Getting started with the STEVAL-LLL014V1 kit based on ALED7709 LED driver

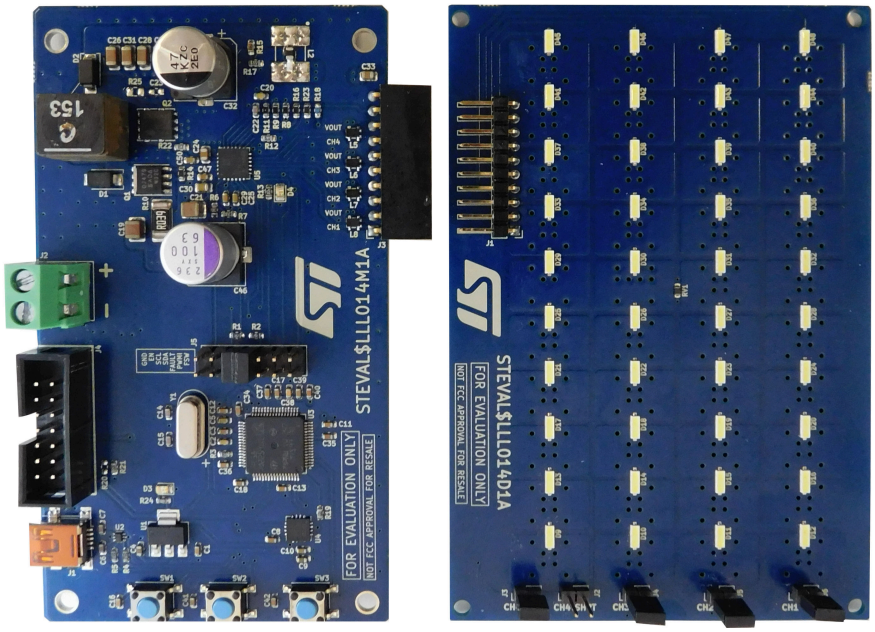
Introduction

The STEVAL-LLL014V1 is a four LEDs strings evaluation kit based on the ALED7709 LED driver

This kit consists of :

- a control board (STEVAL-LLL014M1), based on the ALED7709 LED driver and SPC582B60E1 microcontroller
- a LED board (STEVAL-LLL014D1) hosting the KW DPLS33.KD OSRAM LEDs and Murata NTC

Figure 1. STEVAL-LLL014V1



1 Overview

The STEVAL-LLL014V1 consists of:

- a four LED strings board (STEVAL-LLL014D1)
- a control board (STEVAL-LLL014M1) based on the ALED7709 LED driver.

The ALED7709 is an automotive LED driver (AEC-Q100 Grade1 qualified), it is connected in boost topology and controlled by the MCU SPC582B60E1.

The ALED7709 includes a DC/DC controller usable as boost or SEPIC, and four low-side constant-current sinks. The benefit of having the DC/DC controller integrated with the LED sinks is the possibility of adapting the output voltage for the different LED conditions. This minimizes the power dissipation of the LED driver and therefore increases overall efficiency. The SPC582B60E1 is a 32bit automotive grade microcontroller used to control the ALED7709 via the I²C interface.

The STEVAL-LLL014V1 can be configured and controlled with the STSW-LLL014GUI SW.

The kit is designed in the way that ALED7709 can be disconnected from the on board MCU opening all J5 jumpers. J5 can be used as the input connector for any other I²C system.

ALED7709 is suitable to support automotive lighting and backlight applications; like cluster/infotainment display, head-up display (HUD), instrument lighting system, or ambient light.

The ALED7709 can operate from a DC supply voltage between 4.5V to 42V. The input divider on the EN pin has been set to block the converter functionality below 6V showing the double threshold capability.

The STEVAL has been optimized for a switching frequency of 400KHz set through an external resistor. The switching frequency can be adjusted/synchronized using the FSW signal generated by MCU or supplied from an external source.

Switching frequency can be also derived from the internal oscillator properly setting the BOOSTCFG register.

The spread spectrum can be enabled or disabled for both configurations to reduce the electromagnetic emission. Another way to keep under control the emission is to enable the phase-shift for the PWM dimming. To avoid a large current peak absorbed, phase shift can delay each channel by a quarter of the PWM period.

Dimming can be controlled in different ways:

- by I²C registers, by PWMI signal, or using both at the same time
- using digital dimming and/or analog dimming as independent control, or using the mixed PWM and analog defined by ALED7709

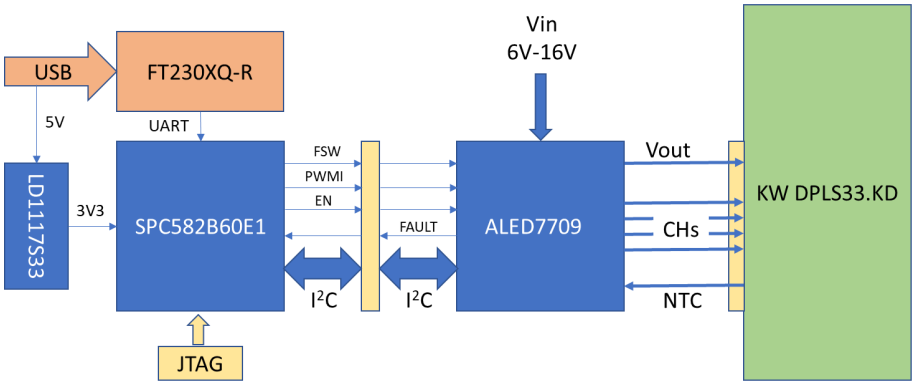
Using the appropriate register setting, it is possible to dim all the channels at the same level (global dimming) or each one independently (local dimming).

STEVAL-LLL014D1 includes jumpers to create OPEN and/or SHORT faults to check the autodisconnect feature. This can be enabled or disabled in the FMCFG register.

The maximum current per channel has been set to 150mA to give enough margin to the LED used in STEVAL-LLL014D1. The current can be reduced acting on the GAIN registers. While to increase the value up to 200mA, the maximum supported by ALED7709, it is necessary to change the R12.

STEVAL-LLL014D1 has an NTC to allow ALED7709 keeping under control the LED temperature. This feature can be enabled or disabled in the OUTCFG register.

Figure 2. STEVAL-LLL014V1 Block diagram



2 Get started with the board

Join the STEVAL-LLL014D1 to the STEVAL-LLL014M1 (with STSW-LLL014FW on board) through the connector J3.

Connect a mini-USB cable between the PC and the connector J1.

Apply the power supply V_{IN} to the connector J2; a power supply capable of at least 6A is required.

Figure 3. STEVA-LLL014M1 connectors

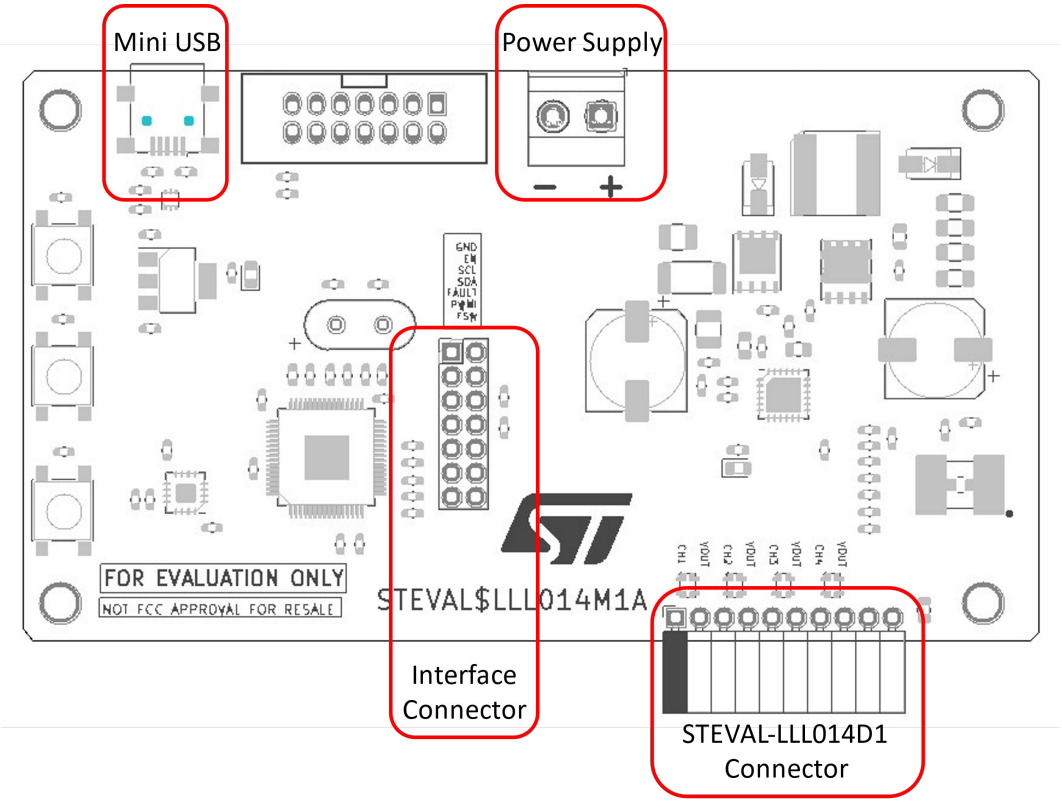


Table 1. Connectors description

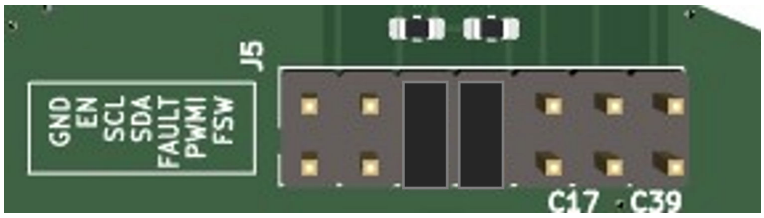
Mini USB (J1)		STEVAL-LLL014D1 connector (J3)	
1	V_{BUS}	1	CH1: Cathode LED string
2	D-	2	CH1: Anode LED string
3	D+	3	CH2: Cathode LED string
4	GND	4	CH2: Anode LED string
		5	CH3: Cathode LED string
Power supply (J2)		6	CH3: Anode LED string
1	Positive terminal of power supply: V_{IN} (typ. 12 V)	7	CH4: Cathode LED string
2	Negative terminal of power supply: GND	8	CH4: Anode LED string
		9	NTC connection
Interface connector (J5)		10	GND
1	GND		
2	GND	**JTAG connector (J4)**	
3	Enable signal from MCU	1	TDI

Mini USB (J1)		STEVAL-LLL014D1 connector (J3)	
4	Enable signal to ALED7709	2	GND
5	SCL from MCU	3	TDO
6	SCL to ALED7709	4	GND
7	SDA from MCU	5	TCK
8	SDA to ALED7709	6	GND
9	FAULT signal to MCU	7	N.C.
10	FAULT signal from ALED7709	8	N.C.
11	PWMI signal from MCU	9	NRST
12	PWMI signal to ALED7709	10	TMS
13	FSW signal from MCU	11	3V3
14	FSW signal to ALED7709	12	GND
		13	N.C.
		14	JTNRST

The connector J4 is dedicated to SPC582B60E1, it allows users to update the firmware if needed, or to develop a specific code. The three buttons on the STEVAL-LLL014M1 have been added as usable resources for firmware developers.

