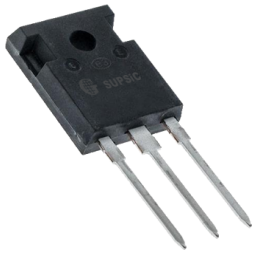
# GC3D20065D

## Silicon Carbide Schottky Diode

## Features

- 650-Volt Schottky Rectifier
- Zero Reverse Recovery Current
- Zero Forward Recovery Voltage
- High-Frequency Operation
- Temperature-Independent Switching Behavior
- Extremely Fast Switching
- Positive Temperature Coefficient on $V_F$

| | | |
|---|---|---|
| $V_{RRM}$ | = | 650 V |
| $I_F$ ($T_C$=135˚C) | = | 26 A** |
| $Q_c$ | = | 48 nC** |



TO-247-3

**Package**

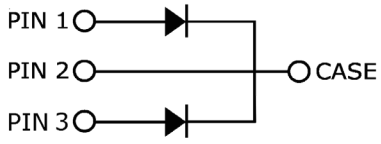
## Benefits

- Replace Bipolar with Unipolar Rectifiers
- Essentially No Switching Losses
- Higher Efficiency
- Reduction of Heat Sink Requirements
- Parallel Devices Without Thermal Runaway

## Applications

- Switch Mode Power Supplies (SMPS)
- Boost diodes in PFC or DC/DC stages
- Free Wheeling Diodes in Inverter stages
- AC/DC converters

| Part Number | Package | Marking |
|---|---|---|
| GC3D20065D | TO-247-3 | GC3D20065 |




## Maximum Ratings ($T_C$ = 25 ˚C unless otherwise specified)

| Symbol | Parameter | Value | Unit | Test Conditions | Note |
|---|---|---|---|---|---|
| $V_{RRM}$ | Repetitive Peak Reverse Voltage | 650 | V | | |
| $V_{RSM}$ | Surge Peak Reverse Voltage | 650 | V | | |
| $V_{DC}$ | DC Blocking Voltage | 650 | V | | |
| $I_F$ | Continuous Forward Current<br>(Per Leg/Device) | 27.5/55<br>13/26<br>10/20 | A | $T_C$=25˚C<br>$T_C$=135˚C<br>$T_C$=149˚C | Fig. 3 |
| $I_{FRM}$ | Repetitive Peak Forward Surge Current | 46*<br>31* | A | $T_C$=25˚C, $t_p$ = 10 ms, Half Sine Wave<br>$T_C$=110˚C, $t_p$=10 ms, Half Sine Wave | |
| $I_{FSM}$ | Non-Repetitive Peak Forward Surge Current | 90*<br>71* | A | $T_C$=25˚C, $t_p$ = 10 ms, Half Sine Wave<br>$T_C$=110˚C, $t_p$ = 10 ms, Half Sine Wave | Fig. 8 |
| $I_{FSM}$ | Non-Repetitive Peak Forward Surge Current | 860*<br>680* | A | $T_C$=25˚C, $t_p$ = 10 µs, Pulse<br>$T_C$=110˚C, $t_p$ = 10 µs, Pulse | Fig. 8 |
| $P_{tot}$ | Power Dissipation (Per Leg/Device) | 115.5/231<br>50/100 | W | $T_C$=25˚C<br>$T_C$=110˚C | Fig. 4 |
| dV/dt | Diode dV/dt ruggedness | 200 | V/ns | $V_R$=0-650V | |
| $T_J$ , $T_{stg}$ | Operating Junction and Storage Temperature | -55 to<br>+175 | ˚C | | |
| | TO-247 Mounting Torque | 1<br>8.8 | Nm<br>lbf-in | M3 Screw<br>6-32 Screw | |

