TPS65287 High Current, Synchronous Step Down Three Buck Switcher Evaluation Module with One USB Switch

This document presents the information required to power the TPS65287 PMIC as well as the support documentation including schematic and bill of materials.

Contents

List of Figures

1 Background

The TPS65287 PMIC is designed to provide 3, 2 and 2 A continuous outputs with an operational range of 4.5 to 18V and a externally set switching frequency ranging from 300kHz to 2.2MHz, with automatic PFM/PWM operation. When the PMIC is not fully load, buck1 can be loaded to 3.5A and buck 2 and 3 to 2.5A. The device also features one USB distribution switch.

As there are many possible options to set the converters, Table 1 presents the performance specification summary for the EVM.

Table 1. Input Voltage and Output Current Summary

EVM	Test Conditions	Output Current Range
TPS65287EVM	Vin = 4.5 V to 18 V Fsw = 500 kHz	Buck1, 1.2V, 3A Buck2, 1.8V, 2A Buck3, 3.3V, 2A (25°C ambient)

This evaluation module is designed to provide access to the features of the TPS65287. Some modifications can be made to this module to test performance at different input and output voltages, current and frequency operation. Contact TI Field Applications Group for advice on these matters.

2 Schematic

The resistor and capacitor values have been chosen according to the guidelines presented on the TPS65287 spec. Note that for the purpose of gains-phase measurements R14, R17 and R37 (zero ohm on the EVM) need to be replaced by suitable low value resistors as per the network analyzer setup required. Test points connections are provided on either end of the resistors to allow for easy measurement. (See next page)

