

Smart Grid Solutions



Engineering a Smarter Grid

Today's solutions for tomorrow's energy systems

- Grid Infrastructure
- Smart Electricity Meters
- Smart Gas, Water and Heat Meters
- Smart Buildings and IoT
- Communication



Smart Grid Solutions Guide

Introduction



Engineering a Smarter Grid

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- Smart Electricity Meters
- Smart Gas, Water and Heat Meters
- Smart Buildings and IoT
- Communication

With millions of energy-meter ICs shipped over the past decade, Texas Instruments is the global systems provider for innovative, secure, economical and future-proof semiconductor solutions for the worldwide smart grid. TI offers the industry's broadest smart grid portfolio of metrology expertise, application processors, communication systems and analog components in readily available silicon. Advanced software, tools and support are also available to meet the needs of the world's grid.

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Engineering a Smarter Grid

Dedicated Silicon + Optimized Software + Global Support = The Power of TI

Across the smart grid application spectrum, TI supports every stage of the design process, from device selection and software development to tools and system solutions.

Electric Meter Metrology

Solutions that meet ANSI C12.20 and IEC 62053 standards, Class 0.2 and 0.5:

- Single-phase System on Chip (SOC): MSP430F673x and MSP430AFE2xx
- Three-phase SOC: MSP430F677x
- Dedicated analog front ends: ADS13xx

Flow Meter Metrology

Dedicated AMR solutions for increased accuracy and ultra-low-power performance:

- Water/heat meter MCU (with Scan IF): MSP430FW42x

Applications Processors

Industry standard microcontrollers and microprocessors:

- Tiva™ C Series® ARM® Cortex™-M4 microcontrollers: TM4C123x 80 MHz, up to 256KB flash
- Tiva C Series ARM Cortex microprocessors: AM335x Cortex-A8 MPUs: Up to 1 GHz
- Powerful SoC DSP + ARM
- MSP430™ Microcontrollers: MSP430F5xx/6xx: ultra-low-power, up to 512KB

Power Line Communications

Complete, certified and field-tested PLC modems for all narrowband PLC standards:

- PRIME, G3, IEEE-P1901.2, ITU G.9903
- TI PLC reference designs for both meter end points and data concentrators

Wireless Connectivity

TI produces the best performing RF solutions for wide-area and home-area networks:

- CC112x: Narrowband transceivers Sub-1GHz, down to 6.25 kHz channels
- CC1200: Broadband transceivers Sub-1GHz with data rates up to 1 Mbps
- CC2538: Most integrated SOC for ZigBee®, Smart Energy with 512KB flash

- CC3000: SimpleLink™ Wi-Fi® module solution is self-contained and integrates total Wi-Fi connectivity, including Wi-Fi access point
- WiLink™ 8 solutions are highly integrated supporting Wi-Fi, Bluetooth® on a single chip.
- Bluetooth®/Bluetooth low energy: CC256x dual-mode controller, CC254x Bluetooth low energy devices.

TI wireless semiconductors are complemented by protocol stacks and application profiles supported by TI, including ZigBee PRO and ZigBee/IP, Smart Energy Profile, Wireless M-BUS and 6LoWPAN.

Prepayment Systems

RFID technology supporting ISO 14443A/B, ISO 15693, MIFARE™ and near field communications provides complete silicon and software stack solutions:

- TRF7970A transceiver
- RF430CL NFC smart interface tag

Power Management

TI provides optimized power management solutions for all smart grid applications (including offline, isolated AC/DC to non-isolated DC/DC) with the widest range of integration and performance options available.

See Power tables for AC/DC, DC/DC, LDO, PMIC and more, on page 16.

Development Tools

Robust and fully tested solutions with one-to-many approach—Industry-leading smart-meter board for development, ZigBee and power line communication large-node network test—and more.

Logistics

Expertise with large-scale production ramps—TI production, assembly and test sites are auditable.

Quality

TI meets high-volume, high-quality requirements with expertise in manufacturing.

People

TI provides dedicated application support teams for hardware and software that support complete analog and digital system solutions in grid infrastructure, metrology, PLC and RF connectivity.

External Representation

TI maintains an active presence in global regulatory bodies, including:

- Bluetooth SIG
- ETSI
- EcoNet Consortium
- Euridis
- EU-US Smart Grid Coordination Group
- G3-PLC Alliance
- IEEE 802.15.4/IEEE 802.15.4g Smart Utility Network (SUN) wireless standard
- IEEE P1901.2 narrowband PLC standard
- IPSO Alliance (6LoWPAN)
- ISO/IEC JWG CI (PEV)
- ITU-T Focus Group on Smart Grid
- ITU-T G.9901, G.9902, G.9903, G.9904 narrowband PLC standard
- KNX Alliance
- PRIME Alliance
- SAE PHEV Committee
- Smart Grid Interoperability Panel (NIST)
- Wi-Fi Alliance
- ZigBee Alliance
- WiSUN



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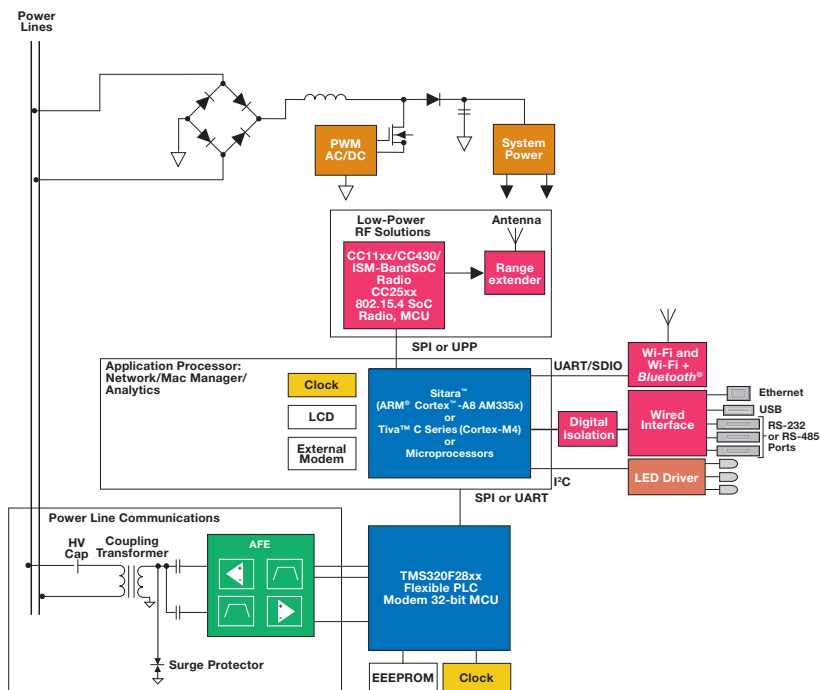
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Smart Grid Infrastructure

Data Concentrator Solutions

Automatic metering infrastructure (AMI) and automatic meter reading (AMR) provide the necessary means to measure, analyze, collect energy usage and communicate that data to a central database for billing, troubleshooting, and analyzing. It would not be practical, technically as well as economically, for all meters to directly communicate with utility servers. Data concentrator applications are an important node in the AMI which is networked with several utility meters and central utility servers and enables communication of the data between the meters and the utility servers. Data concentrators at several points in the infrastructure securely aggregate data from a manageable number of meters and send to the utility servers.

Data Concentrator System



Evaluate TI's solutions for data concentrator based on ARM® technology. Support up to 2000 nodes G3-PLC standard, PRIME standard, IEEE-1901.2 standard

Supports control and data communications: 2x Ethernet, 3-phase PLC interface, sub-1GHz and 2.4GHz, RF 2x RS-232, 3x RS-485

Designed to best practices for high-speed systems: Good reference for design passing ESD system tests; BOM and schematics available

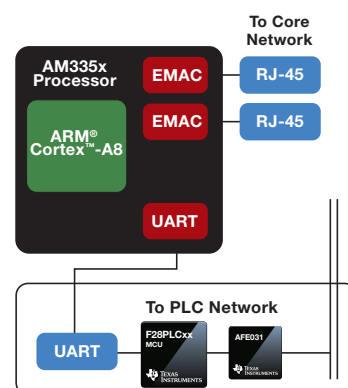
Hardware Features

- Isolation to prevent damage from high-voltage currents
- Three-phase power line communication module support
- On-board 120-/240-V power supply
- AM335x processor:
 - Sitara™ ARM® Cortex™-A8 processor for upper-level data concentrator stack and communications
 - Full Linux BSP supported by TI
- Temperature sensor
- Sub-1GHz and 2.4GHz RF
- Infrared receiver and transmitter
- 2x USB
- 2x Ethernet
- 2x RS-232
- 3x RS-485

The communication mode largely depends on the power infrastructure and can be either wired or wireless communication. Wired communication is comprised of Power Line Communication (PLC) and in some cases with serial or Ethernet-based communication where PLC is not suited for the infrastructure. The wireless communication comprises of mainly low-power RF (IEEE 802.15.4g protocol) communication and in some cases the existing cellular medium. The communication from the concentrator to the utility servers can be via Ethernet, GSM, GPRS, WiMAX or telecom networks.

