



## USB4 Features

- Real-time tracking of up to 4 incremental encoders with or without index (up to 5 MHz encoder input frequency)
- 4 channel pulse width, pulse period and RPM measurement
- Available with single-ended or differential encoder inputs, optional DIN rail mounting
- 8 digital outputs, 8 digital inputs, 4 A/D inputs, 4 D/A outputs
- Flexible triggering modes and 32 Mbyte RAM buffer for data capture
- Programmable sampling period from 2  $\mu$ S to approx. 2 hours
- Digital input levels up to +25V
- Digital outputs with open drain FET for up to 1A switching
- Easy to use demo software, Windows DLLs for C++/C#/Visual Basic and example source code provided



## USB4 Product Description

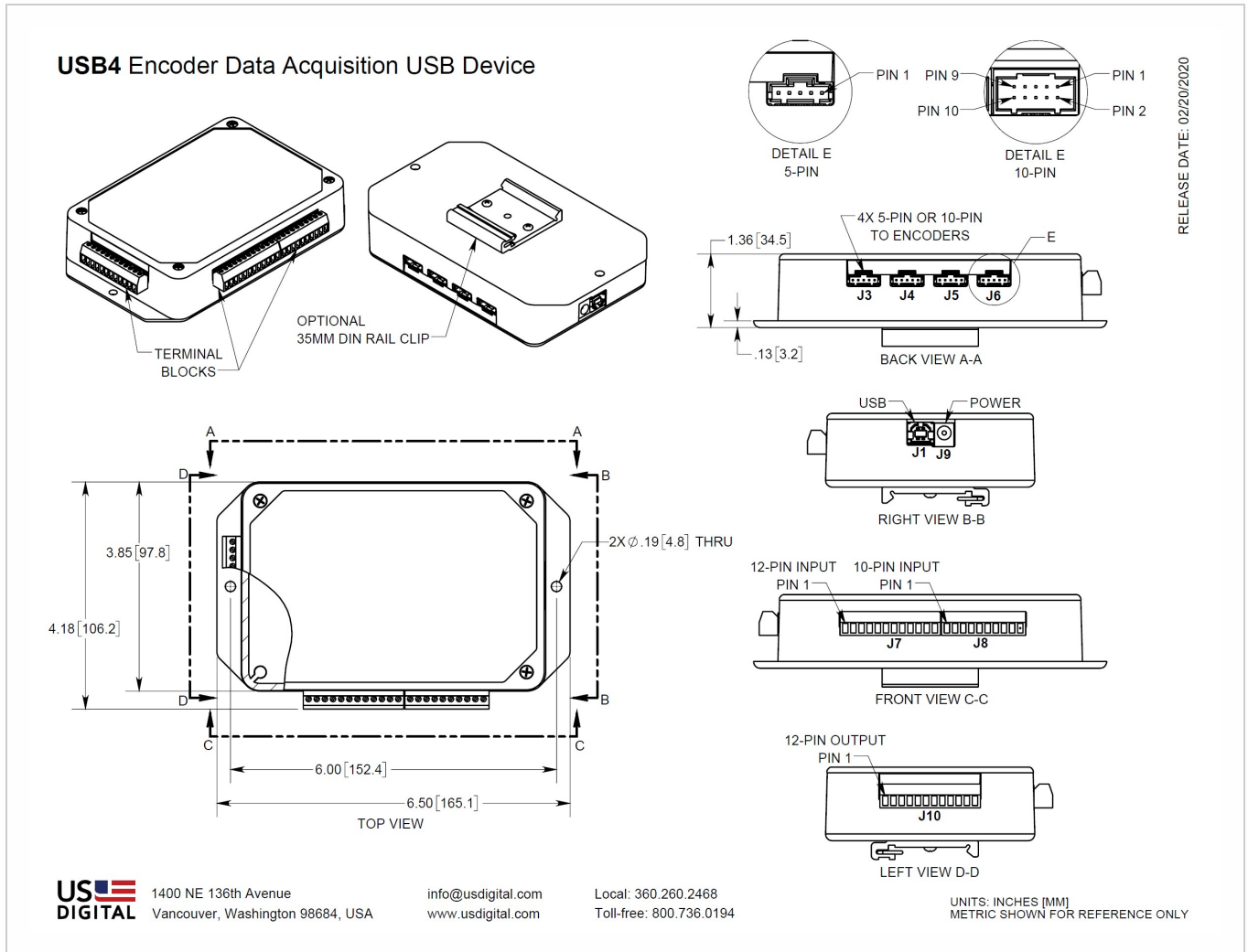
The USB4 is a data acquisition device designed to record data from 4 incremental encoders, 8 digital inputs, and 4 analog input channels. In addition, the USB4 provides 8 digital outputs and 4 analog output channels. The 8 digital outputs also have a latching emergency stop (E-Stop) input. When the E-Stop input is activated, the 8 digital outputs will turn off immediately. The analog input/output channels provide 12-bit data conversions at rates up to 44 kHz per channel. All communication between the USB4 and the host PC is sent over a USB interface. To handle continuous streaming of data over USB to the host PC, the USB4 has a 32 Mbyte FIFO buffer.

