TPS65980EVM

User's Guide

Literature Number: SLVUA50
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TPS65980EVM

1 Introductions

The Texas Instruments TPS65980EVM evaluation module (EVM) helps designers evaluate the operation and performance of the TPS65980: a DC/DC switching regulator that receives power from a Thunderbolt bus ranging from 2.5V to 15.75V on TBT_IN and generates three separate 3.3V supply outputs TBT_OUT, CBL_OUT, and DEV_OUT.

The TBT_OUT supply provides power to the local peripheral Thunderbolt™ controller and support circuitry. The CBL_OUT supply provides power back to the Thunderbolt™ cable and has adjustable current limit. The DEV_OUT supply provides power to all other circuitry in the device to perform its designed function.

The TPS65980 is available in a 24-pin 5mm x 4mm x 0.9mm QFN package.

Table 1. Device and Package Configurations

CONVERTER	IC	PACKAGE
U1	TPS65980RHF	RHF

2 Setup

This section describes the jumpers and connectors on the EVM as well as how to properly connect, set up, and use the TPS65980EVM.

2.1 Power Supply Inputs

Figure 1 shows the connection points needed to fully and correctly interface with the TPS65980EVM.

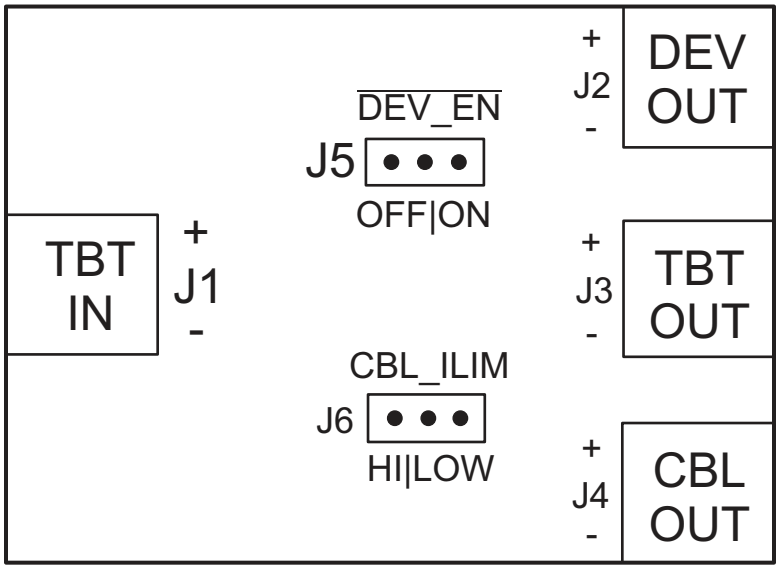


Figure 1. Connection Points

The TPS65980 has three operating modes dictated by the voltage applied on TBT_IN. The total power available at each of the outputs is determined by the operating mode. Table 2 summarizes the operating modes in terms of input voltage range and output current ranges.

Input/Output Supply Ranges

Operating Mode	TBT_IN Vrange	TBT_OUT Irange[1]	CBL_OUT Irange[1]	DEV_OUT Irange[1]
Low Voltage	2.5V – 3.4V	5mA – 50mA	Output Disabled	Output Disabled
High Voltage	10V – 15.75V	235mA – 1A	0 – 1.44A[1]	0 – 2.5A
High Voltage (Sleep)	5.2V – 15.75V	5mA – 31mA	0 – 235mA	0 – 700mA

(1) Note: the total combined output current from TBT_OUT, CBL_OUT, and DEV_OUT should never exceed 3.5A.

