Using the LP8728EVM Evaluation Module

User's Guide



Literature Number: SNVU231
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Introduction

The Texas Instruments' LP8728EVM evaluation module (EVM) helps designers evaluate the operation and performance of this device. The LP8728EVM uses the LP8728's four buck converters to provide 3.3 V, 2.65 V, 1.8 V, and 1.25 V output voltages. Information about output voltage and current ratings of the LP8728 can also be found in the LP8728 datasheet.

In order to facilitate ease of testing and evaluation of this circuit, the LP8728EVM contains screw-in terminals for the VIN and all four VOUT connections. Dual connectors are provided for easy four-wire connection.

For evaluation purposes, the LP8728EVM has been tested over a 4.5 V to 5.5 V input range. Users are cautioned to evaluate their specific operating conditions and choose components with the appropriate voltage ratings before designing in LP8728 into a final product.

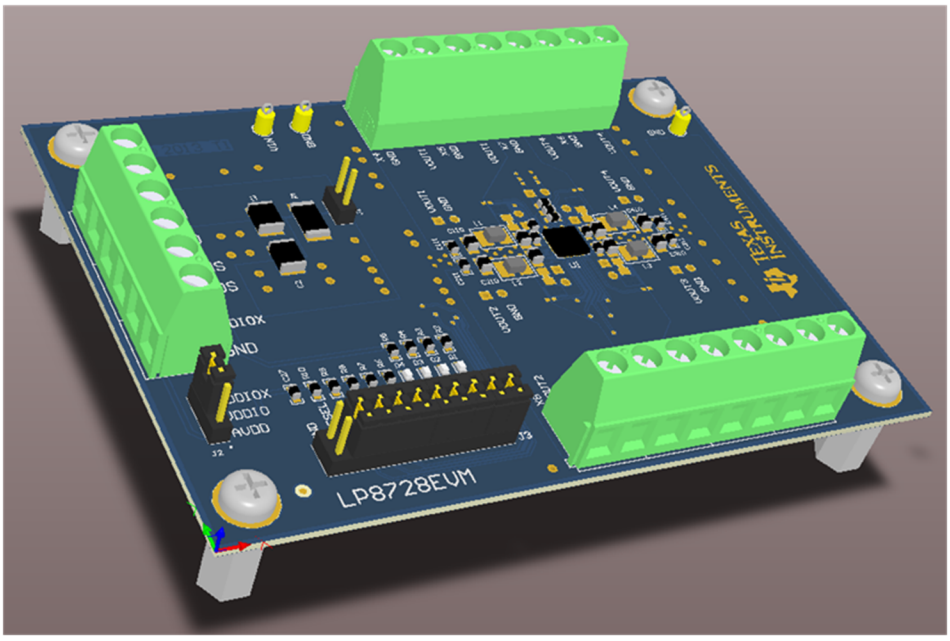


Figure 1-1. LP8728EVM

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Description of LP8728

The LP8728 is a quad output Power Management Unit, optimized for low power FPGAs, microprocessors, and DSPs. This device integrates four highly efficient step-down DC/DC converters into one package. All the converters run at fixed 3.3 MHz switching frequency. Buck converters switching is phase shifted to minimize the input current spiking.

2.1 Features

- Four High-Efficiency Step-Down DC/DC Converters
  - Max output current 1.0 A
  - Forced PWM operation
  - Soft-start control
  - V_{OUT1} = 3.3 V
  - V_{OUT2} - 1.25 V
  - V_{OUT3} = 1.8 V or 2.65 V (pin selectable)
  - V_{OUT4} = 1.8 V
- Separate Enable Inputs for each Converter Control
- Separate Power Good Outputs for each Converter
- Output Over-Current and Input Over-Voltage Protection
- Over-Temperature Protection
- Under-Voltage Lockout (UVLO)
- 28-pin 0.5 mm Pitch QFN Package

