

IGBT/SiC Diode Co-pack

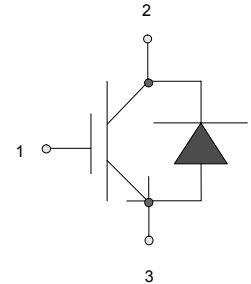
| | | |
|---------------|---|---------------|
| V_{CES} | = | 1200 V |
| I_{CM} | = | 100 A |
| $V_{CE(SAT)}$ | = | 1.9 V |

Features

- Optimal Punch Through (OPT) technology
- SiC freewheeling diode
- Positive temperature coefficient for easy paralleling
- Extremely fast switching speeds
- Temperature independent switching behavior of SiC rectifier
- Best RBSOA/SCSOA capability in the industry
- High junction temperature
- Industry standard packaging

Package

- RoHS Compliant


SOT – 227
Advantages

- Industry's highest switching speeds
- High temperature operation
- Improved circuit efficiency
- Low switching losses

Applications

- Solar Inverters
- Aerospace Actuators
- Server Power Supplies
- Resonant Inverters > 100 kHz
- Inductive Heating
- Electronic Welders

Maximum Ratings at $T_j = 175\text{ }^\circ\text{C}$, unless otherwise specified

| Parameter | Symbol | Conditions | Values | Unit |
|---------------------------|------------|---|-------------|------------------|
| IGBT | | | | |
| Collector-Emitter Voltage | V_{CES} | | 1200 | V |
| DC-Collector Current | I_C | $T_C \leq 130\text{ }^\circ\text{C}$ | 100 | A |
| Peak Collector Current | I_{CM} | Limited by T_{vjmax} | 200 | A |
| Gate Emitter Peak Voltage | V_{GES} | | ± 20 | V |
| IGBT Short Circuit SOA | t_{psc} | $V_{CC} = 900\text{ V}$, $V_{CEM} \leq 1200\text{ V}$ $V_{GE} \leq 15\text{ V}$, $T_{vj} \leq 125\text{ }^\circ\text{C}$ | 10 | μs |
| Operating Temperature | T_{vj} | | -40 to +175 | $^\circ\text{C}$ |
| Storage Temperature | T_{stg} | | -40 to +175 | $^\circ\text{C}$ |
| Isolation Voltage | V_{ISOL} | $I_{SOL} < 1\text{ mA}$, 50/60 Hz, $t = 1\text{ s}$ | 3000 | V |

Free-wheeling Silicon Carbide diode

| | | | | |
|--------------------------------------|------------|--|-----|---|
| DC-Forward Current | I_F | $T_C \leq 130\text{ }^\circ\text{C}$ | 100 | A |
| Non Repetitive Peak Forward Current | I_{FM} | $T_C = 25\text{ }^\circ\text{C}$, $t_p = 10\text{ }\mu\text{s}$ | tbd | A |
| Surge Non Repetitive Forward Current | $I_{F,SM}$ | $t_p = 10\text{ ms}$, half sine, $T_C = 25\text{ }^\circ\text{C}$ | tbd | A |

Thermal Characteristics

| | | | | |
|-------------------------------------|------------|-----------|------|--------------------|
| Thermal resistance, junction - case | R_{thJC} | IGBT | 0.08 | $^\circ\text{C/W}$ |
| Thermal resistance, junction - case | R_{thJC} | SiC Diode | 0.53 | $^\circ\text{C/W}$ |

Mechanical Properties

| | Symbol | Values | | |
|----------------------------|--------|--------|----------------|------|
| | | min. | typ. | max. |
| Mounting Torque | M_d | | 1.5 | Nm |
| Terminal Connection Torque | | 1.3 | | Nm |
| Weight | | | 29 | g |
| Case Color | | | Black | |
| Dimensions | | | 38 x 25.4 x 12 | mm |

