



Introduction:

SIKTEC-EPD is a high grade and professionally made E-Ink / E-Paper Display module. The module is designed to be controlled by any MCU and most of the popular dev boards. The EPD module has dedicated SRAM, MicroSD socket and even a high quality multi directional switch. All of those are easily integrated with the open source SIKTEC libraries that provides excellent examples which have been tested extensively on several physical boards. SIKTEC EPD modules are 3.3v / 5v logic compatible and has the IOREF pin which is commonly used in the Arduino ecosystem. The module has a 2.54 pitch Breadboard compatible header and JST PH2.0mm back connectors for users who prefer wire to board connections which facilitate the integration of the module to your projects.

The EPD Module features:

- High quality 4.2" E-Paper display (3 drivers available all supported by the libraries).
- Onboard Microchip 256kbit SRAM for display drawing – Run on any microcontroller.
- MicroSD Card slot – fully integrated.
- Multi Directional Switch – High quality and debounced with optional interrupt trigger.
- 4 Pin SPI to control the Module – Fully managed by the SIKTEC libraries.
- 3.3/5V Logic tolerant (SD and EPD) – Has optional IOREF Pin.
- 2.54 Breadboard compatible header & JST PH2.0mm connectors.
- Arduino Lib Manager & PlatformIO Libraries - Robust and well documented libraries and examples.
- SIKTEC-EPDs libraries are Adafruit_GFX Compatible.
- 4 Mounting Holes (2.5mm) – M2 screws and mounting spacers included.

The shield supports SIKTEC Libraries and Example codes – All examples can be downloaded from GitHub: <https://github.com/siktec-lab/SIKTEC-EPD>. Or install using the Arduino / PlatformIO IDE Library Manager.

What is an EPD?

E-Paper Display, Also called E-Ink display or electronic paper is a special display that does not need electricity to sustain the displayed text and graphics. Unlike traditional LCD or OLED display, it does not emit light but reflects light. This characteristic makes e-paper display very comfortable to read even under direct sunlight. Millions of people love using Amazon Kindle e-readers because of the way the e-paper display looks like normal paper. There is no flickering or radiated light from the screen and no irritating glare – even in bright sunlight.

E-Paper doesn't require any backlighting for daytime viewing and therefore consumes far less energy than power-hungry LEDs and LCDs. E-Paper screens will not turn dark when the power supply is cut off or if the battery runs out. It continues to hold the last image on the display until an electric charge rearranges the electronic ink particles in another pattern. This makes e-paper a great energy-saving alternative to smartphone and tablet displays and, together with low power wireless communication protocols such as Bluetooth and near field communications (NFC), product designers can let their imaginations go wild with the potential applications available.

The displays are made of minuscule capsules filled with a clear fluid containing microscopic particles of different colours and electrical charges. Electrodes located above and below the capsules move up and down when a positive or negative electric field is applied, can hold static text and images for months without electricity.

SIKTEC – EPDs Specs:

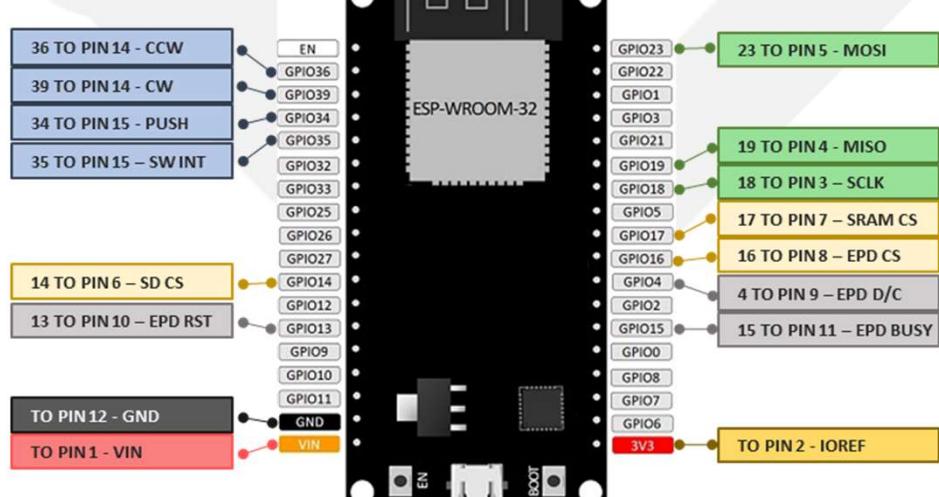
- The board model is marked on the bottom left corner on the back of the display module.

