Smart Grid Solutions

Texas Instruments

Engineering a Smarter Grid

Today's solutions for tomorrow's energy systems

- Grid infrastructure
- Utility metering
- Smart home and building



www.ti.com/smartgrid

1H 2013



Table of contents

Engineering a Smarter Grid 2–3
Smart Grid Infrastructure: Data Concentrator Solutions 4
Power Line Communications (PLC) Solutions 5
Smart E-Meter: AMR/AMI Solutions 6–7
Smart Gas/Water/Heat Meter Solutions 8–9
Wireless M-Bus Solutions 9
Smart Home and Building (HAN) Solutions . . . 10–11
Wireless Connectivity Solutions 12
Analog Components 13
Smart Grid Development Tools 14–15
Power Management Solutions 16–17
Resources . . . . . Back Cover



Engineering a Smarter Grid

Today's solutions for tomorrow's energy systems

- Grid infrastructure
- Utility metering
- Smart home and building

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, connectivity systems, RFID and analog components in readily available silicon. Advanced software, tools and support are also available to meet the needs of the world's grid infrastructure, utility metering and home and building automation.

TI offers smart grid solutions now and for the future.

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:

- Stellaris® ARM® Cortex™-M4 microcontrollers: LM4F1xx: 80 MHz, up to 256KB flash
- Sitara™ ARM Cortex microprocessors: AM335x Cortex-A8 MPUs: Up to 1 GHz
- OMAP™ system on Chip: OMAP-L138: ARM926 MPU plus C6000™ DSP
- MSP430™ Microcontrollers: MSP430F5xx/6xx: ultra-low-power, up to 256KB

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 below 1 GHz, down to 6.25 kHz channels
- CC1200: Broadband transceivers below 1 GHz with data rates up to 1 Mbps
- CC2538: Most integrated SOC for ZigBee®, Smart Energy with 512KB flash
- CC3000: SimpleLink™ Wi-Fi® SOC integrates total Wi-Fi connectivity

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 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:

- 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

TI E2E™ Community

engineer.to.engineer, solving problems

www.ti.com/smartgrid-blog







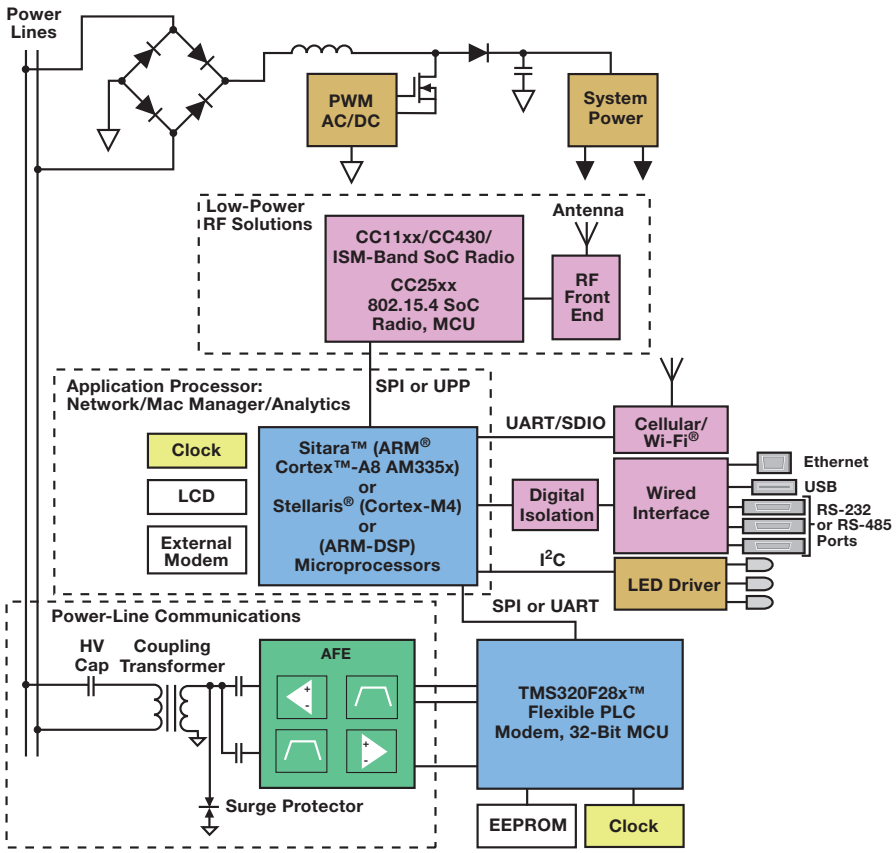


Smart Grid Infrastructure: Data Concentrator Solutions

Automated metering infrastructure (AMI) and automated meter reading (AMR) provide the necessary means to measure, analyze, collect energy usage and communicate that data to a central database for billing, trouble shooting 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 it to the utility servers.

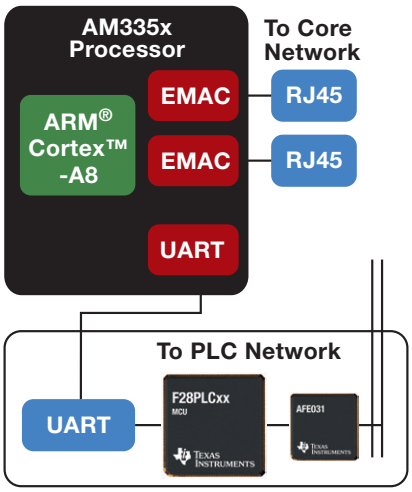
The communication mode largely depends on the power infrastructure and can be either wired or wireless communication. Wired communication is comprised of power line communication (PLC) and in some cases with serial- or Ethernet-based communication where PLC is not suited for the infrastructure. The wireless 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. **Learn more at** www.ti.com/dataconcentrator

Data Concentrator System



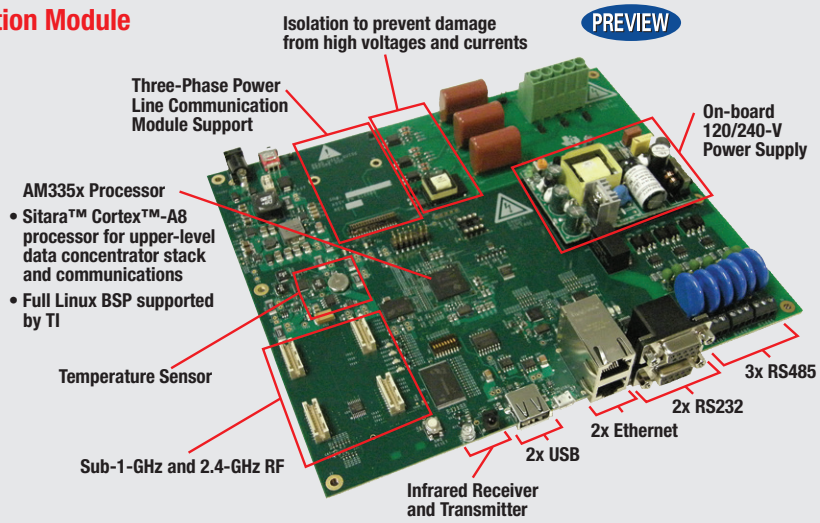
TI PLC Data Concentrator Platform

- 3-Chip Solution: Cortex™-A8 based on AM335x or OMAP™-L138 as application processor and TMS320F28PLC83 + AFE031 as PLC PHY + lowerMAC sub-system
- Single-phase reference design system built on field proven PLC PHY+MAC
- Supports both G3 and PRIME standards NIB (Network Information Base) management to handle thousands of PLC services nodes and switches
- Linux OS on Cortex-A8 to support MAC and above software stack convergence to both IPv6 and IE61334-4-32 COSEM/DLMS demo application framework



TMDSDC-EVMAM335x Data Concentrator Evaluation Module

- Field-proven system solution with AFE, Power, Isolation, MCU and MPU portfolio
- 500- to 1000-node concentrator demo in development
- Complete PHY- and MAC-layer software for Power Line Communication (G3, PRIME, IEEE-1901.2)
- Tailored solution from value line to high-performance processor for future needs (Pin-to-pin compatible, 300-MHz to 1-GHz MPU)
- Supports control and data communications: 2x Ethernet, 3-phase PLC interface, sub-1-GHz and 2.4-GHz RF, 2x RS232, 3x RS485
- Designed to best practices for high-speed systems: Good reference for design passing ESD system tests; BOM and schematics available



