G2R1000MT17D
1700 V 1000 mΩ SiC MOSFET

Silicon Carbide MOSFET
N-Channel Enhancement Mode

Features
- G2R™ Technology - +20 V / -5 V Gate Drive
- Superior \( Q_G \times V_{DS(ON)} \) Figure of Merit
- Low Capacitances and Low Gate Charge
- High \( V_{TH} \) for Increased System Stability
- Fast and Reliable Body Diode
- High Avalanche and Short Circuit Ruggedness
- Low Conduction Losses at High Temperatures

Package
- TO-247-3
  - D = Drain
  - G = Gate
  - S = Source

Advantages
- Increased Power Density for Compact System
- High Frequency Switching
- Reduced Losses for Higher System Efficiency
- Minimized Gate Ringing
- Improved Thermal Capability
- Superior Cost-Performance Index
- Ease of Paralleling without Thermal Runaway
- Simple to Drive

Applications
- Auxiliary Power Supply
- Switched Mode Power Supplies
- High Voltage Converters
- Pulsed Power

Absolute Maximum Ratings (At \( T_C = 25°C \) Unless Otherwise Stated)

<table>
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<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Conditions</th>
<th>Values</th>
<th>Unit</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drain-Source Voltage</td>
<td>( V_{DS(max)} )</td>
<td>( V_{DS} = 0 ) V, ( I_D = 100 \mu A )</td>
<td>1700</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>Gate-Source Voltage (Dynamic)</td>
<td>( V_{GS(max)} )</td>
<td>-10 / +25 V</td>
<td>-</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>Gate-Source Voltage (Static)</td>
<td>( V_{GS(op)} )</td>
<td>Recommended Operation</td>
<td>-5 / +20 V</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>Continuous Forward Current</td>
<td>( I_D )</td>
<td>( T_C = 100°C, V_{GS} = -5 / +20 V )</td>
<td>4</td>
<td>A</td>
<td>Fig. 14</td>
</tr>
<tr>
<td></td>
<td></td>
<td>( T_C = 135°C, V_{GS} = -5 / +20 V )</td>
<td>3</td>
<td>A</td>
<td></td>
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<tr>
<td>Pulsed Drain Current</td>
<td>( I_D(pulse) )</td>
<td>( t_P \leq 10\mu s, D \leq 1% ), Note 1</td>
<td>8</td>
<td>A</td>
<td>Fig. 13</td>
</tr>
<tr>
<td>Power Dissipation</td>
<td>( P_D )</td>
<td>( T_C = 25°C )</td>
<td>53</td>
<td>W</td>
<td>Fig. 15</td>
</tr>
<tr>
<td>Operating and Storage Temperature</td>
<td>( T_J, T_{STG} )</td>
<td></td>
<td>-55 to 175 °C</td>
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Thermal/Package Characteristics

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<th>Values</th>
<th>Unit</th>
<th>Note</th>
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<tbody>
<tr>
<td>Thermal Resistance, Junction - Case</td>
<td>( R_{th,JC} )</td>
<td></td>
<td>2.39 / 2.83°C/W</td>
<td>Fig. 12</td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td>( W_T )</td>
<td></td>
<td>6.1 g</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mounting Torque</td>
<td>( T_M )</td>
<td>Screws to Heatsink</td>
<td>1.1 Nm</td>
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Note 1: Pulse Width \( t_P \) Limited by \( T_J(max) \)
# Electrical Characteristics

(At $T_C = 25^\circ C$ Unless Otherwise Stated)

