

Smart Metering Solutions

Product Innovations



TLE 4966K
Hall-Effect Switch
with Direction Detection
(page 11)

Build Smarter Meters. Faster.

Fourth-Generation SoCs Speed Meter Development and Certification



With more than 50M units shipped to date, Maxim's metrology products are found at the heart of the world's most trusted energy meters. Our Single Converter Technology[®] architecture provides unmatched linearity (up to 0.1% accuracy) over a 2000:1 dynamic range, enabling you to meet tough accuracy requirements with margin to spare.

Development Tools Accelerate Your Time to Market

- Demo boards provide complete testing, prototyping, and code development platforms
- Reference designs include schematics, layout, and bill of materials to speed your design
- Example software, in-circuit emulators, along with programming and firmware tools help you finish the job quickly



Reference designs for solid-state and smart energy meters demonstrate Maxim's complete portfolio of metrology solutions.















Order your reference design today.

www.maxim-ic.com/Meter












MAXIM
INNOVATION DELIVERED[®]

Silica's Metering Linecard

One of the Broadest Portfolios of Smart Metering Components

| | Sensing (electr.) | Sensing (flow) | AFE (electr.) | MCU (electr.) | MCU (flow) | Wireless Comms | Wired Comms | Power | Memory | Supervisors |
|---|-------------------|----------------|---------------|---------------|------------|----------------|-------------|-------|--------|-------------|
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A “Smart Challenge” – Implementing Metering Solutions



Axel Kleinitz PhD
Business Development Manager
Metering

The implementation of smart metering is a complex topic that will require energy companies to introduce new technologies, processes and products. With a Europe-wide goal to have 80% of all households “smart” by 2020, utility companies are frequently faced with challenges as they start piloting metering projects.

SILICA has built an in-depth knowledge of the smart metering market and applications in recent months, including national perspectives and system solutions available of our suppliers. With our linecard we are able to provide one of the broadest portfolios of smart metering components in the distribution market. When combined with technical support from our application specialists, we are able to assist customers during the design and deployment phase of any smart metering project.

Smart Metering Overview

About 10 years ago, the European Commission for Energy(1) kicked off a process to open up the European energy market;

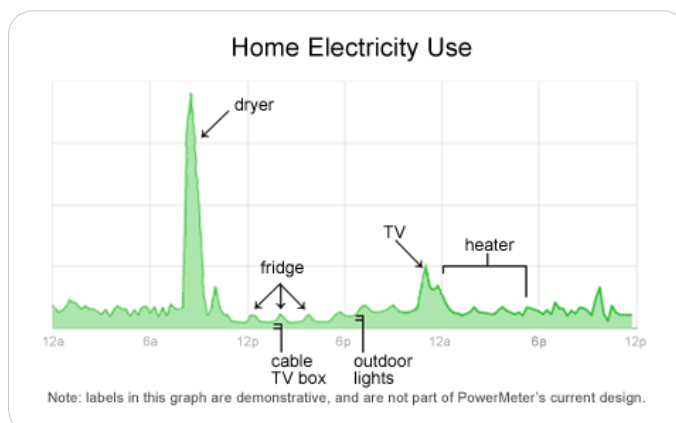
creating major benefits for the European citizens as well as industries in terms of more choice, more competition (lower prices), better services and improved supply security. In order to achieve these objectives supply and production activities had to be separated from each other, national as well as cross-border regulators had to be harmonized and made more transparent.

By 2004 small business customers were given the chance to switch their electricity and gas suppliers. In 2007 all consumers achieved the same level of freedom, with one of the major objectives being the “linearization” of energy consumption(2). The idea was to shave the peak demand through the implementation of demand-response programmes offering an attractive variation of tariffs during peak hours and this way consolidate the reliability of the energy generation infrastructure. This strategy is applicable not only to electricity and gas but also to water and heat consumption.

Requirements

As a result of the above process, a new Smart Meter Generation (AMM) was defined, capable of addressing six main requirements:

- AMR, Automatic Meter Reading, hence the automated collection of consumption, diagnostics and status data
- Bi-Directional Communication, between Utility Service Provider and AMM (Smart Metering System)
- Advanced Tariffs, Time- or Load-flexible, also “Prepayment”



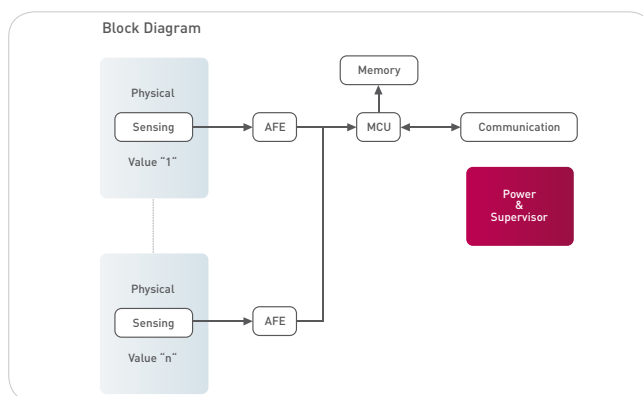
1: http://ec.europa.eu/energy/index_en.htm 2: <http://www.googlewatchblog.de>

- Remote Switch On/Off, also just “Limitation of Consumption”
- Smart Home Capability, Communication to Automated Home Infrastructure
- Data Portal, Centralized Communication Gateway

Within this context, “Smart Metering” therefore means at a first stage the synchronisation of different types of communication. “Innovation” refers to a higher level of sophistication on more robust and reliable multi-protocol communication standards at a significantly reduced, over all meter-power consumption.

Typical block diagram

Using the conclusion, a high-level, generic, metrology-independent Smart Meter Block Diagram may look as follows:



Depending upon the specific metrology the AFE (hence the ADC) might be integrated into the sensing system³ - therefore providing a digitized value to the MCU, or into the MCU with a so called SoC approach (which may include part of the communication interface as well as the memory). The system level problem

will always be to sense a vector with “n” different physical variables in order to determine the specific consumption; the technical challenge for the R&D engineer will therefore be to choose the best fitting Sensing, AFE, MCU and Communication solution to address the specific requirements.

Smart. Smarter. Silica.

Based upon its unique vendor partner’s portfolio, SILICA can offer a great many system solutions for the signal path and power path, as well as other peripherals. This booklet will provide you with an overview of the most innovative solutions, recently launched to the market.

We have also implemented an online forum, specifically to address smart metering applications, issues or new developments in this area: visit <http://community.silica.com/metering>, and I am sure we’ll meet there shortly.

Kind regards,

Axel Kleintz

Axel Kleintz, PhD

Business Development Manager Metering

ADE7953ACPZ
1k units from:

€ 1.60

ADE7878ACPZ
1k units from:

€ 5.30

EVAL-ADE7878EBZ
Eval. Board

€ 275.-

EVAL-ADE7953EBZ
Eval. Board

€ 300.-

ADE7878/ADE7953

Multifunction Energy Metering IC



Ulf Eriksson, SILICA Sweden



Analog Devices provides high accuracy electrical energy measurement ICs intended for single or three phase applications. These integrated devices provide all the signal processing necessary to perform total active, reactive and apparent energy measurement. The ADE7953 is intended for single phase and the ADE7878 for polyphase applications. The ADE7953 meets the needs of the most demanding energy metering applications and provides a wide choice of power measurement information including power quality data and tamper detect conditions.

The ADE7878 is a polyphase multifunction energy metering IC with per phase active and reactive powers. ADE7878 is a high accuracy, 3-phase electrical energy measurement IC with serial interface and three flexible pulse outputs. The ADE7878 device incorporates second-order sigma-delta (Σ - Δ) Analog-to-Digital Converters (ADCs), a digital integrator, reference circuitry, and all of the signal processing required to perform total (fundamental and harmonic) active,

reactive and apparent energy measurement and rms calculations. A fixed function Digital Signal Processor (DSP) executes this signal processing. The DSP program is stored in the internal ROM memory.

