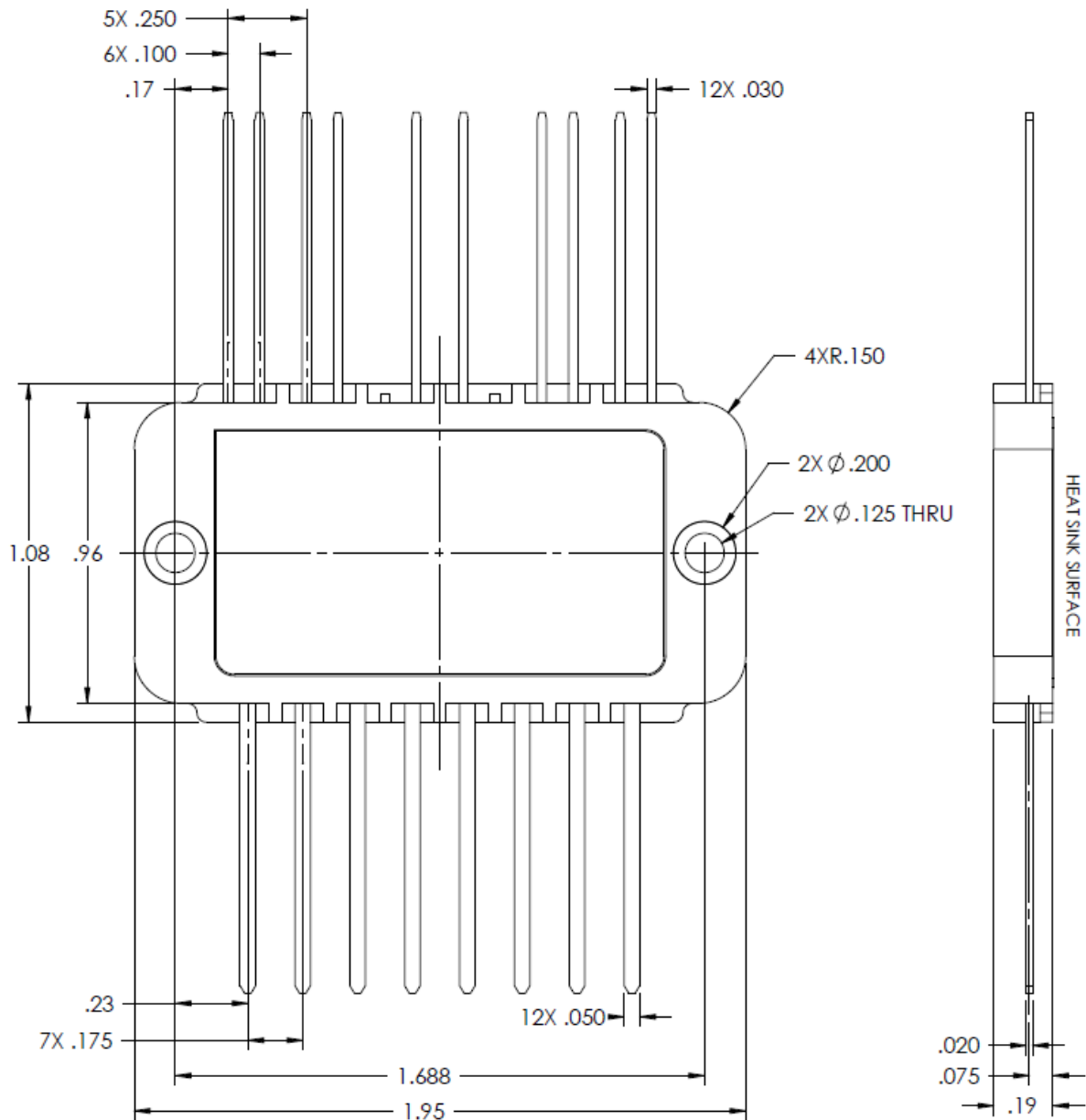
**SCHEMATIC DIAGRAM AND PINOUT:**



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**MECHANICAL OUTLINE (inches):**

