

ADI Renewable Energy—Solar PV Solutions

ADI Energy Segment Overview

Analog Devices leads the industry in highly accurate and precise signal measurement and control by delivering cost competitive, high quality ICs for reliable metering, measurement, and control. These products are used in renewable energy, electrical power transmission, and distribution applications, as well as electric, gas, and water metering. The combination of ADI's proven expertise in optimized system-level signal processing performance and its extensive range of product offerings provides developers with accurate, reliable, and easy to design energy management solutions.

Main Challenges and System Considerations

- Higher reliability and lower assembly/manufacturing costs
- Relatively harsh environment with temperatures up to +125°C
- Power conversion efficiency is critical and components that consume as little power as possible are needed
- Keeping the generated harmonics below the regulatory levels
- Maintain low dc injection current levels onto the grid

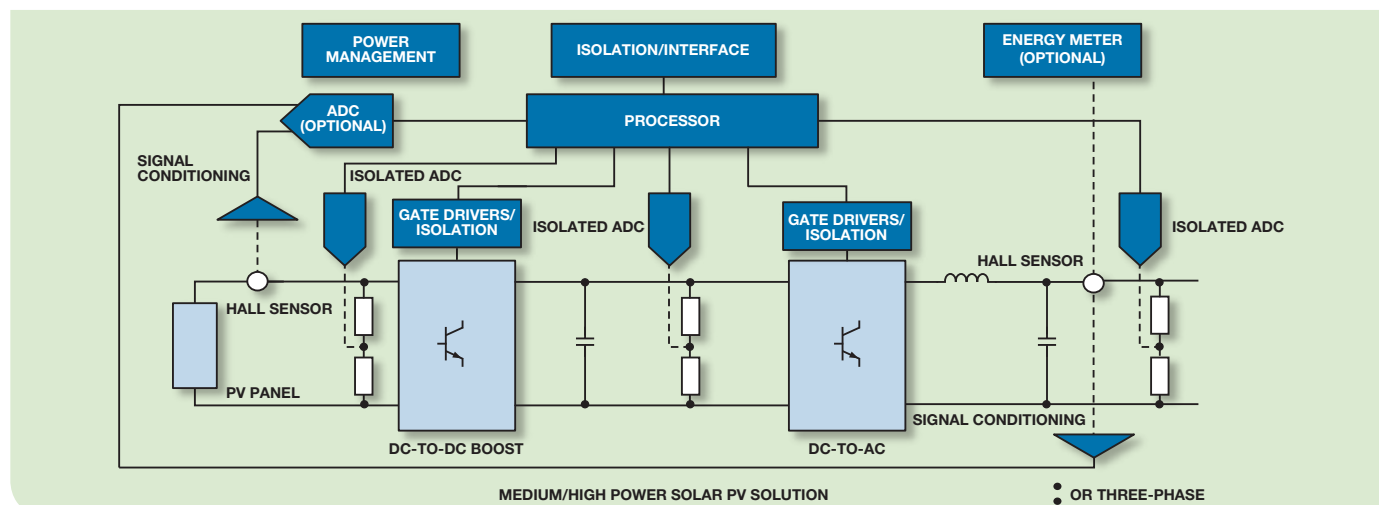
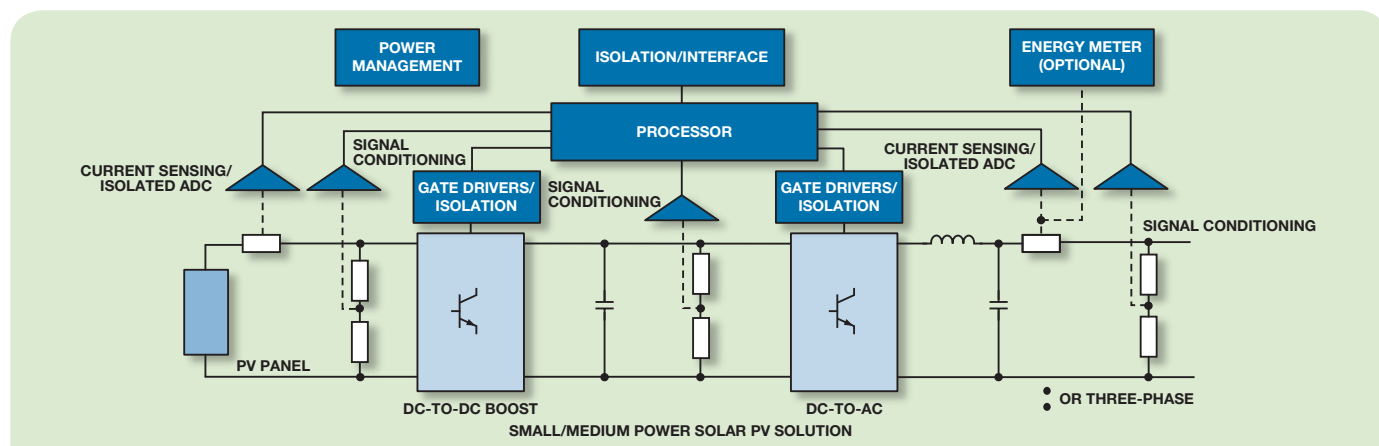
Why Choose ADI?

