CREEKSIDE
CONTROLS

Datasheet
DD-820-0

Stream UX Max Touch Display Module

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Introduction

This datasheet is intended for designers using the StreamUX Max module. The StreamUX Max module enables effortless color touch screen integration into any embedded electronics product with a large variety of compatible displays. The application's user interface is designed using the StreamUX Builder PC tool, then transferred to the module using USB. Interaction with the UI is accomplished by using one of the serial interfaces or an API library if using the module as an application host.

Features

- Full 24bit color TFT interface using standard 40pin or 50pin, 0.5mm pitch ZIF style connectors.
- Onboard TFT voltage generator for AVDD, VCOM, VGL and VGH
- Resistive or capacitive touch integration using separate touch-adapter hardware.
- 5 interfaces for controlling and interacting with the StreamUX touchscreen
    - RS485
    - UART
    - SPI
    - I2C
    - CAN
- Wide DC power input (5V to 30Vdc)
- USB flash drive interface for screen/image transfer and further user application
- Audio output with 1.2W speaker amplifier
- 128Mbit onboard SDRAM using high-speed 32bit bus
- 512Mbit onboard NOR flash ROM on QSPI interface
- 1 Gbit onboard NAND flash ROM on QSPI interface.

StreamUX Max as a Serial Module

The StreamUX Max module allows a fully functional touchscreen over a serial interface. Firmware for this configuration is provided by Creekside Controls, and only certain display configurations are supported. Please visit www.creeksidecontrols.com for more information

When used as a serial module, the following features are supported using serial commands over the chosen interface

- Full display / graphics control using StreamUX
- Audio (also played directly from StreamUX resources)
- Touch interface
- USB file read and write. This works great for logging CSV data to USB stick over serial interface.
- NOR flash is reserved for StreamUX resources
- NAND flash can be used to store extensive data with serial erase, read and write commands

The following tools are available to aid in this development and can be downloaded from www.creeksidecontrols.com:

- Reference Manual DM-220-0 – explains the StreamUX library in detail
- Reference Manual DM-719-0 – explains the serial protocol used with StreamUX packets
- Reference Manual DM-719-1 – explains all StreamUX serial messages
- Software DS-719-1 – is a PC application that sends, receives and logs StreamUX serial messages over a PC COM port. This is a great way to experience how the serial messages and packet protocol function.
- Reference Manual DM-719-2 and Example Project DX-820-0 implements a StreamUX UART driver and demo project using an inexpensive STM32F0 DISCO development board as the display controller.

StreamUX Max as an Application Host

The StreamUX Max features an ST STM32F767BGT6 (Cortex M7) processor with 1Mbyte flash and 512k SRAM memory running at 200MHz. All peripherals, including serial interfaces and IO, Analog expansion connectors are available to the developer when using the module this way.

To get started, download Example Project DX-820-1 from www.creeksidecontrols.com. The project includes all peripheral mappings and drivers. The project also includes a free version of the StreamUX library for use with StreamUX Max hardware. Please note that the StreamUX library is free-to-use ONLY with StreamUX hardware modules purchased from Creekside Controls. The library cannot be used for any other hardware. To purchase a license to use the StreamUX library on any hardware, please contact sales@creeksidecontrols.com.

Connector Locations

Connector pin 1 locations are marked by a white circle on the StreamUX PCB silkscreen.

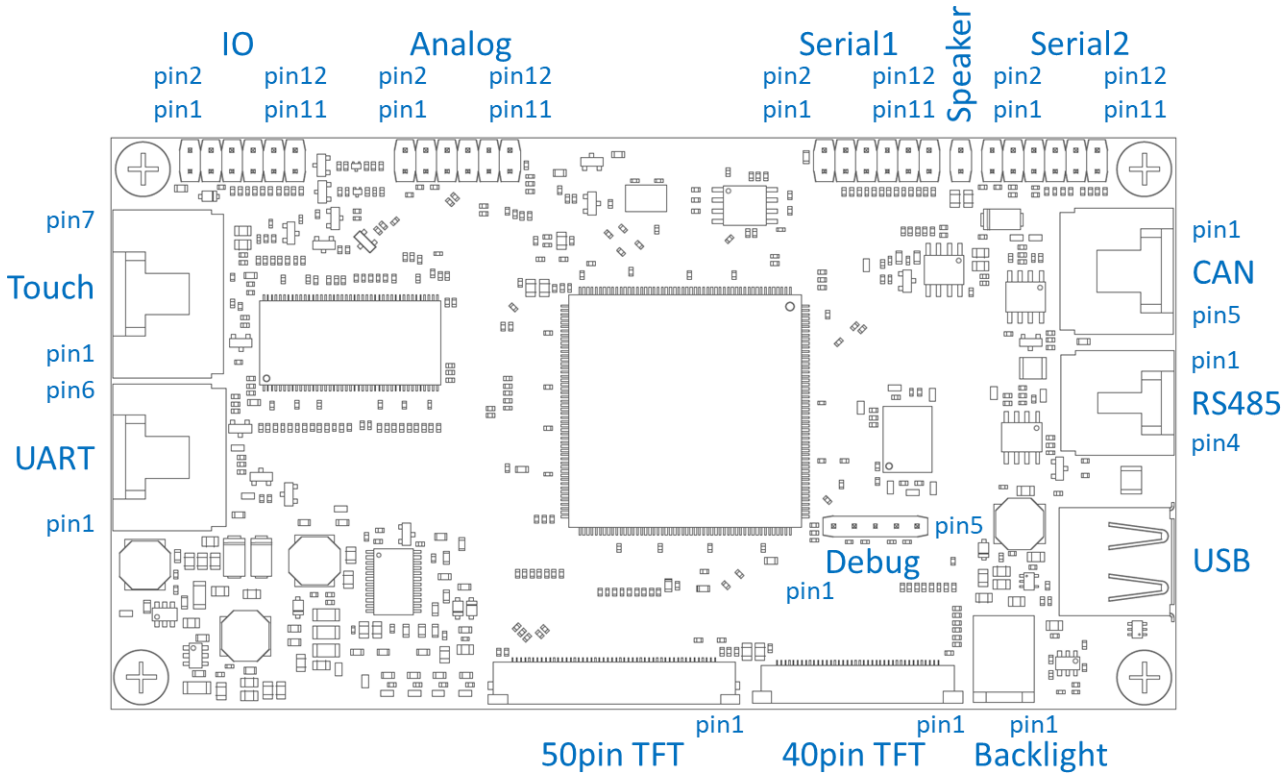

Figure 1 - Connector and pin locations

Figure 2 - StreamUX Max with no display attached

Connector Pinouts

UART

Connector is Tyco 103635-5 or equivalent

Pin	Function	Direction relative to StreamUX	Description
1	Ground	Power	The ground should have a direct, non-filtered path to the control ground.
2	Reset'	Input	Used to reset StreamUX Module. Reset is active low. This pin may be left unconnected if not used.
3	Vin	Power In	Input supply voltage
4	UART6 Receive	Input	
5	UART6 Transmit	Output	
6	Busy / Idle indication	Output	Pin high indicates rendering is idle. Pin low indicates rendering is busy. You can use this pin to measure the time it takes to render any screen

RS485

Connector is Tyco 103635-3 or equivalent

Pin	Function	Direction relative to StreamUX	Description
1	Ground	Power	The ground should have a direct, non-filtered path to the control ground.
2	RS485- Tx and Rx	Bidirectional	Mapped to UART2 of STM32
3	RS485+ Tx and Rx	Bidirectional	Mapped to UART2 of STM32
4	Vin	Power In	Input supply voltage

Touch Adapter Interface

Connector is Tyco 103635-6 or equivalent

Pin	Function	Direction relative to StreamUX	Description
1	Ground	Power	The ground should have a direct, non-filtered path to the control ground.
2	Touch Reset	Output	CAP – Reset pin of the touch panel RES – not used
3	Touch YU or INT	CAP – input RES – Bidirectional	CAP - INT pin of the touch panel RES – YU pin
4	Touch XL or Wake	CAP – input RES – Bidirectional	CAP - Wake pin of the touch panel RES – XL pin
5	Touch YD or SDA	CAP – Bidirectional RES – Bidirectional	CAP – i2c SDA (pullup needed on adapter) RES – YD pin

