

# Smart grid distribution and smart meters







# Content

Introduction .....	4
ST's smart grid strategy .....	4
Energy smart meters .....	5
Water/gas meters .....	11
Data concentrator unit (DCU), multi utility controller (MUC) and gateway .....	14
Evaluation boards .....	17
ST in smart grid standards .....	19





# Introduction

## Smart grids: a step forward in efficiency

Governments and power companies across the world have recognized that the traditional grid, which has not significantly changed in 100 years, must be replaced by more efficient, flexible and intelligent energy-distribution networks, called smart grids. These are digitally monitored, self-healing energy systems that deliver electricity or gas from generation sources, including distributed renewable sources, to points of consumption. They optimize power delivery and facilitate two-way communication across the grid, enabling end-user energy management, minimizing power disruptions and transporting only the required amount of power. The result is a lower cost to the utility and the customer, more reliable power, and reduced carbon emissions.

At STMicroelectronics, we offer a complete set of semiconductor products to implement energy, water, heat and gas meters, as well as concentrators or multi utility controllers (MUC). The portfolio includes power-line modems, 8- and 32-bit microcontrollers, 32-bit microprocessors, ASSPs for metrology, real-time clocks, EEPROMs, power supply products and security products.

### ST'S SMART GRID STRATEGY

With more than 20 years of presence and investment in the field of metering and smart grids, ST has developed the widest portfolio of products and solutions meeting the needs of these segments. ST's strategy in the smart grid can be summed up as follows: the one-stop shop for smart-grid applications. This means we supply most of the semiconductors for each application mentioned in the above picture.

The success stories with Enel in Italy, Iberdrola and Endesa in Spain, and other utilities and meter manufacturers worldwide have already demonstrated the quality of our solutions.





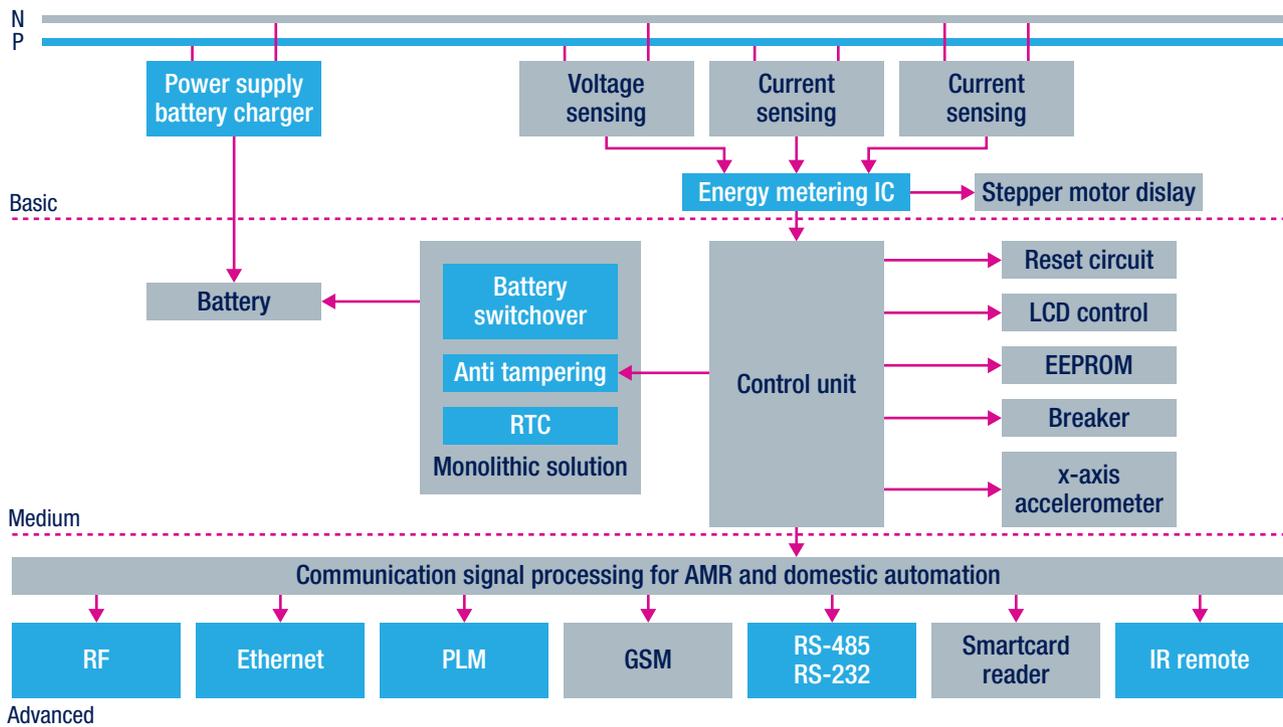
# Energy smart meters

## Smart electricity meters – Overview

Smart metering essentially involves an electronic power meter supplemented by full remote control, diagnostics, power peak and consumption analysis, anti-tampering mechanisms, fault alert, time-variable tariffs, and many more possibilities. Using power-line communication (PLC) or other wired and wireless technologies to connect the meter to the service provider enables all of the above features to be feasible and compatible with future smart-grid protocols.