2.2 Jumper Settings

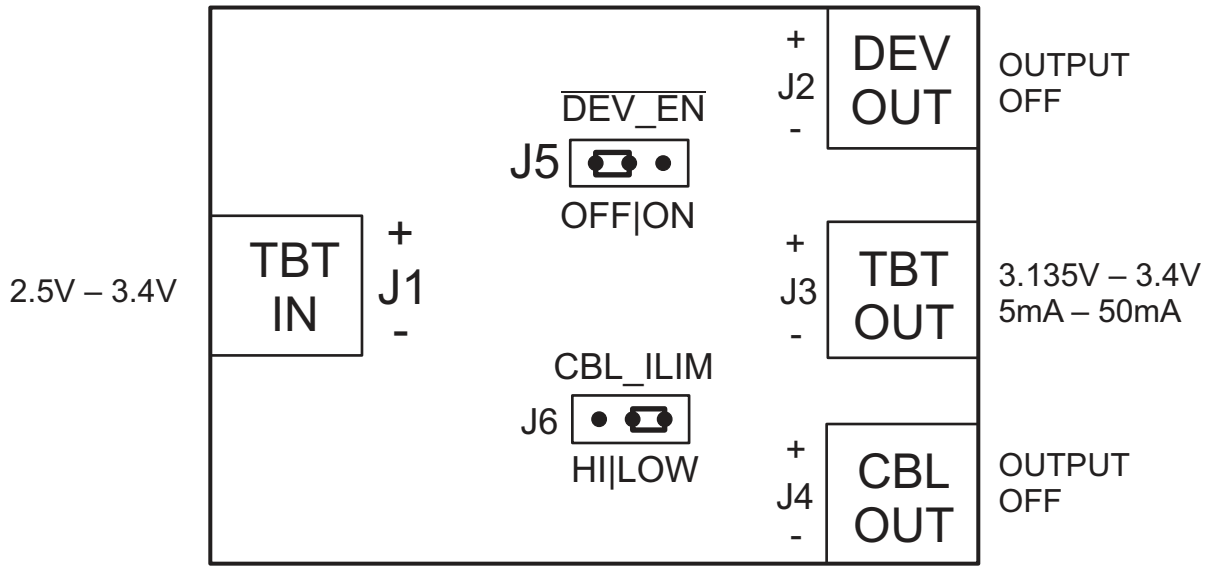
There are two digital input signals which can be set with jumpers as defined in Table 3. These signals can be set to a logical value of “0” or “1” by moving the jumper between the 2 available positions (left and right). See the TPS65980 data sheet for more information on the functionality of these signals.

Digital Signal Jumpers

Header	Name	Logic	Jumper Position	Effect
J5	DEV_EN	1	Left (TBT_OUT)	DEV_OUT Disabled
	DEV_EN	0	Right (GND)	DEV_OUT Enabled
J6	CBL_ILIM	1	Left (TBT_OUT)	CBL_OUT using higher current limit
	CBL_ILIM	0	Right (GND)	CBL_OUT using lower current limit