2.2 Applications

- Automotive Systems

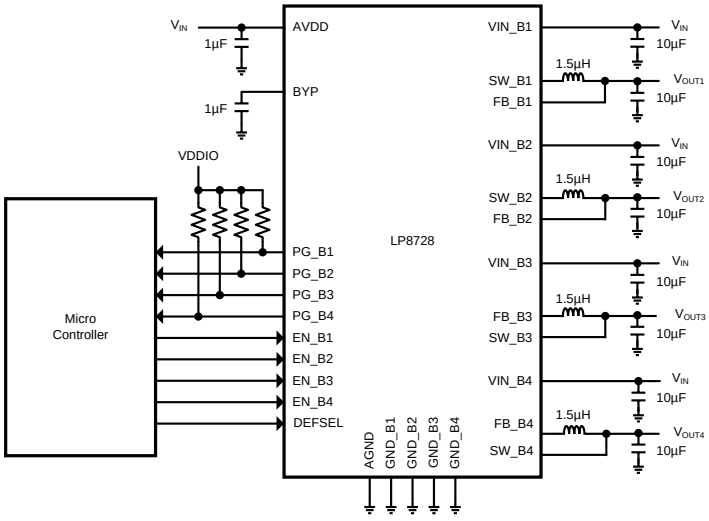


Figure 2-1. Typical Application

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LP8728EVM Setup

Figure 3-1 shows the LP8728EVM with input and output connectors and main components on the board. Input power supply is connected to VIN connectors. Two connectors are provided for easy 4-wire connection. A force line should be connected to connector X1 terminals VIN and GND. Sense wires should be connected to connector X2 terminals VINS and GNDS. If a two-wire connection is used, wires should be connected to connector X1 VIN and GND only. Input voltage needs to be set between 4.5 V to 5.5 V.

Two connectors are also provided for each buck output. This is useful, for example, when connecting the source meter in 4-wire mode for accurate IOUT vs VOUT measurement. Two output terminals are connected in parallel so either one can be used for sense or force lines.

Connector X3 terminals VDDIOX and GND can be used to connect separated pull-up voltage for the EN_Bx and DEFSEL pins. If separated pull-up voltage is not desired, input pins can be pulled up to VIN voltage. Pull-up voltage is selected by changing the shunt position on the J2 terminal. Connecting shunt between VDDIO and VDDIOX selects VDDIOX as the pull-up voltage. Connecting a shunt between VDDIO and AVDD selects VIN as the pull-up voltage.

Extra test points are placed close to the buck output capacitors for convenient probe points for an oscilloscope. Similar test points are also placed close to each input voltage pin (VIN_Bx and AVDD).