Be sure to have closed at least the two I²C jumpers on the connector J5, as shown in the figure below.

Figure 4. SCL and SDA jumpers on J5 connector



STSW-LLL014GUI communicates to the STEVAL boards using a USB port. FTDI VCP drivers (https://ftdichip.com/) need to be installed on a Windows 10 PC/laptop.

Connect the mini-USB cable from a PC to the STEVAL-LLL014M1 board then run the GUI launching the file STSW-LLL014GUI.exe.

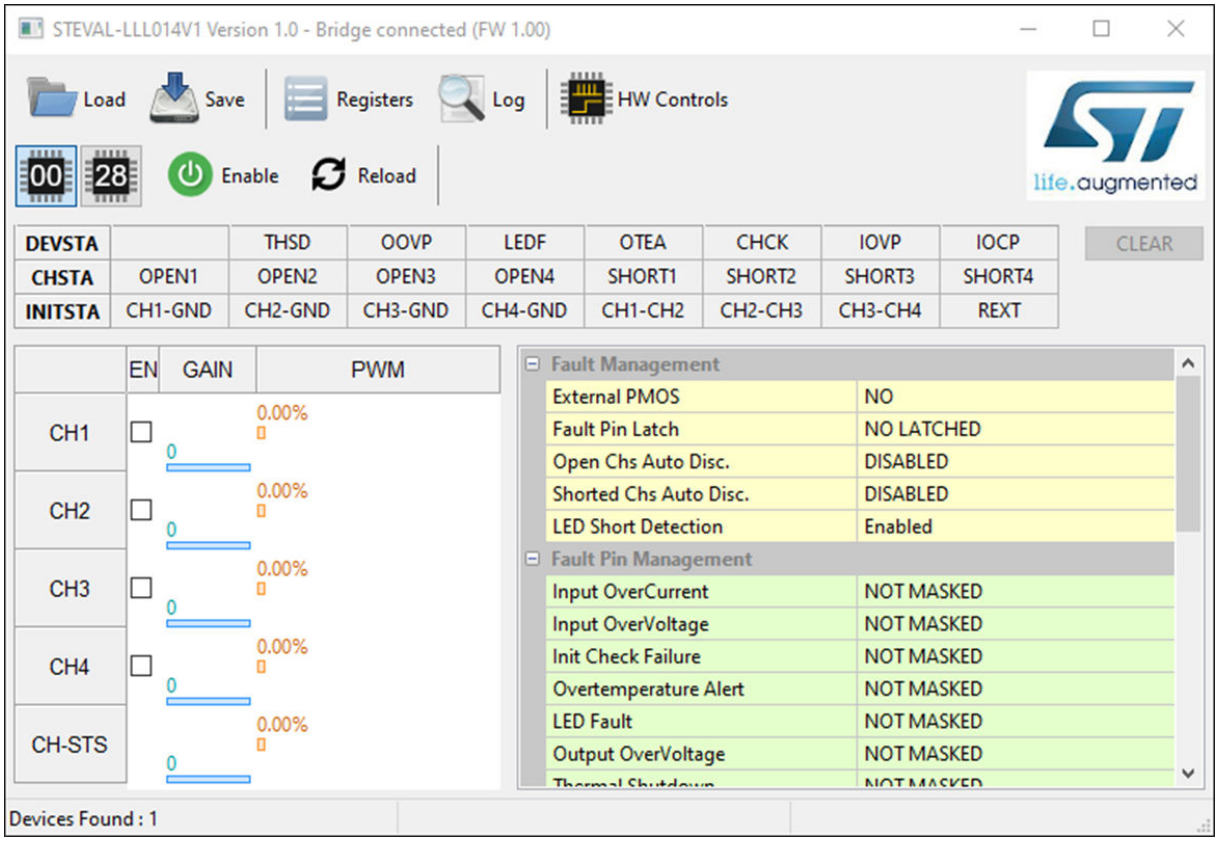
If the board is not yet connected to the PC, on the upper bar appears the indication “No Bridge connected” and only the “00” device icon is present.

When the connection is established, a new “28” device icon appears. The bridge status changes to “Bridge connected (firmware x.y)”; where x.y is the revision number of firmware loaded inside the MCU. It acts as bridge/interpreter for the communication to ALED7709.

On the upper bar, there is also the indication of the STSW-LLL014GUI version.

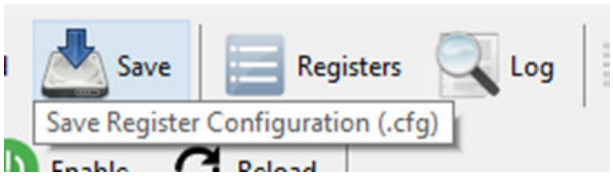
The graphical user interface appears as per the figure below:

Figure 5. **STSW-LLL014GUI main window**



The STSW-LLL014GUI supports the pop-up help, each time the mouse moves on a button a pop up appears to provide a short description.

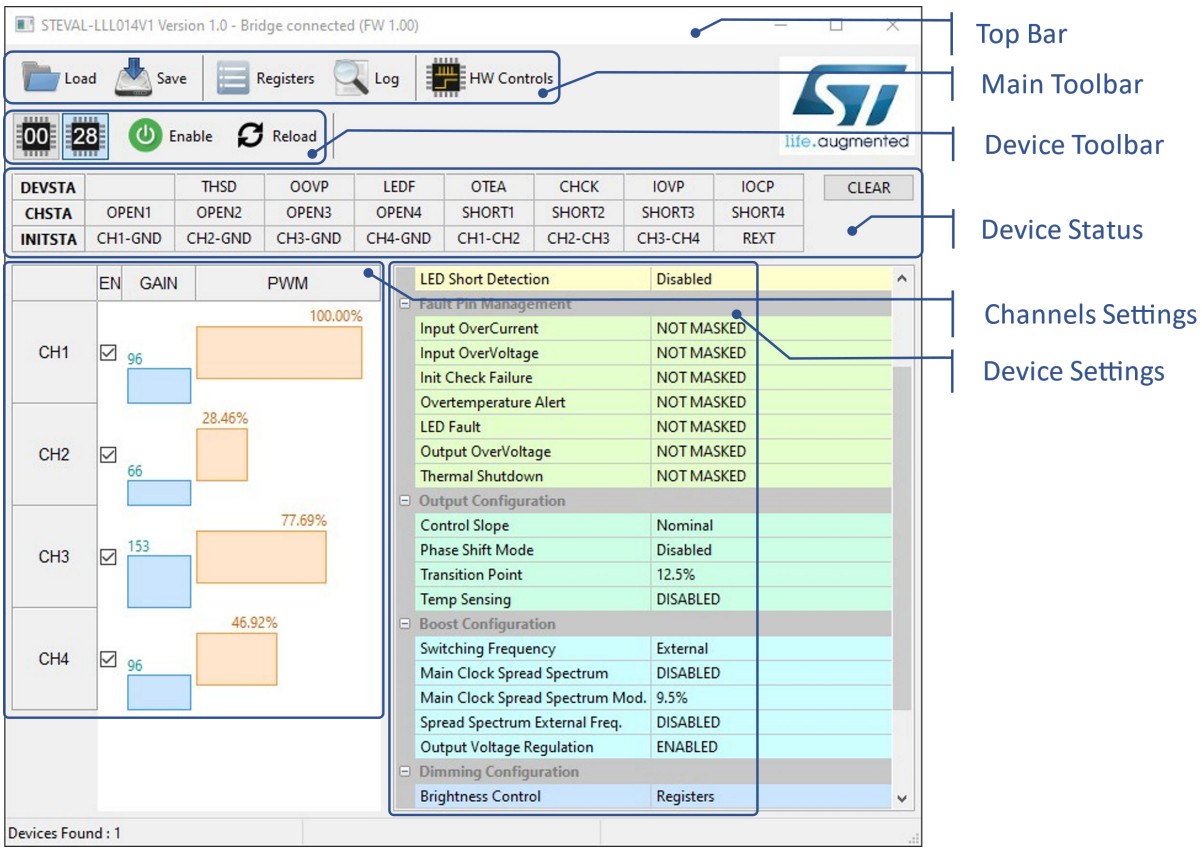
Figure 6. **Pop up example**



3 GUI usage

The main window can be divided into different sections that are detailed in the following paragraphs.

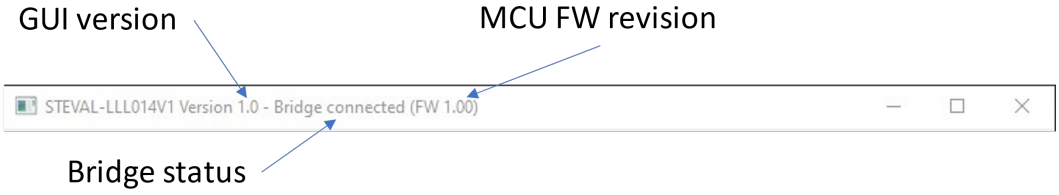
Figure 7. Main window sections



3.1 Top bar

Top bar reports the STSW-LLL014GUI version, the board connection status, and the firmware revision.