Products for Data Concentrators

Description/Device	Key Benefits
Sitara™ ARM® Cortex™-A8 Microprocessors AM335x	- Up to 1-GHz Cortex-A8 32-bit RISC microprocessor - Extensive peripheral set (2x Gbit-Ethernet, CAN, USB, 8x UARTs extended from PRU, ...) - Flexible communication protocols - Linux™ community, Android™, Windows® Embedded CE, DSP/BIOS™ Real-Time Kernel and RTOS ecosystem of development partners
Tiva™ C Series ARM Cortex-M4-Based MCUs TM4C123x	- Up to 80-MHz core 256KB single-cycle Flash, 32KB single-cycle SRAM - Rich interface featuring 8x UARTs, USB, CAN, up to 43 GPIO, etc. 2x 12-bit ADC with 12 analog input channels
C2000™ 32-bit real-time MCUs Piccolo™ floating-point series	- PLC accelerators - Integrated real-time control peripherals - Support multiple PLC modulations



Get more information: www.ti.com/dataconcentrator

Smart Grid Infrastructure

Device	Description
CC1200	SimpleLink CC1200 low power, high performance RF transceiver
CC1120	High performance RF transceiver for Narrowband systems
UCC28710/700	PWM controller with / without integrated 700V startup switch, constant-voltage, constant-current controller with primary-side regulation, QR green mode, optocoupler less feedback, very low no-load pwr, High efficiency
LM3671	2.7V to 5.5V Input, 600mA output, 2MHz, step-down DC-DC converter optimized for powering low voltage circuits
TLV62080	2.5V to 5.5V Input, 1.2A step down converter in 2x2mm package and high efficiency over wide output current range
ADS8558/7/6	12 / 14 / 16-bit 6-channel simultaneous sampling SAR ADC, supports up to 730kSPS in parallel i/f mode, up to 91dB SNR
ADS131E04/06/08	4 / 6 / 8 channel, upto 24bit ($\Delta\Sigma$), simultaneous sampling AFE for relay protection, power monitoring, power quality, upto 64 kSPS, 107 dB SNR

See more Power and Signal Chain recommendations on pp 12-13.

Power Line Communication (PLC)

Power Line Communications (PLC) technology is being adopted by electric utilities around the world for their Advanced Metering Infrastructure (AMI) and Home Area Networks (HANs). PLC offers the advantage of reusing existing infrastructure to lower costs, retain reliable performance and maintain scalability to larger network sizes.

Modern PLC networks utilize OFDM modulation techniques to increase data throughput rates and reliability in inherently noisy environments such as electric grids. Texas Instruments has long been a pioneer in developing OFDM communications technology.

TI's PLC modems provide the best performing platform for today's Smart Grid networks due to this legacy of OFDM expertise and TI's modems are being deployed by utilities around the world.

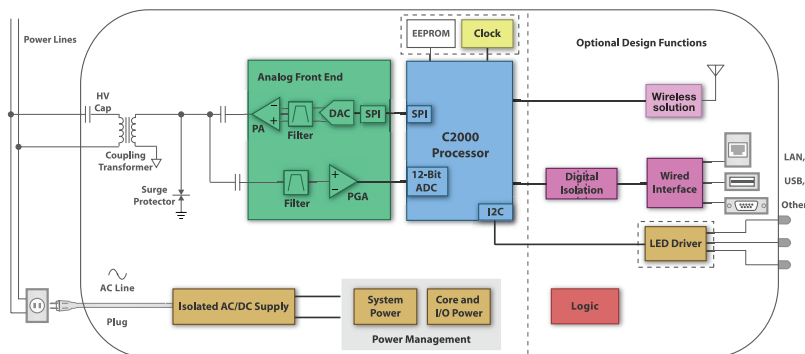
For smart meter OEMs, TI's PLC solutions provide the flexibility of a single hardware and software design that can support multiple standards and therefore a single global platform. This will greatly reduce R&D costs and speed time to market.

PLC standards support

PLC Standard	Frequency Band	TI Chipset
PRIME, G3 or IEEE-P1901.2	CENELEC	TMS320F28PLC83 + AFE03x
G3	FCC, ARIB	TMS320F28M35 + AFE032
IEEE-P1901.2	FCC	TMS320F28M35 + AFE032

TMDSPCKIT-V3 C2000™ Power Line Modem Developer's Kit

- Two PLC modems
- PRIME, G3 or IEEE P1901.2 or IEEE P1901.2 PLC software
- Zero config GUI PLC diagnostic tool
- Built-in USB JTAG emulation
- Integrated Development Environment Code Composer Sutdio (CCS) included
- Connect to TI Data Concentrator Development tool TMDSDC3359
- Plug-In System On Module (SoM) available, see page 12



Power Line Communication Modem System



Learn more at www.ti.com/plc

Smart Electricity Meter

Electric meter requirements around the world are rapidly evolving in response to market forces and governmental regulations that mandate Smart Grid deployments in most areas of the globe. Smart Grid applications such as dynamic pricing, demand response, remote connect and disconnect, outage management, network security, and reduction of non-technical losses are driving the need for increasing technological sophistication in today's smart electric meters.

Metrology

At the heart of any smart meter is the basic energy measurement function. It is critical that utilities and consumers can rely on the accuracy, security and reliability of this metering capability. Energy-measurement products from Texas Instruments are designed to meet all of the requirements of ANSI C12.20 and IEC 62053 accuracy for Class 0.2 and Class 0.5 meters across the entire temperature range and with a full 2000:1 dynamic input range.

Protecting meter integrity is a key to reducing non-technical losses in the field. TI's electric meter metrology solutions include sophisticated anti-tampering protection.

Host Processors

Meter host processors must be able to support the multiple applications and external interfaces required in smart meters today. Meter data management applications such as DLMS/COSEM and communications stacks such as ZigBee® Smart Energy and Wireless MBus are all evolving to require larger amounts of memory and processor performance.

Advanced Meter Infrastructure (AMI) Solutions

AMI networks require robust communications between the individual meters and the data concentrators which aggregate meter data in a neighborhood area before sending that information to the utility's central office through a backhaul link. AMI networks are either RF (mesh or star topology) or powerline communications (PLC). The choice between RF or PLC networks is usually driven by grid topology and geographical environment because these factors have enormous influence on network performance and infrastructure cost. TI's solutions for AMI networks span both RF and PLC. These solutions also support most industry standards, including IEEE-802.15.4g, PRIME, G3, IEEE-P1901.2 and ITU-G.990x.

RFID and NFC

RFID systems using Near Field Communication are an attractive way to deploy pre-payment. TI's solutions cover the entire NFC ecosystem that includes a complete line of ultra-low-power transceiver devices and a broad dynamic and static tag offering. Low-cost, easy-to-use hardware and software solutions lower barriers to using NFC designs that can achieve added connectivity and flexibility and faster time to market. Learn more at: www.ti.com/rfid and www.ti.com/nfc

Metrology Products

Device	Key Benefits
MSP430F673x SoC	Single-phase SoCs with 128KB flash, 320-segment LCD controller, anti-tamper protection, standby power consumption less than 500 nA, TI's Energy Library firmware
MSP430F677x SoC	Three-phase SoCs with 512KB flash, 320-segment LCD controller, anti-tamper protection, standby power consumption less than 500 nA, TI's Energy Library firmware
MSP430AFE2xx	Analog front end with six 24-bit sigma-delta channels, 103-dB performance, integrated PGA and internal reference

Host Processors

Device	Key Benefits
Tiva™ C Series LM4Fx Cortex™-M4 MCUs	80-MHz, 256KB flash, low-power RTC, TivaWare™ for C Series driver library pre-loaded into every device
Sitara™ AM335x Cortex-A8 Microprocessors	500-MHz, three-level cache memory, DDR2 and low-power DDR, complete Linux board support package

