

# G3R20MT17K

## 1700 V 20 mΩ SiC MOSFET



Silicon Carbide MOSFET  
N-Channel Enhancement Mode

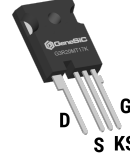
|   |   |        |
|---|---|--------|
| V <sub>DS</sub>                         | = | 1700 V |
| R <sub>DS(ON)(Typ.)</sub>               | = | 20 mΩ  |
| I <sub>D</sub> (T <sub>C</sub> = 100°C) | = | 87 A   |

### Features

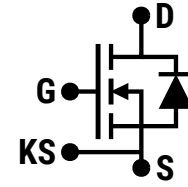
- G3R™ SiC MOSFET Technology
- Superior Q<sub>G</sub> × R<sub>DS(ON)</sub> Figure of Merit
- Low Capacitances and Low Gate Charge
- High V<sub>th</sub> for Increased System Stability
- Fast and Reliable Body Diode
- High Avalanche and Short Circuit Ruggedness
- Low Conduction Losses at High Temperatures
- Optimized Package with Separate Driver Source Pin

### Package

Case (D)



**TO-247-4**



D = Drain  
G = Gate  
S = Source  
KS = Kelvin Source



### Advantages

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

### Applications

- Electric Vehicle Fast Charging
- Solar Inverters
- Traction Inverters
- Smart Grid and HVDC
- High Voltage DC-DC Converters
- Switched Mode Power Supply
- Wind Energy Converters
- Pulsed Power

### Absolute Maximum Ratings (At T<sub>C</sub> = 25°C Unless Otherwise Stated)

| Parameter                         | Symbol                            | Conditions                                     | Values     | Unit | Note    |
|-----------------------------------|-----------------------------------|--|------------|------|---------|
| Drain-Source Voltage              | V <sub>DS(max)</sub>              | V <sub>GS</sub> = 0 V, I <sub>D</sub> = 100 μs | 1700       | V    |         |
| Gate-Source Voltage (Dynamic)     | V <sub>GS(max)</sub>              |  | -10 / +25  | V    |         |
| Gate-Source Voltage (Static)      | V <sub>GS(op)</sub>               | Recommended Operation                          | -5 / +20   | V    |         |
| Continuous Forward Current        | I <sub>D</sub>                    | T <sub>C</sub> = 100°C, V <sub>GS</sub> = 20 V | 87         | A    | Fig. 15 |
|                                   |                                   | T <sub>C</sub> = 135°C, V <sub>GS</sub> = 20 V | 64         |      |         |
| Pulsed Drain Current              | I <sub>D(pulse)</sub>             | t <sub>P</sub> ≤ 10 μs, D ≤ 1%, Note 1         | 300        | A    | Fig. 14 |
| Power Dissipation                 | P <sub>D</sub>                    | T <sub>C</sub> = 25°C                          | 515        | W    | Fig. 16 |
| Operating and Storage Temperature | T <sub>j</sub> , T <sub>stg</sub> |  | -55 to 175 | °C   |         |

### Thermal/Package Characteristics

| Parameter                           | Symbol            | Conditions         | Values |      |      | Unit | Note    |
|-------------------------------------|-------------------|--------------------|--------|------|------|------|---------|
|                                     |                   |                    | Min.   | Typ. | Max. |      |         |
| Thermal Resistance, Junction - Case | R <sub>thJC</sub> |                    |        | 0.29 |      | °C/W | Fig. 12 |
| Weight                              | W <sub>T</sub>    |                    |        | 6.1  |      | g    |         |
| Mounting Torque                     | T <sub>M</sub>    | Screws to Heatsink |        |      | 1.1  | Nm   |         |

Note 1: Pulse Width t<sub>P</sub> Limited by T<sub>j(max)</sub>

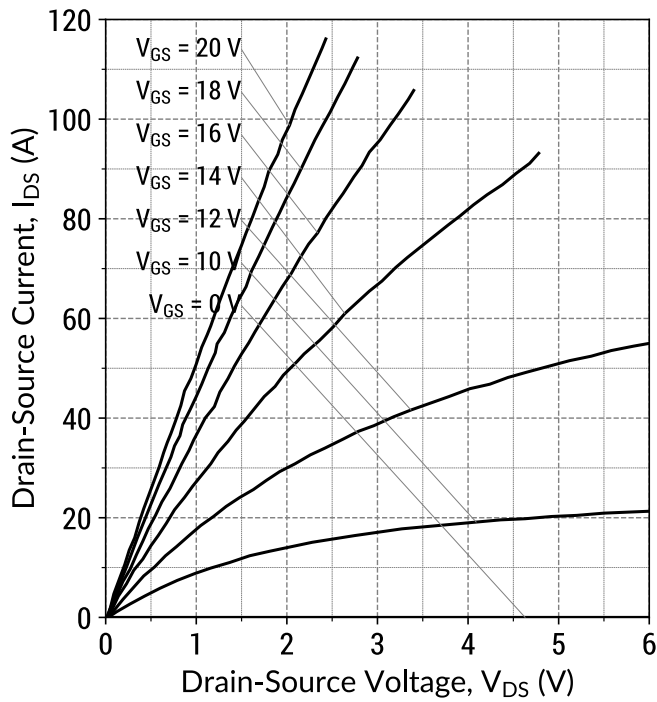
**Electrical Characteristics** (At  $T_c = 25^\circ\text{C}$  Unless Otherwise Stated)