Figure 8. Top bar



3.2 File management

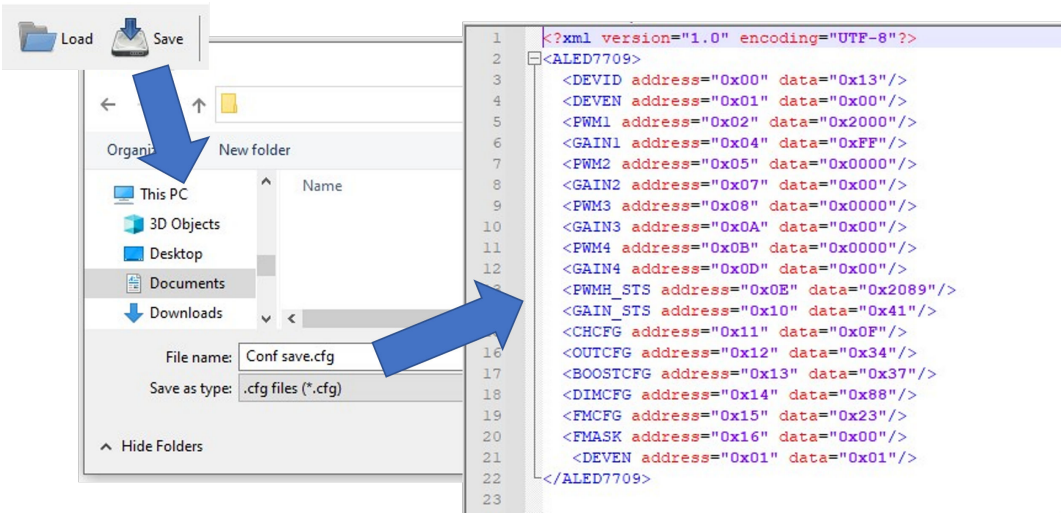
This section includes two buttons: Load and Save.

Save allows storing the configuration of the device in a file. It opens a dialog box to input the file name and to choose the folder where to save it; the default file extension used is .cfg.

Load opens a dialog box as well to locate the wanted configuration file, clicking on the **Open** button the file content is applied to the device.

Note: With the STSW-LLL014GUI package there are a couple of configuration file (Default_Global.cfg and Default_Local.cfg). They can be loaded for the STEVAL-LLL014V1 quick startup. After having loaded one .cfg file into the selected device, press the Enable button to get the LEDs ON.

Figure 9. File configuration manager and example of configuration file



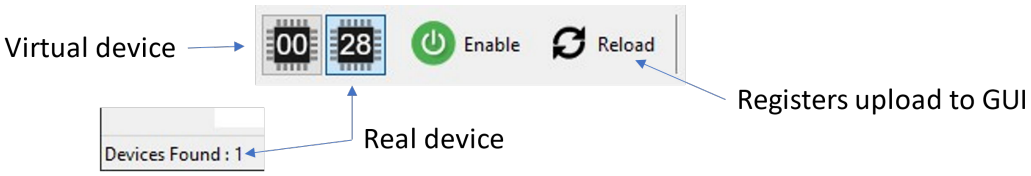
3.3 Device toolbar

The indication “Bridge connected” into the top bar confirms that a STEVAL-LLL014M1 board is properly connected and recognized.

Once the communication is established, the GUI checks the ALED7709 presence. As soon as the device replies to the inquiry:

- the message “Devices Found: 1” is displayed on the bottom left corner of the GUI window
- the device button “28” is shown on the device toolbar.

Figure 10. Device toolbar buttons and device presence message



VIRTUAL device button **“00”** is always present and selectable, even without a board connected. This selection, as the name suggests, is a simulated device on virtual memory and does not use any external communication. It allows playing with the GUI and creating a configuration that can be saved in a file. This file can be loaded into any device, once available.

Pressing the button **“28”** the I²C address is acquired by the GUI. The content of the ALED7709 registers is loaded into the GUI memory and the Main window is updated as consequence. Optionally, the uploading process can be forced anytime by pressing the **Reload** button.

Enable button sets and resets the DEN bit in the DEVEN register. This brings the ALED7709 in operational mode from standby and vice versa.

3.4 Device status

The “Device status” section shows the content of the status registers: DEVSTA, CHSTA, and INITSTA. Whose content can be reset by clicking on the **CLEAR** button. In case the reported FAULT is still present, the information is immediately set again.

Figure 11. **Device status indication and Clear button**

For detailed explanation of each bit, please refer to the ALED7709 datasheet.

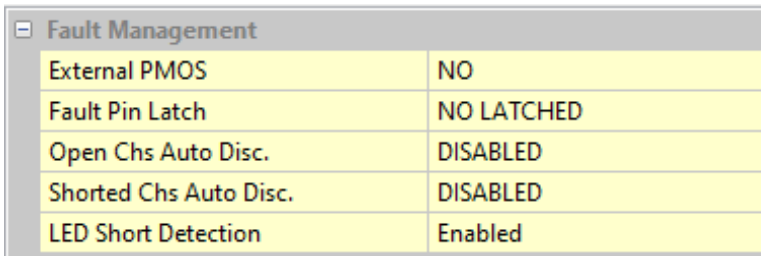
3.5 Device settings

In the “Device settings” section, there is the possibility to configure the way of working of ALED7709.

It contains the following subsections:

- fault management
- fault pin management
- output configuration
- boost configuration
- dimming configuration

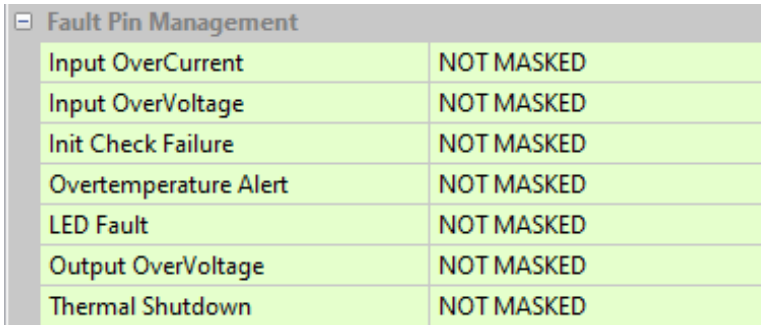
Figure 12. **Fault management subsection**



The fault management subsection acts on the bits inside the FMCFG register.

It is possible to enable or disable the protections associated to the PMOS presence. In STEVAL-LLL014M1, the PMOS is present, so the “External PMOS” must be set YES, otherwise, the power supply does not reach the boost section. To test the functionality setting “External PMOS” as NO, it is necessary to short circuit Source and Drain of Q1.

Figure 13. **Fault pin management subsection**



Fault pin management acts on the FMASK register, it is possible defining which fault is externally signalized using the FAULT pin. On STEVAL-LLL014M1, the FAULT pin drives the D4 LED to indicate when a not masked fault is detected. For firmware developers, it is possible connecting the FAULT pin to the MCU, closing the FAULT jumper on the J5. This signal can be used as a FAULT interrupt for any specific action.

Figure 14. **FAULT jumper closed on J5**

Figure 15. **Output configuration subsection**

Output Configuration	
Control Slope	Nominal
Phase Shift Mode	Disabled
Transition Point	12.5%
Temp Sensing	DISABLED

Output configuration subsection controls the bits inside the OUTCFG register.

“Temp Sensing” can be DISABLED simply acting on the bit; the NTC can be left connected.

Figure 16. **Boost configuration subsection**

Boost Configuration	
Switching Frequency	External
Main Clock Spread Spectrum	ENABLED
Main Clock Spread Spectrum Mod.	9.5%
Spread Spectrum External Freq.	ENABLED
Output Voltage Regulation	DISABLED

Boost configuration subsection adjusts the bits inside the BOOSTCFG register.

In this subsection, it is possible to adjust the boost switching frequency; selecting External, R6 sets the switching frequency to about 400KHz. Otherwise, it is possible to select a fixed switching frequency of 400KHz, 800KHz or 1.6MHz derived as division of the internal Main Clock of 6.55MHz.

It is suggested to put the system in standby (acting on the **Enable** button) before selecting a different switching frequency. The choice of R6 at 61.8KΩ is to allow a seamless transition between External and 400KHz internal.

Main Clock Spread Spectrum can be enabled or disabled in any condition because Main Clock is always running. Even if the “Spread Spectrum External Freq.” is ENABLED, it is active only if the switching frequency is set as External.

Figure 17. **Dimming configuration subsection**

Dimming Configuration	
Brightness Control	PWMI
PWMI Usage	Period&DC control
Dimming Frequency	100Hz
Conversion Curve	Linear
Dimming Mode	User
Local Mode	DISABLED

Dimming configuration subsection is used to select one of the 14 working modes reported in the datasheet, it acts on the DIMCFG register.

Please refer to the datasheet for a detailed explanation of each working mode.

Here to set the way to control the brightness (by register, PWMI or both) and the curve applied to the brightness (Linear or Exponential). To define the dimming frequency (if applicable) and the PWM and GAIN management (User or Mixed). To select if the four channels must be driven together (Global mode) or independently (Local mode).

3.6 Channels settings

Each channel of the ALED7709 can be configured acting in the “Channel settings” section. Channels can be adjusted separately or globally; it depends on the Local mode setting in the dimming configuration subsection.

If Global mode is selected, PWM and GAIN of CH1 are applied to all the active channels. While in Local mode, each channel uses the setting of its PWM and GAIN.

