Overview

The USB-C-Switch is a 4:1 software-programmable USB Type-C port selector and multiplexer switch, designed for demanding industrial environments where advanced control and monitoring of USB Type-C ports is required.

The USB-C-Switch can be used to selectively switch a USB connection from one common port to one of 4 mux ports, conduct Type-C cable flip operations, measure current and voltages on V_{BUS} and V_{CONN} lines of all ports, and independently control USB data and power connections on each port.

Typical applications include:

- Manufacturing testing of USB Type-C ports
- USB device validation and development
- USB functional testing
- USB peripheral management
- USB Alt-mode testing
- USB PD profile testing
- Regression test environments
- Automating USB Type C port "flip"
- Automating USB plug/unplug operations
- Automation of Apple CarPlay® or Android Auto® testing

Features

- Selectively connect one USB Type-C® (USB-C) connection to any one of 4 channels
- Bidirectional 1:4 or 4:1 configurations
- Port priority mode for USB A-to-C connections
- All ports support USB 3.2 Gen 2x1 link speeds up to 10Gbps[1]
- All ports support USB PD profiles up to 100W (20V, 5A)[2]
- Execute USB-C cable flip via software control[3]
- Supports pass through of USB Alt-Modes (DisplayPort, HDMI and Digital Audio)
- High Speed (HS) Data, SuperSpeed (SS) Data, CC/V_{CONN}, SBU, and V_{BUS} power can be independently enabled, disabled, or routed to any channel
- Measure V_{BUS}, V_{CONN} voltage and current on each channel
- Available in Passive or Redriver versions
- DIN-rail mountable
- Certified to withstand ±15kV ESD strikes (IEC61000-4-2 level 4)

Description

The USB-C-Switch gives engineers advanced control of USB connections in testing and development applications. The USB-C-Switch consists of several layers of internal switches to achieve the 4:1 selector and USB line control functionality. Without any hub or other directional intermediary devices, the USB-C switch is can behave "like a cable" to connected devices. USB2, USB3, power, CC, V_{conn}, and SBU, are passed through the USB-C-Switch between the common-port and the selected mux port. Data link, power negotiations and power between USB devices are provided by the attached devices themselves, allowing the USB-C-Switch to be used bidirectionally in either a 1:4 or 4:1 configuration.

Power and software control connections to the USB-C-Switch are established and maintained over a dedicated USB-C control port.

Each USB-C-Switch is uniquely addressable and controllable from a host PC via USB-C control port which also provide power. Built on top of Acroname's BrainStem® platform, the USB-C-Switch is easily controlled over USB with simple high-level APIs in C, C++, Python and LabVIEW.

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[1] Passive version of S85-USBC-SWITCH may impose too much signal loss for systems to operate at 5Gbps or higher data rates; system link budget analysis required.

[2] USB Type-C 2.0 and Power Delivery 3.0

[3] Requires use of Acroname Universal Orientation Cable (UOC), C70-USBC-UOC or C67-USBC-UOC

Passive and Redriver Models

There are two available models of the USB-C-Switch: passive and redriver. The two models have different hardware installed by Acroname during manufacturing; the model cannot be changed after delivery. Acroname places a label on either the side of each USB-C-Switch indicating both the model and hardware revision (see example in Figure 1) or on the bottom of the USB-C-Switch (see example in Figure 2). High-level summary and intended applications of the two models are below with detailed differences in the specification tables.

Passive: Best for emulating off the shelf cables and for eye-diagram validation. Ordering part number: S85-PASS-USBCSW

Redriver: Best for general connectivity or longer cables. Includes a programmable, linear, equalizing redriver which allows USB signal tuning to compensate for insertion and cabling losses. Can provide a known-good reference transceiver plane for verification testing. Ordering part number: S85-RDVR-USBCSW
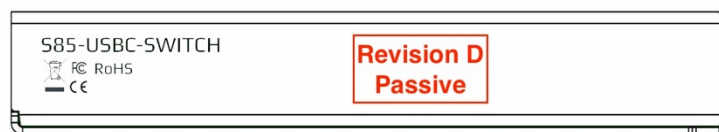

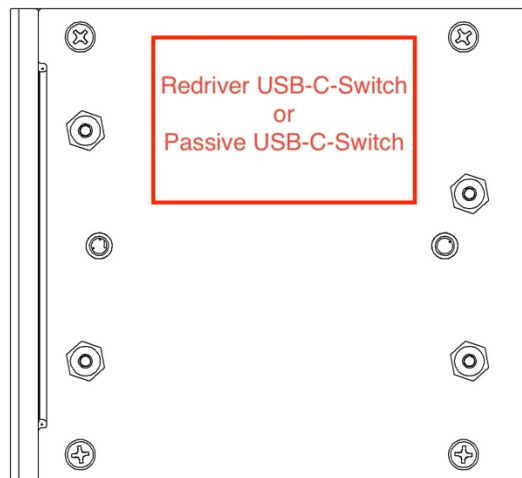*Figure 1: Side view showing model label location*

Figure 2: Bottom view showing model label location
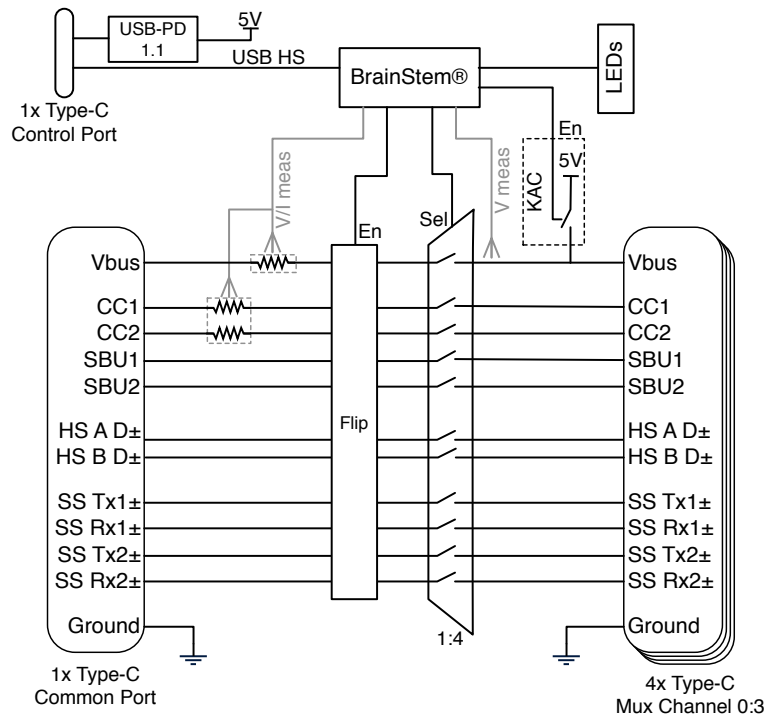
Passive Model Block Diagram

