TCS1405 USB2.0 TYPE-C EVB USER GUIDE

USB TYPE-C Configuration Channel Logic and Port Controller for Smartphone and Tablet

INTRODUCTION

The CHENGYI Semiconductors' TCS1405_USB2.0_TYPE-C_EVB evaluation board provides an easy way to evaluate the operation, function and performance of the TCS1405 USB TYPE-C configuration channel logic and port controller.

FEATURES

- DFP, UFP and DRP configurable

- Strong DRP (try.DFP) mode supported

- Integrated ID emulator for smoothly upgrading from legacy OTG supported smartphone

- GPIO interface and for easy hardware design

- Shutdown mode

- Very low current consumption while standby (5μA)

- VBUS, CC high voltage supported(Up to 30V)

- USB 1.5A and 3.0A detection and configuration with HC<1:0> pins

- 12-pin UQFN package, 2.0 mm x2.0 mm

Contents of TCS1405_USB2.0_TYPE-C_EVB

- TCS1405_USB2.0_TYPE-C_EVB x 2(With label A or B)

- LIR1220 3.6V, 8mAH Li-Ion battery

- USB2.0 type C plug to type C plug standard cable(With label 1)

- USB2.0 type C plug to type A male standard cable(With label 2)

- USB2.0 type C plug to type A female standard cable(With label 3)

- USB2.0 type C plug to USB2.0 micro B male standard cable(With label 4)

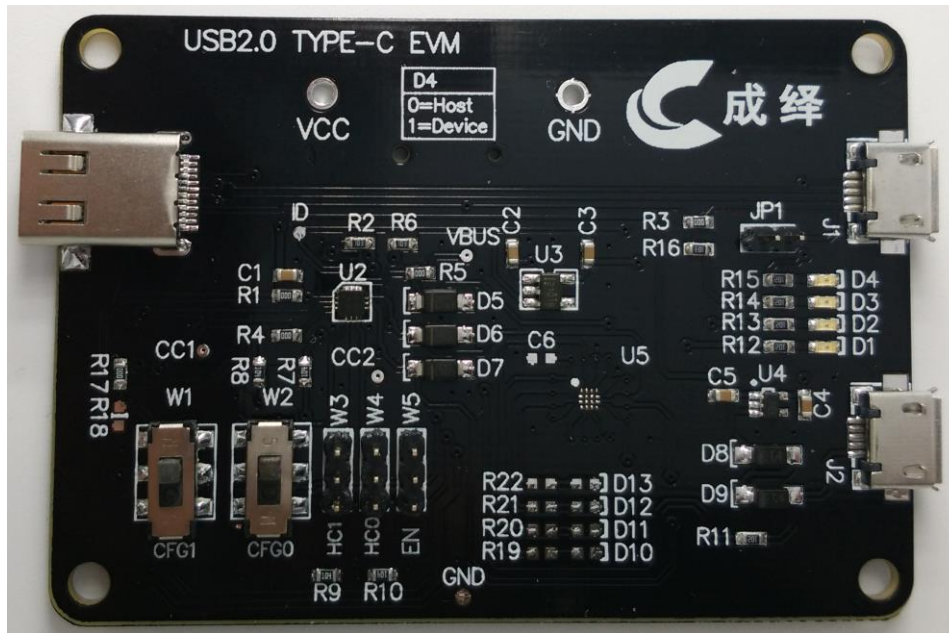- USB2.0 type A plug to USB2.0 micro B male standard cable(With label 5)

Figure 1 TCS1405_USB2.0_TYPE-C_EVB

BOARD OPERATION DETAILS

This section describes how to properly set up and operate the TCS1405_USB2.0_TYPE-C_EVB.

