

LM36010EVM User Guide

The Texas Instruments LM36010EVM evaluation module (EVM) helps designers evaluate the operation and performance of the LM36010 Synchronous-Boost Single-LED Driver with 1.5-A High-Side Current Source. The device offers configurability via I²C-compatible interface. It can be enabled in flash or torch mode via the I²C interface or externally using the STROBE pin. The module utilizes one LED (D1) mounted on the EVM.

The EVM contains one synchronous boost, single-LED flash driver (see Table 1).

Table 1. Device and Package Configurations

FLASH LED DRIVER	DEVICE	PACKAGE
U1	LM36010	0.35-mm pitch 8-pin DSBGA

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Trademarks

LaunchPad is a trademark of Texas Instruments. All other trademarks are the property of their respective owners.



1 Setup

This section describes the jumpers and connectors on the EVM as well as how to properly connect, set up, and use the LM36010EVM.

1.1 Input/Output Connector Description

VINL, GND (Banana Connectors) – These are the power input terminals for the driver and provide a power (VINL) and ground (GND) connection to allow the user to attach the EVM to a cable harness.

TP1 (Test Point) - This pin can be used to measure the input voltage VIN.

VINL, VIN (Jumper J2) – The user can monitor the inductor current and input current waveforms by omitting this jumper and using separate wires from the power supply to the VINL and VIN pins. This will remove the input capacitors from the inductor and eliminate their filtering effect to the inductor current.

STROBE (Jumper J3) – STROBE is an active high hardware flash enable. This pin can be used to monitor the STROBE signal.

PWM, **STROBE**, **GND** (Jumper J4) – This jumper 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 LM36010EVM. To externally drive this pin, either connect a control signal directly to the STROBE pin of the connector or place a jumper between the pins STROBE (J4<2>) and PWM (J4<1>). PWM can be configured as a timeadjustable voltage pulse via the General User Interface (GUI) software provided or can be driven externally using a function generator.

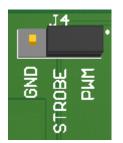


Figure 1. STROBE Jumper Settings

VOUT (Jumper J5) - This pin can be used to measure the output voltage.

VOUT, VLED (Jumper J6) – This jumper provides access to the regulated output of the driver and the output of the LED current sources. The user can measure VOUT with reference to GND, VLED with reference to GND, and current source headroom directly between VOUT and VLED.

GND (Jumpers J8, J9, and J10) - These are additional pins to connect to ground (GND).

VLED, D1A (Jumper J11) – Connect VLED (J11<1>) and D1A (J11<2>) to light the LED as it connects the LED output of the driver to the on-board anode of the flash LED.

VIO (Jumper J12) – This pin can be used to measure the VIO.

3.3V, VIO, VIN (Jumper J13) – This jumper provides pullup for the I²C lines (clock and data). VIO (J13<2>) can be connected to the 3.3-V pin (J13<1>) of the TI LaunchPadTM. Communication via the I²C interface may not be possible if the supply voltage to the LED driver is below approximately 3 V.



Figure 2. VIO Jumper Setting



LED Current Measurements, D1F, D1S, GNDS (Jumper J14) – The LM36010EVM provides a way to accurately measure the LED current through the LED on board. Resistor R4 (0.1 Ω) is placed between the cathode of LED (D1F) and ground. The user can first measure the resistor value accurately by first applying a known current through force pin (D1F) and ground and measuring the voltage between sense pin (D1S) and GNDS. Then, during normal flash or torch operation, the voltage measured across the resistor divided by the resistor value will equal the current through the resistor (or the LED).

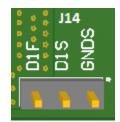


Figure 3. LED Current Measurements Jumper

SDA / SDK (Pins 9 and 10 on Launchpad) – These connections allow the user to externally control the I^2C lines.

1.2 EVM Configuration

Configuration of LM36010EVM jumpers is as shown in Figure 4.

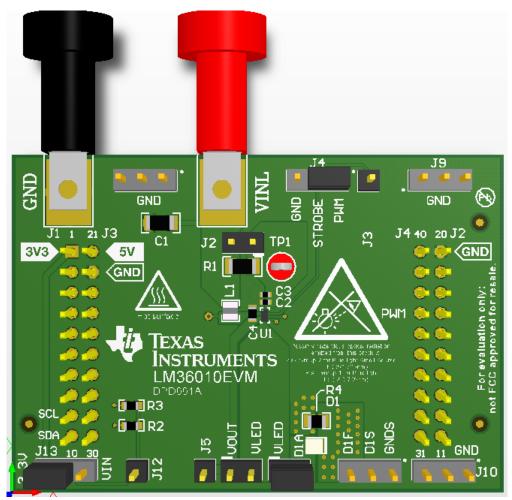


Figure 4. LM36010EVM Jumper Configuration

The input voltage range for the flash driver is 2.5 V to 5.5 V. The on-board LED or an LED module should be connected for proper operation.

The LM36010EVM dissipates power, especially during high current and long duration flash events. Power will also be dissipated on the flash LEDs. TI recommends that in order to prevent overheating, repeated flash events in very short time intervals is avoided. Special care must be taken with regards to thermal management when using time-out values greater than 500 ms.

The EVM layout is designed to minimize temperature rise during operation. Depending on the PCB layout, input voltage, and output current, it is possible to have the internal thermal shutdown circuit trip prior to reaching the desired flash time-out value. A warning is also placed on the EVM as a safety measure.