Electrical Characteristics at $T_j = 175\text{ }^\circ\text{C}$, unless otherwise specified

| Parameter | Symbol | Conditions | Values | | | Unit | |
|--|---------------|---|--------|------------|------|------------|---------------|
| | | | min. | typ. | max. | | |
| IGBT | | | | | | | |
| Gate Threshold Voltage | $V_{GE(th)}$ | $V_{GE} = V_{CE}, I_C = 4\text{ mA}, T_j = 25\text{ }^\circ\text{C}$ | 5 | 6.2 | 7 | V | |
| Collector-Emitter Leakage Current | $I_{CES,25}$ | $V_{GE} = 0\text{ V}, V_{CE} = V_{CES}, T_j = 25\text{ }^\circ\text{C}$ | | 0.10 | 1 | mA | |
| | $I_{CES,175}$ | $V_{GE} = 0\text{ V}, V_{CE} = V_{CES}, T_j = 175\text{ }^\circ\text{C}$ | | 3.15 | | mA | |
| Gate-Leakage Current | I_{GES} | $V_{CE} = 0\text{ V}, V_{GE} = 20\text{ V}, T_j = 175\text{ }^\circ\text{C}$ | -400 | | 400 | nA | |
| Collector-Emitter Threshold Voltage | $V_{GE(TO)}$ | $T_j = 25\text{ }^\circ\text{C}$ | | 1.1 | | V | |
| Collector-Emitter Slope Resistance | $R_{CE,25}$ | $V_{GE} = 15\text{ V}, T_j = 25\text{ }^\circ\text{C}$ | | 7.9 | | m Ω | |
| | $R_{CE,175}$ | $V_{GE} = 15\text{ V}, T_j = 175\text{ }^\circ\text{C}$ | | 11.4 | | m Ω | |
| Collector-Emitter Saturation Voltage | $V_{CE(SAT)}$ | $I_C = 100\text{ A}, V_{GE} = 15\text{ V}, T_j = 25\text{ }^\circ\text{C} (175\text{ }^\circ\text{C})$ | | 1.9 (2.2) | | V | |
| Input Capacitance | C_{ies} | $V_{GE} = 0\text{ V}, V_{CE} = 25\text{ V}, f = 1\text{ MHz}, T_j = 150\text{ }^\circ\text{C}$ | | 8.55 | | nF | |
| Output Capacitance | C_{oes} | | | 1.39 | | nF | |
| Reverse Transfer Capacitance | C_{res} | | | 0.25 | | nF | |
| Internal Gate Resistance | R_{Gint} | | | 2 | | Ω | |
| Gate Charge | Q_G | $V_{CC} = 750\text{ V}, I_C = 100\text{ A}, V_{GE} = -8..15\text{ V}, T_j = 25\text{ }^\circ\text{C} (125\text{ }^\circ\text{C})$ | | 900 (900) | | nC | |
| Module Lead Resistance | R_{mod} | $T_c = 25\text{ }^\circ\text{C} (175\text{ }^\circ\text{C})$ | | tbid | | m Ω | |
| Reverse Bias Safe Operating Area | RBSOA | $T_j = 175\text{ }^\circ\text{C}, R_{\theta} = 56\text{ }^\circ\text{C/W}, V_{CC} = 1200\text{ V}, V_{GE} = 15\text{ V}$ | | 150 | | A | |
| Short Circuit Current | I_{sc} | $T_j = 175\text{ }^\circ\text{C}, R_{\theta} = 56\text{ }^\circ\text{C/W}, V_{CC} = 900\text{ V}, V_{GE} = \pm 15\text{ V}$ | | 470 | | A | |
| Short Circuit Duration | t_{sc} | | | | 10 | | μs |
