REVISION - B

SMM766 Evaluation Kit *Quik-Start* User's Guide

SMM766EV

General Description

The SMM766EVAL kit is a fully functional printed circuit board designed to demonstrate all the features of the SMM766 and SMM766B Nonvolatile, Six-Channel Active DC Output Controllers, Monitors, Marginers and Sequencers with Sequence-Link™. The SMM766EV operates from either a +5V or a +12V supply and includes twelve non-isolated DC-DC converters.

A precision external voltage reference permits the DC-DC converters to be trimmed to within a 0.2% tolerance. The SMM766EVAL manages the power-on/off sequencing of the DC-DC converters in addition to voltage monitoring, margining and trimming of the on-board converters. Power on/off of the converters along with many other programmable features is permitted through the I^2C 2-wire bus interface.

Several key, user-configurable functions are:

1. Power on/off sequence management
2. User-Programmable Voltage Sensor with Under-Voltage or Over-Voltage (UV/OV) fault monitoring (5mV increments)
3. Programmable assertion levels of management input/output pins
4. Programmable nominal, high and low trim/margin voltages
5. Programmable power-on/off intervals
6. Programmable sequence time slots for 12 supplies

Additional features included on the EVAL board:

- EZ connect Power and Signal pins
- User-Programmable Interface connector to digitally control power supply voltages, sequencing, etc.
- 12 Non-Isolated DC-DC converters with Trim/Enable/Sense Functions
- 48-pin TQFP Spring-Loaded Socket for SMM766/B
- Status Indicators (LED) included for power, fault, etc.
- Large PCB ground plane minimizes voltage errors

SMM766EV User's Guide Table of Contents

Evaluation Kit Contents

1. Fully Functional SMM766 Evaluation Board.
2. SMM766 Evaluation Kit User's Guide.
3. SMX3200 or SMX3202 Dongle Programmer Interface Card.
4. Dongle to I^2C Interface or USB Cable (1 meter).
5. One CD-ROM containing: SMM766EV Gerber Files, GUI Software, Hex file, Application Notes/Briefs.
6. Visit 'www.summitmicro.com' for current information.

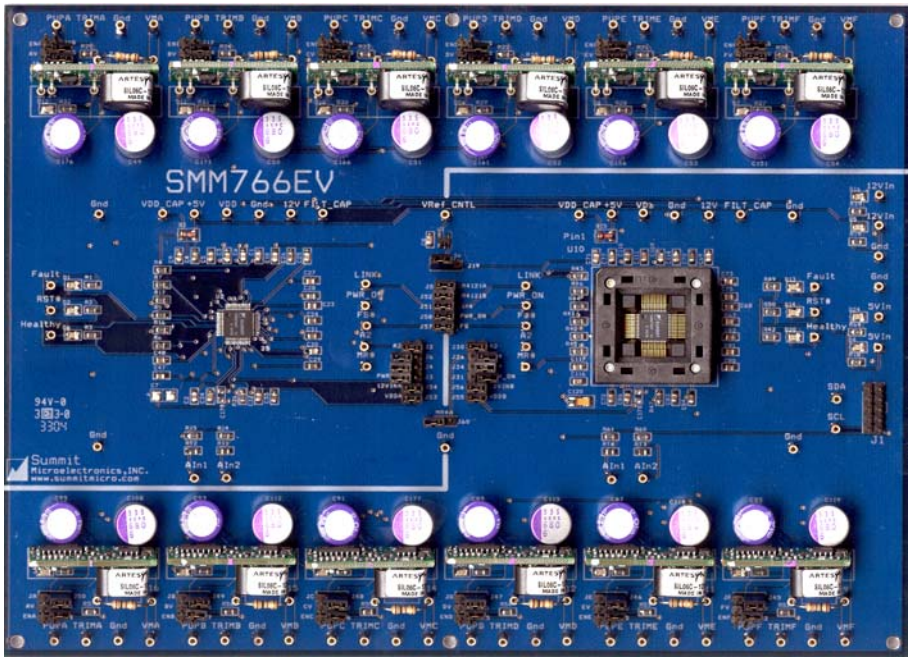


Figure 1: SMM766 Evaluation Board

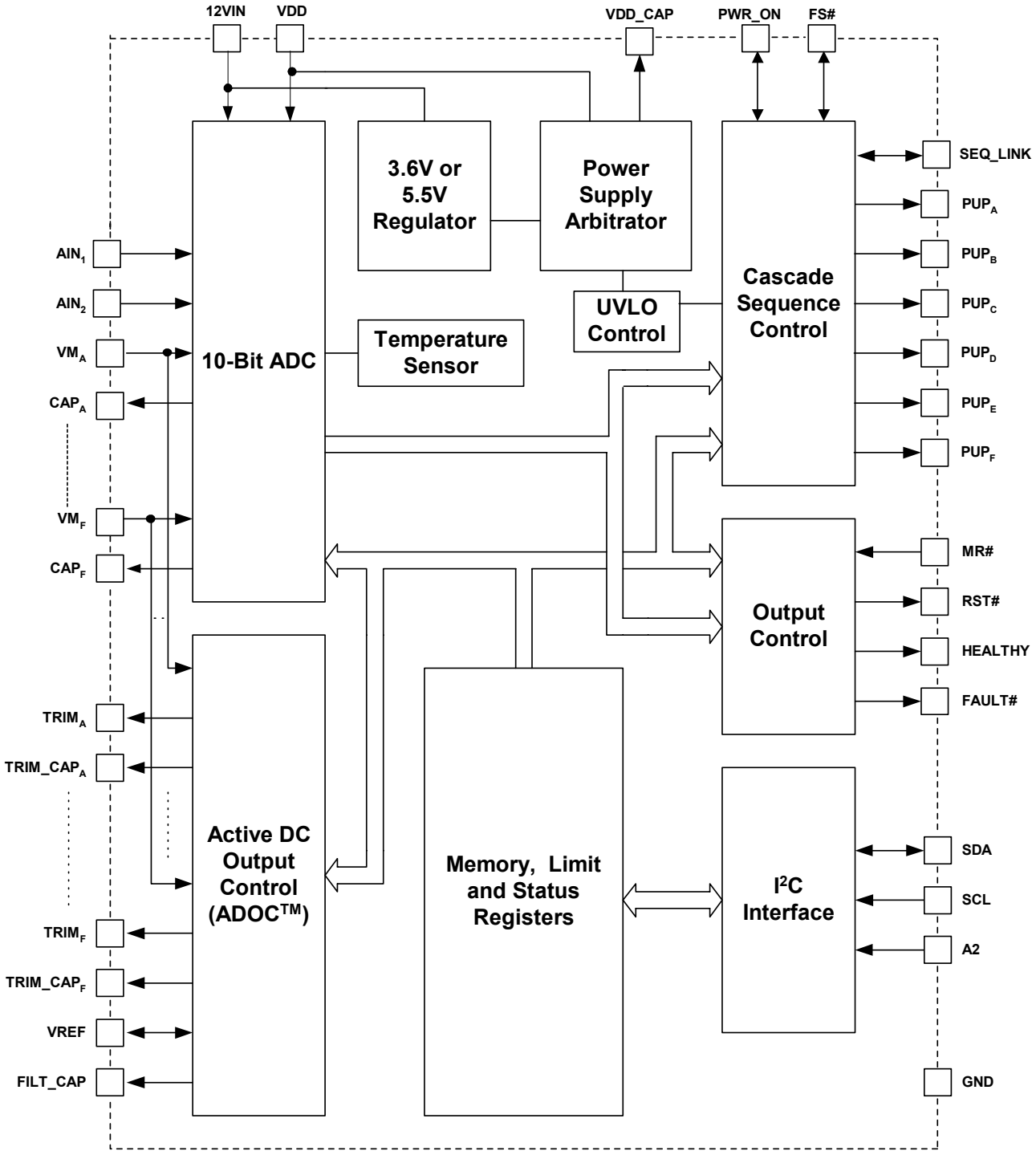


Figure 2: SMM766 and SMM766B Simplified Block Diagram

Operating Instructions

Test Equipment Required

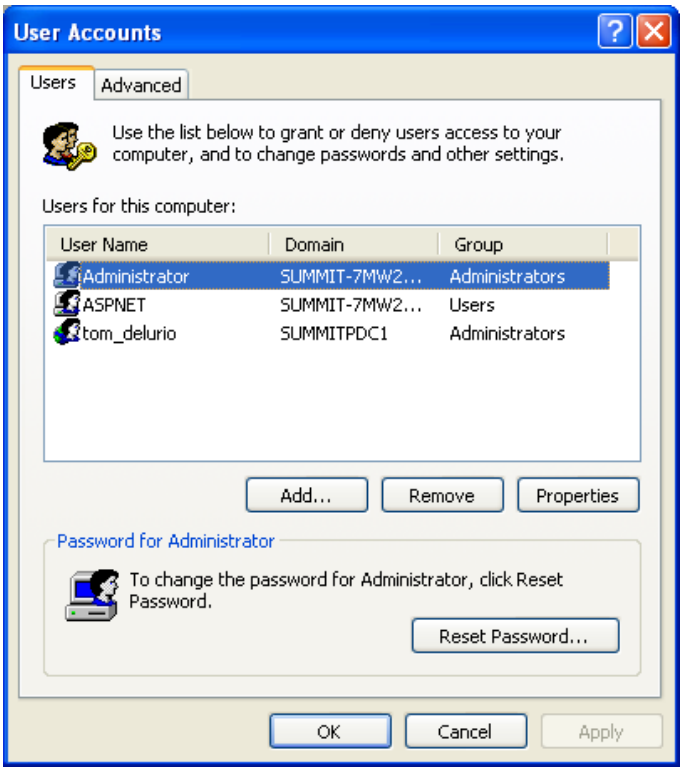
A. Personal Computer with Windows 95 (or later O/S) and a parallel port.
B. Power Supply, 5V, 500mA.
C. Power Supply, 5V, 2A.
D. Oscilloscope, Digital sampling, 2 to 4-channel
E. High Accuracy DVM (e.g., HP34401A or equivalent)

Test Steps

Software setup (The SMX3200 is the parallel port dongle, the SMX3202 is the USB port dongle)

To correctly install the SMX3202 USB drivers, the user must have 'Administrator Rights' on the PC.

Consult the SMX3202 USB2I^{2}C Programming Kit *Quick-Start* User's Guide for correct USB driver installation.



1. Close all open Windows application programs.
2. Insert the "SMM766EV Software" CD into the CD-ROM drive.
3. Follow the installation instructions, rebooting the computer when prompted.
4. After the computer reboots, perform a full power shutdown to install the Dongle.

Dongle installation (The SMX3200 is the parallel port dongle, the SMX3202 is the USB port dongle)

Caution: Do not apply any power sources to the SMM766 evaluation board while the Dongle is connected to the board.

