

# C3D02065E

## 650 V, 2 A Silicon Carbide Schottky Diode

### Features

- 650-Volt Schottky rectifier
- Optimized for PFC boost diode application
- Zero reverse recovery current
- Zero forward recovery voltage
- High-frequency operation
- Temperature-independent switching behavior
- Extremely fast switching
- Positive temperature coefficient on  $V_f$



TO-252-2



Package Types: TO-252-2

Marking: C3D02065

WolfSpeed, Inc. is in the process of rebranding its products and related materials pursuant to the entity name change from Cree, Inc. to WolfSpeed, Inc. During this transition period, products received may be marked with either the Cree name and/or logo or the WolfSpeed name and/or logo.

### Applications

- Switch mode power supplies (SMPS)
- Boost diodes in PFC or DC/DC stages
- Free wheeling diodes in inverter stages
- 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 ( $T_c = 25\text{ }^\circ\text{C}$ Unless Otherwise Specified)

Parameter	Symbol	Value	Unit	Test Conditions	Note
Repetitive Peak Reverse Voltage	$V_{RRM}$	650	V		
Surge Peak Reverse Voltage	$V_{RSM}$	650			
DC Blocking Voltage	$V_{DC}$	650			
Continuous Forward Current	$I_F$	8	A	$T_c = 25\text{ }^\circ\text{C}$	Fig. 3
		4		$T_c = 135\text{ }^\circ\text{C}$	
		2		$T_c = 161\text{ }^\circ\text{C}$	
Repetitive Peak Forward Surge Current	$I_{FRM}$	11	A	$T_c = 25\text{ }^\circ\text{C}$ , $t_p = 10\text{ ms}$ , Half Sine Pulse	Fig. 8
		7.5		$T_c = 110\text{ }^\circ\text{C}$ , $t_p = 10\text{ ms}$ , Half Sine Pulse	
Non-Repetitive Peak Forward Surge Current	$I_{FSM}$	16.5	A	$T_c = 25\text{ }^\circ\text{C}$ , $t_p = 10\text{ ms}$ , Half Sine Pulse	Fig. 8
		15		$T_c = 110\text{ }^\circ\text{C}$ , $t_p = 10\text{ ms}$ , Half Sine Pulse	
Non-Repetitive Peak Forward Surge Current	$I_{FSM}$	120	A	$T_c = 25\text{ }^\circ\text{C}$ , $t_p = 10\text{ }\mu\text{s}$ , Pulse	Fig. 8
		110		$T_c = 110\text{ }^\circ\text{C}$ , $t_p = 10\text{ }\mu\text{s}$ , Pulse	
Power Dissipation	$P_{tot}$	39.5	W	$T_c = 25\text{ }^\circ\text{C}$	Fig. 4
		17		$T_c = 110\text{ }^\circ\text{C}$	
Diode $dV/dt$ Ruggedness	$dV/dt$	200	V/ns	$V_R = 0\text{--}650\text{ V}$	
$i^2t$ Value	$\int i^2 dt$	1.35	$A^2s$	$T_c = 25\text{ }^\circ\text{C}$ , $t_p = 10\text{ ms}$	
		1.12		$T_c = 110\text{ }^\circ\text{C}$ , $t_p = 10\text{ ms}$	
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	$V_F$	1.5	1.7	V	$I_F = 2 \text{ A}, T_J = 25^\circ \text{C}$	Fig. 1
		1.8	2.4		$I_F = 2 \text{ A}, T_J = 175^\circ \text{C}$	
Reverse Current	$I_R$	3.5	18	$\mu\text{A}$	$V_R = 650 \text{ V}, T_J = 25^\circ \text{C}$	Fig. 2
		7.5	60		$V_R = 650 \text{ V}, T_J = 175^\circ \text{C}$	
Total Capacitive Charge	$Q_C$	5.8		nC	$V_R = 400 \text{ V}, I_F = 2 \text{ A}$ $di/dt = 500 \text{ A}/\mu\text{S}$ $T_J = 25^\circ \text{C}$	Fig. 5
Total Capacitance	C	175		pF	$V_R = 0 \text{ V}, T_J = 25^\circ \text{C}, f = 1 \text{ MHz}$	Fig. 6
		10.5			$V_R = 200 \text{ V}, T_J = 25^\circ \text{C}, f = 1 \text{ MHz}$	
		8.5			$V_R = 400 \text{ V}, T_J = 25^\circ \text{C}, f = 1 \text{ MHz}$	
Capacitance Stored Energy	$E_C$	0.8		$\mu\text{J}$	$V_R = 400 \text{ V}$	Fig. 7