| Rise Time | t_r | $V_{CC} = 800\text{ V}, I_C = 100\text{ A}, R_{gon} = R_{goff} = 10\text{ }^\circ\Omega, V_{GE(on)} = 15\text{ V}, V_{GE(off)} = -8\text{ V}, L_S = 0.8\text{ }^\mu\text{H}, T_j = 25\text{ }^\circ\text{C}$ | | 254 | | ns | |
| Fall Time | t_f | | | | 153 | | ns |
| Turn On Delay Time | $t_{d(on)}$ | | | | 244 | | ns |
| Turn Off Delay Time | $t_{d(off)}$ | | | | 488 | | ns |
| Turn-On Energy Loss Per Pulse | E_{on} | | | | 14.2 | | mJ |
| Turn-Off Energy Loss Per Pulse | E_{off} | | | | 15.7 | | mJ |
| Rise Time | t_r | $V_{CC} = 800\text{ V}, I_C = 100\text{ A}, R_{gon} = R_{goff} = 10\text{ }^\circ\Omega, V_{GE(on)} = 15\text{ V}, V_{GE(off)} = -8\text{ V}, L_S = 0.8\text{ }^\mu\text{H}, T_j = 175\text{ }^\circ\text{C}$ | | 211 | | ns | |
| Fall Time | t_f | | | | 172 | | ns |
| Turn On Delay Time | $t_{d(on)}$ | | | | 240 | | ns |
| Turn Off Delay Time | $t_{d(off)}$ | | | | 636 | | ns |
| Turn-On Energy Loss Per Pulse | E_{on} | | | | 11.1 | | mJ |
| Turn-Off Energy Loss Per Pulse | E_{off} | | | | 21.8 | | mJ |
| Free-wheeling Silicon Carbide Diode | | | | | | | |
| Forward Voltage | V_F | $I_F = 100\text{ A}, V_{GE} = 0\text{ V}, T_j = 25\text{ }^\circ\text{C} (175\text{ }^\circ\text{C})$ | | 2.08 (3.5) | | V | |
| Threshold Voltage at Diode | $V_{D(TO)}$ | $T_j = 25\text{ }^\circ\text{C}$ | | 0.8 | | V | |
| Peak Reverse Recovery Current | I_{rrm} | $I_F = 100\text{ A}, V_{GE} = 0\text{ V}, V_R = 800\text{ V}, -di/dt = 625\text{ A}/\mu\text{s}, T_j = 175\text{ }^\circ\text{C}$ | | 10 | | A | |
| Reverse Recovery Time | t_{rr} | | | | 100 | | ns |
| Rise Time | t_r | $V_{CC} = 800\text{ V}, I_C = 100\text{ A}, R_{gon} = R_{goff} = 10\text{ }^\circ\Omega, V_{GE(on)} = 15\text{ V}, V_{GE(off)} = -8\text{ V}, L_S = 0.8\text{ }^\mu\text{H}, T_j = 25\text{ }^\circ\text{C}$ | | 148 | | ns | |
| Fall Time | t_f | | | | 336 | | ns |
| Turn-On Energy Loss Per Pulse | E_{on} | | | | 218 | | μJ |
| Turn-Off Energy Loss Per Pulse | E_{off} | | | | 113 | | μJ |
| Reverse Recovery Charge | Q_{rr} | | | | 730 | | nC |
| Rise Time | t_r | | | | 178 | | ns |
| Fall Time | t_f | $V_{CC} = 800\text{ V}, I_C = 100\text{ A}, R_{gon} = R_{goff} = 10\text{ }^\circ\Omega, V_{GE(on)} = 15\text{ V}, V_{GE(off)} = -8\text{ V}, L_S = 0.8\text{ }^\mu\text{H}, T_j = 175\text{ }^\circ\text{C}$ | | 268 | | ns | |
| Turn-On Energy Loss Per Pulse | E_{on} | | | | 23 | | μJ |
| Turn-Off Energy Loss Per Pulse | E_{off} | | | | 334 | | μJ |
| Reverse Recovery Charge | Q_{rr} | | | | 480 | | nC |

