SPECTRUM DIGITAL
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AppBox D21 System User's Guide

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1.0 Introduction

This document describes the features of the AppBox D21. The AppBox D21 is designed to be used in an industrial environment with a USB, or RS-485 interface and provide flexible, modular I/O (AppIO) for specific applications. These AppIO Modules allow customized solutions to be integrated for a wide variety of applications that need to go into a USB or RS-485 communications environment.

1.1 Features

This AppBox D21 has the following features:

- Atmel ATSAMD21J18A processor (ARM Cortex-M0+), maximum frequency 48 MHz.
- Operates on +12 to +24 volts DC, uses less than 500 Ma. at +12V
- USB interface for industrial computer systems
- RS485 communications for industrial systems
- Communication interface expansion via Distribution Box (sold separately)
- Modular I/O expansion via up to three (3) AppIO Modules, Atmel X PLAINED compatible
- Fully enclosed system with knock out panels for AppIO Modules (sold separately)
- Convenient enclosure mounting holes
- Vented enclosure for cooling
- Front panel push button switch
- Front panel programmable LED
- Atmel-ICE debug header present for development
- Operates 0 - +70C

AppBox D21 Block Diagram
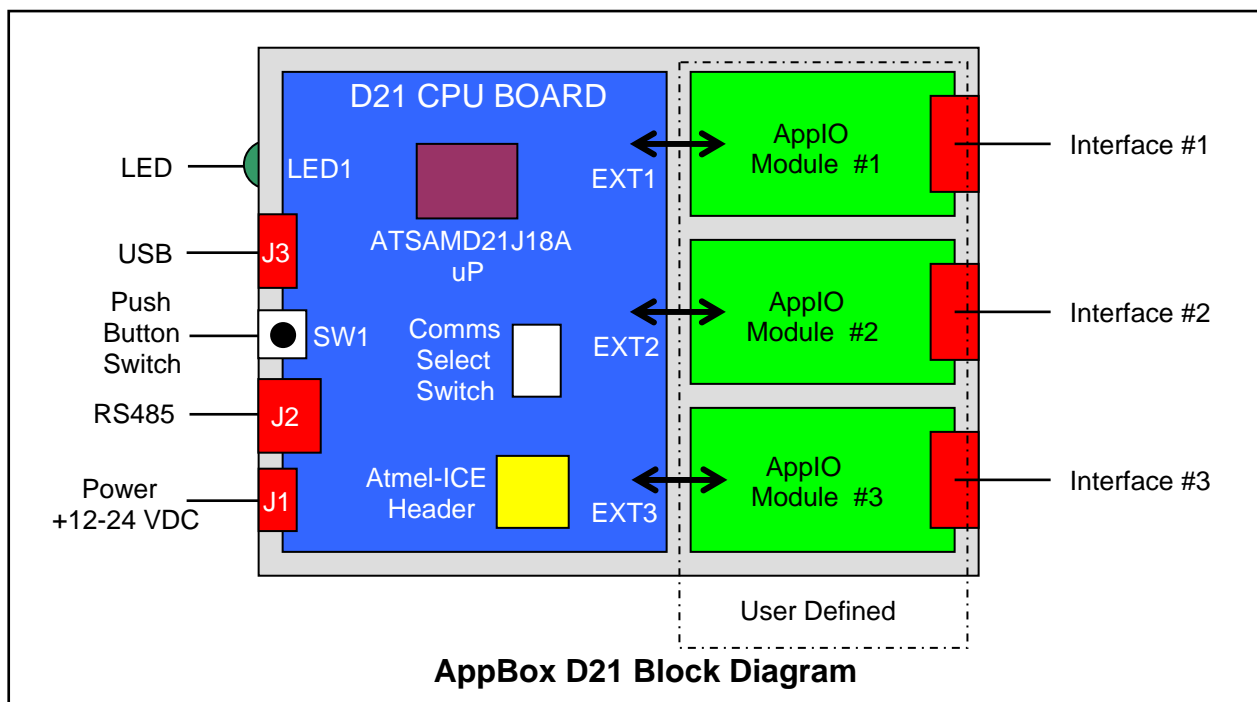
1.2 AppBox D21 Applications

The AppBox D21 can be used in the following applications:

- Battery/low power systems
- Process/industrial control
- Home automation
- Data acquisition
- Communications converter (RS485-USB)
- Operates with industrial voltage levels
- Reconfigurable applications with AppIO Modules

1.3 What's Included In the AppBox D21

The Spectrum Digital AppBox D21 product (Part/SKU #: 703910-0001) includes:

- AppBox D21 in anti-static bag
- Terminal block header for power input
- Product information card

NOTE: This product does not include any software or drivers. Development tools (Atmel-ICE and Software code generation suite) can be obtained from Microchip/Atmel at:

https://www.microchip.com/development-tools/.

1.4 AppBox D21 Front Panel

The features of the front panel on the AppBox D21 are shown in the figure below:

AppBox D21 Front Panel
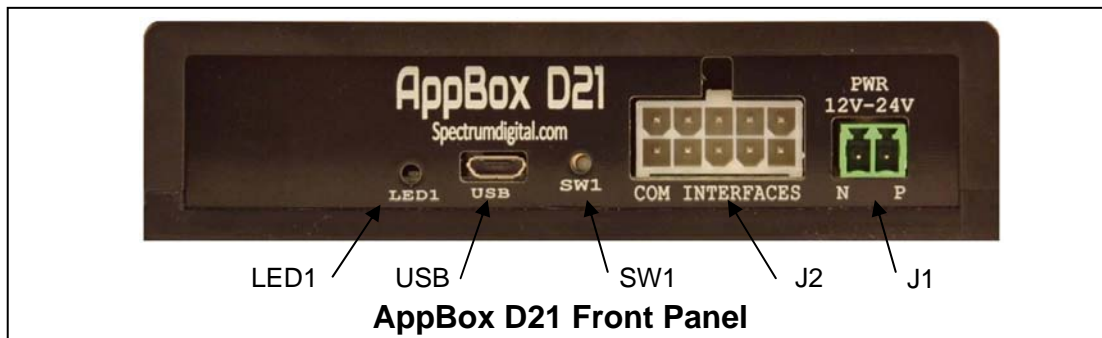
1.5 AppBox D21 Accessories

The following accessories for the AppBox D21 can be ordered from Spectrum Digital or authorized resellers:

Accessory Description	Part/SKU Number
AppBox Power Supply with cable, 110/220 VAC to 12 VDC, 1.5A	703925-0001
Distribution Box	703924-0001
AppBox Cable	703923-0001
RS485 cable	703917-0001
USB-RS485 cable	703914-0001

1.6 AppBox D21 Communication Expansion

The J2 connector on the AppBox D21 presents multiple communication interfaces. The standard factory cables only support one interface at a time. To have access to multiple communication interfaces a Distribution Box (Part/SKU #: 703924-0001) and AppBox cable (Part/SKU #: 703923-0001) are required. The Distribution Box expands the J2 connector to four (4) images of the AppBox D21 J2 connector. The AppBox cable bridges **all** signals on the AppBox D21 J2 connector to a connector on the Distribution Box. Be **aware** that **one** of the Distribution Box connectors will be used for the AppBox bridging cable leaving 3 connectors to be used for communication interfaces. All cables that can plug into the J2 connector on the AppBox D21 can plug into the Distribution Box.

The user should enable all interfaces they want to use with the Distribution Box by setting the switch positions on Switch SW2, position 1. See section 3.3.

The AppBox D21 and Distribution Box system configuration is shown in the figure below:

AppBox D21 with Distribution Box
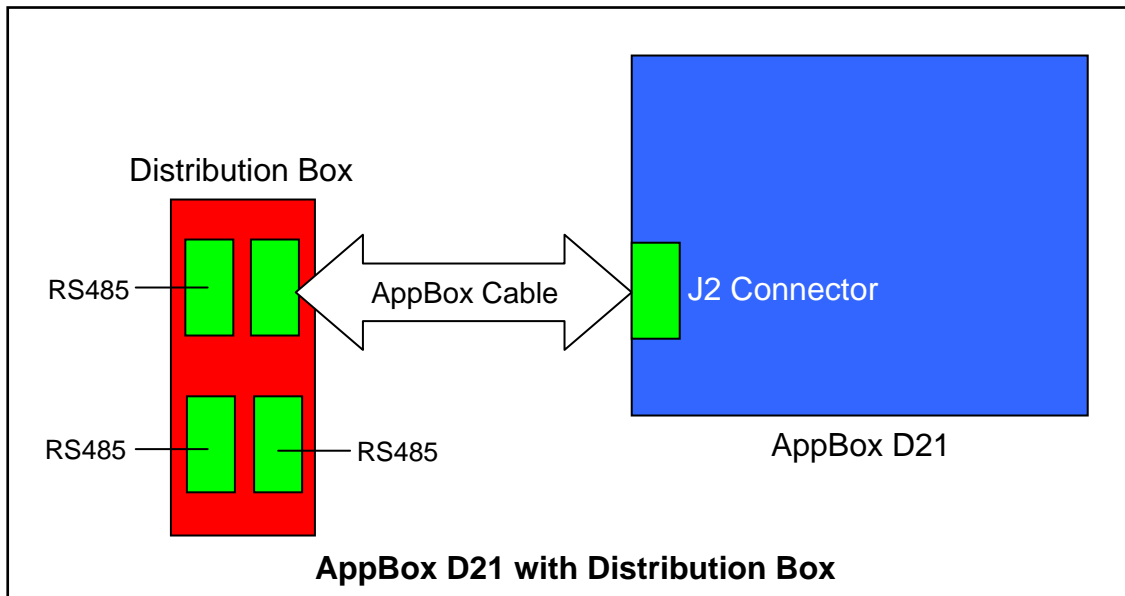
1.7 AppBox D21 Software Development Tools

The AppBox D21 is compatible with the software and hardware development tools from Microchip/Atmel. These tools are described on the Microchip/Atmel website:

> https://www.microchip.com/development-tools/

These tools include the following:

- Editor
- Compiler/assembler/linker
- Libraries
- Operating System
- Debugger
- JTAG Emulator

2.0 Installation

2.1 Attaching Power to the AppBox D21

Power can be provided to the AppBox D21 by two different means; the AppBox power supply with cable (Part/SKU #: 703925-0001), or wiring the 2 position terminal block header (included with AppBox D21) that plugs into the D21 CPU Board's power input connector. See the figure below.