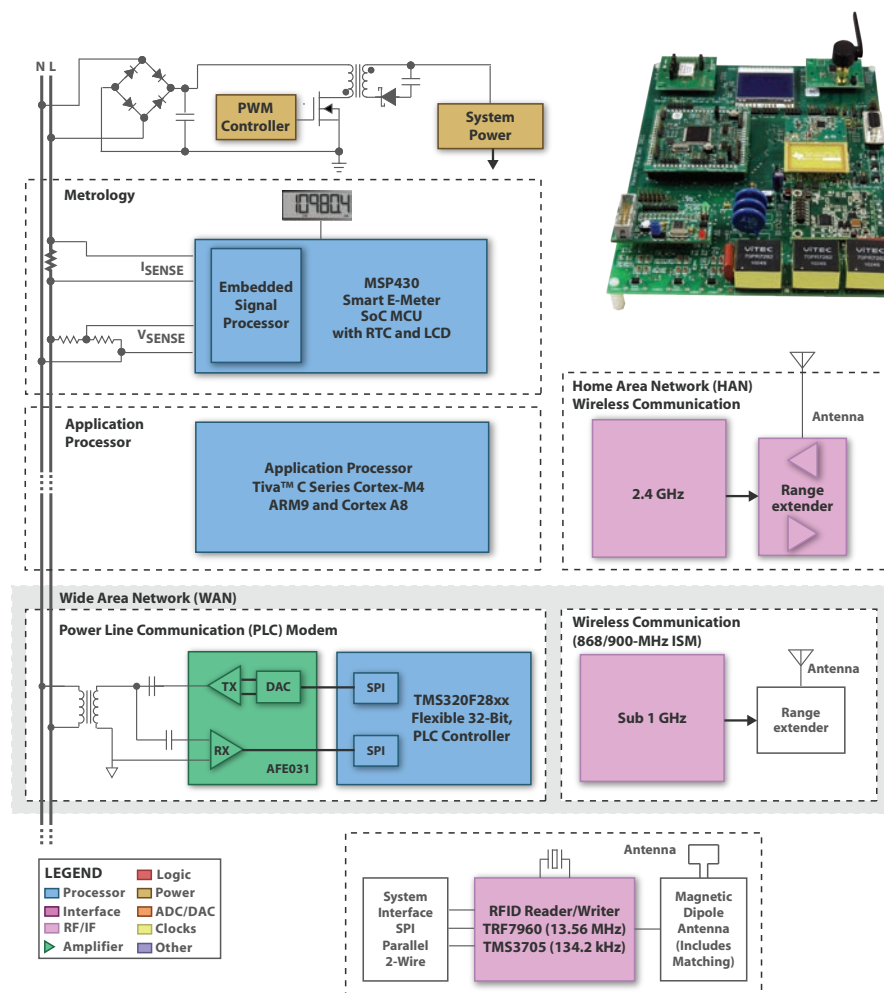
Wireless Connectivity Products

Device	Key Benefits
CC1120	• Ultra-low-power transceiver for narrowband systems • Channel spacing down to 12.5 kHz • 170/315/433/868/915/950-MHz ISM/SRD bands • IEEE 802.15.4g • ETSI, FCC, and ARIB regulatory compliance • Excellent receiver sensitivity ◦ -123 dBm at 1.2 kbps ◦ -110 dBm at 50 kbps • 64-dB adjacent channel selectivity at 12.5-kHz offset • Only 2-mA consumption in RX Sniff Mode
CC1200	• High performance transceiver for broadband systems • Up to 1 Mbps in transmit and receive • 169/433/868/915/920-MHz ISM/SRD bands • Dedicated package handling for 802.15.4g • ETSI, FCC, and ARIB regulatory compliance • Excellent receiver sensitivity ◦ -123 dBm at 1.2 kbps ◦ -110 dBm at 50 kbps • 60-dB adjacent channel selectivity at 12.5-kHz offset • Only 2-mA consumption in RX Sniff Mode
CC2530/CC2538/CC2520 SOC	• Complete 2.4GHz ISM SOC with ZigBee® PRO/SE application profile software • Robust link budget and best in class selectivity for noisy RF environments • Improve range with CC259X PA/LNA front end

RFID and NFC

Device	Key Benefits
RF430CL330H	Dynamic NFC transponder for service interface
TRF7970A	Multi-Protocol Fully Integrated 13.56-MHz RFID/NFC Transceiver IC for prepayment

Smart Electricity Meter



Smart E-Meter System

Smart Meter Board 3.0 (SMB 3.0)

The SMB 3.0 is a modular development platform incorporating key TI Smart Grid devices to demonstrate the capabilities of a smart meter. SMB 3.0 is a unique tool with multiple features; it performs energy or electricity metering and has the capability of transferring key metering data via wired power-line (PLC) and wireless (Wi-Fi®, ZigBee®, Sub-1GHz) communication to showcase a simple automatic meter reading (AMR) and automatic metering infrastructure (AMI) system. Watch video at www.ti.com/smb3

RFID Products

Device	Key Benefits
TRF7970A Transceiver	- ISO 14443A/B, ISO 15963 support - NFCIP-1, NFCIP-2 - Peer-to-peer, card emulation, reader/writer functionality - Ti-supported firmware stack for MIFARE™, NFC
RF430CL NFC Smart Interface Tag	- ISO14443B RF compliant - NFC Tag Type-4 compliant - Up to 848-kbps transfer rate - Serial interface to host MCU

Analog Products

Device	Description	Application	Optimized Solution
UCC28910	PWM HV Switcher with 700V integrated power FET and primary-side regulation. The UCC28910 is dedicated to flyback power supplies and provides isolated output voltage and current regulation without the use of an optical coupler	AC/DC Supply	E-meter, data concentrator, grid infrastructure
TPS5401	Cost-optimized 42-V 0.5-A step-down DC/DC converter; Cap-drop off-line power supplies	Step-Down Regulator	Low-cost cap-drop solution
TPS54227/327	4.5V to 18-V input 2-A and 3A output respectively; DC/DC step-down converter, adaptive on-time D-CAP2™ enables high efficiency over load range, fast transient response, allows use of low ESR caps. adjustable soft start	Step-Down Regulator	E-meter, data concentrator, grid infrastructure, general system supply
SN65HVD3082/85/88	200Kbps / 1 Mbps / 20 Mbps capable half-duplex transceivers, operate with very low supply current	RS485 Interface	E-meter, data concentrator, grid infrastructure
ISO7131	3 Channel small footprint digital isolators provide galvanic isolation up to 2500 VRMS for 1 minute per UL and 4242 VPK	Digital Isolation	E-meter, data concentrator, grid infrastructure

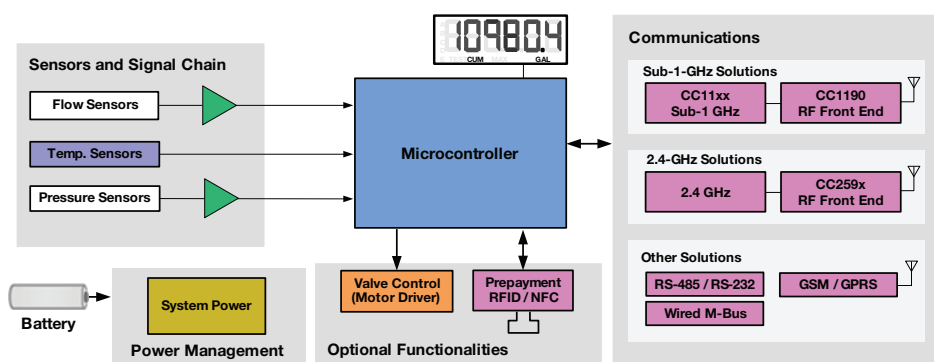
See more Power and Signal Chain recommendations on pp 12-13.



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Flow Meter: Smart Gas/Water/Heat/Heat Cost Allocator



Smart Flow Meter System



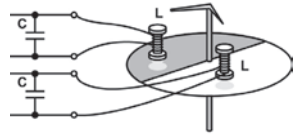
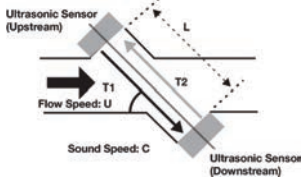
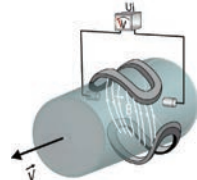
Smart Gas/Water/Heat Meter Products

