APEK81911

APM81911 Evaluation Board User Guide

DESCRIPTION

The APM81911 Evaluation Board is designed to help system designers evaluate the operation and performance of the APM81911 synchronous buck regulator ClearPower module. The APM81911 evaluation board output voltage can be configured with a jumper for 5 V or 3.3 V.

FEATURES

- APM81911 buck converter power module
- User-selectable output voltage, switching frequency, low-power mode, soft-start time, clock source, and output clock state
- Banana jacks for input and output power

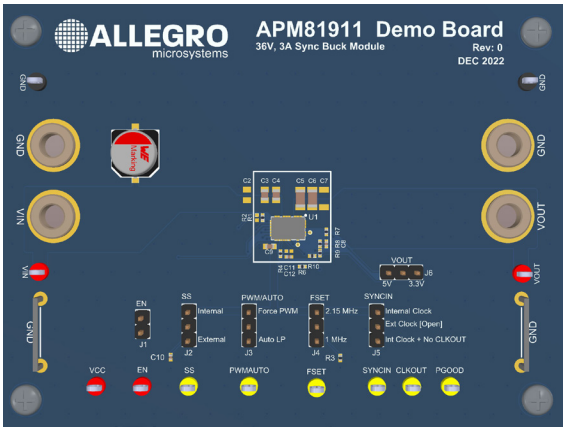

Figure 1: APM81911 Evaluation Board

EMC WITH EASE
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Table of Contents

Table 1: APM81911 Evaluation Board Configurations

Configuration Name	Part Number	Output Voltage
APM81911	APEK81911KNB-01	Selectable (3.3 V or 5 V)

Table 2: General Specifications

Specification	Min.	Nom.	Max.	Units
Input Operating Voltage	3.5	–	36	V
Output Current*	0	–	3	A
Switching Frequency and SYNCIN Frequency	1	–	2.15	MHz

*Maximum output current may be lower due to thermal limitations of the APM81911 and the APM81911 Evaluation Board at certain operating conditions.

USING THE EVALUATION BOARD

This section provides an overview of the connections and configuration options of the APM81911 Evaluation Board. Each group of connections highlighted in Figure 2 has a detail section below. The default jumper positions are highlighted in green. The APM81911 datasheet contains detailed information on the use and functionality of each pin and should be consulted for more detailed information than is contained in this user guide.

