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The technical content of this austriamicrosystems application note is still valid.

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AS8002

Solar Photovoltaic Inverter Measurement IC with Fast Over Current Detection

AS8002-AB-1.0 Adapter Board
OPERATION MANUAL

General Description

Power inverters in solar photovoltaic systems are often connected directly to the electricity grid in order to inject the created energy into the mains and act as an electricity supplier. This energy must comply with certain regulations that set the standard in terms of quality and safety which requires of accurate measurements.

The AS8002 is a highly accurate measurement IC that allows monitoring the generated energy with low cost shunt resistors or other sensors for the current and resistor dividers for the voltage. This approach allows avoiding more expensive sensing devices while achieving the required accuracy for DC and AC measurements of current and voltage as well as stability over the operating temperature range of the inverter.

The 12 bit ADC samples the voltage and current and provides their instantaneous values through an SPI interface.

The 12 Bit ADC is preceded by low noise programmable gain amplifiers in order to accommodate different sensors. The ADC has three multiplexed inputs, offering one secondary channel in addition to the main voltage and current.

The on-chip temperature sensor provides the inverter designer the option of temperature compensation for any of the measured parameters or functional blocks provided, over the full operating temperature range of the device.

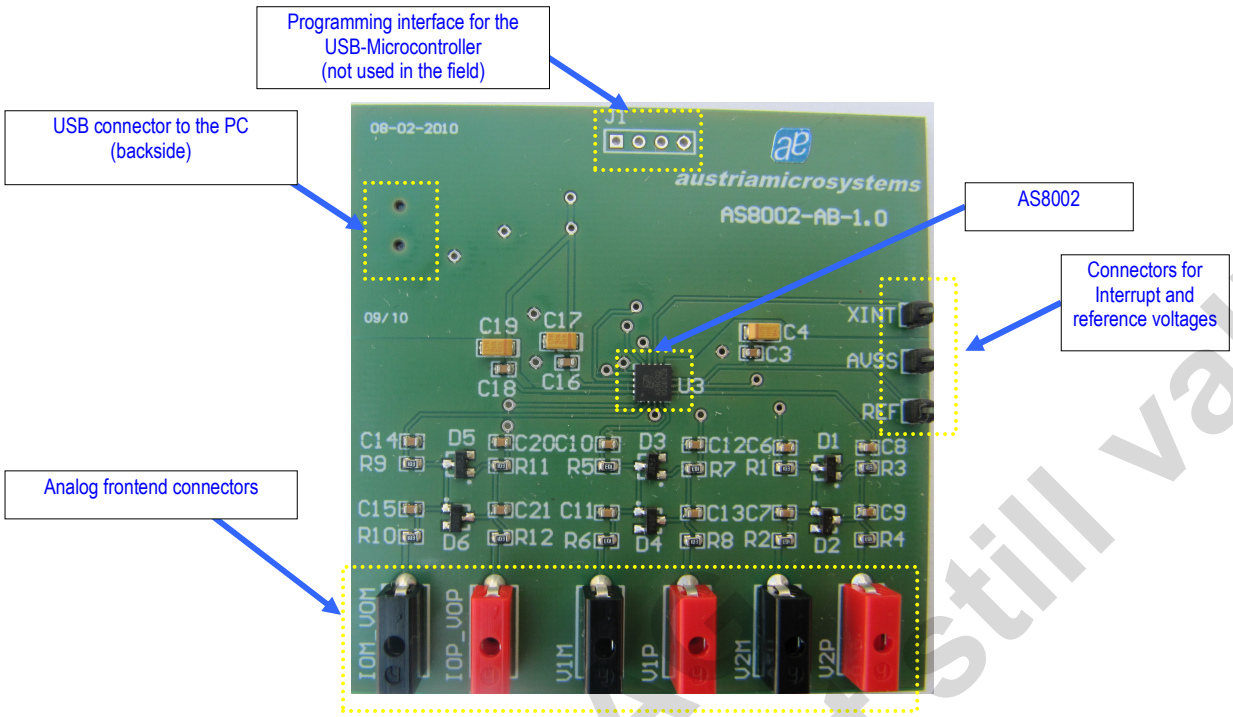
The on-chip voltage reference is connected to the ADC and to REF. An external crystal oscillator is not required as a high accuracy internal oscillator clock is available.

