801 T-USB testing board

This testing board hosts the 801 T-USB daughter board.

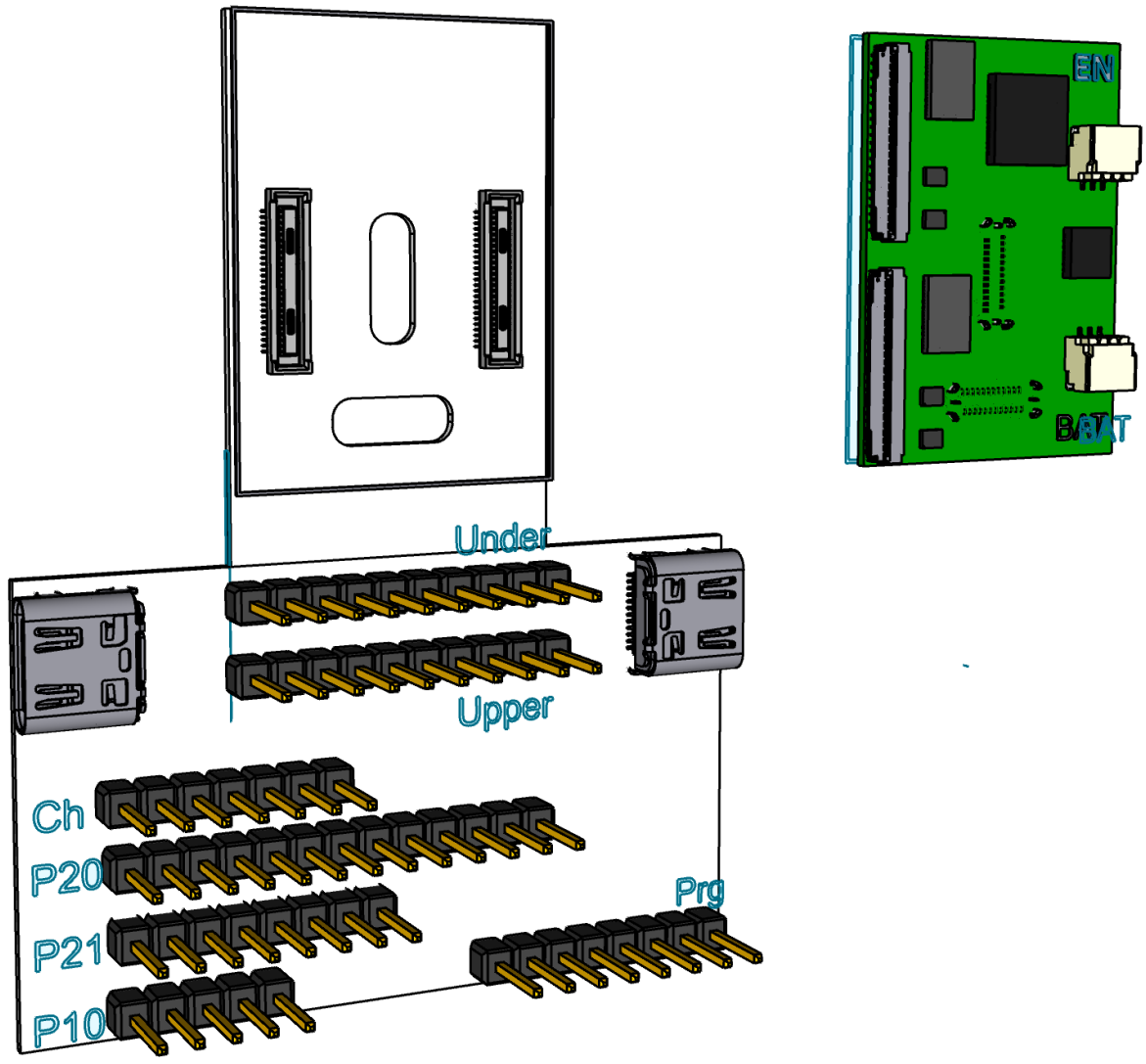
The 801 is a bridge board that connects daughter boards. 801 T-USB is one such daughter board.

