## Low Voltage 16-Bit I^{2}C-bus I/O Expander

Brief Description

The KTS1622 Evaluation (EVAL) Kit is used to demonstrate and evaluate the KTS1622 functionality, performance, and PCB layout. The kit includes a fully assembled and tested PCB with the KTS1622 IC installed, an MCP2221A board with Stemma QT cable, software, and a printed copy of the Quick Start Guide.

Ordering Information

Part Number	Description	IC Package
KTS1622EUAA-MMEV01	KTS1622 EVAL Kit	TQFN44-24

3D CAD Image
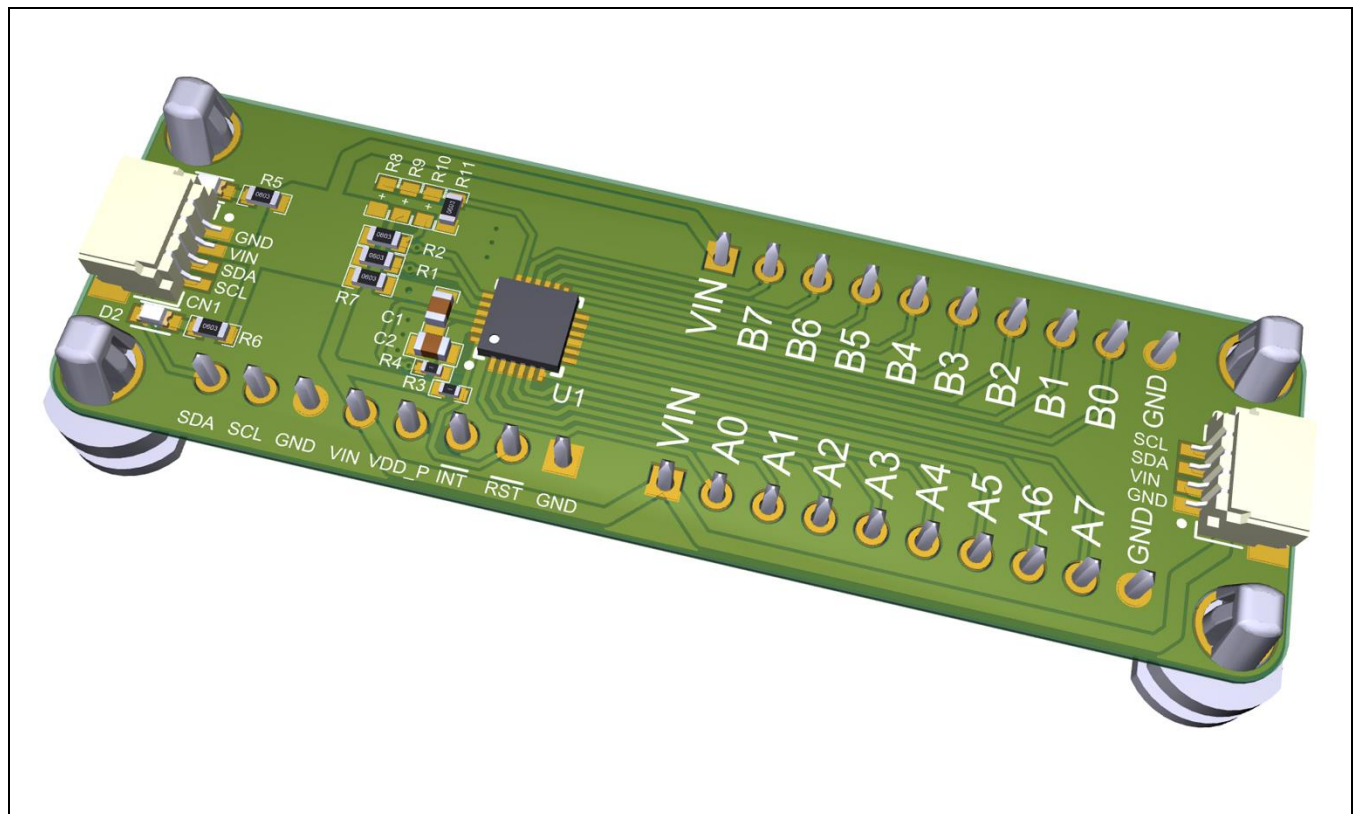
EVAL Kit Physical Contents

Item #	Description	Quantity
1	KTS1622 EVAL Kit fully assembled PCB	1
2	Adafruit MCP2221A Board - General Purpose USB to GPIO ADC I2C - Stemma QT (4471)	1
3	Adafruit Stemma QT / Qwiic JST SH 4-pin Cable - 100mm Long (4210)	1
4	Anti-static bag	1
5	KTS1622 EVAL Kit Quick Start Guide -- printed 1-page (A4 or US Letter)	1
6	EVAL Kit box	1

QR Links for Documents

IC Landing Page	EVAL Kit Landing Page