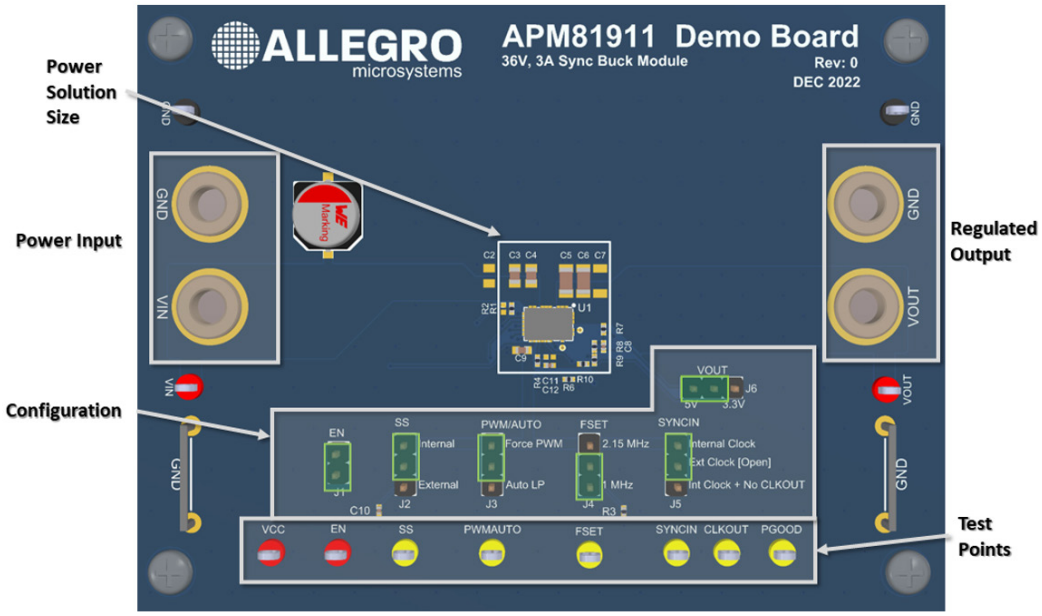

Figure 2: APM81911 Evaluation Board I/O Connections and Default Jumper Positions

Power Input

Connect a power supply using banana cables to the VIN and GND through hole banana jack or with test leads to the VIN and GND test points.

Device Configuration

There are six configuration jumpers on the evaluation board to exercise different operating modes of the APM81911. All configuration jumpers must be installed prior to power-on, unless using an external EN signal or SYNCIN signal where jumper J1 or J5 must be uninstalled, respectively.

Table 3: Jumper Descriptions

Jumper	Name	Description
J1	EN	Install to tie EN to VIN and enable the APM81911 when VIN is above UVLO. Uninstall to control EN through an external signal at the EN test point.
J2	SS	Soft-start select. Install at “Internal” to use internal soft-start or “External” to use the external 47 nF soft-start capacitor.
J3	PWM/AUTO	Low-power mode select. Install at “Auto LP” to allow the part to enter low-power mode under light loads. Install at “Force PWM” to always stay in PWM switching mode.
J4	FSET	Frequency Set select. Install at “2.15 MHz” or “1 MHz”. The “2.15 MHz” option ties FSET to VCC and the “1 MHz” option ties FSET to GND through a resistor.
J5	SYNCIN	Clock synchronization input. Install from center pin to top “Internal Clock” pin to use the internal clock and enable the CLKOUT pin. Install from center pin to the bottom “Int Clock + No CLKOUT” to use the internal clock and disable the CLKOUT signal. Leave the jumper open to apply a synchronization clock at the SYNCIN test point.
J6	VOUT	Output voltage select. Install at “5V” for 5 V output. Uninstall or install at “3.3V” for 3.3 V output.

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Table 4: Test Point Descriptions

Test Point	Description
VIN	Positive terminal for input voltage connection or sensing.
VOUT	Positive terminal for output voltage connection or sensing.
GND	Negative terminal for voltage input/output or sensing.
VCC	VCC pin voltage monitor test point.
EN	EN pin voltage monitor or external logic input. Uninstall J1 to use an external enable signal on the EN test point.
SS	Soft-start pin voltage monitor test point.
FSET	FSET voltage monitor test point.
PWMAUTO	PWM/AUTO voltage monitor test point.
SYNCIN	SYNCIN test point for connecting external PWM signal for clock synchronization.
CLKOUT	Clock monitor test point for CLKOUT signal if SYNCIN jumper is configured to enable CLKOUT.
PGOOD	PGOOD monitor test point. This pin is pulled up to VCC and asserts low to indicate the output is out of regulation.

