Using the LM3697EVM Evaluation Module

User's Guide

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Using the LM3697EVM Evaluation Module

1 Introduction

The Texas Instruments LM3697EVM evaluation module (EVM) helps designers evaluate the operation and performance of the LM3697YFQ High-Efficiency Three String White LED Driver. The LM3697EVM can be easily configured to support 1, 2, or 3 parallel LED strings with 4, 5, 6, 7, 8, 9, or 10 series LEDs. An on-board PWM generator is provided for a quick out-of-the-box setup and evaluation of the LM3697YFQ.

Table 1. Device and Package Configurations

Component	IC	Package
U1	LM3697YFQ	YFQ0012GAA

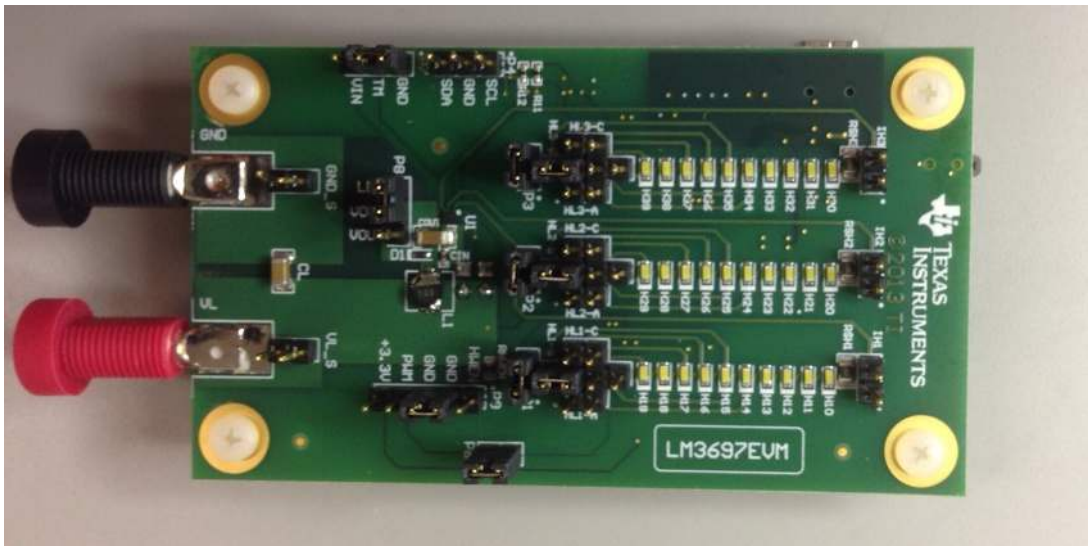

Figure 1. LM3697EVM Picture

2 Setup

This section describes the jumpers and connectors on the LM3697EVM as well as how to properly connect, set up, and use the LM3697YFQ.

2.1 INPUT/OUTPUT Connector Descriptions

VL - INPUT is the power input terminal for the boost converter and the LM3697 VIN supply. This terminal provides a power (VBAT) connection to allow the user to attach the EVM to a power supply via a cable assembly with banana plugs.

GND - INPUT is the power input terminal for the boost converter and the LM3697 GND. This terminal provides a common ground (GND) connection to allow the user to attach the EVM to a power supply via a cable assembly with banana plugs.

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J1 - INPUT/OUTPUT is the USB I/O connection to the MSP430 (USB2ANY). This terminal provides a USB to I²C™ connection to allow the user to evaluate the LM3697 features without the need of an external I²C tool.

P1 - Connector is provided to disconnect HVLED3 string from the LM3697 boost convertor output. A jumper must bin installed for normal operation.

P2 - Connector is provided to disconnect HVLED2 string from the LM3697 boost convertor output. A jumper must bin installed for normal operation.

P3 - Connector is provided to disconnect HVLED1 string from the LM3697 boost convertor output. A jumper must bin installed for normal operation.

P4 - Test Point Connector provide access to the I²C interface signals.

P5 - Connector (located on the bottom side of the LM3697EVM PCB) is the connection between the power input terminal VL and the LM3697 VIN supply. This connector allows the user to insert a current meter between pins 1 & 2 to measure the LM3697 VIN current. A jumper must be installed when a current meter is not connected between pins 1 & 2.

P6 - Connector is provided to allow the user to disconnect the on-board PWM generator from the LM3697 PWM input. This jumper must be removed if the user connects an external PWM signal generator or if a jumper is installed between pins 3 & 4 or 4 & 5 of the PWM Test Point connector.

P7 - Connector is not required by the user and must be connected to either GND or VIN. A jumper must be installed between pins 1 & 2 (GND) or pins 2 & 3 (VIN).

P8- Connector is the connection between the LM3697 boost convertor output and all three parallel LED strings. A jumper must be installed between pins 1 & 2 for normal operation.

P9 - Test Point Connector provides access to the LM3697 HWEN and PWM inputs. An extra jumper is provided between pins 2 (GND) and 3 (GND). A jumper can be installed between pins 3 & 4 or pins 4 & 5 to connect the PWM input to GND or +3.3V, respectively. The PWM jumper on P6 must be removed if a jumper is inserted between pins 3 & 4 or pins 4 & 5 on P9.

P10 - Connector is provided to power the LM3697EVM using only USB power. Normally this jumper should remain open. If use of this feature is desired, the user must ensure that the USB power is not exceeded by the LED string configuration before inserting a jumper between pins 1 & 2.

HL1A, HL1B & HL1C - Connector provides a star connection to the HVLED3 string allowing the user to configure the HVLED3 string for 4, 5, 6 ,7, 8, 9, or 10 series LEDs.

HL2A, HL2B & HL2C - Connector provides a star connection to the HVLED2 string allowing the user to configure the HVLED2 string for 4, 5, 6 ,7, 8, 9, or 10 series LEDs.

HL3A, HL3B & HL3C - Connector provides a star connection to the HVLED1 string allowing the user to configure the HVLED1 string for 4, 5, 6 ,7, 8, 9, or 10 series LEDs.

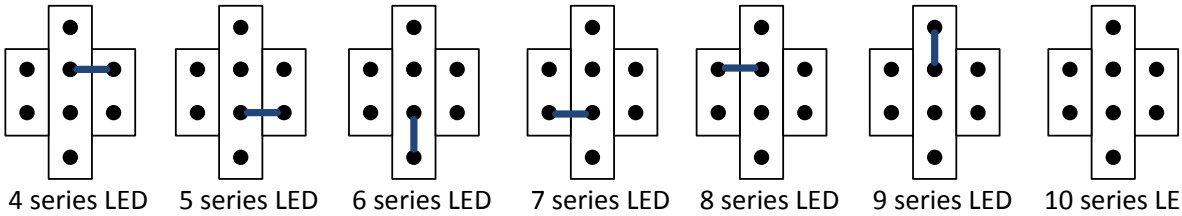

Figure 2. HL1A-C, HL2A-C and HL3A-C star jumper configuration settings (blue line indicates jumper position)

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2.2 LM3697EVM Configuration

Figure 3 and Figure 4 illustrate how to properly configure the LM3697EVM for three parallel six series (3p6s) LED string configuration using the on-board PWM generator.

