# HC4D20120H

Silicon Carbide Schottky Diode

## Features

- 1.2kV Schottky Rectifier
- Zero Reverse Recovery Current
- High-Frequency Operation
- Temperature-Independent Switching
- Extremely Fast Switching
- Positive Temperature Coefficient on $V_F$
- Increased Creepage/Clearance Distance

TO247-2L
**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 |
|---|---|---|
| HC4D20120H | TO247-2L | HC4D20120H |

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

| Symbol | Parameter | Value | Unit | Test Conditions | Note |
|---|---|---|---|---|---|
| $V_{RRM}$ | Repetitive Peak Reverse Voltage | 1200 | V | | |
| $V_{RSM}$ | Surge Peak Reverse Voltage | 1300 | V | | |
| $V_R$ | DC Peak Reverse Voltage | 1200 | V | | |
| $I_F$ | Continuous Forward Current | 54<br>26<br>20 | A | $T_C$=25°C<br>$T_C$=135°C<br>$T_C$=156°C | Fig. 3 |
| $I_{FRM}$ | Repetitive Peak Forward Surge Current | 86<br>56 | A | $T_C$=25°C, $t_P$=10 ms, Half Sine Pulse<br>$T_C$=110°C, $t_P$=10 ms, Half Sine Pulse | |
| $I_{FSM}$ | Non-Repetitive Forward Surge Current | 130<br>104 | A | $T_C$=25°C, $t_P$=10 ms, Half Sine Pulse<br>$T_C$=110°C, $t_P$=10 ms, Half Sine Pulse | Fig. 8 |
| $I_{F,Max}$ | Non-Repetitive Peak Forward Current | 1150<br>950 | 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 | 246<br>106.5 | W | $T_C$=25°C<br>$T_C$=110°C | Fig. 4 |
| dV/dt | Diode dV/dt ruggedness | 200 | V/ns | $V_R$=0-960V | |
| $\int i^2dt$ | $i^2t$ value | 84.5<br>54 | $A^2s$ | $T_C$=25°C, $t_P$=10 ms<br>$T_C$=110°C, $t_P$=10 ms | |
| $T_J$ , $T_{stg}$ | Operating Junction and Storage Temperature | -55 to +175 | °C | | |
| | TO-247 Mounting Torque | 1<br>8.8 | Nm<br>lbf-in | M3 Screw<br>6-32 Screw | |

## Electrical Characteristics

| Symbol | Parameter | Typ. | Max. | Unit | Test Conditions | Note |
|---|---|---|---|---|---|---|
| $V_F$ | Forward Voltage | 1.5<br>2.2 | 1.8<br>3 | V | $I_F$ = 20 A $T_J$=25°C<br>$I_F$ = 20 A $T_J$=175°C | Fig. 1 |
| $I_R$ | Reverse Current | 35<br>65 | 200<br>400 | μA | $V_R$ = 1200 V $T_J$=25°C<br>$V_R$ = 1200 V $T_J$=175°C | Fig. 2 |
| $Q_C$ | Total Capacitive Charge | 99 | | nC | $V_R$ = 800 V, $I_F$ = 20A<br>$di/dt$ = 200 A/μs<br>$T_J$ = 25°C | Fig. 5 |
| C | Total Capacitance | 1500<br>93<br>67 | | pF | $V_R$ = 0 V, $T_J$ = 25°C, f = 1 MHz<br>$V_R$ = 400 V, $T_J$ = 25°C, f = 1 MHz<br>$V_R$ = 800 V, $T_J$ = 25°C, f = 1 MHz | Fig. 6 |
| $E_C$ | Capacitance Stored Energy | 28 | | μJ | $V_R$ = 800 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 | 0.61 | °C/W | Fig. 9 |

