

# TFT LCD Breakout 1.8in 128x160 Hookup Guide

## Introduction

The TFT LCD Breakout 1.8in 128x160 is a versatile, colorful, and easy way to experiment with graphics or create a user interface for your project. In this guide we will familiarize ourselves with the hardware, explain how to connect the display to your microcontroller of choice, cover how to install the Arduino libraries, and give an overview of the software examples that you can start off with.

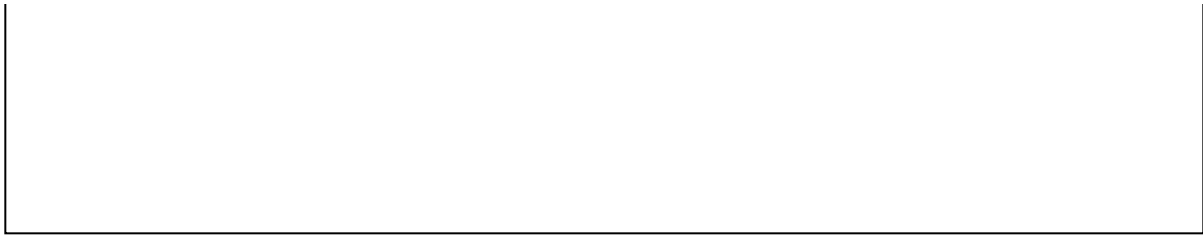


SparkFun TFT LCD Breakout - 1.8" (128x160)

● LCD-15143

Product Showcase: SparkFun TFT LCD Breakout





## Required Materials

The TFT LCD Breakout has Plated-Through-Hole (PTH) connections. You can connect these in a number of different ways but we suggest soldering in breakaway headers for use with a breadboard. You'll also need an Arduino compatible microcontroller of your choice - we recommend something with extra RAM like the ESP32 Thing Plus or the RedBoard Turbo. You may not need everything on this wish list, depending on what you may already have. Add it to your cart, read through the guide, and adjust the cart as necessary.

### TFT LCD Breakout 1.8in 128x160 Hookup Guide Wish List [SparkFun Wish List](#)

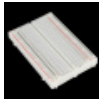


Jumper Wires Premium 12" M/F Pack of 10  
PRT-09385

This is a SparkFun exclusive! These are 12" long jumper wires terminated as male to female. Use these to jumper f...



SparkFun TFT LCD Breakout - 1.8" (128x160)  
LCD-15143



Breadboard - Self-Adhesive (White)  
PRT-12002

This is your tried and true white solderless breadboard. It has 2 power buses, 10 columns, and 30 rows - a total of ...



SparkFun Thing Plus - ESP32 WROOM  
WRL-14689



Break Away Headers - Straight  
PRT-00116

A row of headers - break to fit. 40 pins that can be cut to any size. Used with custom PCBs or general custom head...

## Tools

In addition to those components, you'll need a soldering iron, solder, and probably some general soldering accessories to help with the job.



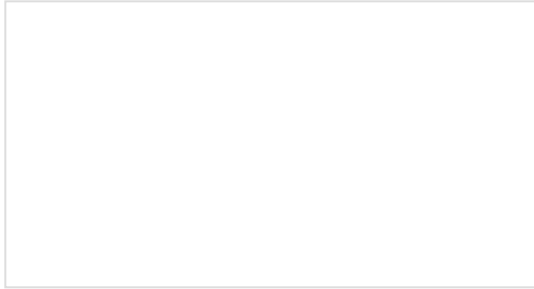
Solder Lead Free - 100-gram Spool  
● TOL-09325



Weller WLC100 Soldering Station  
● TOL-14228

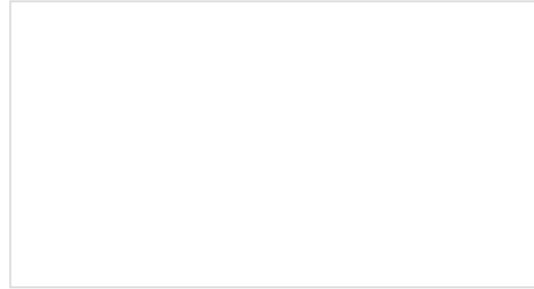
## Suggested Reading

If you aren't familiar with the following concepts, we recommend checking out these tutorials before continuing.



