EVM User's Guide: THS3470REBEVM

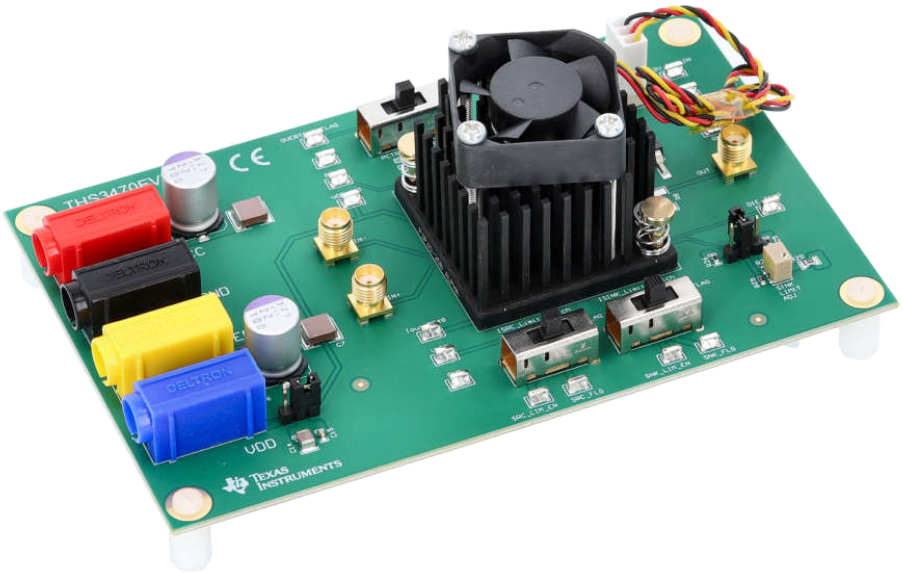
THS3470REBEVM Evaluation Module

Description

The THS3470REBEVM is an evaluation module (EVM) designed for easy measurement and setup of the THS3470REB 60V, 1A, 100MHz, high-speed power amplifier. The board features instructions to configure input and output connections easily, simple control interfaces for changing the functional modes of the device, and provisions for heat sink and fan connections.

Features

- Easy input and output connections using 50Ohm matched SMA connectors
- Configurable output loading network with optional high power load
- Easy power mode and current limit control with simple switches
- Adjustable current limits with potentiometers
- Provisions for heatink and 3-pin fan connector



THS3470REBEVM

1 Evaluation Module Overview

1.1 Introduction

The THS3470REBEVM is an easy-to-use module for evaluating the features and performance of the THS3470 Amplifier. The EVM features easy to use input and output connections as well as configurable loads and gain to simulate many different use case conditions.

This user's guide contains a detailed description on the EVM setup and usage. Each of the device functions are described in detail and a quick start guide is included to make initial setup as easy as possible. The board schematic, layout, and a complete bill of materials (BOM) are also included.

1.2 Kit Contents

Table 1-1 lists the contents of the EVM kit. Contact your nearest Texas Instruments Product Information Center if any component is missing.

Table 1-1. Kit Contents

ITEM	QUANTITY
THS3470REBEVM test board	1

1.3 Specification

The THS3470REBEVM is intended to provide basic functional evaluation of the device. The THS3470REBEVM can be used for AC, DC, or transient measurements. By default, the inputs and outputs are terminated to 50Ohms to provide easy interfacing with 50Ohm based test equipment. The layout is designed to provide configuration flexibility while minimizing parasitics and improving heat dissipation for the best device performance. The EVM includes a heat sink with a fan installed for best cooling performance under heavy load conditions. No external software or boards are required to operate or interface with the board.

1.4 Device Information

The THS3470 is a high-speed current-feedback amplifier (CFA) with a high linear-output current drive (1A), high slew rate (4000V/µs), and wide supply range (60V). The device is stable over a wide range of capacitive loads and supports up to 2A of peak output current that these applications require. The THS3470 has a bandwidth of 100MHz with low-noise and distortion providing great large-signal performance for heavy resistive loads as well.

In addition to high speed and power performance, the THS3470 features a number of useful features such as temperature monitoring, output current monitoring, output current limiting, and output current protection. The output current features of the device can be manually enabled or driven by various flag outputs from the device providing even greater modularity in the use case of the device.