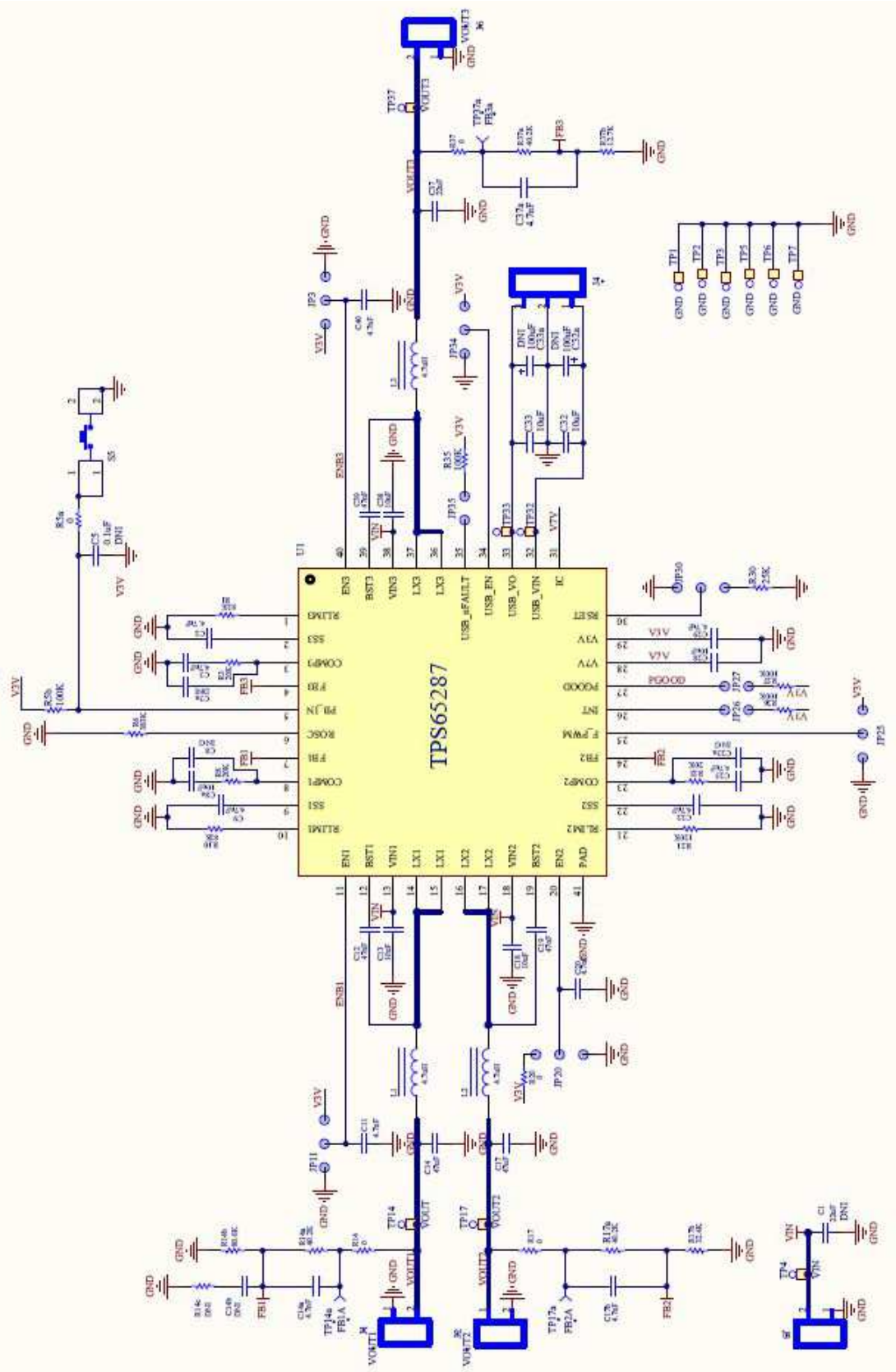

Figure 1. TPS65287 Schematic

3 Board Layout

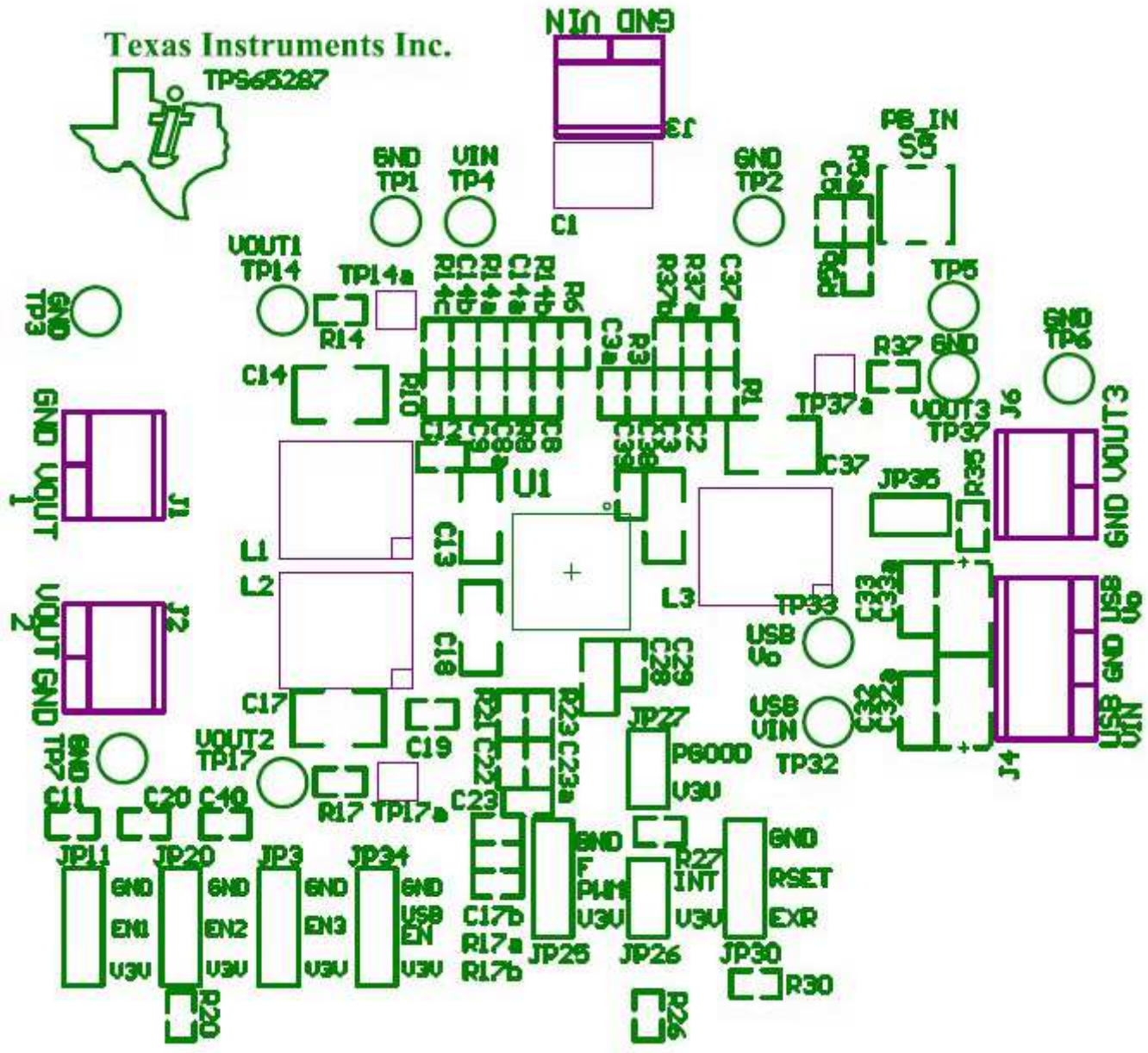