6	Touch XR or SCL	CAP – Bidirectional RES – Bidirectional	CAP – i2c SCL (pullup needed on adapter) RES – XR pin
7	3.3V	Power Out	3.3V power to touch panel

CAN

Connector is Tyco 103635-4 or equivalent

Pin	Function	Direction relative to StreamUX	Description
1	Ground	Power	The ground should have a direct, non-filtered path to the control ground.
2	CANH	Bidirectional	CAN1 interface of STM32
3	CANL	Bidirectional	CAN1 interface of STM32
4	Reset’	Input	Used to reset StreamUX Module. Reset is active low. This pin may be left unconnected if not used.
5	Vin	Power In	Input supply voltage

Serial1

Connector is 100mil, non-shrouded, 2x12 with gold plating

Pin	Function	Direction relative to StreamUX	Description
1	Ground	Power	The ground should have a direct, non-filtered path to the control ground.
2	Vin	Power In	Input supply voltage
3	Reset’	Input	Used to reset StreamUX Module. Reset is active low. This pin may be left unconnected if not used.
4	SPI4 MOSI	Input	SPI data master output and slave input
5	SPI4 CS’	Input	SPI chip select from SPI master, active low
6	SPI4 MISO	Output	SPI data master input and slave output
7	SPI4 Clock	Input	SPI clock from external SPI master
8	Interrupt’	Output	Interrupt signal output from StreamUX. Interrupt is active low.
9	I2c3 Data	Bidirectional	I2c data signal
10	UART7 Receive	Input	
11	I2c3 Clock	Bidirectional	I2c clock signal
12	UART7 Transmit	Output	

Serial2

Connector is 100mil, non-shrouded, 2x12 with gold plating. Note these pins are only available when using the StreamUX as an application host.

Pin	Function	Direction relative to StreamUX	Description

1	Ground	Power	The ground should have a direct, non-filtered path to the control ground.
2	5V	Power Out	Voltage supply for external control
3	3.3V	Power Out	Voltage supply for external control
4	I2c1 Data	Bidirectional	I2c data signal
5	I2c1 Clock	Bidirectional	I2c clock signal
6	SPI1 MOSI	Input	SPI data master output and slave input
7	SPI1 MISO	Output	SPI data master input and slave output
8	SPI1 Clock	Input	SPI clock from external SPI master
9	SPI1 CS'	Input	SPI chip select from SPI master, active low
10	Interrupt'	Output	Interrupt signal output from StreamUX. Interrupt is active low.
11	UART3 Transmit	Output	
12	UART3 Receive	Input	

IO

Connector is 100mil, non-shrouded, 2x12 with gold plating. Note these pins are only available when using the StreamUX as an application host.

Pin	Function	Direction relative to StreamUX	Description
1	Ground	Power	The ground should have a direct, non-filtered path to the control ground.
2	Vin	Power In	Input supply voltage
3	Vbat	Power In	Mapped to STM32 Vbat pin with low Vf Schottky diode separation from 3.3V rail
4	Timer1	Bidirectional	Mapped to STM32 Timer1 Channel3
5	IO1	Bidirectional	Mapped to STM32 PortI, Pin8
6	Timer2	Bidirectional	Mapped to STM32 Timer1, Channel1'
7	IO2	Bidirectional	Mapped to STM32 PortC, Pin13
8	Timer3	Bidirectional	Mapped to STM32 PortB, Pin14 with multiple timer channels
9	IO3	Bidirectional	Mapped to STM32 PortC, Pin14 which includes RTC clock input pin
10	Timer4	Bidirectional	Mapped to STM32 PortB, Pin15 with multiple timer channels
11	I2c4 Clock	Bidirectional	I2c clock signal
12	I2c4 Data	Bidirectional	I2c data signal

Analog

Connector is 100mil, non-shrouded, 2x12 with gold plating. Note these pins are only available when using the StreamUX as an application host.

Pin	Function	Direction relative to StreamUX	Description
1	ADC1	Input	Mapped to ADC1,2 input6

2	DAC	Output	Mapped to DAC2
3	Audio	Output	Direct audio output from DAC1
4	ADC5	Input	Mapped to ADC1,2,3 input3
5	ADC2	Input	Mapped to ADC1,2,3 input2
6	ADC6	Input	Mapped to ADC1,2,3 input1
7	ADC3	Input	Mapped to ADC1,2,3 input0
8	ADC7	Input	Mapped to ADC1,2,3 input13
9	ADC4	Input	Mapped to ADC1,2,3 input12
10	ADC8	Input	Mapped to ADC1,2,3 input11
11	3.3Vanl	Power Output	3.3V analog voltage reference
12	Analog Ground	Power	Analog ground reference

TFT 50 pin Connector

Connector is ZIF, 0.5mm pitch, top contacts, gold plating, FCI 62684-502100ALF or equivalent

Pin	Function	Direction relative to StreamUX	Description
1,2	LED Backlight +	Power Out	Connection to LED Anode of backlight
3,4	LED Backlight -	Power Out	Connection to LED Cathode of backlight
5	Ground	Power	
6	VCOM	Power Out	TFT Voltage
7	3.3V	Power Out	TFT digital voltage
8	Mode	Output	Pulled high with 10kΩ, low pulldown available
9	DEN	Output	TFT data enable pin
10	VSYNC	Output	
11	HSYNC	Output	
12-19	B7 to B0	Output	Blue Data (Pin12 is B7, Pin19 is B0)
20-27	G7 to G0	Output	Green Data (Pin20 is G7, Pin27 is G0)
28-35	R7 to R0	Output	Red Data (Pin28 is R7, Pin35 is R0)
36	Ground	Power	
37	Clock	Output	TFT pixel clock
38	Ground	Power	
39	Scan L/R	Output	Sets scan direction Left or Right
40	Scan U/D	Output	Sets scan direction Up or Down
41	VGH	Power Out	TFT gate voltage H
42	VGL	Power Out	TFT gate voltage L
43	VADD	Power Out	TFT analog voltage
44	Reset	Output	TFT reset signal
45	No Connection		
46	VCOM	Power Out	TFT Voltage
47	Dithering	Output	Pulled low with 10kΩ, high pullup available
48	Ground	Power	
49	No Connection		
50	No Connection		

TFT 40 pin Connector

Connector is ZIF, 0.5mm pitch, top contacts, gold plating, Tyco 4-1734839-0 or equivalent.

Pin	Function	Direction relative to StreamUX	Description
1	LED Backlight -	Power Out	Connection to LED Cathode of backlight
2	LED Backlight +	Power Out	Connection to LED Anode of backlight
3	Ground	Power	
4	3.3V	Power Out	TFT digital voltage
5-12	R0 to R7	Output	Red Data (Pin5 is R0, Pin12 is R7)
13-20	G0 to G7	Output	Green Data (Pin13 is G0, Pin20 is G7)
21-28	B0 to B7	Output	Blue Data (Pin21 is B0, Pin28 is B7)
29	Ground	Power Out	
30	Clock	Output	TFT pixel clock
31	Reset	Output	TFT reset signal
32	HSYNC	Output	
33	VSYNC	Output	
34	DEN	Output	TFT data enable pin
35	3.3V touch	Power Out	Power for touch panel
36	Ground	Power Out	
37	Touch XR / SCL	Bidirectional	Resistive touch X right, Cap touch i2c SCL
38	Touch YD / SDA	Bidirectional	Resistive touch Y down, Cap touch i2c SDA
39	Touch XL / Rst	Bidirectional	Resistive touch X left, Cap touch reset output
40	Touch YU / Int	Bidirectional	Resistive touch Y up, Cap touch interrupt input

Speaker

Connector is 100mil, non-shrouded, 2pins with gold plating

Pin	Function	Direction relative to StreamUX	Description
1	Speaker -	Output	Negative speaker output
2	Speaker +	Output	Positive speaker output

Single Wire Debug / Program

Connector is 100mil, non-shrouded, 5pins with gold plating. Use 100mil jumper cables to connect to the ST debugger/programmer. Once appropriate connections are made, it is recommended to surround the jumpers with tape so that they stay in place relative to each other.

