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CDA02-1000V Measurement

CDA02-1000V Technical Reference

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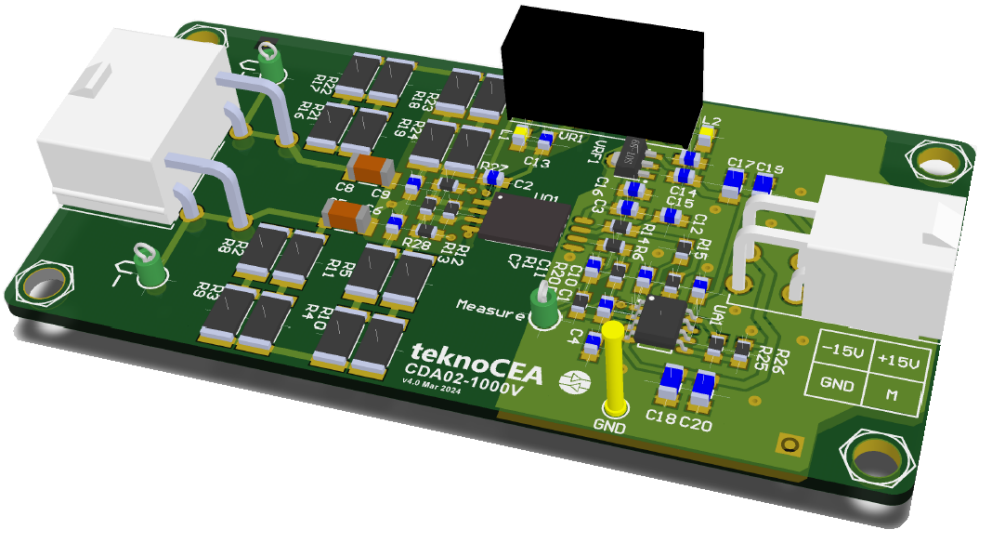

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Contents

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About This Manual

This document describes general characteristics of the CDA02-1000V measurement board, an isolated bipolar sensor used to sense AC or DC voltage from switching converters.

Information About Cautions

This book may contain cautions.

> **IMPORTANT NOTICE**
> **This is an example of caution**

A caution statement describes a situation that could potentially damage your hardware, or other equipment. The information in a caution is provided for your protection. Please read each caution carefully.

1 Introduction to CDA02-1000V

The CDA02-1000V is a versatile isolated bipolar voltage sensor. It is used to sense AC (50-60 Hz) or DC voltage from switching converters. Its block diagram is shown in Figure 1.

On the primary side, there is a resistor-capacitor circuit to reduce and filter the input voltage level and to attenuate the effect of the input-output common mode voltage. Designers can modify the values of the capacitors and resistors in order to modify the input voltage range and filter bandwidth, under their liability.

The CDA02-1000V has a fully differential optical isolation barrier with excellent linearity and dynamic performance up to 200 kHz.

On the secondary side, a differential second order filter with a gain higher than one has been implemented. Application designers can modify the output stage capacitor and resistor values to modify the output voltage range and bandwidth, under their liability.

By default, the CDA02-1000V is set for a ±1000 V input voltage range and ±5 V output voltage range with a 100 kHz bandwidth.

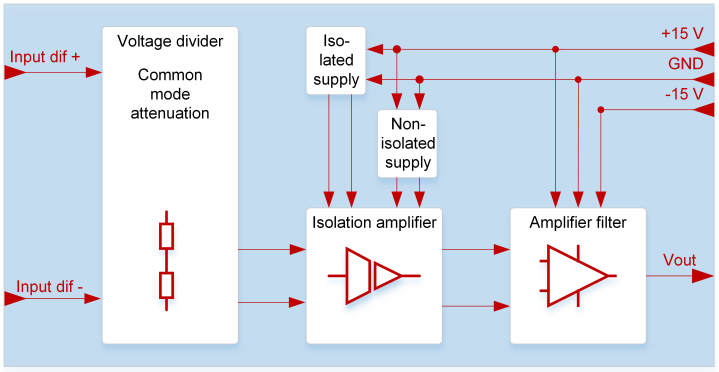

Figure 1: Block diagram of the CDA02-1000V

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2 Electrical Characteristics

Table 1 specifies the electrical characteristics of the CDA02-1000V.