Function	Part Number	Key Features	Category
Ultra-Low-Power Microcontrollers			
MSP430F448/F449 – 48/60KB Flash	MSP430F417	32KB flash, 96-seg LCD	General Purpose
	MSP430F448	48/60KB Flash, 160-seg LCD, 2 USARTs, HW multiplier, temp sensor	
	MSP430FW429	60KB flash, LCD, scan interface peripheral for rotation detection under low-power mode (supports multiple types of sensors)	Dedicated Flow-Meter Devices
	MSP430FR5969	Next-generation MCU platform with embedded FRAM	Embedded FRAM
Apps Processor	MSP430F6736	128KB flash, 320-seg LCD, RTC with battery backup, power management	High Performance
	MSP430F6638	256KB flash, 160-seg LCD, RTC with battery backup	
	MSP430F6779	512KB Flash, 320 segment LCD, RTC with battery back-up power management	
MCU + RF System-on-Chip (SoC)	CC430F6147	Sub-1GHzSoC, LCD; CC1101 transceiver, MSP430 MCU	MCU + RF SoC
Connectivity			
Sub-1 GHz	CC1101	Transceiver; low cost, low power; –116-dBm sensitivity	Proprietary RF wM-Bus
	CC1120	Transceiver; high performance, narrowband, –123-dBm sensitivity	
	CC1175	Transmitter; high performance, narrowband, 16-dBm TX power	
	CC110L	Transceiver; cost-optimized, –116-dBm sensitivity	Range Extender
	CC1190	RF front end; 27-dBm (0.5-W) TX power	
2.4 GHz	CC2510	Low-cost SoC; 8051 MCU (up to 32KB flash), –103-dBm sensitivity	Proprietary RF
	CC2520	Transceiver; 8051 MCU (up to 256KB flash), –98-dBm sensitivity	ZigBee®/IEEE 802.15.4
	CC2530	SoC; 8051 MCU (up to 256KB flash), –97-dBm sensitivity	
	CC2538	SoC; Cortex™-M3 MCU (up to 512K flash, 32K RAM)	
	CC2590	RF front end; cost-effective, for low-power apps, 14-dBm TX power	Range Extender
	CC2591	RF front end; cost-effective, for low-power apps, 22-dBm TX power	
	WL18xx	Transceiver module, integrated Wi-Fi + dual-mode Bluetooth, MIMO, extended range, Wi-Fi direct concurrent operation	Wi-Fi
Wired M-Bus	CC3000	Transceiver module, self-contained Wi-Fi network processor, one-step configuration for Internet	
Wired M-Bus	TSS721A	Meter-Bus (M-Bus) transceiver; meets EN1434-3 standard	Wired M-Bus
Power Management			
PMIC	TPS65290	Power Management IC for Gas/Water Meters	Gas/Water Meter
	TPS65250	Power Management IC with “last gasp” storage and release circuit	E-Meter
Step-Down Regulator	TPS62730	Step Down Converter with Bypass Mode for Ultra Low Power Wireless Applications	Flow (Gas/Water) Meters
	TPS62740	Ultra Low Iq Step-Down Converter for Low Power Wireless Applications	Flow (Gas/Water) Meters
For other Analog and Power Management Solutions, see pp 12-13.			
Additional Smart Functionalities			
Prepayment (RFID/NFC)	TRF7960A	RFID/NFC reader/writer IC; fully integrated protocol handling	RFID/NFC
	TRF7970A	RFID/NFC transceiver IC (supports reader/writer, peer-to-peer and card-emulation modes); fully integrated protocol handling; compliant to NFC standards NFCIP-1 and NFCIP-2	
Valve Control (Motor Driver)	DRV8830	Secure I ² C control interface; up to 1A continuous current w/ inrush protection	Brushed
	DRV8832	Speed regulation: Constant speed over lifetime of battery	
	DRV8833	Up to 3-A continuous current with inrush protection	
	DRV8835	Up to 3-A continuous current in a 2 x 3-mm package; split V _M / V _{CC} supplies	Brushed/Stepper
	DRV8836	Tiny 2 x 3-mm package; dedicated sleep pin; 40-nA sleep current	
	DRV8837	Up to 1.8-A continuous current in a 2 x 2-mm package; split V _M / V _{CC} supplies	Brushed

Flow Metering

Complete system solution for battery lifetime optimization:
Sensing, MCU, Power, Communications and Software

TI Flow Sensing Solution

Sensing Techniques	Sensor Type	TI Solution	Benefits	Actions
Rotation Detection	- LC sensors - Magnetic Sensors (Resistor Ladder, GMR sensors) - Optical Sensors	Flexible solution based on AFE + TDC + MCU + SW optimized combo	- Continuous flow measurement in low power mode - X5 less power consumption compare to equivalent software implementation	
Ultrasonic time of Flight (ToF)	Piezzo ceramic PMUT, CMUT	Flexible solution based on AFE + TDC + MCU + SW optimized combo	- Ultra low noise signal chain offer - customizable system to meet various system requirement - enables system differentiation for developers - optimized combination for accuracy and low power	
Others	Magneto Inductive (MID)	ADC tuned for MID	- high input impedance 24-bit dynamic range - fast wake-up - ultra-low stand-by current	

Wireless M-Bus Solutions

Hardware and software support for both 169 MHz and 868 MHz

- Best Blocking and selectivity performance for a robust and cost optimized solution
- Packet loss reduction mechanism to improve battery lifetime
- “RX Sniff” mode maintains best RF performance in RX while reducing power consumption
- Optimized DC/DC energy management solution for extending battery lifetime
- Analog, Digital, Software evaluation kits immediately available
- See TI’s wM-Bus Guide www.ti.com/wmbus
- wM-Bus tool page www.ti.com/tool/wmbus

wM-Bus Hardware and Software Kits

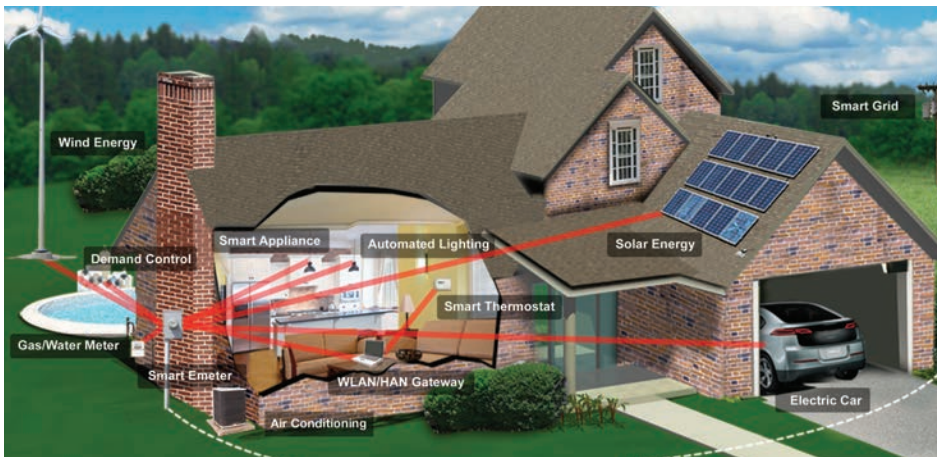
Frequency Band	Microcontroller	Radio		Software
		Option 1: General	Option 2: High Transmit Power	
868 MHz	(CC1120): CC1120DK Includes TrxEB (MCU, USB I/F, LCD, accelerometer, light sensor)		(CC1120 + CC1190): CC1120-CC1190EMK868	wM-Bus Stack
169 MHz	(MSP430F5438): MSP-EXP430F5438 or (MSP430FG4618): MSP-EXP430FG4618	(CC110L): CC1101EMK868-915 or (CC1101): CC110LEM-868-915-RD or (CC1120): CC1120EMK-868-915	(CC1120 + PA) CC1120 Skyworks EM +30 dBm	
Other Solutions	(CC430F6147): EM430F6137RF900		—	

Power Management EVMs for wM-Bus

Issue to Address	Solution	Evaluation Tool
Efficient power supply from primary batteries (Supports all MCU+RF kits listed above)	TPS62730	TPS62730EVM
High power supply (RFPA)	TPS62065/67	TPS62065-67EVM-347
Capacitor-based battery assistance	TPS61251	TPS61251EVM-517

Smart Building and Internet of Things (IoT)

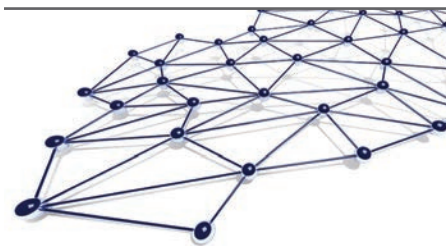
TI has the full system solution to measure, communicate and manage energy for smart homes and building



- Sub-Metering/Smart Plugs
- IoT Gateway
- Sensor Network

Sub-Metering/Smart Plug Solutions

- Sub 1% accuracy metrology solution
- Easy wireless connection
- Reference design



Sensor Network

TI provides connectivity for sensors:

Longevity: High idle power consumption and frequent “listening” cost device battery lifetime

- TI implements 802.15.4e to increase battery life to >10 years

Reliability: Noise and instability in wireless channels & slow recovery

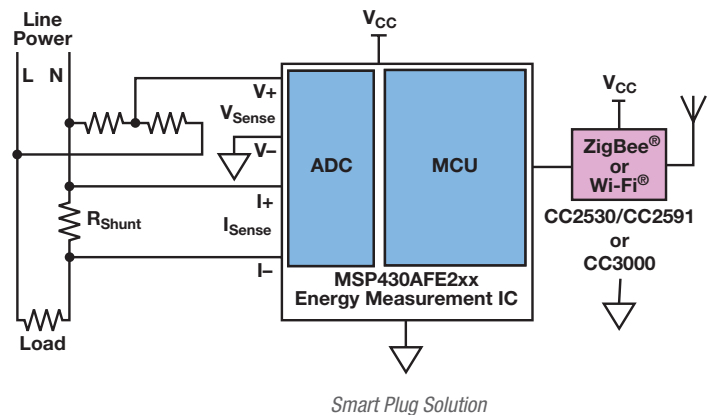
- TI implements TSCH and compensate RF with PLC >99.999% data reliability

Coverage: Many “hops” needed to cross large area or long distance inside building for “flat” network

- TI implements PLC/RF combo mote for a hybrid

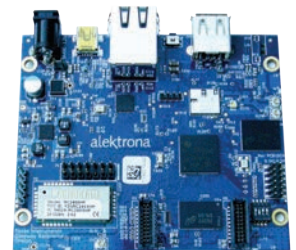
Scalability: Extend network size from 100s to 1000s with “plug & play”

