User's Guide

REF70EVM User's Guide

ABSTRACT

The REF70EVM is a precision voltage reference evaluation module that demonstrates the REF70 ultra-low noise integrated circuit from Texas Instruments (TI).

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1 Overview

The REF70EVM is an adjustable voltage reference evaluation module that demonstrates the REF70 integrated circuit in its FKH ceramic package from Texas Instruments (TI).

The REF70 is a ultra-low noise voltage reference with 2 ppm/C temperature drift. The REF70 is used primarily as a voltage reference for high accuracy data converters to allow for a larger noise free resolution.

The REF70 can be operated from V_{REF} to 18 V, making this part optimal for a wide range of voltages for applications such as precision data acquasition systems, industrial instrumentation, semiconductor test equipment, and PLC analog I/O modules. In order for this device to operate as intended, it does require 6.5 mA I_Q(max) for proper operating across temperature. This device also comes with a enable pin that allows the device to be set in shutdown mode. Under the shutdown condition, the REF70 only consumes 12 µA of current.

The REF70EVM is configured for a LCCC (FKH) ceramic package (U2) and includes a additional MSSOP (DGK) landpattern for alternate packages (U1). The VIN header can be connected to an external power supply to provide power. All of the REF70 input and output pins are accessible for external connection via test headers. For users looking for a alternate packages to test the REF70, contact TI.

1.1 REF70EVM Features

- Includes: REF7025QFKH
- Footprints for resistors and capacitors
- Multiple outputs for voltage measurements

KEY PARAMETERS	PARAMETER	PARAMETER LIMITS
Supply Voltage:	IN	0 V – 18V
Enable Pin	EN	0V to IN
Fixed Output Voltage:	VREF	2.5 V (REF7025)
Output Current:	IOUT	-10 mA to 10 mA

CAUTION

Applying voltages above the limitations given in this table may cause permanent damage to your hardware.

1.2 REF70EVM Schematic

The schematic for the REF70EVM is illustrated in Figure 1-1.