## Electrical Characteristics (Per Leg)

| Symbol | Parameter | Typ. | Max. | Unit | Test Conditions | Note |
|---|---|---|---|---|---|---|
| $V_F$ | Forward Voltage | 1.5<br>2.0 | 1.8<br>2.4 | V | $I_F$ = 10 A $T_J$=25°C<br>$I_F$ = 10 A $T_J$=175°C | Fig. 1 |
| $I_R$ | Reverse Current | 12<br>24 | 60<br>220 | μA | $V_R$ = 650 V $T_J$=25°C<br>$V_R$ = 650 V $T_J$=175°C | Fig. 2 |
| $Q_C$ | Total Capacitive Charge | 24 | | nC | $V_R$ = 400 V, $I_F$ = 10 A<br>d*i*/d*t* = 500 A/μs<br>$T_J$ = 25°C | Fig. 5 |
| C | Total Capacitance | 460.5<br>44<br>40 | | pF | $V_R$ = 0 V, $T_J$ = 25°C, f = 1 MHz<br>$V_R$ = 200 V, $T_J$ = 25°C, f = 1 MHz<br>$V_R$ = 400 V, $T_J$ = 25°C, f = 1 MHz | Fig. 6 |
| $E_C$ | Capacitance Stored Energy | 3.6 | | μJ | $V_R$ = 400 V | Fig. 7 |

Note:This is a majority carrier diode, so there is no reverse recovery charge.

## Thermal Characteristics

| Symbol | Parameter | Typ. | Unit | Note |
|---|---|---|---|---|
| $R_{\theta JC}$ | Thermal Resistance from Junction to Case | 1.3**<br>0.65* | °C/W | Fig. 9 |