SMX3200 installation

1. Remove any existing cabling from the computer's parallel port (LPT1).
2. Connect the Dongle to the parallel port.
3. Insert the Dongle cable onto the SMM766 Evaluation board connector J1 (pin 1 on the board corresponds to the white wire with the orange stripe, also see the SMX3200 Dongle Info on Page 18 or the SMX3200 Data Sheet on the CD ROM, web site or document package).
4. Reapply power to the computer.
5. After the computer restarts, open the 'SMM766 Programmer' or 'SMM766B Programmer' application program and click on the 'Read from Devices' button (Figure 3). The 'Select Devices' dialog box shown in Figure 4 will appear on the screen.
6. Click the 'Next' button (Figure 4). The 'Devices/Sequence Summary' dialog box will now appear (Figure 5).
7. Click the 'Open GUI' button below the Device 1 column (Figure 5). The programming window for U2 will now appear (Figure 6).

SMX3202 installation

8. Remove existing cabling from the computer's USB port.
9. Insert the SMX3202 onto the SMM766EV Evaluation board connector J12 (Refer to Figure 24 for correct orientation). *The SMX3202 must be connected to the SM766EV before connecting the USB cable to the PC port.* The SMX3202 is shown in Figure 22 and 23.
10. Insert the USB cable A plug into the PC USB port. Connect the USB cable mini-B plug to the USB2I^{2}C Programming Board, SMX3202. Open the 'SMM766 Programmer' or 'SMM766B Programmer' application program and click on the 'Standard Settings' button. The GUI shown in Figure 3 will appear on the screen.
11. The LED on the SMX3202 will turn on, indicating that USB power is present.
12. ***The SMX3202 USB2I^{2}C programming board must be connected to the eval board before connection to the USB port/cable for correct operation. Anytime the USB cable connector has been removed and then reconnected while the Windows GUI is open, the 'Refresh USB Connection' button (Figure 6B) must be used to reestablish communication with the GUI. Exiting and restarting the GUI will also perform the same function.***

Note: The SMM766 and SMM766B device registers are pre-configured with the Default Configuration Settings shown in the SMM766 and SMM766B data sheets. Settings specific to the SMM766EV evaluation kit are included in an Intel format Hex file located on the CD ROM and programmed into the SMM766 or SMM766B samples shipped with the SMM766EV kit. When changing parameters, a new hex file can be saved on the PC. To get back to the original settings, read the hex file from the CDROM disk. See the buttons in Figure 3.

13. Optional: Click the 'HEX' folder icon to load the 'SMM766EV Default Hex' or 'SMM766BEV Default Hex' file from the CD-ROM drive.
14. Optional: Click the 'Write Config' button. This configures the SMM766 or SMM766B registers to sequence the 6 DC-DC converters and monitors the DC-DC converter output voltages, etc.
15. Optional: Repeat steps 6 and 7 for U10. Make sure to change the GUI settings for the I^2C address of U10 to A6.

Hardware

Note: The Dongle interface generates a low impedance +5V source to power and program the SMM766B.

Ensure all jumpers are in their correct position as displayed in Figure 1.

Connect the power sources to the EVAL board as follows:

1. Connect the – terminal of the 5V supply to the 'GND' EZ connect pin.
2. Connect the + terminal of the 5V supply to the '5VIN' EZ connect pin.
3. Switch the 5V power source on.
4. Connect the – terminal of the 12V supply to the 'GND' EZ connect pin.
5. Connect the + terminal of the 12V supply to the '12VIN' EZ connect pin.
6. The HEALTHY LED (D13) indicates that the DC-DC converters are enabled and within programmed tolerances.
7. Explore the SMM766 and SMM766B features by changing its many configurable parameters. Confirm the programmed settings agree with actual measurements. Observe the functionality of the SMM766 and SMM766B by varying the supply voltage and changing the states of the input signals.

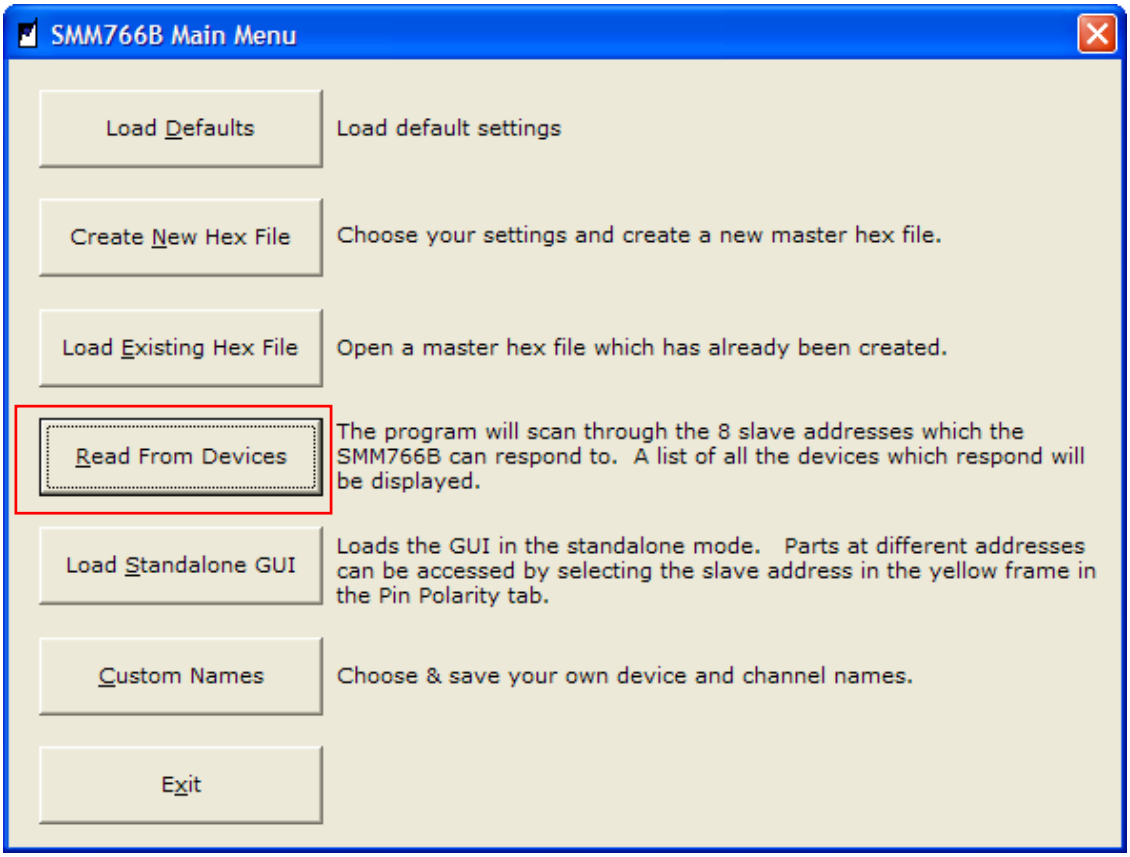


Figure 3: SMM766B Programmer Window with the 'Read From Devices' button clicked (see Figure 4).

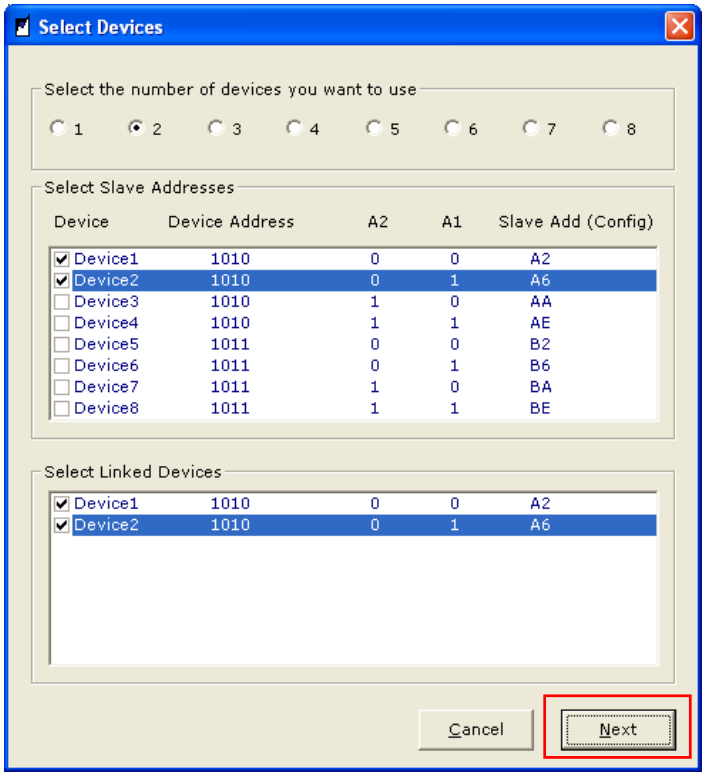


Figure 4: SMM766 or SMM766B 'Select Devices' Window opens after clicking 'Read From Devices' button (see Fig 3).

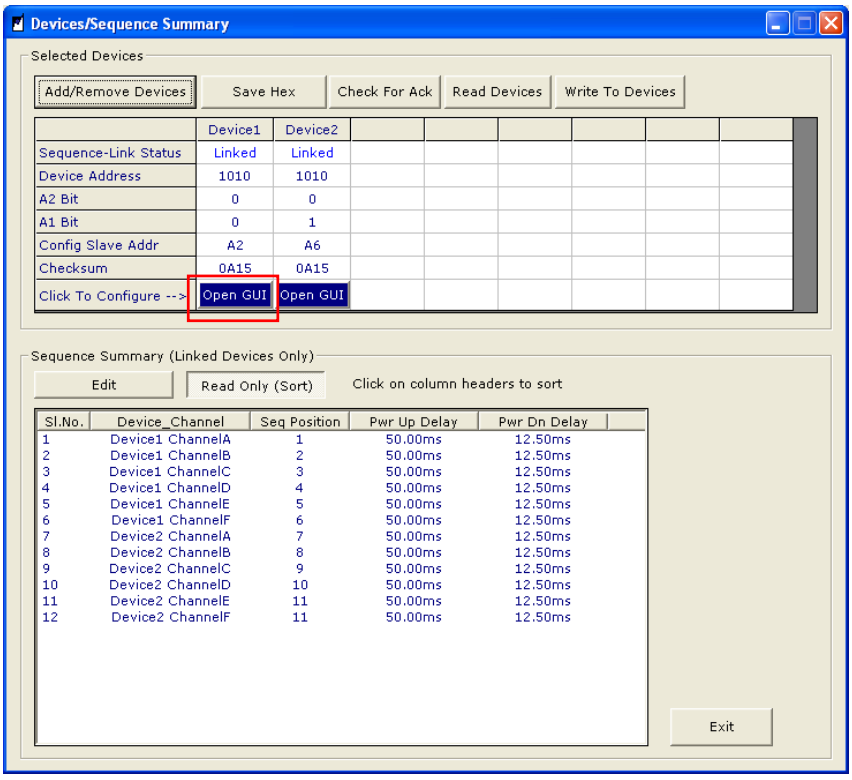


Figure 5: SMM766 or SMM766B 'Devices/Sequence Summary' Window opens after clicking the 'Next' button (Fig 4).

