

PMBus™ 2361 and 6123 ChiP™ BCM® Bus Converter Evaluation Board User Guide

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Introduction

The 2361 and 6123 Converter housed in a Package (ChiP) Bus Converter Module (BCM) evaluation board described in this document is designed to be used with the BCM family of isolated, fixed-ratio, DC-DC Bus converters. The Evaluation board is used for both the analog control and digital control BCM products.

The focus of this document is to assist the user in evaluating the digitally-controlled version of the BCM family.

The BCM evaluation board can be configured for various enabling and fault-monitoring schemes, as well as to exercise various loading conditions depending on the application requirements. The evaluation board can be used to evaluate BCMs in either a stand-alone configuration, or as an array of modules.

It is important to remember the fast response of BCMs can readily show the limitations of the source, load and associated wiring connected to the evaluation board. Care should be exercised to minimize the stray-source and load impedance in order to fully exercise the BCM.

Refer to the appropriate data sheet for performance and operating limits. Data sheets are available at www.vicorpower.com.



IMPORTANT NOTICE:

Hazardous voltages are present on the 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 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.
- Never use a jumper in place of the fuse.
- 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 product evaluation boards described in this document are designed for general laboratory evaluation, and are not suitable for installation in end-user equipment.
- Refer to the specific BCM module data sheet for electrical, thermal and mechanical product details.

This board provides a convenient way to evaluate or demonstrate the performance of the Vicor BCM products. Kelvin connections are provided for accurate voltage measurements on power nodes. Sockets are provided to permit quick installation and changing of bulk-filtering capacitors. The evaluation board also provides lugs for input / output connections, test points and sockets for easy connection to standard test equipment and a high-performance air-cooled heat sink assembly. USB Connectors are in place for use with a graphical user interface which provides digital access to the bus converter.

Enable Options

1. Apply input voltage greater than the BCM under voltage lockout. (Default)
2. PMBus™ control using the BCM Digital Supervisor D44TL1A0.
3. On-board mechanical switch.
4. External control using available test point.

Fault Monitor Options

1. Vicor BCM PMBus application: Graphical user interface provides the BCM status.

Contents

The evaluation board arrives with the following contents:

- 1 x BCM® evaluation board
- 1 x Vicor BCM PMBus™ adapter
- 1 x Top heat sink pre-installed, as well as a bottom of the ChiP™ heat sink when applicable
- 1 x hardware kit:
 - 1 x through hole aluminum-electrolytic output capacitor (C121)
 - 3 x Connector Receptacle 8 position
 - 2 x Connector Socket 2 position
 - 5 x size 10 screws, lugs and washers

Features

The BCM evaluation board has the following features:

1. Input and output lugs for source and load connections.
2. Appropriately-rated input fuse.
3. Input aluminum-electrolytic capacitor for additional source decoupling.
4. Toggle switch for enabling and disabling the BCM from an isolated BCM (EN) enable / disable pin.
5. Connectors used to extend the on-board Digital Supervisor UART signals to additional BCMs in parallel.
6. Connector used to extend the on-board Digital Supervisor PMBus signals to additional Digital Supervisors or an external host.
7. Connector allowing digital control and monitoring through a personal computer.
8. Oscilloscope probe jack for accurate, high-frequency output voltage measurement.
9. Basic output filtering footprint, including sockets for an additional through-hole output aluminum electrolytic capacitor.
10. Kelvin voltage test points for all power pins.

Board Description

The following section provides a detailed description of the evaluation board components and function including test points and sockets.

General Components

1. Input lugs (+V_{IN}, -V_{IN}):
 - Use for making connection to the input source.
 - This board does not contain voltage polarity protection. Check for proper polarity before input source power up.
 - Noise from the source and voltage drops will appear at the output of the bus converter multiplied by its transformation ratio (K). The K factor is the ratio of the secondary-output voltage to the primary-input voltage (V_{SEC_OUT} / V_{PRI_IN}).
 - Sized for #10 hardware.

-
2. Input fuse (F101 & F102):
 - The fuse is meant to protect against excessive damage in a short-circuit event.
 - The fuse is appropriately rated for the BCM® model installed on the board.
 3. Input filtering:
 - Aluminum electrolytic input capacitor (C101).
 4. Output lugs (+V_{OUT}, -V_{OUT}):
 - Use these lugs to connect the converter output to the load.
 - Sized for #10 hardware.
 5. Chassis lug (CHASSIS_GND):
 - Use this lug to connect the heat sink to earth ground for safety as the heat sink will be floating otherwise.
 - Sized for #10 hardware.
 6. Output oscilloscope probe Jack (J101):
 - Used for making accurate scope measurements of the output voltage (e.g., ripple). The jack is directly compatible with many common passive voltage probe models. Remove the grounding lead and insulating barrel of the probe and insert the probe tip and barrel directly into the jack, ensuring that the probe tip sits in the center socket of the jack.
 - To avoid the risk of an inadvertent short circuit, do not attempt to install while power is applied.
 - J101 is Kelvin connected to the module output pins. The effect of the output capacitors will not be noticeable.
 7. Output filter:
 - 10 x 1206 output ceramic capacitors footprint provision (C103, C104, and C113 – C120).
 - Socket (C121) can be used for easy installation of an aluminum electrolytic output capacitor included in the hardware kit with the evaluation board.
 8. Isolation barrier:
 - R106 – R108 each are a 2010 package.
 - The provided footprint can be used as a convenient means to short the isolation barrier or provide an additional AC path using capacitors.

Vicor Components on Board

9. Communication enabled BCM (PS01):
 - The Bus Converter module (BCM) is a Sine Amplitude Converter (SAC™), operating from a primary bus to deliver an isolated fixed ratio secondary voltage.
 - The BCM is a low-noise, fast-transient response bus converter.
 - The BCM provides AC impedance beyond the bandwidth of most downstream regulators, allowing input capacitance normally located at the input of a regulator to be located at the input of the BCM module.
 - The BCM SER-IN and SER-OUT pins make up the Universal Asynchronous Receiver / Transmitter (UART).
 - The BCM, combined with the Digital Supervisor D44TL1A0 and Digital Isolator I13TL1A0, provide a secondary referenced PMBus™ compatible telemetry and control interface.

10. Digital Isolator (U201):

- The Digital Isolator I13TL1A0 is a three-channel passive signal isolator.
- The Digital Isolator I13TL1A0 is a required component used to isolate the BCM UART primary referenced signals.
- The Digital Isolator I13TL1A0 transmission channels draw their internal bias circuitry directly from their respective input signal.
- All signals passing through the Digital Isolator are inverted and must be referenced to the Digital Supervisor secondary-referenced ground (SGND).
- Provision for in-system signal common-mode filtering is available through (L201 – L204).

11. Digital Supervisor (U202):

- The Digital Supervisor D44TL1A0 is a digital power-system supervisor which provides a communication interface between a host processor and up to four ChiP™ BCM Bus Converter Modules.
- The Digital Supervisor acts as a communication bridge to a host via a PMBus™ compatible interface.
- The Digital Supervisor allows a host to configure, monitor and set protection limits of each PMBus connected BCM®.

D44TL1A0 Required Ancillary Components

12. Externally isolated low-voltage bias input connectors (J206) or (J205):

- Both connectors' purpose is to power the Digital Supervisor (U202) through the VDDDB pin.
- The Micro USB type B connector (J206) is designed to mate with a 5V travel adapter.
- The two-pin connector (J205) in combination with the supplied connector Socket 2 position can be used as an alternate input source.

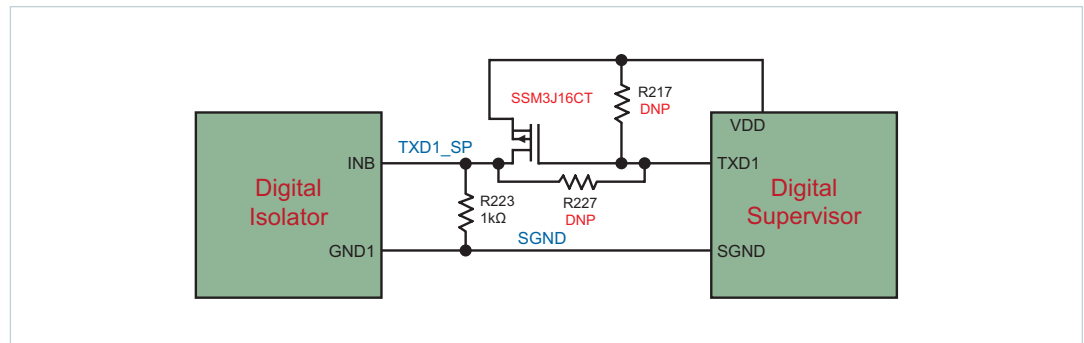
13. Flip-flop (U203):

- (U203) is low-power D-type flip-flop required for Digital Supervisor proper function.
- Its purpose is to identify and report the STOP bit in a repeated-start PMBus message.
- The SSTOP signal can be provided externally. To bypass the onboard flip-flop, disconnect (U203) output by depopulating (R239) and by adding a $0\mu\Omega$ resistor at (R238).

