

# C4D02120E

## 1200 V, 2 A Silicon Carbide Schottky Diode

### Features

- 1.2 kV Schottky rectifier
- Zero reverse recovery current
- High-frequency operation
- Temperature-independent switching
- Extremely fast switching
- Positive temperature coefficient on  $V_F$



TO-252-2



Package Types: TO-252-2

PN: C4D02120

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### Applications

- Switch mode power supplies (SMPS)
- Boost diodes in PFC or DC/DC stages
- Free wheeling diodes in inverter stages
- LED lighting power supplies
- AC/DC converters

### Benefits

- Replace bipolar with unipolar rectifiers
- Essentially no switching losses
- Higher efficiency
- Reduction of heat sink requirements
- Parallel devices without thermal runaway

### Maximum Ratings ( $T_C = 25^\circ\text{C}$ Unless Otherwise Specified)

| Parameter                                  | Symbol         | Value       | Unit                 | Test Conditions                                              | Note   |
|--------------------------------------------|----------------|-------------|----------------------|--------------------------------------------------------------|--------|
| Repetitive Peak Reverse Voltage            | $V_{RRM}$      | 1200        | V                    |                                                              |        |
| Surge Peak Reverse Voltage                 | $V_{RSM}$      | 1300        |                      |                                                              |        |
| DC Blocking Voltage                        | $V_{DC}$       | 1200        |                      |                                                              |        |
| Maximum DC Current                         | $I_F$          | 10          | A                    | $T_C = 25^\circ\text{C}$                                     | Fig. 3 |
|                                            |                | 5           |                      | $T_C = 135^\circ\text{C}$                                    |        |
|                                            |                | 2           |                      | $T_C = 165^\circ\text{C}$                                    |        |
| Repetitive Peak Forward Surge Current      | $I_{FRM}$      | 13          |                      | $T_C = 25^\circ\text{C}$ , $t_p = 10$ ms, Half Sine Pulse    |        |
|                                            |                | 8.4         |                      | $T_C = 110^\circ\text{C}$ , $t_p = 10$ ms, Half Sine Pulse   |        |
| Non-Repetitive Peak Forward Surge Current  | $I_{FSM}$      | 19          |                      | $T_C = 25^\circ\text{C}$ , $t_p = 10$ ms, Half Sine Pulse    | Fig. 8 |
|                                            |                | 16.5        |                      | $T_C = 110^\circ\text{C}$ , $t_p = 10$ ms, Half Sine Pulse   |        |
| Non-Repetitive Peak Forward Current        | $I_{F,Max}$    | 200         |                      | $T_C = 25^\circ\text{C}$ , $t_p = 10$ $\mu\text{s}$ , Pulse  | Fig. 8 |
|                                            |                | 160         |                      | $T_C = 110^\circ\text{C}$ , $t_p = 10$ $\mu\text{s}$ , Pulse |        |
| Power Dissipation                          | $P_{tot}$      | 60          | W                    | $T_C = 25^\circ\text{C}$                                     | Fig. 4 |
|                                            |                | 26          |                      | $T_C = 110^\circ\text{C}$                                    |        |
| Diode $dV/dt$ Ruggedness                   | $dV/dt$        | 200         | V/ns                 | $V_R = 0-650$ V                                              |        |
| $i^2t$ Value                               | $\int i^2 dt$  | 1.8         | $\text{A}^2\text{s}$ | $T_C = 25^\circ\text{C}$ , $t_p = 10$ ms                     |        |
|                                            |                | 1.4         |                      | $T_C = 110^\circ\text{C}$ , $t_p = 10$ ms                    |        |
| Operating Junction and Storage Temperature | $T_J, T_{stg}$ | -55 to +175 | $^\circ\text{C}$     |                                                              |        |



