User's Manual

ELI70-INHW
ELI70-IPHW
ELI70-IRHW
ELI70-INHW-M
ELI70-IPHW-M
ELI70-IRHW-M

ELI70-IPHW

ELI70-IPHW-M (with mounting brackets)

Revision 1.10

Future Designs, Inc.
Your Development Partner
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1.0 Introduction

About ELI (the Easy LCD Interface)

ELI® is Future Designs, Inc.'s family of long-life, plug-and-play embedded displays. ELI products are true modular embedded display solutions that require no engineering or lead-time. All ELI products are compatible with a wide range of single board computers including Raspberry Pi, BeagleBone Black and Windows-based units. FDI designed ELI as an embedded display option that requires minimal development time to help customers reach production quickly. Once a product is in production, FDI's 10-15 year ELI product availability guarantee helps ensure production schedules without the risk of expensive or time-consuming redesigns. Learn more about ELI at TeamFDI.com/ELI.

The ELI70-IxHW Family consists of three versions with different touch screen options:

- ELI70-INHW – No Touch Screen
- ELI70-IPHW – PCAP Touch Screen
- ELI70-IRHW – 4-wire Resistive Touch Screen

Each of these products is also available in a -M version with factory installed mounting brackets for customer convenience.

ELI Compatibility

ELI products are compatible with most Single Board Computers (SBCs), PCs and operating systems. See the product detail pages for the results of FDI's compatibility tests with popular operating systems and platforms.

- ELI70-INHW Product Details
- ELI70-IPHW Product Details
- ELI70-IRHW Product Details
- ELI70-INHW-M Product Details
- ELI70-IPHW-M Product Details
- ELI70-IRHW-M Product Details
-

Our results, as indicated in the table, demonstrate ELI versatility but the table is not exhaustive. ELI products are designed to work with any single board computer that has an HDMI output. To submit a question about ELI compatibility with a platform or operating system that is not included in the table, contact a member of the FDI support team at Support@teamfdi.com.

Your ELI Experience

Share your experience connecting ELI devices to various (single board) computers at: https://www.teamfdi.com/edid/#edidform.

2.0 Recommended Accessories (Purchased Separately)

- 12V DC +/-5% 2A Power Supply with a center positive barrel plug
  - 2.1mm I.D. x 5.5mm O.D. x 9.5mm
  - All ELI units operate from +12V DC so this is the recommended power supply input voltage for the entire Family.
  - See Section 8, Power Details, for more info
- USB Type A to Mini Type B Cable (For touch)
- HDMI Cable (Type A Male)
- Lengths for the USB and HDMI cables will be determined by the ELI mounting location and position in each user application.

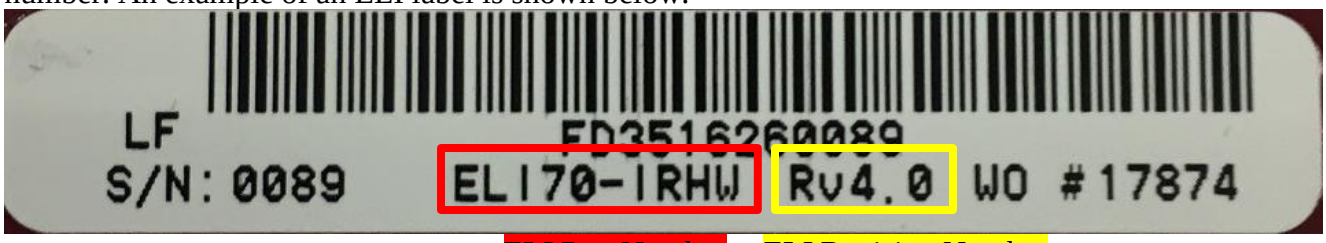
3.0 ESD Warning

Figure 1. Electrostatic Sensitive Device

Our ELI units are shipped in a protective anti-static package. Do not subject the module to high electrostatic potentials. Exposure to high electrostatic potentials may cause damage to the boards that will not be covered under warranty. General practice for working with static sensitive devices should be followed when working with this device.

4.0 Determining the Revision of your ELI

All ELI devices have a label placed on the board to identify the part number and revision of the unit. This label will help you quickly and correctly identify your ELI unit's part number and revision number. An example of an ELI label is shown below.



