PARTII

Yvon Gourdou
Metering Competence Center EMEA
Feb 2010

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Agenda

1) Metering market overview and application technical requirements.

2) The Meter architecture: one or 2 microcontroller. Why?
   - The advantage of STM32 family.

3) The concentrator, MUC core: SPEAR310

4) Power and network quality measurement
   - (STPM01, 10 and C1 + S1)

5) Power Line Communication: the main communication medium for Smart Grid in EU.

6) ZigBee for HAN

6) Specific technical requirement for the SMPS in metering & the ST solutions
STM32 product series

4 product series

Common core peripherals and architecture:

- Communication peripherals: USART, SPI, I2C
- Multiple general-purpose timers
- Integrated reset and brown-out warning
- Multiple DMA
- 2x watchdogs
- Real-time clock
- Integrated regulator
- PLL and clock circuit
- External memory interface (FSMC)
- Dual 12-bit DAC
- Up to 3x 12-bit ADC (up to 0.41 μs)
- Main oscillator and 32 kHz oscillator
- Low-speed and high-speed internal RC oscillators
- -40 to +85 °C and up to 105 °C operating temperature range
- Low voltage 2.0 to 3.6 V or 1.65/1.7 to 3.6 V (depending on series)
- 5.0 V tolerant I/Os
- Temperature sensor

Gateway and mid-end MUC

STM32 F4 series - High performance with DSP (STM32F405/415/407/417)
- 168 MHz Cortex-M4 with DSP and FPU
- Up to 192-Kbyte SRAM
- Up to 1-Mbyte Flash
- 2x USB 2.0 OTG FS/HS
- 3-phase MC timer
- 2x CAN 2.0B
- Crypto/hash processor and RNG
- Ethernet IEEE 1588

STM32 F2 series - High performance (STM32F205/215/207/217)
- 120 MHz Cortex-M3 CPU
- Up to 128-Kbyte SRAM
- Up to 1-Mbyte Flash
- 2x USB 2.0 OTG FS/HS
- 3-phase MC timer
- 2x CAN 2.0B
- Crypto/hash processor and RNG
- Ethernet IEEE 1588

STM32 F1 series - Connectivity line (STM32F105/107)
- 72 MHz Cortex-M3 CPU
- Up to 64-Kbyte SRAM
- Up to 1-Mbyte Flash
- USB 2.0 OTG FS
- 3-phase MC timer
- 2x CAN 2.0B
- 2x SDIO
- Ethernet IEEE 1588

STM32 F1 series - Performance line (STM32F103)
- 72 MHz Cortex-M3 CPU
- Up to 96-Kbyte SRAM
- Up to 1-Mbyte Flash
- USB FS device
- 3-phase MC timer
- CAN 2.0B
- 2x SDIO

STM32 F1 series - Access line (STM32F102)
- 48 MHz Cortex-M3 CPU
- Up to 16-Kbyte SRAM
- Up to 1-Mbyte Flash
- USB FS device

STM32 F1 series - Access line (STM32F101)
- 36 MHz Cortex-M3 CPU
- Up to 80-Kbyte SRAM
- Up to 1-Mbyte Flash

STM32 F1 series - Value line (STM32F100)
- 24 MHz Cortex-M3 CPU
- Up to 32-Kbyte SRAM
- Up to 512-Kbyte Flash
- 3-phase MC timer
- CEC

STM32 L1 series - Ultra-low-power (STM32L151/152)
- 32 MHz Cortex-M3 CPU
- Up to 48-Kbyte SRAM
- Up to 384-Kbyte Flash
- USB FS device
- Data EEPROM up to 12 Kbytes
- LCD 8x40 4x44
- Comparator
- BOR
- MSI
- VScale
- AES 128-bit

Start of the metering platform

To high com meters

To low end market

High low power meters
STM32 – leading Cortex-M portfolio

Over 250 pin-to-pin compatible part numbers

Legend:
- STM32 L1
- STM32 F1
- STM32 F2
- STM32 F4

Note:
1. Available in Q4 2011 for all 100-pin and 104-pin STM32 devices
### Feature highlight

- **168 MHz Cortex-M4 CPU**
- **Floating point unit (FPU)**
- **ART Accelerator™**
- **Multi-level AHB bus matrix**
- **1-Mbyte Flash, 192-Kbyte SRAM**
- **1.7 to 3.6 V supply**
- **RTC: <1 µA typ, sub second accuracy**
- **2x full duplex I²S**
- **3x 12-bit ADC 0.41 µs/2.4 MSPS**
- **168 MHz timers**

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<td>2x 32-bit timers</td>
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</tbody>
</table>