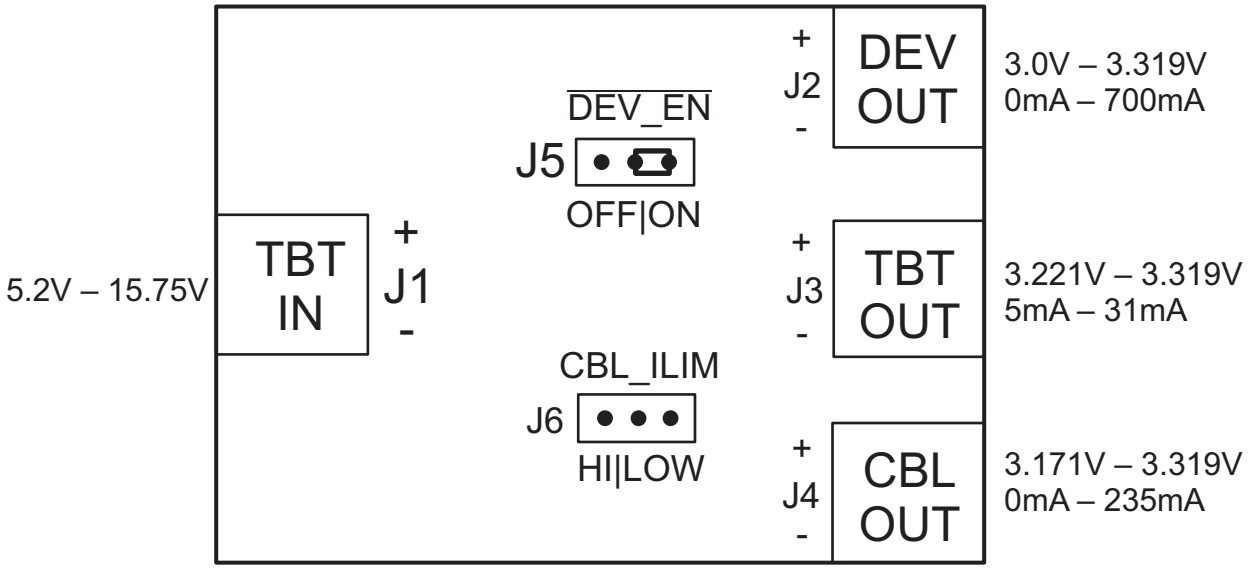
2.3 Device Configurations

Figure 2, Figure 3, Figure 4, and Figure 5illustrate the three operating modes discussed in section 2.1 as well as the two programmable CBL_OUT current limits.



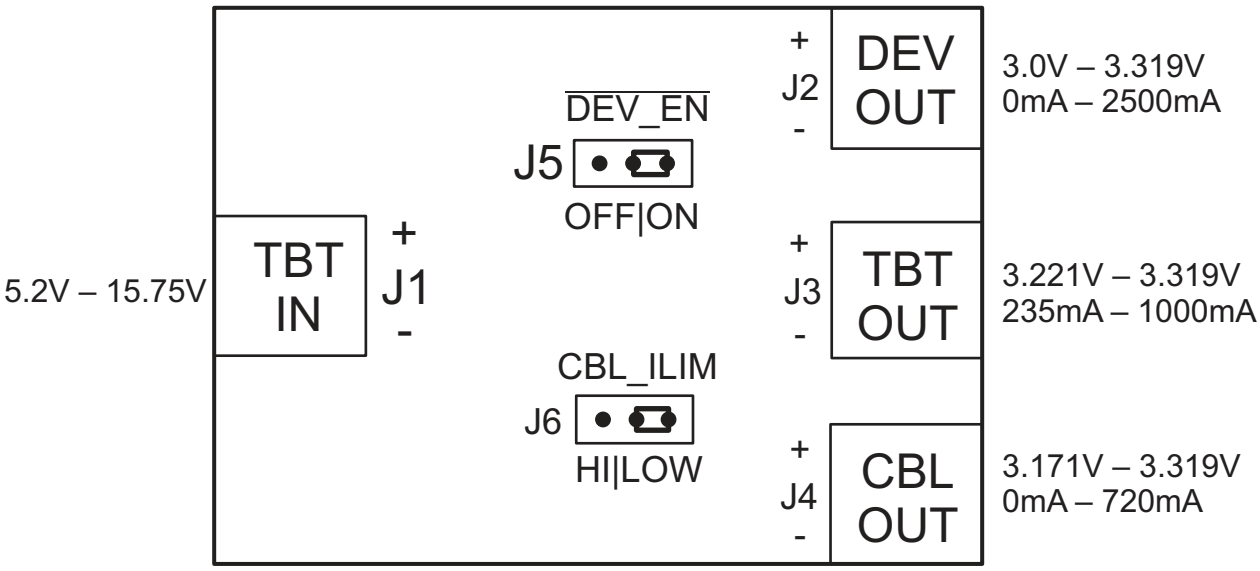
This is the average output voltage range for normal loads. During light load, the peak output voltage from TBT_OUT may surpass 3.4V, but not exceeding 3.42V

Figure 2. Low Voltage Input



This is the average output voltage range for normal loads. During light load, the average output voltage from CBL_OUT may reach 3.4 with peaks not exceeding 3.42V.