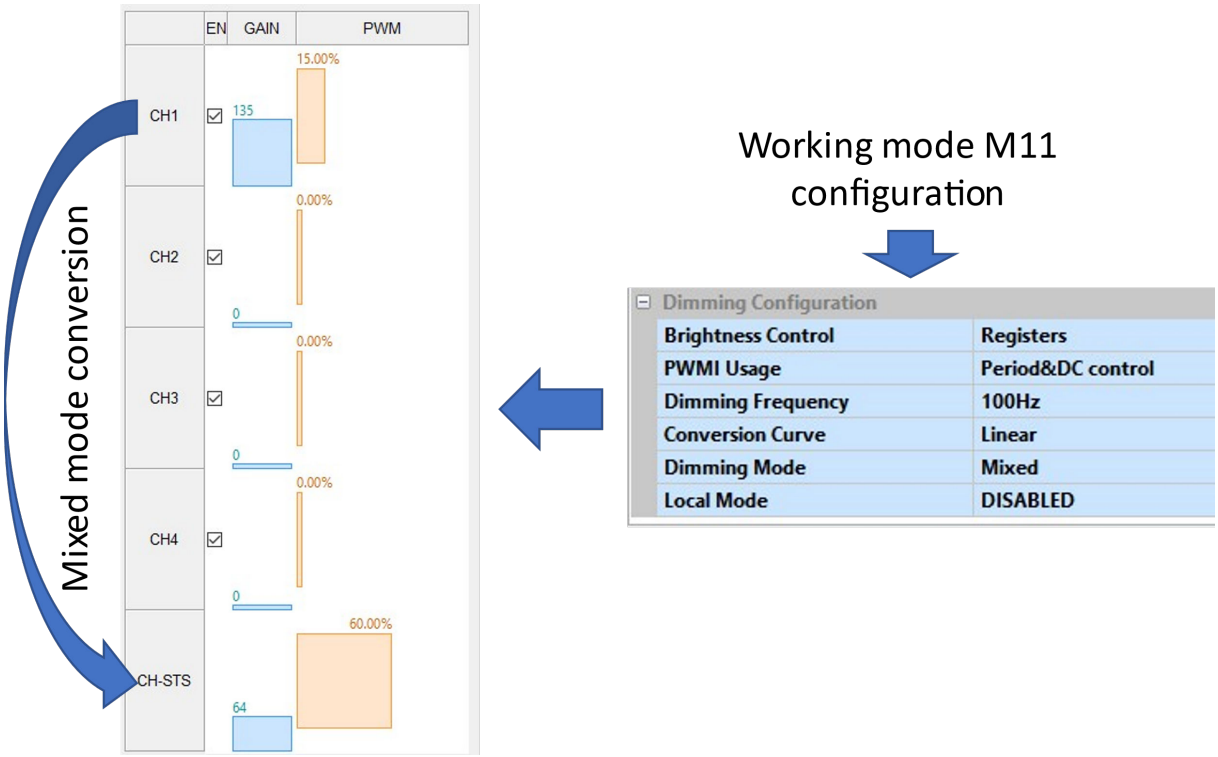
Each bar can be modified dragging it by the mouse, selecting it by double-click and writing the needed value with the keyboard.

Channel enable (EN flags) is always active for the specific channel in any working mode.

PWM information is always in percentage, but it has a different reference for the Linear or the Exponential conversion curve. For the Linear curve, the percentage is related to the maximum value defined by dimming frequency (please refer to paragraph 7.9.1 of the datasheet). While for the Exponential curve, the percentage is always related to 8bit value.

When dimming mode is set as Mixed, the GAIN bar/value is no longer used and the PWM bar/value becomes the only used brightness parameter. When Mixed mode is active, the device computes internally the analog and digital dimming to be used. The CH-STS bars, placed just below CH4 in the Channel settings area, show the resulting values.

Figure 18. STS registers information when in Mixed mode

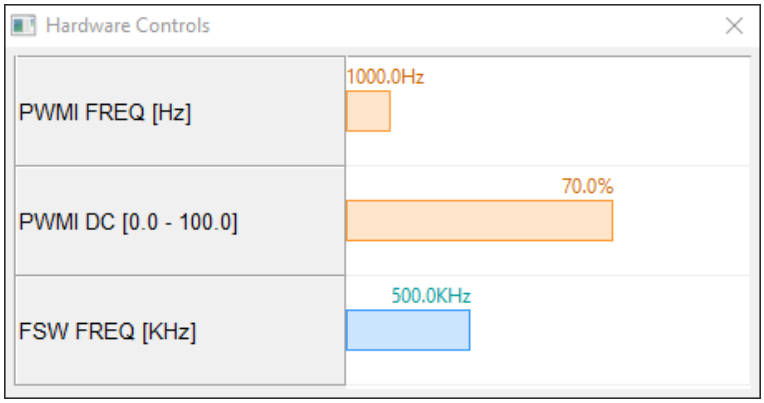


3.7 Hardware Controls window

In the Main toolbar area, there is the **HW Controls** button, click on it to open the Hardware Controls window.

From this window, it is possible to adjust the PWMI and FSW signals, they are generated inside the MCU and used to control the ALED7709.

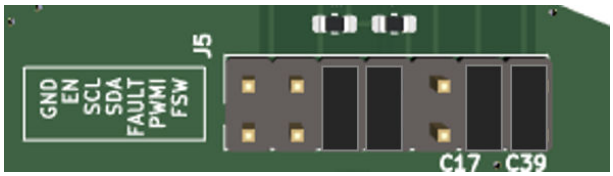
Figure 19. **Hardware Controls window**



Each bar can be modified dragging it by the mouse, selecting it by double-click and writing the needed value with the keyboard.

The relative jumpers in J5 must be closed to connect the signals from MCU to the correspondent ALED7709 pins.

Figure 20. **PWMI and FSW jumpers on J5**



EN pin can be connected to the MCU closing the appropriate jumper on J5 (blue jumper in next figure). Or it can be manually controlled, to force the ALED7709 in shut-down, shorting the EN pin to GND (red jumper in the next figure).

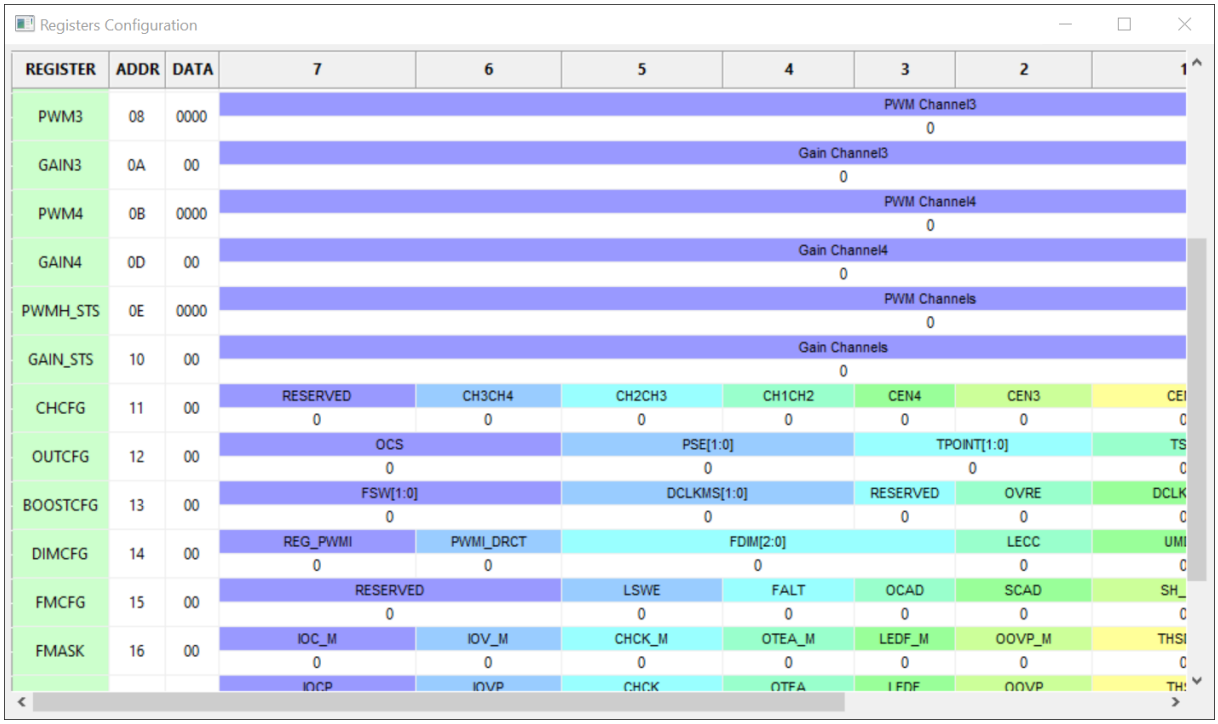
Figure 21. **EN pin connection: to MCU or manually to GND**

3.8 Register configuration window

Click on the **Registers** button, present in the Main toolbar area, to open the Register configuration window.

This window shows in a single grid all the bits of each register of ALED7709.

Figure 22. **Register configuration window**



The REGISTER column identifies the register using the same datasheet name. The ADDR column is the register address, and the DATA column is its content. Both values are in hexadecimal format.

The numbered columns give the name of each bit of every register; for a detailed description of each bit functionality please refer to the datasheet.

All the registers are 8bit, but PWMx, for easy reading, are represented in 16bit concatenating PWMH and PWML.

The content of each Write register can be changed acting on the DATA column or modifying the single bit field. Read only registers cannot be edited.

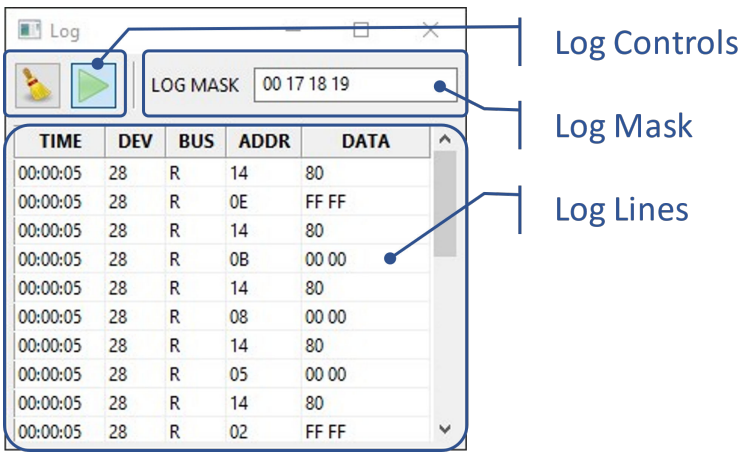
Any content change done in the Register configuration window is reflected in the Main GUI window and vice versa. In both cases, all the changes are applied to the device.