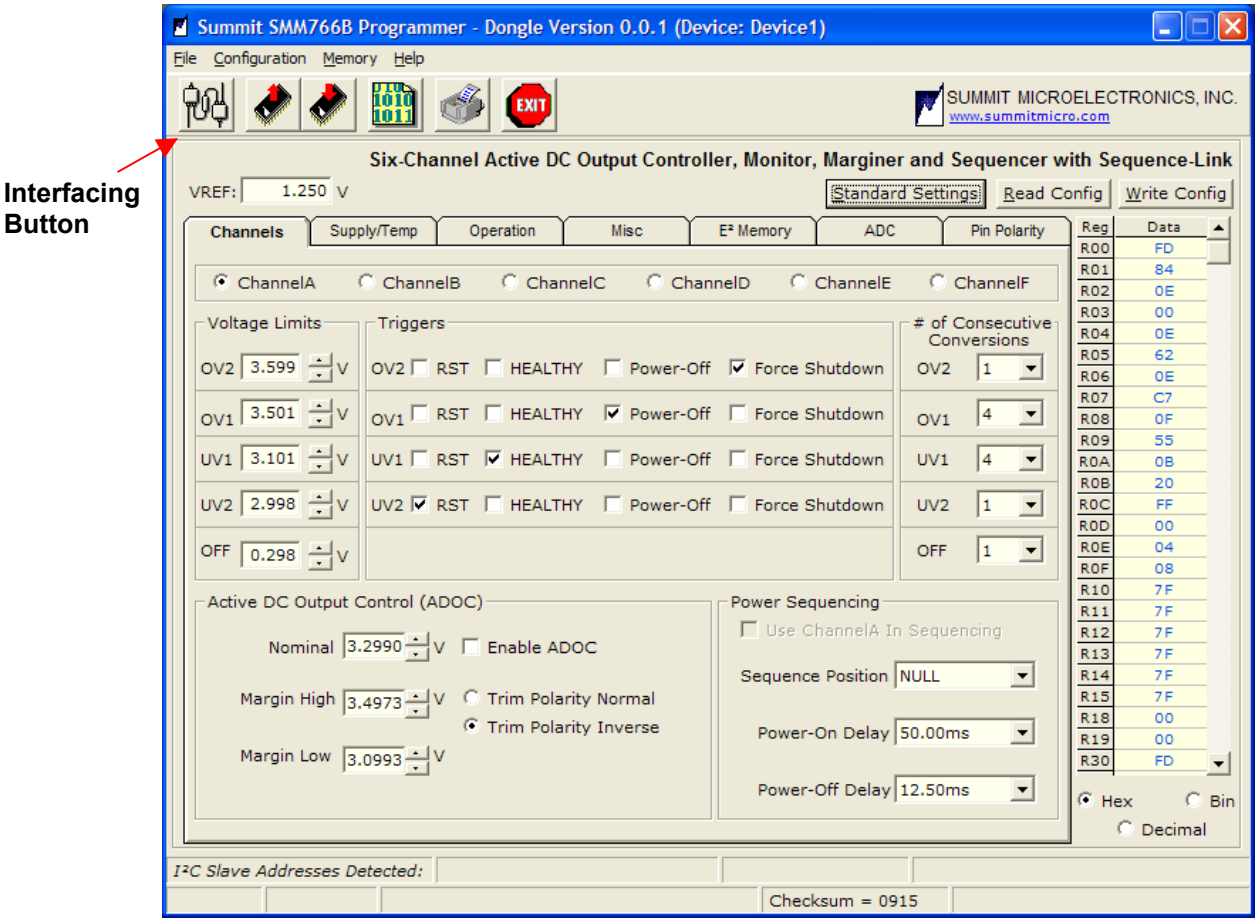


Figure 6A: SMM766B Main Programmer Window opens after clicking the 'Open GUI' button (Fig 5). Choose USB (SMX3202) or Dongle (SMX3200) Interface Options under "File", "Options", "Advanced" then Press "OK" or press the "Interfacing" button (see above).

Figure 6B: The GUI software needs to refresh the USB Programmer when the USB Programmer has been disconnected and reconnected, press the "Refresh USB Connection" button or exit the GUI and then restart.

Performance Measurements

Assuming all input voltages (+5V, +12V) are within the programmed limits, application of power to the board will enable all DC-DC converters according to the sequence programmed for each channel in the SMM766Bs or SMM766Bs. An I²C software Power-On command (Figure 7) can also be used to enable the DC-DC converters. The waveforms in Figure 8 were generated using Channel 2 (3.3V DC-DC converter output) for the time-base trigger. Note the outputs are asserted once the pre-programmed time limit is passed.

Conversely, the SMM766 or SMM766B may be issued an I²C Power-Off command (Figure 7).

As the SMM766 or SMM766B was programmed to reverse the Power-Off sequence, the first supply to shut off is the last to have turned on (Channel F). As displayed in Figure 9, the supplies are turned off in reverse order of the turn-on sequence.

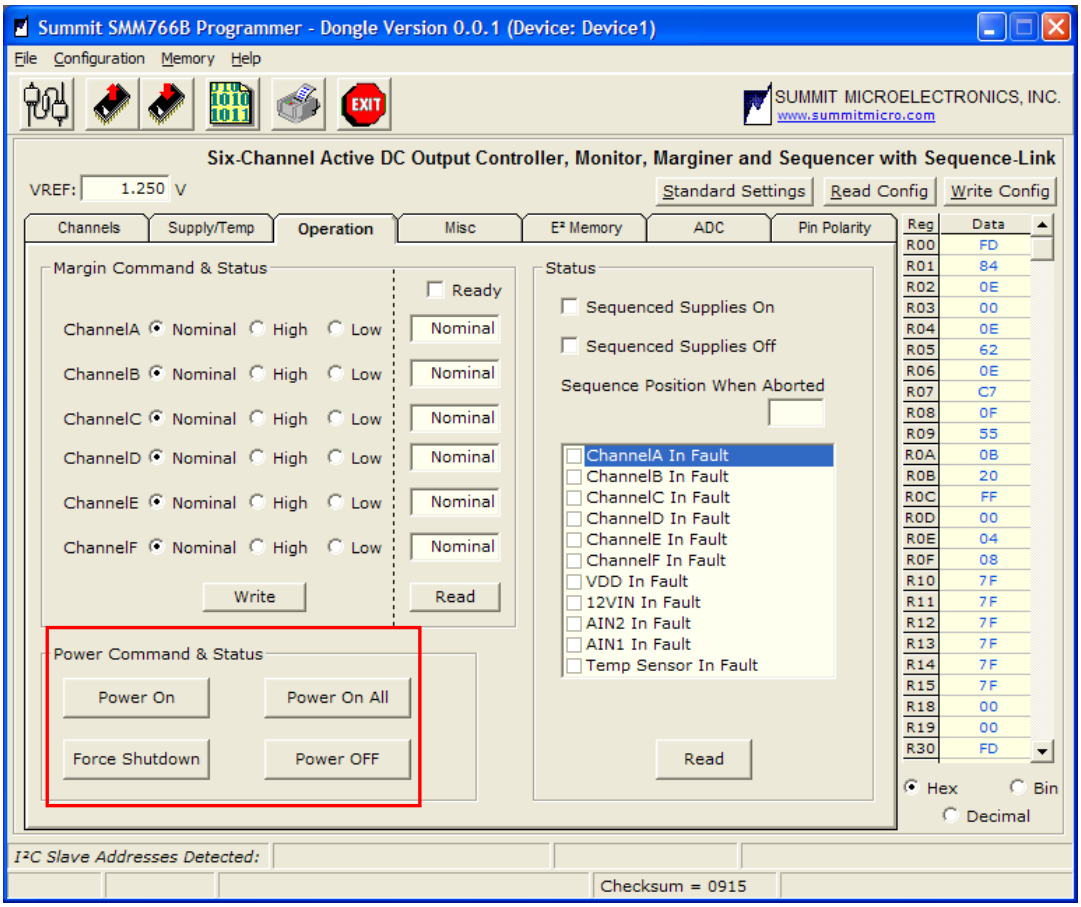


Figure 7: Using the I²C Software Power-On Command to Commence Sequencing.

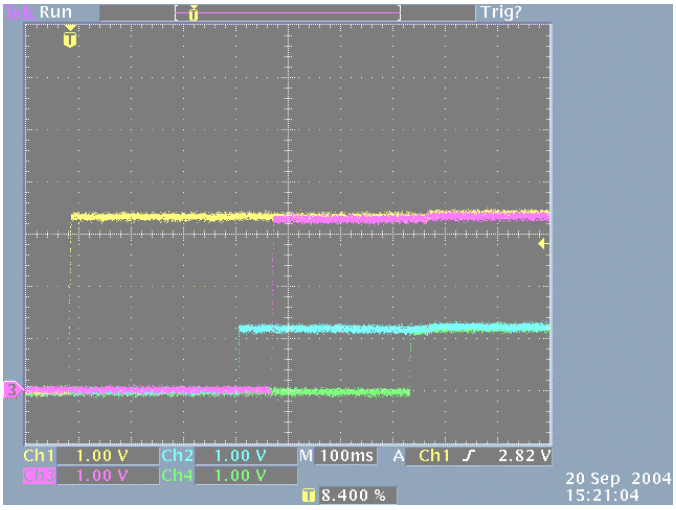


Figure 8: SMM766EV Sequence-On Waveforms
Tektronix TDS3054: Time/Horizontal division = 100mS

Ch 1(1V/Div) = 3.3V (U2-Ch A) DC-DC converter output (Yellow trace)
Ch 2 (1V/Div) = 1.2V (U2-Ch F) DC-DC converter output (Blue trace)
Ch 3 (1V/Div) = 3.3V (U10-Ch A) DC-DC converter output (Purple trace)
Ch 4 (1V/Div) = 1.2V (U10-Ch F) DC-DC converter output (Green trace)

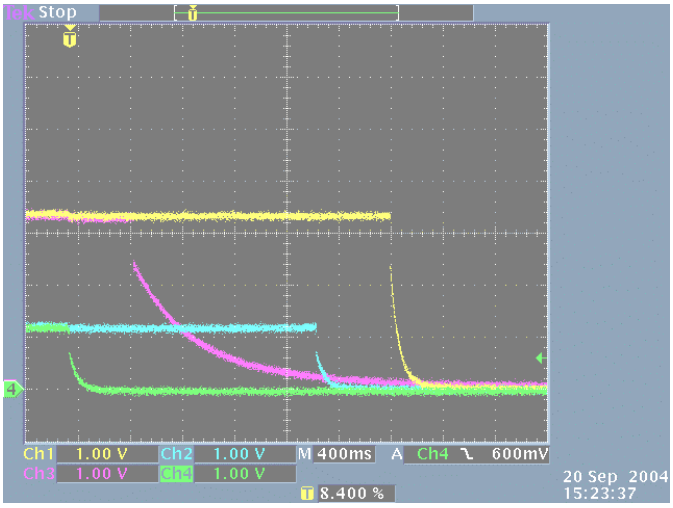


Figure 9: SMM766EV Sequence-Off Waveforms
Tektronix TDS3054: Time/Horizontal division = 400mS

Ch 1(1V/Div) = 3.3V (U2-Ch A) DC-DC converter output (Yellow trace)
Ch 2 (1V/Div) = 1.2V (U2-Ch F) DC-DC converter output (Blue trace)
Ch 3 (1V/Div) = 3.3V (U10-Ch A) DC-DC converter output (Purple trace)
Ch 4 (1V/Div) = 1.2V (U10-Ch F) DC-DC converter output (Green trace)

As a further demonstration of the SMM766's and SMM766B's many features, Voltage Margining is set up and performed on 3 of the 6 Channels (Figure 10). The Channels are first selected to Margin High and then the 'Write' button is clicked to begin the process. As is seen in Figure 11 the 3 supplies begin and complete the margin high event in approximately 200mS.