ELI Part Number ELI Revision Number

5.0 Technical Specifications

Table 1. Technical Specifications

Screen Size:	7.0 inches (diagonal)		
Display Technology:	IPS a-Si TFT LCD		
Resolution:	800 x 480 (WVGA)		
Brightness:	**INHW**	**IPHW**	**IRHW**
	800 nits (typ)	700 nits (typ)	640 nits (typ)
Contrast Ratio:	1000:1 (typ)		
Aspect Ratio:	16:9		
Interface Input Mode:	HDMI		
Colors:	262K (18 bit)		
Horizontal Viewing Angle:	85/85° L/R		
Vertical Viewing Angle:	85/85° U/D		
Surface:	Anti-glare		
Touch Screen:	**INHW**	**IPHW**	**IRHW**
	None	PCAP	4-Wire Resistive
Touch Screen Interface:	USB	**IPHW / IRHW Only**	
Touch Panel Hardness:	>3H		
Touch Panel Force:	120gF (max)		
Active Area:	152.4 (W) x 91.44 (H) mm		
Response Time:	30ms		
Backlight:	21 LED (7S x 3P)		
Backlight Life:	70K hours (typ)		
Input Voltage:	+12V DC ± 5%		
Power Consumption:	500mA (typ) / 650mA (max) @ 12VDC		
Backlight Power Consumption:	Up to 73% of Power Consumption		
USB Power Consumption:	**INHW**	**IPHW**	**IRHW**
	None	50mA (typ) / 100mA (max) @ 5.0VDC	
Operating Temperature:	-30° to 80° C		
Storage Temperature:	-40° to 90° C		
RoHS Compliant:	Yes		
Dimensions [INHW / IRHW]:	167.3 (W) x 150.0 (H) x 29.7 (D) mm		
Dimensions [IPHW]:	169.5 (W) x 150.0 (H) x 29.7 (D) mm		
Mounting:	M3-0.50 screws in 4 corners		
Weight:	**INHW**	**IPHW**	**IRHW**
	312 grams	376 grams	366 grams

6.0 Mechanical and Mounting Details

2D Mechanical Drawings of these models are available on our website under the Documentation tab:
https://www.teamfdi.com/product-details/eli70-inhw
https://www.teamfdi.com/product-details/eli70-iphw
https://www.teamfdi.com/product-details/eli70-irhw

There are also models with factory-installed Mounting Brackets with the following part numbers:

- ELI70-INHW-M
- ELI70-IPHW-M
- ELI70-IRHW-M

2D Mechanical Drawings of the –M models are also available on our website under the Documentation tab:
https://www.teamfdi.com/product-details/eli70-inhw-m
https://www.teamfdi.com/product-details/eli70-iphw-m
https://www.teamfdi.com/product-details/eli70-irhw-m

3D Mechanical Models (in both STEP and EASM format) are available for customers after submitting a simple Non-Disclosure Agreement (NDA). More details at the link below:
https://www.teamfdi.com/mechanicalmodelrequest

One mounting option for the standard ELI70-INHW, ELI70-IRHW and ELI70-IPHW (without mounting brackets) would be to remove the four (4) M3 screws that attach the PCBA to the display back and replace them with four (4) Male to Female Standoffs. An example of this type of standoff is the McMaster PN 93655A353 which is a M3 x 20mm standoff, but they are offered in several different lengths and material types.

Note the four (4) M3 Philips Head Screw locations shown in the picture on the next page (Figure 2).