2 Configuration Details

2.1 Heat Sink Usage

The THS3470 package is designed for a top-side heat sink to help dissipate heat under high-power load conditions. Many types of heat sinks can be used with the device, but the THS3470REBEVM includes the FSP40-25M31-0M06 by Alpha Novatech, Inc. This is a 40 by 40mm aluminum heat sink with 25mm tall fins and included 30 by 30mm 10,000 rpm 12V fan. All heat sinks must also include a low thermal resistance interface material between the heat sink and top-side thermal pad of the THS3470. The EVM includes a standard 3-pin header J9 to connect the heat sink fan to a power supply. The supply voltage for the fan must be provided externally using test point TP12. For the included heat sink the fan power supply voltage is 12V.

When using a heat sink that is larger than the area of the THS3470 device, any additional components under the area of the heat sink must have a height less than 1mm so that the components do not interfere with the contact between the heat sink and THS3470 package. Additionally, if the heat sink is not electrically insulative, put an electrically insulative covering on the bottom of the heat sink in all areas that do not contact the THS3470. The additional insluative coating is to protect against any accidental contact with heat sink or other component causing an electrical connection to the top-side thermal pad of the THS3470, which is biased to the negative supply voltage. A simple insulative coating can be achieved using Kapton® tape to cover the bottom of the heat sink where the heat sink does not contact the THS3470.

2.2 Power Connections

Ths THS3470REBEVM includes four separate power connections. VCC for the positive supply to the device, VEE for the negative supply to the device, GND to connect the board ground, and an optional VDD connection to set the digital logic high level for the control signals. The typical power configuration is a split supply with a range of VCC/VEE = +12V/-12V to VCC/VEE = +30V/-30V. The VDD jack is disconnected by default as the board logic reference is connected to the parts internal VDD supply. To connect to an external VDD, move the jumper to short pins 1 and 2 of J4. The board can also be operated in single-supply with VEE = GND, but be aware that many of the components to the board are terminated to ground which can introduce a DC load in single-supply conditions.

2.3 Input and Output Connections

The THS3470REBEVM features a simple input network with a 50Ω terminated connection on the positive amplifier input (J7). By default, the feedback network is connected in a non-inverting gain of approximately 5V/V. The amplifier can be driven in an inverting configuration through the input J6 by populating R1 and reconfiguring the gain as needed.

The default output of the THS3470REBEVM includes a simple series 4.7Ω isolation resistor R4 located close to the device output along with a 44.2Ω series output resistor R2 to provide a 50Ω matched impedance from the output connector J8. The output also includes an optional high power load through R11, which is a 10Ω 25W resistor by default. To connect R11, short the unpopulated jumper resistor R7. Additional unpopulated loads to ground R6, C17, and R8 are provided for use as needed.

WARNING

Driving very high output voltage DC or slow transient signals into a resistive load does have potential to damage the device. Please use caution to maintain the device operation within the safe-operating region.

2.4 Output Current Limits

The THS3470 features both a sinking and sourcing output current limit function. The current limit values are set by the ISRC_LIMIT (pin 28) and ISINK_LIMIT (pin 7) pins with a resistor. The default EVM configuration features a resistor and potentiometer to adjust the limit and can be altered to change the total limit range as desired. Table 2-1 describes the relationship to properly set the current limits using the EVM resistors.

Table 2-1. THS3470 Current Limit Settings

Current Limit	Pin Number	Current Limit Equation	EVM Resistors
Sourcing	28	ILIMIT = [(VSMID – VEE) / RISRC] × 2048	RISRC = R17 + R18 + R22
Sinking	7	ILIMIT = [(VCC – VSMID) / RISNK] × 2048	RISNK = R27 + R28 + R31

Alternatively, to using the potentiometers, the limits can be shorted to resistors using jumpers J10 and J11 for quick switching between different values. If users are using this method, then R18 and R28 need to be removed.

The current limiting function is enabled by setting pin 3 low for the source limit or pin 4 low for the sink limit. The EVM includes switches S1 and S2 to control the current limit enable function. The switches can be set to GND to enable the limits, VDD to disable the limits, or the the overcurrent source and sink flag voltages to automatically enable the current limit when the flag is tripped.

2.5 Power Control Modes

The THS3470 features two power mode control pins P0 (pin 31) and P1 (pin 30) that set the power level of the device. These pins are controlled by switch S3 on the EVM, which can be set three different positions to connect to VDD, ground, or the overtemperature flag pins. Connect to the overtemperature flag (pins 22 and 23) to automatically shut down the device if the device passes the maximum temperature threshold. Table 2-2 shows a truth table of the different power control connections on the EVM.