14. Digital Supervisor Transmit pin buffer (Q201 – Q204):

- The TX (1-4) pins of the Digital Supervisor require external buffering in order to fully bias the Digital Isolator channel.
- The inverting buffer implemented on this evaluation board is using a single high-speed P-channel MOSFET as shown in the diagram.

Figure 1
PMBus External Buffer



Signal Components

15. Enable / Disable switch (SW201):

- When (SW201) switch actuator is towards “ON” text on the board, the output referred (EN) pin will be pulled low and the BCM® will be enabled.
- When actuator is towards “OFF” text on the board, the isolated (EN) pin will be connected to (VDD) pin and the BCM will be disabled.

16. Switch (SW202):

- A predetermined 16 possible addresses can be achieved using switch (SW202) and 6 resistors (R209 – R214). Each resistor can be either pulled up to VDD or pulled down to SGND forming a different voltage divider network with every actuator movement.

17. Signal connector (J201 and J202):

- Both connectors allow the Digital Supervisor to manage three additional off-board BCMs.
- The transmit/receive pairs are identified by the pin name trailing number.
- TXD1_SP is the externally buffered signal sourced from the Digital Supervisor pin (TXD1) to the on-board BCM. Similarly (RXD1) is the Digital Supervisor receive pin of the same local BCM.

18. Signal connector (J204):

- Micro USB type B connector used to connect the Digital Supervisor PMBus™ signal lines to one end of the communication interface adapter.

19. Signal connector (J208):

- The main function of the connector is to allow multiple Digital Supervisors to attach to the same PMBus.

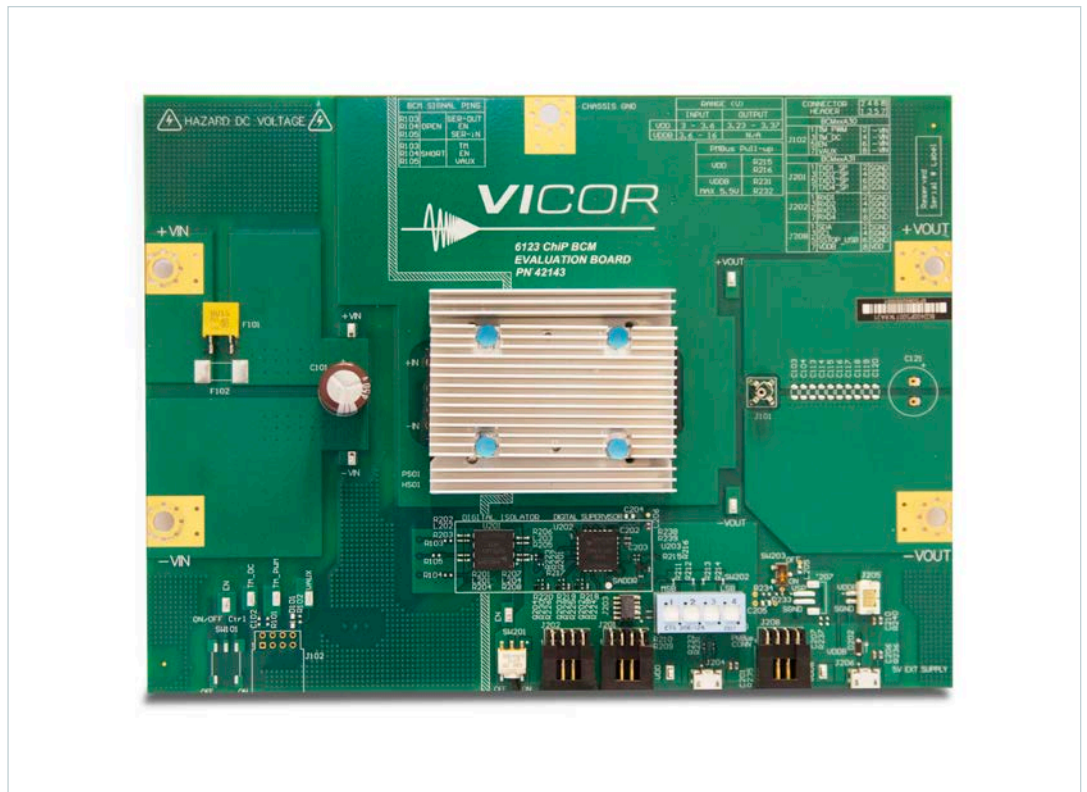
20. PMBus pull-up resistors (R215, R216) and (R231, R232):

- The PMBus signal lines (SCL and SDA) are pulled up externally to the Digital Supervisor (VDD) pin using 3kΩ on (R215, R216). VDD pin is an output source internally regulated to a narrow range (3.23 – 3.37V) when the unit is powered by a wider-range input VDDDB (3.6 – 16V).
- The PMBus signal lines (SCL and SDA) can support a 5V bus. A 1.5kΩ can be used on (R231 – R232) to pull up both signals to VDDDB. Note that the absolute max rating for SCL and SDA specified in the D44TL1A0 data sheet is 5.5V. Failure to follow this restriction may cause permanent damage to the device.

21. Ferrite Bead (L206):

- The chip ferrite bead functions as a resistor to high-frequency noise. It is used to decouple the BCM secondary power-ground return noise from the Digital Supervisor signal-ground reference.

Figure 2
6123 BCM Evaluation Board
Photo, Top Side



Test Points Description

Test nodes are labeled and include an SMT test point for attaching miniature probes, clips or hooks.

Table 1
Primary Referenced Test Point Descriptions

Name	Description
+V _{IN} , -V _{IN}	BCM® module input voltage test points. Test points are Kelvin connected to the module input pins.

Table 2
Secondary Referenced Test Point Descriptions

Name	Description
+V _{OUT} , -V _{OUT}	BCM module output voltage test points. Test points are Kelvin connected to the module output pins.
EN	Isolated BCM (EN) pin, referenced to SGND.
VDD	Digital Supervisor (U202) VDD pin. This test point can be used to measure the Digital Supervisor regulated 3.3V nominal output. This test point can be used to power the Digital Supervisor from a regulated (3 – 3.6V) voltage source.
SADDR	Digital Supervisor (U202) SADDR pin. This test point can be used to measure the voltage divider output. Use the (SW202) switch to change this reference voltage.
Vddb	Digital Supervisor (U202) Vddb pin. This test point can be used to power the Digital Supervisor from an unregulated (3.6 – 16V) voltage source.

Connectors Description

The following is a list of all connectors, pin numbers and associated signal description used in both 6123 and 2361 boards.

