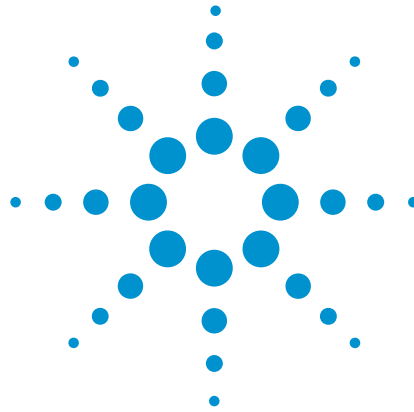


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**Agilent**  
U2300A Series USB Modular Multifunction  
Data-Acquisition Devices

Data Sheet



## Features

- **Up to 3 MSa/s sampling rate for a single channel**
- **Functions as a standalone or modular unit**
- **Easy to use: Plug-and-play and hot-swappable with Hi-Speed USB 2.0**
- **Up to 384 channels when incorporated into U2781A Agilent modular instrument chassis**
- **Easy-to-use bundled software for quick setup and data logging to PC**
- **12-bit or 16-bit A/D resolution**
- **24-bit programmable digital input/output**
- **Self-calibration capability**
- **Compatible with a wide range of Application Development Environments**
- **USB TMC 488.2 standards**



## Introduction

Agilent U2300A Series USB modular multifunction data-acquisition (DAQ) devices are a high-performance PC data-acquisition solution. The U2300A Series DAQ devices consist of two families: basic multifunction DAQ and high-density multifunction DAQ. The basic multifunction DAQ family comes in four models, while the high-density multifunction DAQ family is made up of three models.

The U2300A Series DAQ devices' applications extend across industrial and education environments. The DAQ device is well suited for research and development, manufacturing, and design-validation engineers, who require measurement devices with fast sampling rate.

## High Sampling Rate

The U2300A Series DAQ devices have sampling rates of up to 3 MSa/s for a single channel. When multiple channels are configured, they can sample data up to 1 MSa/s. This fast sampling capability allows users to perform intermittent detection easily. This is ideal for dealing with high-density analog input/output signals, especially with different input ranges and sampling requirements.

## Flexible Standalone or Modular Capability

The U2300A Series DAQ devices are uniquely designed to be flexible enough to function as standalone or modular units. When used with the U2781A modular instrument chassis, the devices can support up to 384 channels.

## Ease of Use

The U2300A Series DAQ devices are equipped with Hi-Speed USB 2.0 interfaces for easy setup, plug-and-play, and hot swappable connectivity. Its ease of use makes it ideal for the education environment. Simplifying this further is the Agilent Measurement Manager software that offers a simple interface for quick setup, configuration, and measurement control.

## Flexible System and Control Options

### Polling and continuous mode

The U2300A Series DAQ devices provide two modes, the polling mode and the continuous mode. The continuous mode enables you to acquire data continuously once the trigger signal is received.

## Trigger sources

U2300 Series offers immediate trigger (none), analog/external digital trigger, System Synchronous Interface (SSI)/star trigger, and master/slave trigger sources. All these trigger options give you the capability to configure trigger sources during A/D and D/A operations. Master/slave trigger and SSI/star trigger are recommended when USB modules are slotted into the Agilent U2781A USB modular instrument chassis.

## Predefined function generator

The two analog output channels offered not only provide DC voltage but also are capable of generating common and predefined waveforms such as sinusoid wave, square wave, triangle wave, sawtooth wave, and noise wave.

## Arbitrary Waveform

U2300A Series supports arbitrary waveform, which allows user to generate arbitrary waveform via Agilent Measurement Manager application software or SCPI commands.

## Burst mode

Burst mode is an enhancement feature of U2300 Series DAQ that enables the DAQ to simulate in simultaneous mode for analog input acquisition. This enables users to perform sampling measurement up to the highest speed the DAQ is capable of reaching.

## Compatible with a Wide Range of Application Development Environments

The Agilent U2300A DAQ devices are compatible with a wide range of Application Development Environments. This minimizes the time that R&D and manufacturing engineers need to use the devices in different software environments, as they can program directly using SCPI commands.

Listed below are the popular development environments and tools with which the DAQ device is compatible:

- Agilent VEE and Agilent T&M Toolkit
- MATLAB® R2007a
- Microsoft Visual Studio.NET, C/C++ and Visual Basic 6
- LabVIEW

For more information, please visit [www.agilent.com/find/U2300A](http://www.agilent.com/find/U2300A).