AppBox Power Connector
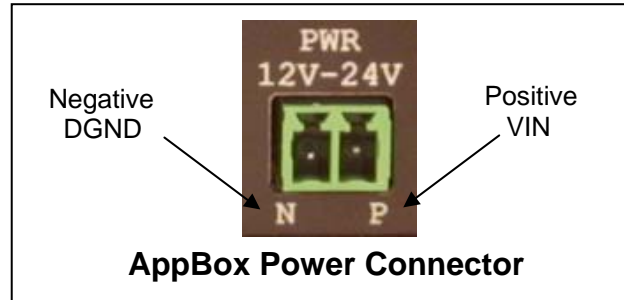
Listed below are the steps to install the terminal block header power connector (included in kit) into the AppBox D21.

1. Cut 2 pieces of wire (preferably 1 red for positive-VIN, 1 black for negative-DGND) to the desired length for your application. This wire should be 22 gauge or heavier
2. Strip ¼ inch (6-7 mm) of insulation from one end of each wire.
3. Position the terminal block header on a flat surface with the key stubs up and away from you. See the figure below.

Terminal Block Header

4. Insert the negative/DGND wire (black) into the left wire hole and tighten the screw.
5. Insert the positive/VIN wire (red or black with strip) into the right wire hole and tighten the screw.
6. The terminal header should look like the figure below.

Wired Terminal Block Header
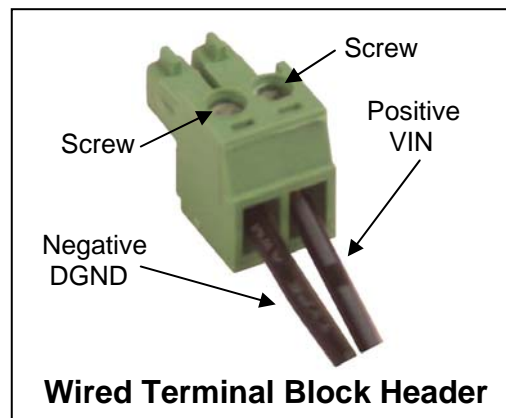
7. Pull/tug on the wires to insure they are secure in the terminal block.

8. Attach the loose end of the wires to a +12 – 24 VDC power source. Be sure of the polarity. This power source should supply at least 1 amp of current. This requirement will vary depending on the current requirements of the C21 CPU Board and the AppIO Modules.
9. Turn on the power source.
10. With a multi-meter or oscilloscope measure the voltage at the terminal block header to verify +12 -24 VDC is present. Place the meter/scope probes on the 2 screws to measure.
11. Turn off the power source
12. Insert the terminal block header into the power input of the AppBox D21.
13. Turn on the power source.

2.2 Installation of AppIO Modules

Listed below are the steps to install AppIO Modules in the AppBox D21:

1. Remove **ALL** power to the AppBox enclosure
2. Remove all interface connections attached to the installed AppIO Modules
3. Remove the USB/RS-485 cables to the D21 processor board
4. Turn the AppBox over and remove the 2 screws from the bottom of the enclosure as shown below

AppBox Bottom Screw Locations
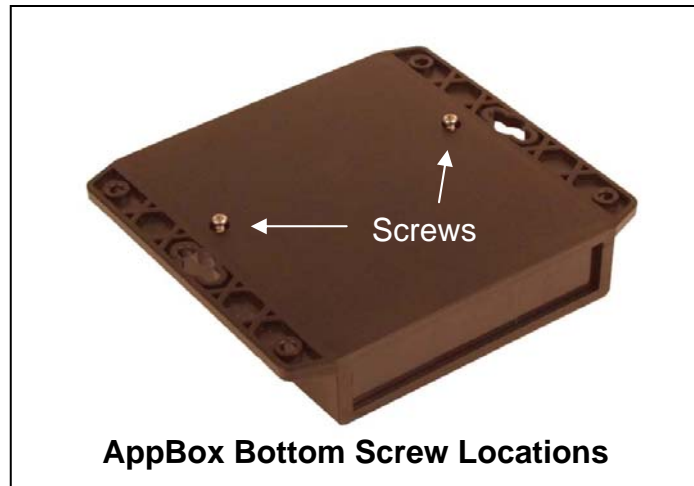
5. Turn the AppBox back over (label showing) and lift the top off the enclosure being careful not to lose the knockout panels
6. If necessary remove one or more existing AppIO Modules and associated knockout panels by unscrewing the 2 screws
7. If the AppIO modules require configuration or jumper settings, do it now.
8. Plug the new AppIO Module(s) into EXT1, EXT2, or EXT3 on the D21 CPU Board

AppIO Module Attached to D21 CPU Board
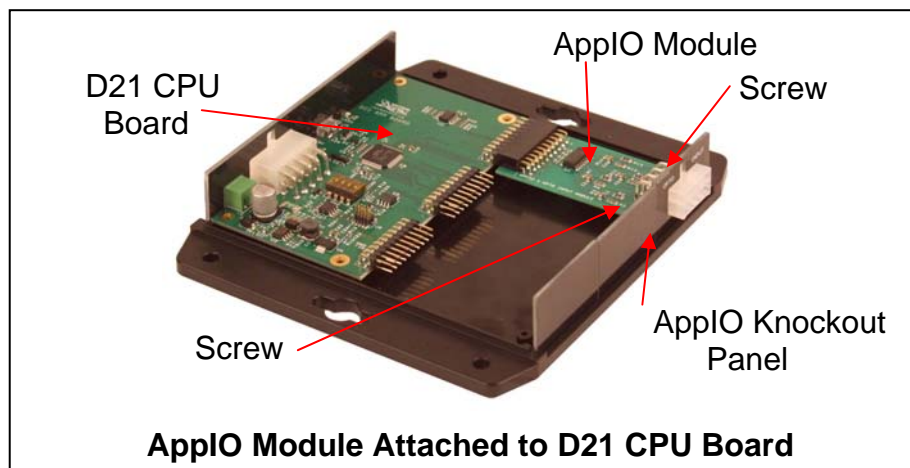
9. Insert the included knock out panel associated with this AppIO Module
10. Insert and tighten the 2 screws for the AppIO Module
11. Insert the knock out panels in any unused positions
12. Place the cover back over the D21 processor board and AppIO Modules
13. Insert the 2 screws back in and tighten until snug, do not over tighten/strip the screws

AppBox D21 with AppIO Module Installed
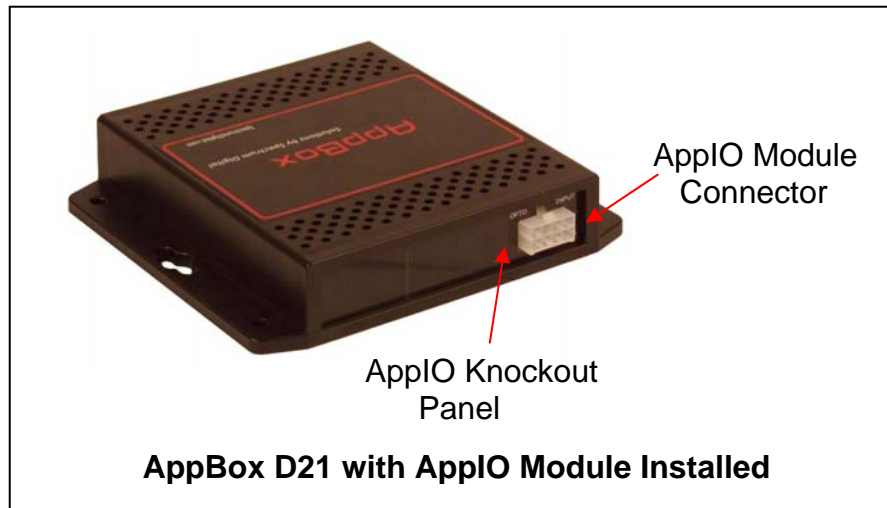
14. Re-attach the USB/RS-485 connections to the processor board
15. Re-attach all interface connections to the AppIO Modules
16. Apply power to the AppBox D21

2.3 Attachment of Distribution Box to the AppBox D21

Listed below are the steps to attach the Distribution Box (Part/SKU #: 903924-0001) to the AppBox D21:

1. Remove **ALL** power to the AppBox D21 enclosure
2. Remove any communication cables from the J2 connector on the AppBox D21
3. Plug one end of the AppBox cable (Part/SKU #: 703923-0001) into the J2 connector on the AppBox D21
4. Plug the other end of the AppBox cable into one of the connectors on the Distribution Box

