

Demonstration System EPC9531 Quick Start Guide

*Test Fixture for EPC9143;
 $1/16$ th Brick DC-DC Converter*

Revision 2.0



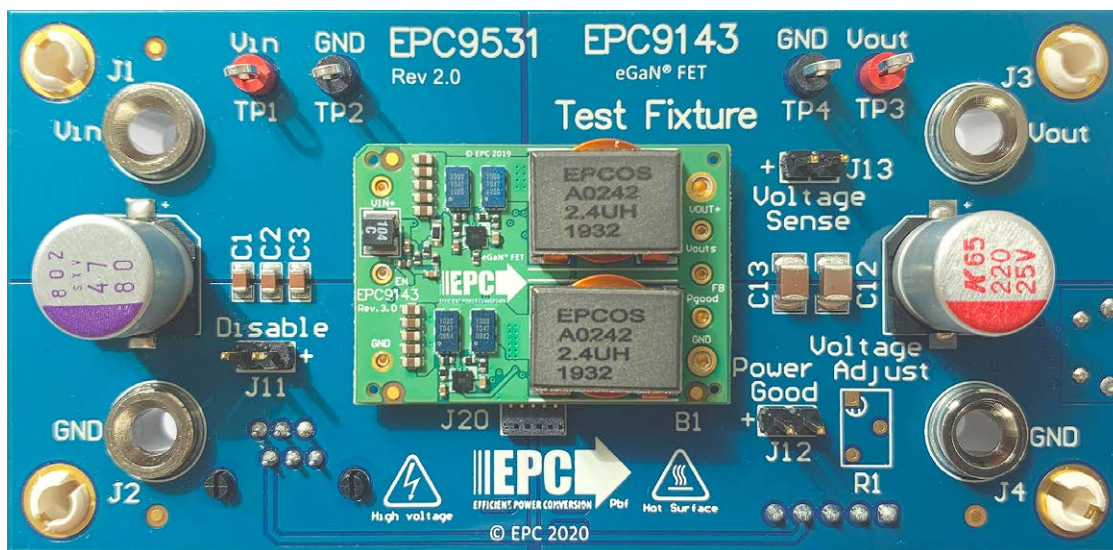
DESCRIPTION

The EPC9531 board is a 60 V maximum input voltage, 16 V maximum output voltage and 25 A maximum output current, testing fixture for the EPC9143 ¹/₁₆th Brick DC-DC Converter. The EPC9531 features:

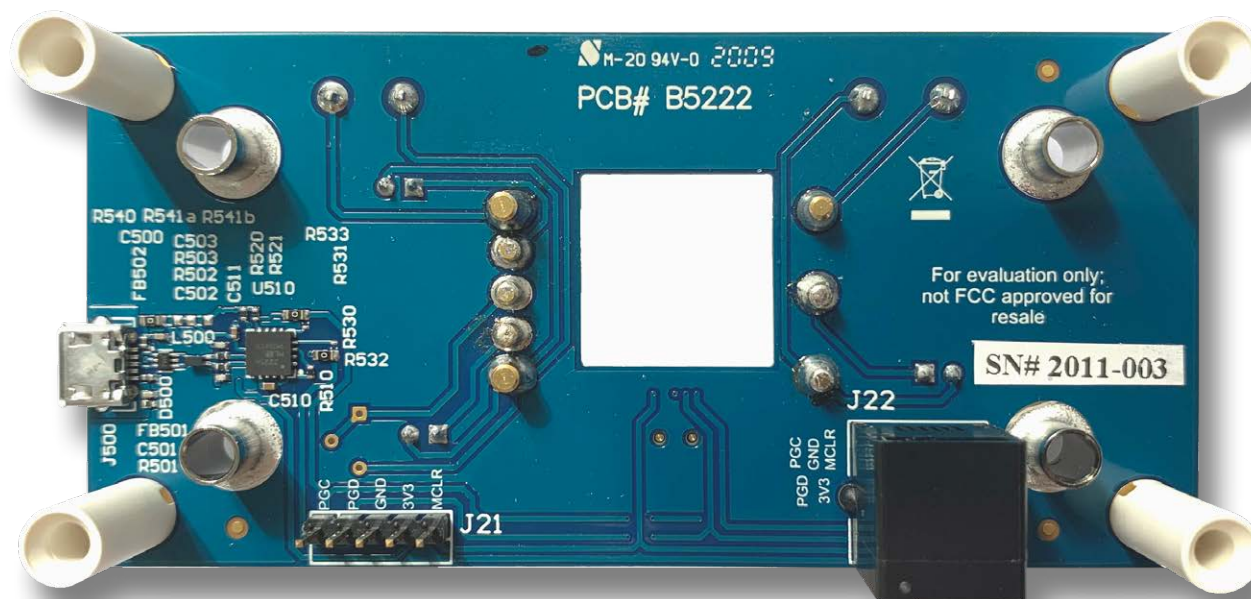
- Programming: 5-pin header and Microchip In-Circuit Debugger (ICD) RJ-11 interface
- Communication: micro USB 2.0 to UART on the EPC9143
- Measurement: input voltage, output voltage (kelvin connection)
- Control/Adjustment: power good output, output voltage trimming resistor, disable jumper, remote voltage sense