- TI implements standard IPv6 with RPL for complete mesh formation in <1s

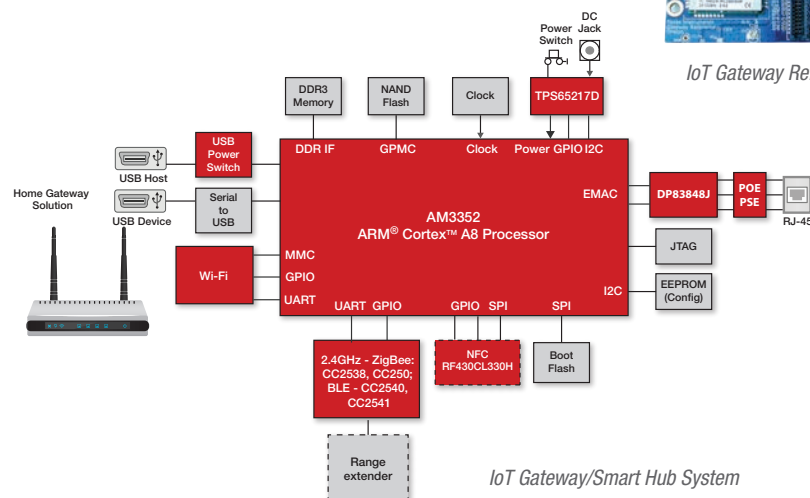


IoT Gateway/Smart Hub Solution:

- Large software foundation for base-line validation
- Enable seamless profile integration for smart energy, lighting and building automation
- Easier coexistence validation



IoT Gateway Reference Design



Smart Building and Internet of Things (IoT)

Smart Building and IoT Products

Device	Description
Host Processors	
AM335x Cortex™-A8	Powerful and scalable host-processor for home gateways and high-end in-home-displays
MSP430F543xA	Host processor with up to 256KB flash for applications such as a simple in-home-display
Energy Measurement ICs	
MSP430AFE2xx	Single-phase energy measurement IC for sub-meters
MSP430F471xx	Poly-phase energy measurement IC that can also be used for multi-outlet smart power strips and PDUs
Communication	
CC2520/2538/2530	2.4-GHz transceivers and SOCs for ZigBee® and 802.15.4-based communications
CC11xx	Sub-1GHz transceivers for backhaul and proprietary HAN communication
WiLink™ 8 WL18xx	High-performance, power-optimized 802.11 b/g/n and dual-mode <i>Bluetooth</i> ® on a single chip; extended range, high throughput and multi-channel, multi-role features
SimpleLink™ CC3000	802.11 b/g solution for Wi-Fi implementation without previous Wi-Fi or RF experience
CC1200	SimpleLink CC1200 low power, high performance rf transceiver
CC1120	High performance rf transceiver for narrowband systems
CC2591	Radio PA/LNA for extended range
TPS650250	Low-cost power management IC for the AM335x processor

Wireless Communication

TI's wireless solutions for Smart Grid communication include more options to create infrastructure, smart meters, and home automation systems.



www.ti.com/iot

Wireless Connectivity Solutions for Smart Grid

Sub-1GHz

www.ti.com/rfperformanceline

- CC1120, High-performance RF transceiver for Narrow-band systems
- CC110L, Low-cost RF transceiver for cost sensitive systems
- CC430, enables smarter, RF solutions with MSP430™ MCU plus low-power RF IC
- Sub-1-GHz enables long range Communications, supporting communication distances of several kilometers

ZigBee (IEEE 802.15.4 / ZigBee PRO) www.ti.com/zigbee

- Complete hardware and software for the ZigBee-Compliant Platform (ZCP), certified by a ZigBee alliance-approved test house
- Free IEEE 802.15.4 MAC software and golden unit status Z-Stack™ protocol stack
- High-performance CC253x radio offers excellent coexistence with WLAN, *Bluetooth* and other 2.4-GHz solutions
- Smart energy and home automation application profiles and support
- Range extenders available for CC2590 and CC2591
- Development kits and tools

6LoWPAN www.ti.com/6lowpan

- Gateway for remote, low-cost wireless sensors to connect to the Internet and a wireless extension of wired IPv6 infrastructures
- Sub-1-GHz product family includes the CC1180 network processor, CC430 complete system-on-chip (SoC), CC1101/MSP430F5xxx platform and 6LoWPAN software stacks
- Supports large-scale mesh networks for applications such as smart grid, security, building automation, street lighting and other wireless sensor networks.
- Available range extender for CC1190

Bluetooth®/*Bluetooth* low energy

www.ti.com/bluetoothsolutions

- Portable, battery-powered devices
- Ultra-low power consumption enables sensor applications to operate for >1 year on a coin cell battery
- Leading RF performance – up to +97 dB link budget for long range. Excellent coexistence with other 2.4-GHz devices.
- One-chip integrated solution – controller, host and application on one 6mm x 6mm device reducing required PCB area. Applications can be written directly onto the CC254x,

which supports both analog and digital peripherals.

- Other *Bluetooth* options: CC256x *Bluetooth/Bluetooth* low energy dual-mode for short range, portable applications; WiLink™ Wi-Fi plus *Bluetooth/Bluetooth* low-energy dual mode for high performance WLAN.

Wi-Fi www.ti.com/wifi

- SimpleLink™ CCC3000: Self-contained 802.11 b/g solution enables easy-to-implement Internet connectivity with SmartConfig™ technology. Embedded Wi-Fi and networking software including drivers, stack and supplicant. Allows Wi-Fi implementation quickly without previous Wi-Fi or RF experience.
- WiLink™ combo solutions: WL18xx modules integrate high-performance 802.11 b/g/n and dual-mode *Bluetooth* platform on a single chip with best-in-class coexistence technology and power optimization. TI's WLAN technology allows secure, high-throughput, extended range, multi-channel and multi-role performance and reliable Wi-Fi connectivity of electronic devices to each other, the Internet and wired networks.

See wireless development tools on p 16.

Analog Components for Smart Grid Solutions

Analog Products

Device	Description	Type	Application
Digital Isolation			
ISO7131	3 Channel small footprint digital isolators provide galvanic isolation up to 2500 VRMS for 1 minute per UL and 4242 VPK	Digital Isolation	E-meter, Data Concentrator, Grid Infrastructure
ISO7140/41	4 Channel small footprint digital isolators provide galvanic isolation up to 2500 VRMS for 1 minute per UL and 4242 VPK	Digital Isolation	E-meter, Data Concentrator, Grid Infrastructure
RS485 (Isolated & Non-Isolated)			
SN65HVD3082/85/88	200Kbps / 1 Mbps / 20 Mbps capable half-duplex transceivers, operate with very low supply current	RS485 Interface	E-meter, Data Concentrator, Grid Infrastructure
SN65HVD3080/83/86	200Kbps to 20 Mbps capable full-duplex transceivers, operate with very low supply current	RS485 Interface	E-meter, Data Concentrator, Grid Infrastructure
ISO3080/82/86/88	Isolated 5V full and half-duplex RS485 transceivers, provide 2500 Vrms of isolation for 60s	Isolated RS485 I/F	E-meter, Data Concentrator, Grid Infrastructure
External RTC			
BQ32000	Real-time clock	RTC	E-meter
Relay / Actuator Drivers			
ULN2003	Family of relay drivers	Relay	E-meter, flow meters, Grid Infrastructure
DRV777	7 low o/p impedance drivers minimizing power dissipation, 140mA / Channel, 1A when tied together, 20V capable o/p pins	Relay	E-meter, flow meters, Grid Infrastructure
DRV8830/60	Low-voltage motor/actuator driver with serial interface. The device has one H-bridge driver which can drive 1A peak output current	Relay	E-meter, flow meters, Grid Infrastructure
Ethernet PHY			
TLK105L	10/100 Ethernet PHY, Error free to 150 meters, cable diagnostics, Auto-MIDX, supports MII & RMII	Interface	Data Concentrator, Home area network
DP83848K	10/100 Ethernet PHY, Error free to 130 meters, Auto-MIDX, supports MII & RMII	Interface	Data Concentrator, Home area network
DP83640	IEEE 1588 precision time protocol transceiver for real time industrial connectivity. Packet time stamps for clock synchronization	Interface	Data Concentrator, Home area network
SAR ADC			
ADS8558/7/6	12 / 14 / 16 bit 6-channel simultaneous sampling ADC, supports up to 730 kSPS in parallel i/f mode, up to 91dB SNR	Interface	e-meters, Grid Infrastructure
ADS8528/48/68	12 / 14 / 16 bit 8-channel simultaneous sampling ADC, supports up to 650 kSPS in parallel i/f mode, up to 91dB SNR	Interface	e-meters, Grid Infrastructure
Delta-Sigma ($\Delta\Sigma$) ADC			
ADS131E04/06/08	4 / 6 / 8 channel, upto 24-bit, simultaneous sampling AFE for relay protection, Pwr Monitoring, Pwr Quality, upto 64 kSPS, 107 dB SNR	Interface	e-meters, Data Concentrator
ADS1271/4/8	1 / 4 / 8 channel, upto 24-bit, simultaneous sampling AFE for Power Monitoring, Quality and Protection, upto 144 kSPS, 111 dB SNR	Interface	e-meters, Data Concentrator
Analog Isolation			
AMC1100	Fully-differential isolation Amp for energy metering, SiO2 barrier up to 4250 VPEAK and resistant to magnetic interference	Analog Isolation	E-meter, Grid Infrastructure
AMC1204/B	20MHz, second-order, isolated delta-sigma modulator for current-shunt measurement, SiO2 barrier up to 4250 VPEAK	Analog Isolation	E-meter, Grid Infrastructure
Op Amps			
OPA4188/71/40	Wide Vs: +4.0 V to +36 V (± 2 V to ± 18 V), low offset voltage, near zero-drift, low Iq, high input impedance and rail-to-rail output swing	Interface	Grid Infrastructure
OPA4277	Vs: operate from ± 2 V to ± 18 V, ultra low offset and drift, low Iq	Interface	Grid Infrastructure
External Reference			
LM4050	Precision micropower shunt voltage reference, external stabilizing capacitor	Voltage Reference	E-meter, Grid Infrastructure
LMV431	1.24V shunt regulators capable of adjustment to 30V	Voltage Reference	E-meter, Grid Infrastructure
ESD			
TPD1E10B06/B09	Single channel ESD protection in small 0402 package, ± 30 KV IEC air-gap, over ± 30 KV contact, bipolar or bidirectional signal support	ESD protection	E-meter, Grid Infrastructure
TPD4E1U06	Quad channel ultra low cap ESD device, offers ± 15 KV IEC air-gap and ± 15 KV, suitable for multiple applications like USB	ESD protection	E-meter, Grid Infrastructure
TPD2E007	2-channel ESD protection offers system level ESD solutions for wide range of industrial applications like RS485, RS232	ESD protection	E-meter, Grid Infrastructure
Temperature Sensors			
TMP275	$\pm 0.5^\circ\text{C}$ accurate from -20°C to $+100^\circ\text{C}$ two-wire, serial output, two-wire and SMBus interface-compatible	Temp. Sensor	E-meter, Grid Infrastructure
TMP108	$\pm 0.75^\circ\text{C}$ accurate from -20°C to $+85^\circ\text{C}$, $\pm 1^\circ\text{C}$ from -40°C to $+125^\circ\text{C}$, features SMBus and two-wire interface	Temp. Sensor	E-meter, Grid Infrastructure
TMP75/LM75A	$\pm 1.5^\circ\text{C}$ to $\pm 3^\circ\text{C}$ accuracy depending on temperature range, features SMBus and two-wire interface	Temp. Sensor	E-meter, Grid Infrastructure

