

VI Chip® High Voltage BCM® Bus Converter 6123 Evaluation Board User Guide

Written by: Peter Makrum
Applications Engineer
November 2013



Contents	Page
<i>Important Notice</i>	1
<i>Introduction</i>	1
<i>Features</i>	2
<i>Using the High Voltage BCM Bus Converter 6123 Evaluation Board</i>	3
+IN, -IN	5
+OUT, -OUT	5
Output Voltage Measurement Jack (J104)	5
Input Current Measurement	5
Output Current Measurement	5
Temperature Monitor (TM)	5
Enable Control (EN)	5
Auxiliary Voltage Source (VAUX)	5
<i>Input Filter Details</i>	6
<i>Thermal Considerations</i>	7
<i>Bill of Materials</i>	9
<i>Ordering Information</i>	10



IMPORTANT NOTICE:

Hazardous voltages are present on the HV BCM Evaluation Board under power. PERSONAL CONTACT WITH LINE VOLTAGE MAY RESULT IN SEVERE INJURY, DISABILITY, OR DEATH. IMPROPER OR UNSAFE HANDLING OF THIS BOARD MAY RESULT IN SERIOUS INJURY OR DEATH.

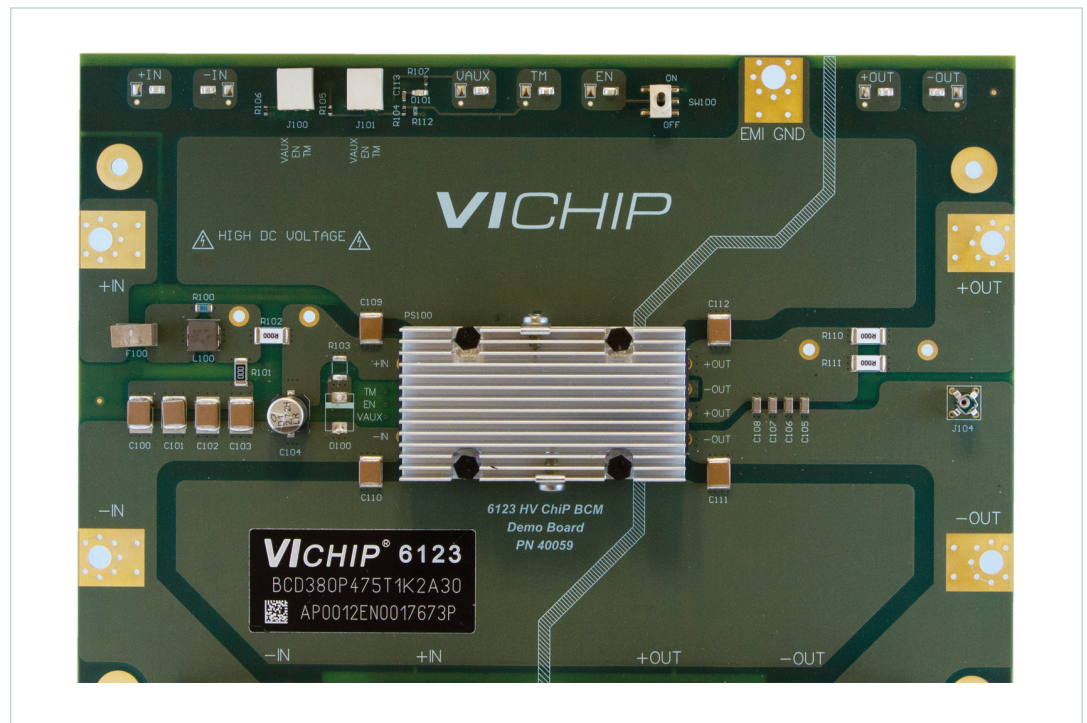
Read the precautions below entirely BEFORE using the HV BCM Evaluation Board. Do not operate the evaluation board unless you have the appropriate safety precautions in place on your bench to guarantee safety.