** Per Leg, * Both Legs

## Typical Performance (Per Leg)

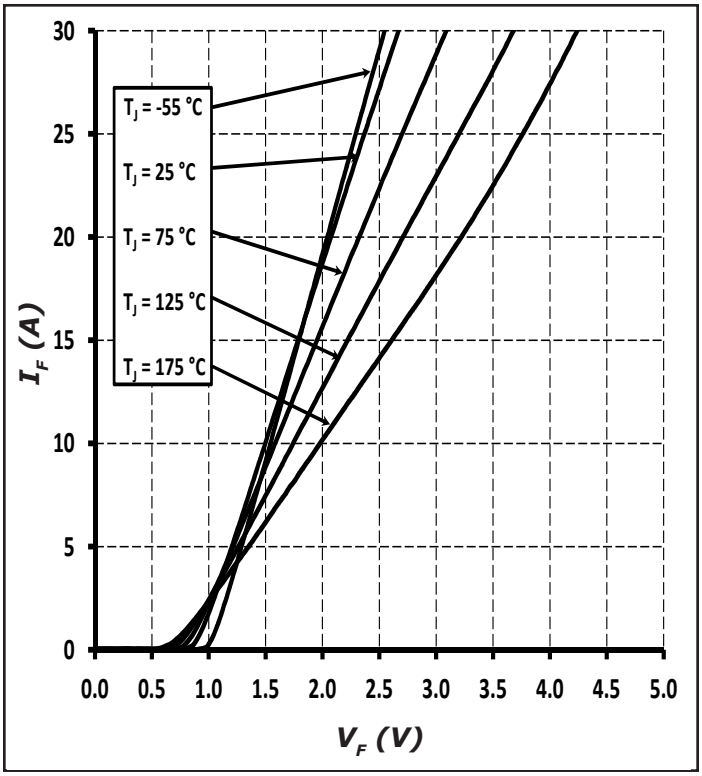



Figure 1. Forward Characteristics

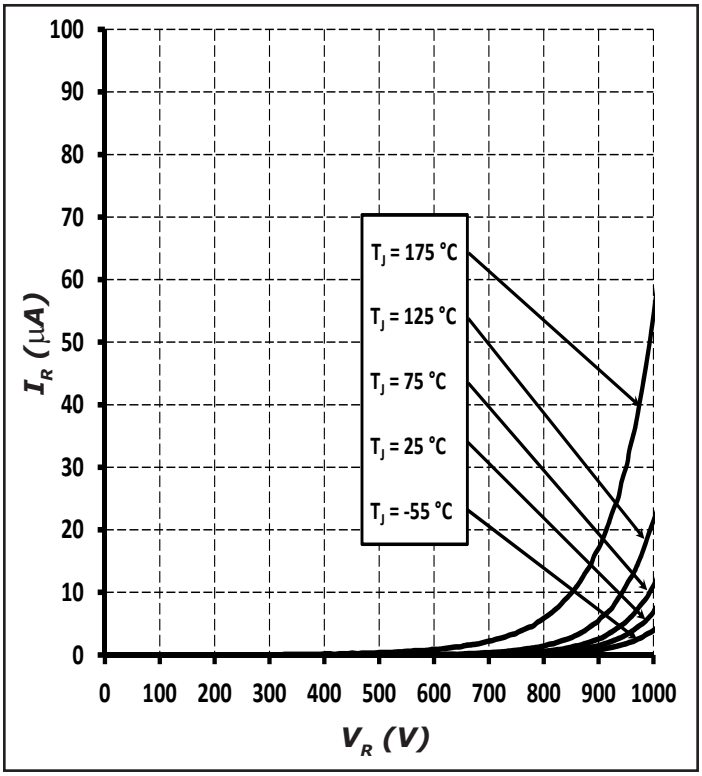



Figure 2. Reverse Characteristics

## Typical Performance (Per Leg)

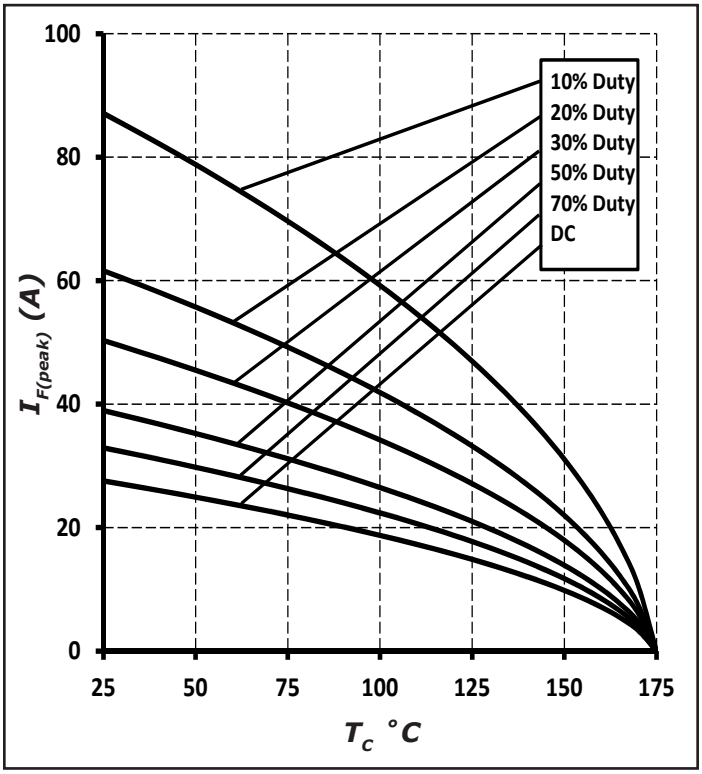