Figure 2. Placement

3.1 EVM Layout

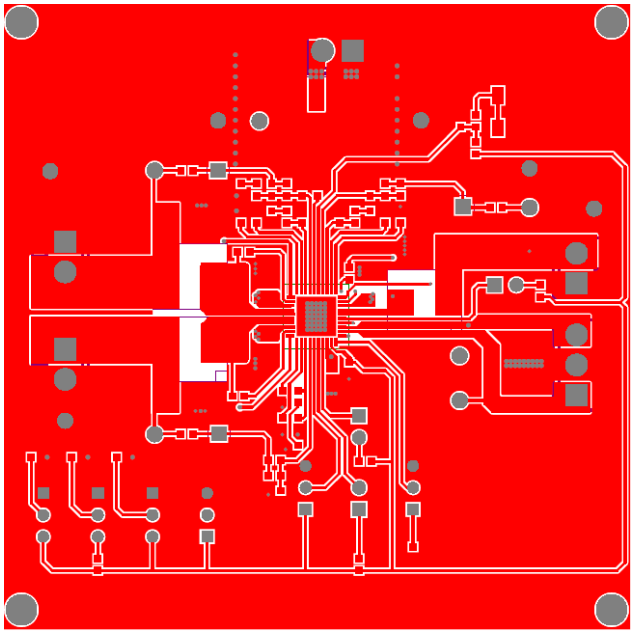

Figure 3. Board Layout (Top Layer)