The list below is not comprehensive and is not a substitute for common sense and good practice.

- During operation, the power devices and surrounding structures can be operated safely at high temperatures.
- Remove power and use caution when connecting and disconnecting test probes and interface lines to avoid inadvertent short circuits and contact with hot surfaces.
- When testing electronic products always use approved safety glasses. Follow good laboratory practice and procedures.
- Avoid creating ground loops when making measurements of the isolated input or output voltage.
- Care should be taken to protect the user from accidental contact when under power.
- Care should be taken to avoid reversing polarities if connecting to the opposite (solder) side of the board.
- The Customer Evaluation Board described in this document is intended to acquaint the reader with the benefits and features of high voltage distribution. They are not designed to be installed in end-use equipment.
- Refer to the specific HV BCM module data sheet for electrical details.

Introduction

This evaluation board offers a convenient means to evaluate the performance of Vicor's HV BCM Bus Converter 6123 and has been optimized for user convenience. Refer to the appropriate data sheet for performance and operating limits. Data sheets are available at vicorpower.com.

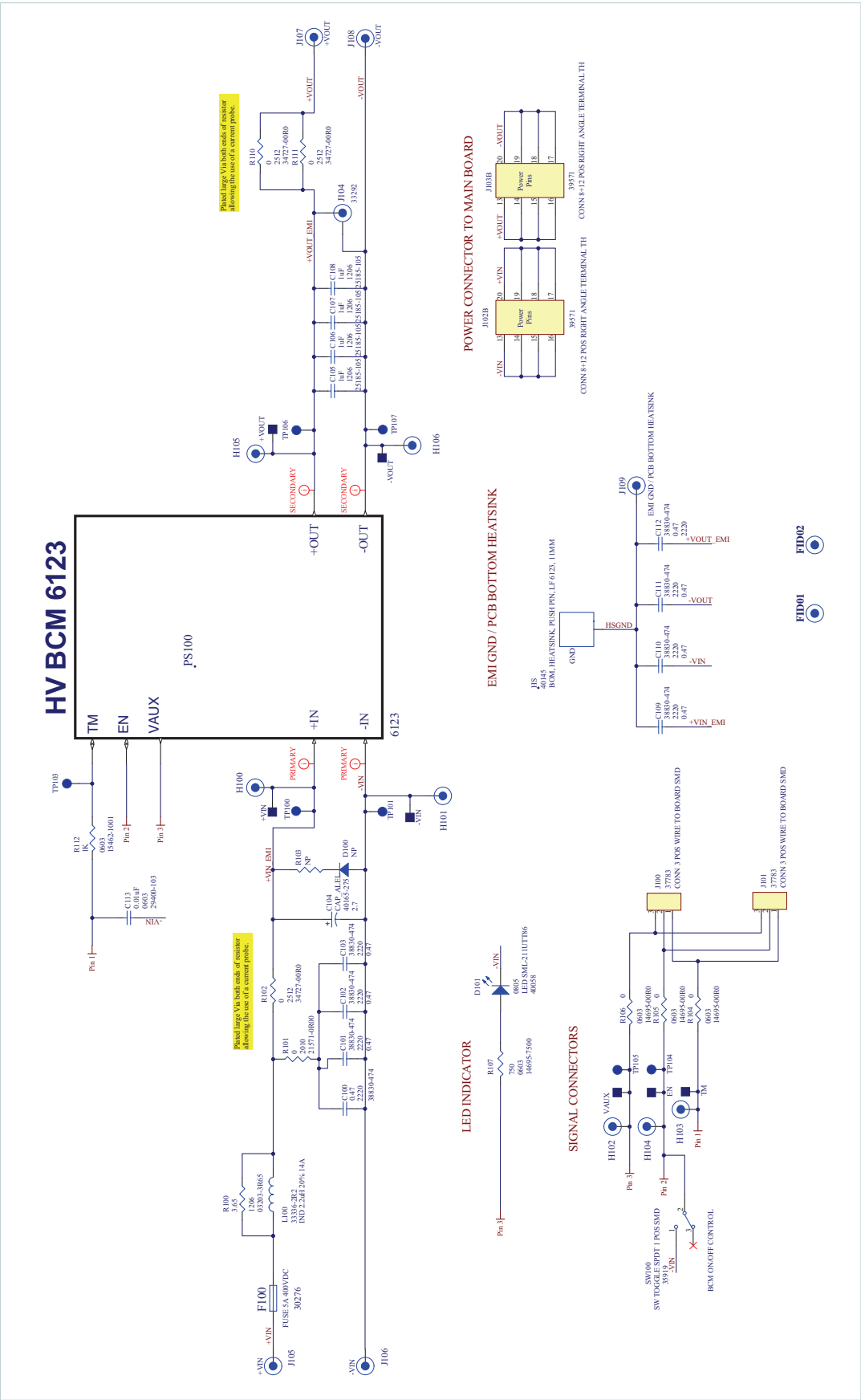


Features

1. Underbelly cooling planes in addition to surface mounted heat sink
2. Input and output accommodation for a current probe wire loops
3. Input, output and signals Kelvin test point
4. Oscilloscope output voltage probe jack for voltage and ripple measurements
5. Input and output board-to-board connector footprint reserved for future use
6. Ring lug or solder connections

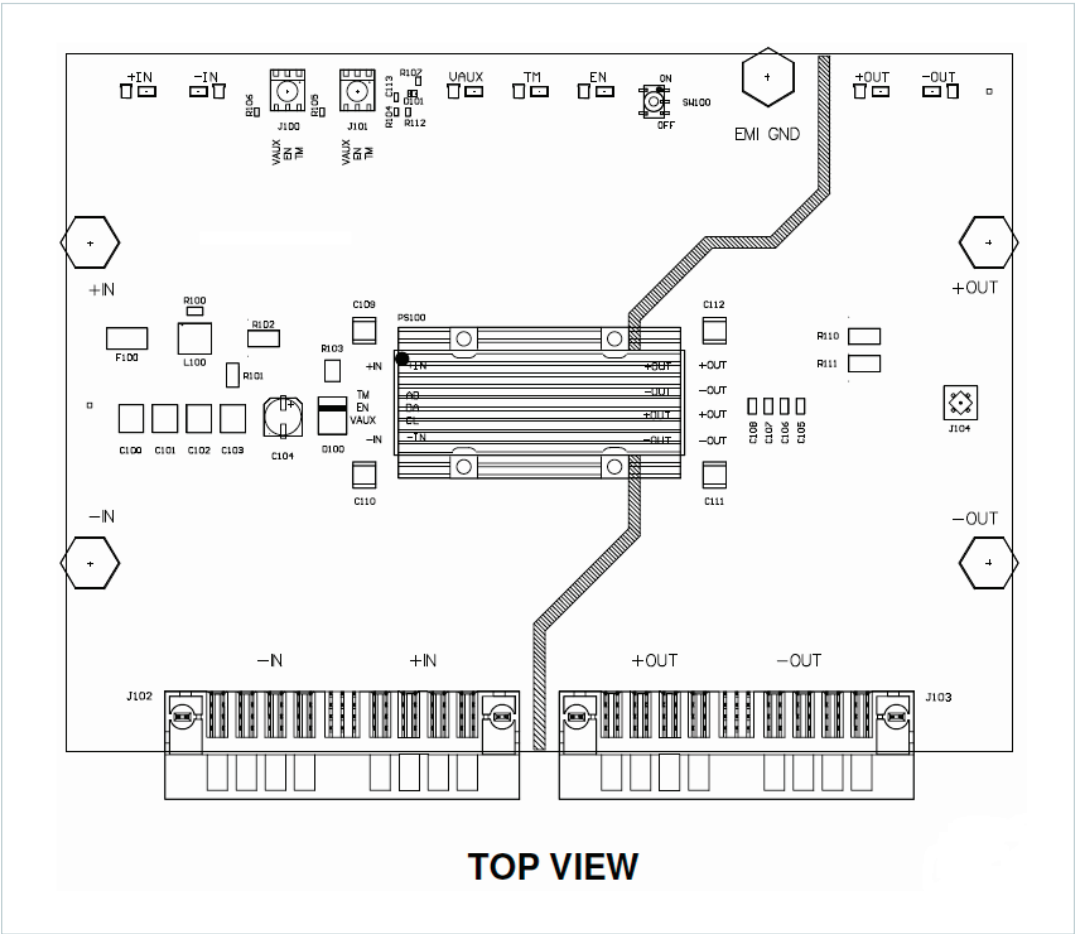
Using the High Voltage BCM[®] Bus Converter 6123 Evaluation Board