Connection and Control Description

Component	Name	Function
U1	Type C Receptacle	Standard USB2.0 type C interface, to connect with type C cable
J1	Micro B Plug	To plug into smart phone or tablet with legacy micro B receptacle, ID pin is connected and controlled by TCS1405
J2	Micro B Receptacle	Optional external power supply for the board from USB type A port, no other functions.
BT1	Li-Ion Battery	On-board battery for the board, 3.6V typical, rechargeable by USB port through J2. It lies on the backside.
W1,W2	CFG<1:0>	Configuration of device role 00: UFP with accessory support 01: DFP 10: Strong DRP with try.DFP 11: Normal DRP Up: VDD(1.8V); Down: GND;
<W3,W4> <D1,D2>	HC<1:0>	In UFP and DRP modes, indicates the connected DFP current output capability 00: Non-power / not connected (default) 01: USB standard power / 500mA 10: USB 1.5A 11: USB 3.0A In DFP mode, indicates and selects DFP's current output capability

		00/01: USB standard power / 500mA
		10: USB 1.5A
		11: USB 3.0A
		Up: VDD(1.8V); Down: GND
D3	VBUS	VBUS available LED indicator
		1: Available
		0: Unavailable
D4	ID	ID emulator output indicator
		1: USB port/Host (Default)
		0: OTG/Device
W5	EN	Chip enable control
		1: Enable
		0: Disable
		Up: GND; Down: VDD
R17, R18	VDD	Placing R17 and removing R18 provides 1.8V GPIO
		Removing R17 and placing R18 provides 3.6V GPIO
		Placing R17=15K and R18=3K provides 3.3V GPIO
D5,D6,D7	TVS	30V TVS for VBUS, CC1 and CC2
U5		Reserved for TCS1421
U3	FPF2101	Load switch
		When ID become low, VBUS can be sent to chip from J2.

Factory Default Configuration(DRP)

The default configuration is

■ DRP mode, CFG<1:0>(W2W1)=11

■ J2 should connect to a 5V supply by computer or wall adapter

■ 1.8V GPIO, place R17 and remove R18

■ HC1 and HC0 (W3 and W4) floating as output

■ EVB is enabled, EN (W5) connect to VDD(downside)

■ If cellphone is unavailable, VBUS should be supplied from J2. And JP1 should be connected. Otherwise, JP1 is disconnect.