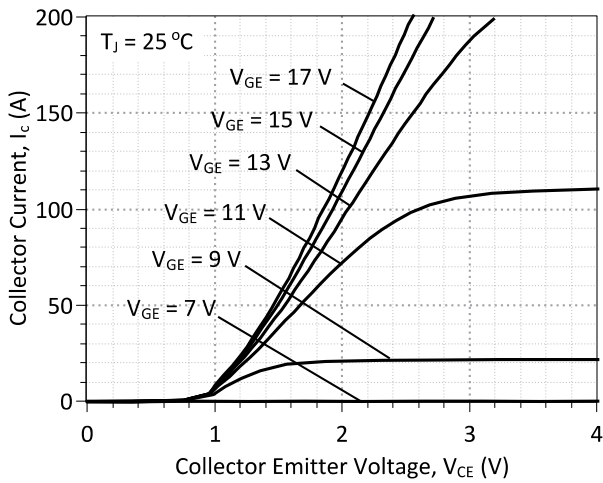


Figure 1: Typical Output Characteristics at 25 °C

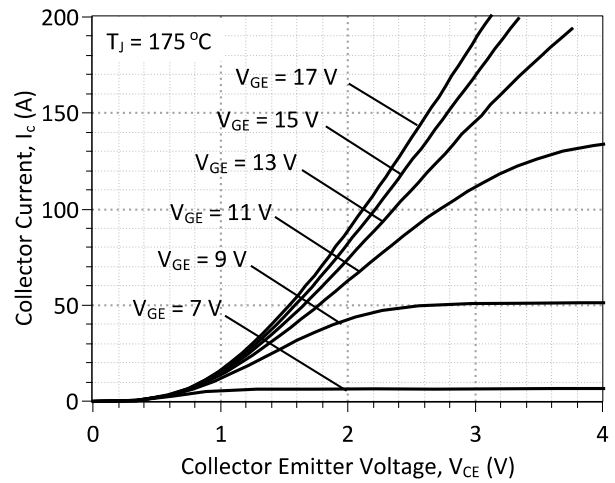


Figure 2: Typical Output Characteristics at 175 °C

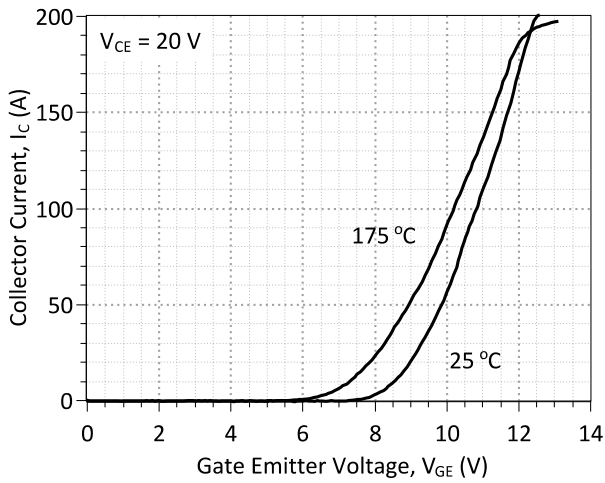


Figure 3: Typical Transfer Characteristics

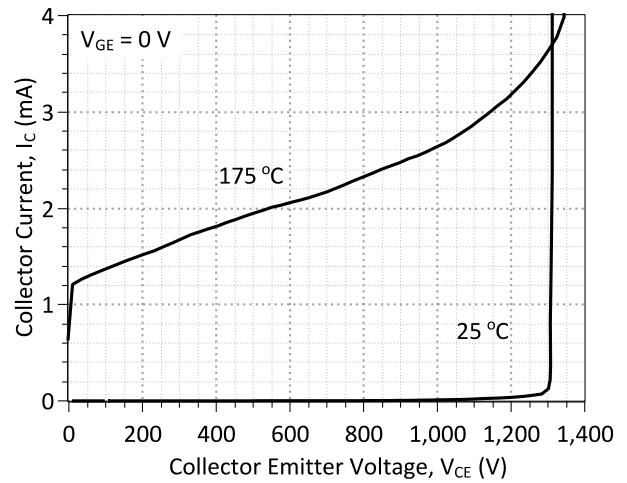


Figure 4: Typical Blocking Characteristics

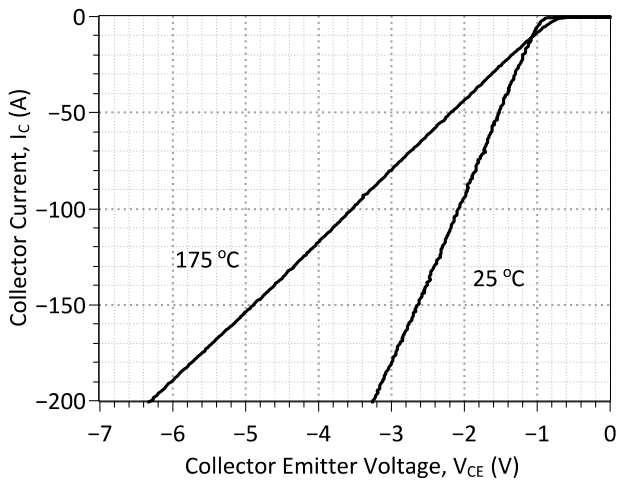