The T-USB daughterboard has two functions

- Supply the system with power
- Provide data signals in the system over two USB-C connectors

The T-USB board exposes two vertical USB-C sockets and connects to the carrier board through two 50 pin B2B connectors. These are routed ultimately through two USB-C connectors on the testing board

The testing board can also be used to test the bridge board. For this purpose there are two plugs on the underside that connect directly to the sockets on the upperside apart from the VSOM pins.



Board Components

- 2 * Hirose DF40-50DS-0.4V mated height 1.5mm Mouser - JLCPCB socket
- 2 * HD3SS3220 10-Gbps USB 3.1 Type-C 2:1 mux with DRP Controller Mouser
- 2 * USB-C connectors DX07S024JA1R1300 or DX07S024JJ2R1300 - Mouser -
- 3 * Samtec TSW-116-14-T-S Header 16 pin - Mouser

Open notes

Step up voltage 3.5V -> 5V

Testing staged power and data enable when plugging in the module.

Chip enable when plugged in. 100ms delay.

TODO remove EX3 exposure

TODO Revised VSOM enable logic testing

TODO RTC battery power switch logic?

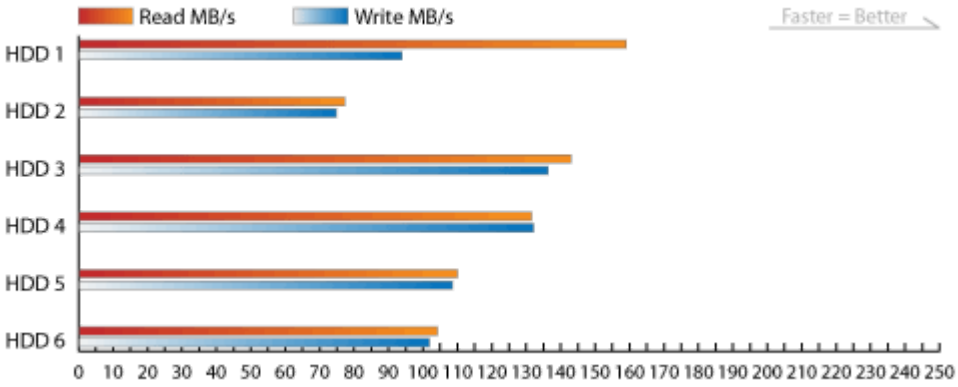
Testing with the board

Testing cases

- Routing UART over breakout connectors
- VSOM load test
- Interrupt triggering
- Requesting system standby
- Detecting system standby
- Triggering system reset
- Detecting system reset
- Powering dev board from T-USB power output
- Simulating CONN_EN signal
- High voltage USB-C (20V / 12V / 9V) power supplies never produces more than 5V SYS_PWR when connected.
- If one USB port receives power (5V) the other port can deliver power (5V).
- VSOM is 3.45V to 4.4V regardless of charger
- If a Apple Dedicated Charger 5V(1A BC1.2) is connected the board can draw 1A
- If a CDP(5V, 1A) compatible charger is connected the board can draw 1A
- If a CDP(5V, 3A) compatible charger is connected the board can draw 3A
- If power is connected to USB the battery can charge
- If no power is connected the system is battery powered
- USB 3.0 data signal can be passed through from T-USB OTG to testing board OTG, and reverse min. 250MB/sec
- USB 3.0 data signal can be passed through from T-USB Host to testing board Host, and reverse min. 250MB/sec

- USB 2.0 data signal can be passed through from T-USB OTG to testing board OTG, and reverse min. 35MB/sec
- USB 2.0 data signal can be passed through from T-USB Host to testing board Host, and reverse min. 35MB/sec
- Power and Data works through T-USB ports with 300 cm cable length.
- USB signal jitter within accepted range (see USB 3.0 Electrical Compliance Methodology)