| Parameter                        | Symbol       | Conditions   | Values |      |      | Unit          | Note     |
|----------------------------------|--------------|--|--------|------|------|---------------|----------|
|                                  |              |  | Min.   | Typ. | Max. |               |          |
| Drain-Source Breakdown Voltage   | $V_{DSS}$    | $V_{GS} = 0\text{ V}, I_D = 100\ \mu\text{A}$  | 1700   |      |      | V             |          |
| Zero Gate Voltage Drain Current  | $I_{DSS}$    | $V_{DS} = 1700\text{ V}, V_{GS} = 0\text{ V}$  |        | 1    |      | $\mu\text{A}$ |          |
| Gate Source Leakage Current      | $I_{GSS}$    | $V_{DS} = 0\text{ V}, V_{GS} = 25\text{ V}$  |        |      | 100  | nA            |          |
|                                  |              | $V_{DS} = 0\text{ V}, V_{GS} = -10\text{ V}$   |        |      | -100 |               |          |
| Gate Threshold Voltage           | $V_{GS(th)}$ | $V_{DS} = V_{GS}, I_D = 12\text{ mA}$  | 3.3    | 4    |      | V             | Fig. 9   |
|                                  |              | $V_{DS} = V_{GS}, I_D = 12\text{ mA}, T_j = 175^\circ\text{C}$                             |        | 3    |      |               |          |
| Transconductance                 | $g_{fs}$     | $V_{DS} = 10\text{ V}, I_D = 75\text{ A}$  |        | 22.1 |      | S             | Fig. 4   |
|                                  |              | $V_{DS} = 10\text{ V}, I_D = 75\text{ A}, T_j = 175^\circ\text{C}$                         |        | 31.6 |      |               |          |
| Drain-Source On-State Resistance | $R_{DS(ON)}$ | $V_{GS} = 20\text{ V}, I_D = 75\text{ A}$  |        | 20   | 24   | mΩ            | Fig. 5-8 |
|                                  |              | $V_{GS} = 20\text{ V}, I_D = 75\text{ A}, T_j = 175^\circ\text{C}$                         |        | 34   |      |               |          |
| Input Capacitance                | $C_{iss}$    |  |        | 6059 |      | pF            | Fig. 10  |
| Output Capacitance               | $C_{oss}$    |  |        | 223  |      |               |          |
| Reverse Transfer Capacitance     | $C_{rss}$    | $V_{DS} = 1000\text{ V}, V_{GS} = 0\text{ V}$<br>$f = 1\text{ MHz}, V_{AC} = 25\text{ mV}$ |        | 38.9 |      | $\mu\text{J}$ | Fig. 11  |
| $C_{oss}$ Stored Energy          | $E_{oss}$    |  |        | 254  |      |               |          |
| $C_{oss}$ Stored Charge          | $Q_{oss}$    |  |        | 395  |      | nC            |          |
| Internal Gate Resistance         | $R_{G(int)}$ | $f = 1\text{ MHz}, V_{AC} = 25\text{ mV}$  |        | 1    |      | Ω             |          |

**Reverse Diode Characteristics**

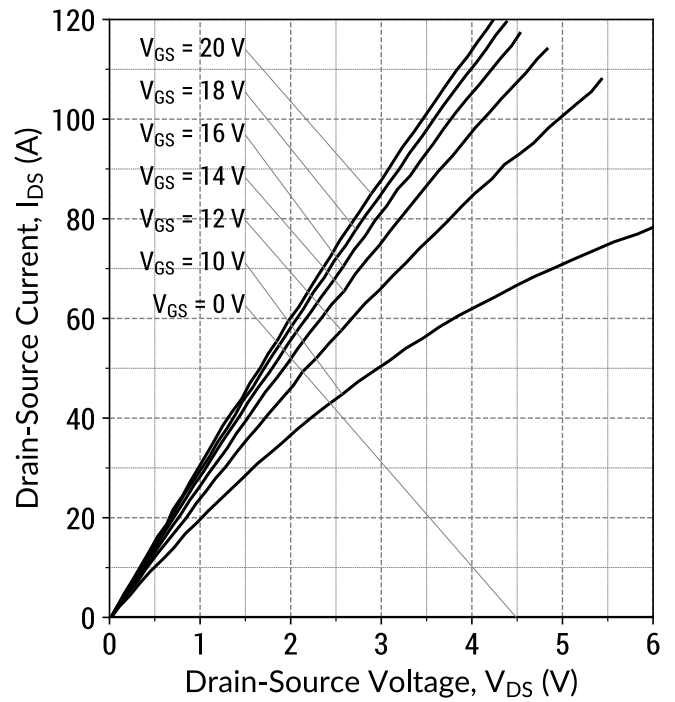
| Parameter                        | Symbol         | Conditions  | Values |      |      | Unit | Note       |
|----------------------------------|----------------|---|--------|------|------|------|------------|
|                                  |                |   | Min.   | Typ. | Max. |      |            |
| Diode Forward Voltage            | $V_{SD}$       | $V_{GS} = -5\text{ V}, I_{SD} = 37\text{ A}$                          |        | 4    |      | V    | Fig. 16-17 |
|                                  |                | $V_{GS} = -5\text{ V}, I_{SD} = 37\text{ A}, T_j = 175^\circ\text{C}$ |        | 3.5  |      |      |            |
| Continuous Diode Forward Current | $I_S$          | $V_{GS} = -5\text{ V}, T_c = 100^\circ\text{C}$                       |        | 59   |      | A    |            |
| Diode Pulse Current              | $I_{S(pulse)}$ | $V_{GS} = -5\text{ V}, \text{Note 1}$                                 |        | 300  |      | A    |            |