Table 2-2. THS3470EVM Bias Control Modes

PWR_CTL_1	PWR_CTL_0	Mode
VDD	VDD	Full bias
GND	GND	Power down mode
Overtemp flag	Overtemp flag	Full bias unless the overtemp flag is triggered, then the part shuts down

2.6 Die Temperature and Output Current Readings

The THS3470 also features a die temperature output (pins 12 and 13) and a output current monitor (pin 11). The die temperature produces a voltage output proportional to the internal junction temperature of the device to monitor the change in temperature over load conditions. The output current pin produces a current that is 1/2048 of the actual output current of the device.

3 Quick Start Instructions

The following instructions describe the basic setup procedure to measure simple input and output signals on the THS3470 Evaluation Module.

3.1 Required Equipment for Basic Evaluation

1. Dual output (positive and negative) floating power supply with output up to 60V and approximately 3A.
   - Two channels or supplies can be used in series to achieve higher voltage. For more information, see Section 3.3.
   - Output current requirements depends on the device load and signal voltages.
2. Voltage source or function generator to create input voltage signal.
3. Multimeter to measure DC output voltages or oscilloscope to measure AC output voltages.
4. *Optional*: Additional +12V power supply to power heat sink fan.

Figure 3-1 shows a typical setup using the THS3470 EVM, a dual output power supply, function generator, and oscilloscope.

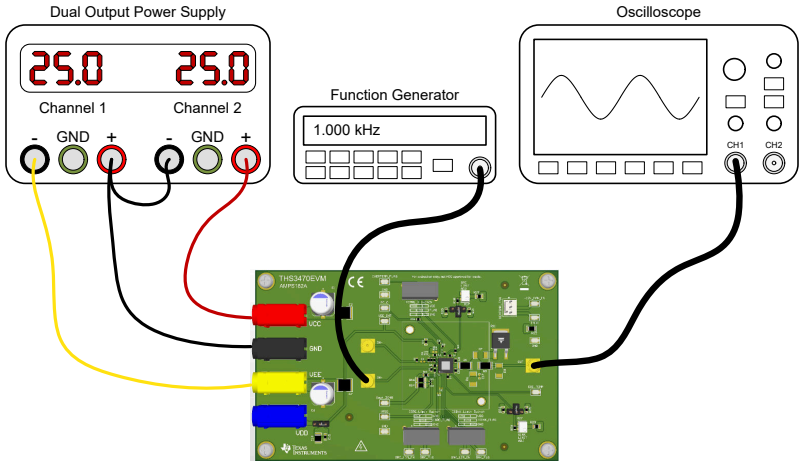


Figure 3-1. Example Configuration Diagram

3.2 Steps for Standard AC or DC Evaluation

1. Configure the power supply output to generate a voltage between ±6V to ±30V. A value such as ±25V is suggested to use for basic evaluation.
2. With the power supply output off, connect the positive output to the EVM VCC input, the negative output to the EVM VEE input, and the common ground point to the EVM GND input.
3. Make sure the power control switch is set to either the VDD or FLAG position.
4. Turn on the power supply. The power supply current reads approximately 30mA. The current value changes slightly depending on the supply voltage.
5. Provide either an AC or DC 10mV input signal to the IN+ SMA connector on the EVM.
6. Connect a multimeter to the OUT SMA connector when using a DC input signal OR connect an oscilloscope to the OUT SMA connector when using an AC input signal.
7. The output voltage reads approximately 50mV.
8. Increase or decrease the input voltage as desired.

WARNING

If using a load that causes the part to output a large amount of current, then increasing the input voltage can result in a significant amount of device heating. When driving significant amounts of output current, have a heat sink installed or the device can be damaged easily. TI recommends to always use a heat sink to avoid accidental device damage.

Table 3-1 shows a list of simple DC input and output measurements for the standard EVM configuration as shown in Figure 4-1.

Table 3-1. THS3470 EVM DC Input and Output Measurements

Input Voltage (V)	Output Voltage (V)
–4	–20.0
–2	–9.98
–1	–4.99
–0.5	–2.51
–0.1	–0.51
0.1	0.48
0.5	2.48
1	4.96
2	9.95
4	19.9

3.3 Using Multiple Power Supplies

Using two separate power supplies or both channels of a two-channel power supply to generate a higher power supply voltage can be necessary. Figure 3-1 shows an example of this configuration using a two-channel power supply to generate 50V total. For this type of configuration, the power supply outputs MUST be floating. The outputs are then connected in series with the midpoint of the two supplies forming the common ground point for the EVM. Connecting the mid-point to the earth ground reference of the power supply if present is not a requirement.

