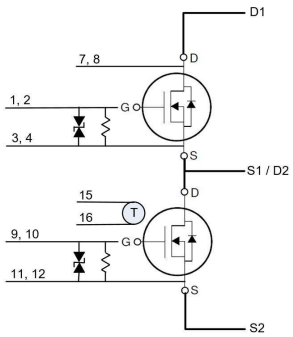
# 1700V Half-Bridge Silicon Carbide
## Power Module

**GE17042CCA3**
**$V_{DS}$: 1700 V $I_{DS}$: 425 A**

Superior performance for high power, high frequency applications needing best-in-class power density

## Features

- Highly reliable GE SiC MOSFET devices
- Low $R_{DS(ON)}$ (3.75 mΩ) (device only)
- Low stray inductance (6 nH)
- Ultra-low switching losses over entire operating range
- Body diode with minimal reverse recovery
- Integrated temperature sensing
- Dedicated DESAT Pin and Source-Kelvin Pin
- AlSiC Baseplate and $Si_3N_4$ AMB Substrate




**MOSFET DC Characteristics @ $T_J$ = 25˚C** (unless otherwise specified)

| Symbols | Parameters | Min. | Typ. | Max. | Unit | Test Conditions | Notes |
|---|---|---|---|---|---|---|---|
| $I_{DS}$ | Continuous Drain Current | | | 425 | A | $V_{GS}$ = 20 V, $T_c$ = 25˚C | Per Switch |
| | | | | 300 | | $V_{GS}$ = 20 V, $T_c$ = 100˚C | |
| | | | | 245 | | $V_{GS}$ = 20 V, $T_c$ = 125˚C | |
| $I_{DS,pulse}$ | Pulsed Drain Current | | | 850 | A | $T_c$ = 25˚C, $t_p$ = 1 ms | |
| $V_{DSmax}$ | Drain - Source Breakdown Voltage | 1700 | | | V | $V_{GS}$ = 0 V, $I_{DS}$ = 100 µA | |
| $V_{GSmax}$ | Maximum Gate - Source Voltage | | | -15/+23 | V | $V_{DS}$ = 0 V | |
| $V_{GSop}$ | Recommended Gate - Source Voltage | | -5/+20 | | V | | |
| $T_{Jmax}$ | Junction Temperature | | | 175 | ˚C | | |
| $T_C$ | Case Temperature Range | -55 | | 150 | ˚C | | |
| $T_{STG}$ | Storage Temperature Range | -55 | | 150 | ˚C | | |
| $P_D$ | Power Dissipation | | | 1250 | W | $T_c$ = 25˚C | |

(Continued) **MOSFET DC Characteristics @ $T_J$ = 25˚C** (unless otherwise specified)

| Symbols | Parameters | Min. | Typ. | Max. | Unit | Test Conditions | Notes |
|---|---|---|---|---|---|---|---|
| $I_{DS}$ | Continuous Drain Current | | | 425 | A | $V_{GS}$ = 20 V, $T_c$ = 25˚C | Per Switch |
| $V_{GS(th)}$ | Gate Threshold Voltage | 2.5 | 2.9 | 4.5 | V | $V_{GS}$ = $V_{DS}$, $I_{DS}$ = 160 mA | |
| $I_{DSS}$ | Drain Leakage Current | | | 0.10 | mA | $V_{DS}$ = 1700 V, $V_{GS}$ = 0 V, $T_J$ = 25˚C | |
| | | | | 1.6 | | $T_J$ = 175˚C | |
| $I_{GSS}$ | Gate-Source Leakage Current | | | 160 | nA | $V_{GS}$ = -15/+23 V | |
| $R_{DS(on)}$ | On State Resistance (Device Only) | | 3.75 | 4.45 | mΩ | $V_{GS}$ = 20 V, $I_{DS}$ = 425 A, $T_J$ = 25˚C | Per Switch |
| | | | 6.70 | 8.25 | | $T_J$ = 175˚C | |
| $R_{G(int)}$ | Gate-Source Series Resistance | | 1.42 | | Ω | $V_{GS}$ = 0 V, f = 100 kHz, $T_c$ = 25˚C | |

**MOSFET Dynamic Characteristics per switch @ $T_J$ = 25˚C** (unless otherwise specified)

| Symbols | Parameters | Min. | Typ. | Max. | Unit | Test Conditions | Notes |
|---|---|---|---|---|---|---|---|
| $C_{iss}$ | Input Capacitance | | 29.10 | | nF | $V_{GS}$ = 0 V<br>$V_{DS}$ = 900 V<br>f = 100 kHz | |
| $C_{oss}$ | Output Capacitance | | 1.08 | | nF | | |
| $C_{rss}$ | Reverse Transfer Capacitance | | 0.08 | | nF | | |
| $E_{on}$ | Turn-On Switching Energy | | 9.5 | | mJ | $V_{GS}$ = -8 V to +20 V<br>$V_{DS}$ = 900 V<br>$I_{DS}$ = 450 A<br>$R_{Gon}$ = $R_{Goff}$ = 1.0 Ω | |
| $E_{off}$ | Turn-Off Switching Energy | | 9.1 | | mJ | | |
| $t_r$ | Rise Time | | 28.9 | | ns | | |
| $t_f$ | Fall Time | | 35.7 | | ns | | |
| $Q_G$ | Total Gate Charge | | 1207 | | nC | $V_{GS}$ = 0 to 18 V<br>$V_{DS}$ = 900 V<br>$I_{DS}$ = 240 A | |
| $Q_{GD}$ | Gate-Drain Charge | | 525 | | nC | | |
| $Q_{GS}$ | Gate-Source Charge | | 186 | | nC | | |