Embedded Processing Solutions for Data Concentrators

Description	Device	Key Benefits
Sitara™ 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 and RTOS ecosystem of development partner.
ARM9 microprocessors and digital signal processing (DSPs)	OMAP™-L138	• ARM9+C674x DSP application processors • Extensive peripheral set (EMAC, CAN, USB, multiple UARTs, ...) • Flexible communication protocols • Linux Community, Android, Windows Embedded CE , DSP BIOS and RTOS ecosystem of development partners
Stellaris® ARM® Cortex-M4-based MCUs	LM4F13x	• Up to 80-MHz core • 256KB single-cycle flash, 32KB single-cycle SRAM • Rich interface featuring 8x UARTs, USB, CAN, up to 43 GIPO, etc. • 2x 12-bit ADC with 12 analog input channels
C2000™ 32-bit real-time MCUs	Piccolo™ floating-point series	• PLC accelerators • Support multiple PLC modulations

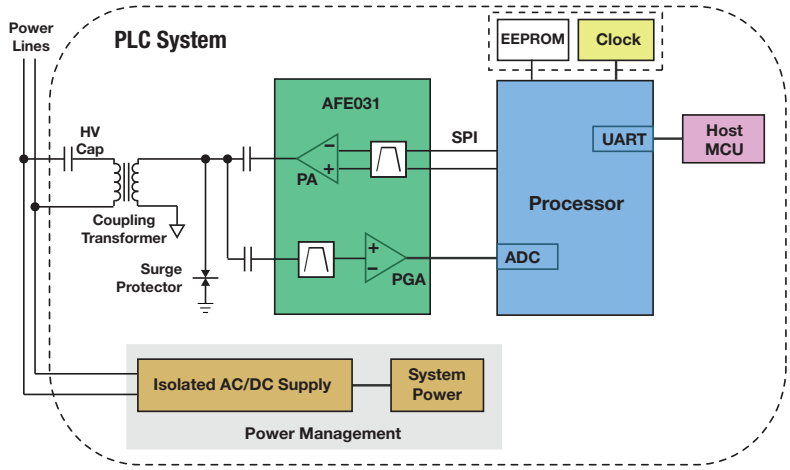
Power Line Communication (PLC) Solutions

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 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. **Learn more at www.ti.com/plc**



TI Chipsets for PLC

PLC Standard	Frequency Band	TI Chipset
PRIME or G3	CENELEC	TMS320F28PLC83 + AFE031
G3	FCC, ARIB	TMS320F28M35 + AFE032
IEEE-P1901.2	FCC	TMS320F28M35 + AFE032

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

- Two PLC modems
- PRIME or G3 PLC software
- Built-in USB JTAG emulation
- All necessary power and connection cables included
- 32KB limited Code Composer Studio™ (CCS) includes integrated development environment









Smart E-Meter: AMR/AMI Solutions

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 Prepayment

In many regions of the world, utilities are deploying pre-payment systems for their electricity customers. RFID systems using Near Field Communications 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/nfc** and at **www.ti.com/rfid**

Electric Meter Metrology Products

Device	Key Features
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	Single-phase metrology front end with three sensor input channels
ADS131E06	Analog front end with six 24-bit sigma-delta channels, 103-dB performance, integrated PGA and internal reference

Host Processors

Device	Key Features
Stellaris® LM4Fx Cortex™-M4 MCUs	80-MHz, 256KB flash, low-power RTC, StellarisWare® 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 Features

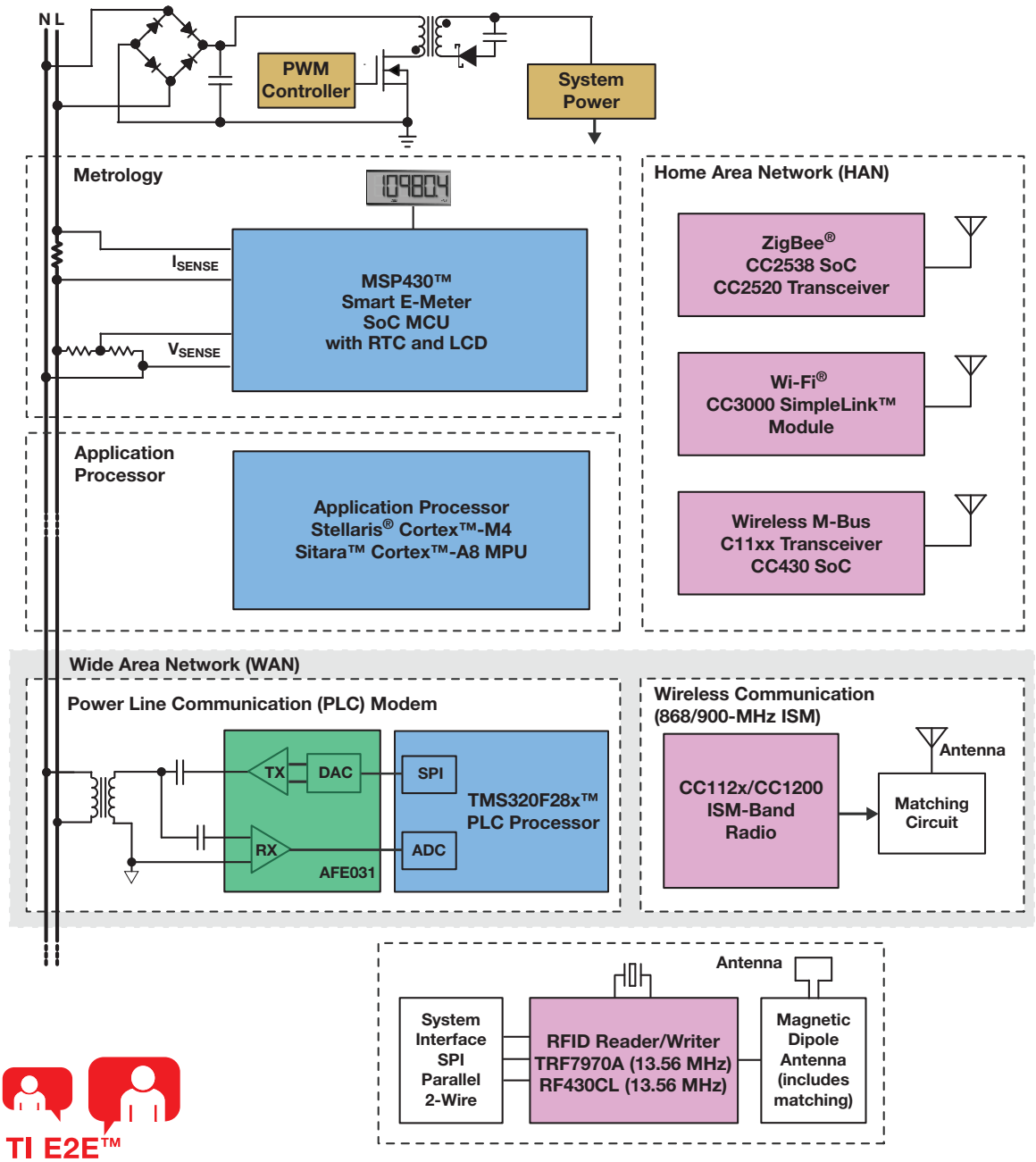
CC1120	• Ultra-low-power transceiver for narrowband systems
	• Channel spacing down to 12.5 kHz
	• 170/315/433/868/915/950-MHz ISM/SRD bands
	• IEEE 802.15.4g
	• ETSI, FCC, and ARIB regulatory compliance
	• Excellent receiver sensitivity
	  ○ –123 dBm at 1.2 kbps
	  ○ –110 dBm at 50 kbps
	• 64-dB adjacent 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

RFID Products

Device	Key Features
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

Smart E-Meter and Support Systems



TI E2E™ Community

engineer.to.engineer, solving problems

www.ti.com/smartgrid-blog







Smart Gas/Water/Heat Meter Solutions

Smart meter solutions from Texas Instruments enable increased flexibility in tomorrow's next-generation gas, water and heat flow metering systems:

- Innovation, expertise, and support covering all the major functions of the flow meter
- Comprehensive hardware and software portfolios to meet specific system requirements
- Solutions that are compliant with standards such as IEC, ANSI, wM-Bus and ZigBee®