Figure 5: Typical FWD Forward Characteristics

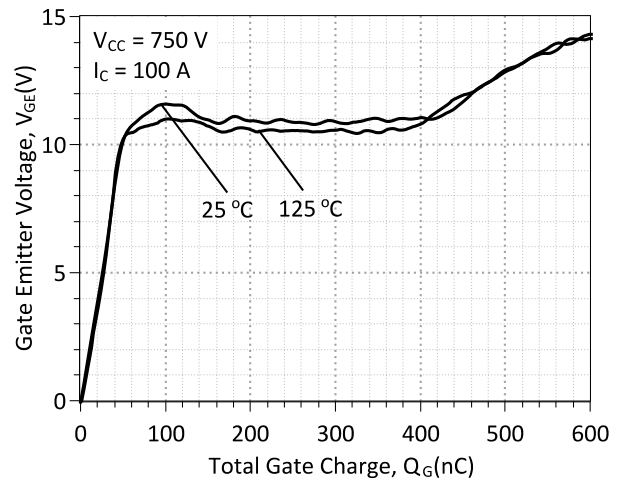


Figure 6: Typical Turn On Gate Charge

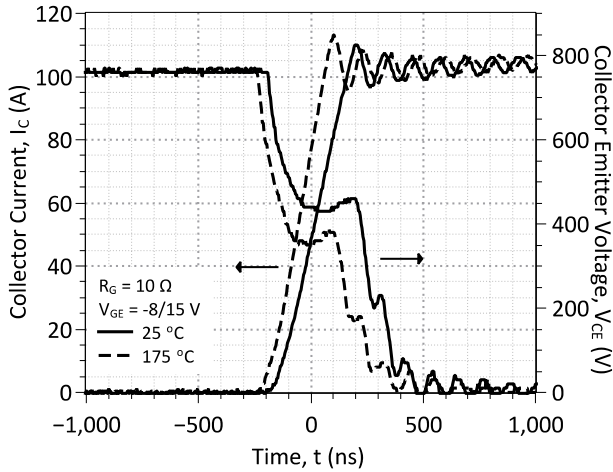


Figure 7: Typical Hard-Switched IGBT Turn On Waveforms

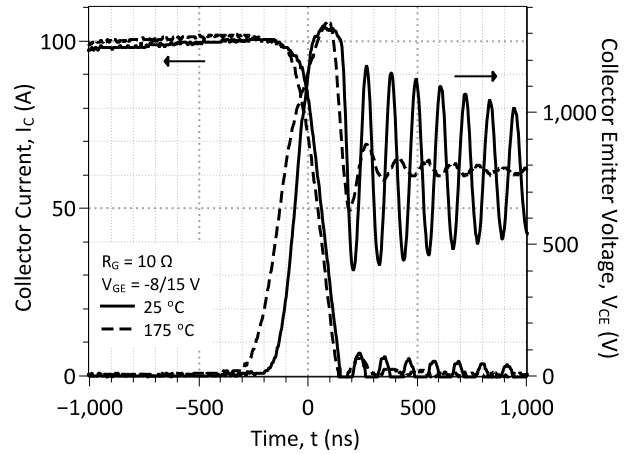


Figure 8: Typical Hard-Switched IGBT Turn Off Waveforms

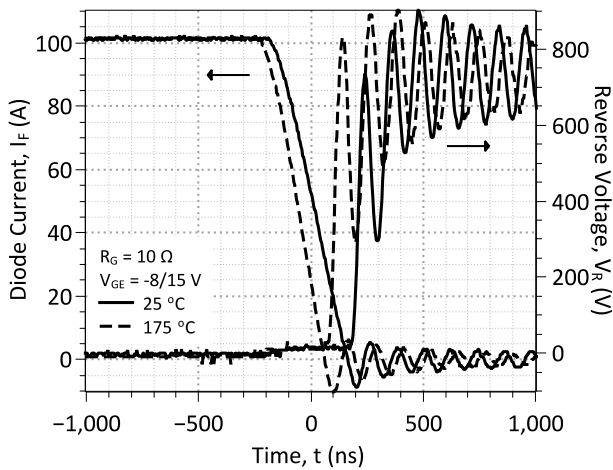


Figure 9: Typical Hard-Switched Free-wheeling SiC Diode Turn Off Waveforms