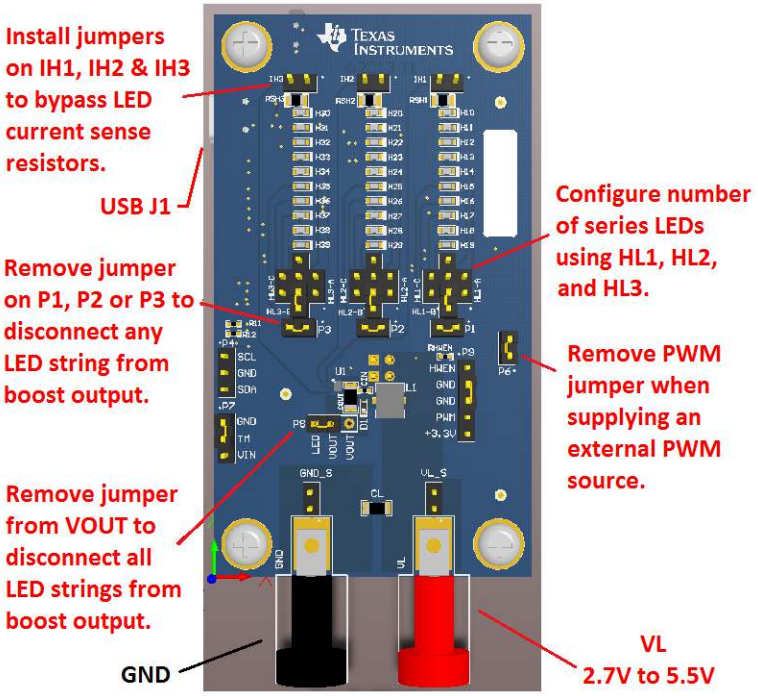

Figure 3. LM3697EVM Configuration (Top Side)

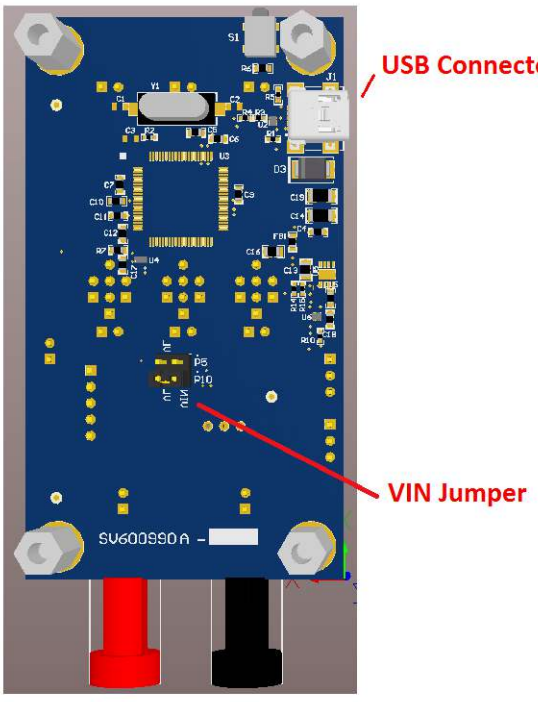

Figure 4. LM3697EVM Configuration (Bottom Side)

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2.3 Instructions for Evaluation with Software

The LM3697EVM kit includes a windows program that can help exercise the part in a simple way. Figure 5 shows the picture of the LM3697EVM board setup for evaluation using the LM3697EVM GUI software.

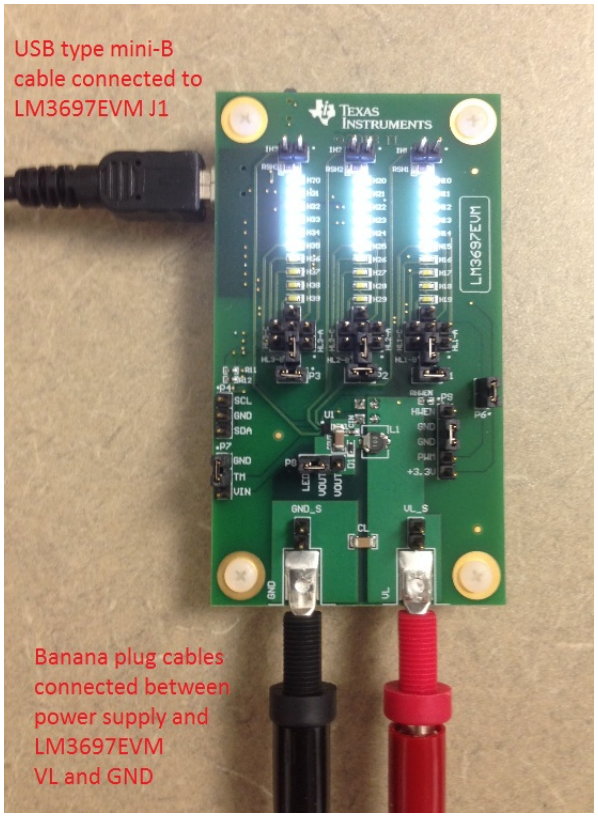

Figure 5. LM3697EVM Test Setup for Evaluation with LM3697EVM GUI Software

The LM3697EVM must be connected to the PC using the provided USB type mini-B cable. A power supply capable of 2.7V to 5.5V voltage range and up to 1.0 Amps current must be connected and turned on prior to configuring the LM3697.

The LM3697EVM GUI is organized into three sections as follows:

- Control Access
- U2A PWM Control
- LM3697

The Control Access section is used to establish the USB connection between the PC and the LM3697EVM, disconnect the USB connection between the PC and the LM3697, select the I^2C repeated start option, and toggle the HWEN input to the LM3697.

The U2A PWM Control section is used to enable the on-board PWM generator, set the PWM frequency (20 Khz to 100 Khz), duty cycle (0 to 100%), and polarity (high/low).

The LM3697 I^2C address (0x36 default) is set by the Slave Address control and is used for all four tabs of the LM3697 section. This section is organized into five separate tab pages as follows:

- High Voltage LED
- LED Fault
- Single I^2C Access
- EVM Quick Test
- Demo

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The High Voltage LED page provides access to all of the user configurable registers in the LM3697. In some cases the information shown on the High Voltage LED page does not match the actual state of the LM3697 registers. To clear up this issue the user can click the Software Reset button, followed by clicking the Default Values button.

The LED Fault page provides the user access to verify the LM3697 LED Open/Short detect feature (refer to the LM3697 datasheet for the proper test sequence).

The Single I^2C Access page provides the user access to individual LM3697 registers.