Ultra-Low-Power Microcontrollers

Function	Part Number	Key Features	Category
Metrology MCU	MSP430F417	32KB flash, 96-seg LCD	General Purpose
	MSP430F448	48KB 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	MSP430F5438A	256KB flash, ideal for apps processor	High Performance
	MSP430F6638	256KB flash, 160-seg LCD, RTC with battery backup	
	MSP430F6736	128KB flash, 320-seg LCD, RTC with battery backup, power management	
MCU + RF System-on-Chip (SoC)	CC430F6147	Sub-1-GHz SoC, 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	
	CC1190	RF front end; 27-dBm (0.5-W) TX power	Range Extender
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	
Wired M-Bus	TSS721A	Meter-Bus (M-Bus) transceiver; meets EN1434-3 standard	Wired M-Bus

Power Management

PMIC	TPS65290	Ultra-low quiescent current, buck/boost, LDO, power switch, I^2C/SPI	
For other power management solutions (DC/DC converters, LDOs and voltage supervisors), see "Power Management Solutions for Smart Grid" on page 16			

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	I^2C interface and speed regulation; up to 9 devices on a single bus	Brushed
	DRV8832	Speed regulation: Constant speed over lifetime of battery	
	DRV8833	Up to 3-A continuous current; 1.6-µA sleep current	Brushed/Stepper
	DRV8835	Tiny 2 x 3-mm package; split V_M and V_{CC} supplies; 10-nA sleep current	
	DRV8836	Tiny 2 x 3-mm package; dedicated sleep pin; 40-nA sleep current	
	DRV8837	Tiny 2 x 2-mm package; split V_M and V_{CC} supplies; 35-nA sleep current	Brushed

Learn more at www.ti.com/flowmeter

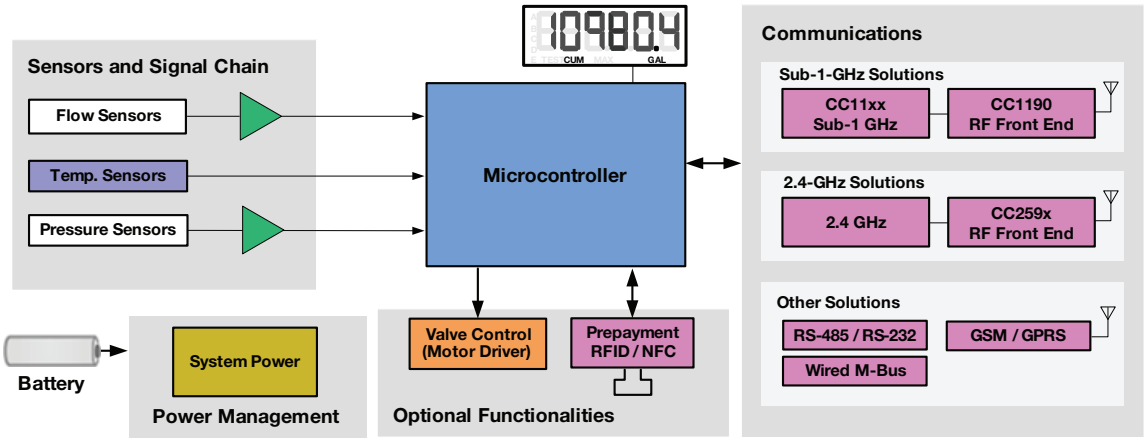
*New products shown in **bold red.***







Flow Metering System Block Diagram



TI E2E™ Community

engineer.to.engineer, solving problems

www.ti.com/smartgrid-blog

MSP430FW42x: MCUs for Water and Heat Meters

The MSP430FW429 is dedicated to simplifying AMR water- and heat-meter designs. The integrated scan-interface (Scan IF) peripheral minimizes external components and power consumption needed to measure flow, thereby extending the battery life of the system.

MSP430FW42x Advantages

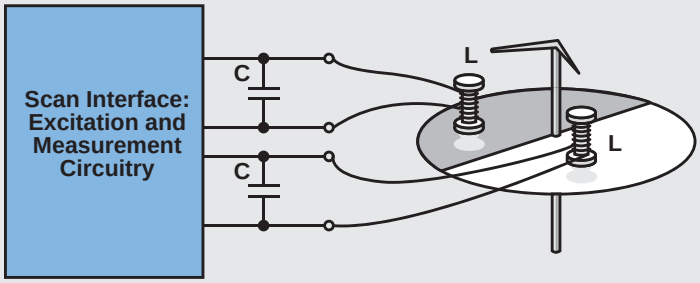
- Less external components required
- No CPU involvement for AMR measurement/ counting; CPU can remain in sleep mode
- Other peripherals (basic timer, Timer_A, and Comparator_A) are free for other operations
- Minimal current consumption needed: 17 to 22 nA (for 2 sensors)
- Supports 96-segment LCD
- Compatible with MSP430F415/7 products

About the Scan IF Peripheral

- Dedicated for AMR sensor measurement under low-power modes
- Peripheral includes excitation and measurement circuitry
- Scan IF wakes up the CPU only when the CPU is needed
- Flexible and easy to configure in order to meet varying requirements

Available Today

- Up to 60KB flash/2KB RAM
- Start evaluation with the MSP430FW42x 64-pin target board: MSP-TS430PM64



Wireless M-Bus Solutions

wM-Bus

- First to market with complete wM-Bus ecosystem: Hardware platform + wM-Bus stack
- Hardware and software support for both 169 MHz and 868 MHz
- Easy-to-use wM-Bus evaluation kits now available

Learn more at **www.ti.com/wmbus**

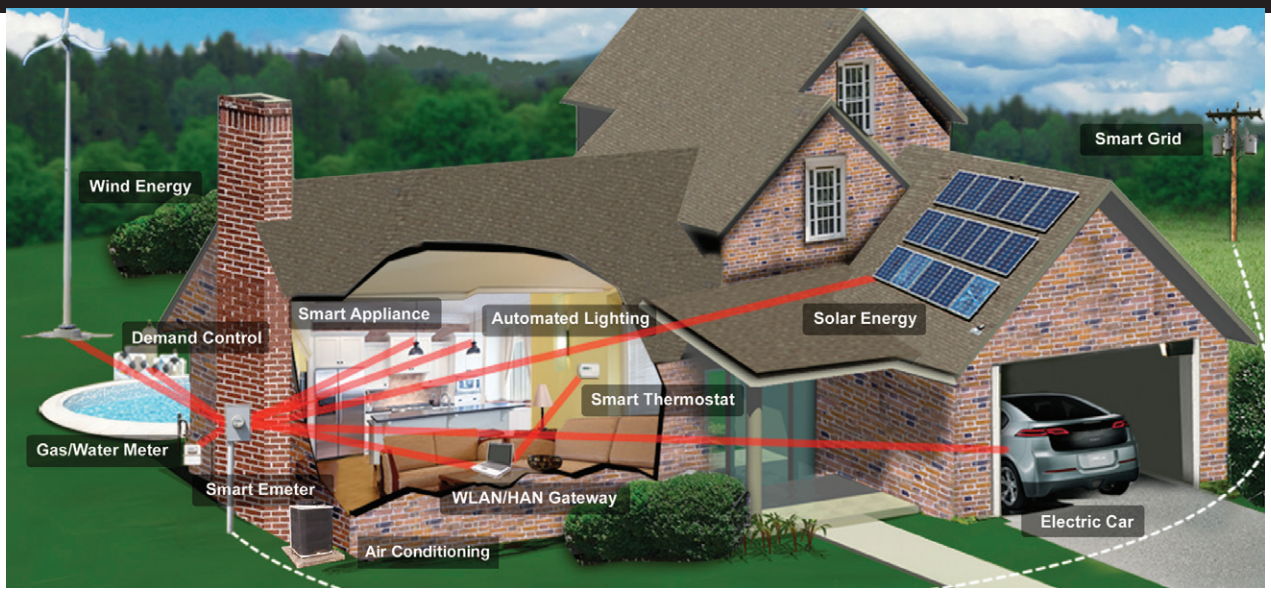
wM-Bus Hardware and Software Kits

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 Home and Building (HAN) Solutions

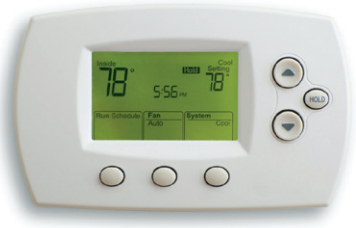


The home area network (HAN) refers to the ecosystem of devices within the home that are connected to the smart grid through a smart meter, a home energy gateway, or directly in some cases. Some examples of these devices are in-home displays (IHDs) for power-consumption monitoring (see block diagram), smart appliances that respond to time-of-use pricing signals, smart thermostats that cycle the air conditioning in response to peak-load-reduction signaling from the utilities, or smart plugs that can monitor power consumption and control appliances.