Figure 3: USB-C-Switch (Passive) functional block diagram for passive model

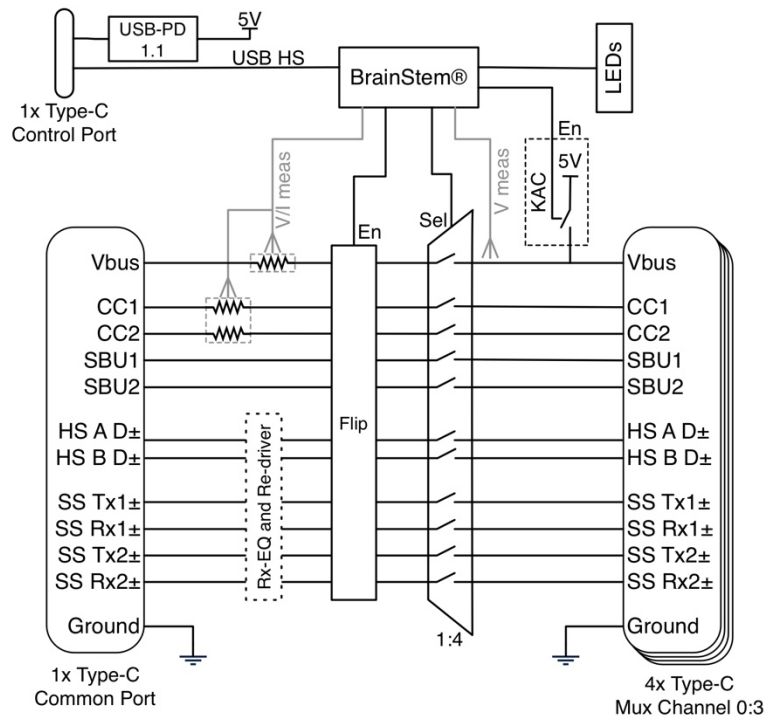## Redriver Model Block Diagram

Figure 4: USB-C-Switch functional block Diagram for redriver model

Application Diagrams

Figure 5: Typical testing application for validation against multiple types of devices.

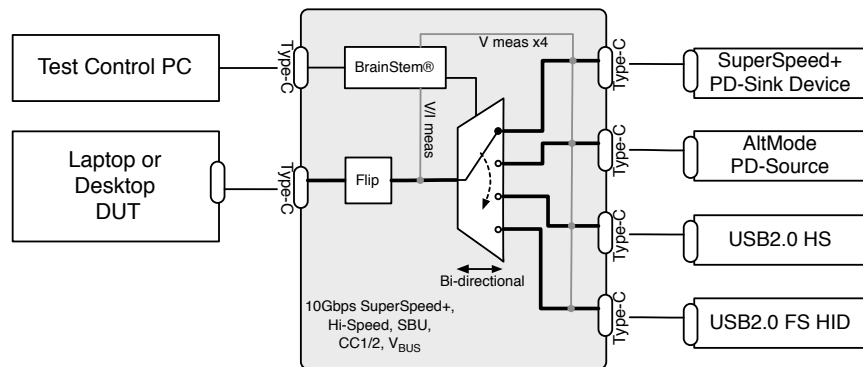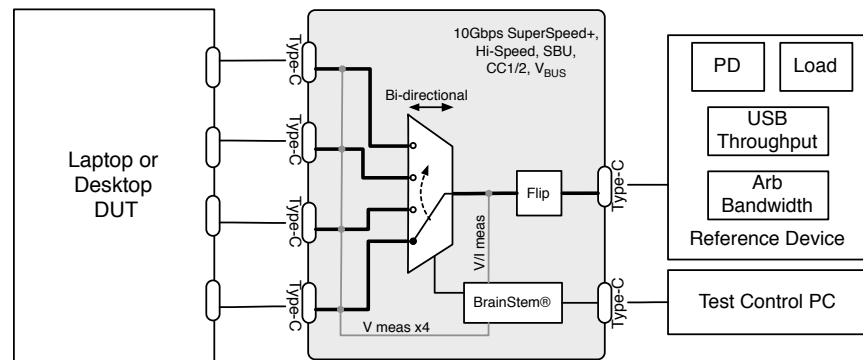*Figure 6: Typical testing application for validation against multiple types of devices.*
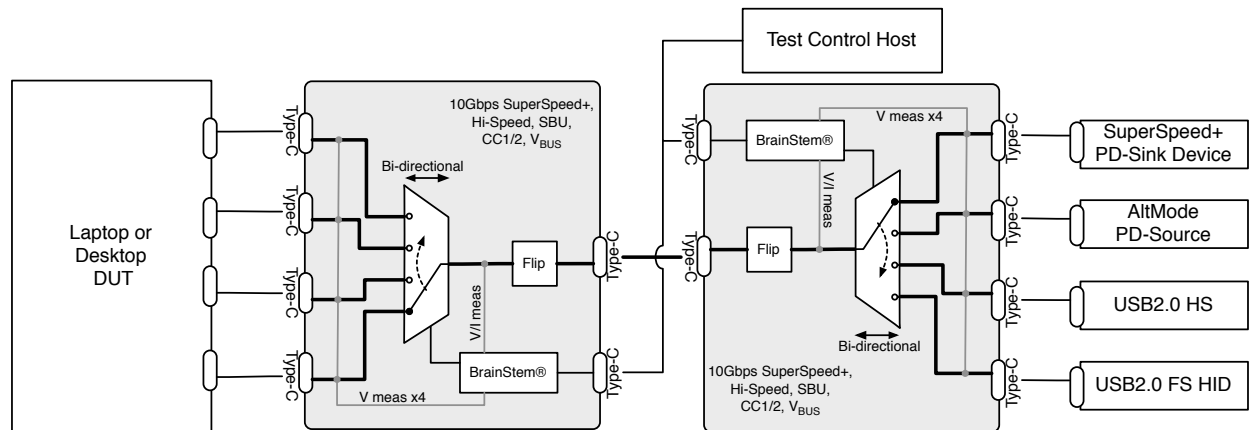
Figure 7: Typical testing application for validating multiple ports against multiple types of devices.[4]

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[4] Link budget considerations are crucial for application involving back-to-back USB-C-Switches. Redriver model is recommended.

Figure 8: Add Power Delivery charging to a non-PD system using the split mode feature[5]

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[5] Split mode can cause irreparable damage to connected devices. Due care should be exercised in setup and application.

Absolute Maximum Ratings[6]

Stresses beyond those listed under ABSOLUTE MAXIMUM RATINGS can cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other conditions beyond those indicated under RECOMMENDED OPE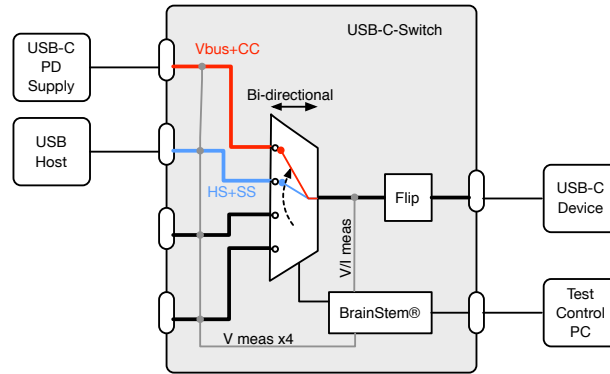RATING CONDITIONS is not implied. Exposure to absolute-maximum rated conditions for extended periods affects device reliability and may permanently damage the device.