Pin	Function	Direction relative to StreamUX	Description
1	Ground	Power	The ground should have a direct, non-filtered path to the control ground.
2	Reset	Input	Reset signal from debugger
3	SWCLK	Input	Single wire clock signal
4	SWDIO	Bidirectional	Single wire data IO signal
5	3.3V	Power Out	Target voltage supplied to the debugger

LED Backlight

Most LED backlight connections run through the ZIF connectors to the backlight, but some use a separate connection. Connector is JST SM02B-BHSS-1-TB(LF)(SN) or equivalent.

Pin	Function	Direction relative to StreamUX	Description
1	Led-	Power Out	Led cathode connection (note, this is the pin closest to the mounting hold)
2	Led+	Power Out	Led anode connection

Schematics of Connections

UART

Figure 3 shows StreamUX schematic of UART pins. The sheet ports for Tx, Rx and IO connect directly to the microprocessor pins.

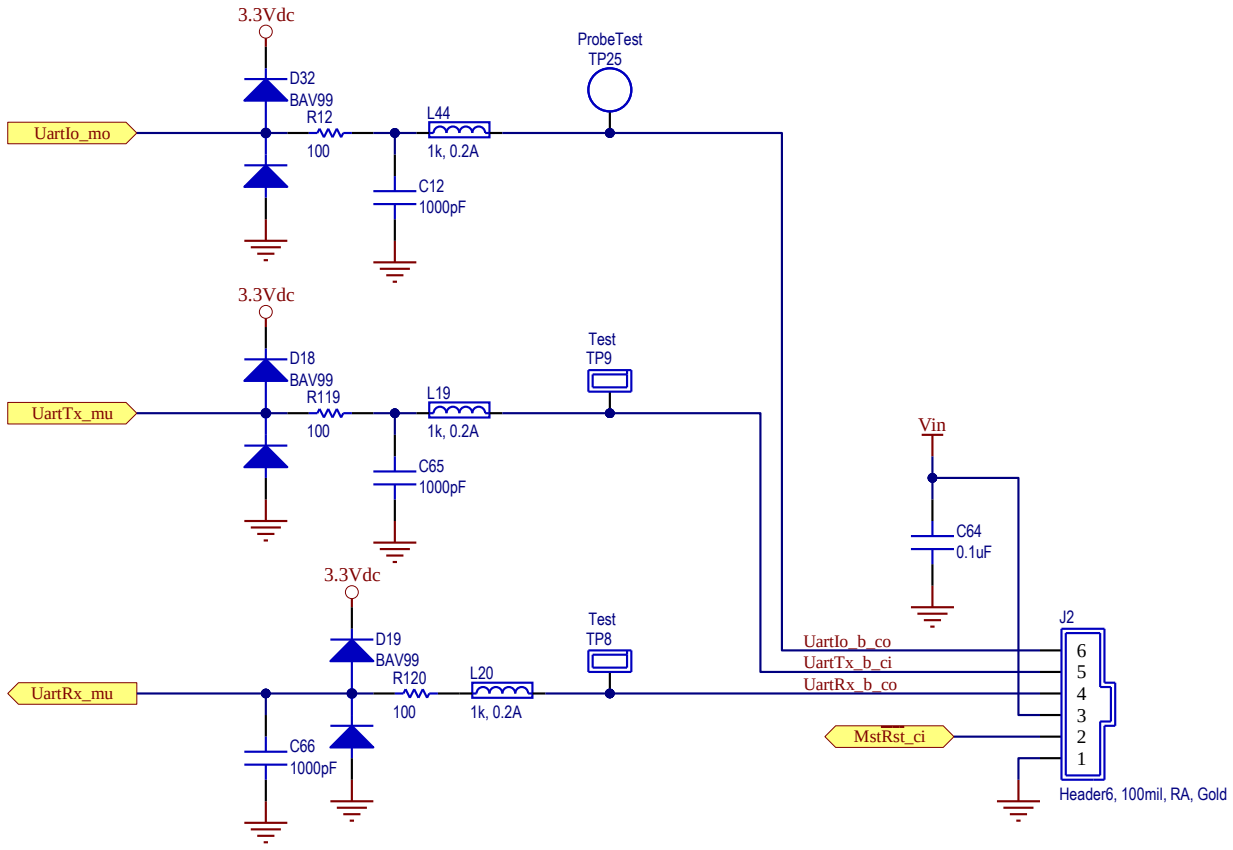

Figure 3 - UART schematic

Serial1

Figure 4 shows schematic of Serial1 connector. All sheet ports except for the master reset signal connect directly to the microprocessor pins.

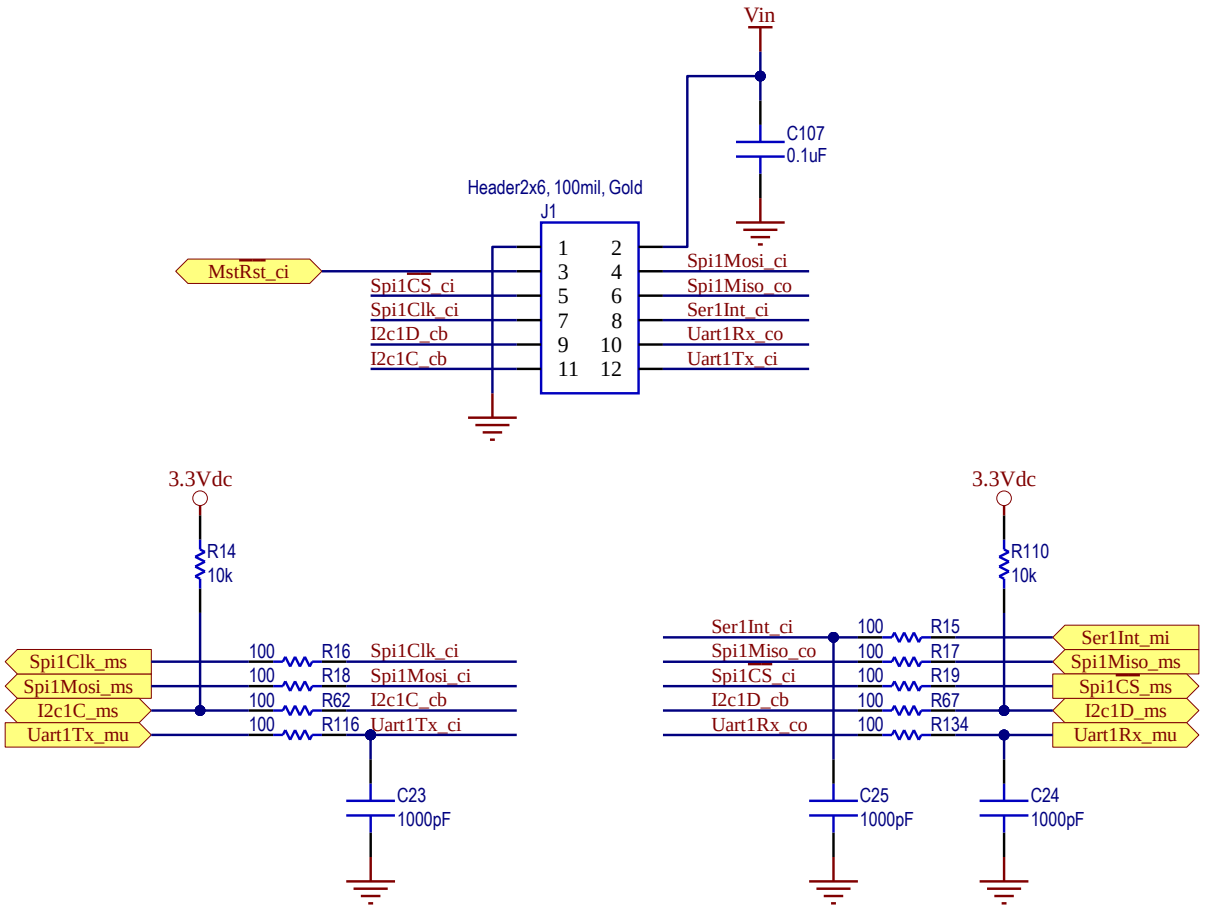

Figure 4 – Serial1 schematic

Serial2

Figure 5 shows schematic of Serial2 connector.