Figure 1: Output Characteristics ( $T_j = 25^\circ\text{C}$ )



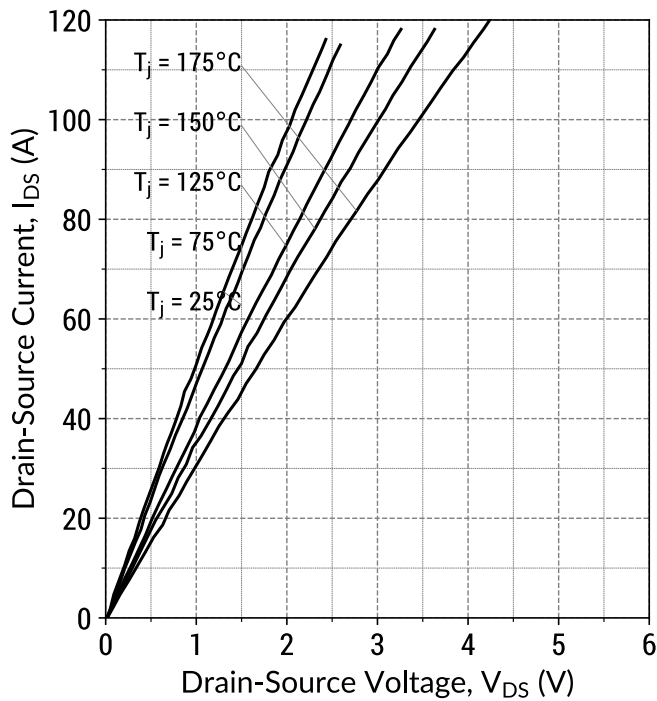
$$I_D = f(V_{DS}, V_{GS}); t_P = 250 \mu\text{s}$$

Figure 2: Output Characteristics ( $T_j = 175^\circ\text{C}$ )



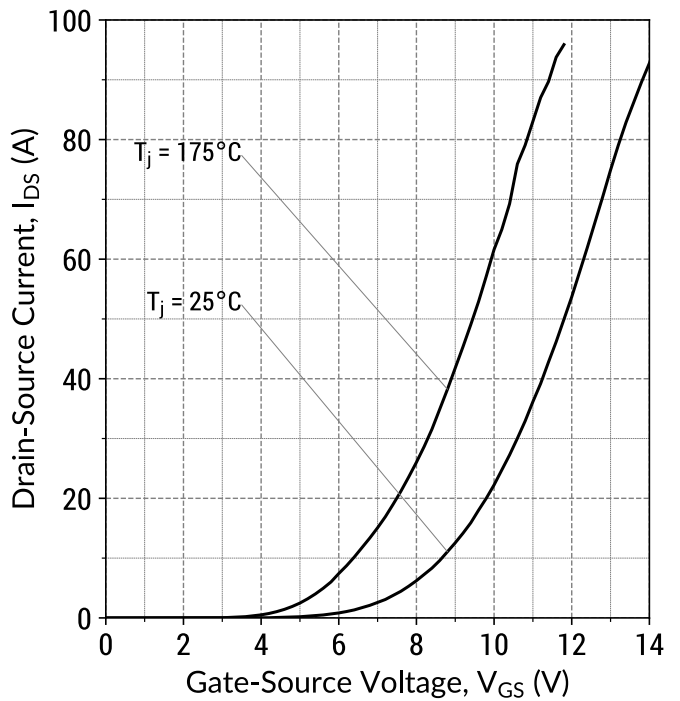
$$I_D = f(V_{DS}, V_{GS}); t_P = 250 \mu\text{s}$$

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



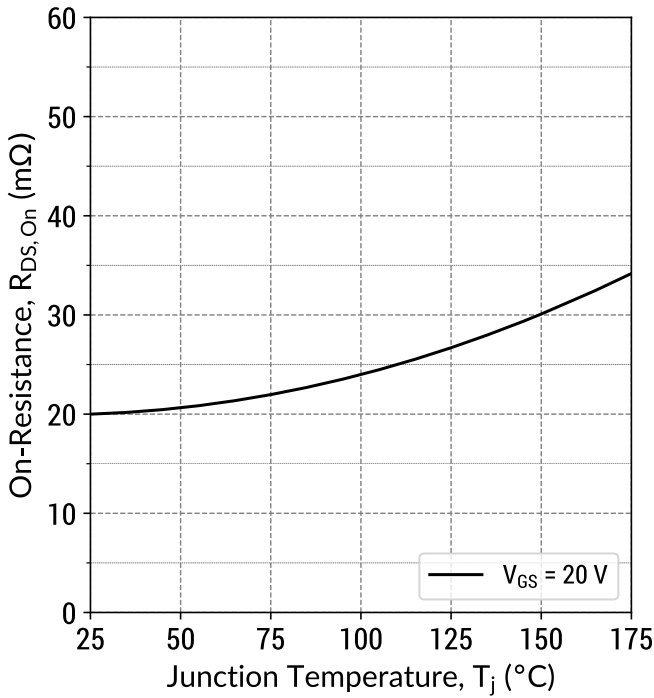
$$I_D = f(V_{DS}, T_j); t_P = 250 \mu\text{s}$$