## Typical Performance

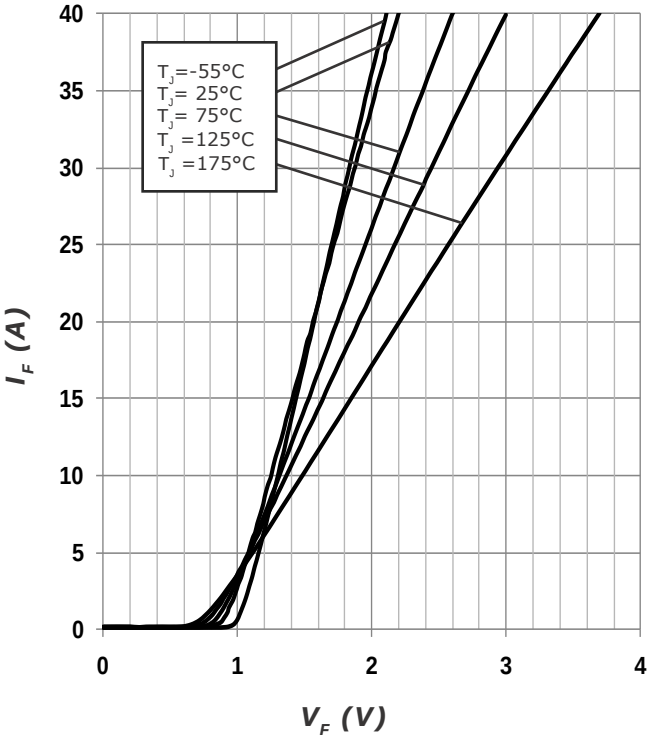



Figure 1. Forward Characteristics

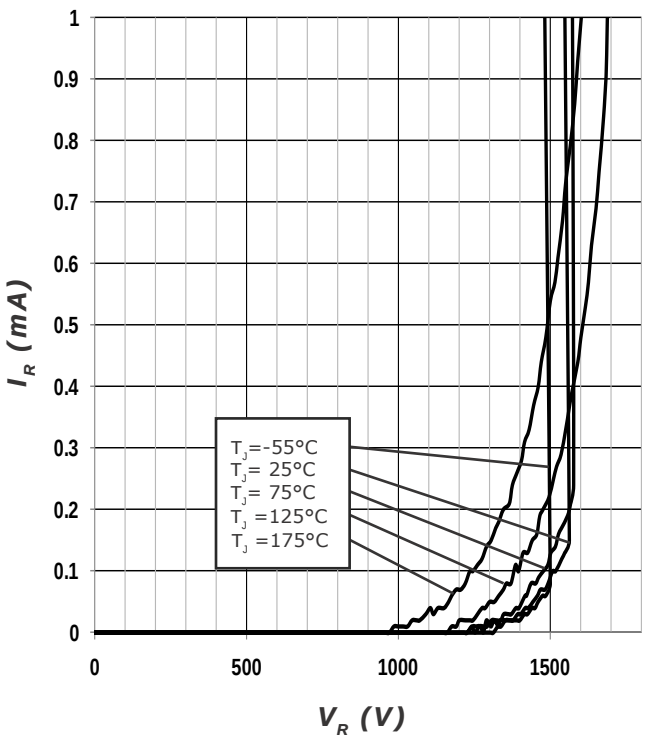



Figure 2. Reverse Characteristics

## Typical Performance