### SMART E-METER BLOCK DIAGRAM



## PRODUCT OFFERING

Functional block	Key products	Description
Power-line modems	ST7570, ST7580, ST7590	Cost-effective STarGRID™ power-line networking SoC platform. Complies with major protocol specifications such as IEC 61334-5-1, PRIME, Meters and More, and others
Control units	STM32F	The STM32F family of 32-bit Flash microcontrollers is based on the breakthrough ARM Cortex™-M3 core, specifically developed for embedded applications
	STM32L	Ultra-low-power 32-bit MCU, 1.65 to 3.6 V, up to 33 MIPS, up to 384-Kbyte Flash, true EEPROM technology, 12-bit ADC, 12-bit DAC, 185 µA/MHz, stop mode at 1.3 µA with RTC and RAM retention
	STM8L	Ultra-low-power 8-bit MCU, 1.65 to 3.6 V, up to 15 MIPS, up to 64-Kbyte Flash
	SPEAr	SPEAr® embedded MPU based on ARM926 at 300 MHz or dual Cortex-A9 @ 600 MHz, up to 3000 DMIPS
Power supplies	ALTAIR04-900	Offline all-primary-sensing switching regulator with 900 V breakdown voltage
Energy metering ICs	ViperPlus family	Innovative 800 V avalanche-rugged SuperMESH™ power MOSFET with state-of-the-art PWM circuitry
	STPM10	New versatile programmable single-phase energy metrology IC
EEPROM	STPMC1, STPMS2	Poly-phase chipset representing the first modular solution for metering systems
	EEPROM	Serial I <sup>2</sup> C or SPI EEPROM, 1 Kbit to 1 Mbit, 1.7 to 5.5 V
X-axis accelerometer	M24LR04E, M24LR16E, M24LR64E	Dual Interface EEPROM, 4-, 16- and 64-Kbit, I <sup>2</sup> C and ISO 15693 RF interface with energy harvesting and NFC compatibility
	Accelerometers	ST's state-of-the-art analog and digital accelerometers feature up to ±24g full scale, high resolution, smart embedded functionalities and advanced power-saving features
RF	SPIRIT1	Low Power RF Transceiver for RF applications in the sub-1GHz Band
	STM32W	The STM32W is a fully-integrated system-on-chip that integrates a 2.4 GHz, IEEE 802.15.4-compliant transceiver, 32-bit ARM® Cortex™-M3 microprocessor, Flash and RAM memory, and peripherals of use to designers of IEEE 802.15.4-based systems
	SPZB32W1A2.1 SPZB32W1C2.1	The SPZB32W1A2.1 and SPZB32W1C2.1 are ready-to-use ZigBee® modules optimized for embedded applications that require low data rate communications; the modules are based on the STM32W108CB
Interface ICs	RS-232	Includes transceivers with auto-power-down and standby functions, multi-channel interfaces and driver/receiver circuits
	RS-485	Includes very high-speed, low-power RS-485 transceivers, usually containing one driver and one receiver in half duplex configuration
Real-time Clocks	M41T56	Low power real-time clock with 56 bytes of NVRAM
	M41T83	Low power real-time clock with analog calibration
Secure MCUs	ST32	32-bit ARM Cortex™-M3 CPU incorporates optimized features and architecture well adapted the requirements of mobile communication and machine to- machine (M2M) applications

## FEATURED PRODUCTS

### SPIRIT1

#### High-performance Sub-GHz RF Transceiver

The SPIRIT1 is a very low-power RF transceiver, intended for RF wireless applications in the sub-1 GHz band. It handles the communication between smart meters in households and businesses and the neighborhood data concentrator, which relays the information to the utility provider control center. By enabling short-range transmissions in frequency ranges below 1 GHz, SPIRIT1 ensures proper wireless signal propagation through concrete walls and building structures.

#### KEY FEATURES

- Bands: 169 MHz, 300-348 MHz, 387-470 MHz, 779-956 MHz
- Modulation schemes: FSK, GFSK, MSK, OOK and ASK
- Very low current consumption: 9 mA in Rx and 21 mA in Tx mode at +11 dBm
- Programmable air data rate: 1 to 500 Kbit/s
- Programmable output power: up to +11 dBm
- Antenna diversity algorithm
- AES-128 encryption coprocessor
- W-MBUS, EN300-220, FCC CFR47 15, ARIB STD T-67, T-93, T-108
- W-MBUS protocol stack available
- QFN20 4 x 4 mm RoHS package



### STM32® MCU FAMILY

#### 32-bit Flash microcontrollers powered by the ARM® Cortex™-M processor

The STM32 family of 32-bit Flash microcontrollers based on the ARM Cortex™-M processor is designed to offer new degrees of freedom to MCU users. By bringing a complete 32-bit product range that combines high-performance, real-time, low-power and low-voltage operation, while maintaining full integration and ease of development, the STM32 family helps you create new applications and design in the innovations you have long been dreaming about.

#### KEY FEATURES

- Flash from 16-Kbyte up to 1-Mbyte
- Cortex-M core
- RTC down to 1 µA
- Crypto accelerator and true random number generator
- Complete tools ecosystem
- Up to 15 communication interfaces



## FIVE REASONS TO CHOSE THE STM32 PLATFORM

More than 350 compatible devices

Real-time performance <b>Cortex</b> Intelligent Processors by ARM	Outstanding power efficiency	Superior and innovative peripherals	Maximum integration	Extensive ecosystem
				
ART Accelerator, CCM-SRAM, Multi-AHB bus matrix, Excellent real-time up to 168 MHz/210 DMIPS zero-wait state execution performance from Flash	< 1 $\mu$ A RTC in $V_{BAT}$ mode, ultra-low dynamic power consumption 188 $\mu$ A/MHz 1.65 to 3.6 V $V_{DD}$ , 0.45 $\mu$ A Stop mode and 0.3 $\mu$ A Standby mode	USB-OTG High Speed, camera interface, Ethernet, CAN, crypto/hash processor, PGA, sigma-delta 16-bit ADC and 12-bit ADC (up to 5 MSPS), external memory interface, CEC	Reset circuitry, voltage regulator, internal RC oscillator, PLL	ARM + ST ecosystem (eval boards, discovery kits, software libraries, RTOS)

### ALTAIR04-900

#### Offline all-primary-sensing switching regulator

ST's ALTAIR04-900 is very efficient at low load (between 10 and 20% of nominal output power) as the AMR remains in this condition for the majority of the time. It is compatible with 3-phase mains voltage, either functional (connected to a 3-phase line) or surviving (wrong connection). Two or more output voltages can be generated to supply a 3.3 V microcontroller as well as a power-line modem (12 V for instance). The IC operates in standard isolated and non-isolated flyback topology all-primary-sensing control, thus no feedback from the secondary side is required for voltage accuracy.