**Body Diode Characteristics per switch @ $T_J$ = 25˚C** (unless otherwise specified)

| Symbols | Parameters | Min. | Typ. | Max. | Unit | Test Conditions | Notes |
|---|---|---|---|---|---|---|---|
| $I_{SD}$ | Pulsed body diode current | | | 720 | A | $V_{GS}$ = 0 V | 1. |
| $V_{SD}$ | Diode Forward Voltage | | 4.65 | | V | $V_{GS}$ = 0 V, $I_{SD}$ = 425 A,<br>$T_J$ = 25˚C | |

1. Use of body diode is recommended in pulse mode only

**Thermal Characteristics**

| Symbols | Parameters | Min. | Typ. | Max. | Unit | Test Conditions | Notes |
|---|---|---|---|---|---|---|---|
| $R_{th}$ | Thermal Resistance Junction-to-Case | | 0.10 | 0.12 | ˚C/W | JESD51-14 | Per Switch |

## Temperature Sensor Characteristics

| Symbols | Parameters | Min. | Typ. | Max. | Unit | Test Conditions | Notes |
|---|---|---|---|---|---|---|---|
| $R_{RTD}$ | Rated Resistance of RTD | | 1k | | ohm | | 2. |
| | Tolerance of Resistance | | 0.12 | | % | | |
| | Accuracy | | 0.3 | | °C | | |
| | Measuring Current | 100 | | 300 | µA | | |
| TCR | Temperature Coefficient | | 3850 | | ppm/K | | |
| | Operating Temperature | -70 | | +500 | °C | | |
| | Insulation Resistance | | 100 | | MOhm | 20°C | |

2. RTD is mounted directly over center-most die allowing direct reading of $T_J$

## Module packaging data

| Symbols | Parameters | Min. | Typ. | Max. | Unit | Test Conditions | Notes |
|---|---|---|---|---|---|---|---|
| $V_{Iso}$ | Case Isolation Voltage | 4 | | | kV | AC 50 Hz, 1 min, 25˚C | |
| CTI | Comparative Tracking Index | | 600 | | | | |
| $M_s$ | Mounting Torque | | | 5.0 | N-m | Power Terminals | |
| | | | | 4.0 | | Baseplate | |
| $L_{D1S2}$ | Loop Inductance | | 6 | | nH | | |
| | Module Mass | | 0.12 | | Kg | | |
| | Clearance Distance | | 9 | | mm | D1 to S2 | |
| | | | 4 | | mm | D1 to S1/D2 | |
| | | | 23 | | mm | Pins 1, 2 to S1/D2 | |
| | | | 25 | | mm | Pins 9, 10 to S1/D2 | |
| | | | 9 | | mm | D1, S2 to Baseplate | |
| | | | 12 | | mm | Pins 7, 8 to Baseplate | |
| | Creepage Distance | | 11 | | mm | D1 to S2 | |
| | | | 6 | | mm | D1 to S1/D2 | |
| | | | 28 | | mm | Pins 1, 2 to S1/D2 | |
| | | | 30 | | mm | Pins 9, 10 to S1/D2 | |
| | | | 12 | | mm | D1, S2 to Baseplate | |
| | | | 17 | | mm | Pins 7, 8 to Baseplate | |
| | | | | | | | |
| $M_{BP}$ | Base Plate Material | | AlSiC | | | | |