Parameter	Minimum	Maximum	Units
Input voltage on V_{BUS} control port pin	-0.3	6.0	V
Voltage on any V_{BUS}, CC pin	-0.3	30	V
V_{BUS} current (bidirectional)	0.0	5.0	A
Voltage on any (SS) data pin	-0.3	2.5	V
Voltage on any USB High Speed (HS) data and SBU pins	-0.3	4.5	V
Altitude	-	2000	M
Overvoltage	-	Overvoltage Category II	-

Table 1: Absolute maximum ratings

Recommended Handling Ratings

Parameter	Conditions/Notes	Minimum	Typical	Maximum	Units
Ambient operating temperature, T_A	Non-Condensing	0	25	50	°C
Relative Humidity Range	Non-Condensing	5	-	95	%RH
Storage temperature, T_{STG}		-10.0	-	85.0	°C
Electrostatic discharge, V_{ESD}	Exceeds IEC 61000-4-2, level 4, air-discharge	-15	-	+15	kV
	Exceeds IEC 61000-4-2, level 4, contact-discharge	-8	-	+8	kV

Table 2: Handling ratings

Recommended Operating Ratings

Specifications are valid at 25°C unless otherwise noted. Indoor use only.

Parameter	Conditions/Notes	Minimum	Typical	Maximum	Units
Ambient operating temperature, T_A	Non-Condensing	0	25	50	°C
Relative Humidity Range	Non-Condensing	5	-	95	%RH
Input voltage on V_{BUS} control port pin		4.5	5.0	6.0	V
Voltage on any V_{BUS} pin		0.0	-	20.0	V
V_{BUS} current	Bidirectional	0.0	-	5.0	A
Voltage on SS data pin	Common mode	0.0	-	2	V
	Differential	0.0	-	1.8	V_{pp}
Voltage on any HS data pin		0.0	-	4.3	V
Voltage on any SBU pin		0.0	-	4.3	V
Voltage on any CC pin		0.0	-	5.0	V
Typical Operating Power	Without KAC Enabled	-	2.0	-	W

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[6] If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

Table 3: Recommended operating ratings

Typical Performance Characteristics

Specifications are valid at 25°C unless otherwise noted. Indoor use only. Sample rates are typically limited by the USB throughput of the host operating system except where bulk capture is supported.

Parameter	Conditions/Notes	Minimum	Typical	Maximum	Units
V_{BUS} common to mux port ON		200	250	350	mΩ
V_{BUS} current measurement resolution		-	1.95	-	mA
V_{BUS} current measurement accuracy		-	±0.5	-	%FS
V_{BUS} voltage measurement resolution		-	8	-	mV
V_{BUS} voltage measurement accuracy		-	±0.2	-	%FS
CCx current measurement resolution		-	976	-	µA
CCx current measurement accuracy		-	±0.5	-	%FS
CCx voltage measurement resolution		-	4	-	mV
CCx voltage measurement accuracy		-	±0.5	-	%FS
Keep-alive charge (KAC) voltage	Sourced from control port V_{BUS}	4.5	5.0	5.5	V
Keep-alive charge (KAC) current limit	Constant current mode short circuit to ground	600	800	1000	mA
A5 common to A5 mux DCR		1.0	-	1.1	Ω
B5 common to B5 mux DCR		1.0	-	1.1	Ω
A5 common to B5 mux DCR	Software flip condition	1.0	-	1.1	Ω
B5 common to A5 mux DCR	Software flip condition	1.0	-	1.1	Ω

Table 4: Typical performance characteristics for both models

Passive Model Typical Performance Characteristics

Values presented apply to the full operating temperature range.

Parameter	Conditions/Notes	Minimum	Typical	Maximum	Units
SS data single-ended insertion loss *(Passive model)*	f = 1.6 GHz	-	-4.5	-	dB
	f = 2.5 GHz	-	-8.0	-	dB
	f = 5.0 GHz	-	-11	-	dB
SS data differential OFF isolation	f = 0.3 MHz	-	-40	-	dB
	f = 2.5 GHz	-	-35	-	dB
	f = 5.0 GHz	-	-28	-	dB
SS data channel crosstalk	f = 0.3 MHz	-	-40	-	dB
	f = 2.5 GHz	-	-35	-	dB
	f = 5.0 GHz	-	-28	-	dB
SS data propagation delay		-	3.0	-	ns
SS data intra-pair skew		-	10	-	ps
SS data inter-pair skew		-	30	-	ps
HS data ON resistance		-	9.0	-	Ω
HS data ON resistance imbalance		-	0.5	-	Ω
HS data ON resistance flatness	V=0.0-1.0, VI=30mA	-	1.5	-	Ω
HS data propagation delay		-	0.6	-	ns
HS data OFF isolation		-	-48	-	dB
HS data crosstalk		-	-30	-	dB

Parameter	Conditions/Notes	Minimum	Typical	Maximum	Units
HS data 3dB bandwidth		-	1200	-	MHz
SuperSpeed SuperSpeed+ data rate	Cable link budget dependent	5	-	10	Gbps
HS data rate	SS data disabled	1	-	480	Mbps

Table 5: Typical performance characteristics for passive model

Redriver Model Typical Performance Characteristics

Specifications are valid at 25°C unless otherwise noted. Indoor use only. Sample rates are typically limited by the USB throughput of the host operating system except where bulk capture is supported. The redriver model is comprised of a daughter-card installed in the passive model. As such, the passive model specifications act as the baseline for the redriver model.

Parameter	Conditions/Notes	Minimum	Typical	Maximum	Units
SuperSpeed receiver equalization gain	5GHz, 1100mV transmitter bias, common to mux ports	-4.4	-	8.6	dB
	5GHz, 1100mV transmitter bias, mux to common ports	-2.1	-	10.5	dB
SuperSpeed input signal detect assert level	10 Gbps PRBS7 pattern, differential	-	80	-	mV_{pp}
SuperSpeed input signal detect de-assert level	10 Gbps PRBS7 pattern, differential	-	60	-	mV_{pp}
SS low-frequency periodic signaling (LFPS) detect threshold		100	-	300	mV
SS receiver dynamic range	Differential to any SS receiver	-	2000	-	mV_{pp}
SS transmitter dynamic range	Differential to any SS transmitter	-	1500	-	mV_{pp}
SS output jitter	PRBS7, 10Gbps	-	0.15	-	UI_{pp}
High Speed (HS) gain	Receiver EQ Level 0 or Transmitter 0mV	-	0	-	dB
	Receiver EQ Level 1, Transmitter 60mV	-	3	-	dB
	Receiver EQ Level 2, Transmitter 60mV	-	5	-	dB
	Receiver EQ Level 2, Transmitter 80mV	-	9	-	dB

Table 6: Typical performance characteristics for redriver model

Typical Measurements

Passive Model Measurements

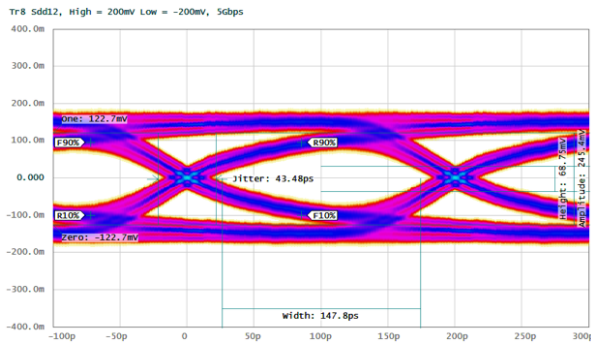*Figure 9: Typical SS data differential insertion loss*