Table 1: Performance Summary (T_A = 25°C) EPC9531

Symbol	Parameter	Min	Typ	Max	Units
V _{IN}	Input Voltage			60	V
V _{OUT}	Output Voltage			16	V
I _{OUT}	Output Current			25	A
I _{IN}	Input Current			12	A
EN	Disable	0		10	V
PG	Power Good			5	V
FB	Output Voltage Adjust			100	kΩ
V _{Sense}	Voltage Sense			*	V



EPC9531 Top View



EPC9531 Bottom View

QUICK START PROCEDURE

Figure 1 shows an example configuration and measurement setup.

1. With power off, carefully insert the EPC9143; 1/16th brick module into EPC9531 and make sure it is properly seated.
 - a. Ensure that the mounting holes on the EPC9531 line up with the pins on the EPC9143
 - b. Carefully insert the module into the mounting holes.
 - c. Ensure all pins insert the mounting holes uniformly
 - i. With your hands, apply a slight pressure to the corners of the 1/16th brick module. Apply only enough pressure such that the 1/16th brick module sits as flat as possible in the mounting holes.
 - ii. Apply pressure alternately (one side at a time) in order to wiggle the 1/16th brick module into place and make sure it is firmly connected to the fixture.
 - d. Ensure the programming/communication contact is secured.
2. With power off, connect the power supply, load, and multimeters according to figure 1:
 - a. Vin (J1) and GND (J2) banana jacks
 - b. Vout (J3) and GND (J4) banana jacks
 - c. Kelvin sensing: Vin (TP1) and GND (TP2), Vout (TP3) and GND (TP4)
 - d. (Optional) Vout sense (J13) to load terminals, shown as dashed lines in figure 1.
3. Turn on the input power supply to the required value (do not exceed the absolute maximum voltage of 60 V on Vin. The output voltage is preset on the EPC9143; 1/16th brick module. During operation, check to make sure the circuit is operating correctly and that the output voltage does not exceed the absolute maximum voltage of 16 V.
4. For shutdown, please follow steps in reverse.
5. To remove the EPC9143; 1/16th brick module:
 - a. Carefully grab the module from the top and bottom (not the side with the pins), and remove the module.
 - b. If the module is difficult to remove, apply alternating pressure to the top and bottom of the module until it loosens.
 - c. Do not use any tools to remove the module, as it can cause damage to the module or test fixture.

