

I2C-LCD44780B, I2C-LCD44780C
I2C Bus LCD Module Controller Boards
1 Features

- Control LCD modules via a standard I2C bus.
- Powered by **PCA9554B** and **PCA9554C** chips.
- Supports reading the **BUSY bit** from LCD modules.
- High-speed I2C communication up to **400kHz**. (Fast mode)
- Onboard adjustable I2C bus pull-up resistors.
- Easy addressing via 3-pin jumpers.
- Operates from **2.3V to 5.5V** (I2C) and **3V to 5.5V** (LCD).
- Built-in circuit protection against wiring errors.
- Integrated potentiometer for LCD contrast adjustment.
- Software-controllable (ON/OFF) with current limiting.
- Designed for installation on the back of the LCD panel.
- Small footprint of only **23.00 x 46.00 mm**.

2 Overview

The I2C Bus LCD Module Controller Board is designed to interface with LCD modules using only two wires via the I2C bus. Available in two models—**I2C-LCD44780B** and **I2C-LCD44780C**—this controller supports LCD modules with operating voltages ranging from **3V** to **5V**. For hardware configuration, the board features three addressing pins, allowing for the selection of up to **eight unique I2C addresses**. It also includes built-in pull-up resistors for the SCL and SDA lines, an onboard potentiometer (POT) for precise contrast adjustment, and integrated resistors to limit the backlight current.

In terms of installation, the board is engineered to be mounted directly onto the back of an LCD module, connecting via either **16-pin** or **2x8-pin** connectors. Additionally, the controller provides a dedicated power connector for the LCD and allows for software-based ON/OFF control of the backlight.

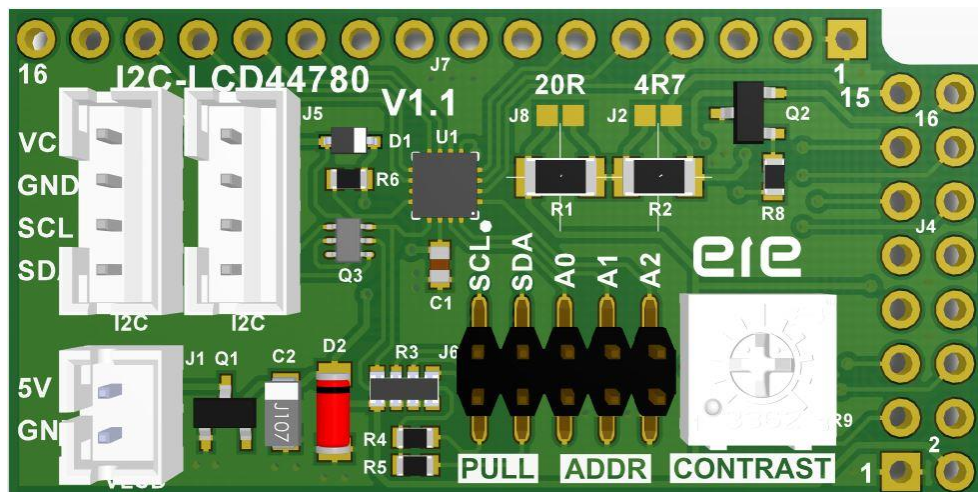


Figure 1: Board layout

3 I2C bus pull-up resistors

The I2C bus requires pull-up resistors on both the **SCL** and **SDA** lines for proper operation. This board includes a pair of **10 kΩ** pull-up resistors that can be enabled by closing the onboard jumpers.

Usage Guidelines:

- **Standard Configuration:** These resistors should be enabled only if no other pull-up resistors are present on the I2C bus. Typically, a single pair of pull-ups is sufficient for the entire bus.
- **Multiple Boards:** When connecting multiple boards to the same bus, adding additional pull-up resistors can strengthen the signal, which is beneficial for high-frequency or "Fast Mode" operations.
- **Bus Speed:** While a **10 kΩ** value is standard for speeds up to **100 kHz**, lower resistance values (stronger pull-ups) may be required to maintain signal integrity at speeds up to **400 kHz**.