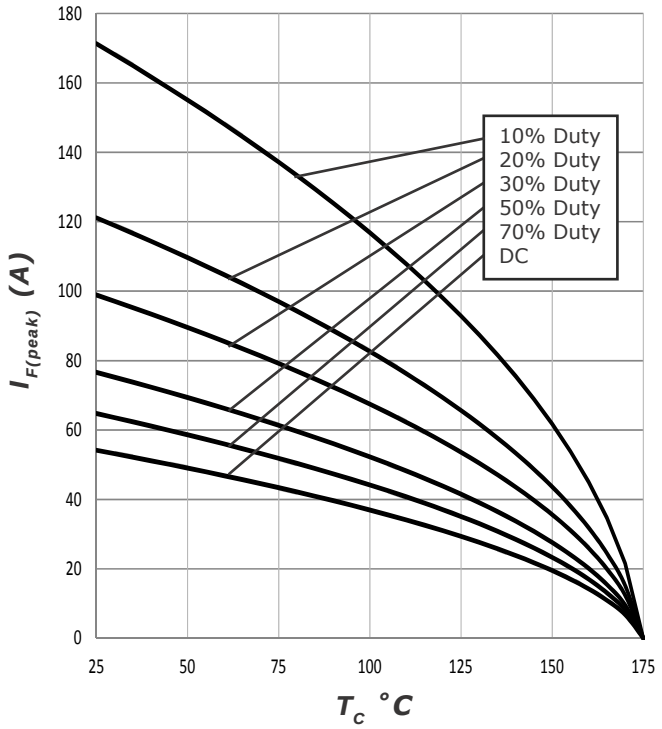



Figure 3. Current Derating

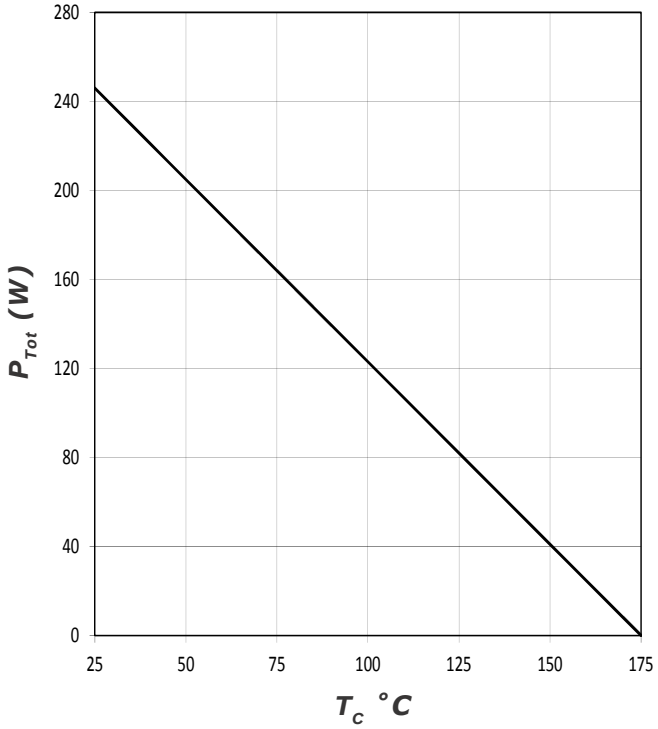



Figure 4. Power Derating

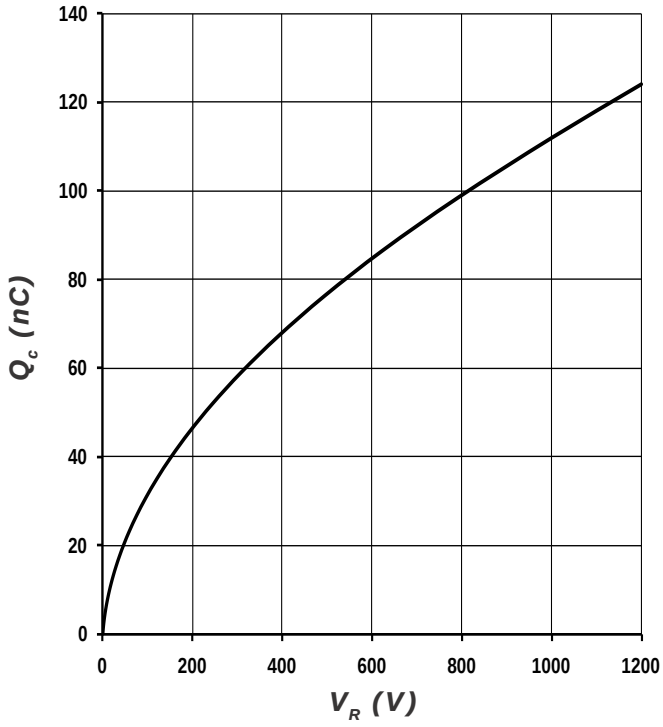



Figure 5. Recovery Charge vs. Reverse Voltage