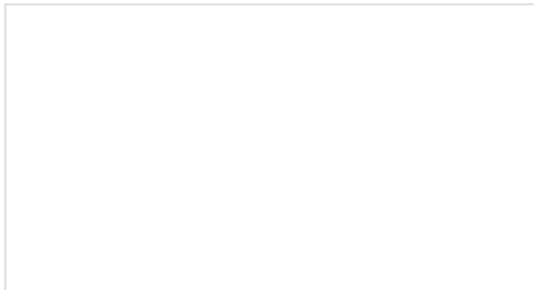
### How to Solder: Through-Hole Soldering

This tutorial covers everything you need to know about through-hole soldering.



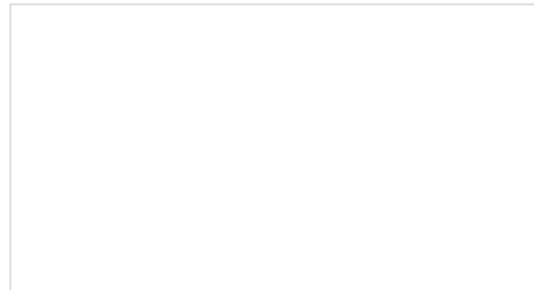
### Installing an Arduino Library

How do I install a custom Arduino library? It's easy! This tutorial will go over how to install an Arduino library using the Arduino Library Manager. For libraries not linked with the Arduino IDE, we will also go over manually installing an Arduino library.



### Serial Peripheral Interface (SPI)

SPI is commonly used to connect microcontrollers to peripherals such as sensors, shift registers, and SD cards.



### Everything You Should Know About HyperDisplay

This is a tutorial to go in-depth about the SparkFun HyperDisplay Arduino Library.

## Hardware Overview

### TFT LCD Module (KWH018ST01)

The TFT module is the heart of this product -- it contains all the subsystems that are required to make an image show up. Starting with one of the most obvious features; the LCD screen is a glass panel with small little cells of liquid crystal (LC) material that can be shifted from opaque to clear with an electronic signal (more on how LCDs work). For each of the 128x160 pixels in the screen there are three LC cells and each cell has either a red, green, or blue filter in it to color the light. A pixel gets colored when white light from the LED backlight passes through the filtered cells in varying amounts.



The amount of light passed through is controlled by the signal applied to the liquid crystal cells, but the sheer number of pins and complexity of those signals is totally impractical to control directly with a microcontroller. Fortunately some really smart cookies created a dedicated driver Integrated Circuit (IC) that stores pixel data and puts it on the screen for us. Connections to the driver, as well as the backlight, are broken out along a flexible flat printed circuit (FPC) cable - and that's where we take over.

### FPC Connector

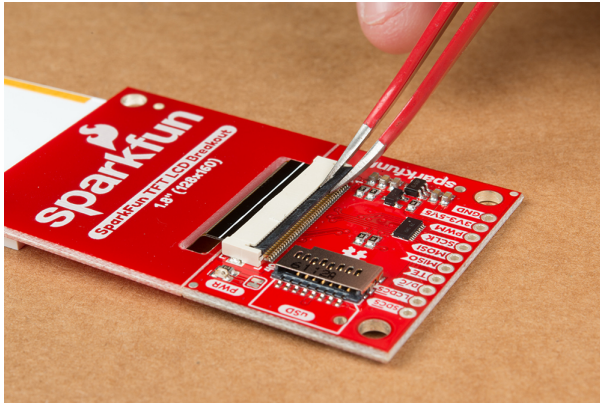
The FPC connector is convenient for two reasons. First, it's extremely simple to (re)connect the display to the breakout board. Second, production of this product is made easier because all soldering can be done in our normal surface mount process.



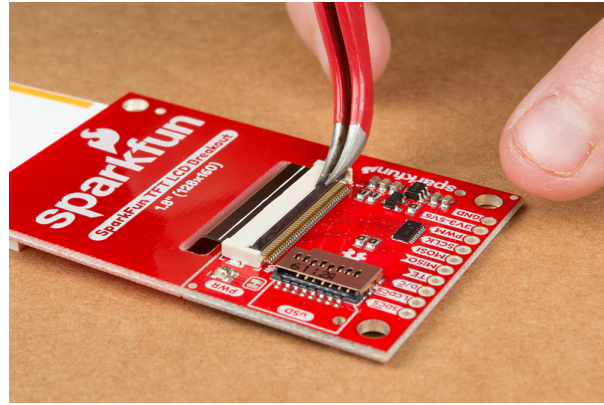
To disconnect the TFT module just flip up the black locking bar with a finger or pair of tweezers and then gently pull the cable straight out from the connector. To put the cable back in, first make sure that the polarity indicators on the cable (1, 40) match up with those on the board and that the black locking bar is flipped up. Next push the cable in evenly for about 2mm.