Sample USB 3.0 data rates



USB Testing Matrix

USB-Type testing matrix

Product Type	Testing Required						
	USB-C CabCon	USB-C EPC	USB PD	USB-C Functional	USB-C IOP	USB-C Source Power	USB 3.1 and 2.0
Cable	X	X	X				
Charger & Battery Pack			X	X	X	X	X
Host & Hub				X	X	X	X
PD Host & PD Hub			X	X	X	X	X
Host Alt Mode Only			X	X	X		
Device				X	X		X
PD Device			X	X	X		X
OTG	Not compatible with USB Type-C						

Ideal testing equipment for USB 3.0 are Loopback Plugs.

Testing articles,

- What's new in USB Power Delivery 3.0
- A first look at USB 3.1 performance
- Here's how fast USB 3.1 is in the real world

DIP switches

To test cases a bank of 8 DIP switches allow enabling features

- 4 * CONN_EN high/low/disconnected
- BAT_CE# - Disable or disconnected

- PD_VIN_EN - Enabled or disconnected
- SPI_3V3 - Enable power to SPI memory, connect to LDO_3V3

LEDs

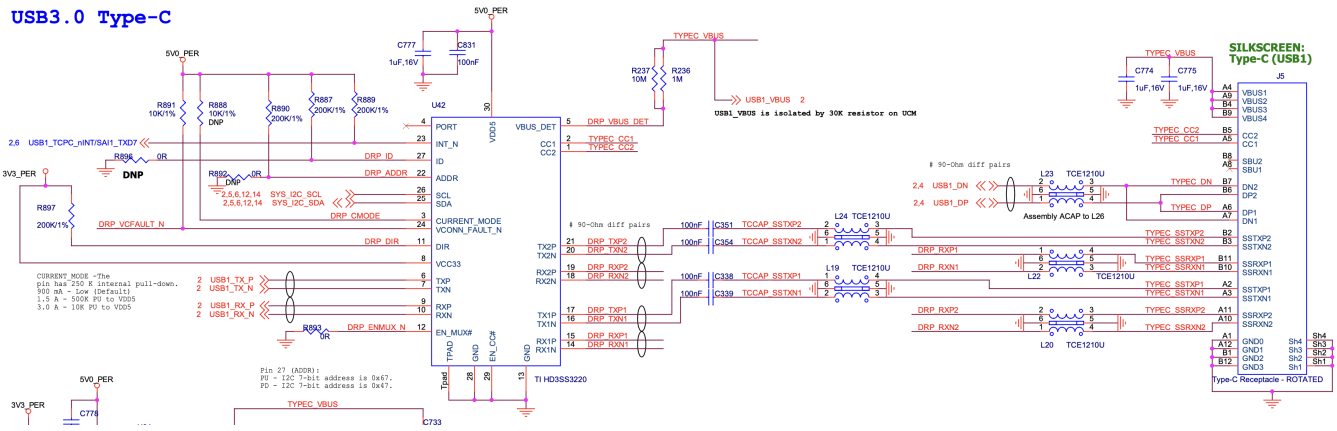
LEDs will test specific situations and test cases

- Battery STAT (BAT_STAT - BAT_LDO)
- Battery power good (PWR_CHARGE above 4.3V)
- VSOM power on
- VSOM voltage >4.5V
- VCC_RTC power on
- Power on Reset POR_B_3P3
- System reset mode
- System powering down

Connecting the Board

Signals passed to USB-C connectors

The signals from the USB-C connectors are routed through a Ti HD3SS3220 (x2) to handle polarity of the plug. The USB 2/3 data lines are connected to the 50 pin connectors on both the upperside and underside.



