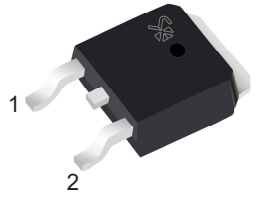
# Silicon Carbide Schottky Barrier Diode

## 650V, 15A SiC SBD

### General Description

The Q-SSC1565 uses a completely new technology and designs to provide superior switching performances and higher reliability. This device is suitable for use in power factor correction (PFC), switch mode power supplies (SMPS) and general purpose applications.

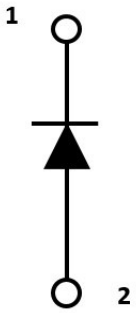
| Product Summary | | | TO-252 |
|---|---|---|---|
| $V_{RRM}$ | 650 | V |  |
| $I_F$ @ $T_C$=127°C | 15 | A | |
| $Q_C$ @ VR=400V | 37.9 | nC | |
| $E_C$ @ VR=400V | 9.36 | μJ | |



### Features

- Temperature independent switching behavior
- No reverse recovery current / No forward recovery
- Excellent thermal performances
- High surge current capability

### Graphic Symbol




### Applications

- Switch mode power supply
- Power factor correction
- Solar inverter
- Uninterruptible power supply

### Maximum Ratings ($T_A$=25°C unless otherwise noted)

| Parameter | | Symbol | Value | Unit |
|---|---|---|---|---|
| Repetitive Peak Reverse Voltage | | $V_{RRM}$ | 650 | V |
| Continuous Forward Current, D=1 | $T_C$=25°C | $I_F$ | 32.2 | A |
| | $T_C$=127°C | | 15 | |
| Non-Repetitive Peak Forward Surge Current, Half Sine Wave, 10ms | $T_C$=25°C | $I_{F,SM}$ | 63 | A |
| | $T_C$=150°C | | 52 | |
| $i^2t$ Value, 10ms | | $\int i^2dt$ | 19.8 | A |
| Non-Repetitive Peak Forward Current, 10us | | $I_{F,max}$ | 378 | A |
| Power Dissipation | | $P_D$ | 81.2 | W |
| Storage Temperature Range | | $T_{STG}$ | -55 to 150°C | °C |
| Operating Junction Temperature Range | | $T_J$ | -55 to 175°C | °C |

## Thermal Characteristics

| Parameter | Symbol | Conditions | Min. | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| Maximum Junction-to-Ambient [1] | $R_{thJA}$ | TO-252 | - | 1.02 | 1.84 | °C/W |
| Maximum Junction-to-Case [1] | $R_{thJC}$ | TO-252 | - | - | 60 | °C/W |