⚡ **PLEASE NOTE:** Pay attention to the direction of the connector cable. Reconnecting the cable upside down could cause shorts since the FPC connector has contacts on both the top and bottom.

Click on any of the below images for a closer look at what's going on:



*Grasp Black Locking Bar*



*Lift Black Locking Bar Up*



*Geni*

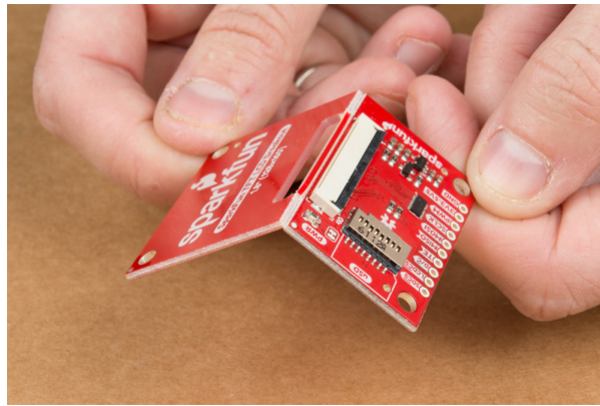
## microSD Card Holder

The microSD card holder is there to relieve your microcontroller's poor memory due to having to store hundreds of images of cats, or really whatever you want to keep there. The SD card is connected to the same SPI bus as the display, which in turn keeps the required pin count low.

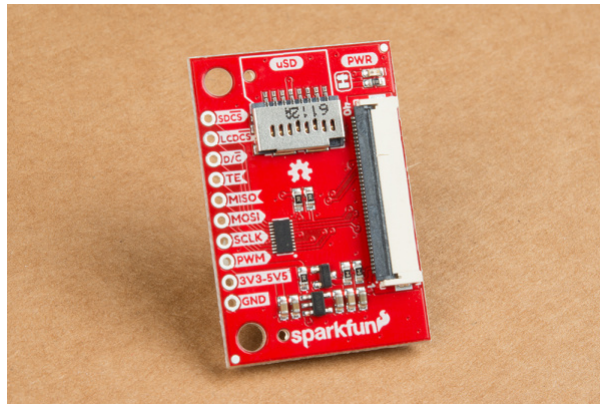


## Breakaway Panel

Out of the box, the TFT will come with a large backing PCB that makes it easy to securely mount the display in a project. If you need a more flexible solution you can remove the display module, snap off half the backing board, and then re-insert the display module. When this is done you'll be left with the bare minimum frame around the display to more seamlessly integrate with your project.



*Breakaway Point of the Backing PCB*



*PCB Without the Backing Board*

## Pinout

The pinout of this breakout includes the standard SPI interfaces for both the TFT and the microSD card as well as a few specialty pins. You can power the breakout with either **5V** or **3.3V** thanks to the onboard voltage regulator and level shifter.



- **SDCS** : The microSD card chip select, pull this pin low to talk to the microSD card
- **LCDCS** : Chip select for the display, pull it low to talk to the TFT module

- **D/C** : This is a special signal found in many display controllers. When it is high the incoming data is interpreted as data as opposed to commands when it is low.
- **TE** : Tearing Effect is an optional output from the display to synchronize data writes - to avoid the 'Tearing Effect' that is seen when data is changed halfway through a screen refresh
- **MISO** : On this line the microSD card sends data back to the uC
- **MOSI** : The uC uses this line to send data into the TFT or microSD
- **SCLK** : Provides synchronization, but rates of up to 32 MHz are possible
- **PWM** : MOSFET input that allows a PWM signal to dim the backlight
- **3V3-5V5** : Since the breakout has a voltage regulator and level shifter built in you can use it with either of these two popular voltages.
- **GND** : It is important to stay grounded!

