

Using the LM3639A Evaluation Module

User's Guide



Literature Number: SNVU211
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LM3639AYFQEVN User's Guide

1 Introduction

The Texas Instruments LM3639AYFQAEVN evaluation module (EVM) helps designers evaluate the operation and performance of the LM3639A Single Chip 40V Backlight + 1.5A Flash LED Driver. The low-voltage, high-current flash LED driver is a synchronous boost which provides the power for a single flash LED at up to 1.5A or dual LEDs at up to 750 mA each. The high-voltage backlight driver is a dual-output asynchronous boost which powers dual LED strings at up to 40V and 30 mA per string.

The EVM contains one LM3639A Single Chip 40V Backlight + 1.5A Flash LED Driver (See [Table 1](#)).

Table 1. Device and Package Configurations

| FLASH LED DRIVER | IC | PACKAGE |
|------------------|-------------|------------|
| U1 | LM3639AYFQT | YFQ0020HGA |

2 Setup

This section describes the jumpers and connectors on the EVM as well as how to properly connect, set up and use the LM3639A EVM.

2.1 Input/Output Connector Description

Input / GND - These are the power input terminals for the driver. The terminal block provides a power (VIN) and ground (GND) connection to allow the user to attach the EVM to a cable harness.

EN - This is the jumper used to enable the LED driver. The driver will be enabled when the EN pin is high (VIO) and disabled when it is low (GND). The EN pin is connected to ground via a 300 kΩ resistor internal to the LM3639A



Figure 1. Enable Jumper Settings

VIO - This pin provides power for the I²C lines (Clock & Data) and for the EN pin. It is recommended that this pin is connected to the VIN pin. If desired, it can be connected to the 3.3V line provided by the USB interface connector. In this configuration, communication via the I²C interface may not be possible if the supply voltage to the LED driver is below approximately 3V.

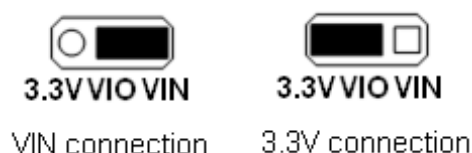


Figure 2. VIO Jumper Settings

J3 - LEDB CON - is the jumper used to connect the on-board backlight LEDs to the LED output of the driver.

J20 and J21 - D1B and D2B LEDs - are the jumper used to select the number of LEDs in each backlight string.

J11 and J12 - D1F CON and D2F CON- are the jumpers used to connect the on-board flash LEDs to the LED output of the driver.

J27 - STROBE - This pin provides an external method for initiating a flash event. The STROBE pin is connected to ground via a 300 k Ω resistor internal to the LM3639A. To externally drive this pin, either connect a control signal directly to the STROBE pin of the connector or place a jumper between connector pins STROBE and PWM2. Pin PWM2 can be configured as time-adjustable voltage pulse via the General User Interface software provided.

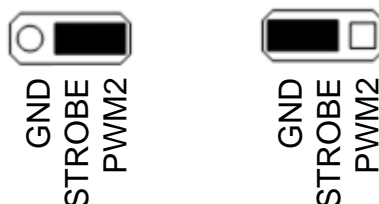


Figure 3. STROBE Jumper Settings

J25 - TX - This pin is used to initiate a TX-interrupt event. The TX pin is connected to ground via a 300 k Ω resistor internal to the LM3639A. To externally drive this pin, either connect a control signal directly to the TX pin of the connector or place a jumper between connector pins TX and PWM1. Pin PWM1 can be configured as continuous voltage pulses via the General User Interface software provided.



Figure 4. TX Jumper Settings

J22 - PWM- This pin provides an external method for adjusting the backlight LED brightness. The PWM pin is connected to ground via a 300 k Ω resistor internal to the LM3639A. To externally drive this pin, either connect a control signal directly to the PWM pin of the connector or place a jumper between connector pins PWM and PWM0. Pin PWM0 can be configured to provide a continuous stream of voltage pulses of adjustable frequency and duty cycle via the General User Interface software provided.



Figure 5. PWM Jumper Settings

J29 - SDA / SCL - These connections allow the user to externally control the I²C lines. For independent control of the I²C lines, do not connect the VIO jumper to either the 3.3V or the VIN pin.

2.2 Setup

The input voltage range for the flash driver is 2.7 volts to 5.5 volts. The on-board LEDs should be connected for proper operation.