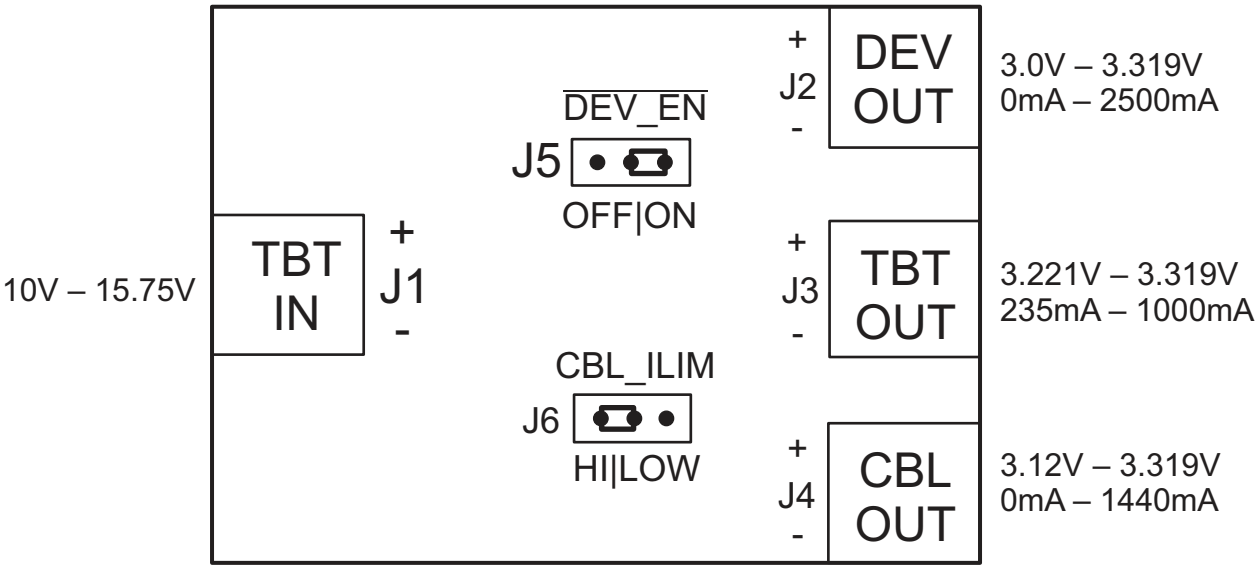
Figure 3. High Voltage Input During Sleep



A This is the average output voltage range for normal loads. During light load, the average output voltage from TBT_OUT and CBL_OUT may reach 3.4 with peaks not exceeding 3.42V

B The total combined output current from TBT_OUT, CBL_OUT, and DEV_OUT should never exceed 3.5A.

Figure 4. High Voltage Input With Lower CBL_OUT Current Limit



A This is the average output voltage range for normal loads. During light load, the average output voltage from TBT_OUT and CBL_OUT may reach 3.4 with peaks not exceeding 3.42V

B The total combined output current from TBT_OUT, CBL_OUT, and DEV_OUT should never exceed 3.5A.

Figure 5. High Voltage Input With Higher CBL_OUT Current Limit

2.4 Test Points

Several test points are provided solely for the purpose measuring certain signals. It is NOT recommended to use the test points to supply power to TBT_IN or load TBT_OUT, CBL_OUT, or DEV_OUT.

Table 2. Test Point Descriptions

Test Point	Signal Description
TP1	GND
TP2	DEV_OUT
TP3	Switching Node
TP4	BOOT
TP5	GND
TP6	TBT_IN
TP7	GND
TP8	TBT_OUT
TP9	Compensation Pin
TP10	GND
TP11	GND
TP12	Soft Start Pin
TP13	RESET_N Signal
TP14	HV_OK Signal
TP15	GND
TP16	CBL_OUT

3 Board Assembly and Layout

Figure 6 and Figure 7 show the top and bottom assembly for the TPS65980EVM.