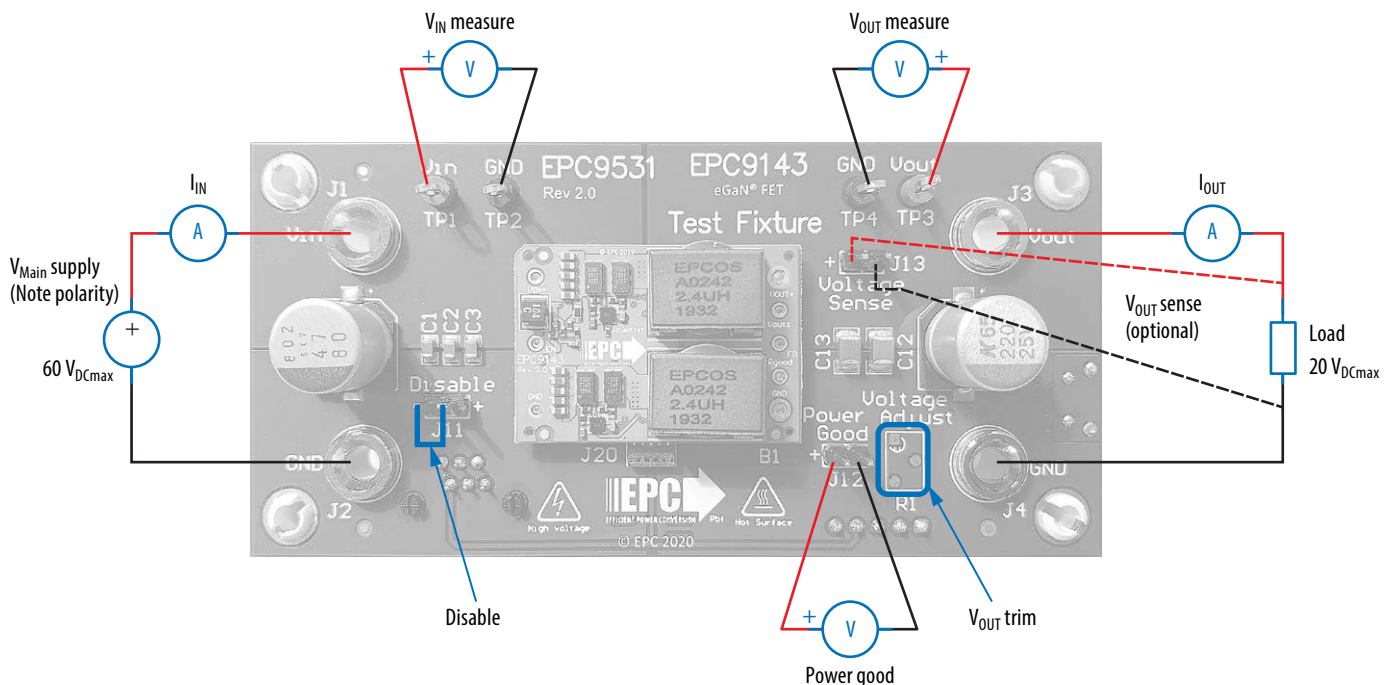


Figure 1. Example measurement setup: Top view of EPC9531 with EPC9143 mounted

CONTROL / ADJUSTMENT

1. Power Good (J12) should have logic high level once the unit is operating.
2. The EPC9143; 1/16th brick module can be disabled by inserting a jumper into J11.
3. The output voltage of the EPC9143; 1/16th brick module can also further be trimmed by adjusting R₁. R₁ is connected between FB and GND, as shown in figure 2. V_{out} can be calculated as follows:

$$V_{OUT} = V_{FB} R_{FB1} \left(\frac{1}{R_{FB2}} + \frac{1}{R_1} \right) + V_{FB}$$

4. For EPC9143, V_{FB} is 2.5 V, R_{FB1} is 18 kΩ, R_{FB2} is 4.75 kΩ, therefore

$$V_{OUT} = 12 + \frac{45}{R_1 [k\Omega]}$$

5. The voltage can also be adjusted by reprogramming the EPC9143 module.

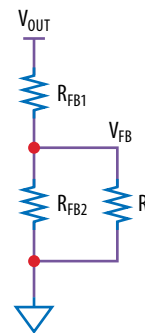


Figure 2. Output voltage adjustment R₁ and connection to the EPC9143 voltage feedback circuitry.

