CEC Continuing Education Center

DesignNews

Designing, Building and Coding Custom Raspberry Pi RP2040 Arduino Devices

Day 2:

Designing and Constructing a Universal RP2040 Arduino Development Platform

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Fred Eady

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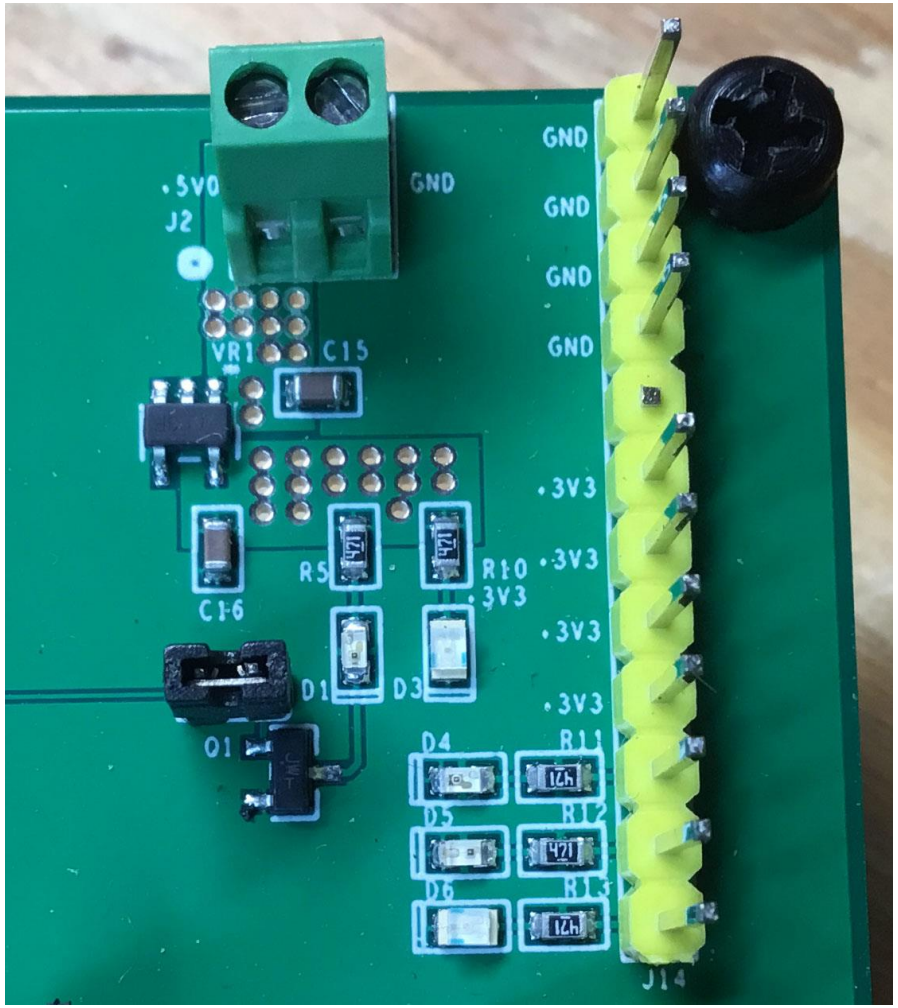
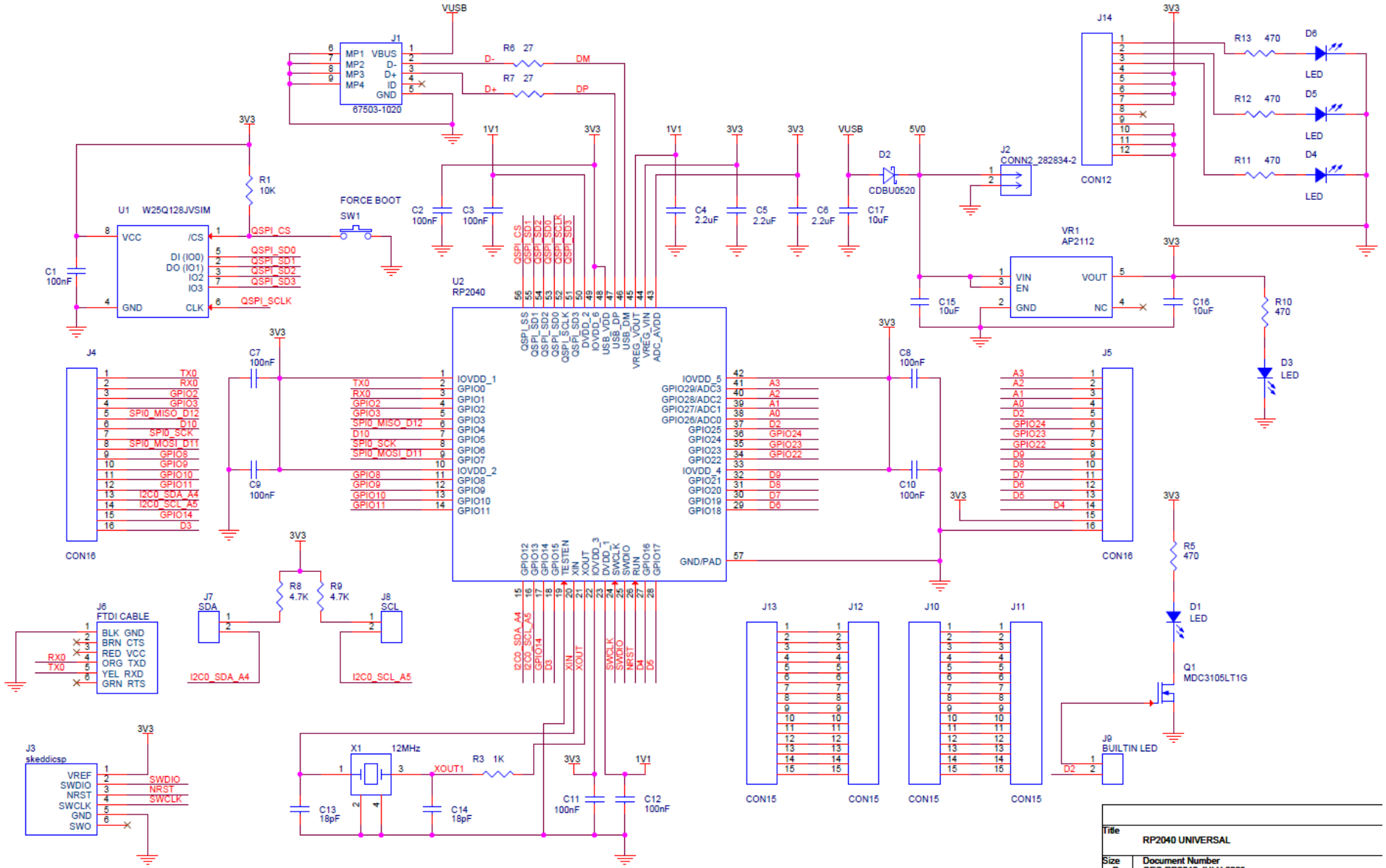
AGENDA

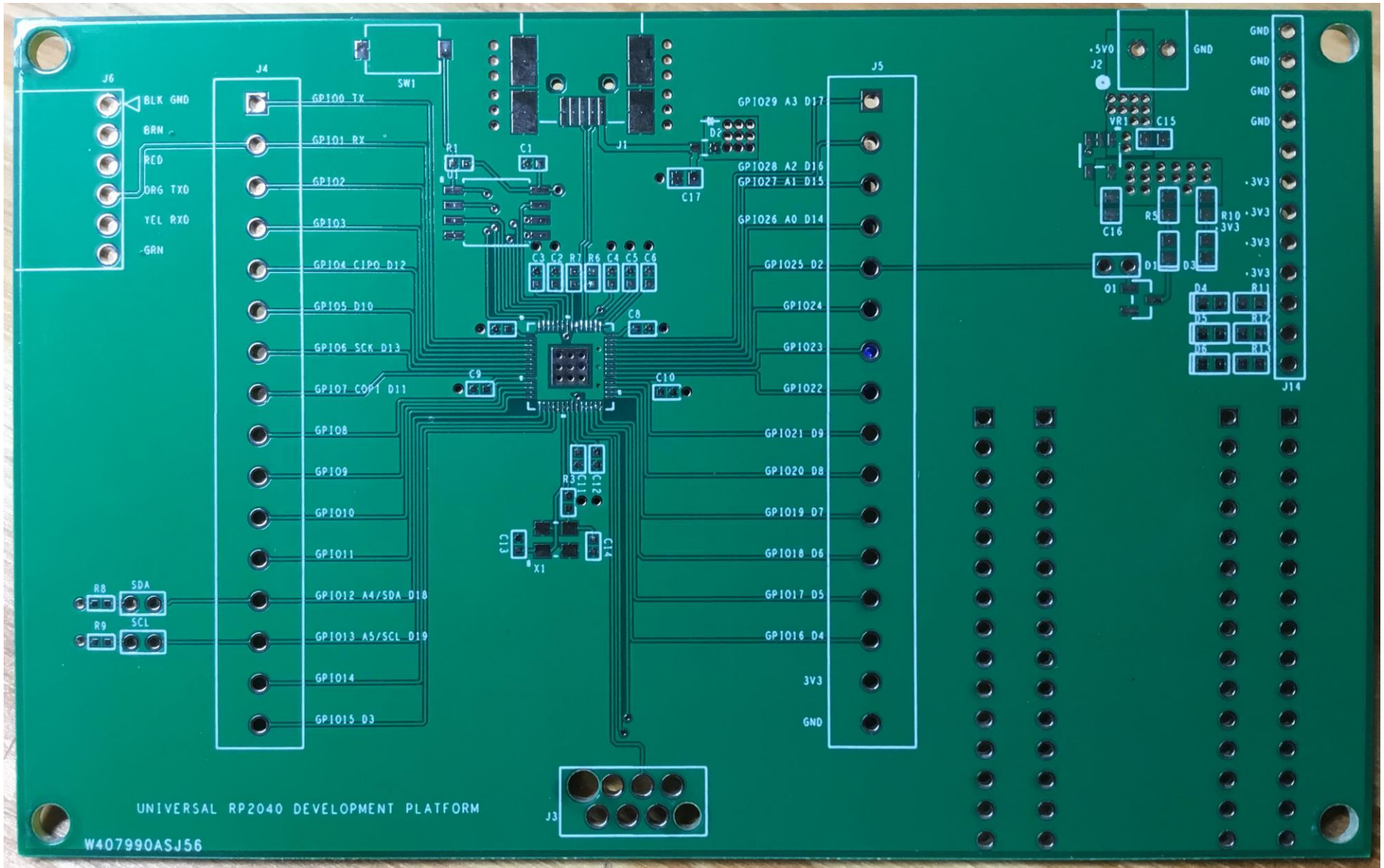
- Universal RP2040 Development Platform Design
- Raspberry Pi PICO Configuration
- Test Runs