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**Notes:**
1. HS requires an external PHY connected to the ULP interface
2. Crypto/hash processor on STM32F417 and STM32F415
Key messages to remember

- STM32 F4 series
  - World’s highest performance
  - Extends the STM32 portfolio to over 250+ compatible devices
  - One-in-two Cortex-M MCUs shipped worldwide is an STM32

Discovery kits available now
STM32 encryption Firmware library

- Optimized crypto library for the STM32 32-bit microcontroller

**STM32 CRYPTO ALGORITHM:**

- AES 128, 192 and 256 bit:
  - ECB (Electronic Code Block) mode
  - CBC (Cipher Block Chain) mode
  - CTR (Counter) mode
  - GCM (Galois Counter mode)

**AES 128 ECB (512 look-up table):**
- Footprint 1.4Kb code, 0.5Kb Constant
- Encryption 16 byte: 11us + 32us
- Encryption 128 byte: 11us + 262us

**AES 128 ECB (2048 look-up table):**
- Footprint 1.8Kb code, 2.5Kb Constant
- Encryption 16 byte: 11us + 27us
- Encryption 128 byte: 11us + 220us
Ultra-low-power EnergyLite™ platform range

- ST’s ultra-low-leakage process technology
- Shared technology, architecture and peripherals
Ultra low power solution for Meters

Feature-rich 32-bit solution
L1 series – STM32L151/152/162 - Cortex-M3 – 32 MHz
- From 32 Kbytes to 384 Kbytes of memory size
- LCD segment, data EEPROM, RTC, analog functions, USB
- From 48 pins to 144 pins
- Stop mode: 0.43 μA; Standby mode: 0.27 μA

Feature-rich 8-bit solution
L1 series – STM8L151/152/162 - STM8 core – 16 MHz
- From 4 Kbytes to 64 Kbytes of memory size
- LCD segment, data EEPROM, RTC, analog functions
- From 20 pins to 80 pins
- Halt mode: 0.4 μA

Entry-level 8-bit solution
L1 series – STM8L101 - STM8 core – 16 MHz
- From 4 Kbytes to 8 Kbytes of memory size
- Internal RC oscillator, comparators, small footprint
- From 20 pins to 32 pins
- Halt mode: 0.35 μA

STMicroelectronics
STM32L - Ultra-low power STM32

- Energy saving
  - 32-bit ARM Cortex-M3 performance
  - Ultra-low power in dynamic and static modes

- Power supply:
  - 1.65 to 3.6V without BOR
  - 1.8 to 3.6V with BOR

- Special features
  - Segment LCD 8x40
  - 4KBytes EEPROM
  - Comparator

- Pin-to-pin compatible with STM32 family
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<td>SPEAr 600</td>
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<td>PBGA420 23 x 23 mm 1mm pitch</td>
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ARM926EJ-S 333Mhz

**SPEAr eMPU Family** : leading performance
SPEAr® 3x0 Family

Dedicated set of peripherals for selected applications.
SPEAr®310 - Data Concentrator and MCU

**SPEAr310**

- ARM926EJ-s 333MHz
- 16K+16K I/D CACHE
- 32KB boot ROM 8kB boot RAM
- System I/O
  - 4 x 16bit Timer
  - Watchdog Timer
  - 8 x DMA
  - Interrupt cntrl.
  - RTC
- Connectivty
  - 10/100 Ethernet MAC
  - UART0
- accelerators
  - SPI Flash
  - mobileDDR/DDR2
- Memory cntr.
- Additional IPs
  - UART1, UART2, UART3, UART4, UART5
  - TDM, HDLC, GPIOs
  - EMI + Flexible Static Memory Controller
  - Quad Ethernet MAC & 125MHz ref.
- Analog i/f
  - 8x10b 1Mmps ADC
- USBs PLL
- Aux PLL
- System SSGC
- JTAG
- SPI
- Fast IrDA RX/TX
- I2C
- External storage / backup
- Remote control
- Pen drive
- Power meter
- Local storage / backup
- UART 1.2Kbps 8E1 RS485 / Down link
- UART 9.6Kbps 8E1 RS485 / Up link
- UART RS232 For GSM and options
- 16Bits NAND flash 256MBytes
- Daisy chain option
- Upgrade with LCD possible through I2C or SPI
- Upgrade with LCD possible through I2C or SPI
- Local control / access / maintenance
- Local control / access / maintenance
- Boot NOR flash 16MBytes
- DDR2-SDRAM 64MBytes
- 10/100 Base-T
- Fast IrDA
- Computer
- Local control / access / maintenance
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Metering Products Portfolio