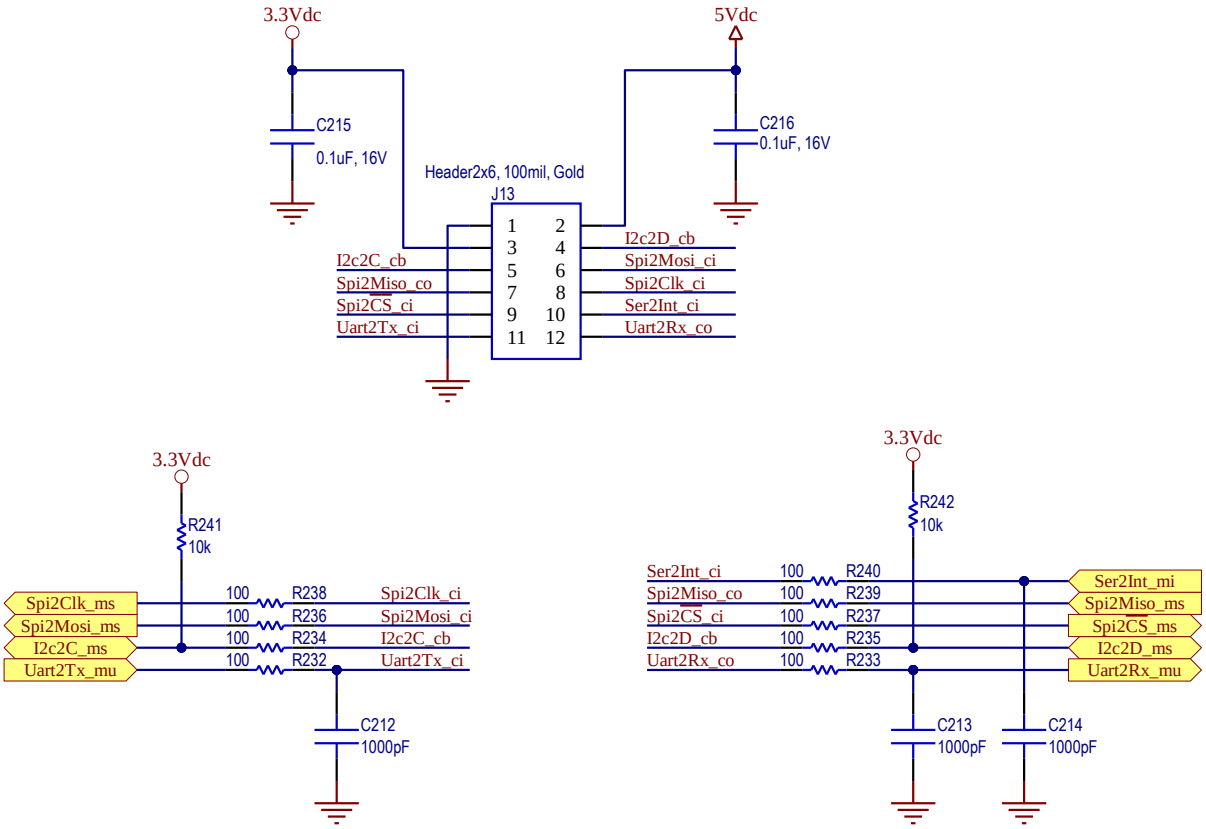

Figure 5 – Serial2 schematic

IO

Figure 6 shows schematic of IO connector.

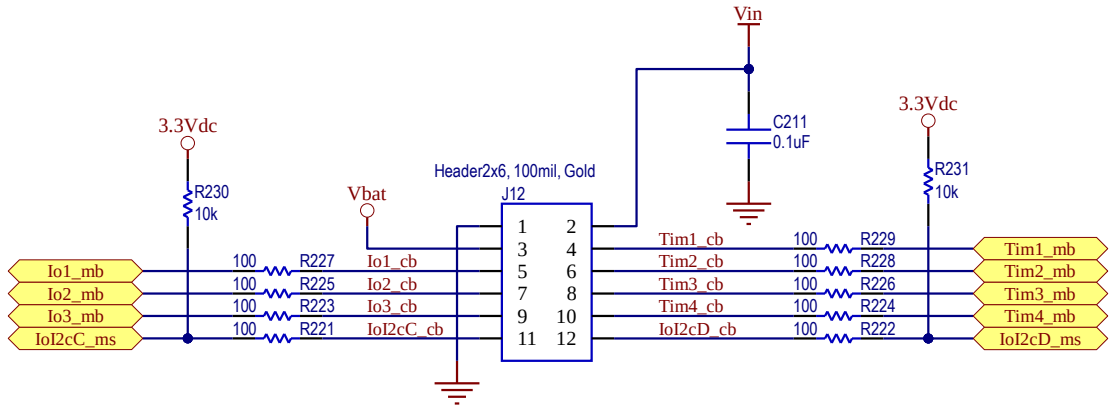

Figure 6 – IO schematic

Analog

Figure 7 shows schematic of Analog connector. Vanl and Analog ground are just filtered versions of 3.3V and control ground.

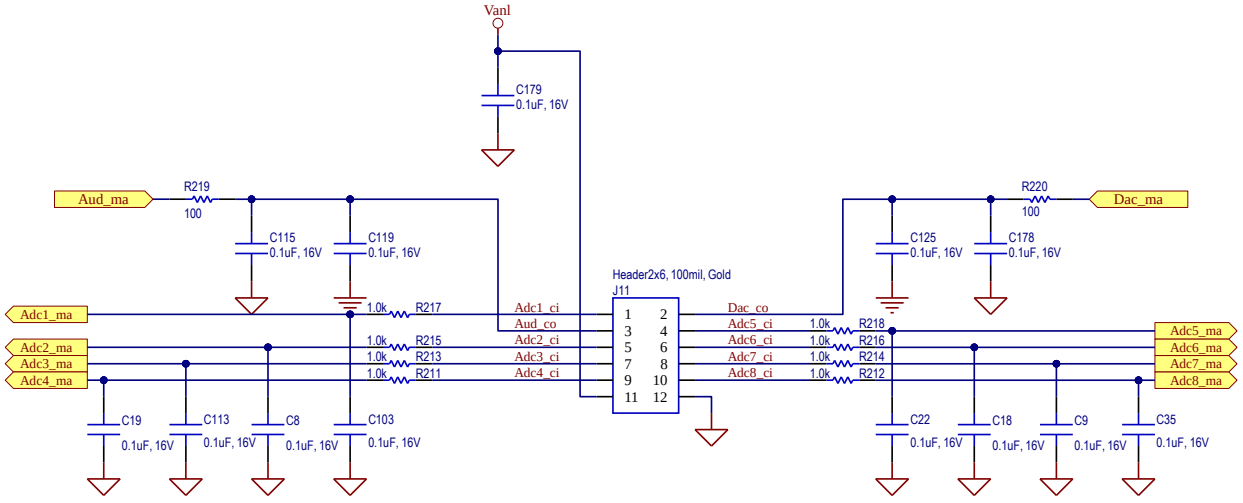

Figure 7 – Analog schematic

Onboard LED Indication

StreamUX Max has 2 onboard LEDs to aid in troubleshooting and development.

Heartbeat

This LED shows that the power and CPU are healthy. It also shows whether the bootloader or application is currently running. Sometimes CPU execution might be held up, for instance when StreamUX resources are loaded. In this case, the LED heartbeat will be paused until normal CPU execution is restored.

State	Description
Dark	Power is not present, CPU is in reset or the CPU clock has stopped for some reason
Blinks 1 time per second	Power is present and application is running normally
Blinks 5 times per second	Power is present and bootloader is running normally

Rx Data

When StreamUX Max is used as a serial display, this LED shows when a serial packet is received over one of the serial interfaces.