https://www.kinet-ic.com/kts1622/	https://www.kinet-ic.com/kts1622euaa-mmev01/

User-Supplied Equipment

Required Equipment

1. Digital Multimeter – one or more, used to measure input/output voltages and currents.

Recommended Operating Conditions

| Symbol	Description	Value	Units
VDD_I2C	I2C bus power supply voltage	1.65 to 5.5	V
VDD_P	VDD_P Port power supply voltage	1.65 to 5.5	V
V_{IH1}	VIH1 High-level input voltage at SCL/SDA	0.7 x VDD_I2C to VDD_I2C	V
V_{IH2}	VIH2 High-level input voltage at $\overline{RESET}$/ADDR	0.7 x VDD_I2C to 5.5	V
V_{IH3}	VIH3 High-level input voltage at all I/O ports	0.7 x VDD_P to 5.5	V
V_{IL1}	Low-level input voltage at SCL/SDA/$\overline{RESET}$/ADDR	-0.3 to 0.3 x VDD_I2C	V
V_{IL2}	Low-level input voltage at all I/O ports	-0.3 to 0.3 x VDD_P	V
I_{OH}	High-level output current at all I/O ports	10 max	mA
I_{OL}	Low-level output current at all I/O ports	25 max	mA
T_A	Operating ambient temperature	-40 to 85	°C