## Electrical Characteristics ($T_A$=25°C unless otherwise noted)

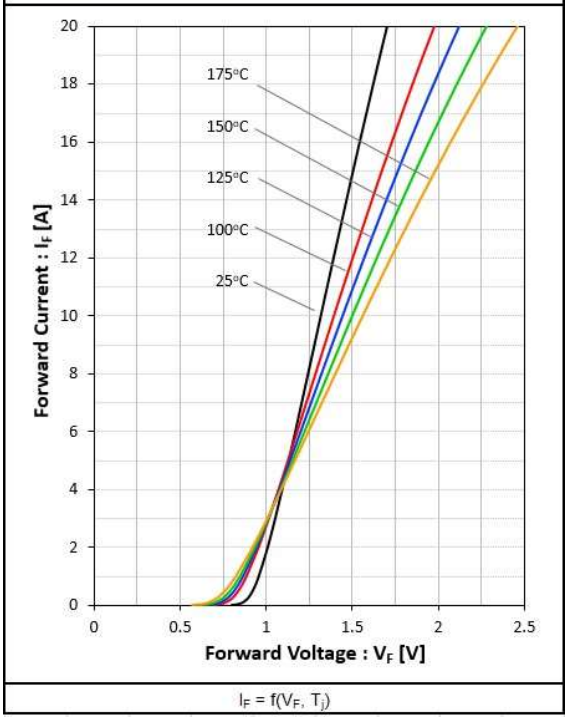
| Parameter | Symbol | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| **STATIC CHARACTERISTICS** | | | | | | |
| DC Blocking Voltage | $V_R$ | $I_R$=100uA, $T_j$=25°C | 650 | - | - | V |
| | | $I_R$=100uA, $T_j$=175°C | 650 | - | - | |
| Forward Voltage | $V_F$ | $I_F$=10A, $T_j$ =25°C | - | 1.4 | 1.7 | V |
| | | $I_F$=10A, $T_j$ =150°C | - | 1.8 | 2.2 | |
| | | $I_F$=10A, $T_j$=175°C | - | 1.9 | 2.4 | |
| Reverse Current | $I_R$ | $V_R$=650V, $T_j$=25°C | - | 1.1 | 55 | μA |
| | | $V_R$=650V, $T_j$=150°C | - | 11 | 110 | |
| | | $V_R$=650V, $T_j$=175°C | - | 25 | 250 | |
| **DYNAMIC CHARACTERISTICS** | | | | | | |
| Total Capacitive Charge | $Q_C$ | $V_R$=400V, $T_j$=25°C $Q_C = \int_0^{V_R} C(V)dV$ | - | 37.9 | - | nC |
| Total Capacitance | C | $V_R$=0.1V, f=1MHz, $T_j$=25°C | - | 668 | - | pF |
| | | $V_R$=200V, f=1MHz, $T_j$=25°C | - | 72.7 | - | |
| | | $V_R$=400V, f=1MHz, $T_j$=25°C | - | 63.2 | - | |
| Capacitance Stored Energy | $E_C$ | $V_R$=400V, f=1MHz, $T_j$=25°C | - | 9.36 | - | μJ |

**Notes:**

1. **Heat sink size: 25 x 17 x 4 $cm^3$**
2. **Pulse Test: Pulse Width ≦300μs, Duty Cycle≦ 2%.**
3. **The power dissipation is limited by 175°C junction temperature.**
4. **The data is theoretically the same as $I_F$ and $I_{FSM}$ in real applications, should be limited by total power dissipation.**