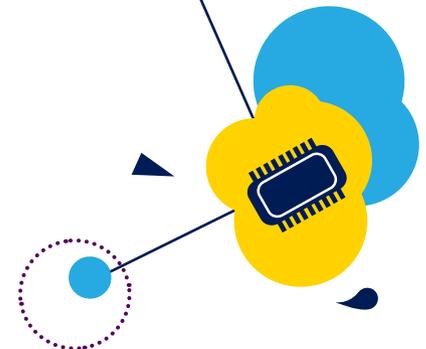
### STPMC1/S2

#### Poly-phase chipset for energy measurement

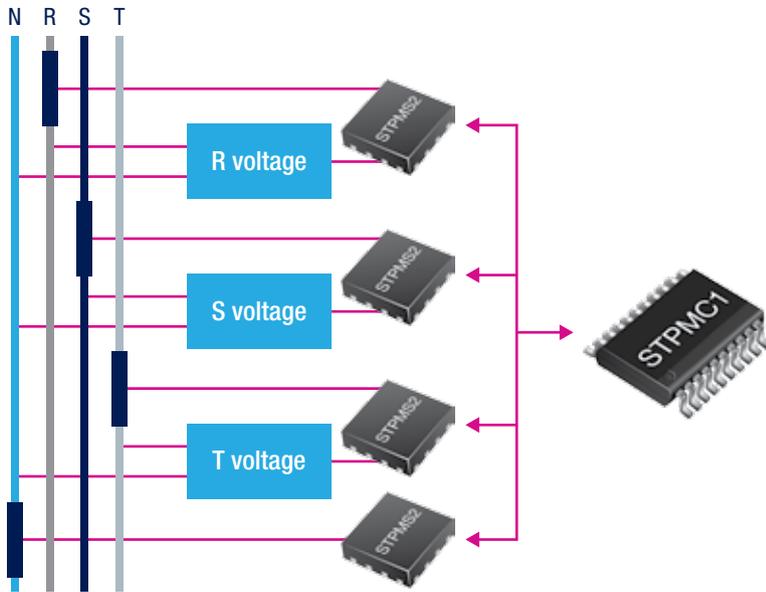
ST's poly-phase chipset represents the first modular solution for metering systems. This flexible solution is built around 2 different parts: the STPMS2 and STPMC1. The STPMC1 works as an energy calculator. It is an ASSP designed for effective energy measurement in power-line systems. Used in combination with one or more STPMS2 ICs, it implements all the functions needed in a 1-, 2- or 3-phase energy meter. The STPMS2 smart sensor is a dual second-order sigma delta (SD) modulator with embedded programmable gain amplifier (PGA). It is highly configurable through hardwired pins on SPI port. This chipset approach allows you to position the A/D conversion (STPMS2) very close to the current transducers, so minimizing noise capture from the analog tracks. Once converted, the SD streaming of voltage and current are multiplexed and transferred through a single-wire data line to a dedicated DSP inside the STPMC1. The STPMC1 can manage from 2 to 9 datastreams coming from the STPMS2 (from 1 to 5 devices) serving 3 voltage channels and 4 current channels, plus 2 optional streams for multiple purposes. Wide sensor support, SPI interface, tamper proofing by neutral current, temperature and magnetic field monitoring make this the ideal solution for multi-purpose, high-performance metering systems.

#### KEY FEATURES

- Integrated 900 V MOSFET for higher reliability and 3-phase operation
- BOM reduction plus compliancy with system specs
- Compactness
- Reliable and cost-effective solution (no need for optoisolator)



## POLY-PHASE MEASUREMENT SCHEME



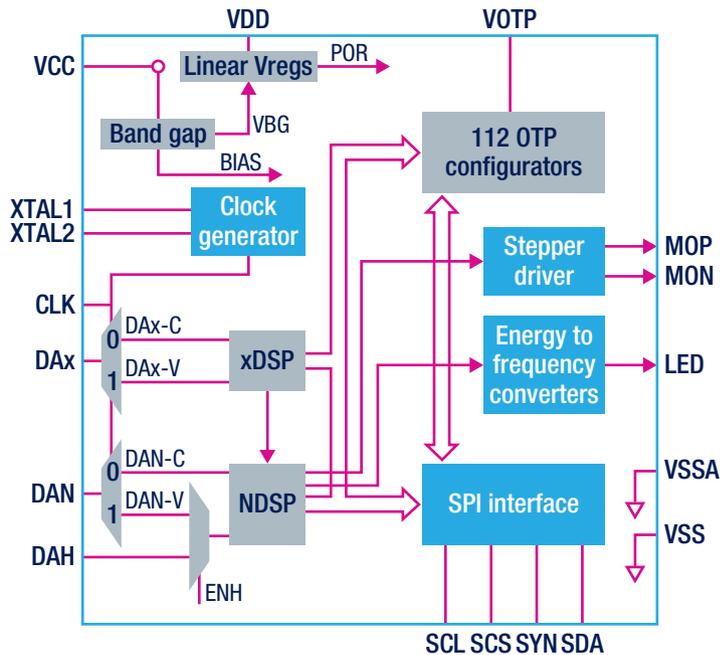
## KEY FEATURES

- Computes active and reactive wideband and fundamental harmonic energies
- Exclusive ripple-free energy calculation algorithm
- 112 configuration and calibration bits
- Neutral current, temperature and magnetic field monitoring
- Two 2nd-order  $\Sigma\Delta$  modulators for voltage and current
- 0.5% accuracy in 1:5000/10000 range (STPMS2)
- Complies with IEC 62052-11/62053-21/62053-22/62053-23, ANSI C12.1-2001/ C12.10-1997/C12.20-2002 standards

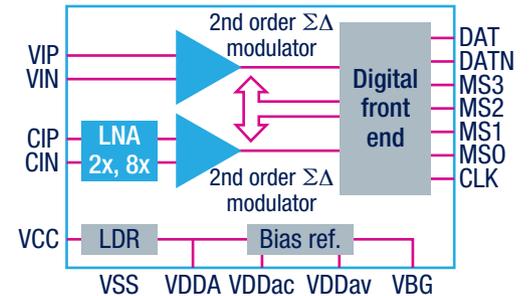
## KEY BENEFITS

- Fast digital calibration
- Higher accuracy
- Flexible approach
- Allows the use of multiple shunts

## STPMC1 BLOCK DIAGRAM



## STPMS2 BLOCK DIAGRAM



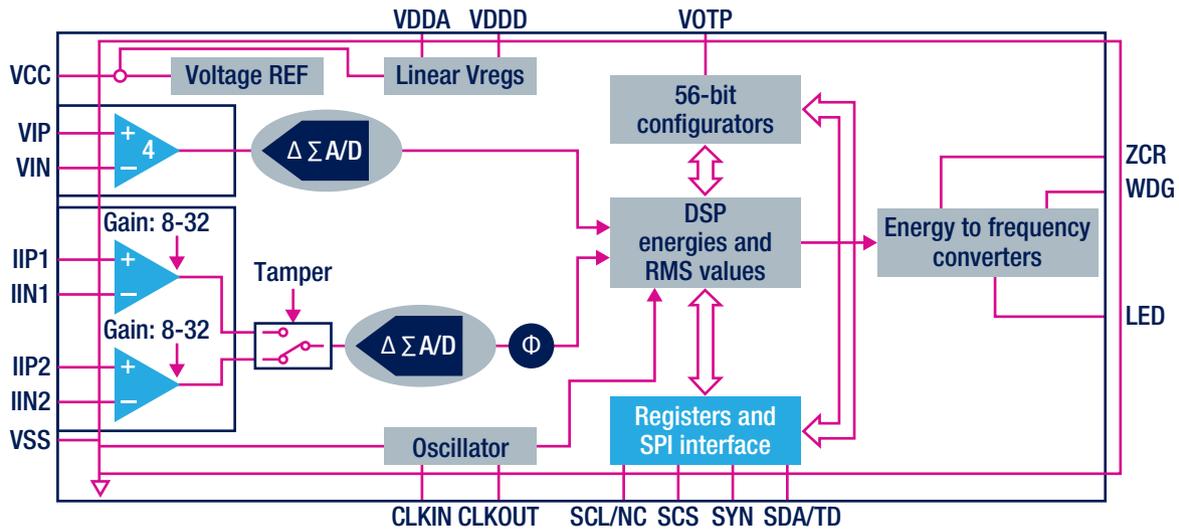
## STPM01, STPM10

### Versatile programmable single-phase energy metrology ICs

The STPM01/STPM10 energy metrology ICs incorporate all the core circuitry required to implement the metrology of a class 1 electricity meter as well as that of a DIN or home (smart plug) meter.