7.0 Connectors

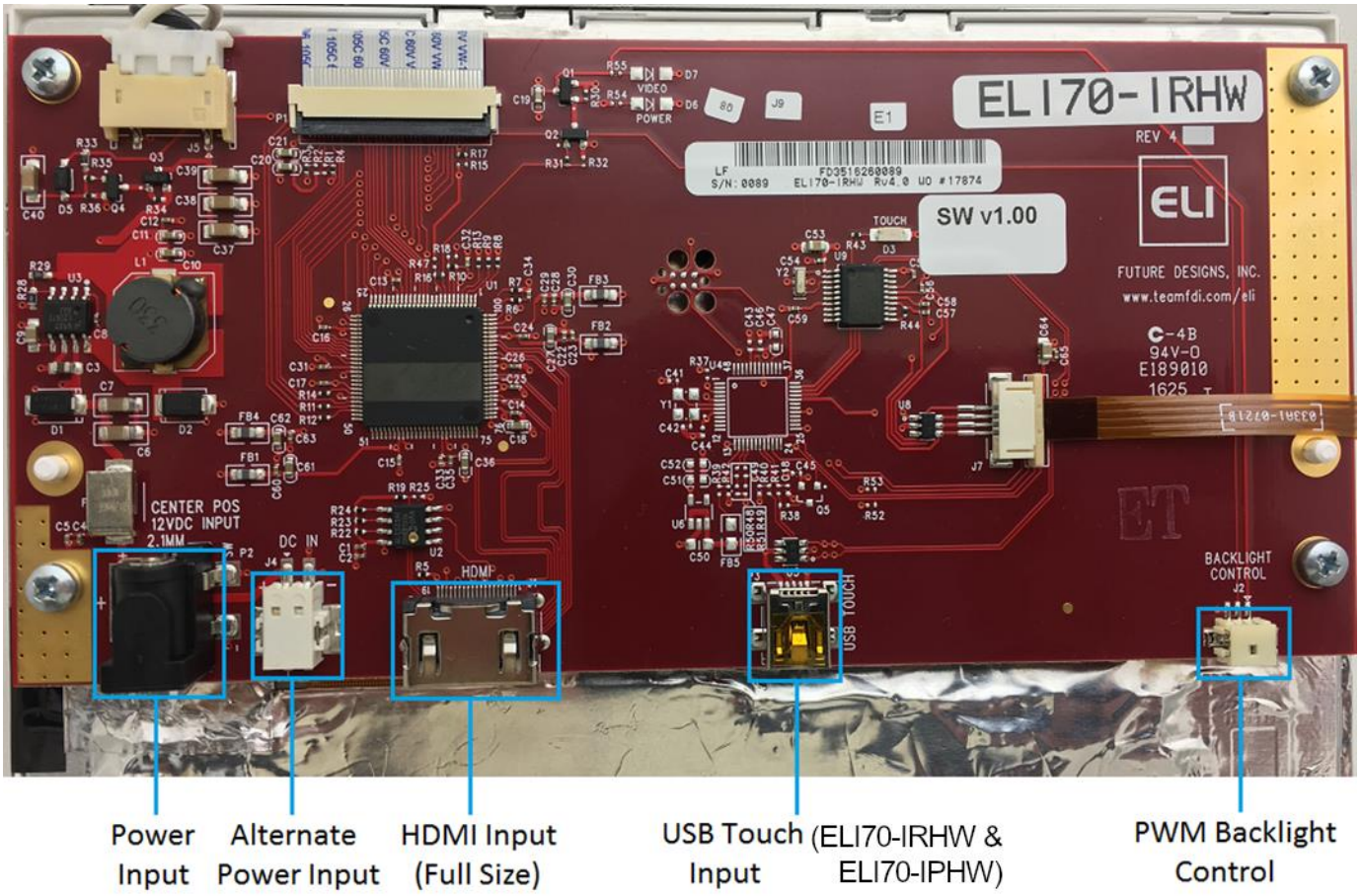


Figure 2. Common Connectors

8.0 Power Details

A 12VDC +/- 5% power supply with a 2.0A output will power any board from the ELI Family. This allows a common, off-the-shelf power supply such as the **T1071-P5P-ND** to be used for quick demos or prototyping across the entire ELI Family. In general, any 12VDC power supply with a 2.1mm center positive plug will be acceptable if it can provide enough current to power the particular ELI unit being used.

If using a standard power supply, plug into the (P2) connector to power the ELI. For volume production applications, the input power can be optimized for your particular ELI unit and lower capacity power supplies can be used.

In cases where the barrel connector is not desired, you can use the alternate power input connector (J4) which supports directly plugging in 20-26 AWG wire with maximum 5A current per contact. The datasheet for this J4 connector (PCB terminal block - PTSM 0,5/ 2-2,5-H SMD WH R24 – 1814634) can be found at https://tinyurl.com/1814634.

To verify that the ELI is correctly powered, you may check the 12VDC input with a Fluke meter or scope by probing the +12V and GND contacts shown below. Please verify that the 12VDC is present, is within the +/- 5% tolerance and is free from excessive noise or AC ripple.