The digital input port can handle input logic levels from +3V to +25V, and the digital output port has open-drain MOSFET outputs to switch up to 1A at +25V. The range of the analog input/output channels is 0V to +5V. Four independent incremental encoder interfaces are implemented in hardware on the USB4. Each encoder channel has a 24-bit up/down counter that is easily reconfigured for various counting modes such as modulo-N, non-recycle, range-limit, and normal counter mode. You can select quadrature input modes of x1, x2, x4, clock/direction, and indexing modes. Each encoder channel can measure the pulse width and pulse period of its "A" input while simultaneously decoding the quadrature state. This feature allows RPM speed measurements to be made from the encoder input or interfacing to sensors with PWM (pulse width modulated) outputs.

The USB4 can capture data once per clock cycle of a user-programmable 32-bit clock generator or on every rising or falling edge of the input port pins. Data capture can be programmed to run continuously or to start only when certain conditions are met, such as the encoder count matching a certain value or if there is encoder movement in a certain direction. Encoder events can also output on the output port to trigger external devices. You can set trigger conditions for the analog input and PWM input channels; in addition, the USB4 can be configured to have the input port pins serve as a trigger to start data acquisition. The input port triggering allows the user to form the final trigger from a combination of conditions on the input port with up to 2 levels of triggering.

Software and documentation needed to use the USB4 are available on the US Digital website. A PC demo application allows the user to configure and explore various features of the USB4 using a graphical user interface. A library with a detailed Application Programming Interface is included so users can develop their own applications. US Digital provides several examples that demonstrate how to use the FIFO, log data, etc. For users that prefer lower-level control, a documented register-based interface is provided so you can configure the USB4's internal registers at the bit level.