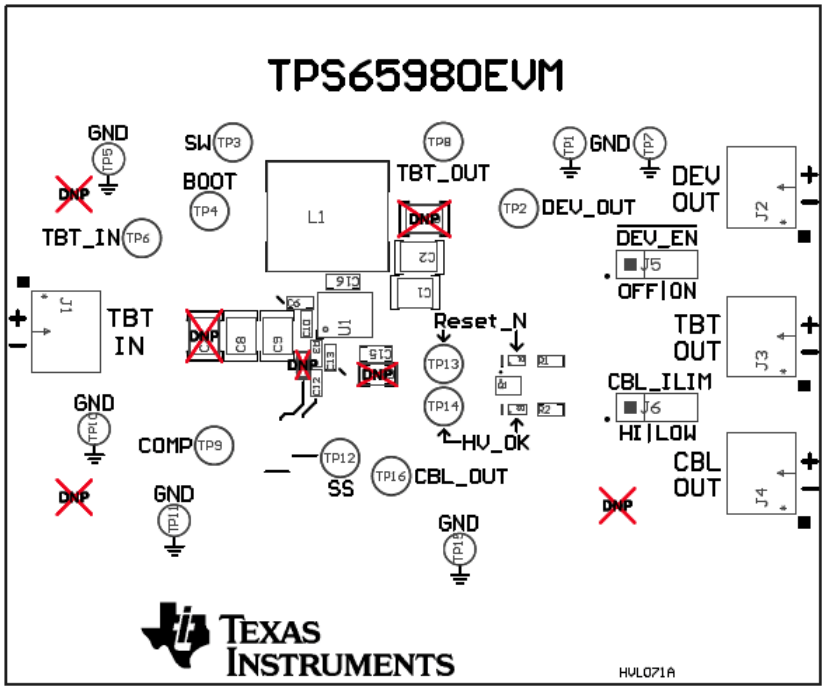


Figure 6. Top Layer Assembly

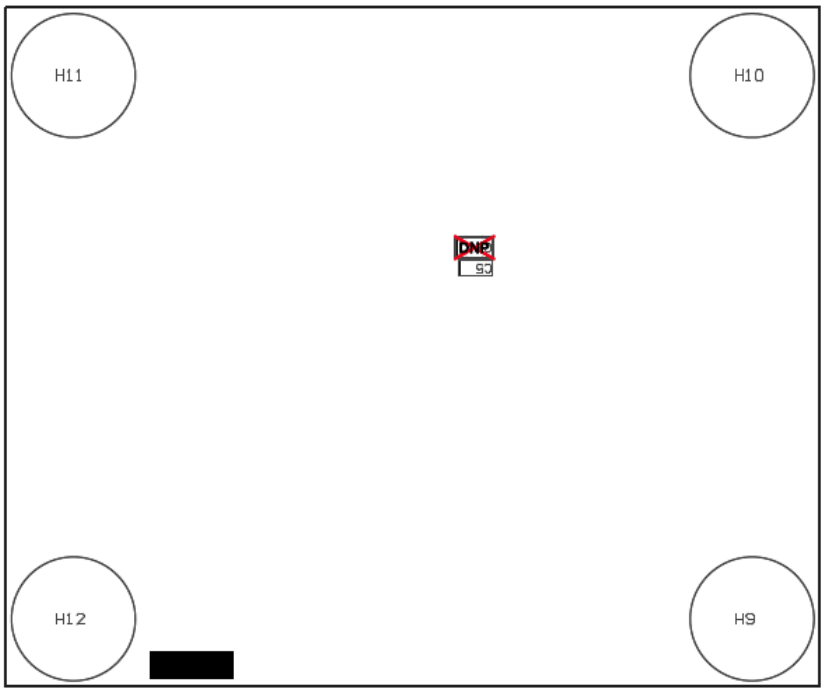


Figure 7. Bottom Layer Assembly

Figure 8 and Figure 9 show the top and bottom layout for the TPS65980EVM.