- ADI's expertise in integrated energy measurement—300 million ADI metrology-based meters deployed
- 50% of all electrical grid equipment worldwide uses ADI converters
- Precision measurement of current and voltage through highly accurate converters and amplifiers
- Enabling power networks using high performance processing technology engineered with robustness and reliability
- Mixed-signal conversion and processing enable ease of design and reduced time to market

Solar PV Application Categories

- Offline solar PV system
- Grid-connected solar PV systems
 - High power solar PV (>100 kW)
 - Medium power solar PV (1 kW to 10 kW)
 - Microinverter (200 W to 300 W)

Main Signal Chain



Current Sensing Amplifiers	Signal Conditioning Amplifiers	Isolated ADCs	ADCs	References	Isolation	Gate Drivers	Interfaces	Processors	Energy Meters	Power Management
AD628, AD629, AD8210, AD8212, AD8217, AD8218	ADA4091-2, ADA4610-x OPx177, AD8622, AD8624, AD8275,	AD7400A, AD7401A	AD7266, AD7606, AD7607, AD7606-6, AD7656-1	AD158x, ADR34xx, ADR421, ADR50xx	ADuM121x, ADuM131x, ADuM141x, ADuM347x, ADuM5000, ADuM520x, ADuM540x,	ADuM5230, ADuM6132, ADuM7234	ADM2587E, ADM3053E, ADM3251E, ADM3485E	ADSP-BF50x, ADSP-BF51x, ADuC702x	ADE7878, ADE7953, ADE8155, ADE8156	ADP125, ADP1710, ADP211x, ADP230X

ADI Product Technologies for Renewable Energy (Solar PV Systems)

- Amps/references
- Precision ADCs
- Current and voltage measurement ICs
- Processors—Blackfin® ADSP-BF50x and ARM7-based processors
- Power management ICs
- Vibration sensors—MEMS and accelerometers
- iCoupler® isolators—integrated isolation with USB and RS-485

Featured Products

Part Number	Description	Key Features	Benefits
Amplifiers			
AD8212	Current sense amp	6 V to >500 V common-mode range, adjustable gain, current output	High common-mode input range
ADA4091-2	Operational amp	Single-supply operation: 3 V to 30 V and wide input voltage range, rail-to-rail output swing, low supply current: 250 μ A/amplifier, overvoltage protection (OVP)	Wide input voltage range and overvoltage protection
ADCs			
AD7400A/AD7401A	Isolated Σ - Δ modulator	Operates from a 5 V power supply and accepts a differential input signal of ± 250 mV (± 320 mV full scale)	Isolated and differential input
AD7606/AD7607	8-channel, 16-/14-bit simultaneous ADC	True bipolar analog input ranges: ± 10 V, ± 5 V, single 5 V analog supply, 2.3 V to 5 V VDRIVE, 1 M Ω analog input impedance, analog input clamp protection	8-channel simultaneous sampling, single 5 V supply
Processors			
ADSP-BF506F	Embedded ADC DSP	300 MHz/400 MHz Blackfin core, embedded 12-bit ADC and 4 MB flash, 6-pair PWM output and multi-interface	12-bit ADC and >300 MHz core
ADuC702x	Microconverter	41 MHz ARM7 core and embedded 12-bit ADC, 3-pair PWM output, 32 kB or 64 kB flash	Embedded 12-bit ADC
Isolation			
ADuM5000	Isolated dc-to-dc	isoPower® integrated isolated dc-to-dc converter, up to 500 mW output power, thermal overload protection	Isolated dc-to-dc
ADuM141x	Quad-channel digital isolator	High data rate: dc to 90 Mbps (NRZ), high common-mode transient immunity: >25 kV/ μ s, low power operation and bidirectional communication	Long lifetime, easy to select different direction
Interfaces			
ADuM2587E	Isolated RS-485/RS-422 transceiver	Half or full duplex, 500 kbps, 5 V or 3.3 V operation	Integrated isolated dc-to-dc converter ± 15 kV ESD protection
ADM3053E	Isolated CAN transceiver	Signal and power isolated CAN transceiver, complies with ISO 11898 standard, high speed data rates up to 1 Mbps	Integrated isolated dc-to-dc
Energy Meters			
ADE7878	3-phase energy meter	Less than 0.1% error in active and reactive energy over a dynamic range of 1000 to 1, less than 0.2% error in active and reactive energy over a dynamic range of 3000 to 1 at $T_A = 25^\circ\text{C}$	High performance, harmonic analysis
ADE7953	1-phase energy meter	Less than 0.1% error in active and reactive energy measurement over a dynamic range of 3000:1, less than 0.2% error in instantaneous I rms and V rms measurements over a dynamic range of 500:1	High performance, wide dynamic range
Processors			
ADP2114	DC-to-DC regulator	Configurable 3 A/1 A or 2 A/2 A dual output load combinations or 4 A combined single output, high efficiency: up to 95%	Programmable frequencies, single 4 A output
ADP2118	DC-to-DC regulator	3 A continuous output current, $\pm 1.5\%$ output accuracy, input voltage range from 2.3 V to 5.5 V	3 A continuous output current

Circuits from the Lab™ Reference Circuits for Energy Management

Reference circuits are subsystem-level building blocks that have been engineered and tested for quick and easy integration.

- *Layout Considerations for an Expandable Multichannel Simultaneous Sampling Data Acquisition System (DAS) Based on the AD7606 16-Bit, 8-Channel DAS (CN0148)* www.analog.com/CN0148
- *A Low Cost, 8-Channel, Simultaneously Sampled, Data Acquisition System with 84 dB SNR and Excellent Channel-to-Channel Matching (CN0175)* www.analog.com/CN0175
- *High Voltage, High Precision Current Sensing with Output Level Shifting Using the AD8210 Current Sense Amplifier and the AD8274 Difference Amplifier (CN0116)* www.analog.com/CN0116

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 Engineer Zone Community ez.analog.com
 Circuits from the Lab
 Reference Circuits www.analog.com/circuits

If you need more ADI solar PV applications and products information, please visit www.analog.com/energy.