## Mechanical Drawings



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UNITS: INCHES [MM]  
METRIC SHOWN FOR REFERENCE ONLY

## Specifications

### ENVIRONMENTAL

PARAMETER	MIN.	MAX.	UNITS
Operating Temperature	0	70	C



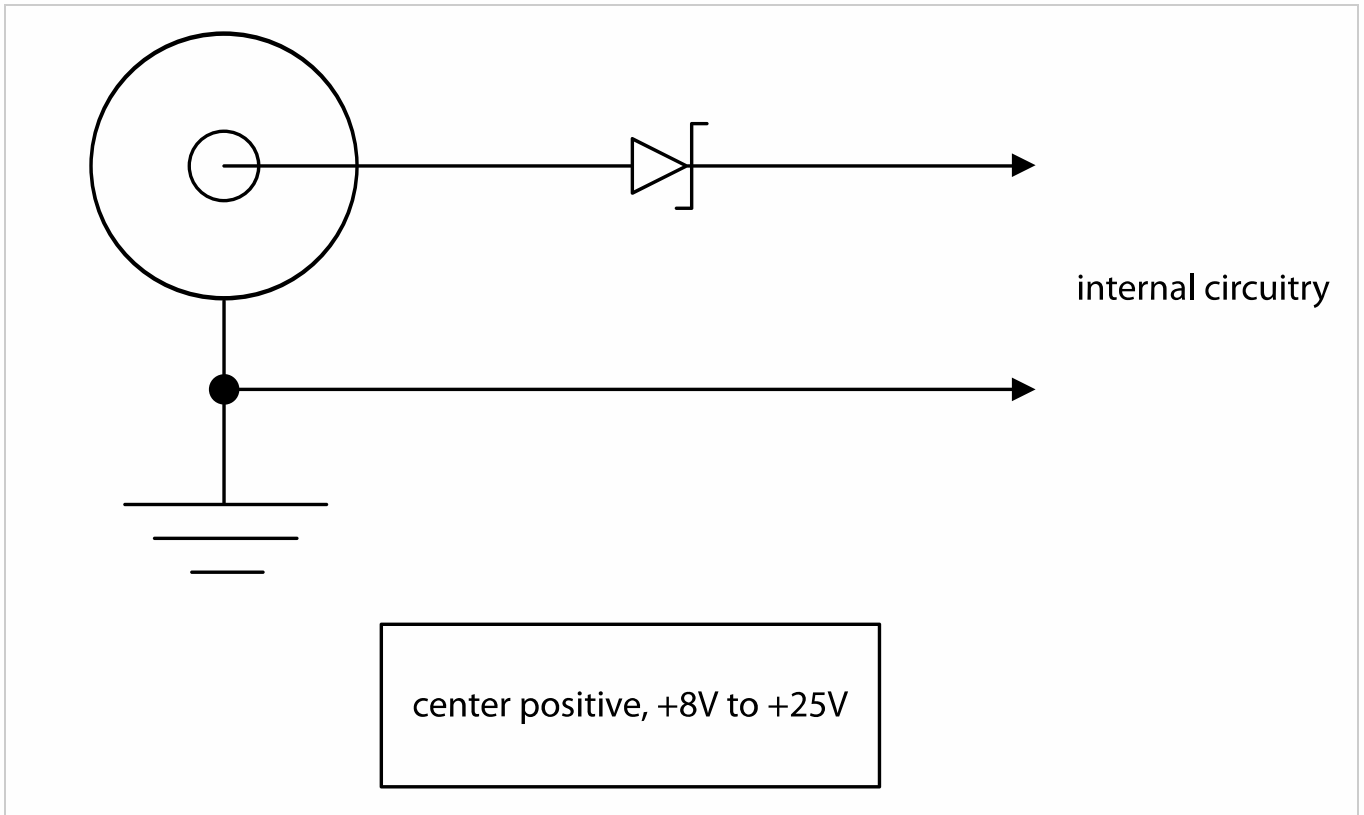
## ELECTRICAL

Parameter	Value
Supply Voltage	8V to 25V
Digital Output Pins	Open drain voltage, 25V max. Open drain sink current, 1A max.
Digital Input Pins	VIL(max) = 0.8V VIH(min) = 2.0V with approx. 100 mV of hysteresis VIH(max) = 24V
Analog Output Range	12-bit DAC, 0V to 5V
Analog Input Range	12-bit ADC, 0V to 5V
Power consumption	115 mA @ 8 V, 77 mA @ 12 V or 42 mA @ 24V typical. (USB connected, no encoders connected, all LED's off)
Max. current drawn from +5V outputs	550 mA (combined current of all +5V output terminals)
Max. encoder input frequency	5 MHz
Max. FIFO write speed (Time Based Triggering)	500 kHz
Max. FIFO write speed (Event Based Triggering)	Counter - 200 kHz, Input Port - 100 kHz



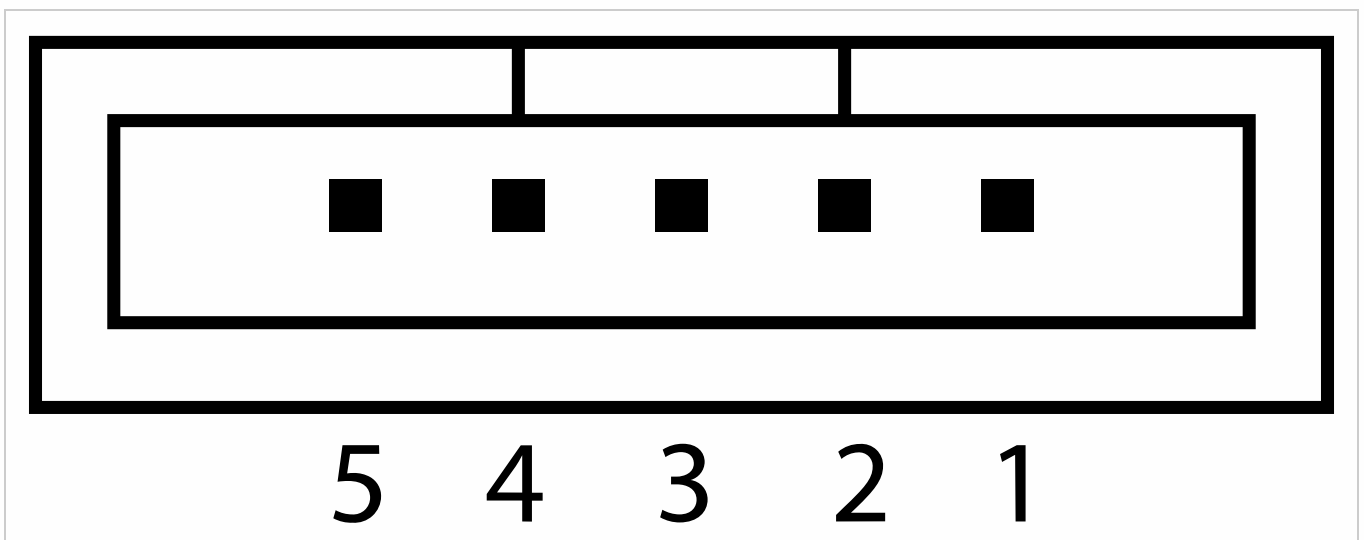
## POWER INPUT

J9:



## SINGLE ENDED ENCODER INPUTS

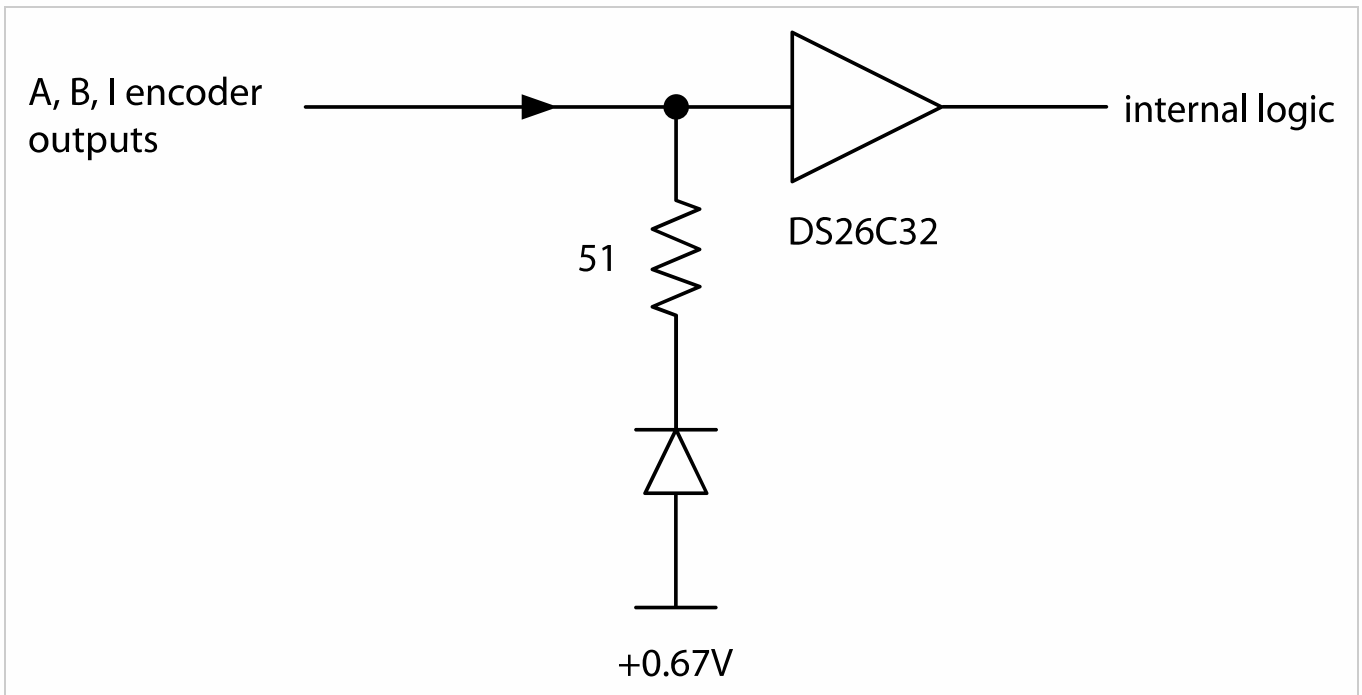
Encoder Channel 3,2,1,0 (J3, J4, J5, J6) Pin-out (USB4-S option):





PIN NUMBER	DESCRIPTION
1	Ground
2	Index
3	A Channel
4	+5V out
5	B channel

### Single Ended input circuit (internal to USB4):

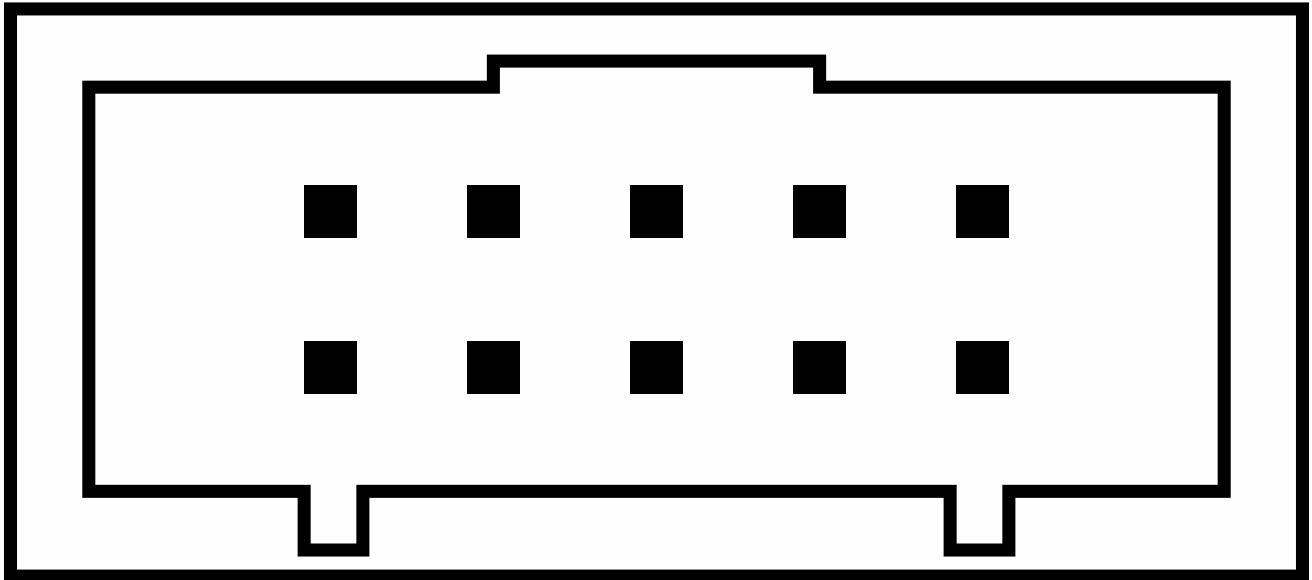


### DIFFERENTIAL ENCODER INPUTS

Encoder Channel 3,2,1,0 (J3, J4, J5, J6) Pin-out (USB4-D option):



9 7 5 3 1



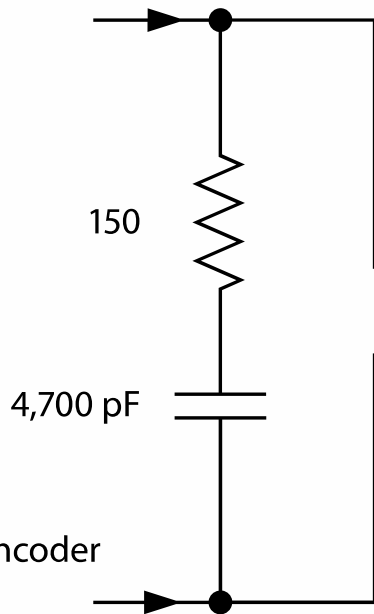
10 8 6 4 2

PIN NUMBER	DESCRIPTION
1	No connection
2	Ground
3	Index-
4	Index+
5	A- channel
6	A+ channel
7	+5V out
8	No connection
9	B- channel
10	B+ channel

