TEXAS INSTRUMENTS

Evaluation Module (EVM) for Buck-Boost Charge Pump REG711

User's Guide

February 2003

Power Management Products

SLLU038

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EVM WARNINGS AND RESTRICTIONS

It is important to operate this EVM within the input voltage range of 1.8 V to 5.5 V with an output current up to 50 mA.

Exceeding the specified input range may cause unexpected operation and/or irreversible damage to the EVM. If there are questions concerning the input range, please contact a TI field representative prior to connecting the input power.

Applying loads outside of the specified output range may result in unintended operation and/or possible permanent damage to the EVM. Please consult the EVM User's Guide prior to connecting any load to the EVM output. If there is uncertainty as to the load specification, please contact a TI field representative.

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Chapter 1

Introduction

This module provides a convenient way for designers to evaluate the REG711-5 charge pump. These evaluation modules (EVMs) allow one to easily examine the voltage accuracy, output ripple, and line/load regulation of the device. Only a dc voltage source is needed to operate the EVM.

The layout and component selection for charge pumps are critical, similar to that of inductive dc/dc converters. The suggested layout and components provided by this EVM can be used as a reference by designers to reduce design time.

The Texas Instruments REG711 family of charge pumps are regulated voltage converters intended for use with a single cell Li-Ion or two and three nickel or alkaline based cells. This EVM is designed for the REG711-5, however the layout and components used are compatible with the other output versions.

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1.1 Basic Operation of the Device

Except for the REG711–5, the REG711 series of charge pumps work in a buck/boost fashion. They produce a regulated output over the entire input range.

The charge pump consists of switches, oscillator, bandgap, comparator, and mode control circuits. The comparator senses a divided down version of output voltage and compares that to the bandgap voltage. If the sensed output voltage is less than the bandgap voltage, the part begins pumping. When the sensed output voltage is greater than the bandgap voltage, the pumping stops. This pulse frequency modulation is how the charge pump regulates the output. The mode control circuit determines if the part needs to operate in boost or buck mode.

In boost mode the pump capacitor is charged up from the input and then connected between the input and output. In buck mode, the pump capacitor is connected to the input and ground. The output capacitor receives current pulses from the switches.

Chapter 2

EVM Description

This chapter illustrates EVM schematics, layout, and EVM setup

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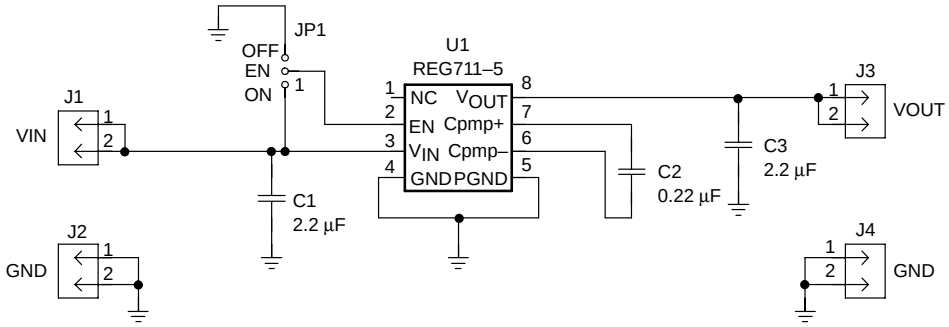
2.1 Schematic of the EVM

Figure 2–1. Schematic of the EVM



To operate the board, connect a power source with the appropriate voltage level between V_{IN} and GND.

To enable the device, the shunt should be connected to JP1 so that the EN-pin is shorted to the ON-pin. To disable the part, move the shunt so the EN-pin is shorted to the OFF-pin. In the disabled state the supply current of the device decreases to less than 0.01 mA. Forgetting to apply the shunt should not damage the device; however, the enable pin will be floating and the output state of the IC will be unknown.