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PERFORMANCE DATA

Startup and Shutdown

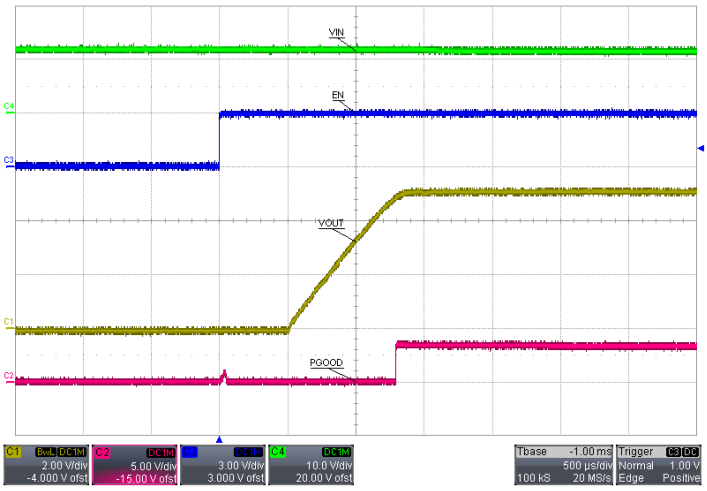

Figure 3: Startup with EN Signal and Internal Soft-Start

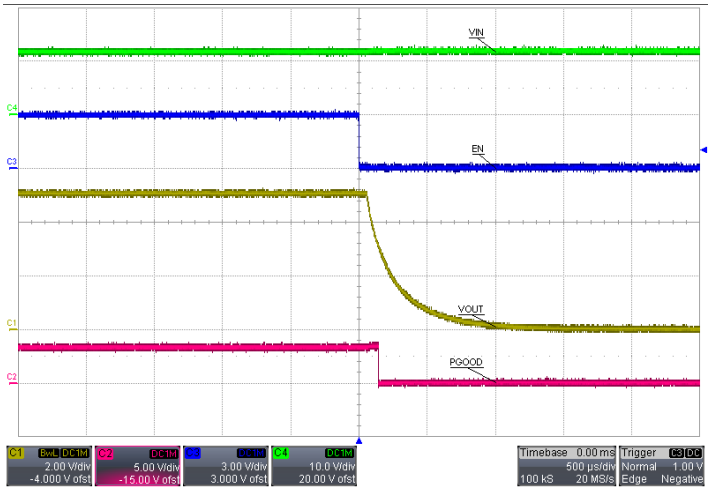

Figure 4: Shutdown with EN Signal; 5 Ω load applied to VOUT

Load Transient Response

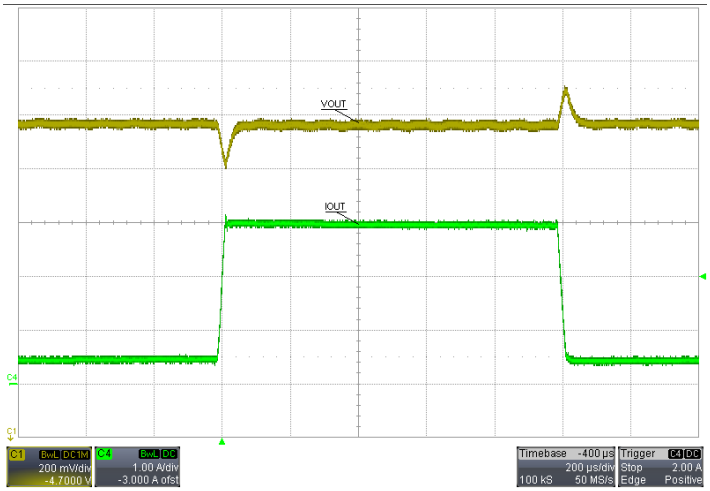

Figure 5: V_{OUT} Response to Load Transient; Load Step = 500 mA to 3 A, V_{OUT} = 5 V