Typical performance: **GE17042CCA3**

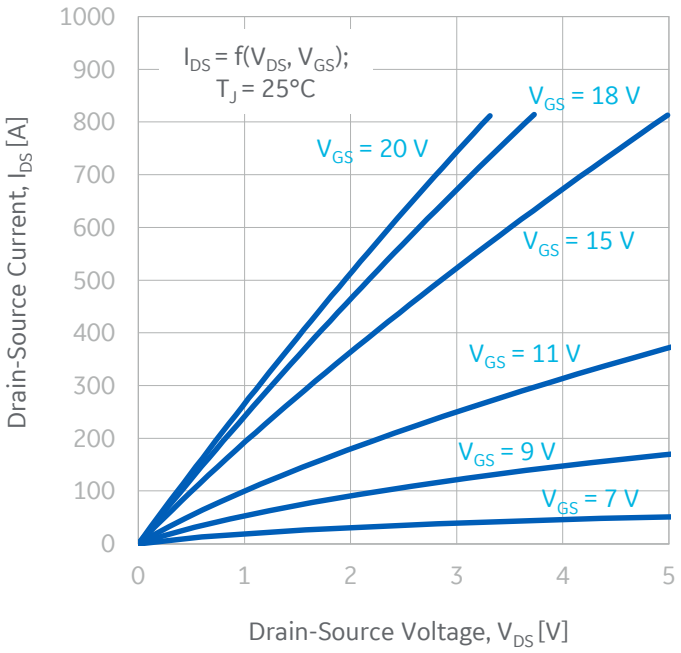



**Figure 1:** Output Characteristics (25°C)

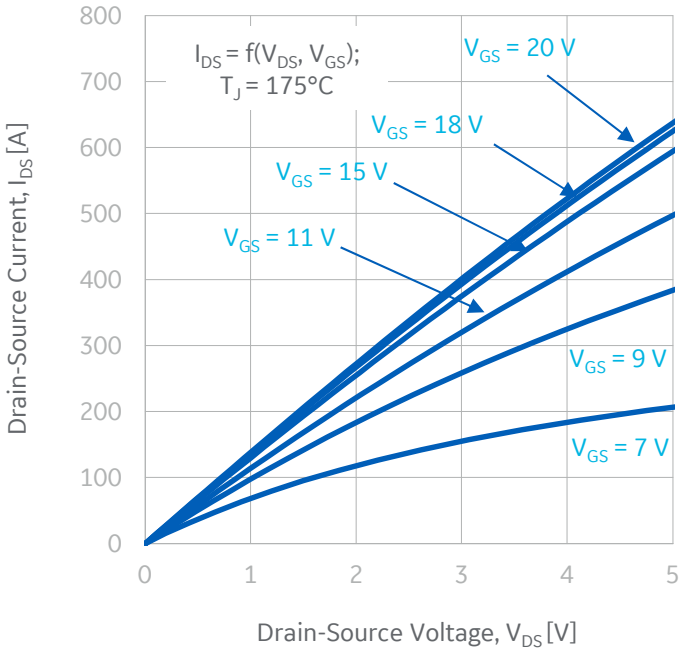



**Figure 2:** Output Characteristics (175°C)

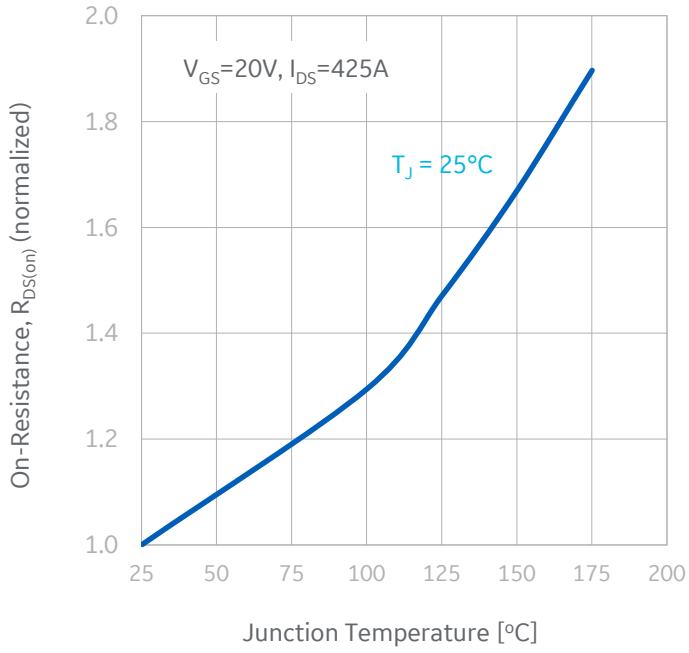



**Figure 3:** Normalized On-state Resistance vs. Temperature

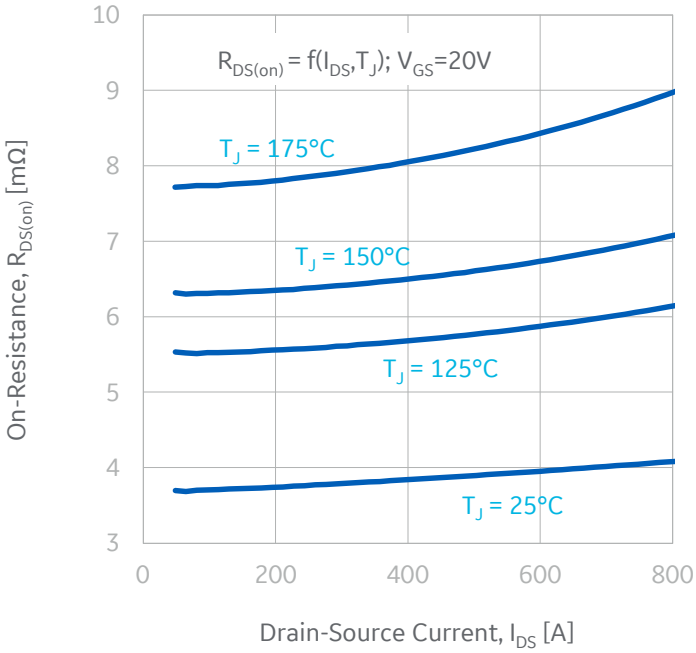



**Figure 4:** Module Drain-Source On-state Resistance

Typical performance: **GE17042CCA3**