## Hardware Hookup

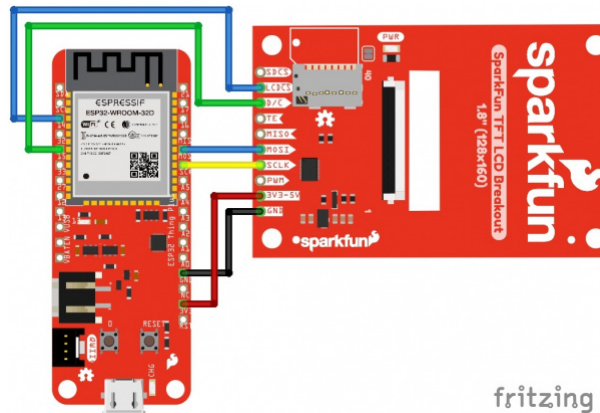
So you've got this breakout board with a whole bunch of pins and all you want to do is make sure it works before you write a bunch of code, right? Let's talk about the bare minimum connections required to get things working.

Required for TFT Display			
Breakout Pin	Arduino Uno	Esp32 Thing Plus	Microcontroller Pin Requirements
MOSI	11	18/MOSI	Data output of chosen SPI port
SCLK	13	5/SCK	Clock output of chosen SPI port
LCDCS	5	14	An output pin
D/C	6	15	An output pin

Required for microSD Card			
Breakout Pin	Arduino Uno	Esp32 Thing Plus	Microcontroller Pin Requirements
MOSI	11	18/MOSI	Data output of chosen SPI port
MISO	12	19/MISO	Data input of chosen SPI port
SCLK	13	5/SCK	Clock output of chosen SPI port
SDCS	4	27	An output pin

Completely Optional			
Breakout Pin	Arduino Uno	Esp32 Thing Plus	Microcontroller Pin Requirements
PWM	3	21	An output pin, ideally PWM capable
TE	7	17	An input pin, ideally interrupt capable

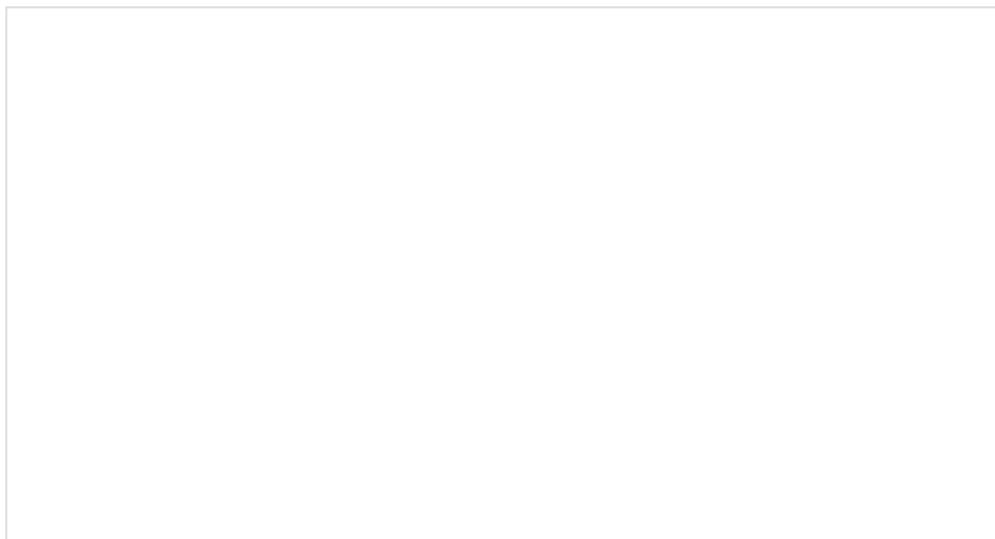
**Please Note:** In the charts above, we are using the pin numbers listed for the Arduino Uno (and similar boards) as well as the ESP32 Thing Plus, but you can choose any pin that satisfies the requirements. Just make sure to use the right pin in your code. The fastest and most re-usable way to connect your breakout is to solder in straight breakaway headers and then connect to the microcontroller using a breadboard.



## Software Setup

**Note:** This example assumes you are using the latest version of the Arduino IDE on your desktop. If this is your first time using Arduino, please review our tutorial on installing the Arduino IDE. If you have not previously installed an Arduino library, please check out our installation guide.

Since the driver IC conveniently supports the SPI protocol you could start using it with just the stock Arduino libraries - but nobody wants to recreate the proverbial 'wheel' of computer graphics so we will get tricked out with the SparkFun HyperDisplay library and a driver made especially for this breakout.