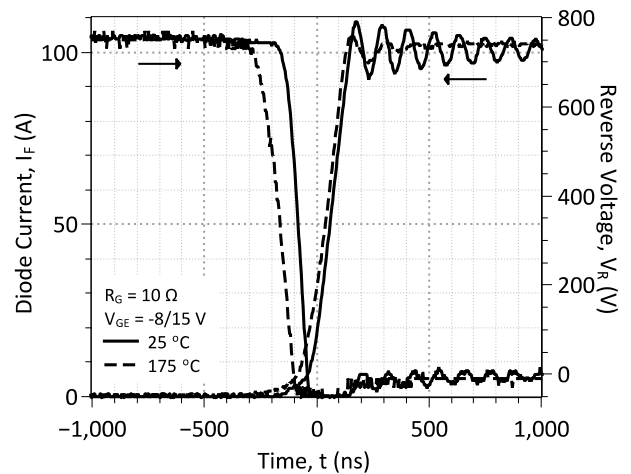


Figure 10: Typical Hard-Switched Free-wheeling SiC Diode Turn On Waveforms

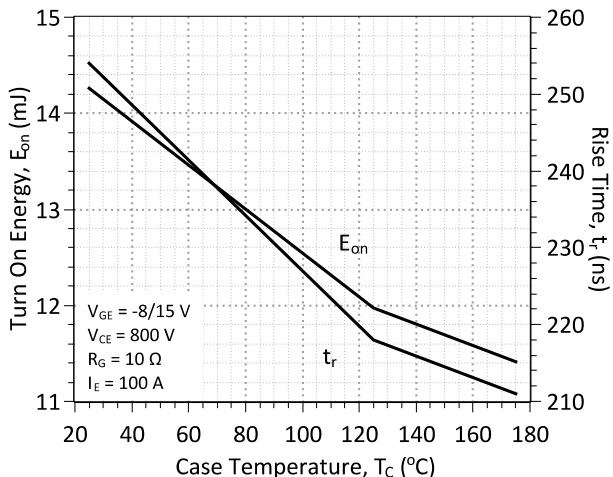


Figure 11: Typical Module Energy Losses and Switching Times at IGBT Turn On vs. Temperature

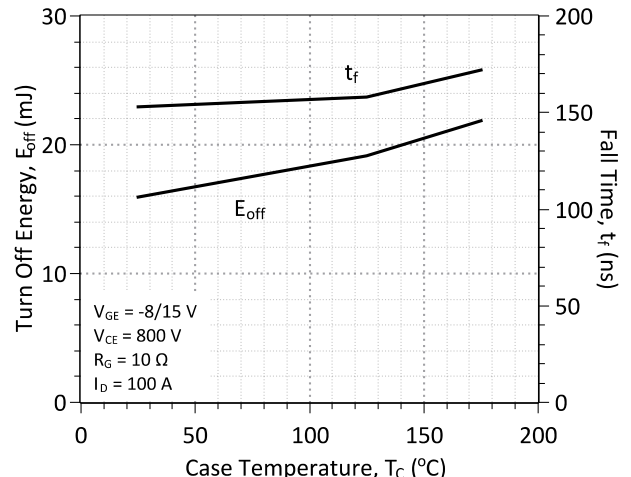


Figure 12: Typical Module Energy Losses and Switching Times at IGBT Turn Off vs. Temperature