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



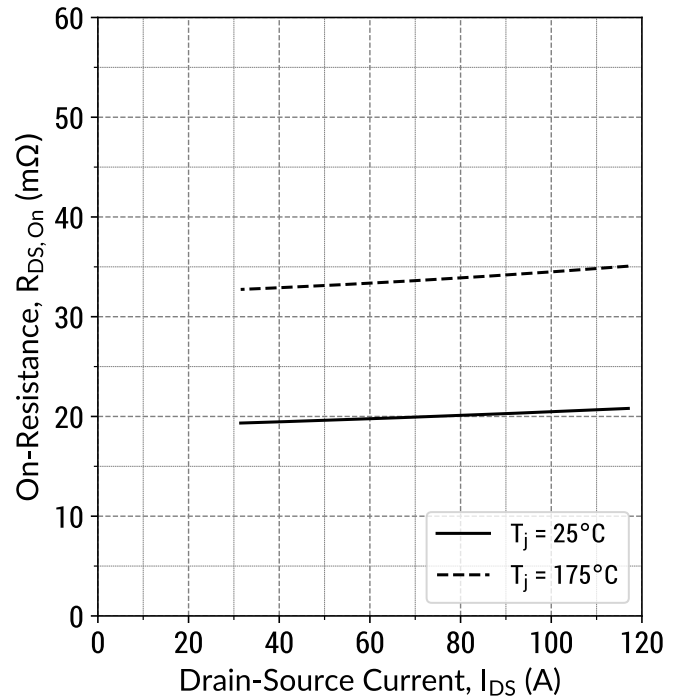
$$I_D = f(V_{GS}, T_j); t_P = 100 \mu\text{s}$$

Figure 5: On-State Resistance v/s Temperature



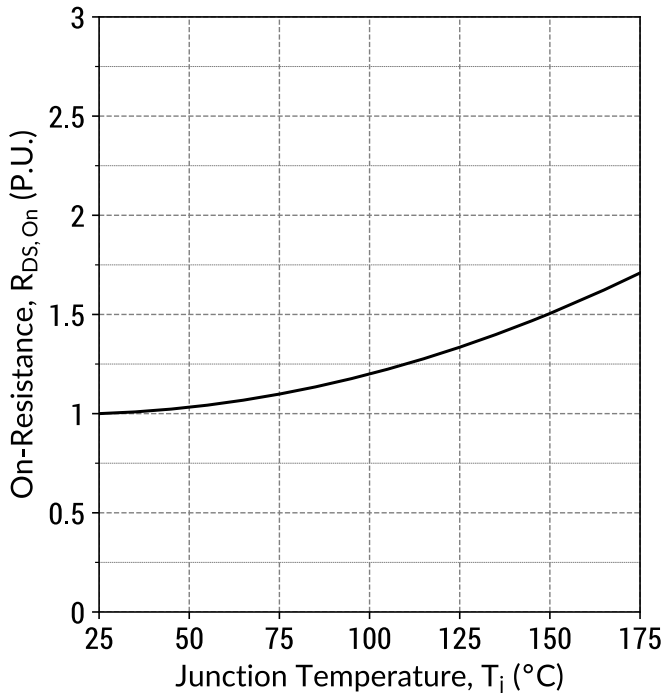
$R_{DS(ON)} = f(T_j, V_{GS}); t_P = 250 \mu s; I_D = 75 A$

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



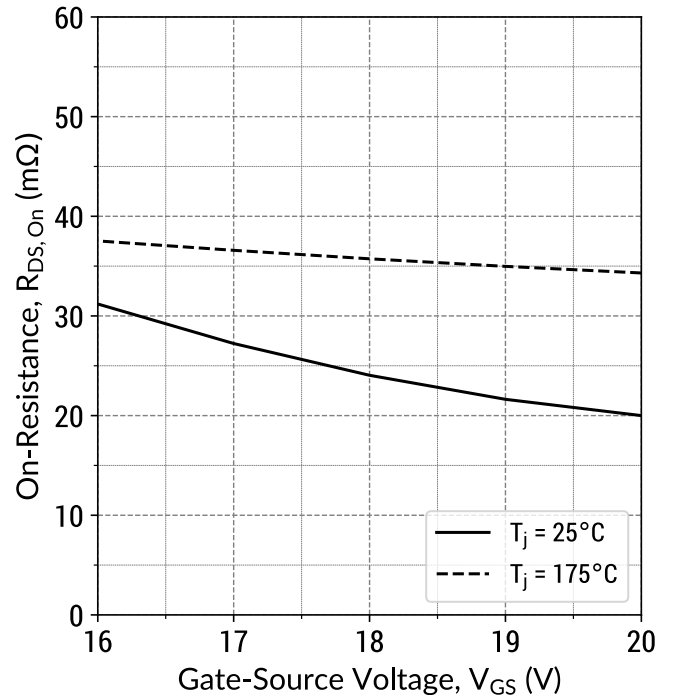
$R_{DS(ON)} = f(T_j, I_D); t_P = 250 \mu s; V_{GS} = 20 V$