Table 3
Connectors Signal Pin
Description

Reference Designator	Pin Number	Signal Name	Description
J201	1	TXD1_SP	Externally-buffered signal TXD1. Digital Supervisor (U202) pin 8 connected to local BCM® isolated UART receive signal through the Vicor Digital Isolator.
	3	TXD2_SP	Externally-buffered signal TXD2. Digital Supervisor (U202) pin 7.
	5	TXD3_SP	Externally-buffered signal TXD3. Digital Supervisor (U202) pin 6.
	7	TXD4_SP	Externally-buffered signal TXD4. Digital Supervisor (U202) pin 5.
	2, 4, 6, 8	SGND	Secondary-referenced signal ground. Digital Supervisor (U202) pin 22.
J202	1	RXD1	Digital Supervisor (U202) pin 4 connected to local BCM isolated UART transmit signal through the Vicor Digital Isolator.
	3	RXD2	Digital Supervisor (U202) pin 3.
	5	RXD3	Digital Supervisor (U202) pin 2.
	7	RXD4	Digital Supervisor (U202) pin 1.
	2, 4, 6, 8	SGND	Secondary-referenced signal ground. Digital Supervisor (U202) pin 22.
J203	1	VDD	Digital Supervisor (U202) pin 17.
	2	SDA	Digital Supervisor (U202) pin 22.
	3, 5, 9	SGND	Secondary-referenced signal ground. Digital Supervisor (U202) pin 22.
	4	SCL	Digital Supervisor (U202) pin 24.
	6, 7, 8, 10	NC	No connect pins.
J204	1	SSTOP_USB	Move 0Ω jumper from (R239) to (R238) to connect to Digital Supervisor (U202) pin 13.
	2	SDA	Digital Supervisor (U202) pin 22.
	3	SCL	Digital Supervisor (U202) pin 24.
	4	NC	No connect pin.
	5	SGND	Secondary-referenced signal ground. Digital Supervisor (U202) pin 22.
	6	Chassis	J204 component chassis connected to SGND through a damping circuit.
J205	1	+5V	Diode connected (D202) to (VDDDB) Digital Supervisor (U202) pin 18.
	2	SGND	Secondary-referenced signal ground. Digital Supervisor (U202) pin 22.
	3	Chassis	J204 component chassis connected to SGND through a damping circuit.
J206	1	+5V	Diode connected (D202) to (VDDDB) Digital Supervisor (U202) pin 18.
	5	SGND	Secondary-referenced signal ground. Digital Supervisor (U202) pin 22.
	6	Chassis	J204 component chassis connected to SGND through a damping circuit.
	4, 5, 6	NC	No connect pins.
J208	1	SDA	Digital Supervisor (U202) pin 22.
	3	SCL	Digital Supervisor (U202) pin 24.
	5	SSTOP_USB	Move 0Ω jumper from (R239) to (R238) to connect to Digital Supervisor (U202) pin 13.
	7	VDDDB	Digital Supervisor (U202) pin 18.
	8	VDD	Digital Supervisor (U202) pin 17.
	2, 4, 6	SGND	Secondary-referenced signal ground. Digital Supervisor (U202) pin 22.