Figure 3. Current Derating

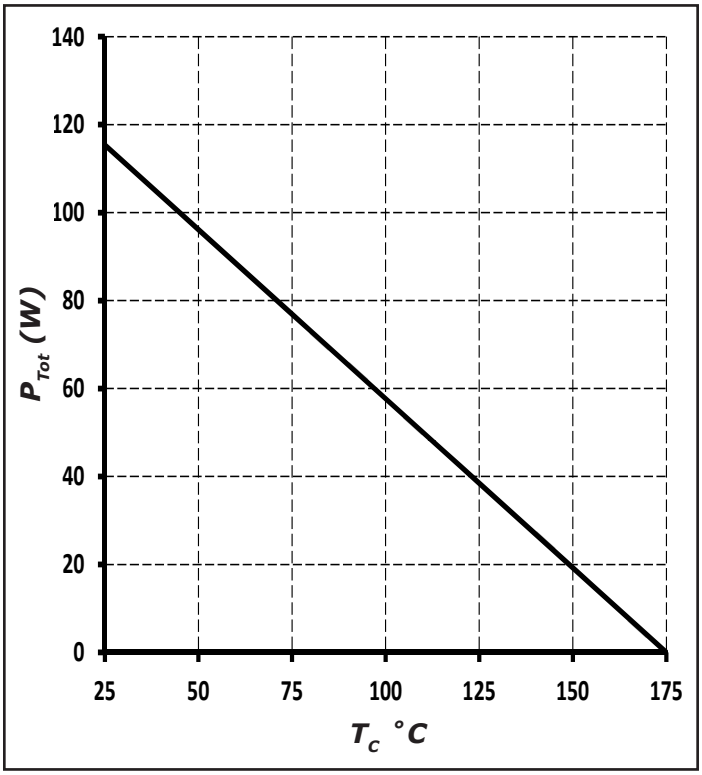



Figure 4. Power Derating

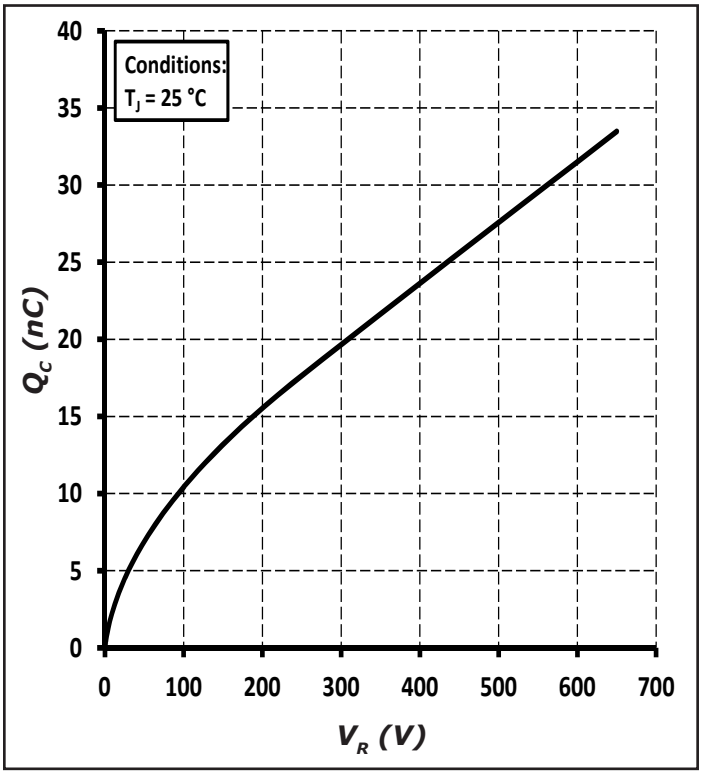



Figure 5. Total Capacitance Charge vs. Reverse Voltage

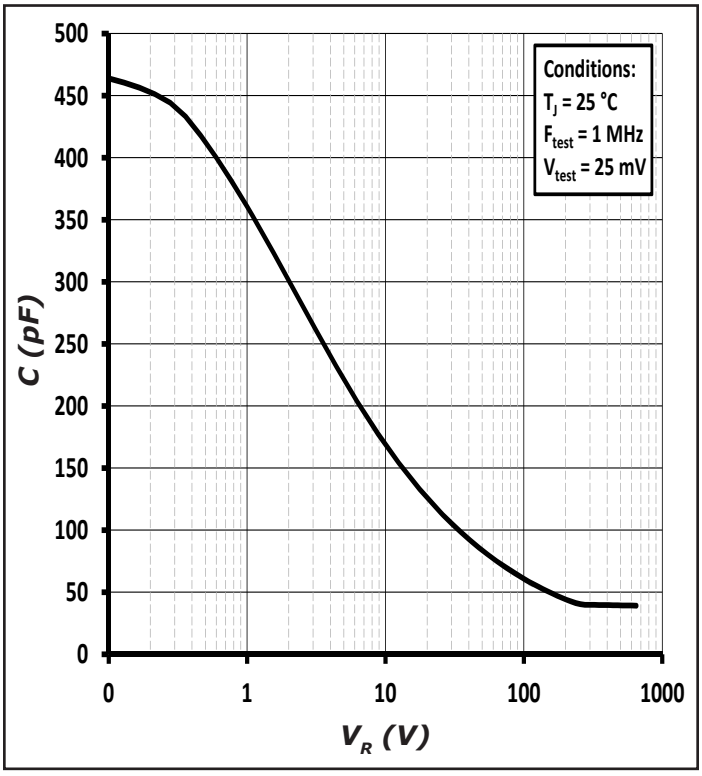