3.9 Log window

The STSW-LLL014GUI monitors continuously the I²C communication with the ALED7709.

Pressing the **Log** button, in the Main toolbar area, display the Log window.

Figure 23. **Log window**



Each Log line reports the following info:

TIME : is the time, relative to the GUI start, of when the I²C packet has been transmitted;

newer packets are placed on top for an easier check.

DEV : is the I²C device address in 7bit hex.

BUS : is the direction of the communication: R–read from device; W–write to device.

ADDR : is the lowest address, in hex, of the registers to be used.

DATA : reports all the data transferred in the packet; the leftmost is related to the lower address.

The log acquisition is started/stopped by pressing the **Green arrow** icon. Click the **Brush** icon to clean the Log lines.

It is possible to exclude from the Log lines the record of communication packets addressed to specific registers. This is achieved adding the ADDR value in the Log mask field; in this way, the I²C operations involving those registers are executed but not displayed.

4 PCB

Figure 24. **STEVAL-LLL014M1 top silkscreen**

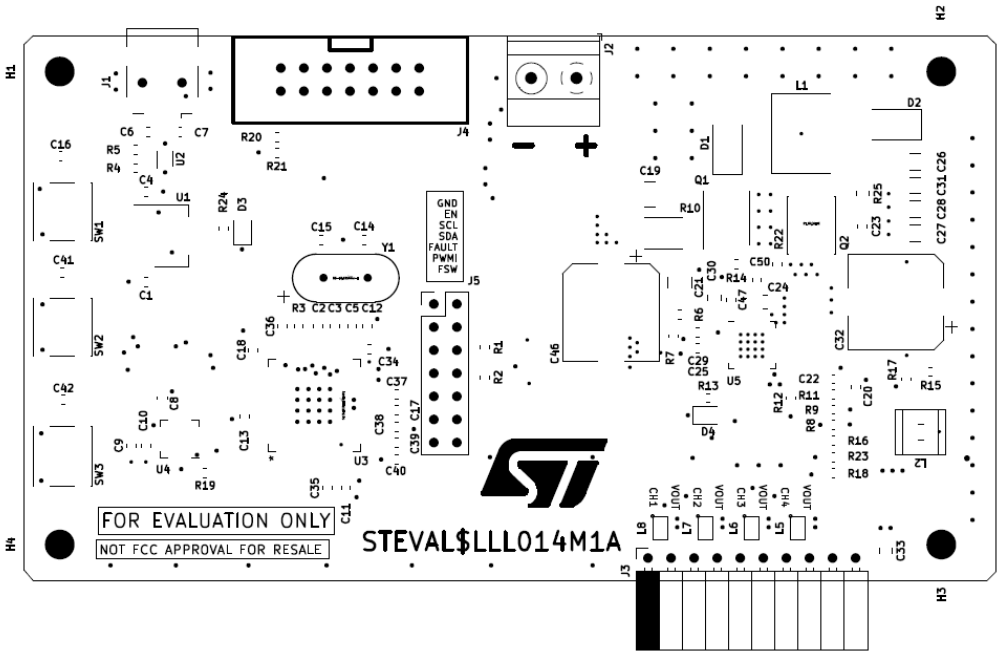


Figure 25. **STEVAL-LLL014M1 bottom silkscreen**

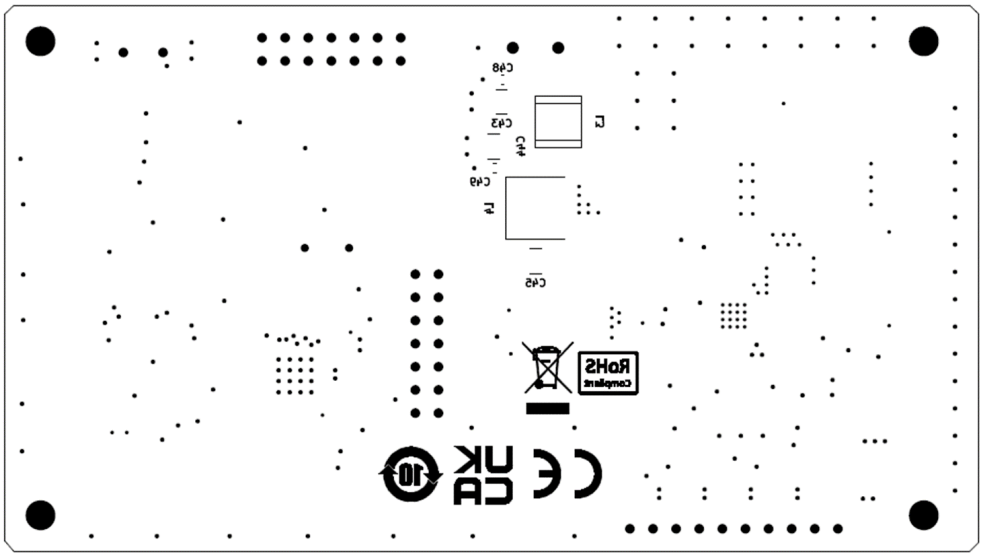


Figure 26. **STEVAL-LLL014M1 top Layer**

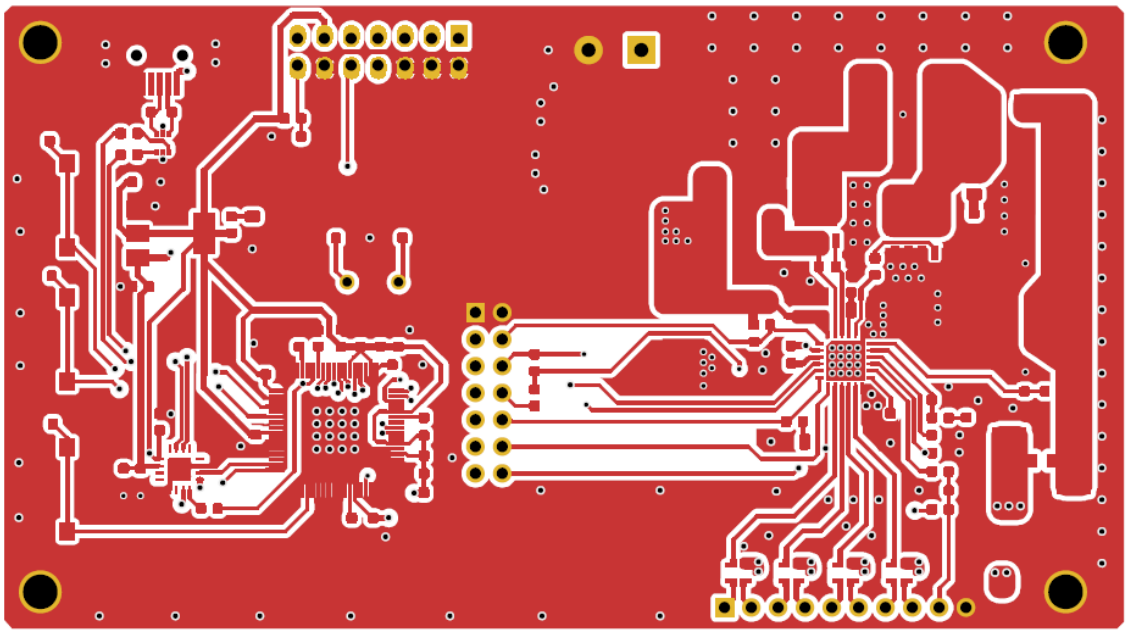


Figure 27. **STEVAL-LLL014M1 bottom Layer**

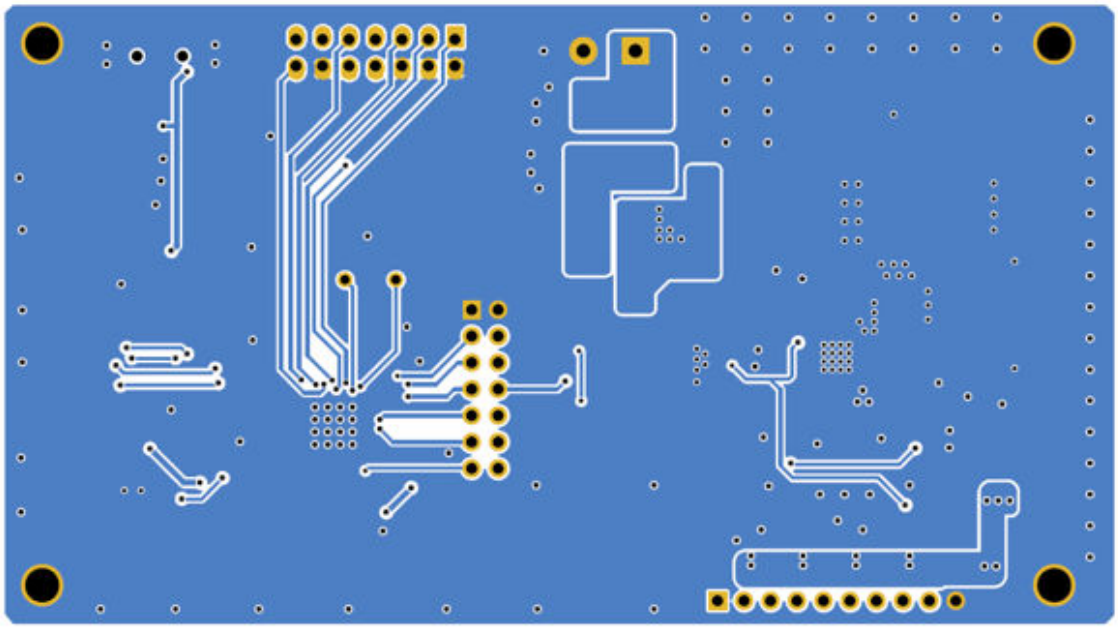


Figure 28. **STEVAL-LLL014D1 top silkscreen**

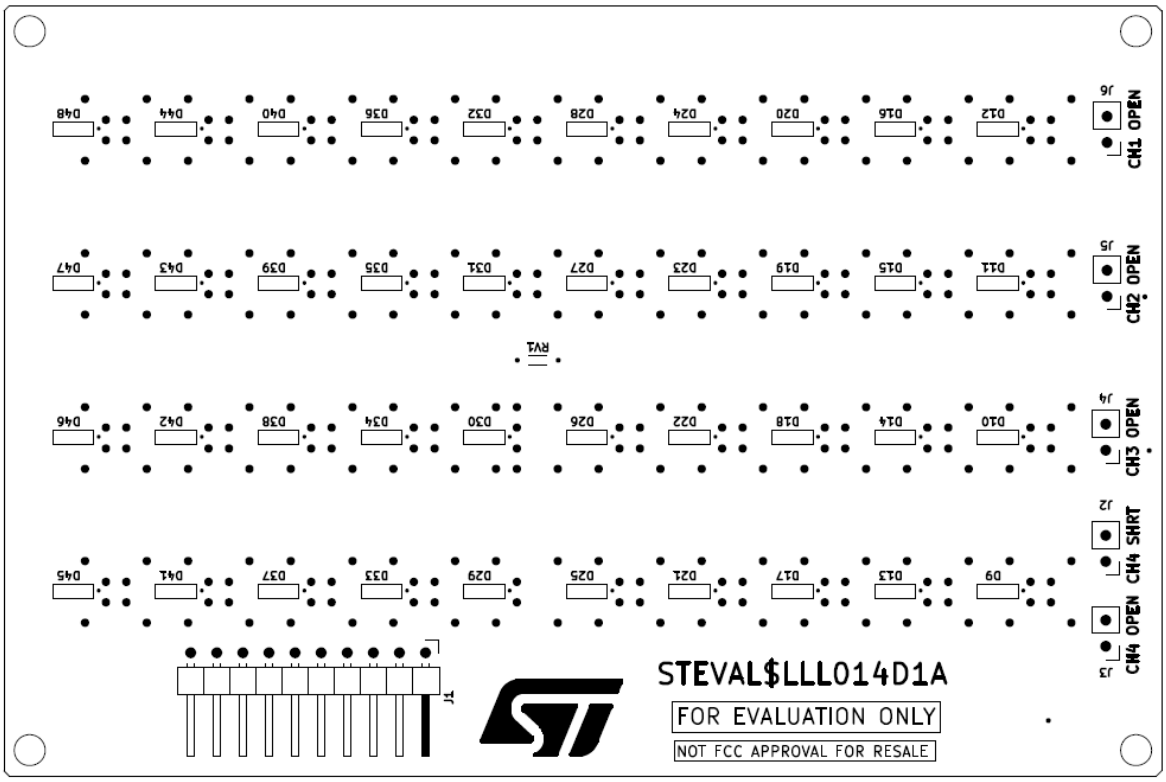


Figure 29. **STEVAL-LLL014D1 bottom silkscreen**

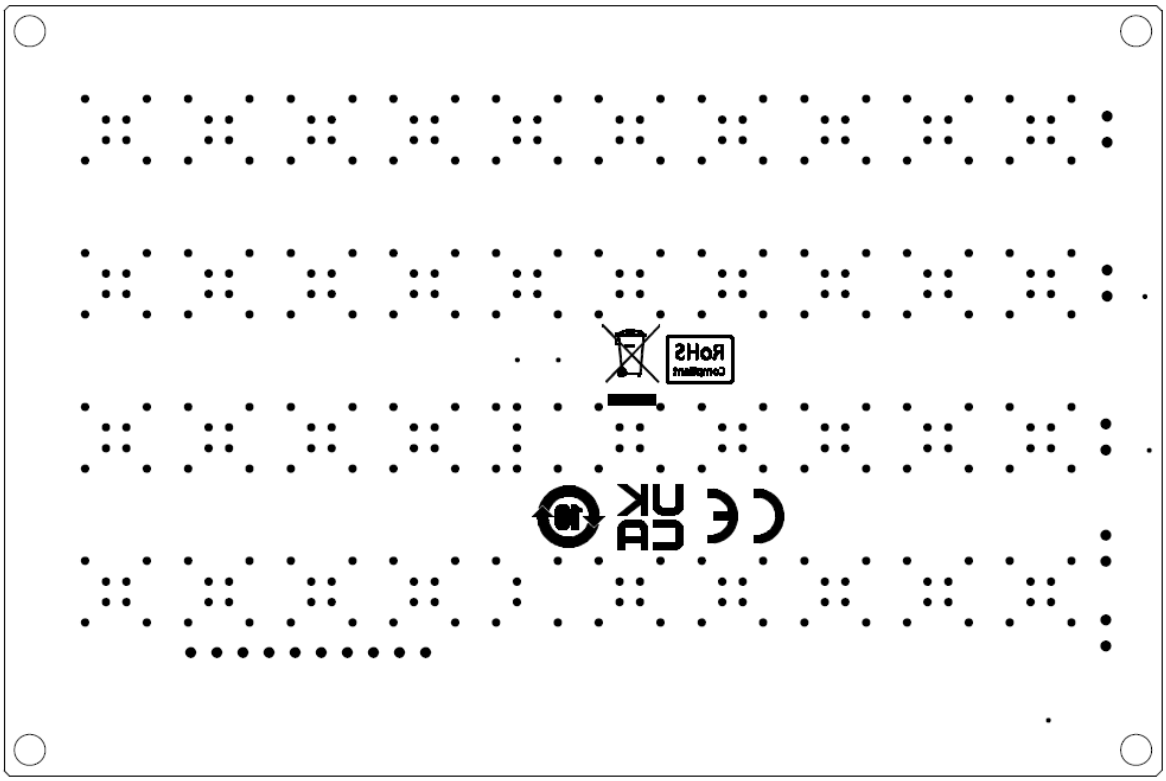


Figure 30. **STEVAL-LLL014D1 top Layer**

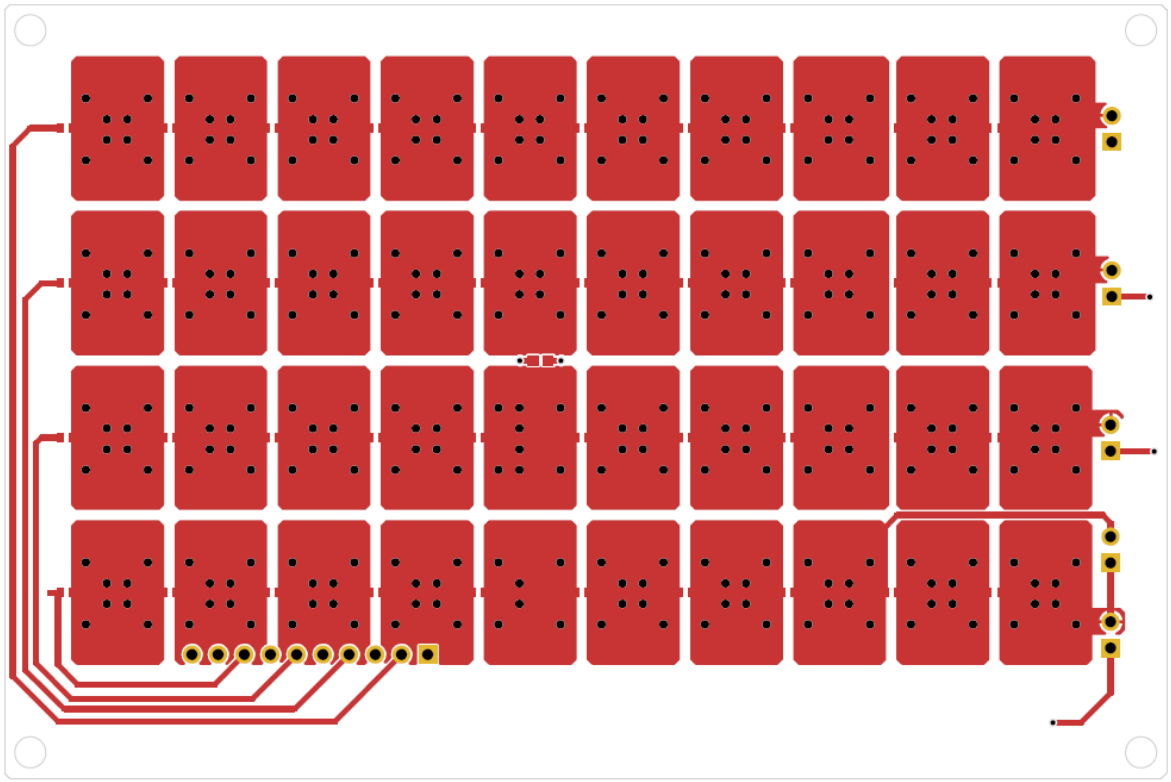
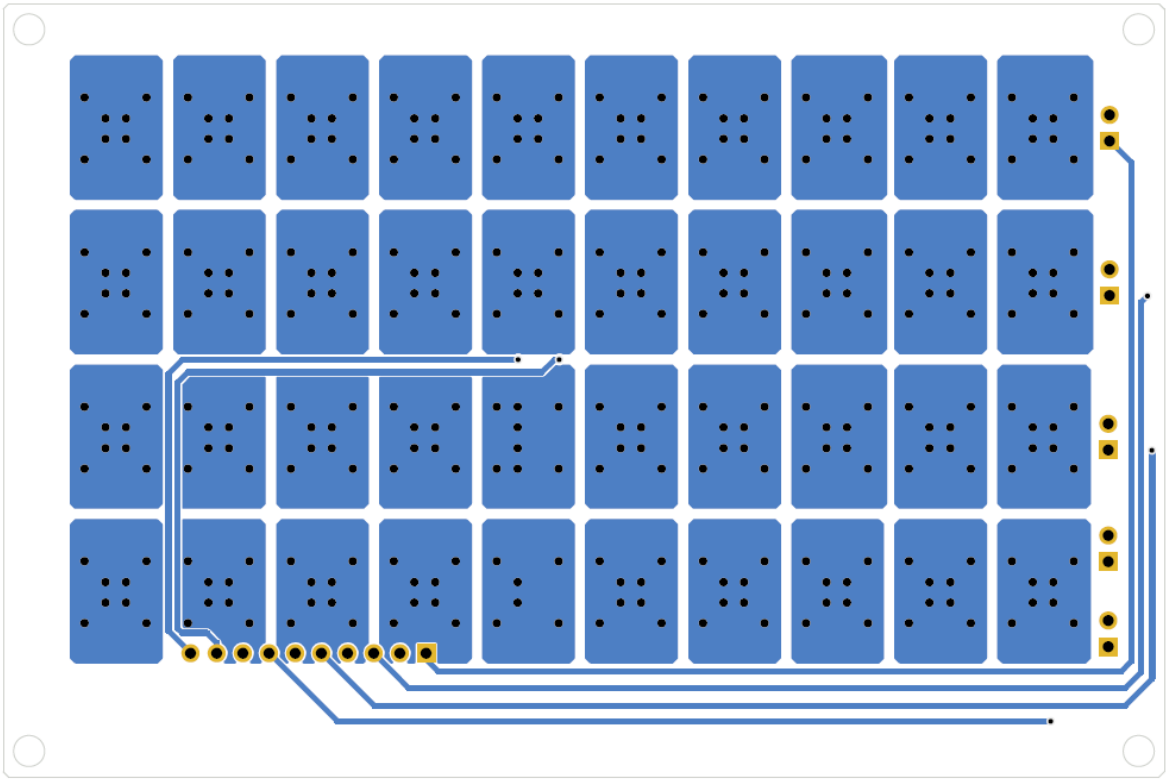