ADE7878 Key Features

- Highly accurate; supports EN 50470-1, EN 50470-3, IEC 62053-21, IEC 62053-22 and IEC 62053-23 standards
- Compatible with 3-phase, 3- or 4-wire (delta or wye), and other 3-phase services
- Supplies total (fundamental and harmonic) active, reactive and apparent energy, and fundamental active/reactive energy on each phase and on the overall system
- Less than 0.1% error in active and reactive energy over a dynamic range of 1,000 to 1 at TA = 25 °C
- Less than 0.2% error in active and reactive energy over a dynamic range of 3,000 to 1 at TA = 25 °C
- Supports current transformer and di/dt current sensors

The ADE7953 is a high accuracy electrical energy measurement IC intended for single phase applications. It measures line voltage and current and calculates active, reactive, apparent energy and instantaneous RMS voltage and current. The device incorporates three sigma delta ADCs with a high accuracy energy measurement core. The third input channel simultaneously measures neutral current and enables tamper detection and neutral current billing. The additional channel incorporates

a complete signal path that allows a full range of measurements. Each input channel supports independent and flexible gain stages making the device suitable for use with a variety of current sensors such as current transformers and low value shunt resistors. Two on-chip integrators facilitate the use of Rogowski coil sensors.

ADE7953 Key Features

- Measures active, reactive, and apparent energy; sampled waveform; current and voltage RMS
- Provides a second current input for neutral current measurement
- Less than 0.1% error in active and reactive energy measurement over a dynamic range of 3000:1
- Less than 0.2% error in instantaneous IRMS and VRMS measurements over a dynamic range of 500:1
- Provides apparent energy measurement and instantaneous power readings
- 1.5 kHz bandwidth operation
- Flexible PGA gain stage (up to X22)
- Includes internal integrator for use with Rogowski coil
- SPI, I²C or UART communication

Key Applications

- Energy Metering Systems

| P/N | Package |
|-------------|-----------|
| ADE7878ACPZ | LFCSFP-40 |
| ADE7953ACPZ | LFCSFP-28 |

ADUM2200BRWZ
1k units from:

€ 1.90

ADUM4400BRWZ
1k units from:

€ 3.40

ADM2582EBRWZ
1k units from:

€ 4.50

EVAL-ADUMQSEBZ
Eval. Board

€ 17.50

EVAL-ADM2582EEBZ
Eval. Board

€ 52.-

ADuM220x/440x and ADM2582E/2587E

Digital Isolators



Ira Kirsten-Hormuth, SILICA EU



iCoupler® digital isolators offer low power consumption and fast data rates for energy metering where small size and robust performance are also needed. The ADuM220x and ADuM440x are two- and four-channel data isolators that support data rates up to 90 Mbps with quiescent power as low as 0.3 mA/channel. They are certified for reinforced insulation and 5 kV rms (1 minute rating).

The ADM2582E/ADM2587E are fully integrated signal and power isolated data transceivers with ±15 kV ESD protection and are suitable for high speed communication on multipoint transmission lines. The ADM2582E/ADM2587E include an integrated isolated dc-to-dc power supply, which eliminates the need for an external dc-to-dc isolation block.

ADuM220x/ADuM440x Key Features

- Enhanced system-level ESD performance per IEC 61000-4-x
- Safety and regulatory approvals
 - UL recognition 5000 V_{RMS} for 1 minute
 - CSA Component Acceptance Notice #5A: IEC 60950-1: 600 V_{RMS} and IEC 60601-1: 250 V_{RMS}
 - VDE Certificate of Conformity [DIN V VDE V 0884-10 (VDE V 0884-10):2006-12; V_{IORM} = 846 V peak]

- Bidirectional communication
- 3 V/5 V level translation
- High temperature operation: 105 °C
- High data rate:
 - dc to 90 Mbps (NRZ) for ADuM440x
 - dc to 10 Mbps (NRZ) for ADuM220x
- Precise timing characteristics
- High common-mode transient immunity: >25 kV/μs
- 16-lead SOIC wide body package

ADuM220x/ADuM440x Key Applications

- General-purpose, high voltage, multichannel isolation
- Medical equipment
- Power supplies

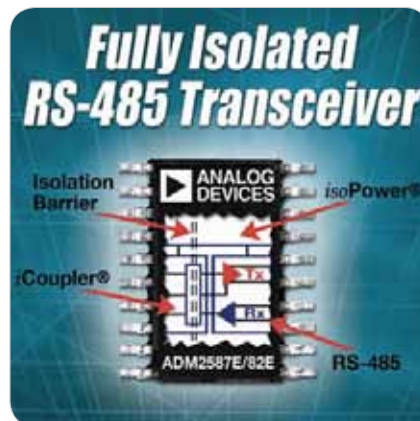
ADM2582E/ADM2587E Key Features

- Isolated RS-485/RS-422 transceiver, configurable as half or full duplex
- isoPower*® integrated isolated dc-to-dc converter
- ±15 kV ESD protection on RS-485 input/output pins
- ADM2582E data rate: 16 Mbps
- ADM2587E data rate: 500 kbps
- Complies with ANSI/TIA/EIA-485-A-98 and ISO 8482:1987(E)
- 5 V or 3.3 V operation
- Connect up to 256 nodes on one bus
- Open- and short-circuit, fail-safe receiver inputs
- High common-mode transient immunity: >25 kV/μs
- Thermal shutdown protection

- Safety and regulatory approvals
 - UL recognition: 2500 V_{RMS} for 1 minute per UL 1577
 - VDE Certificates of Conformity [DIN EN 60747-5-2 (VDE 0884 Part 2): 2003-01; V_{IORM} = 560 V peak]
- Operating temperature range: -40...+85 °C
- Highly integrated, 20-lead, wide-body SOIC package

ADM2582E/ADM2587E Key Applications

- Isolated RS-485/RS-422 interfaces
- Industrial field networks
- Multipoint data transmission systems



| Part Number | Package |
|------------------|------------------|
| ADUM2200BRWZ | SOIC-16 |
| ADUM4400BRWZ | SOIC-16 |
| ADM2582EBRWZ | SOIC-20 |
| EVAL-ADUMQSEBZ | Evaluation Board |
| EVAL-ADM2582EEBZ | Evaluation Board |

MC9S08GW32CLH
for 10k units:

€ 1.75

MC9S08GW64CLK
for 10k units:

€ 1.95

MC9S08GW64/32

Dedicated LCD MCU for Metering

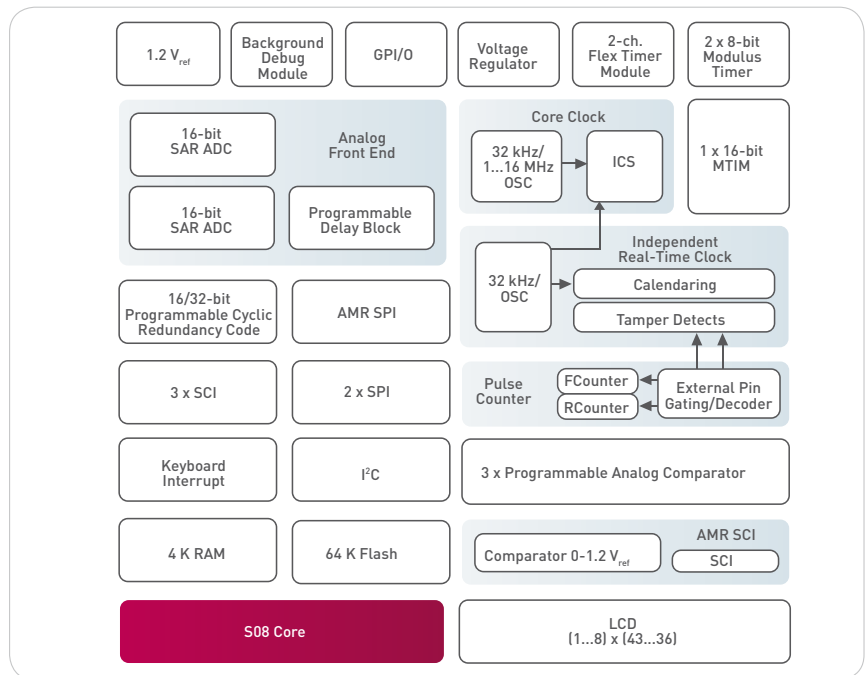


Kristoffer Neerbye, SILICA Norway

The MC9S08GW64/36 devices are targeted specifically toward gas or water flow meters, as well as single phase electric meters. Features that make it ideal for these applications include two independent 16-bit SAR ADC with programmable delay block for electricity metering applications, and a pulse counter with automatic sensor decoding for gas and water flow meters. Add in a flexible LCD controller and you have a fully integrated metering solution.