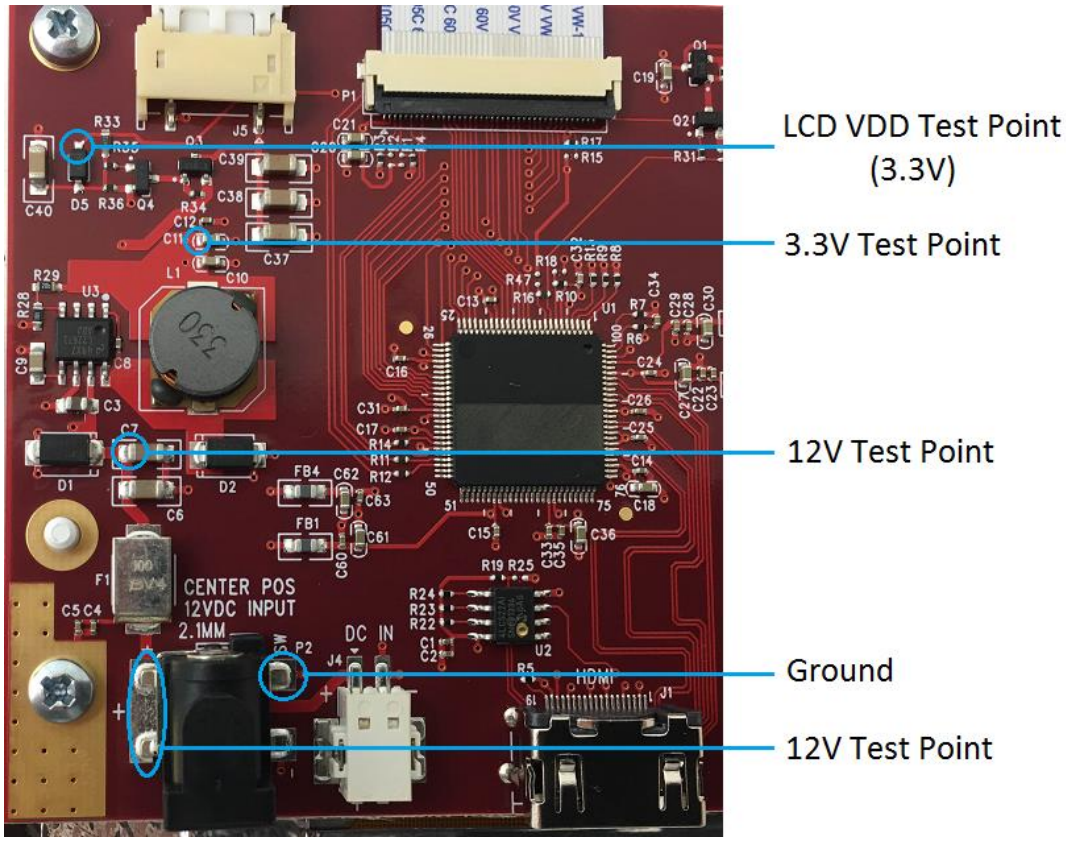


Figure 3. ELI70-IPHW Power Test Points

9.0 Extended Display Information Data (EDID)

ELI uses Extended Display Identification Data (EDID) for automatic configuration with many operating systems. You can find out more on our website at https://www.teamfdi.com/edid/.

10.0 PWM Control of Backlight

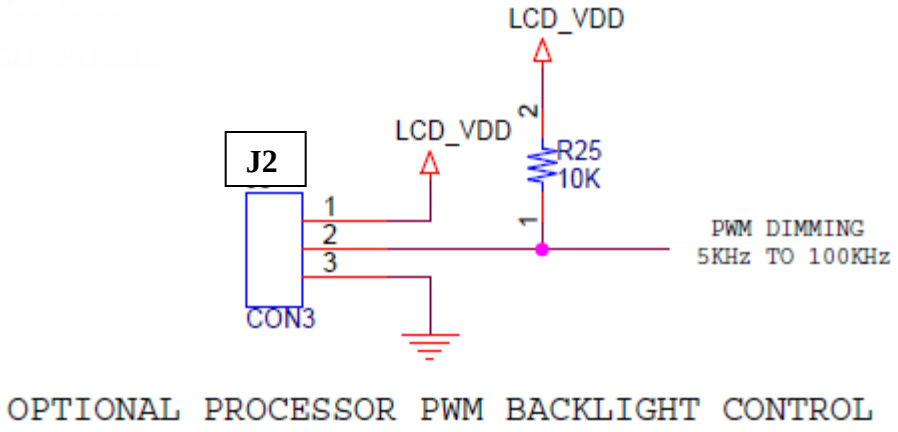


Figure 4. PWM Backlight Control

J2 mating connector housing information:

- Manufacturer: Hirose
- Part Number: DF12-3S-1.25C
- Digi-Key Link: https://www.digikey.com/products/en?keywords=H2180-ND
- Pre-terminated wires https://www.digikey.com/products/en?PPV=1811-9-566967

ELI provides an input so an external processor or SBC can control the backlight to vary the display brightness or to reduce power consumption (the display backlight is typically one of the larger sources of power consumption in the unit). PWM dimming is an input with a 0 to 3.3 VDC range and the user should drive this with a push-pull type output or a suitable open collector output.