State	Description
Dark	No serial packet received over any of the serial interfaces
Brief flash on	Serial packet was received over any of the serial interfaces

Location

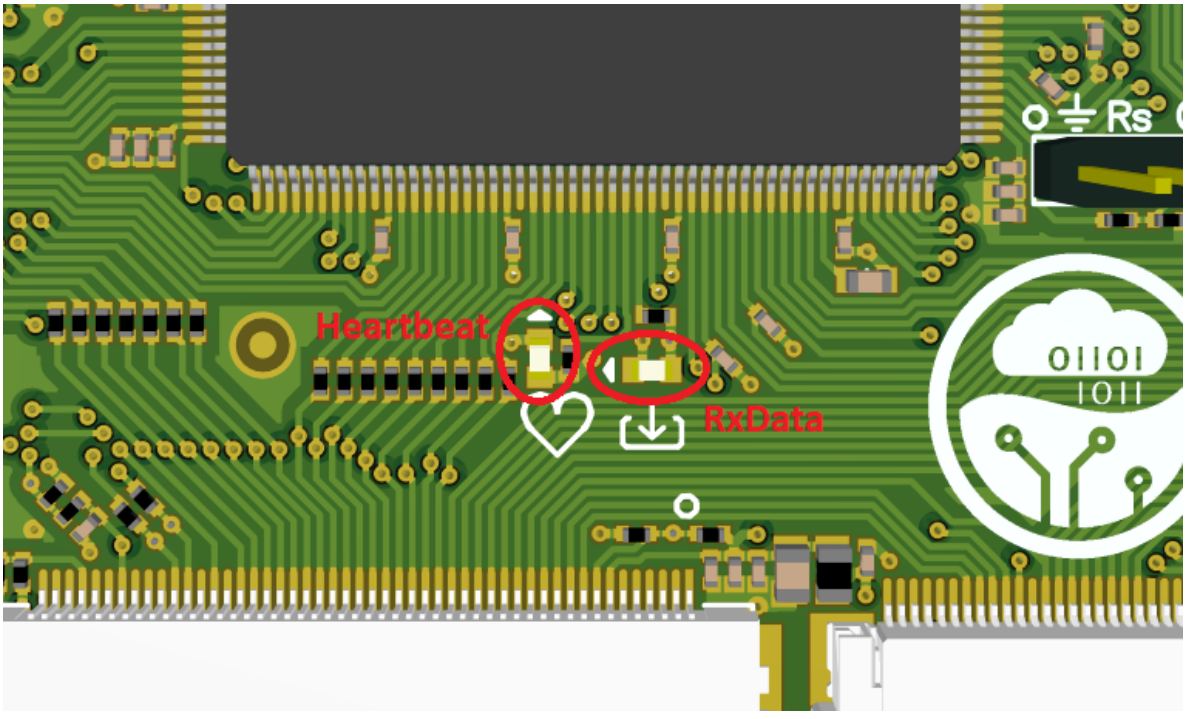

Figure 8 - LED location

Touch Adapter

To handle the myriad of touch options available with TFT panels, StreamUX Max uses a touch adapter board to convert the flex tail from any touch interface to a standard 7pin harness. The touch interface supports both 4-wire resistive and capacitive touch over i2C. For capacitive touch: reset, interrupt and wake pins are available in addition to the SDA and SCL lines. Note that i2C pullups are needed on the adapter board when using capacitive touch.

Although any touch adapter board may be used, including custom hardware, Creekside Controls offers a standard touch interface board (part number PA-520-1) that handles the flex-cable to harness conversion for a wide variety of standard touch screen panels. Please download the datasheet DD-820-1 from www.creeksidecontrols.com for more information on this adapter board.

Figure 9 shows a closeup of the PA-520-1 and Figure 10 shows a typical StreamUX Max assembly.

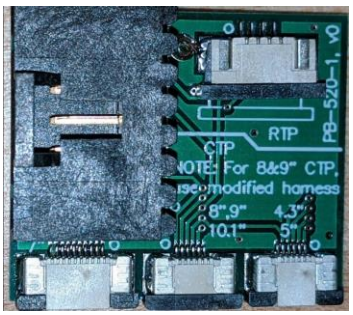

Figure 9 – PA-520-1 Touch Adapter Board

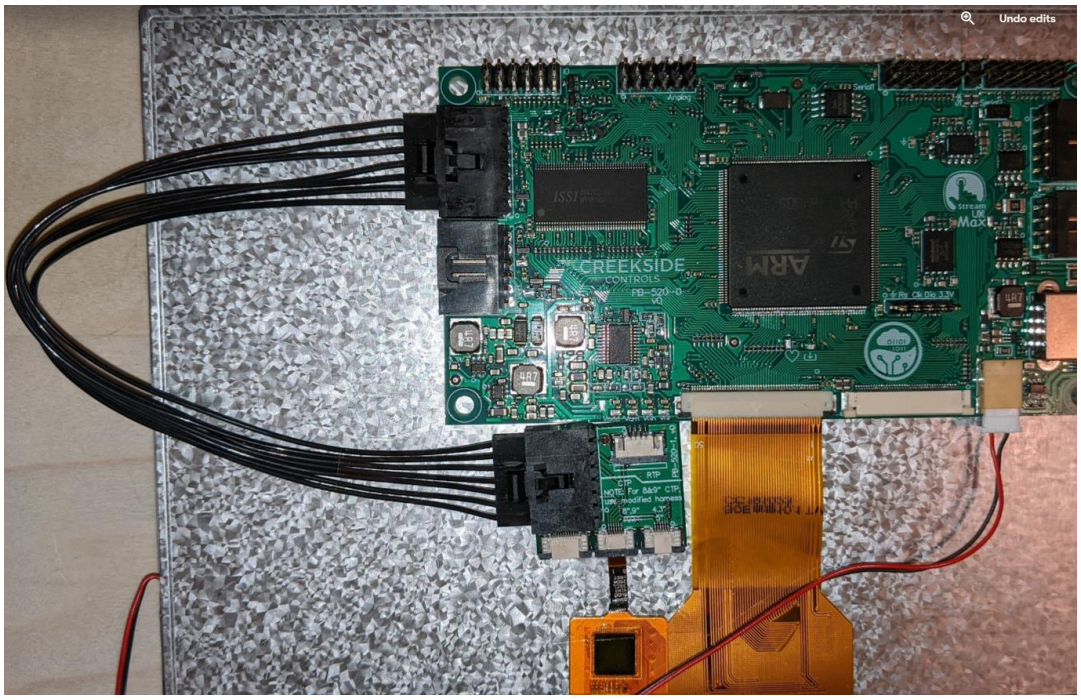

Figure 10 - StreamUX Max with touch adapter on a display

Configuration with Solder Jumpers

To improve the flexibility of StreamUX Max, solder jumpers are used to configure certain aspects of the control.

SJ1 - RS485 Termination

SJ1 adds a 120Ω, 1/2W terminating resistor to the RS485 bus.

SJ1 State	Description
Open	RS485 terminating resistor not present
Shorted	RS485 terminating resistor present