MODEL	Colors	Resolution	Size (inch)	Refresh *(3)	Outline	Active Display Area	OP Temp	Interface	IC	Partial Refresh	Refresh consumption (mW)	Standby consumption (mW)
G4	4 *(1) (Grayscale)	400x300 (120 dpi)	4.2	~ 3s	91x77x1.18	84.8x63.6	0°C~50°C	SPI	IL09398	Supported *(2)	26.4	0.0165
3CU	3 (BWR)	400x300 (119 dpi)	4.2	~ 19s	91x77x1	84.8x63.6	0°C~50°C	SPI	UC8276	Supported *(2)	13.2	0.0165
3CS	3 (BWR)	400x300 (120 dpi)	4.2	~ 16s	91x77x1.2	84.8x63.6	0°C~50°C	SPI	SSD1619	Not supported	24.75	0.0165

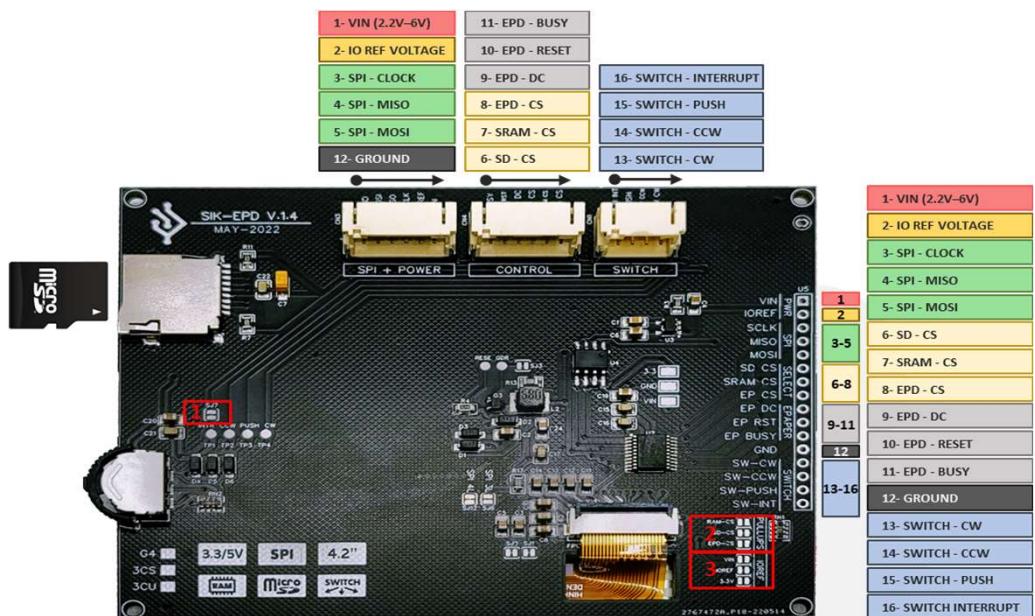
1. White, Light Gray, Dark Gray, Black.
2. Partial refresh is supported – Not directly when using the SIKTEC-EPD libraries – It will be implemented soon. For implementing and controlling the EPDs in “Partial Refresh Mode” please refer the Driver IC datasheet (Also available in SIKTEC-EPD repository).
3. Real life Measurements: room temperature (22°C), 18Mhz SPI Clock, 5V Vin, 3.3V IOREF, ESP32 WROOM using the SIKTEC-EPD Library.