Figure 3
 BCM® 6123 Evaluation Board
 Schematic Page 1

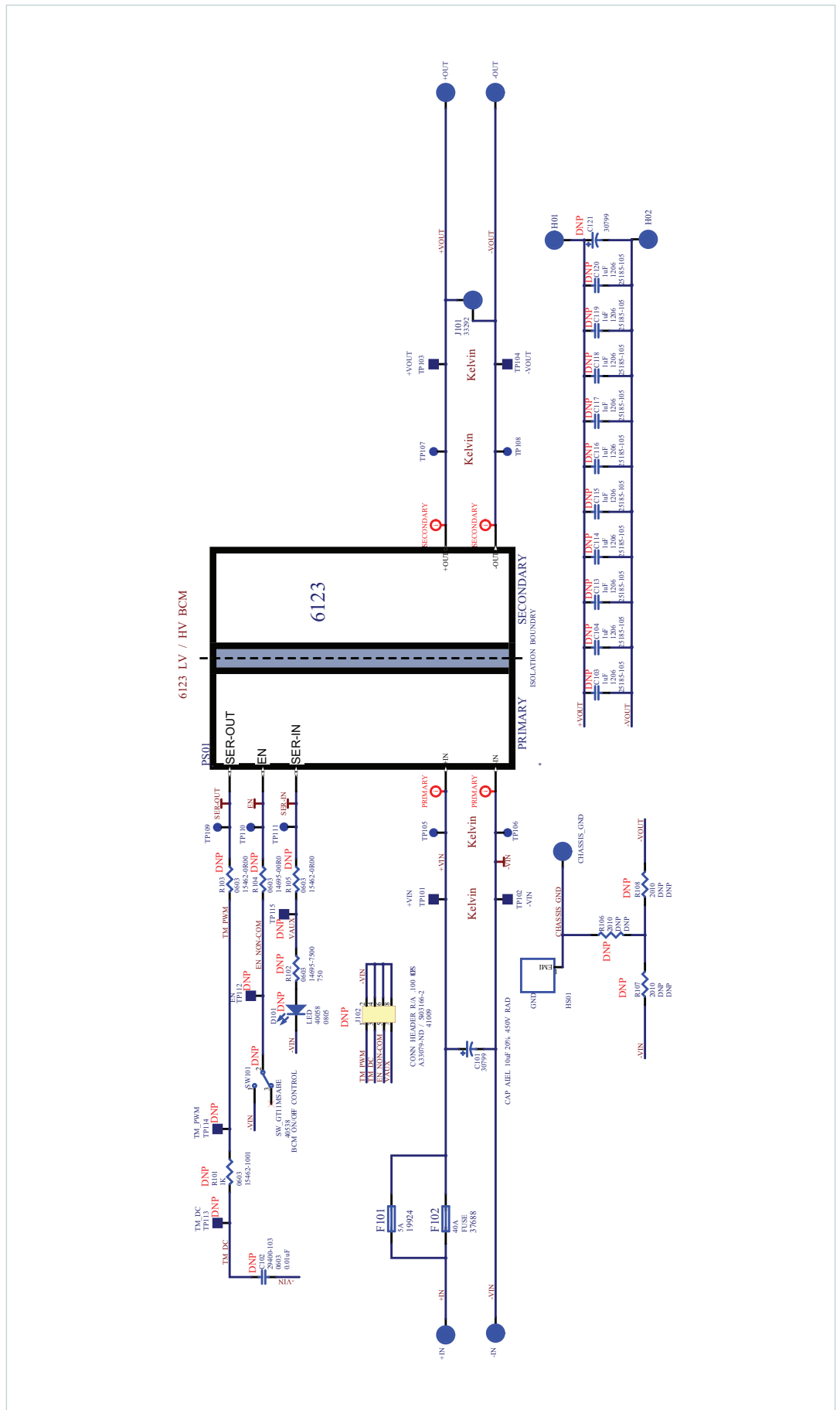


Figure 4
 BCM® 6123 Evaluation Board
 Schematic Page 2

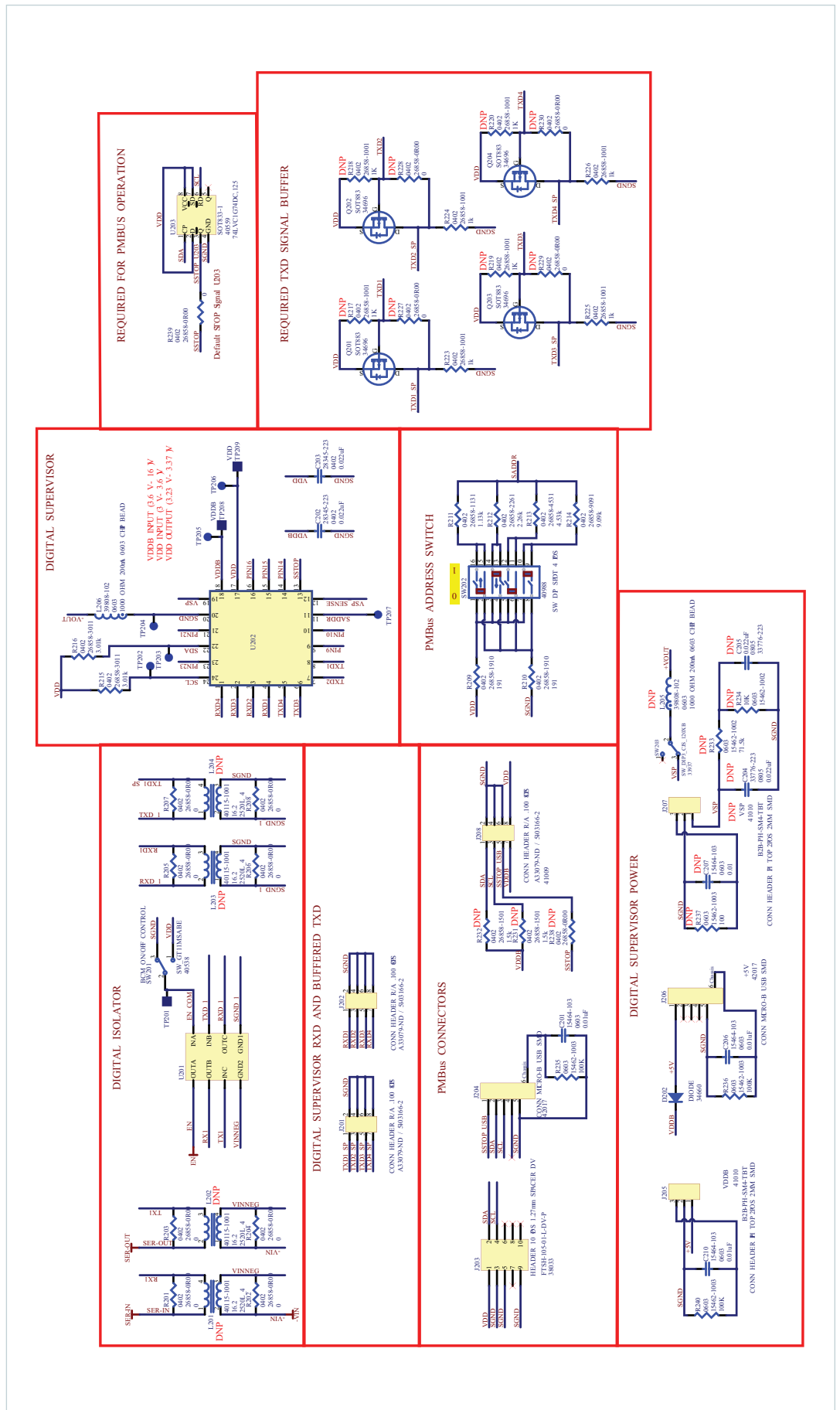


Figure 5
 BCM® 2361 Evaluation Board
 Schematic Page 1

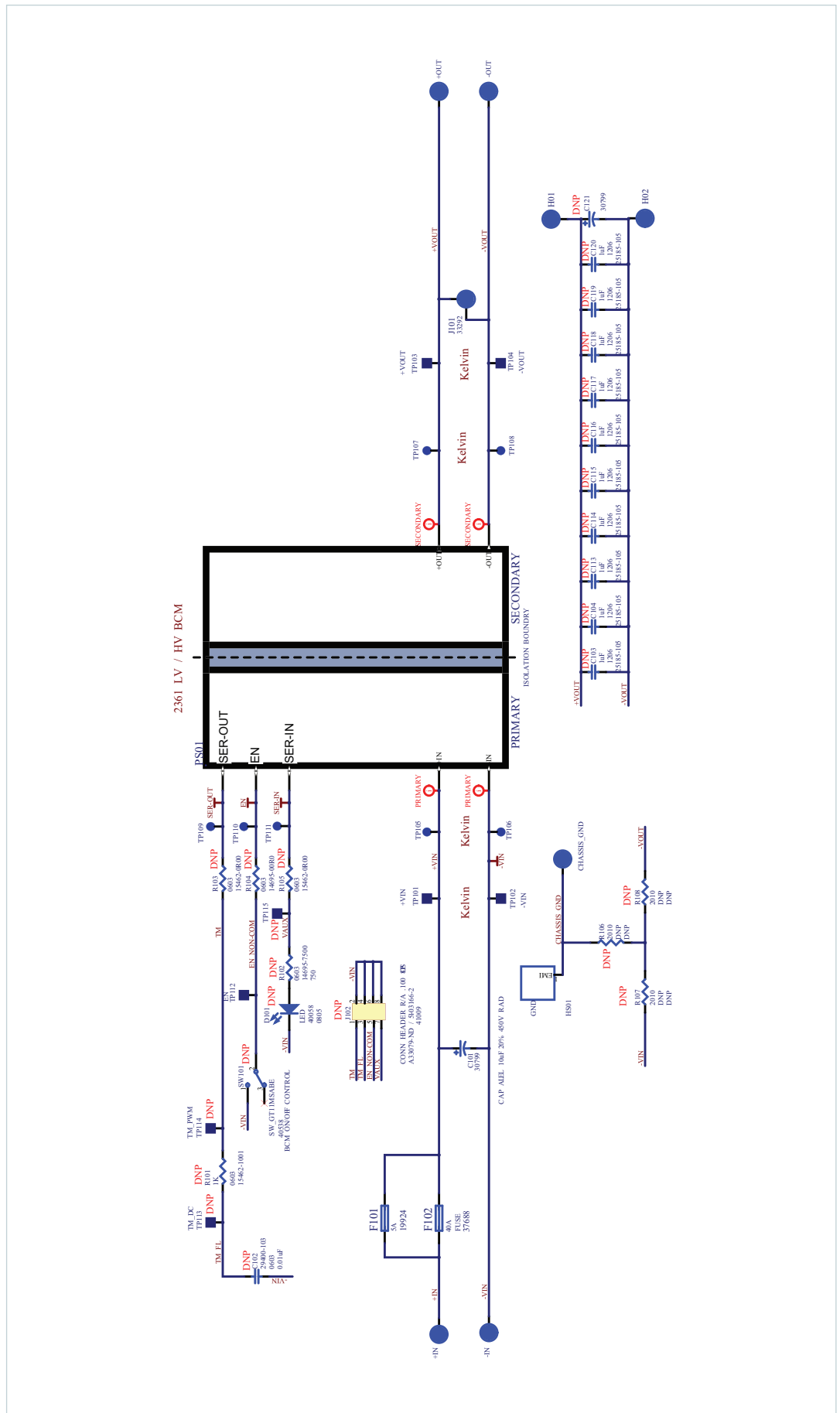


Figure 6
 BCM® 2361 Evaluation Board
 Schematic Page 2

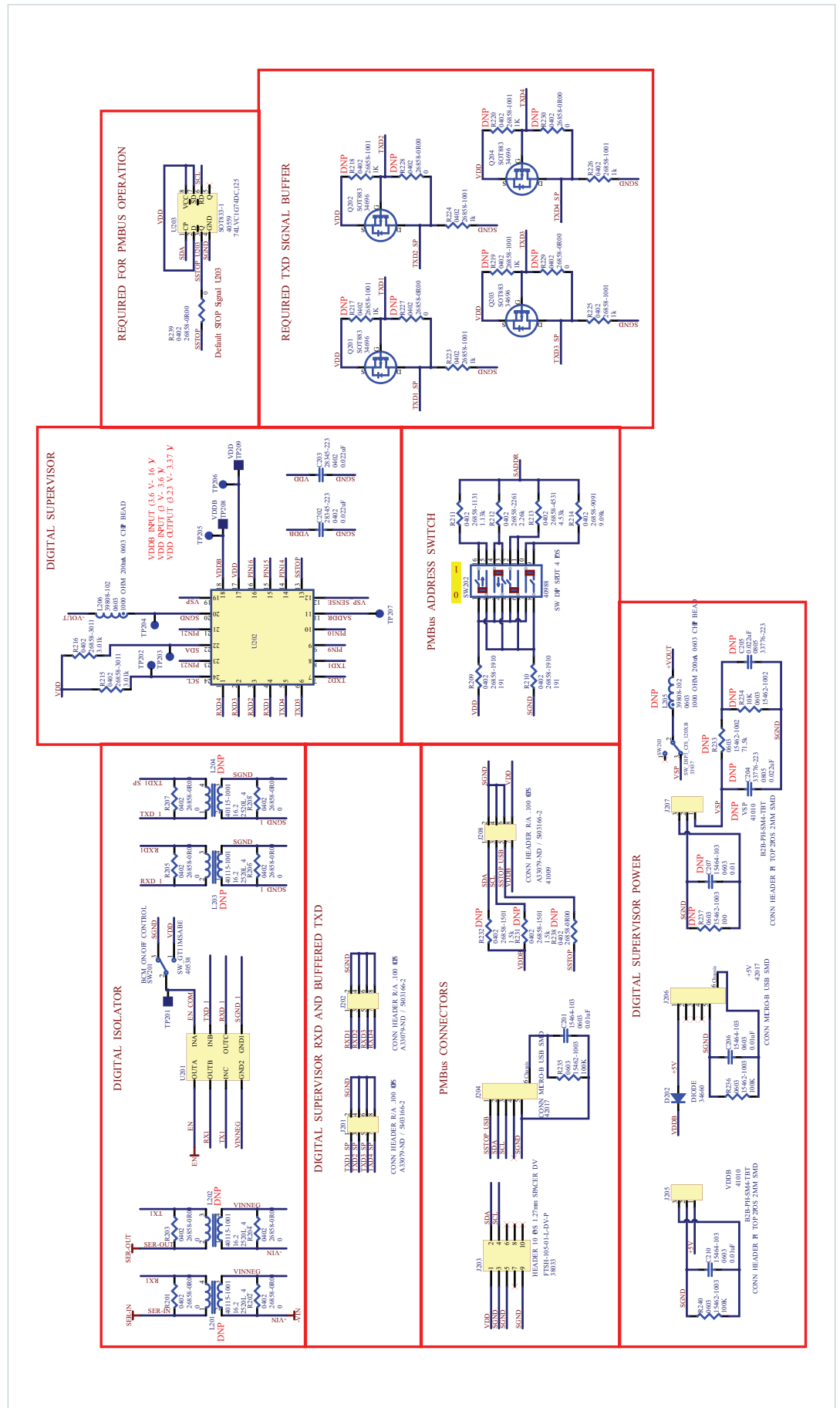


Figure 7
BCM® 6123 Evaluation Board
Top Side

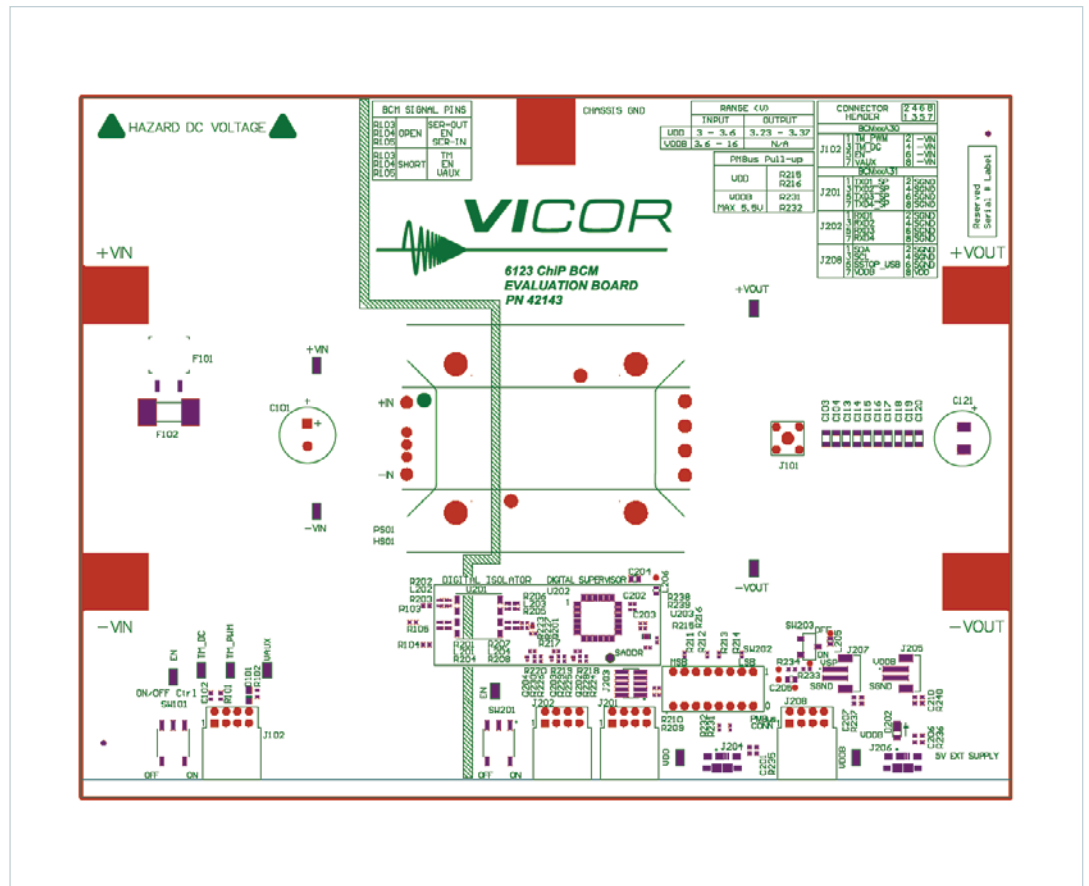


Figure 8
BCM® 6123 Evaluation Board
Bottom Side

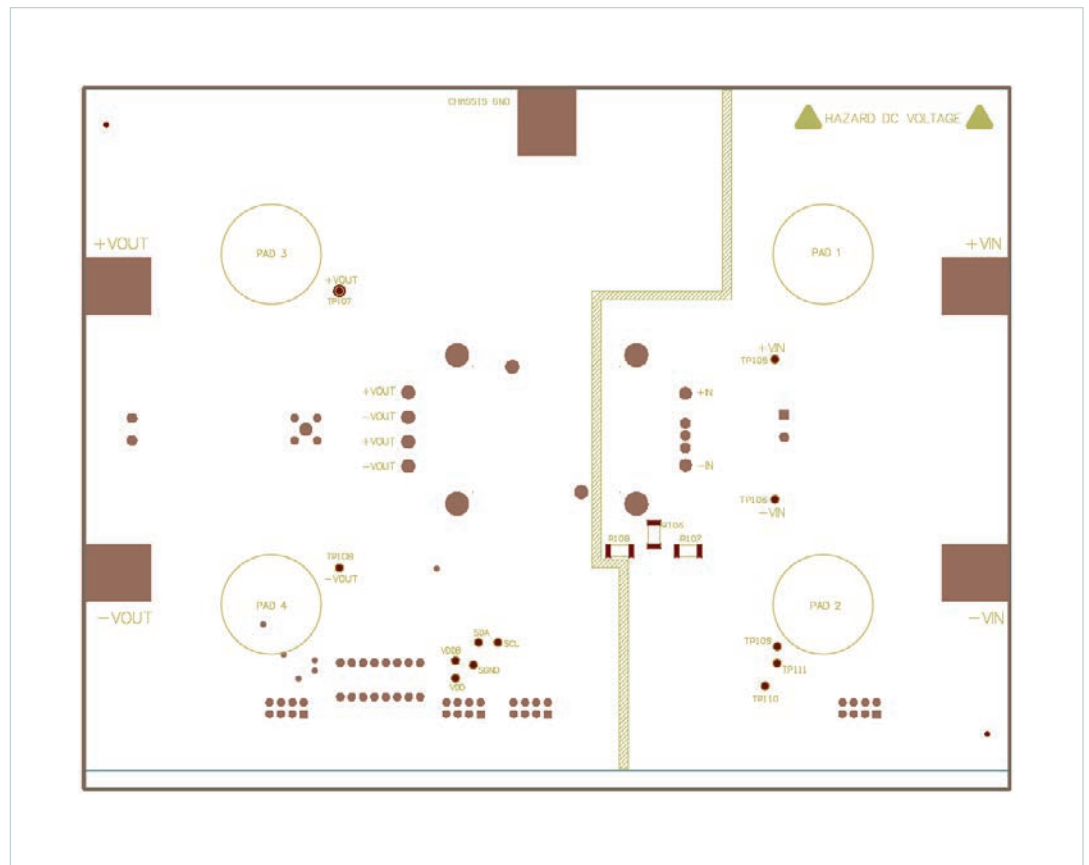


Figure 9
 BCM® 2361 Evaluation Board
 Top Side

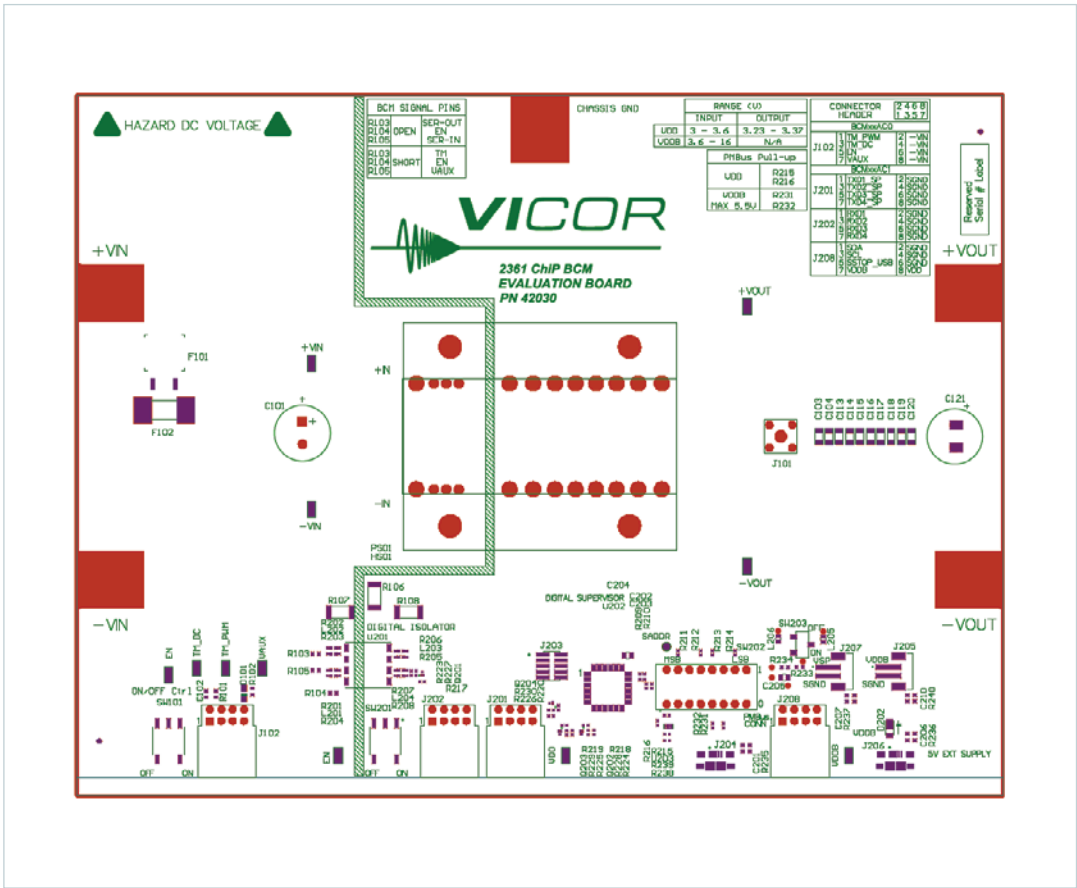
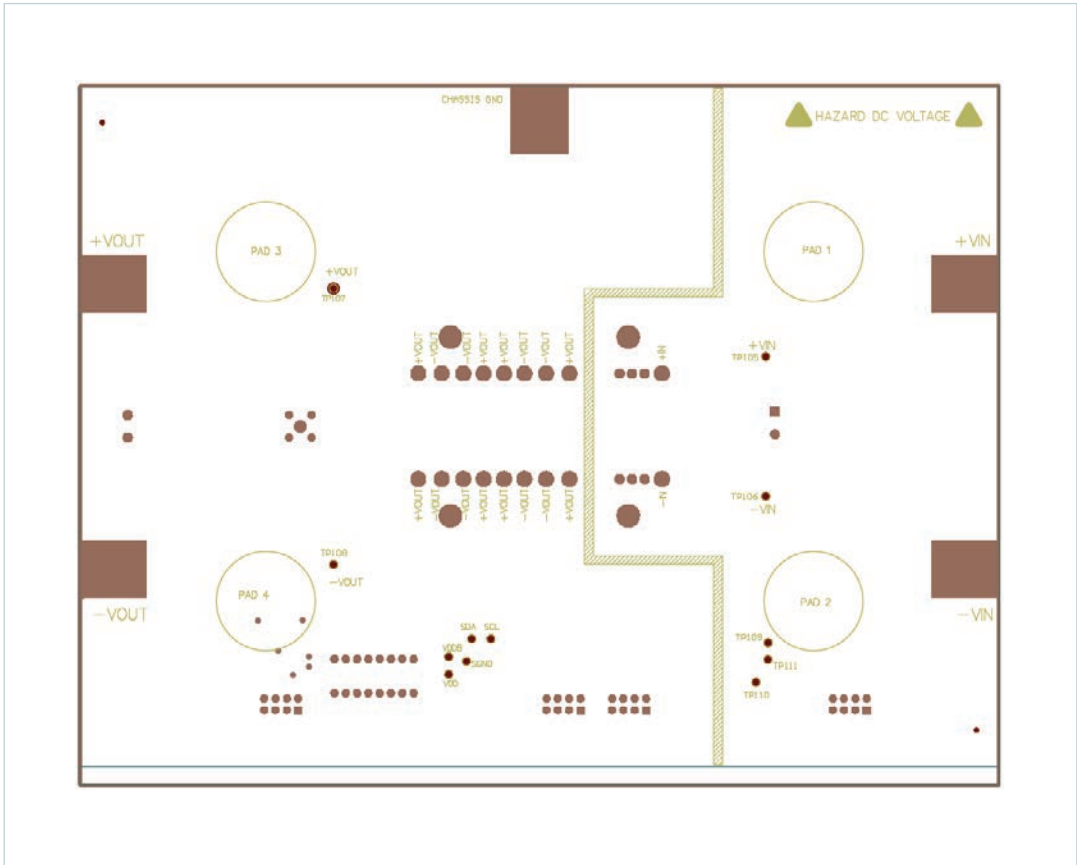


Figure 10
 BCM® 2361 Evaluation Board
 Bottom Side



Bill of Materials

Following table describes the design-specific components of both 2361 and 6123 PMBus™ BCM® evaluation boards covered by this document.