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



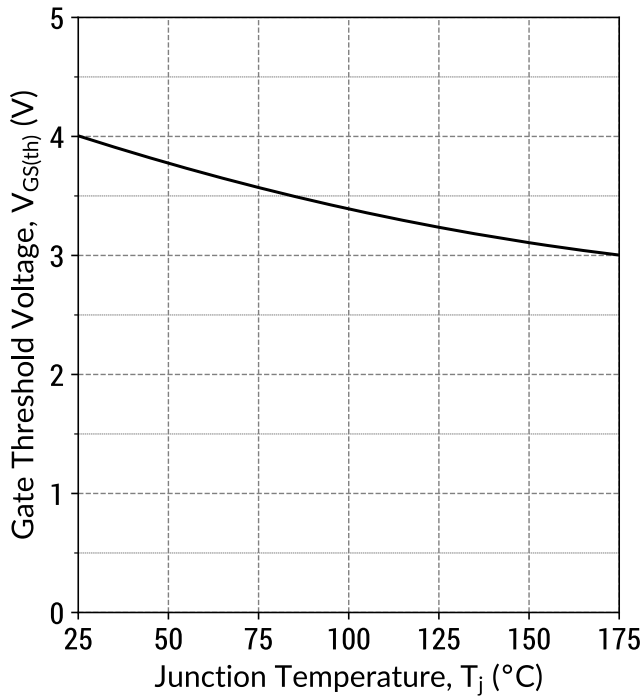
$R_{DS(ON)} = f(T_j); t_P = 250 \mu s; I_D = 75 A; V_{GS} = 20 V$

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



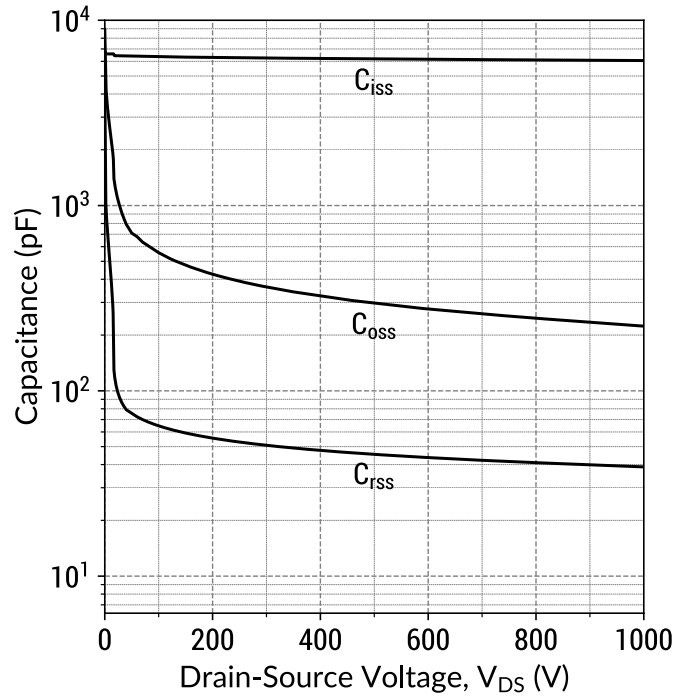
$R_{DS(ON)} = f(T_j, V_{GS}); t_P = 250 \mu s; I_D = 75 A$

Figure 9: Threshold Voltage Characteristics



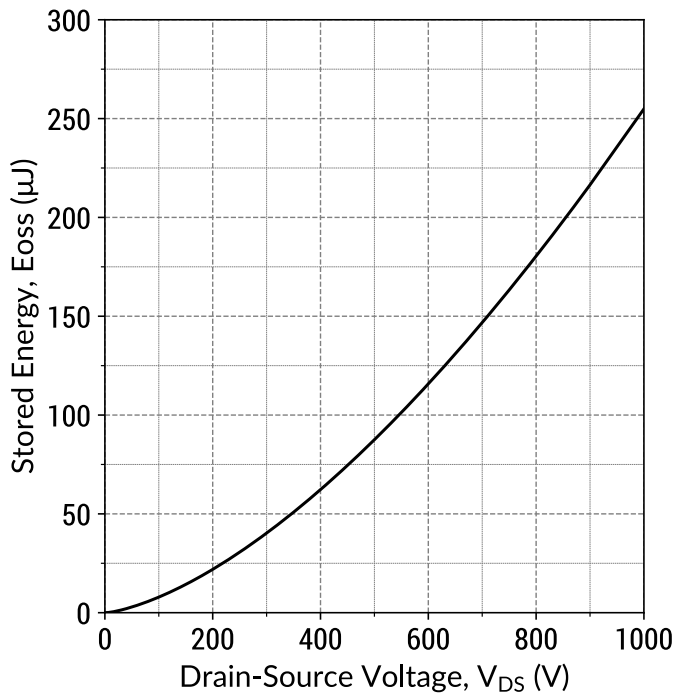
$V_{GS(th)} = f(T_j); V_{DS} = V_{GS}; I_D = 12 \text{ mA}$