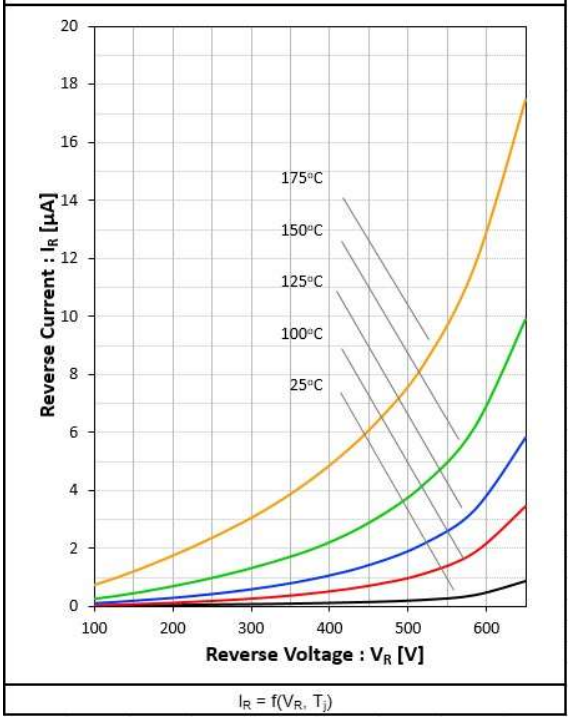
## Typical Operating Characteristics

**Figure 1: Typical Forward Characteristics**



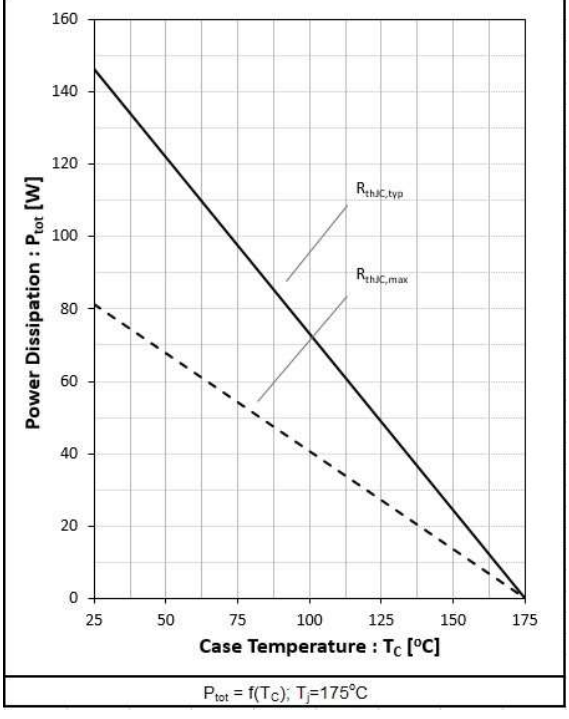

$I_F = f(V_F, T_j)$

**Figure 2: Typical Reverse Characteristics**



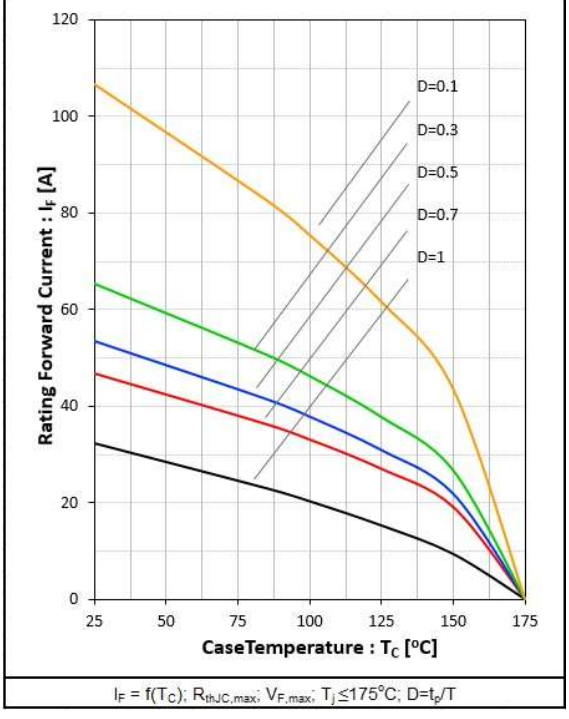

$I_R = f(V_R, T_j)$