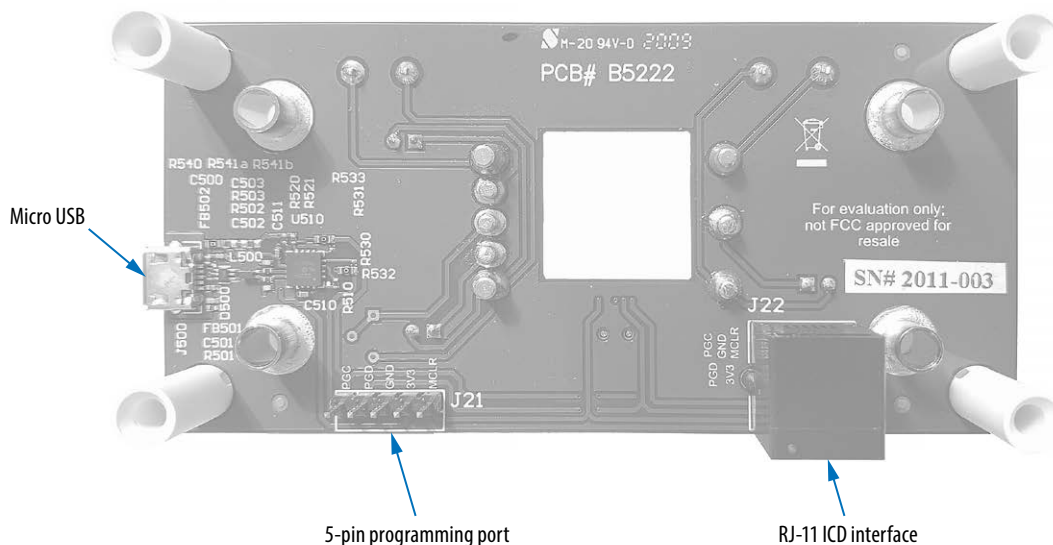


Figure 3. Programming and communication ports: back side of EPC9531.

PROGRAMMING

When plugged in, the EPC9143 can be programmed through the test fixture 5-pin header (J21) or the RJ-11 port (J22) using Microchip In-Circuit Debugger (ICD) or MPLAB PICKit.

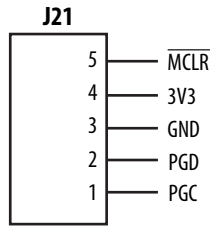


Figure 4. Pin-out of J21 programming port

COMMUNICATION

The built-in USB to UART adaptor uses MCP2221A, and is connected to the same PGD and PGC pins as in J21 and J22.

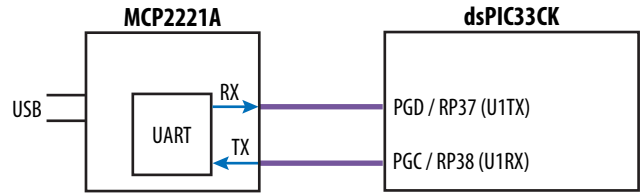


Figure 5. RX and TX pin map of the USB to UART adaptor

THERMAL CONSIDERATIONS

The EPC9531 is intended for bench evaluation with low ambient temperature and convection cooling. The recommended airflow for the board is shown in figure 6.

The 5 V from the USB port does not provide 3.3 V power to the processor. To use I²C instead of UART, the EPC9531 needs to be modified as follows:

- Remove resistors R530 and R531 (size 0402, 0 Ω)
- Install resistors R532 and R533 (size 0603, 0 Ω)

Notes:

- 1) The micro-USB port is not isolated so it is recommend to use a USB Isolator with power such as part number BB-UH201 manufactured by B&B SmartWorx, Inc. to isolated the board from the computer USB.
- 2) Once configured to use I²C, programming of the device is not possible.