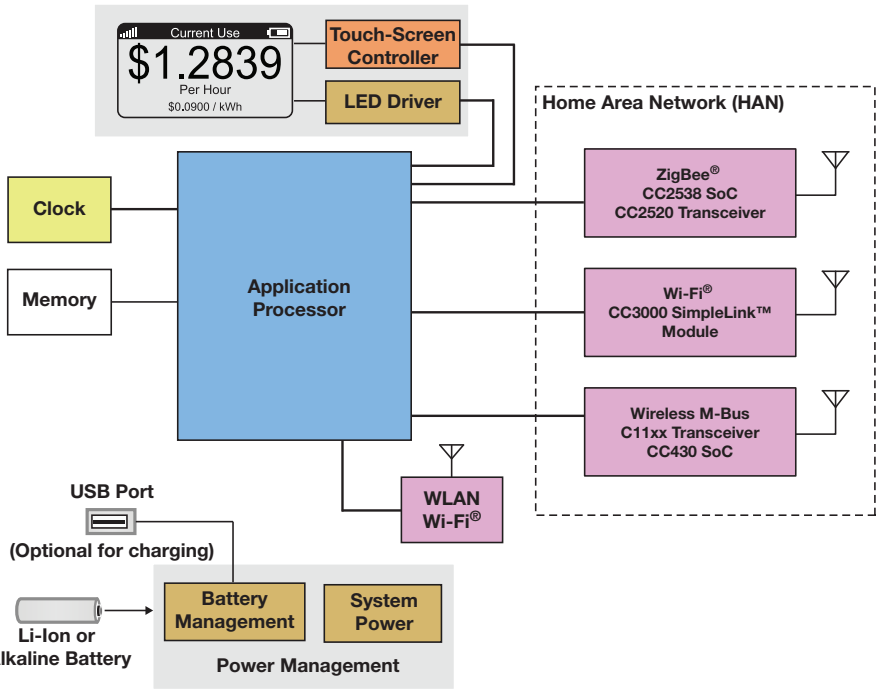
Activities in the HAN can be broadly split into three categories: Measurement, communication and control. TI has comprehensive solutions to address each of these three categories. Measurement refers to the metrology or power and energy measurement piece that is addressed by a suite of our solutions based on the MSP430™ microcontroller. Communications between the smart meter and devices can be via a wireless standard such as ZigBee®. Devices in the HAN might communicate with each other via power line communications (PLC), ZigBee or other wireless standards such as Wi-Fi®. TI has proven software and hardware solutions supporting each of these communication interfaces. The last piece of the HAN is controlling the components based on the measurement and communication. This can be done by using IHDs or via a web portal. It can also be done by sending signals directly to load controllers or smart plugs.

Now and for the future:

- Home gateways
- Sub-meters
- In-home display
- Thermostats
- Smart appliances
- Load controllers



In-Home Display



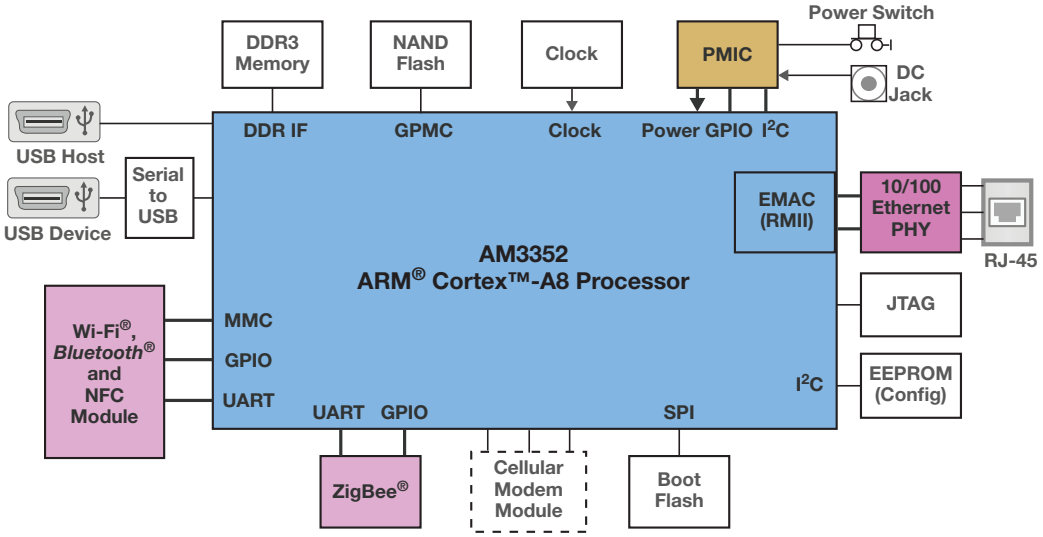
TI E2E™ Community

engineer.to.engineer, solving problems

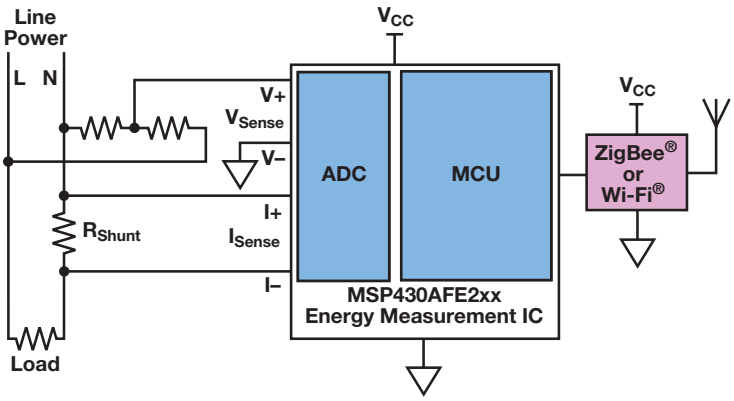
www.ti.com/smartgrid-blog

Home Gateway Solution



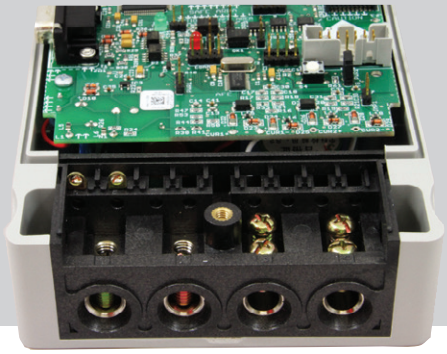


Smart Plug Solution



Single-Phase E-Meter (Analog Front End) Evaluation Module (EVM430-AFE253) ***E-Meter***

Single-phase electricity meter (with anti-tamper) EVM features the MSP430AFE253 which is the industry's first programmable microcontroller with an analog front end. Quickly understand calibration, anti-tamper, and precise measurements which achieve >99.9% accuracy across a dynamic range of 2400:1.



Key Devices for Smart Home and Building

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	
CC25xx	2.4-GHz transceivers and SOCs for ZigBee® and 802.15.4-based communications
CC11xx	Sub-1-GHz transceivers for backhaul and proprietary HAN communication
WiLink™	Highly integrated solutions supporting Wi-Fi®, *Bluetooth*® and NFC in a single chip
CC3000	802.11 b/g solution for Wi-Fi implementation without previous Wi-Fi or RF experience
Analog	
TPS650250	Low-cost power management IC for the AM335x processor
DP83848J	Ethernet PHY (10/100 Mbps) for home gateway application

Wireless Connectivity Solutions for Smart Grid

TI's wireless technologies for Smart Grid communication help create a greener and more sustainable world. As the demand for energy efficiency increases, consumers and energy companies need the ability to monitor, record and transfer usage and data to reduce total energy consumption. With that, smart grid developers can use TI's Wireless Connectivity technologies including Sub-1-Ghz, ZigBee®, 6LowPAN, wM-Bus, Wi-Fi®, *Bluetooth*® and more options to create infrastructure, smart meters, and home and building automation devices. Consumers are then able to connect more devices and receive real time information from their electricity provider, which allow them to make smarter decisions while reducing costs and cumbersome wires.