Figure 1.
Eval Board Schematic



Using the High Voltage BCM® Bus Converter 6123 Evaluation Board (Cont.)

Figure 2.
Eval Board Assembly Drawing



Using the High Voltage BCM® Bus Converter 6123 Evaluation Board (Cont.)

+ IN, -IN

Connect a high-quality, low-noise power supply to the +IN and -IN terminals of the evaluation board. The interconnect leads should be capable of the rated DC current and as short as possible. Additional capacitance may be required on the evaluation board to compensate for impedances in the interconnect leads and source supply. It is important to remember that noise from the source and voltage drops, will appear at the output of the bus converter multiplied by its K factor. Test points +IN and -IN can be used to monitor the input and are located on the PCB top left corner.

+ OUT, -OUT

An electronic or passive load could be connected to +OUT and -OUT terminals. Most commercially available electronic loads do not have current slew rates capable of fully exercising the BCM module. Test points +OUT and -OUT can be used to monitor the output and are located on the PCB top right corner.

Output Voltage Measurement Jack (J104)

This connector is kelvin connected to the module output pins providing accurate measurements of the output voltage ripple of the BCM module. Many types of scope probes may be directly connected to this point.

Input Current Measurement

A current probe can be used when adding a wire loop to R102 side VIAs and removing R102 resistor. Input bulk capacitor C104 is downstream of this measurement point.

Output Current Measurement

A current probe can be used when adding a wire loop to R110 and R111 side VIAs and removing both R110 and R111 resistors.

Temperature Monitor (TM)

The BCM TM pin outputs a 250 kHz PWM signal. A 1 k Ω and a 10 nF low pass filter precedes the TM test point for measurement simplicity.

Enable Control (EN)

Connecting the BCM EN pin to -IN will disable the module. SW100 can be used to disable for convenience. During normal operation or while V_{IN} is applied this pin will be high if read using a DMM through the EN test point.

