I2C-AO112DV

DIN-rail I2C-bus 0-10VDC Analog Voltage Output Modules

1 Features

- Single-Supply Operation: 2.7Vdc to 5.5Vdc
- I2C Interface: Standard (100kps), Fast(400kps) and High-Speed(3.4Mbps)
- Supports up to 8 boards on a single I2C bus
- Resolution: 12 bits
- DAC chips: MCP4725A0, MCP4725A1, MCP4725A2, MCP4725A3
- Build-in EEPROM on DAC chip
- Designed for Driving 0-10Vdc Instruments
- Maximum Capacitive Load: 1nF
- Maximum Output Current: 20mA
- Short-Circuit Protected Output (Short to GND)
- Output Surge Protection
- Mountable on a DIN-rail PCB holder
- PCB Dimensions: 20.0 x 72.0 mm

2 Description

The I2C-AO112DV is an analog voltage output board, also referred to as a digital-to-analog converter (DAC) board. It is designed to generate a standard analog voltage ranging from 0 V to 10 V, suitable for driving equipment such as AC motor drivers and other devices commonly found in industrial control systems. The I2C-AO112DV receives commands from microcontrollers (MCUs) via the I²C bus to generate analog voltage levels based on the received instructions. It supports Standard (100 kbps), Fast (400 kbps), and High-Speed (3.4 Mbps) I²C communication modes. The analog output can drive a load current of up to 20 mA, with a maximum capacitive load of 1 nF. The output is also protected against short circuits to ground and surge voltages, enhancing reliability in demanding environments. Operating from a single supply voltage of 2.6 V to 5.5 V, the I2C-AO112DV is compatible with most MCU platforms. The I2C-AO112DV family includes four models: I2C-AO112DV0, I2C-AO112DV1, I2C-AO112DV2, and I2C-AO112DV3. All models share the same hardware specifications, with the only difference being their factory-assigned I²C addresses. Each model can be configured to use one of two I²C addresses, allowing up to eight unique addresses. This enables up to eight boards to be connected on a single I²C bus. The board dimensions are optimized for compatibility with standard DIN-rail PCB holders, allowing for easy installation in industrial enclosures.

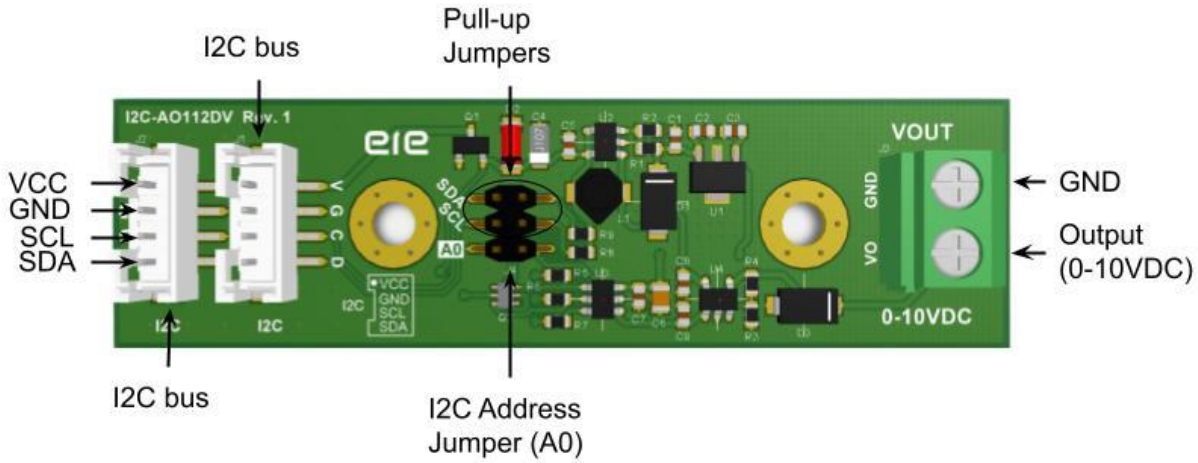

Figure 1: Board diagram

3 Interfacing

The I2C-AO112DV is equipped with two identical I²C bus connectors, allowing an MCU to connect to either one. The second connector can be used to daisy-chain additional I²C boards. To establish a proper connection, the MCU's VCC, GND, SCL, and SDA lines must be connected to the corresponding pins on the I2C-AO112DV board. Thanks to its wide operating voltage range, the I2C-AO112DV is compatible with a variety of MCU families. Typically, an I²C bus requires pull-up resistors on the SCL and SDA lines. The I2C-AO112DV includes configurable solder jumpers that enable onboard pull-up resistors, eliminating the need for external components. However, if the I²C bus—or any board on the bus—already has pull-up resistors, these jumpers on the I2C-AO112DV should be left open to avoid conflicts.