To control the display backlight the user should connect an externally generated Pulse Width Modulated (PWM) signal to J2 pin 2 along with a common ground to J2 pin 3. The frequency range for this signal is from 5KHz to 100KHz. Each ELI unit's display backlight properties will vary, so the user should test their version for an acceptable range of brightness control. For example, your 0 to 100% brightness range may be 40% to 90% of the PWM range. In certain installations, a series resistor on J5 pin 2 may be required to ensure a clean PWM signal is provided to the ELI. The suggested value for the resistor is 100ohms. See Figure 6 below, for example of connectivity. Actual testing in your installation may require this resistor to be changed, or possibly not required at all.

On the ELI unit, the PWM dimming signal is pulled up to LCD_VDD providing 100% backlight power when no PWM signal is applied at pin 2 of J5. If nothing is connected to J5 the ELI will drive the display at 100% brightness (default).

The LCD_VDD output at pin 1 of J2 is a 3.3VDC ± 5%. If the external system is capable of directly driving the PWM dimming signal at 3.3VDC, there is no need to connect pin 1 to the cable. ELI provides the 3.3 VDC signal, called LCD_VDD, for the external system in case this voltage is needed

to generate the correct levels on the PWM Dimming Input.

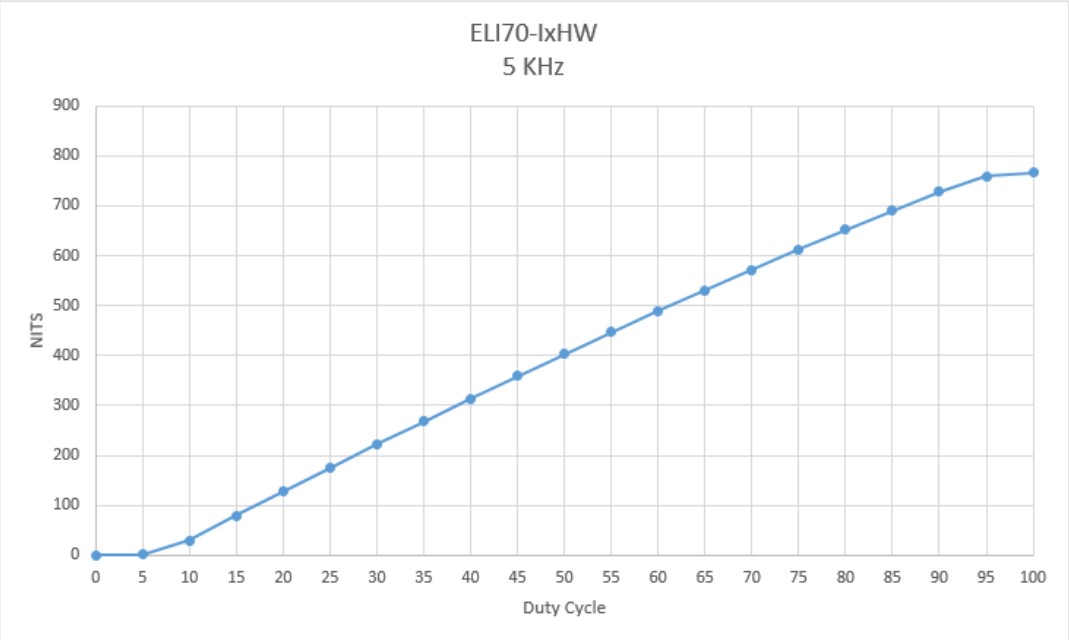


Figure 5. ELI70-IxHW Backlight Curve in Nits

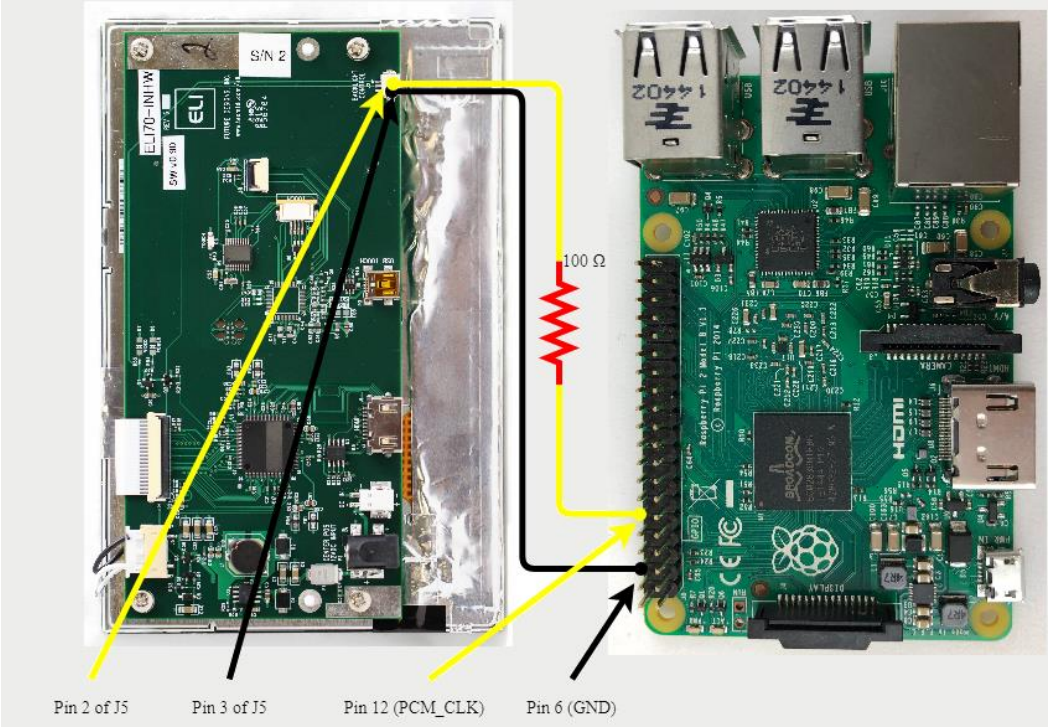


Figure 6. Raspberry Pi Signal and Ground

The ELI backlight can be controlled from a Raspberry Pi. See Figure 6 for a wiring diagram. Our software is available on the FDI website at https://www.teamfdi.com/product-details/eli70-iphw#software. You may also copy the code from here, if using a Raspberry Pi 4 Model B or older. An alternative method, which works on Raspberry Pi 5, can be found after.

```
/* Changes brightness of ELI backlight given a command line argument between 0 and