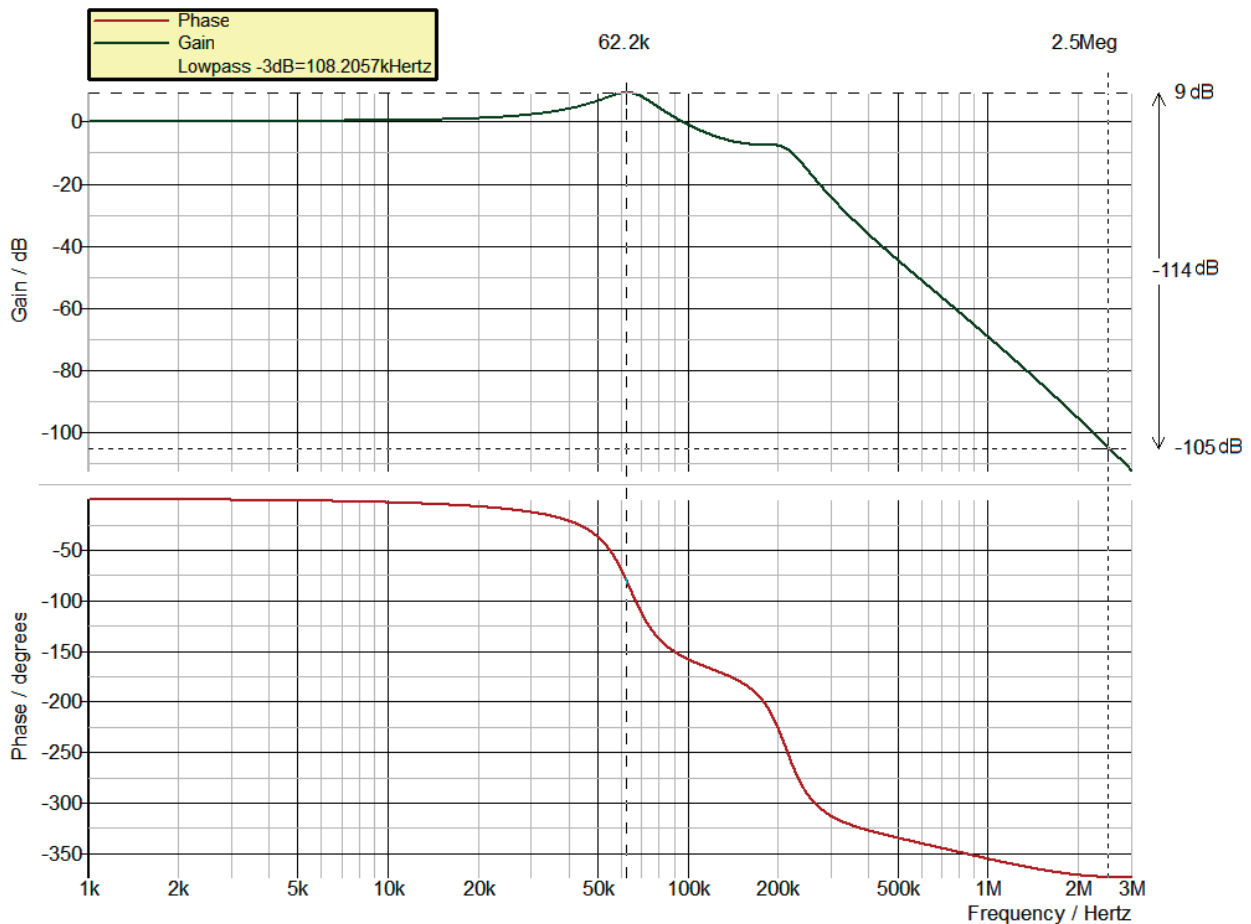
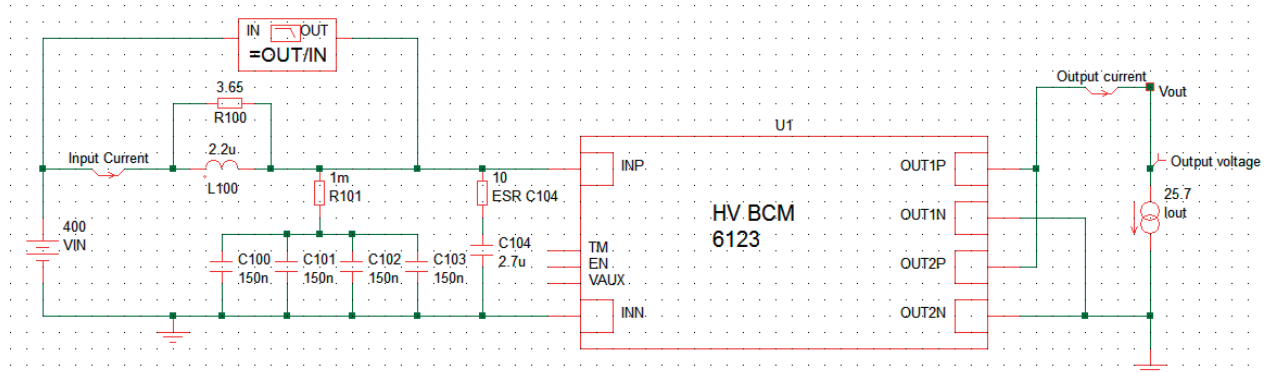
Auxiliary Voltage Source (VAUX)