Key Features

- S08 8-bit core: up to 20 MHz bus frequency
- 4 kB RAM
- 64 kB and 32 kB Flash
- Position counter for gas/water sensor reading: Run in Stop Mode
- Independent on-chip RTC
 - Calendaring
 - On-chip temperature and frequency compensation
 - Tamper detection
 - Up to 3 tamper inputs, each configurable to be an external interrupt or tamper detect
 - Low power mode pulse counting
 - 32 B (configurable) battery backed up RAM
- 2 independent 16-bit SAR ADCs, 12 channels
- Programmable delay block for phase error calibration
- AMR SPI & SCI



- 5 V interface tolerant master/slave SPI
- SCI with high drive, optional comparator receiver and modulated output
- 16/32-bit CRC with programmable G(x)
- 3 V supply, can operate at 1.8 V (1.8...3.6 V)
- -40...+85 °C ambient temperature range
- Flexible LCD controller, up to 288 segments (1.8 x 43...36), regulated charge pump (contrast control)
- 64/80 LQFP package

Key Applications

- Single phase electric meters
- Gas, water and heat flow meters
- Industrial flow measurement and control

Design Tips

The TWR-S08GW64 module is a cost-effective development board. Part of the Freescale Tower System, this modular development platform enables rapid prototyping and tool re-use through reconfigurable hardware. The TWR-S08GW64-KIT includes TWR-S08GW64 controller module, TWR-SER serial module, and TWR-ELEV elevator modules.

| P/N | Package |
|------------------|---------|
| MC9S08GW32/64CLH | LQFP-64 |
| MC9S08GW32/64CLK | LQFP-80 |

TLE4966KXT
1k units from:

€ 0.30

TLE4966K

Hall-Effect Switch with Direction Detection



Wolfgang Bödiker, SILICA Germany



The TLE4966K from Infineon is a device that uses two Hall-effect sensors for highly accurate applications. An integrated active compensation circuit and chopper techniques are used to realize precise magnetic switching points and high temperature stability. Two digital outputs provide direction information at output Q1 and a speed signal at output Q2.

An active error compensation on-board is used to reject offsets in the input stages and the influence of mechanical stress to the Hall probes caused by molding and soldering processes and other thermal stresses in the package. The chopper tech-

niques and the internal threshold generator and a comparator are used to generate high accurate magnetic switching points.

The sensor runs with a single supply voltage between 2.7...24 V.

Additional features are: Reverse battery protection up to -18 V, very low jitter and excellent matching between the two Hall probes. The TLE4966K can withstand peak temperatures up to 195 °C without damage. This makes the part an ideal choice for rough environments. The TLE4966K is available in a 6-pin PG-TSOP6-6-5 package.

Key Features

- 2.7...24 V supply voltage operation
- Operation from unregulated power supply
- High sensitivity and high stability of the magnetic switching points

- High resistance to mechanical stress by Active Error Compensation
- Reverse battery protection (-18 V)
- Superior temperature stability
- Low jitter (typ. 1 µs)
- Peak temperatures up to 195 °C without damage
- Digital output signals
- Bipolar version
- Excellent matching between the 2 Hall probes
- Hall plate distance 1.45 mm
- Direction & speed information
- Direction signal switches before the speed signal
- SMD package PG-TSOP6-6-5

Key Applications

- Automotive, industrial and consumer systems
- BLDC motor control
- Position detection
- Index counting

| P/N | Package |
|------------|--------------|
| TLE4966KXT | PG-TSOP6-6-5 |

71M6531D-IM/F
1k units from:

€ 2.95

71M6533-IGT/F
1k units from:

€ 3.70

Teridian 71M65xx

Energy Metering System on Chip



Stefan Ingenhaag, SILICA Germany

Teridian is offering a solution for energy metering with a wide variety of System-on-Chip (SoC) devices. High accuracy, reliability and having a cost effective alternative to a multi-chip implementation supports your design!

The Single Converter Technology™ is patented by Teridian and delivers a dynamic range better than 2000 : 1 as well as a unique 32-bit programmable metrology engine that can be adapted to changing customer requirements. Three generations of metering SoCs are in production and two additional are in development. These devices enable a best-in-class solution for requirements of today and in the future of energy metering. The product family is supported by one common development platform that enables an efficient and rapid way to develop metering systems according to the ANSI C12.20 and IEC62053.

With the 71M65xx family Teridian is offering high end systems with advanced communication processing and metrology capabilities as well as low end watt-hour, anti-tamper and prepayment meters. The products meet the worldwide requirements

and provide standard features including a RTC, temperature sensor, 8-bit Flash MCU, LCD driver, and multiple serial ports.

Key Features

- 8-Bit MCU
- Flash memory
- Low power consumption
- Up to 0.1% accuracy over the extended temperature range
- Analog to digital converter (monitoring voltage and current of mains)
- Computing engine (calculates power and more)
- Voltage reference
- Temperature sensor (compensation for metrology and RTC)
- UART (meter communication interface like infrared LED interface)
- Comparators (detect power outage)
- Battery back-up (maintain RTC and LCD during power outage)
- LCD display driver
- Digital IOs (switches, indicators and keypads)
- Pulse outputs (meter calibration pulses)
- EEPROM I/F (for calibration coefficients and consumption/billing data)

- Battery back-uped Real-Time-Clock RTC (for time-of-use billing, tamper/event logging)
- ICE interface (emulation and programming interface)

Key Applications

- Single-phase E-Metering SoC for a residential deployment
- Poly-phase metering SoC for industrial and commercial markets
- Applications to use isolated shunt solutions (replacing current transformers for lower cost)
- Poly-phase analog front ends for customers who need to use a discrete solution of AFE and MCU

Design Tips

The advantage of the Teridian metering solution is the ability to adapt a design for new requirements by changing the metrology code and reusing the same platform with a faster time to market.

| | | | | | |
|---------------|----------------------------|--------------|--------------|----------|----------------|
| 71M6531D-IM/F | 3 rd Generation | Single Phase | 128 kB Flash | 4 kB RAM | QFN-68 (8 x 8) |
| 71M6533-IGT/F | 3 rd Generation | Poly Phase | 128 kB Flash | 4 kB RAM | LQFP-100 |

MRF24J40MA

IEEE 802.15.4 2.4 GHz Radio Transceiver Module



Torben Bredkjaer, SILICA Denmark

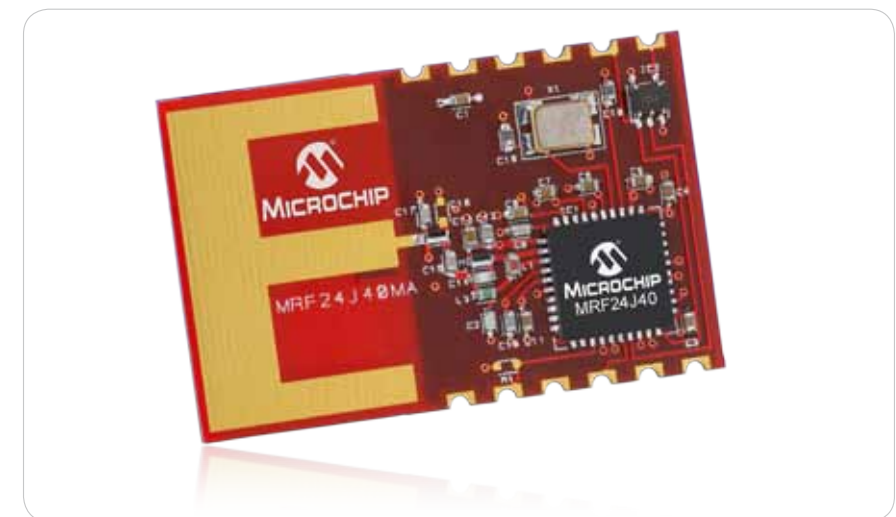
The MRF24J40MA module is a complete IEEE802.15.4 compliant 2.4 GHz surface mount module. The module is based on the MRF24J40 transceiver integrating PHY and MAC in a single-chip solution.