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

## Thermal Characteristics

Parameter	Symbol	Typ.	Unit
TO-252 Package Thermal Resistance from Junction to Case	$R_{\theta JC}$	3.8	$^\circ\text{C}/\text{W}$

## Typical Performance

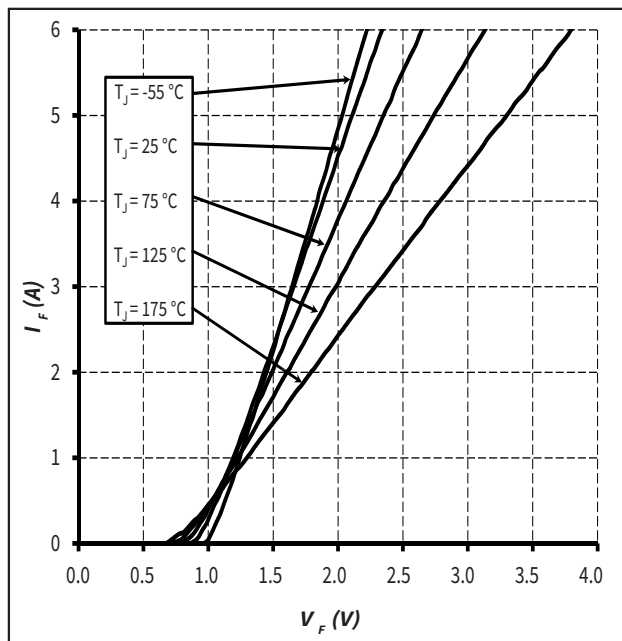


Figure 1. Forward Characteristics