3.4 TI Evaluation Setup Images

Figure 3-2 and Figure 3-3 show example measurement setups for both DC and AC measurements using the THS3470 EVM.

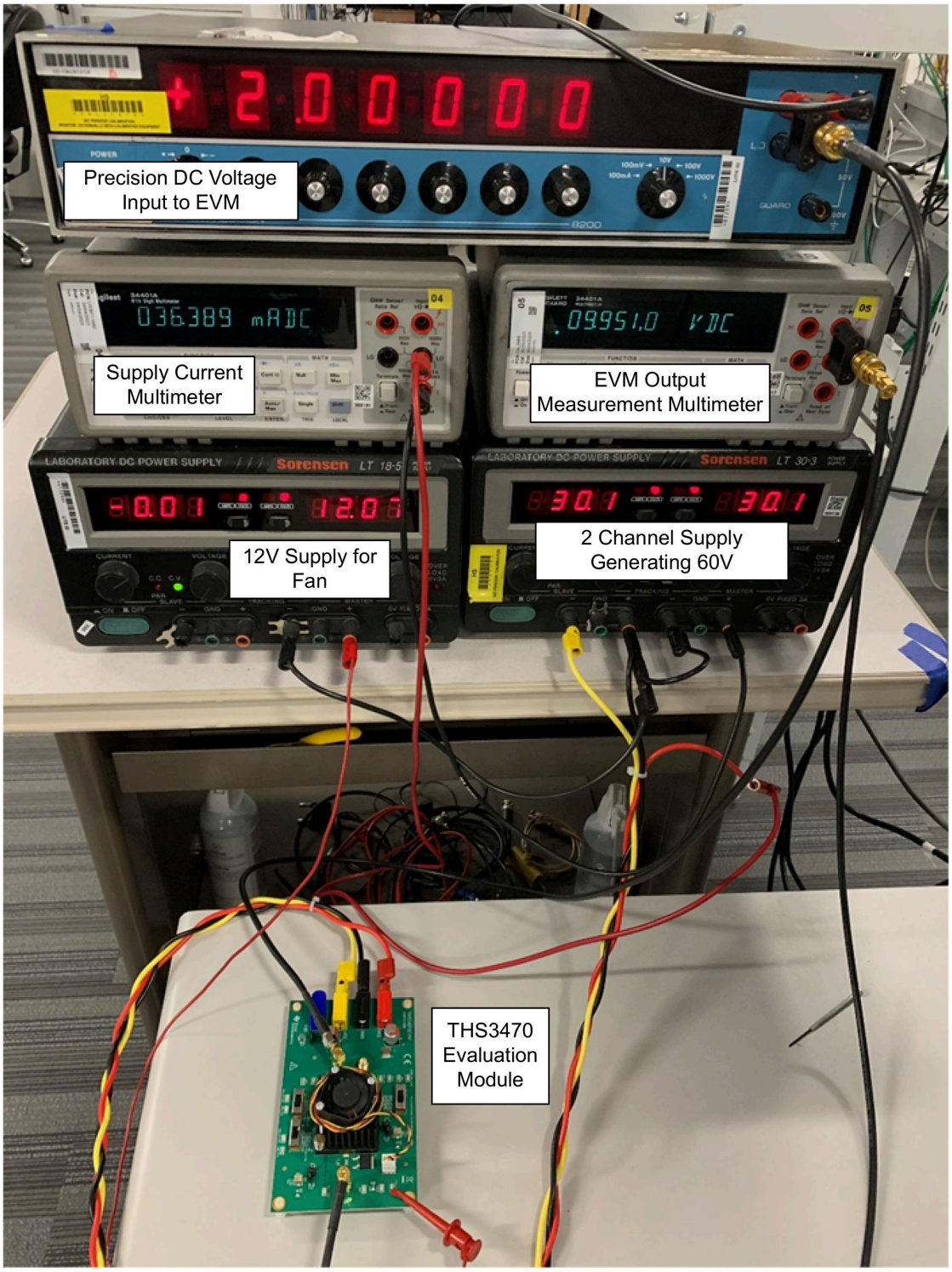


Figure 3-2. DC Measurement Setup

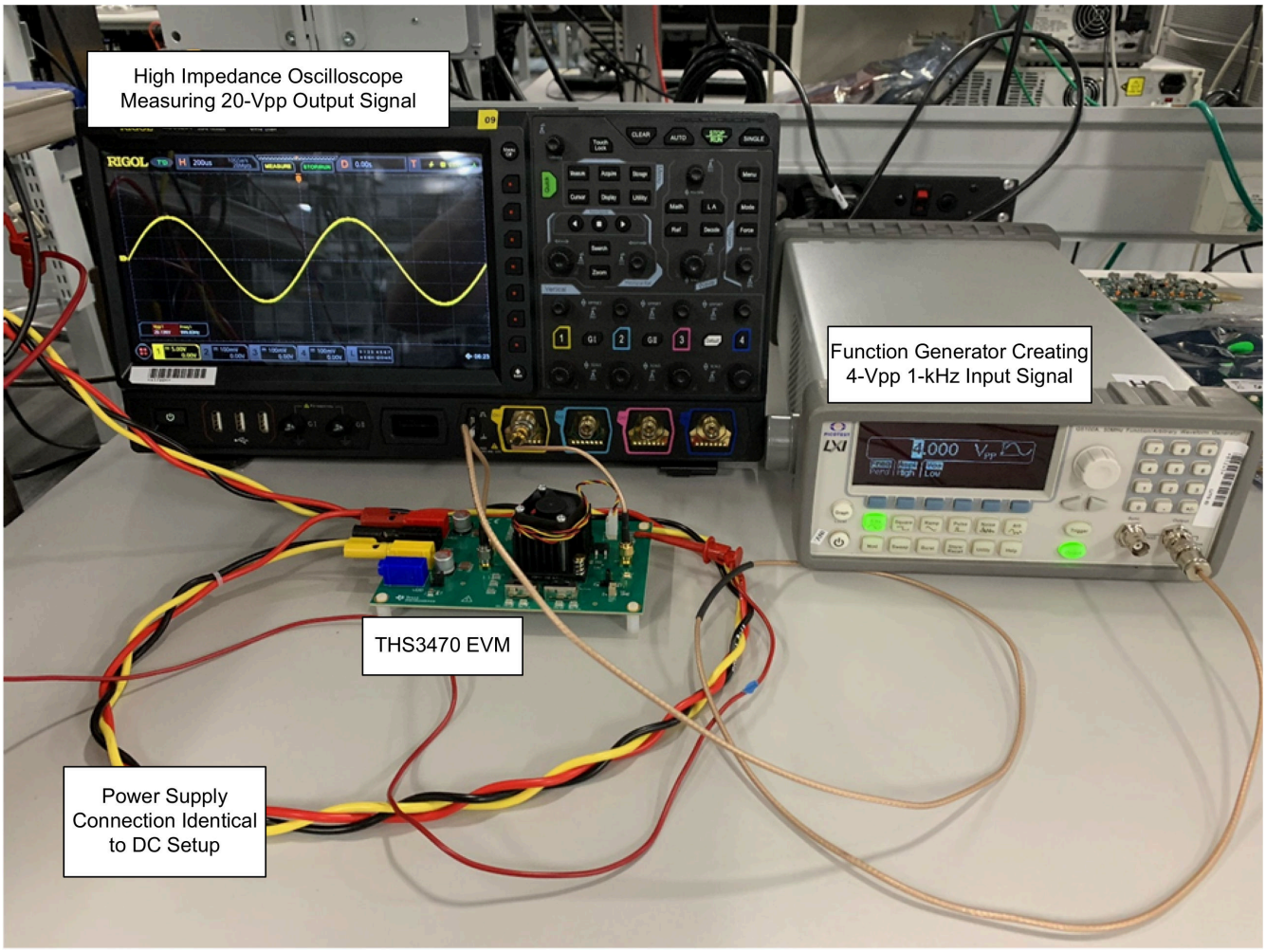


Figure 3-3. AC Measurement Setup

4 Hardware Design Files

4.1 Schematics

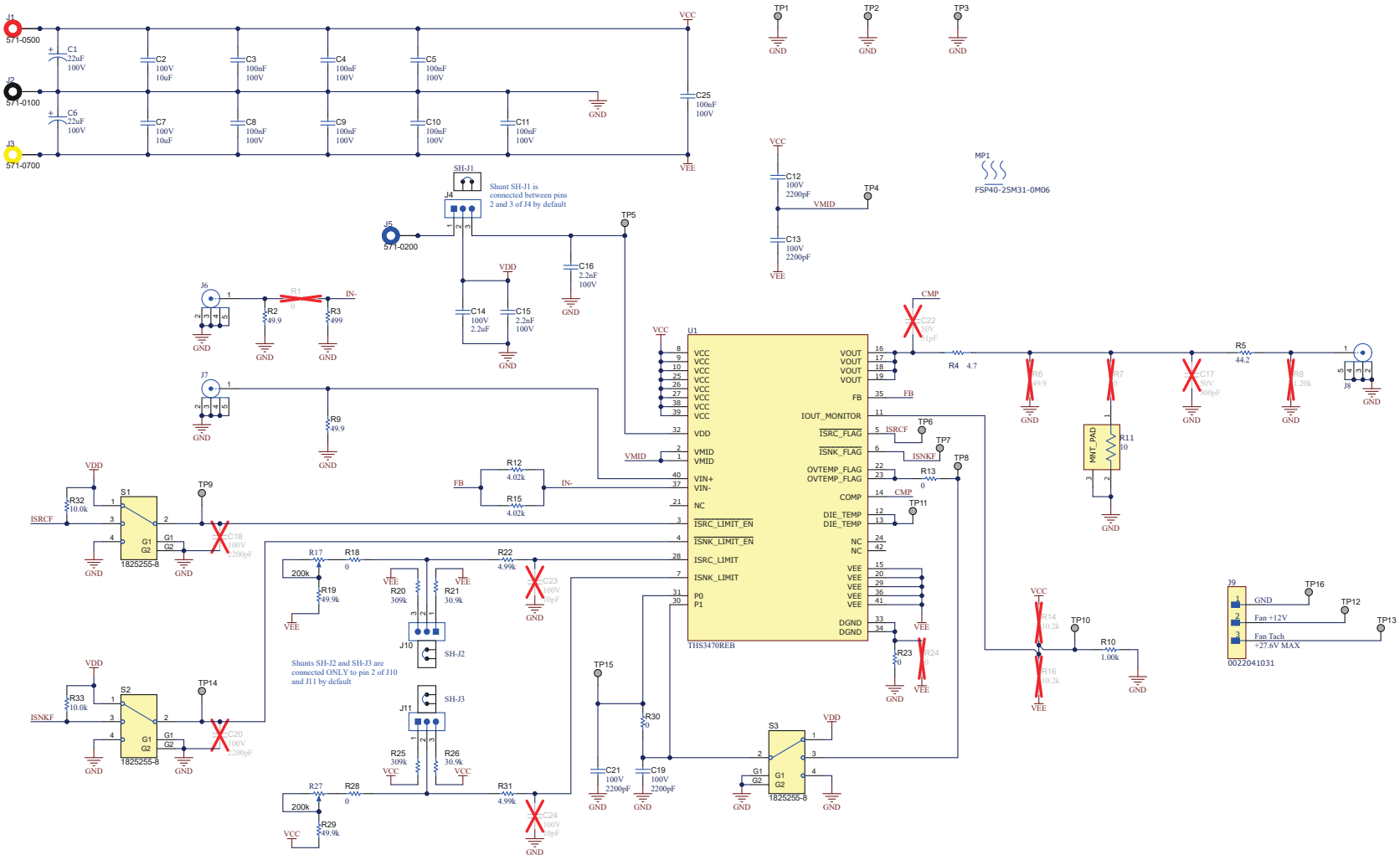


Figure 4-1. THS3470REBEVM Schematic

4.2 PCB Layouts

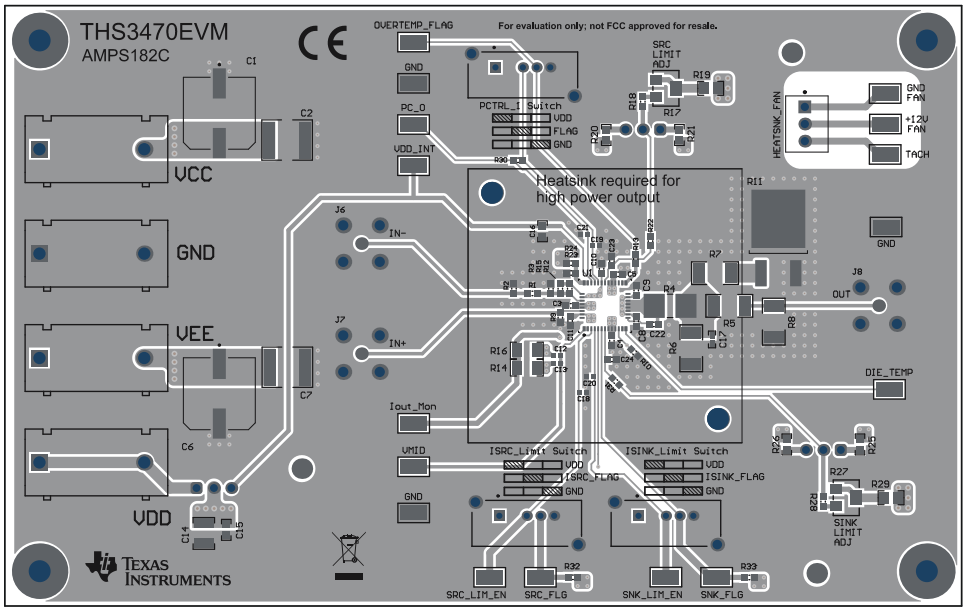


Figure 4-2. THS3470REBEVM Top Layers

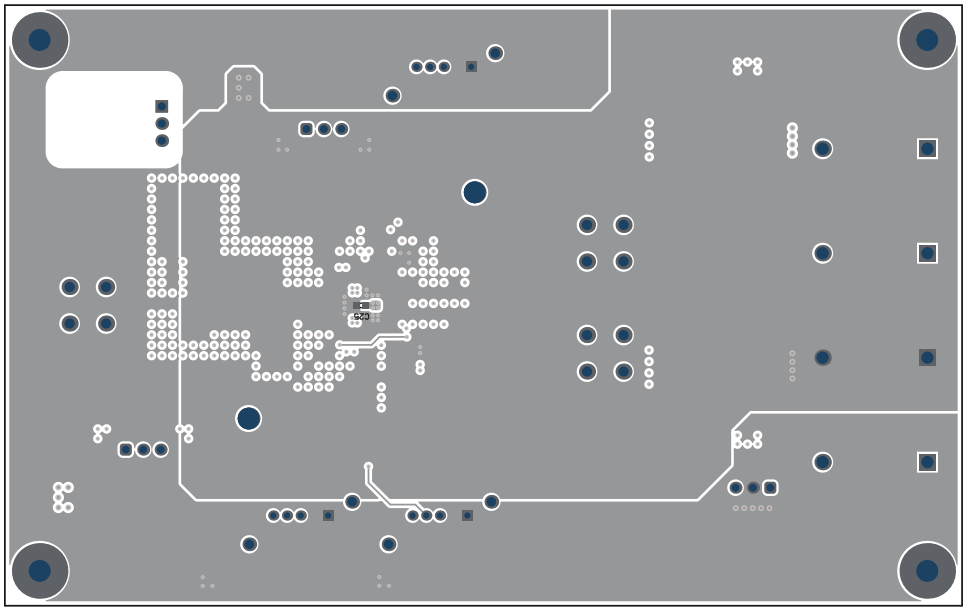


Figure 4-3. THS3470REBEVM Bottom Layers

4.3 Bill of Materials (BOM)

Designator	Quantity	Value	Description	Part Number	Manufacturer	Package Reference
C1, C6	2	22µF	22µF 100V Aluminum - Polymer Capacitors Radial, Can - SMD 30mOhm 1000 Hrs @ 125°C	100SXV22M	Panasonic	RADIAL