**STPM01**
1° order ΣΔ A/D
Accuracy 0.1% in 1:1000 range
OTP, pulsed output

**STPM1x** (4p/n)
1° order ΣΔ A/D
Accuracy 0.1% in 1:1000 range
OTP, pulsed output

**STPM10**
1° order ΣΔ A/D
Accuracy 0.1% in 1:1000 range
SPI

**STPMS1**
1° order ΣΔ A/D
Accuracy 0.1% in 1:1000 range

**STPMS2 (H/L)**
2° order ΣΔ A/D
Accuracy 0.5% in 1:10000 range (H)
Accuracy 0.5% in 1:5000 range (L)

**STPMC1**
Digital calculator
Up to 5 channels input ΣΔ streaming
4 DSPs for ΣΔ i/u streaming
112 configuration bits
OTP, SPI, pulsed output
STPM01/10 : Features

- **MEASUREMENT**
  - Active, Reactive, Apparent Energies,
  - Signed Accumulation
  - V, I, Frequency

- **SENSORS**
  - Rogowski*
  - Current Transformer
  - Shunt

- **OPERATION**
  - Standalone*
  - MCU based

- **ACCURACY**
  - 0.1% in 1:1000 range

- **TAMPER PROOF**
  - 2 current channels available

- **SUPPORT IEC61036 AND ANSI C12.1**

- **FLEXIBILITY**
  - from low to high end allows re-use of already tested boards layouts

- **CALIBRATION**
  - Very short calibration time
  - No ripple in the active energy
  - Separated for voltage and current

- **OTP**
  - Prevention of tamper by changing calibration data
  - No need of loading the configuration data from MCU at startup
  - Perfect data retention in harsh environment

- **2 CURRENT CHANNELS**
  - STPM01 manages itself the anti-tamper features, even without MCU

- **NOT present on STPM10**
**STPM01/10: Device block diagram**

- **2 ΔΣ A/D converters**
- **Voltage Channel 4x gain. Automatic offset compensation**
- **Integrated linear vregs allow reducing component count and cost**
- **OTP configurators: Flexibility, digital calibration and configuration**
- **56 OTP CONFIGURATORS**
  - **DSP**: Calculation of Active, Reactive, Apparent energies, Voltage and current RMS values, Line frequency
- **Oscillator**: Quartz, Internal RC or external
- **2 multiplexed current channels for detecting tamper conditions. With programmable gain. CT, Shunt and Rogowsky coil sensors**
- **Oscillator: Quadrung, Internal RC or external**
- **Programmable Phase compensation up to 0.576°**
- **Voltage REF**
- **Linear Vregs**
- **ΔΣ A/D**
- **Tamper**
- **Energy to Freq Converters**
- **Select CE/Ps: Pulsed signal proportional to active energy**
- **Registers & SPI Interface**: Used to program, configure and read the data registers
- **SPI Interface: Used to program, configure and read the data registers**

* NOT present on STPM10
STPM Family Overview

**SPI Interface**
- STPM01
  - RoCo
  - Shunt
  - CT
  - AW
  - RW
  - SW
  - V, I RMS
  - V, I MOM
  - Freq
  - TAMP
  - RC OSC
  - Quartz
  - SW CAL
  - OTP

**Pulsed Output**
- STPM11
  - RoCo
  - Shunt
  - CT
  - AW
  - TAMP
  - RC OSC
  - Quartz
  - SW CAL
  - OTP

- STPM12
  - RoCo
  - Shunt
  - CT
  - AW
  - TAMP
  - RC OSC
  - Quartz
  - SW CAL
  - OTP

- STPM13
  - RoCo
  - Shunt
  - CT
  - AW
  - TAMP
  - RC OSC
  - Quartz

- STPM14
  - RoCo
  - Shunt
  - CT
  - AW
  - TAMP
  - RC OSC
  - Quartz

* Product in roadmap
STPM01 and 10 demonstration board

- STEVAL-IPE003V1
  - STPM01/1x Board: CT + Shunt
- STEVAL-IPE004V1
  - STPM01/1x Board: Shunt
- STEVAL-IPE002V1
  - STPM01/1x Board: CT+CT
- STEVAL-IPE008V1
  - STPM01/10 3-phase Board: 3xSTPM (CT only)
Metering module

Nullable parameters:
- Voltage and Current
- RMS (WB or 50Hz)
- Active power
- Reactive power
- Power factor
- THD
- Temperature

STPM10 STM8S103F3
3.8 cm

2.8 cm

UART

MCU

Power Supply PFC
3-phase 4-wire with tamper

NRST

- R Current
- R Voltage
- S Current
- S Voltage
- T Current
- T Voltage
- N Current

Voltage and Current $\Delta\Sigma$ conversion

Signal processing and computations

Stepper Counter

1 wire data line

MCU Application Support and Peripheral Control

4 wires

Optional for neutral monitoring

No Load
Negative Power
Tamper
3 Shunts Metering Application
STPMC1 – CALCULATOR

STPMC1 can be implemented as a single chip 1-, 2- or 3-phase energy meter or as a measurement peripheral in a microprocessor based 1-, 2- or 3-phase energy meter.