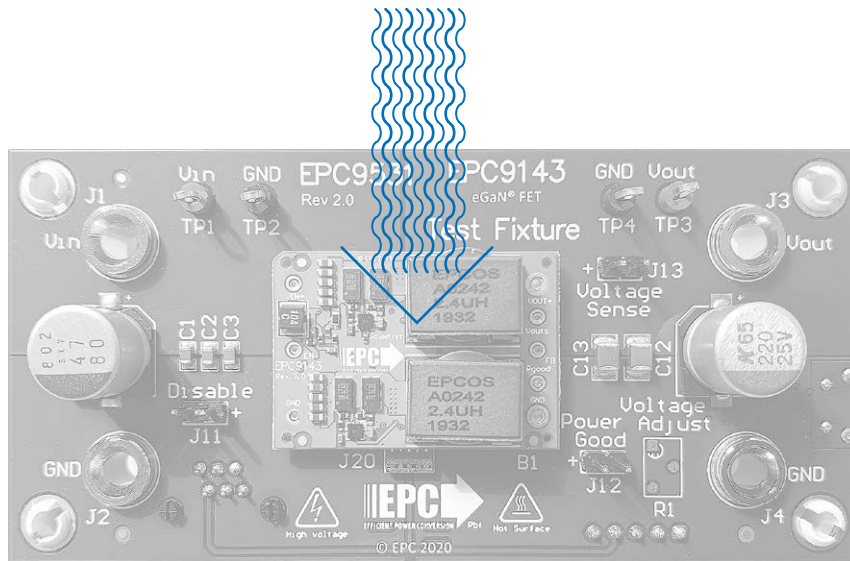


Figure 6. Recommended Air Flow Direction

Table 2: Bill of Materials

Item	Qty	Reference	Part Description	Manufacturer	Part #
1	3	C1, C2, C3	Capacitor, 1 μ F, 100 V	TDK Corporation	C2012X7S2A105M125AE
2	1	C4	Capacitor, 80 V, 47 μ F	Panasonic	80SXV47M
3	1	C11	Capacitor, 25 V, 220 μ F	KEMET	A765MU227M1ELAE050
4	2	C12, C13	Capacitor, 10 μ F, 50 V	KEMET	C1210C106M5PACTU
5	2	C500, C501	Capacitor, 0.1 μ F, 25 V	Yageo	CC0402KRX7R8BB104
6	2	C502, C503	Capacitor, 47 pF, 50 V	Yageo	CC0402JRNPO9BN470
7	1	C510	Capacitor, 10 μ F, 10 V	TDK	C1005X7S1A105K050BC
8	1	C511	Capacitor, 470 nF, 6V3	Murata	GRM155R60J474KE19D
9	1	D500	Diode, TVS Diode Array 6 V	Wurth	82400152
10	2	FB501, FB502	180 Ω @ 100 MHz	Murata	BLM15PX601SN1D
11	4	J1, J2, J3, J4	Non-Insulated Std. Banana PCB socket	Keystone	575-8
12	3	J11, J12, J13	.1" Male Vert.	Tyco	4-103185-0-02
13	1	J20	1 mm pitch	Samtec	SEI-105-02-GF-S-AB
14	1	J21	.1" Male RA	Tyco	4-103185-0-04
15	1	J22	615006138421	Wurth	615006138421
16	1	J500	USB Mini	Amphenol ICC (FCI)	10118194-0001LF
17	1	L500	90E 550 mA 50 V	Wurth	744230900
18	3	R501, R520, R521	Resistor, 4k7	Panasonic	ERJ-2RKF4701X
19	2	R502, R503	Resistor, 15 Ω	Panasonic	ERJ-2RKF15R0X
20	1	R510	Resistor, 10 k	Yageo	RC0402FR-0710KL
21	2	R530, R531	Resistor, 270 Ω	Panasonic	ERJ-2RKF2700X
22	1	R540	Resistor, 0 Ω	Panasonic	ERJ-3GEY0R00V
23	4	SO1, SO2, SO3, SO4	Board Support Snap Fit	Keystone	8834
24	2	TP1, TP3	Red Probe Hookup	Keystone	5010
25	2	TP2, TP4	Black Probe hookup	Keystone	5011
26	1	U510	USB to I ² C and UART	Microchip	MCP2221A-I/ML
27	2	B1	Pin Receptacle Connector .062"	Mill-Max	0363-0-15-15-23-27-10-0
28	6	B1	Pin Receptacle Connector .04"	Mill-Max	0340-0-15-15-34-27-10-0