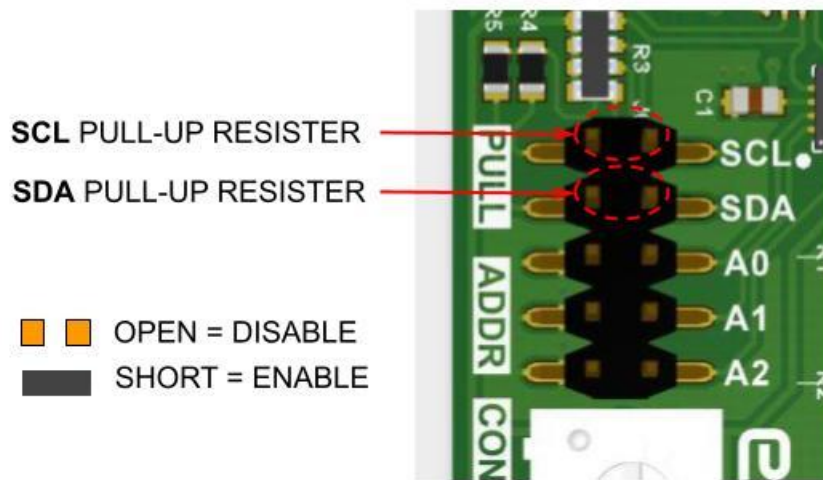


Figure 2: Pull-up resistors for SCL and SDA lines of master bus

4 I2C Bus address

The I2C-LCD44780B and I2C-LCD44780C models are identical in function but utilize different controller chips to provide a wider range of I2C addresses. The I2C-LCD44780B is powered by the PCA9554B, while the I2C-LCD44780C uses the PCA9554C.

The only functional difference between these two chips is their base I2C address range. This allows you to connect up to 16 separate LCD modules on the same bus by using 8 boards of each model.

Address Selection

Each board features three address jumpers (A0, A1, A2). By opening or closing these jumpers, you can configure up to 8 unique addresses for each chip type. This flexibility is essential when multiple I2C devices are sharing the same bus lines to avoid address conflicts.

Board models	Chip Used	Base I2C Address (Hex)	Address Range (with jumpers)
I2C-LCD44780B	PCA9554B	0x20	0x20-0x27
I2C-LCD44780D	PCA9554C	0x38	0x38-0x3F