AppBox D21 Connected to Distribution Box
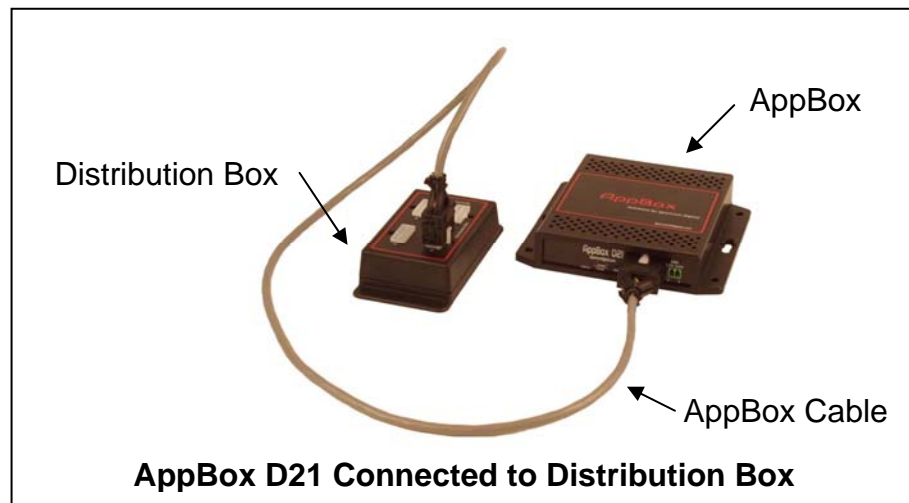
5. Plug the desired communication cables into the Distribution Box
6. Make all other connections before powering
7. Apply power to the AppBox D21

2.4 Installation of Atmel-ICE emulator

Listed below are the steps to install Atmel-ICE emulator:

1. Remove **ALL** power to the AppBox D21 enclosure
2. Remove all interface connections attached to the AppIO Modules
3. Remove the USB/RS-485 connections to the processor Module
4. Turn the AppBox over and remove the 2 screws from the bottom of the enclosure as shown below

AppBox Bottom Screw Locations
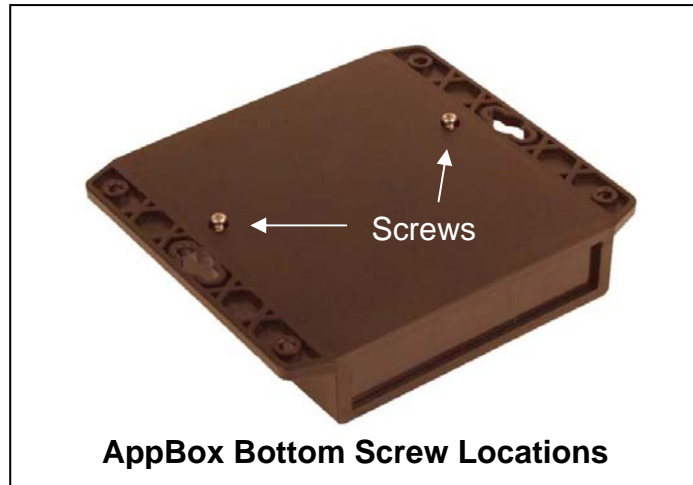
5. Turn the AppBox back over (label showing) and lift the top off the enclosure being careful not to lose the knockout panels
6. Plug the emulator end of the ribbon cable into the "SAM" Port on the emulator
7. Plug in the Atmel-ICE debug into connector J6 on the AppBox D21 CPU board. Visually inspect the connection to insure all the board pins are in the female cable connector.

Atmel-ICE Attached to AppBox D21 CPU Board
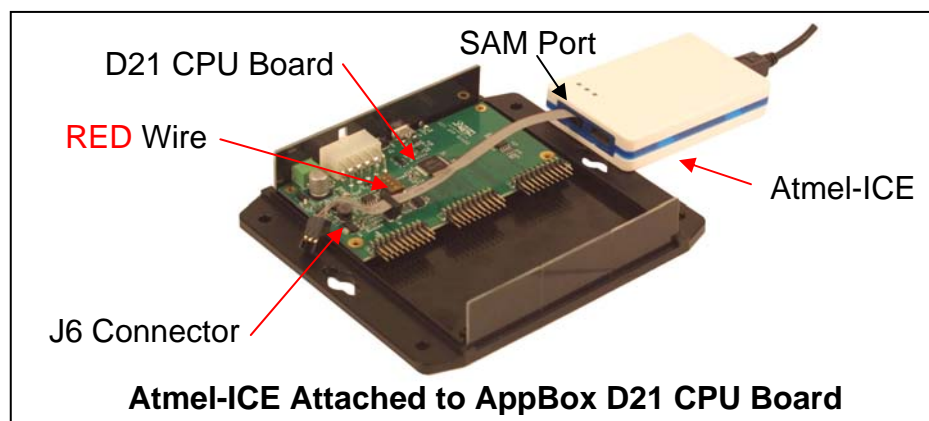
8. Re-attach the USB/RS-485 connections to the processor board
9. Re-attach all interface connections to the AppIO Modules
10. Apply power to the AppBox D21
11. Start debug session on the host computer

3.0 Interfaces

This section describes the interfaces on the AppBox D21 CPU Board. These interfaces include the connectors, jumpers, switches, LEDs, and test points.

The location of each of these interfaces is shown in the figure below:

AppBox D21 CPU Board Interfaces
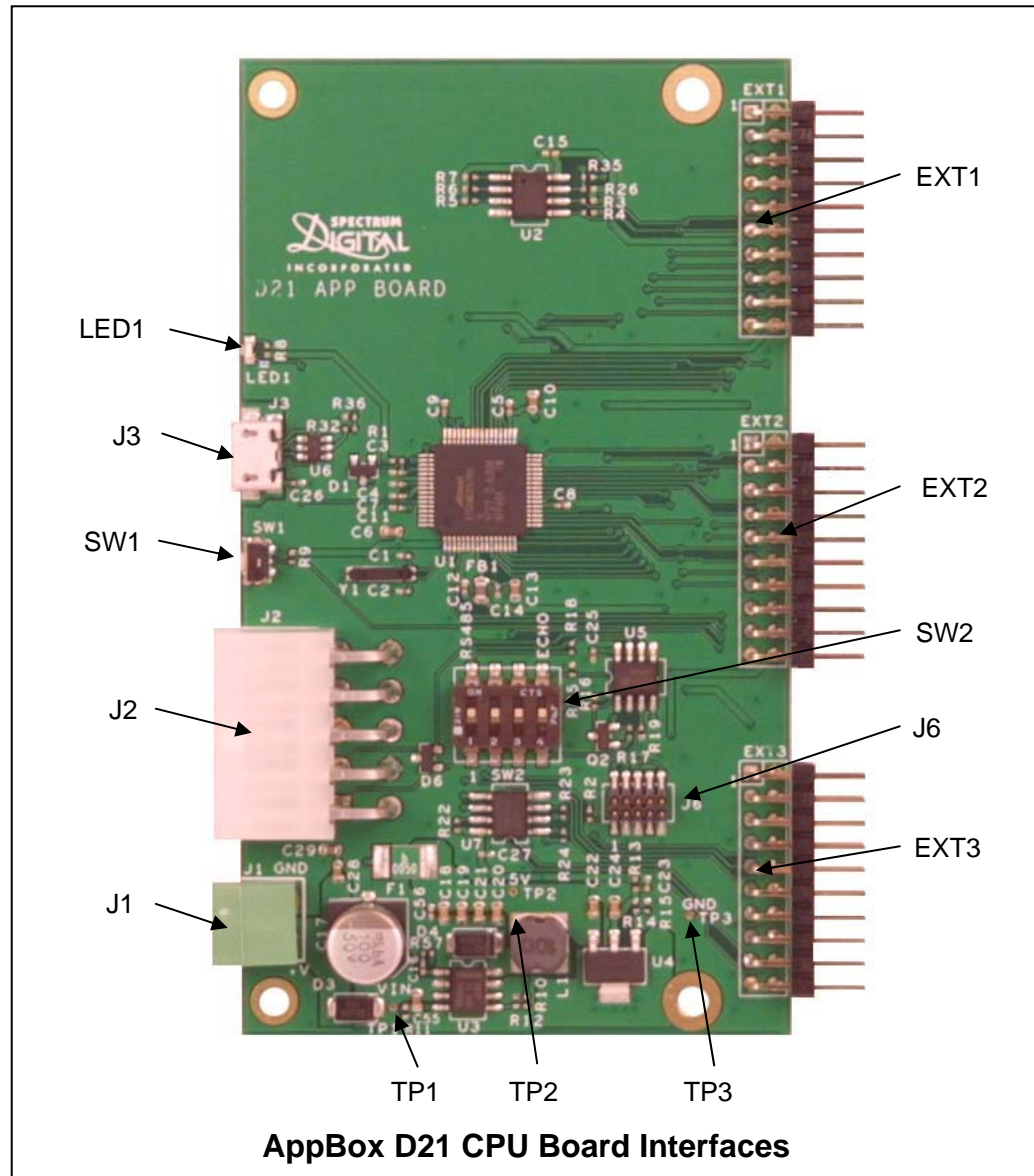
The table below lists all the interfaces on the AppBox D21 CPU Board.

| AppBox D21 CPU BOARD INTERFACES ||
INTERFACE NAME	TYPE OF INTERFACE
J1	Connector for power input
J2	Connector for RS-485
J3	Connector for USB
J6	Connector for header 5x2 Cortex-M Debug
EXT1	Connector to AppIO Module
EXT2	Connector to AppIO Module
EXT3	Connector to AppIO Module
JP1	SMT jumper (bottom)
JP2	SMT jumper (bottom)
JP3	SMT jumper (bottom)
JP4	SMT jumper (bottom)
JP7	SMT jumper (bottom)
JP8	SMT jumper (bottom)
JP9	SMT jumper (bottom)
JP10	SMT jumper (bottom)
JP11	SMT jumper (bottom)
SW1	Pushbutton switch
SW2	4 position DIP switch
LED1	Green LED
TP1	Test point
TP2	Test point
TP3	Test point

3.1 Connectors

The following section describes the connectors on the AppBox D21 CPU Board.

