6½ Digit, ±10 V Digital Voltage Meter

FEATURES

- 6½ digit resolution
- ±0.1 V, ±1 V, and ±10 V range
- Dual channel
- 30 days accuracy: <4 ppm of reading range at 1 V range
- <0.24 ppm RMS noise of 1 V range at 1 NPLC, 1000 samples
- Up to 1 kSPS data rate
- Auto-zero function
- Supports SCPI protocol
- UART communication interface
- Power sequence self checking
- Input protection
- 5 V power supply
- 0°C to 45°C operation

APPLICATIONS

- Precision voltage measurement
- Industry automation test

ADMX3651 DIGITAL VOLTAGE METER

Figure 1. ADMX3651 Digital Voltage Meter (Top View)

Figure 2. ADMX3651 Digital Voltage Meter (Bottom View)

GENERAL DESCRIPTION

The ADMX3651 6½ digit, digital voltage meter (DVM) offers fast throughput (1 kSPS), flexible measurements (manual or automatic selection range), and trustworthy results (6 ppm of measurement accuracy for 30 days under 1 V range). The ADMX3651 provides a compact solution with the most common DVM measurements. With long measurement times, the norm for high integration precision applications—a simple, reliable, pocketable device that can save system space—is a popular addition to the toolbox of engineers.

The current consumption of the ADMX3651 is only around 310 mA for a 5 V power supply in stable working mode. Compared to complex instruments with numerous settings, the ADMX3651 requires simple settings with a preset configuration for a typical application. Electrically, the ADMX3651 is compatible with 1.8 V, 2.5 V, and 3.3 V interfaces, using an internal independently logic supply.

The ADMX3651 is available in a 77.70 mm × 46.30 mm × 20.15 mm, 10-lead module package with operating temperature specified from 0°C to 45°C.

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TABLE OF CONTENTS

Features 1
Applications 1
General Description 1
Specifications 3
Timing Diagram 5
Absolute Maximum Ratings 6
ESD Caution 6
Pin Configuration and Function Description 7
Terminology 8
Theory of Operation 9
Applications Information 10
Compliance and Certifications 11
Electromagnetic Compatibility 11
CE Mark 11
Outline Dimensions 12
Ordering Guide 12
Evaluation Boards 12

REVISION HISTORY

11/2025—Revision 0: Initial Version

SPECIFICATIONS

V_{CC} = 5.0 V, EN floating, and auto-zero on, unless otherwise noted.

Table 1. DC Specification

Parameter	Test Conditions/Comments	Min	Typ	Max	Unit
RESOLUTION	1 V range, 1000 samples, 10 NPLC[1]		6½		Digits
READING RATE (DC)					
Resolution					
5½	NPLC = 0.05		1000		Samples/sec
	NPLC = 0.1		500		Samples/sec
6½	NPLC = 100		0.5		Samples/sec
	NPLC = 10		5		Samples/sec
RMS NOISE	1 V range, 1000 samples				
100 NPLC				0.159	ppm of range
10 NPLC				0.178	ppm of range
1 NPLC				0.220	ppm of range
0.50 NPLC				0.248	ppm of range
0.25 NPLC				0.363	ppm of range
0.10 NPLC				0.503	ppm of range
0.05 NPLC				0.674	ppm of range
DC ACCURACY[2]	NPLC = 100, auto-zero on				
24 Hours (Calculation Temperature (T_{CAL}) ± 1°C)	T_{CAL} = 25°C				
100 mV	100 nV resolution		0.0012 + 0.0010		V±(% of reading + % of range)
1 V	1 µV resolution		0.0003 + 0.0001		V±(% of reading + % of range)
10 V	10 µV resolution		0.00015 + 0.0001		V±(% of reading + % of range)
30 Days (T_{CAL} ± 5°C)					
100 mV	100 nV resolution		0.0017 + 0.0010		V±(% of reading + % of range)
1 V	1 µV resolution		0.0004 + 0.0002		V±(% of reading + % of range)
10 V	10 µV resolution		0.0003 + 0.0001		V±(% of reading + % of range)
Temperature Coefficient/°C					
100 mV	100 nV resolution		0.0005 + 0.0005		V±(% of reading + % of range)
1 V	1 µV resolution		0.0005 + 0.0001		V±(% of reading + % of range)
10 V	10 µV resolution		0.0005 + 0.0001		V±(% of reading + % of range)
NOISE REJECTION					
Common-Mode Rejection Ratio (CMRR)	NPLC = 100	100			dB
Normal-Mode Rejection Ratio (NMRR)	NPLC ≥ 1	90			dB
	NPLC ≤ 1	0			dB
INPUT RESISTANCE					
±0.1 V Range		200			MΩ
±1 V Range		2			GΩ
±10 V Range		20			GΩ
Input Bias Current					
±0.1 V Range				1	nA
±1 V Range				1	nA
±10 V Range				1	nA