Sub-1-GHz Solutions

- CC1120, RF value/performance line: High-performance RF transceiver for narrowband systems
- CC110L, RF value/performance line: Low-cost transceiver for cost sensitive systems
- CC430: Enable smarter, low-power RF applications with more flexibility via the latest MSP430™ MCU and leading low-power RF IC
- Sub-1-GHz enables long range communications for Smart Grid systems supporting communication distances of several kilometers

Learn more at www.ti.com/rfperformanceline

ZigBee Solutions

- Complete hardware and software 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 featuring excellent coexistence with WLAN, *Bluetooth* and other 2.4-GHz solutions
- Smart energy and home automation public-application profiles and support
- Development kits and tools

Learn more at www.ti.com/zigbee

6LoWPAN Solutions

- 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) microcontrollers, CC1101/MSP430F5xxx platform and 6LoWPAN software stacks
- Supports large-scale mesh networks. Suitable for applications such as smart grid, security, home and building automation, street lighting and other wireless sensor networks.

Learn more at www.ti.com/6lowpan

wM-Bus Solutions

TI's Complete wM-Bus Solution includes multiple MSP430+CC11xx hardware platforms with wM-Bus stack. Easy-to-use TI evaluation kits with TI's ULP MSP430 MCU and CC11xx devices immediately available for wM-Bus development:

Also see page 9, and visit www.ti.com/wmbus

Wi-Fi Solutions

- CC3000: 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.
- WL1271: 802.11 b/g/n and *Bluetooth* platform on a single chip with best-in-class coexistence technology. TI's sixth-generation WLAN technology allows secure, high-throughput and reliable Wi-Fi connectivity of electronic devices to each other, the Internet and wired networks. TI's seventh-generation *Bluetooth* technology supports low-power applications in personal area networks.
- TPS82671: High efficiency MicroSiP™ step down converter.

Learn more at www.ti.com/wifi



TI E2E™ Community

engineer.to.engineer, solving problems

www.ti.com/smartgrid-blog

Recommended Development Tools

Part Number	Description	Application
BQ25504EVM-674	Evaluation module for BQ25504 ultra-low-power boost converter with battery management	Metering / Smart Grid / RFID / Wireless Communication
TRF7970AEVM	NFC development kit	NFC
CC2530ZDK-ZNP-Mini	ZigBee® network processor development kit	Wireless Connectivity
CC2531EMK	ZigBee USB dongle development kit	Wireless Connectivity
CC-6LOWPAN-DK-868	Sub-1-GHz 6LoWPAN development kit	Wireless Connectivity
DK-EM2-2520Z	Stellaris® 2.4-GHz ZigBee wireless networking kit (requires Stellaris DK-LM3S9B96 base kit)	Wireless Connectivity
EZ430-TMS37157	Passive low-frequency interface device kit	Wireless Connectivity
CC3000FRAMEMK	Kit with CC3000 Wi-Fi® modules, FRAM experimenter board and access point and USB hub for out-of-box experience	Wireless Connectivity
TMDXEVMWIFI1808L	Full-featured application development kit for evaluating the WL1271 Wi-Fi/*Bluetooth*® functionality combined with TI's highly integrated, energy-efficient AM1808, AM1806 and AM1802 application processors	Wireless Connectivity
CC11XLDK	Complete hardware performance testing and software development platform for TI's Sub-1-GHz Value Line	Wireless Connectivity
430BOOST-CC110L	The CC110L RF BoosterPack is a low-power wireless transceiver extension kit for use with TI's MSP-EXP430G2 LaunchPad development kit.	Wireless Connectivity
CC1120DK	Sub-1-GHz RF performance-line development kit	Wireless Connectivity / wM-Bus

Recommended Analog Products

Device	Descripton and Benefits	Application
Signal Chain		
AMC1100	Isolation amplifier, 4.25-kV peak	e-meters/Smart Meters/Circuit Breakers
ADS131Exx/130Exx	Analog front end for power monitoring, control and protection	e-meters/Power Monitoring
ADS1292	Low-power integrated analog front end for metering applications	e-meters/Power Monitoring
ISO7520/1	Low-power 5-kVrms dual digital isolators	e-meters/Power Monitoring
ISO7240	Quad channel, 4/0, 25 Mbps, digital isolator	Data Concentrators/Grid Infrastructure
AFE030/1	Powerline communications analog front end	e-meters/Smart Grid Infrastructure
ISO3086T/ISO35T	Isolated RS485 transceiver with integrated transformer driver	e-meters/Smart Grid Infrastructure
SN6501	Transformer driver for isolated power supplies	e-meters/Smart Grid Infrastructure
LM1851	Ground-fault interrupter	Ground-Fault Interrupter (GFCI)/CCID
TMP275	Digital-out temperature sensor with 0.5°C accuracy	Smart Meters/Circuit Breakers
TMP112	Low-power digital temperature sensor with SMBus interface	Smart Meters/Circuit Breakers
REF2912	1.25-V voltage (bandgap) reference, 100 ppm/°C, 50 µA in SOT23-3	Metering/Circuit Breakers
SM73307	Dual-precision, 17-MHz, low-noise, CMOS-input amplifier	DC Arc Fault Detection/CCID
SM73308	Single, low-offset, low-noise, RRO op amp	DC Arc Fault Detection/CCID
SM73201	16-bit, 50- to 250-kSPS, differential-input, micropower ADC	DC Arc Fault Detection/CCID
TMP006	Contact-less infrared thermopile sensor	Smart Meters/Circuit Breakers
PGA112	Zero-drift, programmable gain amplifier with MUX	Smart Meters/Circuit Breakers
OPA356	2.5-V, 200-MHz GBW, CMOS single op amp	Data Concentrators/Grid Infrastructure
OPA835/6	Ultra-low-power, rail-to-rail out, negative rail in, VFB amplifier	Flow Meters
INA333	Low-power, precision instrumentation amplifier	Circuit Breakers
OPA4330	1.8-V, 35-µA, micropower, precision, zero-drift CMOS op amp	Circuit Breakers
TL431	Adjustable precision shunt regulator	Circuit Breakers
Digital Isolation		
ISO75xx	Low-power 5-kV_{rms} dual digital isolators	E-meter, Data Concentrator , Grid Infrastructure
ISO7641FM	Quad channel 150-Mbps digital isolator. Offers 6-kV_{peak} isolation employing SiO_2 cap based isolation	E-meter, Data Concentrator , Grid Infrastructure
ISO1540	Bidirectional I^2C isolator, offers low-power, integrated SiO_2 dielectric cap offers proven reliability and high breakdown voltages (4-kVpeak)	Data Concentrator
ISO1541	Bidirectional I^2C isolator (bidirectional data, unidirectional clock), offers low-power, integrated SiO_2 dielectric cap offers proven reliability and high breakdown voltages (4-kV_{peak})	Data Concentrator
External RTC		
bq32000	Real-time clock	E-meter
Relay Drivers		
ULN2003xx	Family of relay drivers	E-meter, Grid Infrastructure
UCC27524	Dual, 5-A, high-speed low-side power MOSFET driver	E-meter, Grid Infrastructure
Ethernet PHY		
DP83848J	10/100 Ethernet PHY	Data Concentrator, Home Area Network

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-1-GHz) 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.



Features

- Smart-meter development platform to develop AMR and AMI systems
- Supports 1-phase and 3-phase metrology function
- Supports application processor ranging from Cortex™-M to Cortex-A8
- Low-power RF sub-1-GHz and 2.4-GHz ZigBee implementation
- Supports power-line communication for PRIME/G1/G3/P1901.2
- Prepayment/NFC capabilities
- Wi-Fi capability to connect smart meter to the IP network
- Supports TI Smart Grid software libraries: SEP1.x, SEP2.0, wM-Bus, 15.4g, 1-phase/3-phase metrology, THD, DLMS, prepayment, MIFARE™, encryption

Benefits

- Modular and scalable: Tune the tool to your needs
- Support from low-end to advanced smart meter
- Supports discrete to integrated implementation with smart-meter SoC
- Ease of software integration with TI Smart Grid software libraries
- Open platform for further development and differentiation

Three-Phase E-meter (Anti-Tamper) Evaluation Module (EVM430-F47197 or EVM430-F6779) ***E-Meter***



Feature a system-on-chip MSP430F47197 (128KB Flash) or MSP430F6779 (512KB flash) metrology with up to seven sigma-delta converters, which allow measurement of three phases with anti-tamper. The 160- or 320-segment LCD displays energy, voltage, current and more for all three phases.