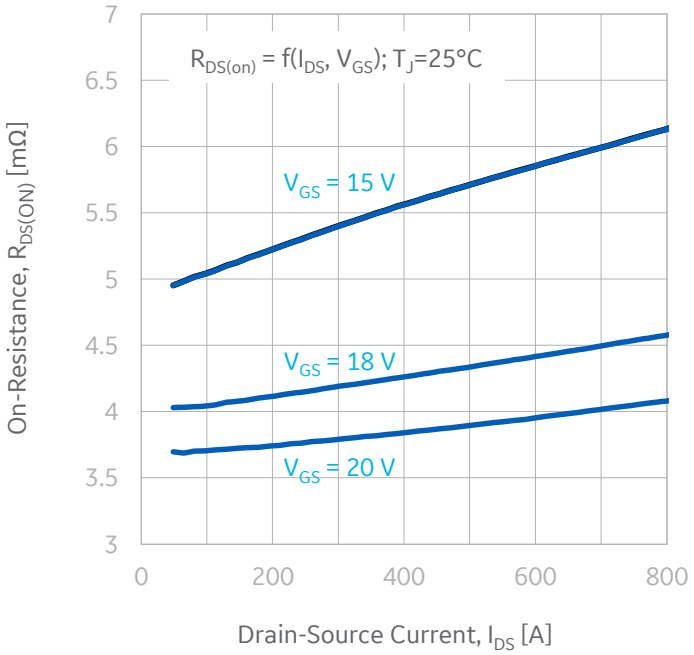



**Figure 5:** Module Drain-Source On-state Resistance

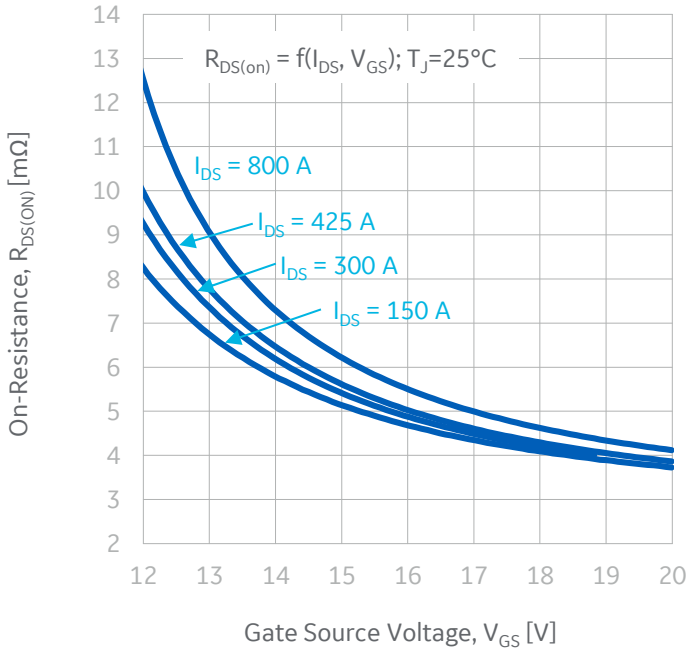



**Figure 6:** Drain-Source On-state Resistance vs. Gate Voltage

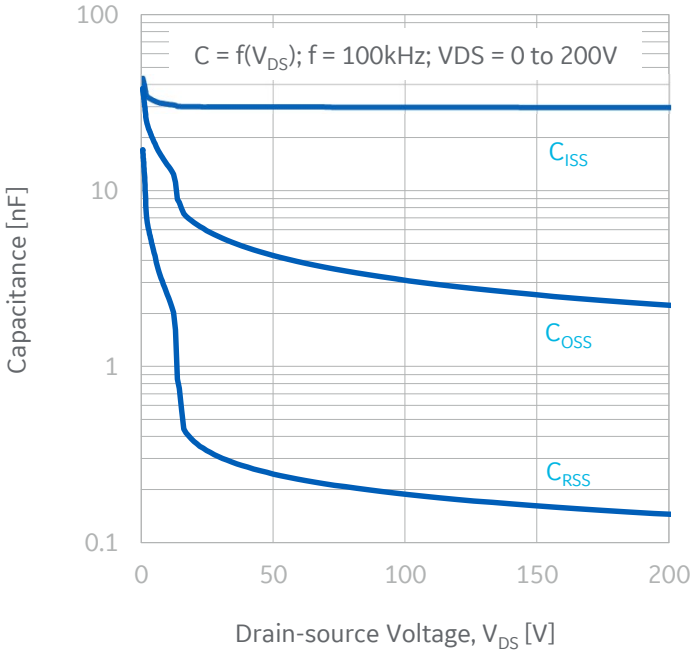



**Figure 7:** Junction Capacitances to 200 V

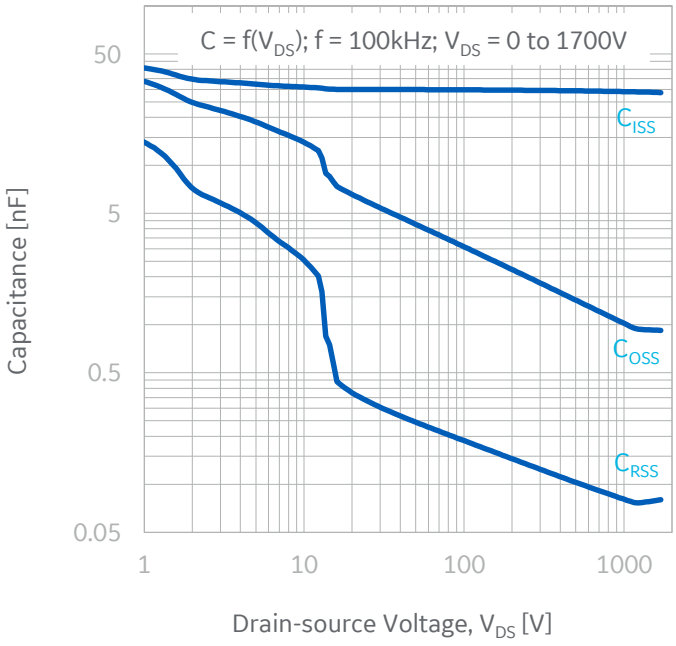



**Figure 8:** Junction Capacitances to 1700 V

Typical performance: **GE17042CCA3**