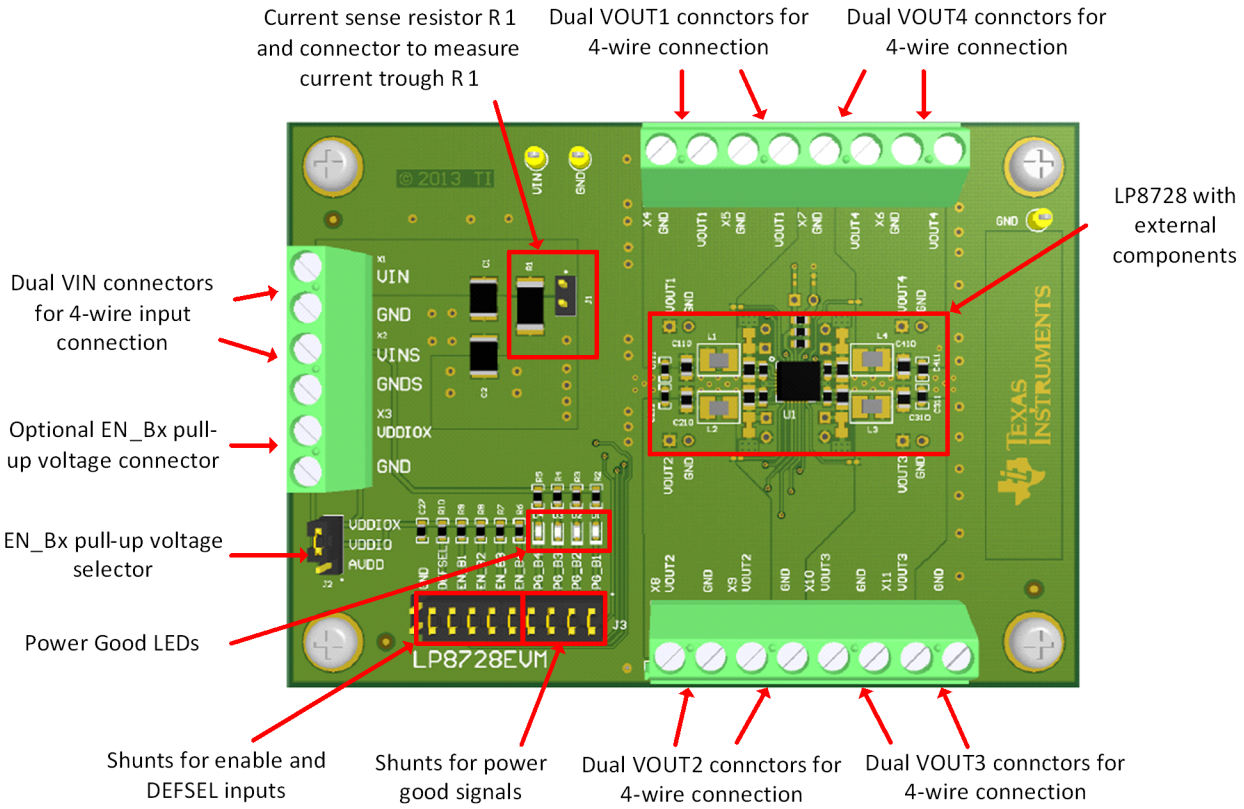


Figure 3-1. Evaluation Board Connectors and Setup

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Board Layout

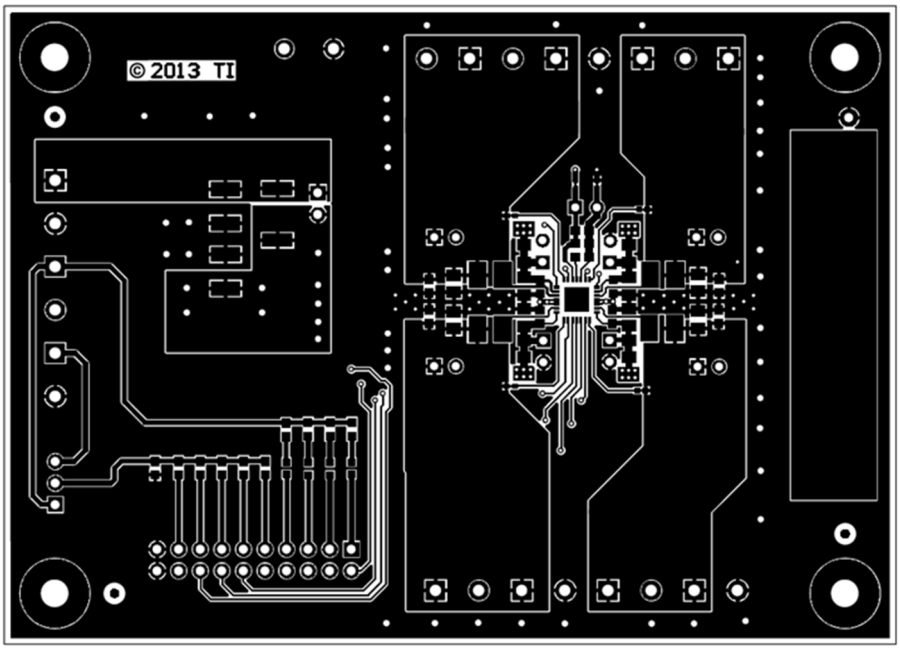


Figure 4-1. Layer 1 Top (Signal)