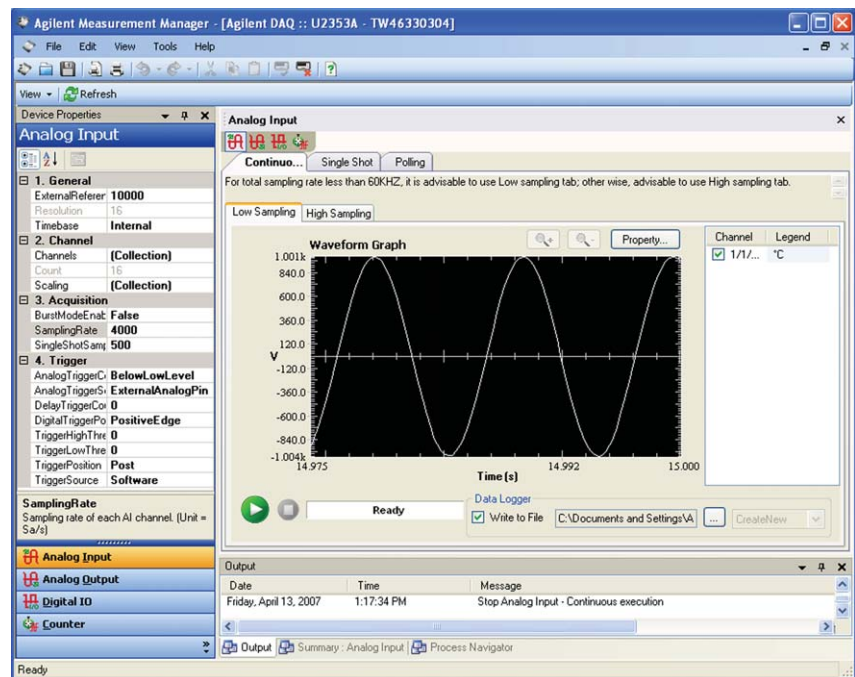


Figure 1. Agilent Measurement Manager application user interface

## Product Characteristics and General Specifications

### REMOTE INTERFACE

- Hi-Speed USB 2.0
- USBTMC class device

### POWER REQUIREMENT

- +12 VDC (TYPICAL)
- 2 A (MAX) input rated current

### POWER CONSUMPTION

- +12 VDC, 550 mA maximum

### OPERATING ENVIRONMENT

- Operating temperature from 0 °C to +55 °C
- Relative humidity at 15% to 85% RH (non-condensing)
- Altitude up to 2000 meters
- Pollution Degree 2
- For indoor use only

### STORAGE COMPLIANCE

- -20 °C to 70 °C

### SAFETY COMPLIANCE

Certified with:

- IEC 61010-1:2001/EN 61010-1:2001 (2nd Edition)
- USA: UL61010-1: 2004
- Canada: CSA C22.2 No.61010-1:2004

### EMC COMPLIANCE

- IEC/EN 61326-1 1998
- CISPR 11: 1990/EN55011:1991, Class A, Group 1
- CANADA: ICES-001: 1998
- Australia/New Zealand: AS/NZS 2064.1

### SHOCK AND VIBRATION

Tested to IEC/EN 60068-2

### IO CONNECTOR

68-pin female VHDCI Type

### DIMENSION (WxDxH)

Module dimension:

- 120.00 mm x 182.40 mm x 44.00 mm (with plastic casing)
- 105.00 mm x 174.54 mm x 25.00 mm (without plastic casing)

Terminal block dimension:

- 103.00 mm x 85.20 mm x 42.96 mm

### WEIGHT

- 565 g (with plastic casing)
- 400 g (without plastic casing)

### WARRANTY

Three years

## Product Outlook and Dimension

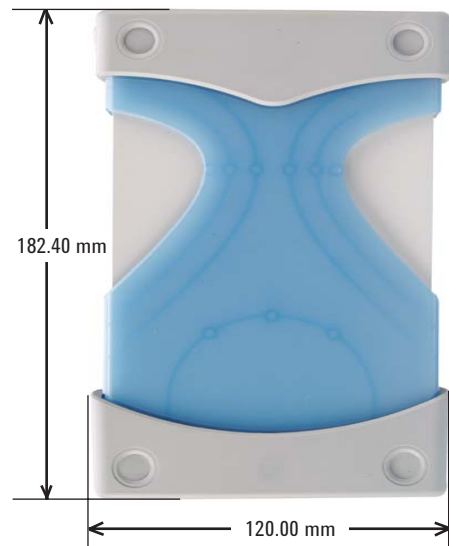
### Front View



### Rear View



### Top View



### Standard Shipped Items

- AC/DC Power Adapter
- Power Cord
- USB Extension Cable
- L-Mount Kit (used with modular instrument chassis)
- Agilent U2300A Series Data Acquisition Devices and Agilent Measurement Manager Quick Start Guide
- Agilent USB Modular Instrument U2300A & U2700A Series Product Reference CD-ROM
- Agilent Automation-Ready CD (contains the Agilent IO Libraries Suite)
- Certificate of Calibration

