MIKROELEKTRONIKA D.O.O, Batajnički drum 23, 11000 Belgrade, Serbia
VAT: SR105917343 Registration No. 20490918
Phone: + 381 11 78 57 600 Fax: + 381 11 63 09 644 E-mail: office@mikroe.com
www.mikroe.com

LCD Mono Click

PID: MIKROE-3789

LCD Mono Click is a Click board™ that uses the LS013B7DH03 LCD display from Sharp which combined with the EFM32, from Silicon Labs, and its energy saving capabilities creates a powerful display application. The application is capable of driving a 128x128 pixel display drawing as little as 2 µA while showing a static image. Even when updating the frame every second the current consumption can be lower than 5 µA.

LCD Mono click is supported by a mikroSDK compliant library, which includes functions that simplify software development. This Click board™ comes as a fully tested product, ready to be used on a system equipped with the mikroBUS™ socket.

How does it work?

The LS013B7DH03 LCD display from Sharp has a reflective active-matrix with slightly transmissive type memory liquid crystal display module with 128 x128 panel which uses CG silicon thin film transistor. Its transmissive mode is available by implementation with backlight and you can control the display with serial data signal communication. It features a thin, light and compact module with monolithic technology and its most important feature is the super low power consumption TFT panel. For an MCU application, a powerful display can often be off-limits, either because of price, CPU processing power or power budget. However, if you use the EFM32's energy saving capabilities together with a Sharp low-power matrix memory LCD you can create a powerful display application. The application is capable of driving a 128x128 pixel display drawing as little as 2 µA while showing a static image. Even when updating the frame every second the current consumption can be lower than 5 µA.

MIKROELEKTRONIKA D.O.O, Batajnički drum 23, 11000 Belgrade, Serbia
VAT: SR105917343 Registration No. 20490918
Phone: + 381 11 78 57 600 Fax: + 381 11 63 09 644 E-mail: office@mikroe.com
www.mikroe.com
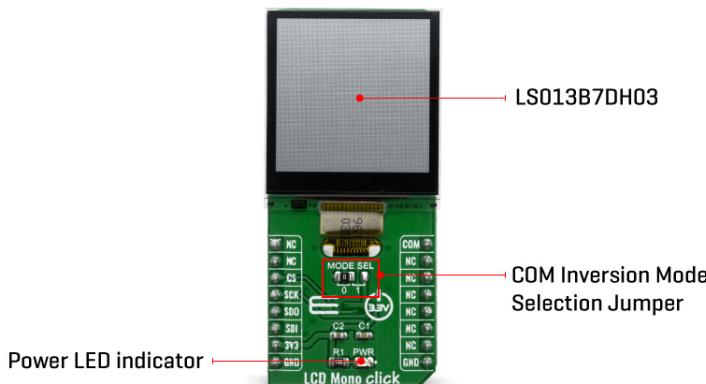
The display used for this click, the LS013B7DH03 LCD, is a 1.28", 128x128 pixels monochrome display, with a 3-wire SPI interface. Apart from the SPI interface, the display requires a 3.3V power supply, and 3 extra pins named EXTMODE, EXTCOMIN and DISP. The SPI protocol consists of three modes. At the start of each SPI transfer, a mode command (1 byte) is sent first. The modes are:

- Update Image
- Toggle Polarity Inversion
- Clear Display

The EXTMODE pin controls how polarity inversion is controlled. The display requires that the polarity across the Liquid Crystal Cell is reversed at a constant frequency. This polarity inversion prevents charge building up within the cell. If EXTMODE is LOW the polarity inversion is toggled by sending a special command over SPI. If it is HIGH polarity inversion is controlled by the EXTCOMIN pin. If EXTMODE is HIGH the polarity inversion is armed for every rising edge of the EXTCOMIN pin. The actual polarity inversion is triggered at the next transision of SCS. The toggling frequency should be at least 1 Hz. If EXTMODE is LOW this pin is ignored. The DISP pin toggles the display on or off (without the pixels losing their state). When LOW the display is off, when HIGH the display is on.

This Click Board™ is designed to be operated only with 3.3V logic level. A proper logic voltage level conversion should be performed before the Click board™ is used with MCUs with logic levels of 5V.

Specifications

Type	LCD
Applications	128x128 pixels monochrome display, with a 3-wire SPI interface
On-board modules	LS013B7DH03 LCD display from Sharp
Key Features	EFM32 helps reduce power consumption, driving a 128x128 pixel display drawing as little as 2 µA while showing a static image
Interface	GPIO,SPI
ClickID	No

MIKROELEKTRONIKA D.O.O, Batajnički drum 23, 11000 Belgrade, Serbia
VAT: SR105917343 Registration No. 20490918
Phone: + 381 11 78 57 600 Fax: + 381 11 63 09 644 E-mail: office@mikroe.com
www.mikroe.com

Compatibility	mikroBUS™
Click board size	L (57.15 x 25.4 mm)
Input Voltage	3.3V

Pinout diagram

This table shows how the pinout on LCD Mono 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	**COM**	COM Inversion polarity OUT
	NC	2	RST	INT	15	NC	
Chip Enable	**CS**	3	CS	RX	14	NC	
SPI Clock	**SCK**	4	SCK	TX	13	NC	
SPI Data Out	**SDO**	5	MISO	SCL	12	NC	
SPI Data IN	**SDI**	6	MOSI	SDA	11	NC	
Power Supply	**3.3V**	7	3.3V	5V	10	NC	
Ground	**GND**	8	GND	GND	9	**GND**	Ground

Onboard settings and indicators

Label	Name	Default	Description
LD1	PWR	-	Power LED indicator
JP1	MODE SEL	Left	COM Inversion mode Selection jumper: left position 0, right position 1

Software Support

We provide a library for the LCD Mono 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 initializes and defines the SPI bus driver and drivers that offer a choice for writing data. The library includes function for displays image or frame, draw text on the screen and function for settings font.

Key functions:

- void lcdmono_draw_const_frame (const uint8_t *frame_data) - Displays draw const frame
- void lcdmono_draw_text (char *text_buf, lcdmono_text_settings_t *cfg , uint8_t end_mode) - Draw text on the screen
- void lcdmono_set_font (const uint8_t *font) - Set font
- void lcdmono_display_reset (void) - Reset procedure

Examples description

The application is composed of three sections :

- System Initialization - Initialization SPI modules and all necessary GPIO pins
- Application Initialization - Driver initialization - Starting LCD Mono display. Print text to the display by changing font size
- Application Task - Drawing an image to the display every 3 second.

Create Image: Save the image in resolution of 128x128 px with the extension (monochrome bmp) ... Upload the image to Image2Lcd program Set parameters to:

- Output file type : C array
- Scan Mode : Horisontal scan
- Bits Pixel : monochrome
- Max width and height : 128x128
- Check only MSB first
- Check Reverse color and adjust Normal type

The image to be generated should contain about 2048 bytes ... Insert the image into the file Click_LCD_Mono_image.h

Create Font: Close existing project, open a new VTFT project Add label and adjust text font Generate source code Copy the font from resource.c file to this project in file Click_LCD_Mono_font.h

The full application code, and ready to use projects can be found on our LibStock page.

Other mikroE Libraries used in the example:

- SPI
- UART

Additional notes and informations

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.
Resources

mikroBUS™

mikroSDK

Click board™ Catalog

Click Boards™

Downloads

LCD Mono click example on Libstock

LCD Mono click 2D and 3D files

LS013B7DH03 datasheet

LCD Mono click schematic