The independent over current interrupt detects a high current on the grid and allows the processor to open the switches without waiting for the ADC conversion.

The AS8002 Adapter Board

The AS8002-AB-1.0 Adapter board allows you an easy-to-use evaluation of the essential functions of the AS8002.
It is a system with built-in microcontroller, USB interface and a simple analogue frontend. The complete system is fully supplied by the PC and needs no additional external power supply.
In combination with the AS8002-GUI PC software is it possible to evaluate all the basic functions.

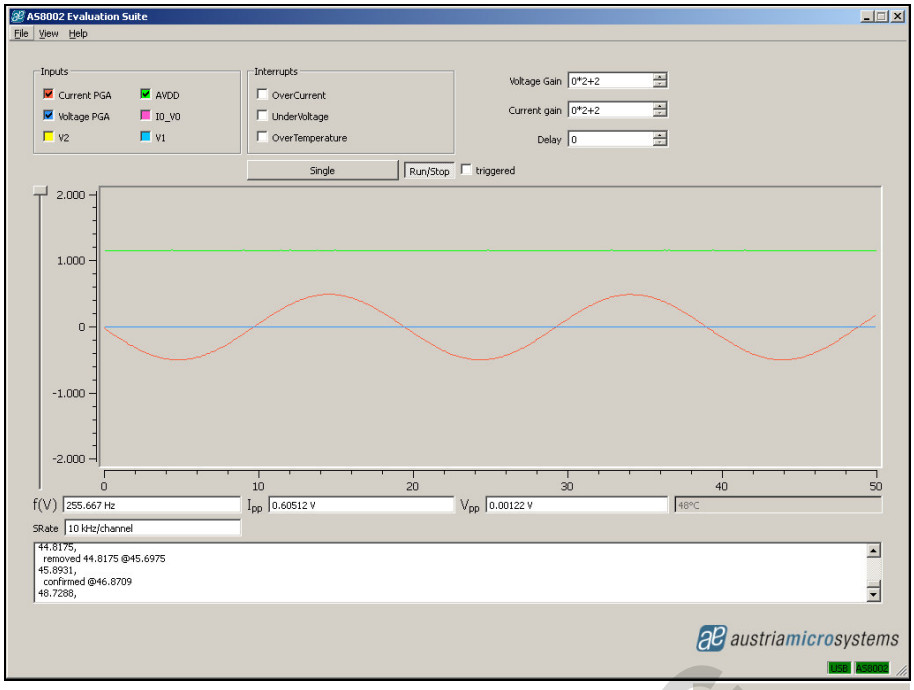
Board overview

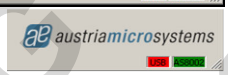


The inputs of the analog frontend are differential. If they are driven from a single ended source it is essential that the source is floating compared to the ground potential of the USB interface which acts as the power supply for the board.

AS8002 GUI Software

The software is developed for a Microsoft Windows XP operating system with Service Pack 2. After installing the "**Install.msi**" package the AS8002_EvalSW application is ready for use.
The GUI works like an Oscilloscope and is able to display the input signals according the selection done in the **Input** checkboxes. Furthermore the register map information can be displayed.





Red USB box indicator:
Adapterboard is not connected

INPUTS

Pin Name	Description
I0P_V0P	Analog Input Channel 0. Positive input of the *differential* analog input.
I0M_V0M	Analog Input Channel 0. Negative input of the *differential* analog input.
V1P	Analog Input Channel 1. Positive input of the *differential* analog input.
V1M	Analog Input Channel 1. Negative input of the *differential* analog input.
V2P	Analog Input Channel 2. Positive input of the *differential* analog input.
V2M	Analog Input Channel 2. Negative input of the *differential* analog input.