Wiring Example (ESP32 for SIKTEC-EPD Examples):

- All the SIKTEC-EPD examples assumes this wiring by default



SIKTEC EPD Module Pinout:



PIN NUMBER	I/O	DESCRIPTION	VOLTAGE	REQUIRED FOR
1	I	EPD MODULE VIN	2.2V to 6V - Optimal 5V	EPD, SRAM, MicroSD, Switch
2	I	VOLTAGE REF FOR IO OUTPUT	3.3V – 6V (use the IOREF pin OR required IO Voltage level).	EPD, SRAM, MicroSD, Switch
3	I	SPI - CLOCK	>= 3.3V	EPD, SRAM, MicroSD
4	O	SPI - MISO	Same as IOREF	MicroSD, SRAM
5	I	SPI - MOSI	>= 3.3V	EPD, SRAM, MicroSD
6	I	SPI -MicroSD chip Select	>= 3.3V	MicroSD
7	I	SPI – SRAM chip select	>= 3.3V	SRAM
8	I	SPI -EPD chip Select	>= 3.3V	EPD
9	I	EPD DATA / COMMAND Set	>= 3.3V	EPD
10	I	EPD Hardware Reset	>= 3.3V	EPD
11	O	EPD Busy signal	Same as IOREF	EPD
12		GROUND		EPD, SRAM, MicroSD, Switch
13	O	SWITCH CW Toggle	Same as VIN	Switch
14	O	SWITCH CCW Toggle	Same as VIN	Switch
15	O	SWITCH PUSH Button	Same as VIN	Switch
16	O	SWITCH INTERRUPT SIGNAL	Same as VIN	Switch (Optional)

SIKTEC-EPD Modules Features

MODEL	EPD	SRAM	Max SPI Freq	Connections	Storage	HID Components	VIN	IO Voltage	Mounting
G4	4.2 Inch – 4 Gray	Microchip 256 Kbit	18 MHz	2.54mm Header PH2.0 4,6 Sockets	MicroSD Socket	Side MDS - HIQ	2.2V – 6V	3.3V - 5.5V	4X2.5mm
3CU	4.2 Inch – B&W&R	Microchip 256 Kbit	18 MHz	2.54mm Header PH2.0 4,6 Sockets	MicroSD Socket	Side MDS - HIQ	2.2V – 6V	3.3V - 5.5V	4X2.5mm
3CS	4.2 Inch – B&W&R	Microchip 256 Kbit	18 MHz	2.54mm Header PH2.0 4,6 Sockets	MicroSD Socket	Side MDS - HIQ	2.2V – 6V	3.3V - 5.5V	4X2.5mm

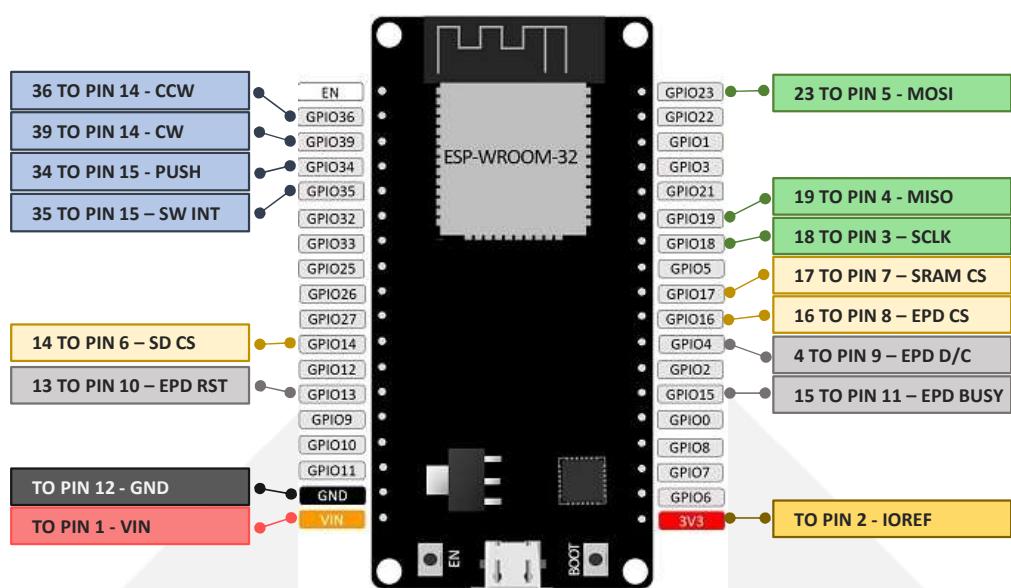
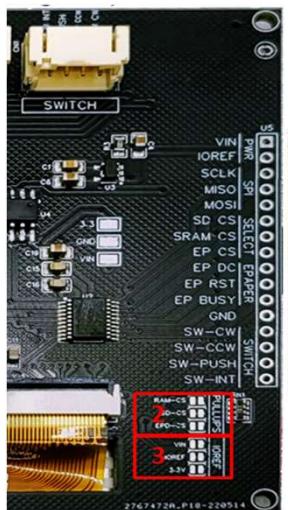
Precautions for E-paper Display Modules :