Symbol	Description	Min.	Typ.	Max.	Unit
Main Parameters					
V_{cc}	Power supply voltage	13.8	15	16.5	V
ΔV_{cc}	Power supply ripple		100		mV
I_s	Supply current @ $T_a = 40°C$, $V_{in} = 1000\ V$		25	35	mA
V_{in}	Voltage range between terminals on J1			±1000	V
V_{out}	Voltage range on the J2 pin 4		±5	10	V
I_{out}	Current on the J2 pin 4 (peak)			40	mA
G	Total Gain of the sensor ($G1 \times G2 \times G3$)		5		mV/V
T_a	Ambient temperature		40		°C
Primary side					
Acc_1	Voltage divider accuracy			2	%
P_{diss}	Power dissipation for voltage divider			8	W
G_1	Gain of the voltage divider		0.198		mV/V
f_{s1}	Frequency bandwidth		167		kHz
Isolator parameters					
V_{diff}[1]	Voltage range at isolator input	0	±0.2	±0.3	V
G_2	Gain of the isolator	8.16	8.2	8.24	V/V
NL_{200}	Nonlinearity over ±200 mVV_{diff}		0.05	0.13	%
f_{s2}	Frequency bandwidth		200		kHz
Secondary side					
Acc_3	Voltage divider accuracy			2	%
f_{s3}	Frequency bandwidth		123		kHz
G_3	Gain of the 2nd order filter		3.084		V/V
CMRR	Amplifier Common mode rejection ratio @ $T_a = 25°C$	75	94		dB
SR	Amplifier slew rate at unity gain @ $T_a = 25°C$, $RL = 10\ k\Omega$, $CL = 100\ pF$	1.5	5.1		$V/\mu s$
B	Amplifier Unity-gain bandwidth @ $T_a = 25°C$, $RL = 10\ k\Omega$, $CL = 100\ pF$		1.1		MHz

Table 1: Electrical Characteristics of the CDA02-1000V

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3 General Description

3.1 Voltage sensing adjustment

The CDA02-1000V uses the optically isolated voltage amplifier ACPL-C79B from Avago Technologies. A voltage divider at the input stage is used to attenuate the voltage level to the input levels of the chip. At the output, a filtering and scaling circuit is implemented. Figure 2 shows the layout of the CDA02-1000V.

By default, the input voltage range is ± 1000 V, and the output voltage ranges is ± 5V, giving a gain G = 5 mV/V that can be computed as the combination of the 3 stages. The first stage includes a first order filter with a cut-off frequency of 167 kHz. The ACPL-C79B chip has a bandwidth of 200 kHz. The third stage includes a second order filter with a cut-off frequency of 123 kHz. The overall cut off-frequency is 100 kHz.

3.1.1 Range and gain configuration

To modify the voltage range, components R12, R13, C6 and C9 can be replaced according to characteristics on Table 2 . The components position on the board is shown in Figure 2.