GAIN

The value Controls the gain of the current and voltage channel PGAs:

- Gain for current channel is given by the formula **2*pga_curr_gain+ 2**
- Gain for voltage channel is given by the formula **2*pga_volt_gain + 2**

Programmable gain amplifiers (apply floating signals only)			**MIN**	**TYP**	**MAX**	
AMP GAIN ch 0	Gain channel 0	Programmable	2		64	V/V
I0P_V0P / I0M_V0M	Input level 0	Differential, with gain of 64		14	20	mV_P
AMP GAIN ch1	Gain channel 1	Programmable	2		8	V/V
V1P / V1M	Input level 1	Differential, with gain of 6		150	212	mV_P

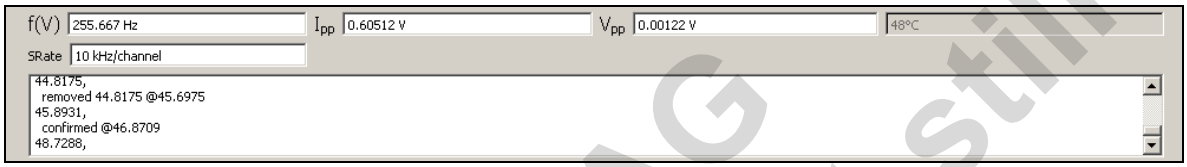
INTERRUPT

When an over current, an under voltage or an over temperature occurs the bit **warning_detected** is set to 1 and the Interrupt state is visible in the checkbox.

SINGLE / RUN-STOP Button

Single button activates a single readout of the selected channels
Run/Stop activates a continuously readout of the selected channels
Triggered check box: displays steady waveform (works only with activated Voltage PGA signal)

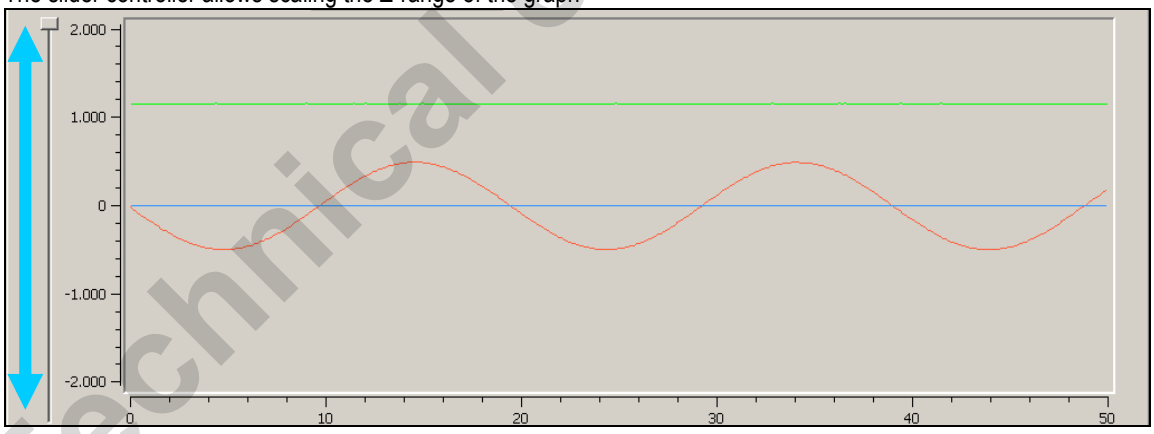
STATUS INFORMATION



f(V)	Analog input channel 2 (voltage channel) frequency
Ipp	Analog input channel 1 (current channel) amplitude
Vpp	Analog input channel 2 (voltage channel) amplitude
°C	On chip temperature
SRate	Displays sampling rate per channel

SCALING (SLIDE CONTROL)

