eINK click

PID: MIKROE-2659
Weight: 26 g

eINK click is an adapter Click board™, used to interface a compatible eINK display with the host MCU. The most distinctive feature of the eINK displays is their very low power consumption and the ability to**retain the information, even after disconnecting from the power source**. The power is consumed only when the display content is changing. The Click board™ comes shipped with the 172x72 eINK display, driven by the integrated SSD1606 controller and it can display 4 shades: black, dark gray, light gray and white. The same type of display is used on the popular Kindle E-readers.

The eINK is a reasonably new technology with a promising future. The displayed content does not degrade when exposed to direct sunlight, the display actually behaves like a real paper; it is more readable when there is more light hitting its surface. There is a wide range of applications, where eINK can be implemented: it can be used for very low power consumption applications that require display output, such as mobile phones and wearables, industrial and packaging applications, electronic reading and writing, electronic shelf labels and similar applications that can utilize this type of display.

How does it work?

The working principle of the eINK display is rather simple: there are black and white pigments trapped inside the microcapsules, which are dispersed in a clear fluid between two electrodes. The white pigments are positively charged, while the black pigments are negatively charged. When the electromagnetic field is formed between the electrodes, the pigments get repelled or attracted to the electrodes, depending on the field orientation. This results in bright or dark pigments being positioned towards the bottom or top surface of the microcapsule. When the black pigments are positioned on the top surface of the microcapsule, it is observed as the black pixel, and vice versa. It is also possible to position the pigment charges so that each color occupies one half of the microcapsule top surface and that is how gray shades are produced.

The display included with the eINK click is the EA-EPA20-A, a 2 inch,172x72 pixels ePAPER display with the integrated SSD1606 driver/controller, from Electronic Assembly. This display uses the SPI communication protocol for the communication with the host MCU. This display features inherently wide viewing angle and high contrast, as well as good readability in daylight conditions. The click board™ itself carries the supporting electronics, used to provide all the necessary voltages for the proper operation of the EPA20-A display. The SSD1606 pins are routed through the flat cable of the display and connected via the 24pin, 0.5mm ZIF connector on the click board. From there, the command and data lines are routed to the appropriate pins on the mikroBUS™ of the eINK click.

The eINK click also contains the LM75 thermal sensor, which uses I2C protocol to communicate with the SSD1606 driver IC. This is required for thermal compensation of the display, so it can be operated in a wide temperature range, from 0°C to +50°C.

The total power consumption of this device is very low. The power is only required when rearranging of the microcell pigments is required, while no power is required to sustain the content of the display. The display retains the content, even when the power is disconnected. The click board and the display are powered via the 3.3V rail of the mikroBUS™.

Note: eINK click is currently supplied with the EA-EPA20-A display with the resolution of 172x72 pixels. The click can also be used with different compatible eINK displays that can be connected to the ZIF onboard connector, which are planned to be supported in the future.

The supplied click library contains easy to use functions, that simplify the workflow with the eINK click. Their usage is demonstrated in the provided example application, which can be used as a reference for the custom design.

Specifications

Type	Electronic Paper Display
Applications	eINK click can be used for applications that require a low power consumption display, which is readable during daylight
On-board modules	EA-EPA20-A, a 2 inch,172x72 pixels ePAPER display with the integrated SSD1606 driver/controller, from Electronic Assembly., LMA75 temperature sensor, onboard.
Key Features	The eINK display retains the display content, even when the power is off, very low power consumption, clearly visible during the daylight
Interface	SPI
Input Voltage	3.3V
Compatibility	mikroBUS
Click board size	S (28.6 x 25.4 mm)

Pinout diagram

This table shows how the pinout on **eINK click** corresponds to the pinout on the mikroBUS™ socket (the latter shown in the two middle columns).

