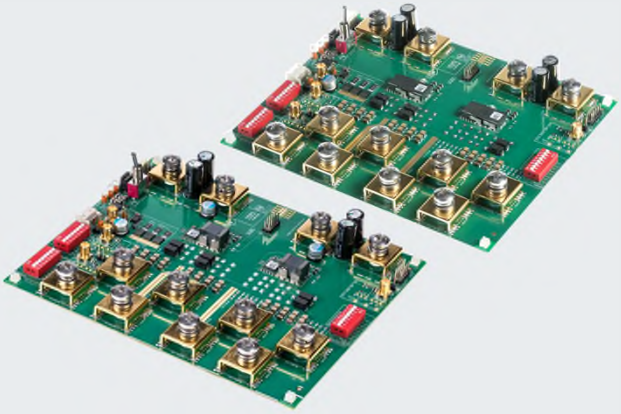
TECHNICAL REFERENCE NOTE

ARTESYN LGA50D
Evaluation Board



PRODUCT DESCRIPTION

Advanced Energy's Artesyn LGA50D evaluation board allows the user to test and investigate the performance of the LGA50D non-isolated modules.

This document is a reference guide for the evaluation board. Refer to the LGA50D module technical reference note for more information about the module specifications and the pin definitions.

AT A GLANCE

Total Power

120 Watts per Module

Input Voltage

7.5 to 14 Vdc

# of Outputs

Dual or Single

CONTENTS

- General
- Component Identification
- Pin Assignment
- Test Setup
- Operation
- Schematic
- PCB Silk-screen

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GENERAL

The LGA50D evaluation board kit includes:

- The evaluation board equipped with two LGA50D modules
- The Artesyn PMBus interface dongle
- The PMBus to USB interface cables



Figure 1 - LGA50D evaluation kit

This equipment allows you monitor and control the modules via your computer, or you can apply settings to the modules by hardware configuration.

See the following table for the options of LGA50D evaluation kit part number.

Table 1 - LGA50D Evaluation Kit Ordering Part Number

Kit Part Number	Description
LGA50D-EVAL-KIT-JLPJ	LGA50D low profile evaluation kit
LGA50D-EVAL-KIT-JSBJ	LGA50D standard profile evaluation kit

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GENERAL

Equipment Required

To run the evaluation board, the following equipment will be required to supply power to the board, apply load to the board, and to cool the DC to DC converters if the board is to be operated for long periods.

Table 2 - Test Equipment Required	
Recommended Test Equipment	
DC Source	7 to 15V, 40A or above
Load	40A or above for Vout1 or Vout2, 80A or above for Vout3
Cooling Fan	Please use fan cool if operate at full load for long time

Power cables with M6 ring terminations are required for the input and output connections to and from the evaluation board.

Below test equipment will also be required:

- A personal computer with the LGA50D GUI software installed on it

  The GUI software is available on the Artesyn website: https://www.artesyn.com/LGA80D-eval-GUI

  Please refer to the GUI user manual for instructions on how to install and use this software.
- Oscilloscope and associated test probes
- Digital multi-meter and associated test probes

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GENERAL

Default Settings

The evaluation board has been supplied with the following configuration and set-up by default.

If no changes are made to the hardware and firmware configuration of the unit then, the user will see that this board is equipped with two LGA50D modules with the following voltage settings:

- One module is configured for a single output

  Output voltage setting is 1.2V via the dip switches on the PCB
- One module is configured for two independent outputs

  Output A voltage is set to 1.2V via the dip switches on the PCB

  Output B voltage is set to 1.2V via the dip switches on the PCB

The PCB has been equipped with the following value of capacitors. These have been selected to provide optimum performance under as many different test conditions as possible, but the user may change or optimize the values according to the specific conditions that are to be replicated:

- Input capacitance (per module)
  - LGA50D-EVAL-KIT-JLPJ evaluation kit:

    6x 22uF/16V ceramic cap
  - LGA50D-EVAL-KIT-JSBJ evaluation kit:

    1x120uF/16V polymer caps (APXS160ARA121MH 70G or equivalent) + 4 x 22uF/16V ceramic cap
- Output capacitance
  - In single O/P configuration

    2 x 680uF/6.3V polymer tan caps (T530X687M006ATE010 or equivalent) + 10 x 100uF/6.3V X6S 1210 ceramic caps (GRM32EC80J107ME20L or equivalent) + 4x10uF/16V X6S 0603 ceramic caps (GRM188C81C106MA73 or equivalent)
  - In dual O/P configuration

    2x 680uF/6.3V polymer tan caps (T530X687M006ATE010 or equivalent) + 8 x 100uF/6.3V X6S 1210 ceramic caps (GRM32EC80J107ME20L or equivalent) + 4x10uF/16V X6S 0603 ceramic caps (GRM188C81C106MA73 or equivalent)

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COMPONENT IDENTIFICATION

The key components and connection locations are shown in the picture of the evaluation board below.

Note that the LGA50D shown at the “top” of this picture is the one that is configured as the single output unit, and the “bottom” converter is configured as a dual output module.