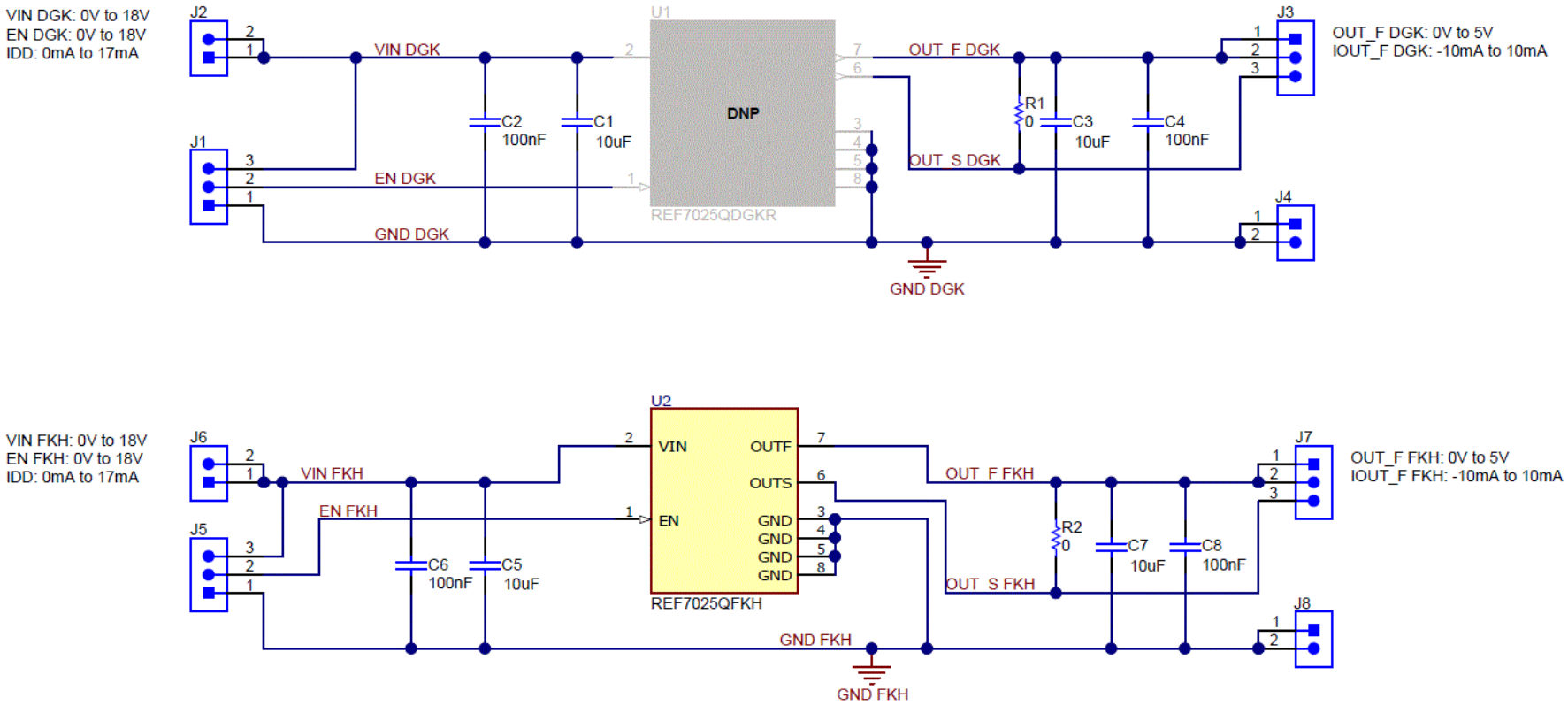

Figure 1-1. REF70EVM Schematic

1.3 REF70EVM Bill of Materials

DESIGNATOR	QUANTITY	VALUE	DESCRIPTION	PACKAGE REFERENCE	PART NUMBER	MANUFACTURER
!PCB	1		Printed Circuit Board		LP026	Any
C1, C3, C5, C7	4	10uF	CAP, CERM, 10 uF, 35 V, +/- 10%, X7R, 1206	1206	GMK316AB7106KL	Taiyo Yuden
C2, C6	2	0.1uF	CAP, CERM, 0.1 uF, 50 V, +/- 10%, X7R, AEC-Q200 Grade 1, 0603	0603	CGA3E2X7R1H104K080AA	TDK
C4, C8	2	0.1uF	CAP, CERM, 0.1 uF, 16 V, +/- 10%, X7R, 0603	0603	C0603X104K4RACTU	Kemet
FID1, FID2, FID3	3		Fiducial mark. There is nothing to buy or mount.	N/A	N/A	N/A
H1, H2, H3, H4	4		Bumpon, Hemisphere, 0.44 X 0.20, Clear	Transparent Bumpon	SJ-5303 (CLEAR)	3M
J1, J3, J5, J7	4		Header, 100mil, 3x1, Gold, TH	3x1 Header	TSW-103-07-G-S	Samtec
J2, J4, J6, J8	4		Header, 100mil, 2x1, Gold, TH	2x1 Header	TSW-102-07-G-S	Samtec
R1, R2	2	0	RES, 0, 5%, 0.063 W, 0402	0402	RC0402JR-070RL	Yageo America
SH-J1, SH-J3, SH-J5, SH-J7	4	1x2	Shunt, 100mil, Flash Gold, Black	Closed Top 100mil Shunt	SPC02SYAN	Sullins Connector Solutions
U2	1		Ultra High-Precision Voltage Reference	LCCC8	REF7025QFKH	Texas Instruments

1.4 REF70EVM Board

The PCB layout for the REF70EVM is illustrated in Figure 1-2 and Figure 1-3.