## Electrical Characteristics

| Parameter                 | Symbol | Typ. | Max. | Unit          | Test Conditions                                                                                                | Note   |
|---------------------------|--------|------|------|---------------|----------------------------------------------------------------------------------------------------------------|--------|
| Forward Voltage           | $V_F$  | 1.4  | 1.8  | V             | $I_F = 2 \text{ A}$ , $T_J = 25^\circ\text{C}$                                                                 | Fig. 1 |
|                           |        | 1.9  | 3    |               | $I_F = 2 \text{ A}$ , $T_J = 175^\circ\text{C}$                                                                |        |
| Reverse Current           | $I_R$  | 10   | 50   | $\mu\text{A}$ | $V_R = 1200 \text{ V}$ , $T_J = 25^\circ\text{C}$                                                              | Fig. 2 |
|                           |        | 40   | 150  |               | $V_R = 1200 \text{ V}$ , $T_J = 175^\circ\text{C}$                                                             |        |
| Total Capacitive Charge   | $Q_C$  | 11   |      | nC            | $V_R = 800 \text{ V}$ , $I_F = 2 \text{ A}$<br>$di/dt = 200 \text{ A}/\mu\text{S}$<br>$T_J = 25^\circ\text{C}$ | Fig. 5 |
| Total Capacitance         | C      | 167  |      | pF            | $V_R = 0 \text{ V}$ , $T_J = 25^\circ\text{C}$ , $f = 1 \text{ MHz}$                                           | Fig. 6 |
|                           |        | 11   |      |               | $V_R = 400 \text{ V}$ , $T_J = 25^\circ\text{C}$ , $f = 1 \text{ MHz}$                                         |        |
|                           |        | 8    |      |               | $V_R = 800 \text{ V}$ , $T_J = 25^\circ\text{C}$ , $f = 1 \text{ MHz}$                                         |        |
| Capacitance Stored Energy | $E_C$  | 3.2  |      | $\mu\text{J}$ | $V_R = 800 \text{ V}$                                                                                          | Fig. 7 |

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

## Thermal Characteristics

| Parameter                                | Symbol          | Typ. | Unit                      | Note   |
|------------------------------------------|-----------------|------|---------------------------|--------|
| Thermal Resistance from Junction to Case | $R_{\theta JC}$ | 2.5  | $^\circ\text{C}/\text{W}$ | Fig. 9 |