The EVM Quick Test page provides the user a simple way to quickly verify the EVM operation using seven different test cases. The user cycles through the test cases by clicking on the Advance Test button. When the test is complete clicking the Advance Test button will restart the test sequence beginning with the first test case. The EVM Test Verification Instructions field will be updated to reflect the test case performed.

The Demo page provides the user with two options (Ramp Test and Cycle Test) to quickly evaluate the LM3697 LED brightness ramp capability. The Ramp Demo provides a simple way to quickly evaluate LED brightness resolution and mapping. The Ramp Demo will change the LED brightness between the high code and low code using the wait time delay between each brightness code step. The user can select the resolution (11-bit to 4-bit) and mapping mode (exponential or linear) and choose to Ramp Up, Ramp Down, or Step between the two brightness codes. The repeat check box will repeat the sequence until the Stop button is depressed. The Cycle Test is used to cycle between 400 µA and 900 µA current levels with the high time, low time, ramp up time, ramp down time, and mapping mode configured by the user. This test will start when the Start Cycle button is depressed and will repeat until the Stop Cycle button is depressed.

When the LM3697EVM GUI software is executed, a basic interface window will open as shown in Figure 6. The user needs to click the Open button under the Control Access section of the GUI interface to establish the USB connection between the PC and the LM3697EVM. When the connection is properly established the Serial: field will be updated, and the Firmware Version: field will be updated with 1.18,0.0. If the communication is not properly established both of these fields will contain the word "Error". When the Close button is clicked, the HWEN signal will be asserted, and the GUI window will be closed.

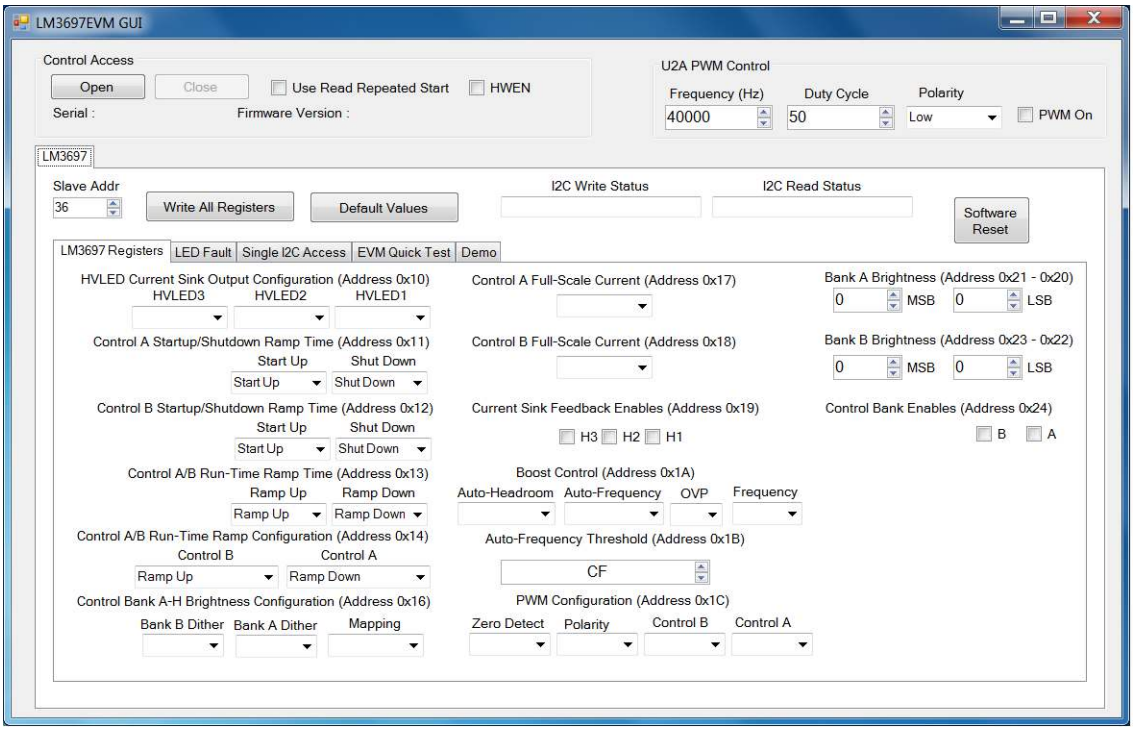

Figure 6. LM3697EVM GUI Initial Window

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Figure 7 shows the updated Serial: and Firmware Version: fields after the USB connection has been successfully opened.

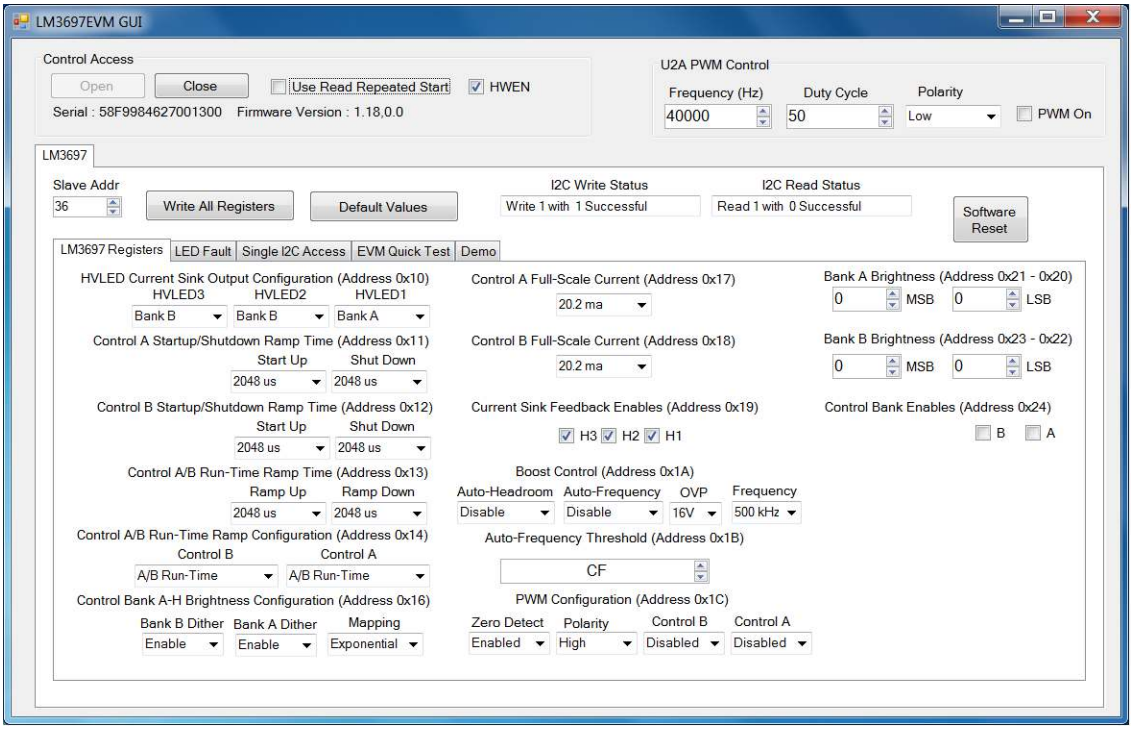

Figure 7. LM3697EVM GUI Open Success

Figure 8 shows the register settings to enable the 3p6s configuration using control bank A with PWM enabled. The registers that need to be configured are as follows:

- Address 0x10 with Data 0x00
- Address 0x1A with Data 0x02
- Address 0x21 with Data 0xFF
- Address 0x24 with Data 0x01

When the LM3697 register contains more than one field the I^2C write packet will be sent when any one of the fields have been changed on the LM3697EVM GUI. The status of the write operation will be updated in the I2C Write Status and I2C Read Status fields. The LM3697EVM GUI will always perform an I^2C read of the address written.