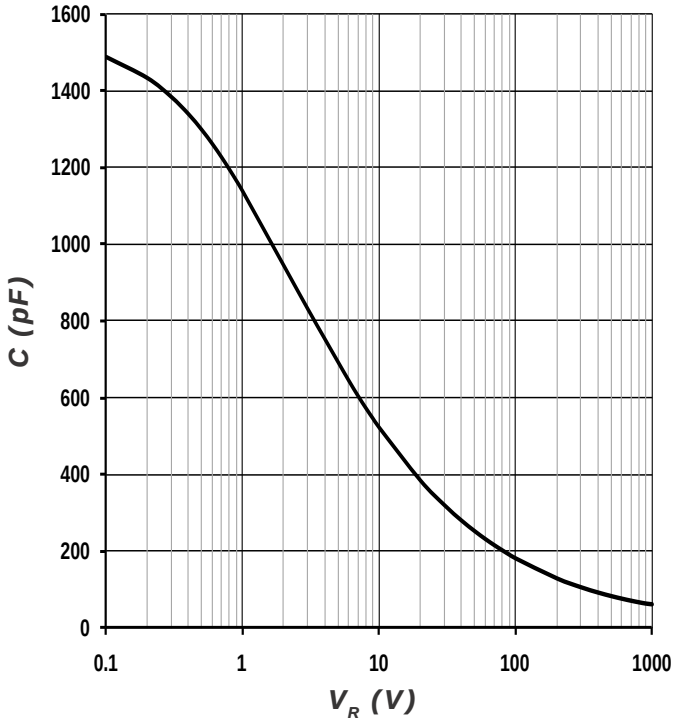



Figure 6. Capacitance vs. Reverse Voltage

## Typical Performance

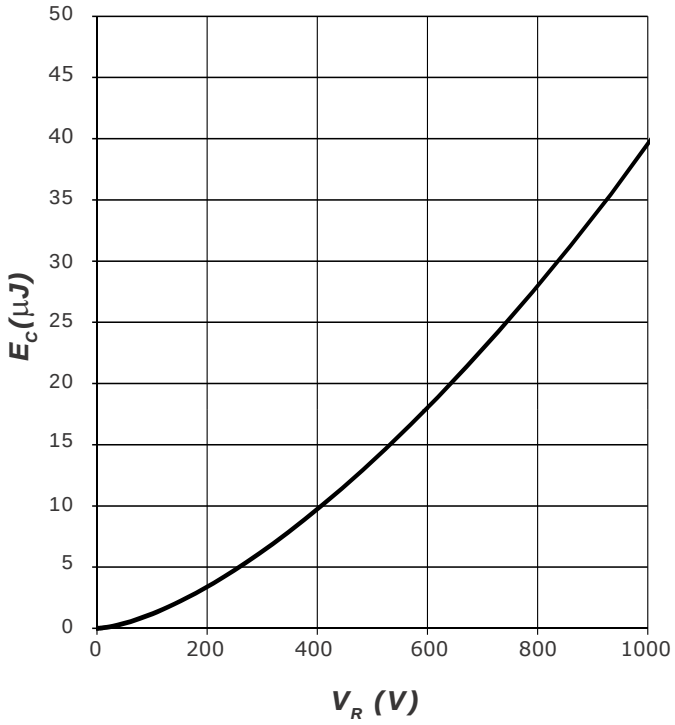



Figure 7. Typical Capacitance Stored Energy