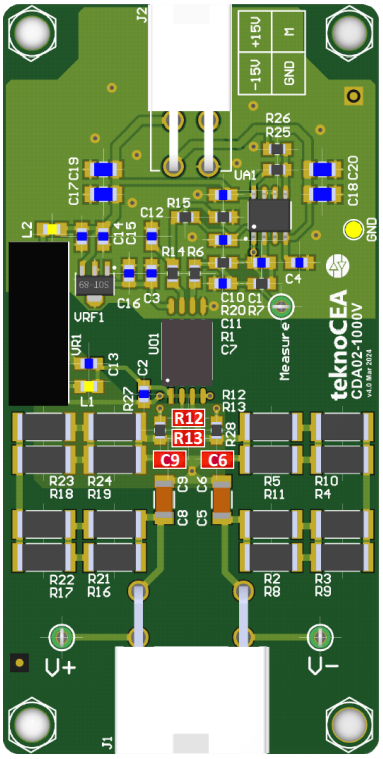

Figure 2: Component position for range configuration

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Range	Gain	R12 (0805 package)	R13 (0805 package)	C6, C9 (0805 package)
1000 V	5,00 mV/V	200 Ω ± 1 %	51,1 Ω ± 1 %	47 pF ± 10 %
800 V	6,25 mV/V	280 Ω ± 1 %	61,9 Ω ± 1 %	36 pF ± 10 %
600 V	8,33 mV/V	402 Ω ± 1 %	82,5 Ω ± 1 %	27 pF ± 10 %
400 V	12,50 mV/V	536 Ω ± 1 %	127 Ω ± 1 %	18 pF ± 10 %
200 V	25,00 mV/V	1020 Ω ± 1 %	261 Ω ± 1 %	9,1 pF ± 10 %

Table 2: Component technical specifications for range configuration

3.1.2 Bandwidth configuration

To modify the bandwidth of the CDA02-1000V, components C1 and C11 can be replaced according to characteristics on Table 3. The components' position on the board is shown in Figure 3.

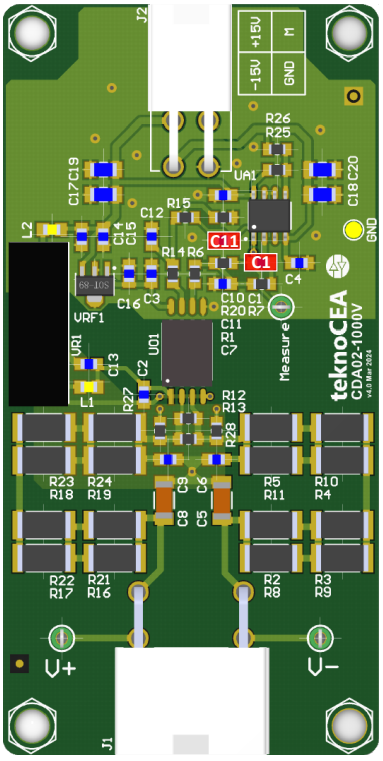

Figure 3: Component position for bandwidth configuration

Cutoff frequency	C1, C11 (0805 package)
100 kHz	22 pF ± 10 %
80 kHz	30 pF ± 10 %
60 kHz	43 pF ± 10 %
40 kHz	62 pF ± 10 %
20 kHz	120 pF ± 10 %

Table 3: Component technical specifications for bandwidth configuration

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3.2 Connectors

3.2.1 J1 connector, measure input voltage

The J1 connector is used to supply to the system the input voltage that will be measured. The J1 connector is from Molex, manufacturer reference 39-30-1081. The female connector that matches the J1 is also from Molex, manufacturer reference 39-01-2080. The corresponding female crimping terminals are also from Molex, manufacturer reference 39-00-0090. Pin arrangement and function of connector J1 is summarized in Table 4.

Pin	Pin name	Function	Description
1, 2	V+	Power	Terminal 1 of voltage to be measured
7, 8	V-	Power	Terminal 2 of voltage to be measured

Table 4: J1 connector, pin function and arrangement

3.2.2 J2 connector, ±15 V supply and measure output voltage.

The J2 connector is used to supply the CDA02-1000V sensor with ±15 V and to obtain the output measure. The J2 connector is from Molex, manufacturer reference 39-30-1041. The female connector that matches the J2 is also from Molex, manufacturer reference 39-01-2040. The corresponding female crimping terminals are also from Molex, manufacturer reference 39-00-0090. Pin arrangement and function of connector J2 is summarized in Table 5.

Pin	Pin name	Function	Description
1	+15V	Power	Power supply +15 VDC
2	Measure	Analog output	Output voltage measured
3	-15V	Power	Power supply -15 VDC
4	GND	Power	Ground for power supply

Table 5: J2 connector, pin function and arrangement

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4 Operation

4.1 Security Precautions

4.1.1 General precautions

Do not disconnect any cable under load.

Do not pull any cable, which may cause their breaking or unplugging.

Before any intervention, ensure no high voltage is still applied to the sensor.

Nylon spacers M3 are recommended for assembly (i.e. Duratool D01496 spacers with Duratool 1110030 nuts).