## Typical Performance

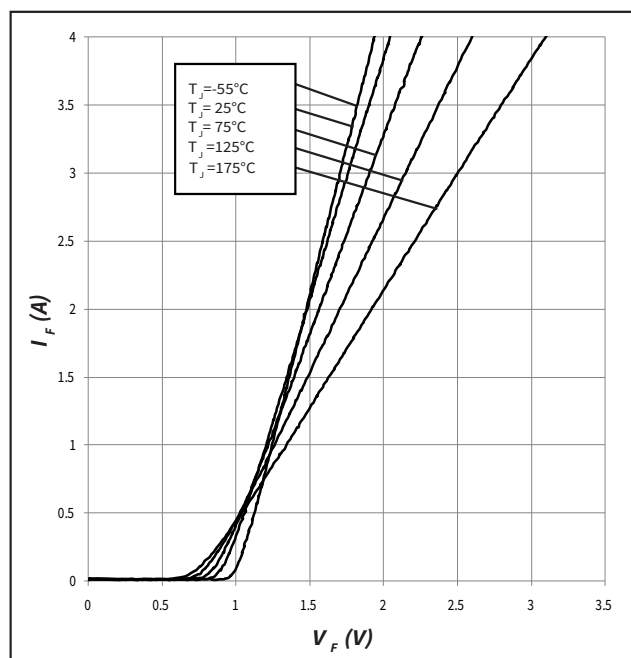


Figure 1. Forward Characteristics

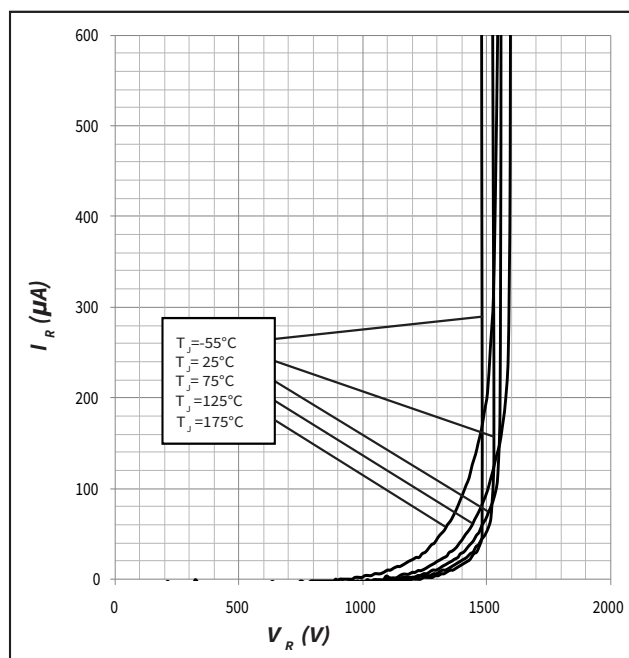


Figure 2. Reverse Characteristics



## Typical Performance

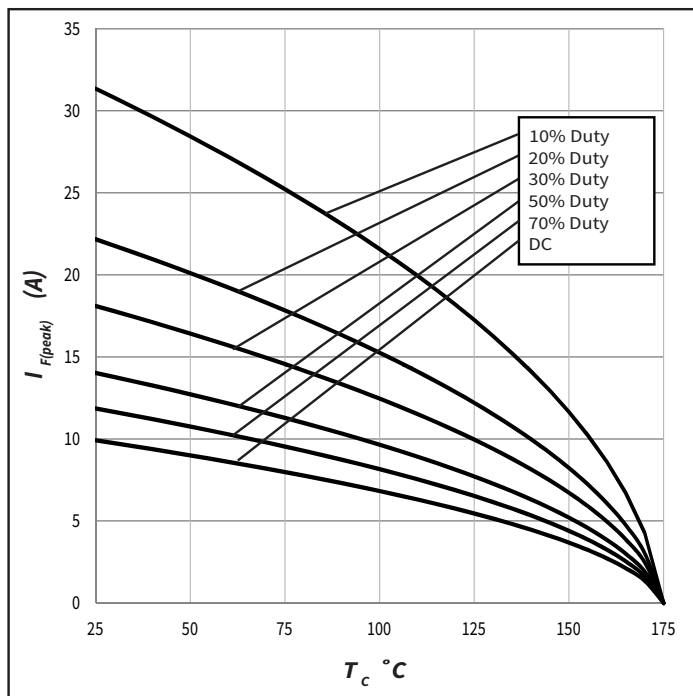