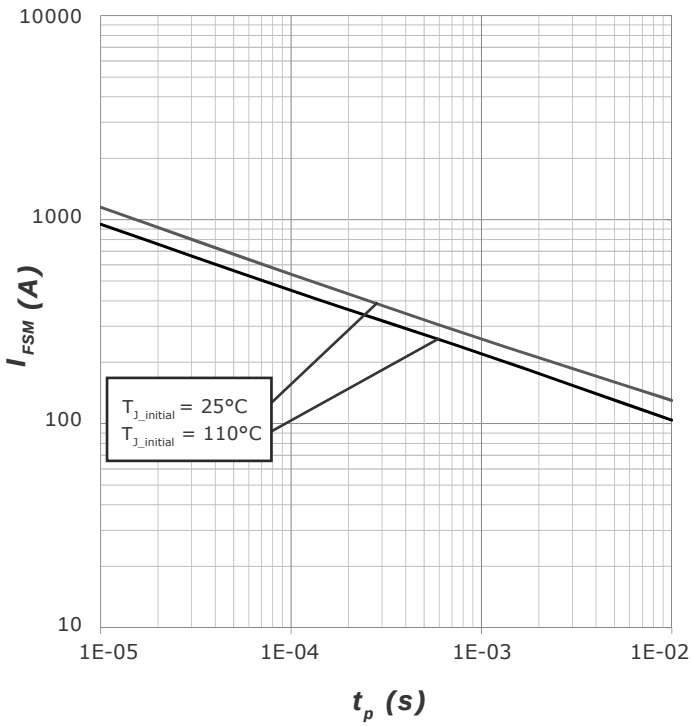



Figure 8. Non-Repetitive Peak Forward Surge Current versus Pulse Duration (sinusoidal waveform)

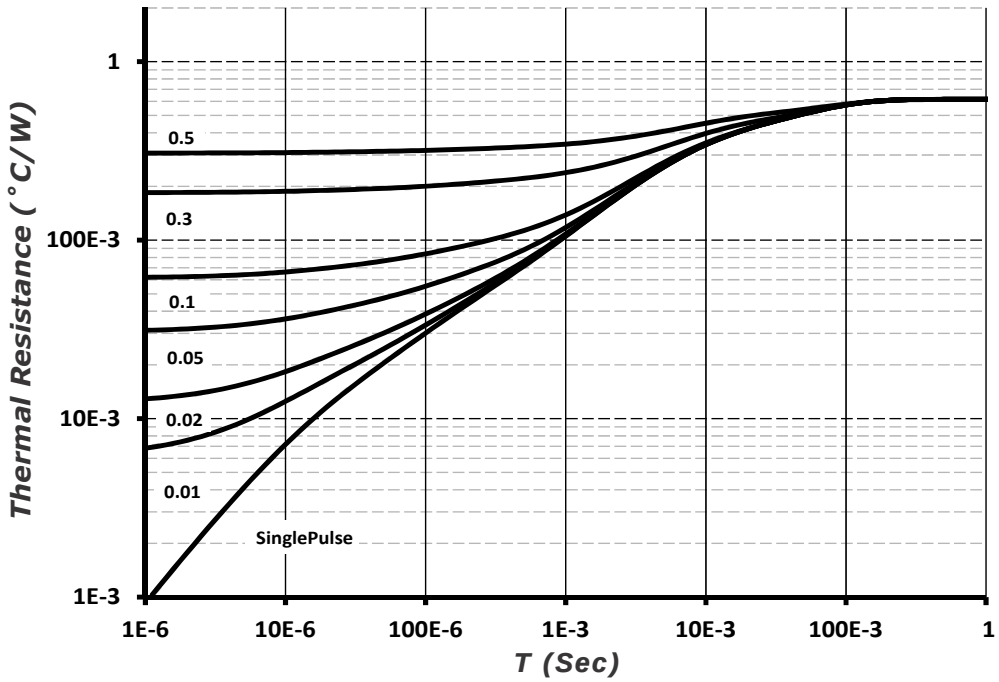
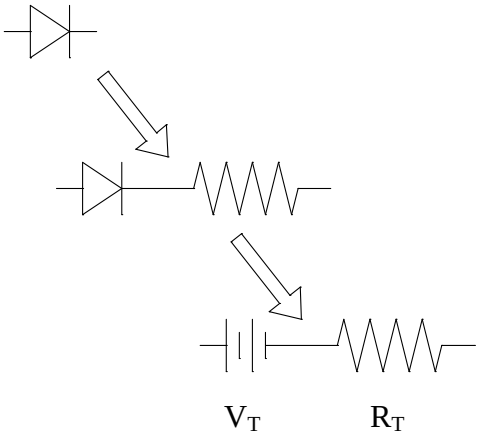