INTERFACE NAME	TYPE OF INTERFACE	MATING CONNECTOR
J1	Connector for power input	Amphenol Anytek Terminal block, 2 pos TJ2031530000G TS02315A0000G
J2	Connector for RS-485 10 position, 2 x 5	Molex 10 Position Rectangular Housing Connector Receptacle Natural 0.165" (4.20mm) 0039012100, 0039000038
J3	Connector for USB	??
J6	Connector for header 5x2 Cortex-M Debug	Cortex-M Debug tail
EXT1	Connector to AppIO Module #1, 20 position, 2 x 10	
EXT2	Connector to AppIO Module #2, 20 position, 2 x 10	
EXT3	Connector to AppIO Module #3, 20 position, 2 x 10	

3.1.1 J1, Power Connector

This section describes J1, he power connector. Shown below is a physical diagram of the J1 connector.

Pin 1, DGND   Pin 2, +12-24V

J1, Power Connector
(card edge view)
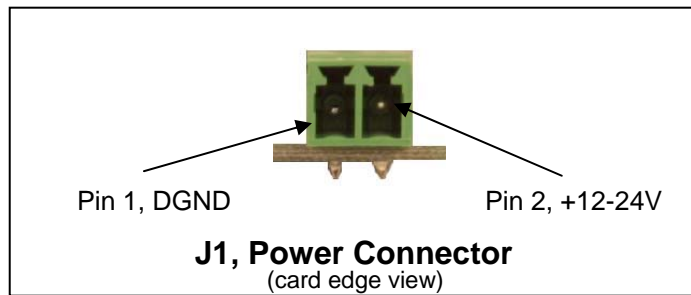
The following table shows the signals present on the J1 connector.

J1, Power Connector	
Pin number	**Signal name**
1	DGND
2	VIN, (+12-24 VDC)

3.1.2 J2, RS485 Connector

This section describes J2, the RS485 connector. The diagram below shows the physical diagram of the J2 connector.

Pin 10, DGND

Pin 6, Pin 2, JP7

Pin 5, No connect

Pin 1, RS-485_A

J2, RS485 Connector
(card edge view)
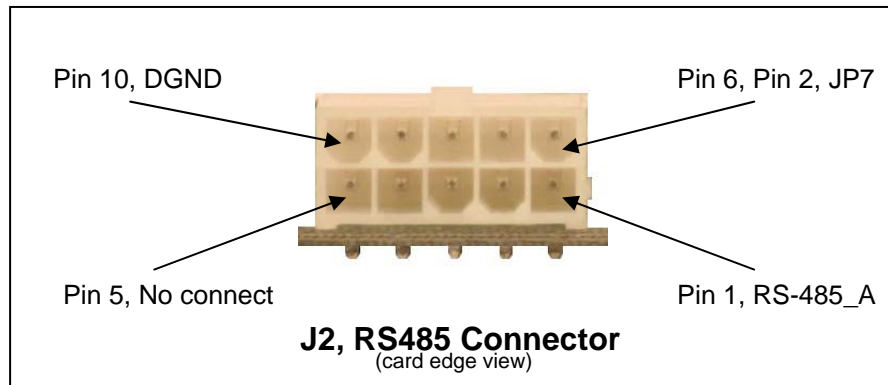
The following table shows the signals present on the J2 connector.

J2, RS485 Connector	
Pin number	**Signal name**
1	RS485_A
2	RS485_B
3	DGND
4	No Connect
5	No Connect
6	JP7, VDD_V5 if JP7 shorted, No connect if JP7 open
7	DGND
8	No Connect
9	No Connect
10	DGND

3.1.3 J3, USB Connector

The following table shows the signals present on the J3 connector. The J3 connector is a female USB connector.

J3, USB Connector	
Pin number	**Signal name**
1	VBUS / Pin 5, U6
2	D- / PA24_USB_DM, Pin 1, U6, IO1
3	D+ / PA25_USB_DP, Pin 3, U6, IO2
4	ID / Pin 4, U6, IO3
5	DGND
6	SHIELD1 / DGND via cap
7	SHIELD2 / DGND via cap
8	SHIELD3 / DGND via cap
9	SHIELD4 / DGND via cap
10	SHIELD5 / DGND via cap
11	SHIELD6 / DGND via cap

3.1.4 J6, Cortex-M Debug Connector

The following table shows the signals present on the J6 connector.

J6, Cortex-M Debug Connector	
Pin number	**Signal name**
1	VDD_3V3, +3.3 volts
2	PA31_SWDIO
3	DGND
4	PA30_SWCLK
5	DGND
6	No Connect
7	No Connect
8	No Connect
9	DGND
10	RESETn

3.1.5 AppIO Module Connectors

The AppBox D21 CPU Board has 3 connectors which allow the AppBox D21 to be customized to meet specific application requirements. By using function specific AppIO Modules, the user can tailor their system configuration to meet their unique requirements. The AppIO Modules can be plugged into any of the 3 connectors (EXT1, EXT2, EXT3). These 3 connectors are 20 pin, 2 x 10 double row, right angle connectors with pins on 0.1 inch (2.54 mm) centers.

Note: The user should be aware that several signals from the AppBox D21 CPU are shared and present on all 3 connectors. If the signals are used by one connector (AppIO Module) they should not be used on the other connectors

The following diagram shows the physical layout of the EXT1, EXT2, and EXT3 connectors.

AppBox D21 CPU Board AppIO Module Connector
(card edge view)
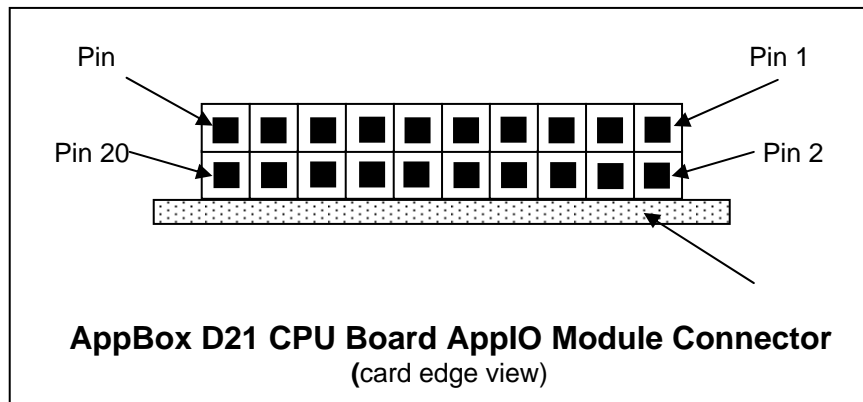
3.1.5.1 EXT1, AppIO Module Connector

The following table shows the signals present on the EXT1 connector.

EXT1, AppIO Module Connector			
Pin #	Signal Name	Function	Shared Functionality
1	Pin 2, JP1, VDD_5V **if** shorted	+5 volts to AppIO Module **if** shorted	VDD_5V
2	DGND	Ground	Ground
3	PB00_ADC(P)	A/D converter, alternatively positive part of differential ADC	
4	PB01_ADC(N)	A/D converter, alternatively negative part of differential ADC	
5	PB06_GPIO	General purpose I/O	
6	PB07_GPIO	General purpose I/O	
7	PB02_PWM(P)	PWM, alternatively positive part of differential PWM	
8	PB03_PWM(N)	PWM, alternatively negative part of differential PWM	
9	PB04_IRQ/GPIO	Interrupt request line and/or GPIO	
10	PB05_SPI_SS_B/GPIO	Slave select for SPI and/or GPIO	
11	PA08_TWI_SDA	Data line for I^2C interface, always implemented, bus type	Pin 11 on EXT2, EXT3, Pin 5, U2
12	PA09_TWI_SCL	Clock line for I^2C interface, always implemented, bus type	Pin 12 on EXT2, EXT3, Pin 6, U2
13	PB09_UART_RX	Receiver line of target device UART	
14	PB08_UART_TX	Transmitter line of target device UART	
15	PA05_SPI_SS_A	Slave select for SPI	
16	PA06_SPI_MOSI	Master out slave out line of serial peripheral interface, always implemented, bus type	
17	PA04_SPI_MISO	Master in slave out line of serial peripheral interface, always implemented, bus type	
18	PA07_SPI_SCK	Clock for serial peripheral interface, always implemented, bus type	
19	DGND	Ground	Ground
20	VDD_3V3	Power for the AppIO Module	Power for the AppIO Module

3.1.5.2 EXT2, AppIO Module Connector

The following table shows the signals present on the EXT2 connector.

EXT2, AppIO Module Connector
Pin #	Signal Name	Function	Shared Functionality
1	Pin 2, JP2, VDD_5V if shorted	+5 volts to AppIO Module **if** shorted	VDD_5V
2	DGND	Ground	Ground
3	PA10_ADC(P)	A/D converter, alternatively positive part of differential ADC	
4	PA11_ADC(N)	A/D converter, alternatively negative part of differential ADC	
5	PA20_GPIO	General purpose I/O	
6	PA21_GPIO	General purpose I/O	
7	PB12_PWM(P)	PWM, alternatively positive part of differential PWM	
8	PB13_PWM(N)	PWM, alternatively negative part of differential PWM	
9	PB14_IRQ/GPIO	Interrupt request line and/or GPIO	
10	PB15_SPI_SS_B/GPIO	Slave select for SPI and/or GPIO	
11	PA08_TWI_SDA	Data line for I^{2}C interface, always implemented, bus type	Pin 11 on EXT1, EXT3, Pin 5, U2
12	PA09_TWI_SCL	Clock line for I^{2}C interface, always implemented, bus type	Pin 12 on EXT1, EXT3, Pin 6, U3
13	PB11_UART_RX	Receiver line of target device UART	Pin 13 on EXT3
14	PA10_UART_TX	Transmitter line of target device UART	Pin 14 on EXT3
15	PB17_SPI_SS_A	Slave select for SPI	
16	PB18_SPI_MOSI	Master out slave out line of serial peripheral interface, always implemented, bus type	
17	PA16_SPI_MISO	Master in slave out line of serial peripheral interface, always implemented, bus type	
18	PB19_SPI_SCK	Clock for serial peripheral interface, always implemented, bus type	
19	DGND	Ground	Ground
20	VDD_3V3	Power for the AppIO Module	Power for the AppIO Module

3.1.5.3 EXT3, AppIO Module Connector

The following table shows the signals present on the EXT3 connector.