The slider controller allows scaling the Z-range of the graph



Register Map (Shortcut CTRL+M)

Register Map

File View

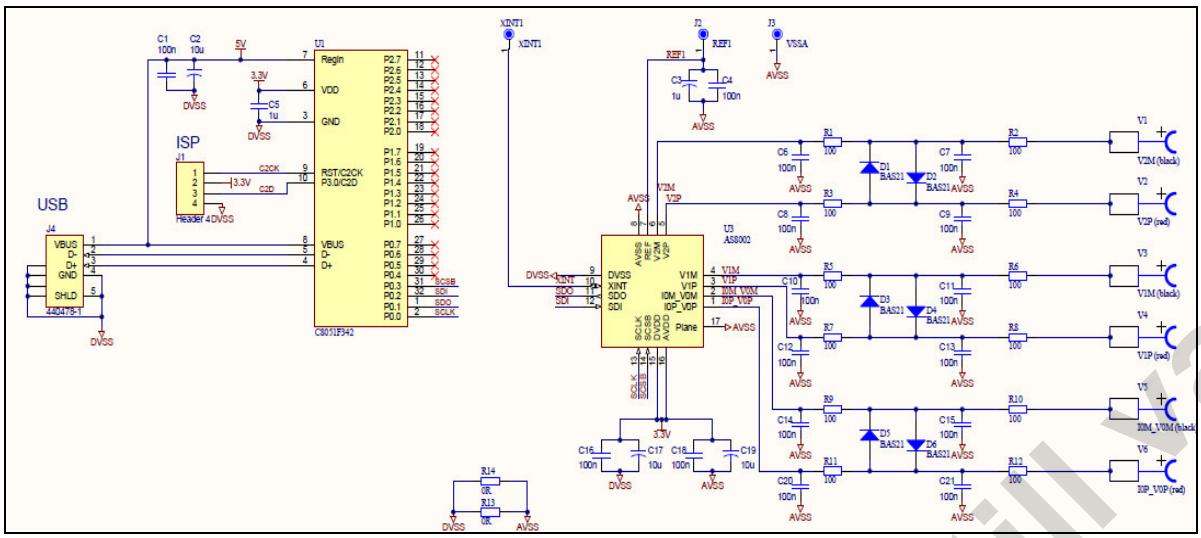
	Addr.	7	6	5	4	3	2	1	0	Value
Control (rst 0x00)	0x1	0	1	1	1	1	1	1	1	0x7f
PGA Gain (rst 0x00)	0x2	0	0	0	0	0	0	0	0	0x00
Input Multiplexer (rst 0x00)	0x3	0	0	0	1	0	1	0	0	0x14
Over Temperature Threshold (rst 0xFF)	0x4	1	1	1	1	1	1	1	1	0xff
Interrupt Enable (rst 0x00)	0x5	0	0	0	0	0	0	0	0	0x00
Over Current Range (rst 0xFF)	0x6	1	1	1	1	1	1	1	1	0xff
Current Measurement MSB (rst 0x00)	0x10	0	0	0	1	0	0	0	1	0x11
Current Measurement LSB (rst 0x00)	0x11	0	0	0	0	1	0	1	0	0x0a
Voltage Measurement MSB (rst 0x00)	0x12	0	0	0	1	0	0	0	0	0x10
Voltage Measurement LSB (rst 0x00)	0x13	0	0	0	0	0	0	0	0	0x00
Auxiliary Measurement MSB (rst 0x00)	0x14	0	0	0	1	0	0	0	0	0x10
Auxiliary Measurement MSB (rst 0x00)	0x15	0	0	0	0	0	0	0	0	0x00
Temperature Measurement (rst 0x00)	0x16	1	0	0	0	0	0	1	0	0x82
Interrupt Status (rst 0x00)	0x17	0	0	0	0	0	0	0	0	0x00
ASIC ID 1 (rst 0x02)	0x18	0	0	0	0	0	0	1	0	0x02
ASIC ID 2 (rst 0x50)	0x19	0	1	0	1	0	0	0	0	0x50
Raw ADC Results MSB (rst 0x00)	0x1a	0	0	0	0	1	1	1	1	0x0f
Raw ADC Results LSB (rst 0x00)	0x1b	0	1	1	1	0	0	1	0	0x72
PGA Current Gain Calibration (rst 0x00)	0x3a	0	0	0	0	0	1	1	0	0x06
PGA Voltage Gain Calibration (rst 0x00)	0x3b	0	0	0	0	0	0	0	0	0x00
Auxiliary Channel Gain Calibration (rst 0x00)	0x3c	0	0	0	0	0	0	0	0	0x00