Quick Start Procedures

1. Connect the Stemma QT 4-wire cable (GND, 3V3, SDA, SCL) to the KTS1622 evaluation board connector CN1, as shown in the Typical Test Setup Figure below.
2. Connect the other end of the Stemma QT cable to the MCP2221A USB to I2C interface board.
3. Connect the MCP2221A board to a computer via the USB type-C cable.
4. Once the evaluation board is connected to the computer via the MCP2221A interface board, the KTS1622 evaluation board green LED D1 should be turned on indicating that the board is powered from the computer. The on-board VIN supply voltage should be around 3.3V. No external power supply is required.
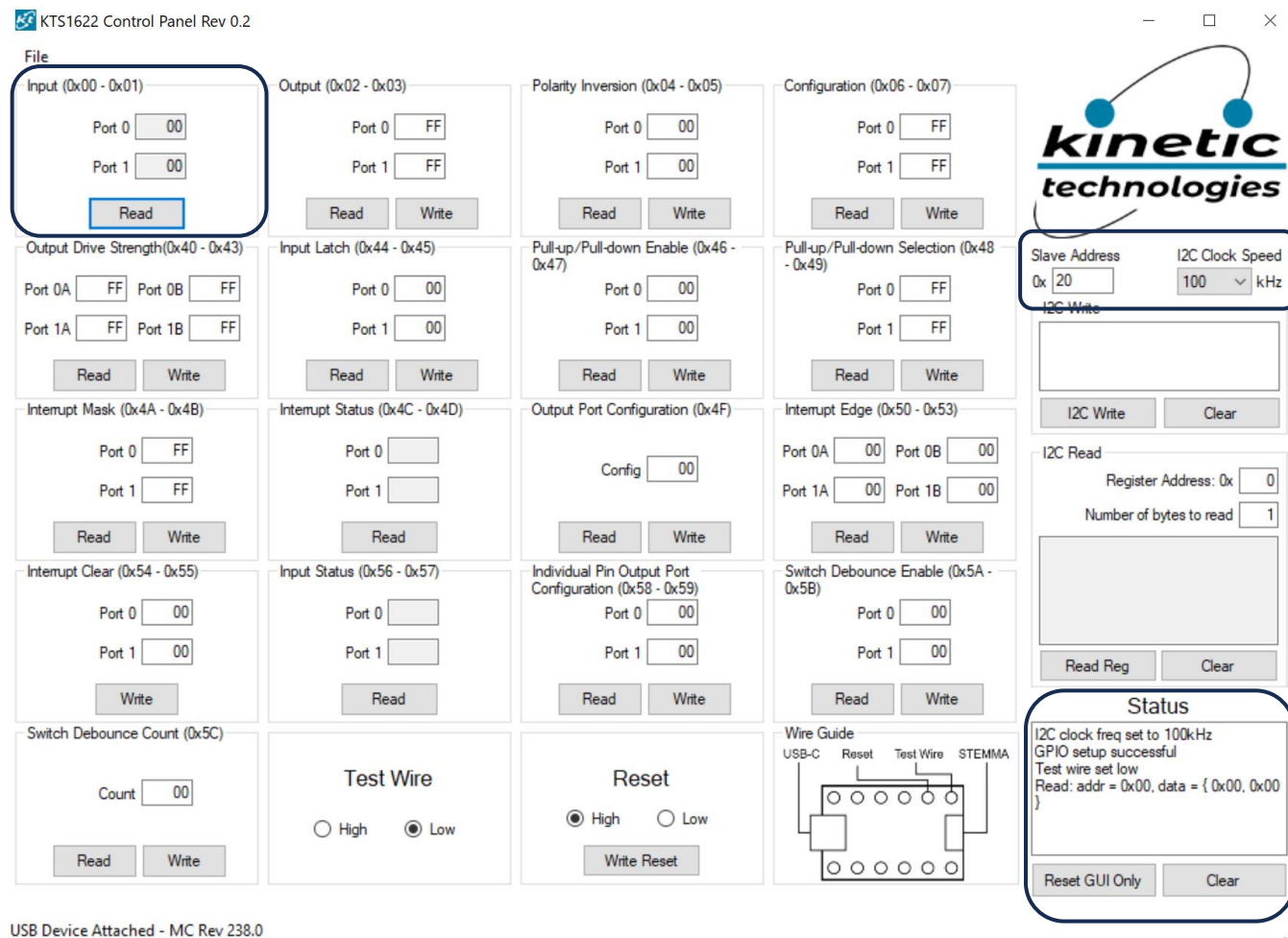5. Install GUI software.

Graphical User Interface (GUI)
1. Download and install GUI software located on EVAL Kit Page
   a. (https://www.kinet-ic.com/kts1622euaa-mmev01/).
2. After installing software, the interface will appear with the status message "USB Device Attached" at the bottom left side of the window.
3. If the displayed message is "USB Device Detached", make sure the computer is properly connected to the board.

Typical Test Setup Diagram

As an example, use the following test setup to measure items x, x, x, x in the Quick Start Procedures.