MRF24J40MA is compatible with Microchip's ZigBee™, MiWi™, MiWi™ P2P software stacks available as free download including source code from www.microchip.com/wireless.

With its pre-certified RF and antenna design, this module is ideal in applications where quick time-to-market and minimal RF certification and design processes are required.

Key Features

- Fully integrated IEEE 802.15.4 radio transceiver module
- Supports ZigBee™, MiWi™, MiWi™ P2P and proprietary wireless networking protocols
- 250 kbps data rate
- Integrated PCB antenna, crystal, power management and matching circuitry
- Low current consumption: Tx 23 mA, Rx 19 mA, Sleep 2 μ A [typ. values]
- Four-wire SPI interface to external microcontroller
- 2.4...3.6 V [3.3 V typ.] operating voltage
- Easy integration into product providing shorter time to market



- Radio regulation certification for United States (FCC), Canada (IC) and Europe (ETSI)
- Small size 0.7" x 1.1" (17.8 x 27.9 mm²)
- Surface mountable
- AES-128 Hardware Security Engine
- Compatible with several Microchip microcontroller families
- Orderable in tray or T/R.
- -40...+85 °C industrial temperature range
- Development kits available

Key Applications

- Wireless sensor networks
- Home automation
- Building automation
- Metering
- Consumer applications

Design Tips

The MRF24J40MA should be placed on a PCB with the antenna sticking out from the edge of the PCB. Keep the area around the antenna free of any metallic structures.

| P/N | Package |
|-----------------|---------|
| MRF24J40MA-I/RM | Module |

EM773FHN33,551

100 units from:

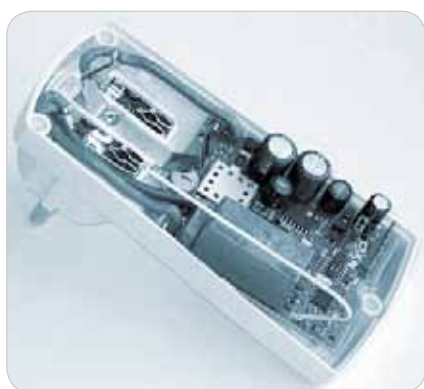
€ 1.60

EM773FHN33

Cortex™-M0 based Energy Metering IC



Hassan Elkhatib, SILICA Denmark



NXP's EM773 energy metering IC stands for the world's first 32-bit ARM®-based solution designed specifically for non-billing electricity metering applications. In recent years, Advanced Metering Infrastructure (AMI) and smart meters have become popular with regulators and utilities as a means to introduce more sophisticated pricing models and tariffs, and incentivise customers to adjust their energy consumption accordingly. The NXP EM773 takes energy metering beyond this traditional billing context, by making it easy for system designers to integrate energy metering functionality into almost any type of device, and make information on electricity consumption more accessible and intuitive for the end user. With the EM773, consumers and industrial users can monitor energy consumption in

real-time, in devices ranging from smart plugs, smart appliances and green consumer electronics, to building sub-meters, industrial sub-meters, and even clusters of rack-mounted servers in the data center.

The EM773 is an ARM® Cortex™-M0 based, low-cost 32-bit energy metering IC, designed for 8/16-bit smart metering applications. The EM773 offers programmability and on-chip metrology functionality combined with a low power, simple instruction set and memory addressing with reduced code size compared to existing 8/16-bit architectures. The EM773 operates at CPU frequencies of up to 48 MHz. The peripheral complement of the EM773 includes up to 32 kB of flash memory, up to 8 kB of data memory, one fast-mode plus I²C-bus interface, one RS-485/EIA-485 UART, one SPI interface with SSP features, three general purpose counter/timers, up to 25 general purpose I/O pins, and a metrology engine for energy measurement.

Key Features

- Serial wire debug
- Single 3.3 V power supply (1.8...3.6 V)

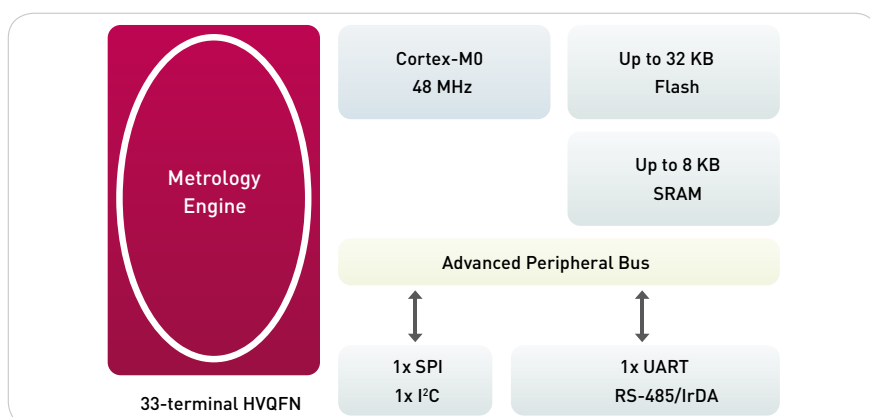
- ARM® Cortex™-M0 built-in Nested Vectored Interrupt Controller (NVIC)
- ARM® Cortex™-M0 processor, running at frequencies of up to 48 MHz
- 32 kB on-chip flash programming memory
- 8 kB SRAM
- GPIO pins can be used as edge and level sensitive interrupt sources
- High-current output driver (20 mA) on one pin
- High-current sink drivers (20 mA) on two I²C-bus pins in fast-mode plus
- In-System Programming (ISP) and In-Application Programming (IAP)
- Metrology engine for smart metering with two current inputs and a voltage input
- System tick timer
- Three reduced power modes: Sleep, deep-sleep, and deep power-down
- Unique device serial number for identification
- Up to 25 General Purpose I/O (GPIO) pins
- Available as 33-pin HVQFN package

Key Applications

- Smart appliances
- Industrial sub-meters
- Rack-mounted servers
- Smart plugs and plug meters
- Green consumer electronics

Design Tips

The KSK-LPC1227-JL Evaluation Board (IAR KickStart Kit for LPC1227) is available.



| Part Number | Package |
|----------------|--|
| EM773FHN33,551 | HVQFN-32 (7 × 7 × 0.85 mm ³) |

JN5148

Single Chip JenNet/ZigBee PRO/IEEE802.15.4 Solution



Ira Kirsten-Hormuth, SILICA EU



The JN5148 is an ultra low power, high performance wireless microcontroller targeted at low-power wireless networking applications. The device features an enhanced 32-bit RISC processor offering high coding efficiency through variable width instructions, a multi-stage instruction pipeline and low power operation with programmable clock speeds. It also includes a 2.4 GHz IEEE802.15.4 compliant transceiver, 128 kB of ROM, 128 kB of RAM, and a rich mix of analogue and digital peripherals. The large memory footprint allows the device to run both the networking stack and an embedded application or in a co-processor mode. The operating current is below 18 mA, allowing operation direct from a coin cell.

Enhanced peripherals include low power pulse counters running in sleep mode designed for pulse counting in AMR applications and a 4-wire I²S audio interface to interface directly to mainstream audio CODECs as well as conventional MCU peripherals.