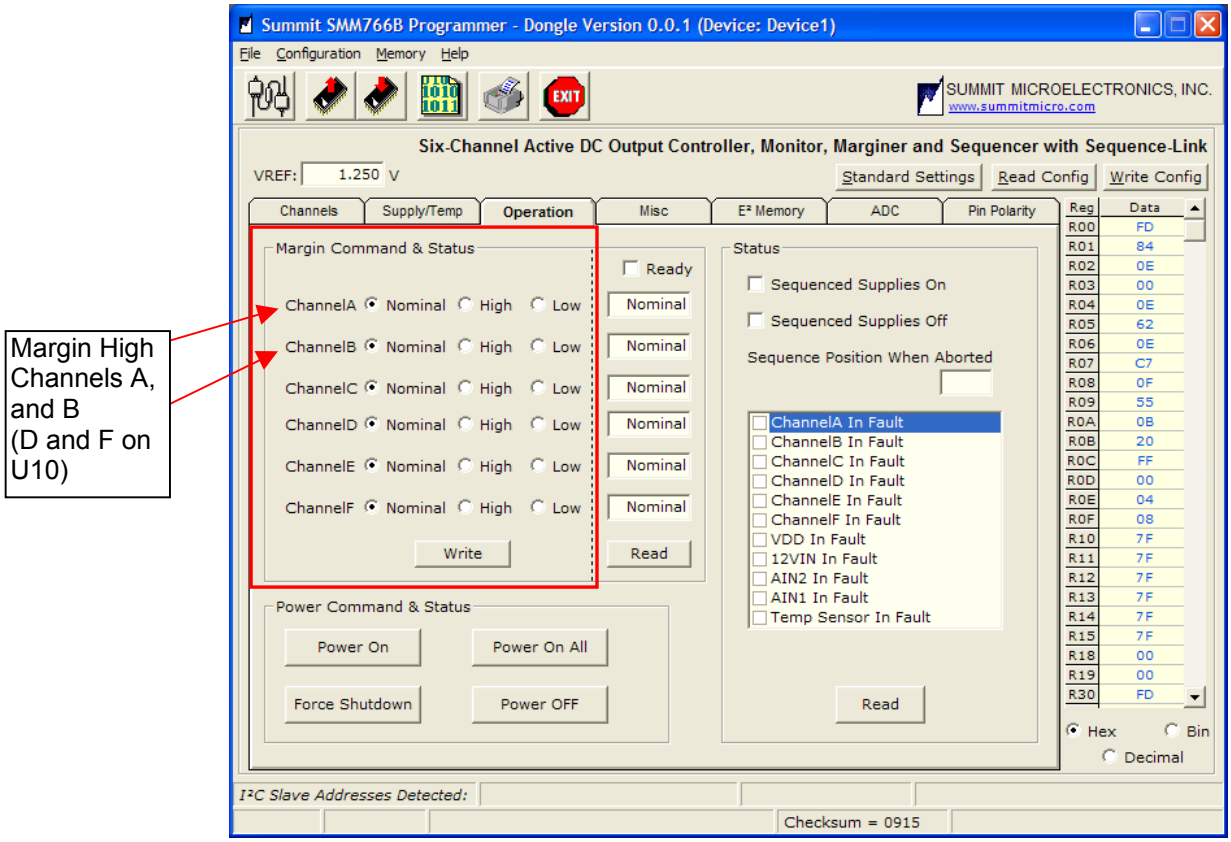


Figure 10: Using the 'Margin Command' to Enable Voltage (High) Margining of 4 Supplies (total).

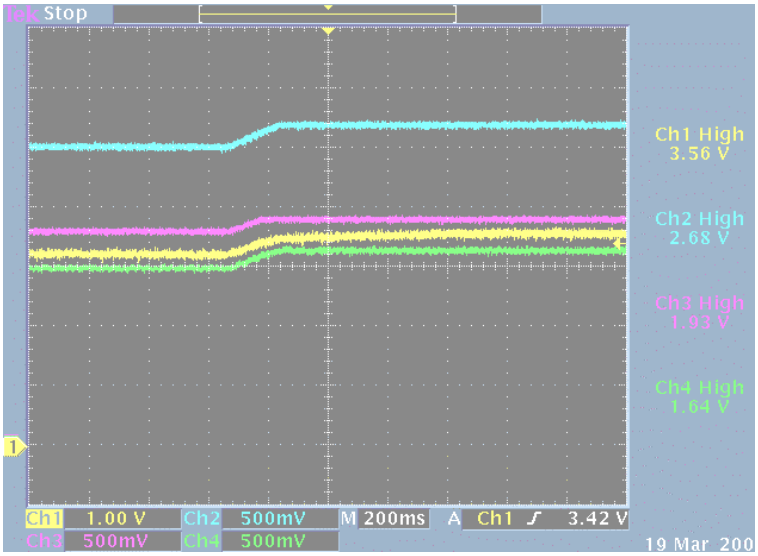
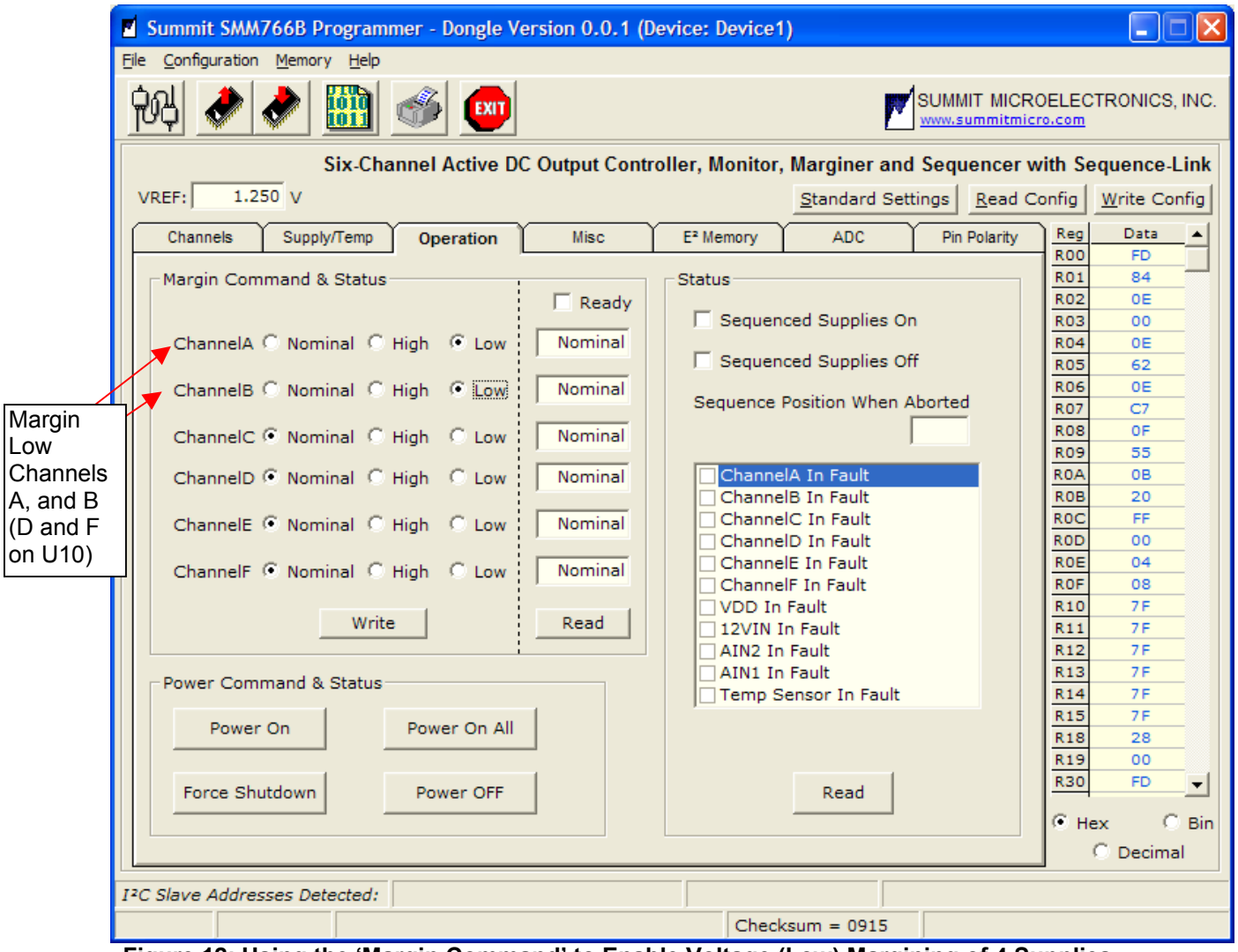


Figure 11: SMM766EV Margin High Waveforms

Tektronix TDS3054: Time/Horizontal division = 200mS
Ch 1 (1V/Div) = 3.3V (U2-Ch A) DC-DC converter output (Yellow trace)
Ch 2 (500mV/Div) = 2.5V (U2-Ch B) DC-DC converter output (Blue trace)
Ch 3 (500mV/Div) = 1.8V (U10-Ch D) DC-DC converter output (Purple trace)
Ch 4 (500mV/Div) = 1.5V (U10-Ch E) DC-DC converter output (Green trace)



Margin Low Channels A, and B (D and F on U10)

Figure 12: Using the 'Margin Command' to Enable Voltage (Low) Margining of 4 Supplies.

Next, the GUI is manipulated to margin the same 3 supplies low (Figure 12). After selecting the 'Margin Command' for the 3 Channels, the 'Write' button is again clicked. Figure 13 displays the Margin Low event. The time required for this event is the same as the Margin High event; approximately 200mS.