Figure 3. Current Derating

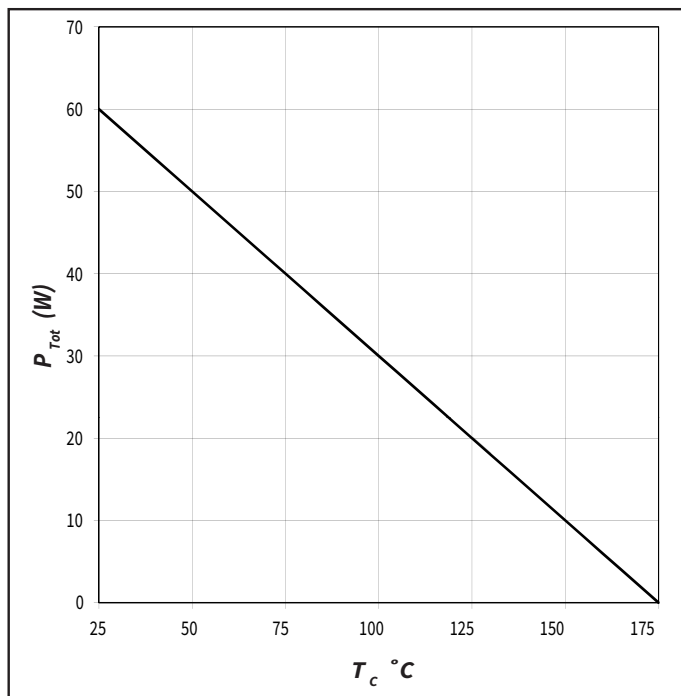


Figure 4. Power Derating

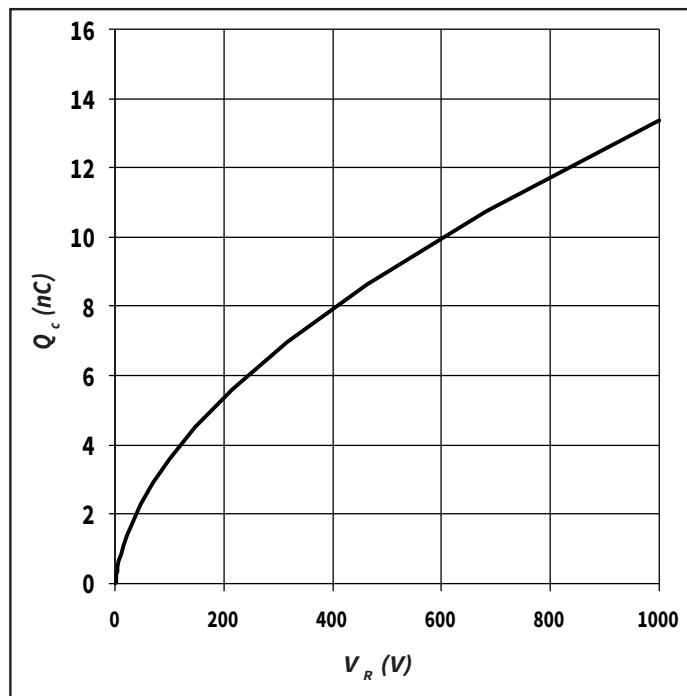


Figure 5. Recovery Charge vs. Reverse Voltage

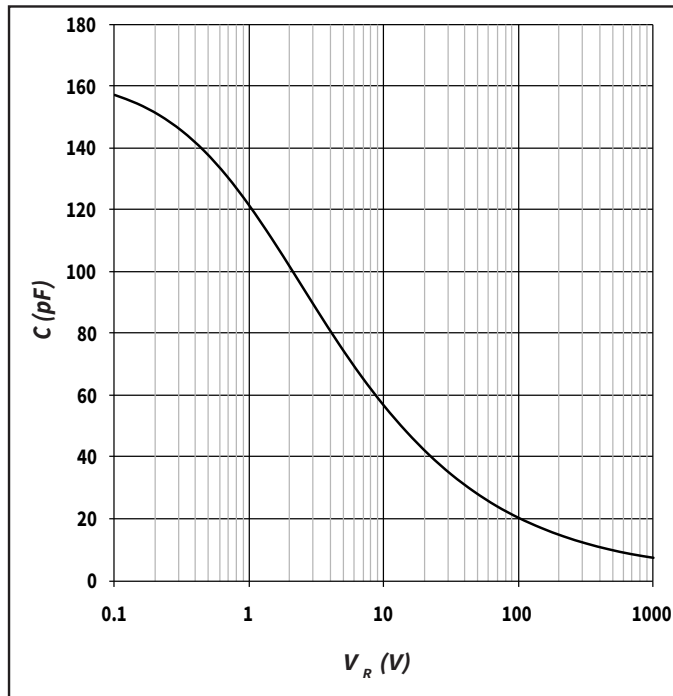


Figure 6. Capacitance vs. Reverse Voltage