Power Management Solutions for Smart Grid

Power Management Products

Device	Description	Type	Application
Isolated AC/DC Power Solutions			
UCC28910	PWM HV switcher with 700V integrated power FET and primary-side regulation. The UCC28910 is dedicated to flyback power supplies and provides isolated output voltage and current regulation without the use of an optical coupler	AC/DC Supply	E-meter, Data Concentrator, Grid Infrastructure
UCC28710/700	PWM controller with / without Integrated 700V startup switch. Constant-voltage, constant-current controller with primary-side regulation, QR green mode, optocoupler less feedback, very low no-load pwr, high efficiency	AC/DC Supply	E-meter, Data Concentrator, Grid Infrastructure
UCC28600/610	QR / DCM PWM controller, excellent efficiency at full load, Industry leading power consumption at no-load, and small footprint	AC/DC Supply	E-meter, Data Concentrator, Grid Infrastructure
Cap Drop Type Power Solutions			
TPS5401	Cost-optimized 42-V 0.5-A step-down DC/DC converter; cap-drop off-line power supplies	Step-Down Regulator	Low-Cost cap-drop solution
TPS54060/160/260	DC/DC switching power supply: 60-V, 0.5-A/1.5-A/2.5-A step-down DC/DC converters with ECOMode for light load efficiency and very low I ^Q	Step-Down Regulator	60V capdrop solutions
LM5017	100V, 600mA constant on-time synchronous buck regulator. Can also be configured in flybuck mode	Step-Down Regulator	E-Meters (low cost)
DC-DC Solutions			
TPS54478	2.95 V to 6 V input, 4A output, DC/DC switching power supply; 2MHz, synchronous step down	Step-Down Regulator	E-Meter / Grid Infrastructure, Processor Power
TPS5432	2.95V to 6V input, 3A output, value concious, 700kHz synchronous step down converter	Step-Down Regulator	E-Meter / Grid Infrastructure, Processor power
TLV62065	2.9V to 5.5V with 2 A output, 2x2 mm footprint, synchronous DC/DC step down converter, up to 97% efficient	Step-Down Regulator	E-Meter / Grid Infrastructure, Processor power
LM3671	2.7V to 5.5V input, 600mA output, 2MHz, step-down DC-DC converter optimized for powering low voltage circuits	Step-Down Regulator	E-Meter, 1-phase or 3-phase
TLV62080	2.5V to 5.5V input, 1.2A step down converter in 2x2mm package and high efficiency over wide output current range.	Step-Down Regulator	E-Meter / Grid Infrastructure
TPS62560	2.5 V to 5.5 V input with up to 600mA output, synchronous step down converter, optimized for low power or battery applications	Step-Down Regulator	E-Meter / Grid Infrastructure, Processor power
TPS62240	2 V to 6 V input with 300mA output, 2.25MHz buck in 2x2 SON/SOT23. Offers high efficiency, power save mode at light loads	Step-Down Regulator	E-Meter / Grid Infrastructure, Processor power
TPS54227/327/427/627	4.5V to 18-V input 2-A, 3A, 4A and 6-A output respectively; DC/DC Step-Down Converter, adaptive on-time D-CAP2™ enables high efficiency over load range, fast transient response, allows use of low ESR caps. Adjustable soft start	Step-Down Regulator	Data concentrator, Grid Infrastructure, General System Supply
TPS62730	Works with battery powered applications. Companion power supply for low power RF devices; bypass mode saves 20-30% battery current withput compromising on transmit power; DCS-control topology provides low output voltage ripple	Step-Down Regulator	Flow (Gas/Water) Meters
LMR12010	20Vin 1A buck regulator.30nA low shutdown Iq and switching upto 3MHz. Offers internal softstart, current-mode PWM control	Step-Down Regulator	Data Concentrator
TPS63030/1	DC/DC buck-boost regulators: 0.8 A, low I ^Q with up to 96% efficiency	Buck-Boost Regulator	General System Supply (Battery operated), Home area network
TPS63060/1	DC/DC buck-boost regulators: 2.5- to 12-V input voltage with 93% efficiency and 2.25-A switch-current limit	Buck-Boost Regulator	General System Supply (Battery operated), Home area network
LM2733	0.6/1.6MHz boost converter, has 40V integrated FET switch with low RDSon. Offers cycle-by-cycle current limiting	Step-Up / Boost Regulator	Data Concentrator
LM5001	75V integrated MOSFET with a 1 amp peak current limit for Boost & SEPIC implementation	Step-Up / Boost Regulator	Data Concentrator
Linear Regulators			
TLV71310/11/12/15/18	Capacitor-free, 150-mA, LDO with 1.5% regulation over temp. This next generation LDO was designed to be stable w/o an o/p cap	LDO	E-meter, Data Concentrator, Grid Infrastructure, Flow Meter
LP38691	500mA low dropout CMOS linear regulator with tight output tolerance, and excellent AC performance with ultra low ESR ceramic caps	LDO	Data Concentrator
TLV70710/11/12/15	200mA LDO with low Iq, tight output regulation (2% typ). Offers excellent line and load transient performance	LDO	Data Concentrator
LP5907	250-mA LDO. Designed RF and analog circuits, provides low noise, high PSRR, low I ^Q , and low lineor load transient response	LDO	Data Concentrator
PMICs			
TPS65290	Power Management IC for gas/water meters	PMU	Gas/Water Meter
TPS650250	Low-cost PMU for AM335x	PMU	Grid Infrastructure
TPS65250	Power management IC for E- meters with "last gasp" storage and release circuit	PMU	E-Meter
Voltage Supervisor & Reset			
TPS3831/9	Ultra-Low Power 150nA, ultra-small voltage supervisor	Voltage Supervisor	E-meter, Grid Infrastructure
TPS3700	UV, OV voltage monitor; wide input voltage	Voltage Supervisor	E-meter, Grid Infrastructure
TLV803/809/810	Low cost voltage supervisor with 200ms reset delay	Voltage Supervisor	E-meter, Grid Infrastructure
TPS3808	Highly accurate (0.5% typ) supervisor with low Iq and adjustable reset delay	Voltage Supervisor	E-meter, Grid Infrastructure
Chargers			
BQ24171	Highly integrated 1 to 3 cell Li-ion / Li-polymer charger w/ battery detection, pre-conditioning, charge monitoring and termination	Battery Charger	Home Area Network, Flow Meters
BQ25504	Ultra-low-power boost converter with battery management for energy-harvester applications	Boost controller, Battery charger, MPPT controller	Home Area Network, Wireless Sensor Nodes