Single-Phase E-Meter Evaluation Module (EVM430-F6736) ***E-Meter***



Single-phase electricity meter EVM features the 25-MHz MSP430F6736 with three 24-bit sigma-delta converters for 50% lower power consumption in metering applications. Includes LCD display for easy readout.

Single-Phase E-Meter (Analog Front End) Evaluation Module (EVM430-AFE253) ***E-Meter***



Single-phase electricity meter (with anti-tamper) EVM features the MSP430AFE253 which is the industry's first programmable microcontroller with an analog front end. Quickly understand calibration, anti-tamper, and precise measurements which achieve >99.9% accuracy across a dynamic range of 2400:1.

Power Line Modem Developer's Kit (TMDSPLCKIT-V3) ***PLC***



Enables easy development of software based Power Line Communication (PLC) modems. Kit includes two PLC modems, software supporting OFDM (PRIME/G3) and SFSK communication, plus more!

Sub-1-GHz SoC Wireless Development Tool (EM430F6137RF900) ***Wide-Area-Network***



Complete development tool for an entire wireless project featuring the CC430 system-on-chip RF transceiver. Kit includes two sub-1-GHz wireless target boards with antennas (868/915 MHz) and the highly integrated MSP430F6137IRGC RF system-on-chip. SimpliciTI™ software stack available.

Smart Grid Infrastructure Evaluation Module (TMDSSGI-EVML138) ***Grid Infrastructure***



The SGI EVM was developed for customers looking to create the next generation data concentrators and power analytics devices. The OMAP™-L138 processor is featured on this device for control, communications, and signal processing. Several control and data communications are supported including Ethernet, PLC, <1-GHz RF, RS-232, USB and CAN.

ZigBee®/IEEE 802.15.4 Development Kit (CC2530ZDK) ***ZigBee Home-Area-Network***



Kit includes all necessary hardware in order to properly evaluate, demonstrate, prototype and develop software targeting not only ZigBee or 802.15.4 compliant applications, but also proprietary applications requiring a DSSS radio. Also features TI's second generation ZigBee/IEEE 802.15.4 RF transceiver for 2.4 GHz band.

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.

In-Home-Display with Wi-Fi® Evaluation Module (TMDXEVMWIFI1808L) ***Smart Home/Smart Building***



Full-featured application development kit for evaluating the functionality of TI's highly integrated, energy-efficient AM1808, AM1806 and AM1802 application processors. Also features *Bluetooth*® and Wi-Fi connectivity with integrated LCD, touch and backlight display.

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.

RFID/NFC Transceiver Evaluation Module Kit (TRF7960AEVM/TRF7970AEVM) ***Secure Prepayment***



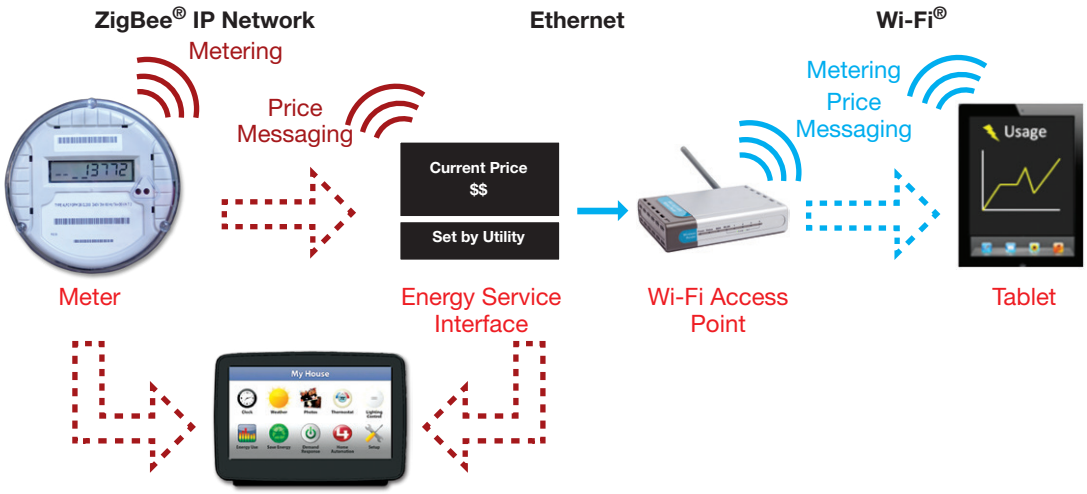
Self contained development platform which can be used to independently evaluate/test the performance of the TRF7960A or TRF7970A RFID/near-field-communications transceiver IC, custom firmware, customer designed antennas and/or potential transponders for a customer defined RFID/NFC application.

Smart Energy Profile 2.0 Demonstration

SEP2.0 is an IP-based application specification under development by the ZigBee and Wi-Fi Alliances along with other industry groups. SEP2.0 has also been identified by the National Institute of Standards and Technology as the recommended protocol for energy information and control in the Home Area Network, or HAN.

SEP2.0 is a PHY diagnostic profile that is designed to run on multiple PHY technologies such as IEEE 802.15.4, power line communications, Ethernet, and Wi-Fi. Device manufacturers can implement any MAC/PHY under an IP layer. This is important in the Home Area Network as it allows consumers to purchase different types of SEP2.0-enabled products and be assured that they will interoperate. It also enables SEP2.0 devices to be seamlessly integrated with existing IP-based utility IT infrastructure.

TI can help with your SEP2.0 Applications with TI hardware and software capable of operating across multiple communications networks including ZigBee IP, Wi-Fi, Power Line Communication and Ethernet. A SEP2.0 demonstration utilizing TI tools and software can be found on our website.