These devices are designed for effective measurement of active, reactive and apparent energy in a power-line system using current transformer, shunt and Rogowski coil sensors (only STPM01).

### STPM10 BLOCK DIAGRAM



### KEY FEATURES

- Measures active, reactive, and apparent energies
- RMS current, voltage and instantaneous measurement
- Frequency measurement
- Ripple-free active energy pulsed output
- Live and neutral monitoring for tamper detection
- Fast and simple one-point digital calibration over the whole current range
- Integrated linear voltage regulators for digital and analog supply
- Selectable RC or crystal oscillator
- Supports 50/60 Hz, IEC 62052-11, IEC 62053-2x specifications
- Less than 0.1% error in the 1000:1 range
- Precision voltage reference: 1.23 V with 30 ppm/°C max
- OTP for calibration and configuration (STPM01 only)

Very simple and low-cost metering applications are addressed by the STPM11, STPM12, STPM13 and STPM14. These devices are able to perform only active power measurement.

## ST7570, ST7580, ST7590

### STarGRID™ power line communication SoC platform

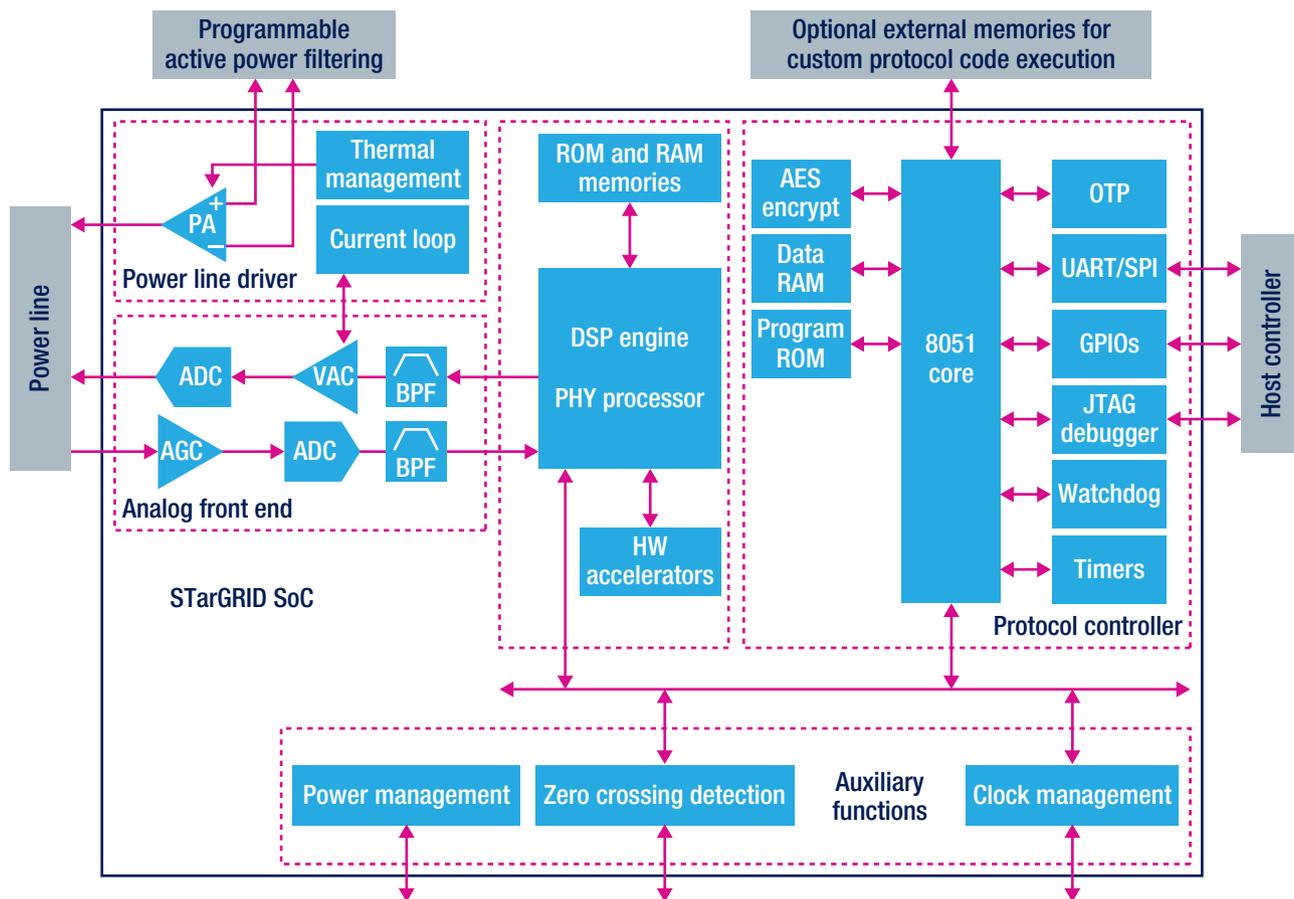
The STarGRID platform meets the needs of large-scale smart metering infrastructure deployments and future smart grid scenarios. The new platform includes different specific SoC implementations (ST7570, ST7580, ST7590), featuring:

- High modularity and flexibility: multiple modulations and protocols
- High integration: DSP PHY processor, protocol stack engine, analog front end, power-line driver, encryption and auxiliary functions in a single chip
- High scalability: future-proof implementation
- Openness: suitable for present and future open standards or proprietary protocol integration
- Ease-of-use: turnkey implementations available compliant with major protocol specifications such as IEC 61334-5-1, PRIME, Meters and More, and others



The StarGRID platform is suitable for the main applications in energy and grid control, such as smart grid, smart metering, smart building/home and e-mobility applications.