Redriver Model Measurements
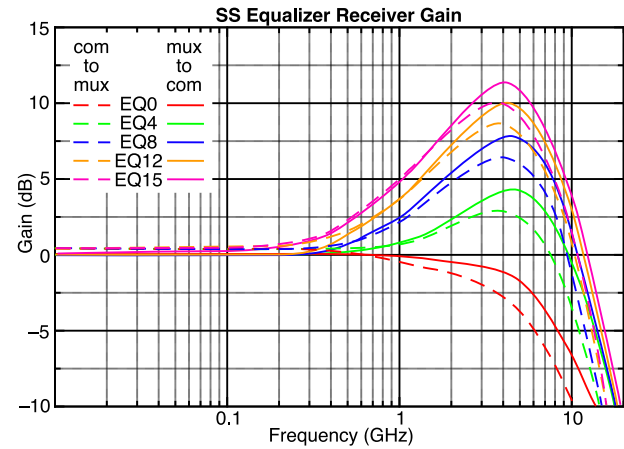
Figure 11: Redriver model SS equalizer receiver gain

Figure 10: Simulated SS data 5Gbps eye diagram

Overview

The USB-C-Switch is a platform to simplify switching of multiple USB Type-C ports. The switch is a bidirectional four-to-one or one-to-four multiplexer (mux) which can create a dedicated connection between a device on the common port and a device on one of the available mux channels. By not using a USB hub, the USB-C-Switch can be truly bidirectional meaning a USB host and device can be attached to either the common or mux side, and that device roles can be swapped. USB-C-Switch is compatible with USB Type-C® (USB-C) applications including link rates up to USB 3.2 Gen 2x1 SuperSpeed+ (10Gbps) and alternate modes (alt-modes), CarPlay® and Android Auto®. Supported alt-modes include HDMI, DisplayPort and digital audio.

At its core the passive model of the switch is an analog mux for USB Hi-Speed (HS), SuperSpeed+ (SS) and side band use (SBU) signals. V_{BUS} and CC signals pass through current and voltage measurement blocks for use in testing and debugging of USB-C systems. The CC lines have USB compliant cable orientation detection circuitry, which enables the USB-C-Switch to properly route signals when using two standard-compliant USB cables. Further, when used with an Acroname Universal Orientation Cable (UOC, part number C38-USBC-UOC), the USB-C-Switch includes circuitry to emulate a cable flip which reverses the apparent cable orientation to connected devices. This programmatic flip feature can be used to automate testing of both cable orientations without manual unplugging, changing orientation and re-inserting a USB-C cable.

The switch is powered and controlled by the USB-C control port, and will appears as a standard USB device when connect to control host. Using the BrainStem software APIs, all features of the USB-C-Switch can be programmatically controlled including selecting a mux channel to be connected to the common port.

Cable Flip

A key feature of the USB-C connector is its symmetric design allowing for insertion in either orientation. This makes the USB-C connector user-friendly yet complicates the development of devices using the USB-C standard. The orientation is defined by the cable or downstream device in the system; more specifically, by components inside of the USB-C male plug of a connection. The USB-C specification makes determining connector orientation a responsibility of the active devices in the system.

Figure 12 shows example block diagrams of the flip feature when connecting a host through a full-featured, non-marked cable to a direct-connected downstream device. Related USB SS, HS and SBU lines are also routed appropriately, though omitted from the diagram for clarity.
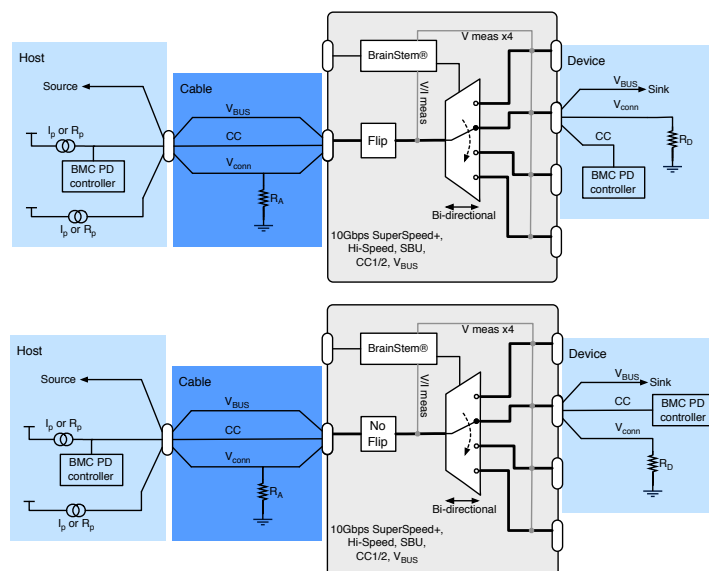

Figure 12: Flip and no-flip setting for full-featured cable and device

With an Acroname UOC cable, the USB-C-Switch enables the unique ability to affect a cable orientation flip. When this orientation flip occurs, it will appear connected devices that the orientation of their connection has reversed. Most USB-C devices with a female socket will include at least one set of muxes in order to route signal to the correct side of the socket based on the

orientation of the cable. These muxes are vital to the end-user orientation agnostic experience of USB-C. When testing such a system it is important to test both orientations to ensure that these internal muxes are functioning. Normally this is done by manually flipping a cable connection, which is time consuming, subjective and error prone. The USB-C-Switch allows flipping of USB-C cable connections to be programmatically automated.

When making connections between devices, as a general rule, ensure that there is only one standard-compliant cable in the connection path between the USB host and USB device. That is, a UOC should be used on either the common port or mux port to enable automated cable flips. The UOC should be connected to the device under test.

When not using the cable flip feature, any standard USB-C cable can be used on both sides of the USB-C-Switch. The orientation of the cables needs to be matched to facilitate a connection through the switch.

Keep-Alive Charging (KAC)

It is common to use battery powered devices on either side of the USB-C-Switch. When these devices are not in the active path, either on the common or mux side, the device battery may discharge. The USB-C-Switch has the unique feature of Keep-Alive Charging (KAC) for the mux channel connections.

When KAC is enabled, the KAC circuit connects power from the control port V_{BUS} to all non-selected mux channel V_{BUS} lines. KAC power is applied only to inactive mux channels and is not applied to the actively selected mux channel since the actively selected channel has a power path to the common port. KAC is automatically disabled when mux split mode is enabled.