2.3 Operation

For proper operation of the LM3639A, the jumpers should be properly configured. The recommended setting, using shorting blocks is:

VIO to VIN

EN to VIO

STROBE to PWM2 or external signal

PWM to PWM0 or external signal

TX to PWM1 or external signal

LEDs (J11, J12, J13, J20, J21) shorted

In this configuration, the device will power up when power is applied.

USB2ANY ribbon cable inserted into J19

3 Board Layout

[Figure 6](#), [Figure 9](#), [Figure 7](#) and [Figure 8](#) show the board layout for the LM3639A EVM. The EVM offers resistors, capacitors and jumpers to Enable the device and to configure it as desired.

The LM3639A will dissipate power, especially during high current and long duration flash events. Power will also be dissipated on the flash LEDs. The EVM layout is designed to minimize temperature rise during operation. It is recommended that in order to prevent overheating, repeated flash events in very short time intervals is avoided.

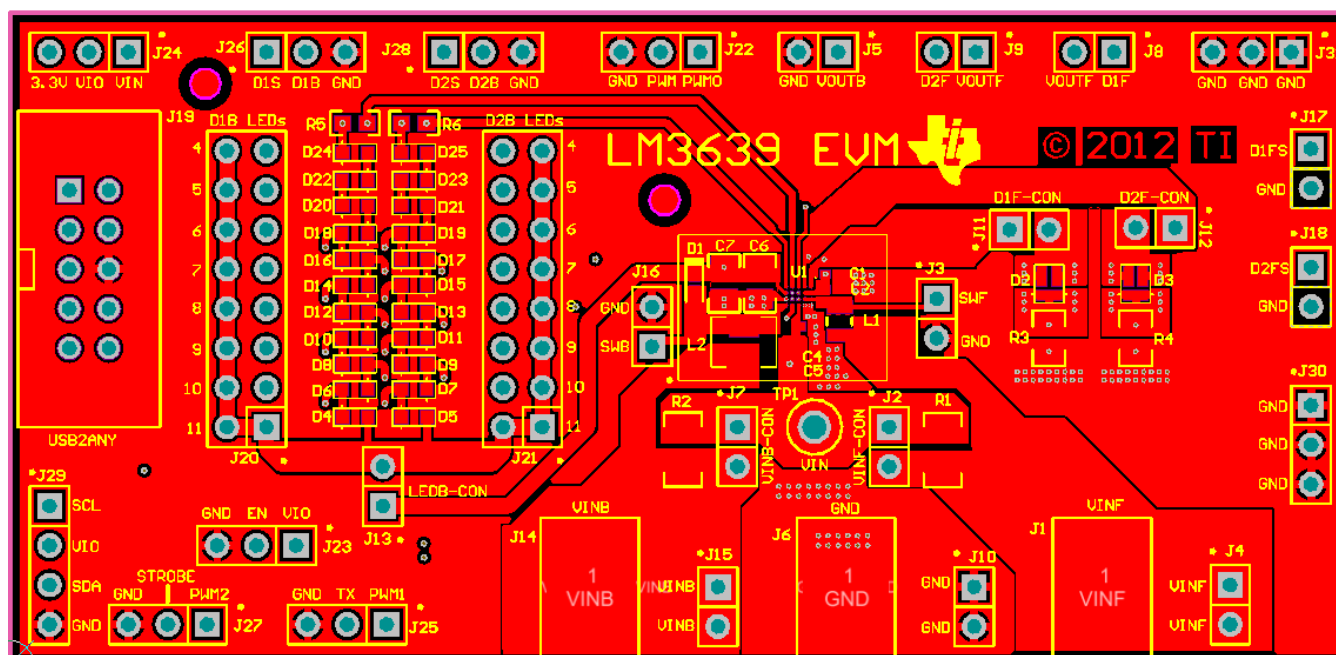


Figure 6. Top Assembly Layer

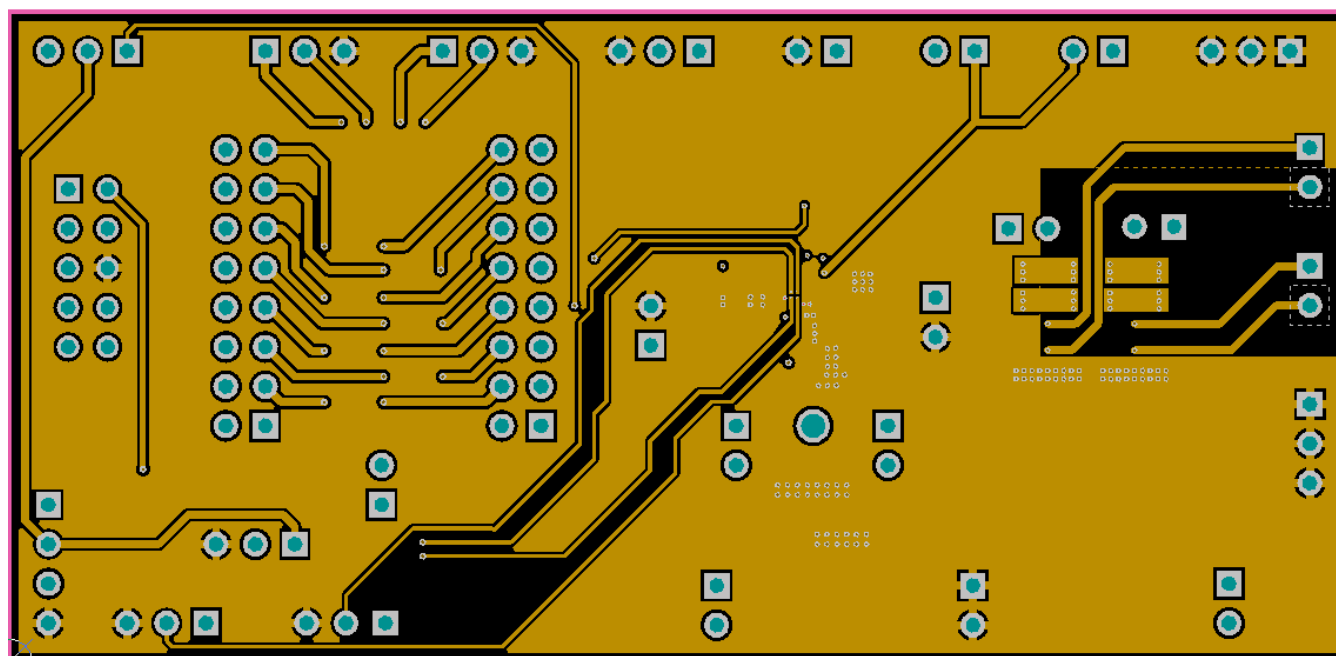


Figure 7. Middle Layer 1 Routing

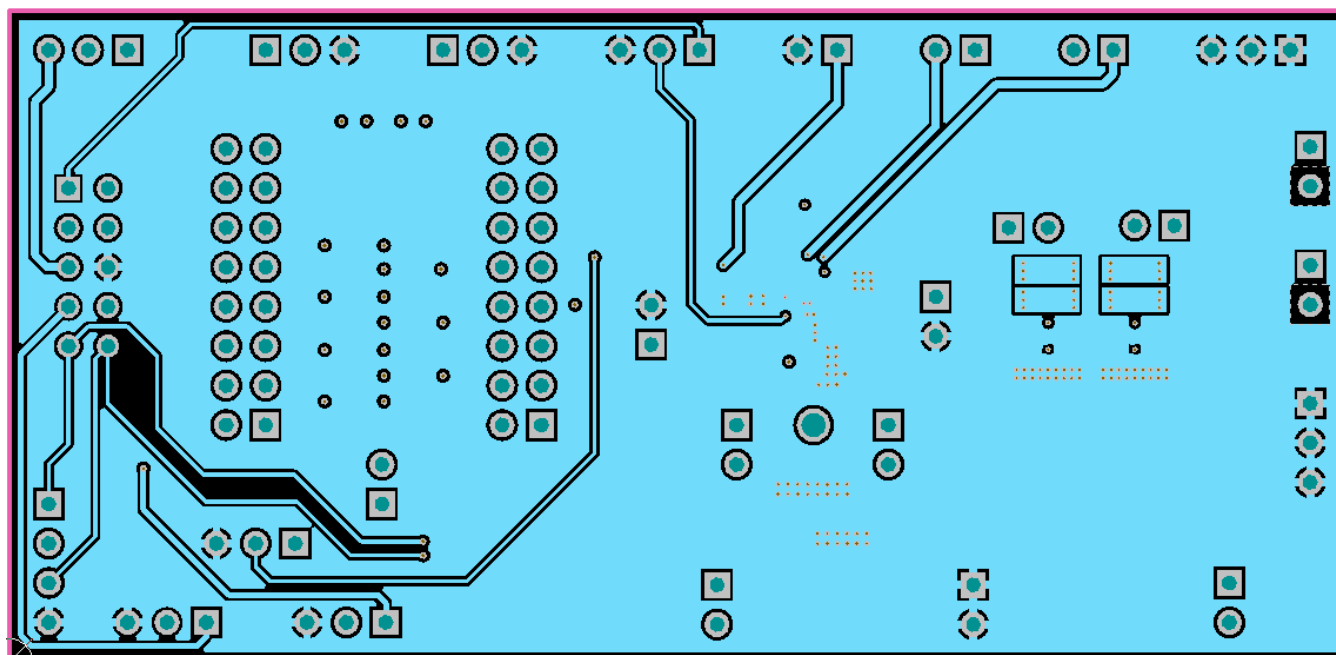


Figure 8. Middle Layer 2 Routing

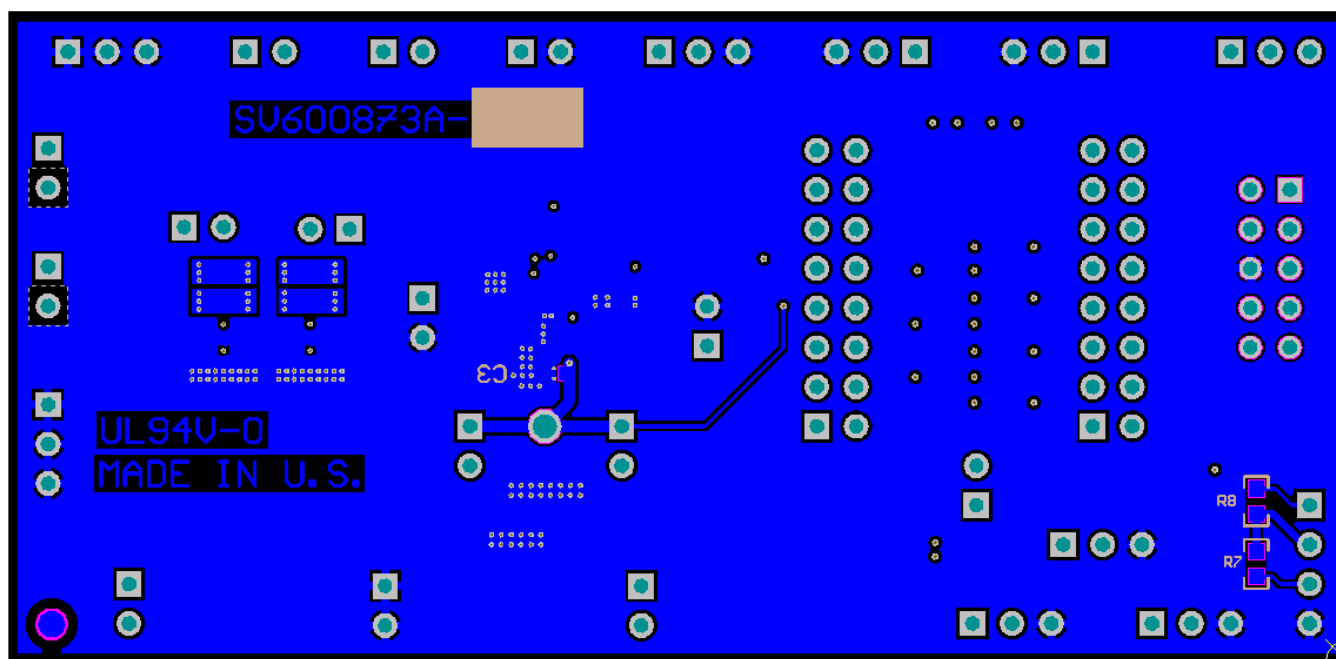


Figure 9. Bottom Assembly Layer (mirrored)