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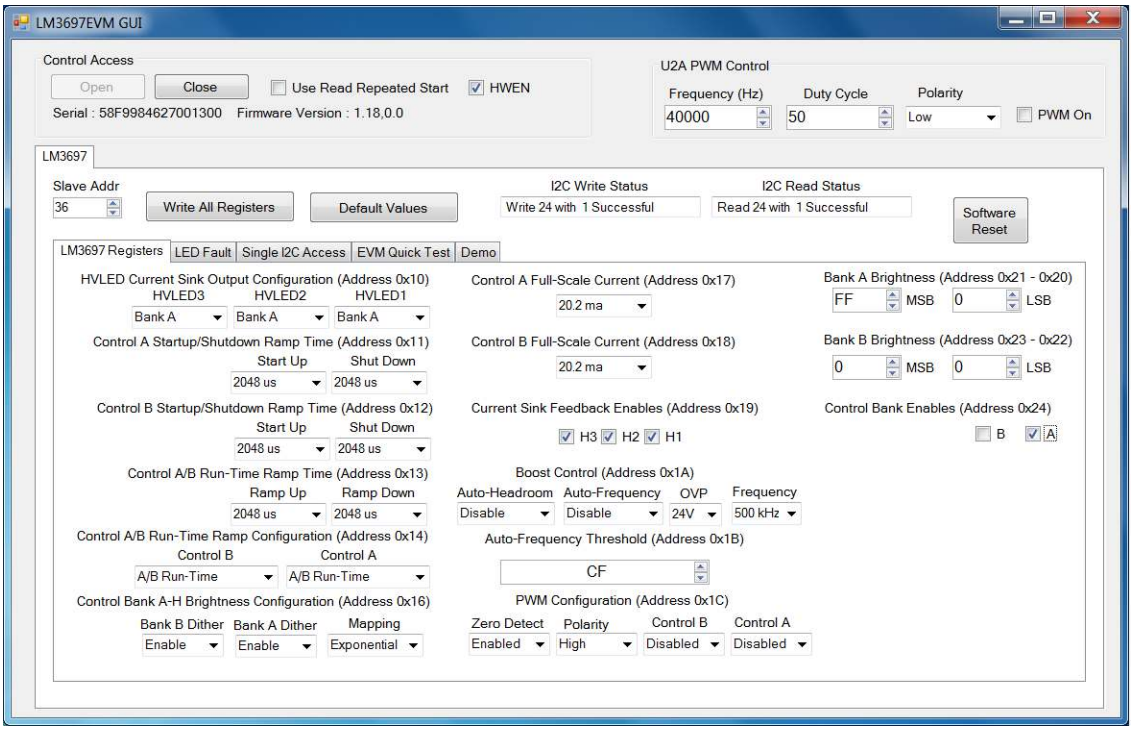

Figure 8. LM3697EVM GUI Control Bank A 3p6s Example with PWM

Figure 9 shows the EVM Quick Test after clicking the Advance Test button three times. In this mode, only control bank A is enabled using the on-board PWM generator set to 25% duty cycle.

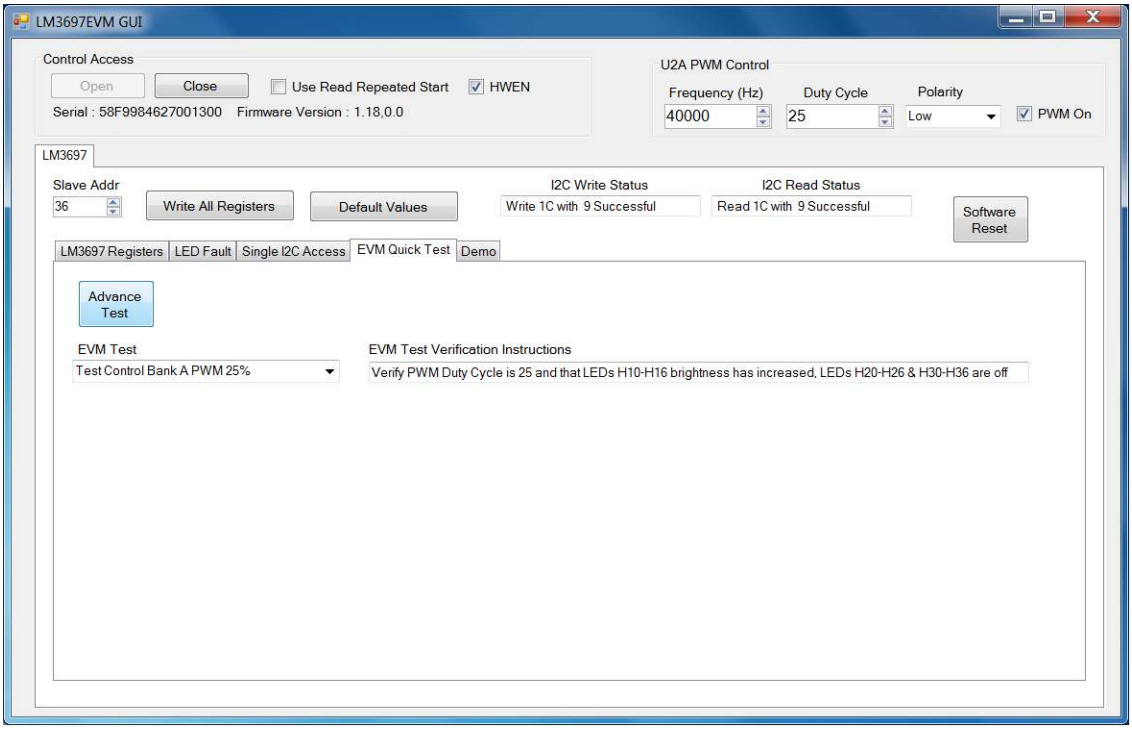

Figure 9. LM3697EVM GUI EVM Quick Test Example

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Figure 10 shows the Ramp Demo configured to repeat a 11-bit ramp up between brightness codes 280 and 300 using 10 msec step.