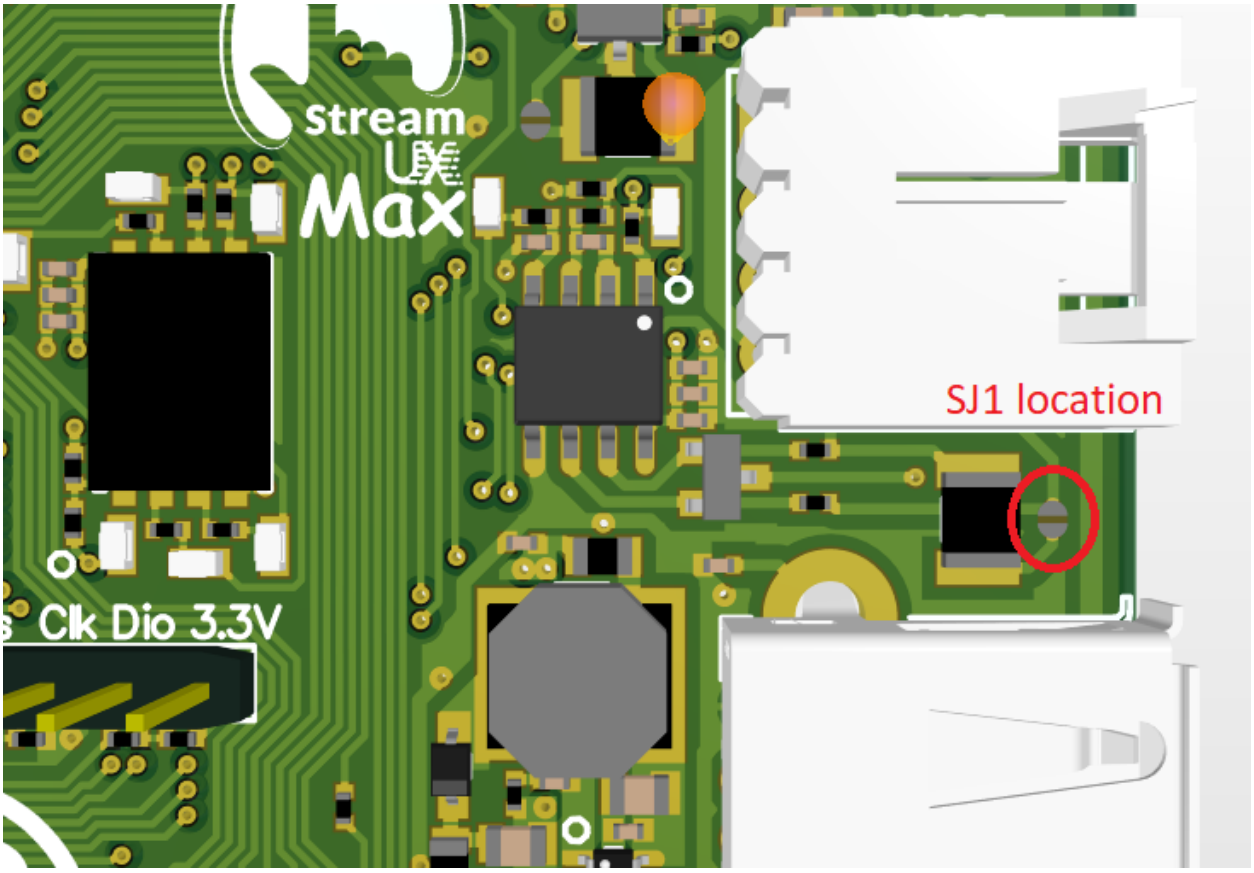

Figure 11 - SJ1 location

SJ6 - CAN Termination

SJ6 adds 120Ω, 1/2W terminating resistor to the CAN bus.

SJ1 State	Description
Open	CAN terminating resistor not present
Shorted	CAN terminating resistor present

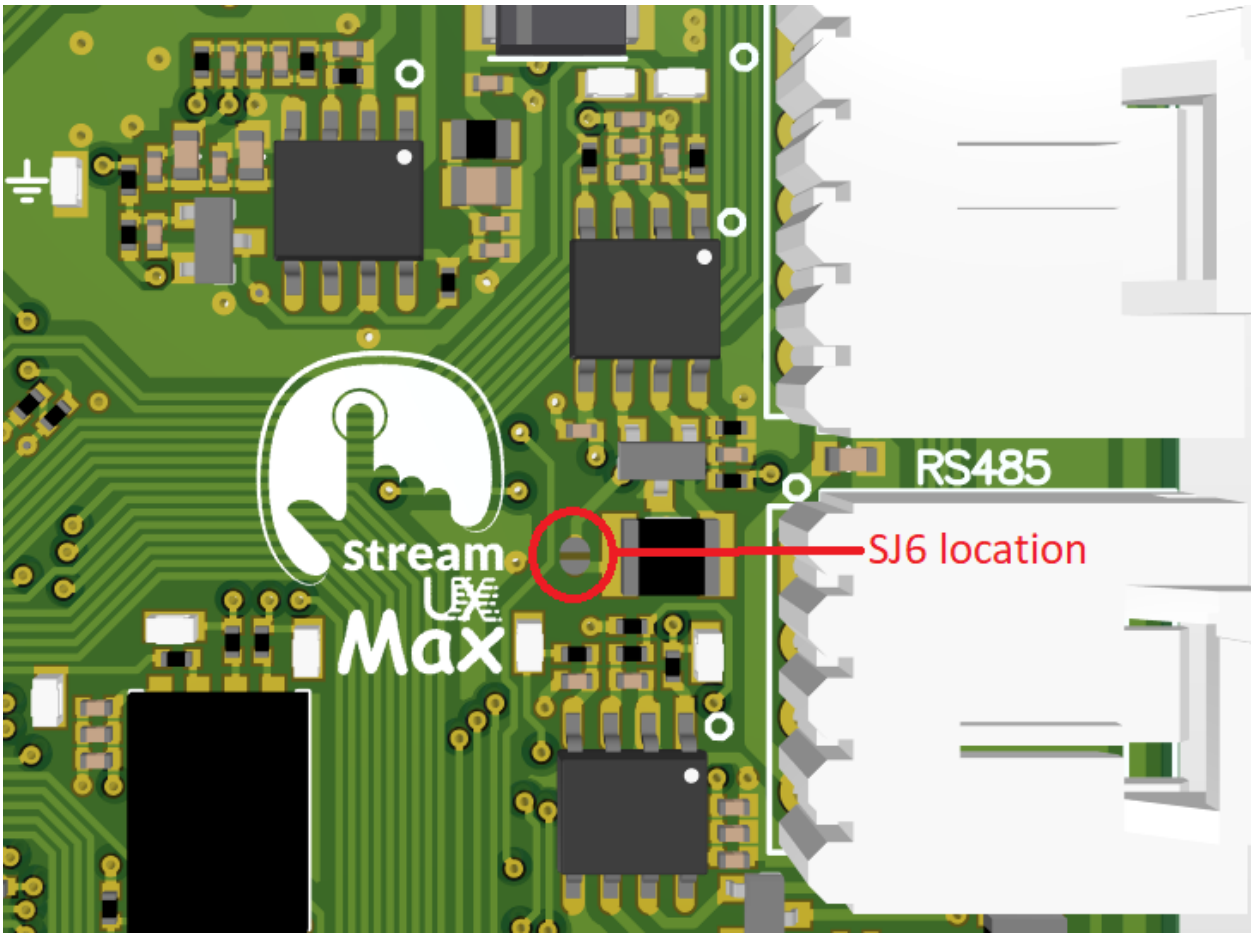

Figure 12 – SJ6 location

TFT Voltage Generation

If using the 40pin TFT interface, you can ignore this section. If using the 50pin TFT interface, you will likely need to generate the necessary voltages used to drive the TFT panel. StreamUX Max features an onboard circuit that generates these voltages for the display. The four voltage rails are VADD, VGL, VGH and VCOM.

Solder Jumper Settings

StreamUX Max voltage values are set with resistors, but solder jumpers are available to offers some alternate voltage values. The jumper settings and output voltages are outlined in the following table.

Solder Jumper State	Voltages Affected
SJ2 open	VADD = 10.4V, VCOM = 3.7V
SJ2 shorted	VADD = 10.8V, VCOM = 3.84V
SJ4 open	VGL = -5.5V
SJ4 shorted	VGL = -7V
SJ3 open, SJ5 shorted	VGH = 16.5V
SJ3 shorted, SJ5 open	VGH = 21V

Resistor Settings

If voltages other than those provided by solder jumpers is required, resistor values will need to change. The resistors are 0603 packages, and they are outlined on the silkscreen to help locate. If high volumes of alternate resistors are required, please contact Creekside Controls to get a quotation for this.

The voltage generation circuit is based on the TPS65105PWPR chipset from Texas Instruments. Please refer to its datasheet for calculations of how to determine output voltage. Schematic circuit is shown in Figure 13.