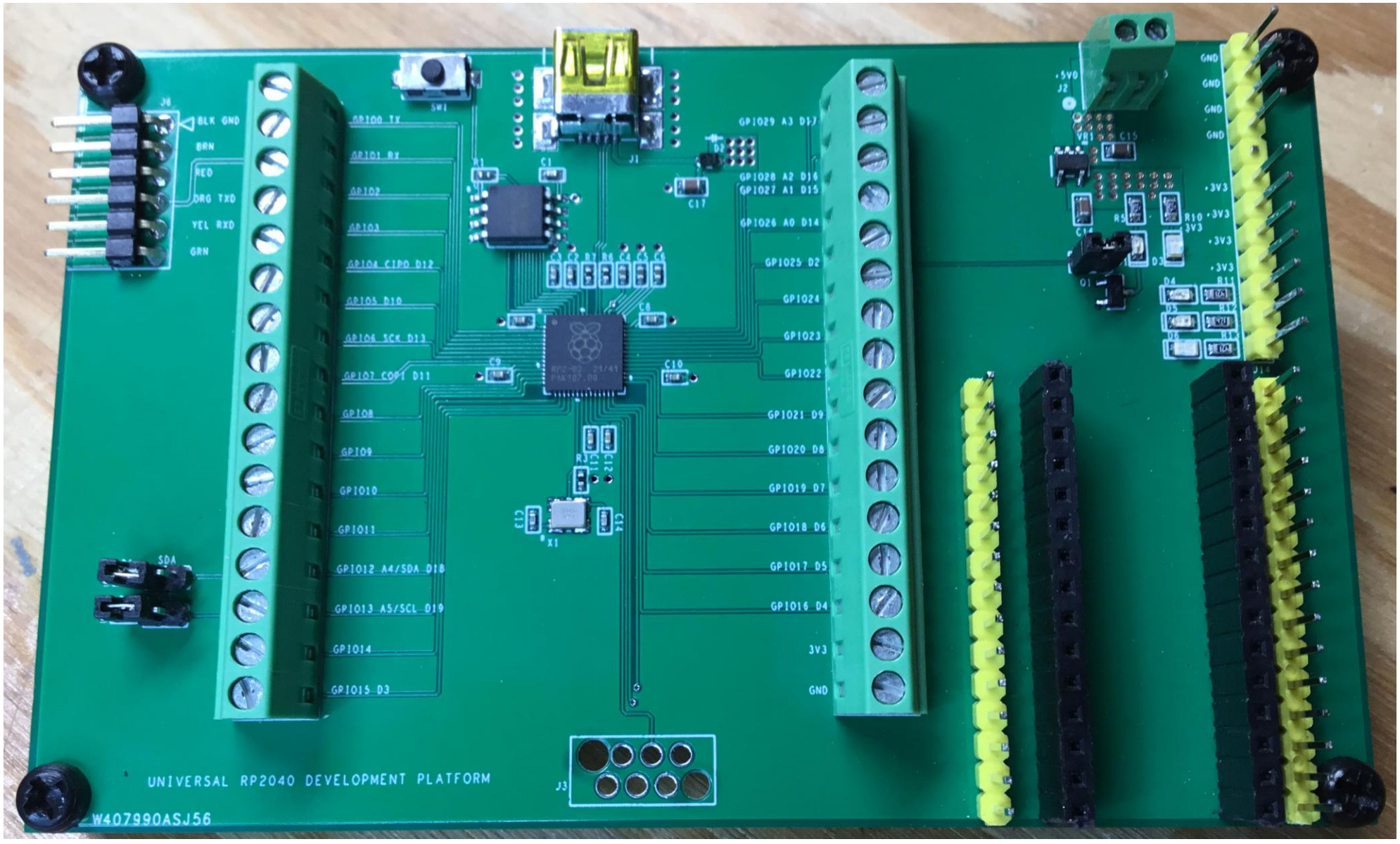
Universal RP2040 Development Platform



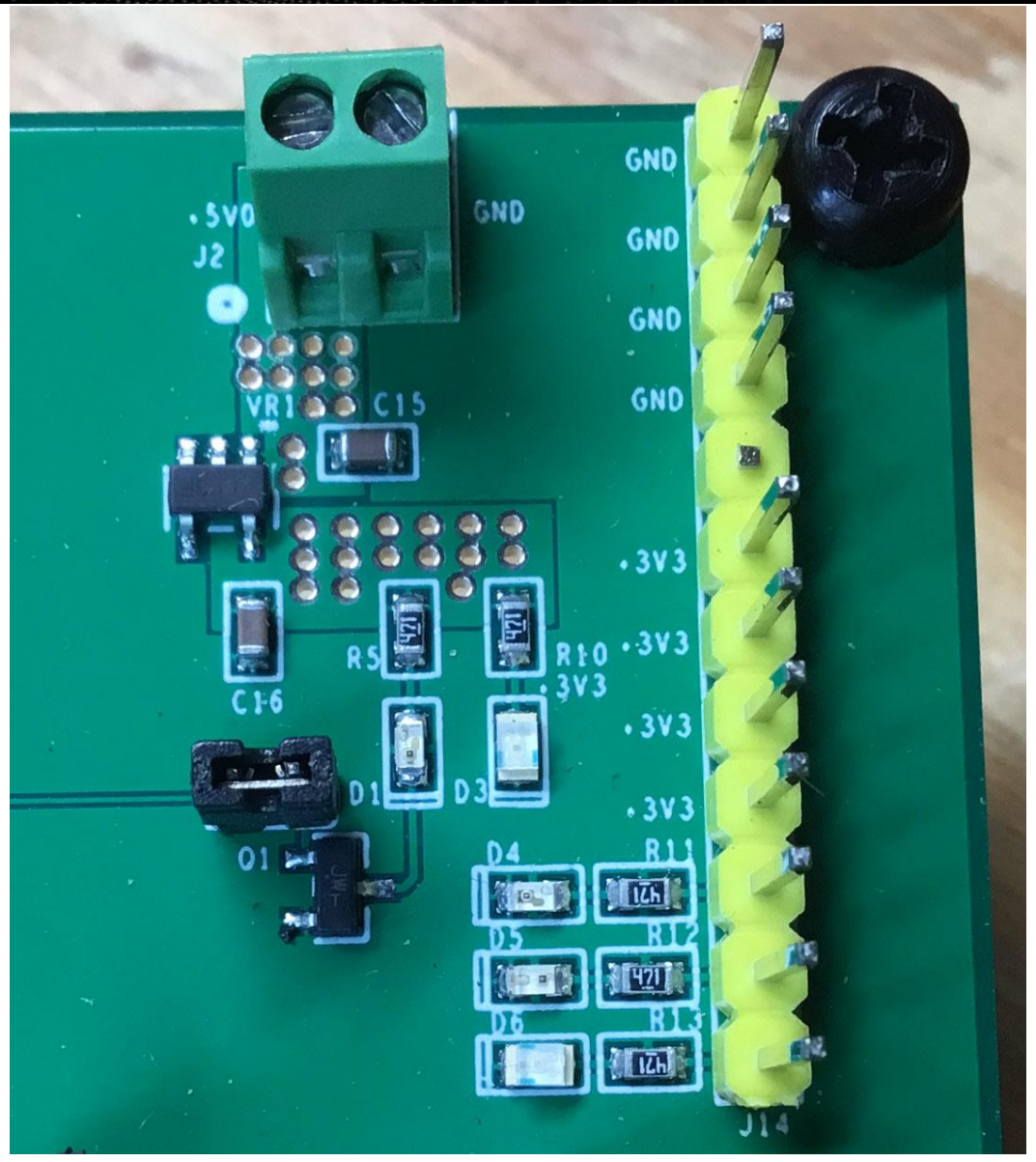
Universal RP2040 Development Platform

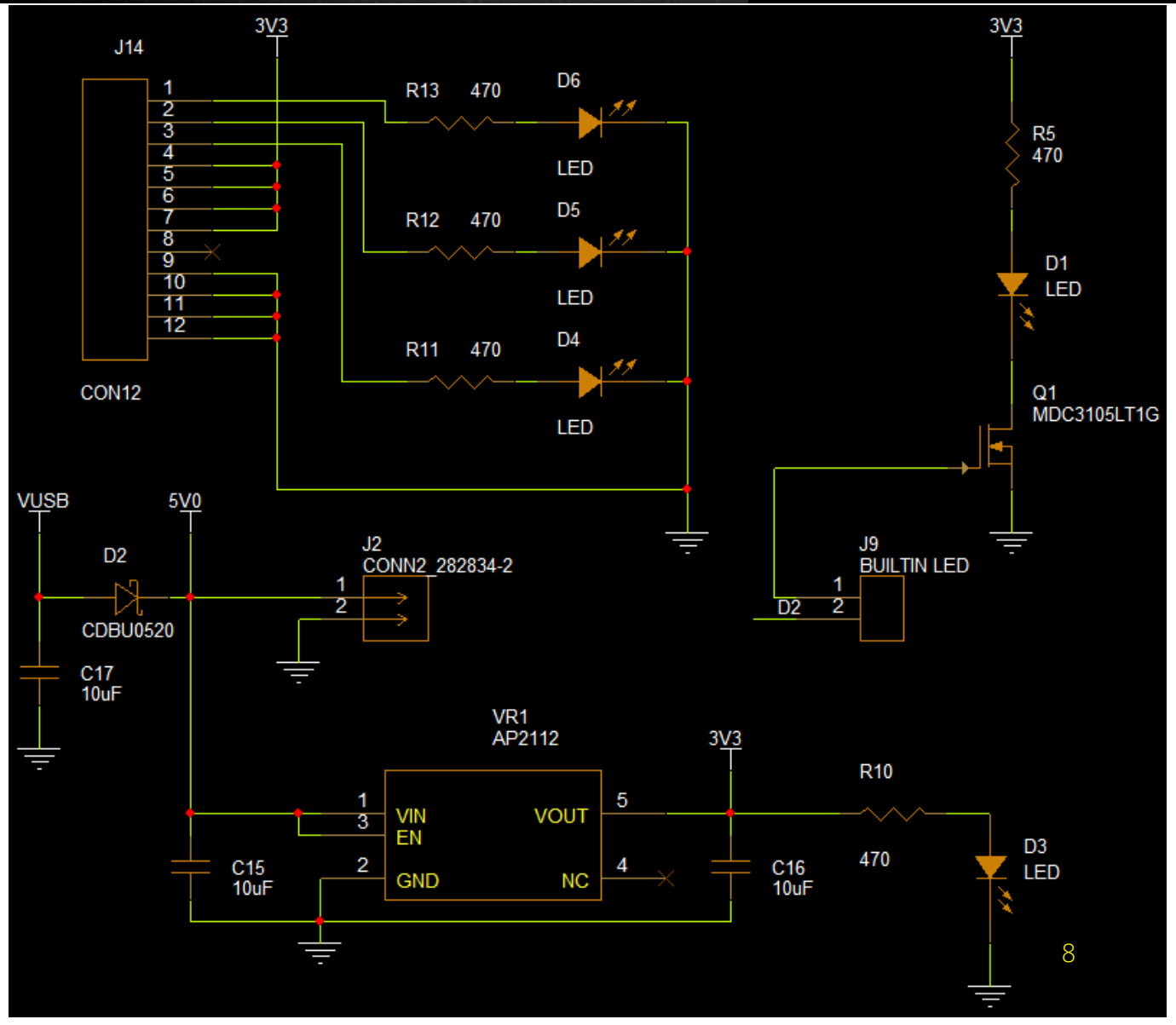


Universal RP2040 Development Platform

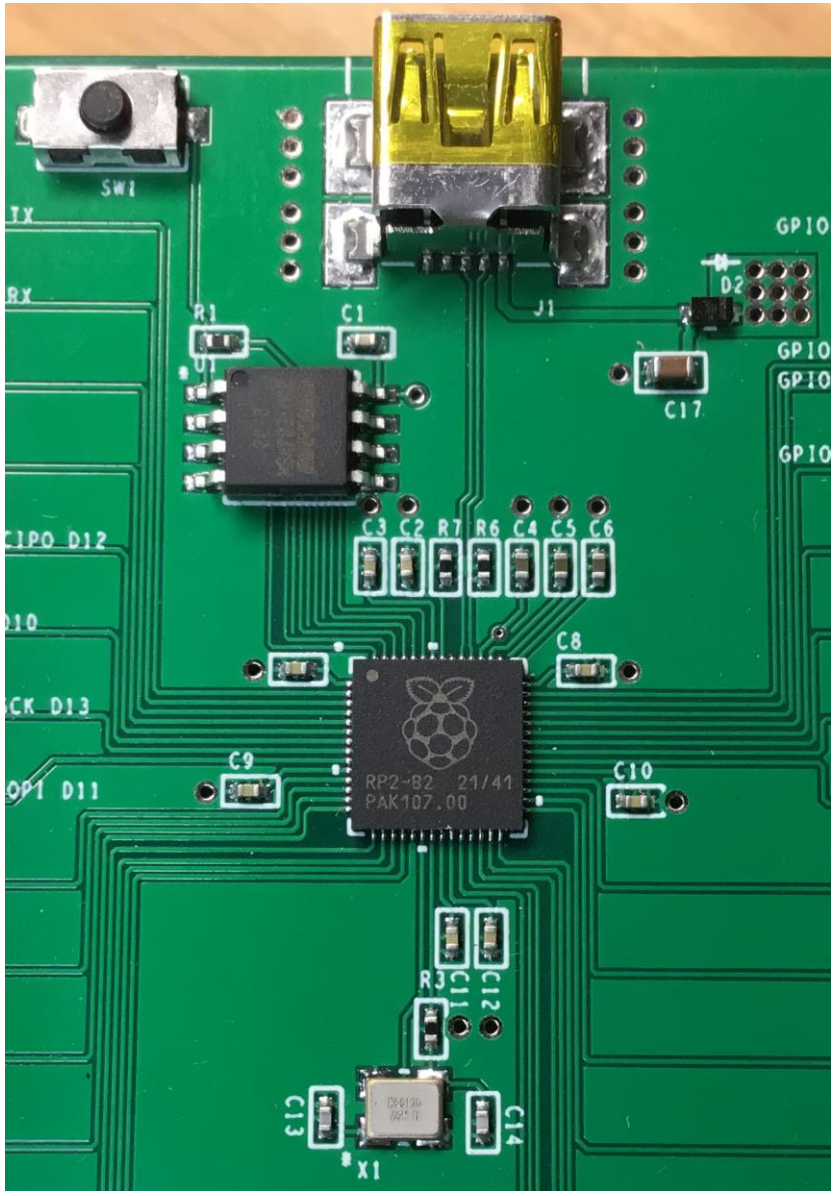


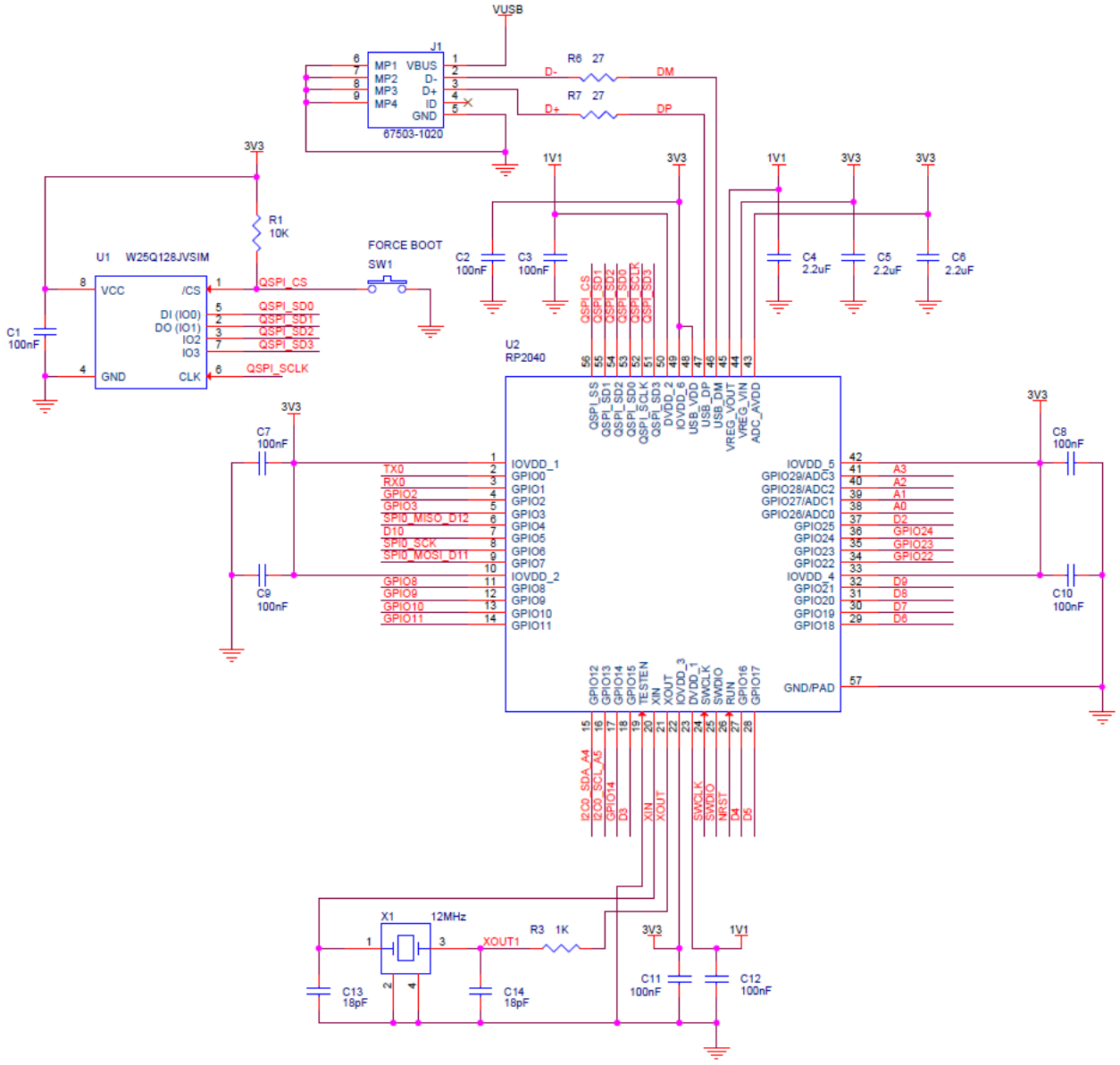