The KAC circuit does not provide any USB power-delivery (USB-PD), USB battery charge specification (BC1.2) or QuickCharge® to these non-selected mux ports. Mux channels with KAC enabled are configured in a dedicated charge port mode (DCP) which is compatible with the CLA protocol from USB v1.1 so most mobile devices will support some level of charging from KAC. KAC is current limited and should a connected device draw more than the allowed current, the KAC circuit will go into a constant current mode, dropping the voltage to maintain the current. The KAC circuit is thermally protected and will disable KAC power outputs if needed. KAC must disabled and re-enabled to restore charging after being disabled on any port due to over-current or over-temperature,.
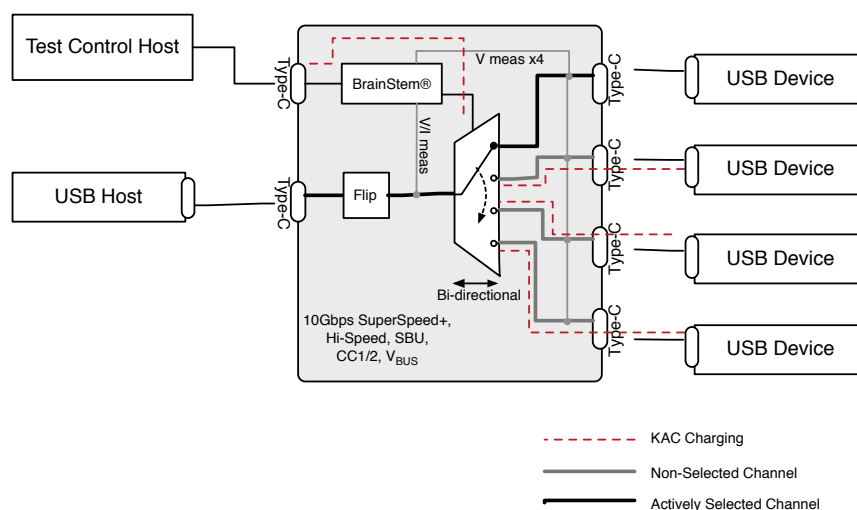

Figure 13: Typical example of KAC charging

Mux Modes

Default Mode

The default behavior of the USB-C-Switch is to act as a port selector, where all USB-C lines are connected between the common port and one selected mux channel.

Channel Priority Mode

In channel priority mode, the USB-C-Switch automatically selects the lowest-numbered mux port where V_{BUS} is detected, enabling simple automatic host selection. Note that this will only work with USB A-to-C cables, since V_{BUS} is not immediately available on USB-C to USB-C connections.

Split Mode

In some cases, it is desirable to split the connections in a USB-C cable and route them to different mux paths. A common application is to be able connect a USB device to a host machine for USB data while connecting V_{BUS} charging from a device specific charger.

Split mode gives control over individual signal groups, allowing each group to be connect to a mux channel. V_{BUS} can be connected to any combination of mux channels or disabled on the mux channels. Signal groups under Split control assignment are: V_{BUS}, SSA (TX1+/-, RX1+/-), SSB (TX2+/-, RX2+/-), HSA (D+/-, Side A), HSB (D+/-, Side B), CC1, CC2, SBU1, and SBU2.

When split mode is enabled, V_{BUS} is given a multi-point split capability such that it can be assigned to multiple mux channels concurrently, which is useful for powering multiple devices. Acroname recommends that V_{BUS} be assigned to only one mux channel. Caution should be used with multi-point V_{BUS} assignments as it is possible to apply a V_{BUS} voltage to a device that has not negotiated for high V_{BUS} voltages which could damage connected devices.

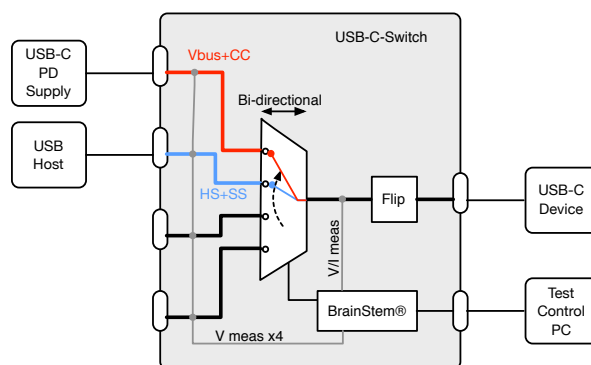When split mode is enabled, USB-C-Switch will automatically disable the Keep-Alive-Charging (KAC) feature.

Figure 14: Adding USB-C PD charging capability to a legacy USB host output

CAUTION: Split mode can create connections and configurations not possible or compliant with standard USB equipment. Using this feature could cause unexpected voltages to be applied to devices which may damage connected equipment

Device Drivers

The USB-C-Switch leverages operating system user space interfaces that do not require custom drivers for operation on all modern operating systems including Windows, Linux and MacOS X. With a connection between a host PC and the USB-C control port, the host PC will recognize a USB full-speed device named "USBCSwitch".

Legacy operating systems like Windows 7 may require the installation of a BrainStem USB driver. Installation details on installing USB drivers can be found within the BrainStem Development Kit under the "drivers" folder.

Capabilities and Interfaces

The USB-C-Switch is built on Acroname's BrainStem platform which provides simple, high-level APIs, a real-time embedded runtime engine, and modular expandability. Details of the API functionality unique to the USB-C-Switch are described in the following sections. Refer to BrainStem Reference documentation[7] for generic information about the APIs. See **Error! Reference source not found.** for a complete list of supported BrainStem API calls. All shortened code snippets are loosely based on the C++ method calls and are meant to be used as example pseudocode. Reflex methods are not currently supported by USB-C-Switch.

At the highest level, BrainStem devices present a unified device class. The USB-C-Switch uses the USBCSwitch class. Within this device class are many entities, sometimes in arrays of entities, which behave like software classes. Each entity has one or more options (similar to methods) which may take parameters. Most entity options are designed as "getters" and "setters".
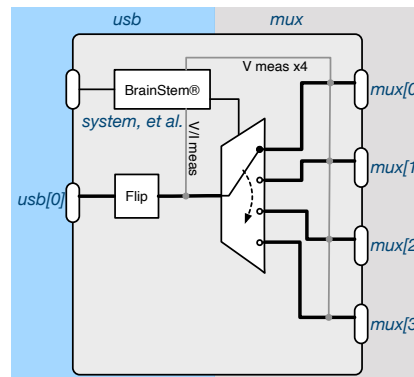

Figure 15: High-level device class division

The USBCSwitch device class logically divides the hardware between the common port and the mux ports as shown in Figure 15. The *usb* entity controls and interfaces to aspects of the common while the *mux* entities controls and interfaces to aspects of the mux ports. Since the USB-C-Switch generally connects the common port to one mux port, the *usb* entity controls many low details of the connection while the *mux* entity generally selects which mux port is enabled. The details of this concept are made clear in each of the entity descriptions.

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[7] BrainStem API reference https://acroname.com/reference/

Pinouts and Connectivity

USB Type-C Connector Overview

The USB-C-Switch uses standard USB pin outs for the Type-C female receptacles shown in Figure 16. The side-A and side-B USB HS D+ and D- are separately passed through the USB-C-Switch. The common port to mux port pin mapping for normal and flip modes is shows in Figure 17.