## STARGRID SOC BLOCK DIAGRAM



10

### KEY FEATURES

- Fully integrated narrowband power-line networking system-on-chip
- Programmable DSP processor for power-line PHY management
- 8-bit 8051 engine for protocol controller and supervision
- Fully integrated analog front end, with high sensitivity receiver and high linearity transmitter with intelligent gain control
- Integrated 5 V and 1.8 V linear regulators for AFE and digital core supply
- Fully integrated single-ended power amplifier for line driving
  - Up to 1 Arms, 14 Vpp output
  - Configurable active filtering topology
  - Very high linearity
  - Embedded temperature sensor
  - Current control feature
- 3.3 V or 5 V I/O power supply
- 8 V to 18 V power amplifier supply
- Suitable for EN 50065 and FCC part 15 compliant applications
- -40 to +85 °C temperature range
- Suitable for multiple power-line communication standards such as PRIME, Meters and More, IEC 61334-5-1

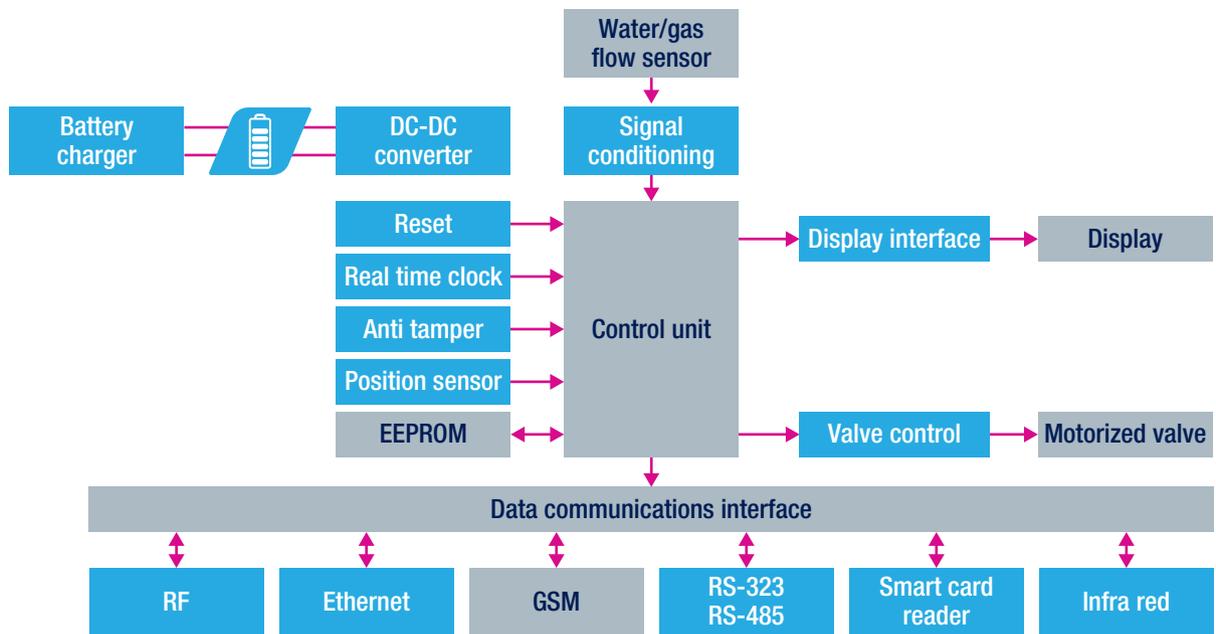


# Water/gas meters

## Overview

Integrated circuits used in today's water and gas meters are supplied by batteries, and thus power consumption is a key factor in their selection. At ST we offer a wide portfolio of high-performance ultra-low-power 8- and 32-bit microcontrollers, as well as RF transmission circuits and highly-efficient power supply devices to meet your design needs.

### WATER/GAS METERS BLOCK DIAGRAM



### PRODUCT OFFERING

Functional block	Key products	Description
Control units	STM32L	Ultra-low-power 32-bit MCU, 1.65 to 3.6 V, up to 33 MIPS, up to 384-Kbyte Flash, true EEPROM technology, 12-bit ADC, 12-bit DAC, 185 µA/MHz, stop mode at 1.3 µA with RTC and RAM retention
	STM8L	Ultra-low-power 8-bit MCU, 1.65 to 3.6 V, up to 15 MIPS, up to 64-Kbyte Flash
Power supply	Step-down DC-DC converters	Monolithic switching regulators offer input voltage capability up to 55 V, deliver output currents up to 4 A, with high switching frequency
EEPROM	EEPROM	Serial I <sup>2</sup> C or SPI EEPROM, 1 Kbit to 1 Mbit, 1.7 to 5.5 V
	M24LR04E, M24LR16E, M24LR64E	Dual Interface EEPROM, 4-, 16- and 64-Kbit, I <sup>2</sup> C and ISO 15693 RF interface with energy harvesting and NFC compatibility
RF	SPIRIT1	Low Power RF Transceiver for RF applications in the sub-1GHz Band
	STM32W	STM32 with embedded 2.4 GHz IEEE 802.15.4 radio, low-power architecture, ZigBee or proprietary stacks
	SPZB32W1A2.1 SPZB32W1C2.1	The SPZB32W1A2.1 and SPZB32W1C2.1 are ready-to-use ZigBee® modules optimized for embedded applications that require low data rate communications; the modules are based on ST's STM32W108CB
	M24LR64-R	Dual Interface EEPROM, 64 Kbits, I <sup>2</sup> C and ISO 15693 RF interface in MLP8 package
Real-Time Clock	M41T62, M41T83	Ultra-low-power RTC with or without embedded crystal, dual calibration analog/digital

## FEATURED PRODUCTS

### STM8 L SERIES

#### 8-bit ultra-low-power MCUs

The ultra-low power platform from ST for 8-bit STM8 L series is based on a proprietary 130 nm ultra-low leakage process technology. The STM8L offers specific features for ultra-low-power applications, such as advanced ultra-low-power modes, optimized dynamic run consumption and specific safety features. The balance between high performance and ultra-low power using different modes ensures optimal energy consumption, an optimal family to support many applications with special care on power savings for metering (electricity/gas/water/heat meters and scales). A full set of features and performances is available with our STM8L15x series, whereas our STM8L05x Value line offers the best price/performance ratio to target lower-end metering solutions. [www.st.com/stm8l](http://www.st.com/stm8l)



#### KEY FEATURES

- Full range from 2- to 64-Kbyte embedded Flash
- RTC with enhanced calibration and features for metering
- AES on board (optional)
- 20 pins to 80 pins
- LCD driver (8 x 40/4 x 44 and 4 x 28/8 x 24)
- Down to 400 nA in Halt mode

#### BENEFITS

- Speed and power consumption independent of MCU power supply, ultra-low leakage
- Reduced overall run- and wait-mode current consumption by turning off clocks of unused peripherals or Flash
- Ultra-low-power modes for applications requiring regular wake up
- Suitable for many applications from complete switch off to continuous monitoring at ultra-low frequency
- Switch and adjust frequency and clock sources on the fly depending on application needs
- Autonomy for peripherals, independent from core; can switch off Flash memory and CPU (large current consumption contributors) while keeping peripherals active
- Integrated safety and security for application
- Full functionality over the complete VDD range
- Smart applications ready (power meters, for example)