Table 4
BCM Evaluation Board
Components Common to all
Boards

Reference Designator	Description	Manufacturer	Manufacturer Part Number
C101	CAP ALEL 10µF 20% 450V RAD	United Chemi-Con	EKXG451ELL100MK20S
F101	Design specific - See Table 5		
F102			
J101	JACK VERTICAL MECH THRU HOLE	Tektronix	131-5031-00
J102	CONN HEADER R/A .100 8 POS 30 AU	TE Connectivity	5-103166-2
HTSNK	Design specific - See Table 5		
PCB Part Number	Design specific - See Table 5		
C201, C206, C210	CAP X7R .01µF 10% 100V 0603	Murata	GRM188R72A103KA01J
C202, C203	CAP X7R .022µF 10% 25V 0402	Murata	GRM155R71E223KA61D
D202	DPN 400V 1A DI123	Diodes Inc.	DFLU1400
J203	HEADER 10 POS 1.27mm SPACER DV	Samtec	FTSH-105-01-L-DV-P
J204, J206	CONN MICRO-B USB SMD	FCI	10118192-0001LF
J205	CONN HEADER PH TOP 2 POS 2mm SMD	JST	B2B-PH-SM4-TB(LF)(SN)
L206	1000Ω 200mA 0603 CHIP BEAD	Murata	BLM18RK102SN1D