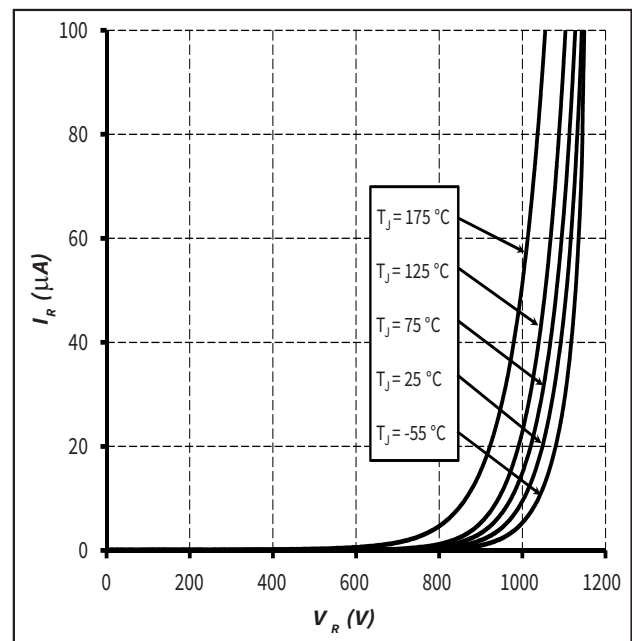


Figure 2. Reverse Characteristics



Typical Performance

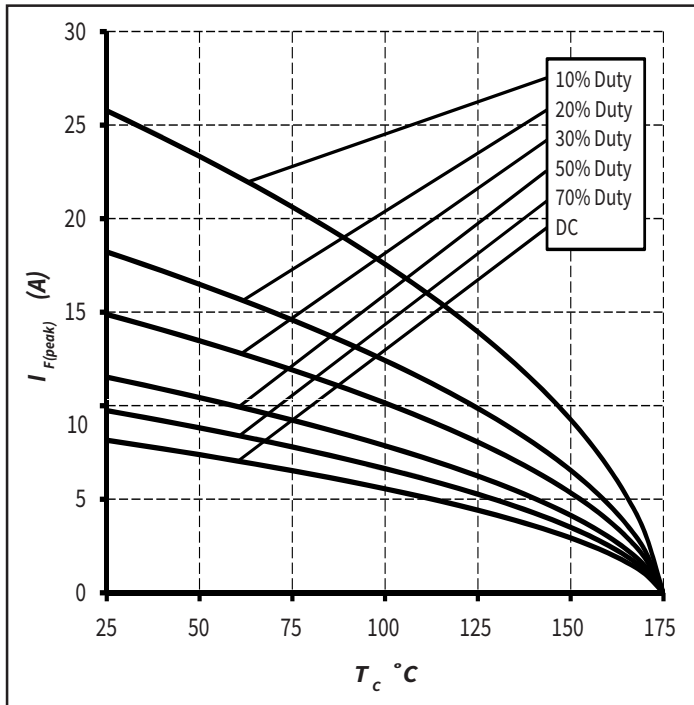


Figure 3. Current Derating

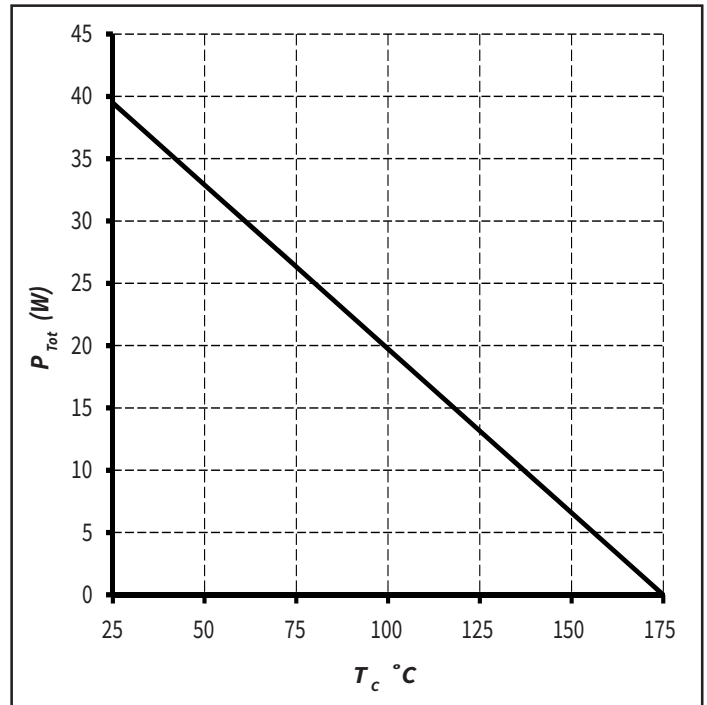


Figure 4. Power Derating

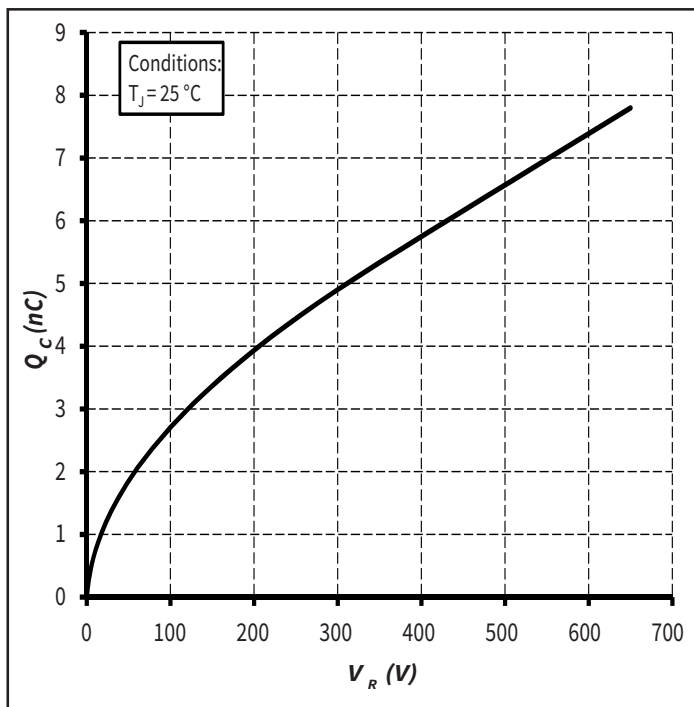


Figure 5. Total Capacitance Charge vs. Reverse Voltage