Figure 5. LED Warning

For proper operation of the LM36010EVM, the jumpers should be properly configured. The recommended setting using shorting blocks is:

- VIO (J13<2>) to 3.3 V (J13<1>) if TI Launchpad is used
- STROBE (J4<2>) to PWM (J4<1>) or external signal
- VLED (J11<1>) to D1A (J11<2>)

Texas Instruments has created LaunchPad (MSP432) and an I²C-compatible graphical user interface (GUI) that can help exercise the part in a simple way. A description of how to install and use the LaunchPad and the GUI is contained in Section 2 and Section 3.

The LM36010EVM has the means to "plug into" the LaunchPad BoosterPack connectors, which provide the control signals for the simple interface. Power to the part needs to be provided externally. A USB cable provided in LaunchPad MSP432 kit should be connected to the LaunchPad board from a PC as shown in Figure 6.



Figure 6. LM36010EVM Test Setup

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Software

2 Software

2.1 Setup Overview

- 1. Verify jumper configuration on the MSP-EXP432P401R LaunchPad and the LM36010EVM as in Figure 7 and Figure 4, respectively.
- 2. Connect the LM36010EVM to the MSP-EXP432P401R LaunchPad.
- 3. If using the MSP432 for the first time, install XDS110 drivers as in Section 2.2.
- 4. If the LM3601x GUI is not installed, refer to section Section 2.3.
- 5. Run the EVM software and select LM36010 button in the EVM selection pop-up window.
- If the LaunchPad is new or was used for another purpose, EVM software asks to update firmware, which can be done by clicking "FW Update" in the File menu on the top. EVM software restarts after updating firmware.
- 7. For LM36010EVM operation with the GUI, refer to Section 3.

2.2 MSP432 LaunchPad Installation

Configuration of MSP432 LaunchPad jumpers is as shown in Figure 7.

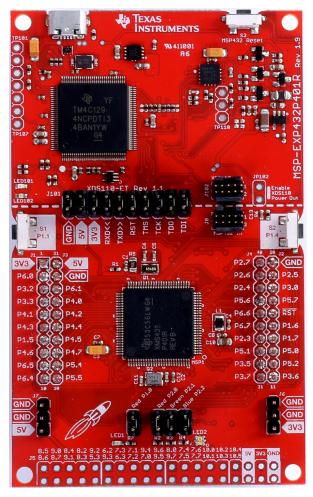


Figure 7. MSP432 LaunchPad Jumper Configuration



Driver XDS110 of the MSP432 LaunchPad must be installed to use the Texas Instruments LM36010 GUI. Go to XDS Emulation Software Package to download the driver. On the driver download website, click "3 XDS110 Reset Download" under Contents.

XDS Emulation Software Package



Figure 8. Driver Download Website (Part 1)

There are several versions to install depending on the computer's operating system. Choose the appropriate version for the computer.

XDS110 Reset Download

The XDS110 Reset utility provides board level reset (via nSRST pin) for the XDS110 debug probe. The software support is available for Windows XP, Windows 7, Linux (Ubuntu 12.04 & SUSE 11), and Mac OS X.

Release	Date	Release Notes	Download
6.0.228.0	April 29, 2016	Delta from last release:	Windows & Linux 32-bit & Linux 64-bit & Mac OS X &

Figure 9. Driver Download Website (Part 2)

Fill out the form for U.S government export approval.

U.S. Government export	
All fields are Required. Incomplete inforr	nation will be DENIED.
First name:	
Last name:	
Your email address:	
Your full company/university name:	
Country this file will be used in:	
What end-equipment/application will you	use this file for:
Military	
Civil	





Software

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At the end of the form, check "Yes" next to the statement "I CERTIFY ALL THE ABOVE IS TRUE". Then, click "Submit".

I certify that the following is true: (a) I understand that this Software/Tool/Document is subject to export controls under the U.S. Commerce Department's Export Administration Regulations ("EAR"). (b) I am NOT located in Cuba, Iran, North Korea, Sudan or Syria. I understand these are prohibited destination countries under the EAR or U.S. sanctions regulations (c) I am NOT listed on the Commerce Department's Denied Persons List, the Commerce Department's Entity List, the Commerce Department's General Order No. 3 (in Supp. 1 to EAR Part 736), or the Treasury Department's Lists of Specially Designated Nationals. (d) I WILL NOT EXPORT, re-EXPORT or TRANSFER this Software/Tool/Document to any prohibited destination, entity, or individual without the necessary export license(s) or authorization(s) from the U.S. Government. (e) I will NOT USE or TRANSFER this Software/Tool/Document for use in any entries of the entrie (f) I understand that countries other than the United States may restrict the import, use, or export of the Subject Product. I agree that we shall be solely responsible for compliance with any such import, use, or export restrictions. I / We hereby certify that we will adhere to the conditions above. I / We do not know of any additional facts different from the above. · I / We take responsibility to comply with these terms. · I / We understand we are responsible to abide by the most current. versions of the Export Administration Regulations and other U.S. export and ns laws. sanctio I CERTIFY ALL THE ABOVE IS TRUE: Yes . No O Submit Thank you, Texas Instruments

Figure 11. U.S. Government Export Approval (Part 2)

If everything is filled out properly, the user can gain access to the file. The zip file can be downloaded by clicking on "Download" or by going to the user's email.

TI Request

You have been approved to receive this file. Click "Download" to proceed.

In a few moments, you will also receive an email with the link to this file.