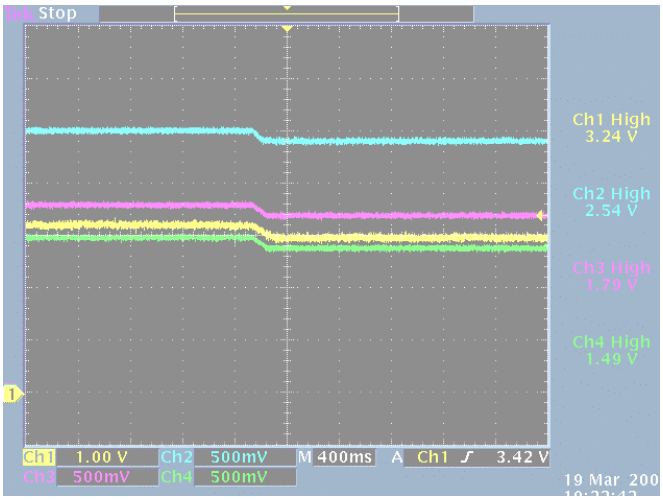


Figure 13: SMM766EV Margin Low Waveforms
Tektronix TDS3054: Time/Horizontal division = 400mS
Ch 1 (1V/Div) = 3.3V (U2-Ch A) DC-DC converter output
Ch 2 (500mV/Div) = 2.5V (U2-Ch B) DC-DC converter output
Ch 3 (500mV/Div) = 1.8V (U10-Ch D) DC-DC converter output
Ch 4 (500mV/Div) = 1.5V (U10-Ch E) DC-DC converter output

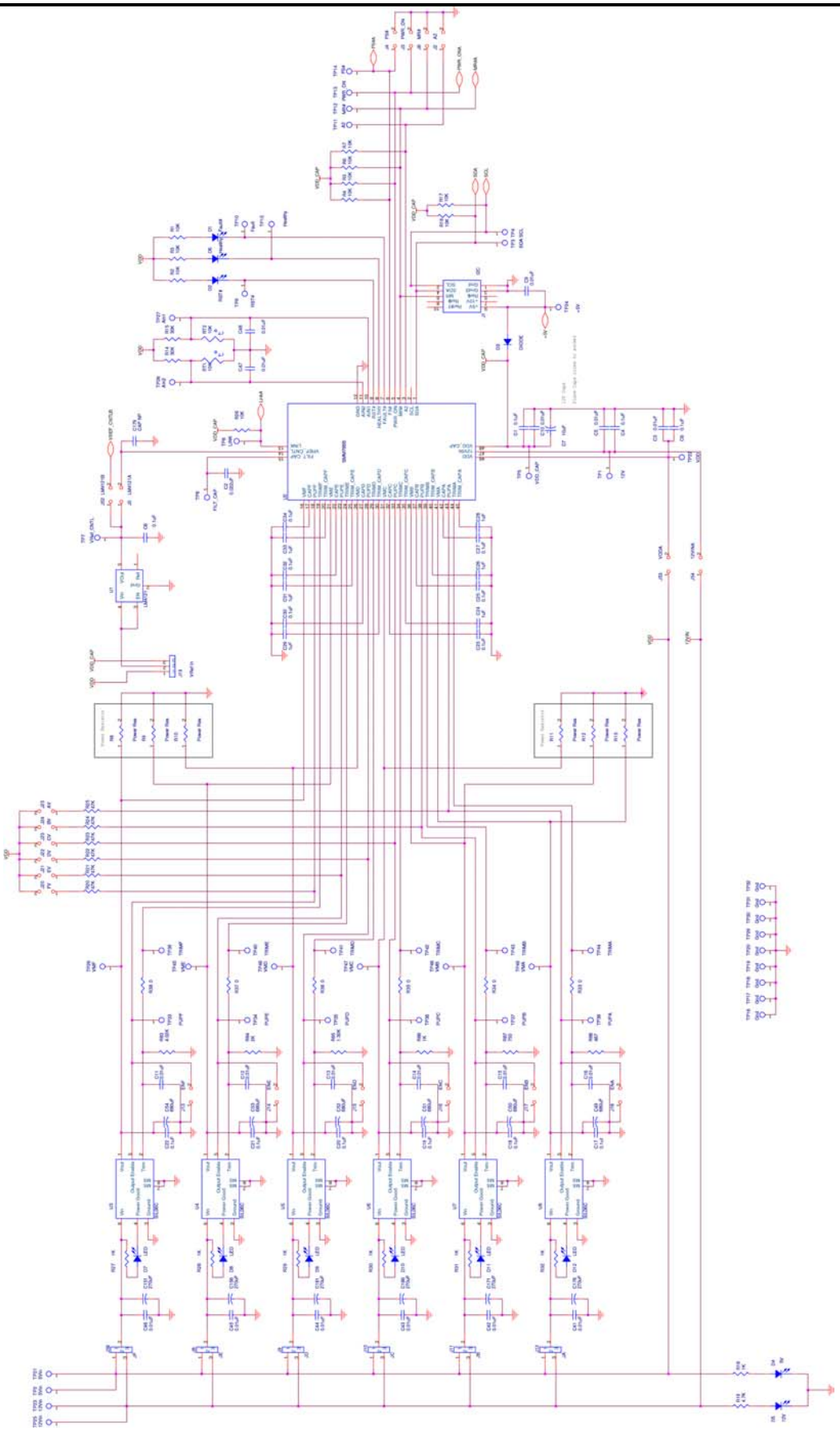


Figure 14: SMM766 Evaluation Board Schematic (Page 1) includes six non-isolated DC/DC converters.

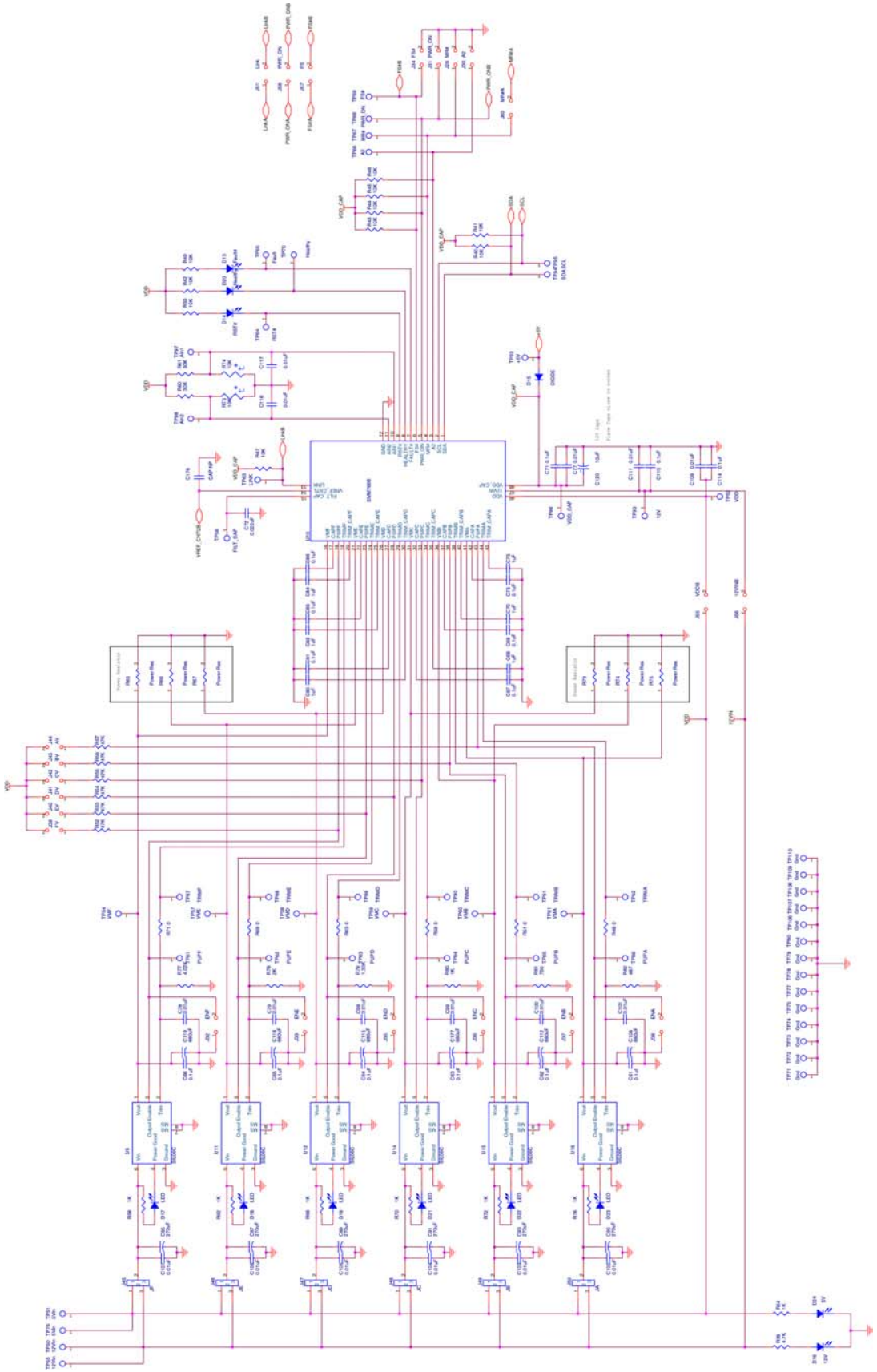


Figure 15: SMM766 Evaluation Board Schematic (Page 2) includes six non-isolated DC/DC converters.