The BCM VAUX can be used as a fault flag as well as an auxiliary 3.3 V up to 4 mA current capability. An LED is placed on this pin indicating operation. A test point is also provided.

Input Filter Details

It is important to remember the fast response of most BCM® modules can readily show the limitations of the source, load, and associated wiring connected to the evaluation board. Care should be exercised to minimize stray source and load impedances in order to fully exercise the module. The evaluation board is equipped with an input filter as simulated in Figure 3.

Figure 3.
Eval Board Assembly Drawing



Thermal Considerations

A fan blowing across the evaluation board and heat sink assembly is required during operation. It is recommended to use a typical (4 x 4) inches fan (similar to an EBM-PAPST 3212). It is recommended to place the evaluation board using the supplied rubber feet about 0.4 inches off a flat surface. As per the example below, the board was tested using a fan about 4 inches from the board. The maximum internal temperatures of the BCM® at full rated power should remain below 80°C at 25°C ambient air.

Figure 4.
Double Side Cooling and Leads
Thermal Model

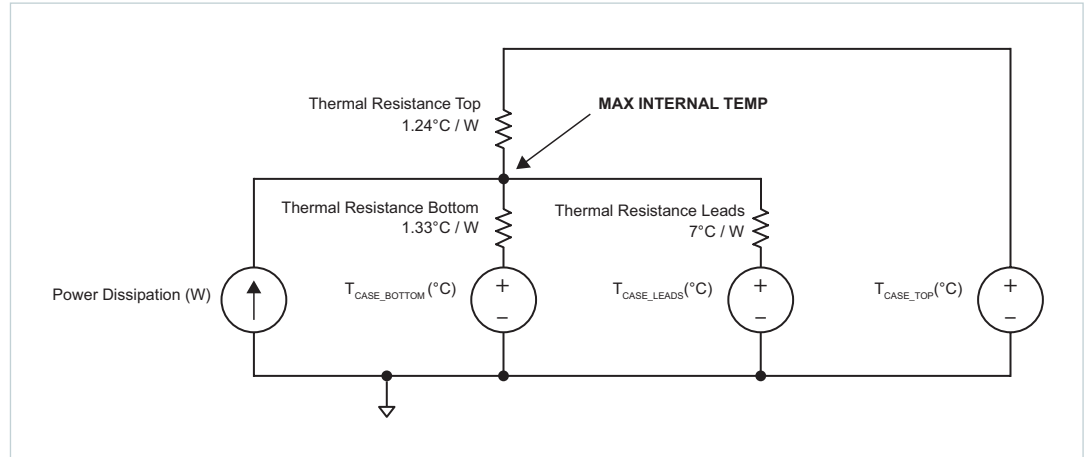
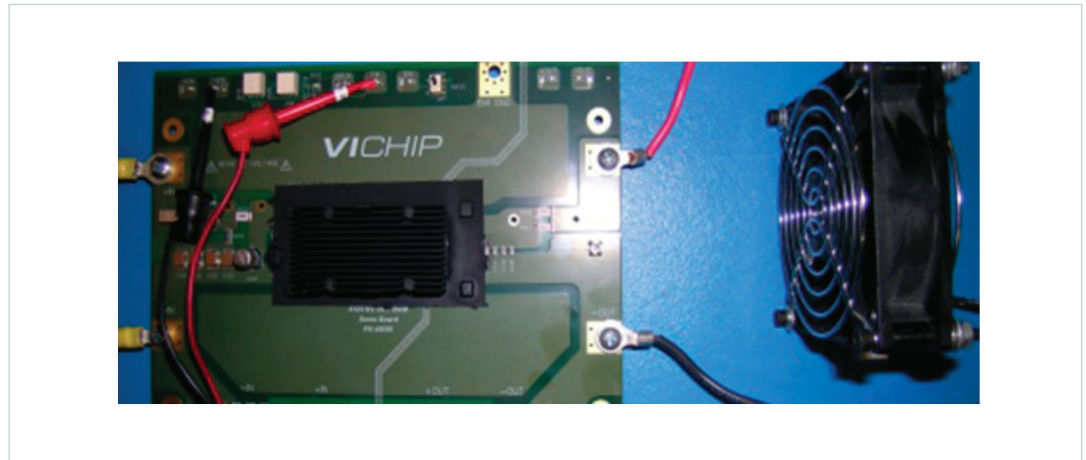