- Prevent EPD from direct sunlight, which may damage the film
- Refresh the tri-color EPDs with a full refresh at least once every 24 hours.
- It is necessary to full refresh EPD after its 5 times of partial refresh. Otherwise, there may be ghosting on the screen.
- It is necessary to set EPD into deep sleep mode after every refresh.
- The EPD should be powered off or enter deep sleep mode if it does not need to refresh for a long time.
- The EPD is made of thin glass and should not be exposed to contact pressure or dropped.
- For best performance please supply a 5V vin.

- Connecting SIKTEC EPD's is easy and trivial. The e-paper display requires an SPI interface 2 control pins and power. The MicroSD card socket and the multi directional switch are optional.
- Make sure you provide the correct IO voltage level required for your MCU using the IOREF pin or by using the onboard jumpers.
- For your convenience here are two wiring examples which are defined by default in all of the SIKTEC-EPD examples.

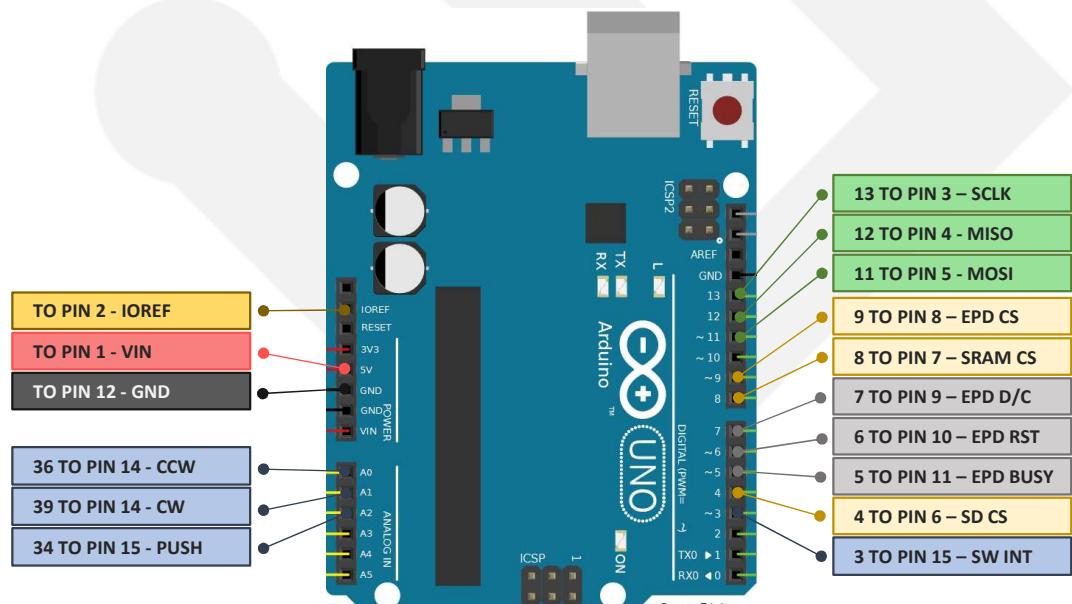
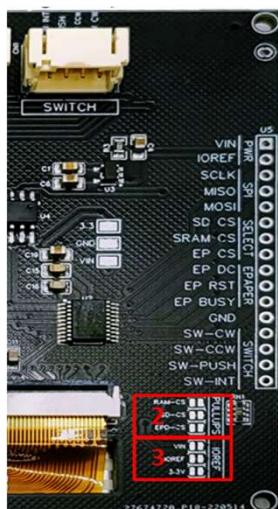
ESP32 Wiring Diagram:

- In this example we connect the IOREF pin to 3.3v which is the recommended operating voltage of the esp32 IO pins.
- For best performance We connect VIN to the supplied voltage of the esp32 – normally 5V.