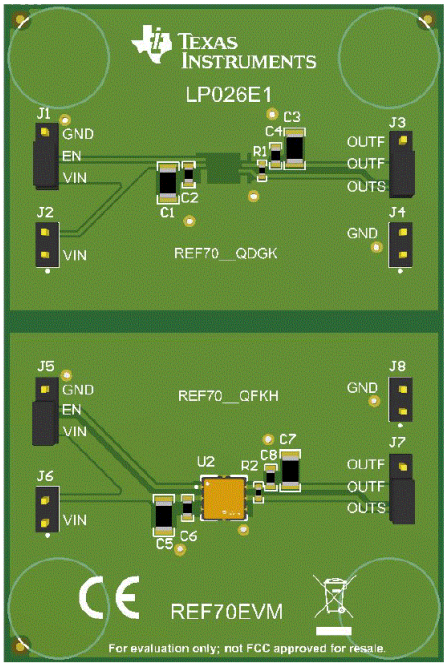

Figure 1-2. REF70EVM Board Top

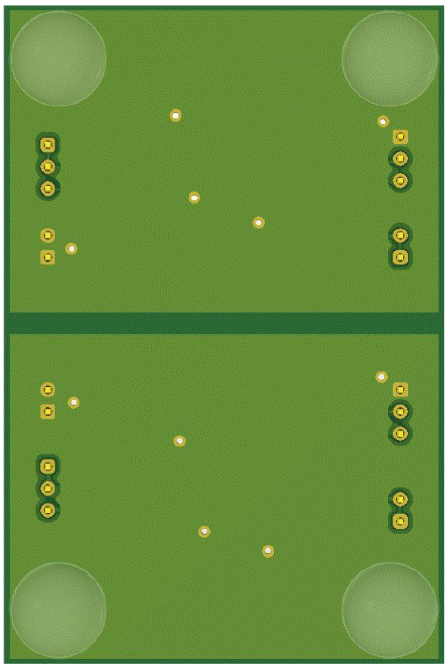

Figure 1-3. REF70EVM Board Bottom

2 Quick Setup Guide

This section describes the setup to quickly check the functionality of the REF70EVM.

2.1 Electrostatic Discharge Warning

Many of the components on the REF70EVM are susceptible to damage by electrostatic discharge (ESD). Customers are advised to observe proper ESD handling precautions when unpacking and handling the EVM, including the use of a grounded wrist strap at an approved ESD workstation.

CAUTION

Failure to observe ESD handling procedures may result in damage to EVM components.

2.2 Unpacking the EVM

After opening the REF70EVM package, ensure that the following is included:

1 pc. REF70EVM board using one REF7025QFKH

2.3 Power Supply Setup and Functional Test

Normal operation:

A 5-V power supply capable of 50 mA of current is required. The REF70 consumes 6.5 mA of current during normal operationg and has a maximum 10 mA of output current for maintaining regulated voltage. During start-up, the REF70 might consume I_{SC} momentarily to charge the output capacitors.

Connect the positive power supply lead to the "VIN" on J6. Connect the negative power supply lead to "GND" on J8.

Connect a voltmeter positive terminal to "OUTF" on J7. Connect the negative voltmeter terminal to "GND" on J8.

The output voltage of the REF7025QFKH will be 2.5V.

Shutdown mode:

The REF70 "EN" pin has an internal pull up which makes the REF70 be active when EN is floating. Use header J5 to connect "EN" to "GND" to put the device in shutdown mode.

3 EVM Theory and Operation

The following schematic is representative of the REF70EVM.

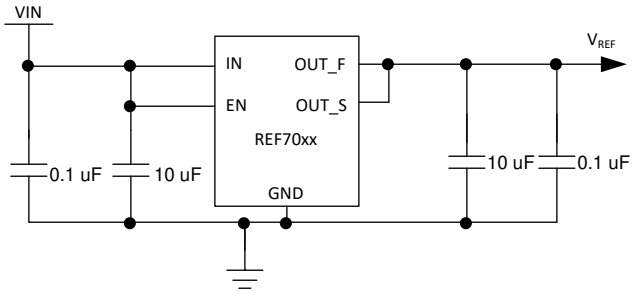

Figure 3-1. REF7025 Schematic

The REF70EVM is designed to allow users to evaluate the configuration in Figure 3-1. With the provided footprints, a user can change the passive components to better suit their application. As shown in Figure 1-2, the EVM is designed to allow users to evaluate the REF70 in FKH. This EVM also has the land pattern for the REF70 in DGK which allows users to test the device in their system with the provided pins.