Q201, Q202, Q203, Q204	QMOS P 20V 8R 100 MA SOT883	Toshiba	SSM3J16CT(TPL3)
R201, R202, R203, R204, R205, R206, R207, R208, R239	RES 0Ω 1/16W 1% 0402	KOA Speer	RK73Z1ETTP
R209, R210	RES 191Ω 1/16W 1% 0402	KOA Speer	RK73H1ETTP1910F
R211	RES 1.13kΩ 1/16W 1% 0402	KOA Speer	RK73H1ETTP1131F
R212	RES 2.26kΩ 1/16W 1% 0402	Vishay	CRCW04022K26FKED
R213	RES 4.53kΩ 1/16W 1% 0402	KOA Speer	RK73H1ETTP4531F
R214	RES 9.09kΩ 1/16W 1% 0402	KOA Speer	RK73H1ETTP9091F
R215, R216	RES 3.01kΩ 1/16W 1% 0402	KOA Speer	RK73H1ETTP3011F
R223, R224, R225, R226	RES 1kΩ 1/16W 1% 0402	KOA Speer	RK73H1ETTP1001F
R235, R236, R240	RES 100kΩ 1/10W 1% 0603	KOA Speer	RK73H1JTDD1003F
SW201	SW Horizontal SPDT 1 POS SMD	C&K	GT11MSABETR
SW203	SW DIP SPDT 1POS SMD	NIDEC Copal	CJS-1200TB
U201	3 WAY DIGITAL ISOLATOR	Vicor Corporation	I13TL1A0
U202	4 UP DPOL BCM	Vicor Corporation	D44TL1A0
U203	IC FLIP FLOP SOT833-1	NXP	74AUP1G74GT,115