4 Schematic

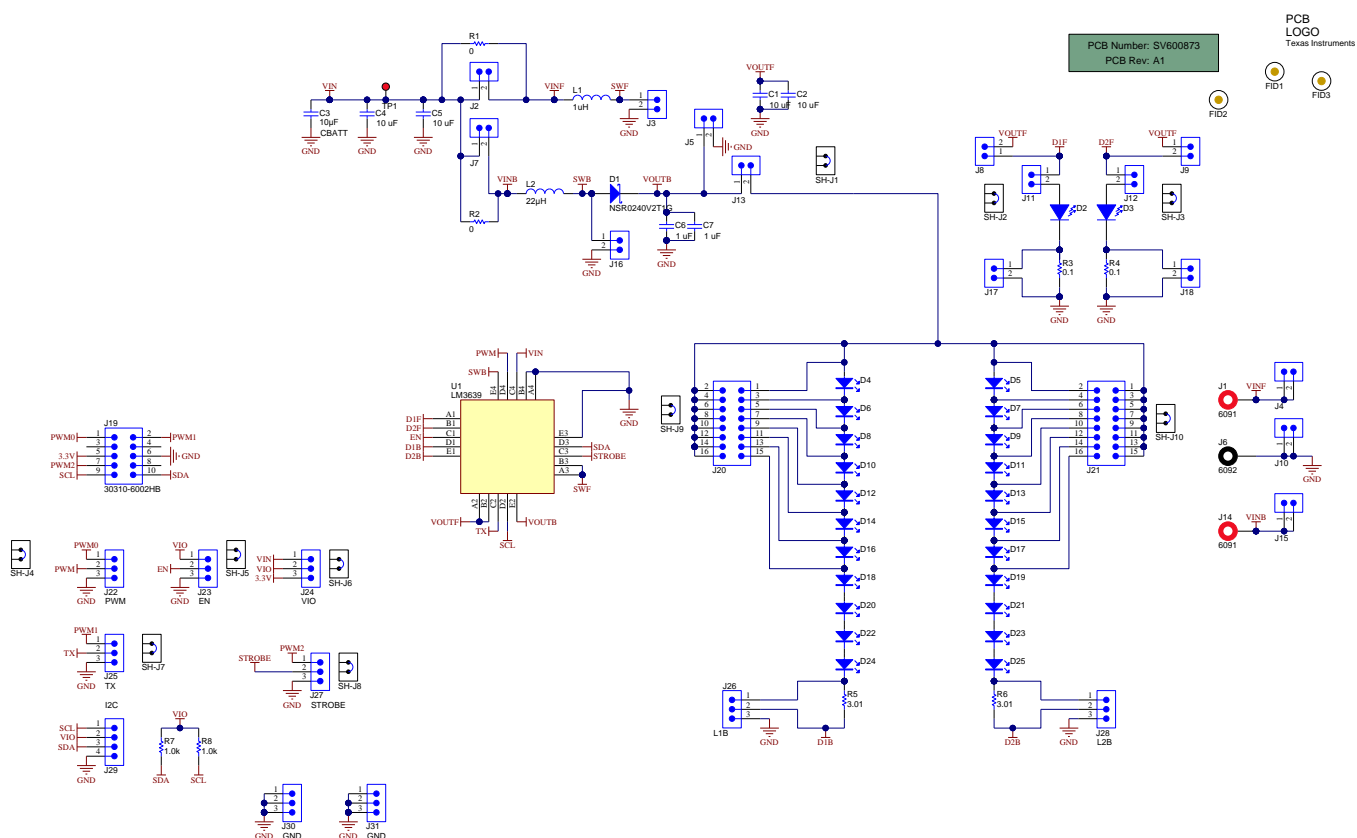


Figure 10. LM3639A EVM Schematic

Table 2. Bill of Materials

| Item | Designator | Description | Manufacturer | Part Number | Quantity |
|------|----------------|---|------------------|---------------------|----------|
| 1 | AA1 | Printed Circuit Board | TI | 551600784-002 REVA | 1 |
| 2 | U1 | IC, LM3639A Single Chip 40V Backlight + 1.5A Flash LED Driver | TI | LM3639AYFQT | 1 |
| 3 | C1, C2, C4, C5 | CAP, CERM, 10uF, 6.3V, X5R 20%, 0402 | Murata | GRM155R60J106ME4 4D | 4 |
| 4 | C3 | CAP, CERM, 100uF, 6.3V, +/-20%, X5R, 1206 | Murata | GRM188R60J106ME4 7D | 1 |
| 5 | C6, C7 | CAP, CERM, 1F, 50V, X5R, 10%, 0603 | TDK | CGA4J3X7R1H105K | 2 |
| 6 | D1 | Diode, Schottky, 40V, 250A, SOD523 | ON Semiconductor | NSR0240V2T1G | 1 |
| 7 | D2, D3 | LED,White SMT | Philips Lumileds | LXCL-EYW4 | 2 |