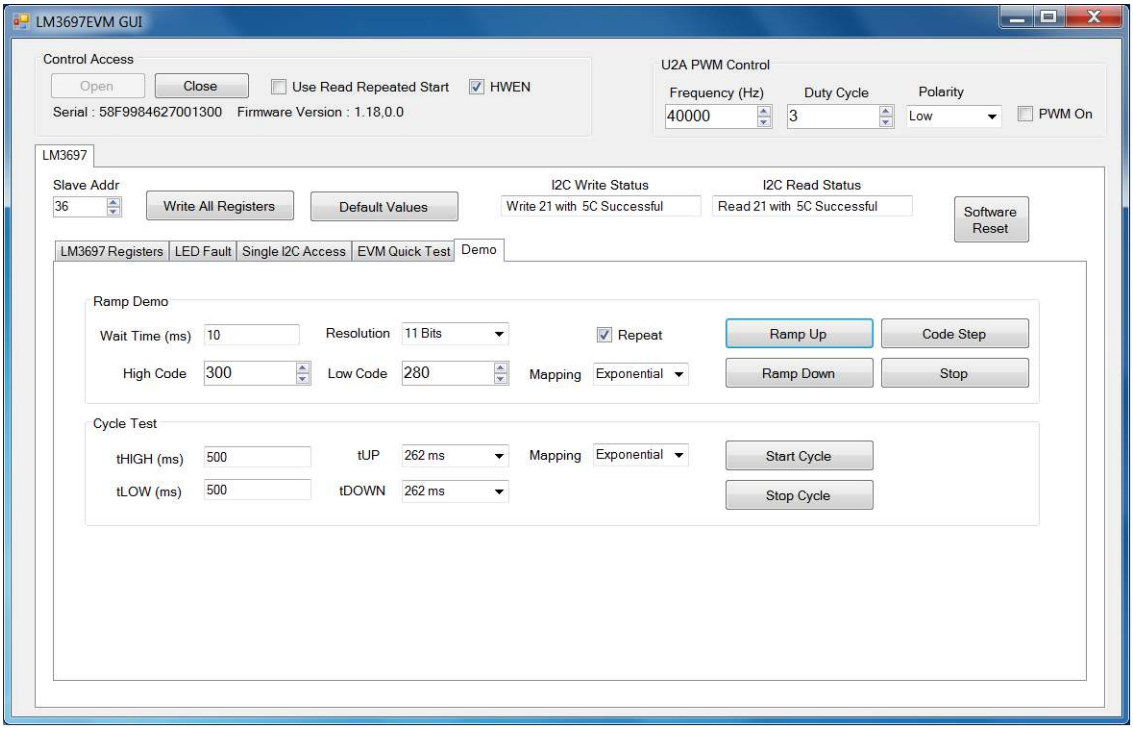

Figure 10. LM3697EVM GUI EVM Ramp Demo Example

3 LM3697EVM Component Placement

Figure 11 shows the top and bottom PCB layers of the LM3697EVM.

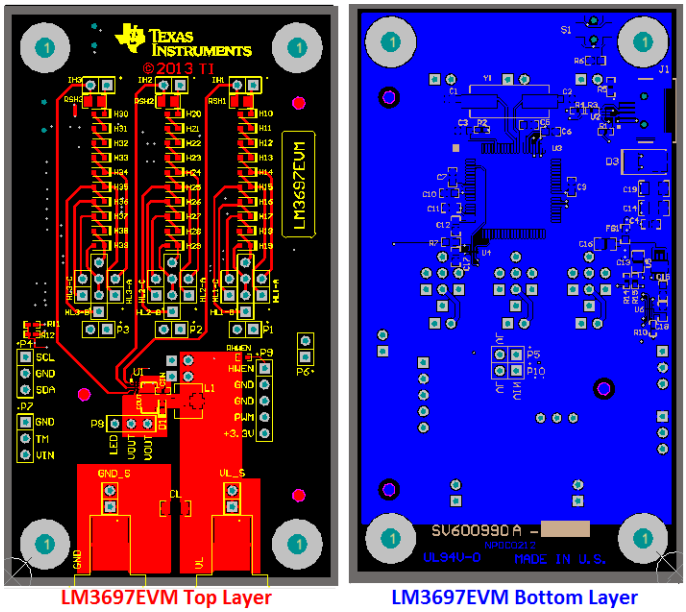

Figure 11. LM3697EVM Top and Bottom Layers

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Table 2. LM3697EVM Component List

Item	Designator	Description	Manufacturer	Part Number	Qty
1	!PCB	Printed Circuit Board	Any	SV600990	1
2	C1, C2	CAP, CERM, 30pF, 100V, +/-5%, C0G/NP0, 0603	MuRata	GRM1885C2A300JA01D	2
3	C3	CAP, CERM, 2200pF, 50V, +/-10%, X7R, 0603	Kemet	C0603X222K5RACTU	1
4	C4, C7, C9, C10, C11, C17, C18	CAP, CERM, 0.1uF, 25V, +/-10%, X5R, 0603	AVX	06033D104KAT2A	7
5	C5, C6	CAP, CERM, 220pF, 50V, +/-1%, C0G/NP0, 0603	AVX	06035A221FAT2A	2
6	C12	CAP, CERM, 0.47uF, 10V, +/-10%, X7R, 0603	MuRata	GRM188R71A474KA61D	1
7	C13	CAP, CERM, 2.2uF, 16V, +/-10%, X5R, 0805	AVX	0805YD225KAT2A	1
8	C14, C19, CL	CAP, CERM, 10uF, 25V, +/-10%, X5R, 1206	MuRata	GRM31CR61E106KA12L	3
9	C15	CAP, CERM, 0.01uF, 50V, +/-10%, X7R, 0603	TDK	C1608X7R1H103K080AA	1
10	C16	CAP, CERM, 1uF, 16V, +/-10%, X7R, 0805	TDK	C2012X7R1C105K	1
11	CIN	CAP, CERM, 2.2uF, 10V, +/-10%, X5R, 0402	TDK	C1005X5R1A225K050BC	1
12	COUT	CAP, CERM, 1uF, 50V, +/-10%, X7R, 1206	TDK	C3216X7R1H105K	1
13	P9	Header, TH, 100mil, 5x1, Gold plated, 230 mil above insulator	Samtec, Inc.	TSW-105-07-G-S	1
14	D1	Diode, Schottky, 40V, 0.25A, SOD-523	ON Semiconductor	NSR0240V2T1G	1
15	D2	Diode, Zener, 7.5V, 550mW, SMB	ON Semiconductor	1SMB5922BT3G	1
16	FB1	Bead, Ferrite, SMT, 60Ohms, 800mA	Taiyo Yuden	BK1608HS600-T	1
17	GND	Standard Banana Jack, Insulated, Black	Keystone	6092	1
18	GND_S, HL1-A, HL1-C, HL2-A, HL2-C, HL3-A, HL3-C, IH1, IH2, IH3, P1, P2, P3, P5, P6, P10, VL_S	Header, TH, 100mil, 2x1, Gold plated, 230 mil above insulator	Samtec, Inc.	TSW-102-07-G-S	17
19	H1, H2, H3, H4	Machine Screw, Round, #4-40 x 1/4, Nylon, Philips panhead	B and F Fastener Supply	NY PMS 440 0025 PH	4
20	H5, H6, H7, H8	Standoff, Hex, 0.5"L #4-40 Nylon	Keystone	1902C	4
21	H10, H11, H12, H13, H14, H15, H16, H17, H18, H19, H20, H21, H22, H23, H24, H25, H26, H27, H28, H29, H30, H31, H32, H33, H34, H35, H36, H37, H38, H39	LED, White, SMD	Rohm	SML312WBCW1	30
22	HL1-B, HL2-B, HL3-B	Header, TH, 100mil, 4x1, Gold plated, 230 mil above insulator	Samtec, Inc.	TSW-104-07-G-S	3
23	J1	Conn Rcpt Mini USB2.0 Type B 5POS SMD	TE Connectivity	1734035-2	1
24	P4, P7. P8	Header, TH, 100mil, 3x1, Gold plated, 230 mil above insulator	Samtec, Inc.	TSW-103-07-G-S	3
25	L1	INDUCTOR POWER 10µH 1.0A SMD	TDK	VLF4014ST-100M1R0	1