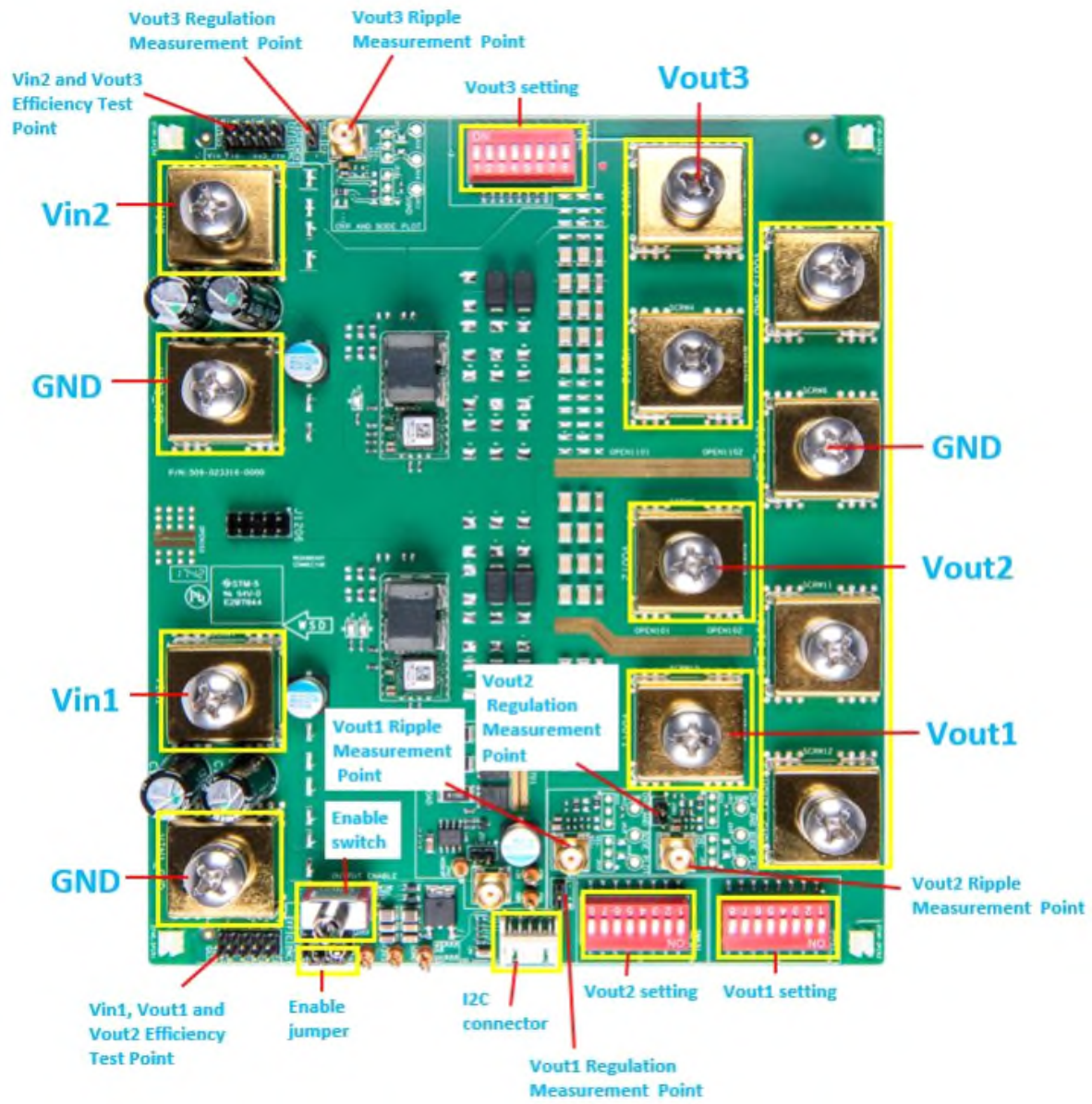


Figure 2 - LGA50D setup

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COMPONENT IDENTIFICATION

Pin Assignment

Table 3 - Pin Assignment		
Item	**Pin Number**	**Function**
Test Point	BUSB101	Vin1
	BUSB102	GND
	BUSB1101	Vin2
	BUSB1102	GND
	BUSB105	Vout1
	BUSB106	GND
	BUSB103	Vout2
	BUSB104	GND
	BUSB1105	Vout3
	BUSB1106	GND
	BUSB1103	Vout3
	BUSB1104	GND
	J205	Vin1, Vout1 and Vout2 Efficiency Test Point
	J1205	Vin2 and Vout3 Efficiency Test Point
	J1403	Vout3 Ripple Measurement Point
	J1401	Vout3 Regulation Measurement Point
	J303	Vout2 Ripple Measurement Point
	J301	Vout2 Regulation Measurement Point
	J403	Vout1 Ripple Measurement Point
	J401	Vout1 Regulation Measurement Point
Jumper	J203	Output Enable Jumper
Switch	S201	Output Enable Switch
Connector	J204	I^2C Connector

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TEST SET UP

Hardware Test Setup

The LGA50D can be connected with the E-load via the Vout and Return terminals, and communicates with LGA5D GUI by the I²C connector J204.

Example:

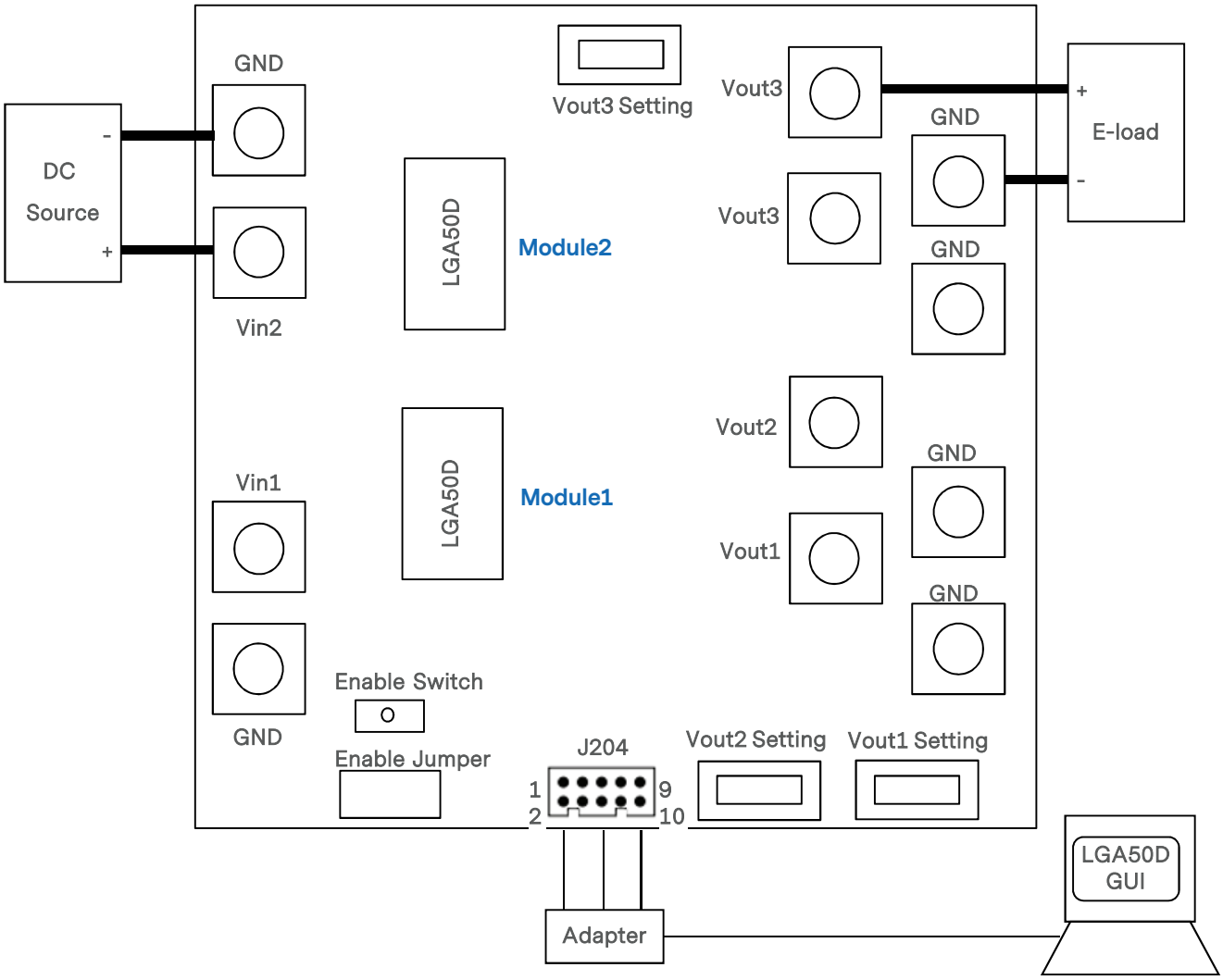


Figure 3 - Hardware Interface Setup

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TEST SET UP

Software Test Setup

The LGA50D has an evaluation software, LGA50D GUI, designed to make the unit accessible to the user. It is intended to control and monitor the LGA50D units as they would be used in an application.