Table 5
BOM Additions. Components
which are BCM Model Specific

Reference Designator	Description	Manufacturer	Manufacturer Part Number
Evaluation board numbers: BCM6123ED1E13A3T01; BCM6123ED1E1368T01; BCM6123ED1E2663T01			
PS01	HV BCM - 2361	Vicor Corporation	BCM6123TD1E13A3T01; BCM6123TD1E1368T01; BCM6123TD1E2663T01
PCB Part Number	2361 BCM Evaluation Board	Vicor Corporation	42030
F101	FUSE PC-TRON PCI 5A	Cooper Industries	PCI-5-R
HTSNK	BOM HEAT SINK, TOP, 2361 CHIP	Vicor Corporation	41248
Evaluation board numbers: BCM6123ED1E5135T01; BCM6123ED1E5126T01; BCM6123ED1E5117T01			
PS01	HV BCM - 6123	Vicor Corporation	BCM6123TD1E5135T01; BCM6123TD1E5126T01; BCM6123TD1E5117T01
PCB Part Number	6123 BCM Evaluation Board	Vicor Corporation	42143
F101	FUSE PC-TRON PCI 5A	Cooper Industries	PCI-5-R
HTSNK	BOM ASSY 6123 DUAL HTSNK NO TRIM FOR 11mm	Vicor Corporation	40528

Recommended Test Equipment

The following is a list of recommended test equipment.

1. Safety glasses.
2. DC power supply: Refer to the specific BCM® model data sheet to ensure the supply has sufficient power and current capability.
3. Electronic load: Refer to the specific BCM model data sheet to ensure the load has sufficient power handling and current capability for testing.
4. Cooling fan.
5. Digital multi-meters (DMMs).
6. Oscilloscope and probes.
7. Interconnect wires, cables and fastening hardware.

Basic Connections

- Confirm bench equipment is powered off.
- Connect the input DC power supply positive lead to the +IN input lug of the evaluation board. Connect the input power supply negative lead to the –IN input lug of the evaluation board.
- Connect the CHASSIS_GND lug of the evaluation board to a safety “green wire” earth ground.
- Connect the +OUT lug of the evaluation board to the electronic load-positive input. Connect the –OUT lug of the evaluation board to the electronic load-negative input.
- Verify proper polarity of the connections.
- Verify (SW101) desired actuator position.
- Direct airflow from the cooling fan through the BCM heat-sink fins.
- Have the latest BCM data sheet on hand for reference.

Board Operation Details

1. Evaluation board start up:

- The (SW201) is a secondary-referenced control switch and is a signal input to the Digital Isolator I13TL1A0 (U201) pin (INA). The "ON" and "OFF" states are inverted logic in comparison to the BCM® enable pin (EN) default polarity.
 - In the "OFF" position, the switch will connect the isolator (INA) pin to the VDD net, which disables the BCM.
 - In the "ON" position, the BCM (EN) pin is allowed to float by connecting isolator (INA) pin to SGND.
 - The BCM enable pin when left floating is internally pulled up allowing the unit to start upon application of $V_{PRI} > V_{PRI_UVLO+}$.
- Using the Digital Supervisor commands and the provided graphical interface, it is possible to change SW202 behavior and/or override an enable switch setting. The table provided below shows all different settings, allowing a successful power train turn on.
 - The BCM_EN_POLARITY bit defines the logic level of both the BCM (EN) pin and the (SW201) switch.
 - The OPERATION command (01h) can turn the module ON or OFF only if the BCM (EN) pin is in active state allowing the module to power up.
 - The DISABLE_FAULT command (D7h) can set $V_{IN_UV_FAULT}$ protection bit to "1". Note that once the $V_{IN_UV_FAULT}$ bit is set to "1" a default pre-set bias voltage level is then required for a successful power up. Refer to the specific BCM data sheet for details.

Table 6
Startup Conditions

Digital Supervisor Commands			SW201 Switch State		BCM Module		
DISABLE_FAULT (D7h)	BCM_EN_POLARITY (D0h)	Operation (01h)	Acuator Position	OUTPUT (i.e., Digital Isolator (INA) pin; Secondary Referenced EN TP)	Primary Stage Voltage (+V _{IN})	EN Pin	Powertrain State
VIN_UV_FAULT bit set to "0"	SET (02h)	SET (80h)	"ON"	SGND	$V_{PRI_UVLO+} < +V_{PRI} < V_{PRI_OVLO+}$	3.3V	Enabled
VIN_UV_FAULT bit set to "0"	SET (00h)	SET (80h)	"OFF"	3.3V	$V_{PRI_UVLO+} < +V_{PRI} < V_{PRI_OVLO+}$	-V _{IN}	Enabled
VIN_UV_FAULT bit set to "1"	SET (02h)	SET (80h)	"ON"	SGND	$V_{\mu C_ACTIVE} < +V_{PRI} < V_{PRI_OVLO+}$	3.3V	Enabled
VIN_UV_FAULT bit set to "1"	SET (00h)	SET (80h)	"OFF"	3.3V	$V_{\mu C_ACTIVE} < +V_{PRI} < V_{PRI_OVLO+}$	-V _{IN}	Enabled

2. Adjusting the PMBus™ address:

- The PMBus address of the Digital Supervisor can be set only at start up. It is required to recycle the Digital Supervisor input source in order to change its address.
- Using (SW202): Sliding the actuator towards the number depicted on the switch surface sets the switch value to “1” and sliding the actuator towards the nearest edge of the PCB board sets its value to “0”.
- The out-of-the box default address setting is (50h). Follow the table below to change the default PMBus address.

Table 7
PMBus Address Setting

ID	Digital Supervisor Address in (HEX)	Switch SW202 Actuator			
		1	2	3	4
1	50h	0	0	0	0
2	51h	0	0	0	1
3	52h	0	0	1	0
4	53h	0	0	1	1
5	54h	0	1	0	0
6	55h	0	1	0	1
7	56h	0	1	1	0
8	57h	0	1	1	1
9	58h	1	0	0	0
10	59h	1	0	0	1
11	5Ah	1	0	1	0
12	5Bh	1	0	1	1
13	5Ch	1	1	0	0
14	5Dh	1	1	0	1
15	5Eh	1	1	1	0
16	5Fh	1	1	1	1

3. Using the interface adapter:

- The communication interface adapter is supplied with the evaluation board.
- The software interface can be downloaded for free on the Vicor website.
- The software interface can detect and communicate individually with several Digital Supervisors on the bus, provided they have unique addresses.

Thermal Considerations

The evaluation board is supplied with a pre-installed 11mm double-sided heat sink assembly for a 6123 BCM[®] and a 27mm top only for a 2361 BCM. A fan blowing across the evaluation board and heat sink assembly is required during operation at load. The fan should be placed about four inches away from the evaluation board facing the output voltage side. A typical bench top fan is recommended providing about 1000LFM. Using the supplied rubber feet is also required in order to elevate the board about 0.4in off a flat surface and enable air flow underneath the PCB.

The PCB top layer used for the 2361 ChiP[™] is required to be of the same potential of the heat sink this is to allow heat transfer from the bottom of the ChiP and leads to the heat sink. Chomerics GEL-8010 is used between the ChiP bottom and the top surface of the PCB similarly between the PCB top surface and the heat sink extended around the ChiP.

Use the READ_TEMPERATURE_1 (8Fh) command to monitor the BCM reported internally measured temperature. The temperature value is provided once the BCM is active. A reading of -273°C indicates a BCM is disabled or is in a fault condition.