**MAIN FEATURES**

- 4 DSPs processing Sigma Delta current/voltage streamings delivered by STPMSx
- Basic computational functions plus integrators, decimators, filters
- Measurement of active, reactive, apparent energy, current/voltage RMS and frequency values
- Software calibration and mutual compensation
Dual channel SD modulator for Power Metering application

QFN16 4x4

MAIN FEATURES

Vcc supply range 3 – 5.5V
2nd order Sigma Delta Modulators
Programmable chopper stabilized low noise and low offset amplifier
Exceed 50-60 Hz IEC 687/1036 spec for class1, class0.5 and class0.2 AC watt meters
Less than 0.1% error over 1:5000 range
Internal low drop regulator @ 3V typ
Precision voltage reference: 1.23V and 30 ppm/° C Max (only STPMS2L)
STPMS2 – Key features

- Two part numbers:
  - STPM02H Less than 0.5% error over 1:10000 range
  - STPM02L Less than 0.5% error over 1:5000 range
- Two 2\textsuperscript{nd} order sigma-delta modulators \( f_{\text{SPL}} = f_{\text{CLK}}, f_{\text{BWD}} = 4 \text{ kHz} \)
- Two pins for data exchange: CLK, DAT to STPMC1 or other DSP
- Operating modes:
  - **Hard mode**: configuration pins MS0-3
  - **Soft mode**: when MS3 = CLK, internal configuration bits can be programmed through SPI pins MS0-2
- Selectable precision/consumption modes
- Built-in self-test capability
Pulse current sensor is a di/dt sensors, based on Rogowski coil principle:
- It offers by design high electrical isolation from line
- No magnetic core ensures very high linearity over current, frequency and temperature
- Insensitive to DC magnetic fields
- Flexible in size and shape

Using the Pulse current sensor together with the STPMxx presents multiple benefits because of:
- a proprietary power calculation and digital signal processing algorithm developed specifically for Rogowski coil-based sensors
- the capability of mutual current compensation when multiple sensors are used

PA2999.006NL sensor and STPM01 were tested together with the following results:
ST's STPMxx ICs combined with Pulse current sensors boost power meter accuracy while decreasing overall isolation costs:

- Isolated sensing solution based on STPMxx family
- No saturation due to absence of amorphous core
- Mutual current compensation on polyphase systems
- Exceptional linearity over the current range
- Different sensor shape adaptability
- Fast digital calibration in only one load point
STPMC1 + STPMS2 Promotion tool

- Demonstration boards for modular approach
  - STPMC1 board: STEVAL-IPE010V1
  - STPMS2 Daughter board: STEVAL-IPE014V1
- Application note and user manual
  - AN 3157: how to use SPTMC1 +S1/2 and performances
- UM 0746: Evaluation kit getting started
STPMC1 + S2 evaluation kit

STEVAL-IPE014V1

STEVAL-IPE010V1
STPMC1 + S2 evaluation kit

STEVAL-IPE010V1

STEVAL-IPE014V1
STPMC1 + S2 evaluation kit
All-shunt 3ph evaluation board

Key Feature

Complete Isolation
Magnetic based Isolation
Single supply voltage
Class 0.5 accuracy
Modular system

Today the schematic is available, The baord is to come later.
How to connect STPM board to a PC

- STEVAL-IPE005V1

- USB connection board in development
GUI interface

STPM01/10 Software
Parallel port
Complete configuration
Calibration Wizard
OTP burn

STPM11/12/13/14
Parallel port
Complete configuration
Calibration Wizard
OTP Burn

STPMC1 Software
Parallel port
Complete configuration
Calibration Wizard
OTP burn
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The communication modules: PLM + Wireless
ST leading PLC market delivering field proven and cost-effective solutions for more than 20 years

More than 30 Million PLC transceivers sold in the last 5 years!

Smart Meters

PV Monitoring, Street lighting

Home Area Networking (HAN)
Home and Building automation, Smart Energy control Connectivity....