Table 1: I2C Bus Addresses

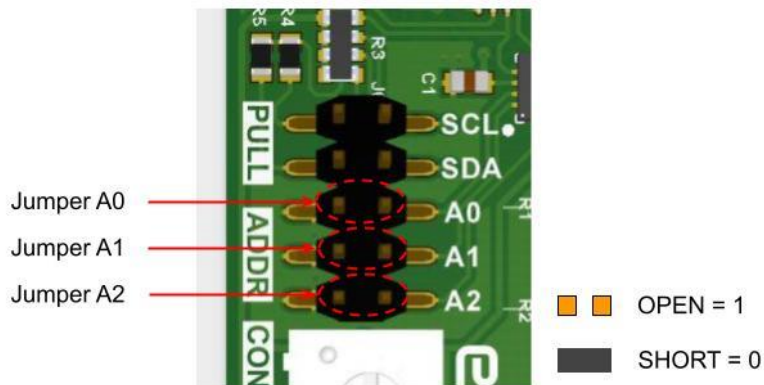


Figure 3: I2C bus address jumpers

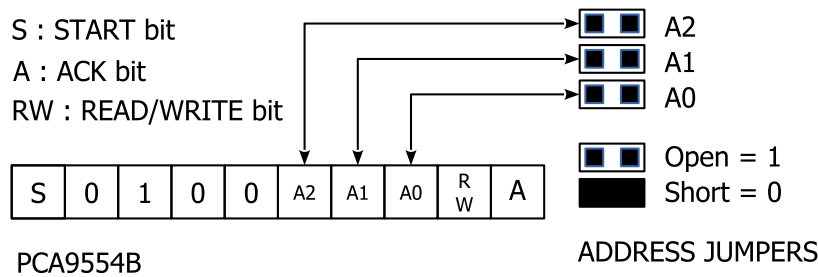


Figure 4: PCA9554B I2C bus addresses

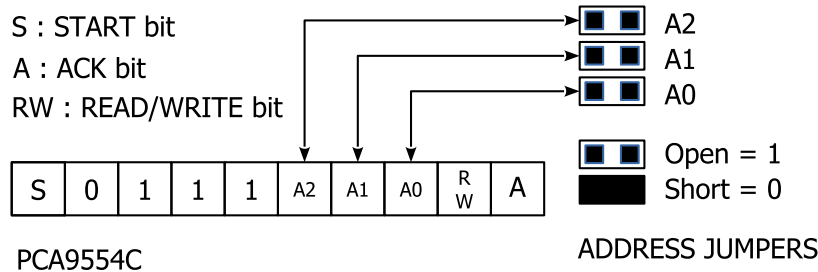


Figure 5: PCA9554C I2C bus Address

5 Using 3.3V I2C Bus with 5V LCD

When using an LCD module that requires a 5V power supply while your I2C bus operates at a different voltage (such as 3.3V), you must provide separate power to the module.

Power Connection Requirements:

- **LCD Module Power:** Connect a dedicated 5V external power source directly to the 5V power connector on the controller board.
- **I2C Bus Voltage:** The I2C bus lines (SCL/SDA) will continue to operate at the host's logic level (e.g., 3.3V).
- **Common Ground:** Ensure that the ground (GND) of the 5V power supply is connected to the ground of the I2C bus host to maintain a common reference point.

Note: The onboard PCA9554B/C controller chips are designed to bridge these voltage levels safely, allowing a 3.3V microcontroller (like an ESP32 or Raspberry Pi) to control a 5V LCD without damaging the I2C bus.

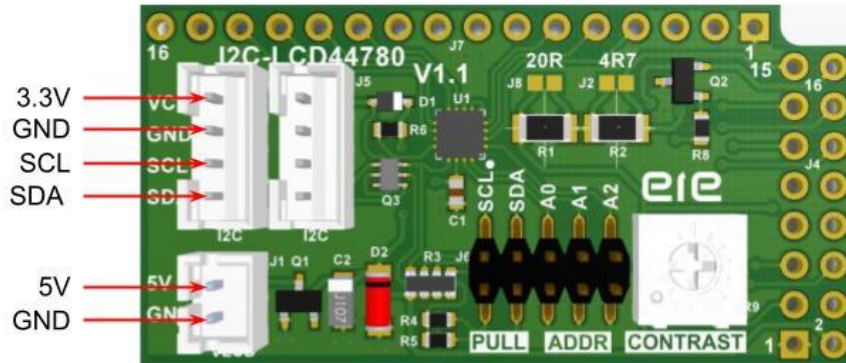


Figure 6: 5V LCD with 3.3V I2C bus

6 Using 5V I2C Bus with 5V LCD

If both your LCD module and the I2C bus host (such as an Arduino Uno) operate at a 5V logic level, the power configuration is simplified.

Wiring Instructions:

- **Shared Power:** The LCD module will receive its 5V power directly from the I2C bus connection (VCC).
- **Power Connector:** In this configuration, do not connect an external power source to the dedicated 5V LCD power connector.

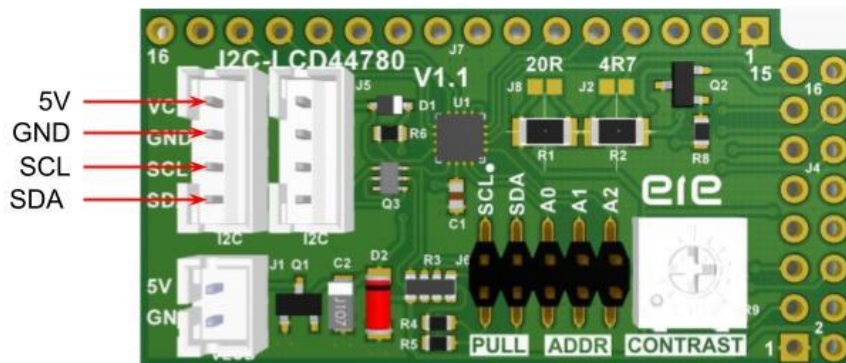


Figure 7: 5V LCD with 5V I2C bus

7 Using 3.3V I2C bus with 3.3V LCD

When both the LCD module and the I2C bus host (such as a Raspberry Pi or ESP32) operate at a 3.3V logic level, no external power is required.

Wiring Instructions:

- **Integrated Power:** The LCD module will draw its 3.3V power directly from the VCC line of the I2C bus.
- **External Power Connector:** In this configuration, the dedicated 5V LCD power connector must remain disconnected.