Figure 31. **STEVAL-LLL014D1 bottom Layer**



5 Schematic diagrams

Figure 32. **STEVAL-LLL014M1 schematic diagram**

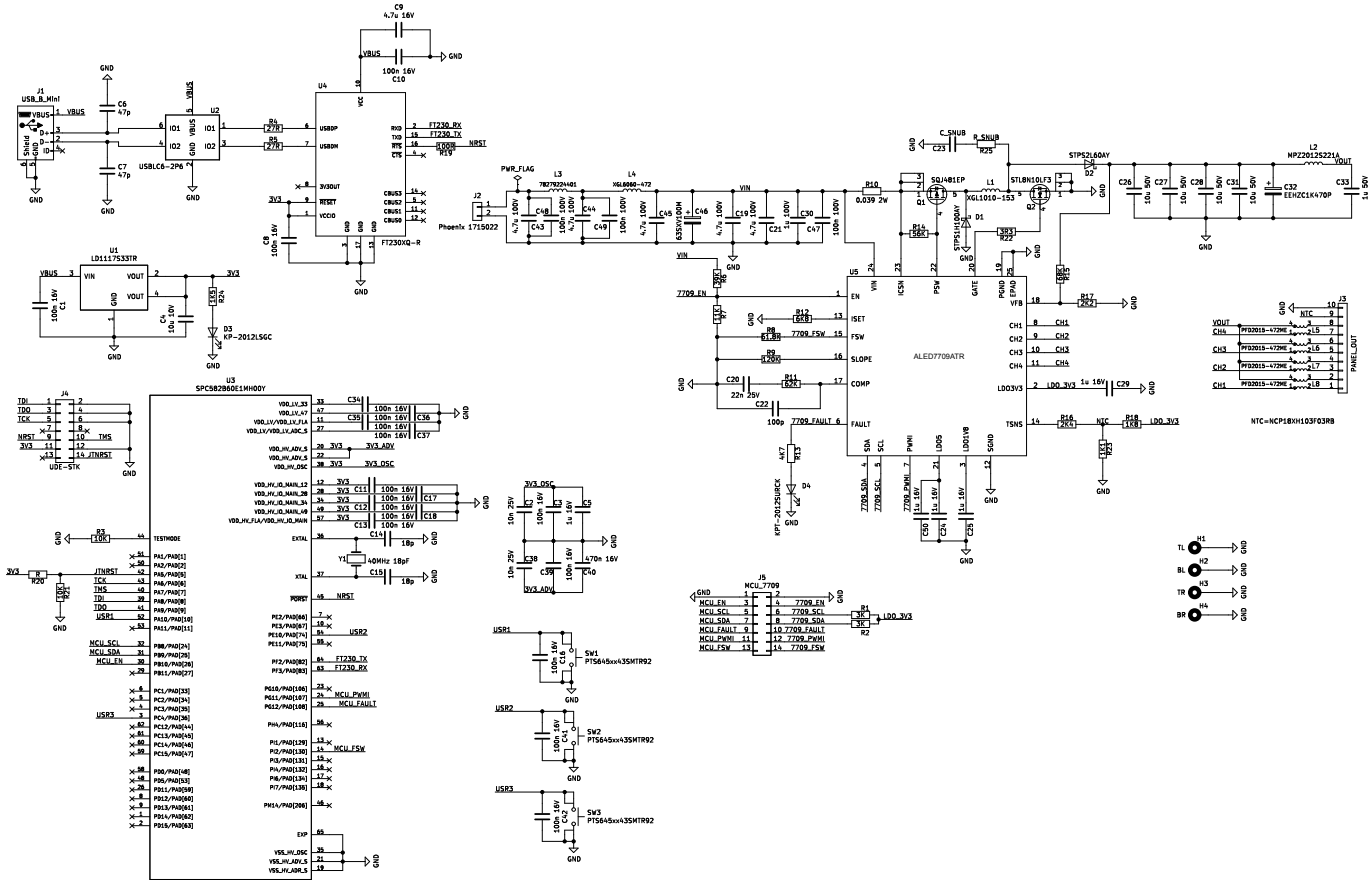
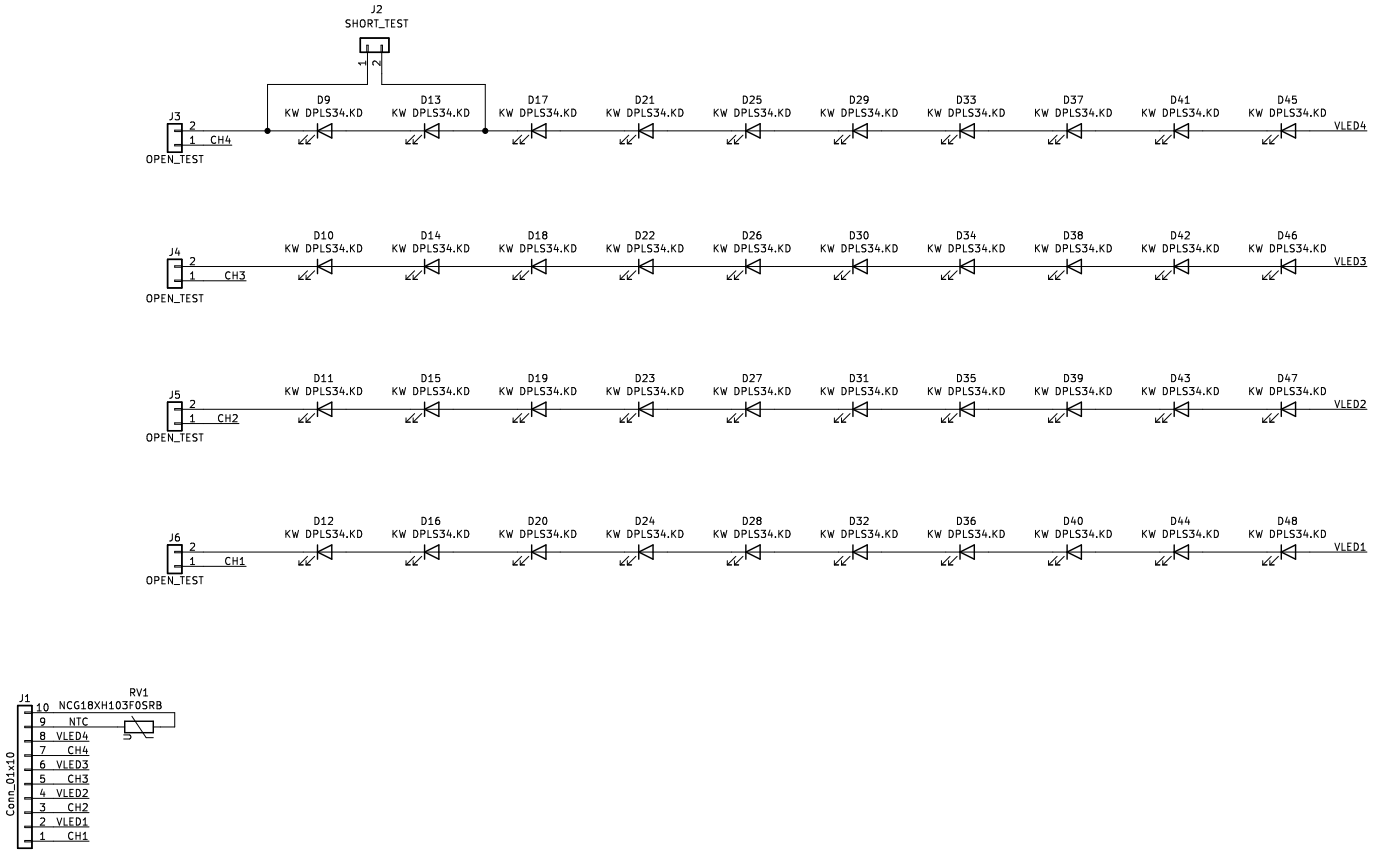


Figure 33. **STEVAL-LLL014D1 schematic diagram**



6 BOM

Table 2. STEVAL-LLL014V1 bill of materials

Item	Q.ty	Ref.	Part / Value	Description	Manufacturer	Order code
1	1	-	Table 3. STEVAL-LLL014M1	Control board	ST	Not available for separate sale
2	1	-	Table 4. STEVAL-LLL014D1	LED board	ST	Not available for separate sale