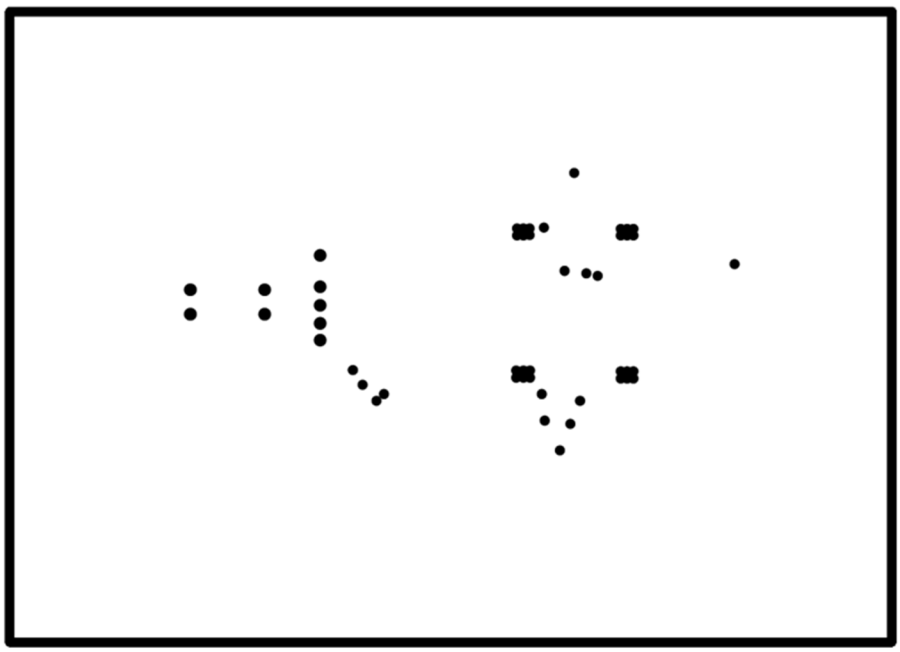


Figure 4-2. Layer 2 (GND) (Picture in reverse colors)

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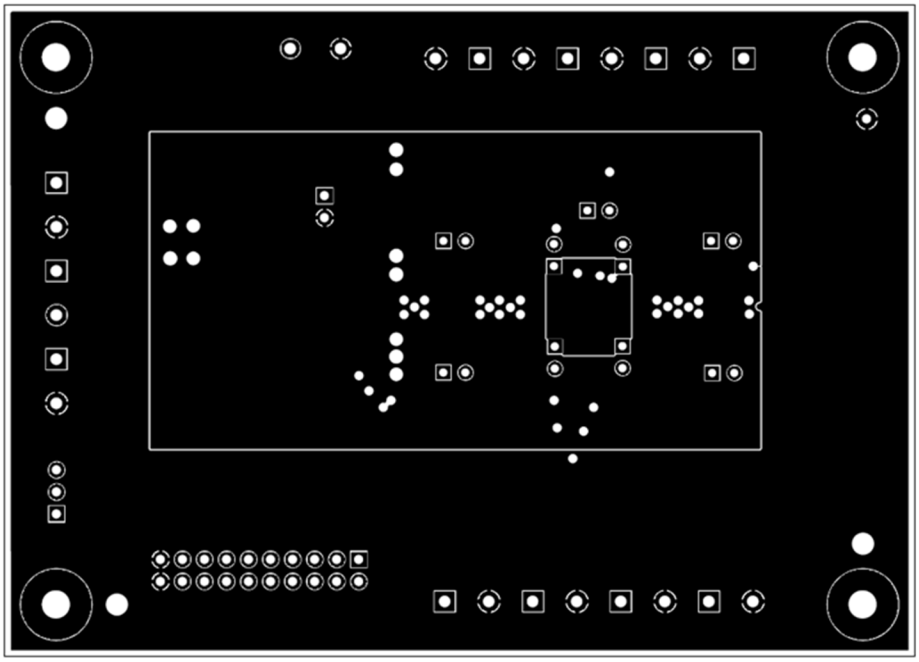