Typical Performance

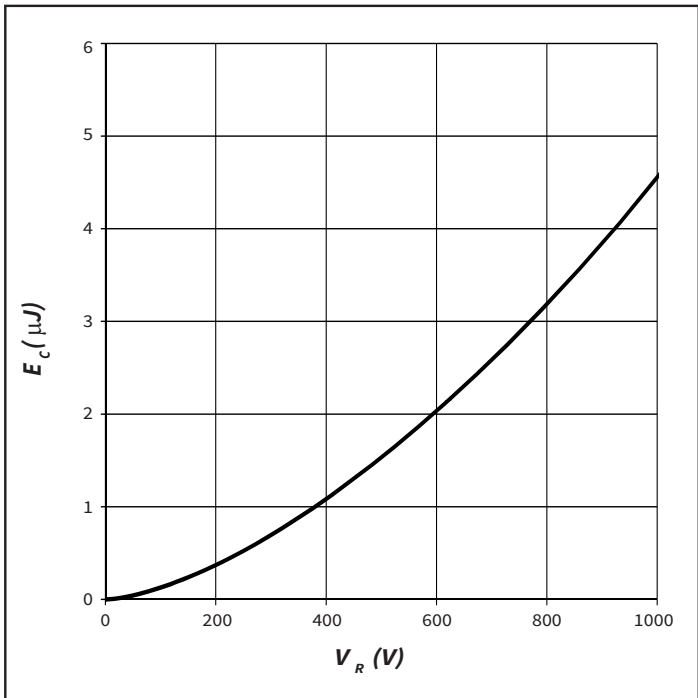


Figure 7. Typical Capacitance Stored Energy

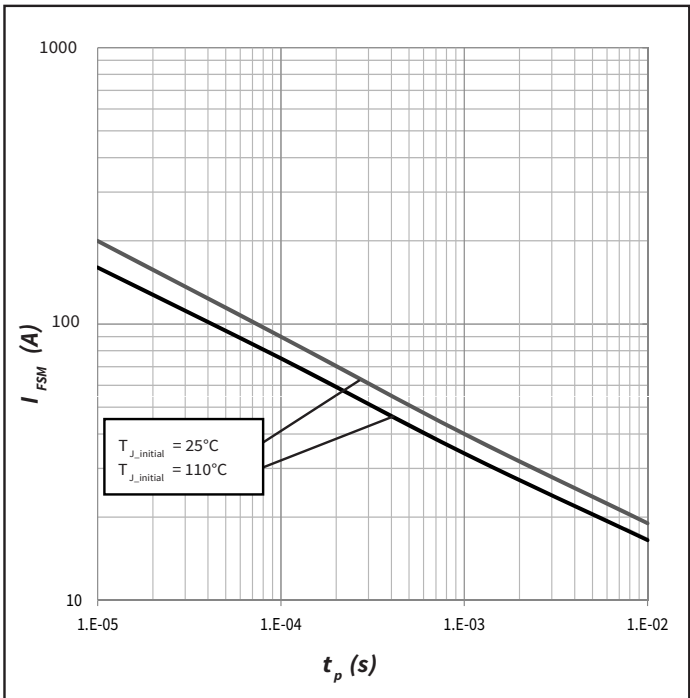


Figure 8. Non-Repetitive Peak Forward Surge Current Versus Pulse Duration (Sinusoidal Waveform)