Figure 5.
Example Setup



Top airflow was measured above the edge of the midpoint of the output side of the PCB, over the oscilloscope probe terminal. Bottom airflow was measured under the edge of the midpoint of the output side of the PCB.

IR images were taken while evaluating several fans to guarantee full power operation within data sheet thermal specification. Figure 6 shows one case where an off-the-shelf fan “EBM-PAPSTJH3” was set to 12 V_{IN}. The measured top airflow is 1,500 LFM and bottom is 2,250 LFM. The internal temperature is estimated to be 66°C. Figure 7 shows a top surface IR image max of 40°C. Figure 8 shows another case using the same fan where V_{IN} is set 6 V. In this case, the measured top airflow is 1,000 LFM and bottom is 1,750 LFM. The internal temperature is estimated to be 64°C. Figure 8 a top IR image max of 44°C.

Thermal Considerations (Cont.)

Figure 6.

IR with EBM-PAPSTJH3 Fan
Fan Input 12 V, Top 1,500 LFM,
Bottom 2,250 LFM

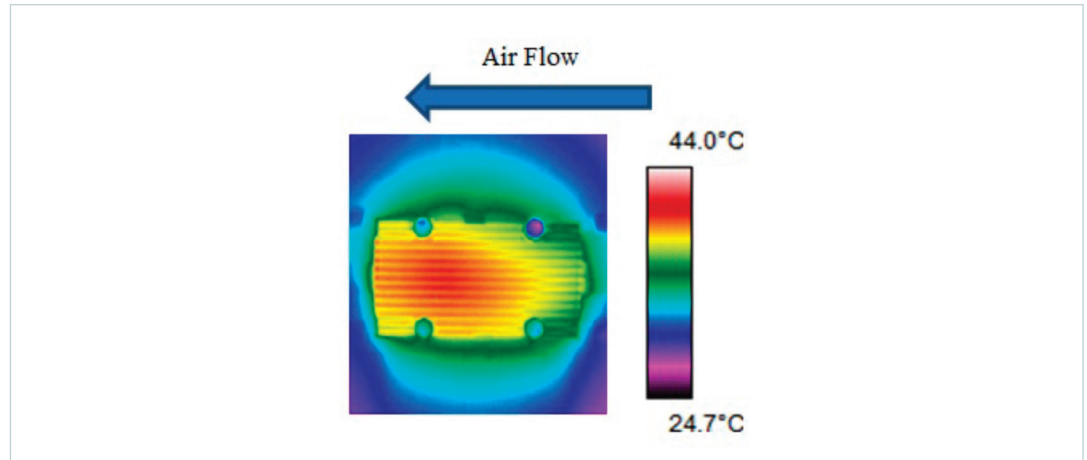
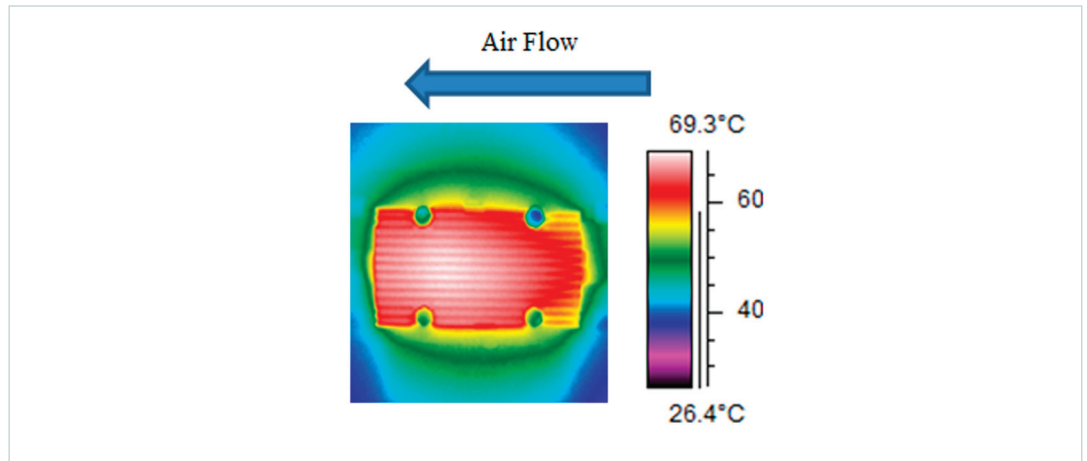