Universal RP2040 Development Platform - Power





Universal RP2040 Development Platform – RP2040



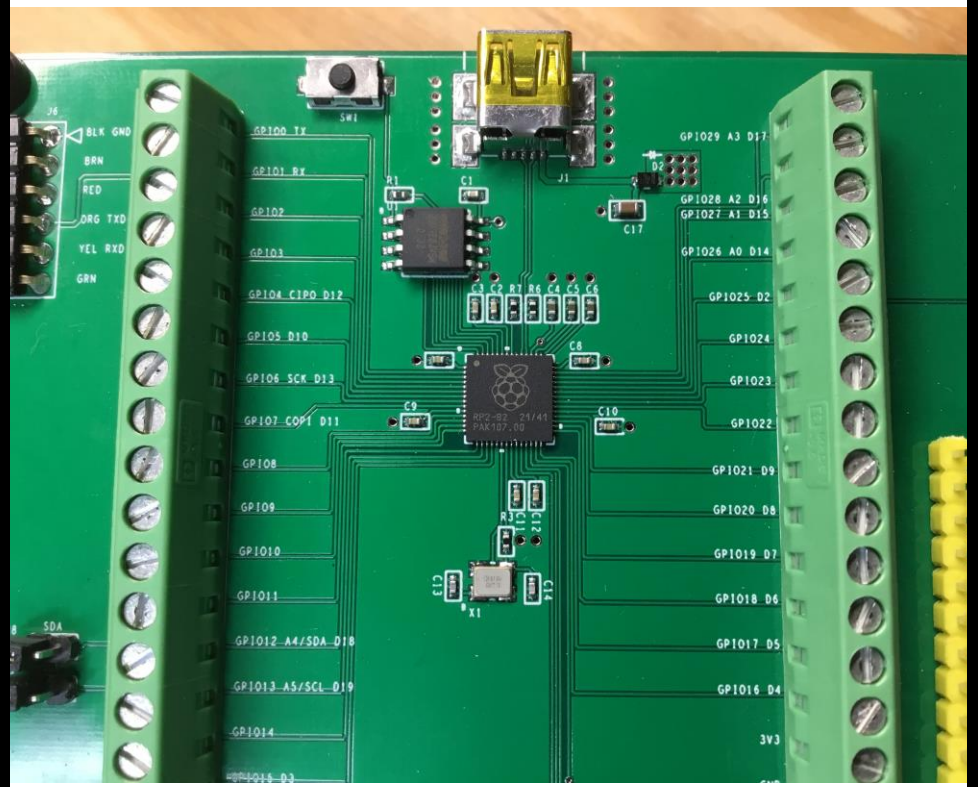


Universal RP2040 Development Platform – GPIO

J4

1	TX0
2	RX0
3	GPIO2
4	GPIO3
5	SPI0_MISO_D12
6	D10
7	SPI0_SCK
8	SPI0_MOSI_D11
9	GPIO8
10	GPIO9
11	GPIO10
12	GPIO11
13	I2C0_SDA_A4
14	I2C0_SCL_A5
15	GPIO14
16	D3