A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12
GND	TX1+	TX1-	VBUS	CC1	D+	D-	SBU1	VBUS	RX2-	RX2+	GND

GND	RX1+	RX1-	VBUS	SBU2	D-	D+	CC2	VBUS	TX2-	TX2+	GND
B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1

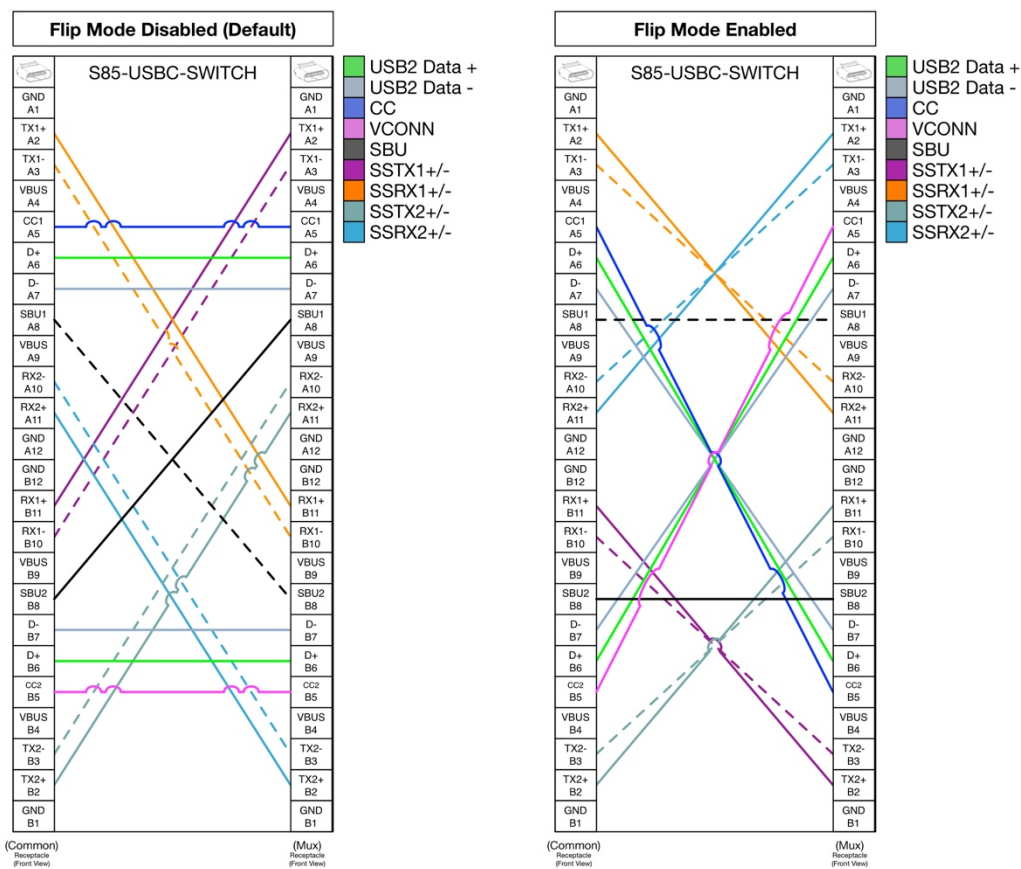*Figure 16: USB type-C receptacle pin out*

Figure 17: Common to mux port pin mappings

Redriver Model Alt-Mode Configurations

For alt-modes, the pin mappings and directions may affect connectivity and functionality. In many cases, the connected devices should simply negotiate through the switch. With some alt-modes, some of the functional groups need to be assigned a specific direction.

Common Port Pin								Mux Port Pin Normal	Mux Port Pin Flipped
Redriver Config	USB 3.1	4 Lane DisplayPort Host on Common	4 Lane DisplayPort Host on Mux	2 Lane DisplayPort Host on Mux with USB3.1	2 Lane DisplayPort Host on Common with USB3.1	2 Lane DisplayPort Host on Common with USB 3.1 Inverted	2 Lane DisplayPort Host on Mux with USB 3.1 Inverted	*Color Key* USB HS / USB SS / DisplayPort (alt-mode)	
A2	←	→	←	←	→	→	←	B11	A11
A3	←	→	←	←	→	→	←	B10	A10
A10	→	→	←	←	→	→	←	B3	A3
A11	→	→	←	←	→	→	←	B2	A2
B2	←	→	←	←	←	→	→	A11	B11
B3	←	→	←	←	←	→	→	A10	B10
B10	→	→	←	→	→	←	←	A3	B3
B11	→	→	←	→	→	←	←	A2	B2
A8	↔	↔	↔	↔	↔	↔	↔	B8	A8
B8	↔	↔	↔	↔	↔	↔	↔	A8	B8

Table 7: Redriver model pin function and direction

Physical Connections and Interface

LED Indicators

On common side of the USB-C-Switch there is a set of indicators that show control information and connectivity status. The meaning and location of each LED are described in the following tables and diagrams.

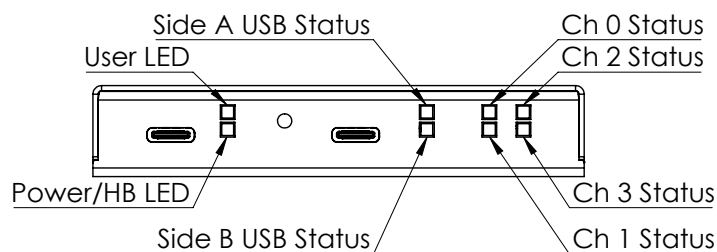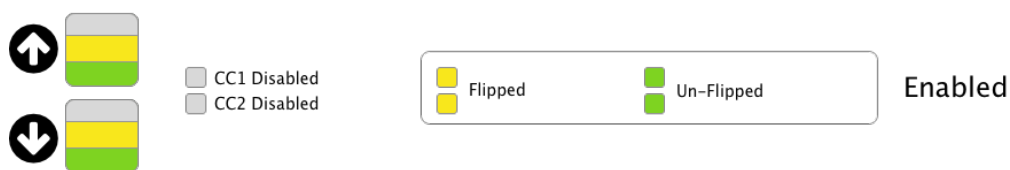| LED Name	Color	Description
User	Blue	Can be manipulated through the available APIs
Power/ Heartbeat	Red/Green	Red indicates system is powered. Flashing green is the heartbeat which indicates an active software connection. Pulses at a rate determined by the system heartbeat rate to indicate an active BrainStem link.
Side A USB Status	Green/Yellow	See Figure 12 for status indications.
Side B USB Status	Green/Yellow	
Channel 0 Status	Blue	Indicates Mux Channel selection. Disabled when Split mode is enabled.
Channel 1 Status	Blue	
Channel 2 Status	Blue	
Channel 3 Status	Blue	

Figure 18: LED positions

Figure 19: LED status

USB Connections

The rear of the USB-C-Switch has two USB Type-C connections – BrainStem control/power, and the single port side of the switch, referred to as the common port.
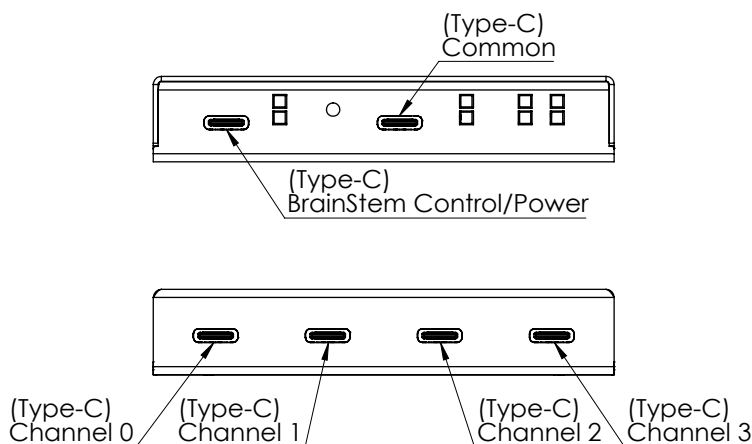
(Type-C)
Common

(Type-C)
BrainStem Control/Power

(Type-C)
Channel 0   (Type-C)
Channel 1

(Type-C)
Channel 2   (Type-C)
Channel 3

Figure 20: USB-C connector names

Power Input

Power for the USB-C-Switch is provided by the V_{BUS} line on the control port. This port supports USB Power Delivery 1.1 (USB-PD) high current mode of 5V at 3A. See Table 3: Recommended operating ratings for input voltage and power requirements.