Legacy Smartphone + TCS1405EVB = TYPE-C Supported Smartphone

Figure 3, a legacy OTG supported smartphone is connected with TCS1405_USB2.0_TYPE-C-EVB through the USB micro B connectors, which makes up a full feature USB2.0 Type-C supported smartphone, the connections between the smartphone and EVB are only VBUS, D+, D-, ID, GND. The key signal of the connection is ID which is generated by TCS1405 accordingly. A high voltage level ID indicates the smartphone is in default USB slave or UFP mode, a low voltage level ID indicates the smartphone is in OTG or DFP mode. All other Type-C full features are demonstrated on the TCS1405EVB.
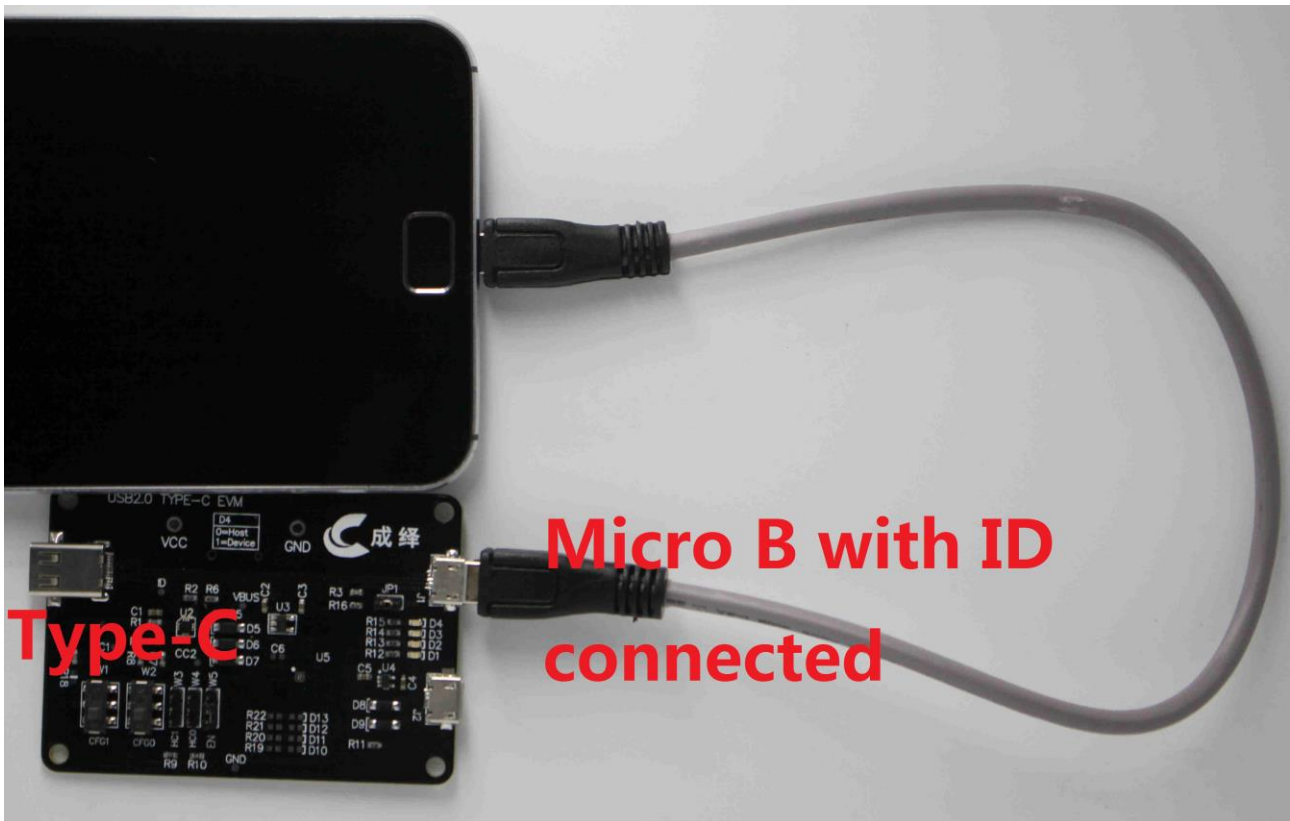
Figure 3 TCS1405EVB+Legacy smartphone makes up Type-C supported smartphone

DRP to DRP

Usually a smartphone, tablet or PC behaves as DRP, they can be connected through a type C to type C standard cable. The two DRPs accept the resulting DFP-to-UFP relationship achieved randomly according to the USB TYPE C Specification V1.0.

1. Configure the EVB A and B as DRP and default USB current mode(W1W2=11, W3W4 floating)

2. Connect EVB A and B through a type C to type C cable(With label 1)

Figure 4 DRP-DRP

DRP to Strong DRP(Try.DFP)

Usually a smartphone behaves as DRP, while the power bank behaves as Strong DRP or Try.DFP because it always needs to be charged as UFP and charge a smartphone/tablet as DFP

1. Configure EVB A as DRP and default USB current mode(W1W2=11)

2. Configure EVB B as Strong DRP and default USB current mode(W1W2=10), this is to simulate a Strong DRP power bank. Or a standard type-C power bank can work and demonstrate with EVB A.