Smart Grid Development Tools



Metrology: Single-phase	Description	Support	Get Started!
Class 0.2 Single-Phase Metrology Analog Front End Evaluation Module (EVM430-AFE253)	Metrology Front End Single-phase, class 0.2 accuracy electricity-meter/sub-meter (3 Sigma Delta 24-bits sensor inputs, 16kB Flash, 0.5kB RAM) evaluation board. Comes with application note, energy library and schematics. Features MSP430AFE253 the industry's first programmable analog front end microcontroller	MSP430 Energy Library Read white paper at www.ti.com/wp-AFE2xx	Watch video at www.ti.com/afe-video Contact TI representative.
NEW Class 0.5 Single-Phase Metrology Analog Front End Evaluation Module (EVM430-i2040)	Metrology Front End Single-phase, class 0.5 accuracy electricity-meter/sub-meter (4 Sigma Delta 24-bits sensor inputs, 32kB Flash, 2kB RAM), evaluation board with application notes, energy library and schematics. Features MSP430i2040 ultra low-power metrology analog front end AMI capability: RF interface: ZigBee, WMBUS/ <1GHz, Wi-Fi/PLC via UART Software features: 1-phase 0.5% energy library, Anti-tampering	MSP430 Energy Library	Sampling today Production by November 2013 Contact TI representative
NEW Server Power Single-Phase Metrology solution	Metrology Front End Hardware based on the MSP430i2040, metrology analog front end (4 SD24, 32kB Flash, 2kB RAM), Works across supply AC/DC input 90 – 220VAC, 100 – 200VDC Software: Server power library, power library for Vrms, Irms, active, reactive and apparent powers, THD for current/voltage, fundamental voltage/current, readings update every 4 AC cycles, capable of AC and DC supply measurement, automatic switching between AC and DC, EMI filter capacitor compensation capabilities, no separate DC calibration required, serial port command reading and calibration interface	MSP430 Server Power Library	Sampling today Production by December 2013 Contact TI representative
Class 0.5, Low End Single-Phase E-Meter System On Chip Evaluation Module (EVM430-FE4272)	Metrology SoC Low end single-phase, class 0.5 electricity meter (32kB Flash, 2 Sigma Delta sensors inputs + segment LCD) evaluation board. Comes with application notes, energy library and schematics (features TI metrology SoC), features ultra-low power MSP430FE4272 metrology system on chip	Read white paper at www.ti.com/wp-FE42x2	Orderable at www.ti.com/tool/evm430-fe4272
Class 0.5, Low End Single-Phase E-Meter System On Chip (+ Anti-Tamper) Evaluation Module (EVM430-FE427A)	Metrology SoC Low end single-phase, class 0.5 accuracy electricity-meter plus Anti-Tamper (32 kB Flash, 3 Sigma Delta sensor inputs + Segment LCD), evaluation board with application notes, energy library and schematics, Features MSP430FE427A ultra-low-power metrology system on chip	Read white paper at www.ti.com/wp-FE42x2	Orderable at www.ti.com/tool/evm430-fe427a
Class 0.1, Single-Phase Smart E-Meter System On Chip (+Anti-tamper + Communication) Evaluation Module (EVM430-MSP430F6736)	Metrology SoC Optimized smart meter SoC, class 0.1 accuracy electricity meter (128kB Flash, 8kB RAM, 3 Sigma Delta 24-bits sensor inputs, anti-tamper, 320 segment LCD + communications ports). Support for CT/Shunt AMI capability: RF interface: ZigBee, WMBUS/ <1GHz, Wi-Fi/PLC via UART Software features: 1-phase 0.1% energy library, THD and fundamental, anti-tampering, temperature compensation, DLMS	Watch video at www.ti.com/f6736video	www.ti.com/tool/EVM430-F6736
Metrology: Poly-phase	Description	Support	Get Started!
NEW Class 0.5, Optimized Three-Phase E-Meter (+anti-tamper) Evaluation Module (EVM430-F6700)	Metrology SoC Optimized three-phase, class 0.5 accuracy electricity meter (128kB Flash, 8kB RAM, 3 Sigma Delta 24-bits current sensor inputs, 4 ADC10 voltage/anti-tamper inputs, 320 segment LCD + communications ports). Support for CT AMI capability: RF interface: ZigBee, WMBUS/ <1GHz, Wi-Fi/PLC via UART Software features: 3-phase 0.5% energy library, anti-tampering	MSP430 Energy Library	Sampling October 2013 Production by December 2013 Contact TI sales rep

Smart Grid Development Tools



Metrology: Poly-phase cont.	Description	Support	Get Started!
Class 0.1, Three-Phase E-meter (Anti-Tamper) Evaluation Module (EVM430-F47197)	Metrology SoC Three-phase electricity-meter, class 0.1 (with Anti-Tamper) (120kB Flash, 4kB RAM, 7 Sigma Delta 24-bits sensor inputs, 120 Segments LCD controller) evaluation board with application notes, software and schematics; features MSP430F47197 ultra-low-power metrology SoC	Watch video at www.ti.com/vid-F471xx	Orderable at www.ti.com/tool/evm430-f47197 Buy on TI e-store at www.ti.com/e-F47197
Class 0.1, Three-Phase E-meter (+anti-tamper) evaluation module (EVM430-F6779)	Metrology SoC Three-phase electricity-meter, class 0.1 (with Anti-Tamper) (512kB Flash, 32kB RAM, 7 Sigma Delta 24-bits sensor inputs, 360 segments LCD controller) evaluation board with application notes, software and schematics; features MSP430F6779 ultra-low-power metrology soc AMI capability: RF interface: ZigBee, WMBUS/ <1GHz, Wi-Fi/PLC via UART Software features: 3-phase 0.1% energy library, anti-tampering, THD and fundamental, temperature compensation, DLMS	Read white paper at www.ti.com/wp-F677x Watch video at www.ti.com/F6779	www.ti.com/product/MSP430F6779 Contact TI representative
Flow Meter Solutions	Description	Support	Get Started!
NEW Scan Interface based	SCAN IF Flow Meter Features: MSP430FW427; manual wheel spin to simulate flow rate; Real-time update to LCD; Legacy design improved to showcase our Scan IF	http://www.ti.com/lstds/ti/apps/smartgrid/gasmeter/support.page	Sampling today Contact TI representative
NEW Scan Interface + FRAM Flow Meter	SCAN IF + FRAM Flow Meter Features: Based on FRAM device, uses enhanced Scan-IF to measure flow, motor control board to simulate flow rate, Real-time update to LCD and RF modules, SW Features, Extended Scan I/F water measurement library for GMR, LC, optical sensor, integration to wireless-MBUS using CC1120 + Steinbeis stack	http://www.ti.com/lstds/ti/apps/smartgrid/gasmeter/support.page	Sampling today Contact TI representative
NEW Ultrasonic Time Of Flight	Ultrasonic for Flow Meter Features: Time of Flight technique, HW features, discrete AFE + TDC + MCU, interface to RF modules SW Features: <100ps resolution for ultrasonic flow library	http://www.ti.com/lstds/ti/apps/smartgrid/gasmeter/support.page	Sampling today Contact TI representative
Power Line Communication	Description	Support	Get Started!
TMDSPICKIT-V3 C2000 Power Line Modem Developer's Kit	The PLC developer's kit enables easy development of software-based Power Line Communication (PLC) modems. The kit includes two PLC modem based on the C2000 TMS320F28069 controlCARD and TI's advanced PLC analog front end AFE031. The included PLC SUITE software supports several communication techniques, including OFDM (PRIME/G3 and P1901.2) and is SFSK-capable. The kit includes onboard USB JTAG emulation and code composer studio	www.ti.com/plc	Order now www.ti.com/tool/tmdspickit-v3
NEW SOMPLC-PLC83 System On Module (SOM) for CENELEC Power Line Communication (SFSK/PRIME/G3/P1901.2)	The SOMPLC-PLC83 is a self-contained hardware System On Module (SOM) for power line communication, including the Analog Front End AFE031 and the digital modem F28PLC83 on one single PCB. It is the ideal plug-in tool for developers willing to easily and quickly evaluate the most popular narrowband CENELEC power line communication standards like SFSK/PRIME/G3/P1901.2 in their application environment. Plugs onto the TI PLC docking station	www.ti.com/plc	Order now www.ti.com/SOMPLC
NEW SOMPLC-PLCM35 System On Module (SOM) for FCC Power Line Communication (G3-FCC, G3-ARIB, P1901.2 FCC)	The SOMPLC-PLCM35 is a self-contained hardware System On Module (SOM) for power line communication, including the Analog Front End AFE032 and the digital modem F28M35 on one single PCB. It is the ideal plug-in tool for developers willing to easily and quickly evaluate the most popular narrowband FCC power line communication standards like G3-FCC, G3-ARIB, P1901.2 FCC in their application environment. Plugs onto the TI PLC docking station	www.ti.com/plc	Sampling October 2013 Production by December 2013 Contact TI representative