Download Having trouble downloading? Try www.ti.com/software-help Thank you, Texas Instruments

Figure 12. Driver Download (Part 1)



Save the driver zip file to any folder on the computer.

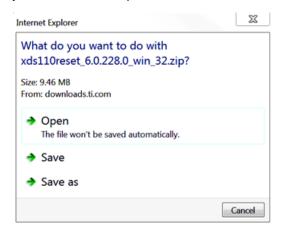


Figure 13. Driver Download (Part 2)

Organize Share with New folder				
Favorites Documents library Driver Downloads				
b Downloads 🟐 Recent Places	Name	Date modified	Туре	Size
Ap necent Places	👢 xds110reset_6.0.228.0_win_32.zip	7/21/2017 2:44 PM	Compressed (zipp	9,698 KB
🖉 🎬 Libraries				
Documents				
🛛 📗 My Documents				
🛛 👢 Public Documents				
🛛 🤳 Music				
> Spectrum				
🛛 🧕 Videos				

Figure 14. Driver Zip Folder

The zip file can then be extracted to any folder.

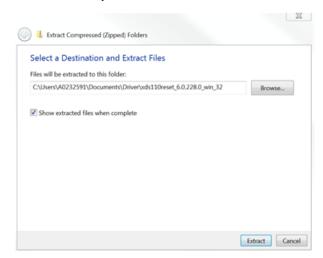


Figure 15. Extract Files

Software



Software

Click the folder to access the driver installation. In the folder, click "xdsdrivers-1.7.0.0-windows-installer.exe".

Favorites	Name	Date modified	Type	Size
💻 Desktop]]a Downloads	🗼 xds110reset_6.0.228.0_win_32	7/21/2017 2:50 PM	File folder	
🕵 Recent Places				
🚆 Libraries				
Documents				
Jusic Sciences				
J Videos				



→ Favorites	Name	Date modified	Туре	Size
E Desktop	libusb-1.0.dll	4/28/2016 7:47 AM	Application extension	105 K
👍 Downloads	💐 xds110drivers-1.7.0.0-windows-installer.e	xe 4/8/2016 3:21 PM	Application	11,245 k
laces Recent Places	JE xds110reset.exe	4/28/2016 7:43 AM	Application	97 1
Libraries				
Documents				
Jusic				
S Pictures				
Videos				

Figure 17. Driver Folder (Inside)

Once the driver setup is selected, a window appears as shown below. Click "Next" to proceed.

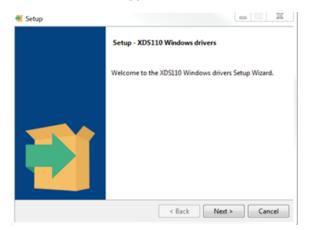


Figure 18. Driver Setup

Check "I accept the agreement" and click "Next" to proceed.



License Agreement	-	
Please read the following Li agreement before continuir	cense Agreement. You must accept the terms of this g with the installation.	
Texas Instruments Inco License Agreement	orporated	^
THIS IS A LEGALLY BIN AGREEMENT, YOU WILL BI TERMS OF THIS LICENSE	h lith, 2004) D THE FOLLOWING LICENSE AGREEMENT CAREFULLY. DING AGREEMENT. AFTER YOU READ THIS LICENSE E ASKED WHETHER YOU ACCEPT AND AGREE TO THE AGREEMENT. DO NOT CLICK I HAVE READ AND ARE AUTHORIZED TO ACCEPT AND AGREE TO THE	
	I accept the agreement	

Figure 19. Driver License Agreement

A default installation directory is already filled in the box, but it can be changed to the user's preferred location. When ready, click "Next".

		- 0	22
		-	
ctory where XDS110 W	indows drivers will be	installed.	
C:\ti		12	
	< Back	lext > Car	ncel
	ctory where XDS110 W C:\ti	ctory where XDS110 Windows drivers will be i	ctory where XDS110 Windows drivers will be installed.

Figure 20. Driver Installation Directory

Click "Next" again to begin the installation. However, a series of security windows appears to confirm the installation. Click "Install" for each window.

Setup			-	22
Ready to Install				
Setup is now ready to	begin installing XDS110 Wind	lows drivers on your	computer.	
stallBuilder				
		< Back Next	> Can	cel

Figure 21. Device Driver Installation (Part 1)



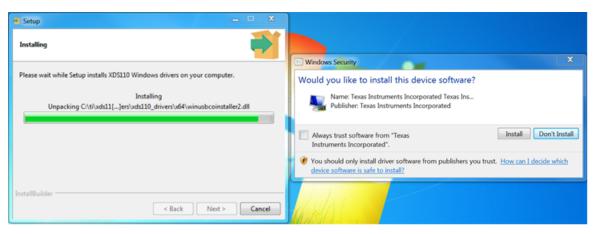


Figure 22. Device Driver Installation (Part 2)

In the end, a final window shows that the installation has completed. Click "Finish" to complete the installation process.

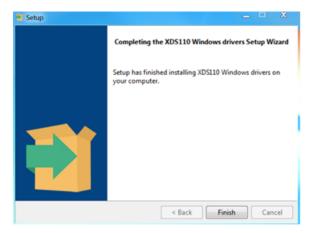


Figure 23. Device Driver Installation (Part 3)



2.3 EVM GUI Installation

LM36010 GUI is available to download from the TI website: LM3601xEVM GUI.