### Optional Accessories

- U2901A Terminal block and SCSI-II 68-pin connector with 1-meter cable
- U2902A Terminal block and SCSI-II 68-pin connector with 2-meter cable
- U2718A 6-slot USB modular instrument chassis

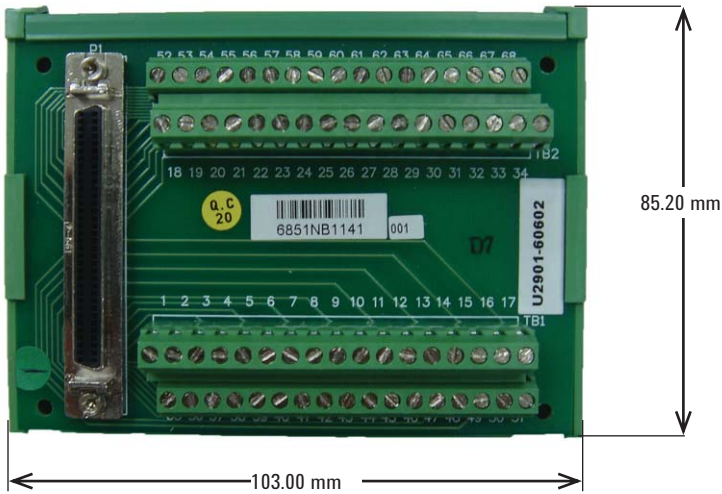
# System Requirements

<b>PROCESSOR</b> 1.6 GHz Pentium IV or higher
<b>OPERATING SYSTEM</b> One of the following Microsoft® Windows® versions: <ul style="list-style-type: none"><li>• Windows XP Professional or Home Edition (Service Pack 1 or later)</li><li>• Windows 2000 Professional (Service Pack 4 or later)</li></ul>
<b>BROWSER</b> Microsoft Internet Explorer 5.01 or higher
<b>AVAILABLE RAM</b> 512 MB or higher recommended
<b>HARD DISK SPACE</b> 1 GB
<b>PREREQUISITES</b> <ul style="list-style-type: none"><li>• Agilent IO Libraries Suite 14.2<sup>[1]</sup> or higher</li><li>• Agilent T&amp;M Toolkit 2.1 Runtime version<sup>[2]</sup></li><li>• Microsoft .NET Framework version 1.1 and 2.0<sup>[2]</sup></li></ul>

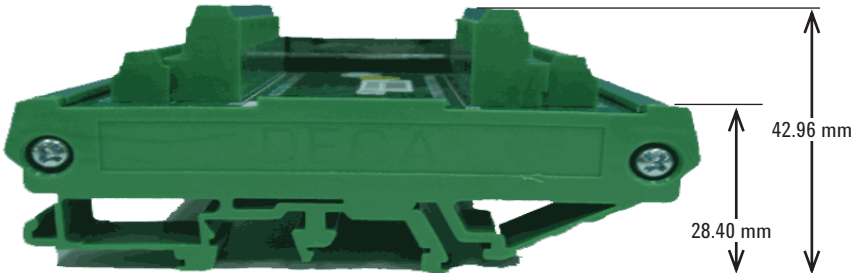
[1] Available in Agilent Automation-Ready CD  
[2] Bundled with Agilent Measurement Manager software application installer