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<thead>
<tr>
<th>Parameter</th>
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<th>Conditions</th>
<th>Values</th>
<th>Unit</th>
<th>Note</th>
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<tr>
<td>Drain-Source Breakdown Voltage</td>
<td>$V_{DSS}$</td>
<td>$V_{GS} = 0 , V, , I_D = 100 , \mu A$</td>
<td>1700</td>
<td>V</td>
<td></td>
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<tr>
<td>Zero Gate Voltage Drain Current</td>
<td>$I_{DSS}$</td>
<td>$V_{DS} = 1700 , V, , V_{GS} = 0 , V$</td>
<td>1</td>
<td>$\mu A$</td>
<td></td>
</tr>
<tr>
<td>Gate Source Leakage Current</td>
<td>$I_{GS}$</td>
<td>$V_{DS} = 0 , V, , V_{GS} = 25 , V$</td>
<td>100</td>
<td>nA</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>$V_{DS} = 0 , V, , V_{GS} = -10 , V$</td>
<td>-100</td>
<td>nA</td>
<td></td>
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<tr>
<td>Gate Threshold Voltage</td>
<td>$V_{GS(th)}$</td>
<td>$V_{DS} = V_{GS} , I_D = 2 , mA$</td>
<td>2.5</td>
<td>V</td>
<td>Fig. 9</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$V_{DS} = V_{GS} , I_D = 2 , mA, , T_J = 175^\circ C$</td>
<td>4</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>Transconductance</td>
<td>$g_{m}$</td>
<td>$V_{DS} = 10 , V, , I_D = 2 , A$</td>
<td>0.74</td>
<td>S</td>
<td>Fig. 4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$V_{DS} = 10 , V, , I_D = 2 , A, , T_J = 175^\circ C$</td>
<td>0.71</td>
<td>S</td>
<td></td>
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<tr>
<td>Drain-Source On-State Resistance</td>
<td>$R_{DS(ON)}$</td>
<td>$V_{GS} = 20 , V, , I_D = 2 , A$</td>
<td>1000</td>
<td>m$\Omega$</td>
<td>Fig. 5-8</td>
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<tr>
<td></td>
<td></td>
<td>$V_{GS} = 20 , V, , I_D = 2 , A, , T_J = 175^\circ C$</td>
<td>1680</td>
<td>m$\Omega$</td>
<td></td>
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<tr>
<td>Input Capacitance</td>
<td>$C_{iss}$</td>
<td></td>
<td>139</td>
<td>pF</td>
<td></td>
</tr>
<tr>
<td>Output Capacitance</td>
<td>$C_{oss}$</td>
<td>$V_{DS} = 1000 , V, , V_{GS} = 0 , V$</td>
<td>22</td>
<td>pF</td>
<td>Fig. 10</td>
</tr>
<tr>
<td>Reverse Transfer Capacitance</td>
<td>$C_{rss}$</td>
<td>$f = 1 , MHz, , V_{AC} = 25mV$</td>
<td>6.2</td>
<td>pF</td>
<td></td>
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<tr>
<td>$C_{oss}$ Stored Energy</td>
<td>$E_{oss}$</td>
<td></td>
<td>15</td>
<td>$\mu J$</td>
<td>Fig. 11</td>
</tr>
<tr>
<td>$C_{oss}$ Stored Charge</td>
<td>$Q_{oss}$</td>
<td></td>
<td>27</td>
<td>nC</td>
<td></td>
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<tr>
<td>Internal Gate Resistance</td>
<td>$R_{G(int)}$</td>
<td>$f = 1 , MHz, , V_{AC} = 25 , mV$</td>
<td>5</td>
<td>Q</td>
<td></td>
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</table>

## Reverse Diode Characteristics

<table>
<thead>
<tr>
<th>Parameter</th>
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<th>Conditions</th>
<th>Values</th>
<th>Unit</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diode Forward Voltage</td>
<td>$V_{SD}$</td>
<td>$V_{GS} = -5 , V, , I_{SD} = 1 , A$</td>
<td>4</td>
<td>V</td>
<td>Fig. 16-17</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$V_{GS} = -5 , V, , I_{SD} = 1 , A, , T_J = 175^\circ C$</td>
<td>3.5</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>Continuous Diode Forward Current</td>
<td>$I_S$</td>
<td>$V_{GS} = -5 , V, , T_J = 100^\circ C$</td>
<td>4</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>Diode Pulse Current</td>
<td>$I_{S(pulse)}$</td>
<td>$V_{GS} = -5 , V, , Note , 1$</td>
<td>16</td>
<td>A</td>
<td></td>
</tr>
</tbody>
</table>
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Figure 1: Output Characteristics (T_J = 25°C)

\[ I_D = f(V_{DS}, V_{GS}); \tau_p = 250 \mu s \]

\( V_{GS} = 20 \, V \)
\( V_{GS} = 18 \, V \)
\( V_{GS} = 16 \, V \)
\( V_{GS} = 14 \, V \)
\( V_{GS} = 12 \, V \)
\( V_{GS} = 10 \, V \)
\( V_{GS} = 0 \, V \)

\( V_{DS} \) vs. \( I_D \)

Figure 2: Output Characteristics (T_J = 175°C)

\[ I_D = f(V_{DS}, V_{GS}); \tau_p = 250 \mu s \]