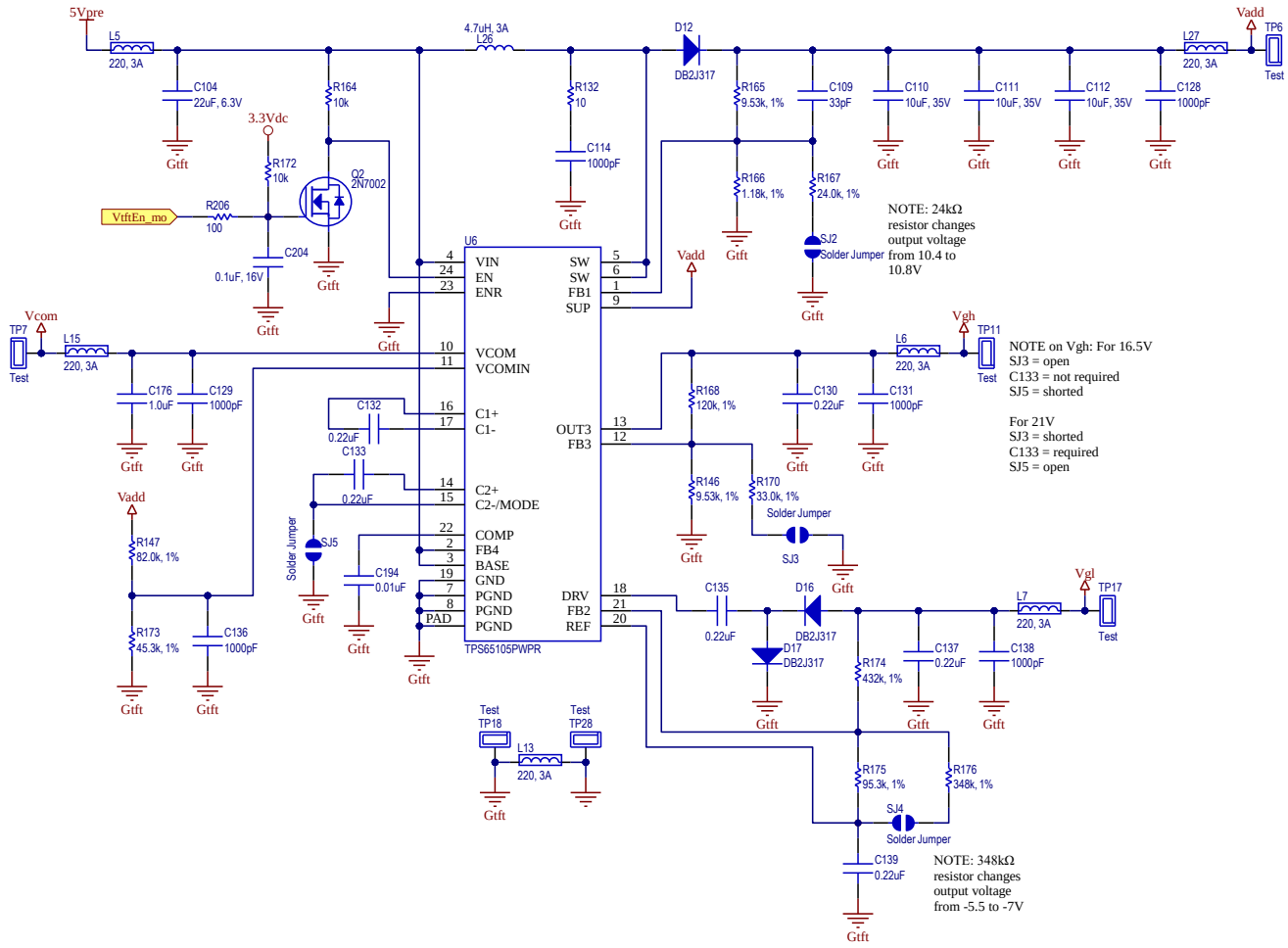

Figure 13 - Voltage Generation Schematic

Component Locations

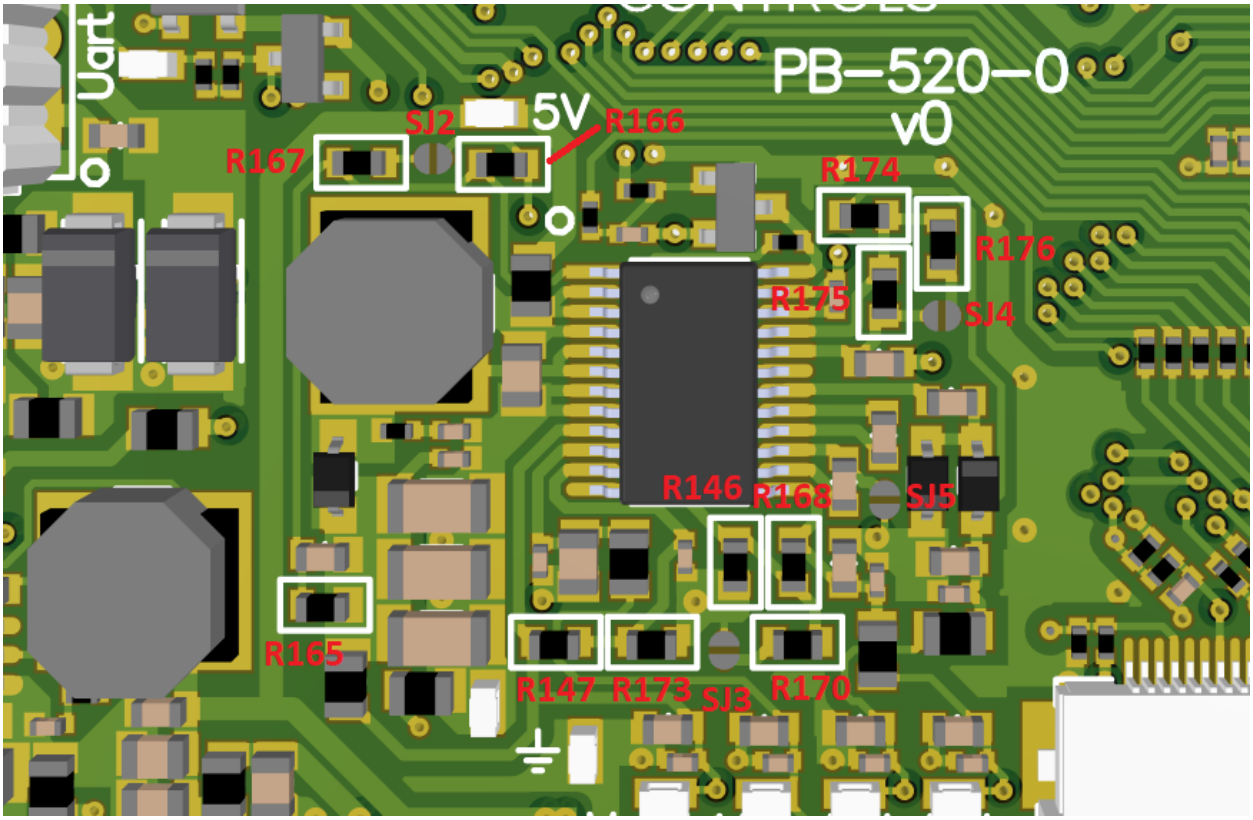

Figure 14 - Voltage Generator Component Locations

LED Backlight Driver

StreamUX Max features a boost converter that can drive most LED backlights at a constant current.

Output Current using PWM

The LED backlight current is programmed via a resistor in the circuit. The factory setting of this output is 0.3A. However, a lower constant current can be achieved by a PWM from the onboard STM32 controller. The PWM input to the backlight driver lowers the DC feedback voltage, so that a lower constant current is achieved at the output (rather than a PWM at the output).

Output Current using Resistor Change

In cases where the desired output current cannot be achieved using PWM setting, it is possible to change R145 (an 0805 resistor) to accomplish this. The LED backlight is based on the TPS61169DCKR chipset from Texas Instruments. Use the datasheet of this chipset to determine the proper resistance value. The schematic of this circuit is shown in Figure 15.

R145 is outlined on the silkscreen to help locate it. The location is shown in Figure 16.