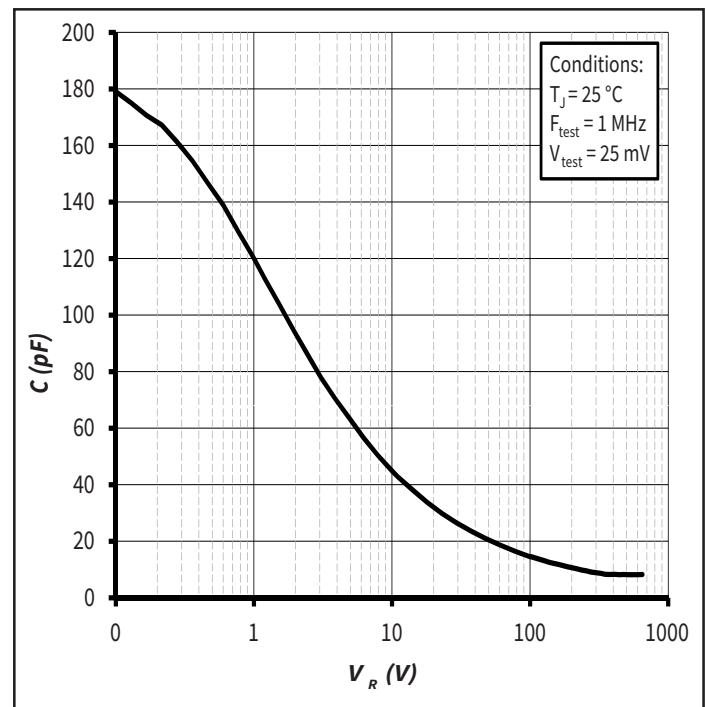


Figure 6. Capacitance vs. Reverse Voltage



Typical Performance

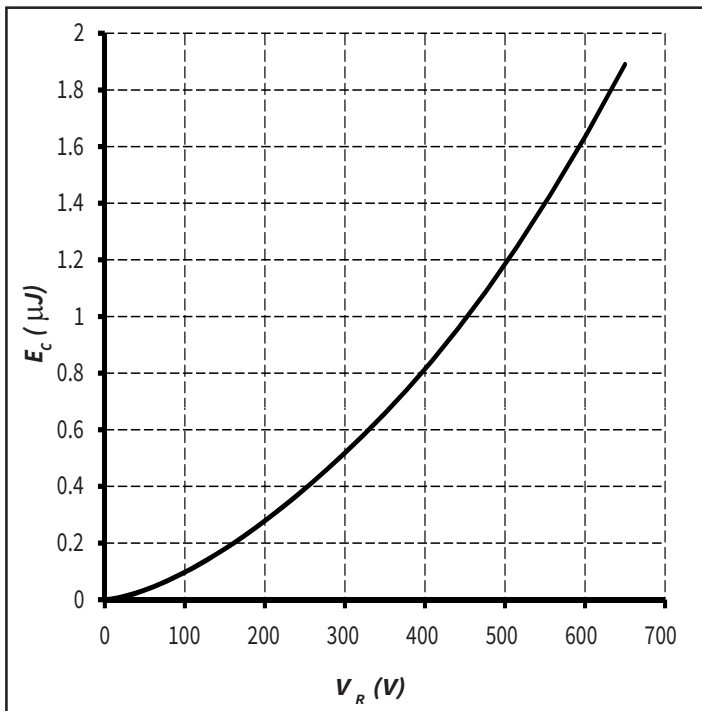


Figure 7. Capacitance Stored Energy

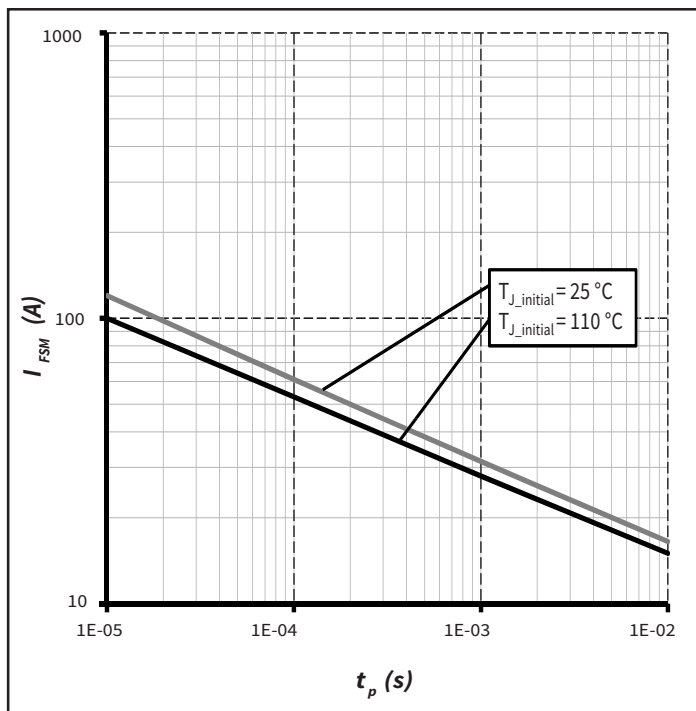


Figure 8. Non-Repetitive Peak Forward Surge Current Versus Pulse Duration (Sinusoidal Waveform)