Figure 7.

IR image with EBM-PAPSTJH3 Fan
Fan Input 6 V, Top 1,000 LFM,
Bottom 1,750 LFM



Bill of Materials

Table 1.

Reference Designator	Description	Vicor Part Number
+IN, -IN, TM, EN, VAUX, +OUT, -OUT	TEST POINT, SURFACE MOUNT	27995
C100, C101, C102, C103, C109, C110, C111, C112	CAP X7T 0.47 μ F 10% 630 V 2,220	38830-474
C104	CAP ALEL 2.7 μ F 20% 500 V 8 x 10	40165-275
C105, C106, C107, C108	CAP X7R 1.0 μ F 10% 100 V 1,206	25185-105
C113	CAP X7R 0.010 μ F 10% 50 V 0603	29400-103
D101	LED SML-211UTT86 0805	40058
HARDWARE	BOM CONN KIT ARRAY EVAL BRD	26647
HS	BOM, ASSEMBLY, 6123 LF PUSH PIN HEAT SINK	40145
F100	FUSE 5 A 125 V PCD-5-R	30276
J100, J101	CONN 3 POS WIRE TO BOARD SMD	37783
J104	JACK VERTICAL MECH THRU HOLE	33292
L100	IND 2.2 μ H 20% 14 A 2,525 0.095HT	33336-2R2
PAD1, PAD2, PAD3, PAD4	BUMPER, ADHESIVE-BACKED, RECESSED	38269
PCB	SINGLTD PCB 6123 CHIP HV BCM EVAL BRD	40059
R100	RES 3.65 Ω 1/4 W 1% 1,206	03203-3R65
R101	RES 0 Ω 3/4 W 5% 2,010	21571-0R00
R102, R110, R111	RES 0 Ω 2 W 2,512	34727-00R0
R104, R105, R106	RES 0 Ω JUMPER 1 A 0603	14695-00R0
R107	RES 750 Ω 1/10 W 5% 0603	14695-7500
R112	RES 1 k Ω 1/10 W 1% 0603	15462-1001
SW100	SW TOGGLE SPDT 1 POS SMD	35919

Ordering Information

To order evaluation boards, substitute BCM with BCD in part number.

For any questions, comments or further design support, please contact your local Field Applications Engineer.

Go to: <http://www.vicorpower.com/contact-us> for ordering information and application support.

The Power Behind Performance