# Terminal Block Overview

## Front View



## Side View



## Electrical Specifications

### Basic Multifunction USB DAQ

Model Number	U2351A	U2352A	U2353A	U2354A
<b>Analog Input</b>				
Resolution	16 bits, no missing codes			
Number of channels	16 SE/8 DI (software selectable/channel)			
Maximum sampling rate <sup>[1]</sup>	250 kSa/s		500 kSa/s	
Scan list memory	Up to 100 selectable channel entries			
Programmable bipolar input range	±10 V, ±5 V, ±2.5 V, ±1.25 V			
Programmable unipolar input range	0 to 10 V, 0 to 5 V, 0 to 2.5 V, 0 to 1.25 V			
Input coupling	DC			
Input impedance	1 GΩ / 100 pF			
Operational common mode voltage range	±7.5 V maximum			
Overvoltage protection	Power on: Continuous ±30 V, Power off: Continuous ±15 V			
Trigger sources	External analog/digital trigger, SSI/star trigger <sup>[2]</sup>			
Trigger modes	Pre-trigger, delay-trigger, post-trigger and middle-trigger			
FIFO buffer size	Up to 8 MSa			
<b>Analog Output</b>				
Resolution	16 bits	N/A	16 bits	N/A
Number of channels	2	N/A	2	N/A
Maximum update rate	1 MSa/s	N/A	1 MSa/s	N/A
Output ranges	0 to 10 V, ±10 V, 0 to AO_EXT_REF, ±AO_EXT_REF <sup>[3]</sup>	N/A	0 to 10 V, ±10 V, 0 to AO_EXT_REF, ±AO_EXT_REF <sup>[3]</sup>	N/A
Output coupling	DC	N/A	DC	N/A
Output impedance	0.1 Ω typical	N/A	0.1 Ω typical	N/A
Stability	Any passive load up to 1500 pF	N/A	Any passive load up to 1500 pF	N/A
Power on state	0 V steady state	N/A	0 V steady state	N/A
Trigger sources	External analog/digital trigger, SSI/star trigger <sup>[2]</sup>	N/A	External analog/digital trigger, SSI/star trigger <sup>[2]</sup>	N/A
Trigger modes	Post-trigger and delay-trigger	N/A	Post-trigger and delay-trigger	N/A
FIFO buffer size	One channel: Maximum 8 MSa Two channels: Maxi- mum 4 MSa/ch	N/A	One channel : Maximum 8 MSa Two channels : Maxi- mum 4 MSa/ch	N/A
Function generation mode	Sine, square, triangle, sawtooth and noise waveforms	N/A	Sine, square, triangle, sawtooth and noise waveforms	N/A
<b>Digital I/O</b>				
Number of channels	24-bit programmable input/output			
Compatibility	TTL			
Input voltage	$V_{IL} = 0.7 \text{ V max}, I_{IL} = 10 \text{ } \mu\text{A max}$ $V_{IH} = 2.0 \text{ V min}, I_{IH} = 10 \text{ } \mu\text{A max}$			
Input voltage range	-0.5 V to +5.5 V			
Output voltage	$V_{OL} = 0.45 \text{ V max}, I_{OL} = 8 \text{ mA max}$ $V_{OH} = 2.4 \text{ V min}, I_{OH} = 400 \text{ } \mu\text{A max}$			

<b>General Purpose Digital Counter</b>	
Maximum count	$(2^{31}-1)$ bits
Number of channels	Two independent up/down counter
Compatibility	TTL
Clock source	Internal or external
Base clock available	48 MHz
Maximum clock source frequency	12 MHz
Input frequency range <sup>[4]</sup>	0.1 Hz to 6 MHz at 50% duty cycle
Pulse width measurement range	0.167 $\mu$ s to 178.956 s
<b>Analog Trigger</b>	
Trigger source	All analog input channels, External analog trigger (EXTA_TRIG)
Trigger level	$\pm$ Full scale for internal; $\pm$ 10 V for external
Trigger conditions	Above high, below low and window (software selectable)
Trigger level resolution	8 bits
Bandwidth	400 kHz
Input impedance for EXTA_TRIG	20 k $\Omega$
Coupling	DC
Overvoltage protection	Continuous for $\pm$ 35 Vmaximum
<b>Digital Trigger</b>	
Compatibility	TTL/CMOS
Response	Rising or falling edge
Pulse width	20 ns minimum
<b>Calibration<sup>[5]</sup></b>	
On board reference voltage	5 V
Temperature drift	$\pm$ 2 ppm/ $^{\circ}$ C
Stability	$\pm$ 6 ppm/1000 hrs
<b>General</b>	
Remote interface	Hi-Speed USB 2.0
Device class	USBTMC class device
Programmable interface	Standard Commands for Programmable Instruments (SCPI) and IVI-COM

[1] When multiple channels are used, the sampling rate of each channel is the maximum sampling rate divided by the number of channels used.

[2] System Synchronous Interface (SSI) and Star-trigger commands are used when modular devices are used in the instrument chassis.

[3] Maximum external reference voltage for analog output channels (AO\_EXT\_REF) is  $\pm$ 10 V.

[4] Measurement frequency's resolution

= 12 MHz/n, n = 2, 3, 4, 5, ..., 120 M

= 6 MHz, 4 MHz, 3 MHz, 2.4 MHz, 2.0 MHz, ..., 0.1 Hz (up to six decimal points)

[5] 20 minutes warm-up time is recommended.