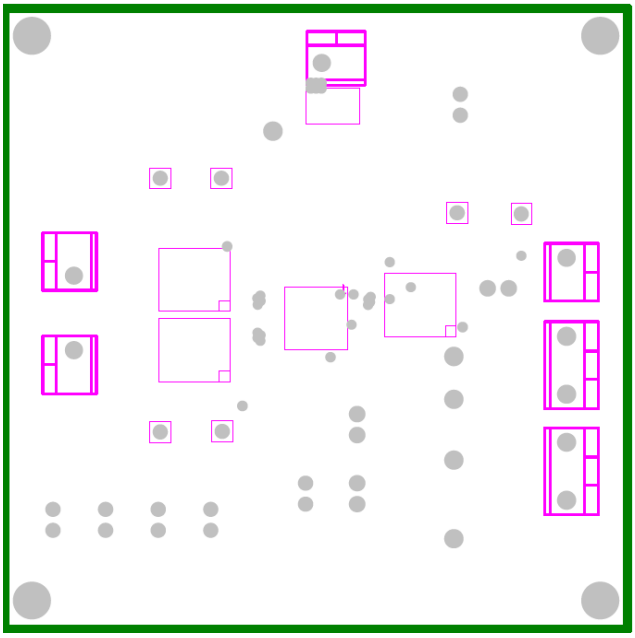

Figure 4. Board Layout (Middle 2nd) Layer

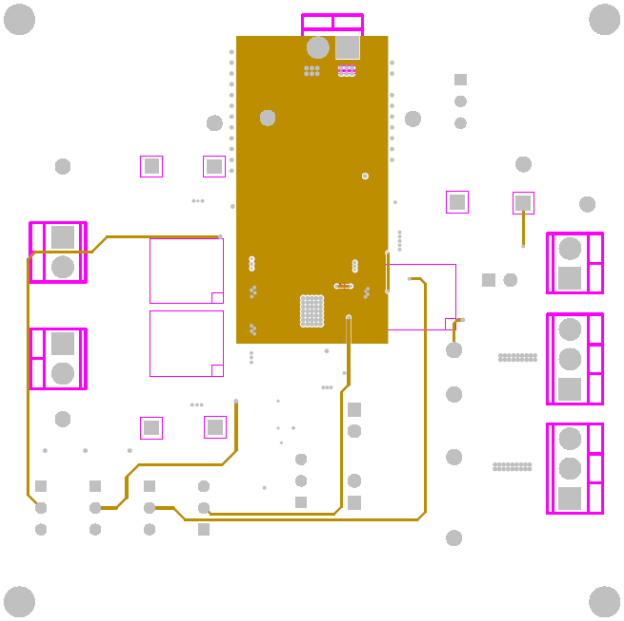

Figure 5. Board Layout (Middle 3rd) Layer

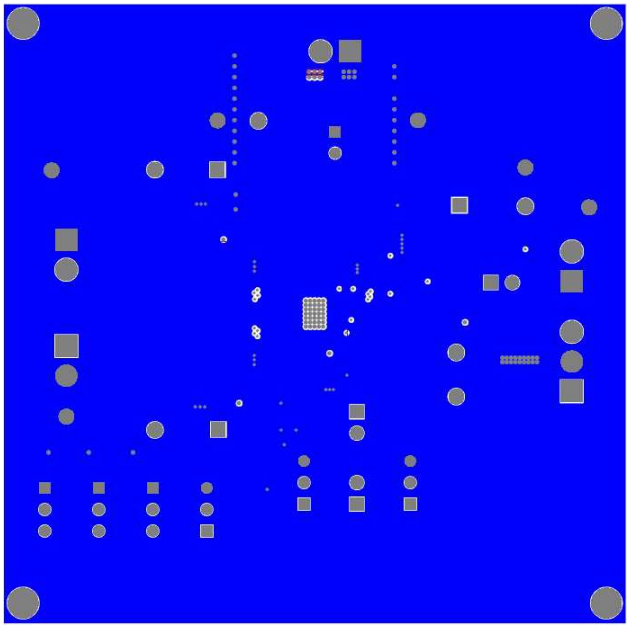

Figure 6. Board Layout (Bottom Layer)