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Table 2. LM3697EVM Component List (continued)

26	LBL1	Thermal Transfer Printable Labels, 0.650" W x 0.200" H - 10,000 per roll	Brady	THT-14-423-10	1
27	R1, R3	RES, 33 ohm, 5%, 0.063W, 0402	Vishay-Dale	CRCW040233R0JNED	2
28	R2, R5	RES, 33k ohm, 5%, 0.063W, 0402	Vishay-Dale	CRCW040233K0JNED	2
29	R4	RES, 1.5k ohm, 5%, 0.063W, 0402	Vishay-Dale	CRCW04021K50JNED	1
30	R6	RES, 1.2Meg ohm, 5%, 0.1W, 0603	Vishay-Dale	CRCW06031M20JNEA	1
31	R7	RES, 200 ohm, 1%, 0.1W, 0603	Vishay-Dale	CRCW0603200RFKEA	1
32	R10	RES, 200k ohm, 5%, 0.063W, 0402	Vishay-Dale	CRCW0402200KJNED	1
33	R11, R12, R14, R15, RHWEN	RES, 10k ohm, 5%, 0.063W, 0402	Vishay-Dale	CRCW040210K0JNED	5
34	R16	RES, 0 ohm, 5%, 0.1W, 0603	Vishay-Dale	CRCW06030000Z0EA	1
35	RSH1, RSH2, RSH3	RES 10 OHM 1/8W .1% 0805 SMD	Bourns	CRT0805-BY-10R0ELF	3
36	S1	Switch, SMD Light-Touch, Side Operation	Panasonic	EVQ-PSD02K	1
37	SH-JMP1, SH-JMP2, SH-JMP3, SH-JMP4, SH-JMP5, SH-JMP6, SH-JMP7, SH-JMP8, SH-JMP9, SH-JMP10, SH-JMP11	Shunt, 100mil, Gold plated, Black	3M	969102-0000-DA	11
38	U1	LM3697 High-Efficiency Three-String White LED Driver, YFQ0012AEAC	Texas Instruments	LM3697YFQ	1
39	U2	ESD-Protection Array for High-Speed Data Interfaces, 4 Channels, -40 to +85 degC, 6-pin SON (DRY), Green (RoHS & no Sb/Br)	Texas Instruments	TPD4E004DRYR	1
40	U3	IC, Mixed Signal Microcontroller	Texas Instruments	MSP430F5529IPN	1
41	U4	IC BUS TRANSCVR 2B N-INV 8DSBGA	TI	SN74LVC2T45YZPR	1
42	U5	IC, 500mA, Low Quiescent Current, Ultra-Low Noise, High PSRR LDO, 3.3-V	Texas Instruments	TPS73533DRBT	1
43	U6	IC VOLT LEVEL TRANSLATOR 8-VSSOP	TI	PCA9306DQER	1
44	VL	Standard Banana Jack, Insulated, Red	Keystone	6091	1
45	Y1	Crystal, SMT Quart Crystal	ECS	ECS-240-20-5PX-TR	1