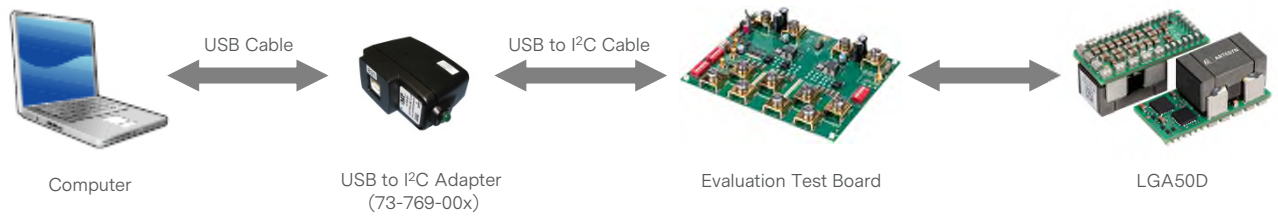


Figure 4 - Software Interface Setup

The LGA50D GUI must be installed on a PC before using of all of the functions of this program. Please refer to the Figure 5.

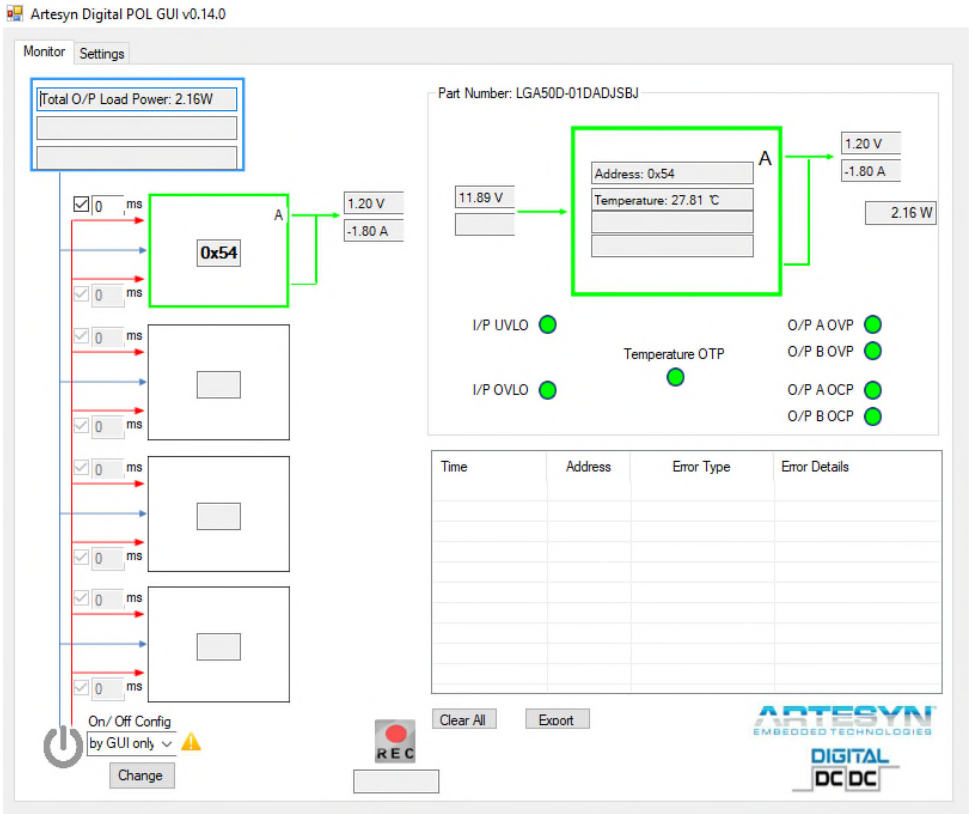


Figure 5 - LGA50D GUI

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TEST SET UP

Programming Sequence

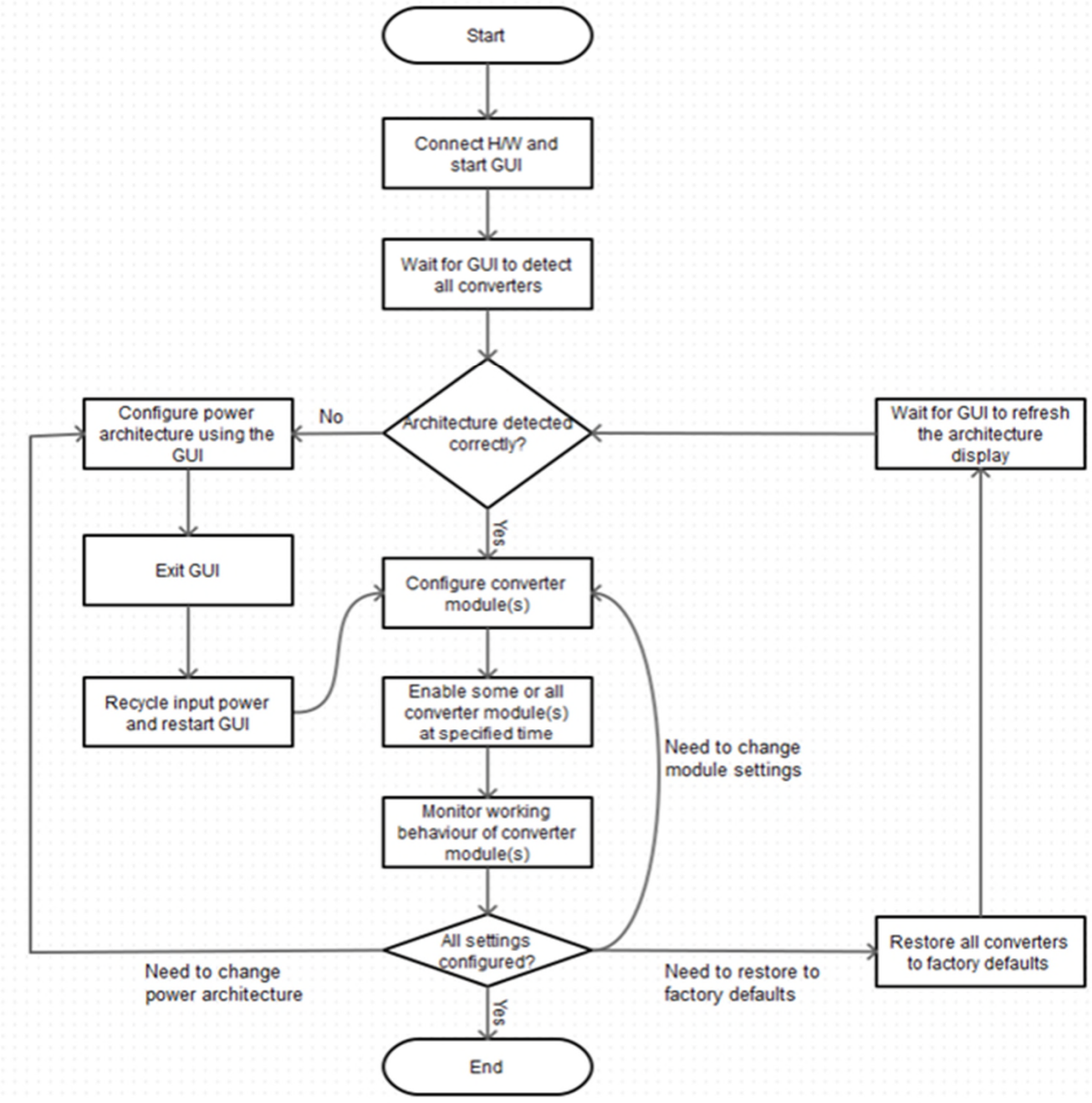


Figure 6 - Programming Sequence

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TEST SET UP

Test Setup Example

The setup example is shown in figure 6. Equipment used is:

- DC Source
- LGA50D evaluation board
- Artesyn PMBus adapter
- Cooling fan
- Computer with LGA50D GUI installed on it

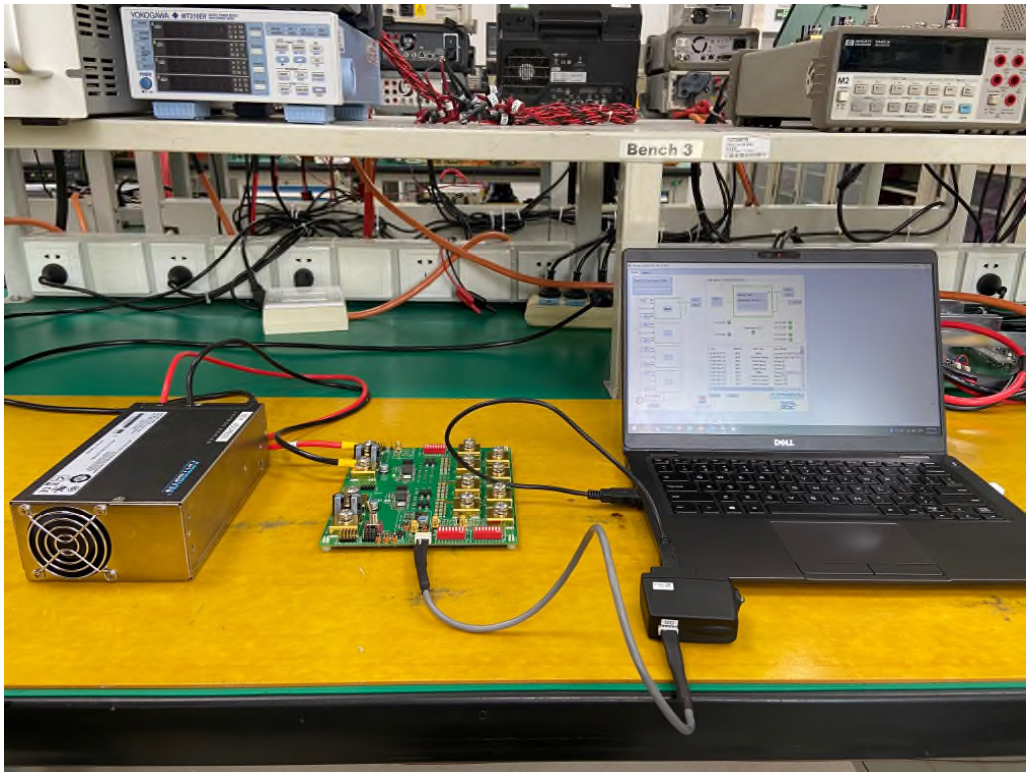


Figure 6 - Setup Example

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OPERATION

Power Up Sequence

To power up and configure the evaluation board, please follow the steps as described below.

1. Initial set position of the enable switch

Please make sure the OUTPUT ENABLE toggle switch (S201) is in the “disable” orientation as shown below with the toggle of the switch leaning toward the modules and the output side of the PCB (and away from the input side of the board).

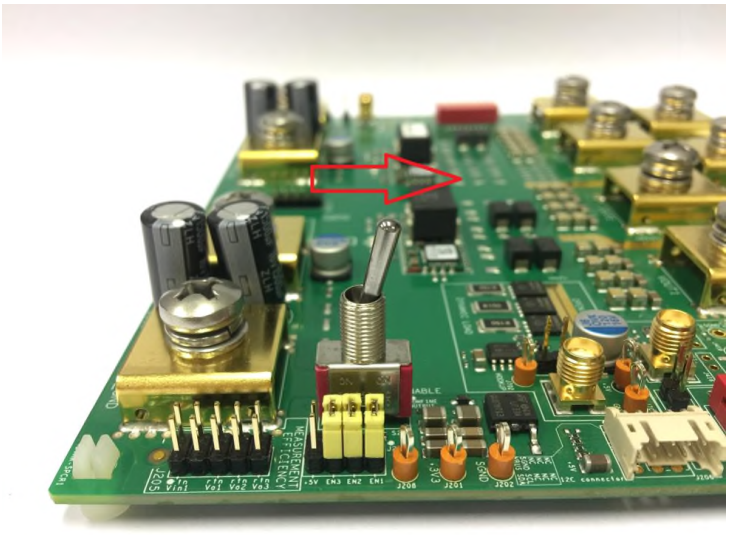


Figure 7 - Initial enable switch orientation

2. Connection and configuration

Connect the input and output cables to the M6 terminations of the PCB.

Then connect the following:

a. Connect the Vin1 and Vin2 connections to the DC power source with a voltage setting in the range of 7.5Vdc to 14Vdc.

b. Connect the Vout1, Vout2 and Vout3 connections to your E-load.

c. Add the enable jumpers to the En1, EN2 and EN3 locations on J203 - this will ensure that the 3 outputs will be enabled. Note these are the jumper components located next to the enable switch - they are shown below.



Figure 8 - Enable jumper location and population

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OPERATION

3. Connection of the I²C dongle to I²C connector

This is the interconnect cable between your PMBus dongle and the evaluation PCB. It is polarized and will only fit into the connection in one orientation.

The other end of this cable should be plugged into your dongle. The dongle also has USB connections (and the cable is provided) to connect your dongle to the USB port of your computer.

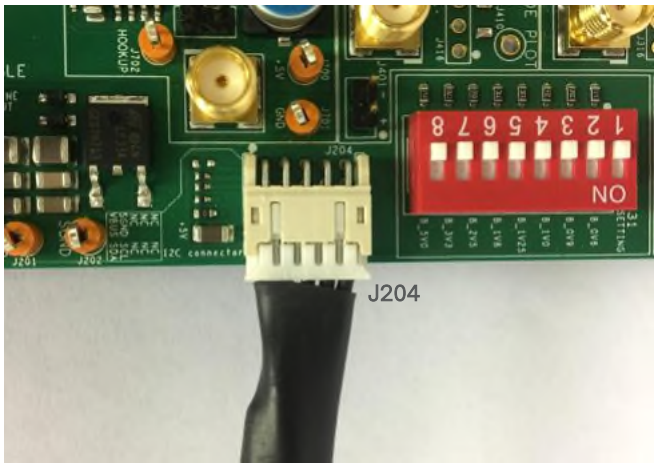


Figure 9 - I²C cable connection to the evaluation board

4. Voltage setting

Select the suitable voltage for Vout1, Vout2 and Vout3 by the voltage selector DIP switches Vo setting. The silk screen marking shows the voltage settings that can be achieved by these switches.