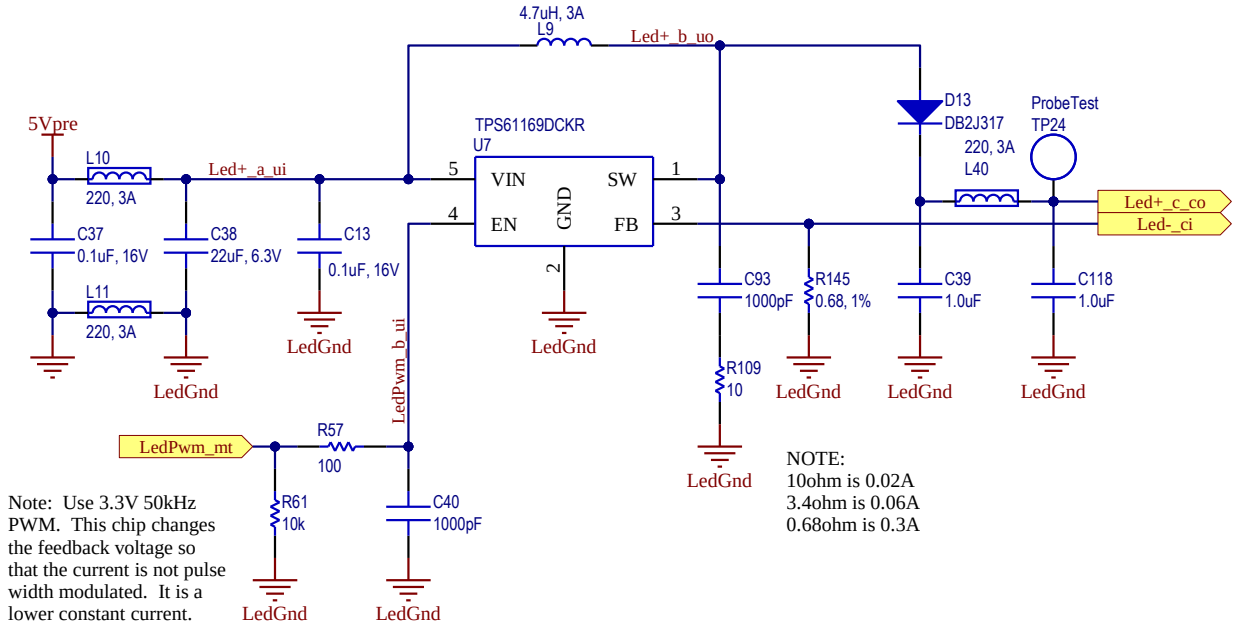

Figure 15 - Schematic of LED backlight driver

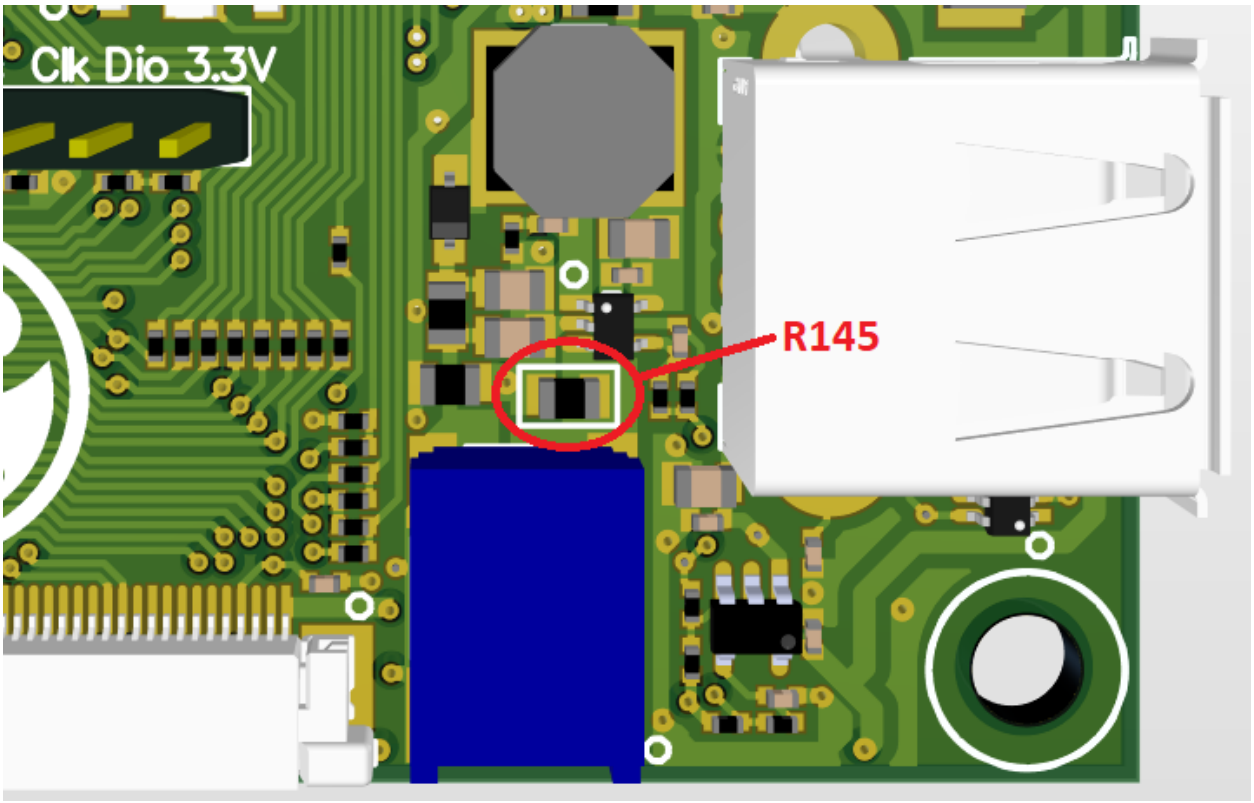

Figure 16 - R146 location

Electrical Characteristics

Absolute Maximum Ratings

Symbol	Parameter	Rating	Unit
V_{IN}	DC Supply Voltage	0 to 31V	V
T_{STO}	Storage Temperature Range	-30 to +80	°C
V_{RSI}	RS485 +/- Data Pins Voltage Range	-14 to 14	V
V_{IO}	IO Pin Voltage Range	-0.5 to 5.2	V

Recommended Operating Conditions

(@ temperature 25°C unless otherwise specified)

Symbol	Parameter	Min	Max	Unit
V_{IN}	DC Supply Voltage	4.8	30	V
T_{OP}	Operating Temperature Range	-20	70	°C

Electrical Specifications

(@ T_{OP} = 25°C)

Symbol	Parameter	Min	Typ	Max	Unit
Voltage					
V_{IO}	Logic Level Voltage (all digital IO pins)	3.2	3.3	3.4	V
V_{USB}	USB output voltage	4.8	5	5.2	V
V_{5Vdc}	5V DC output on Serial2 Connector	4.8	5	5.2	V
$V_{3.3Vdc}$	3.3V DC output on Serial2 Connector	3.2	3.3	3.4	V
V_{ANL}	3.3V Analog reference on Analog Connector	3.2	3.3	3.4	V
V_{OL}	Output Voltage Low Level (all digital IO pins)		0	0.4	V
V_{OH}	Output Voltage High Level (all digital IO pins)	2.8	3.3	3.4	V
V_{IH}	Input Voltage High Level (all digital IO pins)	2.24			V
V_{IHYS}	Input Voltage Hysteresis (all digital IO pins)	0.33			V
V_{ADD}	TFT Main Boost Converter Output (±2%)	5	10.4	15	V
V_{GL}	TFT Negative Charge Pump (±2%)	-2	-5.5	*Note1*	V
V_{GH}	TFT Positive Charge Pump (±2%)	*Note1*	16.5	30	V
V_{COM}	TFT VCOM Supply (±2%)	2.25	3.7	V_{ADD} - 2	V
V_{LED}	LED Backlight Voltage	4.8		38	V
Current					
I_{USB}	USB output current *(Note2)*			100	mA
I_{5Vdc}	5V DC output on Serial2 Connector *(Note2)*			100	mA
$I_{3.3Vdc}$	3.3V DC output on Serial2 Connector			100	mA
I_{ANL}	3.3V Analog reference on Analog Connector			50	mA
I_{IO}	Output Source/Sink Current (all digital IO pins)			5	mA
I_{IOlkg}	Input Leakage Current (all digital IO pins)			5	µA
I_{ADD}	TFT Main Boost Converter Output *(Note2)*			40	mA
I_{GL}	TFT Negative Charge Pump *(Note2)*			1	mA
I_{GH}	TFT Positive Charge Pump *(Note2)*			1	mA

I_{COM}	TFT VCOM Supply *(Note2)*		1	mA
I_{LED}	LED Backlight Output Current (±9%) *(Note2)*		300	mA
Speaker				
R_{SPK}	Speaker impedance	8		Ω
Power Draw				
Pspk	Power Draw, Speaker, full	1.18		W

- *Note1 – Charge pump voltage range depends on various factors. See TI, TPS65105PWPR datasheet for details.*
- *Note2 – TFT voltage, backlight driver, USB voltage, 5V output on Serial2 connector and speaker amplifier are all derived from the same 5V rail. Higher individual currents are possible if the collective load on the 5V rail is below 2A.*

Revision History

Rev	Date	Changes
0	8/13/2020	Initial Release
1	8/28/2020	Changed processor to STM32F767BGT with 1MB flash Removed warning about memory wear when used with graphics resources. This can be done, but access to the flash still should be limited. Touch adapter now needs i2c pullups
2	12/16/2020	Changed external NOR flash to 512Mbit
3	12/18/2020	Added cap touch to 40 pin LCD connector
4	2/19/2021	Fixed typo in 40 pin TFT connector table

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