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Efficiency

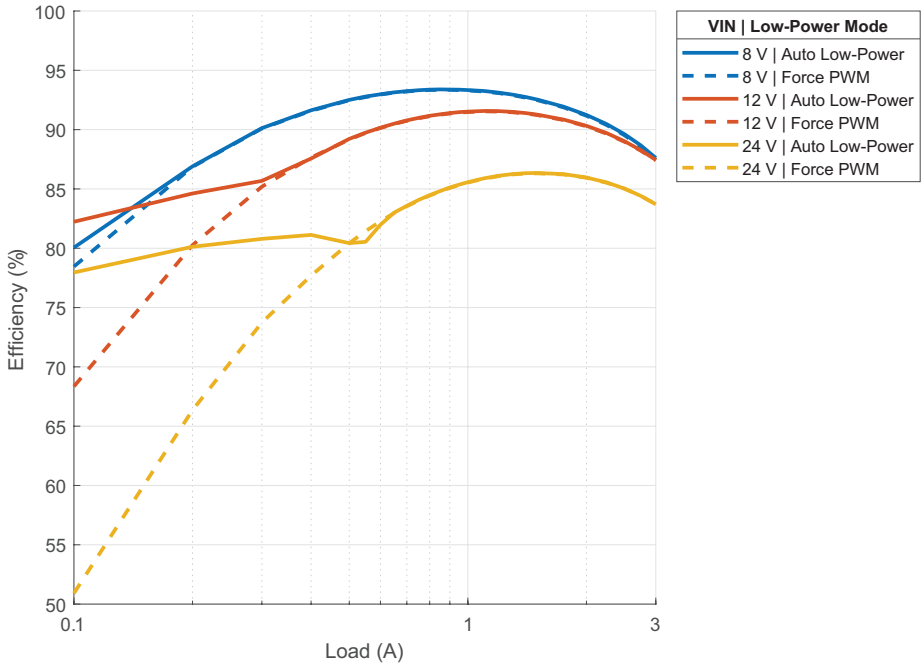

Figure 6: Efficiency at V_{OUT} = 5 V, f_{SW} = 2.15 MHz

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Thermal Performance

The following figure shows the thermal performance of the APM81911 Evaluation Board after five minutes of continuous operation with ambient temperature near 25°C.

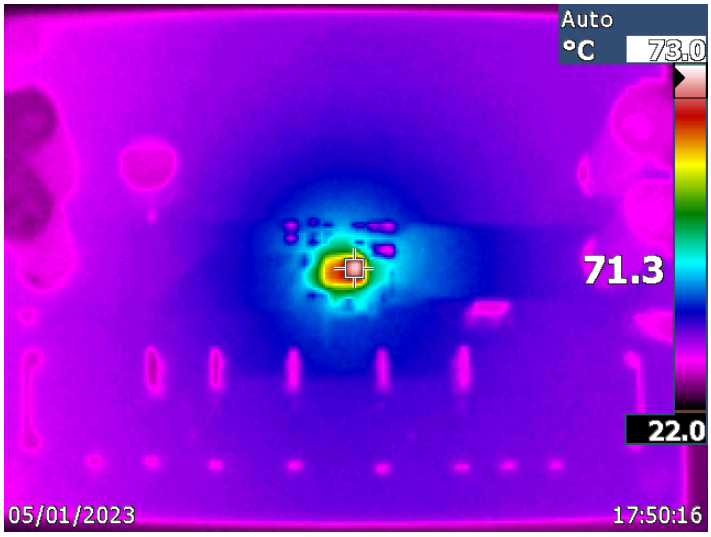

Figure 7: APM81911 Evaluation Board Thermal Image at V_{IN} = 12 V, V_{OUT} = 5 V, I_{OUT} = 3 A, f_{SW} = 2.15 MHz