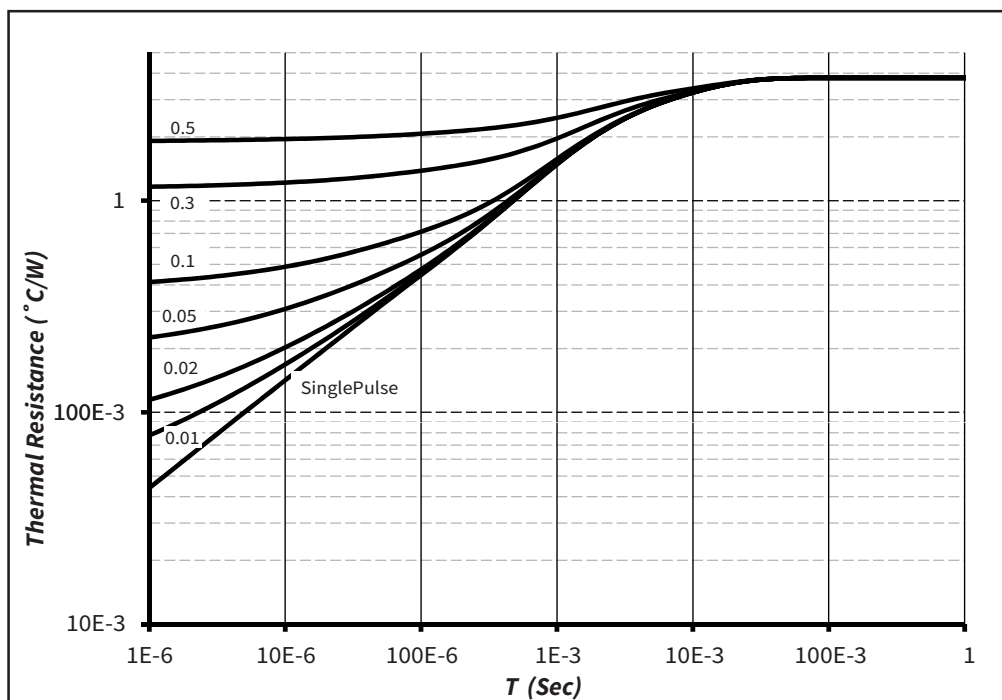