	EXT3, AppIO Module Connector		
Pin #	**Signal name**	**Function**	**Shared Functionality**
1	Pin 2, JP3, VDD_5V if shorted	+5 volts to AppIO Module **if** shorted	VDD_5V
2	DGND	Ground	Ground
3	PA02_ADC(P)	A/D converter, alternatively positive part of differential ADC	
4	PA03_ADC(N)	A/D converter, alternatively negative part of differential ADC	
5	PB30_GPIO	General purpose I/O	LED1
6	PA15_GPIO	General purpose I/O, SW1	
7	PA12_PWM(P)	PWM, alternatively positive part of differential PWM	
8	PA13_PWM(N)	PWM, alternatively negative part of differential PWM	
9	PA28_IRQ/GPIO	Interrupt request line and/or GPIO	
10	PA27_SPI_SS_B/GPIO	Slave select for SPI and/or GPIO	
11	PA08_TWI_SDA	Data line for I^{2}C interface, always implemented, bus type	Pin 11 on EXT1, EXT2, Pin 5, U2
12	PA09_TWI_SCL	Clock line for I^{2}C interface, always implemented, bus type	Pin 12 on EXT1, EXT2, Pi 6, U2
13	PB11_UART_RX	Receiver line of target device UART	Pin 13 on EXT2
14	PB10_UART_TX	Transmitter line of target device UART	Pin 14 on EXT2
15	PA17_SPI_SS_A	Slave select for SPI	
16	PB22_SPI_MOSI	Master out slave out line of serial peripheral interface, always implemented, bus type	Pin 5, U7
17	PB16_SPI_MISO	Master in slave out line of serial peripheral interface, always implemented, bus type	Pin 2, U7
18	PB23_SPI_SCK	Clock for serial peripheral interface, always implemented, bus type	Pin 6, U7
19	DGND	Ground	Ground
20	VDD_3V3	Power for the AppIO Module	Power for the AppIO Module

3.2 Jumpers

This section describes the jumpers on the AppBox D21 CPU Board. All jumpers are located on the bottom side of the circuit board. All jumpers are surface mount jumpers. The figure below shows the location of each jumper.

AppBox D21 CPU Board Jumper Positions
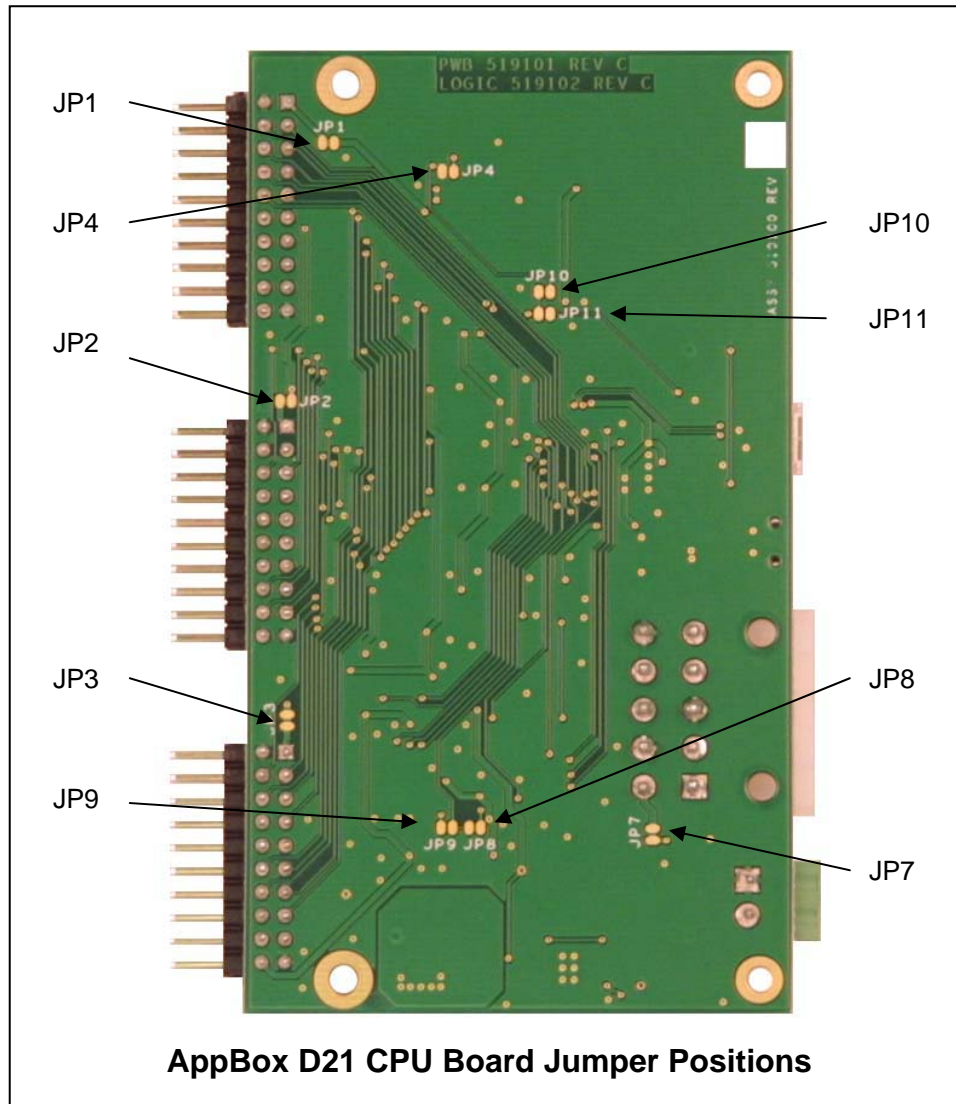
The table below describes the jumpers on the AppBox D21 CPU Board.

JUMPER NAME	POSITION DESCRIPTION	FACTORY SHIPPED POSITION
JP1	Installed = +5 V power to Pin 1, EXT1	Installed
JP2	Installed = +5 V power to Pin 1, EXT2	Installed
JP3	Installed = +5 V power to Pin 1, EXT3	Installed
JP4	Installed = DGND to Pin 5, U7	Installed
JP7	Installed = +5 V power to Pin 6, J2	Open
JP8	Installed = VDD_3V3, PA13_PWM(N)CS to pin 1, U7	Installed – see warning 1
JP9	Installed = PA13_PWM(N)CS connected to PA13_PWM(N)	Open – see warning 1
JP10	Installed = PA14_WP connected to PA14_WP/VBUS_DETECT, Pin 31, U1	Installed – see warning 2
JP11	Installed = VBUS_DETECT connected to PA14_WP/VBUS_DETECT, Pin 31, U1	Open - see warning 2

WARNING 1 !

! Jumpers JP8 and JP9 are used in the same circuit. Only 1 should be installed. If both are installed the circuit could be damaged.

WARNING 2 !

! Jumpers JP10 and JP11 are used in the same circuit. Only 1 should be installed. If both are installed the circuit could be damaged.

3.3 Switches

The table below describes the switches on the AppBox D21 CPU Board.

SWITCH NAME	TYPE OF SWITCH	FUNCTION	FACTORY DEFAULT POSITION
SW1	Pushbutton switch	PA15_GPIO	Open
SW2, position 1, on	Rocker switch	Connects RS485A to RS485B RS485 terminator on	X
SW2, position 1, off	Rocker switch	Disconnects RS485A from RS485B RS485 terminator off	
SW2, position 2	Rocker switch	Not used	
SW2, position 3	Rocker switch	Not used	
SW2, position 4, on	Rocker switch	Connects PB31_RS485_EN to RS485_ECHO, RS485 echo	
SW2, position 4, off	Rocker switch	Disconnects PB31_RS485_EN to RS485_ECHO, No RS485 echo	X

The figure below shows the switch, SW2, in the "Factory Default Position". Switch position 1 is in the "ON" position (slide moved to the right). Switch positions 2, 3, and 4 are in the "OFF" position (slide moved to the left). Positions 2 and 3 are not used on the D31 APP Board.

OFF Position   ON Position

Switch SW2
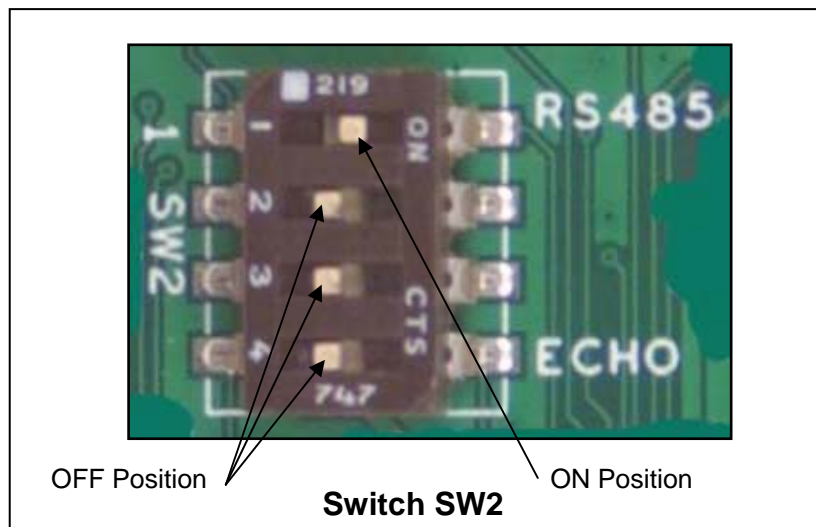
3.4 LEDs

The table below describes the LED on the AppBox D21 CPU Board.