Figure 6. Capacitance vs. Reverse Voltage

## Typical Performance

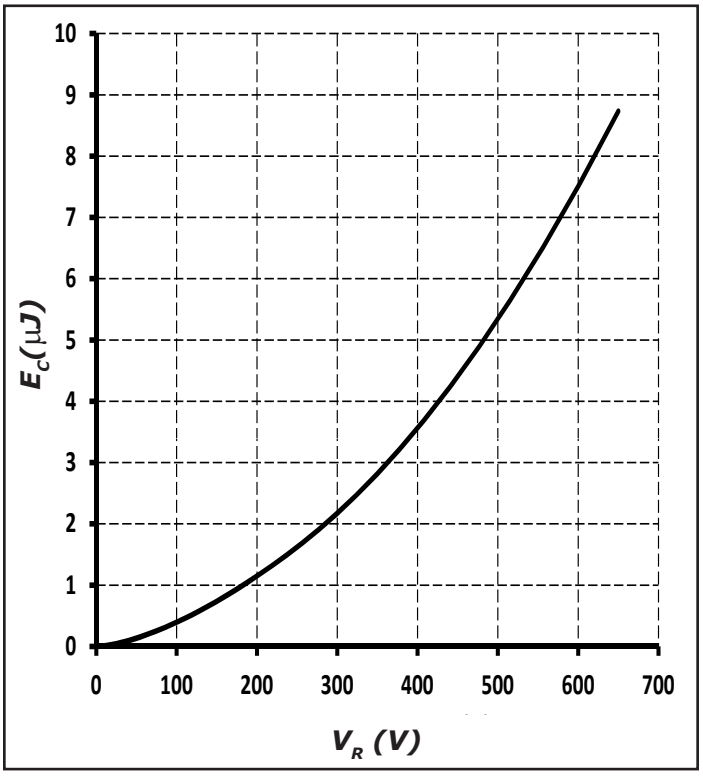



Figure 7. Capacitance Stored Energy

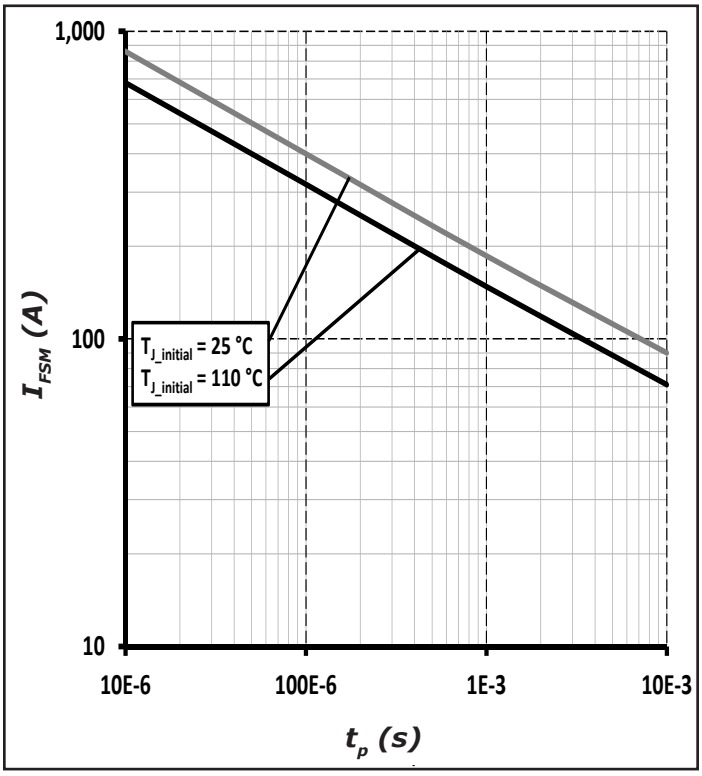



Figure 8. Non-repetitive peak forward surge current versus pulse duration (sinusoidal waveform)