Figure 9. Transient Thermal Impedance

## Diode Model




$$V_{fT} = V_T + If * R_T$$

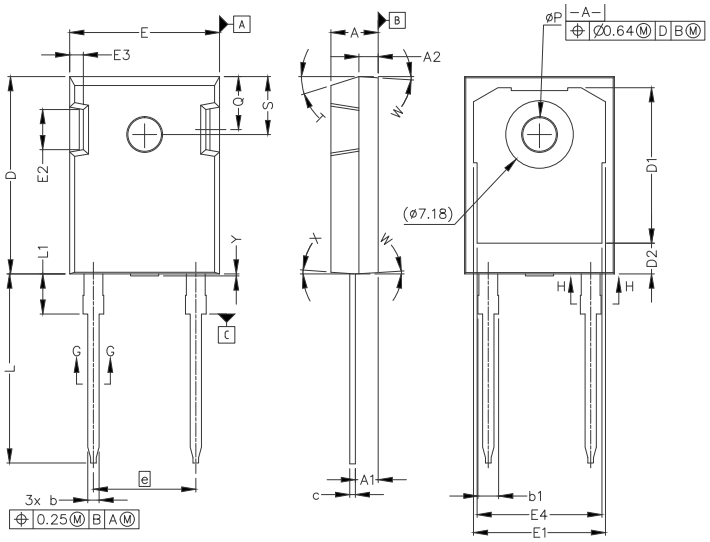
$$V_T = 0.97 + (T_J * -1.40 * 10^{-3})$$
$$R_T = 0.023 + (T_J * 2.71 * 10^{-4})$$

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

## Package Dimensions

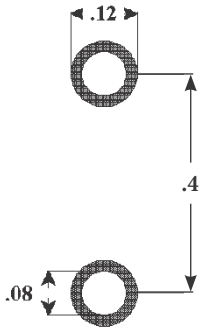
Package: TO247-2L

All dimensions in mm.




| SYM | MILLIMETERS | | INCHES | |
|---|---|---|---|---|
| | MIN | MAX | MIN | MAX |
| A | 4.83 | 5.21 | .190 | .205 |
| A1 | 2.29 | 2.54 | .090 | .100 |
| A2 | 1.91 | 2.16 | .075 | .085 |
| b' | 1.07 | 1.28 | .042 | .050 |
| b | 1.07 | 1.33 | .042 | .052 |
| b1 | 1.91 | 2.41 | .075 | .095 |
| b2 | 1.91 | 2.16 | .075 | .085 |
| c' | 0.55 | 0.65 | .022 | .026 |
| c | 0.55 | 0.68 | .022 | .027 |
| D | 20.80 | 21.10 | .819 | .831 |
| D1 | 16.25 | 17.35 | .640 | .683 |
| D2 | 2.86 | 3.16 | .112 | .124 |
| E | 15.75 | 16.13 | .620 | .635 |
| E1 | 13.10 | 14.15 | .516 | .557 |
| E2 | 3.68 | 5.10 | .145 | .201 |
| E3 | 1.00 | 1.90 | .039 | .075 |
| E4 | 12.38 | 13.43 | .487 | .529 |
| e | 10.88 BSC | | .428 BSC | |
| L | 19.81 | 20.32 | .780 | .800 |
| L1 | 4.10 | 4.40 | .161 | .173 |
| øP | 3.51 | 3.65 | .138 | .144 |
| Q | 5.49 | 6.00 | .216 | .236 |
| S | 6.04 | 6.30 | .238 | .248 |
| T | 17.5° REF. | | | |
| W | 3.5° REF. | | | |
| X | 4° REF. | | | |
| Y | 0 | 0.50 | 0 | 0.020 |

## Recommended Solder Pad Layout




TO247-2L

*all units are in inches*

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