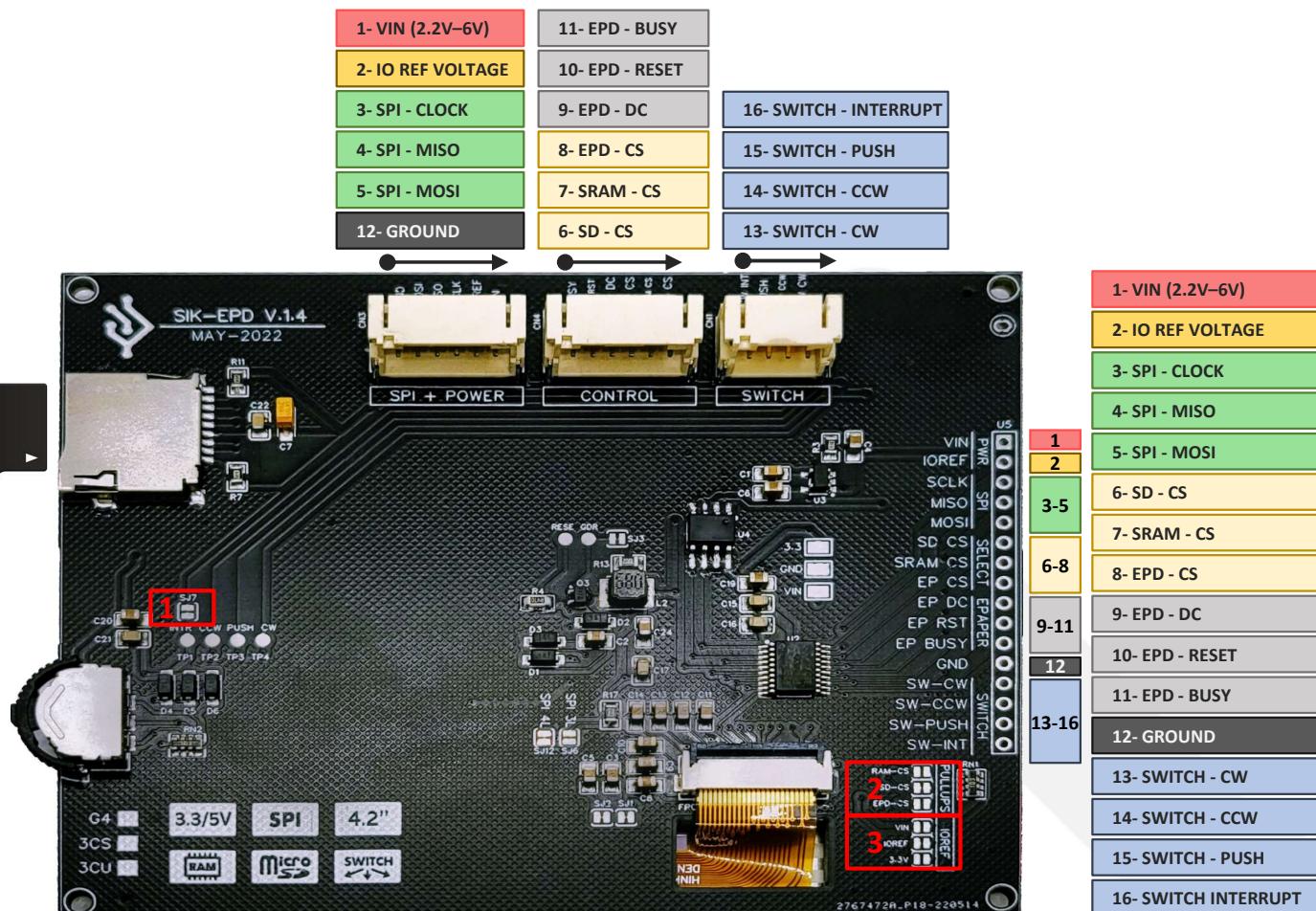
ARDUINO UNO Wiring Diagram:

- In this example we connect the IOREF pin to the ARDUINO IOREF Pin – most of the AVR boards has a dedicated IOREF Pin.
- For best performance We connect VIN to the 5V regulated power of the UNO board.
- On the UNO board only pins 2,3 are interrupt pins so we are using pin 3 for the multi directional switch.