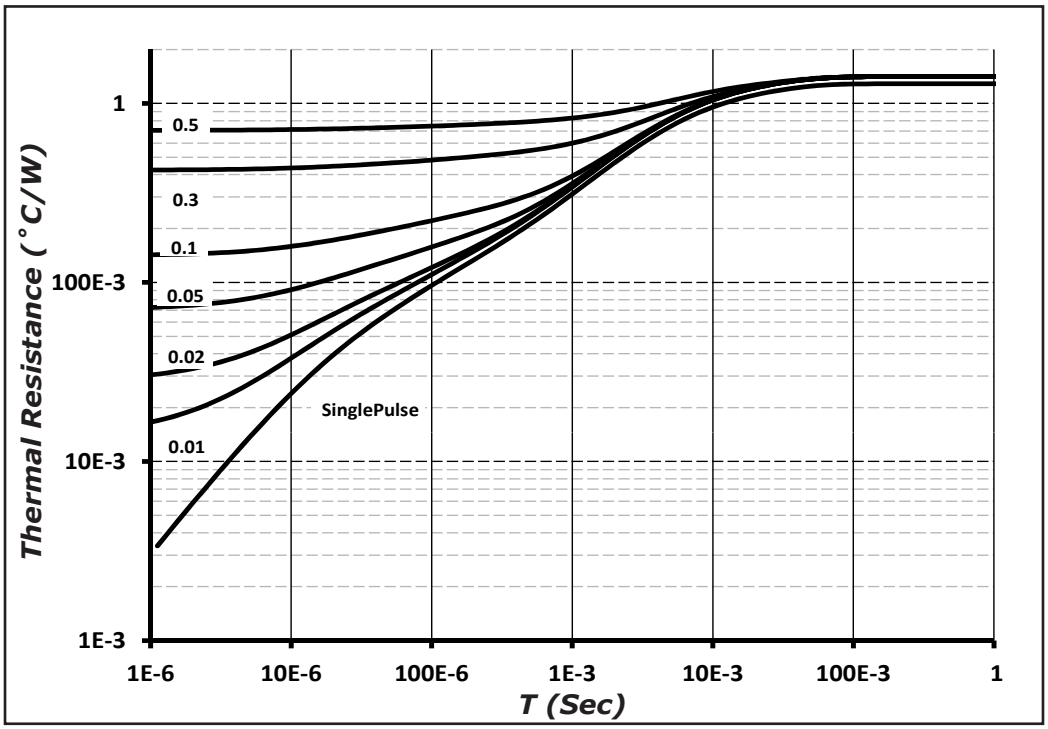
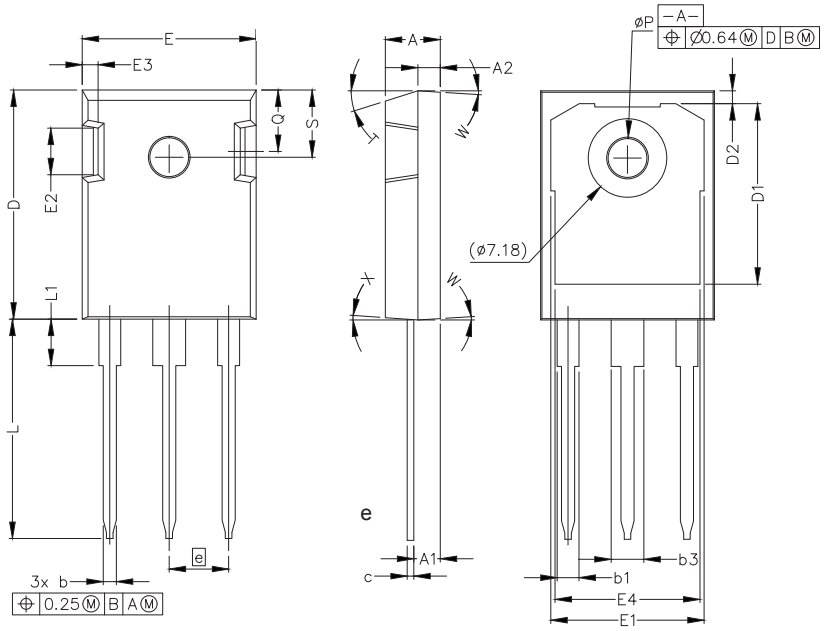