3V3, SDA, SCL, GND
4-Wire Cable

MCP2221A interface Board

KTS1622 Module

USB-C to Computer
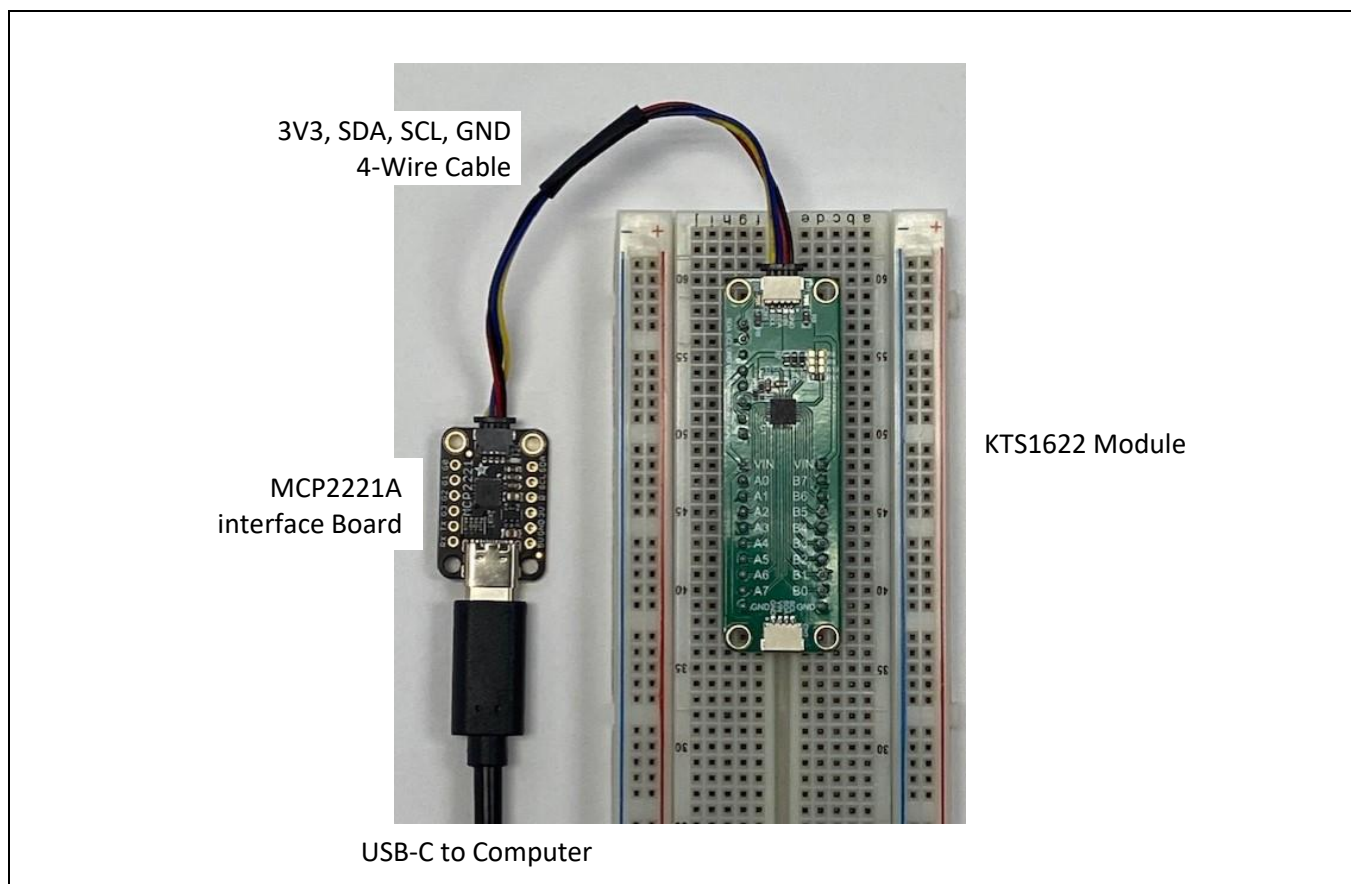
Graphical User Interface (GUI) Window

To Check the I²C Connection and Turn on RGB LED

To check the I²C communication, read the evaluation board input registers Port 0 (0x00) and Port 1 (0x01).

In the "Input (0x00 – 0x01)" register section, click on the Read button. The GUI should display in the Status window the register data, data = 0x00, 0x00, since the default input is low. To check a high input, connect a pin to Vin and click the Read button. The select pin bit will now be a 1.

If the device is not responding (I2C communication failed), make sure the KTS1622 EVB is connected to the MCP2221A board, the GUI Slave address (0x20) is correct, and the EVB VIN test point voltage is around 3.3V.