Notes	Pin	mikro™ BUS		Pin	Notes
	NC	1	AN	PWM	16	**D/C**	Data/Config

Reset	**RST**	2	RST	INT	15	**BSY**	Busy indicator
SPI chip select	**CS**	3	CS	TX	14	NC	
SPI clock	**SCK**	4	SCK	RX	13	NC	
	NC	5	MISO	SCL	12	NC	
SPI data input	**SDI**	6	MOSI	SDA	11	NC	
Power supply	**+3.3V**	7	3.3V	5V	10	NC	
Ground	**GND**	8	GND	GND	9	**GND**	Ground

Software Support

We provide a library for the eINK Click on our Libstock page, as well as a demo application (example), developed using MikroElektronika compilers. The demo can run on all the main MikroElektronika development boards.

Library Description

The library covers all functionalities of EPA20-A eINK display.

Key functions:

- `eink_fill_screen( uint8_t color )` - Fills the screen with provided color.
- `eink_text( uint8_t *text, uint8_t x, uint8_t y )` - Writes text on the screen.
- `eink_image_bmp( const uint8_t* img )` - Displays image on the screen.

Examples Description

The application is composed of three sections:

- System Initialization - Initializes SPI module and CS pin, RST pin, PWM pin as output and INT pin as an input.

- Application Initialization - Initializes driver and configures the display

- Application Task - (code snippet) - Repeats operations with a pause of 3 seconds between them.

- Display black letters on a white background

- Display white letters on a black background

- Display external image

```
void applicationTask()
{
 eink_fill_screen( _EINK_COLOR_WHITE );
 eink_set_font( &guiFont_Exo_2_Condensed21x32_Regular[0], _EINK_COLOR_BLACK, _FO_HORIZONTAL );
 eink_text( &_eINK_Text[0], 14, 50 );
 delay_ms( 3000 );

 eink_fill_screen( _EINK_COLOR_BLACK );
 eink_set_font( &guiFont_Exo_2_Condensed21x32_Regular[0], _EINK_COLOR_WHITE, _FO_HORIZONTAL );
 eink_text( &_eINK_Text[0], 14, 50 );
 Delay_ms( 3000 );

 eink_image_bmp( &_mikroe_bmp[0] );
 Delay_ms( 3000 );
}
```