## High Density Multifunction USB DAQ

Model Number	U2355A	U2356A	U2331A
<b>Analog Input</b>			
Resolution	16 bits, no missing codes		12 bits, no missing codes
Number of channels	64 SE/32 DI (software selectable/ch)		
Maximum sampling rate <sup>[1]</sup>	250 kSa/s	500 kSa/s	3 MSa/s (single channel) 1 MSa/s (multiple channels)
Scan list memory	Up to 100 selectable channel entries		
Programmable bipolar input range	±10 V, ±5 V, ±2.5 V, ±1.25 V		±10 V, ±5 V, ±2.5 V, ±1.25 V, ±1 V, ±0.5 V, ±0.25 V, ±0.2 V, ±0.05 V
Programmable unipolar input range	0 to 10 V, 0 to 5 V, 0 to 2.5 V, 0 to 1.25 V		0 to 10 V, 0 to 5 V, 0 to 4 V, 0 to 2.5 V, 0 to 2 V, 0 to 1 V, 0 to 0.5 V, 0 to 0.4 V, 0 to 0.1 V
Input coupling	DC		
Input impedance	1 GΩ / 100 pF		
Operational common mode voltage range	±7.5 V maximum		
Overvoltage protection	Power on: Continuous ±30 V, Power off: Continuous ±15 V		
Trigger sources	External analog/digital trigger, SSI/star trigger <sup>[2]</sup>		
Trigger modes	Pre- trigger, delay-trigger, post-trigger and middle-trigger		
FIFO buffer size	Up to 8 MSa		
<b>Analog Output</b>			
Resolution	12 bits		
Number of channels	2		
Maximum update rate	1 MSa/s		
Output ranges	0 to 10 V, ±10 V, 0 to AO_EXT_REF, ±AO_EXT_REF <sup>[3]</sup>		
Output coupling	DC		
Output impedance	0.1 Ω Typical		
Stability	Any passive load up to 1500 pF		
Power on state	0 V steady state		
Trigger sources	External analog/digital trigger, SSI/star trigger <sup>[2]</sup>		
Trigger modes	Post-trigger and delay-trigger		
FIFO buffer size	One channel: Maximum 8 MSa Two channels: Maximum 4 MSa/ch		
Function generation mode	Sine, square, triangle, sawtooth and noise waveforms		
<b>Digital I/O</b>			
Number of bits	24-bit programmable input/output		
Compatibility	TTL		
Input voltage	$V_{IL} = 0.7 \text{ V max}$ , $I_{IL} = 10 \text{ } \mu\text{A max}$ $V_{IH} = 2.0 \text{ V min}$ , $I_{IH} = 10 \text{ } \mu\text{A max}$		
Input voltage range	-0.5 V to +5.5 V		
Output voltage	$V_{OL} = 0.45 \text{ V max}$ , $I_{OL} = 8 \text{ mA max}$ $V_{OH} = 2.4 \text{ V min}$ , $I_{OH} = 400 \text{ } \mu\text{A max}$		
<b>General Purpose Digital Counter (GPC)</b>			
Maximum count	$(2^{31} - 1)$ bits		
Number of channels	Two independent up/down counter		
Compatibility	TTL		
Clock source	Internal or external		
Base clock available	48 MHz		
Maximum clock source frequency	12 MHz		
Input frequency range <sup>[4]</sup>	0.1 Hz to 6 MHz at 50% duty cycle		
Pulse width measurement range	0.167 μs to 178.956 s		

<b>Analog Trigger</b>	
Trigger source	All analog input channels, External analog trigger (EXTA_TRIG)
Trigger level	±Full scale for internal; ±10 V for external
Trigger conditions	Above high, below low and window (software selectable)
Trigger level resolution	8 bits
Bandwidth	400 kHz
Input impedance for EXTA_TRIG	20 kΩ
Coupling	DC
Overvoltage protection	Continuous for ±35 V maximum
<b>Digital Trigger</b>	
Compatibility	TTL/CMOS
Response	Rising or falling edge
Pulse width	20 ns minimum
<b>Calibration<sup>[5]</sup></b>	
On board reference	5 V
Temperature drift	±2 ppm/°C
Stability	±6 ppm/1000 hrs
<b>General</b>	
Remote interface	Hi-Speed USB 2.0
Device class	USBTMC class device
Programmable interface	Standard Commands for Programmable Instruments (SCPI) and IVI-COM

[1] When multiple channels are used in the U2355A or U2356A, the sampling rate of each channel is the maximum sampling rate divided by the number of channels used. For multiple channels used in the U2331A, the sampling rate of each channel = (1 MSa/s) / number of channels used.