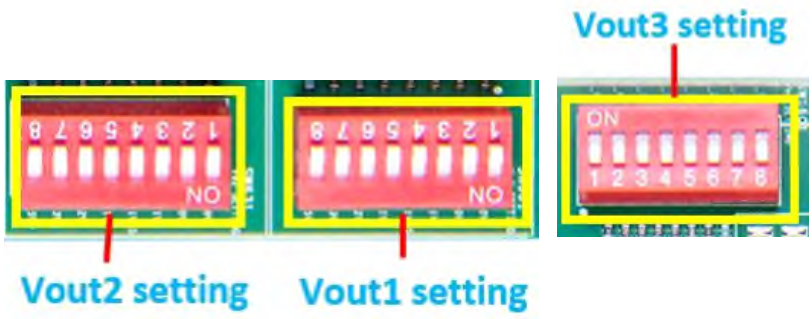


Figure 10 - Nominal output voltage settings by DIP switch setting

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OPERATION

5. Power up sequence

With all connections to and from the evaluation board applied, to enable the DC to DC converters to work, take the following steps:

a. Apply the input voltage to Vin1 and Vin2.

b. Operate the toggle enable switch (S201) so that the toggle is leaning toward the input connections and away from the output connections.

The LGA50D modules should now be operating and supplying power to your E-load.

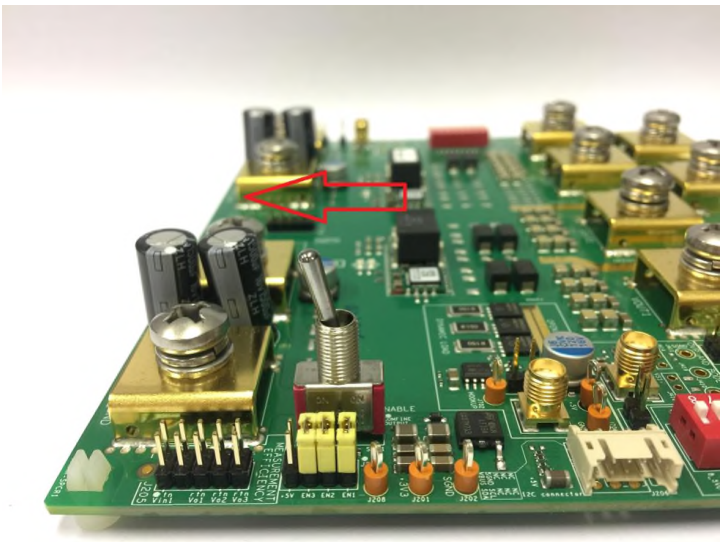


Figure 11 - Toggle switch position to enable the outputs of the modules

6. Power down sequence

To disable the outputs from the evaluation board, take the following steps:

a. Toggle Enable switch to disable Vout.

b. Turn off main voltage to Vin1 and Vin2.

Note that not following power up/down sequence may damage the evaluation board.

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OPERATION

Additional Information

1. Using a single input to supply the board

This demo board is designed to have two LGA50D modules which can be tested independently with two independent input supplies.

However, if the user wants to use one input (either Vin1 or Vin2) to power both modules, then this can be done by linking the two solder pads together as identified in the picture below:



Figure 12 - Shorted pads required to use a single input to supply both LGA50D modules

Note: The short should be removed for efficiency test, because it effects the test result.

2. Enabling each output

The outputs of the individual converters can be enabled or disabled by populating and depopulating the enable jumpers as required.

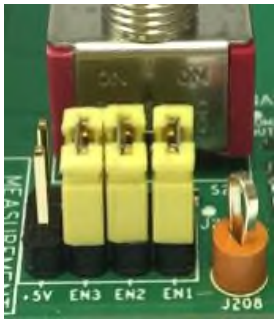


Figure 13 - The enable jumpers (all 3 shown in place) to enable all three outputs

If the enable signal is bouncing during enable and disable, a 0.1uF 0603 capacitor can be added at C211, C212 and C213 for monotonic signal (Refer to Page 16 PCB SILK-SCREEN LAYER section for the location of the capacitors).

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OPERATION

Test Functions

The evaluation board is also equipped with test points to provide easily accessible voltage measurement points.

1. Vin and Vout sense locations

Accurate input and output voltage measurements via pin-headers can be found on J205 and J1205.

Use J1205 for monitoring the input voltage and output voltage of the “top” LGA50D (when the input connections are on the left). Note that this converter is configured for a single 50A maximum output.

The location of the J1205 connector and the pin details when viewing the connector from the top side (component side) is shown below.

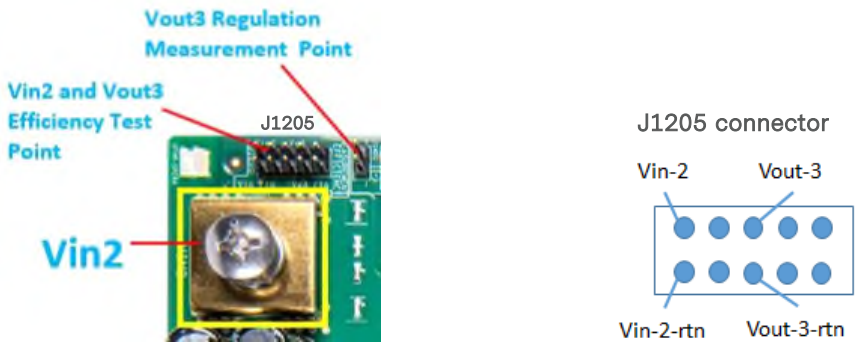


Figure 14 - Voltage sense locations for Vin2 and Vout3

Use J205 for monitoring the input voltage and output voltage of the “bottom” LGA50D (when the input connections are on the left). Note that this converter is configured for two independent 25A maximum outputs.

The location of the J205 connector and the pin details when viewing the connector from the top side (component side) is shown below.

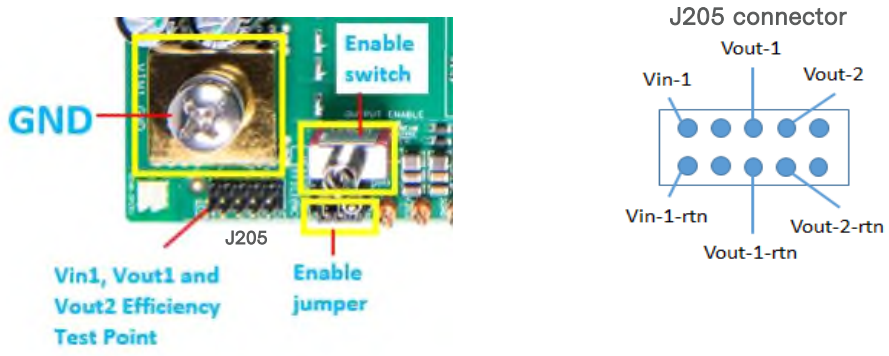


Figure 15 - Voltage sense locations for Vin1 and Vout2 and Vout1

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OPERATION

2. Ripple and regulation measurement locations

There are three test points provided to give accurate measurements of the output noise and ripple from the LGA50D.