Connector 1 high-speed data

Pin	Code	Type	Details	Voltage
2	USB1_RX_DP	USB	USB1 RX D+	
3	USB1_RX_DN	USB	USB1 RX D-	
4	GND	Power	Ground	
5	USB1_TX_DP	USB	USB1 TX D+	
6	USB1_TX_DN	USB	USB1 TX D-	
7	GND	Power	Ground	

Pin	Code	Type	Details	Voltage
8	USB1_RX_DP	USB	USB2 RX D+	
9	USB1_RX_DN	USB	USB2 RX D-	
10	GND	Power	Ground	
11	USB1_TX_DP	USB	USB2 TX D+	
12	USB1_TX_DN	USB	USB2 TX D-	
13	GND	Power	Ground	

Connector 2 PD controller

Pin	Code	Type	Details	Voltage	Misc
3	USB1_DP	USB	USB1 D+		
4	USB1_DN	USB	USB1 D-		
5	GND	Power	Ground		
6	USB2_DP	USB	USB2 D+		
7	USB2_DN	USB	USB2 D-		
8	GND	Power	Ground		

Underside 50 pin plugs VSOM connection

This connector enables the underside to be connected to a bridge board and be supplied with VSOM on different pins than what is received from the module connected on the upperside. These pins are not connected to the upperside.

Under Power (10 pins)

Pin	Code	Type	Details	Voltage	Misc
1	C1_VSOM_1	Enable	Corner VSOM pin	3.45V - 4.5V	
1	C2_VSOM_1	Enable	Corner VSOM pin	3.45V - 4.5V	
26	C1_VSOM_26	Enable	Corner VSOM pin	3.45V - 4.5V	
26	C2_VSOM_26	Enable	Corner VSOM pin	3.45V - 4.5V	
11	BOTH_VSOM	Enable	Signal from bridge board that VSOM is connected on both sides	3.45V - 4.5V ?	

Pin	Code	Type	Details	Voltage	Misc
15	VSOM_LOCK	Power	Main power for board, if mechanical lock shorted	3.45V - 4.5V	Mech. lock
21	PWRBTN	Boot	Power button trigger		
48	C1_VSOM	Power	C1 power (36, 39, 42, 45)	3.45V - 4.5V	
49	GND	Power	Ground		
49	GND	Power	Ground		

Upperside 50 pin sockets VSOM connection

These pins are from both 50 pins connectors reflecting the connector VSOM pins (10 pins) The breakout enables testing partial connection of the sockets. These are not connected to the underside.

Upper Power (10 pins)

Pin	Code	Type	Details	Voltage	Misc
1	C1_VSOM_1	Enable	Corner VSOM pin	3.45V - 4.5V	
1	C2_VSOM_1	Enable	Corner VSOM pin	3.45V - 4.5V	
26	C1_VSOM_26	Enable	Corner VSOM pin	3.45V - 4.5V	
26	C2_VSOM_26	Enable	Corner VSOM pin	3.45V - 4.5V	
11	BOTH_VSOM	Enable	Signal from bridge board that VSOM is connected on both sides	3.45V - 4.5V ?	
15	VSOM_LOCK	Power	Main power for board, if mechanical lock shorted	3.45V - 4.5V	Mech. lock
21	PWRBTN	Boot	Power button trigger		
48	C1_VSOM	Power	C1 power (36, 39, 42, 45)	3.45V - 4.5V	
49	GND	Power	Ground		
49	GND	Power	Ground		

Signals for two 50 pin connectors from dev board (13 + 8 + 5 pins)

50 pins for PD Controller -> Dev Board P20 (13 pins)

Pin	Code	Type	Details	Voltage	Misc
48	UART1_TXD	UART	P1.72 UART1 Tx		P20.9
47	UART1_RXD	UART	P1.19 UART1 Rx		P20.11
46	UART2_TXD	UART	UART2 Tx		P20.1
45	UART2_RXD	UART	UART2 Rx		P20.3
44	UART3_TXD	UART	P1.61 UART3 Tx		P20.2
43	UART3_RXD	UART	P1.21 UART3 Rx		P20.4
42	UART4_TXD	UART	UART4 Tx		P20.8
41	UART4_RXD	UART	UART4 Rx		P20.10
38	I2C3 SCL	I2C	Stem SCL		P21.2 ?
37	I2C3 SDA	I2C	Stem SDA		P21.4 ?
13	EX_OH_nINT	IRQ	Interrupt signal (GPIO1_IO0)		P20.12
14	EX_T_nINT	IRQ	Interrupt signal (GPIO1_IO1).		P20.14
	GND	Power	Ground		