Paralleling

Power Connections

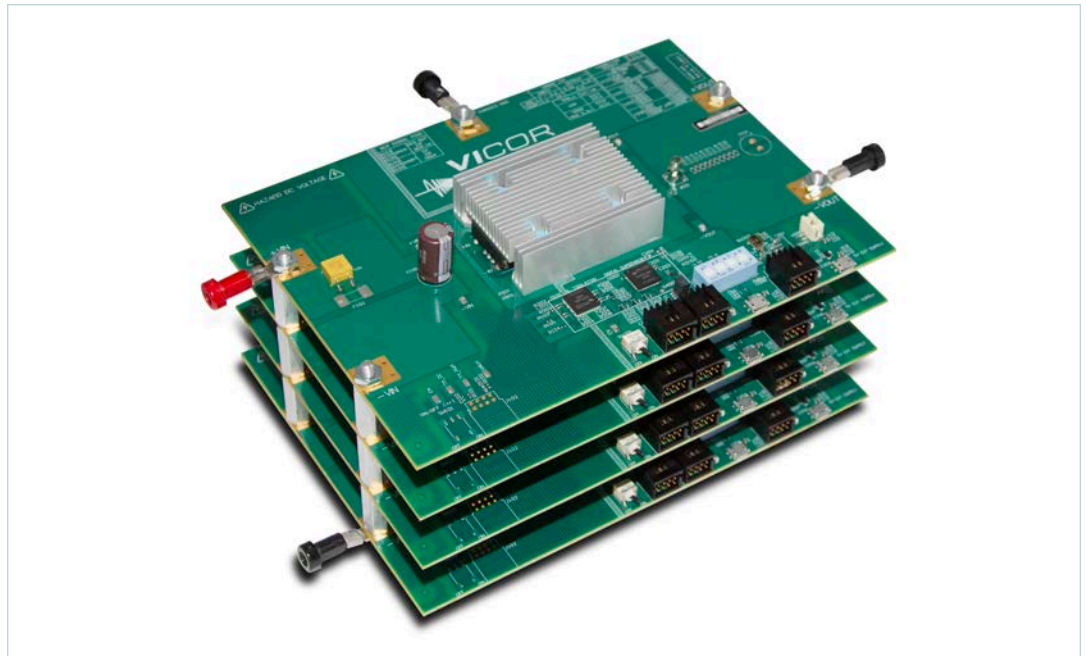
The paralleling and sharing performance of multiple BCMs can be easily demonstrated by stacking multiple evaluation boards and interconnecting the inputs and outputs with standoffs to create a parallel array. Each BCM in an array operates in the same way as it does as a stand-alone unit. With equal impedance, the load is effectively shared across multiple BCMs. Mismatches in this case are modest and are further canceled by an effective negative voltage vs. temperature coefficient.

The following connections and settings should be used for an array of BCM evaluation boards:

- All BCMs in a parallel array must be the same model.
- The boards should be physically stacked using metal standoffs at the +IN & -IN lugs, the +OUT & -OUT lugs, and the CHASSIS_GND lug. This also connects these nodes electrically so that a single source, single load and earth-ground connection can be made to the system.
- The +IN lugs are required to be connected together for an array of BCMs.
- Standoffs must be sufficient in length to avoid contact between boards and to permit airflow to all BCMs in the system.
- If coordinated enable control is needed to synchronize start up, use the graphical interface to send OPERATION (01h) command to all BCMs with PAGE (00h) command value equal to FFh. Page value FFh allows the Digital supervisor to send the same command to all connected BCMs at the same time.

The paralleling and current sharing capability of the power train can be demonstrated by stacking multiple evaluation boards and interconnecting the inputs and outputs with standoffs of sufficient current rating to create a parallel array.

Figure 11
 BCM Evaluation Boards Stacked
 to form a High Power Parallel
 Array, using Common –IN and
 the Paralleling Connectors.
 Paralleling of BCM
 Evaluation Board



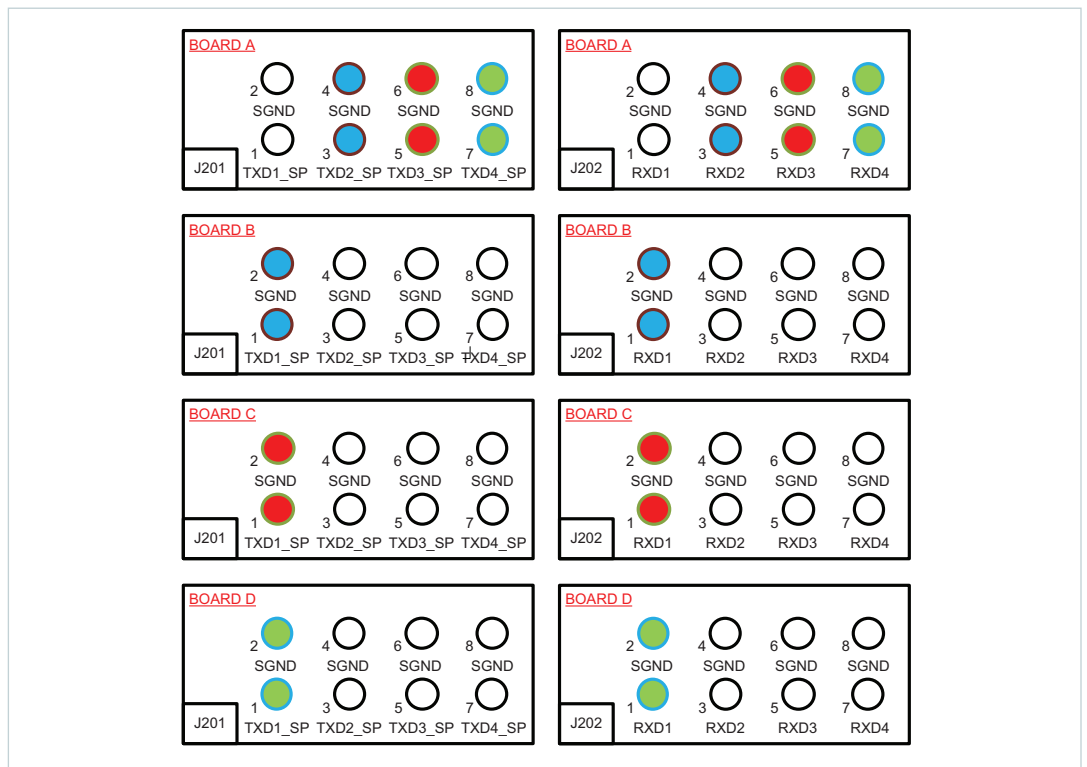
Using one Digital Supervisor with Multiple BCMs®

The paralleling of the Digital communication lines can be demonstrated by following the color code shown in the diagram below to connect the UART signals. Board A Digital Supervisor will manage four BCMs: one on the same board using the (TXD1, RXD1) pair and three on similar evaluation boards sharing the same secondary-ground reference.

Using a twisted pair for each signal and ground is preferred. It is recommended to depopulate Q201 and R223 from Board B, C and D in order not to overload the TX signal.

The supplied connectors will accept a wire size range 26 – 22AWG, 0.12 – 0.3mm² wires.

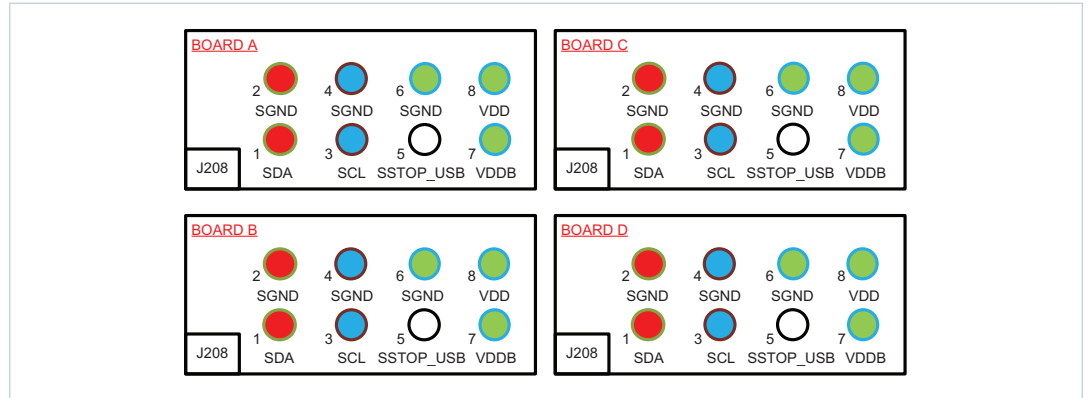
Figure 12
 Digital Supervisor UART Signal
 Connectors (J201, J202)



Using Multiple Digital Supervisors with One Host

The paralleling of the Digital communication lines can be demonstrated by following the color code shown in the diagram below to connect the additional Digital Supervisors mounted on a similar evaluation board. These lines can also be extended to an external PMBus™ host. The PMBus host in this case is the Vicor interface adapter mounted through (J204). Note that the Digital Supervisor should be powered with either the VDD or the VDDB pin but not both at the same time.

Figure 13
Digital Supervisor PMBus Signal
Connector (J208)



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