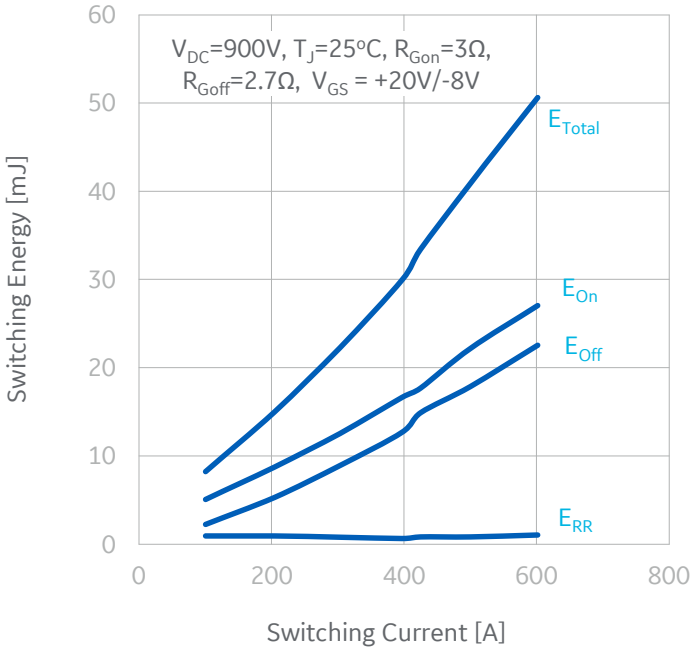



**Figure 9:** Switching Energy vs. Drain Current (900 V)

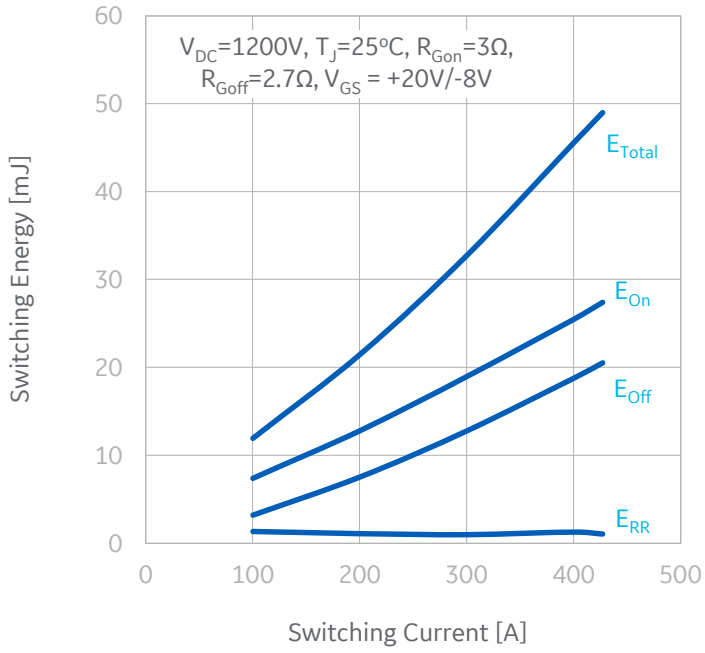



**Figure 10:** Switching Energy vs. Drain Current (1200 V)

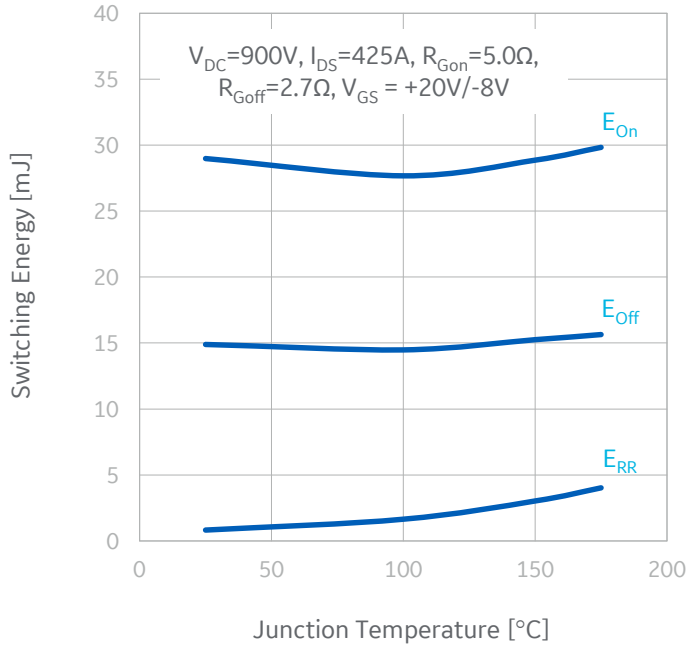



**Figure 11:** Switching Energy vs. Junction Temperature

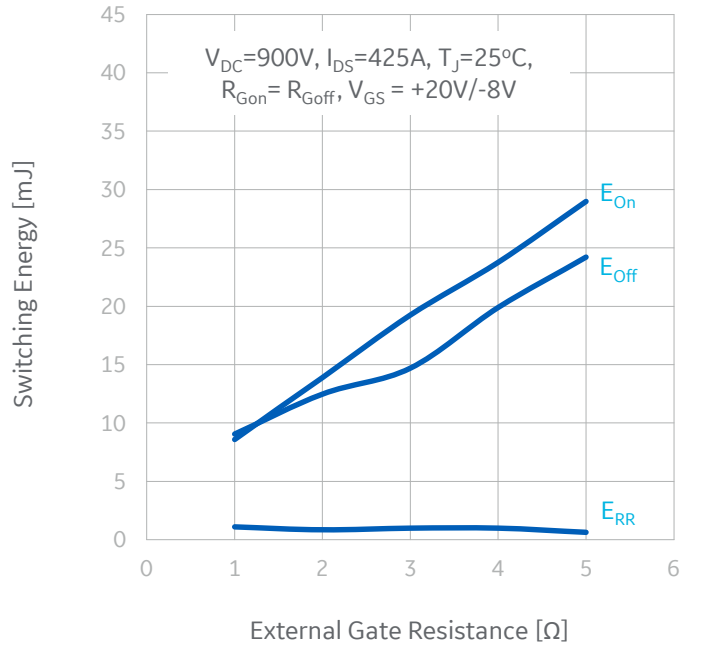