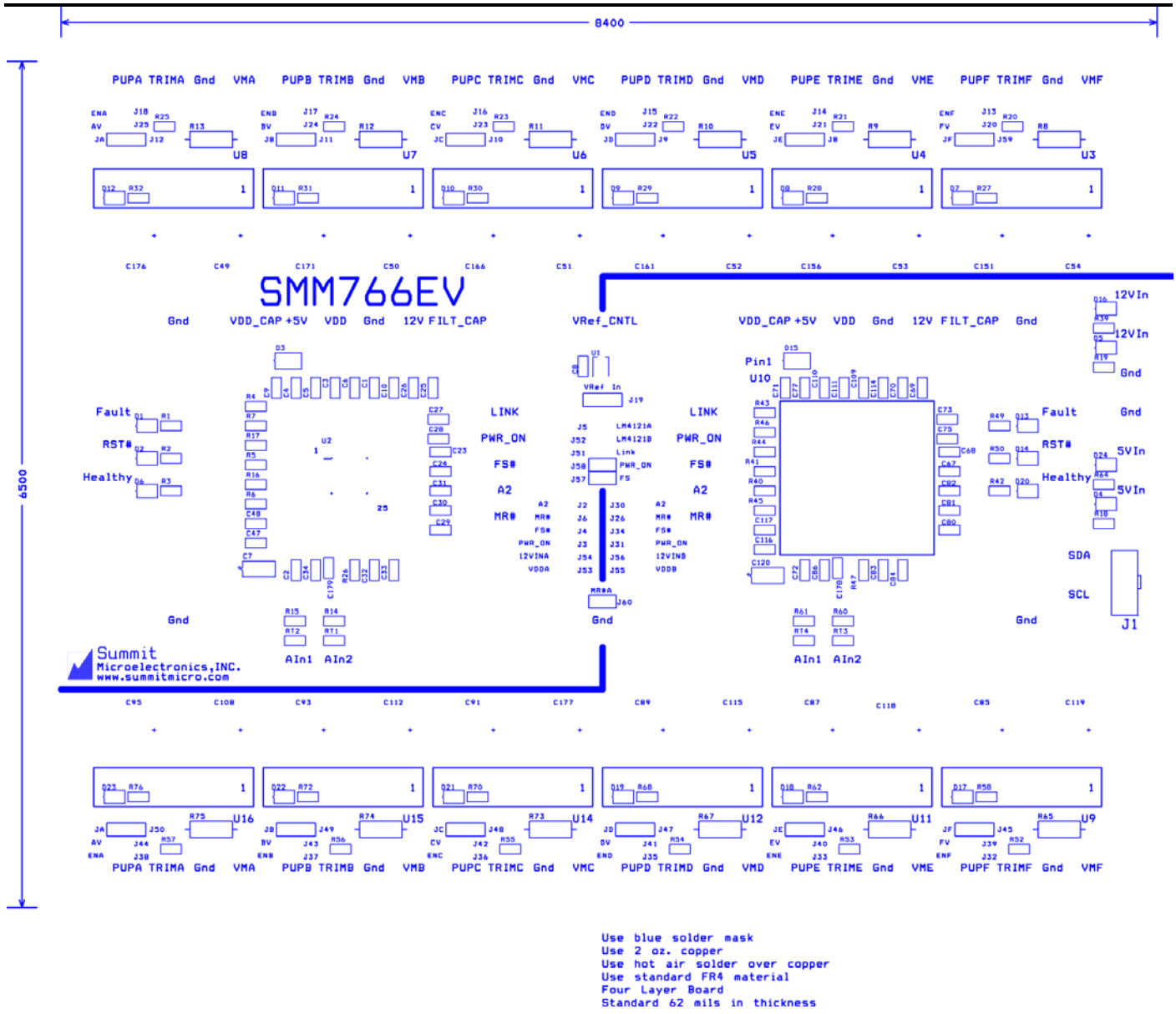


Figure 16: SMM766 Evaluation Board Top Silkscreen (Not to Scale)

Table 1: SMM766 Evaluation Board Jumper List (see Figures 1, 11, 12 and 16 for locations and function)

Jumper	Name	Default	Function
J2	A2	On	Sets A2 for U2 to GND.
J3	PWR_ON	Off	Sets U2 PWR_ON input state (Default = High).
J4	FS#	Off	Sets U2-FS# input state (Default = GND).
J5	LM4121A	On	Connects external voltage ref to U2 VREF_CNTL.
J6	MR#	Off	Sets U2 MR# input state (Default = High).
J8	JE	On (Closest to "J8" text)	Connects U2-E channel converter's input to 12V input.
J9	JD	On (Closest to "J9" text)	Connects U2-D channel converter's input to 12V input.
J10	JC	On (Closest to "J10" text)	Connects U2-C channel converter's input to 12V input.
J11	JB	On (Closest to "J11" text)	Connects U2-B channel converter's input to 12V input.
J12	JA	On (Closest to "J12" text)	Connects U2-A channel converter's input to 12V input.
J13	ENF	Off	Enables U2-F channel DC-DC converter.
J14	ENE	Off	Enables U2-E channel DC-DC converter.
J15	END	Off	Enables U2-D channel DC-DC converter.
J16	ENC	Off	Enables U2-C channel DC-DC converter.
J17	ENB	Off	Enables U2-B channel DC-DC converter.

Table 1: SMM766 Evaluation Board Jumper List Cont. (see Figures 1, 11, 12 and 16 for locations and function)

Jumper	Name	Default	Function
J18	ENA	Off	Enables U2-A channel DC-DC converter.
J19	Vref In	On (Furthest from "J19" text)	Input supply for external reference (defaults to VDD)
J20	FV	Off	Connects U2-PUPF output to VDD pullup resistor.
J21	EV	Off	Connects U2-PUPE output to VDD pullup resistor.
J22	DV	Off	Connects U2-PUPD output to VDD pullup resistor.
J23	CV	Off	Connects U2-PUPC output to VDD pullup resistor.
J24	BV	Off	Connects U2-PUPB output to VDD pullup resistor.
J25	AV	Off	Connects U2-PUPA output to VDD pullup resistor.
J26	MR#	Off	Sets U10 MR# input state (Default = High).
J30	A2	On	Sets A2 for U10 to GND.
J31	PWR_ON	Off	Sets U10 PWR_ON input state (Default = High).
J32	ENF	Off	Enables/disables U10 channel F DC-DC converter.
J33	ENE	Off	Enables/disables U10 channel E DC-DC converter.
J34	FS#	Off	Sets U10 FS# input state (Default = GND).
J35	END	Off	Enables/disables U10 channel D DC-DC converter.
J36	ENC	Off	Enables/disables U10 channel C DC-DC converter.
J37	ENB	Off	Enables/disables U10 channel B DC-DC converter.
J38	ENA	Off	Enables/disables U10 channel A DC-DC converter.
J39	FV	Off	Connects U10-PUPF output to VDD pullup resistor.
J40	EV	Off	Connects U10-PUPE output to VDD pullup resistor.
J41	DV	Off	Connects U10-PUPD output to VDD pullup resistor.
J42	CV	Off	Connects U10-PUPC output to VDD pullup resistor.
J43	BV	Off	Connects U10-PUPB output to VDD pullup resistor.
J44	AV	Off	Connects U10-PUPA output to VDD pullup resistor.
J45	JF	On (Closest to "J45" text)	Connects U10-F channel converter's input to 12V input.
J46	JE	On (Closest to "J46" text)	Connects U10-E channel converter's input to 12V input.
J47	JD	On (Closest to "J47" text)	Connects U10-D channel converter's input to 12V input.
J48	JC	On (Closest to "J48" text)	Connects U10-C channel converter's input to 12V input.
J49	JB	On (Closest to "J49" text)	Connects U10-B channel converter's input to 12V input.
J50	JA	On (Closest to "J50" text)	Connects U10-A channel converter's input to 12V input.
J51	LINK	On	Connects U2 and U10 LINK pin together.
J52	LM4121B	On	Connects external voltage ref to U10 VREF_CNTL.
J53	VDDA	On	Connects U2 VDD pin to 5V In connector.
J54	12VINA	Off	Connects U2 12VIN pin to 12V In connector.
J55	VDDB	On	Connects U10 VDD pin to 5V In connector.
J56	12VINB	Off	Connects U10 12VIN pin to 12V In connector.
J57	FS#A, FS#B	Off	Connects FS# of U2 and U10 together.
J58	PWR_ONA, PWR_ONB	On	Connects PWR_ON of U2 and U10 together.
J59	JF	On (Closest to "J59" text)	Connects U2-F channel converter's input to 12V input.
J60	MR#A	Off	Connects MR# of U2 and U10 together.