LED NAME	COLOR	MEANING
LED1	Green	User control, PB30_GPIO

3.5 Test Points

This section discusses the test points on the AppBox D21 CPU Board. All test points are on the top side of The circuit board. Their location is shown is the diagram in section 3.0. The table below describes the test points on the AppBox D21 CPU Board.

TEST POINT NAME	SIGNAL PRESENT
TP1	Input DC voltage, (+12-24 vdc)
TP2	VDD_5V, +5 volts
TP3	DGND

4.0 Physical Characteristics

The physical characteristics of the AppBox D21 are described below:

Enclosure (with flanges): 5.83 in(148.26 mm) x 5.13 in(130.5 mm) x 1.10 in(27.94 mm)

D21 CPU Board (without connectors): L: 4.15 in(105 mm) x W: 2.36 in (60 mm)

D21 CPU Board (width with connectors): W: 2.77 (70.5 mm)

D21 CPU Board (maximum height): H: 0.59 in (15 mm)

Weight of enclosure with controller board: 6 ounces (.17 kg)

Operating Temperature: -0C to +70C

Storage Temperature: -40C to +85 C

Relative Humidity: 0 to 90% (non-condensing)

Maximum power consumption of controller board: 1 amp at +12 volts

RoHS Compliant: Yes

5.0 Mechanical Information

The following drawing provides the mechanical information for the AppBox D21. All dimensions are in inches.

Note: Drawing is **NOT** to scale.

Top View AppBox D21

Side View AppBox D21
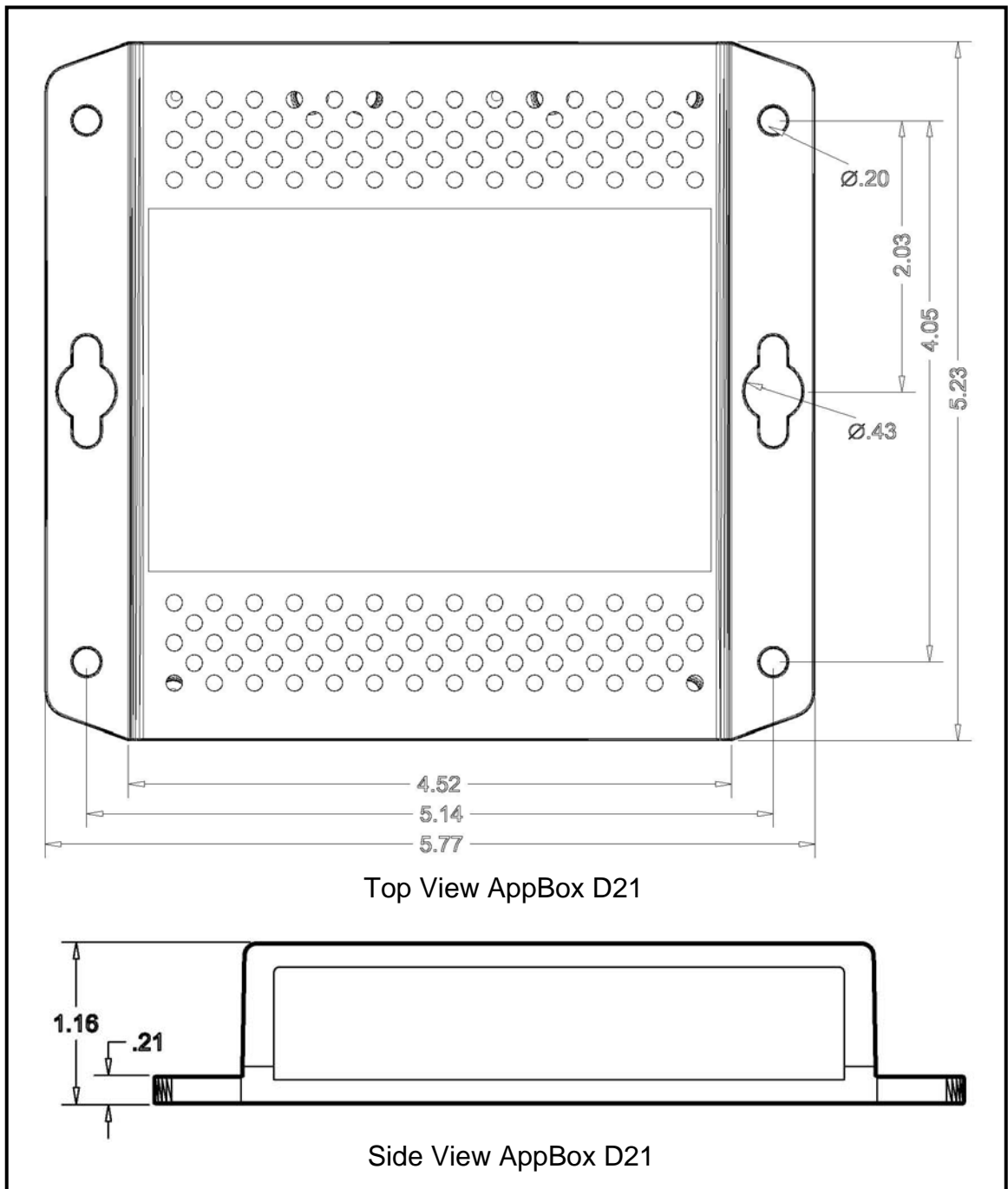
6.0 Schematics

The following pages include the schematics for the D21 APP Board inside the AppBox D21.

Notes:

1. Jumpers are on back of board

J2

10	9	8	7	6
5	4	3	2	1

Shared Pins

PA8_TWI_SDA	EXT1-3, CAT24C512
PA9_TWI_SCL	EXT1-3, CAT24C512
PA13_PWM(N)/CS	EXT3, AT25DF081A
PA14_WP/VBUS_DETECT	VBUS_DETECT, CAT24C512
PA15_GPIO	EXT3, SW1
PB10_UART_TX	EXT2-3
PB11_UART_RX	EXT2-3
PB16_SPI_MISO	EXT3, AT25DF081A
PB22_SPI_MOSI	EXT3, AT25DF081A
PB23_SPI_SCK	EXT3, AT25DF081A
PB30_GPIO	EXT3, LED1

SWITCH	Pos	Function
SW2-1	On	RS458 Termination
SW2-2		
SW2-3	Off	RS485 Echo
SW2-4		

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VDD_3V3

R1
10K 1%

C3
0.1uF

DGND

D1
BAS16/SOT_2

VDD_3V3

FB1
BLM21AG151SN1D

VDDA_MCU

C13
4.7uF 6.3V

C14
0.1uF

DGND

U1
ATSAMD21J18A-AU

PB03   64
PB02   63
PB01   62
PB00   61
PB31   60
PB30   59
PA31   58
PA30   57
VDDIN   56
VDDCORE 55
GND54   54
PA28   53
RESET   52
PA27   51
PB23   50
PB22   49
VDDIO   48
GND47   47
PA25   46
PA24   45
PA23   44
PA22   43
PA21   42
PA20   41
PB17   40
PB16   39
PA19   38
PA18   37
PA17   36
PA16   35
VDDIO34 34
GND33   33

PA00   1
PA01   2
PA02   3
PA03   4
PA04   5
PA05   6
GNDANA 7
VDDANA 8
PB06   9
PB07   10
PB08   11
PB09   12
PA04   13
PA05   14
PA06   15
PA07   16
PA08   17
PA09   18
PA10   19
PA11   20
VDDIO21 21
GND22   22
VDDIO22 23
PB10   24
PB11   25
PB12   26
PB13   27
PB14   28
PB15   29
PA12   30
PA13   31
PA14   31
PA15   32

PB03_PWM(N)   6
PB02_PWM(P)   6
PB01_ADC(N)   6
PB00_ADC(P)   6
PB31_RS485_EN 5
PB30_GPIO   3,6
PA31_SWDIO   3
PA30_SWCLK   3
RESETn   3

PA28_IRQ/GPIO 6

PA27_SPI_SS_B/GPIO 3,6
PB23_SPI_SCK   3,6
PB22_SPI_MOSI   3,6

PA25_USB_DP   5
PA24_USB_DM   5
PA23_RS485_RX   5
PA22_RS485_TX   5
PA21_GPIO   6
PA20_GPIO   6
PB17_SPI_SS_A   6
PB16_SPI_MISO   3,6
PA19_SPI_SCK   6
PA18_SPI_MOSI   6
PA17_SPI_SS_A   6
PA16_SPI_MISO   6

PA02_ADC(P)   6
PA03_ADC(N)   6
PA04_IRQ/GPIO   6
PB05_SPI_SS_B/GPIO 6

PB06_GPIO   6
PB07_GPIO   6
PB08_UART_TX   6
PB09_UART_RX   6
PA04_SPI_MISO   6
PA05_SPI_SS_A   6
PA06_SPI_MOSI   6
PA07_SPI_SCK   6
PA08_TWI_SDA   3,6
PA09_TWI_SCL   3,6
PA10_ADC(P)   6
PA11_ADC(N)   6

PB10_UART_TX   6
PB11_UART_RX   6
PB12_PWM(P)   6
PB13_PWM(N)   6
PB14_IRQ/GPIO   6
PB15_SPI_SS_B/GPIO 6
PA12_PWM(P)   6
PA13_PWM(N)/CS   3