Table 2. Bill of Materials (continued)

| Item | Designator | Description | Manufacturer | Part Number | Quantity |
|------|---|---|--------------------|-------------------|----------|
| 8 | D4, D5, D6, D7, D8, D9, D10, D11, D12, D13, D14, D15, D16, D17, D18, D19, D20, D21, D22, D23, D24, D25 | White LED, ROHM, 30mA, 0603 | Rohm Semiconductor | SML312WBCW1 | 22 |
| 9 | J1, J14 | Standard Banana Jack, Insulated, Red | Keystone | 6091 | 2 |
| 10 | J2, J3, J4, J5, J7, J8, J9, J10, J11, J12, J13, J15, J16, J17, J18 | Header, TH, 100mil, 2x1, Gold plated, 230 mil above insulator | Samtec, Inc. | TSW-102-07-G-S | 15 |
| 11 | J6 | Standard Banana Jack, Insulated, Black | Keystone | 6092 | 1 |
| 12 | J19 | CONN HEADER 10POS DL STR GOLD | 3M | 30310-6002HB | 1 |
| 13 | J20, J21 | Header, TH, 100mil, 8x2, Gold plated, 230 mil above insulator | Samtec, Inc. | TSW-108-07-G-D | 2 |
| 14 | J22, J23, J24, J25, J26, J27, J28, J30, J31 | Header, TH, 100mil, 3x1, Gold plated, 230 mil above insulator | Samtec, Inc. | TSW-103-07-G-S | 9 |
| 15 | J29 | Header, TH, 100mil, 4x1, Gold plated, 230 mil above insulator | Samtec, Inc. | TSW-104-07-G-S | 1 |
| 16 | L1 | Inductor, Metal Alloy, 1uH, 3.1A, 0.068ohm, SMT | TOKO | DFE201612C-H-1R0M | 1 |
| 17 | L2 | Inductor, Ferrite, 10uH, 0.690A, 0.299ohm, SMT | TDK Corporation | VLF403212MT-220M | 1 |
| 18 | R1, R2 | RES, 0 ohm, 5%, 0.25W, 1206 | Yageo America | RC1206JR-070RL | 2 |
| 19 | R3, R4 | RES, 0.1 ohm, 5%, 0.125W, 0805 | Panasonic | ERJ-6RSJR10V | 2 |

Table 2. Bill of Materials (continued)

| Item | Designator | Description | Manufacturer | Part Number | Quantity |
|------|---|-----------------------------------|--------------|------------------|----------|
| 20 | R5, R6 | RES, 3.01 ohm, 1%, 0.1W, 0603 | Vishay-Dale | CRCW06033R01FKEA | 2 |
| 21 | R7, R8 | RES, 1.0k ohm, 5%, 0.1W, 0603 | Vishay-Dale | CRCW06031K00JNEA | 2 |
| 22 | TP1 | Test Point, TH, Compact, Red | Keystone | 5005 | 1 |
| 23 | SH-J1, SH-J2, SH-J3, SH-J4, SH-J5, SH-J6, SH-J7, SH-J8, SH-J9, SH-J10 | Shunt, 100mil, Gold plated, Black | 3M | 969102-0000-DA | 10 |

5 USB2ANY Interface Board and I²C-Compatible Interface Program

Texas Instruments has created an I²C-compatible program and USB2ANY docking board that can help exercise the part in a simple way. This document describes how to use the USB2ANY docking board and interface software.

The LM3639A EVM has the means to connect the USB2ANY controller module which provides all the control signals to operate the evaluation module. Power to the EVM must be provided externally. A USB cable (provided) must be connected to the board from a PC.

The I²C-compatible interface program provides all of the control that the LM3639A part requires. For proper operation, the USB docking board should be plugged into the PC before the interface program is opened. Once connected, and the program is executed, a basic interface window will open.