4 Bench Test Setup Conditions

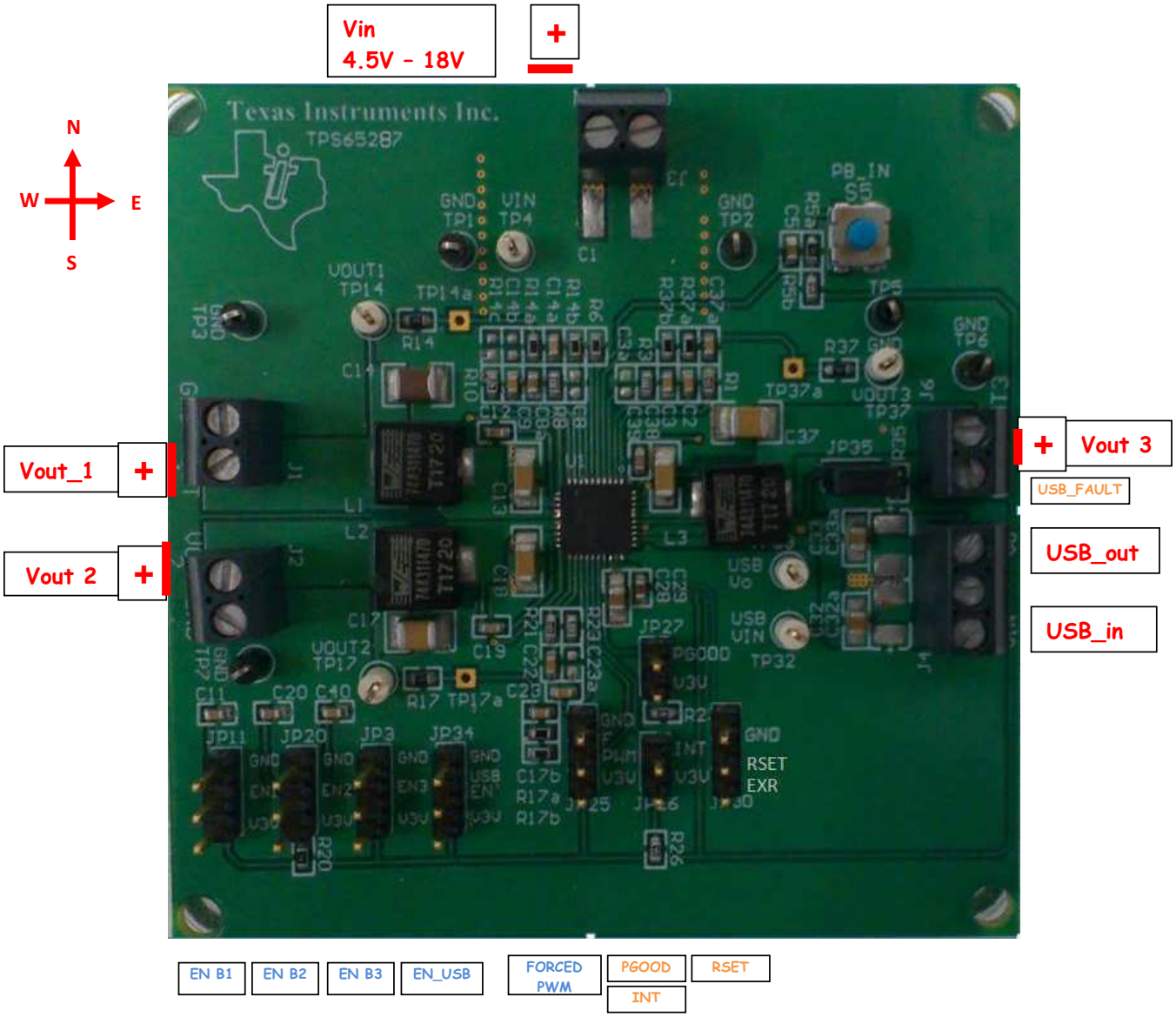

Figure 7. Headers Description and Jumper Placement

4.1 Jumpers and Switches

Number	Function	LOC	Placement	Comment
JP11	BUCK1 enable (EN1)	SW	For immediate start-up fit jumper to V3V For sequencing do not fit jumper To disable converter fit jumper to GND	Fit according to test requirement
JP20	BUCK2 enable (EN2)	SW	For immediate start-up fit jumper to V3V For sequencing do not fit jumper To disable converter fit jumper to GND	Fit according to test requirement
JP3	BUCK3 enable (EN3)	SW	For immediate start-up fit jumper to V3V For sequencing do not fit jumper To disable converter fit jumper to GND	Fit according to test requirement

Number	Function	LOC	Placement	Comment
JP25	Forced PWM (F_PWM)	S	For forced PWM operation fit jumper to V3V For automatic PFM/PWM operation fit jumper to GND	**Do not leave this header open. Use a jumper to set either forced PWM mode or automatic PFM/PWM mode**
JP34	USB enable (USB1EN)	SW	For automatic start-up fit jumper to V3V To disable SWITCH fit jumper to GND	Fit according to test requirement
JP35	USB_nFAULT	E	USB fault indicator pulled to 3V3	Fit according to test requirement
JP30	USB ILIMIT SET	NE	For internal set fit jumper to GND For external R set fit jumper to resistor	Fit according to test requirement
JP26	INT	S	BUCK interrupt indicator pulled to 3V3	Fit according to test requirement
JP27	PGOOD	S	PGOOD indicated pulled to 3V3	Fit according to test requirement

4.2 Test Points and Placement

Buck converter outputs are white and have a label for easy location. Close to any of these test points there are black ground test points to allow for DVM measurement or to use a metal exposed scope probe to reduce common mode noise measurements. All test points are described in the following table:

TP	Name	Signal	Color	Comment
TP1	GND	GND	Black	
TP2	GND	GND	Black	
TP3	GND	GND	Black	
TP4	Vin	Vin	White	
TP5	GND	GND	Black	
TP6	GND	GND	Black	
TP7	GND	GND	Black	
TP14	Vout1	Output voltage Buck1	Not fitted	
TP14a		Injection Point gain-phase measurement buck1	Not fitted	Normally not used
TP17	Vout1	Output voltage Buck2	Not fitted	
TP17a		Injection Point gain-phase measurement buck2	Not fitted	Normally not used
TP37	Vout1	Output voltage Buck3	Not fitted	
TP37a		Injection Point gain-phase measurement buck3	Not fitted	Normally not used
TP32	USB1_Vin	USB1 switch input	White	
TP33	USB1_Vo	USB1 switch output	White	