🕒 💽 📙 🕨 Ubraries 🕨	Documents + LM3061X +				
Organize • Share with	 New folder 				
★ Favorites ■ Desktop	Documents library				
) Downloads 🚓 Recent Places	Name setup_LM3601X_EVM_1.0.0.1701200.zip	Date modified 7/13/2017 3:28 PM	Type Compressed (zipp	Size 23,505 KB	
Computer Computer Computer					

Figure 24. EVM Software Zip File

The zip file to install the GUI can be downloaded into any folder.

	23
) 🧵 Extract Compressed (Zipped) Folders	
Select a Destination and Extract Files	
Files will be extracted to this folder:	
Users\A0232591\Documents\LM3061X\setup_LM3601X_EVM_1.0.0.1701200	Browse
Show extracted files when complete	
Show extracted lifes when complete	
	Extract Cancel

Figure 25. EVM Software Extract Files



Software

Click the extracted file to access the EVM software installation. If there are any security programs, allow the file to be added to the computer.

★ Favorites	Name	Date modified	Туре	Size
Desktop Downloads Recent Places	setup_LM3601X_EVM_1.0.0.1701200.exe	7/13/2017 3:39 PM	Application	25,187 KB
 Libraries Documents Music Pictures Videos 				
s Computer				
Network				

Figure 26. EVM Software Setup File

Once the file has been clicked, a window opens to install the EVM software. Click "Next" to proceed.

🧃 Setup		
Texas Instruments	Setup - LM36010 EVM	
	Welcome to the LM36010 EVM Setup Wi	zard.
- ¹⁶		
	< Back Next >	Cancel

Figure 27. EVM Software Setup Wizard

Check "I accept the agreement" and click "Next" to proceed.

🝯 Setup		
License Agreement		
Please read the following Lice agreement before continuing	ense Agreement. You must accept the ter g with the installation.	ms of this
SEE MANIFEST FOR ADDIT	IONAL OPEN SOURCE LICENSES	_ _
LM36010 EVM GUI License	25	
Source and Binary Code	Internal Use License Agreement	-
Do you accept this license?	 I accept the agreement I do not accept the agreement 	
InstallBuilder —	< Back Next	> Cancel

Figure 28. EVM Software License Agreement

A default installation directory is already filled in the box, but it can be changed to the user's preferred location. When ready, click "Next".

🍯 Setup				X
Installation Directory	,		€	
Please specify the dire	ctory where LM36010 EVM will be installed.			
Installation Directory	C:\Program Files (x86)\Texas Instruments\LM:	~		
InstallBuilder —	< Back Next	>	Can	cel

Figure 29. EVM Software Installation Directory



Software

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Click "Next" again to begin the installation. The window then shows the progress of the installation.

er.
t > Cancel

Figure 30. EVM Software Installation (Part 1)

🝯 Setup	
Installing	
Please wait while Setup installs LM36010 EVM on your computer.	
Installing	
Unpacking C:\Program []\LM36010 EVM\DSLite\common\us	cif\xdstrove.dll
InstallBuilder	
Sack Nex	t > Cancel

Figure 31. EVM Software Installation (Part 2)

After the installation is finished, the user has the option to open the program and create a shortcut on the Desktop. This step is optional. Click "Finish" to complete the installation process.





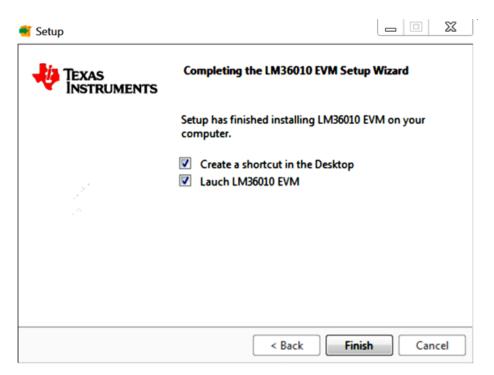


Figure 32. EVM Software Installation (Part 3)







3 GUI Operation

For proper operation, plug in the LM36010EVM and the LaunchPad to the computer before the GUI is opened. Once connected, and the program is executed, an EVM selection screen opens. Clicking on LM36010EVM leads to the appropriate GUI.



Figure 34. LM3601X Selection

A basic interface window opens with the default information view (Info). The status bar at the bottom of EVM software screen provides information regarding hardware connection status, I²C communication status, and software version. Once the EVM software is connected to the hardware and starts to communicate with the firmware of MSP432, "Hardware Connected" and the light blue sign is displayed.



Figure 35. Status Bar

There are three available views of main menu: "Info", "Register", and "Control". The components in each view are synchronized, so any changes performed in one view of menu are automatically updated in the others.



Figure 36. Menu

3.1 Information View

The Information View provides brief information of the LM36010EVM. For more detailed information, refer to the LM36010 data sheet.

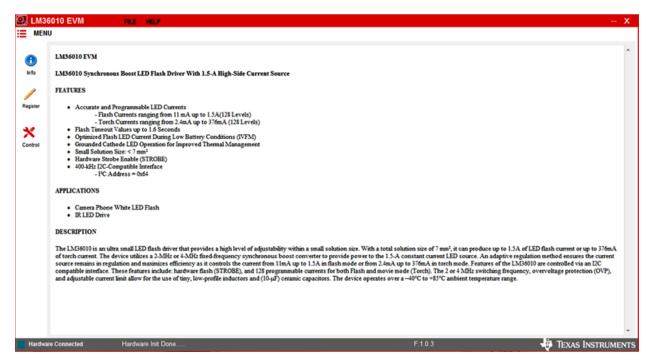


Figure 37. LM36010EVM Information View

3.2 Register View

The register view is shown when "Register" icon is clicked, and it provides the Register values, FieldView and Description fields. The user can enter the desired hex value to the registers in the "Value" column of Register values or in the "Value" column of FieldView, or can also perform a bit-wise configuration of any register fields by double-clicking on the corresponding register bit. "FieldView" displays the description of all fields of the selected register. Each register can be read independently or all registers can be read at once by utilizing the "Read" and "Read All" buttons, respectively.