5.1 EVM Setup

1. Plug in USB2ANY interface board into PC via USB cable and 10-pin Ribbon Cable into LM3639A EVM.
2. Connect Power Supply to LM3639A EVM. Use the Red and Black Banana Jacks. Ensure current limit is set to greater than 3A and that the voltage is set below 5.5V.
3. Unzip four GUI files (1 exe file, 3 DLLs) into a dedicated folder.
4. Run LM3639A_GUI_R1.0 application

5.2 LM3639A GUI

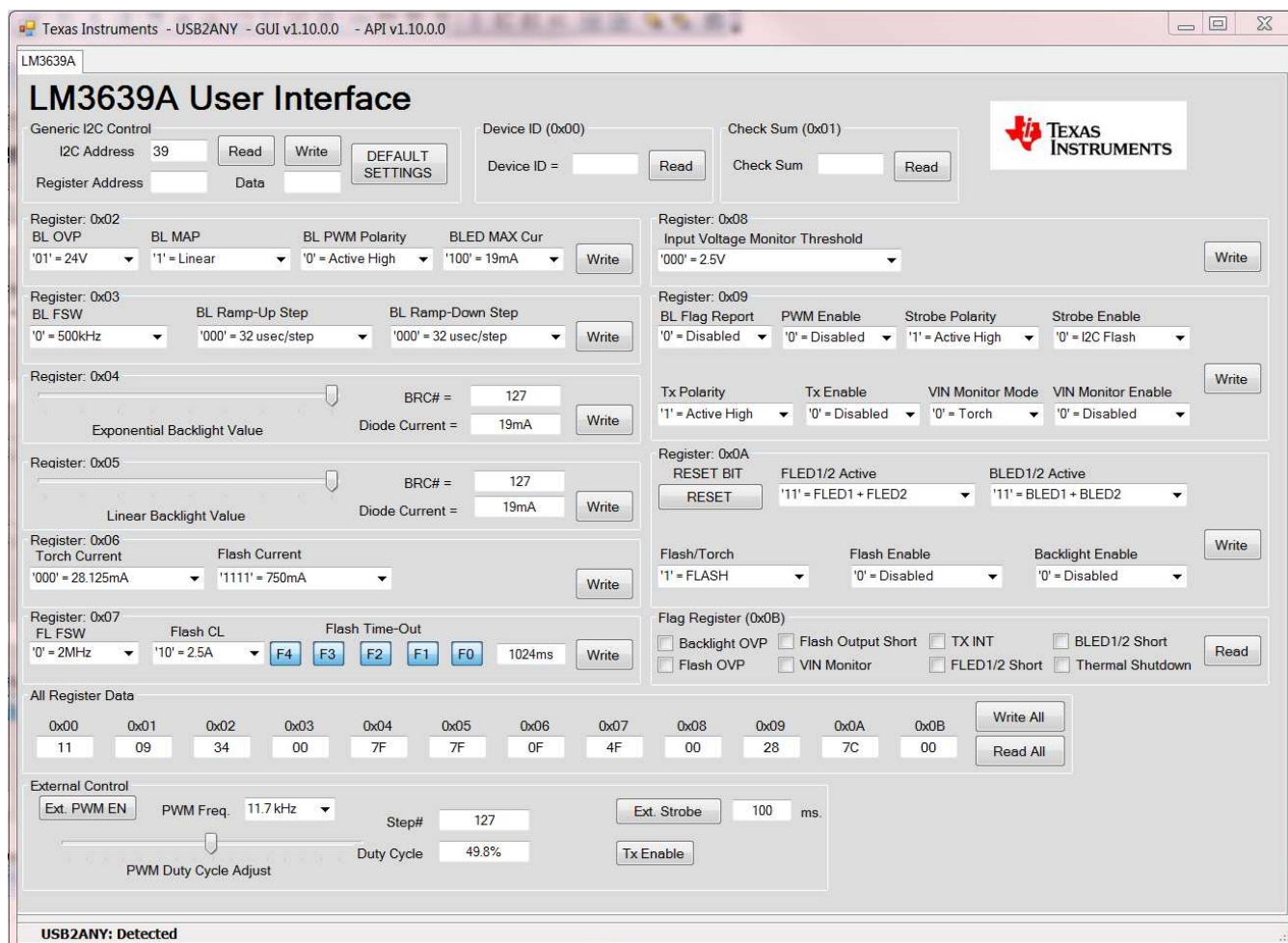
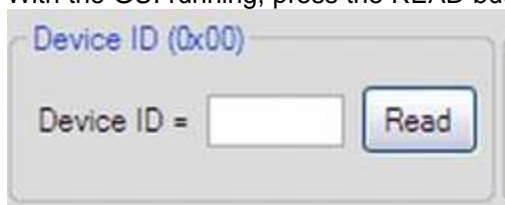
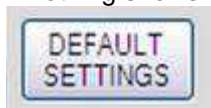