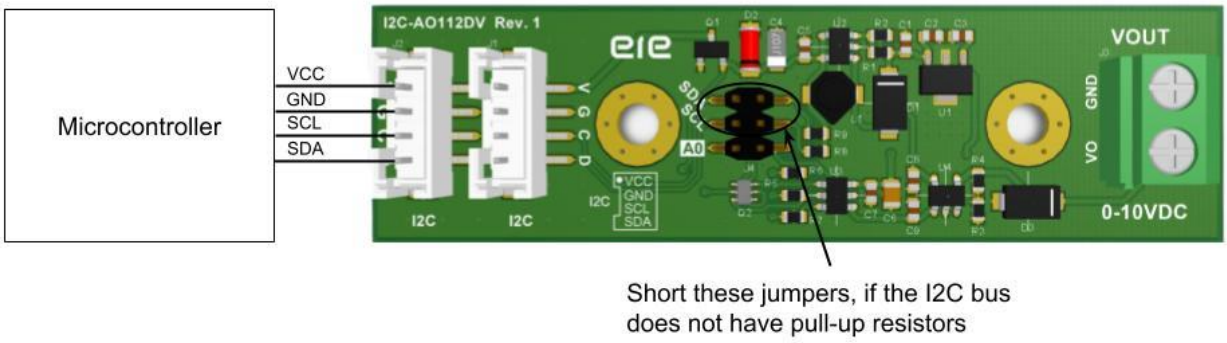

Figure 2: Interfacing

4 I2C bus Addresses

The I2C-AO112DV uses a digital-to-analog converter (DAC) chip from the MCP4725 family. This family includes four sub-part numbers: MCP4725A0, MCP4725A1, MCP4725A2, and MCP4725A3. Each MCP4725 variant has a unique identification code printed on the chip, as shown in the table below. Additionally, each chip has its own distinct I2C address. As a result, the I2C-AO112DV is available in four sub-models, each utilizing a different MCP4725 chip, as indicated in the table. The I2C-AO112DV board supports two configurable I2C addresses, which can be set by adjusting the A0 jumper.

Table 1: I2C bus addresses

Board Models	DAC Chips	Chip Codes	Address: A0 = 0 (jumper shorted)	Address: A0=1 (jumper open)
I2C-AO112DV0	MCP4725A0	AJNN	0x60	0x61
I2C-AO112DV1	MCP4725A1	APNN	0x62	0x63
I2C-AO112DV2	MCP4725A2	AQNN	0x64	0x65
I2C-AO112DV3	MCP4725A3	ARNN	0x66	0x67

5 Multiple Boards on a Single Bus

The I2C-AO112DV family includes four sub-models, and each model supports two different I2C addresses. This allows up to eight boards to be connected on a single I2C bus, each with a unique address. The method for connecting all eight boards on the same bus is illustrated in the picture below. The board is designed to support easy daisy-chain connections. The important thing when connecting multiple boards on a single bus is that each board must be configured with a unique I2C address.