Note: Each time an I²C command is sent out on the SDA line, the on-board red indicator LED D2 (labeled SDA) blinks briefly.

I2C Interface

The interface parameters are displayed on the right side of the GUI.

- Slave Address: shows the I2C address of the LED driver in hexadecimal. The default address of the KTS1622 is 0x20 (or 32 in decimal).
- I2C Clock Speed: shows the I2C interface clock frequency. The default clock frequency is 500kHz.
- Status: the Status section shows the activity and the command transferred on the I^{2}C bus. All Status previous messages can be erased/cleared by clicking on the "Clear" button.

Important note: If any parameter setting is changed on the GUI (other than I2C interface and the control knobs), the user must click on the associated "Write" or "Read" button within the same section in order to update/read the register.

I2C Registers

Table 1 summarizes the 36 I2C registers. They can be reset to default values by power-on reset, toggling $\overline{\text{RESET}}$ pin or I2C software reset.

Table 1. I2C Register

| Register	7-bit Register Address (Hex)
Input Port Registers	00h, 01h
Output Port Registers	02h, 03h
Polarity Inversion Registers	04h, 05h
Configuration Registers	06h, 07h
Output Drive Strength Registers	40h, 41h, 42h, 43h
Input Latch Registers	44h, 45h
Pull-up/Pull-down Enable Registers	46h, 47h
Pull-up/Pull-down Selection Registers	48h, 49h
Interrupt Mask Registers	4Ah, 4Bh
Interrupt Status Registers	4Ch, 4Dh
Output Port Configuration Register	4Fh
Interrupt Edge Registers	50h, 51h, 52h, 53h
Interrupt Clear Registers	54h, 55h
Input Status Registers	56h, 57h
Individual Pin Output Configuration Registers	58h, 59h
Switch Debounce Enable Registers	5Ah, 5Bh
Switch Debounce Count Register	5Ch

Electrical Schematic
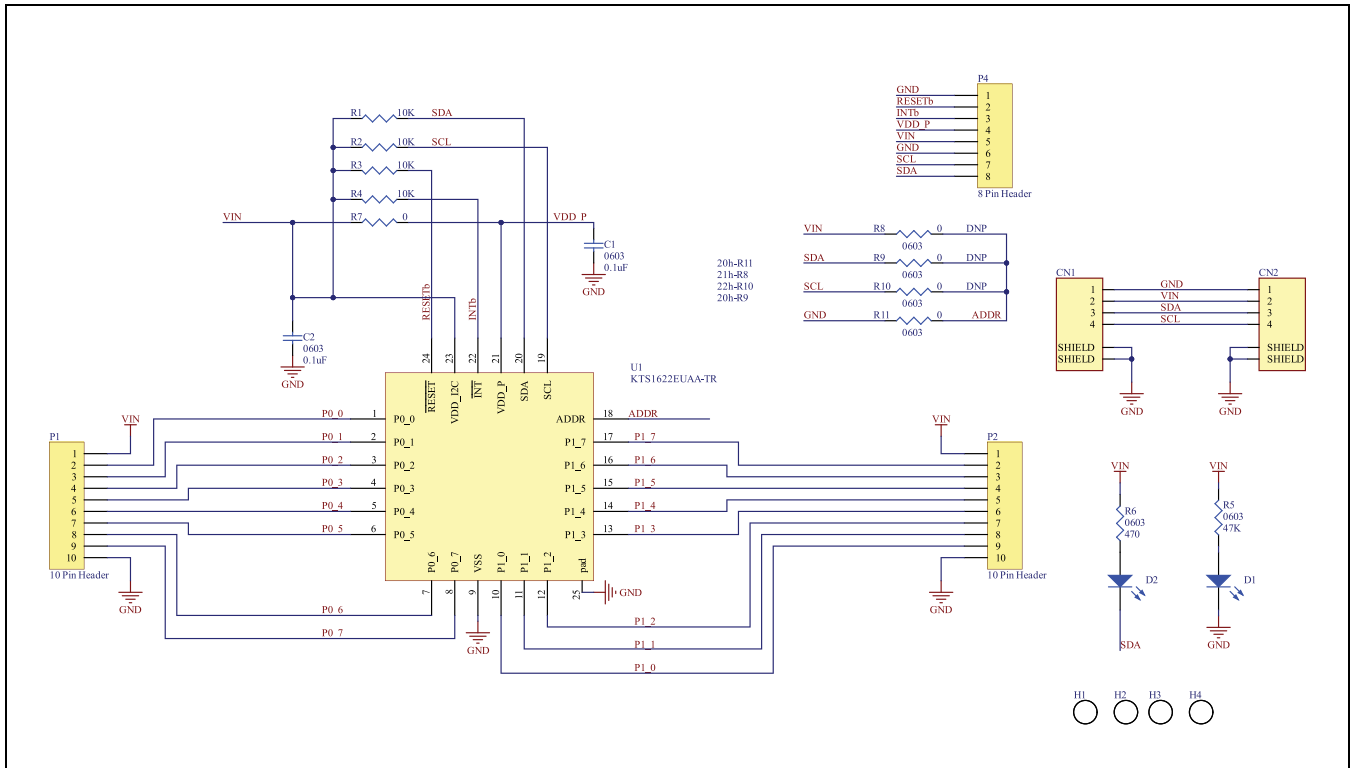
Bill of Materials (BOM)