Key Features

Transceiver

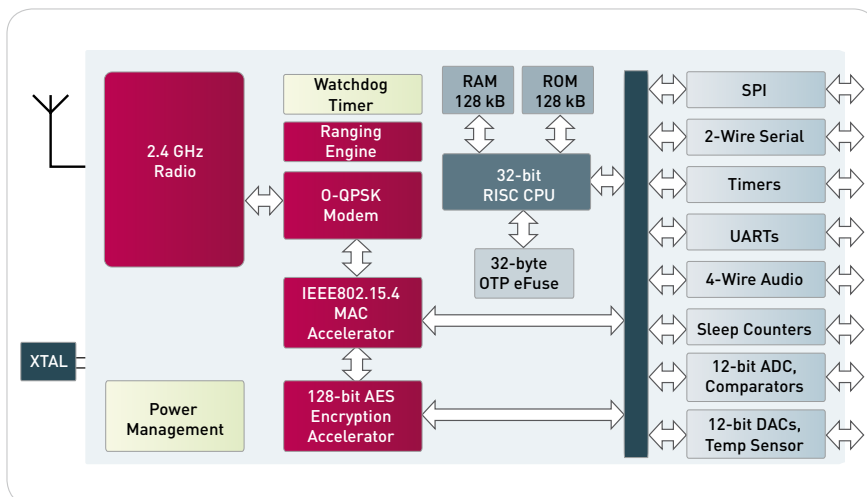
- 2.4 GHz IEEE802.15.4 compliant
- 128-bit AES security processor
- MAC accelerator with packet formatting, CRCs, address check, auto-acks, timers
- 500 & 667 kbps data rate modes
- Integrated sleep oscillator for low power
- On chip power regulation for 2.0...3.6 V battery operation
- Deep sleep current 100 nA
- Sleep current with active sleep timer 1.25 µA
- Rx current 17.5 mA, Tx current 15 mA
- Receiver sensitivity -95 dBm
- Transmit power 2.5 dBm

Microcontroller

- 32-bit RISC CPU, 4...32 MHz clock speed
- Low power operation
- Variable instruction width for high coding efficiency
- Multi-stage instruction pipeline
- 128 kB ROM and 128 kB RAM for bootloaded program code
- JTAG debug interface
- 4-input 12-bit ADC, 2 12-bit DACs, 2 comparators
- 3 application timer/counters
- 2 UARTs
- SPI port with 5 selects
- 2-wire serial interface
- 4-wire digital audio interface
- Watchdog timer and Power-on-Reset circuit
- Up to 21 DIO

Key Applications

- Robust and secure low power wireless applications
- ZigBee PRO and JenNet networks
- Utilities metering (e.g. AMR)
- Home and commercial building automation
- Remote Control



| Part Number | Package |
|----------------|---------|
| JN5148/001,515 | QFN-56 |

NCS5650MNTXG
1k units from:
€ 2.00

AMIS49587C5871/2G
1k units from:
€ 4.10

AMIS49587 & NCS5650

Robust Power Line Communication Solution



Hassan Elkhatib, SILICA Denmark



The AMIS49587 combined with the NCS5650 provides a turnkey power line communication solution, speeding up the time to market while keeping implementation cost low. Isolation of the power amplifier from the high precision analog front end enables unique features and outstanding performances.

Manufactured in mixed signal process, the AMIS49587 embeds a 16-bit RISC processor running the PHY and MAC protocol layers. It fully complies with the well established and widely adopted IEC-61334-5-1 standard. The highly efficient NCS5650 is a Class AB, low

distortion driver. Its two stages architecture and 2 Amps drive capability makes it the most performing line driver on the market.

With millions of equipments currently in operation, this latest generation of PLC products fully benefits from more than 10 years of field experience and collaboration with utilities and meters manufacturers.

Key Features

AMIS49587 PLC Modem

- Half duplex communication up to 2400 Bauds
- SoC with 16-bit RISC processor and high precision AFE
- Embedded PHY and MAC layer, compliant with IEC61334-5-1
- Simple UART interface to Host controller
- Robust S-FSK/ASK modulation
- Master, Slave and Spy mode of operation
- Programmable carrier frequencies in Cenelec A-B band

- Single 3.3 V supply
- Ambient temperature range -40...+85 °C

NCS5650 Line Driver

- 2 A peak drive capability
- High efficiency, rail-to-rail drop of only ± 1 V
- Suitable for EN50065 and FCC part 15 compliant specification
- Single-sided (6...12 V) or dual-balanced supply ± 6.0 V
- Flexible 4th-order filtering
- Adjustable current limit and thermal threshold
- Diagnostic flags
- Junction temperature range: -40...+125 °C

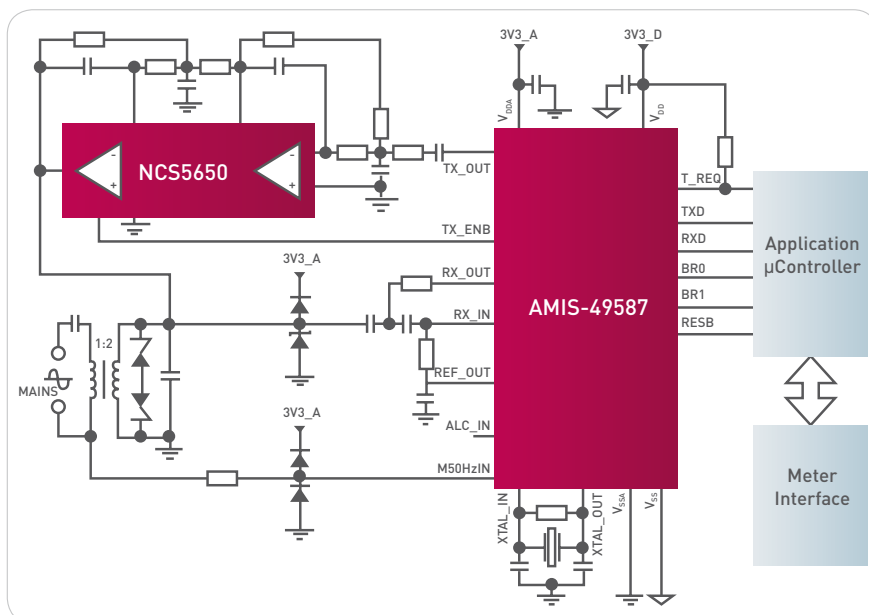
Key Applications

- Smart and split metering
- Street lighting control
- Solar inverters
- Industrial control

Design Tips

The AMIS49587GEVK evaluation kit comes with two modules and a user friendly GUI.

ON Semiconductor offers a wide range of reference design and application notes to ease integration of PLC technology into your design.



| Part Number | Package |
|-----------------|---------|
| AMIS49587C5871G | PLCC-28 |
| AMIS49587C5872G | QFN-52 |
| NCS5650MNTXG | QFN-20 |

R5F2M122ANSP#U0
1k units from:
€ 0.98

R5F21321CNSP#U0
1k units from:
€ 1.10

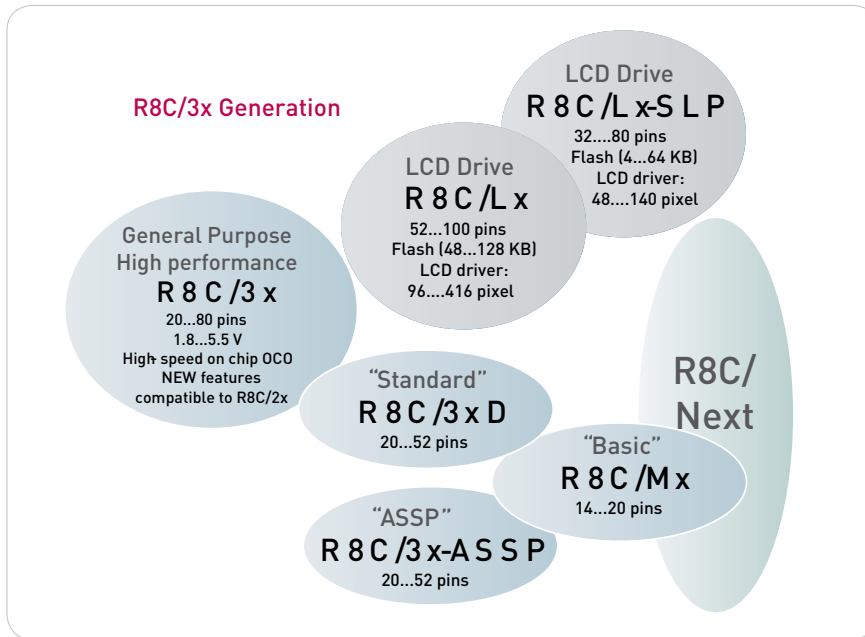
R5F2L357CDFP#U1
1k units from:
€ 2.20

R8C/Lx, R8C/Lx-SLP, R8C/3x and R8C/Mx

Perfect Fit for Low Cost & Low Power Meters



Ira Kirsten-Hormuth, SILICA EU



- Extremely low power
- High speed on-chip oscillator
- DTC function
- 10-bit ADCs
- DAC
- Comparators
- Fail safe functions
- 14...100-pin package options
- Super low prices

Key Applications

- Single phase electricity meters
- Gas meters
- Water meters
- Low power wireless modules

Choose from over 500 R8C derivatives to date!