PA00 XIN32
PA01 XOUT32

PA14_WP/VBUS_DETECT

VDD_MCU
VDDA_MCU
VDDIO_MCU

C4
0.1uF
DGND
DGND
DGND
DGND

C1   18 pF
C2   18 pF
Y1
32.768KHz
DGND
DGND

VDD_3V3
C12   0.1uF
C11   1uF 6.3V
C10   4.7uF 6.3V
VDD_MCU
DGND

VDD_3V3
C9   0.1uF
C8   0.1uF
C7   0.1uF
C5   1uF 6.3V
C6   4.7uF 6.3V
VDDIO_MCU
DGND

JP10
JUMPER/NC_12

JP11
JUMPER/NO

3   PA14_WP
5   VBUS_DETECT

PA14_WP   3,6
PA15_GPIO   3,6

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U2 CAT24C512
- A0 1
- A1 2
- A2 3
- SDA 5
- SCL 6
- WP 7
- VCC 8
- GND 4

C15 0.1uF
VDD_3V3
DGND

R7 10K 1%
R6 10K 1%
R5 10K 1%
R26 100K 1%
VDD_3V3

R35 121 1%
JP4 1 2
JUMPER/NC_12
DGND

R4 4.7K 1%
R3 4.7K 1%
VDD_3V3

2,6 PA08_TWI_SDA
2,6 PA09_TWI_SCL
2   PA14_WP

U7 AT25DF081A-SSH-T
- SDI 5
- SCLK 6
- HOLD 7
- WP 3
- CS 1
- VCC 8
- SDO 2
- GND 4

VDD_3V3
C27 0.1uF
DGND

PB16_SPI_MISO 2,6

R22 100K 1%
R23 10K 1%
R24 10K 1%
VDD_3V3

JP8 1 2
JUMPER/NC_12

JP9 1 2
JUMPER/NO

PA13_PWM(N) 6

2,6 PB22_SPI_MOSI
2,6 PB23_SPI_SCK
2   PA13_PWM(N)/CS

J6 HEADER 5X2 CORTEX-M DEBUG
- 2 4 6 8 10
- 1 3 5 7 9

PA31_SWDIO 2
PA30_SWCLK 2
RESETn 2

R2 121 1%
VDD_3V3
DGND

LED1 LTST-S270KGKT
R8 1K 1%
VDD_3V3
GREEN

2,6 PB30_GPIO

SW1 TL3340AF160QG
R9 10K 1%
VDD_3V3

PA15_GPIO 2,6

DGND

12V/24V AC/DC

FC1 20020110-D021A01LF

J1

C28 0.1uF 100V
C29 0.1uF 100V

D3 S1B-13-F

VIN

TP1 RD30

C17 100uF 63V

C55 0.1uF 100V

LMR_VIN

U3 LMR160X0

1 BOOT BOOT
2 VIN
3 EN
4 RT/SYNC
8 SW
5 FB
6 PGOOD
7 GND
TPAD 6

C16 0.1uF BOOT2

R57 0 Ohm

R11 41.2K 1%

L1 10uH

LMR_SW

D4 B360A

R10 100K 1%

LMR_FB

R12 17.8K 1%

C56 0.1uF

C18 22uF 10V
C19 22uF 10V
C20 22uF 10V
C21 22uF 10V

VDD_5V

TP2 RD30

TP3 RD30

AZ1117EH-ADJ 442 Ohm 732 Ohm
AP2114H NO-POP 0 Ohm

VDD_5V

C22 22uF 10V

U4 AP2114H-3.3TRG1
3 IN OUT2 4
OUT 2
ADJ/GND 1

3.3_OUT

R14 0402-NOPOP-R