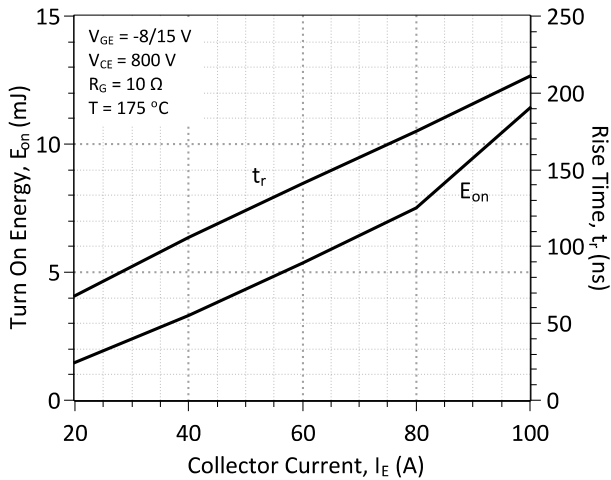


Figure 13: Typical Module Energy Losses and Switching Times at IGBT Turn On vs. Current

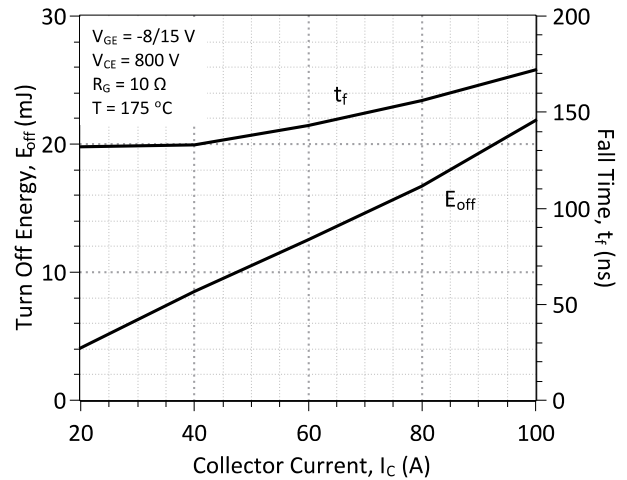


Figure 14: Typical Module Energy Losses and Switching Times at IGBT Turn Off vs. Current