Table 3. STEVAL-LLL014M1 bill of materials

Item	Q.ty	Ref.	Part / Value	Description	Manufacturer	Order code
1	17	C1, C3, C8, C10, C11, C12, C13, C16, C17, C18, C34, C35, C36, C37, C39, C41, C42	100n 16V	Ceramic Capacitor	Murata	GCJ188R71C104KA01#
2	2	C2, C38	10n 25V	Ceramic Capacitor	Murata	GCJ188R71E103KA01#
3	1	C4	10u 10V	Ceramic Capacitor	Murata	GRT188D71A106ME73#
4	4	C5, C25, C29, C50	1u 16V	Ceramic Capacitor	Murata	GCM188R71C105KA64#
5	2	C6, C7	47p	Ceramic Capacitor	Murata	GCM1885C2A470GA16#
6	1	C9	4.7u 16V	Ceramic Capacitor	Murata	GRT188C71C475KE13#
7	2	C14, C15	18p	Ceramic Capacitor	Murata	GCM1885C2A180GA16#
8	5	C19, C21, C43, C44, C45	4.7u 100V	Ceramic Capacitor	Murata	GCJ32DC72A475KE01#
9	1	C20	22n 25V	Ceramic Capacitor	Murata	GCJ188R71E223KA01#
10	1	C22	100p	Ceramic Capacitor	Murata	GCM1885C2A101GA16#
11	1	C24	1u 16V	Ceramic Capacitor	Murata	GCJ21BR71C105KA01#
12	4	C26, C27, C28, C31	10u 50V	Ceramic Capacitor	Murata	GCM31CD71H106KE36#
13	1	C30	1u 100V	Ceramic Capacitor	Murata	GCJ21BC72A105KE02#
14	1	C32	EEHZC1K470P	Polarized Capacitor	Panasonic	EEHZC1K470P
15	1	C33	1u 50V	Ceramic Capacitor	Murata	GCJ21BR71H105KA01#
16	1	C40	470n 16V	Ceramic Capacitor	Murata	GCJ188R71C474KA12#
17	1	C46	63SXV100M	Polarized Capacitor	Panasonic	63SXV100M
18	3	C47, C48, C49	100n 100V	Ceramic Capacitor	Murata	GCJ188R72A104KA01#
19	1	D1	STPS1H100AY, SMA	Power Diode	ST	STPS1H100AY
20	1	D2	STPS2L60AY, SMA	Power Diode	ST	STPS2L60AY
21	1	D3	KP-2012LSGC	LED SMD GREEN	Kingbright	KP-2012LSGC
22	1	D4	KPT-2012SURCK	LED SMD RED	Kingbright	KPT-2012SURCK
23	1	J1	USB_B_Mini	USB Mini Connector	Wuerth	65100516121

Item	Q.ty	Ref.	Part / Value	Description	Manufacturer	Order code
24	1	J2	Phoenix 1715022	Power Connector	Phoenix	1725656
25	1	J3	PANEL_OUT	LED Connector	Wuerth	613010143121
26	1	J4	UDE-STK	JTAG Connector	Wuerth	61201421621
27	1	J5	MCU_7709	2x07 Stripline 2.54 pitch	Wuerth	61301421121
28	1	L1	XGL1010-153	Power Inductor	Coilcraft	XGL1010-153
29	1	L2	MPZ2012S221A	Ferrite Bead	TDK	MPZ2012S221A
30	1	L3	78279224401	Ferrite Bead	Wuerth	78279224401
31	1	L4	XGL6060-472	Ferrite Bead	Coilcraft	XGL6060-472
32	4	L5, L6, L7, L8	PFD2015-472ME	EMI Filter	Coilcraft	PFD2015-472ME
33	1	Q1	SQJ481EP	Power PMOS	Vishay	SQJ481EP-T1_GE3
34	1	Q2	STL8N10LF3, PowerFLAT 5x6 WF	Power NMOS	ST	STL8N10LF3
35	2	R1, R2	3K	SMD Resistor	Panasonic	ERJPA3F3001V
36	2	R3, R21	10K	SMD Resistor	Panasonic	ERJPA3F1002V
37	2	R4, R5	27R	SMD Resistor	Panasonic	ERJPA3F27R0V
38	1	R6	39K	SMD Resistor	Panasonic	ERJPA3F3902V
39	1	R7	11K	SMD Resistor	Panasonic	ERJPA3F1102V
40	1	R8	61.8K	SMD Resistor	Panasonic	ERJPA3F6192V
41	1	R9	120K	SMD Resistor	Panasonic	ERJPA3F1203V
42	1	R10	0.039 2W	2W SMD Resistor	TE Connectivity	TLRP3A20CR039FTE
43	1	R11	62K	SMD Resistor	Panasonic	ERJUP3F6202V
44	1	R12	6K8		Panasonic	ERJPA3F6801V
45	1	R13	4K7	SMD Resistor	Panasonic	ERJPA3F4701V
46	1	R14	56K	SMD Resistor	Panasonic	ERJPA3F5602V
47	1	R15	68K	SMD Resistor	Panasonic	ERJPA3F6802V
48	1	R16	2K4	SMD Resistor	Panasonic	ERJPA3F2401V
49	1	R17	2K2	SMD Resistor	Panasonic	ERJPA3F2201V
50	1	R18	1K8	SMD Resistor	Panasonic	ERJUP3F1801V
51	1	R19	100R	SMD Resistor	Panasonic	ERJPA3F1000V
52	1	R22	3R3	SMD Resistor	Panasonic	ERJH3QF3R30V
53	1	R23	1K1	SMD Resistor	Panasonic	ERJPA3F1101V
54	1	R24	1K5	SMD Resistor	Panasonic	ERJUP3F1501V
55	3	SW1, SW2, SW3	PTS645xx43SMTR92	Tactile Switch	C&K	PTS645SM43SMTR92LFS
56	1	U1	LD1117S33TR, SO-8	3.3V LDO	ST	LD1117S33TR
57	1	U2	USBLC6-2P6, SOT666	USB Filter	ST	USBLC6-2P6
58	1	U3	SPC582B60E1MH00Y, TQFP 64 10x10x1.0	Automotive 32bit MCU	ST	SPC582B60E1MH00Y

Item	Q.ty	Ref.	Part / Value	Description	Manufacturer	Order code
59	1	U4	FT230XQ-R	USB-UART bridge	FTDI	FT230XQ-R
60	1	U5	ALED7709ATR, QFPN 5X5X0.90 24L PITCH 0.65	Automotive LED driver	ST	ALED7709ATR
61	1	Y1	40MHz 18pF	40MHZ Crystal	Citizen	HC-49/U-S40000000ABJB

Table 4. STEVAL-LLL014D1 bill of materials

Item	Q.ty	Reference	Part/Value	Description	Manufacturer	Order code
1	40	D9, D10, D11, D12, D13, D14, D15, D16, D17, D18, D19, D20, D21, D22, D23, D24, D25, D26, D27, D28, D29, D30, D31, D32, D33, D34, D35, D36, D37, D38, D39, D40, D41, D42, D43, D44, D45, D46, D47, D48	KW DPLS34.KD	Automotive SMD LED	OSRAM	KW DPLS34.KD
2	1	J1	Conn_01x10	LED Connector	Wuerth	61301011021
3	1	J2	SHORT_TEST	Jumper	TE CONN	5-146276-2
4	4	J3, J4, J5, J6	OPEN_TEST	Jumper	TE CONN	5-146276-2
5	1	RV1	NCG18XH103F0SRB	NTC Resistor	Murata	NCG18XH103F0SRB

7 Kit versions

Table 5. **STEVAL-LLL014V1 versions**

PCB version	Schematic diagrams	Bill of materials
STEVAL$LLL014V1A (1)	STEVAL$LLL014V1A schematic diagrams	STEVAL$LLL014V1A bill of materials

1. *This code identifies the STEVAL-LLL014V1 evaluation kit first version. The kit consists of a STEVAL-LLL014M1 whose version is identified by the code STEVAL$LLL014M1A and a STEVAL-LLL014D1 whose version is identified by the code STEVAL$LLL014D1A.*

8 Regulatory compliance information

Notice for US Federal Communication Commission (FCC)

For evaluation only; not FCC approved for resale

FCC NOTICE - This kit is designed to allow:

(1) Product developers to evaluate electronic components, circuitry, or software associated with the kit to determine

whether to incorporate such items in a finished product and

(2) Software developers to write software applications for use with the end product.

This kit is not a finished product and when assembled may not be resold or otherwise marketed unless all required FCC equipment authorizations are first obtained. Operation is subject to the condition that this product not cause harmful interference to licensed radio stations and that this product accept harmful interference. Unless the assembled kit is designed to operate under part 15, part 18 or part 95 of this chapter, the operator of the kit must operate under the authority of an FCC license holder or must secure an experimental authorization under part 5 of this chapter 3.1.2.

Notice for Innovation, Science and Economic Development Canada (ISED)

For evaluation purposes only. This kit generates, uses, and can radiate radio frequency energy and has not been tested for compliance with the limits of computing devices pursuant to Industry Canada (IC) rules.

À des fins d'évaluation uniquement. Ce kit génère, utilise et peut émettre de l'énergie radiofréquence et n'a pas été testé pour sa conformité aux limites des appareils informatiques conformément aux règles d'Industrie Canada (IC).

Notice for the European Union

This device is in conformity with the essential requirements of the Directive 2014/30/EU (EMC) and of the Directive 2015/863/EU (RoHS).

Notice for the United Kingdom

This device is in compliance with the UK Electromagnetic Compatibility Regulations 2016 (UK S.I. 2016 No. 1091) and with the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012 (UK S.I. 2012 No. 3032).

Revision history

Table 6. **Document revision history**

Date	Revision	Changes
18-May-2023	1	Initial release.
12-Oct-2023	2	Minor text changes in Section 1 Overview. Modified Table 1. Connectors description. Updated Section 3.2 File management. Added Figure 27. STEVAL-LLL014M1 bottom Layer.

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