### STM32 W SERIES

#### 32-bit Wireless MCUs

With a configurable total link budget up to 109 dB and the efficiency of the ARM Cortex-M3 core, the STM32 W is the perfect solution to make a home energy display or to connect your meter with a display or other device of the smart grid ecosystem. This open and flexible platform supports protocol stacks such as ZigBee IP, 6LoWPAN, and more. [www.st.com/stm32w](http://www.st.com/stm32w)



#### KEY FEATURES

- Outstanding 2.4 GHz radio performances to IEEE 802.15.4
- Best-in-class code density, thanks to its ARM Cortex-M3 core
- Low-power architecture
  - Wide range of memory options: 64- to 256-Kbyte Flash and 8- to 16-Kbyte SRAM
- Open platform with extra resources for application integration: configurable I/Os, ADC, timers, SPI, UART
- Main software libraries: RF4CE, IEEE 802.15.4 MAC, ZigBee IP and Smart Energy Profile 2.0
- Available as both SoC and coprocessor, either in QFN48 or QFN40

#### BENEFITS

- Cost efficiency through a true SoC
- Open platform supporting IEEE 802.15.4-based protocol stacks
- Wide STM32 Cortex-M3 developers community
- Unmatched network throughput and latency
- Longer battery lifetime

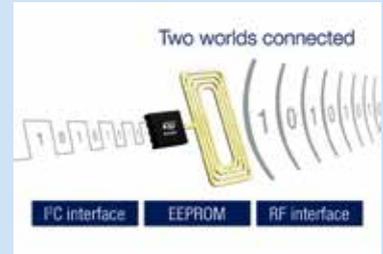
## M24LR64-R

### Dual Interface EEPROM

The Dual Interface EEPROM is an electrically-erasable memory which communicates with read and write attributes through both a wired I<sup>2</sup>C interface with MCU or chipset as well as an RF interface, using the industry-standard ISO 15693 which does not require any on-board power. It enables a wide range of use cases in the smart meter ecosystem. The first is in manufacturing and logistics where you can remotely set parameters at the last minute and update or customize settings when your meter is already in the box. You can also activate keys and trace the production process. The second use case is during meter installation and maintenance. Here the Dual Interface EEPROM simplifies and speeds up the identification of the model and customer, or the download of event logs such as tamper or fault detection. Finally, it could be used by consumers to interface with their meters using a hand set (NFC compatible phone). The user could download the loading curve on a mobile phone, for instance. It gives multiple value added services to your smart grid devices. Take the lead with ST now and check the product information to improve your application.

### KEY FEATURES

- NFC and RFID compatible Energy Harvesting
- Simple but very flexible data protection schemes
- Best-in-class quality memory
- Up to 40 years of data retention
- 1 million read and write cycles



## M41T83

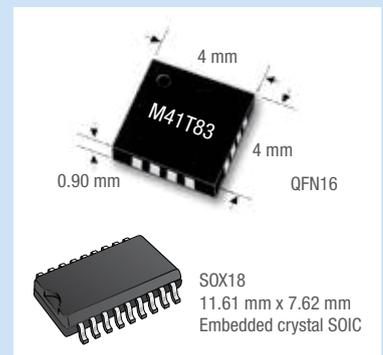
### Ultra-low power RTC with analog/digital calibration and battery switchover

The M41T83 is a low-power serial I<sup>2</sup>C real-time clock (RTC) with a built-in 32.768 kHz oscillator (external crystal-controlled for the QFN16 package, embedded crystal for the SOX18 package). The M41T83 is ideally suited to the needs of battery-powered designs. By operating at low voltages from 2 to 5.5 V, it can be driven directly from an Li-ion battery and draws only 365 nA.



### KEY FEATURES

- Power consumption: 365 nA
- Analog calibration
- Timekeeping down to 1 V for longer battery life
- 3 V operation
- Oscillator fail detect ensures safe operation
- Provides 32 KHz on start-up suitable for driving a microcontroller in low-power mode
- Programmable alarm ideal for wake-up functions
- ±1 ppm (±2.5s per month))
- Package options:
  - 16-lead QFN
  - 18-lead embedded crystal SOIC





# DCU, MUC and gateway

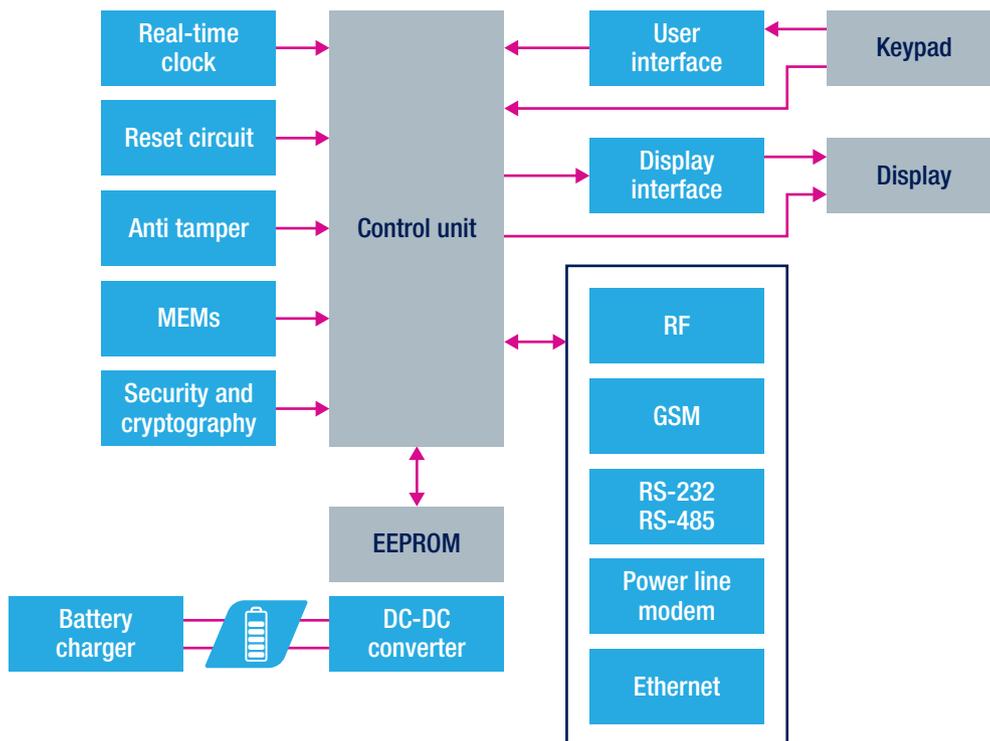
## Overview

DCU, MUC and gateway are devices acting as an interface between the utility-controlled smart grid and the home area network. They manage the data exchange between smart meters, utility providers and energy-consuming in-house objects.