Source: Fritzing

SIKTEC-EPD Module Pinout (All Models):

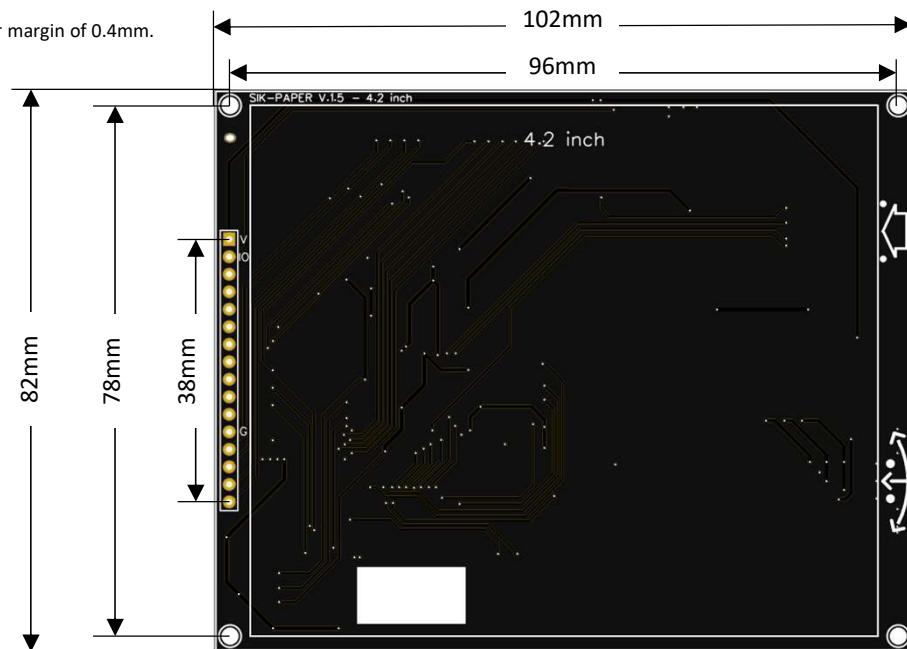


PIN NUMBER	I/O	DESCRIPTION	VOLTAGE	REQUIRED FOR
1	I	EPD MODULE VIN	2.2V to 6V - Optimal 5V	EPD, SRAM, MicroSD, Switch
2	I	VOLTAGE REF FOR IO OUTPUT	3.3V – 6V (use the IOREF pin OR required IO Voltage level).	EPD, SRAM, MicroSD, Switch
3	I	SPI - CLOCK	>= 3.3V	EPD, SRAM, MicroSD
4	O	SPI - MISO	Same as IOREF	MicroSD, SRAM
5	I	SPI - MOSI	>= 3.3V	EPD, SRAM, MicroSD
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JUMPER	DESCRIPTION	FACTORY DEFAULT	REMARKS
1	Physically connect / disconnect Interrupt pin from the switch circuit	Connected (Trace)	
2	Pullups (10K) for CS pins	Only SD CS is connected (Trace)	CS pins are controlled by the MCU
3	IO Output Reference Select (VIN IOREF 3.3V)	IOREF Pin is connected (Trace)	By Default, IOREF Pin must be connected to the required IO Voltage.