[2] System Synchronous Interface (SSI) and Star-trigger commands are used when modular devices are used in the instrument chassis.

[3] Maximum external reference voltage for analog output channels (AO\_EXT\_REF) is ±10 V.

[4] Measurement frequency's resolution  
= 12 MHz/n, n = 2, 3, 4, 5, ..., 120 M  
= 6 MHz, 4 MHz, 3 MHz, 2.4 MHz, 2.0 MHz, ..., 0.1 Hz (up to six decimal points)

[5] 20 minutes warm-up time is recommended.

# Electrical Measurement Specifications

## Basic Multifunction USB DAQ

Analog Input Measurement <sup>[1]</sup>				
Model Number	U2351A   U2352A		U2353A   U2354A	
Function	23 °C ± 5 °C	0 °C to 18 °C 28 °C to 45 °C	23 °C ± 5 °C	0 °C to 18 °C 28 °C to 45 °C
Offset error	±1 mV	±5 mV	±1 mV	±5 mV
Gain error	±2 mV	±5 mV	±2 mV	±5 mV
–3 dB small signal bandwidth <sup>[2]</sup>	760 kHz		1.5 MHz	
1% THD large signal bandwidth <sup>[2]</sup>	300 kHz		300 kHz	
System noise	1 mVrms	2 mVrms	1 mVrms	2.5 mVrms
CMRR	62 dB		62 dB	
Spurious-free dynamic range (SFDR) <sup>[3]</sup>	88 dB		82 dB	
Signal-to-noise and distortion ratio (SINAD) <sup>[3]</sup>	80 dB		78 dB	
Total harmonic distortion (THD) <sup>[3]</sup>	–90 dB		–82 dB	
Signal-to-noise ratio (SNR) <sup>[3]</sup>	80 dB		78 dB	
Effective number of bits (ENOB) <sup>[3]</sup>	13		12.6	

Analog Output Measurement <sup>[1]</sup>		
Model Number	U2351A   U2353A	
Function	23 °C ± 5 °C	0 °C to 18 °C 28 °C to 45 °C
Offset Error	±1 mV	±4 mV
Gain Error	±4mV	±5 mV
Slew rate	19 V/μs	
Rise time	0.9 μs	
Fall time	0.9 μs	
Settling time to 1% output error	4 μs	
Driving capability	5 mA	
Glitch energy	5 ns-V (Typical), 80 ns-V (Maximum)	

[1] Specifications are for 20 minutes of warm-up time, calibration temperature at 23 °C and input range of ±10 V.

[2] Specifications are based on the following test conditions.

Bandwidth Test	Model Number	Test Conditions (DUT setting at ±10 V bipolar)	
• –3 dB small signal bandwidth • 1% THD large signal bandwidth	U2351A U2352A	Sampling Rate: Input voltage: • –3 dB small signal bandwidth • 1% THD large signal bandwidth	250 kSa/s 10% FSR FSR –1 dB FS
	U2353A U2354A	Sampling Rate: Input voltage: • –3 dB small signal bandwidth • 1% THD large signal bandwidth	500 kSa/s 10% FSR FSR –1 dB FS

[3] Specifications are based on the following test conditions.

Dynamic Range Test	Model Number	Test Conditions (DUT setting at ±10 V bipolar)	
SFDR, THD, SINAD, SNR, ENOB	U2351A U2352A	Sampling Rate: Fundamental Frequency: Number of points: Fundamental input voltage:	250 kSa/s 2.4109 kHz 8192 FSR –1 dB FS
	U2353A U2354A	Sampling Rate: Fundamental Frequency: Number of points: Fundamental input voltage:	500 kSa/s 4.974 kHz 16384 FSR –1 dB FS