Figure 4-3. Layer 2 (GND / VIN)

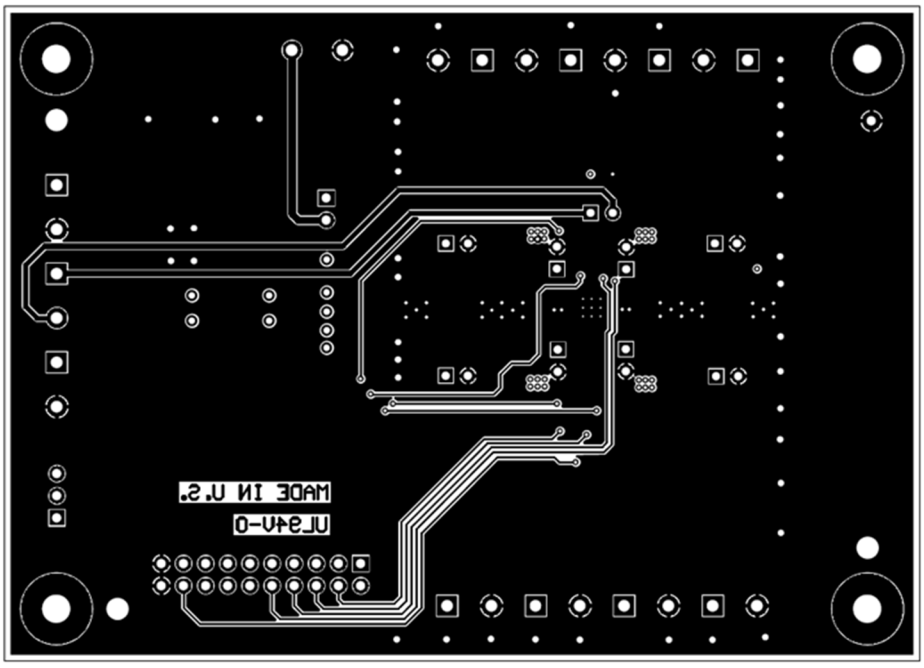


Figure 4-4. Layer 4 Bottom (Signal)

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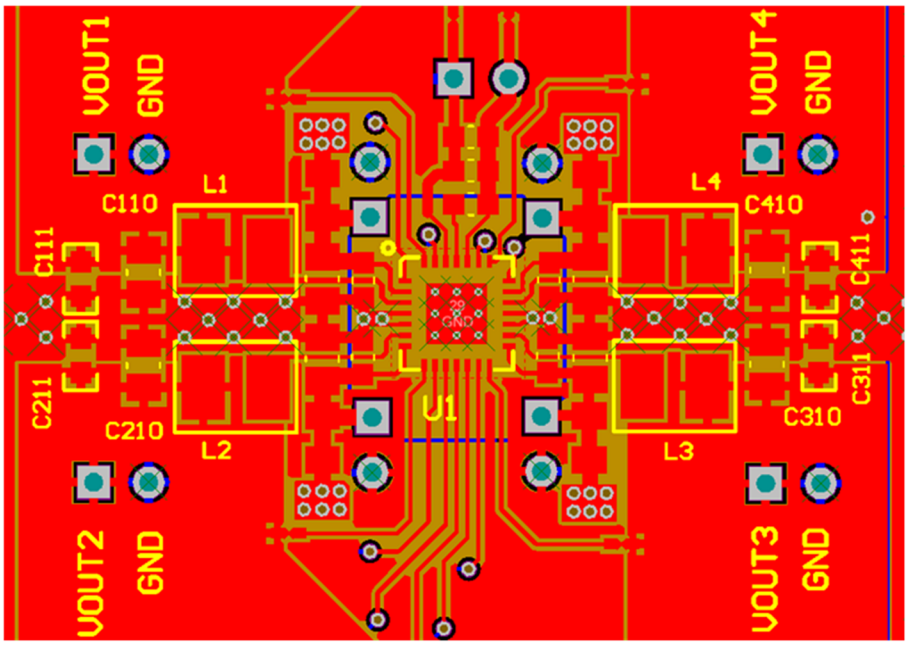