The 16-bit CISC MCUs of the R8C Family feature high ROM code efficiency, superb noise performance, low power consumption and high processing performance. With the advantage of abundant on-chip peripherals such as comprehensive timer functions and various serial communication functions, the R8C Family supports a wide range of applications. Products with built-in modules such as a high-speed on-chip oscillator which negates the necessity of a resonator, a power-on reset circuit for cutting back on external parts, a low voltage detection circuit, or an oscillator stop detector to support system safety, are available, contributing to the development of low cost and safe systems.

The R8C/Lx & R8C/Lx-SLP Series provides everything needed to implement a high performance, low power, low cost LCD design.

The R8C/3x series offers low power and additional features.

The R8C/Mx series offers lowest power & small package.

Key Features

- R8C family series of 16-bit microcontrollers (same core as M16C)
- Flash 1...128 kB and SRAM up to 10 kB
- High level of integration: RTC, LCD, LVD, POR, etc.
- Low voltage 1.8 V operation

Design Tools

- A full range of development tools guarantees easy development, various online information is available!
- HEW4
- Renesas Evaluation Boards
- Renesas Starter Kits
- E8a on-chip emulator
- E100 Emulator
- Compiler support eco system: Renesas, IAR, KPIT, Tasking, Green Hills
- Flash programming tools: Renesas FDT, third party: Lloyd Research, Softec, Segger

| P/N | Package |
|-----------------|------------|
| R5F2M122ANSP#U1 | P-LSSOP-20 |
| R5F21321CNSP#U0 | P-LSSOP-20 |
| R5F2L357CDFP#U1 | P-LQFP-52 |

BU52011 (Omnipolar) / BU52012 (Unipolar) Low Power Consumption Hall Sensor IC



Ira Kirsten-Hormuth, SILICA EU

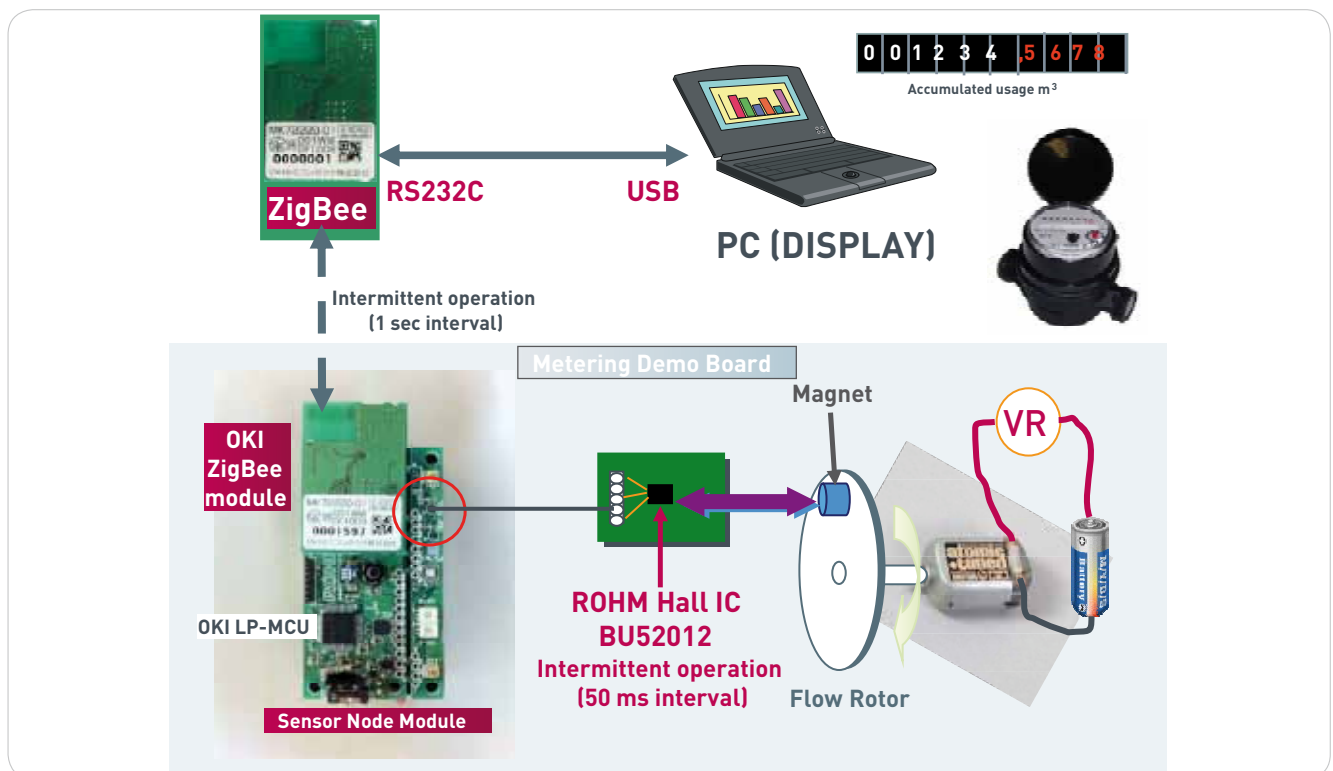


BU52011/12 Hall Sensor IC from ROHM Semiconductor integrate a highly sensitive Hall element on a very small single chip that can perform open/close switch operations through magnetic field detection. Supporting -40...+85° C operating temperature range and high ESD resistance (8 kV), this contactless method increases reliability by eliminating failures due to repeated switching or the introduction of foreign

objects. In smart metering, Hall Sensor IC can perform noncontacting sensing and counter measurement of wheel position/rotation. BU52011/12 featuring intermittent operation mode also contributes to optimise power consumption of battery cell powered such as gas/water meters. Moreover, BU52011/12 may simplify LCD display management as it can detect open/close detection of the cover. This allows to turn on LCD backlight only while user open it to read the counter value, and keep LCD off the rest of the time. ROHM's wide portfolio perfectly fits to metering systems; as for example: FeRAM, Low Power MCU for water/gas meter, Wireless modules/chipsets, Discretes, compact & high efficiency Power Managements...

Key Features

- Single chip with built-in Hall element
- Low current consumption with CMOS output
 - Eliminates the need of pull-up resistor
- Intermittent operation for longer battery life → 3.5 µA (typ) for BU52012
- High detection sensitivity
 - Integrated dynamic offset cancellation yields high performance
- Compact package
- High reliability for industrial applications
 - -40...+85 °C operating range & 8 kV ESD withstand



| P/N | Package |
|------------------|---------|
| BU52011/12HFV-TR | HV50F-5 |

ST7570
1k units from:
€ 4.35

ST7570

S-FSK Power Line Networking System-on-Chip



Manfred Degener, SILICA Germany



The ST7570 is a powerful power line networking system on-chip, combining a high-performing PHY DSP core and an 8051 protocol controller with a full Analog Front End (AFE) and line driver, for a scalable future-proof, cost effective single chip narrow-band power line communication.

Key Features

- Programmable 8051 protocol engine compliant with IEC 61334-5-1 PHY and MAC standard
- CENELEC A band compliant
- Suitable for EN50065 and FCC part 15 compliant specifications
- Programmable baudrate up to 2.4 kbps

- On-chip peripheral: Host controller UART interface
- JTAG debugging
- Fully integrated single-ended power amplifier for line driving (up to 1 A_{RMS}, 14 V_{PP} output)
- -40...+85 °C temperature range
- 3.3 V or 5 V I/O power supply
- Package: QFN-48, 7 x 7 mm²

Key Applications

- Smart metering and smart grid
- Street lighting control
- Command and control networking

Design Tips

The STM32 MCU APIs (driver libraries) are provided free of charge from ST. For the first steps into your design you can utilise a free ST7570 GUI, made by ST. AN3213 describes the complete ST7570 design and

the Evaluation Platform.