The mating connector to the SMA connector on the Evaluation board is “SMA Connector, Plug, Crimp Termination type RG174U”.

- J1403 - Point of Measurement for Vout3 ripple.
- J1401 - Point of Measurement for Vout3 regulation.

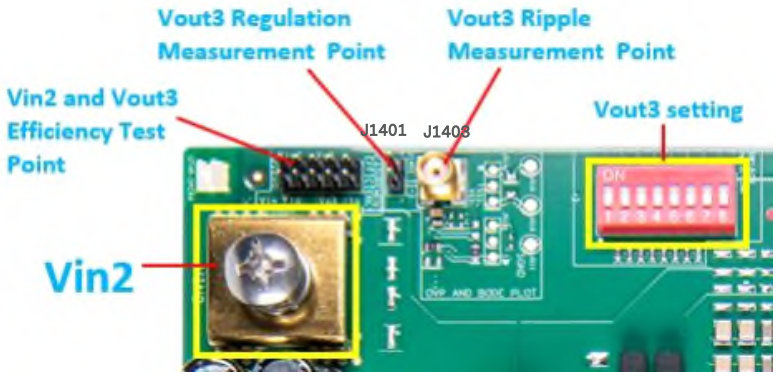


Figure 16 - Ripple and regulation measurement point for Vout3

- J303 - Point of Measurement for Vout2 ripple
- J301 - Point of Measurement for Vout2 regulation

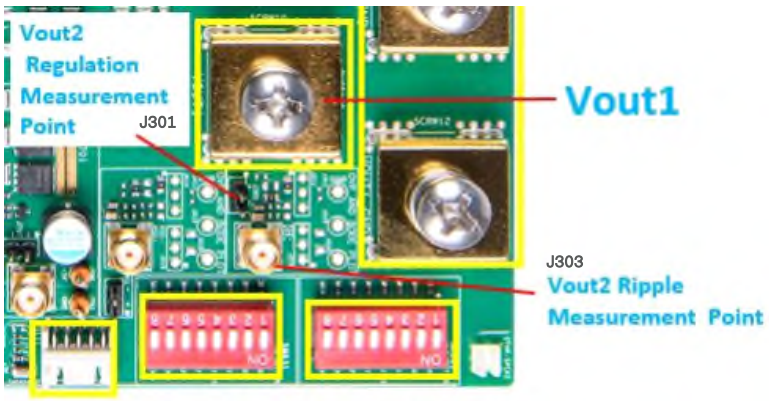


Figure 17 - Ripple and regulation measurement point for Vout2

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OPERATION

- J403 Point of Measurement for Vout1 ripple
- J401 Point of Measurement for Vout1 regulation

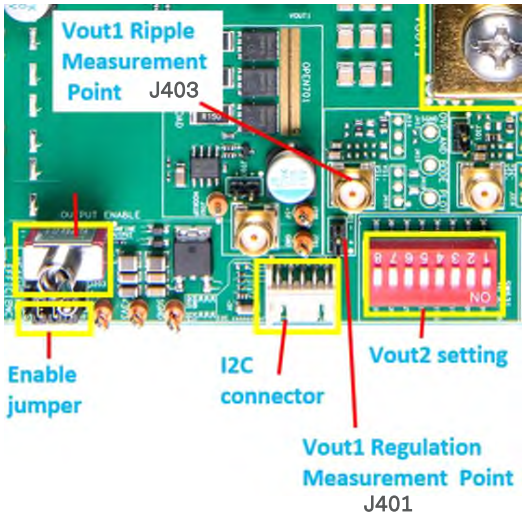


Figure 18 - Ripple and regulation measurement point for Vout3

3. Errata

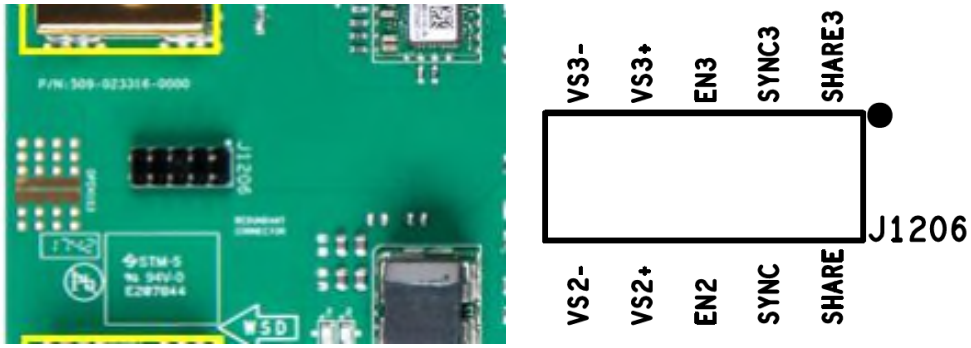


Figure 19 - J1206 silk screen

Note: The silk screen on the demo PCB is missing on J1206. The silk screen is shown on the right in the figure above. The J1206 is for 4 phase setting.

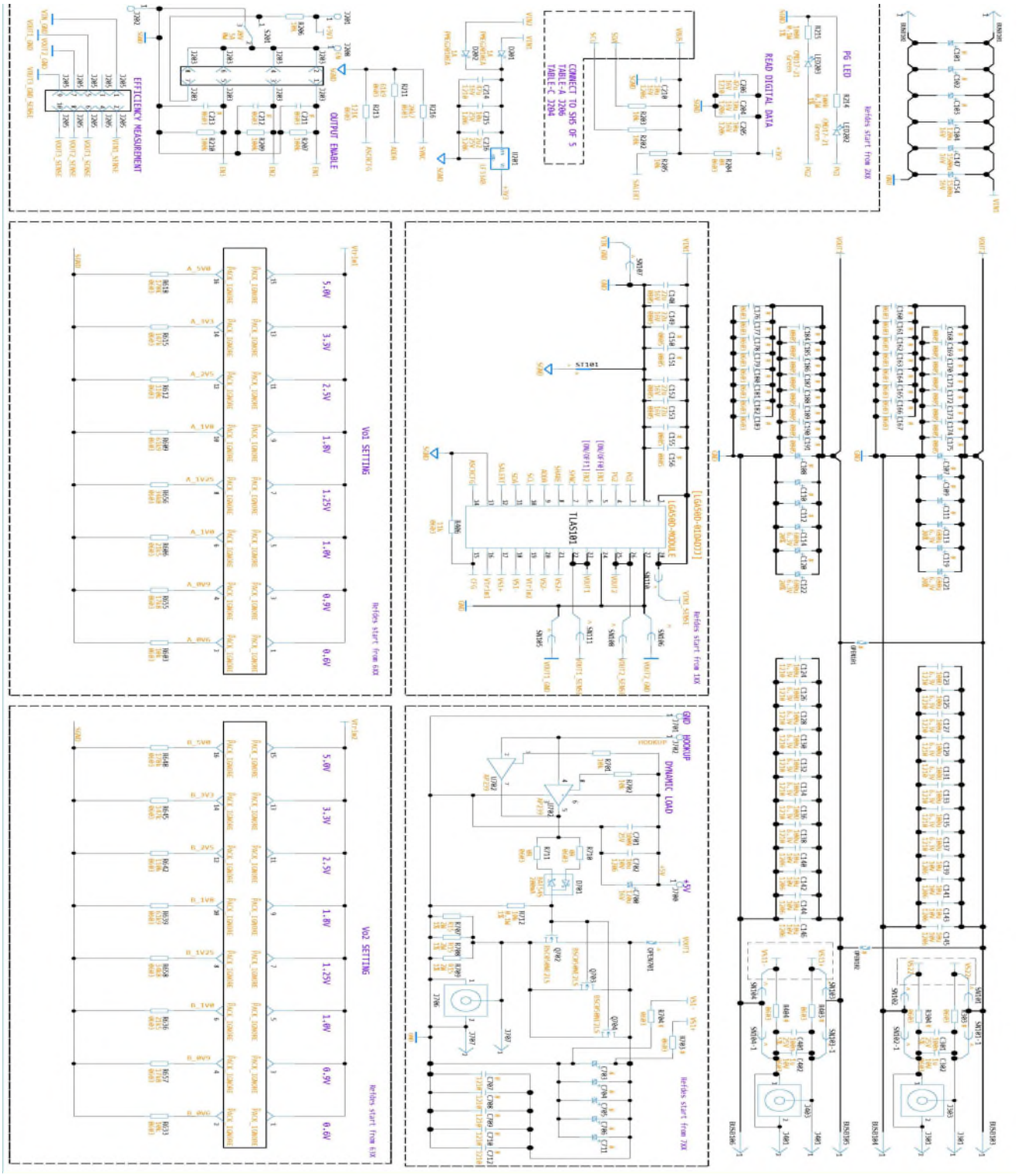
4. For any other measurements and configurations

