

A. Specifications

Specifications at 25 degrees C and Vusb/Vext = 5.0V, except where noted.

Parameter	Conditions	Min	Typical	Max	Units
General					
USB Cable Length	Hardware V1.21+	YTBD	5.0 YTB	5	meters
Supply Voltage				YTBD	volts
Supply Current (1)					mA
Operating Temperature				-40	°C
Clock Error					ppm
	~ 25 °C		±30	ppm	
	-10 to 60 °C		±50	ppm	
	-40 to 85 °C		±100	ppm	
Typ. Command Execution Time (2)	USB high-high	0.6			ms
	USB other	4			ms
Vs Outputs					
Typical Voltage (3)	Self-Powered	4.75	5.0	5.25	volts
	Bus-Powered	YTBD	5.0	5.25	
Maximum Current (3)	Self-Powered		YTBD		mA
	Bus-Powered		YTBD		mA
Vm+/Vm- Outputs					
Typical Voltage	No-load		±12		volts
	@ 1 mA		±YTBD		volts
Maximum Current			1		mA

(1) Typical current drawn by the U6 itself, not including any user connections.

(2) Total typical time to execute a single Feedback function with no analog inputs. Measured by timing a Windows application that performs 1000 calls to the Feedback function. See Section 3.1 for more timing information.

(3) These specifications are related to the power provided by the host/hub. Self- and bus-powered describes the host/hub, not the U6. Self-powered would apply to USB hubs with a power supply, all known desktop computer USB hosts, and some notebook computer USB hosts. An example of bus-powered would be a hub with no power supply, or many PDA ports. The current rating is the maximum current that should be sourced through the U6 and out of the Vs terminals.

Parameter	Conditions	Min	Typical	Max	Units
Analog Inputs					
Typical Input Range (1)	Gain=1	-10.5		10.1	volts
Max AIN Voltage to GND (2)	Valid Readings	-12		12	volts
Max AIN Voltage to GND (3)	No Damage	YTBD		YTBD	volts
Input Bias Current (4)			YTBD		nA
Input Impedance (4)			1		GΩ
Source Impedance (4)					kΩ
Integral Linearity Error			±YTBD		% FS
Differential Linearity Error			±YTBD		counts
Absolute Accuracy	Gain=1		±YTBD		% FS
Temperature Drift			YTBD		ppm/°C
Noise (Peak-To-Peak) (5)					counts
Effective Resolution (RMS) (6)	Gain=1		16-22		bits
Noise-Free Resolution (5)					bits
					mV
Command/Response Speed	See Section 3.1				
Stream Performance	See Section 3.2				

(1) With DAC1 disabled on hardware versions < 1.30.

(2) This is the maximum voltage on any AIN pin compared to ground for valid measurements. Note that a differential channel has a minimum voltage of -2.44 volts, meaning that the positive channel can be 2.44 volts less than the negative channel, but no AIN pin can go more than 0.3 volts below ground.

(3) Maximum voltage, compared to ground, to avoid damage to the device. Protection level is the same whether the device is powered or not.

(4) The low-voltage analog inputs essentially connect directly to a SAR ADC on the U3, presenting a capacitive load to the signal source. The high-voltage inputs connect first to a resistive level-shifter/divider. The key specification in both cases is the maximum source impedance. As long as the source impedance is not over this value, there will be no substantial errors due to impedance problems.

(5) Measurements taken with AIN connected to a 2.048 reference (REF191 from Analog Devices) or GND. All "counts" data are aligned as 12-bit values. Noise-free data is determined by taking 128 readings and subtracting the minimum value from the maximum value.

(6) Effective (RMS) data is determined from the standard deviation of 128 readings. In other words, this data represents *most* readings, whereas noise-free data represents *all* readings.

Parameter	Conditions	Min	Typical	Max	Units
Analog Outputs (DAC)					
Nominal Output Range (1)	No Load @ ±2.5 mA	0.04 0.225		4.95 4.775	volts volts
Resolution			12		bits
Absolute Accuracy	5% to 95% FS		±0.1		% FS
Integral Linearity Error			±YTBD		counts
Differential Linearity Error			±YTBD		counts
Error Due To Loading	@ 100 µA @ 1 mA		0.1 1		% %
Source Impedance			50		Ω
Short Circuit Current (2)	Max to GND		YTBD		mA
Slew Rate			YTBD		V/ms
Digital I/O, Timers, Counters					
Low Level Input Voltage		-0.3		0.8	volts
High Level Input Voltage		2		5.8	volts
Maximum Input Voltage (3)	FIO	-10		10	volts
	EIO/CIO	-6		6	volts
Output Low Voltage (4)	No Load		0		volts
	FIO Sinking 1 mA		0.55		volts
	EIO/CIO Sinking 1 mA		0.18		volts
	EIO/CIO Sinking 5 mA		0.9		volts
Output High Voltage (4)	No Load		3.3		volts
	FIO Sourcing 1 mA		2.75		volts
	EIO/CIO Sourcing 1 mA		3.12		volts
	EIO/CIO Sourcing 5 mA		2.4		volts
Short Circuit Current (4)	FIO		6		mA
	EIO/CIO		18		mA
Output Impedance (4)	FIO		550		Ω
	EIO/CIO		180		Ω
Counter Input Frequency (5)				8	MHz
Input Timer Total Edge Rate (6)	No Stream			30000	edges/s
	While Streaming			7000	edges/s

(1) Maximum and minimum analog output voltage is limited by the supply voltages (Vs and GND). The specifications assume Vs is 5.0 volts. Also, the ability of the DAC output buffer to drive voltages close to the power rails, decreases with increasing output current, but in most applications the output is not sinking/sourcing much current as the output voltage approaches GND.

(2) Continuous short circuit will not cause damage.

(3) Maximum voltage to avoid damage to the device. Protection works whether the device is powered or not, but continuous voltages over 5.8 volts or less than -0.3 volts are not recommended when the U3 is unpowered, as the voltage will attempt to supply operating power to the U3 possibly causing poor start-up behavior.

(4) These specifications provide the answer to the question: "How much current can the digital I/O sink or source?". For instance, if EIO0 is configured as output-high and shorted to ground, the current sourced by EIO0 into ground will be about 18 mA (3.3/180). If connected to a load that draws 5 mA, EIO0 can provide that current but the voltage will droop to about 2.4 volts instead of the nominal 3.3 volts. If connected to a 180 ohm load to ground, the resulting voltage and current will be about 1.65 volts @ 9 mA.

(5) Hardware counters. 0 to 3.3 volt square wave. Limit about 2 MHz with older hardware versions.

(6) To avoid missing edges, keep the total number of applicable edges on all applicable timers below this limit. See Section 2.9 for more information. Limit about 10000 with older hardware versions.