PEV communication
ST PLC strategic approach: Cover all open standards

- ST has been playing a key active role in all most important PLC standardization initiatives: EHS; KONNEX / EN 50090; IEC PRIME alliance; OPEN meter project, and will continue to do

- ST7538/40 are protocol “agnostic” and comply with EN 50090 and IEC 61334-5-2 standards

- ST7570 complies with present IEC 61334-5-1 standard (S-FSK) and its evolutions for ERDF (LINKY) or Netherland NTA8030

- ST7580: Meters and More M-PSK: Endesa, Enel, IBM, SAGEM, STM. (open meter and Cenelec TC1)

- ST7590 complies with PRIME specifications for OFDM communication. (open meter project and Cenelec TC13 for standardization)

- The future ready G.hnem P1901.2 of IEEE
Power Line Communication Solution

**Integration**

**NETWORK INTERFACES**

**TRANSCEIVERS**

**MAC**

- IEC 61334-5-1 compliant (S-FSK)
- FSK, M-PSK modes
- The first in the market with integrated PLI!

**PHY**

- 1.2kb/s to 4.8kb/s
- Up to 28.8kb/s
- up to 130kb/s

**Performance:** speed, encryption, correction coding

**All mature products**

**“PRIME” protocol compliant (OFDM)**

**SML DLMS**

**MC:30**

**MC:21**

**STMicroelectronics**
PLM ST7570 tools overview

- PLM ST7570 EvalKit
- Interconnection
- µC or MPU
- Interconnection
- indirect PC GUI
- USB
- UART
- STM32 USB
- SPEAr
- STM8 USB
- USB

STMicroelectronics
STMicroelectronics and Andrea Informatique have agreed to promote the protocol DLMS COSEM in the STM32 microcontroller and in the STarGRID components.
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RF communication solutions
ZigBee Modules

**COMMON Features**

- On board 24 MHz stable Xtal and Selectable Integrated RC Oscillator
- Pins available for non intrusive debug interface (SIF)
- Single 3V Supply, deep sleep power consumption <1uA, suitable for battery supply
- Integrated MURATA antenna aboard for 0dBm (+2dBm in boost mode) output power allow a top class reach: 30 meters indoor/urban, 100 meters and more, outdoor line-of-sight
STM32W – IEEE 802.15.4 radio

- Microcontroller
  - ARM Cortex-M3 core architecture
  - Embedded memory (eFlash 16kx64, SRAM 4kx16)

- IEEE 802.15.4 2.4 GHz radio
  - Transmitter: 2-point direct synthesizer modulation
  - Receiver: low IF super heterodyne architecture
  - Digital baseband DSP and MAC support
  - -100 dBm sensitivity and up to 7 dBm output power

- Networking
  - ZigBee compliant PRO and RF4CE stacks
  - 128-Kbyte Flash for stack and apps codes
  - IEEE 802.15.4 simple MAC library

- Peripherals
  - AES encryption HW accelerator
  - Debug channel via JTAG
  - USART, SPI, I²C, 24 GPIOs

- Other
  - Compatible with SN2xx series
  - QFN48 and QFN40 packages available
STM32W architecture overview

- 32-bit ARM Cortex-M3 core running @ 24 MHz
- 128-Kbyte Flash, 8-Kbyte RAM (256k soon)
- Fully IEEE 802.15.4 compliant radio @ 2.4 GHz
- Power management
  - Deep sleep mode <1 µA with RAM retention
- On-chip debug support
  - ARM JTAG/SWD
  - Packet trace interface enables remote monitoring of radio messages
- ARM memory protection unit
  - To detect erroneous software accesses
- Sleep timer, watchdog timer and GP timers
- AES 128 encryption acceleration
- Serial communication (UART/SPI/I²C)
- GPIO
- ADC (6 channels, first order 12 bits sigma delta)
Power management modes

Native Cortex-M3 sleep mode is a perfect foundation to implement several STM32W system low-power modes

<table>
<thead>
<tr>
<th>Mode</th>
<th>Regulators</th>
<th>Low-frequency 10 kHz RC oscillator</th>
<th>32 kHz crystal oscillator</th>
<th>High-frequency 12 MHz RC oscillator</th>
<th>24 MHz crystal oscillator</th>
<th>Power consumption</th>
</tr>
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<tbody>
<tr>
<td>Deep sleep 2</td>
<td>off</td>
<td>off</td>
<td>off</td>
<td>off</td>
<td>off</td>
<td>0.7 µA</td>
</tr>
<tr>
<td>Deep sleep 1</td>
<td>off</td>
<td>off</td>
<td>optional</td>
<td>off</td>
<td>off</td>
<td>0.4 µA</td>
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<tr>
<td>Standby</td>
<td>on</td>
<td>on</td>
<td>optional</td>
<td>off</td>
<td>off</td>
<td>2 mA</td>
</tr>
<tr>
<td>Active at 12 MHz</td>
<td>on</td>
<td>on</td>
<td>optional</td>
<td>off</td>
<td>on</td>
<td>6 mA</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Active mode</th>
<th>Sensitivity</th>
<th>Rx current</th>
<th>Tx current</th>
<th>Tx current</th>
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</thead>
<tbody>
<tr>
<td>Radio peripheral</td>
<td>dBm</td>
<td>mA</td>
<td>mA at 0 dBm</td>
<td>mA at -32 dBm</td>
</tr>
<tr>
<td>-100</td>
<td>20</td>
<td>24</td>
<td>15</td>
<td></td>
</tr>
</tbody>
</table>
F/W & Libraries IEEE802.15.4 (1/3)