Read only register map

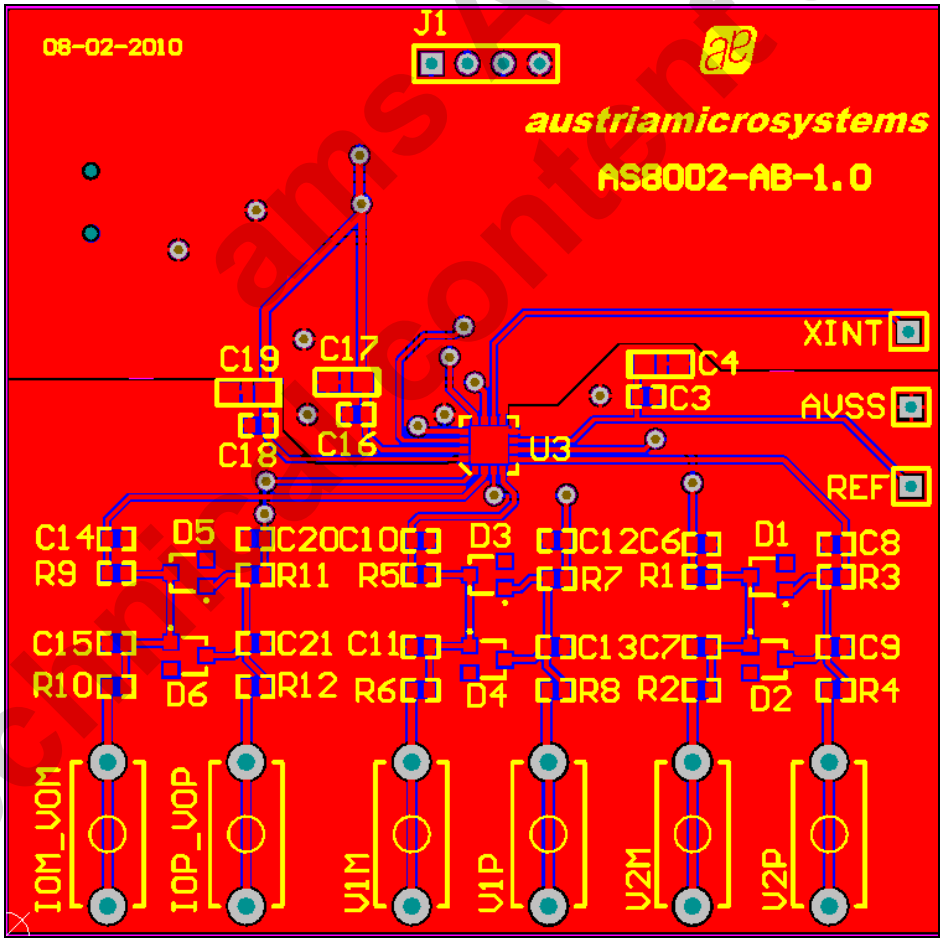
Available Shortcuts:

CTRL + U	**Update register contents**
CTRL + V	**toggle HEX/DEC view**

AS8002 Demoboard Schematic and Blockdiagram



AS8002 Adapterboard schematic



AS8002 Adapterboard PCB Layout

Revision History

Revision	Date	Description
1.0	April 2010	First version

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