

# WS4A020065K

## Silicon Carbide Schottky Diode

|                                    |   |     |      |
|------------------------------------|---|-----|------|
| $V_{RRM}$                          | = | 650 | V    |
| $I_F (T_C \leq 135^\circ\text{C})$ | = | 36  | A**  |
| $Q_C$                              | = | 50  | Nc** |

### Features

- New Thin Wafer Technology
- Low Forward Voltage Drop ( $V_F$ )
- Zero Reverse Recovery Current
- Zero Forward Recovery Voltage
- Positive Temperature Coefficient on  $V_F$
- Temperature-independent Switching

### Benefits

- Replace Bipolar with Unipolar Device
- Reduction of Heat Sink Size
- Parallel Devices Without Thermal Runaway
- Essentially No Switching Losses

### Applications

- Switch Mode Power Supplies
- Uninterruptible Power Supplies
- Motor drive, PV Inverter, Wind Power Station

### Package



| Part Number | Package  | Marking     |
|-------------|----------|-------------|
| WS4A020065K | TO-247-3 | WS4A020065K |

### Maximum Ratings

| Symbol         | Parameter                                  | Value                   | Unit             | Test Conditions                                                                             | Note  |
|----------------|--------------------------------------------|-------------------------|------------------|---------------------------------------------------------------------------------------------|-------|
| $V_{RRM}$      | Repetitive Peak Reverse Voltage            | 650                     | V                | $T_C = 25^\circ\text{C}$                                                                    |       |
| $V_{RSM}$      | Surge Peak Reverse Voltage                 | 650                     | V                | $T_C = 25^\circ\text{C}$                                                                    |       |
| $V_R$          | DC Blocking Voltage                        | 650                     | V                | $T_C = 25^\circ\text{C}$                                                                    |       |
| $I_F$          | Forward Current<br>(Per leg/Device)        | 35/70<br>18/36<br>10/20 | A                | $T_C \leq 25^\circ\text{C}$<br>$T_C \leq 135^\circ\text{C}$<br>$T_C \leq 156^\circ\text{C}$ |       |
| $I_{FSM}$      | Non-Repetitive Forward Surge Current       | 86*                     | A                | $T_C = 25^\circ\text{C}$ , $t_p = 8.3\text{ms}$ , Half Sine Wave                            |       |
| $P_{tot}$      | Power Dissipation                          | 150/300                 | W                | $T_C = 25^\circ\text{C}$                                                                    | Fig.3 |
| $T_J, T_{STG}$ | Operating Junction and Storage Temperature | -55 to 175              | $^\circ\text{C}$ |                                                                                             |       |
|                | TO-247 Mounting Torque                     | 1                       | Nm               | M3 Screw                                                                                    |       |

\*Per Leg, \*\*Per Device

## Electrical Characteristics (Per leg)

| Symbol | Parameter               | Typ.            | Max.       | Unit    | Test Conditions                                                                                                                     | Note  |
|--------|-------------------------|-----------------|------------|---------|-------------------------------------------------------------------------------------------------------------------------------------|-------|
| $V_F$  | Forward Voltage         | 1.27<br>1.38    | 1.5<br>1.6 | V       | $I_F = 10A, T_J = 25^{\circ}C$<br>$I_F = 10A, T_J = 175^{\circ}C$                                                                   | Fig.1 |
| $I_R$  | Reverse Current         | 6<br>25         | 50<br>200  | $\mu A$ | $V_R = 650V, T_J = 25^{\circ}C$<br>$V_R = 650V, T_J = 175^{\circ}C$                                                                 | Fig.2 |
| C      | Total Capacitance       | 640<br>66<br>48 | /          | pF      | $V_R = 0.1V, T_J = 25^{\circ}C, f = 1MHz$<br>$V_R = 200V, T_J = 25^{\circ}C, f = 1MHz$<br>$V_R = 400V, T_J = 25^{\circ}C, f = 1MHz$ | Fig.5 |
| $Q_C$  | Total Capacitive Charge | 25              | /          | nC      | $V_R = 400V, I_F = 10A$<br>$di/dt = 200A/\mu s, T_J = 25^{\circ}C$                                                                  | Fig.4 |