\( V_{GS} = 20 \, V \)
\( V_{GS} = 18 \, V \)
\( V_{GS} = 16 \, V \)
\( V_{GS} = 14 \, V \)
\( V_{GS} = 12 \, V \)
\( V_{GS} = 10 \, V \)
\( V_{GS} = 0 \, V \)

\( V_{DS} \) vs. \( I_D \)

Figure 3: Output Characteristics (V_{GS} = 20 V)

\[ I_D = f(V_{GS}, T_J); \tau_p = 250 \mu s \]

\( T_J = 175°C \)
\( T_J = 150°C \)
\( T_J = 125°C \)
\( T_J = 75°C \)
\( T_J = 25°C \)

\( V_{GS} \) vs. \( I_D \)

Figure 4: Transfer Characteristics (V_{DS} = 10 V)

\[ I_D = f(V_{GS}, T_J); \tau_p = 100 \mu s \]

\( T_J = 175°C \)
\( T_J = 25°C \)

\( V_{GS} \) vs. \( I_D \)
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Figure 5: On-State Resistance v/s Temperature

\[ R_{DS(ON)} = f(T_J, V_{GS}); \tau_P = 250 \, \mu s; I_D = 2 \, A; V_{GS} = 20 \, V \]

![Graph showing On-Resistance vs Junction Temperature with curves for \( V_{GS} = 16 \, V \) and \( V_{GS} = 20 \, V \).]

Figure 6: On-State Resistance v/s Drain Current

\[ R_{DS(ON)} = f(T_J, I_D); \tau_P = 250 \, \mu s; V_{GS} = 20 \, V \]

![Graph showing On-Resistance vs Drain Source Current with curves for \( T_J = 25^\circ C \) and \( T_J = 175^\circ C \).]

Figure 7: Normalized On-State Resistance v/s Temperature

\[ R_{DS(ON)} = f(T_J); \tau_P = 250 \, \mu s; I_D = 2 \, A; V_{GS} = 20 \, V \]

![Graph showing Normalized On-Resistance vs Junction Temperature with curves for \( T_J = 25^\circ C \) and \( T_J = 175^\circ C \).]

Figure 8: On-State Resistance v/s Gate Voltage

\[ R_{DS(ON)} = f(T_J, V_{GS}); \tau_P = 250 \, \mu s; I_D = 2 \, A \]

![Graph showing On-Resistance vs Gate-Source Voltage with curves for \( T_J = 25^\circ C \) and \( T_J = 175^\circ C \).]
Figure 9: Threshold Voltage Characteristics

\[ V_{GS(0)} = f(T_j); V_{DS} = V_{GS}; I_D = 2 \text{ mA} \]

Figure 10: Capacitance v/s Drain-Source Voltage

\[ f = 1 \text{ MHz}; V_{AC} = 25\text{mV} \]

Figure 11: Output Capacitor Stored Energy

\[ E_{oss} = f(V_{DS}) \]

Figure 12: Transient Thermal Impedance

\[ Z_{th,JC} = f(t_p, D); D = t_p/T \]
Figure 13: Safe Operating Area ($T_c = 25^\circ C$)

$\text{Drain-Source Voltage, } V_{DS} (\text{V})$

$\text{Drain-Source Current, } I_{DS} (\text{A})$

$10^{-1}$ $10^{0}$ $10^{1}$ $10^{2}$ $10^{3}$

$100 \text{ ms}$ $10 \text{ ms}$ $100 \mu s$

$I_D = f(V_{DS}, t_d); T_J \leq 175^\circ C; D = 0$

Figure 14: Current De-rating Curve

$\text{Case Temperature, } T_C (\text{C})$

$\text{Continuous Drain Current, } I_D (\text{A})$

$10$ $9$ $8$ $7$ $6$ $5$

$25$ $50$ $75$ $100$ $125$ $150$ $175$

$I_D = f(T_C); T_J \leq 175^\circ C$

Figure 15: Power De-rating Curve

$\text{Case Temperature, } T_C (\text{C})$

$\text{Power Dissipation, } P_D (\text{W})$

$60$ $50$ $40$ $30$ $20$ $10$

$25$ $50$ $75$ $100$ $125$ $150$ $175$

$P_D = f(T_C); T_J \leq 175^\circ C$

Figure 16: Body Diode Characteristics ($T_J = 25^\circ C$)