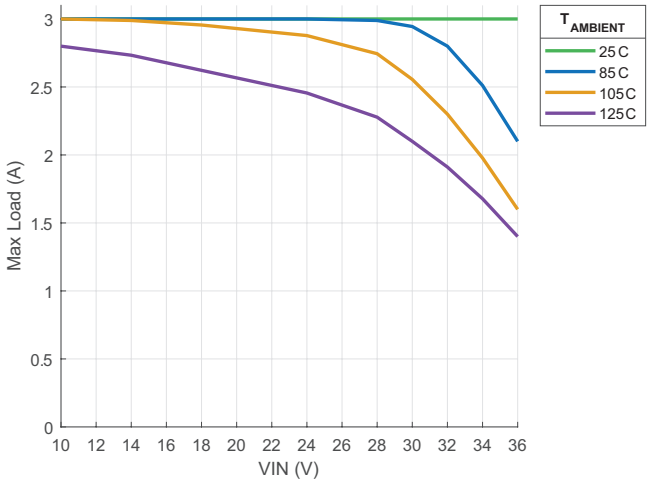

Figure 8: Maximum Load Current Derating for V_{OUT} = 3.3 V, f_{SW} = 2.15 MHz

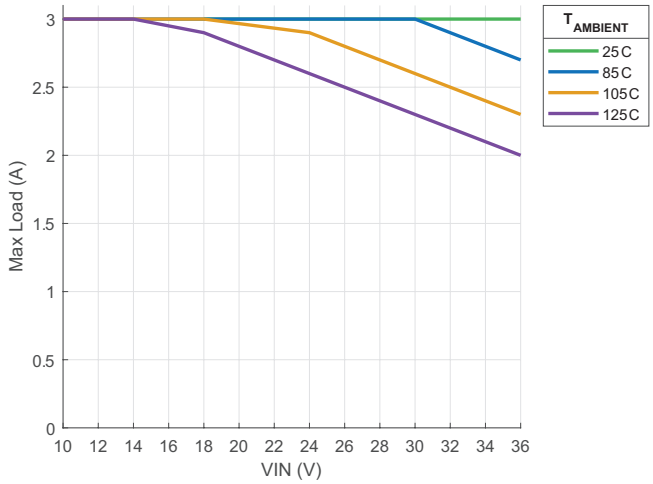