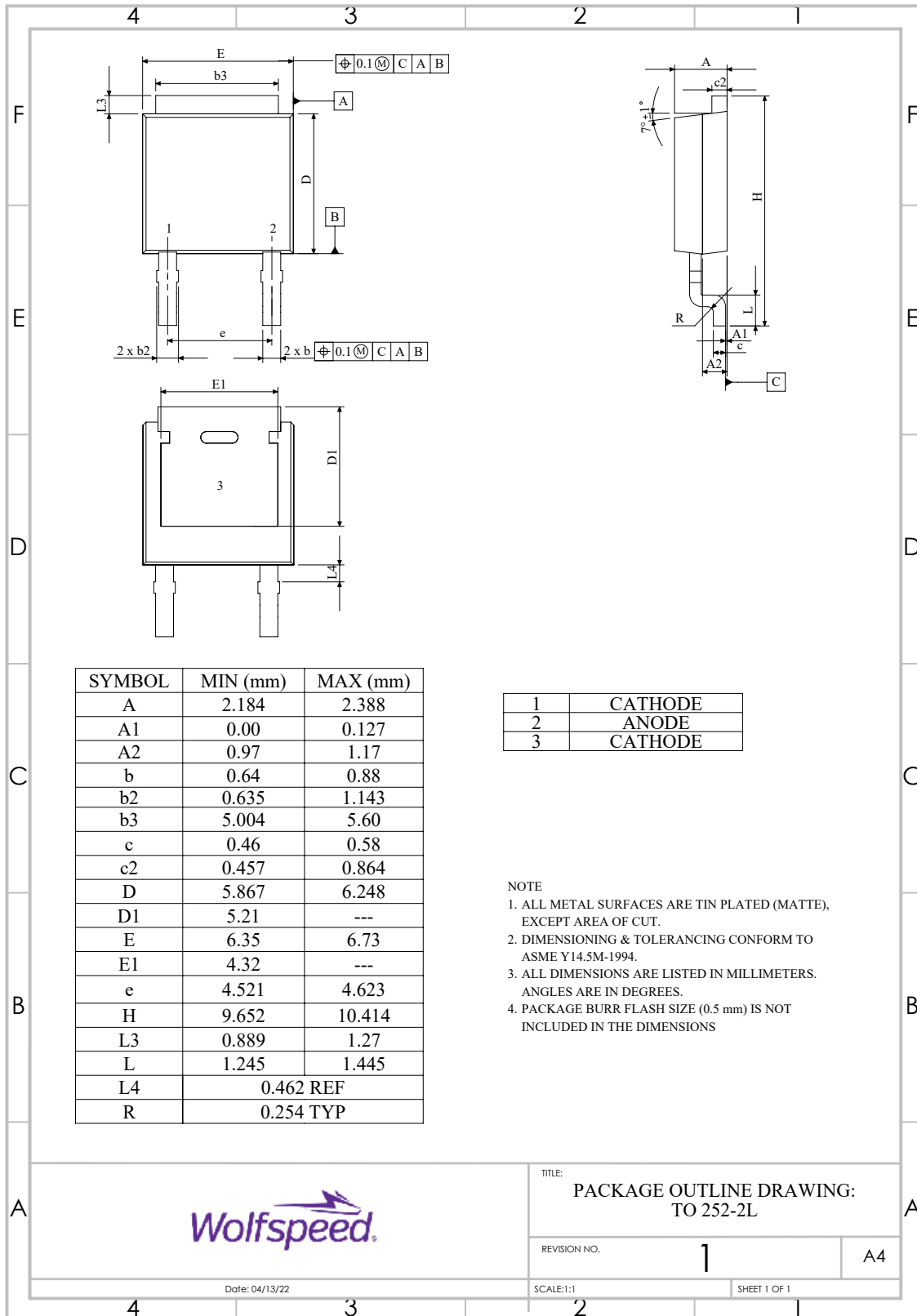