Item #	Quantity	Designator	Description	Value	Package	Manufacturer	Manufacturer Part Number	Digikey Part Number	Mouser Part Number
1	2	C1, C2	CAP CER 0.1µF 25V X7R 0603	0.1µF	0603	Samsung	CL10B104KA8NNNC	187-CL10B104KA8NNNC	81-GCJ188R71H104KA2D
2	2	CN1, CN2	CONN HEADER SMD R/A 4POS 1MM			JST Sales America Inc.	SM04B-SRSS-TB(LF)(SN)	455-1804-1-ND	
3	1	D1	LED GREEN DIFFUSED 0603 SMD		0603	OSRAM	LG L29K-G2J1-24-Z	475-2709-1-ND	720-LGL29KG2J124Z
4	1	D2	Red 625nm LED Indication - Discrete 2V 0603 (1608 Metric)		0603	Würth Elektronik	150060RS75000	732-4978-1-ND	710-150060RS75000
5	4	H1, H2, H3, H4	BRD SPT SNAP LOCK REST MNT 4MM			Essentra Components	PSD-4M-19	PSD-4M-19-ND	144-PSD-4M-19
6	2	P1, P2	CONN HEADER VERT 10POS 2.54MM		TH	Sullins	PREC010SAAN-RC	S1012EC-10-ND	
7	1	P4	CONN HEADER VERT 8POS 2.54MM		TH	Sullins Connector Solutions	PREC008SAAN-RC	S1012EC-05-ND	
8	4	R1, R2, R3, R4	RES 10KΩ 1% 1/10W 0603	10K	0603	Yageo	RC0603FR-0710KL	311-10.0KHRCT-ND	603-RC0603FR-0710KL
9	1	R5	RES 47KΩ 1% 1/10W 0603	47K	0603	Yageo	RC0603FR-0747KL	311-47.0KHRCT-ND	603-RC0603FR-0747KL
10	1	R6	RES 470Ω 1% 1/10W 0603	470	0603	Yageo	RC0603FR-07470RL	311-470HRCT-ND	603-RC0603FR-07470RL
11	5	R7, R8, R9, R10, R11	RES SMD 0Ω 0603	0	0603	Yageo	RC0603FR-070RL	311-0.0HRCT-ND	603-RC0603FR-070RL
12	1	U1	Low Voltage 16-Bit I2C-bus I/O Expander		TQFN44-24	Kinetic Technologies	KTS1622EUAA-TR		389-KTS1622EUAA-TR