CON16

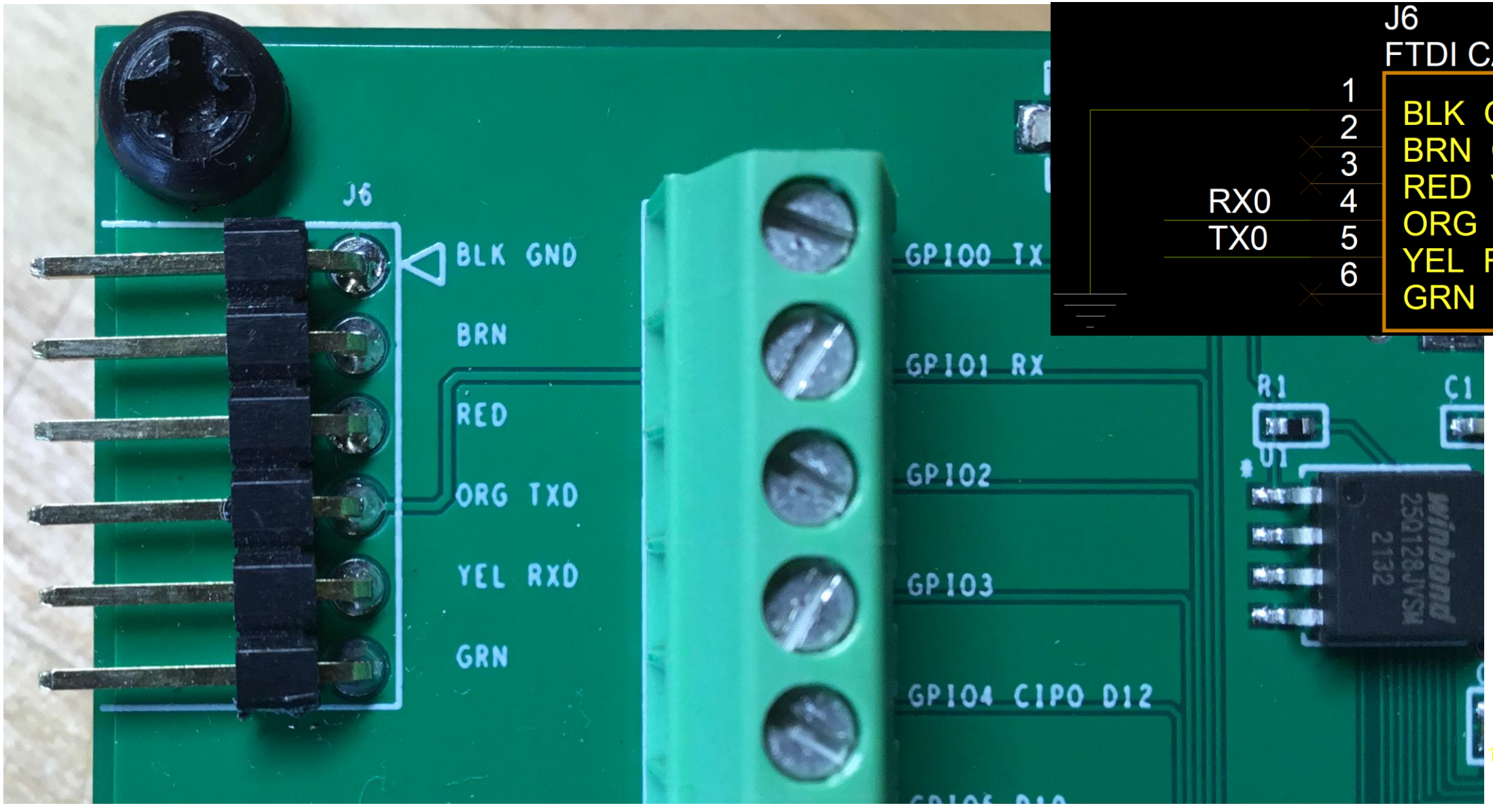


J5

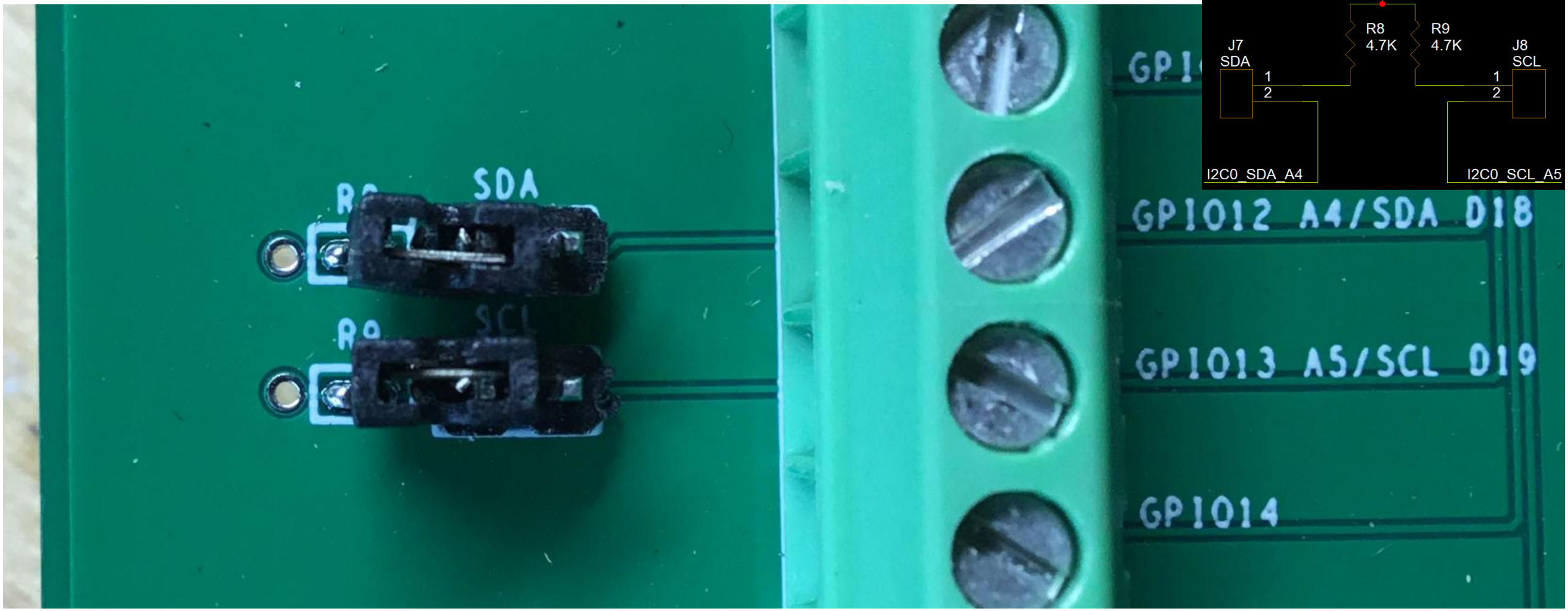
A3	1
A2	2
A1	3
A0	4
D2	5
GPIO24	6
GPIO23	7
GPIO22	8
D9	9
D8	10
D7	11
D6	12
D5	13
D4	14
3V3	15
	16

CON16

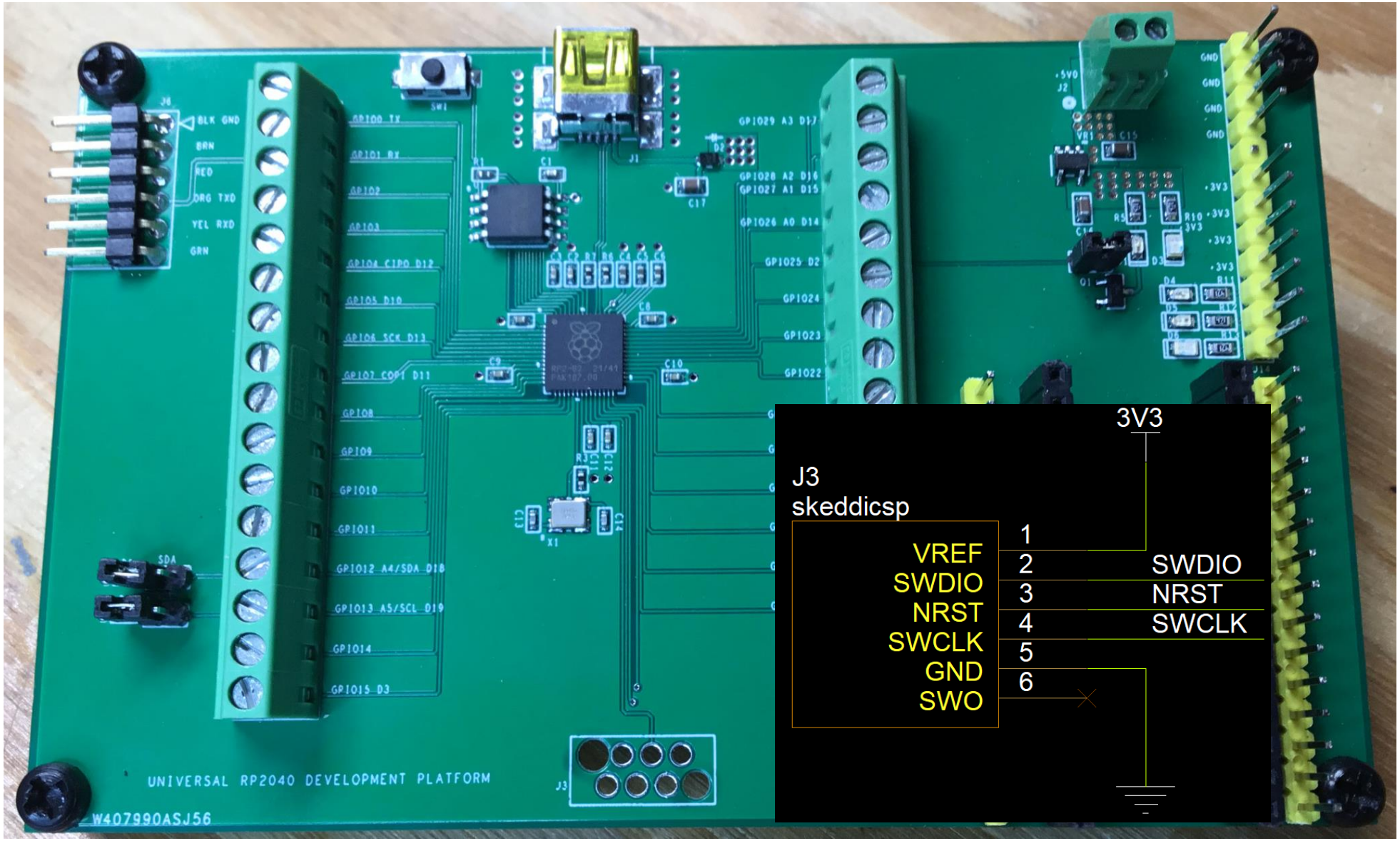
Universal RP2040 Development Platform – FTDI Cable



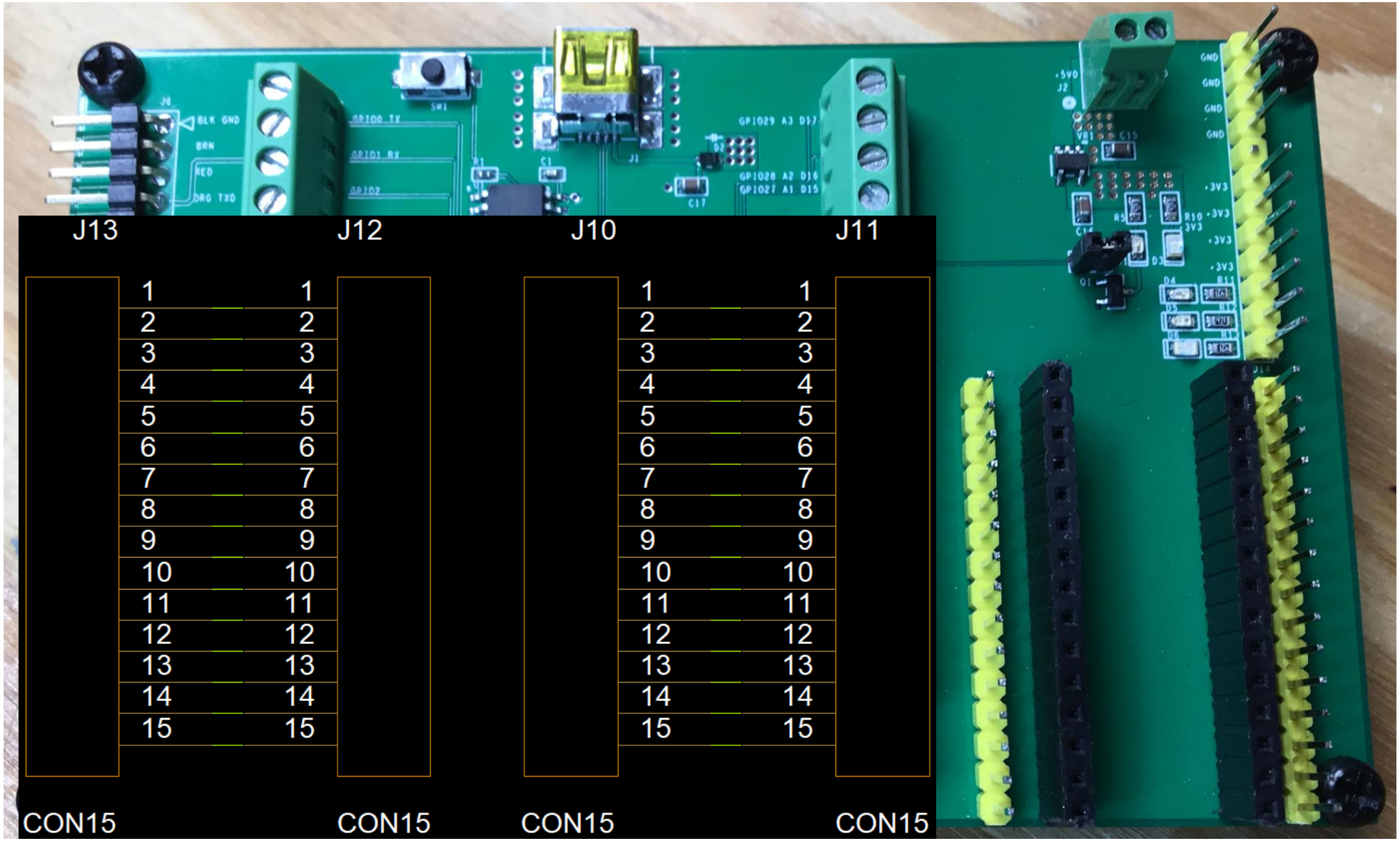
Universal RP2040 Development Platform – I²C