## High Density Multifunction USB DAQ

Analog Input Measurement <sup>[1]</sup>						
Model Number	U2355A		U2356A		U2331A	
Function	23 °C ± 5 °C	0 °C to 18 °C 28 °C to 45 °C	23 °C ± 5 °C	0 °C to 18 °C 28 °C to 45 °C	23 °C ± 5 °C	0 °C to 18 °C 28 °C to 45 °C
Offset error	±1 mV	±2 mV	±1 mV	±2 mV	±2 mV	±3 mV
Gain error	±2 mV	±3 mV	±2 mV	±6 mV	±6 mV	±7.5 mV
-3 dB small signal bandwidth <sup>[2]</sup>	760 kHz		1.3 MHz		1.2 MHz	
1% THD large signal bandwidth <sup>[2]</sup>	400 kHz		400 kHz		N/A	
System noise	1 mVrms	2 mVrms	1 mVrms	4 mVrms	3 mVrms	5 mVrms
CMRR	64 dB		61 dB		62 dB	
Spurious-free dynamic range (SFDR) <sup>[3]</sup>	88 dB		86 dB		71 dB	
Signal-to-noise and distortion ratio (SINAD) <sup>[3]</sup>	80 dB		78 dB		72 dB	
Total harmonic distortion (THD) <sup>[3]</sup>	-90 dB		-84 dB		-76 dB	
Signal-to-noise ratio (SNR) <sup>[3]</sup>	80 dB		78 dB		72 dB	
Effective number of bits (ENOB) <sup>[3]</sup>	13		12.6		11.6	

Analog Output Measurement <sup>[1]</sup>				
Model Number	U2355A   U2356A		U2331A	
Function	23 °C ± 5 °C	0 °C to 18 °C 28 °C to 45 °C	23 °C ± 5 °C	0 °C to 18 °C 28 °C to 45 °C
Offset Error	±1 mV	±4 mV	±1.5 mV	±3 mV
Gain Error	±4 mV	±5 mV	±4 mV	±5 mV
Slew rate	19 V/μs		19 V/μs	
Rise time	0.9 μs		0.9 μs	
Fall time	0.9 μs		0.9 μs	
Settling time to 1% output error	4 μs		4 μs	
Driving capability	5 mA		5 mA	
Glitch energy	5 ns-V (Typical), 80 ns-V (Maximum)		5 ns-V (Typical), 80 ns-V (Maximum)	

[1] Specifications are for 20 minutes of warm-up time, calibration temperature at 23 °C and input range of ±10 V.

[2] Specifications are based on the following test conditions.

Bandwidth Test	Model Number	Test Conditions (DUT setting at ±10 V bipolar)	
• -3 dB small signal bandwidth • 1% THD large signal bandwidth	U2355A	Sampling Rate: Input voltage: • -3 dB small signal bandwidth • 1% THD large signal bandwidth	250 kSa/s 10% FSR FSR -1 dB FS
	U2356A	Sampling Rate: Input voltage: • -3 dB small signal bandwidth • 1% THD large signal bandwidth	500 kSa/s 10% FSR FSR -1 dB FS
	U2331A	Sampling Rate: Input voltage: • -3 dB small signal bandwidth • 1% THD large signal bandwidth	3 MSa/s 10% FSR FSR -1 dB FS

[3] Specifications are based on the following test conditions.

Dynamic Range Test	Model Number	Test Conditions (DUT setting at ±10 V bipolar)	
• -3 dB small signal bandwidth • 1% THD large signal bandwidth	U2355A	Sampling Rate: Fundamental Frequency: Number of points: Fundamental input voltage:	250 kSa/s 2.4109 kHz 8192 FSR -1 dB FS
	U2356A	Sampling Rate: Fundamental Frequency: Number of points: Fundamental input voltage:	500 kSa/s 4.974 kHz 16384 FSR -1 dB FS
	U2331A	Sampling Rate: Fundamental Frequency: Number of points: Fundamental input voltage:	3 MSa/s 29.892 kHz 65536 FSR -1 dB FS

## DC Characteristics

### Accuracy Specifications

#### Analog Input

U2351A | U2352A | U2353A | U2354A

Unipolar Range (V)	Offset Error (mV) <sup>[1]</sup>	Gain Error (mV)	Accuracy ( % of reading + offset error ) <sup>[2]</sup>
10	1.5	2.0	0.04% + 1.5 mV
5	1.5	2.0	0.08% + 1.5 mV
2.5	1.0	1.0	0.08% + 1.0 mV
1.25	1.0	1.0	0.16% + 1.0 mV
Bipolar Range (V)	Offset Error (mV) <sup>[1]</sup>	Gain Error (mV)	Accuracy ( % of reading + offset error ) <sup>[2]</sup>
10	1.0	2.0	0.02% + 1.0 mV
5	1.0	2.0	0.04% + 1.0 mV
2.5	1.0	1.5	0.06% + 1.0 mV
1.25	1.0	1.5	0.12% + 1.0 mV