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4 LM3697EVM Schematic

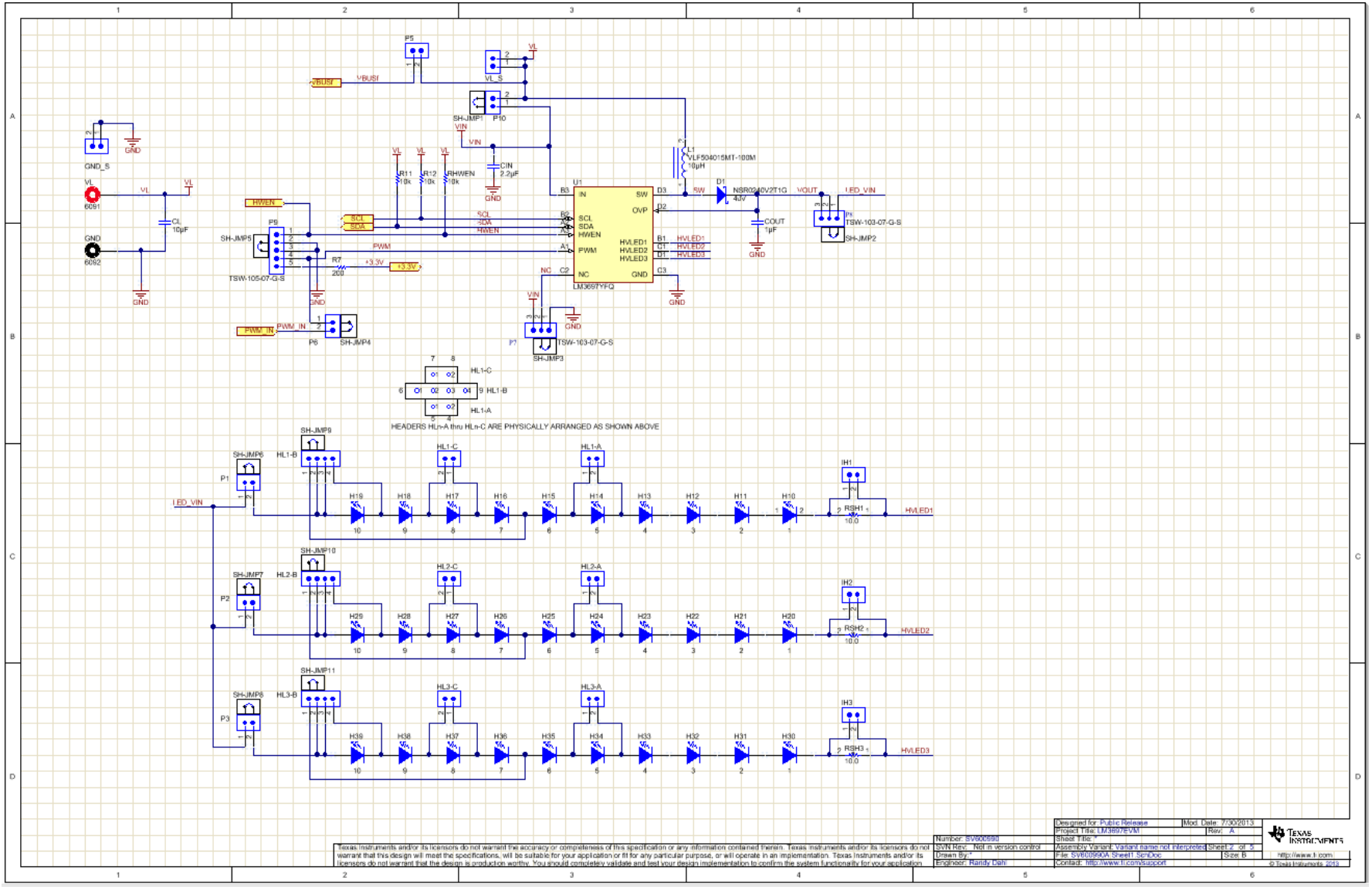

Figure 12. LM3697EVM Schematic Sheet1

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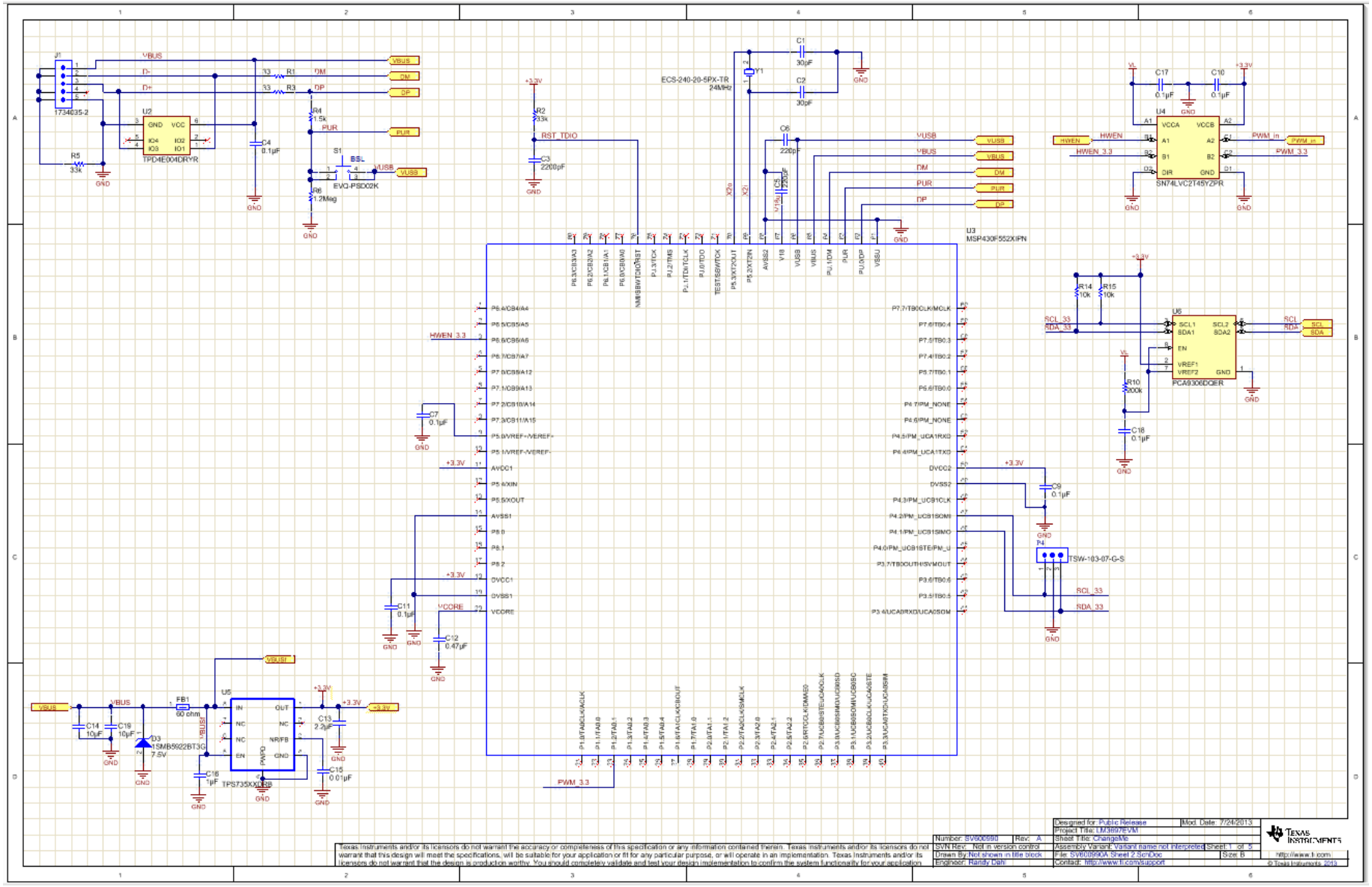

Figure 13. LM3697EVM Schematic Sheet2

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EVALUATION BOARD/KIT/MODULE (EVM) ADDITIONAL TERMS

Texas Instruments (TI) provides the enclosed Evaluation Board/Kit/Module (EVM) under the following conditions:

The user assumes all responsibility and liability for proper and safe handling of the goods. Further, the user indemnifies TI from all claims arising from the handling or use of the goods.

Should this evaluation board/kit not meet the specifications indicated in the User's Guide, the board/kit may be returned within 30 days from the date of delivery for a full refund. THE FOREGOING LIMITED WARRANTY IS THE EXCLUSIVE WARRANTY MADE BY SELLER TO BUYER AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED, IMPLIED, OR STATUTORY, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE. EXCEPT TO THE EXTENT OF THE INDEMNITY SET FORTH ABOVE, NEITHER PARTY SHALL BE LIABLE TO THE OTHER FOR ANY INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES.

Please read the User's Guide and, specifically, the Warnings and Restrictions notice in the User's Guide prior to handling the product. This notice contains important safety information about temperatures and voltages. For additional information on TI's environmental and/or safety programs, please visit www.ti.com/esh or contact TI.

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REGULATORY COMPLIANCE INFORMATION

As noted in the EVM User's Guide and/or EVM itself, this EVM and/or accompanying hardware may or may not be subject to the Federal Communications Commission (FCC) and Industry Canada (IC) rules.