Everything You Should Know About HyperDisplay  
FEBRUARY 20, 2019



This is a tutorial to go in-depth about the SparkFun HyperDisplay Arduino Library.

HyperDisplay is an abstracted library for pretty much any 2D graphics display and has a focus on extensibility. Since the interface is standardized you can write display applications just once and make them work on many different displays with a few small changes. If you want to go more in depth check out this HyperDisplay tutorial. To get your TFT breakout working as soon as possible just keep reading along!

To use the breakout with HyperDisplay you will need to have all three of the following libraries installed in your Arduino IDE. You can head on over to the individual GitHub pages to download or simply click the appropriate link for each of the libraries listed below:

Library Name	Arduino Library Manager Search Term	GitHub Link	Download Link
HyperDisplay	SparkFun HyperDisplay	HyperDisplay GitHub	HyperDisplay Download
HyperDisplay ILI9163C	SparkFun HyperDisplay ILI9163C	ILI9163C GitHub	ILI9163C Download
HyperDisplay KWH018ST01 4WSPI	SparkFun HyperDisplay KWH018ST01 4WSPI	KWH018ST01 4WSPI GitHub	KWH018ST01 4WSPI Download

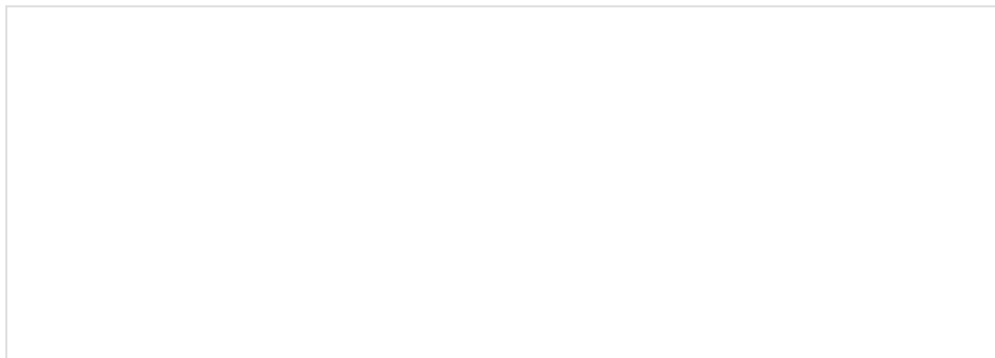
Check out this tutorial on how to install an Arduino library if you are unfamiliar.

Each of the libraries above contain some examples, however the ones that will actually make your TFT breakout light up are contained in the 'KWH018ST01' library -- in case you are wondering that name comes from the name of the TFT module that is used on the breakout. Once your libraries have been installed move on to the next section and try out a few of the examples.

## Example Sketches

The HyperDisplay library for the TFT breakout is named after the LCD module that it uses - the KWH018ST01. If you've properly installed the required libraries, you'll notice a number of examples in *File -> Examples -> SparkFun HyperDisplay KWH018ST01 4WSPI*.

All of the following examples are explained in depth in the Everything You Should Know About HyperDisplay Tutorial. We'll show you a quick overview of each example here, but if you want more information on how these examples and their code work, head on over to the HyperDisplay Tutorial.



# Everything You Should Know About HyperDisplay

FEBRUARY 20, 2019

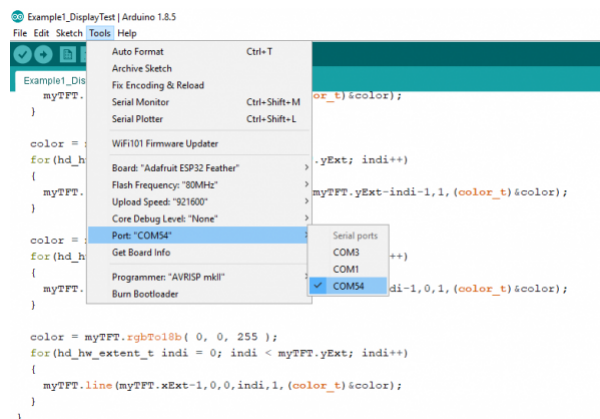
This is a tutorial to go in-depth about the SparkFun HyperDisplay Arduino Library.

## Examples 1-3

These are basic sketches to help you get the TFT running and show you the options for working with HyperDisplay.