Coming soon:

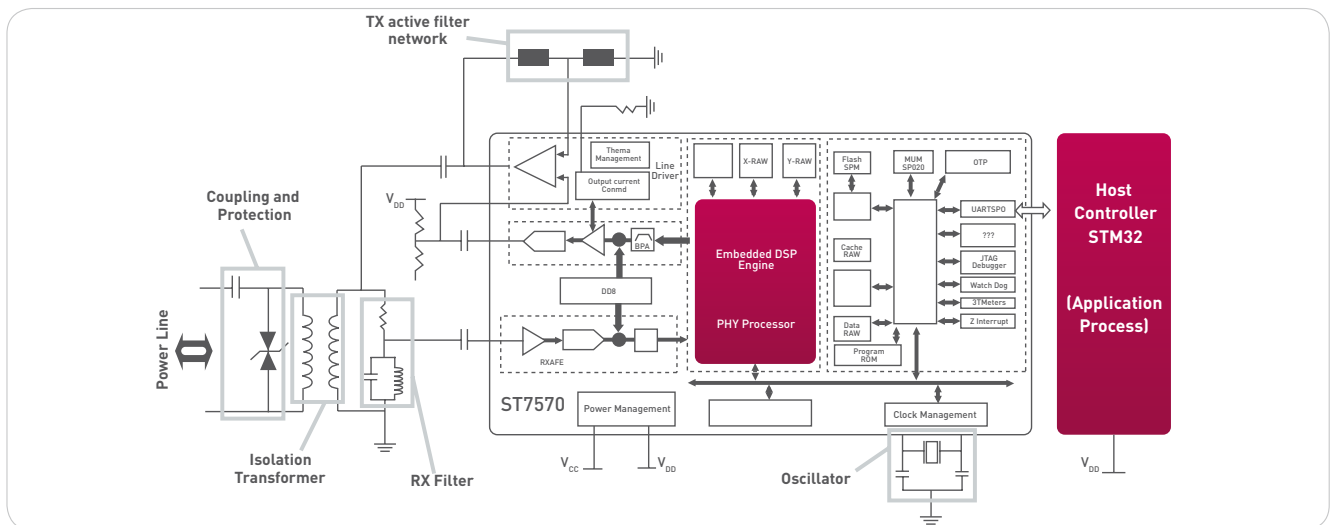
- ST7580 FSK; N-PSK; max. 28,8 kbps
- ST7590 OFDM; 128 kbps; PRIME compliant

Design Tools

The minimum set of evaluation tools to test the ST7570 power line communication requires two communication nodes, each one made of the following elements:

- A PC running the ST7570 GUI software tool
- EVALST7570-1 boards
- ALTAIR04-900 demonstration board as Power Supply Unit (PSU)

For further details about the ST7570 GUI software and the available evaluation tools, please visit <http://www.st.com/powerline>. Partners of ST offer DLMS/COSEM software stack.



| P/N | Package |
|--------|-------------------------------|
| ST7570 | QFN-48, 7 x 7 mm ² |

STPMS2H-PUR
1k units from:
€ 0.90

STPM10BTR
1k units from:
€ 0.95

STPMC1BTR
1k units from:
€ 1.45

STPM10/STPMS2

Energy Metrology ICs



Ira Kirsten-Hormuth, SILICA EU

STMicroelectronics has enlarged its portfolio of metrological ICs by two chips, the STPM10 for single-phase applications and the STPMS2 dedicated to poly-phase applications.

The STPM10 energy metrology ICs incorporate all of the core circuitry necessary to implement the metrology of a class 1 electricity meter as well as the one of a DIN or home (smart Plug) meter. The STPM10 is designed for effective measurement of active, reactive and apparent energy in a power line system using current transformer and shunt sensors. The device can be implemented for peripheral measurement in a microcontroller-based single-phase or poly-phase energy meter.

The STPMS2 - STMicroelectronics' new member of poly-phase metering chipsets - offers the industry's most accurate and cost-effective solution for next-generation smart meters. The STPMS2 as well as the already introduced STPMS1 is a dual-channel delta-sigma modulator that convert analog current and voltage values from each phase and transmit digital data to the STPMC1. They can be placed very close to the current sensor to avoid long analog tracks and high-noise

capture. In addition, the reduced number of connections and the discrete implementation leads to the potential use of three shunt resistors via low-cost isolation on digital data paths, instead of using significantly more expensive isolated sensors. The STPMS1 has a first-order modulator, while the STPMS2 has a second-order modulator delivering enhanced accuracy.

STPM10 Key Features

- Measures active, reactive, and apparent energies
- Current, voltage RMS and instantaneous measurement
- Frequency measurement
- Live and neutral monitoring for tamper detection
- Fast and simple one-point digital calibration over the whole current range
- Ripple-free active energy pulsed output
- Integrated linear voltage regulators for digital and analog supply
- Selectable RC or crystal oscillator
- Supports 50...60 Hz - IEC62052-11, IEC62053-2x specifications

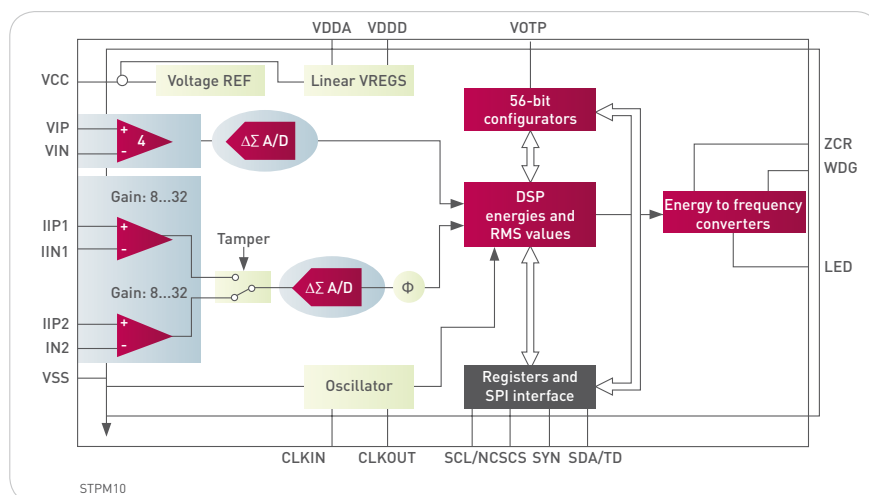
- Less than 0.1% error in the 1000:1 range
- Precision voltage reference: 1.23 V with 30 ppm/°C max.

STPMS2 Key Features

- Two sigma-delta modulators
- Programmable chopper stabilised low-noise and low-offset amplifier
- Precision voltage reference: 1.23 V and 30 ppm/°C max.
- Support EN, IEC and ANSI standard up to 0.2 class AC Watt meters

Features together with STPMC1

- Measures active, reactive, and apparent energies
- Current, voltage RMS and instantaneous measurement
- Frequency measurement
- Ripple-free energy calculation algorithm
- Supports Rogowski coil, current transformer or shunt current sensing
- OTP memory for configuration and calibration
- SPI interface
- 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



| P/N | Package |
|-------------|----------|
| STPM10BTR | TSSOP-20 |
| STPMS2H-PUR | QFN-16 |
| STPMC1BTR | TSSOP-20 |

CC1120

RF Transceiver for Narrowband Systems



Ira Kirsten-Hormuth, SILICA EU

The CC1120 is a fully integrated single-chip radio transceiver designed for high performance at low power and low voltage operation in cost effective wireless systems. All filters are integrated, removing the need for costly external SAW and IF filters. The device is mainly intended for the ISM (Industrial, Scientific and Medical) and SRD (Short Range Device) frequency bands at 164...192 MHz, 410...480 MHz and 820...960 MHz.

The CC1120 provides extensive hardware support for packet handling, data buffering, burst transmissions, clear channel assessment, link quality indication and Wake-On-Radio. The CC1120 main operating parameters can be controlled via an SPI interface. In a typical system, the CC1120 will be used together with a microcontroller and only few external passive components.