**Differential Input Circuit (internal to USB4):**



A+,B+,I+ encoder outputs



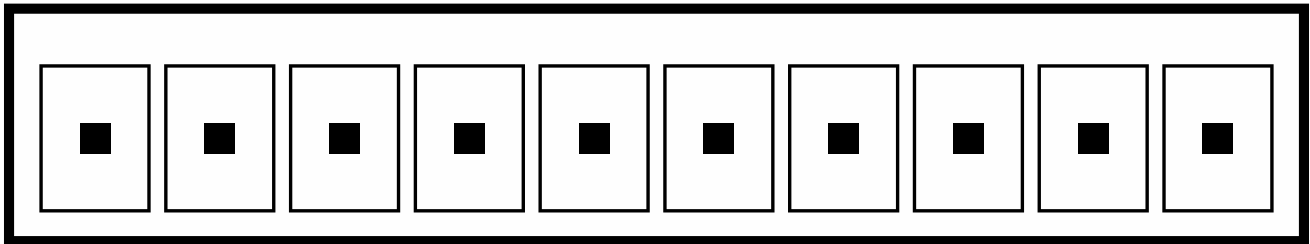
DS26C32

internal logic

A-,B-,I- encoder outputs

## DIGITAL INPUT PORT

J8 Pin-out:

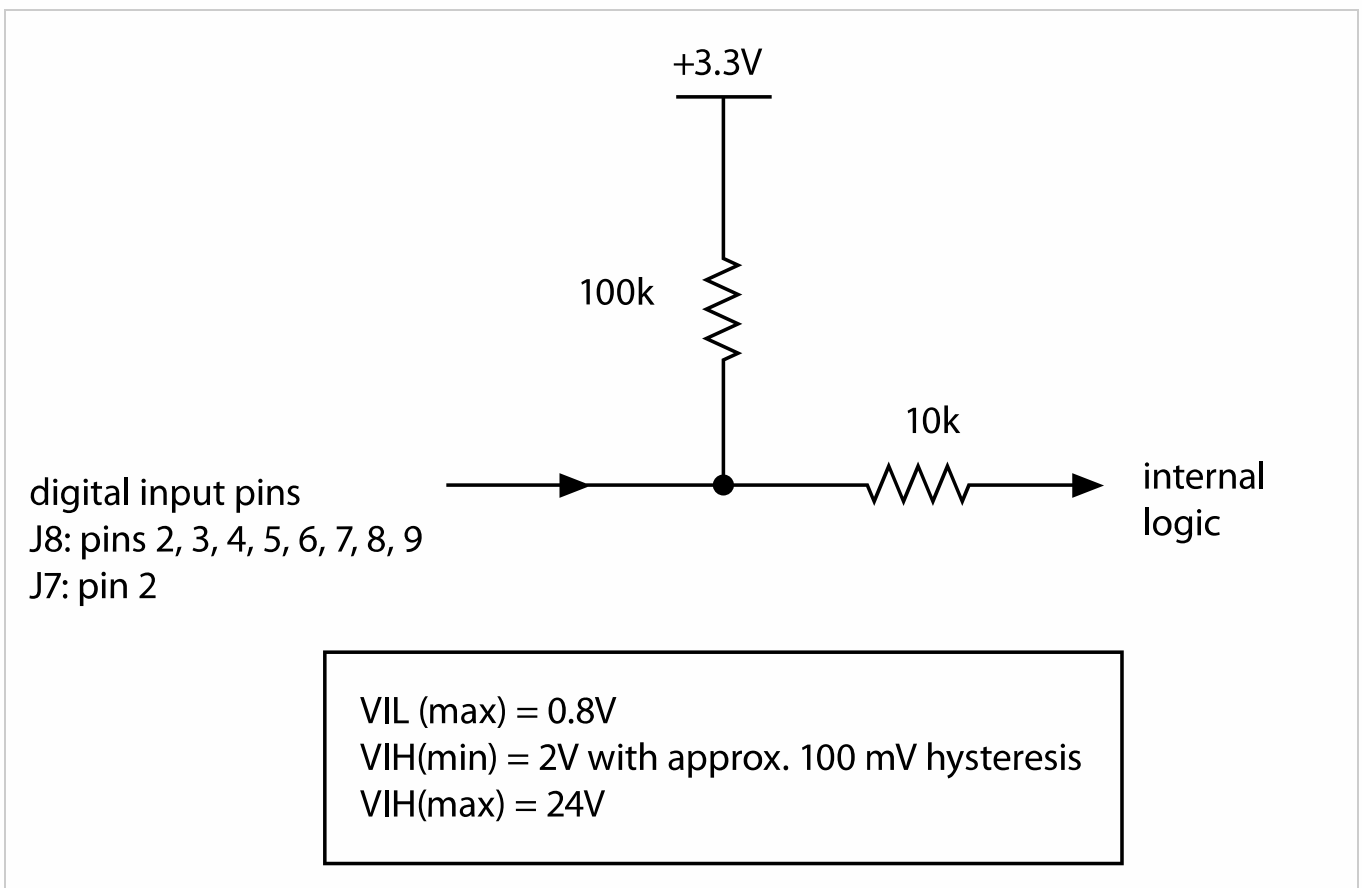


1 2 3 4 5 6 7 8 9 10



PIN NUMBER	DESCRIPTION
1	+5V power out
2	Din0 (LSB)
3	Din1
4	Din2
5	Din3
6	Din4
7	Din5
8	Din6
9	Din7 (MSB)
10	Ground