Universal RP2040 Development Platform – SWD

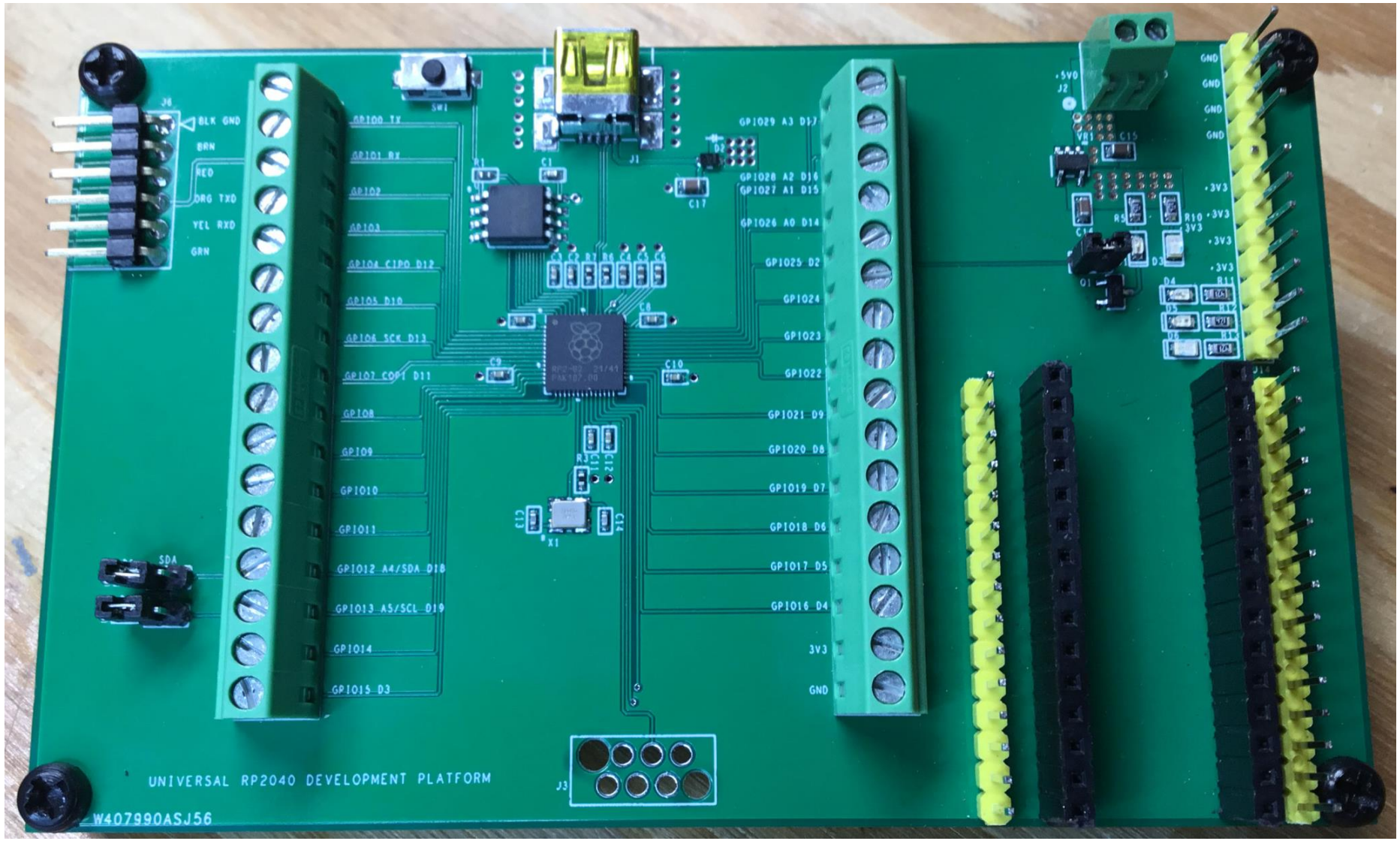


Universal RP2040 Development Platform – Target



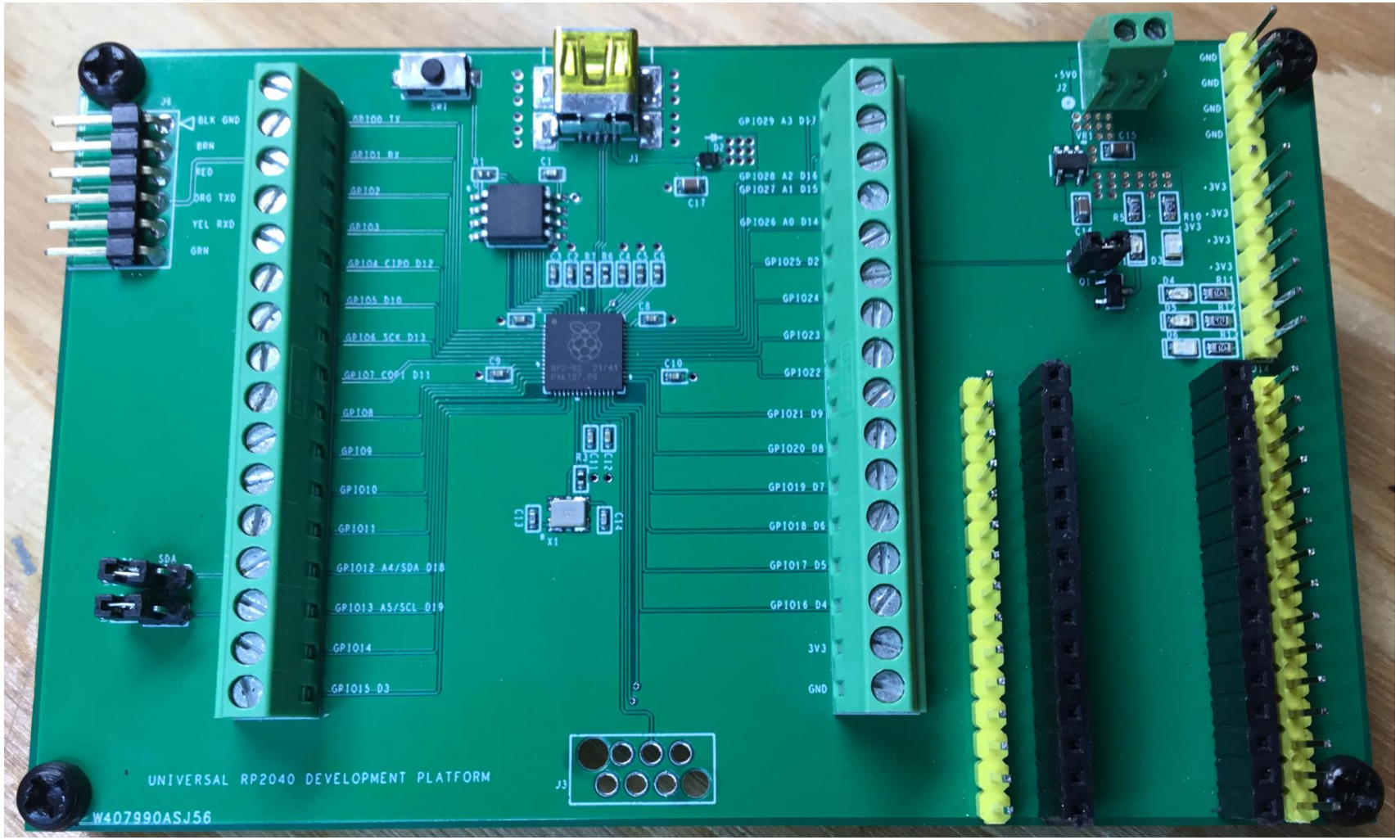
variant.cpp

```
11  PinDescription g_APinDescription[] = {
12    // D0 - D29
13    { p0,  NULL, NULL, NULL },
14    { p1,  NULL, NULL, NULL },
15    { p2,  NULL, NULL, NULL },
16    { p3,  NULL, NULL, NULL },
17    { p4,  NULL, NULL, NULL },
18    { p5,  NULL, NULL, NULL },
19    { p6,  NULL, NULL, NULL },
20    { p7,  NULL, NULL, NULL },
21    { p8,  NULL, NULL, NULL },
22    { p9,  NULL, NULL, NULL },
23    { p10, NULL, NULL, NULL },
24    { p11, NULL, NULL, NULL },
25    { p12, NULL, NULL, NULL },
26    { p13, NULL, NULL, NULL },
27    { p14, NULL, NULL, NULL },
28    { p15, NULL, NULL, NULL },
29    { p16, NULL, NULL, NULL },
30    { p17, NULL, NULL, NULL },
31    { p18, NULL, NULL, NULL },
32    { p19, NULL, NULL, NULL },
33    { p20, NULL, NULL, NULL },
34    { p21, NULL, NULL, NULL },
35    { p22, NULL, NULL, NULL },
36    { p23, NULL, NULL, NULL },
37    { p24, NULL, NULL, NULL },
38    { p25, NULL, NULL, NULL },
39    { p26, NULL, NULL, NULL },
40    { p27, NULL, NULL, NULL },
41    { p28, NULL, NULL, NULL },
42    { p29, NULL, NULL, NULL },
43  };
```



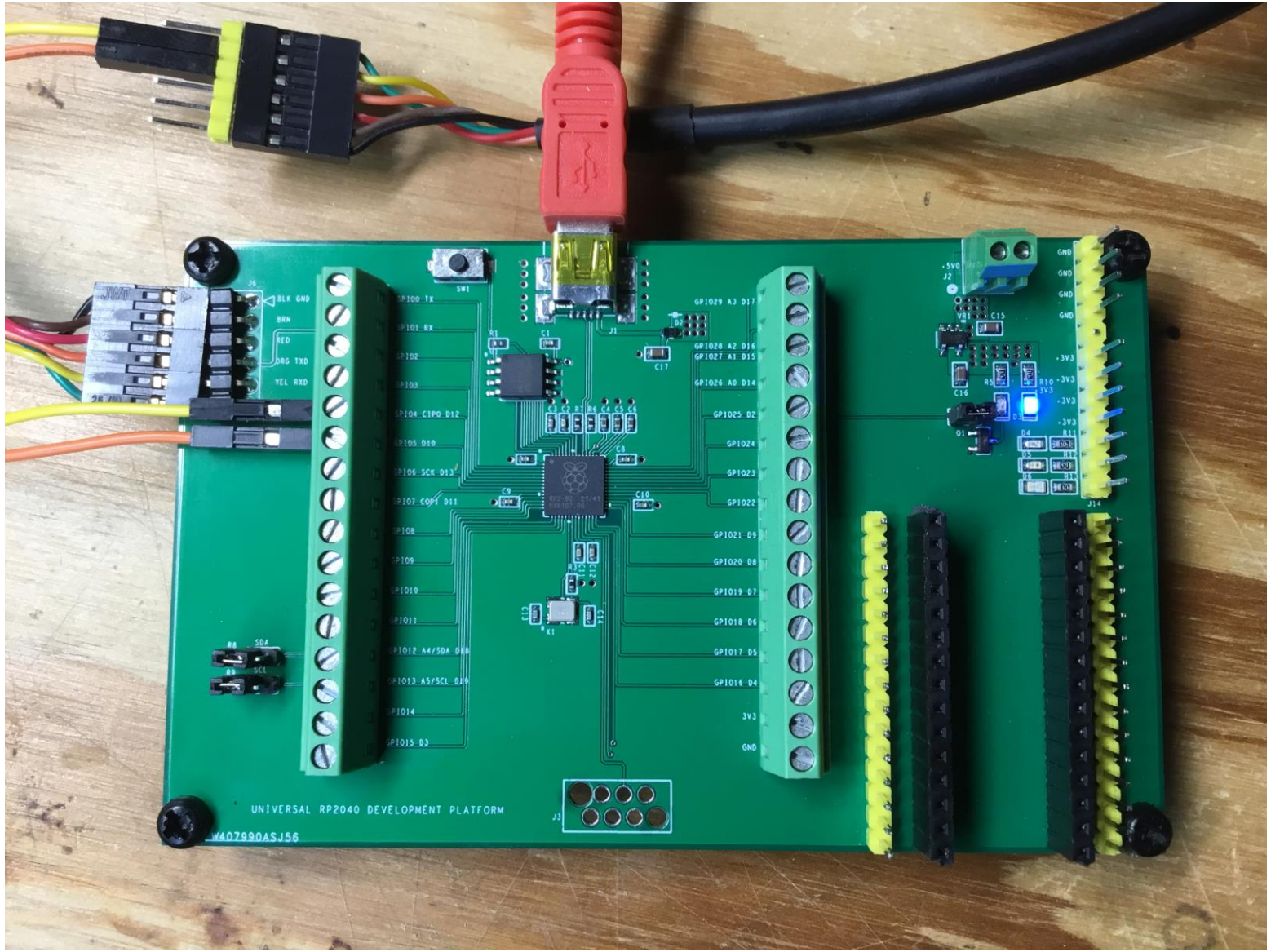
pins_arduino.h

```
21  // LEDs
22  // ----
23  #define PIN_LED     (25u)
24  #define LED_BUILTIN PIN_LED
25
26  // Analog pins
27  // -----------
28  #define PIN_A0 (26u)
29  #define PIN_A1 (27u)
30  #define PIN_A2 (28u)
31  #define PIN_A3 (29u)
32  #define ADC_RESOLUTION 12
33
34  // Serial
35  #define PIN_SERIAL_TX (0ul)
36  #define PIN_SERIAL_RX (1ul)
37
38  // SPI
39  #define PIN_SPI_MISO  (16u)
40  #define PIN_SPI_MOSI  (19u)
41  #define PIN_SPI_SCK   (18u)
42  #define PIN_SPI_SS    (17u)
43
44  // Wire
45  #define PIN_WIRE_SDA  (8u)
46  #define PIN_WIRE_SCL  (9u)
47
48  #define SERIAL_HOWMANY      2
49  #define SERIAL1_TX          (digitalPinToPinName(PIN_SERIAL_TX))
50  #define SERIAL1_RX          (digitalPinToPinName(PIN_SERIAL_RX))
51  #define SERIAL2_TX          (digitalPinToPinName(4))
52  #define SERIAL2_RX          (digitalPinToPinName(5))
53
54  #define WIRE_HOWMANY    (1)
55  #define I2C_SDA         (digitalPinToPinName(PIN_WIRE_SDA))
56  #define I2C_SCL         (digitalPinToPinName(PIN_WIRE_SCL))
57
58  #define SERIAL_CDC          1
59  #define HAS_UNIQUE_ISERIAL_DESCRIPTOR
60  #define BOARD_VENDORID      0x2e8a
61  #define BOARD_PRODUCTID     0x00c0
62  #define BOARD_NAME          "RaspberryPi Pico"
```