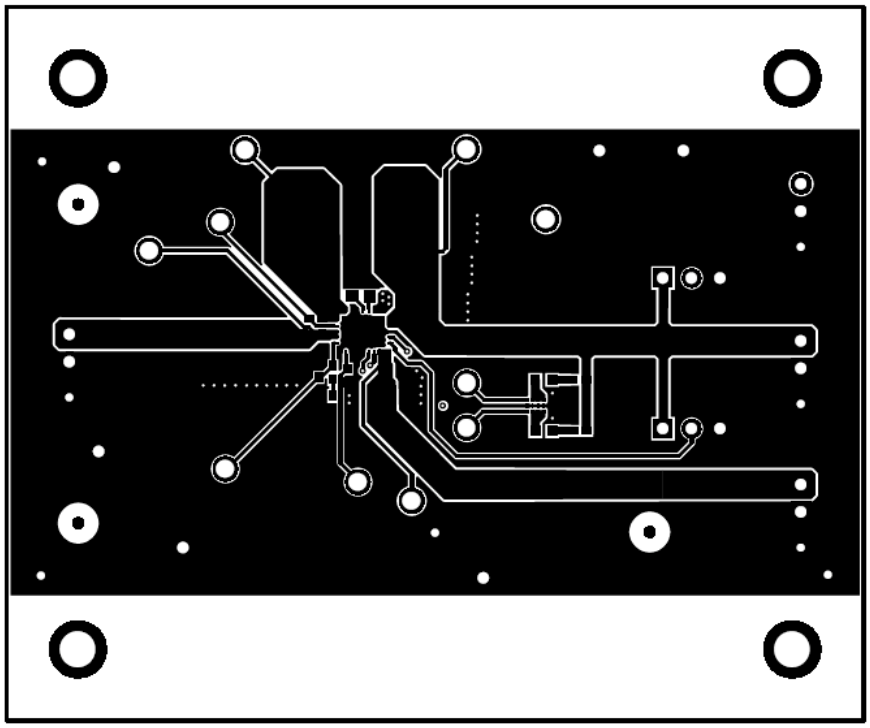


Figure 8. Top Layer Routing

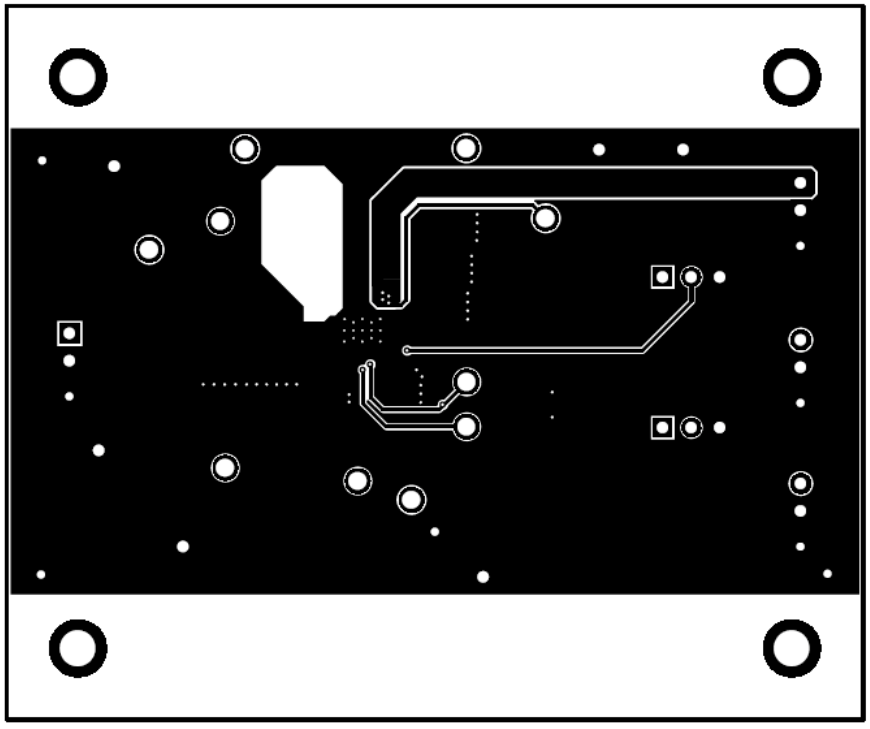


Figure 9. Bottom Layer Routing

4 Schematic

The Schematic for the EVM is given in Figure 10.