The data is written to the register(s) in one of two ways, depending on the "Update Mode" field selection. In "Immediate" mode, the register data is written immediately following a "Value", an individual bit, or a "Value" change. In "Deferred" mode, the displayed data is written to all registers upon depression of the "Write" button. The "Read All" button can be pressed to read back all the registers, which updates the values on the table.

Register settings can be saved to text file format by selecting "Save Registers" from file menu. Text file format register settings file can be loaded and programmed automatically by selecting "Load Register" from file menu.



Save Load	Wrte	Read	Read	Al			Update	Mode Im	mediate	•	Field/Vew FieldName	Bits	RW	,
RegisterName	RegNo	RW Value	7	6	5	4	3	2	1	0	ivfm_levels	[7:5]	RW	0
User Registers											flash_time_out	[4:1]	RW	0
Enable_Mode	0x0001 F	RW 0x002	9 0	0	1	0	1	0	0	1	torch_ramp	[0]	RW	0
Config	0x0002 F	RW 0x002	9 0	0	1	0	1	0	0	1				
LED_Rash	0x0003 F	RW 0x002	9 0	0	1	0	1	0	0	1				
LED_Torch	0x0004 F	RW 0x002	9 0	0	1	0	1	0	0	1				
Rag	0x0005 F	R 0x002	9 0	0	1	0	1	0	0	1				
Device_ID	0x0006	RW 0x002	9 0	0	1	0	1	0	0	1				
											Description Flash Time-Out Duration 0000 = 40ms 0010 = 100ms 0011 = 150ms 0010 = 200ms 0100 = 200ms 0110 = 400ms 1011 = 600ms			

Figure 38. LM36010 Register View

3.3 Control View

The LM36010EVM GUI provides the user with access to all of the registers found on the device. The user can control these registers by clicking on "Control" on the left sidebar menu. Through a combination of buttons, drop-down boxes and sliders, the user can configure the LM36010EVM to perform in the desired mode. Unlike the Register View, the Control View only provides "Immediate" mode.

00 00 00 00 00 00 00 00 00 00	V Direct Access Reg(hex) 0x000 Read V Dsta(hex) 0x0000 Write	07 06 05 04	03 02 01 00 StrobePin 100 ms (min. 60ms) PNM 30 • Hz 50 0 • %
Control Log			
Enable(0x01)			
Boost Mode	Boost Freq Boost Current Limit		LED Flash Register 0x03
Normal		 Disabled 	Thermal Current Scale Back
Strate Type	Strobe Enable Node Bits		
Level Triggered	Disabled Standby	• Write	0 = Disabled 1 = Enabled If enabled, the LED current will decrease if TJ reaches XXX *C
]			
Configuration(0x02)			LED Flash Brightness Level
MFM Levels	Flash Time-Out Duration Torch Ramp		In flash mode, the LED current source (LED) provides 128 target current levels from 11 mA to 1500 mA. O
2.9V	• 600 ms • 1 ms	Wite	the flash sequence is activated the current source (LED) ramps up to the programmed flash current by ste
			through all current steps until the programmed current is reached. The headroom on the current source is
FLASH Brightness(0x03)		_	through all current steps until the programmed current is reached. The headroom on the current source is regulated to provide 11 mA to 1.5 A. When the dwice is enabled in flash node through the Enable Regist mode bits in the Enable Resister are cleared after a flash time-out event
FLASH Brightness(0x03) Themai Current		127	regulated to provide 11 mA to 1.5 A. When the device is enabled in flash mode through the Enable Regis
	LED Flash Brightness Level	127	regulated to provide 11 mA to 1.5 Å. When the device is enabled in flash mode through the Enable Regis mode bits in the Enable Register are cleared after a flash time-out event • 0000000 = 11 mA (Default)
Thermal Current	LED Flash Brightness Level		regulated to provide 11 mA to 1.5 Å. When the device is enabled in flash mode through the Enable Regis mode bits in the Enable Register are cleared after a flash time-out event 0000000 = 11 mA (Default)
Thermal Current Scale Beck			regulated to provide 11 mA to 1.5 Å. When the device is enabled in flash mode through the Enable Regis mode bits in the Enable Register are cleared after a flash time-out event 0000000 = 11 mA (Default)
Thermal Current Scale Beck	LED Flash Brightness Level		regulated to provide 11 mA to 15 Å. When the device is enabled in flash mode through the Enable Regis mode bits in the Enable Register are cleared after a flash time-out event 0000000 = 11 mA (Default) 0111111 = 750 mA
Thermal Current Scale Book Enabled	LED Flash Brightness Level		regulaited to provide 11 mA to 1.5 Å. When the device is enabled in flash mode through the Enable Regis mode bits in the Enable Register are cleared after a flash time-out event 0000000 = 11 mA (Default) 0111111 = 750 mA 1111111 = 750 mA 1111111 = 7.5 mA
Thermal Current Scale Book Enabled	LED Flash Brightness Level		regulaited to provide 11 mA to 1.5 Å. When the device is enabled in flash mode through the Enable Regis mode bits in the Enable Register are cleared after a flash time-out event • 0000000 = 11 mA (Default) • 0111111 = 750 mA • 0111111 = 750 mA • 0111111 = 7.5 A Device D (\$206)
Thermal Current Scale Book Enabled	LED Flash Brightness Level		regulaited to provide 11 mA to 1.5 Å. When the device is enabled in flash mode through the Enable Regis mode bits in the Enable Register are cleared after a flash time-out event 0000000 = 11 mA (Default) 0111111 = 750 mA 1111111 = 750 mA 1111111 = 7.5 mA
Thermal Current Scale Back Esabled Torch Brightness(0xC4)	LED Flash Brightness Level		regulated to provide 11 mA to 1.5 Å. When the device is enabled in flash mode through the Enable Regis mode bits in the Enable Register are cleared after a flash time-out event 0000000 = 11 mA (Default) 0111111 = 750 mA 11111111 = 750 mA Device D (bx08)
Thermal Current Scale Beck Enabled Torch Brightness(0xC4)	LED Flash Brightness Level		regulated to provide 11 mA to 1.5 Å. When the device is enabled in flash mode through the Enable Regis mode bits in the Enable Register are cleared after a flash time-out event 0000000 = 11 mA (Default) 0111111 = 750 mA 11111111 = 750 mA Device D (bx08)
Thermal Current Scale Back Esabled Torch Brightness(0xC4)	LED Flash Brightness Level		regulated to provide 11 mA to 1.5 Å. When the device is enabled in flash mode through the Enable Regis mode bits in the Enable Register are cleared after a flash time-out event 0000000 = 11 mA (Default) 0111111 = 750 mA 11111111 = 750 mA Device D (bx08)