the set range. Uses bcm2835 header file provided by Broadcom at
https://www.airspayce.com/mikem/bcm2835/bcm2835-1.52.tar.gz This source code must be
compiled using "g++ brightness.cpp -o brightness -l bcm2835"in order to properly
link the header file. Must be run using sudo, accessing GPIO pins requires root
permissions. After compiling, you may add executable to "/usr/bin" which allows you
to type "sudo brightness <value>" to change brightness anywhere in terminal. The
"/boot/config.txt" file must also be changed by adding a "#" before the line
"dtparam=audio=on". This disables audio output from the Raspberry Pi. If this is
not disabled then anytime sound is output the screen will return to 100%
brightness.
*/

#include<iostream>
#include<bcm2835.h>
#include<string>

using namespace std;

#define LED RPI_GPIO_P1_12 // PWM pin number for backlight control
#define RANGE 20 // Range for PWM steps
```

```
#define CLOCK 192 // Clock rate

int main(int argc, char *argv[]){

    int data = 0; // Brightness level

    if(argc != 2){ // Give user correct usage if ran incorrectly
                cout << "Error: correct usage, brightness <value>" << endl;
                return 1;
        }

    data = stoi(argv[1]);

    if(data > RANGE || data < 0){
        cout << "Error: brightness value must be between 0 and " << RANGE << endl;
        return 1;
    }

    if(!bcm2835_init())
        return 1;

    bcm2835_gpio_set_pad(BCM2835_PAD_GROUP_GPIO_0_27, BCM2835_PAD_DRIVE_2mA); //
Sets the drive current to 2mA
    bcm2835_gpio_fsel(LED, BCM2835_GPIO_FSEL_ALT5); // Sets up pin 18 for alt5 pwm
mode

    bcm2835_pwm_set_clock(CLOCK); // Sets pwm clock to 19.2 MHz / CLOCK
    bcm2835_pwm_set_mode(0,1,1); // Sets mode to markspace
    bcm2835_pwm_set_range(0,RANGE); // Sets range
    bcm2835_pwm_set_data(0,data); // Sets data rate to argument value

    bcm2835_close();
    return 0;
}
```