Figure 11. LM3639A General User Interface

1. With the GUI running, press the READ button next to the Device ID Box



- If communication is working, a 0x11 should appear in the box.
- If nothing shows up in the box, press the default settings button



and press YES

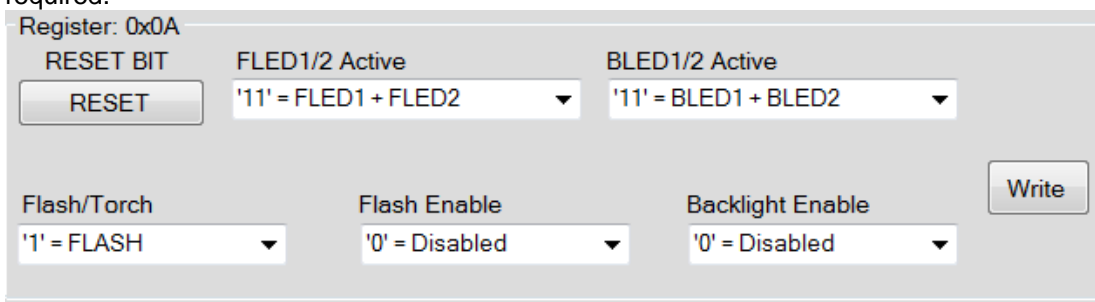


- Try to Read the Device ID again.

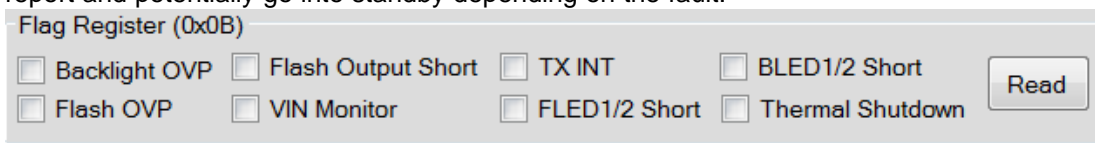
2. For General I2C Reads and Writes use the Generic I2C Control section



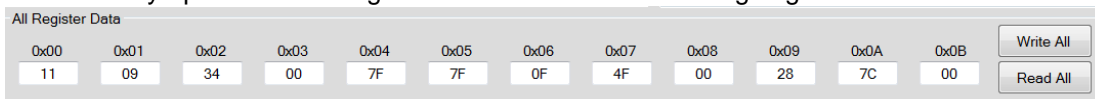
3. To adjust the setting on the LM3639A, Set desired conditions via the Drop Down Boxes, Slider Switches and Buttons found in each register section.
NOTE: The options selected in each register field are not written to the part until the Write Button Associated with each register is pressed.
4. To enable the LM3639A functions using the settings chosen, use of the Enable Register (0x0A) is required.



5. In the event of a fault condition, the Fault Register (0x0B) will report where the fault has occurred via a check box upon reading the register. Once the Fault Register has been read, the fault flags are cleared, and the LM3639A is allowed to try to restart. If the fault is still present, the LM3639A will again report and potentially go into standby depending on the fault.



6. Near the Bottom of the GUI, there are a series of fields available to allow fast I²C reads and writes to all accessible registers. Pressing the Write All button will write all the values stored in the field to the LM3639A. Pressing the Read All will load the fields with the contents found in the LM3639A Registers. Any time a field in this section changes (either via a Read All or a field enter for a Write), the GUI will automatically update the settings in the GUI to reflect what is going to be written or what was read.



7. To control the PWM, TX and STROBE input on the LM3639A, an External Control Interface is provided at the bottom of the GUI.



- (a) For External PWM, the user can select a Frequency and a Duty Cycle. Pressing the Ext. PWM EN button enables the PWM signal.
- (b) For External Strobe, the user can enter a strobe time and enable the Strobe via the Ext. Strobe Button
- (c) For an external TX interrupt, the user can enable the Tx Enable button to create a Tx clock.

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 this Product 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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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. 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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