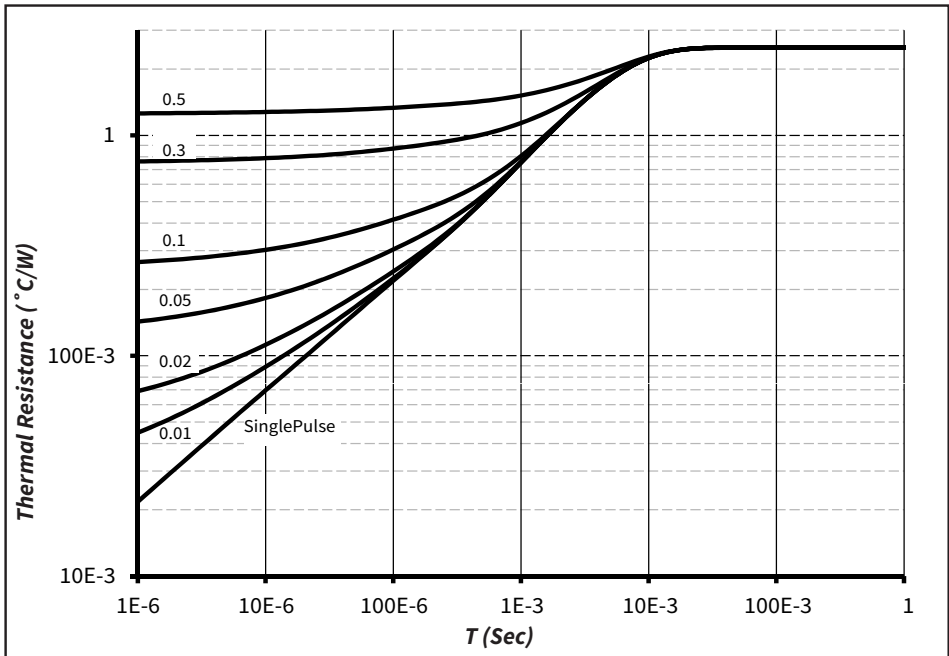
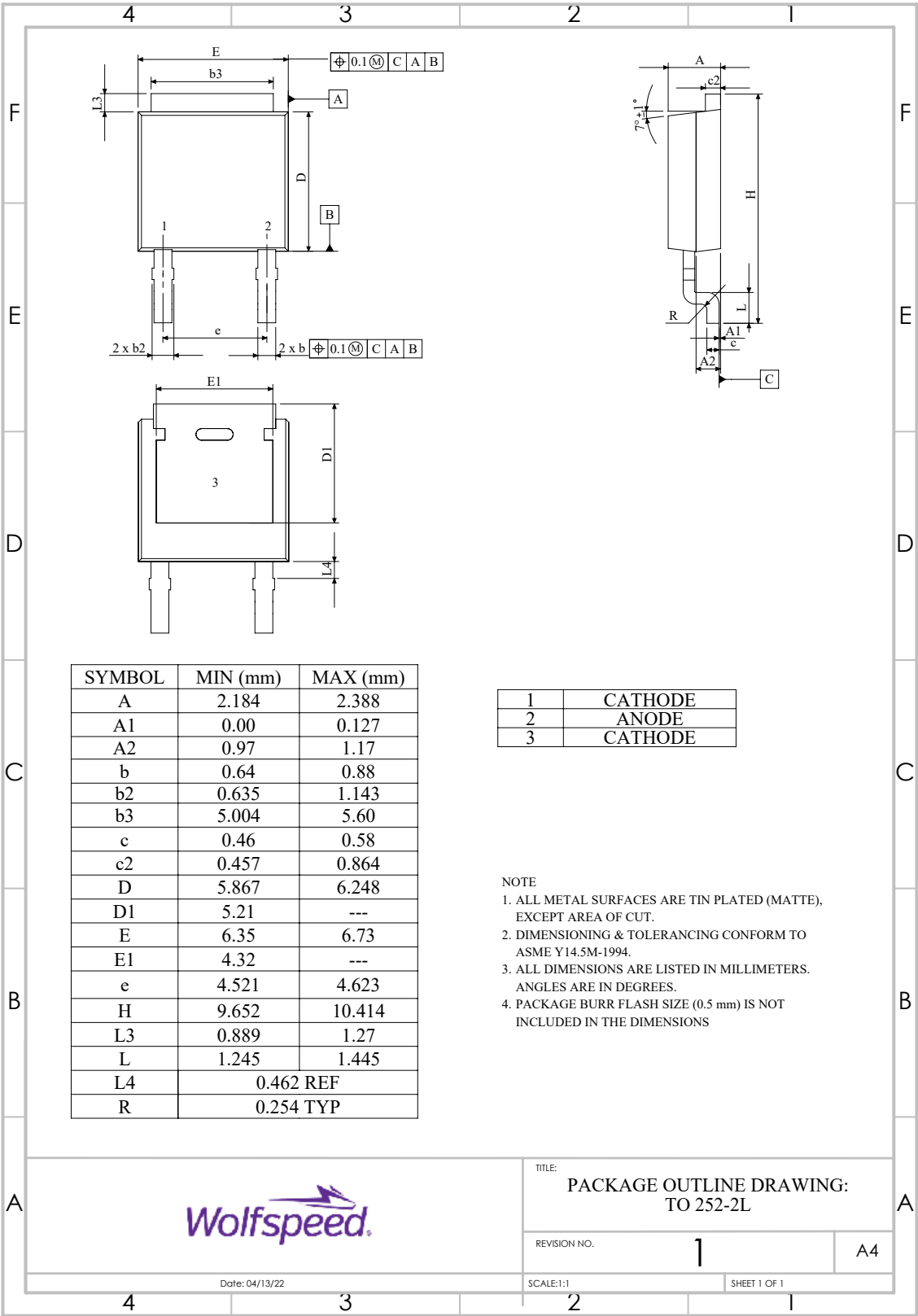