Figure 9: Maximum Load Current Derating for V_{OUT} = 5 V, f_{SW} = 2.15 MHz

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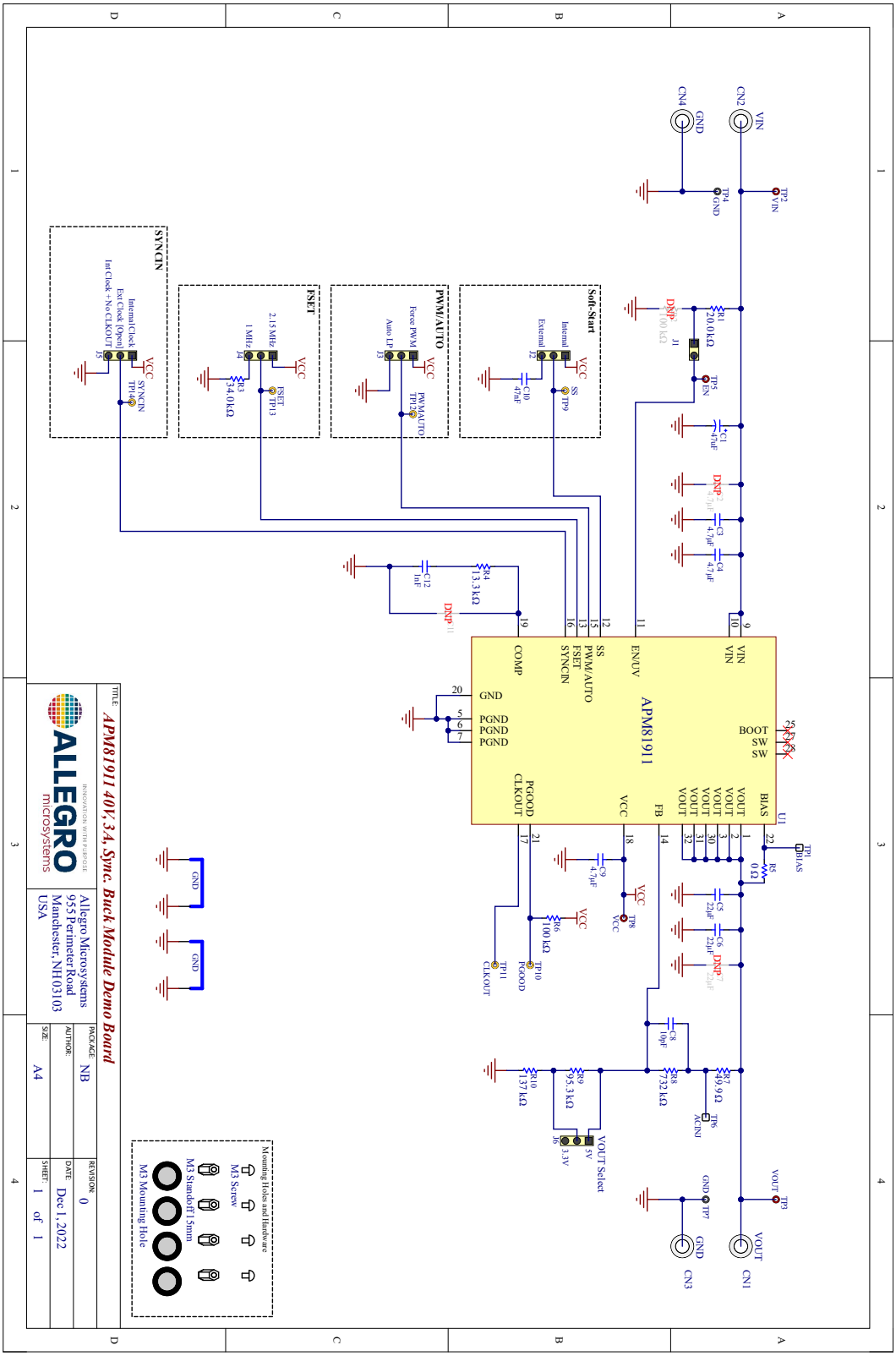
SCHEMATIC