Figure 4-5. Close-up of the LP8728 and Main External Components

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Board Stackup

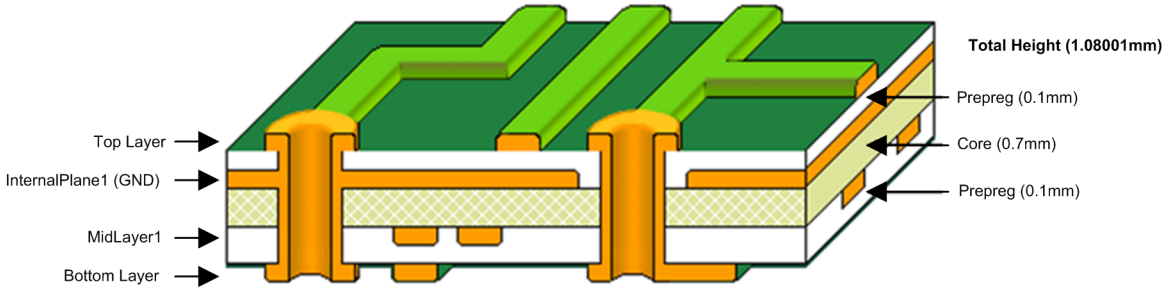


Figure 5-1. Evaluation Board Stackup

Details:

- 4-layer board FR4
- Top layer 1 - copper, 35µm
- Prepreg 0.1 mm
- Internal Layer 2, 35 µm
- Core 0.7 mm
- Ground plane Layer 3, 35 µm
- Prepreg 0.1 mm
- Bottom Layer 4 - copper, 35 µm
- Surface finish immersion gold

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The LP8728 has four enable pins (EN_Bx). When any of the enable pins are pulled high, the device activates and starts up corresponding the buck converter (EN_B1 controls buck1, EN_B2 controls buck2, etc). When all EN_Bx pins are low, the device goes to shutdown mode.

DEFSEL is used to select buck 3 output voltage. If the DEFSEL pin is pulled high, buck 3 output voltage is set to 2.65 V. If DEFSEL pin is set low, buck 3 output voltage is set to 1.8 V

EN_Bx pins and the DEFSEL pin have internal pull-down resistors (500 kΩ) which will set the state to low when the EN input is floating.

Power good outputs indicate the status of each buck converter. Once buck output voltage reaches 96% (typ) of the desired output voltage, the power good pin is pulled high. If output voltage drops below 93% (typ) of desired output voltage due to, for example, an overload condition, the corresponding power good pin is set low.