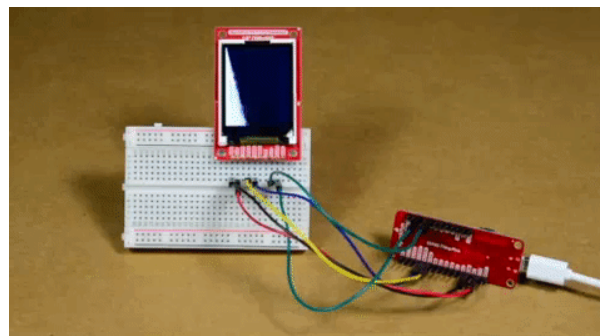
### Example 1

This first example just helps you determine if everything is hooked up correctly and you can upload code and images to your modules. To start, go to *File->Examples->SparkFun HyperDisplay KWH018ST01 4WSPI Library* and load *Example1\_DisplayTest*. Make sure you have the correct board selected, as well as the correct COM port. In windows, it will look like this:



*Click the image for a closer look.*

Upload your code, and you should see the following:



*Click the image for a closer look.*

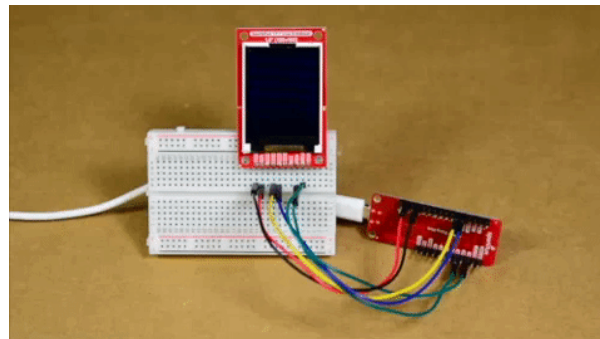
Does it work? If not, go back to the Hardware Hookup section and make sure all the connections are set correctly.

❗ **Check your code!** Make sure as well that whatever pins you've selected for the CS\_PIN and DC\_PIN are set correctly. By default, the example code lists these two pins as Arduino pins 5 and 6. However, with the ESP32 Thing Plus, these pins will be 14 and 15.

## Example 2

This code walks you through the simplest uses of HyperDisplay so that you can start to write your own code. To start, go to *File->Examples->SparkFun HyperDisplay KWH018ST01 4WSPI Library* and load *Example2\_HyperDisplayBasics*. As above, please make sure you have the correct board selected, as well as the correct COM port. Go ahead and upload your code.

❗ **Please Note:** The text capabilities of the ESP32 Thing Plus are still a work in progress. If you are using an Arduino board, you will see "Hello World". The ESP32 Thing Plus will show the shapes, but not text.

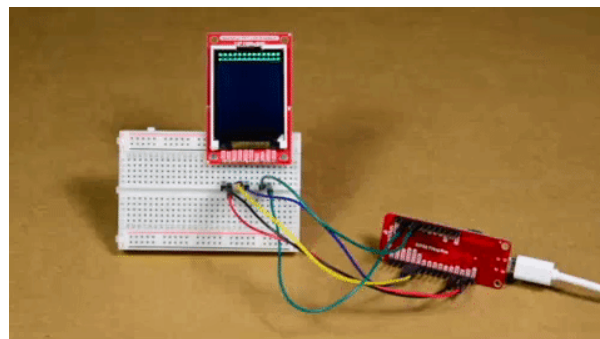


*Click the image for a closer look.*

## Example 3

Example 3 goes over all the options currently available in the HyperDisplay drawing functions. To start, go to *File->Examples->SparkFun HyperDisplay KWH018ST01 4WSPI Library* and load *Example3\_AdvancedHyperDisplay*. As above, please make sure you have the correct board selected, as well as the correct COM port. Go ahead and upload your code.

If everything is set up correctly, you should see the following. As noted above, text capabilities for the ESP32 Thing Plus are still a work in progress. Arduino boards will show some text, ESP32 Thing Plus boards will not.