Unit Reset

The USB-C-Switch can be reset to factory default settings using the reset button on the control side. Pressing the reset button once will restart the USB-C-Switch as if it had been power cycled. To restore factory default settings, press the reset button two times within 5 seconds.
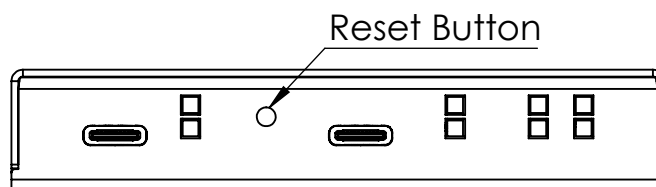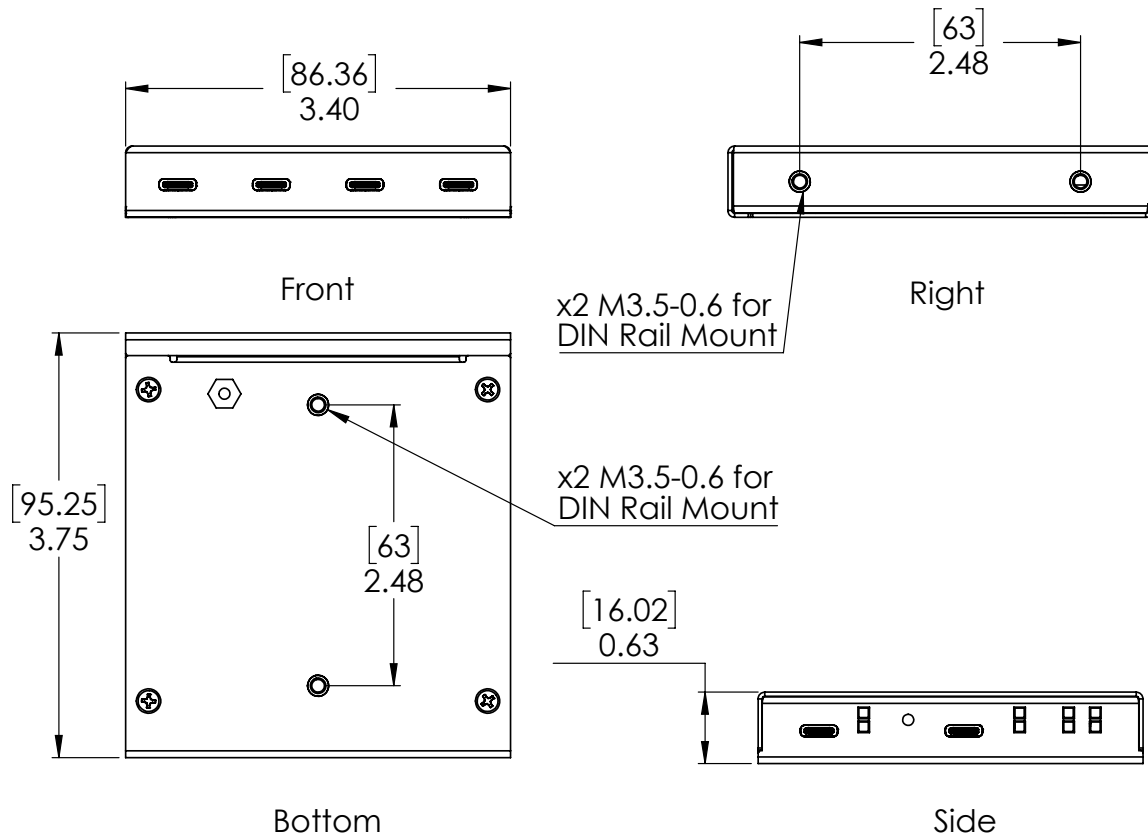
Reset Button

Figure 21: Reset button location

Mechanical

Dimensions are shown in inches [mm]. 3D CAD models available from https://acroname.com.

Figure 22: USB-C-Switch Mechanical Dimensions

DIN Rail Mounting

DIN rail mounting provisions have been designed into the USB-C-Switch case. Holes for a DIN rail clip/adapter are provided to allow mounting of the switch to standard DIN rails. Mounting clip hardware is available separately in a kit from Acroname: part number C31-DINM-1.

The USB-C-Switch can be mounted in two positions as shown in Figure 17.

Warning: Care should be taken to only use clip mounting hardware included by Acroname. Longer screws will cause irreparable damage to the USB-C-Switch.
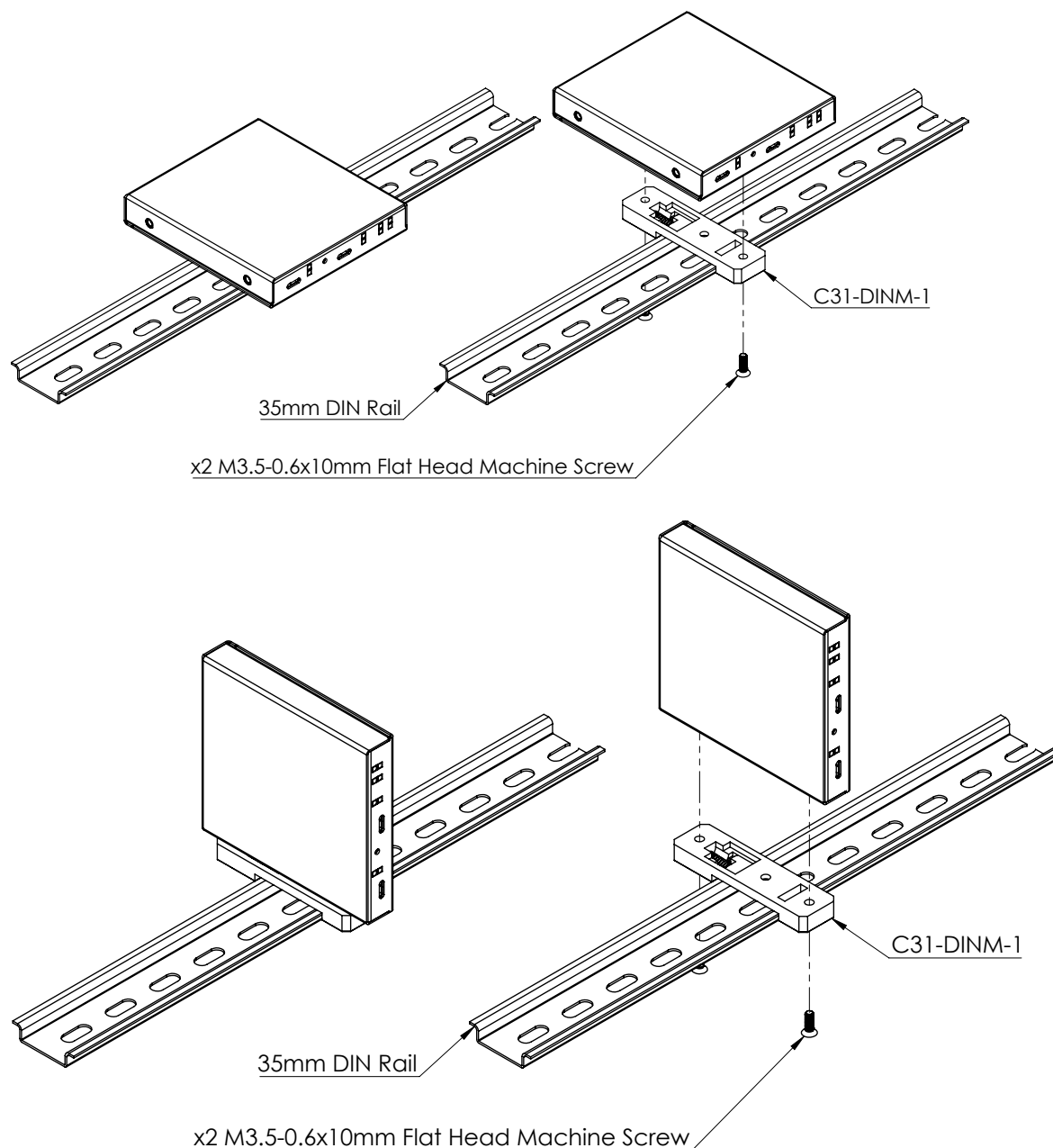