C2, C7	2	10uF	CAP, CERM, 10uF, 100V, +/- 20%, X7S,	C5750X7S2A106M230KB	TDK	
C3, C4, C5, C8, C9, C10, C11, C25	8	0.1uF	CAP, CERM, 0.1 µF, VAC/ 100VDC,+/- 20%, X7R, AEC-Q200 Grade 1, 0603	HMK107B7104MAHT	Taiyo Yuden	0603
C12, C13, C19, C21	4	2200pF	CAP, CERM, 2200pF, 100V, +/- 10%, X7R, 0402	GRM155R72A222KA01D	MuRata	0402
C14	1	2.2uF	CAP, CERM, 2.2uF, 100V, +/- 10%, X7R, 1210	GRM32ER72A225KA35L	MuRata	1210
C15, C16	2	2200pF	CAP, CERM, 2200pF, 100V, +/- 10%, X7R, 0603	06031C222KAT2A	AVX	0603
H1, H2, H3, H4	4		Machine Screw, Round, #4-40x 1/4, Nylon, Philips panhead	NY PMS 440 0025 PH	B&F Fastener Supply	Screw
H5, H6, H7, H8	4		Standoff, Hex, 0.5"L #4-40 Nylon	1902C	Keystone	Standoff
J1	1		Standard Banana Jack, insulated, 10A, red	571-0500	DEM Manufacturing	571-0500
J2	1		Standard Banana Jack, insulated, 10A, black	571-0100	DEM Manufacturing	571-0100