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PCB LAYOUT

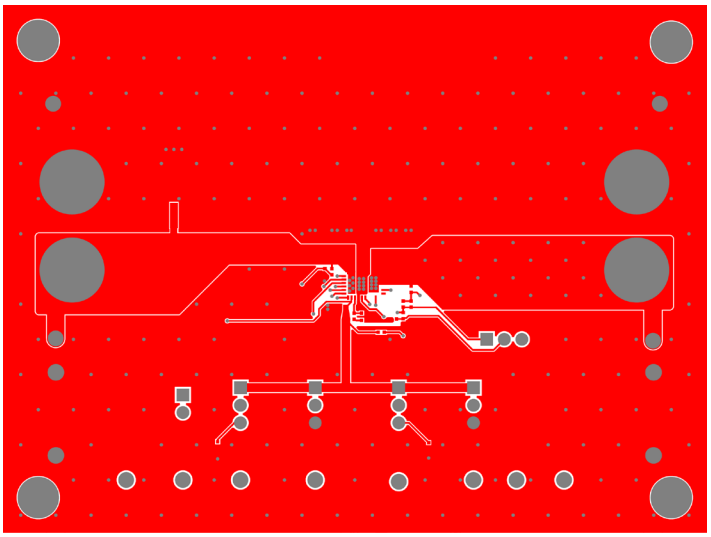

Figure 10: Top Layer

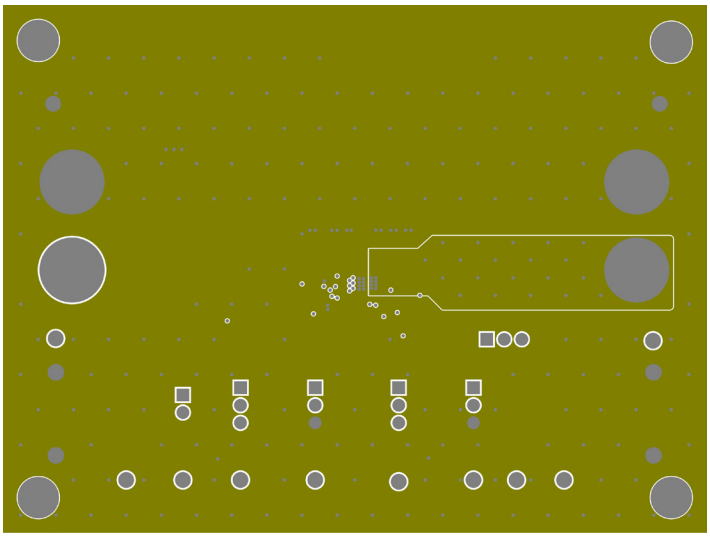

Figure 12: Inner Layer 2 (PGND Plane)

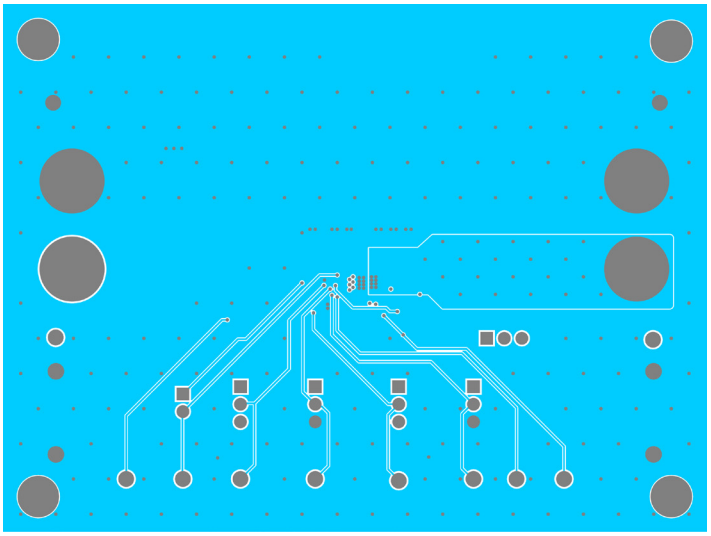

Figure 11: Inner Layer 1 (PGND Plane)