For EVMs **not** subject to the above rules, this evaluation board/kit/module is intended for use for ENGINEERING DEVELOPMENT, DEMONSTRATION OR EVALUATION PURPOSES ONLY and is not considered by TI to be a finished end product fit for general consumer use. It generates, uses, and can radiate radio frequency energy and has not been tested for compliance with the limits of computing devices pursuant to part 15 of FCC or ICES-003 rules, which are designed to provide reasonable protection against radio frequency interference. Operation of the equipment may cause interference with radio communications, in which case the user at his own expense will be required to take whatever measures may be required to correct this interference.

General Statement for EVMs including a radio

User Power/Frequency Use Obligations: This radio is intended for development/professional use only in legally allocated frequency and power limits. Any use of radio frequencies and/or power availability of this EVM and its development application(s) must comply with local laws governing radio spectrum allocation and power limits for this evaluation module. It is the user's sole responsibility to only operate this radio in legally acceptable frequency space and within legally mandated power limitations. Any exceptions to this are strictly prohibited and unauthorized by Texas Instruments unless user has obtained appropriate experimental/development licenses from local regulatory authorities, which is responsibility of user including its acceptable authorization.

For EVMs annotated as FCC – FEDERAL COMMUNICATIONS COMMISSION Part 15 Compliant

Caution

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

FCC Interference Statement for Class A EVM devices

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

FCC Interference Statement for Class B EVM devices

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

For EVMs annotated as IC – INDUSTRY CANADA Compliant

This Class A or B digital apparatus complies with Canadian ICES-003.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Concerning EVMs including radio transmitters

This device complies with Industry Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Concerning EVMs including detachable antennas

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication.

This radio transmitter has been approved by Industry Canada to operate with the antenna types listed in the user guide with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Cet appareil numérique de la classe A ou B est conforme à la norme NMB-003 du Canada.

Les changements ou les modifications pas expressément approuvés par la partie responsable de la conformité ont pu vider l'autorité de l'utilisateur pour actionner l'équipement.

Concernant les EVMs avec appareils radio

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Concernant les EVMs avec antennes détachables

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante.

Le présent émetteur radio a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés dans le manuel d'usage et ayant un gain admissible maximal et l'impédance requise pour chaque type d'antenne. Les types d'antenne non inclus dans cette liste, ou dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur.

【Important Notice for Users of EVMs for RF Products in Japan】

This development kit is NOT certified as Confirming to Technical Regulations of Radio Law of Japan

If you use this product in Japan, you are required by Radio Law of Japan to follow the instructions below with respect to this product:

1. Use this product in a shielded room or any other test facility as defined in the notification #173 issued by Ministry of Internal Affairs and Communications on March 28, 2006, based on Sub-section 1.1 of Article 6 of the Ministry's Rule for Enforcement of Radio Law of Japan,
2. Use this product only after you obtained the license of Test Radio Station as provided in Radio Law of Japan with respect to this product, or
3. Use of this product only after you obtained the Technical Regulations Conformity Certification as provided in Radio Law of Japan with respect to this product. Also, please do not transfer this product, unless you give the same notice above to the transferee. Please note that if you could not follow the instructions above, you will be subject to penalties of Radio Law of Japan.

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EVALUATION BOARD/KIT/MODULE (EVM)
WARNINGS, RESTRICTIONS AND DISCLAIMERS

For Feasibility Evaluation Only, in Laboratory/Development Environments. Unless otherwise indicated, this EVM is not a finished electrical equipment and not intended for consumer use. It is intended solely for use for preliminary feasibility evaluation in laboratory/development environments by technically qualified electronics experts who are familiar with the dangers and application risks associated with handling electrical mechanical components, systems and subsystems. It should not be used as all or part of a finished end product.

Your Sole Responsibility and Risk. You acknowledge, represent and agree that:

1. You have unique knowledge concerning Federal, State and local regulatory requirements (including but not limited to Food and Drug Administration regulations, if applicable) which relate to your products and which relate to your use (and/or that of your employees, affiliates, contractors or designees) of the EVM for evaluation, testing and other purposes.
2. You have full and exclusive responsibility to assure the safety and compliance of your products with all such laws and other applicable regulatory requirements, and also to assure the safety of any activities to be conducted by you and/or your employees, affiliates, contractors or designees, using the EVM. Further, you are responsible to assure that any interfaces (electronic and/or mechanical) between the EVM and any human body are designed with suitable isolation and means to safely limit accessible leakage currents to minimize the risk of electrical shock hazard.
3. Since the EVM is not a completed product, it may not meet all applicable regulatory and safety compliance standards (such as UL, CSA, VDE, CE, RoHS and WEEE) which may normally be associated with similar items. You assume full responsibility to determine and/or assure compliance with any such standards and related certifications as may be applicable. You will employ reasonable safeguards to ensure that your use of the EVM will not result in any property damage, injury or death, even if the EVM should fail to perform as described or expected.
4. You will take care of proper disposal and recycling of the EVM’s electronic components and packing materials.

Certain Instructions. It is important to operate this EVM within TI’s recommended specifications and environmental considerations per the user guidelines. Exceeding the specified EVM ratings (including but not limited to input and output voltage, current, power, and environmental ranges) may cause property damage, personal injury or death. If there are questions concerning these ratings please contact a TI field representative prior to connecting interface electronics including input power and intended loads. Any loads applied outside of the specified output range may result in unintended and/or inaccurate operation and/or possible permanent damage to the EVM and/or interface electronics. 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. During normal operation, some circuit components may have case temperatures greater than 60°C as long as the input and output are maintained at a normal ambient operating temperature. These components include but are not limited to linear regulators, switching transistors, pass transistors, and current sense resistors which can be identified using the EVM schematic located in the EVM User's Guide. When placing measurement probes near these devices during normal operation, please be aware that these devices may be very warm to the touch. As with all electronic evaluation tools, only qualified personnel knowledgeable in electronic measurement and diagnostics normally found in development environments should use these EVMs.

Agreement to Defend, Indemnify and Hold Harmless. You agree to defend, indemnify and hold TI, its licensors and their representatives harmless from and against any and all claims, damages, losses, expenses, costs and liabilities (collectively, "Claims") arising out of or in connection with any use of the EVM that is not in accordance with the terms of the agreement. This obligation shall apply whether Claims arise under law of tort or contract or any other legal theory, and even if the EVM fails to perform as described or expected.

Safety-Critical or Life-Critical Applications. If you intend to evaluate the components for possible use in safety critical applications (such as life support) where a failure of the TI product would reasonably be expected to cause severe personal injury or death, such as devices which are classified as FDA Class III or similar classification, then you must specifically notify TI of such intent and enter into a separate Assurance and Indemnity Agreement.

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TI has specifically designated certain components as meeting ISO/TS16949 requirements, mainly for automotive use. In any case of use of non-designated products, TI will not be responsible for any failure to meet ISO/TS16949.

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