3.1 V_{REF} Output's OUTF and OUFS

The REF70 V_{REF} is the output of the REF70 when the OUTF and OUTS are shorted together. OUTF and OUTS refer to the force and sense configuration of the REF70 reference buffer. The benefit of having force and sense connection is to reduce the IR loss from long trace wires at high currents. In the normal active configuration, the OUTF and OUTS are shorted together. In the REF70EVM this is done by the R1 and R2 which are 0 Ohm resistors. If R1 or R2 is removed, OUTF and OUTS must be connected in a loop by the headers J3/J7 or externally for proper operation. If the OUTF and OUTS are not connected together in a loop then the device will not operate the correct voltage.

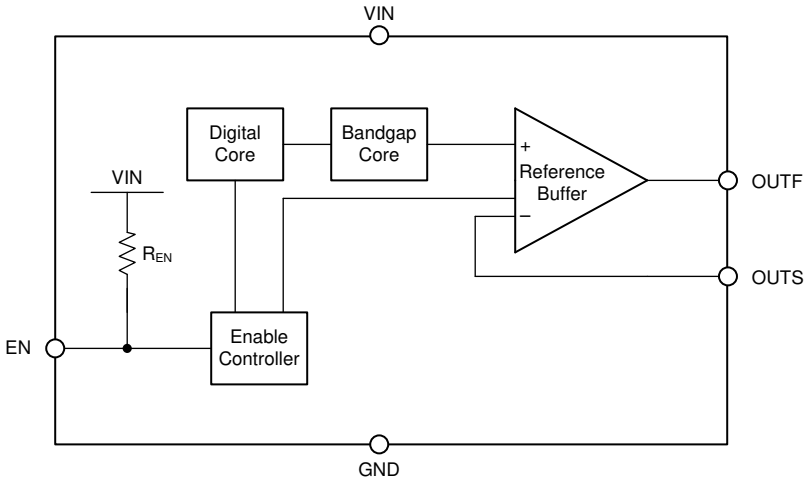

Figure 3-2. REF70 Functional Block Diagram

3.2 Output Capacitor

The REF70 requires an output capacitor between 0.1 uF to 100uF for proper operation and stability. Larger capacitors are able to help with load transcient respones.

A large capacitor can also help with lowering the broadband/white noise. It is necessary to understand output capacitors when selecting the capacitor for the appliation.

4 Layout and Component Placement

Figure 4 and Figure 5 show the top and bottom assemblies of the printed circuit board (PCB) to show the component placement on the EVM.

Figure 6 and Figure 7 show the top and bottom layouts, Figure 8 and Figure 9 show the top and bottom layers, and Figure 10 shows the top solder mask of the EVM.