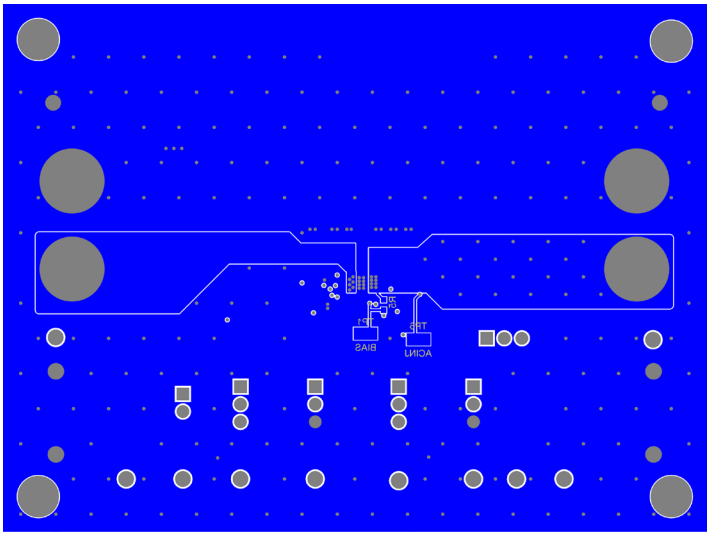

Figure 13: Bottom Layer

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BILL OF MATERIALS

Table 5: APEK81911 Bill of Materials

Designator	Description	Quantity	Manufacturer	Manufacturer Part Number
Electrical				
C1	Capacitor, Electrolytic, 47 µF, 50 V, 8 mm	1	Nichicon	UUX1H470MNL6GS
C3, C4	CAP CER 4.7 µF, 50 V, X7S 0805	2	Murata	GRM21BC71H475KE11L
C5, C6	CAP CER 22 µF, 25 V, X5R 1206	2	TDK	C3216X5R1E226M160AB
C8	CAP CER 10 pF, 50 V, NP0 0402	1	TDK	C1005NP01H100D050BA
C9	CAP CER 4.7 µF, 10 V, X5R 0603	1	KEMET	C0603C475M8PACTU
C10	CAP CER 0.047 µF, 16 V, X7R 0402	1	Murata	GRM155R71C473KA01D
C12	CAP CER 1000 pF, 50 V, NP0 0402	1	Murata	GRM1555C1H102GA01D
R1	Resistor, 20.0 kΩ,1/16 W, 1%, 0402	1	Yageo	RC0402FR-0720KL
R3	Resistor, 34.0 kΩ,1/16 W, 1%, 0402	1	Yageo	RC0402FR-0734KL
R4	Resistor, 13.3 kΩ,1/16 W, 1%, 0402	1	Yageo	RC0402FR-0713K3L
R5	Resistor, 0 Ω,1/10 W, Jumper, 0603	1	Yageo	RC0603JR-070RL
R6	Resistor, 100 kΩ,1/16 W, 1%, 0402	1	Yageo	RC0402FR-07100KL
R7	Resistor, 49.9 Ω,1/16 W, 1%, 0402	1	Yageo	RT0402FRE0749R9L
R8	Resistor, 732 kΩ,1/16 W, 1%, 0402	1	Yageo	RC0402FR-07732KL
R9	Resistor, 95.3 kΩ,1/16 W, 1%, 0402	1	Yageo	RC0402FR-0795K3L
R10	Resistor, 137 kΩ,1/16 W, 1%, 0402	1	Yageo	RC0402FR-07137KL
U1	APM81911 in QFN 4 mm × 6 mm	1	Allegro MicroSystems	APM81911KNBATR
Mechanical				
CN1, CN2, CN3, CN4	Banana Jack- Non-Insulated 0.218" Length	4	Keystone Electronics	575-4
J1	CONN HEADER VERT 2 POS 2.54 mm	1	Wurth Electronics	61300211121
J2, J3, J4, J5, J6	CONN HEADER VERT 3 POS 2.54 mm	5	Wurth Electronics	61300311121
MS1, MS2, MS3, MS4	PAN HEAD SCREW_M 3 × 8 mm CROSS SL	4	Wurth Electronics	97790803111
STND1, STND2, STND3, STND4	Standoffs & Spacers 5.0 HEX 15.0 mm NYLON	4	Keystone Electronics	25512
BIAS, ACINJ	Test Point, SMT, 105 mil × 40 mil	2	Keystone Electronics	5015
VIN, VOUT, EN, VCC	Test Point, Red, Through Hole Mount, 1.6 mm	4	Keystone Electronics	5010
GND	Test Point, Black, Through Hole Mount, 1.6 mm	2	Keystone Electronics	5011
SS, PGOOD, CLKOUT, PWMAUTO, FSET, SYNCIN	Test Point, Yellow, Through Hole Mount, 1.6 mm	6	Keystone Electronics	5014
Not Fitted				
C2	CAP CER 4.7 µF, 50 V, X7S 0805	0	Murata	GRM21BC71H475KE11L
C7	CAP CER 22 µF, 25 V, X5R 1206	0	TDK	C3216X5R1E226M160AB
C11	CAP CER 0.1 pF, 25 V, NP0 0402	0	Murata	GRM1555C1ER10WA01D
R2	Resistor,100 kΩ, 1/16 W, 1%, 0402	0	Yageo	RC0402FR-07100KL

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RELATED LINKS

- Product page: https://www.allegromicro.com/en/products/regulate/clearpower-modules/regulator-modules/apm81911
- Datasheet: https://www.allegromicro.com/-/media/files/datasheets/apm81911-datasheet.pdf

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Revision History

Number	Date	Description
–	February 14, 2023	Initial release
1	February 22, 2023	Addition of Clearpower logo

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