Customer application

Network layer (optional)

15.4 simple MAC

IEEE802.15.4 Platform

Generic IEEE802.15.4

Customer application

ZigBee Remote Control Profile

Zigbee RF4CE Stack

15.4 simple MAC

IEEE802.15.4 Platform

ZigBee PRO stack (incl. Std periph lib)

Customer application

Smart Energy Profile

Home Automation Profile

Customer code

Libraries provided by ST to customers

Silicon

Customer application

Consumer

Industrial

IEEE802.15.4 Platform

STMicroelectronics

CONFIDENTIAL
STM32W development tools

- Network analyser
- IAR J-Link Lite & compiler
- RF application board
- Extension board + Primer 2
- Developer kit
- Extension kit
- RF application board*
- RF extension
- Sniffer
- Infrared
- USB

*Includes RF certified pre-cut module

STMicroelectronics
SPIRIT1
Sub 1GHz Proprietary Transceiver

**RF PERFORMANCE**
- Freq Bands: 300-348 MHz, 387-470 MHz, 779-956 MHz
- Programmable output power: from -30dBm to +12dBm
- Programmable Data Rate: from 1 to 500 kbps
- Low current consumption (6mA RX, 433 MHz, FSK, 38.4kbps)

**ANALOG FEATURE**
- Modulations: FSK, GFSK, MSK, OOK and ASK
- Frequency Hopping is allowed
- Automatic Frequency Offset Compensation
- Battery indicator and low battery detection

**DIGITAL FEATURE**
- 4 pre-defined packets:
  - Basic
  - Virtual Multi Channel
  - STack
  - **Wireless M-BUS**
- Hardware support for packet handling and burst transmission
- Link quality indicators and received signal qualifier (RSSI, LQI, PQI, SQI, CS)
- Supports CSMA/CA
Agenda

- 1) Metering market overview and application technical requirements.
- 2) The Meter architecture: one or 2 microcontroller. Why?
  - The advantage of STM32 family.
- 3) The concentrator, MUC core: SPEAR310
- 4) Power and network quality measurement
  - (STPM01, 10 and C1 + S1)
- 5) Power Line Communication: the main communication medium for Smart Grid in EU.
- 6) ZigBee for HAN
- 6) Specific technical requirement for the SMPS in metering & the ST solutions
Power Supply.
We offer solutions not only a components
  - We take the needs
  - We give schematic + MOB for each request.

A Power Supply Competence Center to serve you:
  - More than 10 years of experiences.
  - Design for or with you to save your time.
  - Hot line.

We adapt the products to the market need:
  - Low end meter <1W: regulator and DC/DC converter: Viper12
  - Multifunction meter > 1W: buck and fly back with viper12, viper16
  - Ultra wide voltage range : AN2625
  - AMM >5 W + ultra wide voltage range: L6565 + MOS or Viper 17
  - Concentrator #20 W L6565 + MOS
ST SMSP Offer for metering

Direct Conversion from AC Mains to DC Low Voltage DC
Very low stand by consumption 30mW

- VIPer35
- VIPer25
- VIPer15
- VIPer05
- VIPer37
- VIPer26
- VIPer16
- VIPer06
- VIPer27
- VIPer17
- VIPer07
- Altair04- 900V

Topologies
- Isolated
- Non Isolated
- Buck/ Buck-boost / Fly-back
- Isolated
- Fly-back

POWER (W) with universal mains
- 15W -
- 10W -
- 5W -
- 3W -

For metering application

In production
Production Q1 2010
Production Q2 2010
Application: metering with Altair04

Metering SMSP needs at a glance

- Fault tolerant (connection between to phase) => high break down voltage
- Up to 5 W output
- Strong efficiency in low load condition (95%) of the time
- Topologies: Standard not/isolated flyback

SELLING POINTS:

900V MOSFET → RELIABILITY + BOM REDUCTION + COMPLIANCE WITH SYSTEM SPECS, COMPACTNESS EXTREMELY LOW COST (NO NEED OF OPTO)
ALTAIR04-900 : ST7590 demo
Serial RTC and Supervisor
Advanced Analog in Electricity Metering

Serial RTC with Switch Over
M41T00S, M41T81S, M41T56, M41T11 – I2C RTC optimized for a lithium battery back-up

Serial RTC
M41T6x – I2C RTC optimized for a supercap back-up

Serial RTC with Security Features
M41ST87 – I2C RTC in an embedded crystal package, physical tamper detect and Microprocessor Supervisor

Serial RTC with Analog Calibration
M41T82 – I2C RTC with reset
M41T83/93 – I2C/SPI RTC with reset and programmed calibration in embedded package

Microprocessor Supervisors
STM69x/ STM7xx / STM8xx / STM63xx /STM68xx – Reset, Watchdog, Early Power Fail Warning, Switch Over

Temperature Sensor
STLM75 : Digital Temperature Sensor
STLM20 : Analog Temperature Sensor

Single Voltage Reset
STM8xx/ STM1001 / STM18xx – Reset with Push-Pull, Open drain, Open Drain with pull-up resistor or Open Drain bi-directional output
Low cost single Chip GPRS solutions: PNX4902

- Highest integration and smallest footprint
  - Integration in a single chip for best-in-class power consumption and cost-driven solutions
  - Industry's smallest footprint
- Robust, powerful and cost-effective
  - Platforms are thoroughly tested and operator approved before market release
  - Reduced cost through optimized platform size and minimal external components
- Lowest cost of ownership
  - Lowest-cost BOM, fewer PCB layers, Simplified supply chain
  - Enhanced yield and reliability
  - Optimized factory test times
    - More system specs pre-tested at IC-level
- Highest performance
  - Best-in-class RF performance
    - Based on proven Aero XCVR, over 500M handsets shipped worldwide
    - Large margin to all GCF RF specs
  - Industry-lowest power consumption
Commodities
EEPROM

ST N° 1 WW supplier

Source: Actual iSuppli, Competitive landscape March 08
## Broadrange Portfolio of EEPROM

### Table

<table>
<thead>
<tr>
<th>Bus</th>
<th>Density</th>
<th>1Kb</th>
<th>2Kb</th>
<th>4Kb</th>
<th>8Kb</th>
<th>16Kb</th>
<th>32Kb</th>
<th>64Kb</th>
<th>128Kb</th>
<th>256Kb</th>
<th>512Kb</th>
<th>1 Mb</th>
<th>2 Mb</th>
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<td>SO8</td>
<td>M95020</td>
<td>M95040</td>
<td>M95080</td>
<td>M95160</td>
<td>M95320</td>
<td>M95640</td>
<td>M95128</td>
<td>M95256</td>
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<td>M95M01</td>
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</tbody>
</table>

### Notes

- * Under development
- PDIP package available for I²C 1Kb to 64Kb, and for MICROWIRE 1Kb
- M93S series feature programmable write protect
Innovative in High Density

2005 to 2010:
- 256Kb-512Kb-1Mb

- **2007**
  - 1Mb SO8N in full prod
- **2009**
  - First
  - 512Kb in MLP 2x3
- Since Q1 2011:
  - NEW
  - 2Mb I²C & SPI in SO8N

- LCD Panel
- TV
- Metering
- Bluetooth
- Hearing Aids
Lockable Page EEPROM

- Helps you to store parameters, which must remain permanently protected:
  - ST Device ID
  - Unique ID
  - Serial Number
  - Board description
  - Traceability code
  - Packages: SO8N, TSSOP8 and MLP 2x3

<table>
<thead>
<tr>
<th>Product</th>
<th>Salestype</th>
<th>Availability</th>
</tr>
</thead>
<tbody>
<tr>
<td>2Mb I²C &amp; SPI</td>
<td>M24M02-DRxxx</td>
<td>Q1 2011</td>
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<tr>
<td></td>
<td>M95M02-DRxxx</td>
<td>Q1 2011</td>
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<tr>
<td>1Mb I²C &amp; SPI</td>
<td>M24M01-DRxxx</td>
<td>2011</td>
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<td>M95M01-DRxxx</td>
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<td>512Kb I²C &amp; SPI</td>
<td>M24512-DRxxx</td>
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<td>M95512-DRxxx</td>
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<tr>
<td>256Kb I²C &amp; SPI</td>
<td>M24256-DRxxx</td>
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<td>M95256-DRxxx</td>
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</tr>
<tr>
<td>128Kb I²C &amp; SPI</td>
<td>M24128-DRxxx</td>
<td>2011</td>
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<td>M95128-DRxxx</td>
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<tr>
<td>64Kb I²C &amp; SPI</td>
<td>M24C64-DRxxx</td>
<td>Available Q1 2011</td>
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<td>M95640-DRxxx</td>
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<tr>
<td>32Kb I²C &amp; SPI</td>
<td>M24C32-DRxxx</td>
<td>2011</td>
</tr>
<tr>
<td></td>
<td>M95320-DRxxx</td>
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</tbody>
</table>
New Specific product: Event recorder