5 Power-Up Procedure

1. Define which converters are to be enabled or disabled by connecting jumpers to JP3, JP11 and JP20 accordingly, or to wiring external drive signals to the ENx headers.
2. If PGOOD signal is required connect JP27 or wire the PGOOD pin to a pull-up supply.
3. Define the strategy to enable the USB switch, either with jumpers or external drive signals to the USBEN pin.
4. If USB_nFAULT signal is required connect J35 jumper or wire the alarms pin to a pull-up supply.
5. Connect loads to the output connectors.
6. Apply a DC voltage to header J3. Polarity is marked on the silk-screen.
7. Converters will start according to the setting on JP3, JP11 and JP20. Check the outputs.
8. To power the USB switch apply a DC voltage to JP4. Enable the switch with JP34. Check the outputs.

6 Bill of Materials

Qty	Designator	Value	Footprint	Description	Comment
1	C1	22uF	1812	CAP CERAMIC 22UF 25V X5R 1210	DNI
12	C2, C3, C8a, C9, C11, C14a, C17b, C20, C22, C23, C37a, C40	4.7nF	0603	CAP 4700PF 50V CERAMIC X7R 0603	
3	C3a, C8, C23a		0603		DNI
3	C12, C19, C39	47nF	0603	CAP 47000PF 25V CERM X7R 0603	
1	C5	0.1uF	0603	CAP 100nF 25V CERM X7R 0603	
3	C13, C18, C38	10uF	1206	CAP CERAMIC 10UF 25V X5R 1206	
2	C14, C17,	47uF	1210	CAP CERAMIC 22UF 25V X5R 1210	
1	C37	22uF	1210	CAP CERAMIC 22UF 25V X5R 1210	
3	C28, C32, C33	10uF	0805	CAP CER 10UF 10V X7R 0805	
1	C29	4.7uF	0603	CAP CER 4.7UF 10V X5R 0603	
2	C32a, C33a		CAP_POL_1210	CAPACITOR TANT 100UF 10V 20% SMD	DNI
5	J1, J2, J3, J6	ED555/2DS	TB_2X3.5MM	TERMINAL BLOCK 3.5MM 2POS PCB	
1	J4	ED555/3DS	TB_3X3.5MM	TERMINAL BLOCK 3.5MM 2POS PCB	
7	JP3, JP5, JP11, JP20, JP25, JP34,JP30		JMP0.3	CONN HEADER 50POS .100" SGL GOLD	
3	JP26, JP27, JP35		JMP0.2	CONN HEADER 50POS .100" SGL GOLD	
3	L1, L2, L3	4.7uH	IND_RLF7030	Magnetic-Core Inductor	
1	R21	120K	0603	RES 120K OHM 1/10W 5% 0603 SMD	
2	R1, R10	82K	0603	RES 82K OHM 1/10W 1% 0603 SMD	
3	R3, R8, R23	20K	0603	RES 20K OHM 1/10W 5% 0603 SMD	
1	R6	383K	0603	RES 383K OHM 1/10W 1% 0603 SMD	
4	R5b, R26, R27, R35	100K	0603	RES 100K OHM 1/10W 5% 0603 SMD	
5	R5a, R14, R17, R20, R37	0	0603	RES 0.0 OHM 1/10W 5% 0603 SMD	
3	R14a, R17a, R37a	40.2K	0603	RES 40.2K OHM 1/10W 1% 0603 SMD	
1	R14b	80.6K	0603	RES 80.6K OHM 1/10W 1% 0603 SMD	
1	R17b	32.4K	0603	RES 32.4K OHM 1/10W 1% 0603 SMD	
1	R37b	12.7K	0603	RES 12.7K OHM 1/10W 1% 0603 SMD	
1	R30	25k	0603	RES 25.0K OHM 1/10W 1% 0603 SMD	
1	S5		7914J	SWITCH KEY 4MM SQ SMD J-HOOK	
6	TP1, TP2, TP3, TP5, TP6, TP7		TEST POINT 0.052	Glass Beaded Test Point	
6	TP4, TP14, TP17, TP32, TP33, TP37		TEST POINT 0.052	Glass Beaded Test Point	
3	TP17a, TP37a, TP14a		TEST POINT 0.052	Test Point, O.032 Hole	DNI
1	U1		QFN-40	TPS65287	

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