Figure 10: Capacitance v/s Drain-Source Voltage



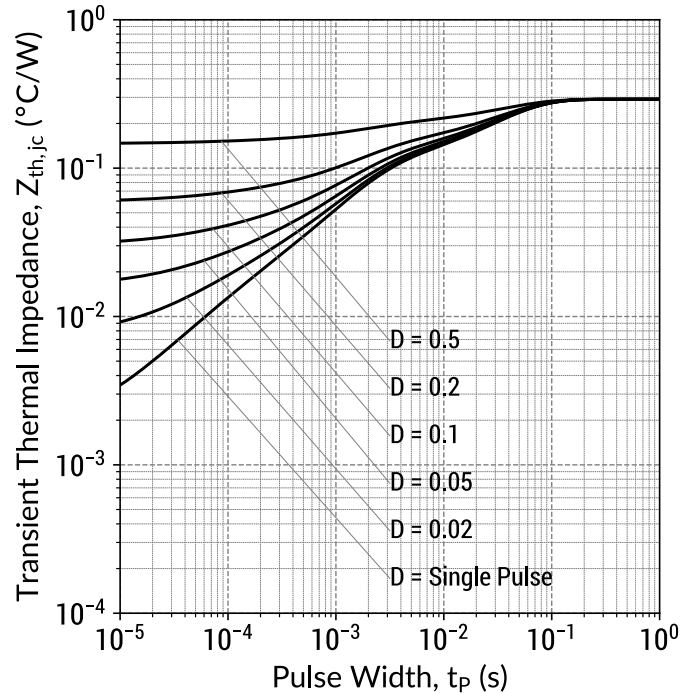
$f = 1 \text{ MHz}; V_{AC} = 25 \text{ mV}$

Figure 11: Output Capacitor Stored Energy



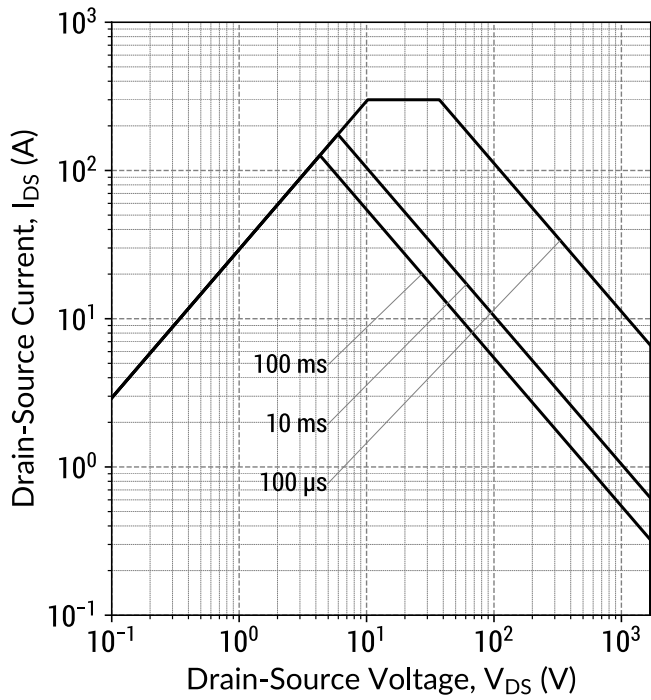
$E_{oss} = f(V_{DS})$

Figure 12: Transient Thermal Impedance



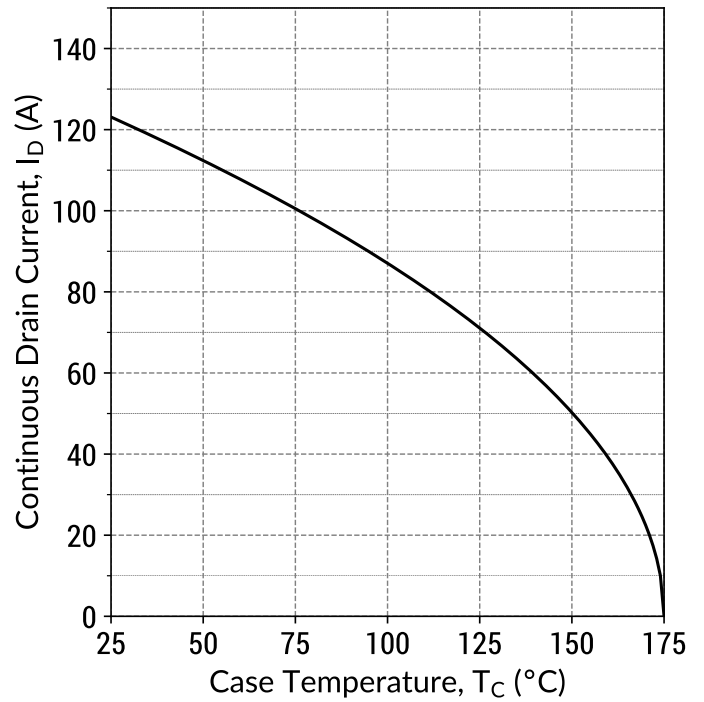
$Z_{th,jc} = f(t_p, D); D = t_p/T$

Figure 13: Safe Operating Area ( $T_c = 25^\circ\text{C}$ )