## Thermal Characteristics

| Symbol          | Parameter                                   | Typ.        | Unit          | Note  |
|-----------------|---------------------------------------------|-------------|---------------|-------|
| $R_{\theta JC}$ | Thermal Resistance from Junction to Case    | 1*<br>0.5** | $^{\circ}C/W$ | Fig.6 |
| $R_{\theta JA}$ | Thermal Resistance from Junction to Ambient | 80          | $^{\circ}C/W$ |       |
| $T_{sold}$      | Soldering Temperature                       | 260         | $^{\circ}C$   |       |

\*Per Leg, \*\*Per Device

## Typical Performance (Per leg)

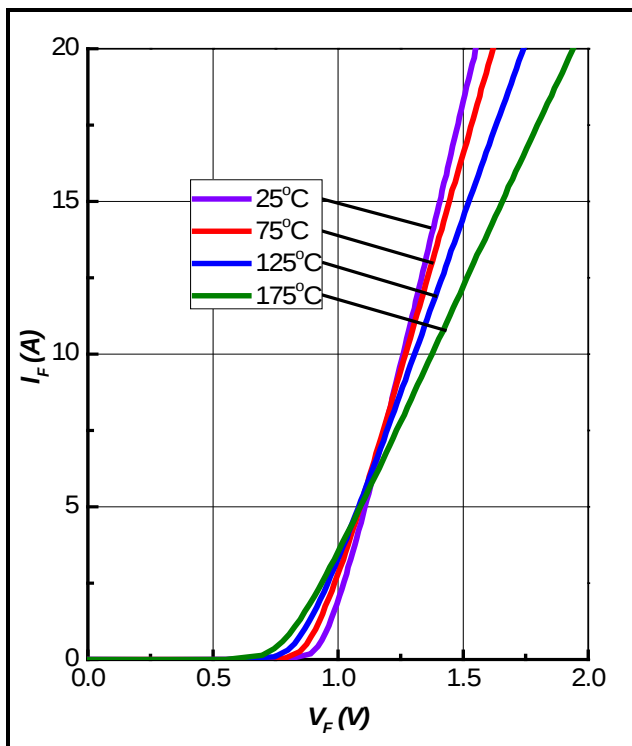


Figure 1. Forward Characteristics

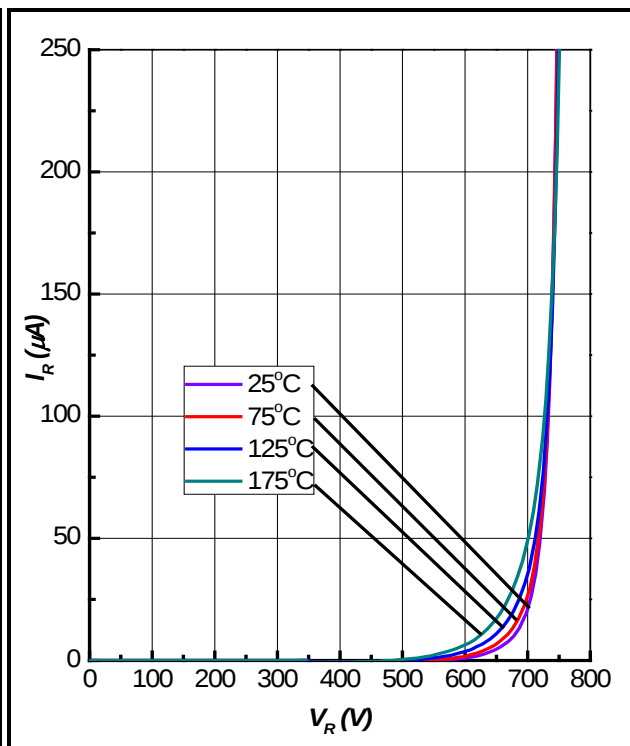


Figure 2. Reverse Characteristics

Typical Performance (Per leg)

