

# LCD Validation

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## Design Details

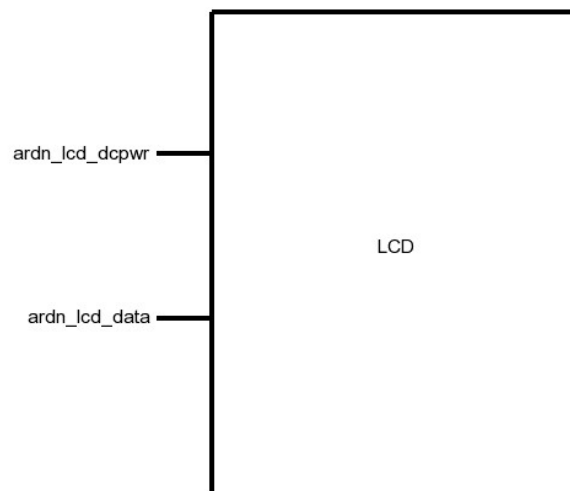


Figure 1: Black Box for LCD Block

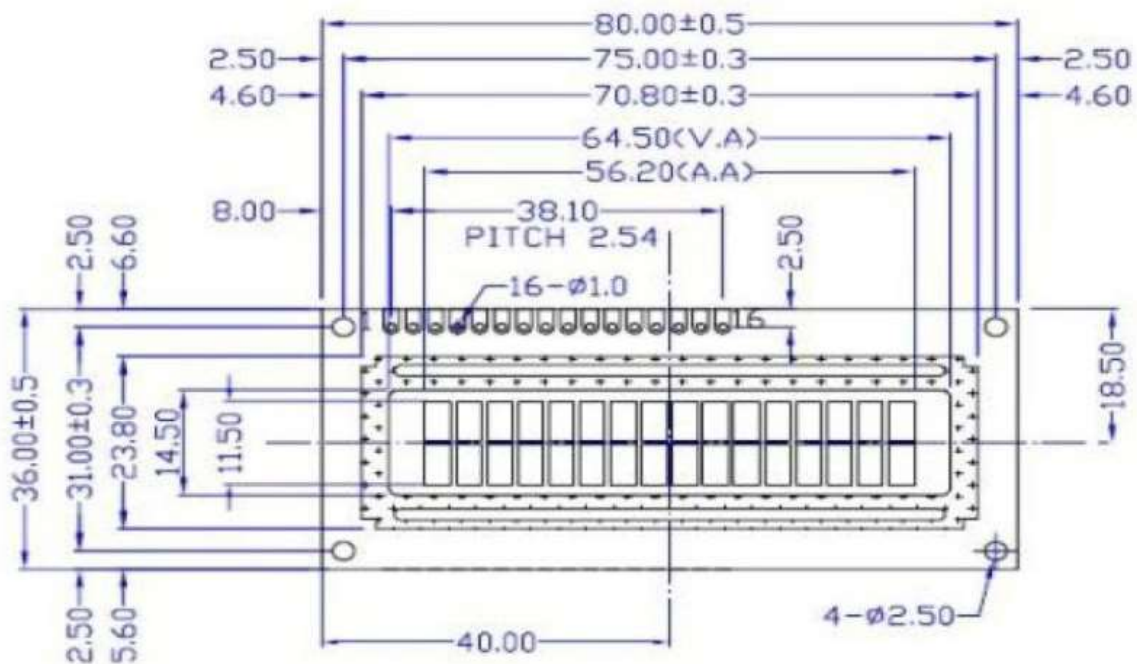


Figure 2: [Schematic/External Dimensions](#) of the 16x02 LCD board.

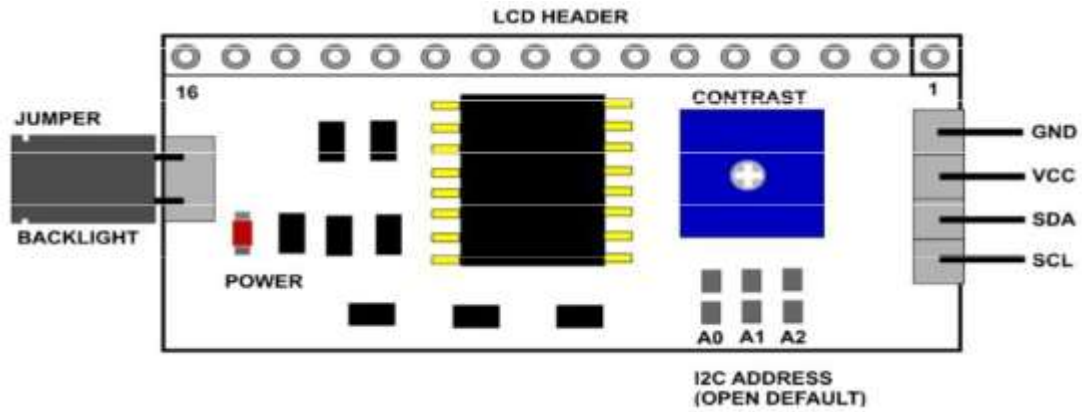


Figure 3: [Board layout](#) of the I2C-to-LCD piggy-backboard/backpack.