univ_serial.ino

```
2   void setup(){
3
4       //set GPIO25 for output
5       pinMode(LED_BUILTIN,OUTPUT);
6       //illuminate LED for 2 secs
7       digitalWrite(LED_BUILTIN,HIGH);
8       delay(2000);
9       digitalWrite(LED_BUILTIN,LOW);
10      //fire up the serial ports
11      Serial.begin(9600);
12      while(!Serial);
13      Serial1.begin(9600);
14      while(!Serial1);
15      Serial2.begin(9600);
16      while(!Serial2);
17  }
18
19  void loop(){
20      Serial.println("Serial -> USB");
21      Serial1.println("Serial1 -> FTDI");
22      Serial2.println("Serial2 -> GPIO 4/5");
23      delay(1000);
24  }
```



univ_serial.ino

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    //set GPIO25 for output
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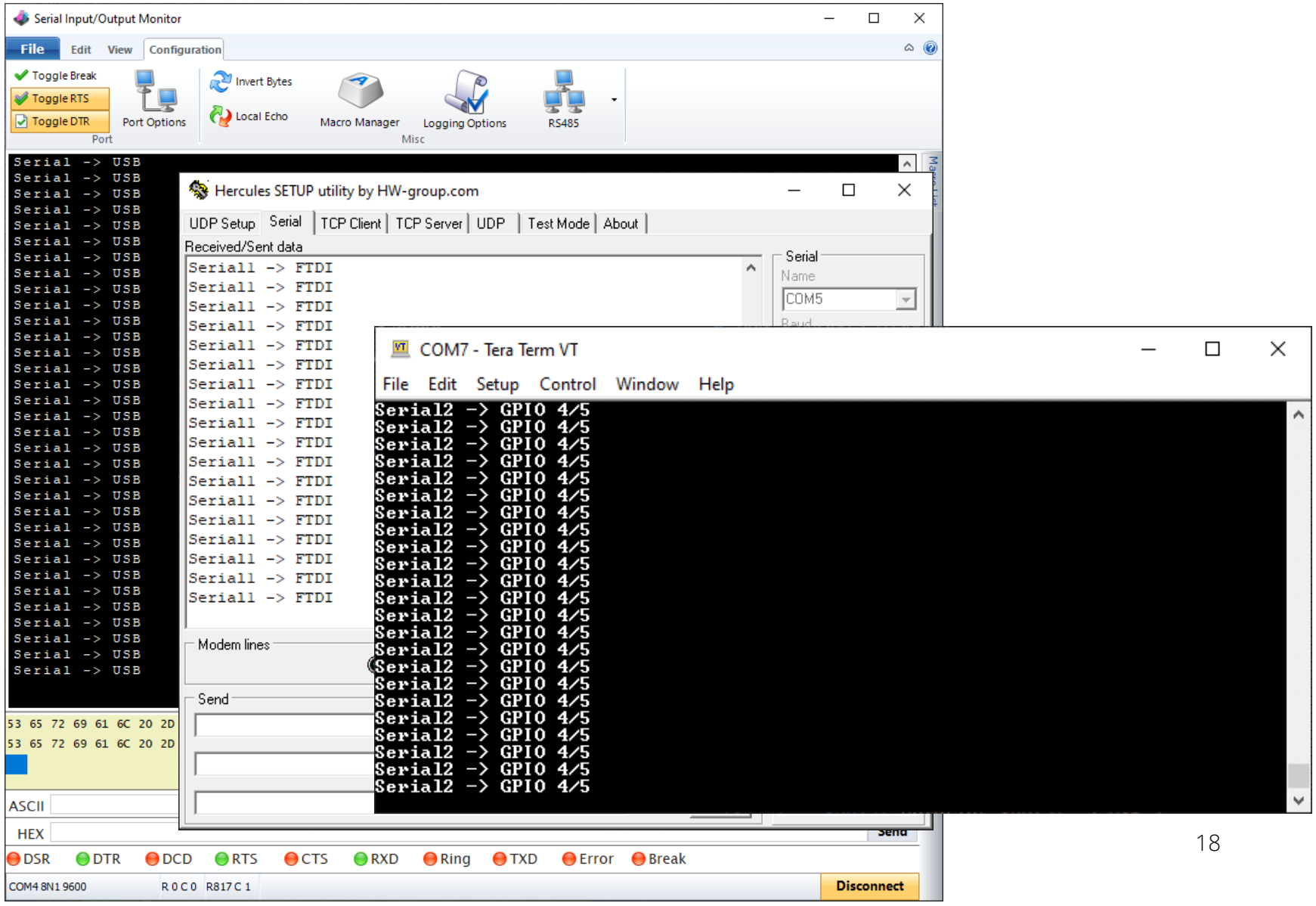
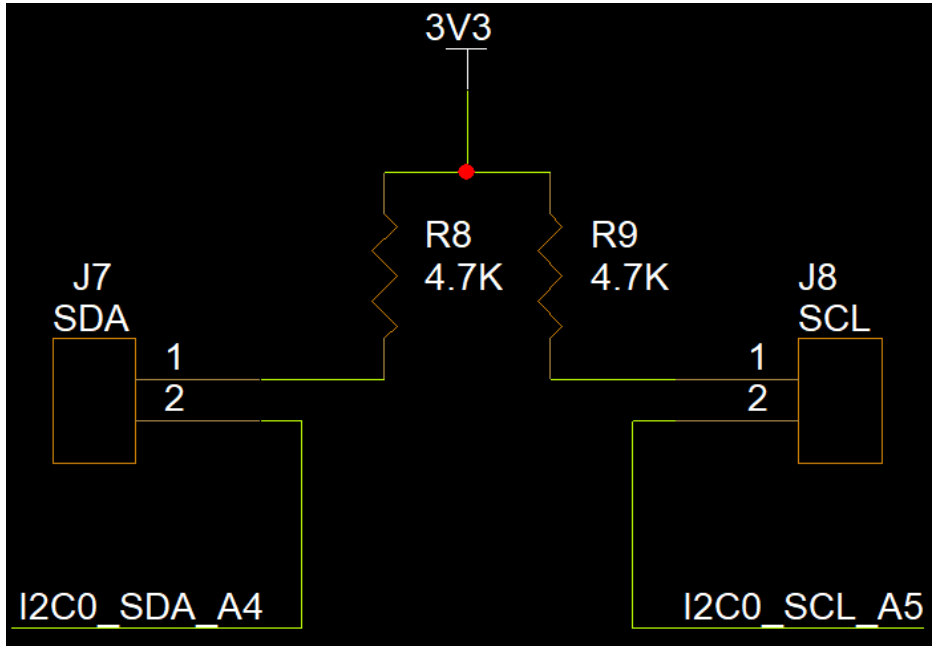
```

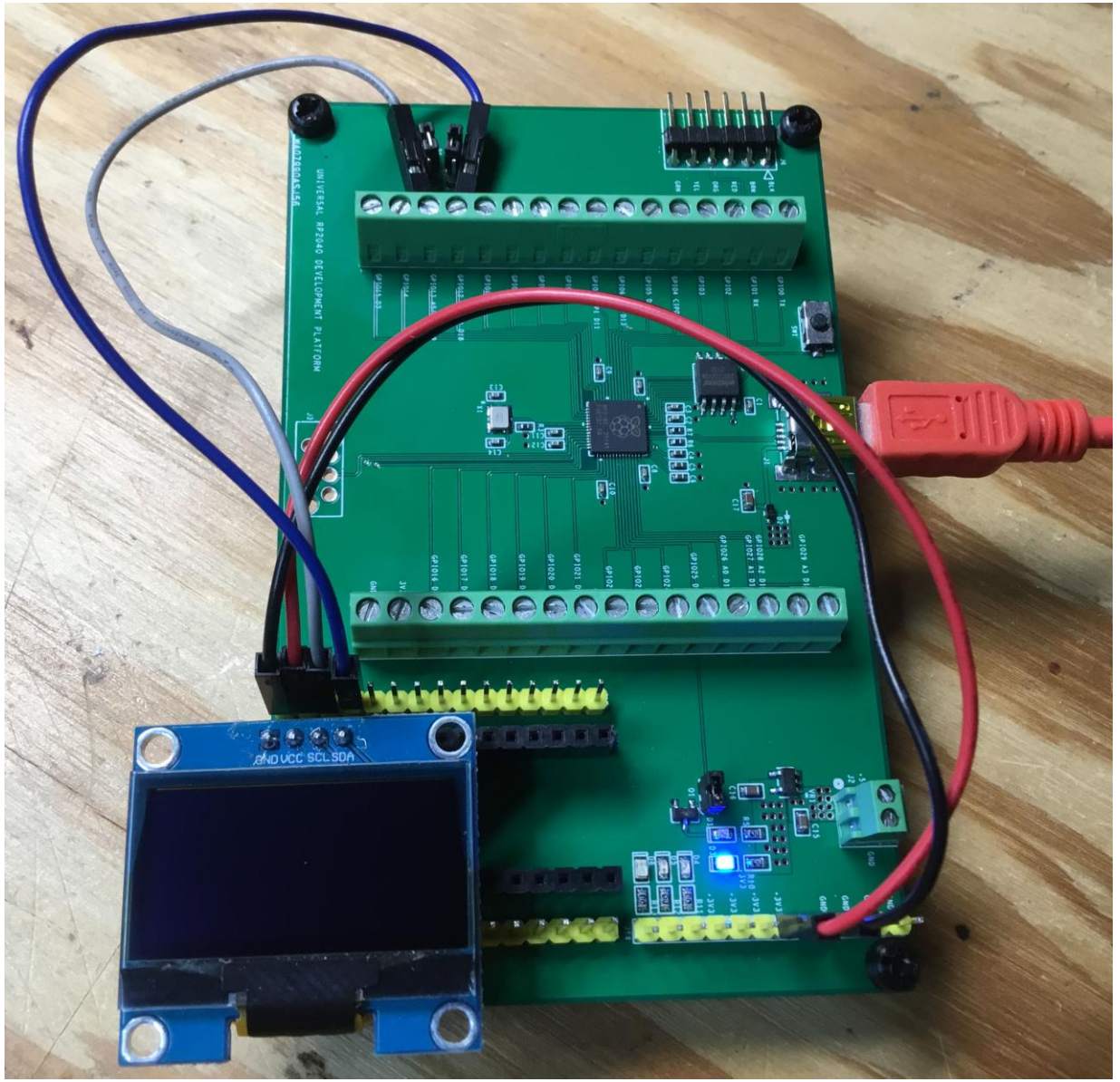


univ_i2c.ino – pins_arduino.h / arduino.json