Table 2–1. Bill of Materials

Count	Ref. Des.	Description	Size	Manufacturer	Part Number
2	C1, C3	Capacitor, ceramic, 2.2 µF, 6.3 V, X5R, 10%	805	Murata	GRM21BR60J225KC01
1	C2	Capacitor, ceramic, 0.22 µF, 10 V, X7R, 20%	603	Murata	GRM188R71A224KA01
4	J1, J2, J3, J4	Header, 2 pin, 100 mil spacing, (36-pin strip)	0.100 × 2	Sullins	PTC36SAAN
1	JP1	Header, 3 pin, 100 mil spacing, (36-pin strip)	0.100 × 3	Sullins	PTC36SAAN
1	U1	IC, DC to DC converter, 50 mA	MSOP8	TI	REG711EA-5
1	—	PCB, 2 in × 1 in × 0.062 in		Any	SLVP232
1	—	Shunt, 100 mil, black	0.100	3M	929950–00

Notes: 1) These assemblies are ESD sensitive, ESD precautions shall be observed.

2) These assemblies must be clean and free from flux and all contaminants. Use of no clean flux is not acceptable.

3) These assemblies must comply with workmanship standards IPC-A-610 Class 2.

4) Reference designators marked with an asterisk(**) cannot be substituted. All other components can be substituted with equivalent MFG's components.

2.2 Layout of the EVM

Figure 2–2 shows the placement of the components of the EVM. The components are only placed on the top layer of the board, and the board is routed with a single layer of metal. The size of the EVM is 1 inch x 2 inches. The total space required for the IC and the capacitors on the EVM is only about 0.08 in^2 (approximately 52 mm^2). The layout of the capacitors is optimized for space and performance.

Figure 2–2. Assembly Layer

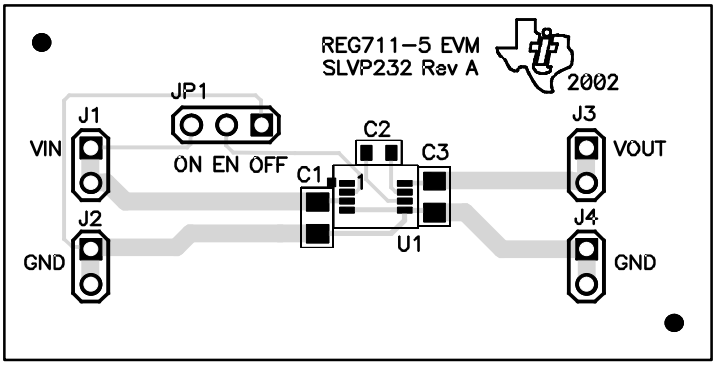


Figure 2–3 shows the metal layer of the board.

Figure 2–3. Top Layer

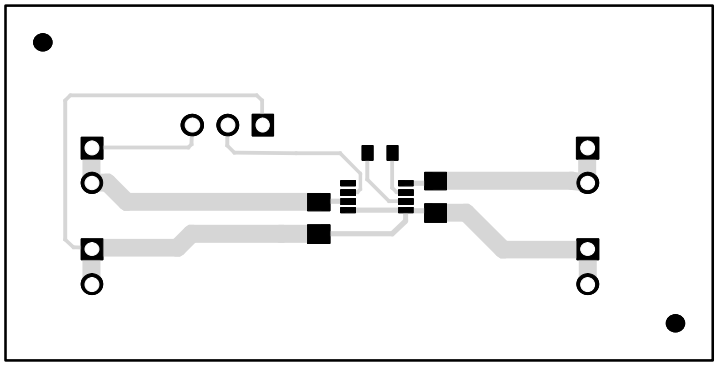


Figure 2–4. Bottom Layer

2.3 Setup of the EVM

For proper operation of the EVM, follow these steps:

1) Place the provided shunt on JP1 to connect the EN-pin and ON-pin to enable the device. The device can be disabled by positioning the shunt to connect the EN-pin to the OFF-pin.

2) Connect a signal source (or battery pack) with the appropriate voltage between V_I (J1) and GND (J2). The input voltage range for the REG711-5 is 2.7 V to 5.5 V. Exceeding 5.5 V may damage the device.

3) Connect a load to the output between V_O (J3) and GND (J4). For input voltages between 2.7 V and 3.0 V the device is specified for a 15 mA maximum load. For input voltages greater than 3.0 V the device is specified for a 50 mA maximum load.