[1] NPLC is the number of power cycles.

[2] Warm-up time = 30 minutes

SPECIFICATIONS

Table 2. General Specification

Parameter	Test Conditions/Comments	Min	Typ	Max	Unit
POWER CONSUMPTION					
Input Voltage		4.5	5	5.5	V
EN Threshold Voltage			1.05		V
Inrush Current			860		mA
Operating Current			310		mA
TRIGGER CONDITIONS					
Minimum Pulse Width		1			µs
Maximum Data Rate				1	kSPS
Edge Type			Rising		
CTRL Threshold Voltage	See Figure 3				
Logic High		2.31			V
Logic Low				0.99	V
OVERRANGE	All ranges		10		%
SYSTEM SPEED					
Auto Range Time	NPLC = 10, auto-zero on		400		ms
Trigger Latency	NPLC = 10, auto-zero on, external trigger		400		ms
COMMUNICATION INTERFACE					
Type			UART		
Baud Rate[1]		9600	460,800	460,800	BPS
Stop Bit			1		Bit
Data Bit			8		Bits
Check Bit			None		
RX Input Threshold Voltage					
Logic High		2.31			V
Logic Low				0.99	V
TX Output Voltage					
Logic High		3.2	3.3		V
Logic Low			0.0	0.1	V

[1] The options of baud rate are 9600, 14,400, 19,200, 38,400, 57,600, 115,200, 230,400, and 460,800.

SPECIFICATIONS

TIMING DIAGRAM

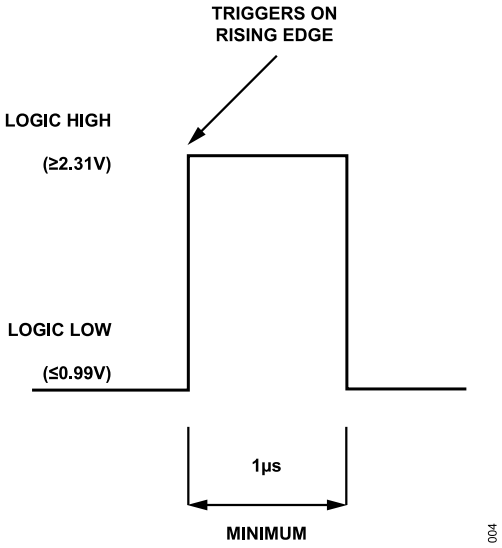


Figure 3. External Trigger for the CTRL Threshold Voltage Specification

ABSOLUTE MAXIMUM RATINGS

Table 3. Absolute Maximum Ratings

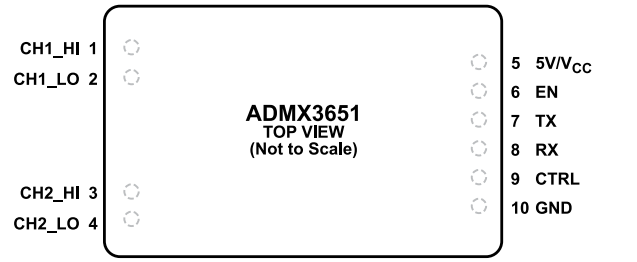
Parameter	Rating
V_{CC} to GND	0 V to ~7 V
EN to GND	0 V to ~V_{CC}
CTRL to GND	−0.5 V to ~+3.8 V
UART TX to GND	−0.5 V to ~+3.8 V
UART RX to GND	−0.5 V to ~+3.8 V
Analog Input Voltage to GND	
Channel 1	70 V
Channel 2	70 V
Environment (Indoor Use Only)	
Maximum Altitude	2,000 m (at 25°C ambient temperature)
Pollution Degree	2
Operating Environment	
Temperature	
Operating Range	0°C to ~45°C
Storage Range	−40°C to ~+70°C
Relative Humidity Range	10% to 90%, noncondensing
Calibration Interval	1 year recommended
Warm-Up Time	30 minutes to rated accuracy