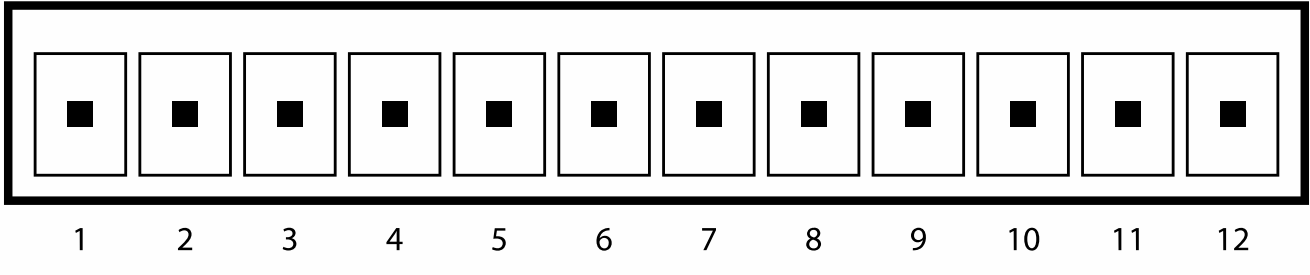
### Input Port Circuit (internal to USB4):



### DIGITAL OUTPUT PORT

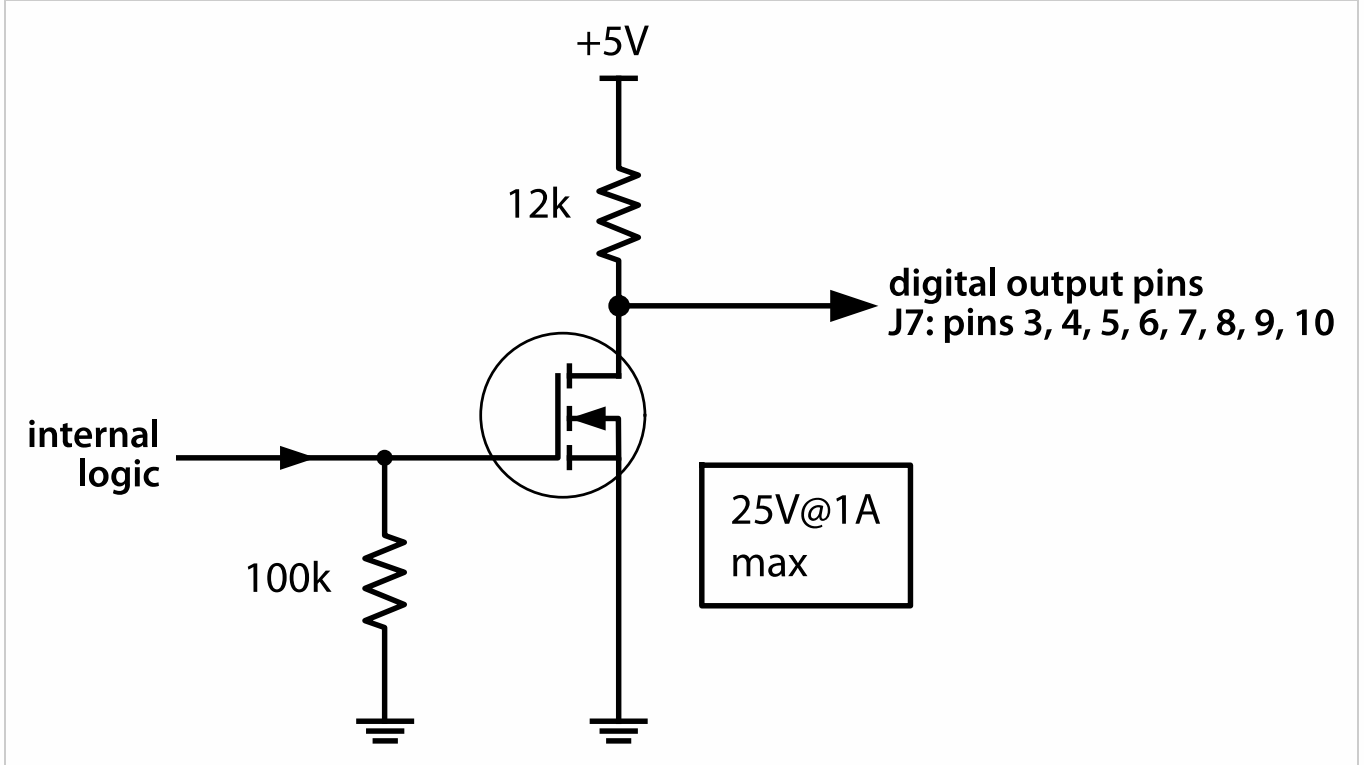
J7 Pin-out:





PIN NUMBER	DESCRIPTION
1	+5V out
2	E-Stop input (active low)
3	Dout0 (LSB)
4	Dout1
5	Dout2
6	Dout3
7	Dout4
8	Dout5
9	Dout6
10	Dout7 (MSB)
11	Ground
12	Ground

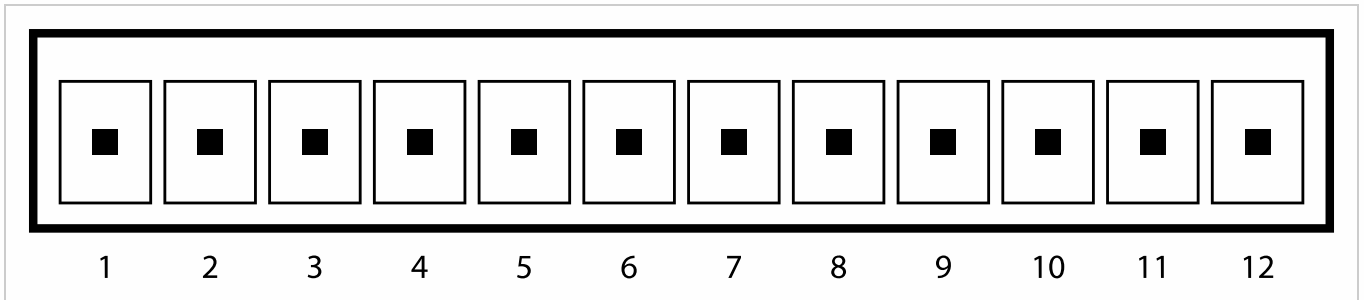
### Output Port Circuit (internal to USB4):



Note: When driving inductive loads, add an external reversed biased diode in parallel with the load to protect the USB4 from damage caused by large voltage transients.

## INTERFACE PORT

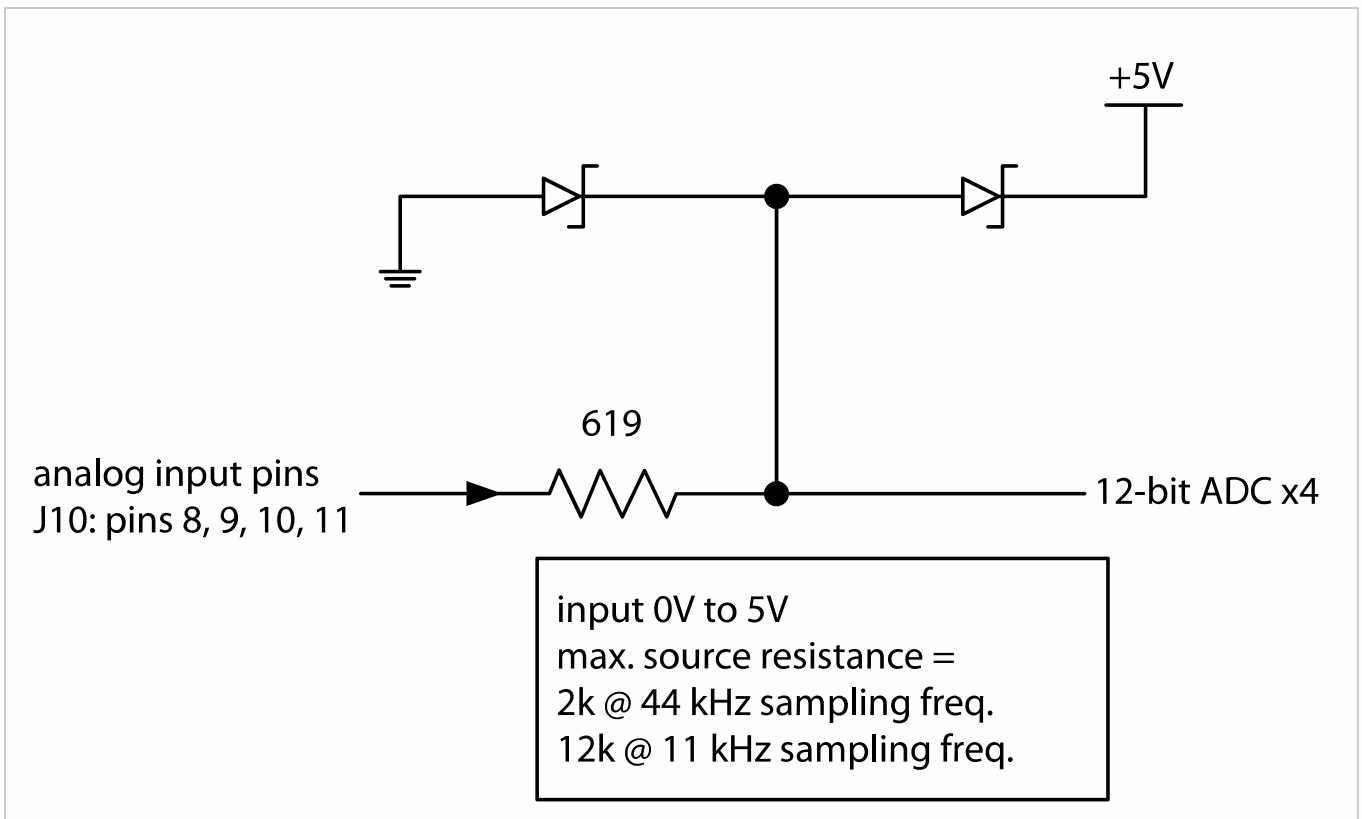
### J10 Pin-out:



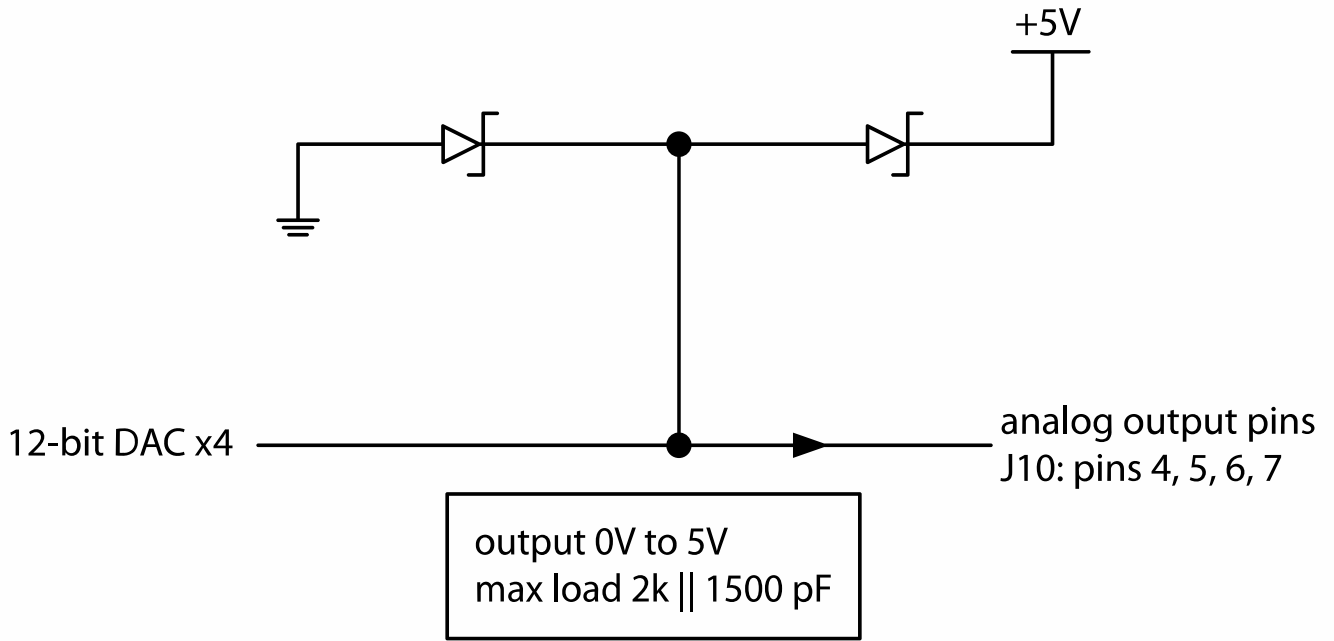


PIN NUMBER	DESCRIPTION
1	+5V out
2	Reserved
3	Reserved
4	DAC0 (analog outputs)
5	DAC1
6	DAC2
7	DAC3
8	ADC0 (analog inputs)
9	ADC1
10	ADC2
11	ADC3
12	Ground

### ADC Input Circuit (internal to USB4):



### DAC Output Circuit:



## INCLUDED ACCESSORIES

PS-12 Power Supply (<https://www.usdigital.com/products/accessories/power-supplies/ps-12/>)



## PRODUCT CHANGE NOTIFICATIONS

Title	Date	Description	Download
PCN 4464 - CE - RoHS	6/30/2014	<p>US Digital is aware of the increasing attention to world-wide environmental regulations, specifically with regard to the need for hazardous substance restrictions in electronic components and systems. As of July 10th, 2014 US Digital will now be CE Marking certain products inline with compliance under RoHS Directive (2011/65/EU). In order to achieve RoHS Compliance, the products will not contain more than the acceptable levels of the listed restricted substances within the RoHS 2011/65/EU directive.</p> <p>Part Numbers Affected:</p> <ul style="list-style-type: none"><li>• ED3</li><li>• USB4</li><li>• QSB</li><li>• SEI-USB</li><li>• MD2S</li><li>• PS-5, PS-12, PS-24, PS-48 (Power Supplies)</li><li>• PE</li></ul> <p>For the part numbers listed above, US Digital <b>cannot confirm</b> that they meet Low-Voltage and EMC Directives and for that reason <b>US Digital cannot support shipping those products / product families into the CE required countries</b> (For Example countries in the EU). Those products can still be shipped to Non-CE required countries with a Statement of Material Conformance to the RoHS Directive 2011/65/EU, in place of a RoHS Compliance Declaration.</p>	<p>Download <a href="https://www.usdigital.com/support/resources/product-change-notifications/pcn-4464-ce-rohs/">(https://www.usdigital.com/support/resources/product-change-notifications/pcn-4464-ce-rohs/)</a></p>

## Notes

- Cables and connectors are not included and must be ordered separately.
- US Digital® warrants its products against defects in materials and workmanship for two years. See complete warranty (<https://www.usdigital.com/company/warranty>) for details.