Figure 39. LM36010EVM Control View

3.3.1 I2C Interface Fields

The I²C Interface fields can be used to write or read any LM36010EVM register.

20			Direct Access			
12C 12C	0x64	-	Reg(hex)	0x000	Read 07 06 05 04 03	07 06 05 04 03 02 01 00
	400kHz	•	Data(hex)	0x0000	Write	

Figure 40. I2C Interface Fields

3.3.2 Control Panel

The Control Panel provides easy ways to control registers and pin values. There are two tabs available in the Control Panel: "Control" and "Log". The left side of these tabs contains the controls for the corresponding block of the LM36010EVM. The right side contains data log information.

The LM36010EVM has two main modes for testing: **Flash** and **Torch**. Both of them can be controlled on the Control Panel.

To produce a flash from the LED, the user can select **Flash** mode in the "Mode Bits" Options. Under "Configuration (0x02)", the flash duration can be changed. Under "FLASH Brightness (0x03)", the LED flash brightness level can either be adjusted with the scale or be written in the field provided. The max brightness code is 127, corresponding to 1.5 A. Once the settings are adjusted, the user can press the "Write" button to see the flash. Note that the LM36010EVM automatically switches to **Stand-by** mode after the **Flash** event.

- 2C		DirectAccess	
	0x64	 Reg(hex) 0x003 Read 	StrobePin 100 ms (min. 60ms)
	400kHz	Data(hex) 0x00FF Write Data(hex) 0x00FF	Restart GUI
Cont	trol Log		
E	nable(0x01)		
	Boost Mode	Boost Freq Boost Current Limit IVFM	Register 0x01
11	Normal		P. 1111
1	Strobe Type	Strobe Enable More Bits	Flash Mode
1	Level Triggered	Disabled	In flash mode, the LED current source (LED) provides 128 target current levels from 11 mA to 1500 mA. One
		Standby	the flash sequence is activated the current source (LED) ramps up to the programmed flash current by step through all current steps until the programmed current is reached. The headroom on the current source is
Co	infiguration(0x02)	R Drive Tarch	regulated to provide 11 mA to 1.5 A. When the device is enabled in flash mode through the Enable Registe
1	VFM Levels	Flash Time-Out Duratio Flash	mode bits in the Enable Register are cleared after a flash time-out event
	2.9 V	• 600 ms • 1 ms • Write	Torch Mode
FL	ASH Brightness(0x03)		In torch mode, the LED current source (LED) provide 128 target current levels from 1.954 mA to 358 mA. Th
		LED Flash Brightness Level 127	Torch current is adjusted via the LED Torch Brightness Register. Torch mode is activated by the Enable Register (setting M1, M0 to 10). Once the TORCH sequence is activated the active current source (LED) rate
	Scale Back	0	up to the programmed Torch current by stepping through all current steps until the programmed current is
	Enabled 👻	1500.00mA 0x007F Write	reached. The rate at which the current ramps is determined by the value chosen in the Timing Register
-	rch Brightness(0x04)		IR Mode
10		LED Torch Brightness Level 0	
			Device ID (0x06)
		2.4mA 0x0000 Write	SW Reset Device ID 0x0000 Silicon Revision 0x0000
Fie	egs(0x05)		
	Read Pol	oling	
1.1.61	OVP Fault	MFM Trip Vout/Vied Short Current Limit	Thermal Current Scale-Back Thermal Shut Down UVLO Flash Time-Out

Figure 41. Flash Settings

To produce torch from the LED, the user can select **Torch** mode in the "Mode Bits" Options. Under "Torch Brightness (0x04)", the LED torch brightness level can be adjusted either with the scale or be written in the field provided. The maximum brightness code is 127. Once the settings are adjusted, the user can press the "Write" button to see the torch. LM36010EVM remains in **Torch** mode until it is switched to another mode.