**Figure 3: Power Derating Curves**




$P_{tot} = f(T_C)$; $T_j$=175°C

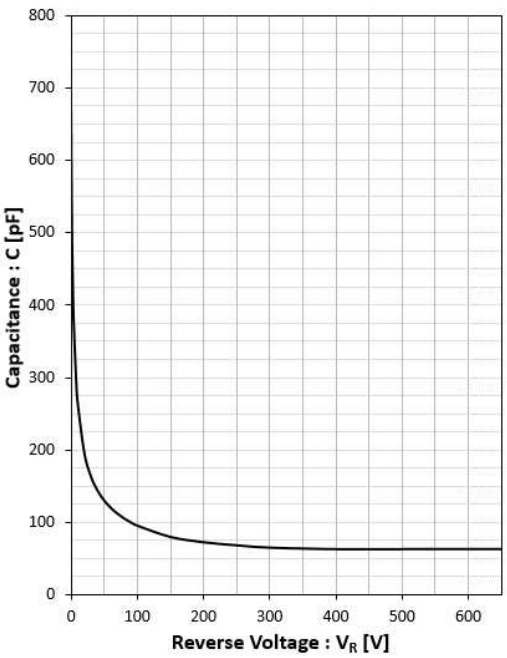
**Figure 4: Current Derating Curves**




$I_F = f(T_C)$; $R_{thJC,max}$; $V_{F,max}$; $T_j \leq 175°C$; $D=t_p/T$

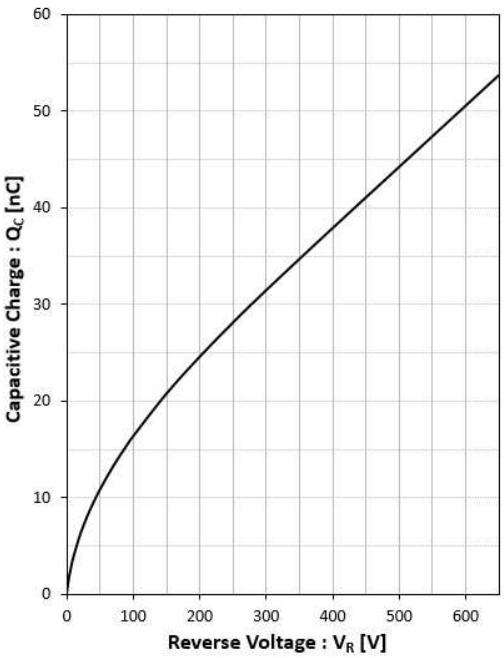
## Typical Operating Characteristics (Cont.)