The example carries bmp image converted to an array using Visual TFT.
The full application code, and ready to use projects can be found on our Libstock page.
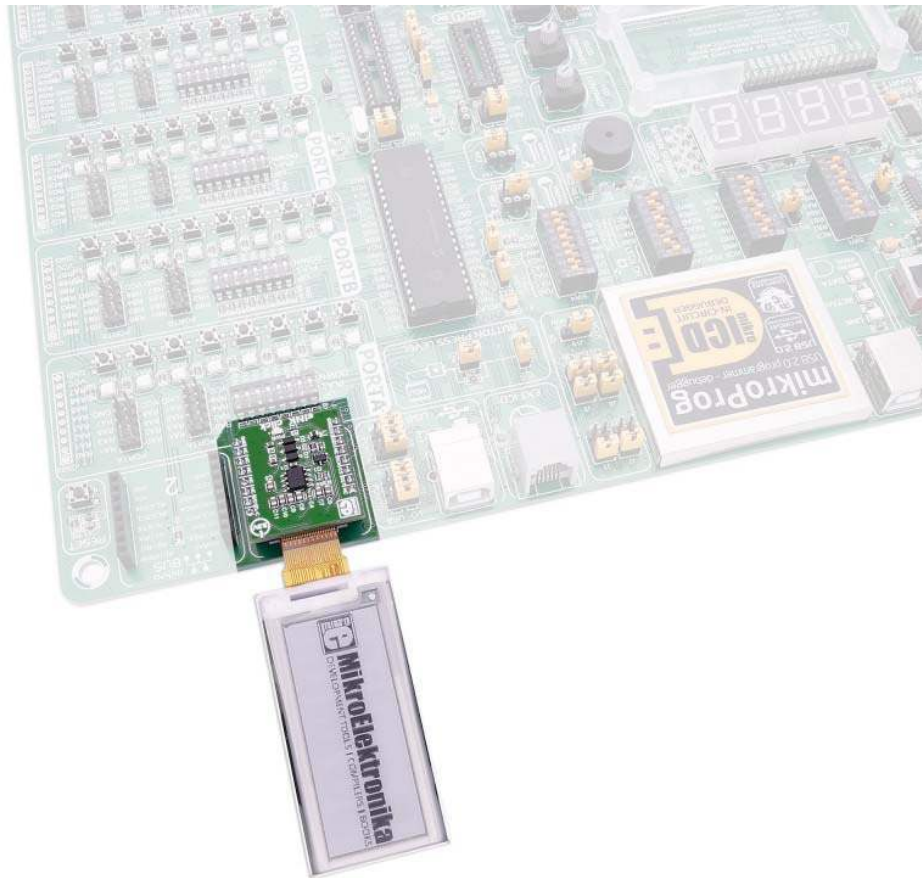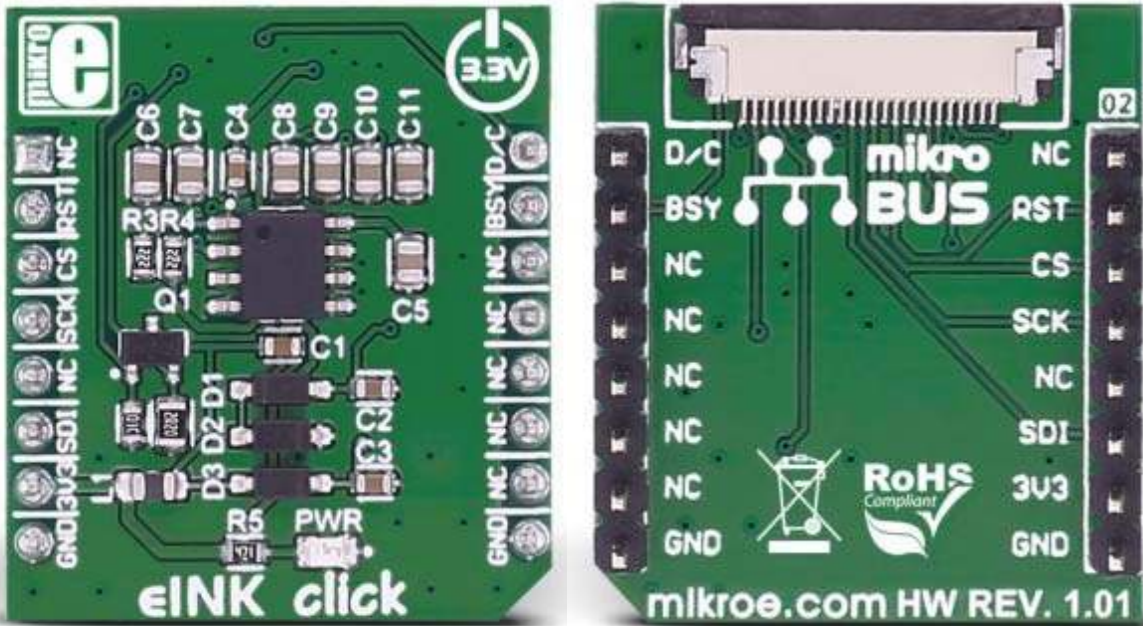Other mikroE Libraries used in the example:

- SPI

Additional notes and information
Depending on the development board you are using, you may need USB UART click, USB
UART 2 click or RS232 click to connect to your PC, for development systems with no UART
to USB interface available on the board. The terminal available in all
MikroElektronika compilers, or any other terminal application of your choice, can be used
to read the message.

mikroSDK

This click board is supported with mikroSDK - MikroElektronika Software Development
Kit. To ensure proper operation of mikroSDK compliant click board demo applications,
mikroSDK should be downloaded from the LibStock and installed for the compiler you are
using.

For more information about mikroSDK, visit the official page.

https://www.mikroe.com/eink-click 5-14-18