*Click the image for a closer look.*

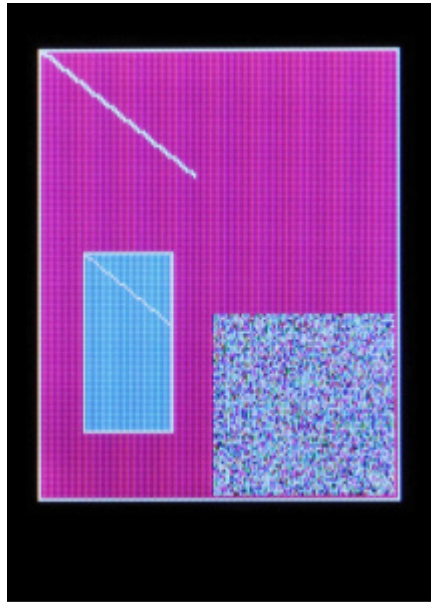
## Examples 4-6

These examples require a microcontroller with at least 6 kB RAM such as the Esp32 Thing Plus.

#### Example 4

This example shows you the basics of how to use the buffering abilities of HyperDisplay. To start, go to *File->Examples->SparkFun HyperDisplay KWH018ST01 4WSPI Library* and load *Example4\_BufferingHyperDisplay*. As above, please make sure you have the correct board selected, as well as the correct COM port. Go ahead and upload your code.

You should see something like what we have pictured here:

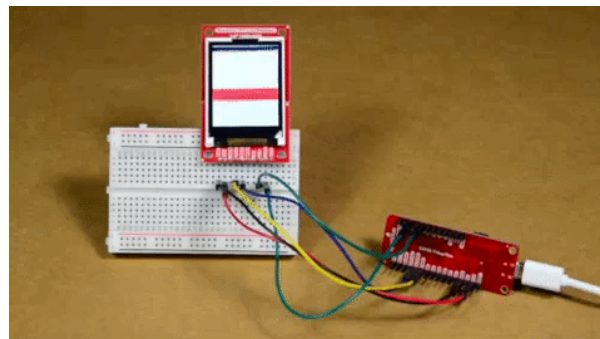


*Click the image for a closer look.*

What you see may not be exactly what we have pictured here - some boards (like the ESP32 Thing Plus) have advanced memory protections in place and will not access uninitialized memory.

#### Example 5

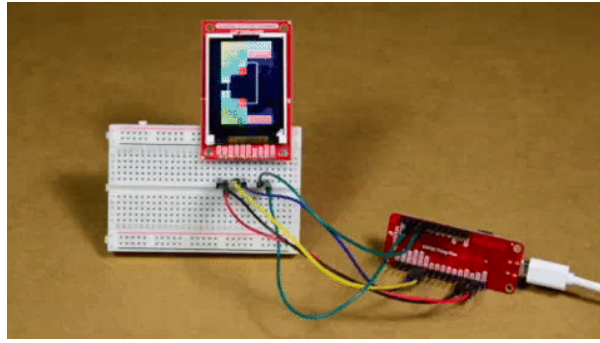
This example highlights a unique use of a TFT display - visualizing the contents of RAM. Open *Example5\_ExploringRAM* from the *File->Examples->SparkFun HyperDisplay KWH018ST01 4WSPI Library* folder and upload your code. You'll see something like the following:



*Click the image for a closer look.*

#### Example 9

Example9\_Fractals uses Nick Gammon's Big Number Library to explore the Mandelbrot set fractal. It takes a few minutes to run through all the calculations, but the result is this beautiful image below:



*Click the image for a closer look.*

If you've followed along with the examples then you're well enough acquainted with the capabilities of your TFT breakout and the HyperDisplay library to venture out and start writing your own code. Fly, be free, and make something neat!

## Resources and Going Further

For more information, check out some of the resources listed here:

- [LCD TFT Breakout GitHub Repo](#)
- [Schematic \(PDF\)](#)
- [Eagle Files \(ZIP\)](#)
- [HyperDisplay Tutorial Link](#)

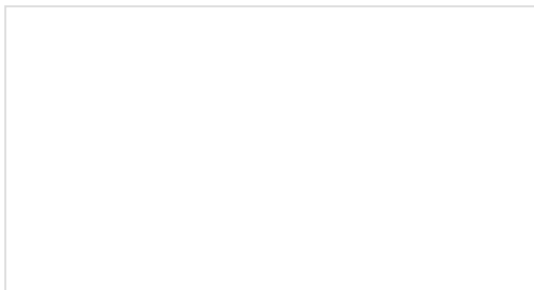
Arduino Libraries:

- [KWH018ST01 4WSPI Arduino Library](#)
- [HyperDisplay ILI9163C Arduino Library](#)
- [SparkFun HyperDisplay Arduino Library](#)