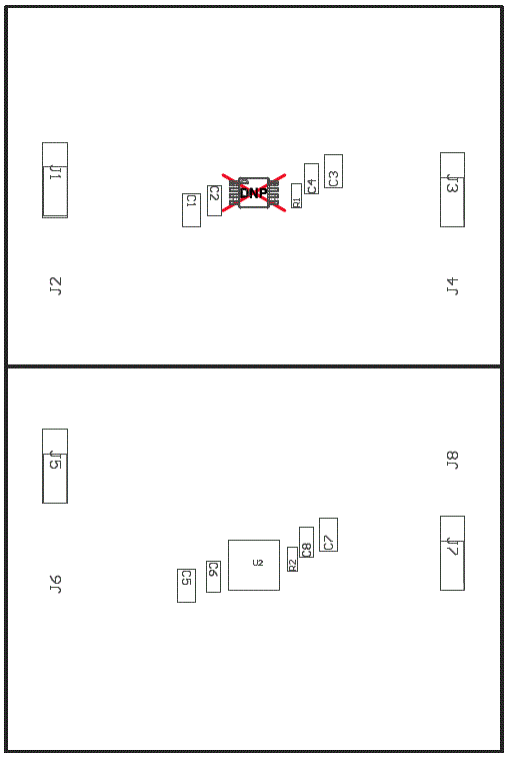

Figure 4-1. Component Placement—Top Assembly

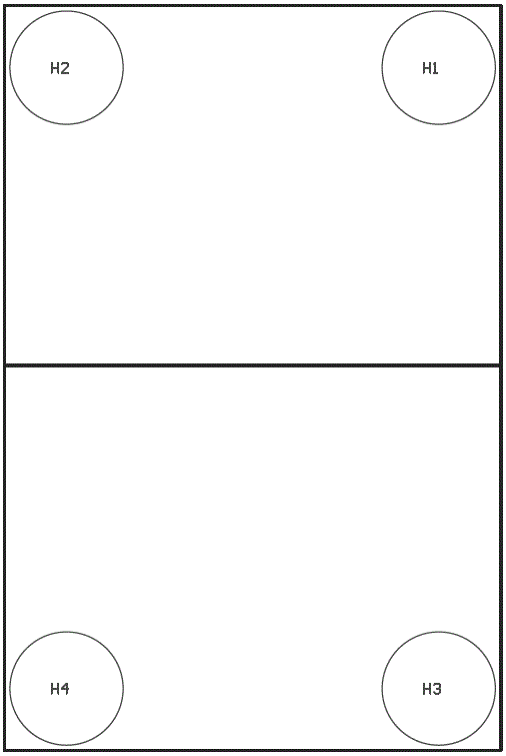

Figure 4-2. Component Placement—Bottom Assembly

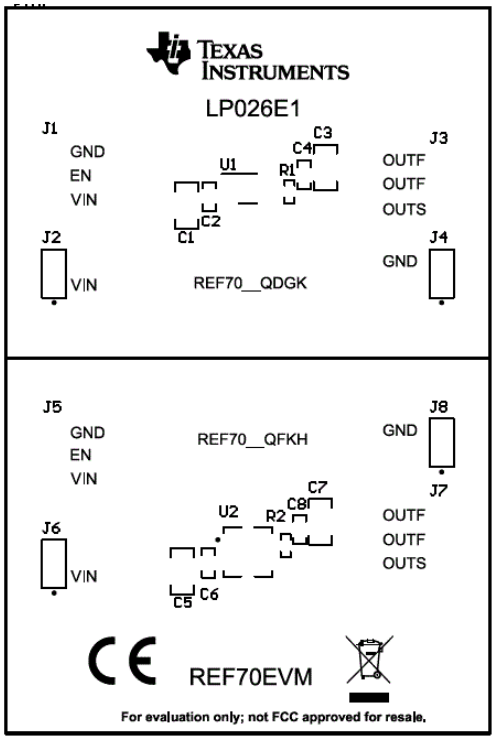

Figure 4-3. Layout Top

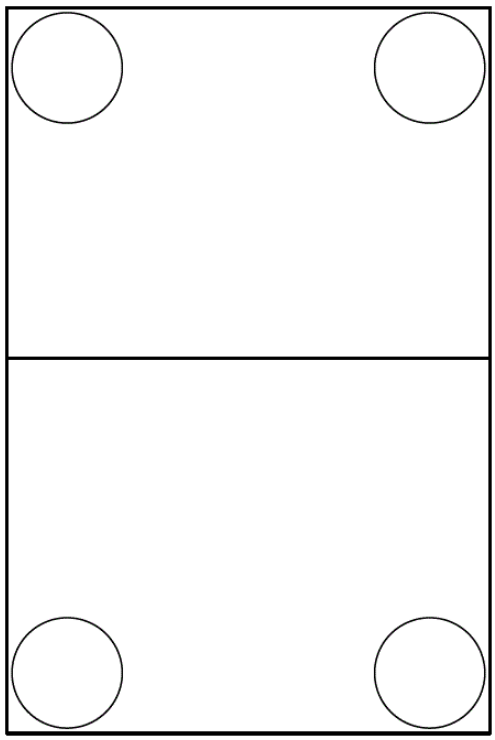

Figure 4-4. Layout Bottom