Table 3: Optional Components

Item	Qty	Reference	Part Description	Manufacturer	Part #
1	1	R1	100 k	Murata	PV37Y104C01B00
2	3	R532, R533, R541a, R541b	0 Ω	Panasonic	ERJ-3GEY0R00V

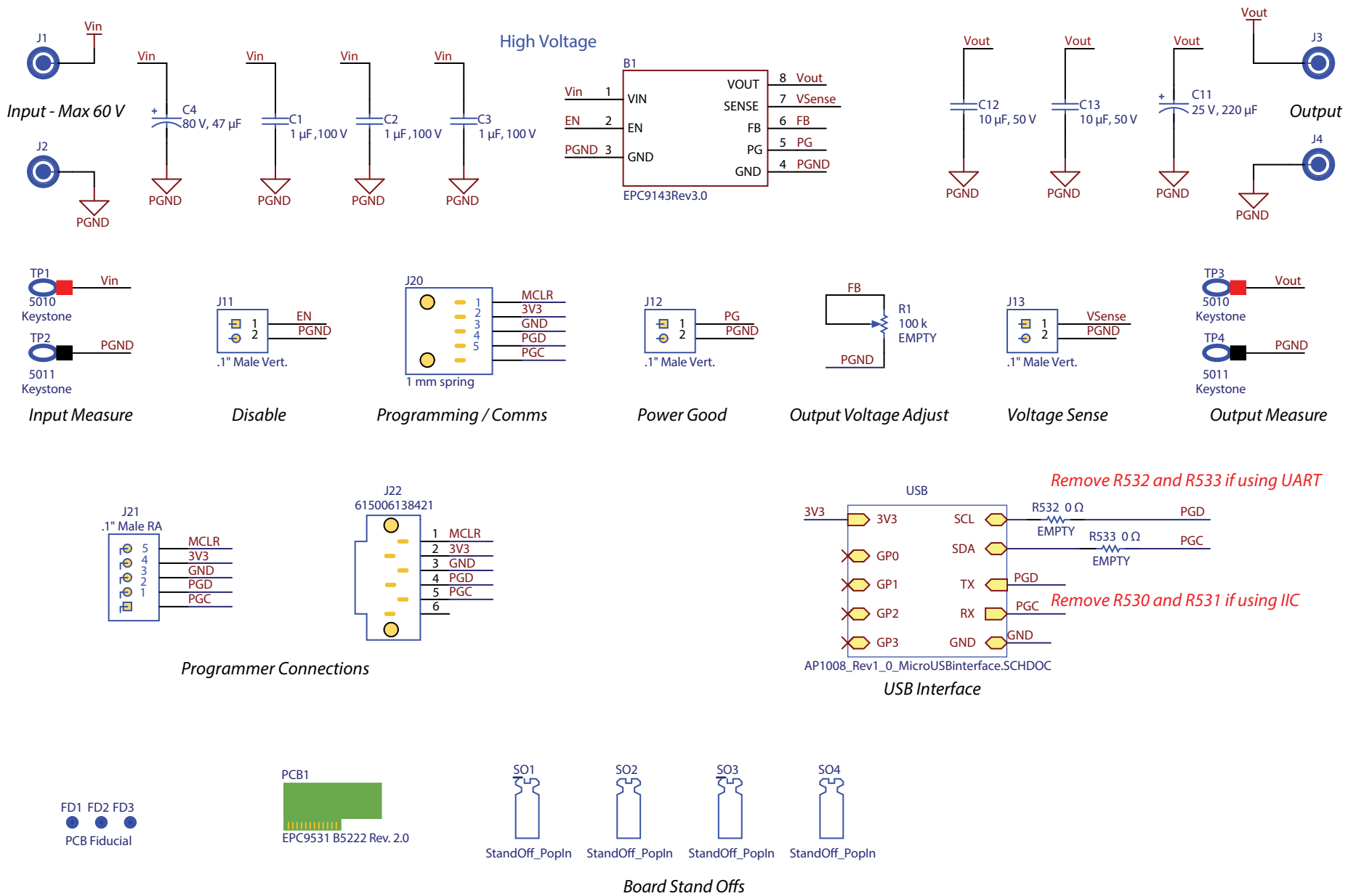


Figure 7: EPC9531 Controller schematic

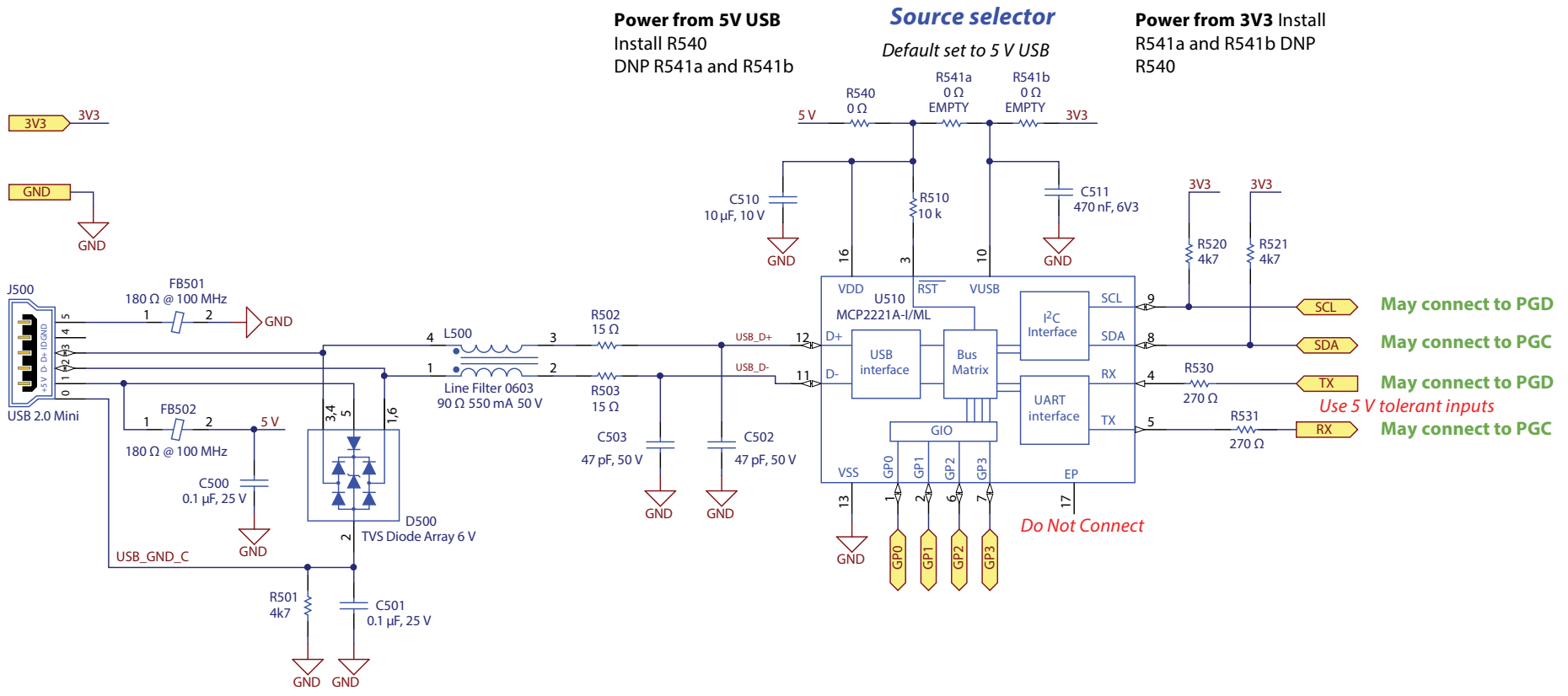


Figure 8: EPC9531 Controller schematic

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