6.1 LP8728EVM Control Interface

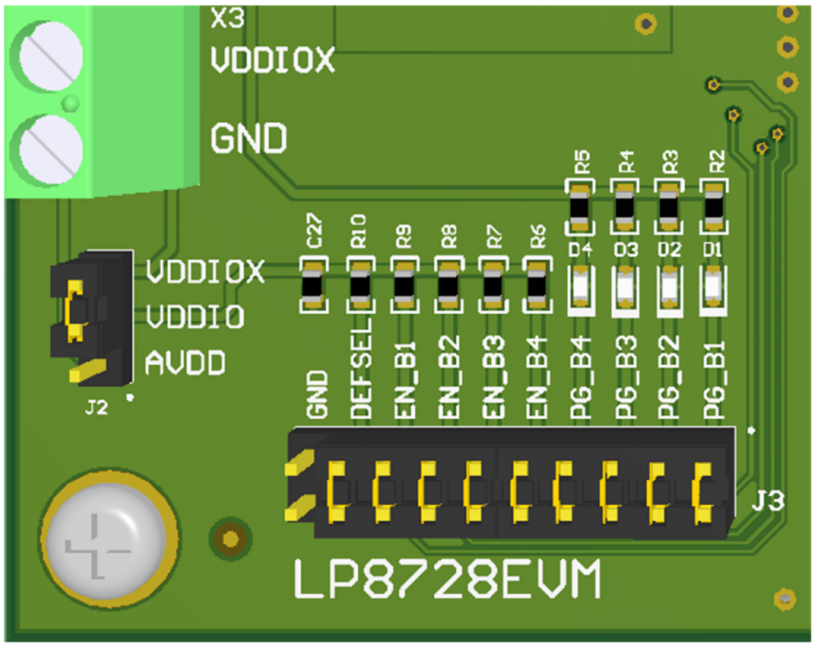


Figure 6-1. LP8728EVM Control Pins

All LP8728 digital input and out signals are routed to 20-pin connector (J3) pins. Pins closer to PCB edge go straight to the LP8728 digital pins. These pins can be used to connect LP8728 pins to any external source (signal generators, external controllers, etc). For simple enable / disable operation pull-up resistors are connected to adjacent pins of the digital inputs. This allows enabling the bucks by setting shunts between the J3 pins.

Indicator LEDs are provided for power good signals PG_Bx. LEDs are connected between VIN and PG_Bx pin so the LED illuminates when power good signal is low (buck is disabled or output voltage out of regulation). Indicator LEDs can be disconnected from the PG_Bx pins by removing the shunts form connector J3.