50 pins for PD Controller -> Dev Board P21 + direct connects (8 pins)

Pin	Code	Type	Details	Voltage	Misc
40	I2C SCL	I2C	P1.99 SYS SCL		P21.7
39	I2C SDA	I2C	P1.97 SYS SDA		P21.5
12	EX0_nINT	IRQ	Interrupt signal (GPIO4_IO19)		P21.30
20	VCC_RTC	Power	Low power mode supply		
21	PWRBTN	Boot	Power button trigger		
22	ALT_BOOT	Boot	Alternate boot		
23	QSPI_BOOT_EN_3P3	Boot	SPI boot		P21.18
	GND	Power	Ground		

50 pins for PD Controller -> Dev Board P10 (5 pins)

Pin	Code	Type	Details	Voltage	Misc
16	SYS_RST_PMIC	Reset	PMIC reset input pin. Internally pulled up with LDO1 power rail. Once low, PMIC performs reset.		P10.9
17	POR_B_3P3	Reset	Power On reset output pin. Open drain output requiring external pull up resistor.		P10.7

Pin	Code	Type	Details	Voltage	Misc
18	PMIC_ON_REQ	Reset	PMIC ON input from Application processor. When high, the device starts power on sequence.		P10.5
19	PMIC_STBY_REQ	Reset	Standby mode input from Application processor. When high, device enters STANDBY mode.		P10.3
	GND	Power	Ground		

Breakout of Charging Signals

From 50 pins for PD Controller -> programming (8 pins)

Pin	Code	Type	Details	Voltage	Misc
9	SWD_CLK	Debug	PD Controller GPIO12		
10	SWD_DAT	Debug	PD Controller GPIO13		
33	SPI_CS	PD	Programming/External flash directly	3.3V	
32	SPI_CLK	PD	Programming/External flash directly	3.3V	
31	SPI_MISO	PD	Programming/External flash directly	3.3V	
30	SPI_MOSI	PD	Programming/External flash directly	3.3V	
50	PD_HRESET	PD	PD Controller HRESET (High)		
	GND	Power	Ground		

From 50 pins for PD Controller -> Charging power (7 pins)

Pin	Code	Type	Details	Voltage	Misc
24	BAT_CE#	Charger	Charge Enable Active-Low Input. Connect to a high logic level to place the battery charger in standby mode.		
24	PWR_CHARGE	Power	Internal charging power		
25	PD_VIN_EN		Enable VIN_5V/3V3 from PWR_SYS (TBD)		
29	VIN_3V3		Supply for TPS64988 circuitry and I/O. Current 50 mA	3.3V	
34	SPI_3V3	Power	Power to the flash chip. Bridge connects to VIN_3V3	3.3V	
28	VIN_5V	Power	System 5V power source (PPHV1, PPHV2, PP1_CABLE, PP2_CABLE). 500 mA.	5V	

Pin	Code	Type	Details	Voltage	Misc
	GND	Power	Ground		

Signals **NOT** connected on 50 pin connectors

These signal pins are however connected between the upperside and underside.

Pin	Code	Type	Details	Voltage
50	LVCLK+	LVDS	LVDS CLK+	
49	LVCLK-	LVDS	LVDS CLK-	
47	LVD0+	LVDS	LVDS D0+	
46	LVD0-	LVDS	LVDS D0-	
44	LVD1+	LVDS	LVDS D1+	
43	LVD1-	LVDS	LVDS D1-	
41	LVD2+	LVDS	LVDS D2+	
40	LVD2-	LVDS	LVDS D2-	
38	LVD3+	LVDS	LVDS D3+	
37	LVD3-	LVDS	LVDS D3-	