J3	1		Standard Banana Jack, insulated, 10A, yellow	571-0700	DEM Manufacturing	571-0700
J4, J10, J11	3		Header, 2.54mm, 3x1, Gold, TH	61300311121	Wurth Elektronik	Header, 2.54mm, 3x1, TH
J5	1		Standard Banana Jack, insulated, 10A, blue	571-0200	DEM Manufacturing	571-0200
J6, J7, J8	3		JACK, SMA, 50 Ohm, Gold, TH	SMA-J-P-H-ST-MT1	Samtec	JACK, SMA, 50 Ohm, TH
J9	1		Mini-Latch / KK Wire-to-Board Header, Vertical, with Friction Ramp, 3 Circuits, Tin (Sn) Plating, Natural	22041031	Molex	HDR3
MP1	1		HEATSINK AND FAN ASSEMBLY, 40x40mm	FSP40-25M31-0M06	Alpha	HTSNK_ASSY_40MM0_40MM0
R2, R9	2	49.9	RES, 49.9, 1%, 0.1W, 0603	RC0603FR-0749R9L	Yageo	0603
R3	1	499	RES, 499, 1%, 0.1W, 0603	RC0603FR-07499RL	Yageo	0603
R4	1	4.7	Res Thin Film 2512 4.7 Ohm 1% 16W ±50ppm/C Molded SMD T/R	CPA2512Q4R70FS-T10	Susumu	2512
R5	1	44.2	RES, 44.2, 1%, 0.75W, AEC-Q200 Grade 0, 2010	CRCW201044R2FKEF	Vishay-Dale	2010