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Evaluation Board Schematic

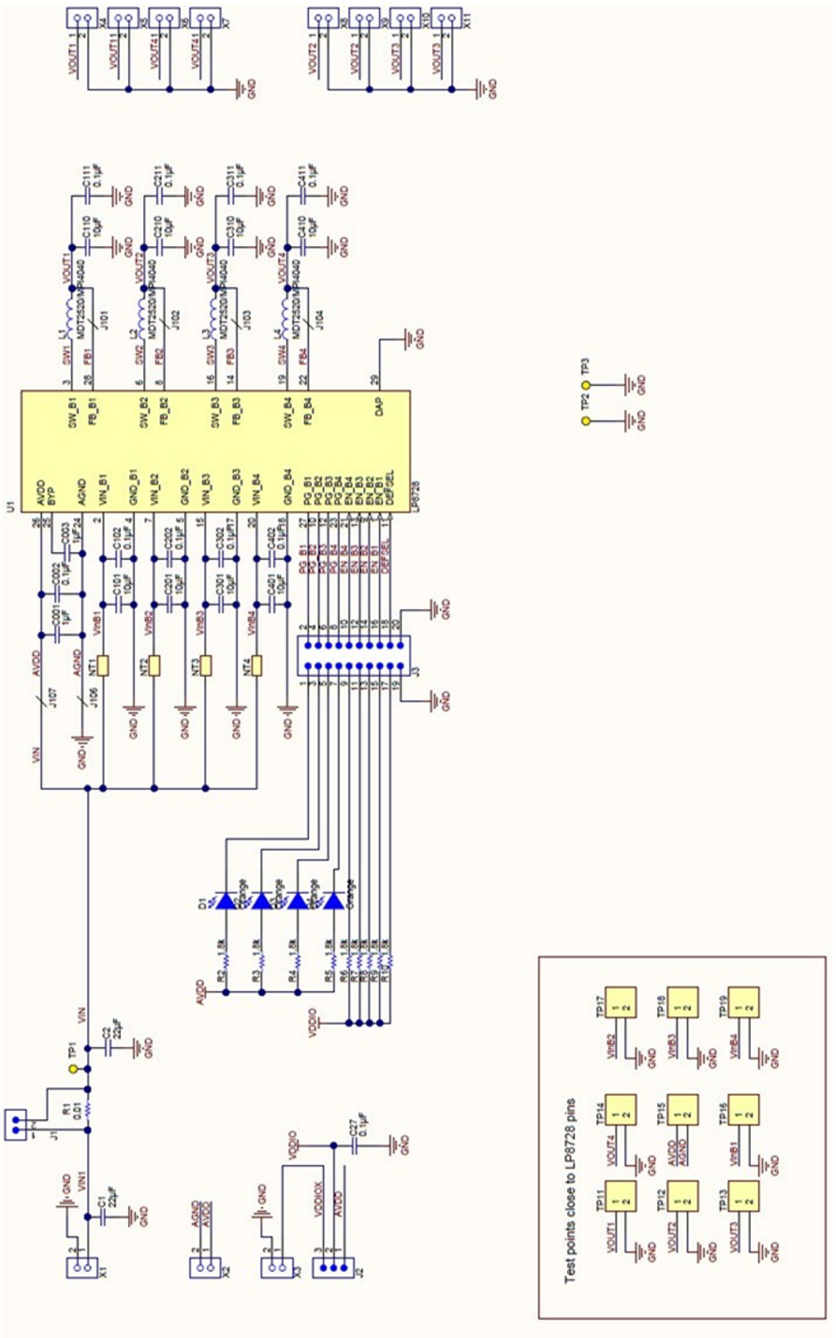


Figure 7-1. Evaluation Board Schematic

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Bill of Materials

Designator	QTY	Value	Description	Package	Part Number	Manufacturer
C001, C003	2	1uF	CAP, CERM, 1uF, 16V, +/-10%, X7R	0603	C1608X7R1C105K	TDK
C1, C2	2	22uF	CAP, CERM, 22uF, 16V, +/-20%, X7R	1812	CGA8N3X7R1C226M	TDK
C002, C27, C102, C111, C202, C211, C302, C311, C402, C411	10	0.1uF	CAP, CERM, 0.1uF, 16V, +/-10%, X7R	0603	C1608X7R1C104K	TDK
C101, C110, C201, C210, C301, C310, C401, C410	8	10uF	CAP, CERM, 10uF, 10V, +/-10%, X7R	0805	GRM21BR71A106KE51L	MuRata
D1, D2, D3, D4	4	Orange	LED, Orange, SMD	1.6x0.8x0.8mm	LTST-C190KFKT	Lite-On
J1	1		Header, 100mil, 2x1, Gold plated	TSW-102-07-G-S	TSW-102-07-G-S	Samtec, Inc.
J2	1		Header, 100mil, 3x1, Gold plated	TSW-103-07-G-S	TSW-103-07-G-S	Samtec, Inc.
J3	1		Header, 100mil, 10x2, Gold plated	TSW-110-07-G-D	TSW-110-07-G-D	Samtec, Inc.
L1, L2, L3, L4	4	1.5uH	1.1uH	2.0x2.5x1.2	MDT2520-CN1R5M	Toko
R1	1	0.01	RES, 0.01 ohm, 1%, 3W, High Power Current Sense Chip Resistor	2512	CRA2512-FZ-R010ELF	Bourns
R2, R3, R4, R5, R6, R7, R8, R9, R10	9	1.8k	RES, 1.8k ohm, 5%, 0.1W, 0603	0603	CRCW06031K80JNEA	Vishay-Dale
U1	1		LP8728	QFN-28	LP8728	Texas Instruments
X1, X2, X3, X4, X5, X6, X7, X8, X9, X10, X11	11	2x1	Conn Term Block, 2POS, 5.08mm, TH	PhoenixContact_1715721	1715721	Phoenix Contact

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