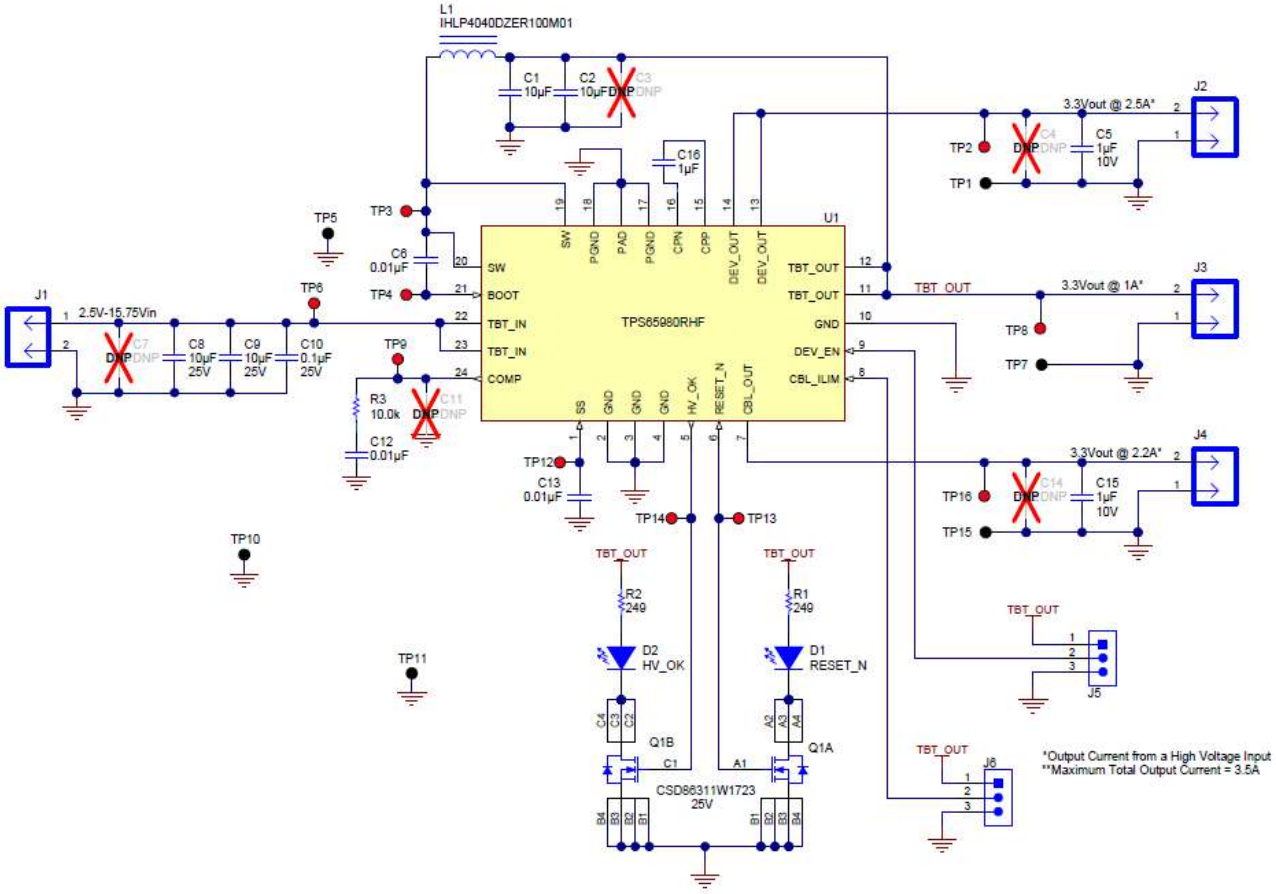


Figure 10. Schematic

5 Bill of Materials

This section contains details on the bill of materials for the TPS65980EVM. Unpopulated items have a quantity of 0.