Part Number SPM1019C3-1  
Straight Leads



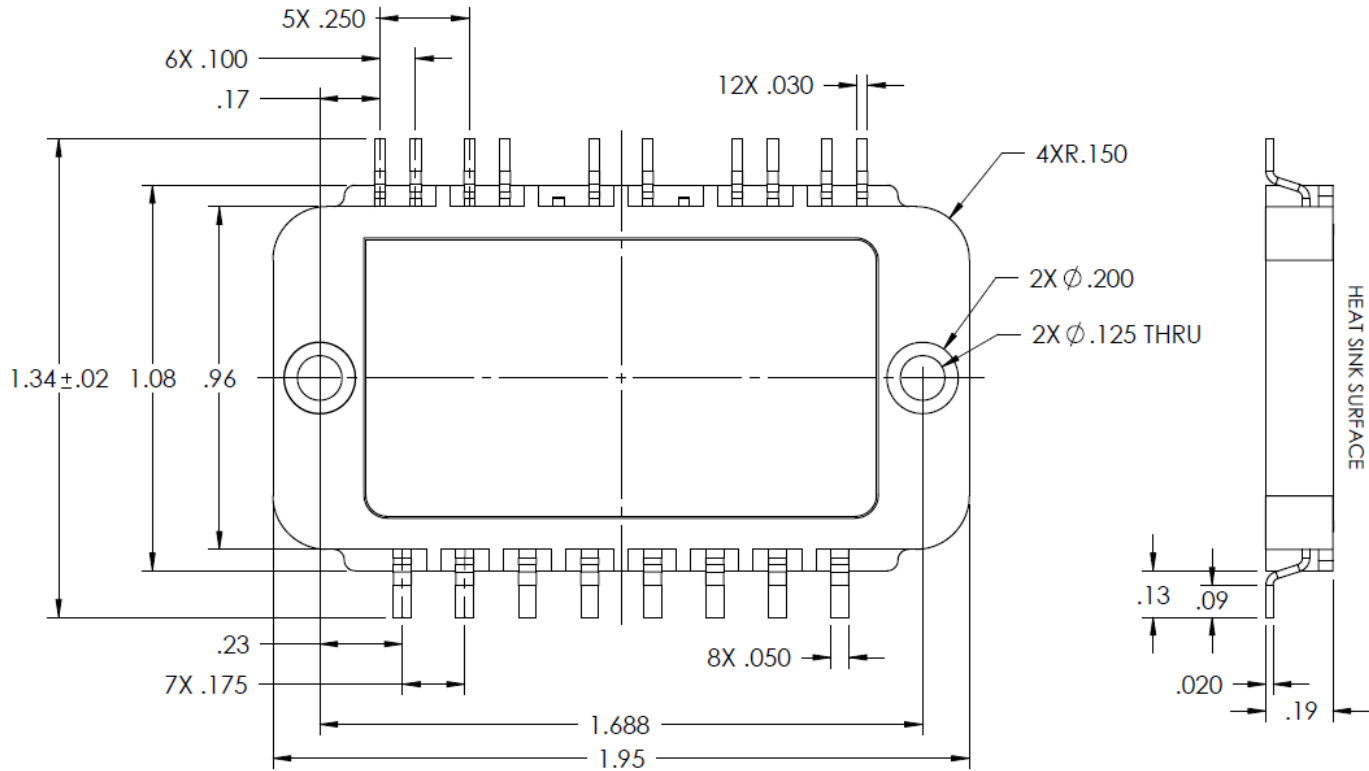
TOLERANCE UNLESS OTHERWISE NOTED:  
.XX = ±.01  
.XXX = ±.005

PINS 13 AND 16 REMOVED

**TECHNICAL DATA**

DATASHEET 6177, Preliminary

Part Number SPM1019C3-2  
SMT leads, reverse mounting



TOLERANCE UNLESS OTHERWISE NOTED:

.XX = ±.01  
.XXX = ±.005

PINS 13 AND 16 REMOVED

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