$\text{Drain-Source Voltage, } V_{DS} (\text{V})$

$\text{Drain-Source Current, } I_{DS} (\text{A})$

$0$ $-1$ $-2$ $-3$ $-4$

$V_{GS} = -5 \text{ V}$ $V_{GS} = -4 \text{ V}$ $V_{GS} = -3 \text{ V}$ $V_{GS} = -2 \text{ V}$ $V_{GS} = -1 \text{ V}$ $V_{GS} = 0 \text{ V}$

$-8$ $-6$ $-4$ $-2$ $0$

$I_D = f(V_{DS}, V_{GS}); t_p = 250 \mu s$
Figure 17: Body Diode Characteristics (Tj = 175°C)

\[ I_D = f(V_{DS}, V_{GS}); \tau_p = 250 \mu s \]

Drain-Source Current, \( I_D \) (A)

Drain-Source Voltage, \( V_{DS} \) (V)

\( V_{GS} = -5 \) V
\( V_{GS} = -4 \) V
\( V_{GS} = -3 \) V
\( V_{GS} = -2 \) V
\( V_{GS} = -1 \) V
\( V_{GS} = 0 \) V

Figure 18: Third Quadrant Characteristics (Tj = 25°C)

\[ I_D = f(V_{DS}, V_{GS}); \tau_p = 250 \mu s \]

Drain-Source Current, \( I_D \) (A)

Drain-Source Voltage, \( V_{DS} \) (V)

\( V_{GS} = 20 \) V
\( V_{GS} = 15 \) V
\( V_{GS} = 10 \) V
\( V_{GS} = 5 \) V
\( V_{GS} = 0 \) V

Figure 19: Third Quadrant Characteristics (Tj = 175°C)

\[ I_D = f(V_{DS}, V_{GS}); \tau_p = 250 \mu s \]

Drain-Source Current, \( I_D \) (A)

Drain-Source Voltage, \( V_{DS} \) (V)

\( V_{GS} = 20 \) V
\( V_{GS} = 15 \) V
\( V_{GS} = 10 \) V
\( V_{GS} = 5 \) V
\( V_{GS} = 0 \) V
**Package Dimensions**

**TO-247-3 Package Outline**

**Recommended Solder Pad Layout**

**Package View**

**NOTE**

1. CONTROLLED DIMENSION IS INCH. DIMENSION IN BRACKET IS MILLIMETER.
2. DIMENSIONS DO NOT INCLUDE END FLASH, MOLD FLASH, MATERIAL PROTRUSIONS.
Compliance

RoHS Compliance

The levels of RoHS restricted materials in this product are below the maximum concentration values (also referred to as the threshold limits) permitted for such substances, or are used in an exempted application, in accordance with EU Directive 2011/65/EC (RoHS 2), as adopted by EU member states on January 2, 2013 and amended on March 31, 2015 by EU Directive 2015/863. RoHS Declarations for this product can be obtained from your GeneSiC representative.

REACH Compliance

REACH substances of high concern (SVHCs) information is available for this product. Since the European Chemical Agency (ECHA) has published notice of their intent to frequently revise the SVHC listing for the foreseeable future, please contact a GeneSiC representative to insure you get the most up-to-date REACH SVHC Declaration. REACH banned substance information (REACH Article 67) is also available upon request.

Disclaimer

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Related Links

- SPICE Models: https://www.genesicsemi.com/sic-mosfet/G2R1000MT17D/G2R1000MT17D_SPICE.zip
- PLECS Models: https://www.genesicsemi.com/sic-mosfet/G2R1000MT17D/G2R1000MT17D_PLECS.zip
- CAD Models: https://www.genesicsemi.com/sic-mosfet/G2R1000MT17D/G2R1000MT17D_3D.zip
- Gate Driver Reference: https://www.genesicsemi.com/technical-support
- Evaluation Boards: https://www.genesicsemi.com/technical-support
- Reliability: https://www.genesicsemi.com/reliability
- Compliance: https://www.genesicsemi.com/compliance

Revision History

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<th>Revision</th>
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<tr>
<td>Aug. 3, 2020</td>
<td>Rev 2</td>
<td>Part Number Changed from G3R1000MT17D to G2R1000MT17D</td>
<td>Rev 1</td>
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<tr>
<td>Jun. 2, 2020</td>
<td>Rev 1</td>
<td>Initial Release</td>
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www.genesicsemi.com/sic-mosfet/