Bill of Materials

Designator	Quantity	Value	Description	Package Reference	Part Number	Manufacturer	Alternate Part Number	Alternate Manufacturer
!PCB	1		Printed Circuit Board		HVL071	Any		
C1, C2, C8, C9	4	10µF	CAP, CERM, 10µF, 25V, ±20%, X7R, 1210	1210	C3225X7R1E106M250AC	TDK		
C5, C15, C16	3	1µF	CAP, CERM, 1µF, 10V, ±10%, X5R, 0603	0603	GRM188R61A105KA61D	MuRata		
C6, C12, C13	3	0.01µF	CAP, CERM, 0.01µF, 25V, ±10%, X7R, 0402	0402	GRM155R71E103KA01D	MuRata		
C10	1	0.1µF	CAP, CERM, 0.1µF, 25V, ±10%, X5R, 0402	0402	GRM155R61E104KA87D	MuRata		
D1, D2	2	Blue	LED, Blue, SMD	BLUE 0603 LED	LB Q39G-L2N2-35-1	OSRAM		
H9, H10, H11, H12	4		Bumpon, Hemisphere, 0.44 X 0.20, Clear	Transparent Bumpon	SJ-5303 (CLEAR)	3M		
J1, J2, J3, J4	4	C-282834-2	Header, Shrouded 2-pin, 100 mil space,	6.5x5.54 mm	C-282834-2	Tyco		
J5, J6	2		Header, TH, 100mil, 3x1, Gold plated, 230 mil above insulator	3x1 Header	TSW-103-07-G-S	Samtec		
L1	1	10µH	Inductor, Shielded, Powdered Iron, 10µH, 6.8A, 36.5Ω, SMD	IHLP-4040DZ	IHLP4040DZER100M01	Vishay-Dale		
Q1	1	25V	MOSFET, N-CH, 25V, 4.5A, 2.28x.62x1.7mm	2.28x.62x1.7mm	CSD86311W1723	Texas Instruments		None
R1, R2	2	249	RES, 249Ω, 1%, 0.063W, 0402	0402	CRCW0402249RFKED	Vishay-Dale		
R3	1	10.0kΩ	RES, 10.0kΩ, 1%, 0.063W, 0402	0402	CRCW040210K0FKED	Vishay-Dale		
SH-J5, SH-J6	2	1x2	Shunt, 100mil, Gold plated, Black	Shunt	969102-0000-DA	3M	SNT-100-BK-G	Samtec
TP1, TP5, TP7, TP10, TP11, TP15	6	Black	Test Point, Miniature, Black, TH	Black Miniature Testpoint	5001	Keystone		
TP2, TP3, TP4, TP6, TP8, TP9, TP12, TP13, TP14, TP16	10	Red	Test Point, Compact, Red, TH	Red Compact Testpoint	5005	Keystone		
U1	1		Thunderbolt™ Bus Power Buck/Boost, RHF0024A	RHF0024A	TPS65980RHF	Texas Instruments		None
C3, C7	0	10µF	CAP, CERM, 10µF, 25V, ±20%, X7R, 1210	1210	C3225X7R1E106M250AC	TDK		
C4, C14	0	1µF	CAP, CERM, 1µF, 10V, ±10%, X5R, 0805	0805	GRM219R61A105KC01D	MuRata		
C11	0	0.01µF	CAP, CERM, 0.01µF, 25V, ±10%, X7R, 0402	0402	GRM155R71E103KA01D	MuRata		
FID1, FID2, FID3	0		Fiducial mark. There is nothing to buy or mount.	Fiducial	N/A	N/A		

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