GUI Operation



6010 EVM FILE HELP U Direct Access Reptext Direct Access Reptext 0.000 Read 0.7 06 05 04 03 0 20 0x64 U Data(hex) 0x000 Write 0.7 06 05 04 03 0 control Log Data(hex) 0x0000 Write 0.7 06 05 04 03 Control Log Enable(0x01) Boost Freq Boost Current Limit NFM Disabled U Strobe Type Strobe Type Strobe Table U U Toron U VMIL Levels Flash Time-Out Dura Roma U Toron U FLASH Brightness(0x03) Flash Brightness Level 0 0 U Thermal Current LED Flash Brightness Level 0 0 U State Back	Image: StrokePn 100 ms (mn. 60ms) Restart GUI Image: StrokePn 00 ms (mn. 60ms) Restart GUI Image: StrokePn 00 ms (mn. 60ms) Restart GUI Config Register 0x02 The LM36010 has the ability to adjust the flash current based upon the voltage level present at the IN pin ublicing the input voltage flash monitor (IVFM). The adjustable threshold IVFM-D ranges from 2.9 V to 3.6 V in 100-mV steps. The Flags2 Register has the IVFM flag bit set when the input voltage crosses the IVFM-D value. 000 = 2.9 V (Default) 001 = 3 V 010 = 3.1 V 010 = 3.3 V 100 = 3.3 V 101 = 3.4 V 100 = 3.5 V 101 = 3.4 V
Torch Brightness(0x04) LED Torch Brightness Level 0 0 0 0 2.4mA 0x00000 Write	110 = 5.5 V 111 = 3.6 V Device ID (0x00) SW Reset Device ID 0x0000 Silicon Revision 0x0001
Fags(bx05) Poling OVP Fault NFM Trip Vout/Ved Short Current Limit Th	hermal Current Scale-Back Thermal Shut Down UVLO Flash Time-Out

Figure 42. Torch Settings

Note that no data is written to the device until the "Write" button found within the corresponding register is pressed.

Control Log					
Enable(0x01)					
Boost Mode	Boost Freq	Boost Current Limit	IVFM		
Pass Mode Only	▼ 4 MHz ▼	1.9A 👻	Disabled 👻		
Strobe Type	Strobe Enable	Mode Bits			
Level Triggered	Disabled	Standby -	Write		
Configuration(0x02)			_		
IVFM Levels	Flash Time-Out Dura	tion Torch Ramp			
3.6 V	✓ 1600 ms	✓ No Ramp	✓ Write		
FLASH Brightness(0x03)					
	ED Flash Brightness Lev	vel	0		
Scale Back	D		_		
Disabled -	×	11mA 0x0	0000 Write		
Torch Brightness(0x04)					
	ED Torch Brightness Lev	vel	0		
	0		_		
	Ţ	2.4mA 0x0	0000 Write		

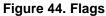
Figure 43. Write Buttons



3.3.3 Flags

The contents of the LM36010 fault registers are read upon clicking the "Read Flags" button. The registers are cleared upon read back.

Flags(0x05)							
Read	Polling						
OVP Fault	IVFM Trip	Vout/Vied Short	Current Limit	Thermal Current Scale-Back	Thermal Shut Down	UVLO	Flash Time-Out



3.3.4 I/O Pin Controls

The LM36010 provides the user with the capability to control the STROBE input without the need of an external supply. The "StrobePin" button toggles the STROBE pin high for the duration entered in the field next to the button. The "PWM" button along with the frequency and duty cycle fields generate a continuous pulse train that can be used to generate a current pulse pattern on the enabled LED.

StrobePin	100		ms	s)		
PWM	30	•	Hz	50.0	•	%

Figure 45. I/O Pin Controls

GUI Operation



Schematic

www.ti.com

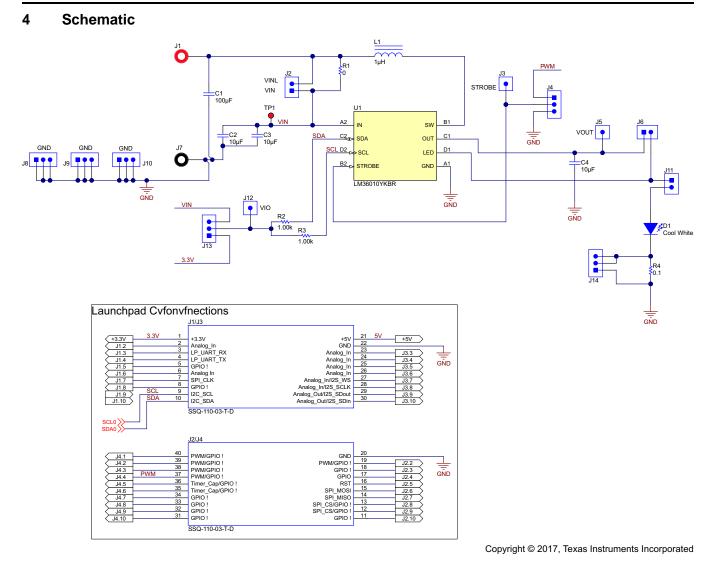


Figure 46. LM36010EVM Schematic

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5 Board Layout

Figure 47, Figure 48, and Figure 49 show the board layout for the LM36010EVM. The EVM offers resistors, capacitors, and jumpers to enable the device and to configure it as desired.