**Figure 5: Typical Junction Capacitance**



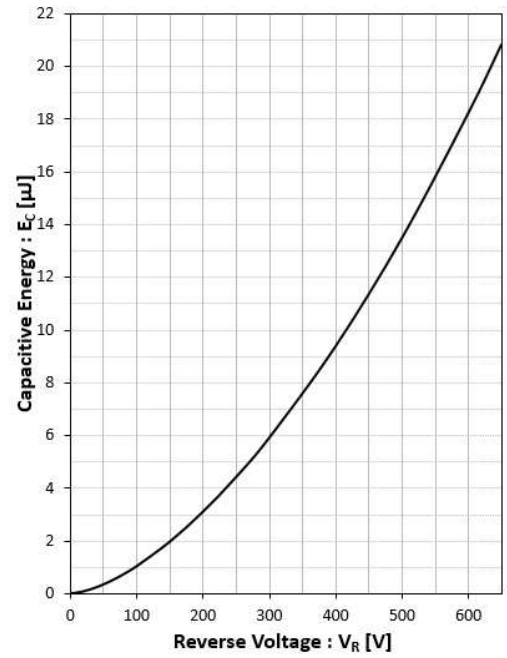

C = f($V_R$); f=1MHz

**Figure 6: Typical Capacitive Charge**



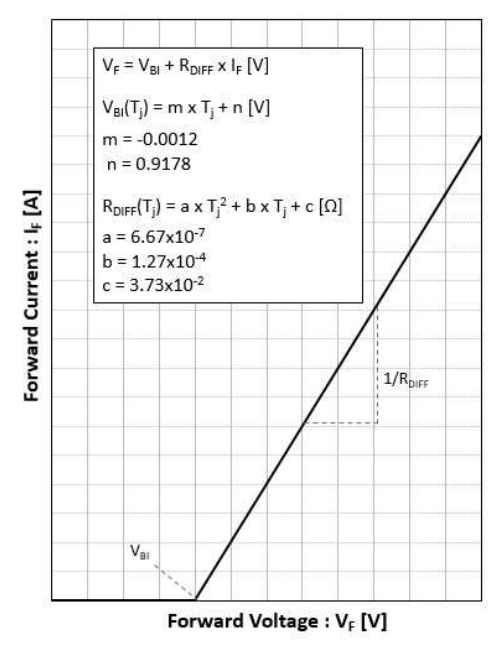

$Q_C$ = f($V_R$); f=1MHz

**Figure 7: Typical Capacitive Energy**




$E_C$ = f($V_R$); f=1MHz

**Figure 8: Forward Curve Model**

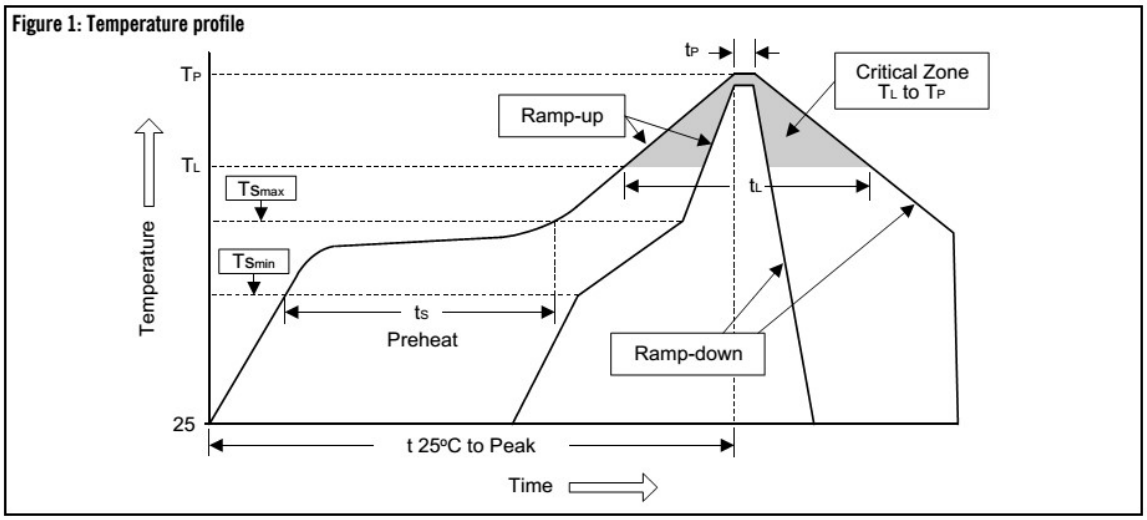



$I_F$ = f($V_F$, $T_j$)

## Soldering Methods for CW Product

1. Storage environment: Temperature=10˚C to35˚C Humidity=65%±15%
2. Reflow soldering of surface-mount devices

Figure 1: Temperature profile




| Profile Feature | Sn-Pb Eutectic Assembly | Pb-Free Assembly |
|---|---|---|
| Average ramp-up rate ($T_L$ to $T_P$) | <3°C/sec | <3°C/sec |
| Preheat<br>- Temperature Min ($Ts_{min}$)<br>- Temperature Max ($Ts_{max}$)<br>- Time (min to max) (ts) | <br>100°C<br>150°C<br>60 to 120 sec | <br>150°C<br>200°C<br>60 to 180 sec |
| Tsmax to $T_L$<br>- Ramp-up Rate | <br><3°C/sec | <br><3°C/sec |
| Time maintained above:<br>- Temperature ($T_L$)<br>- Time ($t_L$) | <br>183°C<br>60 to 150 sec | <br>217°C<br>60 to 150 sec |
| Peak Temperature ($T_P$) | 240°C +0/-5°C | 260°C +0/-5°C |
| Time within 5°C of actual Peak Temperature ($t_P$) | 10 to 30 sec | 20 to 40 sec |
| Ramp-down Rate | <6°C/sec | <6°C/sec |
| Time 25°C to Peak Temperature | <6 minutes | <8 minutes |

3. Flow (wave) soldering (solder dipping)

| Products | Peak Temperature | Dipping Time |
|---|---|---|
| Pb devices. | 245°C ±5°C | 5sec ±1sec |
| Pb-Free devices. | 260°C +0/-5°C | 5sec ±1sec |