GND/FB

R15 0 Ohm

R13 0 Ohm
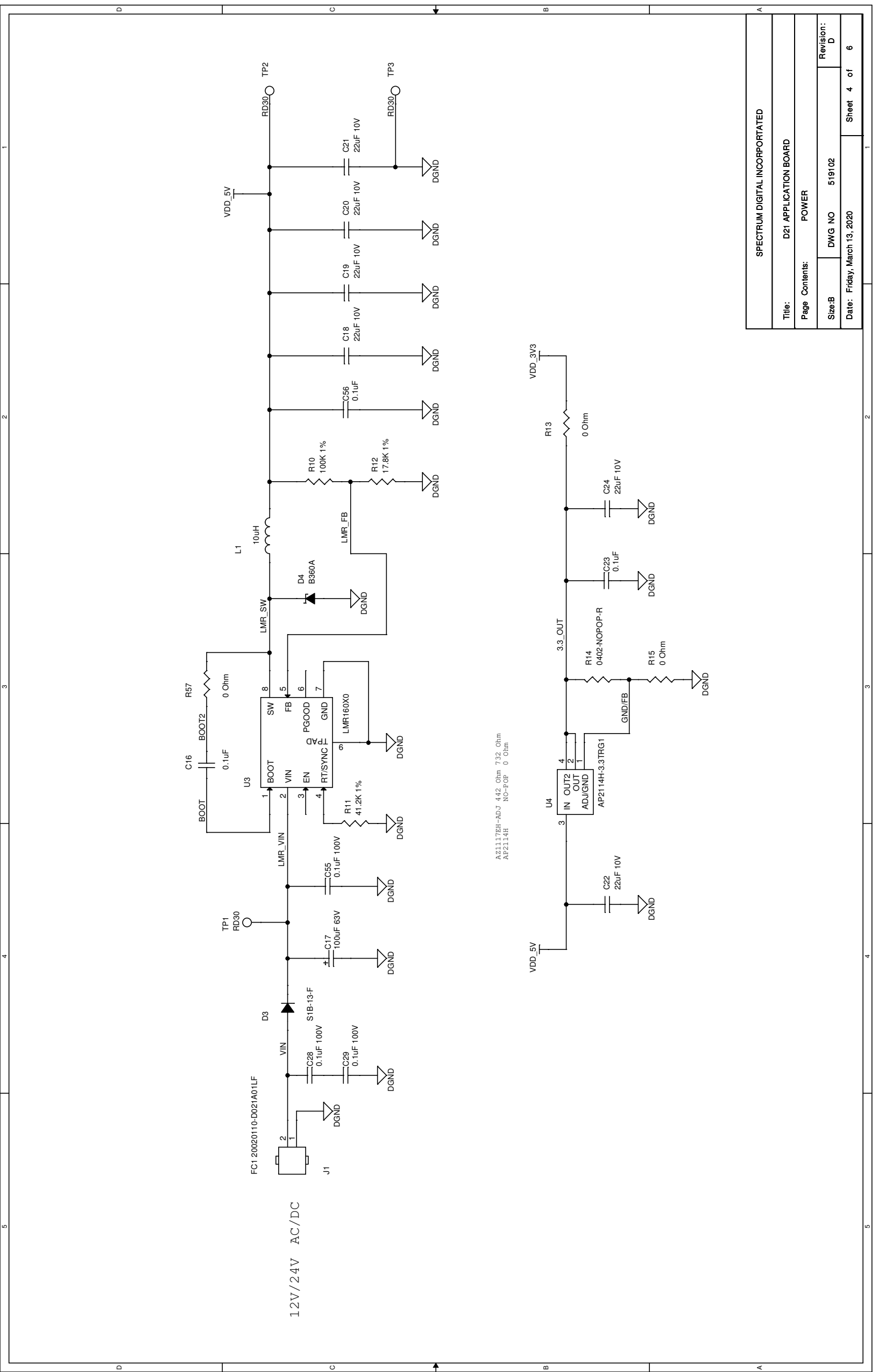
VDD_3V3

C23 0.1uF
C24 22uF 10V

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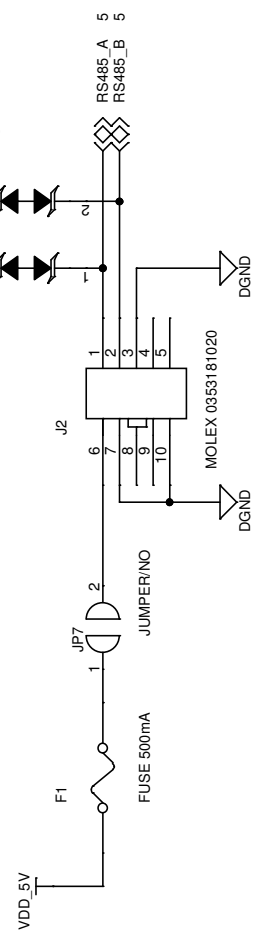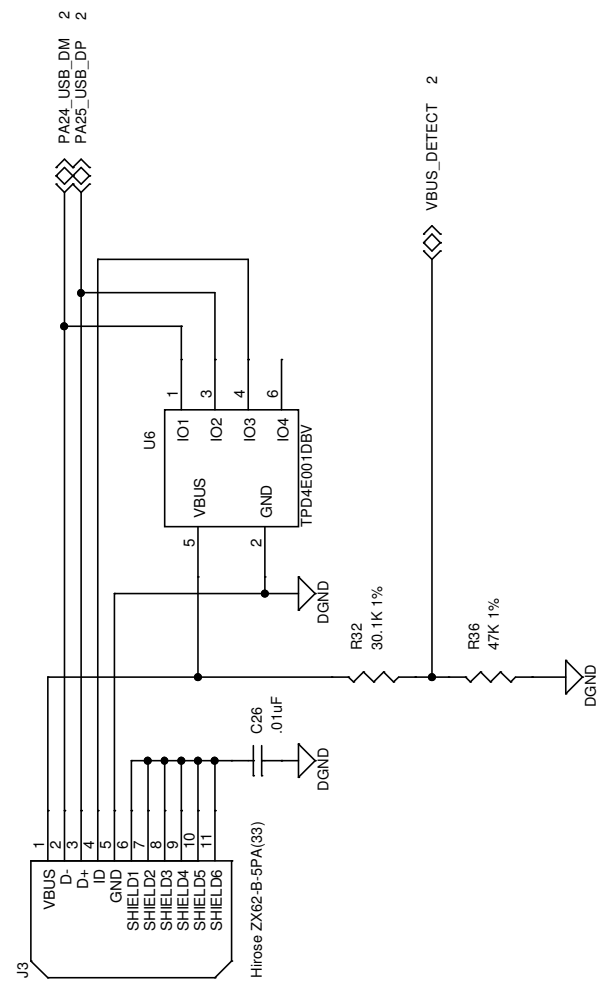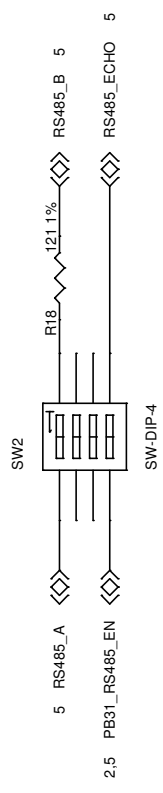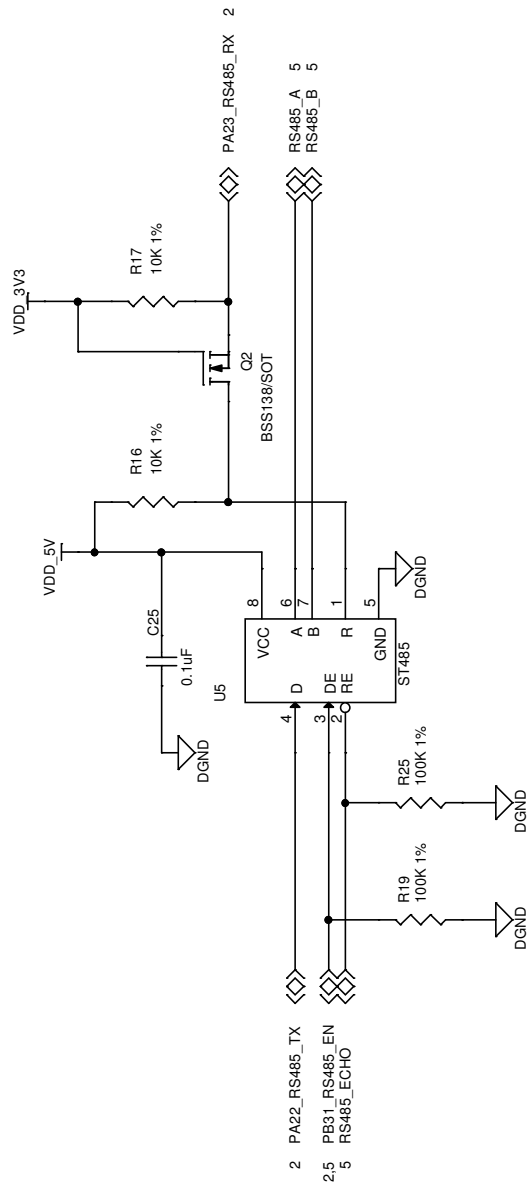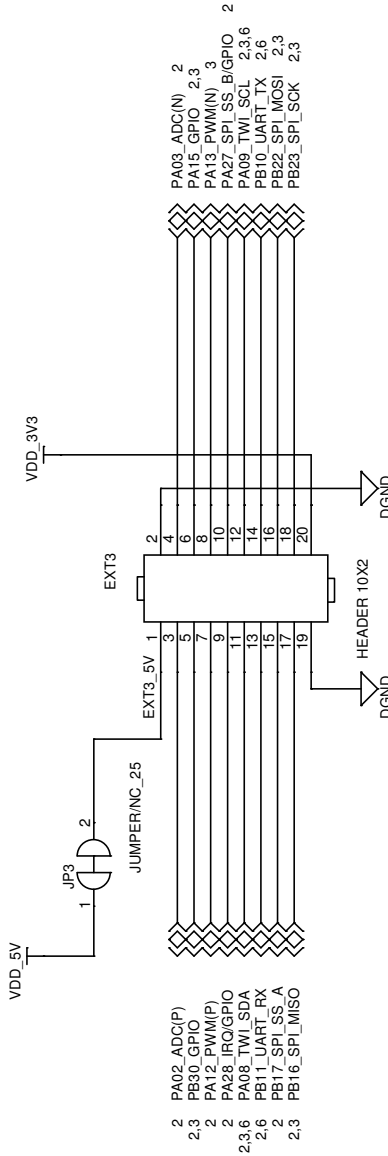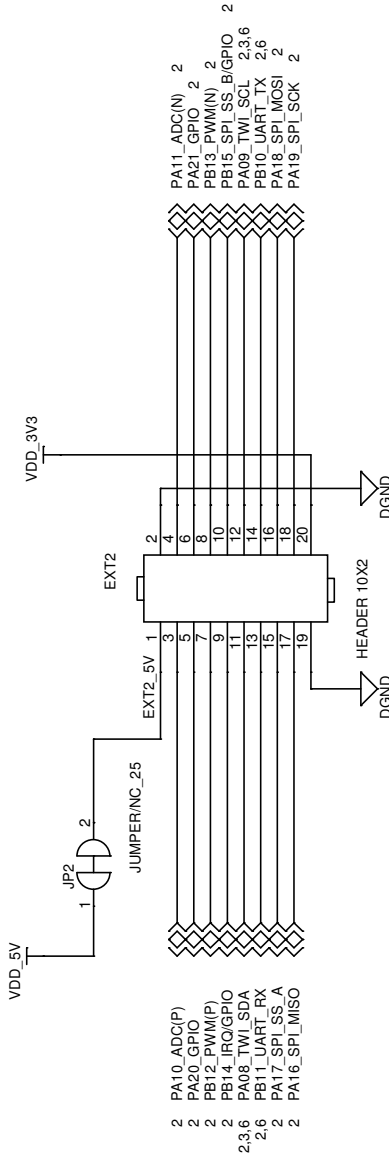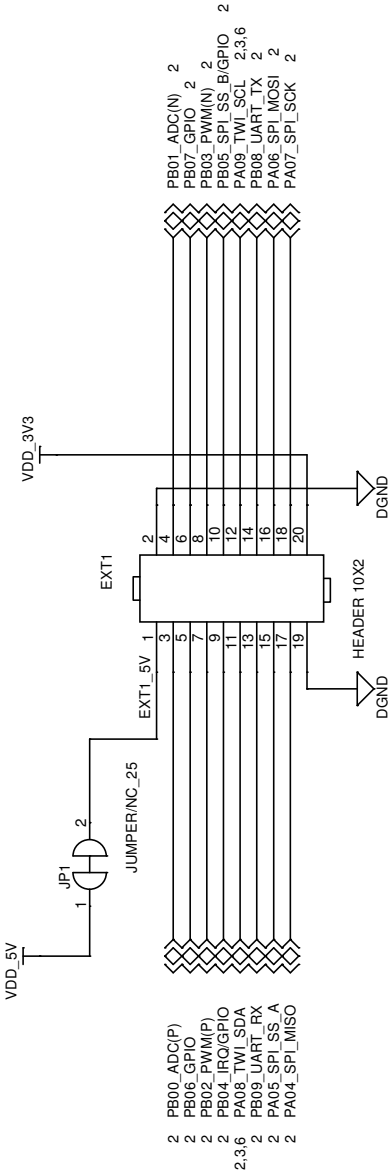Revision: D

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EXT1 (HEADER 10X2)

VDD_3V3

Pin	Signal	Ref
2	PB01_ADC(N)	2
4	PB07_GPIO	2
6	PB03_PWM(N)	2
8	PB05_SPI_SS_B/GPIO	2
10	PA09_TWI_SCL	2,3,6
12	PB08_UART_TX	2
14	PA06_SPI_MOSI	2
16	PA07_SPI_SCK	2
18		
20	DGND	

Pin	Signal	Ref
1	EXT1_5V	
3	PB00_ADC(P)	2
5	PB06_GPIO	2
7	PB02_PWM(P)	2
9	PB04_IRQ/GPIO	2
11	PA08_TWI_SDA	2,3,6
13	PB09_UART_RX	2
15	PA05_SPI_SS_A	2
17	PA04_SPI_MISO	2
19	DGND	

JP1 JUMPER/NC_25
VDD_5V

EXT2 (HEADER 10X2)

VDD_3V3

Pin	Signal	Ref
2	PA11_ADC(N)	2
4	PA21_GPIO	2
6	PB13_PWM(N)	2
8	PB15_SPI_SS_B/GPIO	2
10	PA09_TWI_SCL	2,3,6
12	PB10_UART_TX	2,6
14	PA18_SPI_MOSI	2
16	PA19_SPI_SCK	2
18		
20	DGND	

Pin	Signal	Ref
1	EXT2_5V	
3	PA10_ADC(P)	2
5	PA20_GPIO	2
7	PB12_PWM(P)	2
9	PB14_IRQ/GPIO	2
11	PA08_TWI_SDA	2,3,6
13	PB11_UART_RX	2,6
15	PA17_SPI_SS_A	2
17	PA16_SPI_MISO	2
19	DGND	

JP2 JUMPER/NC_25
VDD_5V

EXT3 (HEADER 10X2)

VDD_3V3

Pin	Signal	Ref
2	PA03_ADC(N)	2
4	PA15_GPIO	2,3
6	PA27_SPI_SS_B/GPIO	2
8	PA09_TWI_SCL	2,3,6
10	PB10_UART_TX	2,6
12	PA13_PWM(N)	3
14	PB22_SPI_MOSI	2,3
16	PB23_SPI_SCK	2,3
18		
20	DGND	

Pin	Signal	Ref
1	EXT3_5V	
3	PA02_ADC(P)	2
5	PA30_GPIO	2,3
7	PA12_PWM(P)	2
9	PA28_IRQ/GPIO	2
11	PA08_TWI_SDA	2,3,6
13	PB11_UART_RX	2,6
15	PB17_SPI_SS_A	2
17	PB16_SPI_MISO	2,3
19	DGND	

JP3 JUMPER/NC_25
VDD_5V

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