While a data concentrator manages the information for several homes, a multi utility controller, also known as an energy gateway, manages the data exchange for a single home.



## TYPICAL BLOCK DIAGRAM



## PRODUCT OFFERING

Functional block	Key products	Description
Power-line modems	ST7570, ST7580, ST7590	Cost-effective STarGRID power-line networking SoC platform. Complies with major protocol specifications such as IEC 61334-5-1, PRIME, Meters and More, and others
Control units	STM32F	The STM32F family of 32-bit Flash microcontrollers is based on the breakthrough ARM Cortex™-M3 core, specifically developed for embedded applications; they combine high performance with first-class peripherals and low-power, low-voltage operation
	SPEAr	SPEAr® embedded MPU based on ARM926 at 300 MHz or dual Cortex-A9 @ 600 MHz, up to 3000 DMIPS
Power supplies	ALTAIR04-900	Offline all-primary-sensing switching regulator with 900 V breakdown voltage
	VIPerPlus family	Innovative 800 V avalanche-rugged SuperMESH™ power MOSFET with state-of-the-art PWM circuitry
RF	SPIRIT1	Low Power RF Transceiver for RF applications in the sub-1GHz Band
	STM32W	The STM32W is a fully-integrated system-on-chip that integrates a 2.4 GHz, IEEE 802.15.4-compliant transceiver, 32-bit ARM® Cortex™-M3 microprocessor, Flash and RAM memory, and useful peripherals for designers of IEEE 802.15.4-based systems
	SPZB32W1A2.1 SPZB32W1C2.1	The SPZB32W1A2.1 and SPZB32W1C2.1 are ready-to-use ZigBee® modules optimized for embedded applications that require low data rate communications; these modules are based on ST's STM32W108CB
	M24LR64-R, M24LR16E	Dual Interface EEPROM, 64-Kbit, I <sup>2</sup> C and ISO 15693 RF interface in MLP8 package
Real-Time Clock	M41T62, M41T83	Ultra-low-power RTC with embedded crystal, dual calibration features, analog/digital

## FEATURED PRODUCTS SPEAR310 AND SPEAR320

### SPEAr embedded microprocessors

The SPEAr310 and SPEAR320 eMPUs fit naturally into the communication intensive applications needed by concentrators or multi utility controllers (aggregators) in the smart grid arena.

Built around the industry standard ARM926EJS core, SPEAr310 and SPEAr320 include a comprehensive range of communication peripherals to meet all the design constraints of concentrator applications: no need for external companion chips except the memory and power supply subsystem. The complete set of evaluation boards and software allows an efficient design.

### KEY FEATURES

- ARM 926EJS @ 333 MHz (366 DMIPS)
- Linux BSP provided by ST
- Other OS supported through 3rd party network (Integrity, VxWorks, WinCE, and more)
- Industrial operating temperature range: -40 to +125 °C
- Flexible external memory interface: DDR2, NAND Flash, serial and parallel NOR Flash, SDIO/MMC, and others
- Numerous communication peripherals: 2x USB Host, USB Device, up to 5 Ethernet, up to 6x UART, 2x CAN, I2C, SPI, 4x PWM, IRDA, and more
- Cryptographic engine
- Human machine interface: 1024 x 768 x 24 LCD support, touchscreen, keyboard matrix, GPIO, and others
- 8-channel 10-bit ADC, 1 MSPS
- LFBGA289 15 x 15 mm package

## STM32 F4 SERIES

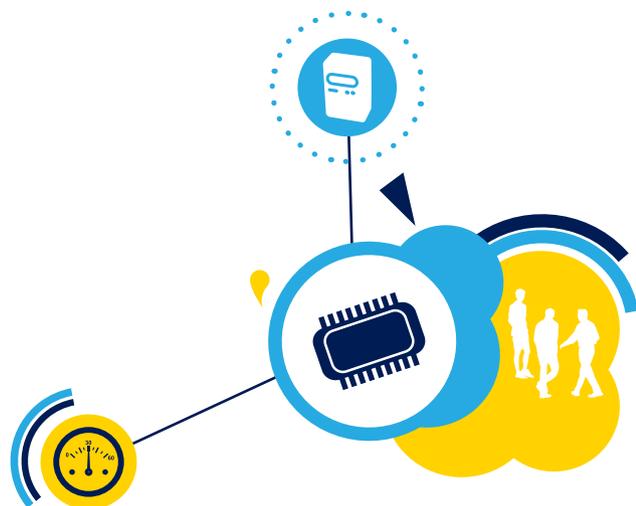
### High-performance Cortex-M4 MCU

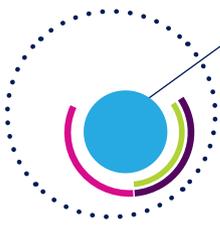
ST is extending its target applications with the STM32 F4 series. Based on the Cortex-M4 core, this series opens the door to the digital signal controller (DSC) market. This extension to our STM32 product portfolio offers devices with pin-to-pin and software compatibility with the STM32 F2 series, but with more performance, DSP capability, a floating point unit, more SRAM, and peripheral improvements such as full duplex I<sup>2</sup>S, less than 1  $\mu$ A RTC and 2.4 MSPS ADCs. The ARM Cortex-M4 core features built-in single-cycle multiply-accumulate (MAC) instructions, optimized SIMD arithmetic and saturating arithmetic instructions. The adaptive real-time ART Accelerator™ combined with ST's 90 nm technology provides linear performance up to 168 MHz, unleashing the full performance of the core. These features expand the number of addressable applications in the industrial, consumer and healthcare segments. The STM32 F4 series includes devices with 512 Kbytes to 1 Mbyte of on-chip Flash memory, and 192 Kbytes of SRAM, and 15 communication interfaces. WLCSP90 (< 4.5 x 4.5 mm), LQFP64, LQFP100, LQFP144, LQFP176 and UFBGA176 packages are available.  
[www.st.com/stm32f4](http://www.st.com/stm32f4)



### KEY FEATURES

- STM32 F4 series based on Cortex-M4 with up to 168 MHz/210 DMIPS
- Outstanding performance: 210 DMIPS/501 CoreMark executing from Flash at 168 MHz operating frequency
- ART Accelerator™ and 7-layer bus matrix
- Low dynamic consumption: 230  $\mu$ A/MHz
- HS-USB, IEEE 1588 Ethernet, camera interface





# Evaluation boards

## Development tools for smart meters

Developers can take advantage of ST's range of evaluation boards that are specifically designed to help them evaluate ST device features and start their own applications.