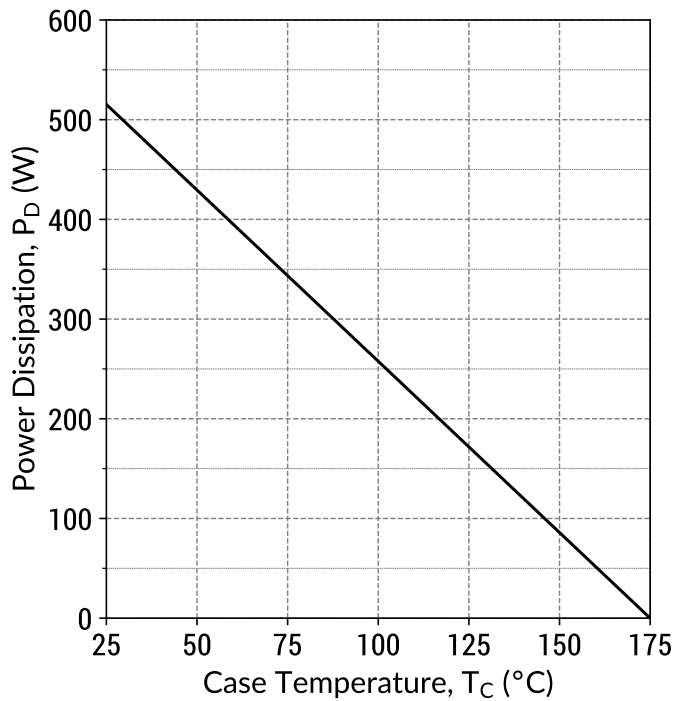
$$I_D = f(V_{DS}, t_p); T_j \leq 175^\circ\text{C}; D = 0$$

Figure 14: Current De-rating Curve



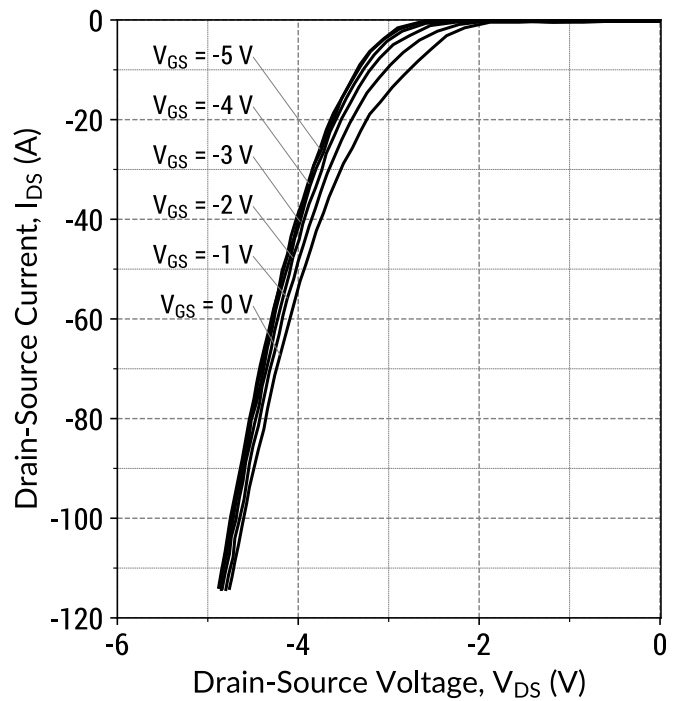
$$I_D = f(T_C); T_j \leq 175^\circ\text{C}$$

Figure 15: Power De-rating Curve



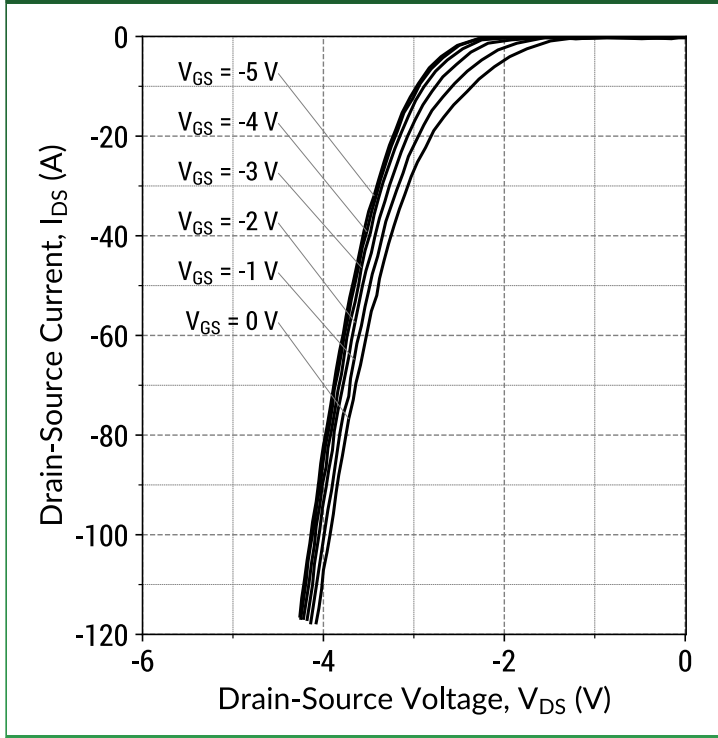
$$P_D = f(T_C); T_j \leq 175^\circ\text{C}$$

Figure 16: Body Diode Characteristics ( $T_j = 25^\circ\text{C}$ )