Caution: Do not apply 5V to the external power connector if your LCD is a 3.3V model, as this will likely result in permanent damage to the LCD panel and the controller board.

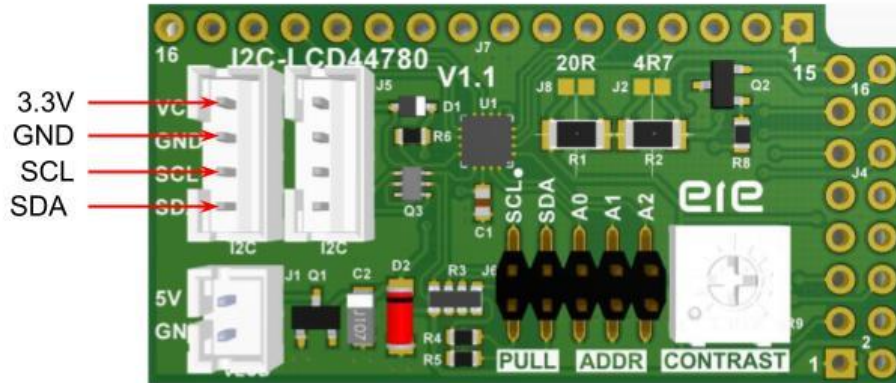


Figure 8: 3.3V LCD with 3.3V I2C bus

Summary of Power Configurations

To help users avoid errors, here is a quick-reference table for the power connector:

LCD Voltage	I2C bus Voltage	5V External Power Connector
5V	3.3V	REQUIRED (Connect 5V)
5V	5V	DO NOT CONNECT
3.3V	3.3V	DO NOT CONNECT

Table 2: LCD Voltage

8 Backlight Current Limiting and Control

To protect the LCD backlight and manage brightness, the I2C-LCD44780 includes an integrated current-limiting circuit and software-based control.

Current Limit Resistors

The board features two current-limiting resistors, 20 Ω and 4.7 Ω , connected in series. These resistors can be bypassed (disabled) using jumpers J8 and J2 to suit different LCD backlight requirements:

Jumper J8: Short this jumper to disable (bypass) the 20 Ω resistor.

Jumper J2: Short this jumper to disable (bypass) the 4.7 Ω resistor.

Caution: Always check your LCD module's datasheet for the maximum backlight current. Disabling both resistors (shorting J2 and J8 simultaneously) will remove all current limiting and may damage the LCD backlight if no other resistor is present.

Backlight Software Control

The LCD backlight is toggled via Port P3 of the onboard driver chip. Please note the inverse logic for this operation:

Turn ON Backlight: Set Port P3 to Logic '0' (LOW).

Turn OFF Backlight: Set Port P3 to Logic '1' (HIGH).