3. Connect EVB A and B through a type C to type C cable(With label 1)

Figure 5 DRP-Strong DRP

DRP to DFP

There are three DRP to DFP scenarios:

1. Smartphone as DRP to a legacy type A USB host(PC) as DFP

    a) Configure EVB A as DRP and default USB current mode(W1W2=11)

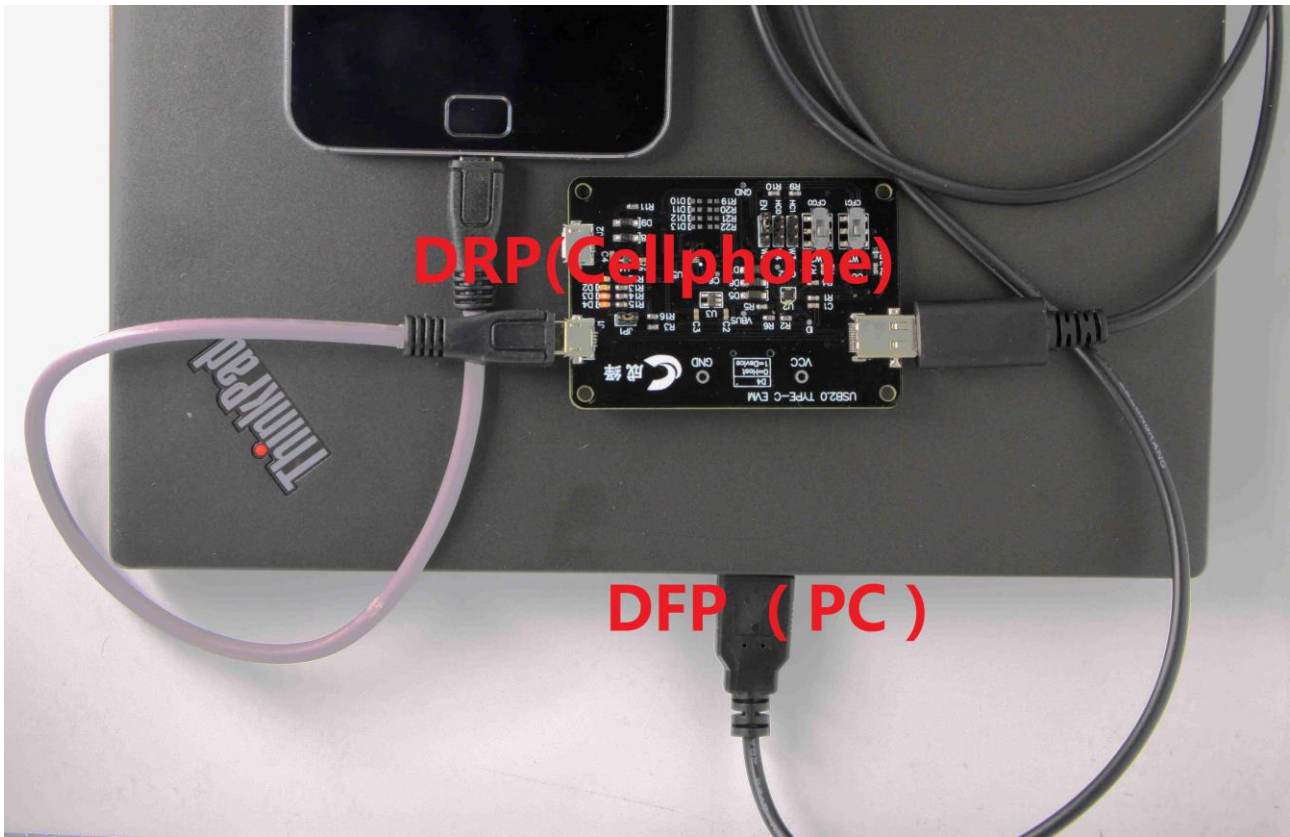   b) Connect EVB A with legacy PC through a type C to type A male cable(With label 2)

Figure 7 DRP-DFP(PC)

2. Smartphone as DRP to a legacy type A adapter as DFP

   a) Configure EVB A as DRP and default USB current mode(W1W2=11)

   b) Connect EVB A with legacy adapter through a type C to type A male cable(With label 2)

Figure 8 DRP-DFP(Legacy adapter)

DRP to UFP

Usually a smartphone behaves as DRP, and a U-Disk or legacy smartphone behaves as UFP.