**Figure 12:** Switching Energy vs. Gate Resistance

Typical performance: **GE17042CCA3**

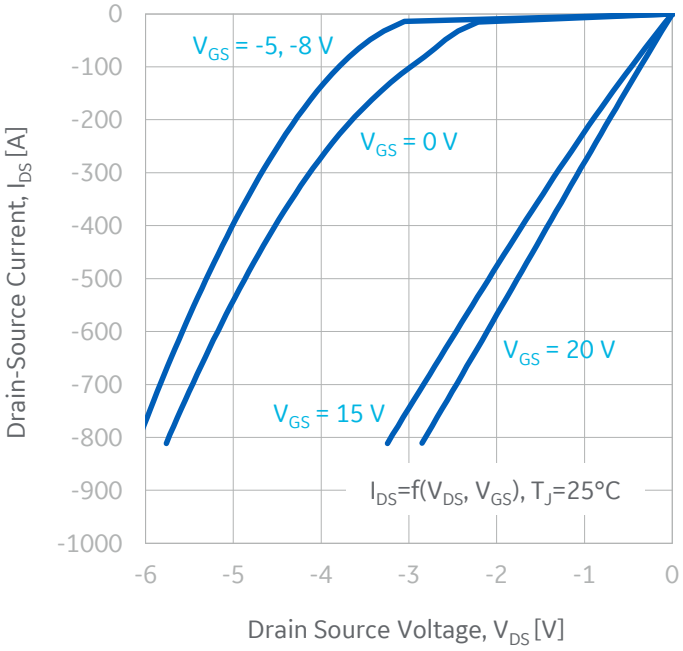



**Figure 13:** 3rd Quadrant Characteristics (25°C)

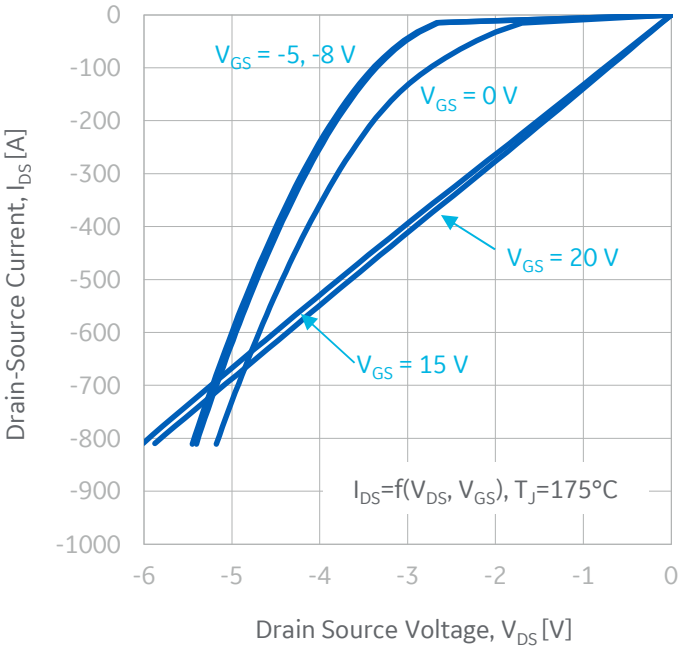



**Figure 14:** 3rd Quadrant Characteristics (175°C)

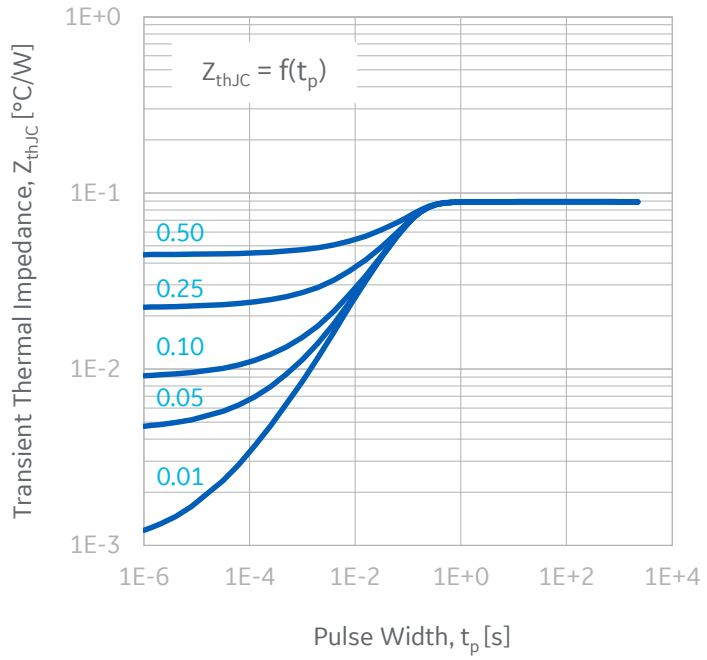



**Figure 15:** Transient Thermal Impedance

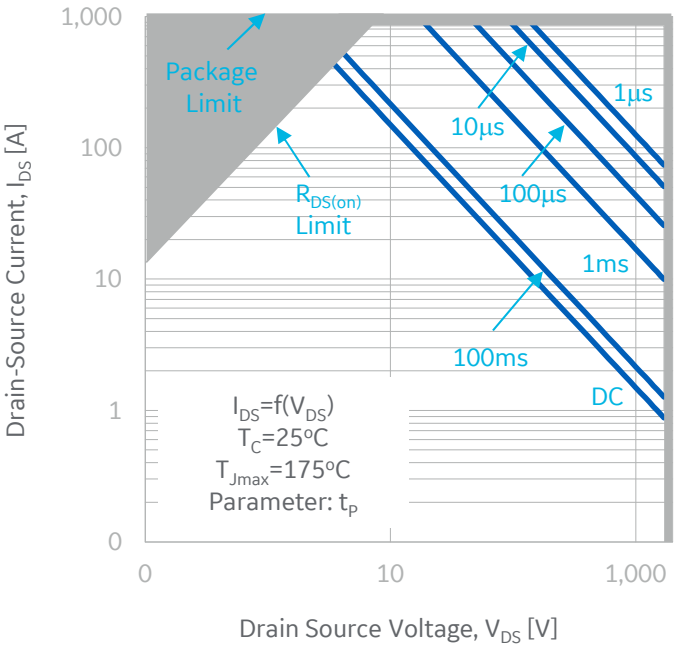