```
55  // Wire
56  #define PIN_WIRE_SDA        (12u)
57  #define PIN_WIRE_SCL        (13u)
58
59  #define WIRE_HOWMANY    (1)
60  #define I2C_SDA         (digitalPinToPinName(PIN_WIRE_SDA))
61  #define I2C_SCL         (digitalPinToPinName(PIN_WIRE_SCL))
```

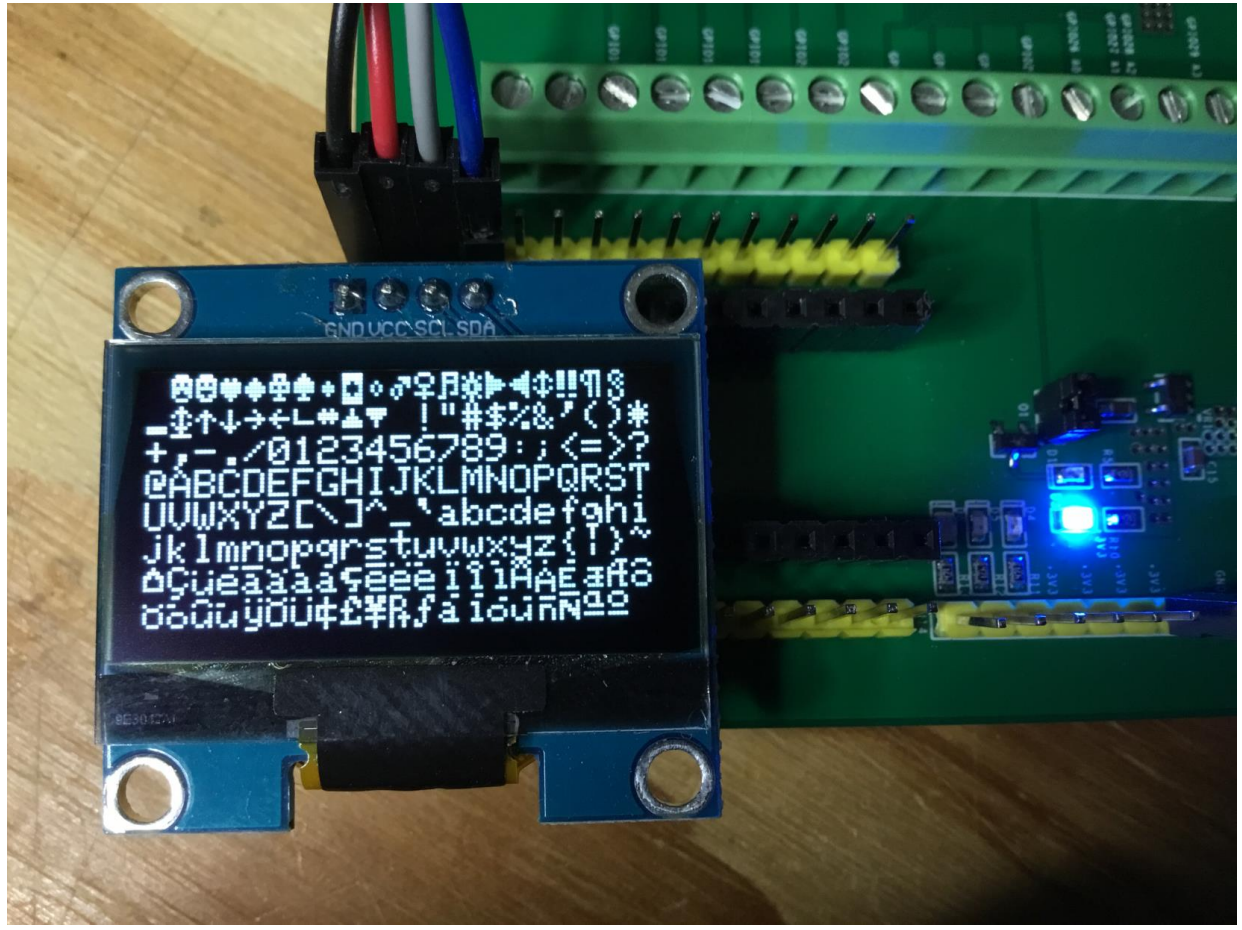
```
1  {
2      "board": "arduino:mbed_rp2040:pico",
3      "sketch": "univ_i2c.ino",
4      "port": "COM4",
5      "output": "C:/Users/Public/univ_i2c/build"
6  }
```





univ_i2c.ino

```
18  #include <SPI.h>
19  #include <Wire.h>
20  #include <Adafruit_GFX.h>
21  #include <Adafruit_SH110X.h>
22
23  #define i2c_Address 0x3c //initialize with the I2C addr 0x3C Typically eBay OLED's
24  #define SCREEN_WIDTH 128 // OLED display width, in pixels
25  #define SCREEN_HEIGHT 64 // OLED display height, in pixels
26  #define OLED_RESET -1   //   QT-PY / XIAO
27  Adafruit_SH1106G display = Adafruit_SH1106G(SCREEN_WIDTH, SCREEN_HEIGHT, &Wire, OLED_RESET);
28
29  #define XPOS 0
30  #define YPOS 1
31
32  void setup()   {
33
34    Serial.begin(9600);
35    delay(250); // wait for the OLED to power up
36    display.begin(i2c_Address, true); // Address 0x3C default
37    // Clear the buffer.
38    display.clearDisplay();
39    testdrawchar();
40    display.display();
41    delay(5000);
42    display.clearDisplay();
43    // text display tests
44    display.setTextSize(1);
45    display.setTextColor(SH110X_WHITE);
46    display.setCursor(0, 0);
47    display.println("Universal RP2040");
48    display.println("Development Platform");
49    display.print("0x"); display.println(0xDEADBEEF, HEX);
50    display.display();
51  }
52
53  void loop() {}
```



univ_i2c.ino

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19  #include <Wire.h>
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26  #define OLED_RESET -1   //   QT-PY / XIAO
27  Adafruit_SH1106G display = Adafruit_SH1106G(SCREEN_WIDTH, SCREEN_HEIGHT, &Wire, OLED_RESET);
28
29  #define XPOS 0
30  #define YPOS 1
31
32  void setup()   {
33
34    Serial.begin(9600);
35    delay(250); // wait for the OLED to power up
36    display.begin(i2c_Address, true); // Address 0x3C default
37    // Clear the buffer.
38    display.clearDisplay();
39    testdrawchar();
40    display.display();
41    delay(5000);
42    display.clearDisplay();
43    // text display tests
44    display.setTextSize(1);
45    display.setTextColor(SH110X_WHITE);
46    display.setCursor(0, 0);
47    display.println("Universal RP2040");
48    display.println("Development Platform");
49    display.print("0x"); display.println(0xDEADBEEF, HEX);
50    display.display();
51  }
52
53  void loop() {}
```
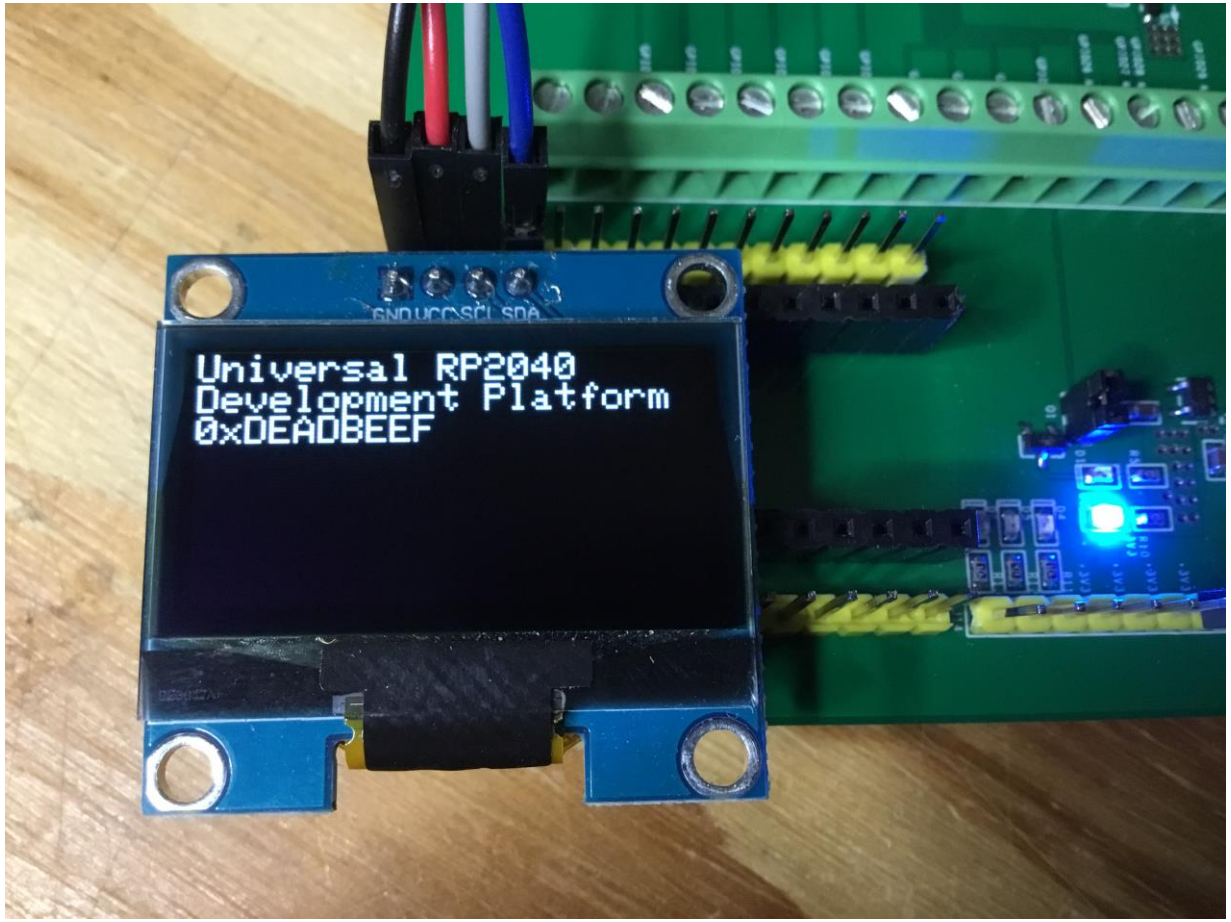
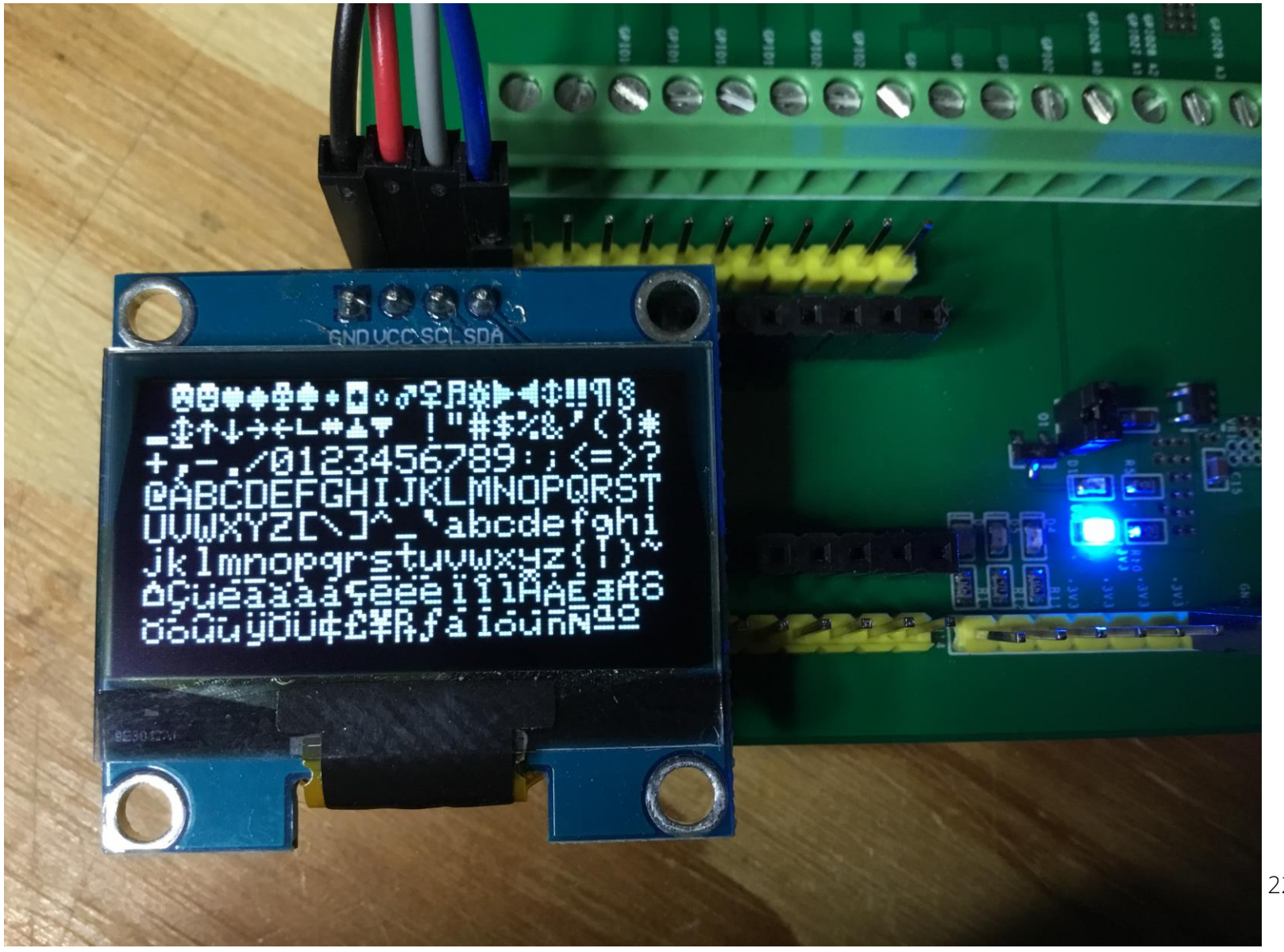