Please contact technical support for any further configurations or evaluation parameters that you wish to investigate.

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SCHEMATICS

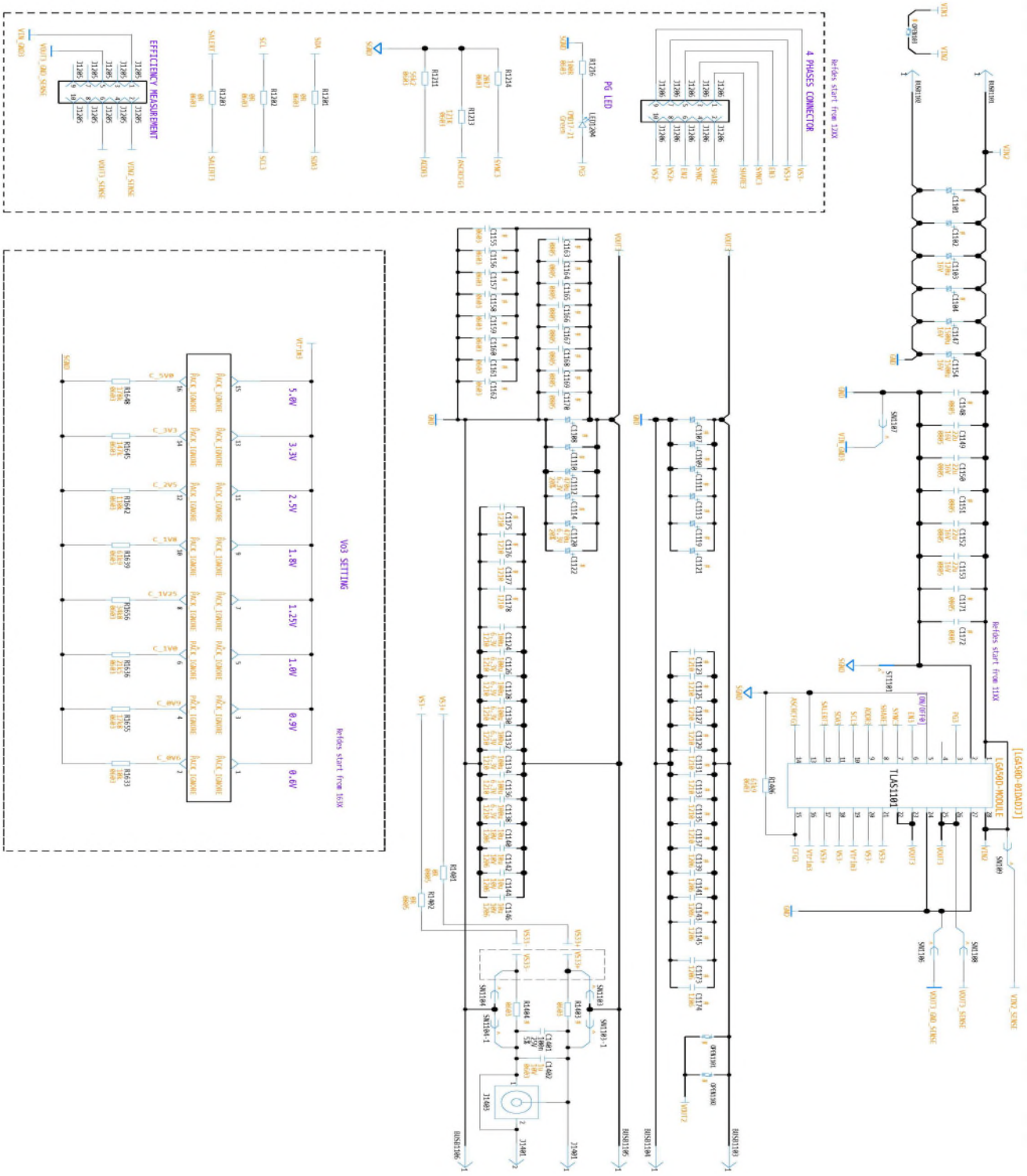
Schematics of the Evaluation Board



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SCHEMATICS

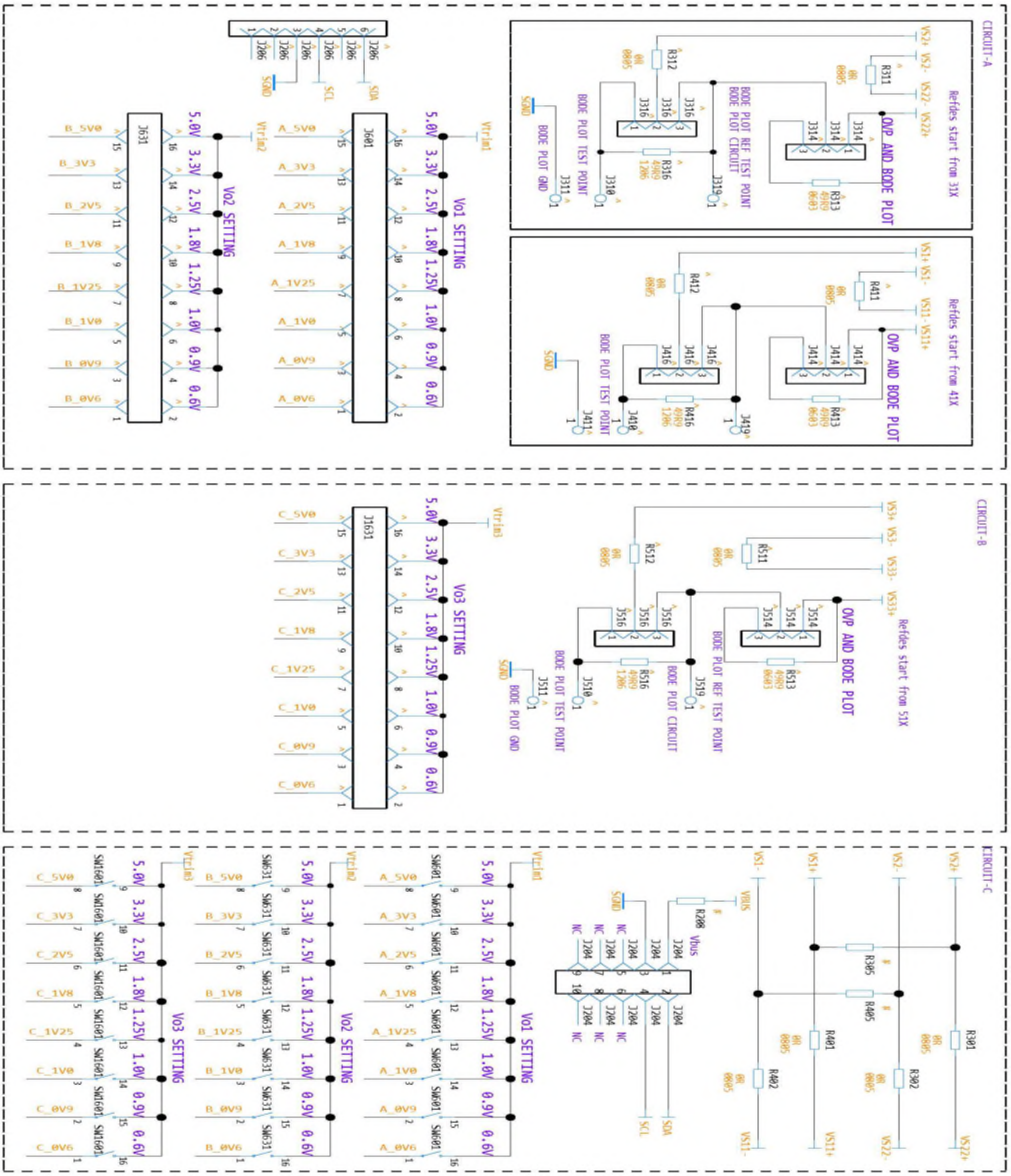
Schematics of the Evaluation Board (Con't)



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SCHEMATICS

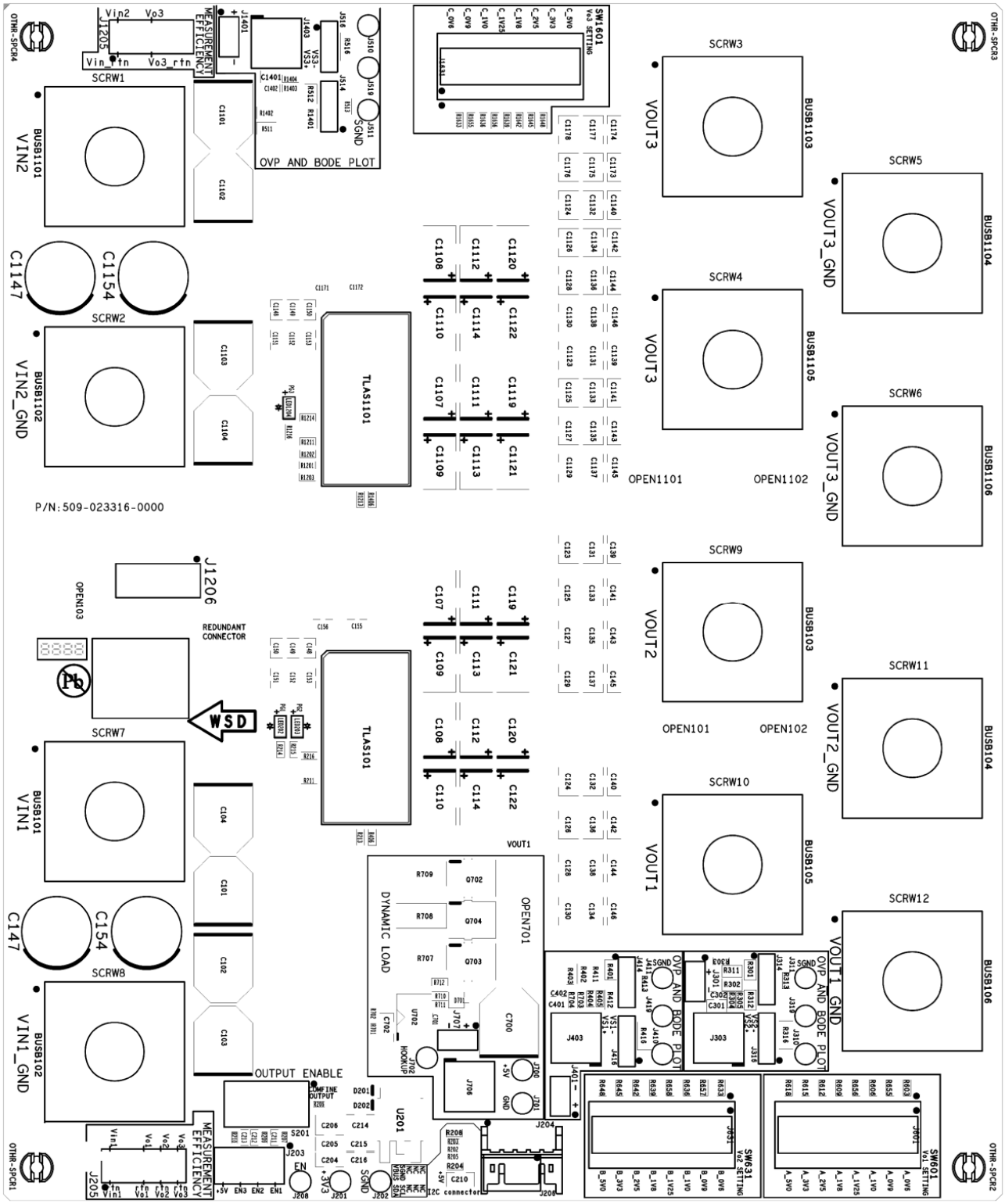
Schematics of the Evaluation Board (Con't)



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PCB SILK-SCREEN

Silk-screen Layer of the Evaluation Board



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RECORD OF REVISION AND CHANGES

Issue	Date	Description	Originators
1.0	04.15.2022	First Issue	E. Wang

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ABOUT ADVANCED ENERGY

Advanced Energy (AE) has devoted more than three decades to perfecting power for its global customers. AE designs and manufactures highly engineered, precision power conversion, measurement and control solutions for mission-critical applications and processes.

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