1. Smartphone as DRP to a U-Disk as UFP

    a)   Configure EVB A as DRP and default USB current mode(W1W2=11, W3W4=00)

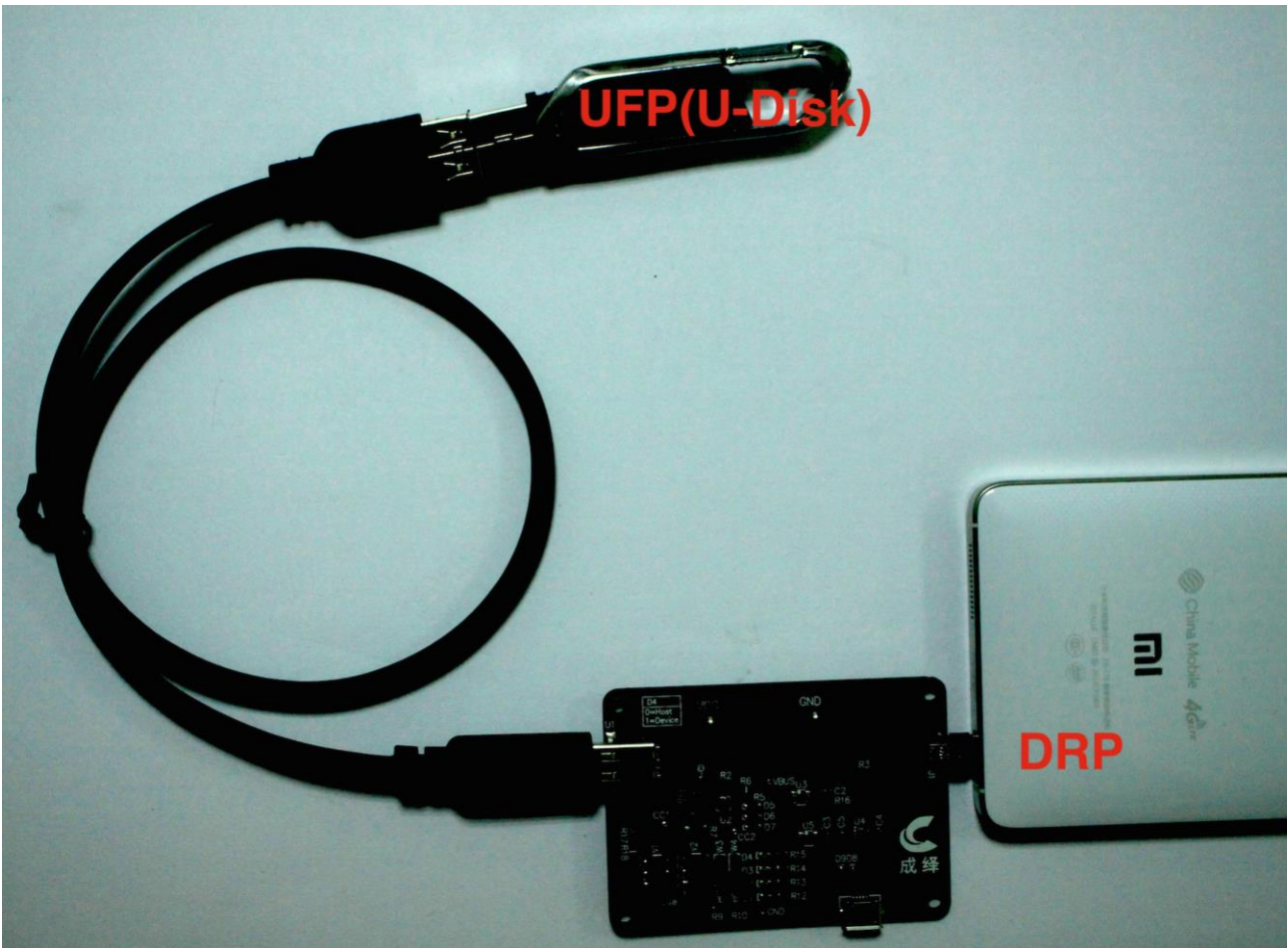