- Enables design for real time and fast data recording in EEPROM
  - Record 256 bytes of data in one shot in less than 1 ms
  - Low power consumption makes it easy to supply from small size capacitor (unlike Flash).
  - Ideal to handle unexpected power off situation
- Suited for Metering, Industrial applications
- Product features
  - 32Kb SPI EEPROM
  - Large page size of 256 bytes
  - Fast write EE area: program in less than 1 ms for 256 bytes!
  - SO8 & TSSOP8 and MLP2x3 packages
  - Fast clock frequency: >10Mhz at 2.5V

Product name: M35B32, samples available March’11
The Dual Interface EEPROM is an electrically-erasable memory which communicates with Read and Write attributes through:

- a wired I²C interface with MCU or chipset
- RF, using an industry-standard ISO 15693 which does not require any on-board power
Enabling a wide range of use cases...

MANUFACTURING & LOGISTICS
- Parameter setting
- Activation key
- Factory settings
- Traceability

SERVICING & MAINTENANCE
- Fault report
- Wear-out information
- Activation parameters
- Traceability
- Tamper Detection

END USER
- Model ID
- Customer ID
- Usage/load information
- Event recorder
- Traceability

Activation parameters
Fault report
Wear-out information
Tamper Detection
Parameter setting
Activation key
Factory settings
Traceability

STMicroelectronics
Portfolio of serial RTCs

Low Power < 500nA
- Supercap backup
- No backup
- 1.8V applications

Battery Backup
- Analog Calibration
  - M41T82
  - M41T83
  - M41T93
- Digital Calibration
  - M41T56
  - M41ST84
  - M41T94
  - M41ST85
  - M41ST95

Simple RTC
- M41T60

Alarm + 32KHz
- M41T62
- M41T66

Alarm + WD
- M41T65

Dual 32KHz
- M41T64

Best fit for long life
Gas, Heat and water

Accuracy
- Analog Calibration
  - M41T82
  - M41T83
  - M41T93

No Calibration
- M41T0
- M41T80

Digital Calibration
- Go to Low Power or Full Featured

Full Featured
- Alarm + WD
  - M41T81(S)
  - M41T80
  - M41T6x

Reset & Supervisors
- M41ST84/T94
- M41ST85
- M41ST95
- M41T83
- M41T93
- M41T82 (no WD)

Tamper
- M41ST87
Commodities Kit for Electricity Meter

**POWER SUPPLY**
- Turbo II diodes:
  - STTH8R06D/ STTH8L06D
  - STTH5R06D/STTH5L06D
  - STTH110
- 150V Schottky:
  - STPS1150
  - STPS2150
- Linear regulator
  - L78xx

**PROTECTION / VOLTAGE REFERENCE**
- Transils:
  - P6KExx, SM6Txx, SMBJxx
  - SM15Txx, SMCJxx
  - BZW06xx, BZW50xx

**ESD PROTECTION**
- RS232 / 422
  - ESDA25B1+ESDA25SC6

**REVERSE BATTERY**
- Schottky diodes:
  - STPS1L60 / STPS0560Z

**ESD for display**
- ESDA6V1-5W6
Other Smart Grid tools
ST : Meter with communication interface

- SMPS
- External Flash
- EEPROM
- Metrology (AFE + legal FW)
- MCU Application
- MCU Communication
- Sensor(s)
- Isolation
- Anti tamper
- Backup battery
- LCD
STEVAL-IPP002V
Smart meter system for AMI

- Compatible to STPMxx AFE application
- DLMS/COSEM Application available by 3rd party
- PLC communication integrated based on SFSK modulation (ST7570)
- Compatible to Linky Spec G1
ST technology and qualifying factors in Smart Metering

ST offers a unique mix of qualifying factors:

- Reliable and independent Semiconductor vendor
- World wide support and supply chain to any subcontractor
- Wide electronic meter system coverage with a complete kit of advanced semiconductor devices
- Ability to identify, support and adapt to market evolution trends and changes
- ST approach is to promote open standards and provide cost effective royalty-free solutions
- Long term presence in the AMR market and strong field based system know-How