Power Management Products

Device	Description and Benefits	Type	Application
Isolated AC/DC Power Solutions			
UCC28710	Constant-voltage, constant-current controller with primary-side regulation, QR green mode, optocoupler less feedback, very low no-load pwr, integrated 700-V startup switch, high efficiency	AC/DC supply	E-meter, data concentrator, grid infrastructure
UCC28700	Constant-voltage, constant-current controller with primary-side regulation, QR Green mode, optocoupler less feedback, very low no-load pwr	AC/DC supply	E-meter, data concentrator, grid infrastructure
UCC28610	Cascoded green mode PWM controller, 85%+ efficiency at full load, Industry leading power consumption at no-load, and small footprint	AC/DC supply	E-meter, data concentrator, grid infrastructure
UCC28600	Quasi-resonant flyback, full green mode capability in 8-pins, high efficiency due to valley switching and low EMI	AC/DC supply	E-meter, data concentrator, grid infrastructure
DC/DC Converters			
LM25011	DC/DC buck regulator: 42-V current-limit adjustable to 2 A, 2-MHz switching frequency	Step-down regulator	E-meter
LM34923	DC/DC buck regulator: 6- to 75-V input-voltage range, 600-mA constant ontime switching, no loop compensation required, has integrated 80-V N-ch MOSFET switch, offers ultra-fast transient response	Step-down regulator	E-meter, data concentrator
LM5006/7/10A	DC/DC buck regulator: 75-V maximum input capability, synchronous or nonsynchronous rectification. Up to 1-A output current	Step-down regulator	E-meter
TPS2841	300 mA up to 42-V input step-down DC/DC regulator	Step-down regulator	E-meter
TPS5402/TPS5403/ TPS5405	3.5- to 28-V input, 2-A output current, non-sync buck	Step-down regulator	E-meter
TPS54020	High-efficiency SWIFT™ DC/DC converter: 10 A, 4.5- to 17-V input in 3.5x3.5-mm HotRod™ QFN package	Step-down regulator	E-meter/grid infrastructure processor and system power
TPS54218	DC/DC switching power supply: 2.95- to 6-V input, 2-A output, 2 MHz, synchronous step down	Step-down regulator	E-meter/grid infrastructure processor power
TPS54478	DC/DC switching power supply: 2.95- to 6-V input, 4-A output, 2 MHz, synchronous step-down switcher	Step-down regulator	E-meter/grid infrastructure processor power
TPS54320	DC/DC switching power supply: 4.5- to 17-V input, 3-A synchronous step down SWIFT™ converter	Step-down regulator	E-meter/grid infrastructure processor power
TPS54623	DC/DC switching power supply: 4.5- to 17-V input, 6-A synchronous step-down converter with light load efficiency	Step-down regulator	E-meter/grid infrastructure processor power
TPS62067	Synchronous DC/DC step-down converter: 2-A output, Power Good output, <50-mm^2 solution footprint	Step-down regulator	E-meter/grid infrastructure processor power
TPS54062	60-V, 50-mA synchronous step-down DC/DC converter with sub-100-µA I_Q	Step-down regulator	E-meter/highly efficient single-phase meters needing <50 mA; 2-wire 4–20-mA loop sensors
TPS54061/2	60-V, 200-mA synchronous step-down DC/DC converter with sub-100-µA I_Q	Step-down regulator	E-meter/highly efficient three-phase meters needing <200 mA; 3-wires 4–20-mA loop sensors
LM5017	DC/DC buck regulator: 100-V maximum input capability, synchronous rectification, no loop compensation required	Step-down regulator	E-meter/PLC
LMR14003/6	DC/DC, ultra-low quiescent current, low UVLO, 300-mA/600-mA non-synchronous buck regulator	Step-down regulator	E-meter, 1-phase or 3-phase
TPS62130/TPS62140/ TPS62150	DC/DC step-down converter with up to 17-V supply, 1-A to 3-A output current, DCS-control topology provides very high efficiency over load range, fast AC line and transient load response on a small-solution footprint (<95 mm^2), Power Good indicator	Step-down regulator	Data concentrator, grid infrastructure, general system supply
TPS62160/TPS62170	DC/DC step-down converter with up to 17-V supply, 0.5-A or 1-A output current, DCS-control topology provides very high efficiency over load range, fast AC line and transient load response on a small-solution footprint (<45 mm^2), soft-start/tracking, pin-selectable switching frequency, Power Good indicator	Step-down regulator	Data concentrator, grid infrastructure, general system supply
TPS62125	DC/DC step-down converter with up to 17-V supply, 0.3-A output current, adjustable ENABLE threshold and hysteresis, DCS-control topology provides fast AC line and transient load response, Power Good indicator	Step-down regulator	General system supply: "Harvesting" or 4–20-mA loop operated
TPS62230	3-MHz step-down converter with V_{IN} from 2.05 to 6 V. Offers high efficiency with power save mode (PFM) at light loads and has low I_Q of 22 µA	Step-down regulator	Data concentrator
TPS62240	2.25-MHz, 300-mA buck in 2x2 SON/SOT23. Offers high efficiency, power save mode at light loads	Step-down regulator	Data concentrator
TPS62270	400-mA buck, offers two-level dynamic voltage scaling, selectable V_{OUT} from 0.8 to 1.575 V in 25-mV steps	Step-down regulator	Data concentrator
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	Low-cost 60-V cap-drop solutions
TPS5401	Cost-optimized 42-V, 0.5-A step-down DC/DC converter; cap-drop off-line power supplies—refer to App note SLVA491	Step-down regulator	Low-cost cap-drop solution

Learn more at www.ti.com/power

Power Management Products (Continued)

Device	Description and Benefits	Type	Application
DC/DC Converters (Continued)			
TPS62175	DC/DC step-down converter with up to 28-V supply, 0.5-A output current, DCS-control topology provides fast AC line and transient load response on a small-solution footprint; Power Good indicator	Step-down regulator	Low-power MCU supply
TPS62730	DC/DC step-down converter: Companion power supply for LP RF devices; bypass mode saves 20 to 30% battery current withput compromising on transmit power; DCS-control topology provides low output voltage ripple	Step-down regulator	RF transceiver/receiver supply
TPS54040/140/240	DC/DC switching power supply: 42-V, 0.5-A/1.5A/2.5-A step-down DC/DC converters with ECOMode for light load efficiency and very low I_Q	Step-down regulator	E-meter, home area network
TPS5423x/TPS5433x	DC/DC switching power supply: 24-V, 2-A/3-A/3.5-A DC/DC converters	Step-down regulator	E-meter, home area network
LMR12010	20-V_{IN},1-A buck regulator offers internal softstart, currrent-mode PWM control, 30-nA low shutdown I_Q and switching upto 3 MHz	Step-down regulator	Data concentrator
TPS6303x	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
TPS6306x	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	0.6/1.6-MHz boost converter with 40-V integrated FET switch with low $R_{DS(on)}$. Offers cycle-by-cycle current limiting	Step-up regulator	Data concentrator
LM5022	60-V low-side controller for boost and SEPIC, with CMC and max f_{SW} of 2 MHz, Low EMI and high current capability	Step-up regulator	Data concentrator
Linear Regulators			
TPS709xx	150 mA, 30 V input, 1-µA I_Q with reverse current protection and EN	LDO	E-meter, data concentrator, grid infrastructure
TLV713xx	150-mA, cap-free cost-effective LDO with foldback current limit	LDO	E-meter, data concentrator, grid infrastructure, Flow meter
TLV704xx	LDO linear regulator: 24 V, 150 mA; ultra-low 3.2-µA I_Q	LDO	E-meter, Data Concentrator, Grid Infrastructure, Flow meter
TPS782x	LDO linear regulator: Ultra-low 0.5-µA IQ, 150 mA, low noise	LDO	E-meter, Data Concentrator, Grid Infrastructure, Flow meter
TPS7A1601	LDO linear regulator: 60 V, 100 mA; ultra-low 5-µA I_Q; PG pin	LDO	E-meter, data concentrator, grid infrastructure
TPS7A4001	LDO linear regulator: 100 V, 50 mA; low I_Q	LDO	E-meter, data concentrator, grid infrastructure
LP38691	500-mA low dropout CMOS linear regulator with tight output tolerance, and excellent AC performance with ultra-low ESR ceramic caps	LDO	Data concentrator
TLV70030	200-mA LDO with low I_Q, tight output regulation (2% typ). Offers excellent line and load transient performance	LDO	Data concentrator
TPS70933	130-mA, 30-V linear reg. Offers ultra-low I_Q of about 1.35 µA, reverse current protection and 2% accuracy over temp	LDO	Data concentrator
TPS72728	200-mA, RF Low-dropout regulator. Ultra-low I_Q and fast transient response with EEPROM programmable V_{OUT}. Small 0.8x1.2-mm^2 WCSP package	LDO	Data concentrator
PMICs			
TPS65250	Power management IC for E-meters	PMU	E-meter
TPS65290	Power management IC for gas/water meters	PMU	Gas/water meter
TPS650250	Low-cost PMU for AM335x	PMU	Grid infrastructure
TPS65290	PMU: Ultra-low quiescent current, buck/boost, LDO, power switch, I^2C/SPI	PMU	Water meter
Voltage Supervisor & Reset			
TPS3839	Ultra-low power 150 nA, 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 200 ms reset delay	Voltage supervisor	E-meter, grid infrastructure
TPS3839A09	Supply voltage supervisor with ultra-low suppy current (150 nA typ). Offers operating supply voltage of 0.6 to 605 V, small size 1x1-mm SON	Voltage supervisor	Data concentrator
Chargers			
BQ24210	800-mA, single-input, single-cell Li-Ion solar battery charger	Battery charger	Home area network
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

Learn more at www.ti.com/power

Visit www.ti.com/smartgrid for smart grid solutions from TI

Engineering a Smarter Grid:

Today's solutions for tomorrow's energy systems

- Grid Infrastructure
- Utility Metering
- Home and Building Automation

The power of TI saves you time to market.

- Globally deployed metering know-how and products
- Comprehensive end-to-end system-on-chip (SoC) solutions
- Innovation and expertise across a robust portfolio

Speed your design cycle with TI's flexible solutions.

- Hardware, software and SoCs tailored to functional requirements
- Upgradable, in-system programmable flash memory to support evolving worldwide standards
- Available standards include IEC, ANSI, ZigBee®, Wireless M-Bus (wM-Bus), PLC and 6LoWPAN
- Scalable for optimization of system requirements and future deployments



Outsmart the competition with smarter solutions.