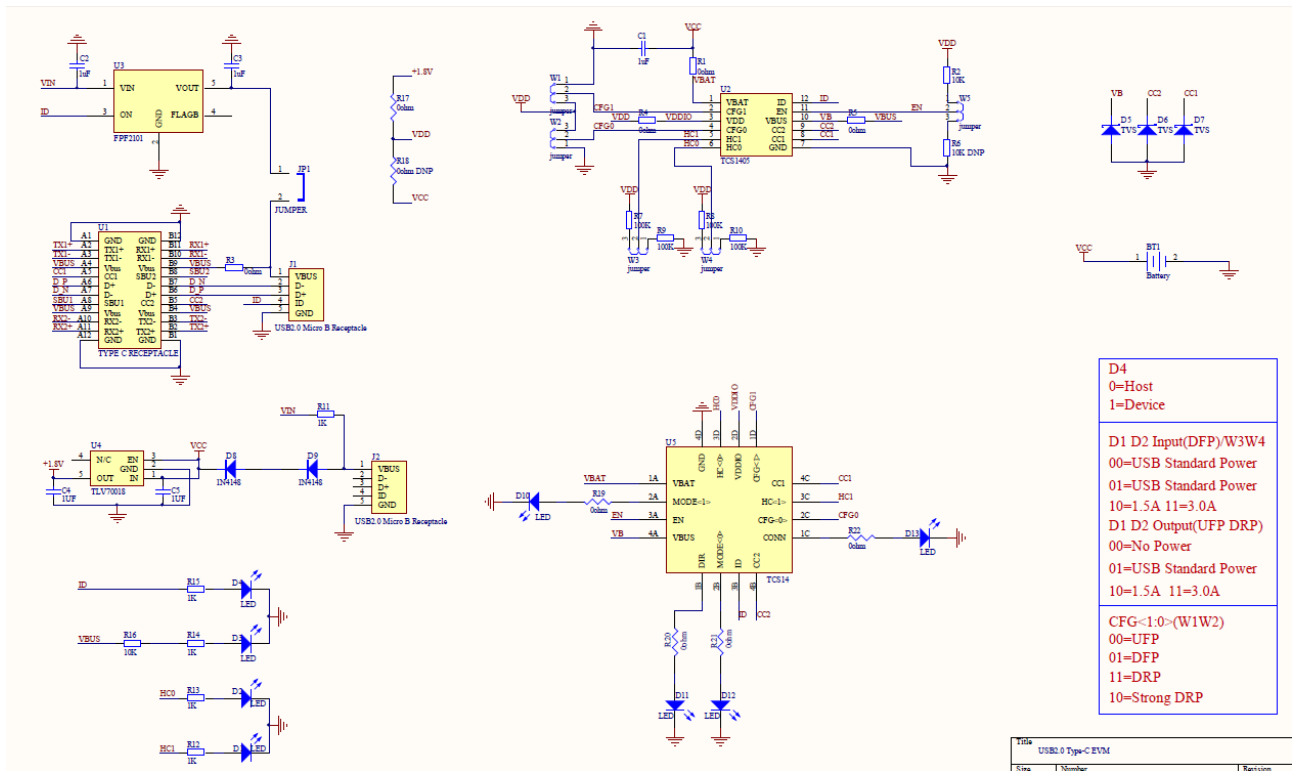   b)   Connect EVB A with a U-Disk through a type C to type A female cable(With label 3)