Figure 9. Transient Thermal Impedance

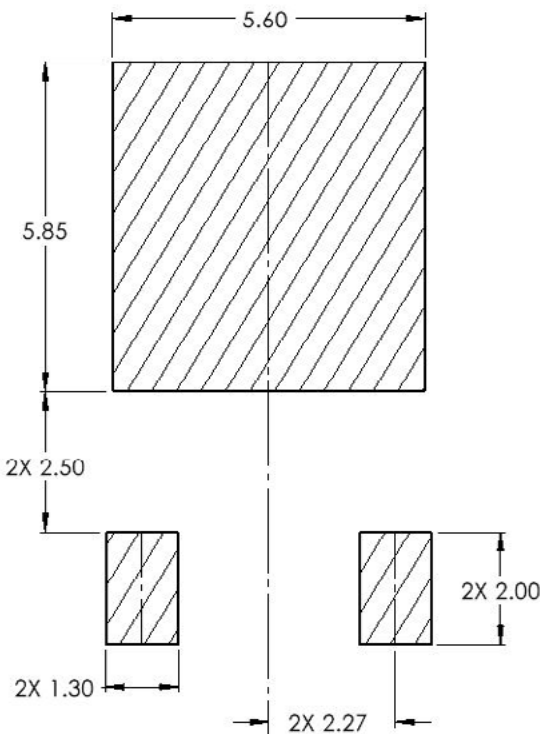
Package Dimensions

Package: TO-252-2



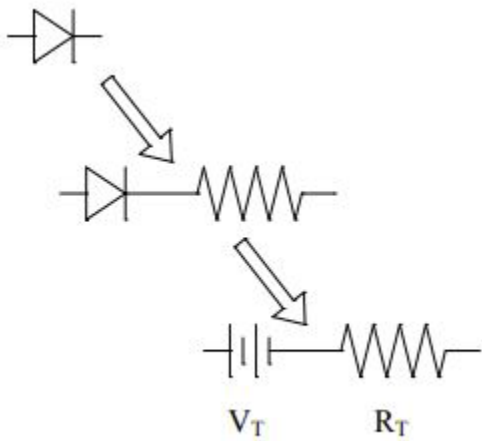


Recommended Solder Pad Layout



| Part Number | Package  | Marking  |
|-------------|----------|----------|
| C4D02120E   | TO-252-2 | C4D02120 |

Diode Model



$$V_{\text{FT}} = V_T + I_f \cdot R_T$$
$$V_T = 0.9592 + (T_J \cdot -1.20 \cdot 10^{-3})$$
$$R_T = 0.1673 + (T_J \cdot 2.10 \cdot 10^{-3})$$

Note:  $T_J$  = Diode Junction Temperature in Degrees Celsius, valid from 25°C to 175°C



Revision History

| Current Revision | Date of Release | Description of Changes                                             |
|------------------|-----------------|--------------------------------------------------------------------|
| 11               | September-2023  | Updated Wolfspeed branding, package drawing, and solder pad layout |
| 12               | October-2023    | Corrected solder pad layout and diode model                        |



## Notes & Disclaimer

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