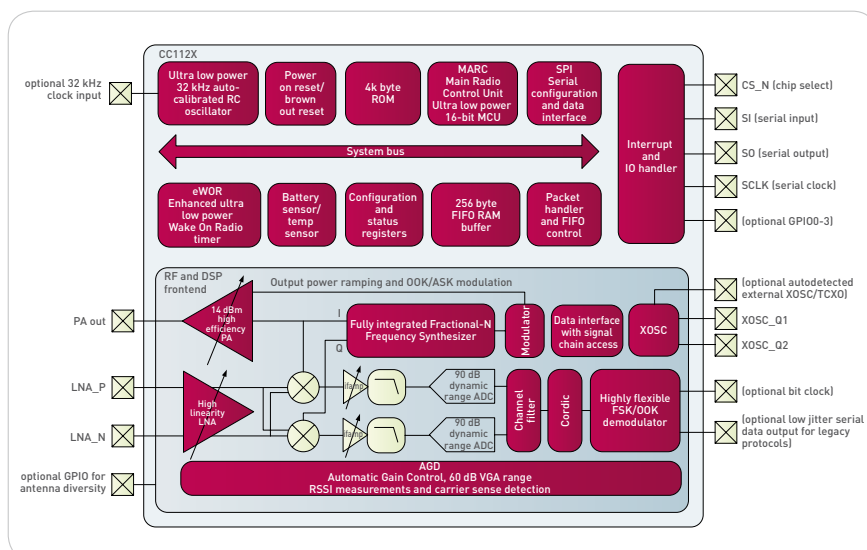
Key Features

- High performance single chip transceiver
 - Excellent receiver sensitivity:
 - -123 dBm at 1.2 kbps
 - -110 dBm at 50 kbps
 - -127 dBm using built-in coding gain
 - Blocking performance: 91 dB at 10 MHz
 - Adjacent channel selectivity: 64 dB at 12.5 kHz offset
 - Very low phase noise: -111 dBc/Hz at 10 kHz offset
- Suitable for systems targeting ETSI cat. 1 compliance in 169 MHz and 433 MHz bands
- High spectral efficiency (9.6 kbps in 12.5 kHz channel in compliance with FCC narrowbanding mandate)

- Power supply
 - Wide supply voltage range (2...3.6 V)
 - Low current consumption:
 - RX: 3 mA in RX Sniff Mode
 - RX: 21 mA Peak Current
 - TX: 45 mA +14 dBm
 - Power down: < 1 μ A
- Programmable output power up to 16 dBm with 0.5 dB Step Size
- Automatic output power ramping
- Configurable data rates: 1.2...200 kbps

Key Applications

- Narrowband ultra low power wireless systems with channel spacing down to 12.5 kHz
- 170 / 433 / 868 / 915 / 950 MHz ISM/SRD band
- Wireless Metering and Wireless Smart Grid (AMR and AMI)
- IEEE 802.15.4g systems
- Home and building automation
- Wireless alarm and security systems
- Industrial monitoring and control



Design Tools

The CC1120 development kit provides a complete hardware performance testing and software development platform for TI's Sub-1 GHz Performance Line devices. It supports 868 MHz and 915 MHz. Additional Evaluation Module Kits can be purchased separately to support other frequencies.

| P/N | Package |
|------------|---------|
| CC1120RHMT | QFN-32 |

AFE031
1k units from:
€ 2.-

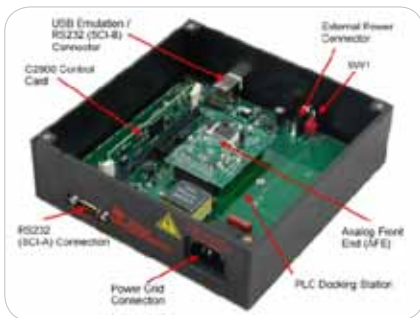
TMDSPLCKIT-V3
Developer's Kit
€ 420.-

AFE031

Powerline Communications AFE



Uwe Harms, SILICA Germany



The AFE031 is a low-cost, integrated powerline communications Analog Front-End (AFE) device that is capable of a transformer-coupled connection to the powerline while under the control of a DSP or microcontroller. It is ideal for driving high-current, low-impedance lines that drive up to 1.5 A into reactive loads. The integrated receiver is able to detect signals down to $20 \mu\text{V}_{\text{RMS}}$ and is capable of a wide range of gain options to adapt to varying input signal conditions. This monolithic integrated circuit provides high reliability in demanding powerline communications applications.

The AFE031 transmit power amplifier operates from a single supply in the range of 7...26 V. At maximum output current, a wide output swing provides a 13 V_{PP} ($I_{\text{OUT}} = 1.5 \text{ A}$) capability with a nominal 15 V supply. The AFE031 is internally protected against over temperature conditions. It also provides an accurate, user-selected, current limit. An interrupt output is provided that indicates current limit, thermal limit, and power lost. It also has a shut-down pin that can be used to quickly put the device into its lowest power state. Through the four-wire SPI™, the user can enable or disable each functional block to optimise power dissipation. The AFE031 is housed in a thermally-enhanced, surface-mount PowerPAD package (QFN-48).

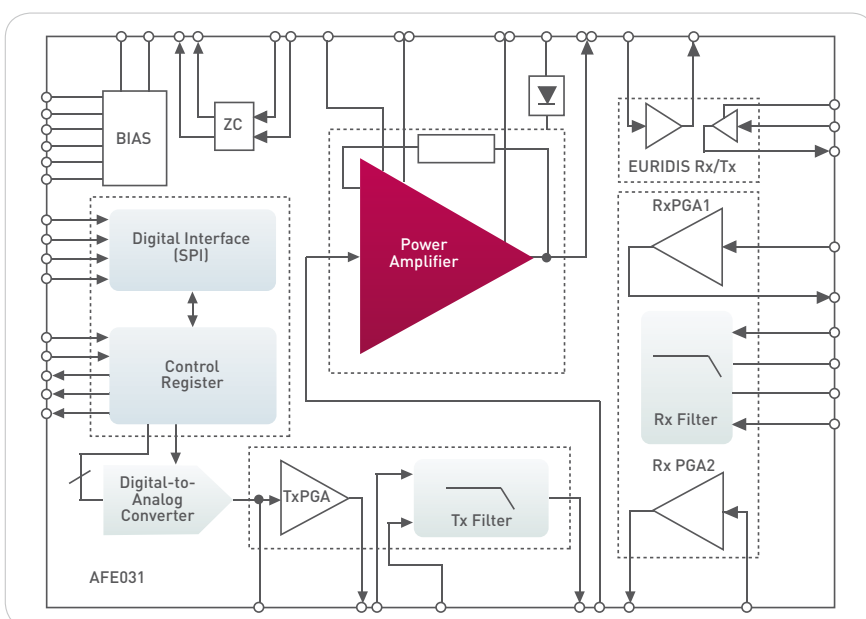
Key Features

- Shut-down override
- Receive sensitivity $20 \mu\text{V}_{\text{RMS}}$, typically

- Integrated Powerline Driver with thermal and over-current warnings
- Large Output Swing: 12 V_{PP} at 1.5 A 15 V supply
- Low power consumption 15 mW (receive mode)
- Supply voltage: 7...24 V
- Supports EN50065 Cenelec Bands A, B, C, D
- Supports FSK and OFDM
- Programmable gain control
- Four-wire serial interface
- Two integrated zero crossing detectors
- Euridis 1 & 2 transceiver buffer
- 48-pin QFN PowerPAD™ package
- Extended temperature range: $-40...+125 \text{ }^\circ\text{C}$

Key Applications

- Power-Line communications
- eMetering, solar power, HVAC
- Street lighting
- Industrial and home automation



Design Tools

The TMDSPLCKIT-V3 C2000™ Power Line Modem Developer's Kit enables easy development of software based Power Line Communication (PLC) modems. The kit includes two PLC modems based on the C2000™ F28069 controlCARD and TI's integrated analog front end AFE031. The included PLC SUITE software supports several communication techniques, including OFDM and SFSK. The kit includes onboard USB JTAG emulation and Code Composer Studio.

| Part Number | Package |
|---------------|-----------------|
| AFE031 | 48-QFN |
| TMDSPLCKIT-V3 | Developer's Kit |

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SILICA | The Engineers of Distribution.

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