

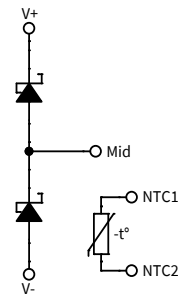
# CAR600M12HN6

1200 V, 600 A, Silicon Carbide, Half-Bridge Rectifier

$V_R$	<b>1200 V</b>
$I_F$	<b>600 A</b>

## Technical Features

- Ultra-Low Loss, High Frequency Operation
- Low Forward Voltage ( $V_f$ ) Drop with Positive Temperature Coefficient
- Zero Reverse Recovery Current
- Zero Forward Recovery Voltage
- Temperature-Independent Switching Behavior



## Applications

- Railway, Traction, and Motor Drives
- EV Chargers
- High-Efficiency Converters / Inverters
- Renewable Energy
- Smart-Grid / Grid-Tied Distributed Generation

## System Benefits

- Enables Compact, Lightweight Systems
- Increased System Efficiency, due to Low Switching & Conduction Losses of SiC
- Reduced Thermal Requirements and System Cost

## Maximum Parameters (Verified by Design)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test Conditions	Note
Maximum Reverse Voltage	$V_{R-Max}$			1200	V		
Continuous Forward Current	$I_F$		908		A	$T_C = 25^\circ\text{C}, T_{VJ} \leq 175^\circ\text{C}$	
			642			$T_C = 90^\circ\text{C}, T_{VJ} \leq 175^\circ\text{C}$	
Maximum Pulsed Forward Current	$I_{F(Pulsed)}$			1200		$t_{Pmax}$ limited by $T_{VJmax}$ $T_C = 25^\circ\text{C}$	
Maximum Virtual Junction Temperature	$T_{VJ}$	-40		175	$^\circ\text{C}$		



### Diode Characteristics (Per Position) ( $T_{vj} = 25^{\circ}\text{C}$ unless otherwise specified)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test Conditions	Note
Diode Forward Voltage	$V_F$		1.5		V	$I_F = 600 \text{ A}$	
			2.0			$I_F = 600 \text{ A}, T_{vj} = 175^{\circ}\text{C}$	
Reverse Current	$I_R$		0.16		mA	$V_R = 1200 \text{ V}, T_{vj} = 25^{\circ}\text{C}$	
			0.90			$V_R = 1200 \text{ V}, T_{vj} = 175^{\circ}\text{C}$	
Total Capacitive Charge	$Q_C$		3.5		mC	$V_R = 800 \text{ V}$	
Total Capacitance	C		45.3		nF	$V_R = 0 \text{ V}, f = 100 \text{ kHz}$	
			3.2			$V_R = 400 \text{ V}, f = 100 \text{ kHz}$	
			2.5			$V_R = 800 \text{ V}, f = 100 \text{ kHz}$	
Thermal Resistance, Junction to Case	$R_{TH-JC}$		0.063			Per position	

Note:

<sup>1</sup>SiC Schottky diodes are majority carrier devices, so there is no reverse recovery charge.



## Module Physical Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test Conditions
Package Resistance, M1 (High-Side)	$R_{1-2}$		106.5		$\mu\Omega$	$T_c = 125^\circ\text{C}$ , Note 1
Package Resistance, M2 (Low-Side)	$R_{2-3}$		126.3			$T_c = 125^\circ\text{C}$ , Note 1
Stray Inductance	$L_{\text{Stray}}$		4.9		nH	Between DC- and DC+, $f = 10 \text{ MHz}$
Case Temperature	$T_c$	-40		125	$^\circ\text{C}$	
Mounting Torque	$M_s$	3	4.5	5	N-m	Baseplate, M6 bolts
		0.9	1.1	1.3		Power Terminals, M4 bolts
Weight	$W$		167		g	
Case Isolation Voltage	$V_{\text{isol}}$	4			kV	AC, 50 Hz, 1 minute
Comparative Tracking Index	CTI	600				
Clearance Distance		13.07			mm	Terminal to Terminal
		6.00				Terminal to Heatsink
Creepage Distance		14.27				Terminal to Terminal
		12.34				Terminal to Heatsink