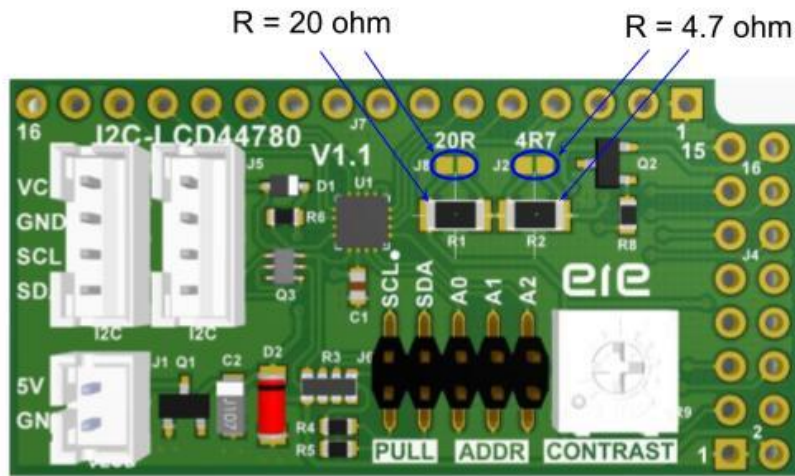


Figure 9: Current limit for LCD backlight

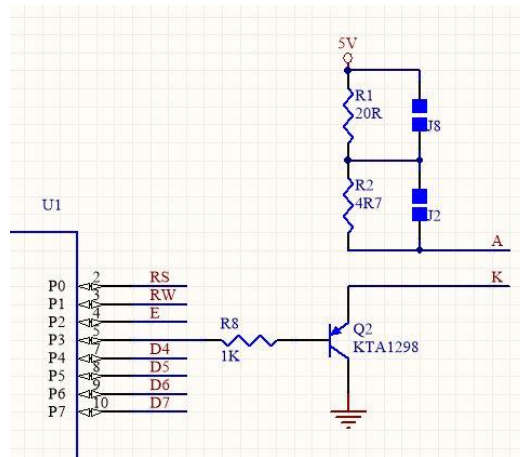


Figure 10: LCD backlight schematic

9 Installation

The I2C-LCD44780 is designed for flexible installation, supporting various LCD module pin configurations. It features both a single-line (1x16) and a dual-line (2x8) connector for seamless integration.

Installation for Single-Line Connectors:

- **Compatibility:** Specifically designed for LCD modules using a standard 16-pin single-row interface.
- **Direct Mounting:** The I2C-LCD44780 can be installed directly onto the back of the LCD module.
- **Space Saving:** This "backpack" style mounting reduces wiring clutter and results in a more compact, professional assembly.

Assembly Tip: When soldering the controller to the back of the LCD, ensure the pins are correctly aligned with the VSS (Pin 1) and K (Pin 16) markings on both boards to avoid orientation errors.



Figure 11: Install on a single-line 16 pins connector

For modules featuring a dual-line (2x8 pin) header, the I2C-LCD44780 maintains its versatile "backpack" mounting capability.

Installation for Dual-Row Connectors:

- **Interface Compatibility:** The controller board is fully compatible with LCD modules using a 16-pin dual-row (8x2) connector layout.
- **Rear Mounting:** Just like the single-row version, the I2C-LCD44780 can be installed directly onto the back of the LCD module to save space and simplify wiring.
- **Secure Connection:** Ensure all 16 pins (8x2) are properly aligned and soldered to maintain high-signal integrity across the I2C bus.

Caution: Before soldering, verify the pinout of your specific LCD module. While the 8x2 layout is common, some manufacturers may vary the power (VCC/GND) or backlight pin locations.



Figure 12: Install on a dual-line 8x2 pins connector

10 Specifications

Parameters	Values
Operating voltage (VCC)	2.3V – 5.5V
I2C Bus frequency (Maximum)	400kHz
I2C bus pull-up resistance	SDA: 10 kΩ SCL : 10 kΩ <i>These resistors can be enabled and disabled using jumpers.</i>
I2C bus chip	PCA9554B (I2C-LCD44780B) PCA9554C (I2C-LCD44780C)
I2C bus connectors	Pin-count: 4-pin Pin-pitch: 2.00mm
5V connector	Pin-count: 2-pin Pin-pitch: 2.00mm

Table 3: Specifications

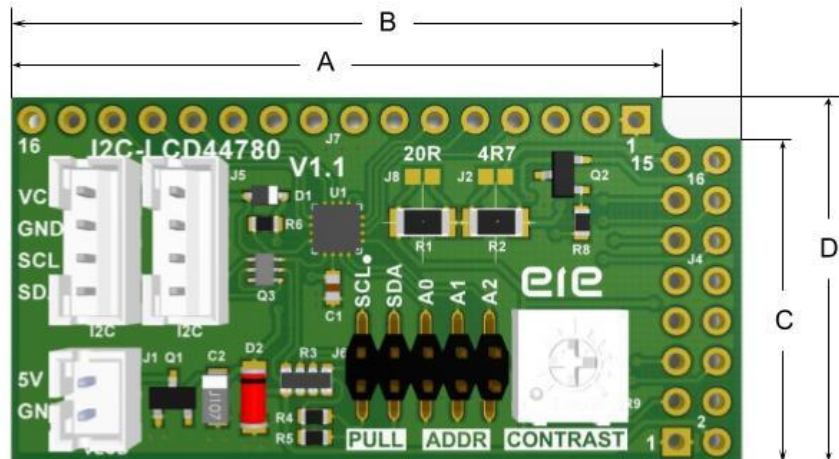
11 Dimensions


Figure 13: Dimensions

	Inch	mm
A	1.6141	41.00
B	1.8110	46.00
C	0.8031	20.40
D	0.9055	23.00

Table 4: Dimensions



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