**Figure 16:** Forward-Bias Safe Operating Area

Typical performance: **GE17042CCA3**

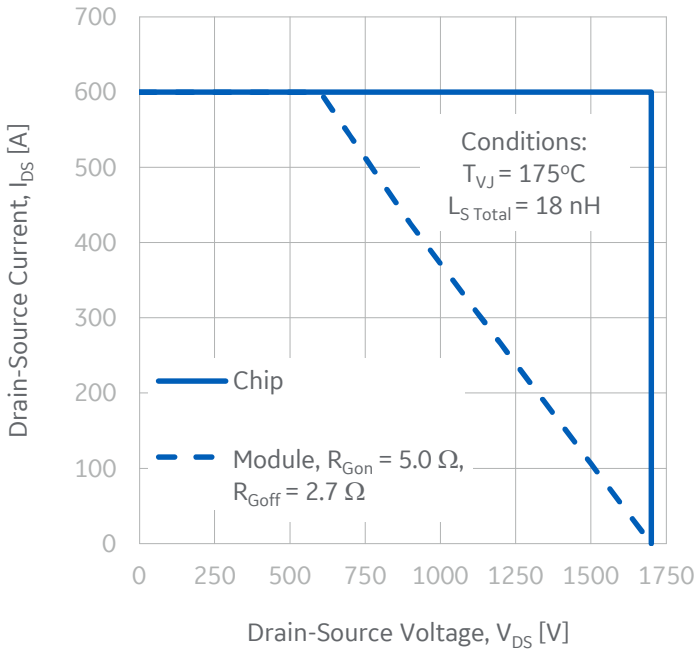



**Figure 17:** Reverse-Bias Safe Operating Area

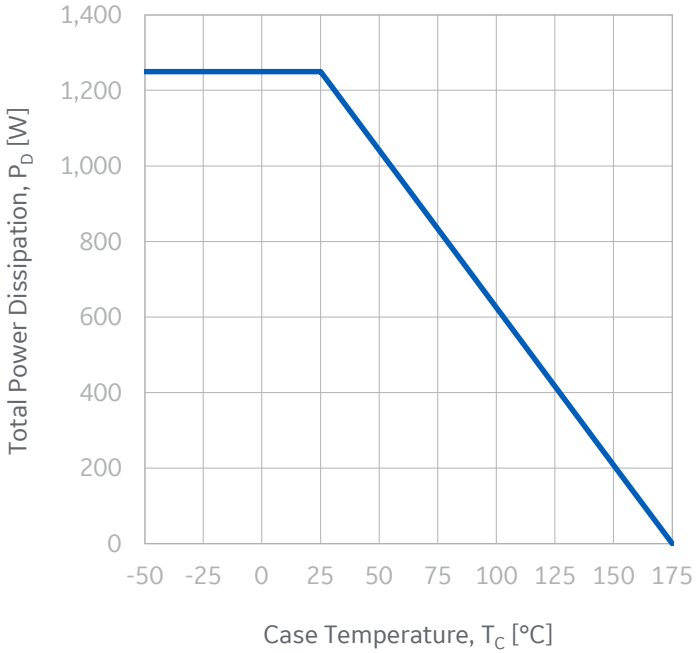
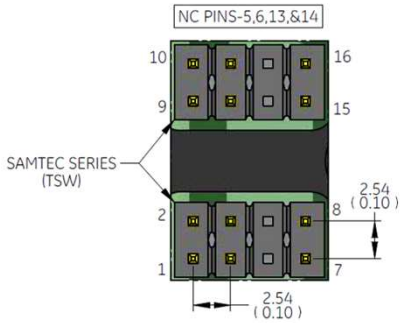



**Figure 18:** Maximum Power Dissipation vs. Case Temperature

## Electrical interface outline drawing

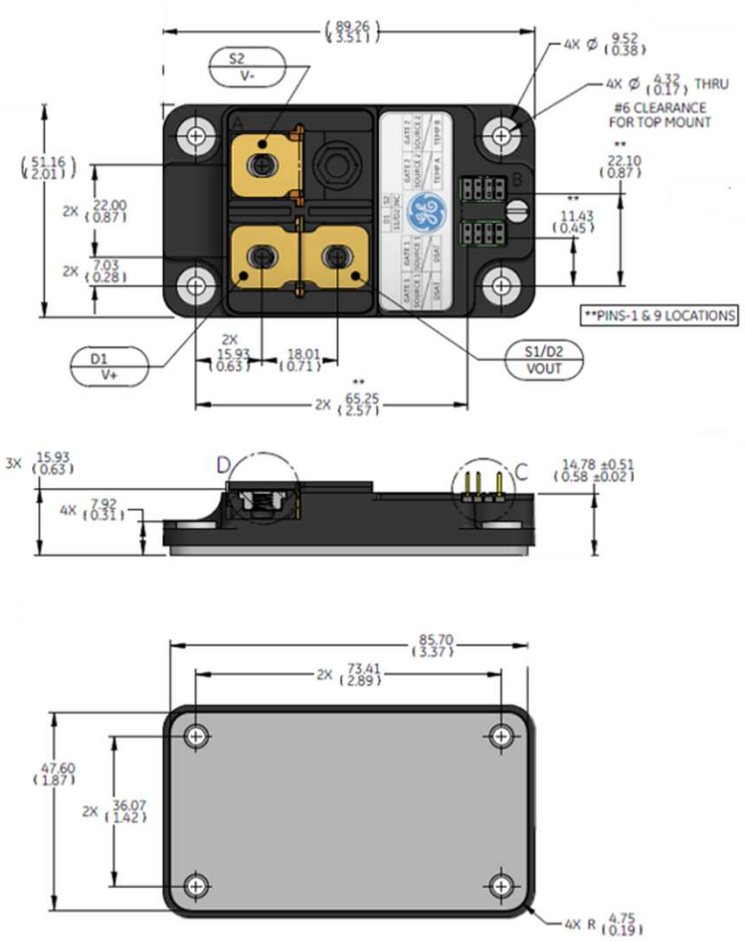
| Lower switch | |
|---|---|
| 9 | Gate 2 |
| 10 | Gate 2 |
| 11 | Source 2 |
| 12 | Source 2 |
| 13 | ** |
| 14 | ** |
| 15 | Temp A |
| 16 | Temp B |




DETAIL B

| Upper switch | |
|---|---|
| 1 | Gate 1 |
| 2 | Gate 1 |
| 3 | Source 1 |
| 4 | Source 1 |
| 5 | ** |
| 6 | ** |
| 7 | DESAT |
| 8 | DESAT |

## Module dimensions (millimeters)

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**Document revisions**
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