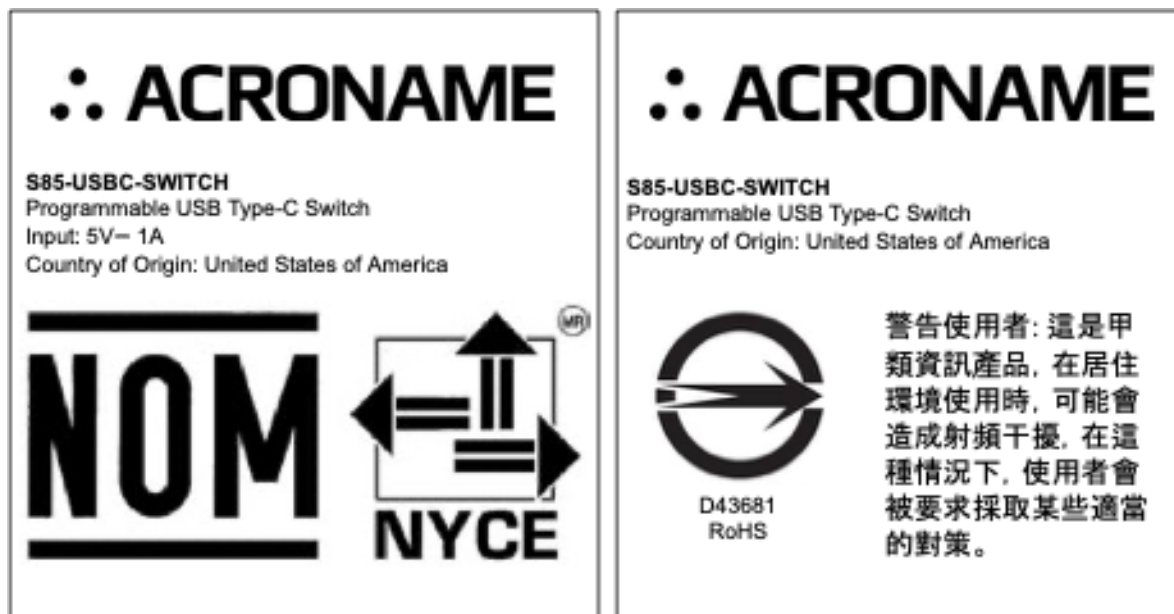*Figure 23: USB-C-Switch DIN Rail mounting*

FCC Compliance Statement

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.

- Increase the separation between the equipment and receiver.

- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

- Consult the dealer or an experienced radio/TV technician for help.

```
This device complies with part 15 of
FCC Rules.  Operation is subject to the
following two conditions; (1) This
device may not cause harmful
interference, and (2) this device must
accept any interference received,
including interference that may cause
undesired operation.
```

Compliance Information

BSMI RoHS Table

設備名稱： USB-C-Switch ， Equipment name 型號（型式）：S85-USBC-SWITCH Type designation (Type)						
單元Unit	限用物質及其化學符號 Restricted substances and its chemical symbols					
	鉛Lead (Pb)	汞Mercury (Hg)	鎘Cadmium (Cd)	六價鉻 Hexavalent chromium (Cr^{+6})	多溴聯苯 Polybrominate d biphenyls (PBB)	多溴二苯醚 Polybrominate d diphenyl ethers (PBDE)
機殼 Chassis	○	○	○	○	○	○
電路板 PCB Board	○	○	○	○	○	○
連接器 Connector	○	○	○	○	○	○
電子元件 Electronic Component	○	○	○	○	○	○
備考1.〝超出0.1 wt %〞及〝超出0.01 wt %〞係指限用物質之百分比含量超出百分比含量基準值。 Note 1： "Exceeding 0.1 wt %" and "exceeding 0.01 wt %" indicate that the percentage content of the restricted substance exceeds the reference percentage value of presence condition. 備考2.〝○〞係指該項限用物質之百分比含量未超出百分比含量基準值。 Note 2： "○" indicates that the percentage content of the restricted substance does not exceed the percentage of reference value of presence. 備考3.〝—〞係指該項限用物質為排除項目。 Note 3：The "-" indicates that the restricted substance corresponds to the exemption.						

Product Support

Questions about the product operation or specifications are welcome through Acroname's contact portals. Software downloads, reference API and application examples are available online at:

https://acroname.com/support

Direct communication and additional technical support are available at:

https://acroname.com/contact-us

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Document Revision History

All major documentation changes will be marked with a dated revision code

Revision	Date	Engineer	Description
0.1	January 2017	JTD	Pre-Release
0.2	July 2017	JLG	Preliminary release
0.3	September 2017	JRS	API updates to preliminary release
1.0	September 2018	LCD	Release and update for hardware, API enhancements
1.1	November 2018	LCD	Corrected support for reflex method
1.2	May 2019	MJK	Added initial documentation support for Redriver
1.3	September 2019	TDH	Corrected typo
1.4	February 2021	MJK	Contact information for technical support.
1.5	June 2021	JLG	Clean up; update loss specifications
1.6	October 2021	MJK	Added altitude, overvoltage information.
1.7	April 2022	FEC	Included NOM label
1.8	April 2022	FEC	Included BMSI Label and BMSI RoHS Table; Changed recommended operating range for VBUS
1.9	August 2022	CJD	Removed API Entities
1.10	February 2024	KSP	Added bottom view of redriver vs passive label
1.11	November 2024	RMA	Added channel priority
1.12	July 2025	KSP	Added typical power consumption to table 3