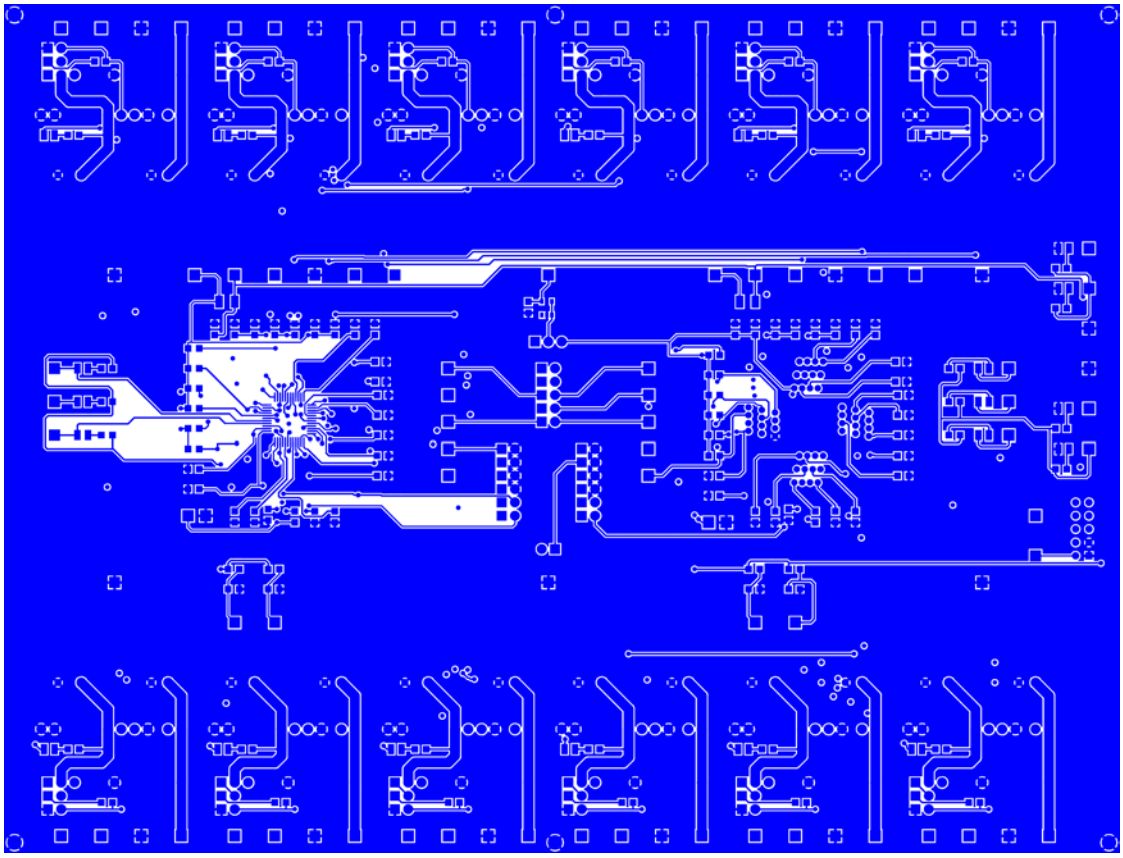


Figure 17: SMM766EV Top Copper

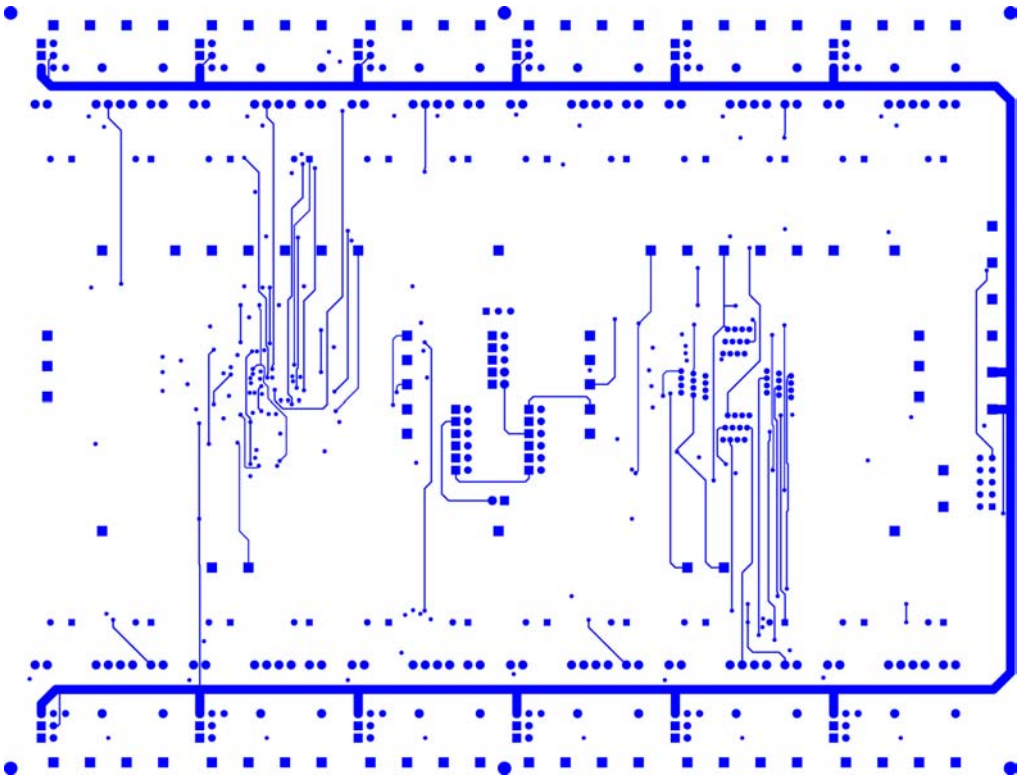


Figure 18: SMM766EV Inner Layer #1

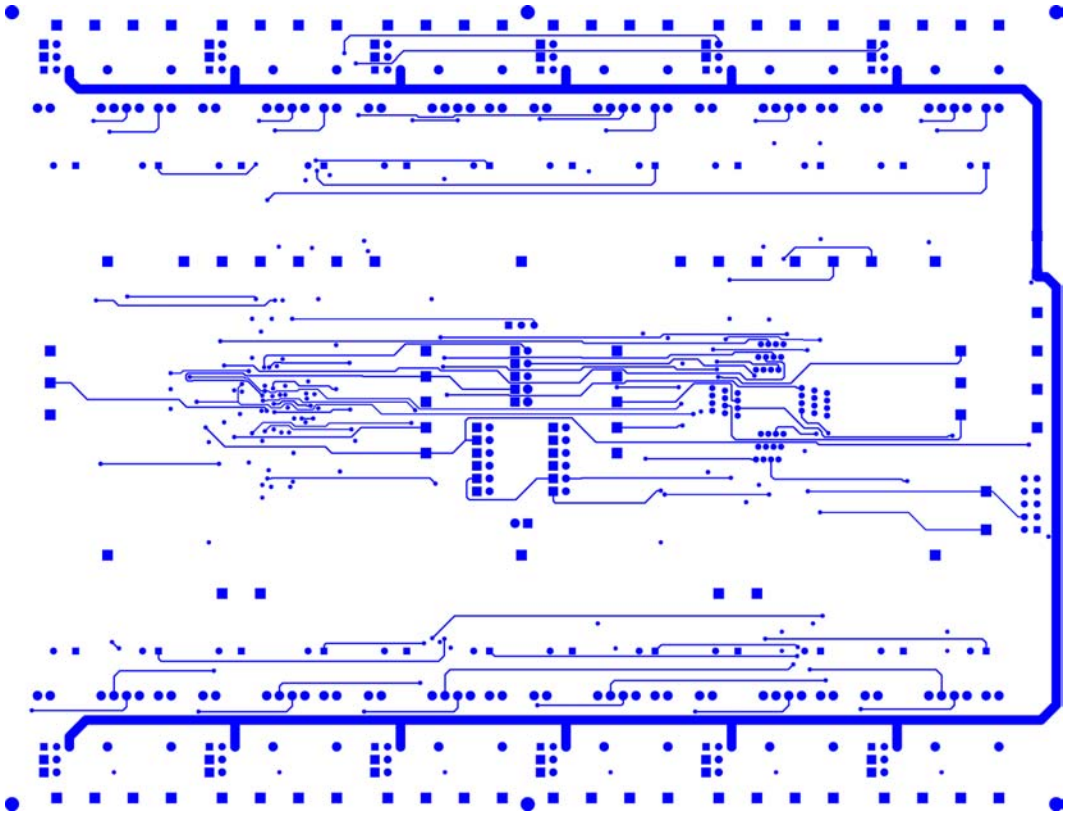


Figure 19: SMM766EV Inner Layer #2

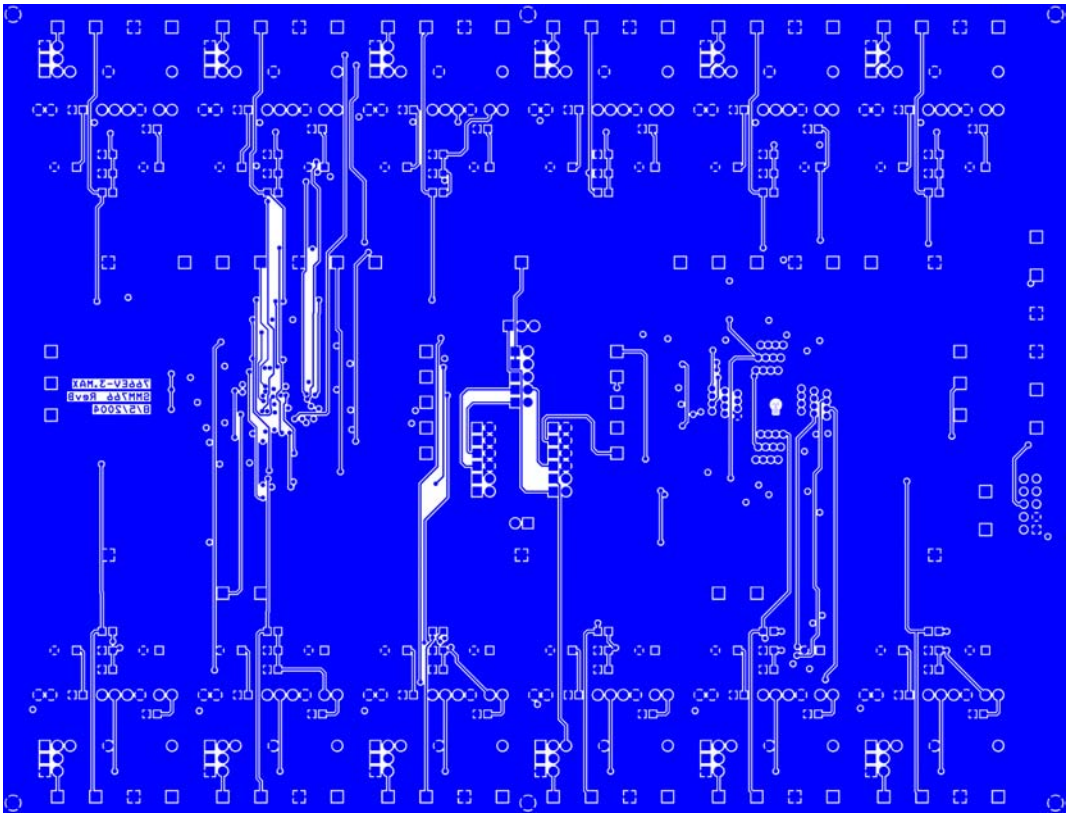


Figure 20: SMM766EV Bottom Copper

Table 2: SMM766B Evaluation Board Parts List

Item	Description	Vendor / Part Number	Qty	Ref. Des.
	Resistors			
1	10KΩ, 1/10W, 5%, 0805, SMD	Any	4	RT1-RT4
2	10KΩ, 1/10W, 5%, 0805, SMD	Any	20	R1-R7, R16, R17, R26, R40-R50
3	30KΩ, 1/10W, 5%, 0805, SMD	Any	4	R14, R15, R60, R61
4	1KΩ, 1/10W, 5%, 0805, SMD	Any	14	R18, R27-R32, R58, R62, R64, R68, R70, R72, R76
5	4.7KΩ, 1/10W, 5%, 0805, SMD	Any	2	R19, R39
6	47KΩ, 1/10W, 5%, 0805, SMD	Any	12	R20-R25, R52-R57
7	1KΩ, 1/4W, 5%, leaded	Optional load resistors, for test purposes	12	R8-R13, R65-R67, R73-R75
8	0Ω, 1/10W, 5%, 0805, SMD	Any	12	R33-R38, R48, R51, R59, R63, R69, R71
9		Optional Trim resistors for DC-DC converters, for test purposes.	12	R77-R88
	Capacitors			
10	0.1uF, 50V, ceramic, X7R, 0805, SMD	Any	31	C1, C4, C6, C8, C17-C23, C25, C27, C30, C32, C34, C61-C67, C69, C71, C73, C81, C83, C86, C110, C114
11	0.022uF, 50V, ceramic, X7R, 0805, SMD	Any	2	C2, C72
12	0.01uF, 50V, ceramic, X7R, 0805, SMD	Any	35	C3, C5, C9, C10-C16, C41-C48, C77-C79, C98-C107, C109, C111, C116, C117
13	1uF, 50V, ceramic, X7R, 0805, SMD	Any	12	C24, C26, C28, C29, C31, C33, C68, C70, C75, C80, C82, C84
14	10uF, 10V, Tantalum, Size 'B'	AVX, TAJB106M010	2	C7, C120
15	680uF, 6V, Oscon	Sanyo. 6SEP680M	11	C49-C53, C54, C108, C112, C115, C118, C119, C177
16	270uF, 16V, Oscon	Sanyo. 16SP270M	12	C85, C87, C89, C91, C93, C95, C151, C156, C161, C166, C171, C176
17		No Populate	2	C178, C179
	Semiconductors			
18	LED, Red, 0805, SMD	Digi-Key, 160-1176-1-ND	22	D1, D2, D4-D14, D16-D24
19	Diode, Small Signal, 1N4148, SMD	Any	1	D3, D15
20	LM4121	Digi-Key, LM4121IM5-1.2CT-ND	1	U1
21	SMM766FC or SMM766BFC, Six-Channel Power Supply DC Output Controller, Monitor and Sequencer	Summit Microelectronics	1	U2, U10
22	DC-DC Converter, Non-Isolated, SIP, SIL-06	Artesyn	12	U3-U9, U11, U12, U14, U15, U16

Table 2: SMM766 Evaluation Board Parts List (Continued).