## NTC Characteristics ( $T_{\text{NTC}} = 25^\circ\text{C}$ unless otherwise specified)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
Resistance at $25^\circ\text{C}$	$R_{25}$		4700		$\Omega$	
Tolerance of $R_{25}$			$\pm 1$		%	
Beta Value for $25^\circ\text{C}$ to $85^\circ\text{C}$	$B_{25/85}$		3435		K	
Beta Value for $0^\circ\text{C}$ to $100^\circ\text{C}$	$B_{0/100}$		3399		K	
Tolerance of $B_{25/85}$			$\pm 1$		%	
Maximum Power Dissipation	$P_{\text{Max}}$		50		mW	

## Steinhart & Hart Coefficients for NTC Resistance & NTC Temperature Computation (T in K)

$$\ln\left(\frac{R}{R_{25}}\right) = A + \frac{B}{T} + \frac{C}{T^2} + \frac{D}{T^3}$$

$$\frac{1}{T} = A_1 + B_1 \ln\left(\frac{R}{R_{25}}\right) + C_1 \ln^2\left(\frac{R}{R_{25}}\right) + D_1 \ln^3\left(\frac{R}{R_{25}}\right)$$

A	B	C	D
-1.289E+01	4.245E+03	-8.749E+04	-9.588E+06

$A_1$	$B_1$	$C_1$	$D_1$
3.354E-03	3.001E-04	5.085E-06	2.188E-07



Typical Performance

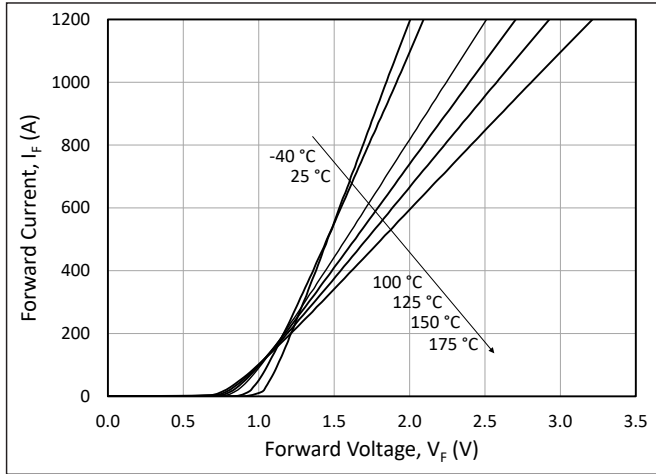


Figure 1. Typical Forward Characteristics

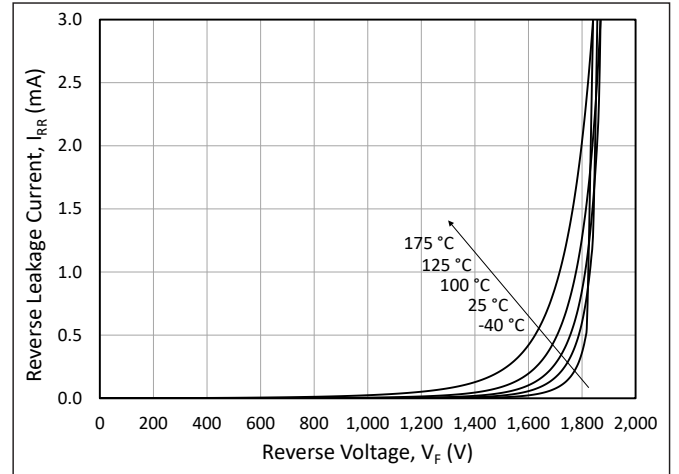


Figure 2. Typical Reverse Characteristics

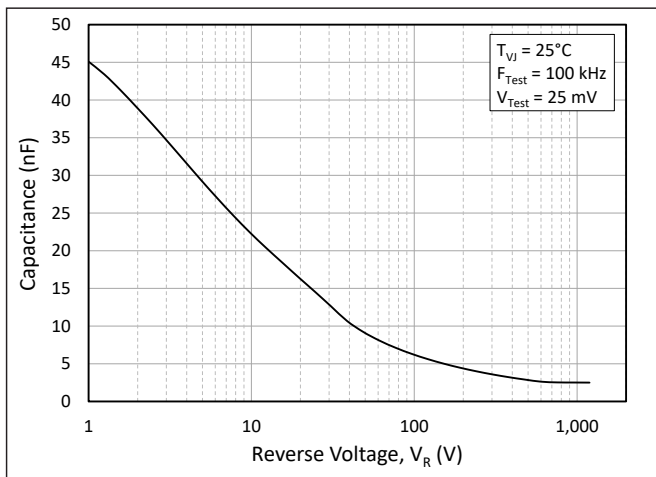


Figure 3. Typical Capacitance vs. Reverse Voltage

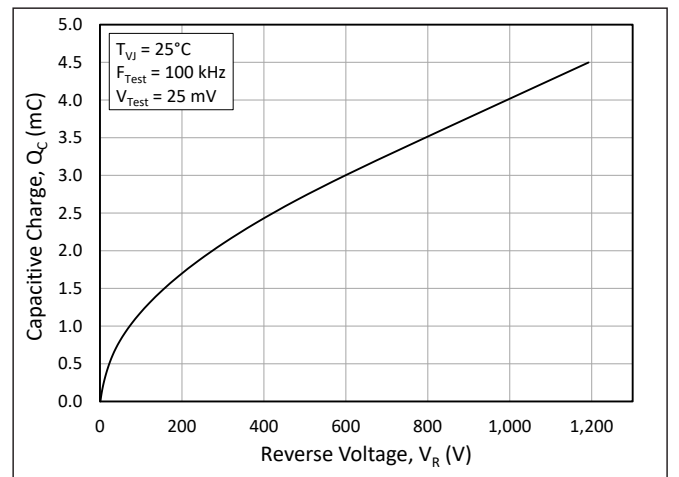


Figure 4. Typical Capacitive Charge vs. Reverse Voltage

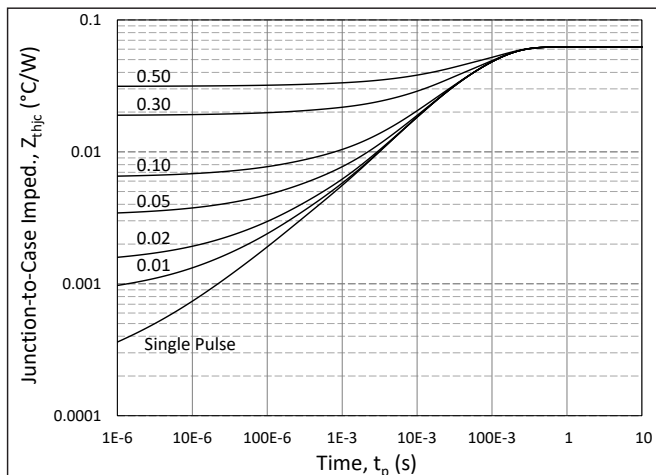


Figure 5. Diode Junction to Case Transient Thermal Impedance,  $Z_{thJC}$  (°C/W)

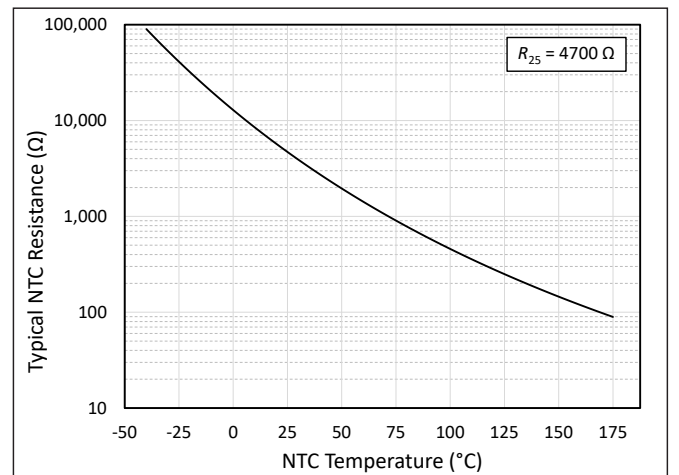
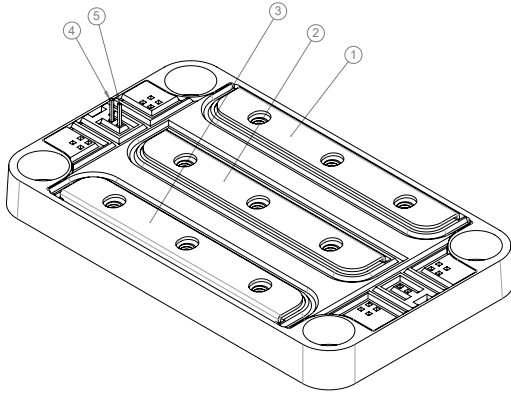


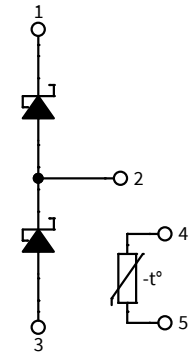
Figure 6. NTC Resistance vs. NTC Temperature