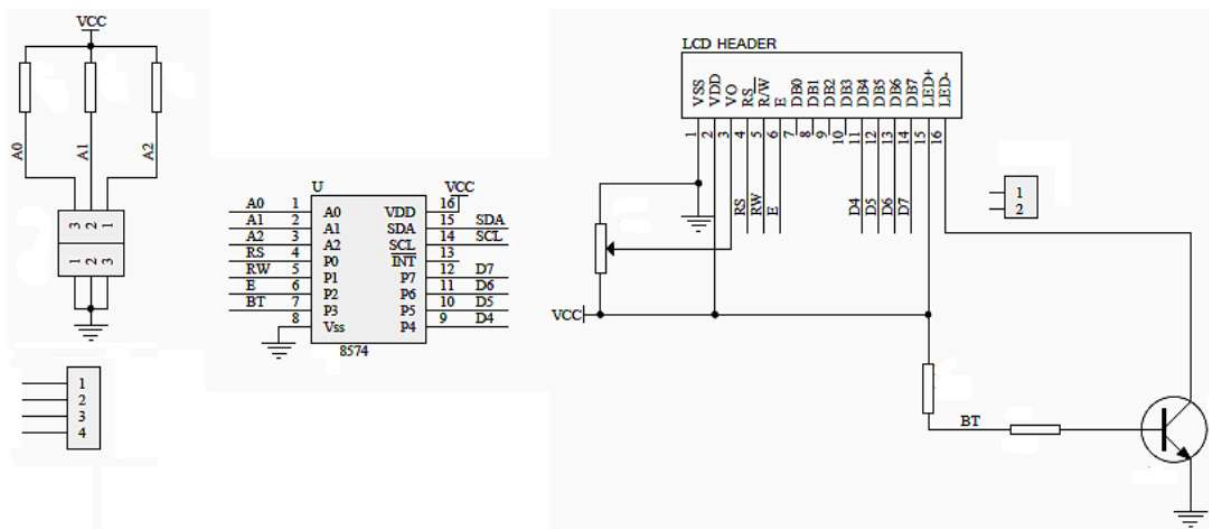


Figure 4: [Circuit diagram](#) of the I2C-to-LCD piggy-backboard/backpack.



Notes:

- VCC /VDD is one of two inputs to this block, ardn\_lcd\_dcpwr
- SDA and SCL are the other two inputs, ardn\_lcd\_data
  - SDA is the raw data of the message to be displayed
  - SCL is the clock cycle

## Design Validation Overview

This LCD block represents a module that contains an LCD Display, and an I2C-to-LCD backpack. One of the needs of the system is to be able to measure the resistance and current of the plant material while the system is on. In order to do that, we need to see the value readings in real time. The easiest solution was to use a small enough LCD display and have that attached to the probe so that voltage output could be adjusted immediately as needed without needing to look at a computer monitor. It was also a module that was ready on hand, since it was purchased for a previous project.

The LCD is a standard 16x02 LCD display – making up 32 total characters – with a blue backlight. The I2C backpack consists of a [PCF8574T CMOS Circuit](#) that provides general purpose remote 8-bit quasi-bidirectional I/O expansion for most microcontroller families via the two-line bidirectional bus (I2C-bus).

## Design Validation Interface Table

**ardn\_lcd\_dcpwr**

|                       |                                                                                                                                                  |
|-----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|
| Inominal: 200 $\mu$ A | High level current ranges from a min of 30 $\mu$ A to a max of 300 $\mu$ A, ( <a href="#">PCF8574T datasheet</a> , page 15)                      |
| Ipeak: 300 $\mu$ A    | A max level current value of 300 $\mu$ A, ( <a href="#">PCF8574T datasheet</a> , page 15)                                                        |
| Vmax: 5.5V            | Vin for the CMOS circuit can range from -0.5V-7V, ( <a href="#">PCF8574T datasheet</a> , page 14), but operating voltage ranges from 2.5V to 6V. |
| Vmin: 2.7V            | Vin can range from -0.5V-7V, ( <a href="#">PCF8574T datasheet</a> , page 14).                                                                    |

**ardn\_lcd\_data**

|                                                                      |                                                                                                                                            |
|----------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|
| Datarate: Data gets sent to the LCD every 1/10th of a second (10 Hz) | Max kHz is 100 kHz, with no min. As long as there is a clock cycle, the data will be sent, ( <a href="#">PCF8574T datasheet</a> , page 16) |
| Messages: Data Transmitted: resistance and current sensor values     | Data Information Only                                                                                                                      |

## References

<https://www.sparkfun.com/datasheets/LCD/HD44780.pdf>

<https://funduino.de/DL/1602LCD.pdf>

<http://www.mantech.co.za/datasheets/products/lcd2004-i2c.pdf>

[http://www.handsontec.com/dataspecs/module/I2C\\_1602\\_LCD.pdf](http://www.handsontec.com/dataspecs/module/I2C_1602_LCD.pdf)

[https://www.digchip.com/datasheets/download\\_datasheet.php?id=748656&part-number=PCF8574T](https://www.digchip.com/datasheets/download_datasheet.php?id=748656&part-number=PCF8574T)