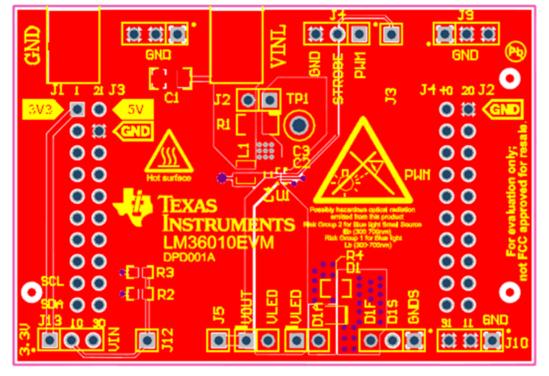


Figure 47. Top Assembly Layer

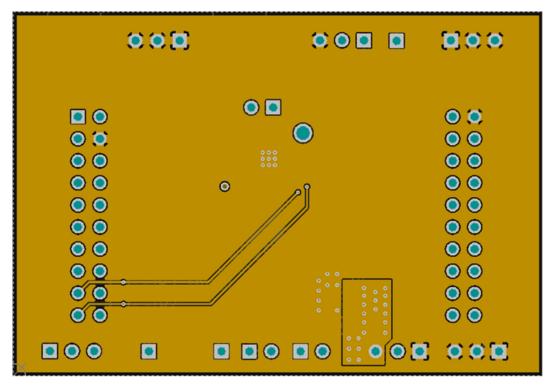


Figure 48. Middle Layer 1 Routing

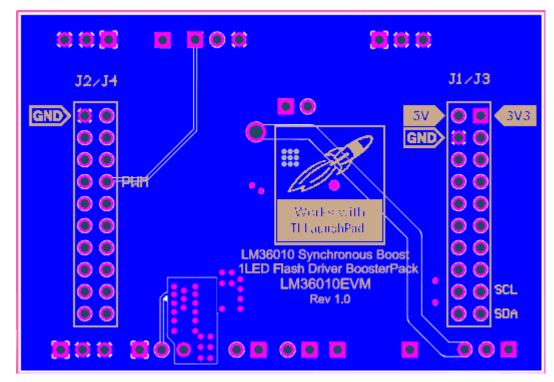


Figure 49. Bottom Assembly Layer (UNMIRRORED)



6 LM36010EVM Bill of Materials

Designator	Quantity	Value	Description	Package Reference	PartNumber	Manufacturer	Alternate PartNumber	Alternate Manufacturer
IPCB1	1		Printed Circuit Board		DPD001	Any	-	-
C1	1	100uF	CAP, CERM, 100uF, 6.3V, +/-20%, X5R, 1206	1206	GRM31CR60J10 7ME39L	MuRata	-	-
C2	1	10uF	CAP, CERM, 10uF, 6.3V, +/-20%, X5R, 0402	402	CL05A106MQ5N UNC	Samsung		
C4	1	10uF	CAP, CERM, 10 µF, 25 V, +/- 20%, X5R, 0603	603	GRM188R61E10 6MA73D	MuRata		
D1	1	Cool White	LED, Cool White, SMD	2.04x0.7x1.64m m	LXCL-EYW4	Philips Lumileds		
J1	1		Standard Banana Jack, Insulated, Red	6091	6091	Keystone		
J1/J3, J2/J4	2		Receptacle, 2.54mm, 10x2, Tin, TH	10x2 Receptacle	SSQ-110-03-T-D	Samtec	CRD-081413-A- G	Major League Electronics
J2, J6, J11	3		Header, 100mil, 2x1, Gold, TH	2x1 Header	TSW-102-07-G- S	Samtec		
J3, J5, J12	3		Header, 100mil, 1pos, Gold, TH	Testpoint	TSW-101-07-G- S	Samtec		
J4, J8, J9, J10, J13, J14	6		Header, 100mil, 3x1, Gold, TH	Header, 100mil, 3x1, TH	HTSW-103-07- G-S	Samtec		
J7	1		Standard Banana Jack, Insulated, Black	6092	6092	Keystone		
L1	1	1uH	Inductor, Shielded, Metal Composite, 1 µH, 2.6 A, 0.058 ohm, SMD	1.6x2mm	DFE201610P- 1R0M=P2	MuRata Toko		
R1	1	0	RES, 0, 5%, 0.25 W, 1206	1206	RC1206JR- 070RL	Yageo America		
R2, R3	2	1.00k	RES, 1.00 k, 1%, 0.1 W, 0603	603	CRCW06031K00 FKEA	Vishay-Dale		
R4	1	0.1	RES, 0.1 ohm, 5%, 0.125W, 0805	805	ERJ-6RSJR10V	Panasonic	-	-
SH-J1, SH-J2, SH-J3	3	1x2	Shunt, 100mil, Flash Gold, Black	Closed Top 100mil Shunt	SPC02SYAN	Sullins Connector Solutions		
TP1	1	Red	Test Point, TH, Compact, Red	Keystone5005	5005	Keystone	-	-
U1	1		Synchronous Boost LED Flash Driver with 1.5-A High-Side Current Source, YKB0008AGAG (DSBGA-8)	YKB0008AGAG	LM36010YKBR	Texas Instruments		Texas Instruments
C3	0	10uF	CAP, CERM, 10uF, 6.3V, +/-20%, X5R, 0402	402	CL05A106MQ5N UNC	Samsung		
FID1, FID2, FID3	0		Fiducial mark. There is nothing to buy or mount.	Fiducial	N/A	N/A		

Table 2. Bill of Materials

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