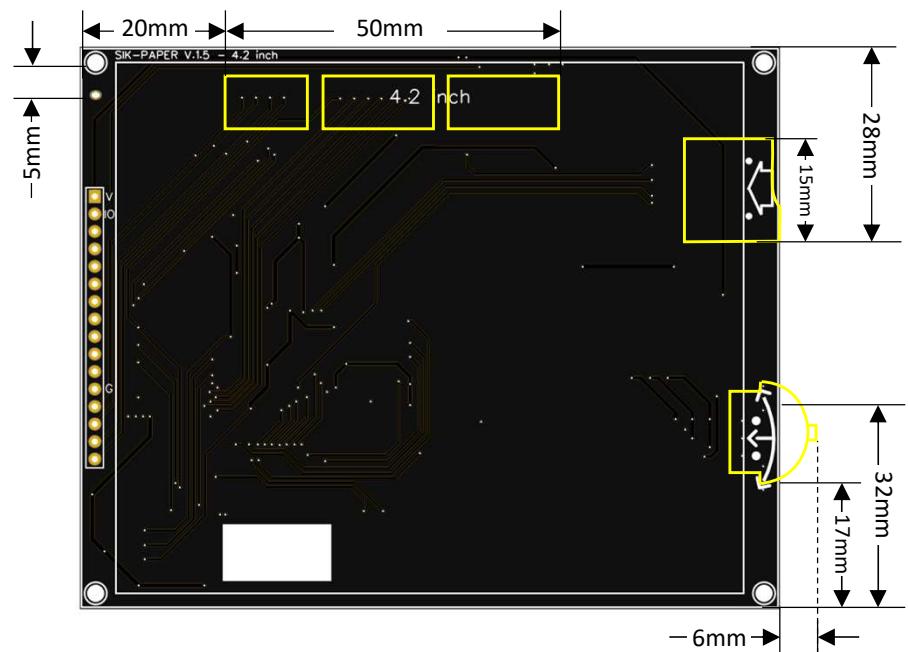
SIKTEC-EPD Module Dimensions:

*All Dimension should be considered with an error margin of 0.4mm.



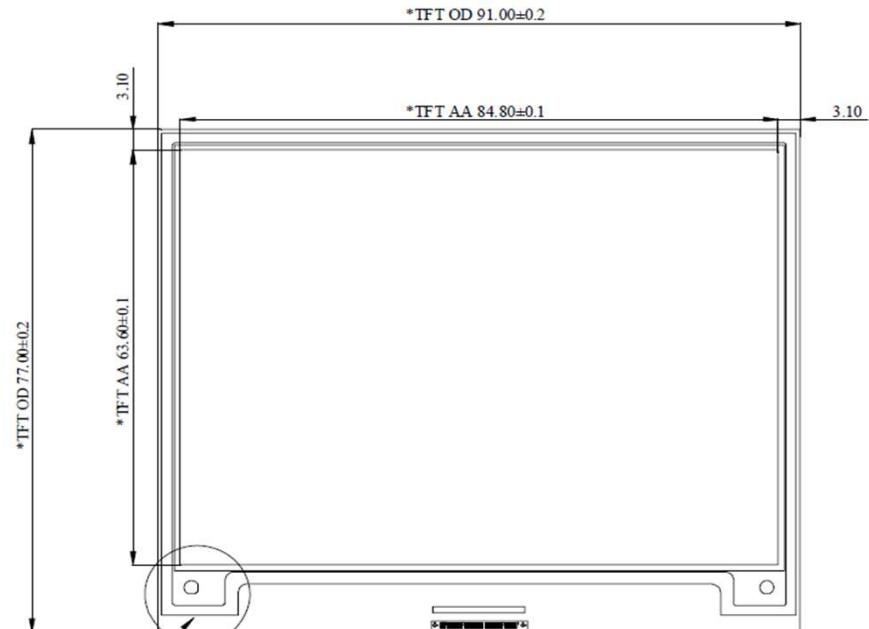
Thickness:

- Without connectors: Max – 5.6mm (Switch)
Min – 3.1mm
- With connectors : 8.7mm (Switch)



Only E-Paper Display:

- Size: 91.00mm X 77.00mm
- Active Area: 84.8mm X 63.6mm
- Thickness: 1.25mm.



Real-life SIKTEC-EPD Module pictures:

Those picture are not edited and are showcasing various examples that you can find in the SIKTEC-EPD library <https://github.com/siktec-lab/SIKTEC-EPD>. On the left the G4 module is used (4 Gray) and on the right the 3CS and 3CU modules. If you are wondering how we are applying those filters to the pictures... You will be surprised its all done On The Fly with the built-in filters – (<https://github.com/siktec-lab/SIKTEC-EPD/tree/master/examples/BitmapFiltersNDither>).