Printed Circuit Board (PCB)
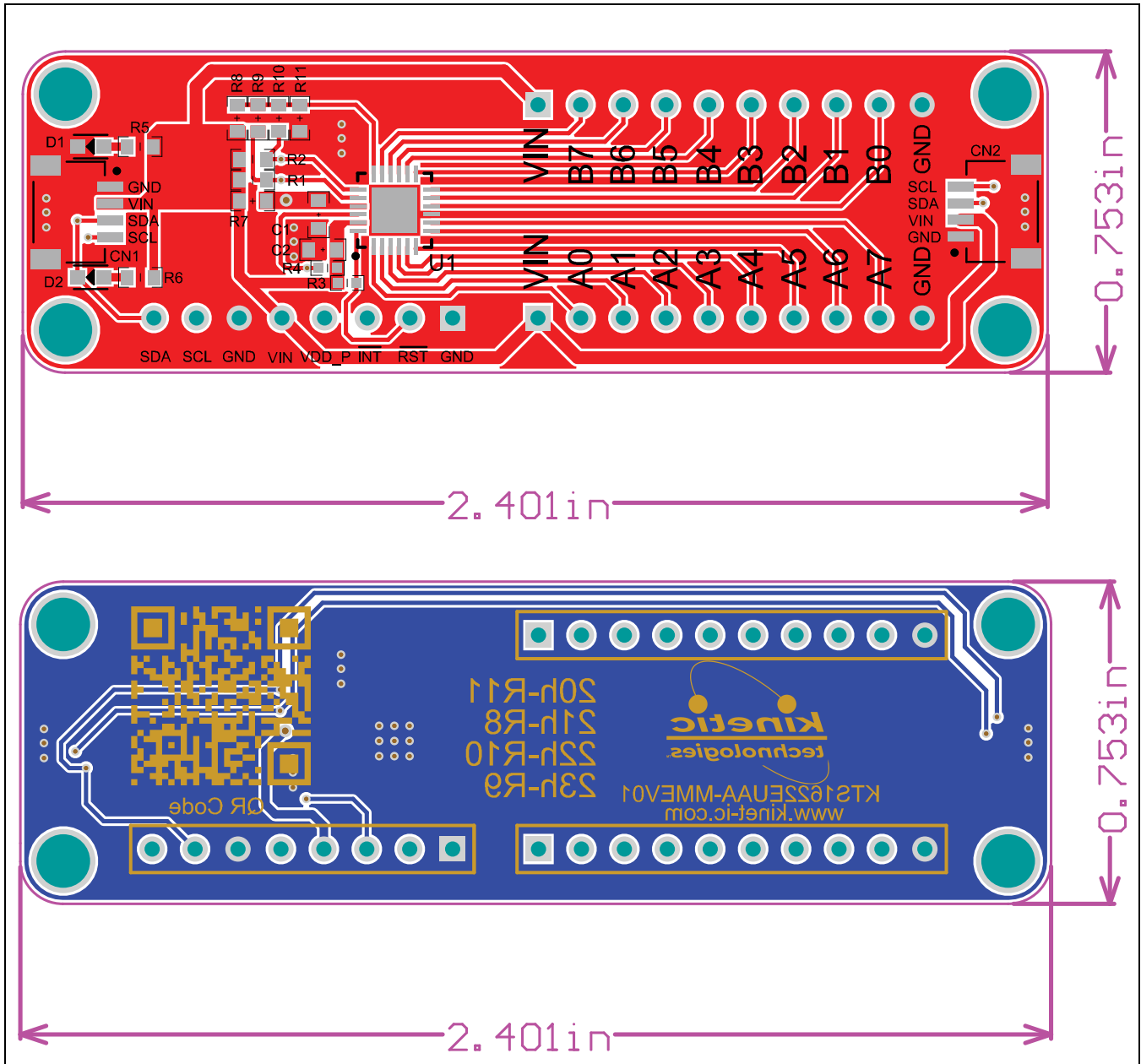
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