Stresses at or above those listed under Absolute Maximum Ratings may cause permanent damage to the product. This is a stress rating only; functional operation of the product at these or any other conditions above those indicated in the operational section of this specification is not implied. Operation beyond the maximum operating conditions for extended periods may affect product reliability.

ESD CAUTION

ESD (electrostatic discharge) sensitive device. Charged devices and circuit boards can discharge without detection. Although this product features patented or proprietary protection circuitry, damage may occur on devices subjected to high energy ESD. Therefore, proper ESD precautions should be taken to avoid performance degradation or loss of functionality.

PIN CONFIGURATION AND FUNCTION DESCRIPTION



NOTES
1. THE 0327-0-15-01-34-27-10-0 (MILL-MAX) IS RECOMMENDED AS THE PIN RECEPTACLE, AND SOLDER MOUNT IN 1.91mm MINIMUM MOUTING HOLES.
2. THE TWO M3 NUTS CAN BE USED TO ASSIST IN SECURING THE PRODUCT, IF REQUIRED. THE MAXIMUM THREAD DEPTH ON PRODUCT IS 3mm. SCREWING BOLTS INTO THE PRODUCT FOR MORE THAN 3mm MAY DAMAGE THE PRODUCT. CONTACT ANALOG DEVICES FOR SELECTING THE SCREWS PROPERLY.

003

Figure 4. Pin Configuration

Table 4. Pin Function Descriptions

Pin No.	Mnemonic	Description
1	CH1_HI	Channel 1 Input High.
2	CH1_LO	Channel 1 Input Low.
3	CH2_HI	Channel 2 Input High.
4	CH2_LO	Channel 2 Input Low.
5	$5V/V_{CC}$	Positive Power Supply, 5 V DC.
6	EN	Enable Input. The ADMX3651 is shut down when the EN pin is low and active when the EN pin is high. Leave floating if the shutdown feature is not used.
7	TX	UART Transmit.
8	RX	UART Receive.
9	CTRL	External Trigger Input. The external trigger input requires a rising-edge pulse with the specifications, as shown in Figure 3.
10	GND	Power Ground.

TERMINOLOGY

APERTURE TIME

Aperture time is the period, measured in seconds, during which the analog-to-digital converter (ADC) samples the input signal for measurement. A longer aperture yields better resolution, and a shorter aperture provides for faster measurements. This mode allows the user to set a specific integration time that is not based on power-line frequency. Use aperture, instead of PLC, only when precise control over the integration time of the DVM is required.

RESOLUTION

The display digits refer to the level of resolution that the DVM can measure. Resolution is a level of detail that is quantifiable on a DVM. The higher the number of DMM display digits, the higher the resolution of the DVM. A 6½ digit DVM has an actual measurement range of ±1,999,999 resolution counts or +2,000,000 resolution counts. The ½ digit refers to the most significant digit but can only be either a 0 or a 1. Resolution is the level of detail that is measurable or the number of significant digits on a digital multimeter.

POWER LINE CYCLES (PLCS)

Using PLCs sets the number of PLCs during which the ADC samples the input signal for measurement. The DVM automatically detects the AC line frequency, using it and the PLC selection to set integration time. Use a larger PLC value for better resolution, and use a smaller PLC value for faster measurements. To obtain normal mode (line-frequency noise) rejection, select PLC mode, with an integral number of PLCs (for example, 1 PLC, 10 PLCs, or 100 PLCs).