U2355A | U2356A

Unipolar Range (V)	Offset Error (mV) <sup>[1]</sup>	Gain Error (mV)	Accuracy ( % of reading + offset error ) <sup>[2]</sup>
10	1.0	1.5	0.03% + 1.0 mV
5	1.0	1.5	0.06% + 1.0 mV
2.5	1.0	1.0	0.08% + 1.0 mV
1.25	1.0	1.0	0.16% + 1.0 mV
Bipolar Range (V)	Offset Error (mV) <sup>[1]</sup>	Gain Error (mV)	Accuracy ( % of reading + offset error ) <sup>[2]</sup>
10	1.0	2.0	0.02% + 1.0 mV
5	1.0	2.0	0.04% + 1.0 mV
2.5	1.0	1.5	0.06% + 1.0 mV
1.25	1.0	1.5	0.12% + 1.0 mV

U2331A

Unipolar Range (V)	Offset Error (mV) <sup>[1]</sup>	Gain Error (mV)	Accuracy ( % of reading + offset error ) <sup>[2]</sup>
10	1.5	4.0	0.08% + 1.5 mV
5	1.5	2.0	0.08% + 1.5 mV
4	1.5	2.0	0.10% + 1.5 mV
2.5	1.0	1.5	0.12% + 1.0 mV
2	1.0	1.0	0.10% + 1.0 mV
1	1.0	1.0	0.20% + 1.0 mV
0.5	1.0	1.0	0.41% + 1.0 mV
0.4	1.0	1.0	0.51% + 1.0 mV
0.1	1.0	1.0	2.04% + 1.0 mV

1. The above specifications are typical for 23°C.
2. Specifications are for 20 minutes warm-up and self calibration.
3. The measurements are calculated with 100 points averaging of data.

[1] Offset error is measured at midscale of full scale range.

[2] Accuracy = +/- [% of |(Gain Error / (Measured value – Midscale of FSR))| + Offset Error]

## U2331A

Bipolar Range (V)	Offset Error (mV) <sup>[1]</sup>	Gain Error (mV)	Accuracy ( % of reading + offset error ) <sup>[2]</sup>
10	2.0	6.0	0.06% + 2.0 mV
5	1.5	4.0	0.08% + 1.5 mV
2.5	1.5	2.0	0.08% + 1.5 mV
1.25	1.0	1.5	0.12% + 1.0 mV
1	1.0	1.0	0.10% + 1.0 mV
0.5	1.0	1.0	0.20% + 1.0 mV
0.25	1.0	1.0	0.40% + 1.0 mV
0.2	1.0	1.0	0.50% + 1.0 mV
0.05	1.0	1.0	2.02% + 1.0 mV

1. The above specifications are typical for 23°C.
2. Specifications are for 20 minutes warm-up and self calibration.
3. The measurements are calculated with 100 points averaging of data.

[1] Offset error is measured at midscale of full scale range.

[2] Accuracy = +/- [% of |(Gain Error / (Measured value – Midscale of FSR))| + Offset Error]

## Analog Output

### U2351A | U2352A | U2353A | U2354A

Unipolar Range (V)	Offset Error (mV) <sup>[1]</sup>	Gain Error (mV)	Accuracy ( % of reading + offset error ) <sup>[2]</sup>
10	1.0	2.0	0.02% + 1.0 mV
Bipolar Range (V)	Offset Error (mV) <sup>[1]</sup>	Gain Error (mV)	Accuracy ( % of reading + offset error ) <sup>[2]</sup>
10	1.0	4.0	0.04% + 1.0 mV

### U2355A | U2356A

Unipolar Range (V)	Offset Error (mV) <sup>[1]</sup>	Gain Error (mV)	Accuracy ( % of reading + offset error ) <sup>[2]</sup>
10	1.0	2.0	0.02% + 1.0 mV
Bipolar Range (V)	Offset Error (mV) <sup>[1]</sup>	Gain Error (mV)	Accuracy ( % of reading + offset error ) <sup>[2]</sup>
10	1.0	4.0	0.04% + 1.0 mV

## U2331

Unipolar Range (V)	Offset Error (mV) <sup>[1]</sup>	Gain Error (mV)	Accuracy ( % of reading + offset error ) <sup>[2]</sup>
10	2.5	4.0	0.04% + 2.5 mV
Bipolar Range (V)	Offset Error (mV) <sup>[1]</sup>	Gain Error (mV)	Accuracy ( % of reading + offset error ) <sup>[2]</sup>
10	1.5	4.0	0.04% + 1.5 mV

1. The above specifications are typical for 23°C.
2. Specifications are for 20 minutes warm-up and self calibration.

[1] Offset error is measured at 0 V.

[2] Accuracy = +/- [% of |Gain Error/Output value| + offset voltage]



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