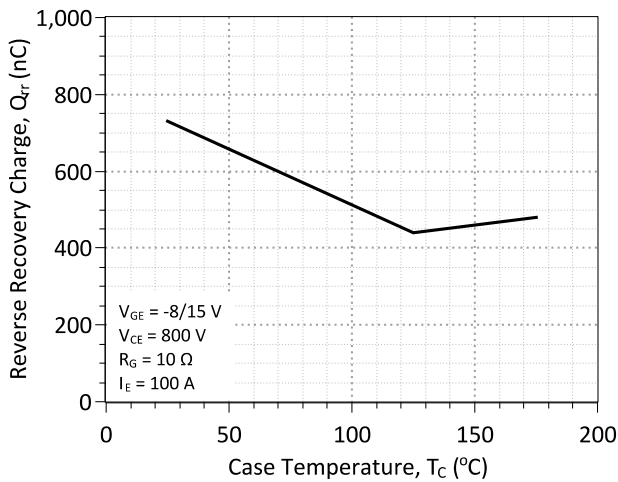


Figure 15: Typical Hard-Switched Reverse Recovery Charge vs. Temperature

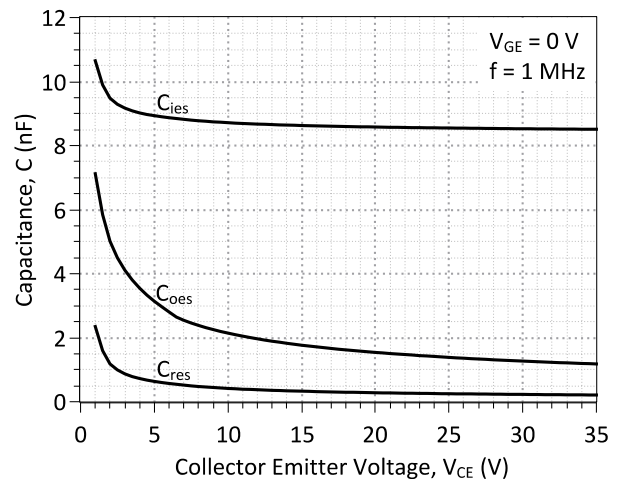
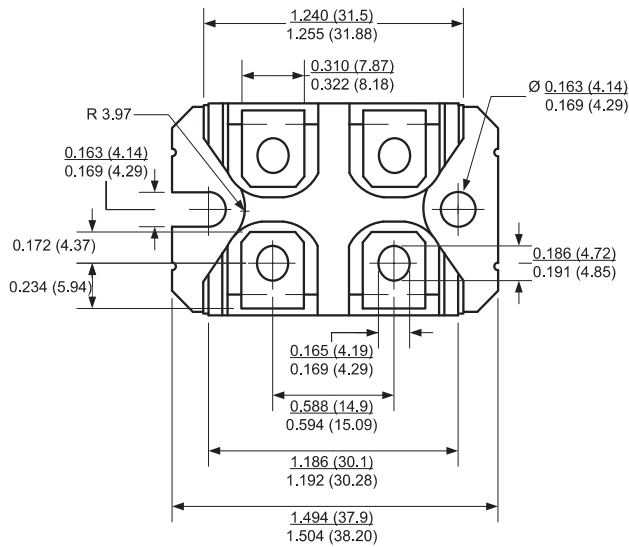
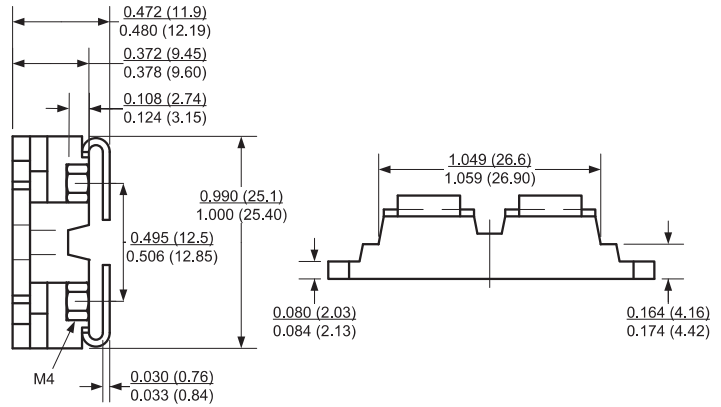


Figure 16: Typical C-V Characteristics

Package Dimensions:
SOT-227

PACKAGE OUTLINE

NOTE

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

| Revision History | | | |
|------------------|----------|------------------------------------|----------------|
| Date | Revision | Comments | Supersedes |
| 2013/02/08 | 2 | Updated Electrical Characteristics | |
| 2012/07/30 | 1 | Second generation release | GA100XCP12-227 |
| 2011/01/06 | 0 | Initial release | |

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 43670 Trade Center Place Suite 155
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- Оперативные поставки широкого спектра электронных компонентов отечественного и импортного производства напрямую от производителей и с крупнейших мировых складов;
- Поставка более 17-ти миллионов наименований электронных компонентов;
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- Подбор оптимального решения, техническое обоснование при выборе компонента;
- Подбор аналогов;
- Консультации по применению компонента;
- Поставка образцов и прототипов;
- Техническая поддержка проекта;
- Защита от снятия компонента с производства.



Как с нами связаться

Телефон: 8 (812) 309 58 32 (многоканальный)

Факс: 8 (812) 320-02-42

Электронная почта: org@eplast1.ru

Адрес: 198099, г. Санкт-Петербург, ул. Калинина, дом 2, корпус 4, литера А.