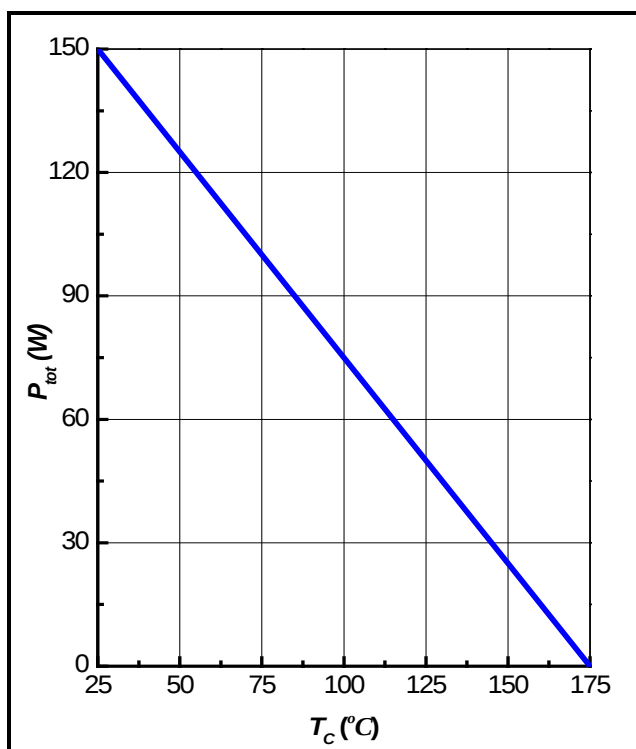


Figure 3. Power Derating

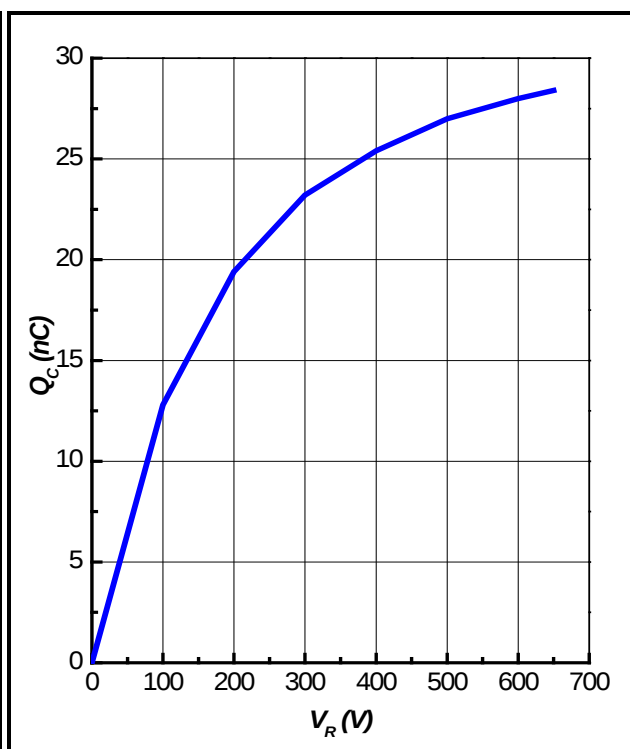


Figure 4. Total Capacitive Charge vs. Reverse Voltage

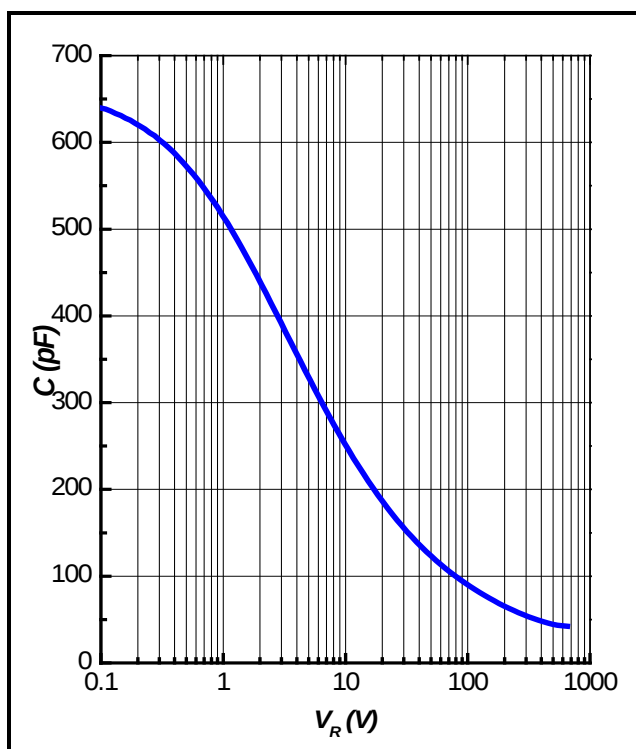


Figure 5. Total Capacitance vs. Reverse Voltage

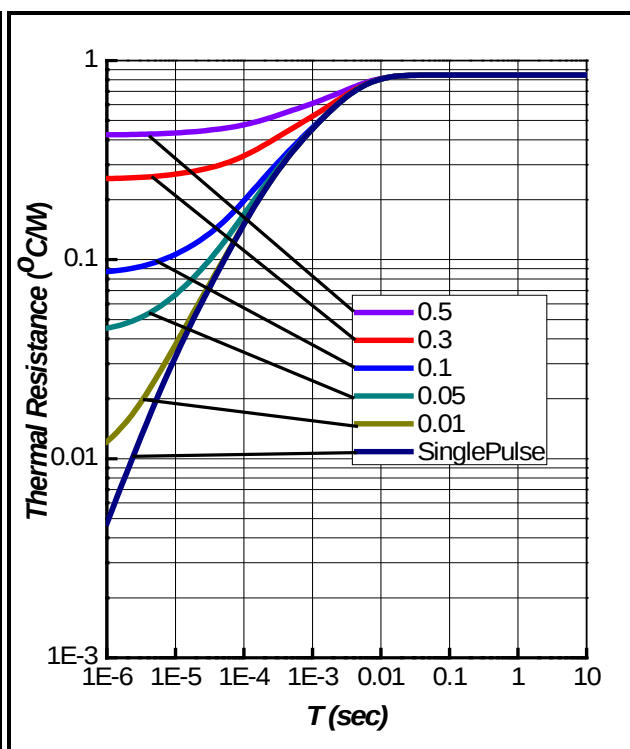
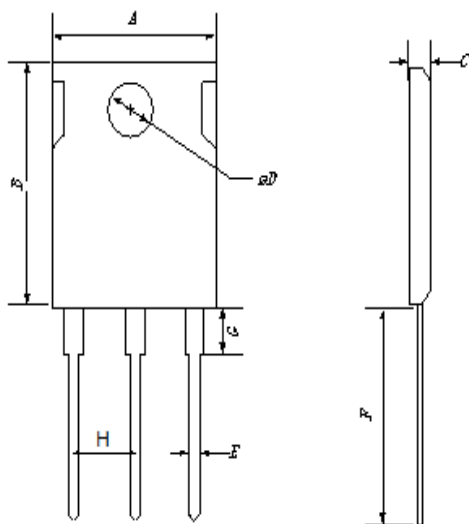


Figure 6. Transient Thermal Impedance

## Package Dimensions

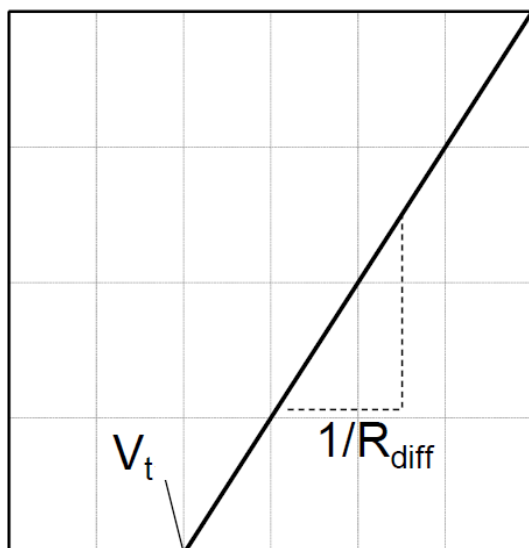
Package TO-247-3



| Symbol | Min. (mm) | Typ. (mm) | Max. (mm) |
|--------|-----------|-----------|-----------|
| A      | 14.18     | 15.75     | 17.33     |
| B      | 18.45     | 20.5      | 22.55     |
| C      | 4.50      | 5.00      | 5.50      |
| D      | 3.15      | 3.50      | 3.85      |
| E      | 1.08      | 1.20      | 1.32      |
| F      | 18.27     | 20.30     | 22.33     |
| G      | 4.21      | 4.68      | 5.15      |
| H      | 4.91      | 5.46      | 6.01      |

## Simplified Diode Model (Per leg)

Equivalent IV Curve for Model



Mathematical Equation

$$V_F = V_t + I_F \times R_{diff}$$

$$V_t = -0.001 \times T_j + 0.99 \text{ [V]}$$

$$R_{diff} = 6.9 \times 10^{-7} \times T_j^2 + 4.3 \times 10^{-5} \times T_j + 0.28 \text{ [\Omega]}$$

Note:

$T_j$  = Diode Junction Temperature In Degrees Celsius,  
valid from 25°C to 175°C

$I_F$  = Forward Current

Less than 20A

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