Figure 7. Backlight Control for Raspberry Pi

The GPIO pinout on Raspberry Pi 5 is identical to Raspberry Pi 4, but it uses a different hardware GPIO configuration, so the above method will not work. Instead, you will need to install the gpiozero python module.

```
sudo apt-get install python3-gpiozero
```

An example python script using gpiozero to control backlight PWM can be found on the FDI website at https://www.teamfdi.com/product-details/eli70-iphw#software. You can also copy the code from below.

```
try:
    from gpiozero import PWMOutputDevice
except ImportError:
    print("Failed to import gpiozero module.")
    print("try entering this into the console:")
    print("sudo apt-get install python3-gpiozero")
    exit(0)
import time

cycles = 50

# gpiozero uses Broadcom pin numbering. Any pin labelled as GPIO in the RPI header
pinout can be used.
# GPIO18 is 'PCM_CLK
# When using'PWMOutputDevice':
     '''0.0 = off,
        0.5 = 50% on,
        1.0 = fully on'''
pin = PWMOutputDevice(18, frequency = 5000)

# Gradually increases/decreases backlight intensity [cycles] times
while cycles > 0:
    # Fade in
    for dc in range(0, 100, 1):
        pin.value = dc / 100
        time.sleep(0.01)
    # Fade out
    for dc in range(100, 0, -1):
        pin.value = dc / 100
        time.sleep(0.01)
    cycles -= 1

# Gpiozero automatically clears GPIO pins upon completion,
# so the screen will always go back to max brightness when this script finishes
exit(0)
```

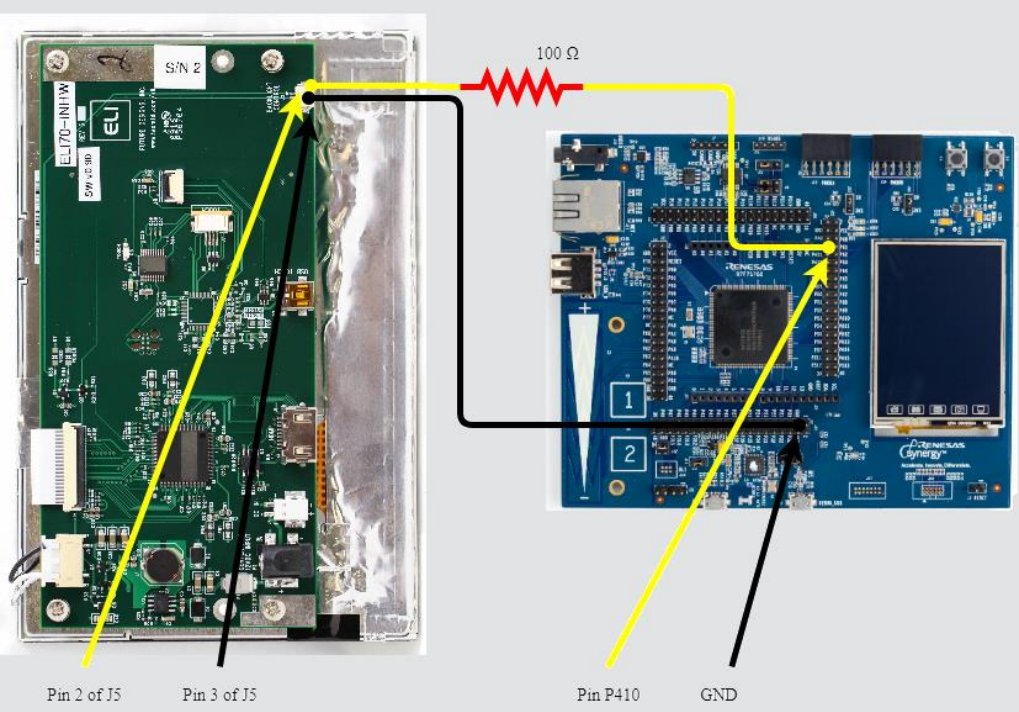


Figure 8. Renesas Synergy S7G2 Signal and Ground

The ELI backlight can also be controlled from a Renesas Synergy S7G2 wired as shown in Figure 8. The software for Synergy can be found on our website at https://www.teamfdi.com/product-details/eli70-iphw#software.

11.0 Bracket

The ELI70-INHW-M, ELI70-IPHW-M, and ELI70-IRHW-M come with brackets to provide additional mounting options. The dimensions of the bracket and mounting holes are shown below for your reference. If necessary, the brackets can be removed or replaced by removing two screws on each side of the ELI display.