### PRODUCT OFFERING

Part number	Description
<b>EVALKITST7570-1</b>	ST7570 S-FSK power-line networking system-on-chip evaluation kit for AMR
<b>STEVAL-IPE012V1</b>	Single-phase energy meter demonstration board using the STPM10 and STM8L152
<b>STEVAL-IPP002V1</b>	IEC 61334-5-1 compliant smart meter system for AMI application based on STM32, ST7570 PLM and STPMC1/STPMS1 chipset
<b>STEVAL-IPE002V1</b>	STPM10 energy meter (mono phase) - measurement board, 2 current transformers
<b>STEVAL-IPE003V1</b>	STPM10 energy meter (mono phase) - measurement board, 1 current transformer + shunt
<b>STEVAL-IPE010V1</b>	Energy meter demonstration kit motherboard based on the STPMC1 and STPMS1
<b>STEVAL-IPE012V2</b>	Single-phase electricity meter with 10 A / 80 A current range based on the STPM10 and STM8L152
<b>STEVAL-IPE012V3</b>	Single-phase energy meter with Rogowski coil sensor based on the STPM01 and STM8L152C6
<b>STEVAL-IPE014V1</b>	Energy meter demonstration kit daughterboard based on the STPMS2
<b>STEVAL-IPE015V1</b>	STPM10 single-phase meter board, 2 current transformers
<b>STEVAL-IPE016V1</b>	STPM10 single-phase meter board, 1 current transformer + shunt
<b>STEVAL-IPE017V1</b>	STPM10 single-phase meter board, 1 shunt
<b>STEVAL-IPE018V1</b>	STPM10 single-phase meter board, 1 current transformer
<b>STEVAL-IPE020V1</b>	Single phase electricity meter with dual EEPROM M24LR64 and STPM10 and STM8L152
<b>STEVAL-IKR001V*</b>	Sub-GHz transceiver development kits based on the SPIRIT1
<b>STEVAL-IPT002V1</b>	Smartcard interface demonstration board based on the ST8024
<b>EVLALTAIR900-M1</b>	SMPS for metering and PLC applications
<b>STEVAL-ISA010V1</b>	Ultra-wide range, dual-output buck converter demonstration board based on the VIPER16
<b>STEVAL-ISA062V1</b>	6 W dual-output SMPS demonstration board based on the VIPER17
<b>DEVKIT-M24LR-A</b>	Development kit for M24LR64-R
<b>EVALSPEAR3*</b>	SPEAR300/310/320 demonstration boards
<b>STEVAL-IHP002V1</b>	SmartPlug system to measure and control AC loads based on STM32, ST7540 PLM and STPM01
<b>STEVAL-PCC012V1</b>	STM32F107 connectivity gateway, demonstration board
<b>STEVAL-IPB001V1</b>	2 W, 3-phase SMPS breaker with ESBT

Note: \* is used as a wildcard character for related part numbers

## FEATURED SOLUTIONS

### STEVAL-IPP002V1

#### IEC 61334-5-1 compliant smart meter system for AMI applications

The STEVAL-IPP002V1 demonstration board can be used as a guideline to designing a typical energy meter board for smart metering applications compliant with the IEC 61334-5-1 standard. It was designed to include advanced features as well as to fit the requirements for next generation energy meters. These extra features can be included in the board by modules for easy customizing.

#### KEY FEATURES

- Smart metering library based on free RTOS and flexible microcontroller
- S-FSK power-line communication
- High-efficiency power supply in quasi resonant mode (Altair04-900)
- Energy measurement by an external metrology board for STPMC1 + STPMS1 (STEVAL-IPE010V1) or STPM1\*
- LCD display to show energy consumption information
- USB and RS-232/IrDA connectivity
- Optional ZigBee communication capability
- Optional MEMS module support
- Expansion capability for smartcard interface
- RoHS compliant

Note: \* is used as a wildcard character for related part numbers



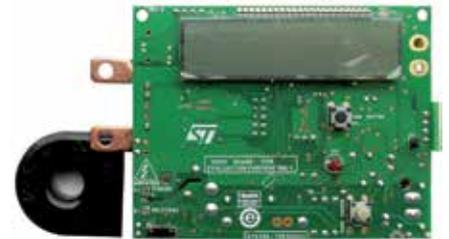
### STEVAL-IPE020V1

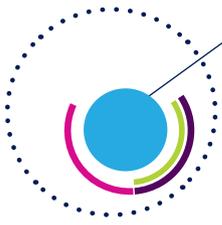
#### Single phase electricity meter with dual EEPROM

The STEVAL-IPE020V1 demonstration board implements a single-phase energy meter based on the STPM10 metering IC and STM8L152 microcontroller. The demonstration board is a fully functional single-phase solution with parameter display, tamper management, maximum demand (MD) calculation, EEPROM data logging, and low power management. The metering data stored in the dual EEPROM can be read using the RFID reader.

#### KEY FEATURES

- Accuracy: class 1 with dynamic range 200:1
- Nominal voltage: 240 V
- Nominal current: 10 A (ITYP)
- Maximum current: 80 A (IMAX)
- Operating range: 0.6 Vb to 1.2 Vb
- Meter constant: 3200 impulses/kWh
- Power frequency range: 45 Hz to 65 Hz
- Sensor: primary side CT and secondary side Shunt Communication interface: IrDA
- RoHS compliant





# ST in smart grid standards

## ST's membership of major steering committees

ST is actively contributing to all the major industrial and standardization smart grid initiatives:

- Technical working group member of DKE 461 German standard
- Steering committee chairman of EU Smart Grid Task Force and participant in the smart meter and smart grid specification working group
- Member of the G3-PLC alliance
- Board of Directors of Home Plug Alliance, major US industrial organization for PLC
- Participation in SAE International and IEC V2G JWG meetings for electric-vehicle to charging-station communication standardization
- Working group member of IEEE P1901.2 for the standardization of low band OFDM PLC standard for smart grids
- Principle member of Meters and More, the non-profit organization in Brussels for Enel/Endesa smart metering system standardization and promotion
- Member of NIST - PAP 15 group for PLC technology coexistence definition
- Technology provider of OPENmeter, the EU funded project of FP7 framework for multi-utility standardization
- Principle member of PRIME Alliance: driven by Iberdrola for the development of a PLC OFDM standard for smart metering applications

More information: [www.st.com/metering](http://www.st.com/metering)



# life.augmented



© STMicroelectronics - March 2015- Printed in United Kingdom - All rights reserved  
The STMicroelectronics corporate logo is a registered trademark of the STMicroelectronics group of companies  
All other names are the property of their respective owners