univ_i2c.ino

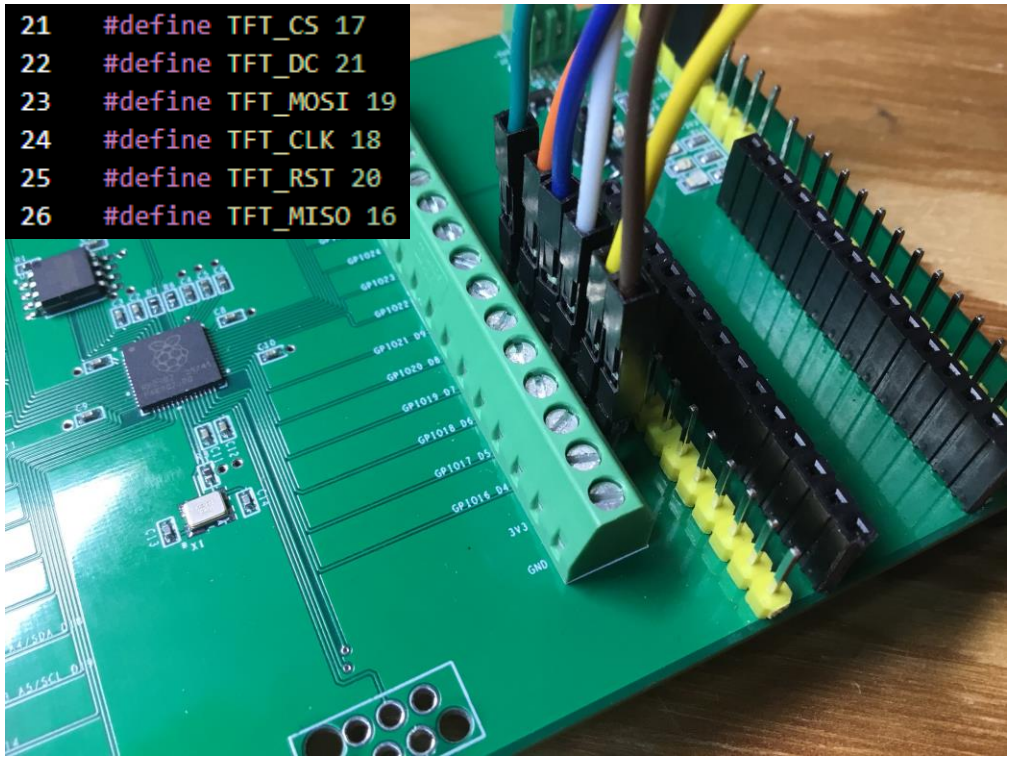
```
202  void testdrawchar(void) {
203    display.setTextSize(1);
204    display.setTextColor(SH110X_WHITE);
205    display.setCursor(0, 0);
206
207    for (uint8_t i = 0; i < 168; i++) {
208      if (i == '\n') continue;
209      display.write(i);
210      if ((i > 0) && (i % 21 == 0))
211        display.println();
212    }
213    display.display();
214    delay(1);
215  }
```

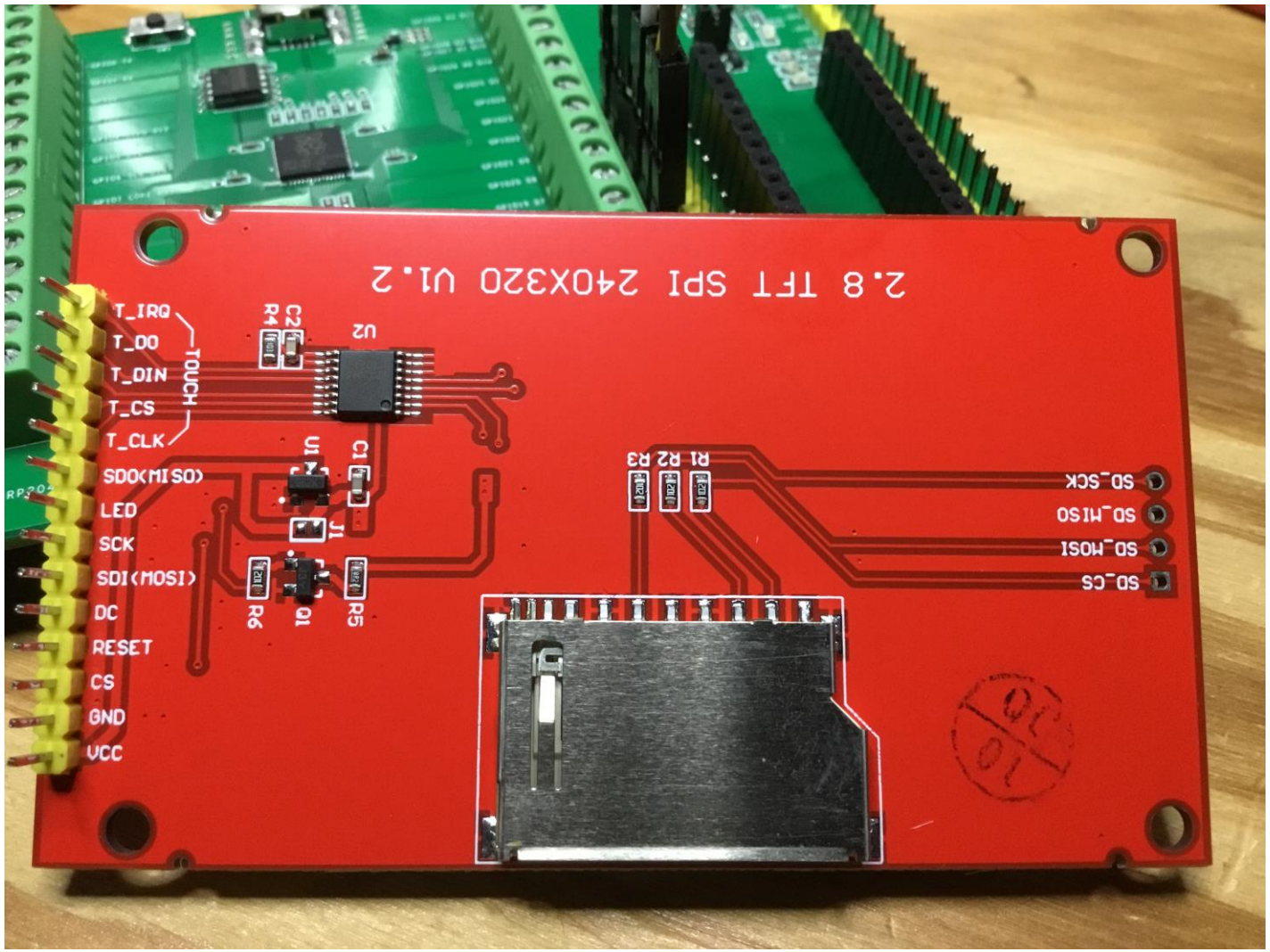


univ_spi.ino – pins_arduino.h / TFT SPI Connects

```
44  // SPI
45  #define PIN_SPI_MISO  (16u)
46  #define PIN_SPI_MOSI  (19u)
47  #define PIN_SPI_SCK   (18u)
48  #define PIN_SPI_SS    (17u)
49
50  #define SPI_HOWMANY      (1)
51  #define SPI_MISO         (digitalPinToPinName(PIN_SPI_MISO))
52  #define SPI_MOSI         (digitalPinToPinName(PIN_SPI_MOSI))
53  #define SPI_SCK          (digitalPinToPinName(PIN_SPI_SCK))
```

```
21  #define TFT_CS 17
22  #define TFT_DC 21
23  #define TFT_MOSI 19
24  #define TFT_CLK 18
25  #define TFT_RST 20
26  #define TFT_MISO 16
```





univ_spi.ino

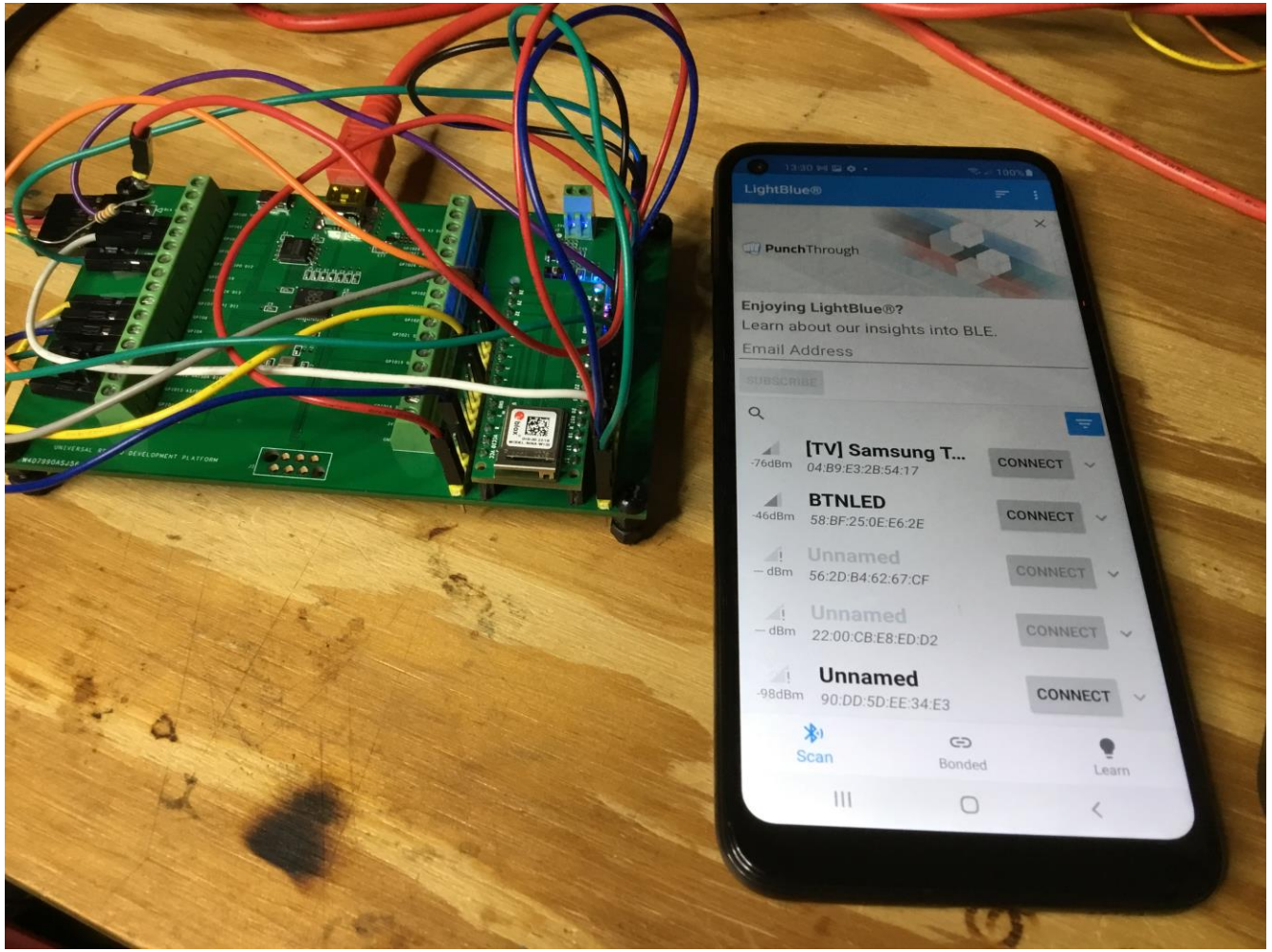
```
17  #include "SPI.h"
18  #include "Adafruit_GFX.h"
19  #include "Adafruit_ILI9341.h"
20
21  #define TFT_CS 17
22  #define TFT_DC 21
23  #define TFT_MOSI 19
24  #define TFT_CLK 18
25  #define TFT_RST 20
26  #define TFT_MISO 16
27
28  Adafruit_ILI9341 tft = Adafruit_ILI9341(TFT_CS, TFT_DC, TFT_MOSI, TFT_CLK, TFT_RST, TFT_MISO);
29
30  void setup() {
31    Serial1.begin(9600);
32    Serial1.println("ILI9341 Test!");
33
34    tft.begin();
35    tft.setRotation(1);
36    tft.fillScreen(ILI9341_BLACK);
37    tft.setCursor(0, 0);
38    tft.setTextColor(ILI9341_WHITE);
39    tft.setTextSize(2);
40    tft.println("Universal RP2040");
41    tft.println("Development Platform");
42  }
43  void loop(){}
```

Thank you for attending!!!

Please consider the resources below:

- arduino.cc
- raspberrypi.org

MORE TO COME..



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