4.1.2 Maintenance

It is important to clean the CDA02-1000V regularly in order to avoid short-circuits between terminals on the high voltage side.

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5 Mechanical drawings

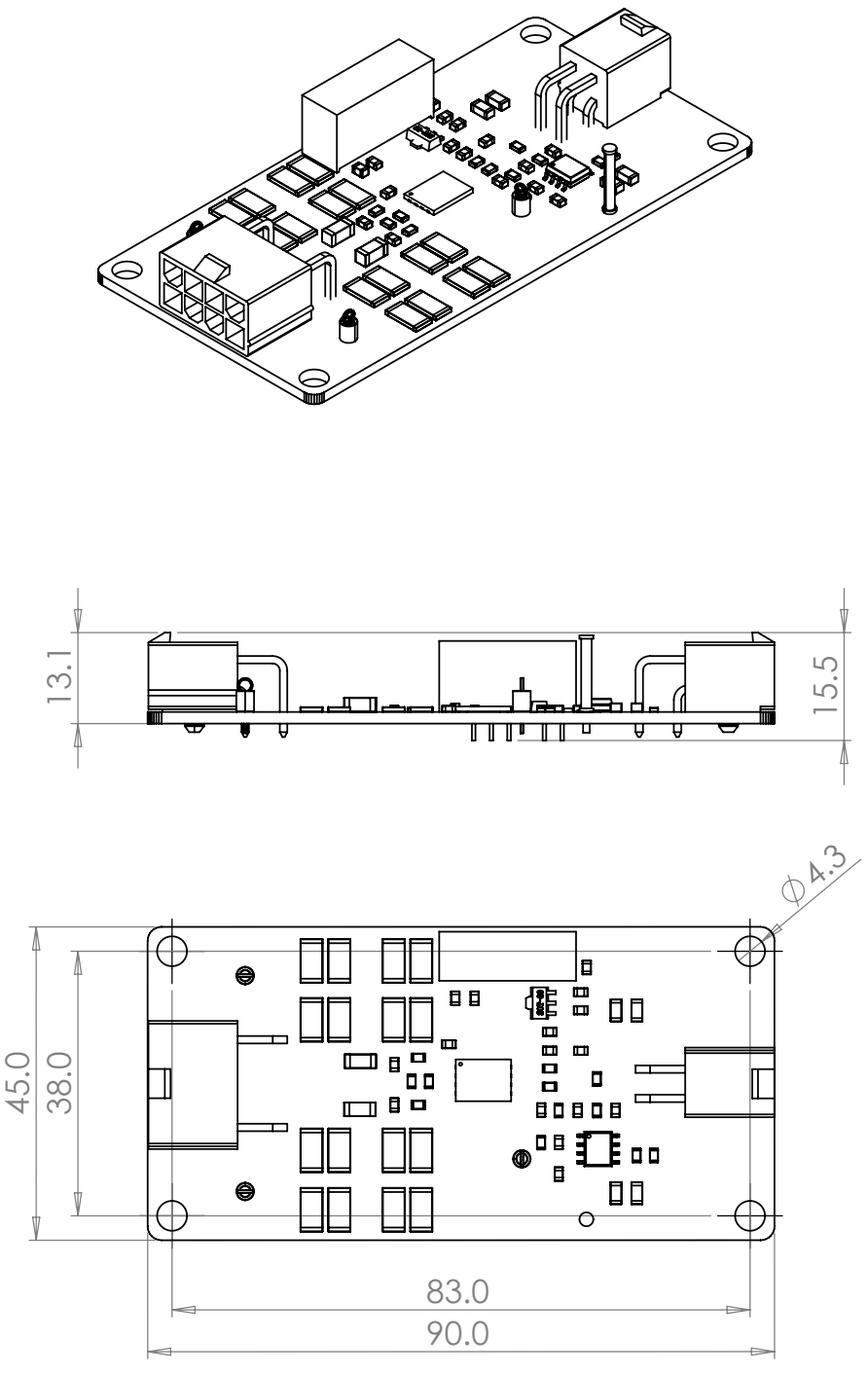

Figure 4: CDA02-1000V Mechanical drawings.

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