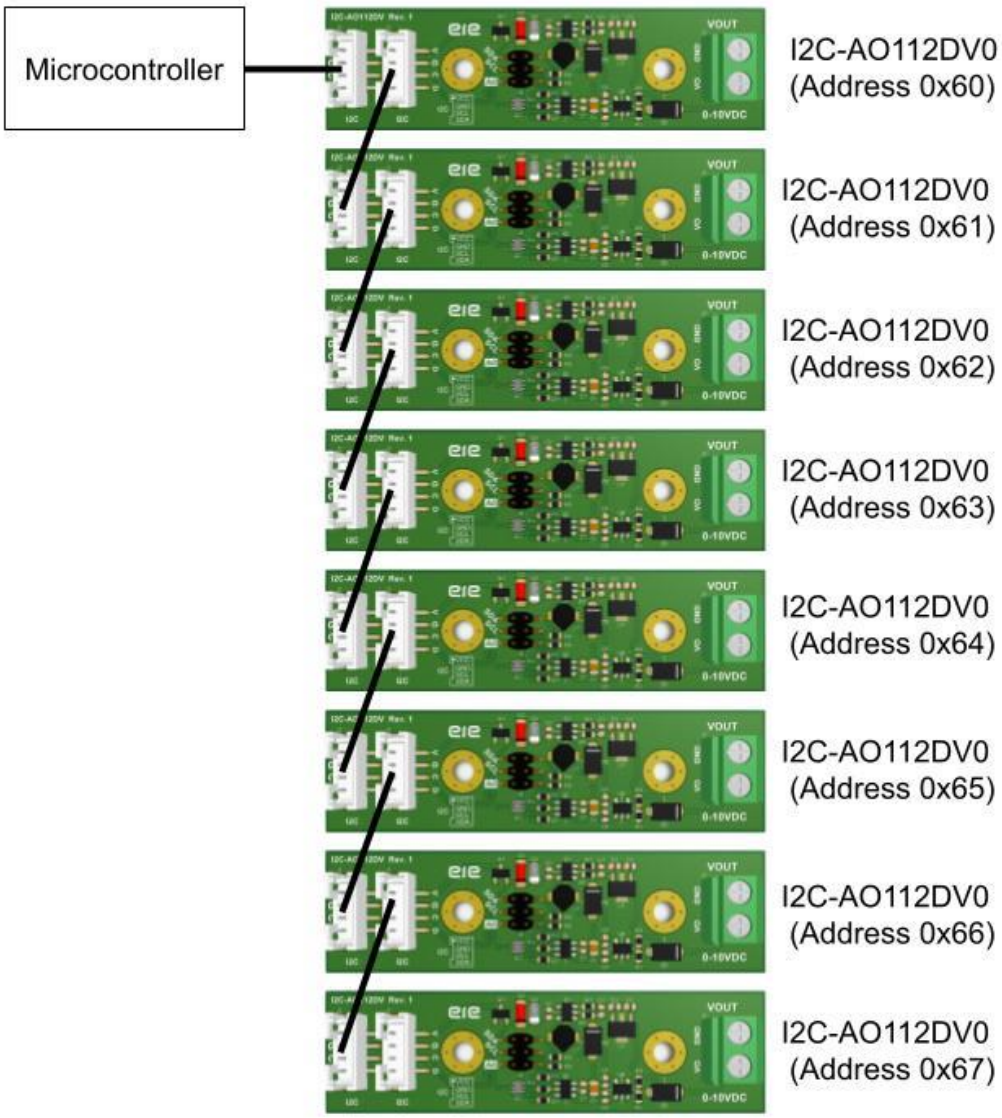

Figure 3: Multiple boards on a single bus

6 Specification

Table 2: Specification

Specification	Parameters
Operating Voltage	2.7Vdc - 5.5Vdc
Interface	I2C bus
I2C bus Speed	Standard (100kps), Fast(400kps), High-Speed(3.4Mbps)
Output Voltage	0Vdc -10.2Vdc
Resolution	12 bits (0 - 4095)
Maximum Output Current	20mA
Maximum Capacitive Load	1nF
On-board pull-up resistor value (if enabled)	10K

7 Dimensions

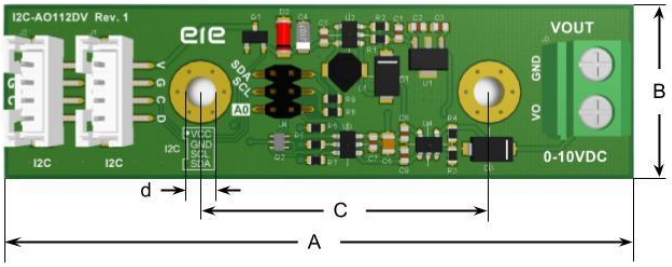

Figure 4: Board dimensions

Table 3: Board dimensions

Dimensions	Unit: mm	Unit: inch
A	70.00	2.7559
B	20.00	0.7874
C	33.00	1.2992
d	3.60	0.1417

8 Applications

8.1 Driving Low Capacitive Load Input

The I2C-AO112DV board is typically capable of driving a load with up to 1 nF of capacitive input without oscillation, as shown in the picture below. However, if the load has a higher input capacitance, oscillation may occur. To correct this issue, a series resistor should be added between the output and the load input, Fore more details refer to the next section.

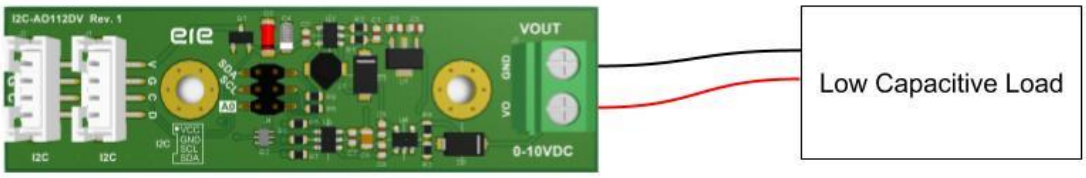

Figure 5: Driving low capacitive load

8.2 Driving High Capacitive Load Input

If the load input has high capacitance, it may cause oscillation. To prevent this issue, a series resistor should be added, as shown in the picture below. However, adding a series resistor will cause a voltage drop, which depends on the resistor value and the current flowing through it. The I2C-AO112DV can typically generate up to 10.2 VDC, which means a voltage drop of up to 0.2 VDC is generally acceptable and will not affect the load. The picture below shows an example of a series resistor used in a circuit where 10 mA of current flows through the load input.

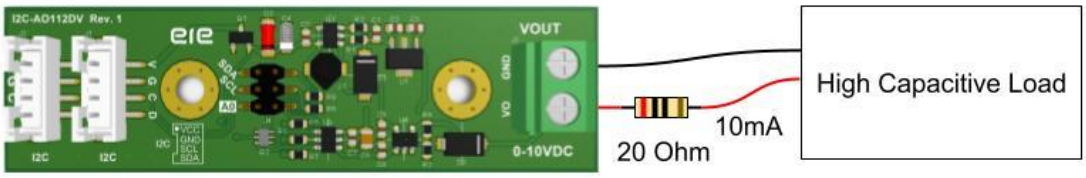

Figure 6: Driving high capacitive load