Item	Description-	Vendor / Part Number	Qty	Ref. Des.
	Hardware			
23	Connector, Test Point	Milmax, 0300-1-15-01-47-27-10-0	108	TP1-TP61, TP63-TP98, TP100-TP110 (Various)
24	Connector, 18-pin, dual-row, 0.1" spacing (2-pin)	Digi-Key, S2112-36-ND	55	J2-J6, J8-J26, J30-J60 (Various)
25	Connector, 10-pin, dual-row, 0.1" spacing	Digi-Key, S2112-36-ND	1	J1 (I^2C)
26	Jumper, 2-pin, 0.1" spacing	Digi-Key, 929955-06-ND	55	(Various)
27	Socket, 48-pin, spring-loaded	Wells, QFP-7MM-48-LD, 7007-048-1-07	1	U10 (Reference)
28	SMM766EV Printed circuit board	Summit Microelectronics	1	SMM766EV

Comments & Precautions

Ensure that the SMM766 or SMM766B device is securely seated in the 48-pin TQFP Spring-Loaded Socket and pin 1 is correctly oriented as indicated on the PCB and the block dot/void on the IC. Do not go by the part marking orientation. Occasionally, the socket may lose contact from oxidation. With power turned-off, reseat the device by pressing down and releasing the socket.

The SMM766 and SMM766B are precision integrated circuits requiring certain attention be spent with regards to component selection and printed circuit board layout to ensure the greatest possible performance. Since the SMM766 and SMM766B do not measure each voltage differentially, special attention must be paid to where the part's GND pin is connected. The measurements are best made at the load of any of the power supplies, so the GND pin should also be connected to the power supply return *at the load*. Accurate measurements of all supplies is possible by laying out the PCB such that a large copper trace from each individual supply voltage return (at the load) is routed separately and directly to the SMM766 or SMM766B GND pin and all joined together there (a 'star ground'). The large trace ensures that any currents flowing between supply returns does not result in a voltage drop occurring between the point of load and the single point connection made at the SMM766B or SMM766B GND pin.

Choose low-leakage ceramic or film capacitors for the TRIMx pins sample-and-hold function, making sure these components are located as close to the SMM766 or SMM766B as possible.

Although an internal voltage reference is available, the higher accuracies are possible using an external 0.1% reference. Locate this device nearby the SMM766 or SMM766B and keep the ground connection from the reference to the SMM766 or SMM766B. The TRIM_CAP physical location is important in that it forms a low-pass filter with the TRIM_CAP pin to filter out DC-DC converter switching noise. A ceramic capacitor is sufficient for this purpose.

SMX3200 Parallel Port Programming Dongle

Top View – SMX3200 cable connector

	1	2
	3	4
Key	5	6
	7	8
	9	10

Pin	Name	Wire Color Code
1	Ground	white and orange
2	SCL	orange
3	Ground	white and green
4	SDA	green
5	Reserved	blue and white
6	MR#	blue
7	10 Volts	brown and white
8	Reserved	NC
9	5 Volts	brown
10	Reserved	NC

Figure 21: SMX3200 Dongle and Dongle Interface Cable

SMX3202 USB Port Programming Dongle

Top View – SMX3202 Evaluation Kit connector

	1	2
	3	4
Key	5	6
	7	8
	9	10

Pin	Name
1	Ground
2	SCL
3	Ground
4	SDA
5	Reserved
6	MR#
7	GPIO
8	GPIO
9	5 Volts
10	GPIO

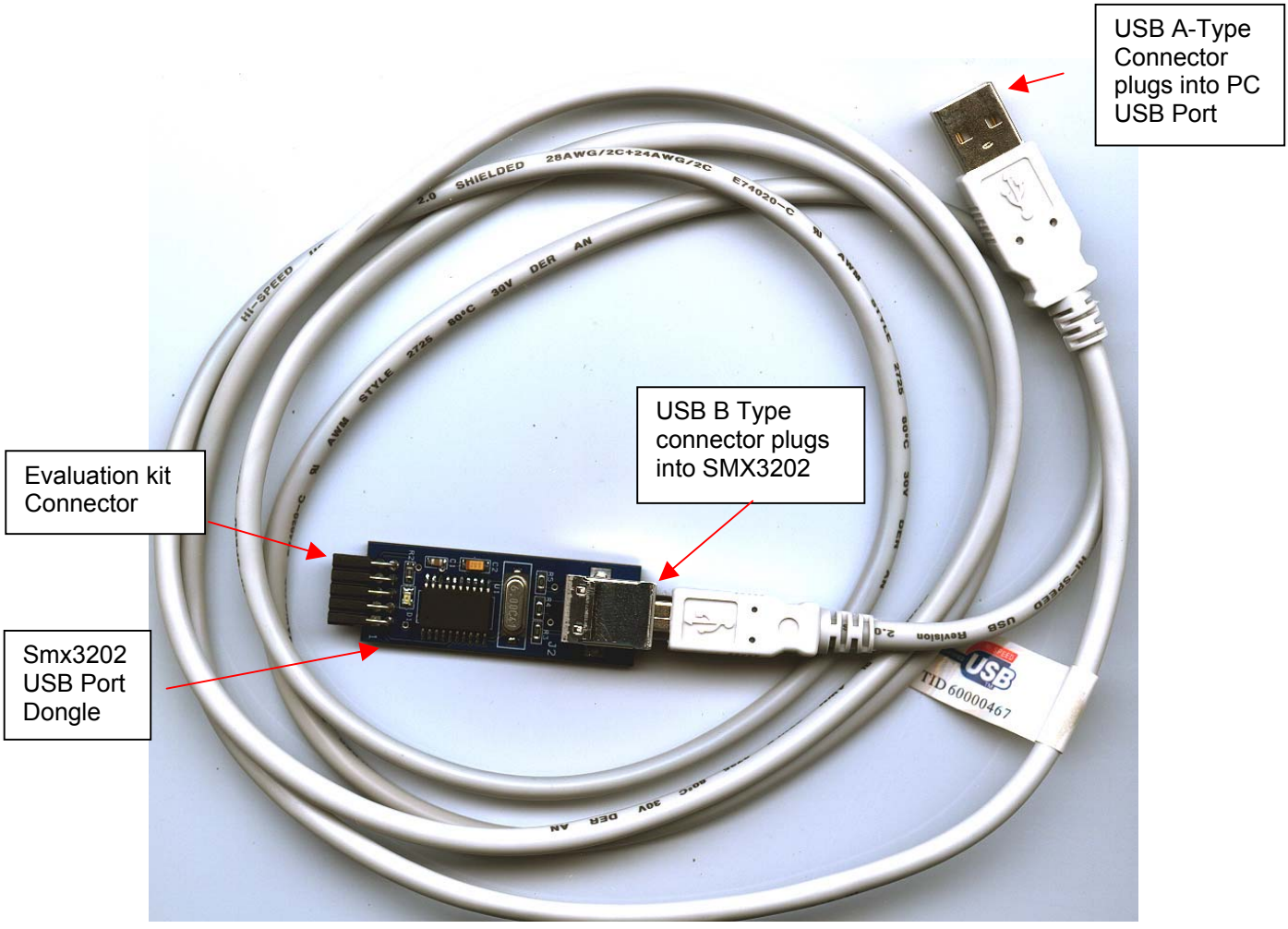


Figure 22: SMX3202 Board and cable.

SMX3202 USB2I^{2}C Programming Board

Figure 23: SMX3202 USB2I^{2}C Board. The SMX3202 provides 5V to pin 9 of J12 on the SMM766EV board.

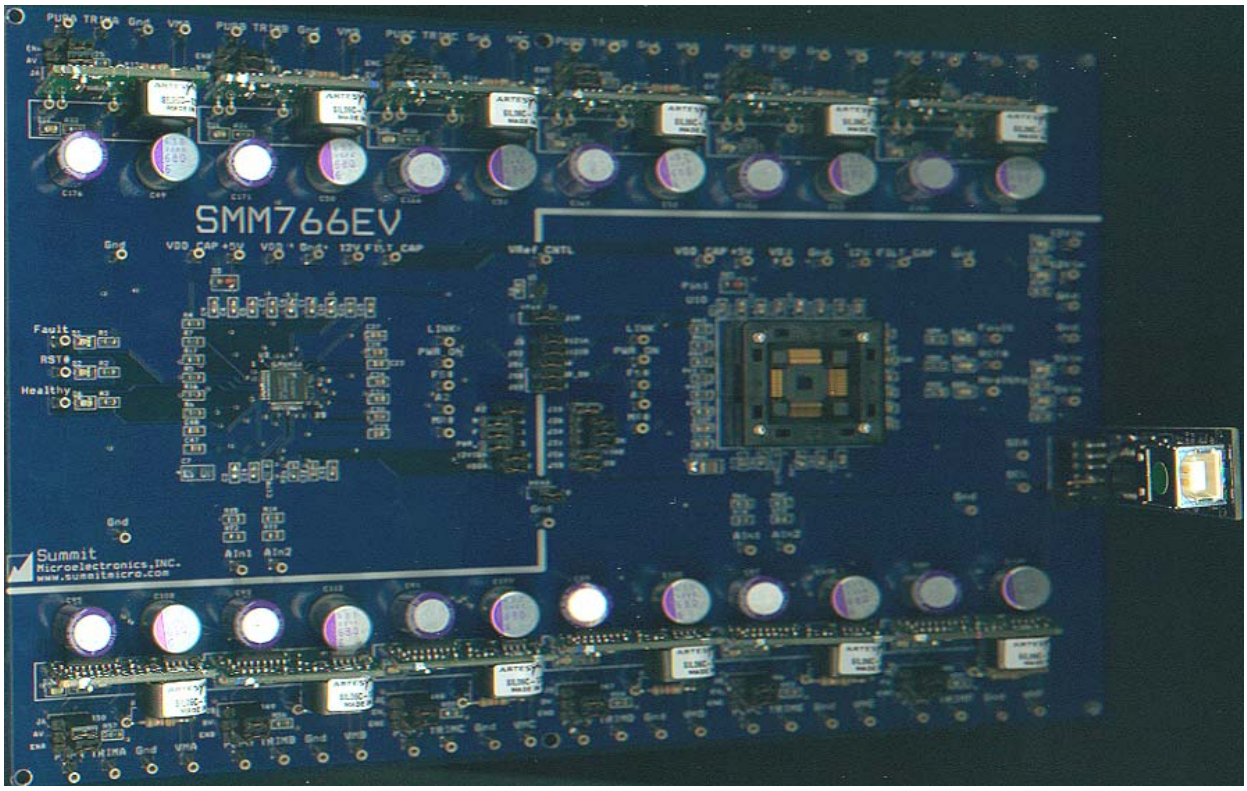


Figure 24: SMX3202 USB2I^{2}C Board. The Board connects directly perpendicular to the SMM766EV board and to a USB cable as shown. Before connecting to the PC USB port, install the SMM766 or SMM766B Windows GUI, which includes the USB drivers.

NOTICE

Revision B - This document supersedes all previous versions.