Smart Grid Development Tools

Power Line Communication cont.	Description	Support	Get Started!
 NEW Power Line Communication Docking Station	The TI PLC docking station is the new TI PLC kit compatible with CENELEC and FCC PLC standards. Developers can plug TI PLC SOM modules to supports the various narrowband standards HW Features: Single hardware can support multiple modulation and standards Interface to RF modules to support ZigBee, WMBUS, Wi-Fi, USB to PC, RJ45 Ethernet connector SW Features: Library plcSUITETM, zero config. GUI, service node SW for PRIME, G3, P1901.2, Up to FCC/ARIB bands, automated testing and firmware upgrade	www.ti.com/plc	Sampling October 2013 Production by December 2013 <i>Contact TI representative</i>
Wireless Connectivity	Description	Support	Get Started!
 Sub-1-GHz Performance Line Development Kit (CC1120DK)	Wide-Area-Network Kit provides a complete hardware performance testing and software development platform for TI's sub-1-GHz performance line devices. Test power consumption and RF range/robustness with different settings (supports 868/915 MHz). Additional kits can be purchased separately to support other frequencies	www.ti.com/lit/swru290	Order now www.ti.com/tool/cc1120dk
 CC2530 Development Kit (CC2530DK)	ZigBee Home-Area-Network The CC2530DK development kit supports TI's second generation 2.4GHz IEEE 802.15.4 compliant System-on-Chip, the CC2530 – and contains all hardware, software, and tools necessary to build your 802.15.4-compliant product. It includes CC2530-based evaluation modules, development boards, a USB interface dongle, cables, antennas and documentation. The CC2530EM evaluation modules can be plugged into SmartRF05EB boards, which are included	www.ti.com/lit/swrs081	Order now www.ti.com/tool/cc2530dk
 ZigBee Network Processor Mini Development Kit (CC2530ZDK-ZNP-MINI)	ZigBee Home-Area-Network This kit provides the perfect introduction to 2.4-GHz ZigBee wireless sensor networks. Designed for engineers who want to get familiar with this technology without having to port a lot of software to get up and running	http://processors.wiki.ti.com/index.php/CC2530ZDK-ZNP-MINI	Order now www.ti.com/tool/cc2530zdk-znp-mini
 RFID/NFC Transceiver Evaluation Module Kit (TRF7960AEVM/TRF7970AEVM)	Prepayment Self contained development platform which can be used to independently evaluate/test the performance of the TRF7960A or TRF7970A RFID/near-field-communications transceiver IC, custom firmware, customer designed antennas and/or potential transponders for a customer defined RFID/NFC application.	www.ti.com/lit/slos743	Order now www.ti.com/tool/trf7970aevm
 RF430CL330HTB Target Board for Development with the NFC Dynamic Transponder Interface	NFC Interface The RF430CL330HTB target board enables the evaluation of the Dynamic NFC Transponder with SPI/I²C Interface for short range wireless communication with the NFC enabled smart phones. The target board features an on-board PCB antenna and can be used with many different TI microcontroller platforms	www.ti.com/lit/slas916	Order now www.ti.com/tool/rf430cl330htb <i>Contact TI representative</i>
 MSP-EXP430G2-CC3000BOOST - SimpleLink™ Wi-Fi CC3000 BoosterPack and MSP430™ LaunchPad Bundle	Internet of Things The SimpleLink Wi-Fi CC3000 Booster Pack (CC3000BOOST) is an add-on board designed to bring Wi-Fi to the MCU LaunchPad, based on TI's SimpleLink Wi-Fi CC3000 module. The CC3000 module enables simplified Wi-Fi connectivity for Internet-of-Things MCU-based applications and comes with a full suite of support tools. Additionally through its unique SmartConfig™ technology, the CC3000 delivers an easy one-click network set up for end-users. It is also compatible with the MSP430 LaunchPad as well as the Tiva™ C Series TM4C123G LaunchPad	www.ti.com/cc3000wiki	Order now https://estore.ti.com/msp-exp430g2-cc3000boost.aspx <i>Contact TI representative</i>
 CC256XQFNEM	This is the reference design for CC256x <i>Bluetooth</i>® solution which supports <i>Bluetooth</i> classic & <i>Bluetooth</i> low energy or ANT. The device brings a product-proven solution that supports 4.0 dual mode (BR/EDR/LE) protocols. MSP-EXP430F5529, MSP-EXP430F5438 or Tiva C Series development kit work with this evaluation module	www.ti.com/tool/cc256xqfnem	Order now www.ti.com/tool/cc256xqfnem

Smart Grid Development Tools



Grid Infrastructure	Description	Support	Get Started!
TMDSDC3359 Smart Data Concentrator Evaluation Module (EVM)	Smart data concentrator evaluation module (EVM) with accompanying power line communication (PLC) system-on-module and supporting software for smart grid developers. The highly integrated TMDSDC3359 EVM provides the ultimate level of flexibility and scalability with numerous performance, cost and connectivity options so developers can create data concentrator designs that can adapt to many worldwide smart grid standards Hardware Support: Sitara AM335x Cortex A8, Interface to all PLC SOM modules, Interface to all RF modules (CC1101, CC1120, CC25xx), Ethernet, USB and CAN Software Support: MAC layers and Library plcSUITETM, Showcase a full network solution, Single base board offers multiple RF technologies and PLC standards, Usable for e-meter and flow meter networks, 3rd Party provides full DC solution PLC: PRIME, G3, P1901.2, PLC lite, proprietary RF: ZigBee, WMBUS, WiFi, 802.15.4g, proprietary	Watch videos at http://focus.ti.com/general/docs/video/Portaltsp?entryid=0_49f2k7cv&lang=en : Demo http://focus.ti.com/general/docs/video/Portaltsp?entryid=0_2liokrw8&lang=en: Overview	Order now www.ti.com/tool/TMDSDC3359
Smart Building/ Internet of things	Description	Support	Get Started!
NEW Linux Based Gateway/ Smart Hub Reference Design	The IoT Gateway reference design creates a bridge between ZigBee and Wi-Fi or Ethernet and enables applications such as real-time energy monitoring or interaction with Wi-Fi enabled smart appliances or smart plugs. It also aggregates data from wireless sensor networks and can provide additional functions like security and monitoring. Additional communications interfaces like NFC for smart phone pairing or prepayment and Bluetooth can also be used. TheLinux based IoT Gateway manages communications, data processing and applications locally instead of relying on intelligence in the cloud Hardware Support: Sitara AM335x Cortex A8, TI ZigBee CC2530 SoC, TI Combo WiFi+ <i>Bluetooth®</i>, TI NFC RF430, Interfaces available for Power Line Communication Software Support: TI Linux SDK, TI WiFi Drivers, TI ZigBee library (HA and SE profile), TI NFC	Watch video at www.ti.com/smartgrid	Schematics available Sampling today <i>Contact TI representative</i>
Full System Solution Demo	Description	Support	Get Started!
Smart Meter Board 3.0 (SMB 3.0)	The SMB 3.0 is a modular development platform incorporating key TI Smart Grid devices to demonstrate the capabilities of a smart meter. SMB 3.0 is a unique tool with multiple features; it performs energy or electricity metering and has the capability of transferring key metering data via wired power-line (PLC) and wireless (Wi-Fi®, ZigBee®, Sub-1GHz) communication to showcase a simple automatic meter reading (AMR) and automatic metering infrastructure (AMI) system. The development platform takes advantage of TI Smart Grid software libraries to implement key communication standards and typical utility-meter functions; and, along with the hardware, allows developers to choose the development tool matching their project needs	Watch video at www.ti.com/smb3	www.ti.com/smartgrid

Notes

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Today's solutions for tomorrow's energy systems

- Grid Infrastructure
- Smart Electricity Meters
- Smart Gas, Water and Heat Meters
- Smart Buildings and IoT
- Communication

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- Optimized electricity-meter SoC (MSP430™)
- Flexible applications-processor SoC (LM4F1x)
- Dedicated MCU peripheral for flow meter rotation detection
- High performance for graphical user interfaces (AM335x Sitara™ ARM® MPU and LM4F1x)
- Optimized, low-power radio SoC (CC1101/CC1120 ISM)
- Flexible power line communication processors (TMS320F28PLCxx)
- Secure RFID and NFC prepayment options (TRF79xx, TMS37xx)
- Complementary interface and power management
- Cost-effective integration and volume manufacturing
- Compliance with wM-Bus and 802.15.4g
- Compliance with future worldwide security requirements
- Multiple Wi-Fi offerings from easy configuration, extended range, more throughput and simultaneous streaming. (CC3000, WL18xx modules)



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