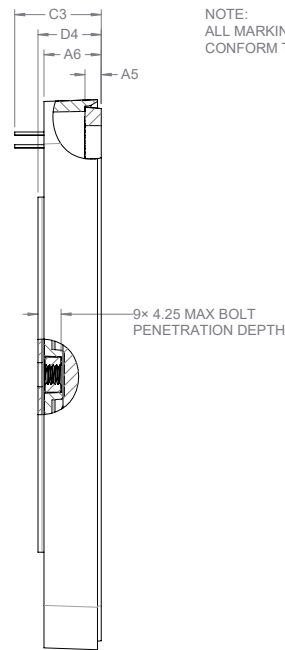
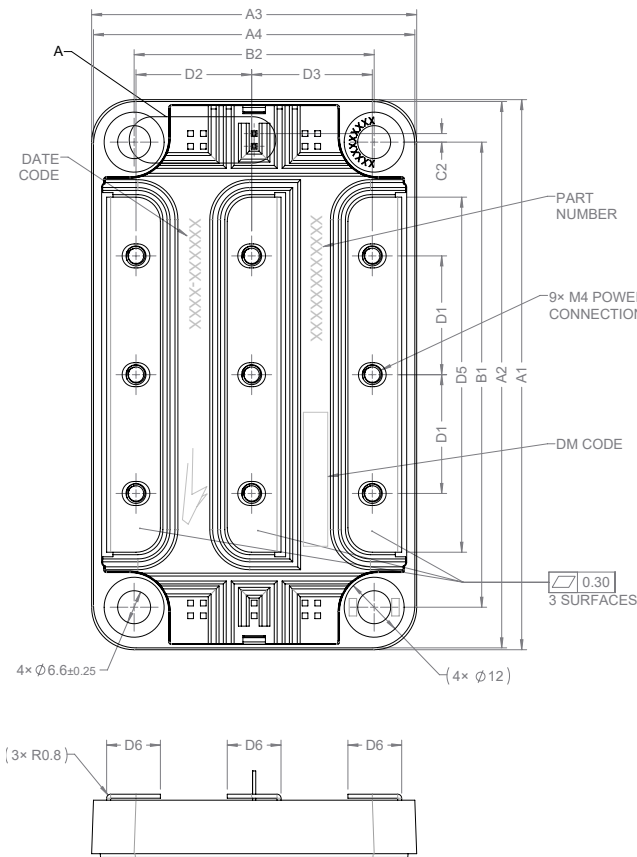
**Schematic and Pin Out**



PIN OUT SCHEME	
PIN	LABEL
①	V+
②	Mid
③	V-
④	NTC1
⑤	NTC2

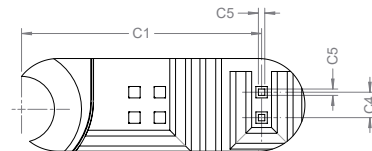


**Package Dimension (mm)**



NOTE:  
ALL MARKINGS SHALL  
CONFORM TO PRC-00786.

DIMENSION TABLE		
SYMBOL	DIMENSION	TOLERANCE
A1	110.00	±0.60
A2	109.25	±0.60
A3	65.00	±0.60
A4	64.25	±0.60
A5	3.25	±0.30
A6	11.45	±0.60
B1	93.00	±0.30
B2	48.00	±0.30
C1	24.00	±0.40
C2	1.71	±0.40
C3	17.30	±0.50
C4	2.54	±0.30
C5	0.64	±0.30
D1	23.75	±0.50
D2	23.13	±0.50
D3	24.13	±0.50
D4	12.20	±0.50
D5	71.00	±0.30
D6	10.75	±0.30



DETAIL A  
SCALE: 4:1



## Supporting Links & Tools

### Evaluation Tools & Support

- [CAR600M12HN6 PLECS Model](#)
- [SpeedFit 2.0 Design Simulator™](#)
- [Technical Support Forum](#)

### Application Notes

- [CPWR-AN35: 62mm Thermal Interface Material Application Note](#)
- [CPWR-AN39: KIT-CRD-CIL12N-HM User Guide](#)



## 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 Cree. No communication from any employee or agent of Cree or any third party shall effect an amendment or modification of this document. No responsibility is assumed by Cree 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 Cree.

Notwithstanding any application-specific information, guidance, assistance, or support that Cree 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 Cree representative or from the Product Documentation sections of [www.cree.com](http://www.cree.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 Cree 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)