COMMON-MODE REJECTION RATIO (CMRR)

CMRR describes the ability of the digital multimeter (DMM) to reject a common-mode signal and is often specified with a 1 kΩ resistance in the input lead (CHx_LO) of the ADMX3651. CMRR is important because it indicates how much of the common-mode signal affects measurement.

THEORY OF OPERATION

The ADMX3651 is a digital voltage meter of a precision signal chain with a selectable range of 0.1 V, 1 V, or 10 V. At the front end, the ADMX3651 incorporates a precision ADC driver with integrated precision resistors. The precision resistors can be strapped to achieve different gains for the ADC driver, which allows the user to match with the input signal range.

All active and passive components in the circuit, including the thin-film resistors with precise matching, are designed by Analog Devices, Inc., and are factory calibrated to achieve a high degree of specified accuracy and minimize temperature dependent error sources.

APPLICATIONS INFORMATION

Refer to the EVAL-ADMX3652 User Guide for the applications information.

COMPLIANCE AND CERTIFICATIONS

ELECTROMAGNETIC COMPATIBILITY

The ADMX3651 meets the requirements of the following EMC standards for electrical equipment for measurement, control, and laboratory use:

- EN 61326-1: Class A emissions; basic immunity
- FCC 47 CFR Part 15: Class A emissions
- ICES-003: Class A emissions
- KS C9991-2019 Class A emissions

CE MARK

The ADMX3651 meets the essential requirements of the following applicable European Union directives:

- 2014/35/EU: Low-Voltage Directive (Safety)
- 2014/30/EU: Electromagnetic Compatibility Directive (EMC)
- 2011/65/EU + 2015/863/EU: RoHS Directive

OUTLINE DIMENSIONS

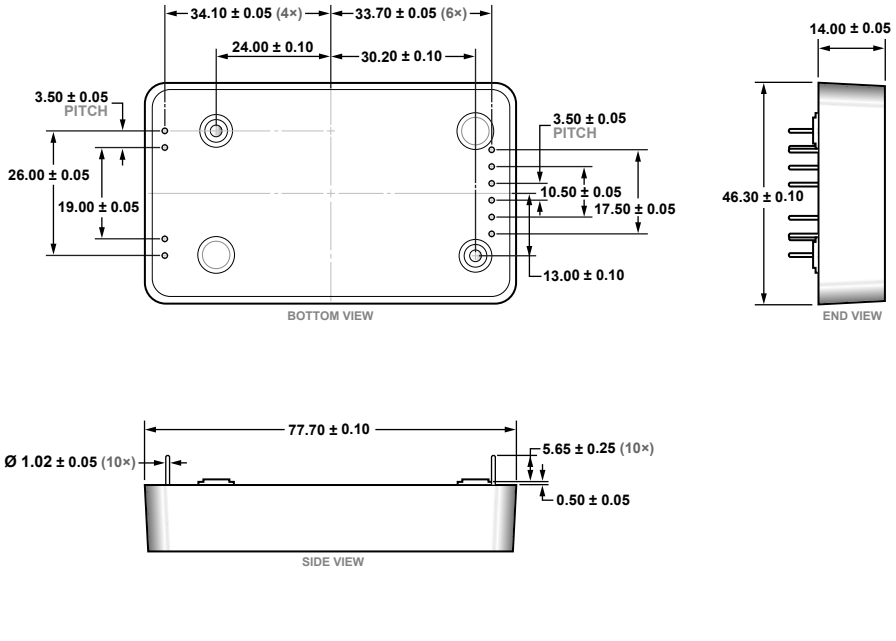


Figure 5. 10-Lead Module with Connector Interface [MODULE]
(ML-10-1)
Dimensions shown in millimeters

ORDERING GUIDE

Model[1]	Temperature Range	Package Description	Packing Quantity	Package Option
ADMX3651Z-ML	0°C to +45°C	10-Lead Module with Connector Interface	EACH, 1	ML-10-1

[1] Z = RoHS Compliant Part.

Updated: March 20, 2024

EVALUATION BOARDS

Model[1]	Description
EVAL-ADMX3652Z-INT	Evaluation Board

[1] Z = RoHS Compliant Part.