Figure 9 DRP-UFP(U-Disk)
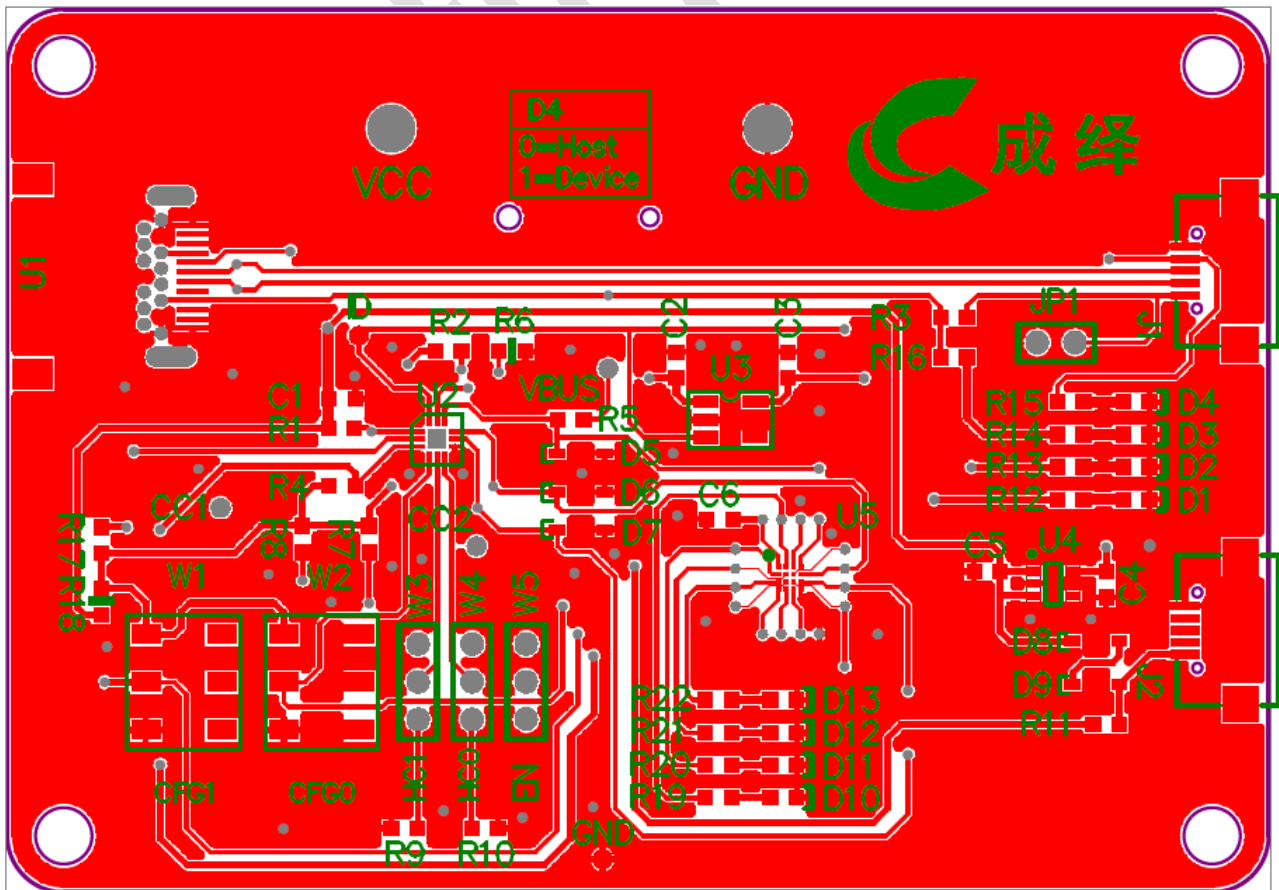
SCHEMATIC

Title: USB2.0 Type-C EVM

D4
0=Host
1=Device

D1 D2 Input(DFP)/W3W4
00=USB Standard Power
01=USB Standard Power
10=1.5A 11=3.0A
D1 D2 Output(UFP DRP)
00=No Power
01=USB Standard Power
10=1.5A 11=3.0A