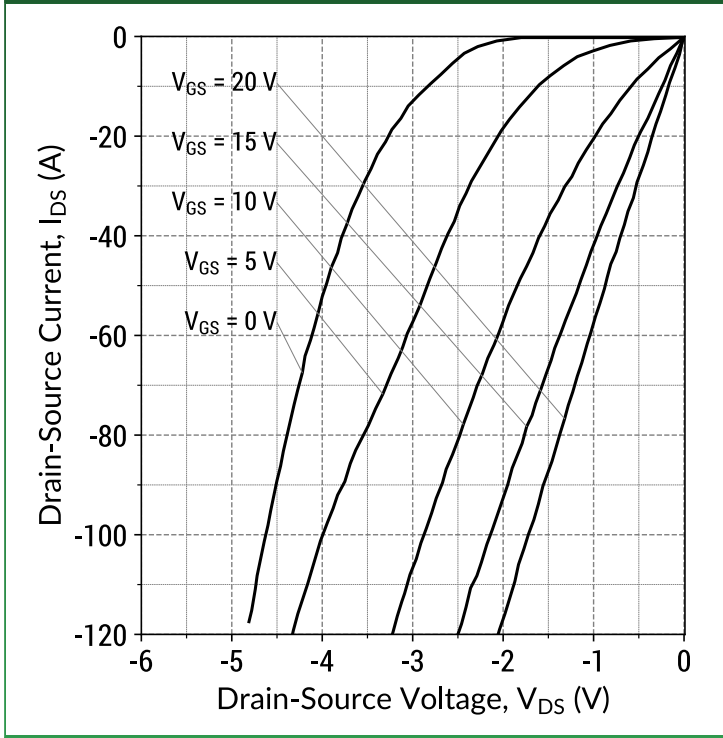
$$I_D = f(V_{DS}, V_{GS}); t_p = 250 \mu\text{s}$$

Figure 17: Body Diode Characteristics ( $T_j = 175^\circ\text{C}$ )



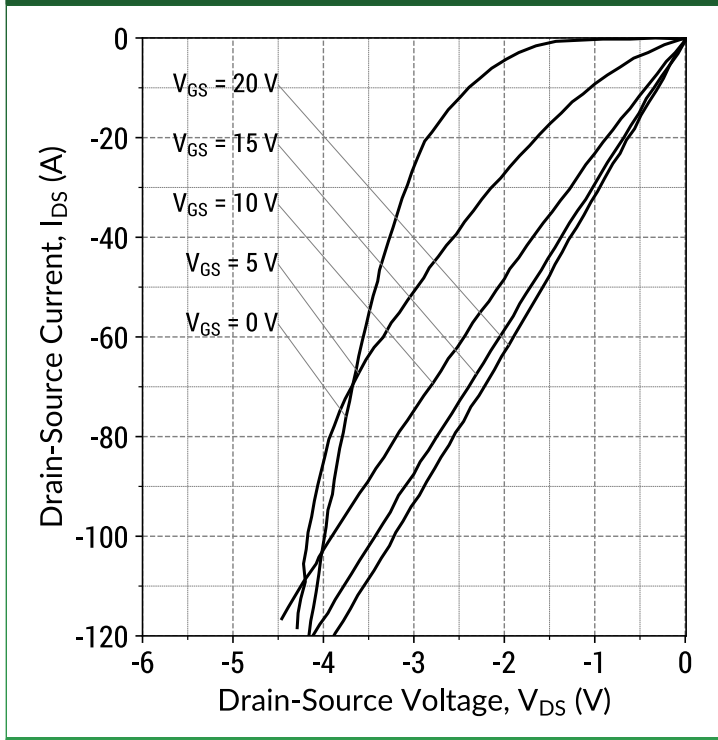
$I_D = f(V_{DS}, V_{GS}); t_P = 250 \mu\text{s}$

Figure 18: Third Quadrant Characteristics ( $T_j = 25^\circ\text{C}$ )



$I_D = f(V_{DS}, V_{GS}); t_P = 250 \mu\text{s}$

Figure 19: Third Quadrant Characteristics ( $T_j = 175^\circ\text{C}$ )



$I_D = f(V_{DS}, V_{GS}); t_P = 250 \mu\text{s}$

### 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.

This product has not been designed or tested for use in, and is not intended for use in, applications implanted into the human body nor in applications in which failure of the product could lead to death, personal injury or property damage, including but not limited to equipment used in the operation of nuclear facilities, life-support machines, cardiac defibrillators or similar emergency medical equipment, aircraft navigation or communication or control systems, or air traffic control systems.

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### Related Links

- SPICE Models: [https://www.genesicsemi.com/sic-mosfet/G3R20MT17K/G3R20MT17K\\_SPICE.zip](https://www.genesicsemi.com/sic-mosfet/G3R20MT17K/G3R20MT17K_SPICE.zip)
- PLECS Models: [https://www.genesicsemi.com/sic-mosfet/G3R20MT17K/G3R20MT17K\\_PLECS.zip](https://www.genesicsemi.com/sic-mosfet/G3R20MT17K/G3R20MT17K_PLECS.zip)
- CAD Models: [https://www.genesicsemi.com/sic-mosfet/G3R20MT17K/G3R20MT17K\\_3D.zip](https://www.genesicsemi.com/sic-mosfet/G3R20MT17K/G3R20MT17K_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>
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