R10	1	1.00k	RES, 1.00k, 1%, 0.1W, 0603	RC0603FR-071KL	Yageo	0603
R11	1	10	10 Ohms ±5% 25W Chip Resistor TO-252-3, DPak (2 Leads + Tab), SC-63 Automotive AEC-Q200, Non-Inductive Thick Film	DTO025C10R00JTE3	Vishay	DPAK
R12, R15	2	4.02k	RES, 4.02k, 1%, 0.1W, AEC-Q200 Grade 0, 0603	CRCW06034K02FKEA	Vishay-Dale	0603
R13, R18, R23, R28, R30	5	0	RES, 0, 5%, 0.1W, 0603	RC0603JR-070RL	Yageo	0603
R17, R27	2	200k	Trimmer, 200K, 0.25W, SMD	3224W-1-204E	Bourns	3.5x5.3x4.8mm

Designator	Quantity	Value	Description	Part Number	Manufacturer	Package Reference
R19, R29	2	49.9k	RES, 49.9k, 1%, 0.125W, AEC-Q200 Grade 0, 0805	ERJ-6ENF4992V	Panasonic	0805
R20, R25	2	309k	RES, 309k, 1%, 0.1W, 0603	RC0603FR-07309KL	Yageo	0603
R21, R26	2	30.9k	RES, 30.9k, 1%, 0.1W, 0603	RC0603FR-0730K9L	Yageo	0603
R22, R31	2	4.99k	RES, 4.99k, 1%, 0.1W, 0603	RC0603FR-074K99L	Yageo	0603
R32, R33	2	10.0k	RES, 10.0k, 1%, 0.1W, 0603	RC0603FR-0710KL	Yageo	0603
S1, S2, S3	3		Switch, Slide, SP3T, 3 Pos, 0.4A, 20 VAC, TH	1825255-8	TE Connectivity	Switch, 4-Leads, SP3T, Body 16x6.7mm, TH
SH-J1, SH-J2, SH-J3	3		Shunt, 2.54mm, Gold, Black	60900213421	Wurth Elektronik	Shunt, 2.54mm, Black
TP1, TP2, TP3, TP4, TP5, TP6, TP7, TP8, TP9, TP10, TP11, TP12, TP13, TP14, TP15, TP16	16		Test Point, Miniature, SMT	5019	Keystone	Test Point, Miniature, SMT
U1	1		THS3470REB	THS3470REB	Texas Instruments	VQFN42

5 Additional Information

5.1 Trademarks

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6 Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

Changes from Revision A (October 2025) to Revision B (November 2025) **Page**

Changes from Revision * (March 2025) to Revision A (October 2025) **Page**

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Last updated 10/2025