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 of up to +125°C
- Power conversion efficiency is critical and need components that consume as little power as possible
- Keeping the generated harmonics below the regulatory levels
- Maintain low dc injection current levels onto the grid

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)
  - Micro-inverter (200 W to 300 W)

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 & 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

Main Signal Chain

SMALL/MEDIUM POWER SOLAR PV SOLUTION

MEDIUM/HIGH POWER SOLAR PV SOLUTION
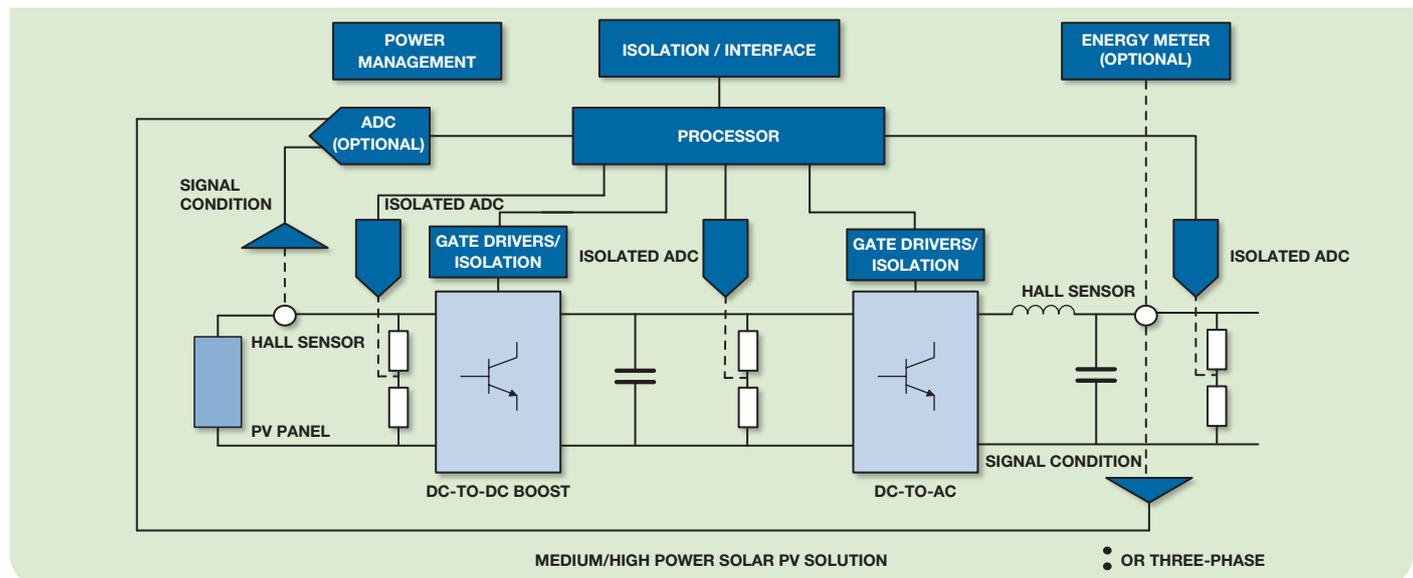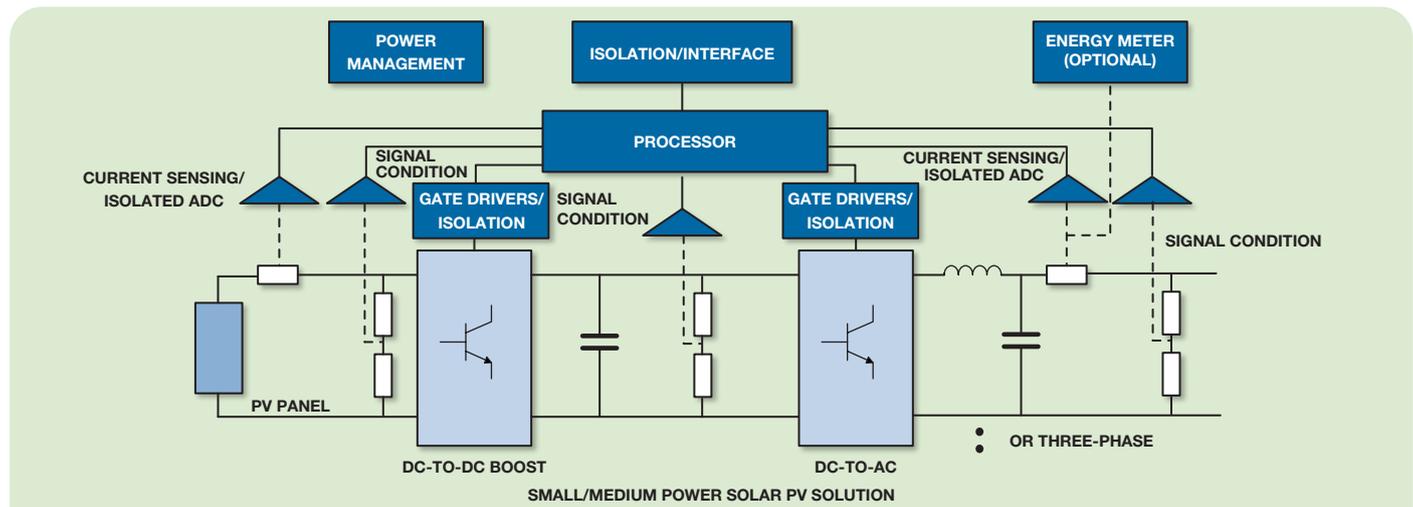
Current Sensing	Signal Condition	Isolated ADC	ADC	REF	Isolation	Gate Driver	Interface	Processor	Energy Meter	Power Management
AD628/ AD629 AD8210/ AD8212/ AD8217/ AD8218	ADA4091-2 0Px177 AD8622/ AD8624 AD8275	AD7400A/ AD7401A	AD7266 AD7606/ AD7607 AD7606-6/ AD7656-1	AD158x ADR34xx ADR421 ADR50xx	ADuM121x/ADuM131x/ 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/REFs
- Precision ADCs
- *i*Coupler isolators—integrated isolation with USB and RS-485
- Processors—Blackfin® ADSP-BF50x and ARM7-based processors
- Power management ICs
- Vibration sensors—MEMS & accelerometers
- Current and voltage measurement ICs

Featured Products

Part Number	Description	Key Features	Benefit
Amplifier			
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 µA/amplifier, overvoltage protection (OVP)	Wide input voltage range and overvoltage protection
ADC			
AD7400A/ AD7401A	Isolated sigma-delta 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-bit/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 MΩ analog input impedance, analog input clamp protection	8-channel simultaneous sampling, single 5 V supply
Processor			
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	Micro-converter	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	*iso*Power® 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/µs, low power operation and bidirectional communication	Long lifetime, easy to select different direction
Interface			
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 Meter			
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 $T_A = 25°C$	High performance, harmonic analysis
ADE7953	1-phase energy meter	Less than 0.1% error in active and reactive energy measurement over a synamic range of 3000:1, less than 0.2% error in instantaneous IRMS and VRMS measurements over a dynamic range of 500:1	High performance, wide dynamic range
Power Management			
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 , ±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

- *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

More reference circuits are available at *www.analog.com/circuits*

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

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Engineer Zone *ez.analog.com/index.jspa*
Free Sample *www.analog.com/pr/sample*

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ANALOG DEVICES