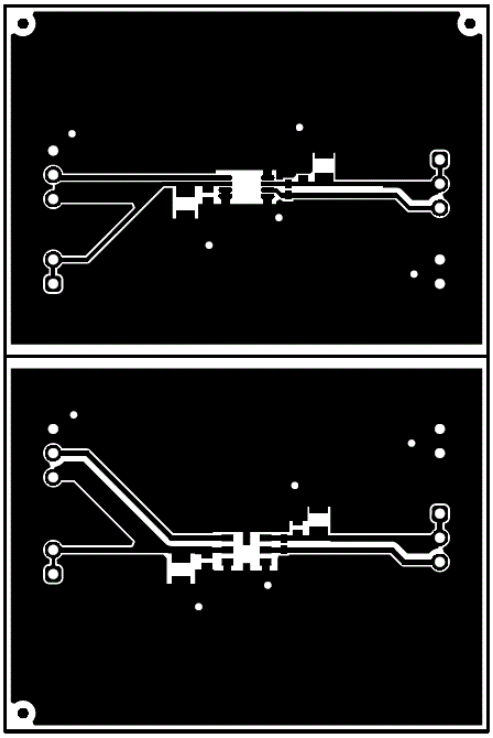

Figure 4-5. Top Layer

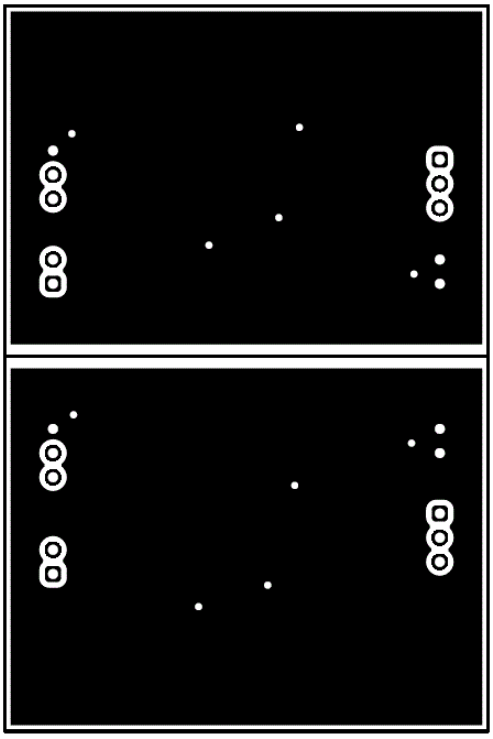

Figure 4-6. Bottom Layer

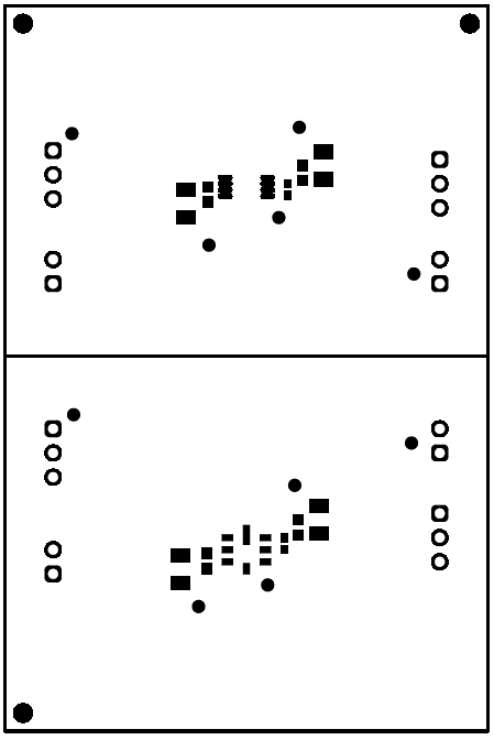

Figure 4-7. Top Solder Mask

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Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265