Figure 9. Transient Thermal Impedance



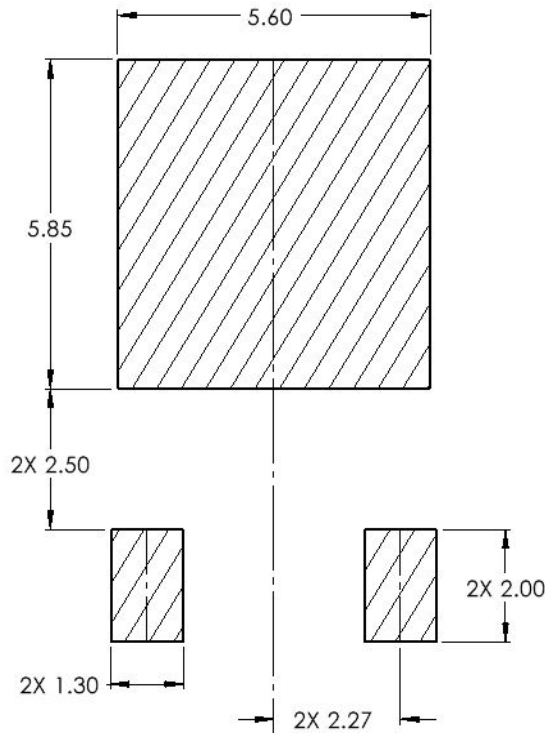
### Package Dimensions

Package: TO-252-2



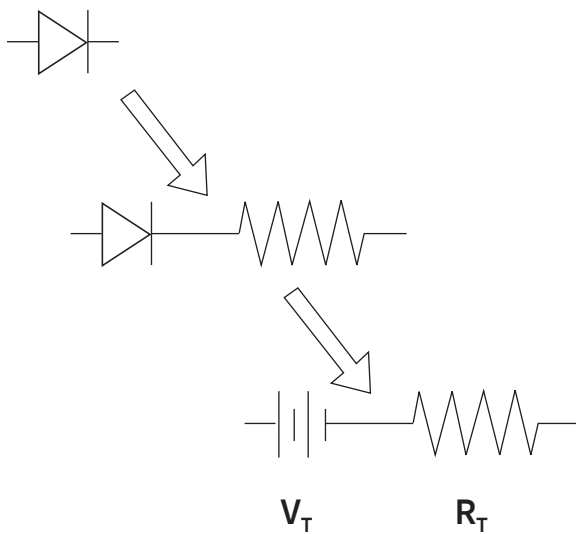


### Recommended Solder Pad Layout



Part Number	Package	Marking
C3D02065E	TO-252-2	C3D02065

### Diode Model



$$V_{fT} = V_T + I_f \cdot R_T$$

$$V_T = 0.98 + (T_j \cdot -1.1 \cdot 10^{-3})$$

$$R_T = 0.18 + (T_j \cdot 1.8 \cdot 10^{-3})$$

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
5	September-2023	Updated Wolfspeed branding, package drawing, and solder pad layout, Removed AEC-Q101 banner
6	October-2023	Corrected solder pad layout



## Notes & Disclaimer

---

This document and the information contained herein are subject to change without notice. Any such change shall be evidenced by the publication of an updated version of this document by Wolfspeed. No communication from any employee or agent of Wolfspeed or any third party shall effect an amendment or modification of this document. No responsibility is assumed by Wolfspeed for any infringement of patents or other rights of third parties which may result from use of the information contained herein. No license is granted by implication or otherwise under any patent or patent rights of Wolfspeed.

Notwithstanding any application-specific information, guidance, assistance, or support that Wolfspeed may provide, the buyer of this product is solely responsible for determining the suitability of this product for the buyer's purposes, including without limitation for use in the applications identified in the next bullet point, and for the compliance of the buyers' products, including those that incorporate this product, with all applicable legal, regulatory, and safety-related requirements.

This product has not been designed or tested for use in, and is not intended for use in, applications in which failure of the product would reasonably be expected to cause death, personal injury, or property damage, including but not limited to equipment implanted into the human body, life-support machines, cardiac defibrillators, and similar emergency medical equipment, aircraft navigation, communication, and control systems, aircraft power and propulsion systems, air traffic control systems, and equipment used in the planning, construction, maintenance, or operation of nuclear facilities.

### **RoHS Compliance**

The levels of RoHS restricted materials in this product are below the maximum concentration values (also referred to as the threshold limits) permitted for such substances, or are used in an exempted application, in accordance with EU Directive 2011/65/EC (RoHS2), as implemented January 2, 2013. RoHS Declarations for this product can be obtained from your Wolfspeed representative or from the Product Documentation sections of [www.wolfspeed.com](http://www.wolfspeed.com).

### **REACH Compliance**

REACH substances of high concern (SVHCs) information is available for this product. Since the European Chemical Agency (ECHA) has published notice of their intent to frequently revise the SVHC listing for the foreseeable future, please contact your Wolfspeed representative to ensure you get the most up-to-date REACH SVHC Declaration. REACH banned substance information (REACH Article 67) is also available upon request.

### **Contact info:**

4600 Silicon Drive  
Durham, NC 27703 USA  
Tel: +1.919.313.5300  
[www.wolfspeed.com/power](http://www.wolfspeed.com/power)