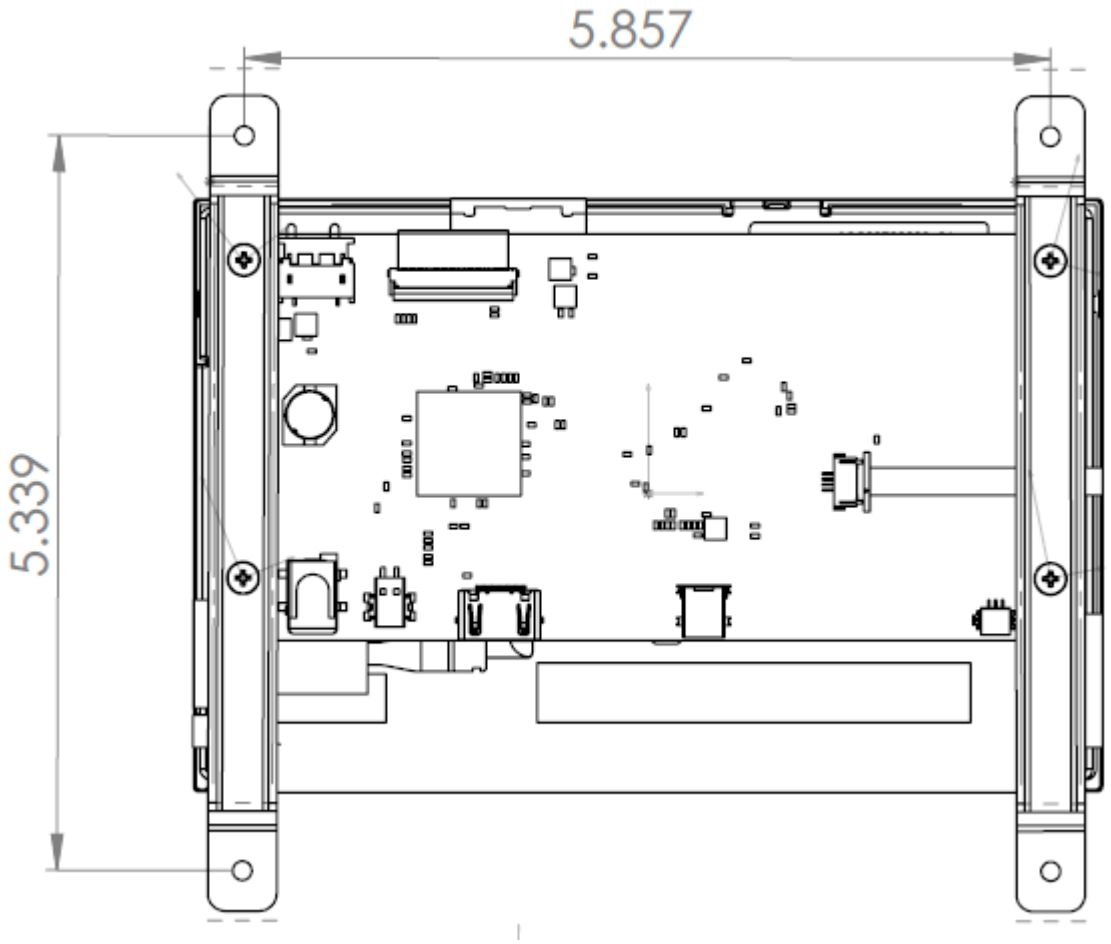


Figure 9. Renesas Synergy S7G2 Signal and Ground

12.0 Support

12.1 Where to Get Help

Online technical support is available at https://www.teamfdi.com/support/

12.2 Useful Links

- Future Designs, Inc. Forums: https://www.teamfdi.com/forum
- ELI70-INHW Product Page: https://www.teamfdi.com/product-details/eli70-inhw
- ELI70-IPHW Product Page: https://www.teamfdi.com/product-details/eli70-iphw
- ELI70-IRHW Product Page: https://www.teamfdi.com/product-details/eli70-irhw

ELI Software User's Manual: https://fdiwebdocs.s3.us-east-2.amazonaws.com/2024/wp-content/uploads/ELI-Software-Users-Manual.pdf

- Tell us about your ELI experience: https://www.teamfdi.com/edid/#edidform
- EDID Information Page: https://www.teamfdi.com/edid/