Datasheets:

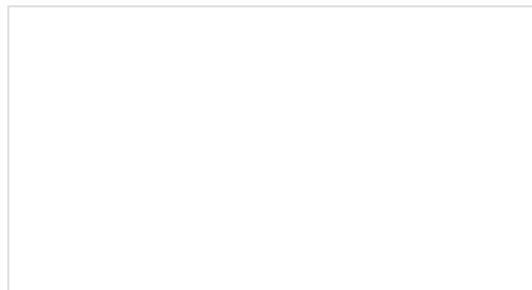
- [ILI9163C Driver IC Datasheet](#)
- [TFT Module Datasheet](#)

Need inspiration? Check out these other great display tutorials from SparkFun:



### ELastoLite Hookup Guide

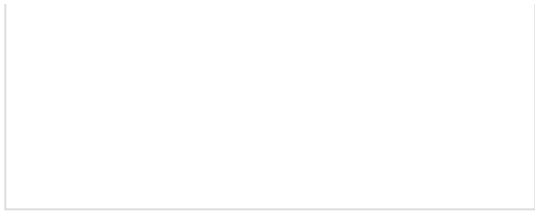
Everything you need to setup a circuit using ELastoLite super flexible EL Panels from Oryon Technologies.



### Large Digit Driver Hookup Guide

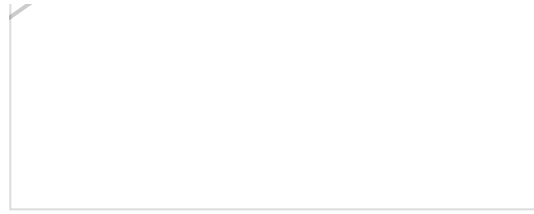
Getting started guide for the Large Digit display driver board. This tutorial explains how to solder the module (backpack) onto the back of the large 7-segment LED display and run example code from an Arduino.





### Transparent Graphical OLED Breakout Hookup Guide

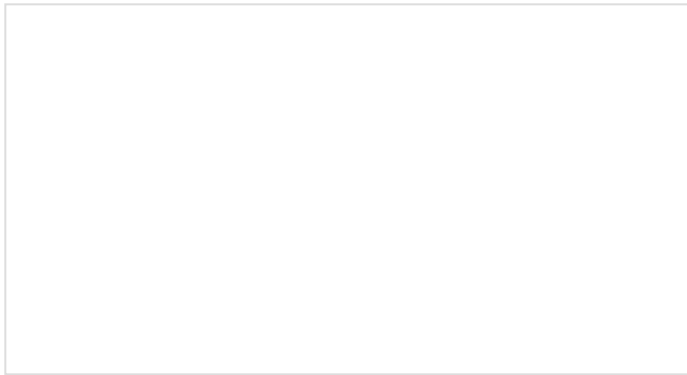
The future is here! Our Qwiic Transparent Graphical OLED Breakout allows you to display custom images on a transparent screen using either I2C or SPI connections.



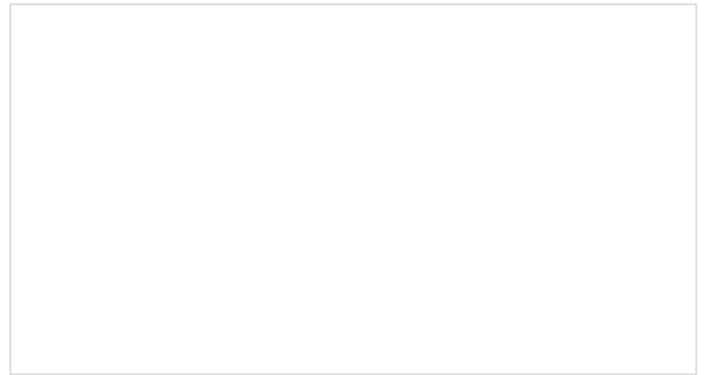
### Beginner Parts Kit Identification Guide

The essential parts for beginning (or even experienced) hobbyists that gives you all of the basic through-hole components you will need to get started playing with embedded projects. We'll identify a few parts in the kit and provide a few basic circuits to get started!

Or check out some of these blog posts for ideas:



**Electronic Campfire**  
MARCH 4, 2015



**Shades of Gray in the 3D Printing Marketplace**  
FEBRUARY 21, 2018