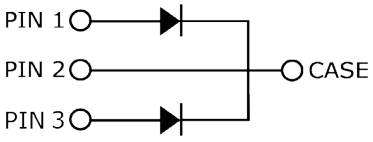

Figure 9. Transient Thermal Impedance

## Package Dimensions

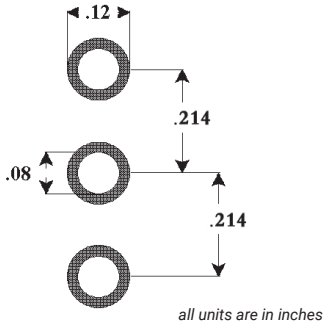
Package TO-247-3




| POS | Inches | | Millimeters | |
|---|---|---|---|---|
| | Min | Max | Min | Max |
| A | .190 | .205 | 4.83 | 5.21 |
| A1 | .090 | .100 | 2.29 | 2.54 |
| A2 | .075 | .085 | 1.91 | 2.16 |
| b | .042 | .052 | 1.07 | 1.33 |
| b1 | .075 | .095 | 1.91 | 2.41 |
| b3 | .113 | .133 | 2.87 | 3.38 |
| c | .022 | .027 | 0.55 | 0.68 |
| D | .819 | .831 | 20.80 | 21.10 |
| D1 | .640 | .695 | 16.25 | 17.65 |
| D2 | .037 | .049 | 0.95 | 1.25 |
| E | .620 | .635 | 15.75 | 16.13 |
| E1 | .516 | .557 | 13.10 | 14.15 |
| E2 | .145 | .201 | 3.68 | 5.10 |
| E3 | .039 | .075 | 1.00 | 1.90 |
| E4 | .487 | .529 | 12.38 | 13.43 |
| e | .214 BSC | | 5.44 BSC | |
| L | .780 | .800 | 19.81 | 20.32 |
| L1 | .161 | .173 | 4.10 | 4.40 |
| N | 3 | | | |
| ØP | .138 | .144 | 3.51 | 3.65 |
| Q | .216 | .236 | 5.49 | 6.00 |
| S | .238 | .248 | 6.04 | 6.30 |
| T | 17.5° REF | | | |
| W | 3.5° REF | | | |
| X | 4° REF | | | |



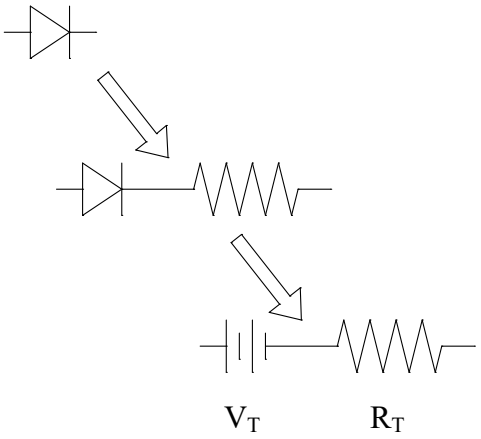

## Recommended Solder Pad Layout




TO-247-3

| Part Number | Package |
|---|---|
| GC3D20065D | TO-247-3 |

## Diode Model (Per Leg)




$$Vf_T = V_T + If * R_T$$

$$V_T = 0.94 + (T_J * -1.3*10^{-3})$$
$$R_T = 0.044 + (T_J * 4.4*10^{-4})$$

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