- 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 prepayment (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

TI Worldwide Technical Support

Internet

TI Semiconductor Product Information Center Home Page
support.ti.com
TI E2E™ Community Home Page
e2e.ti.com

Product Information Centers

Americas Phone +1(512) 434-1560
Brazil Phone 0800-891-2616
Mexico Phone 0800-670-7544
Fax +1(972) 927-6377
Internet/Email support.ti.com/sc/pic/americas.htm

Europe, Middle East, and Africa
Phone
European Free Call 00800-ASK-TEXAS (00800 275 83927)
International +49 (0) 8161 80 2121
Russian Support +7 (4) 95 98 10 701

Note: The European Free Call (Toll Free) number is not active in all countries. If you have technical difficulty calling the free call number, please use the international number above.

Fax +(49) (0) 8161 80 2045
Internet www.ti.com/asktexas
Direct Email asktexas@ti.com

Japan
Phone Domestic 0120-92-3326
Fax International +81-3-3344-5317
Domestic 0120-81-0036
Internet/Email International support.ti.com/sc/pic/japan.htm
Domestic www.tij.co.jp/pic

Asia
Phone
International +91-80-41381665
Domestic Toll-Free Number
Note: Toll-free numbers do not support mobile and IP phones.

Australia	1-800-999-084	Malaysia	1-800-80-3973
China	800-820-8682	New Zealand	0800-446-934
Hong Kong	800-96-5941	Philippines	1-800-765-7404
India	1-800-425-7888	Singapore	800-886-1028
Indonesia	001-803-8861-1006	Taiwan	0800-006800
Korea	080-551-2804	Thailand	001-800-886-0010

Fax +8621-23073686
Email tiasia@ti.com or ti-china@ti.com
Internet support.ti.com/sc/pic/asia.htm

Important Notice: The products and services of Texas Instruments Incorporated and its subsidiaries described herein are sold subject to TI's standard terms and conditions of sale. Customers are advised to obtain the most current and complete information about TI products and services before placing orders. TI assumes no liability for applications assistance, customer's applications or product designs, software performance, or infringement of patents. The publication of information regarding any other company's products or services does not constitute TI's approval, warranty or endorsement thereof.

B090712

The platform bar, C2000, C6000, C64x+, C67x+, Code Composer Studio, Concerto, controlCARD, DCS-Control, DSP/BIOS, E2E, Eco-mode, FlexOFDM, MSP430, OMAP, Piccolo, plcSUITE, SimpleLink, SimpliciTI, SmartConfig, Sitara, SWIFT, TI-RFid, TMS320F28x and Z-Stack are trademarks and Stellaris and StellarisWare are registered trademarks of Texas Instruments. The *Bluetooth* word mark and logos are owned by the Bluetooth SIG, Inc., and any use of such marks by Texas Instruments is under license. Android is a registered trademark of Google, Inc. ARM9, ARM926EJ-S, Cortex and Neon are trademarks and ARM is a registered trademark of ARM Limited. MIFARE is a trademark of NXP Semiconductors. Wi-Fi is a registered trademark of the Wi-Fi Alliance. ZigBee is a registered trademark of the ZigBee Alliance. All other trademarks are the property of their respective owners.

© 2013 Texas Instruments Incorporated
Printed in U.S.A. by (Printer, City, State)

Texas Instruments

SLYM071K

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, enhancements, improvements and other changes to its semiconductor products and services per JESD46, latest issue, and to discontinue any product or service per JESD48, latest issue. Buyers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All semiconductor products (also referred to herein as “components”) are sold subject to TI’s terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its components to the specifications applicable at the time of sale, in accordance with the warranty in TI’s terms and conditions of sale of semiconductor products. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by applicable law, testing of all parameters of each component is not necessarily performed.

TI assumes no liability for applications assistance or the design of Buyers’ products. Buyers are responsible for their products and applications using TI components. To minimize the risks associated with Buyers’ products and applications, Buyers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right relating to any combination, machine, or process in which TI components or services are used. Information published by TI regarding third-party products or services does not constitute a license to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of significant portions of TI information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of TI components or services with statements different from or beyond the parameters stated by TI for that component or service voids all express and any implied warranties for the associated TI component or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

Buyer acknowledges and agrees that it is solely responsible for compliance with all legal, regulatory and safety-related requirements concerning its products, and any use of TI components in its applications, notwithstanding any applications-related information or support that may be provided by TI. Buyer represents and agrees that it has all the necessary expertise to create and implement safeguards which anticipate dangerous consequences of failures, monitor failures and their consequences, lessen the likelihood of failures that might cause harm and take appropriate remedial actions. Buyer will fully indemnify TI and its representatives against any damages arising out of the use of any TI components in safety-critical applications.

In some cases, TI components may be promoted specifically to facilitate safety-related applications. With such components, TI’s goal is to help enable customers to design and create their own end-product solutions that meet applicable functional safety standards and requirements. Nonetheless, such components are subject to these terms.

No TI components are authorized for use in FDA Class III (or similar life-critical medical equipment) unless authorized officers of the parties have executed a special agreement specifically governing such use.

Only those TI components which TI has specifically designated as military grade or “enhanced plastic” are designed and intended for use in military/aerospace applications or environments. Buyer acknowledges and agrees that any military or aerospace use of TI components which have ***not*** been so designated is solely at the Buyer's risk, and that Buyer is solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI has specifically designated certain components as meeting ISO/TS16949 requirements, mainly for automotive use. In any case of use of non-designated products, TI will not be responsible for any failure to meet ISO/TS16949.

Products		**Applications**	
Audio	www.ti.com/audio	Automotive and Transportation	www.ti.com/automotive
Amplifiers	amplifier.ti.com	Communications and Telecom	www.ti.com/communications
Data Converters	dataconverter.ti.com	Computers and Peripherals	www.ti.com/computers
DLP® Products	www.dlp.com	Consumer Electronics	www.ti.com/consumer-apps
DSP	dsp.ti.com	Energy and Lighting	www.ti.com/energy
Clocks and Timers	www.ti.com/clocks	Industrial	www.ti.com/industrial
Interface	interface.ti.com	Medical	www.ti.com/medical
Logic	logic.ti.com	Security	www.ti.com/security
Power Mgmt	power.ti.com	Space, Avionics and Defense	www.ti.com/space-avionics-defense
Microcontrollers	microcontroller.ti.com	Video and Imaging	www.ti.com/video
RFID	www.ti-rfid.com		
OMAP Applications Processors	www.ti.com/omap	**TI E2E Community**	e2e.ti.com
Wireless Connectivity	www.ti.com/wirelessconnectivity		

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265
Copyright © 2013, Texas Instruments Incorporated

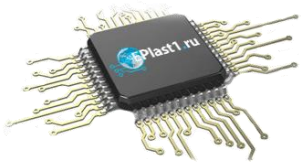
Компания «ЭлектроПласт» предлагает заключение долгосрочных отношений при поставках импортных электронных компонентов на взаимовыгодных условиях!

Наши преимущества:

- Оперативные поставки широкого спектра электронных компонентов отечественного и импортного производства напрямую от производителей и с крупнейших мировых складов;
- Поставка более 17-ти миллионов наименований электронных компонентов;
- Поставка сложных, дефицитных, либо снятых с производства позиций;
- Оперативные сроки поставки под заказ (от 5 рабочих дней);
- Экспресс доставка в любую точку России;
- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- Лицензия ФСБ на осуществление работ с использованием сведений, составляющих государственную тайну;
- Поставка специализированных компонентов (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Aeroflex, Peregrine, Syfer, Eurofarad, Texas Instrument, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits,General Dynamics и др.);

Помимо этого, одним из направлений компании «ЭлектроПласт» является направление «Источники питания». Мы предлагаем Вам помощь Конструкторского отдела:

- Подбор оптимального решения, техническое обоснование при выборе компонента;
- Подбор аналогов;
- Консультации по применению компонента;
- Поставка образцов и прототипов;
- Техническая поддержка проекта;
- Защита от снятия компонента с производства.



Как с нами связаться

Телефон: 8 (812) 309 58 32 (многоканальный)
Факс: 8 (812) 320-02-42
Электронная почта: org@eplast1.ru
Адрес: 198099, г. Санкт-Петербург, ул. Калинина, дом 2, корпус 4, литера А.