CFG<1:0>(W1W2)
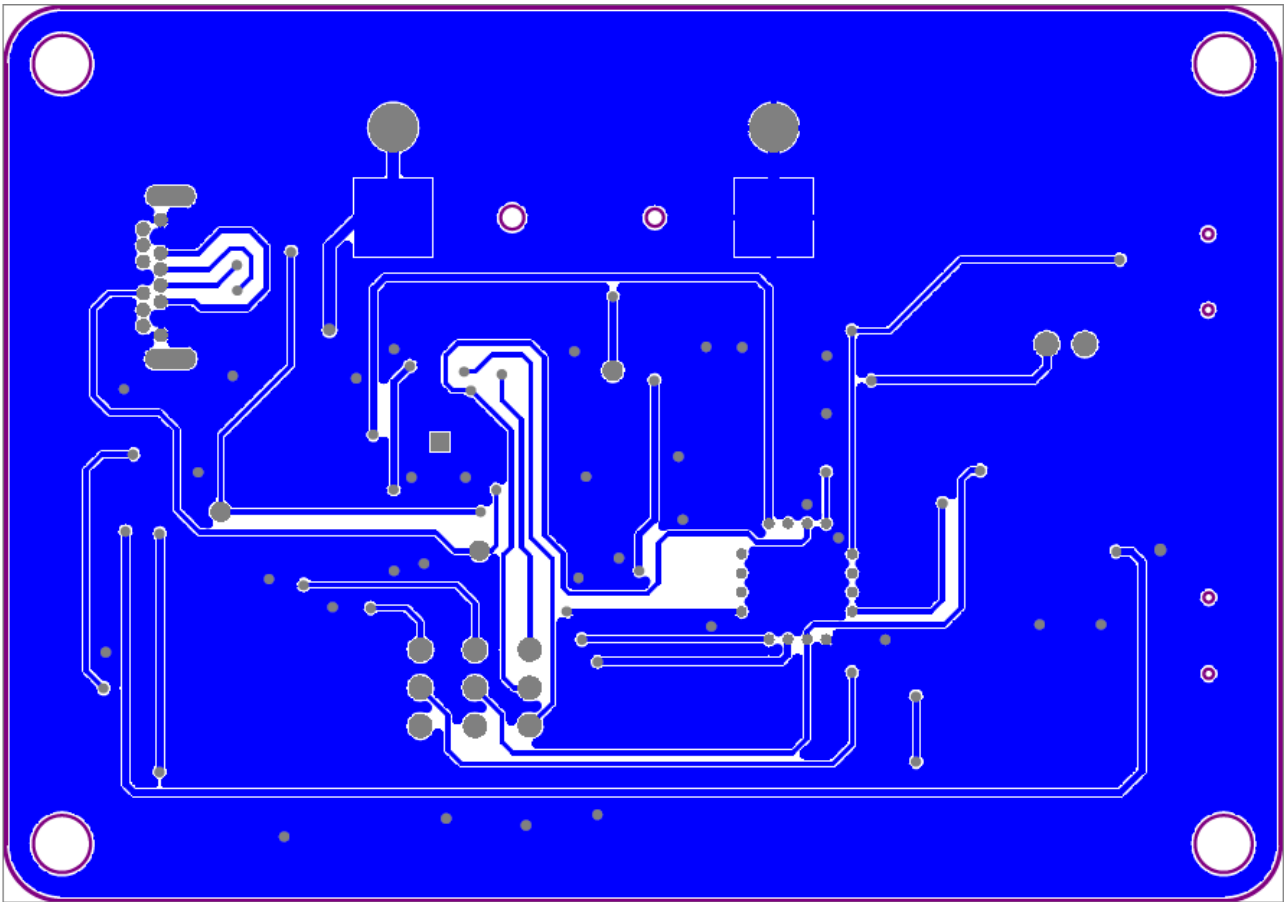00=UFP
01=DFP
11=DRP
10=Strong DRP

PCB LAYOUT

Top layer:

Bottom layer:

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