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New Ultra-Low Power devices

from EM Microelectronic

EVV 2009 conference

Prague, Czech Republic, Jun. 9, 2009

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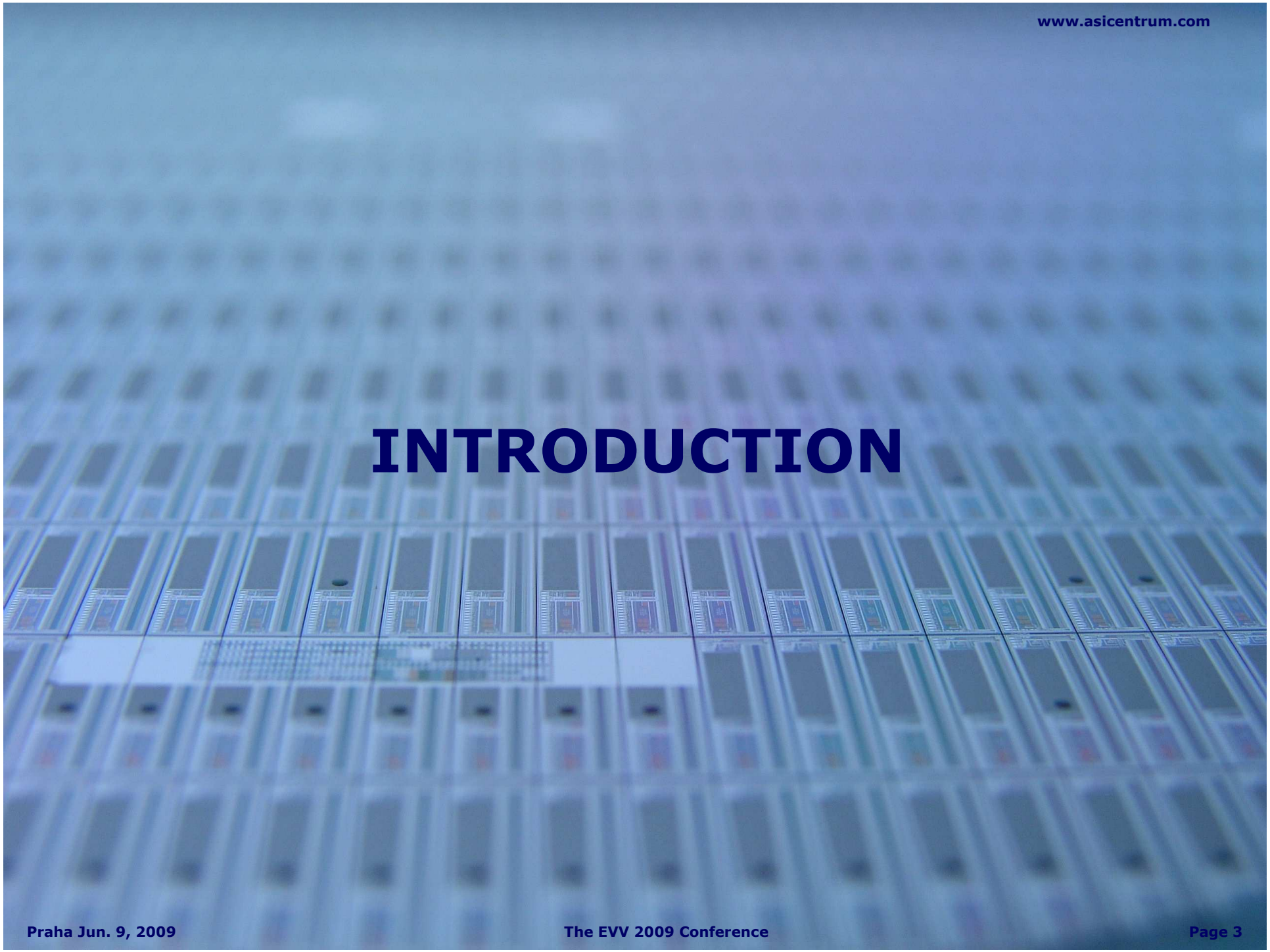
AGENDA

- Introduction
- EM Microelectronic Standard devices portfolio
- EM6819 – 8bit, FLASH ultra low-power microcontroller family
- EM6420 – Capacitive Touch Sensor Interface IC
- EM3027 – RTC, Crystal Temp. Compensation, Battery Switchover
- EM7604 - Very Low Power Crystal Oscillator 32.768kHz
- Hot news: EM9201 - World's First Fully Integrated Single-Cell Battery 2.4 GHz Transceiver

  EM6869 - 8bit, FLASH ultra low-power uC with 125kHz transponder and UHF transmitter
- Q & A



INTRODUCTION

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ASICentrum®
A COMPANY OF THE SWATCH GROUP

Founded in 1992

~ 50 employees nowadays

EM MICROELECTRONIC
SWATCH GROUP ELECTRONIC SYSTEMS

Founded in 1970

~ 600 employees nowadays

SWATCH GROUP

Founded in 1983

~ 20.000 employees nowadays

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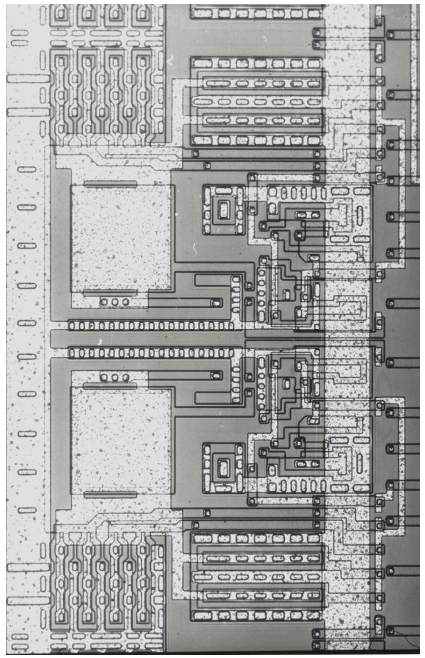
MAIN ACTIVITIES



IC design

Both ASIC and standard mixed-signal integrated circuits

- **Ultra low power**
- **Low voltage**
- **Sensors (optical, acceleration, magnetic, temperature, ...)**
- **Non-volatile memory (EEPROM and FLASH)**

MENTOR GRAPHICS EDA software

distribution in CZ and SK,

sales, technical support,

training and hotline

Mentor Graphics
The Power to Create

Training, consulting

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USA
(Colorado Springs)

Germany
(Frankfurt)

France
(Paris)

Switzerland
(Marin)

Prague

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Shanghai
& Shenzhen

Bangkok

Singapore

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EM Microelectronic Standard devices portfolio

RF Identification
Read Only, Read/Write
125kHz, 13.56MHz
UHF, 2.45GHz
Crypto
Anti-Collision
ISO compliance

S&A interfaces
MEMS Interfaces (accelerometers, presure, ..)
CMOS Image sensors (OCR, tracking,..)
Mix of Analog, Digital, EEPROM.

STANDARDS
Voltage Supervisors:
- ⇨Reset ICs
- ⇨Watchdogs (WD)
- ⇨Regulators + WD

LCD Drivers
Real Time Clocks

LCD & Modules
Custom specials
Ultra-thin
with holes

SMART CARD ICs
100% FLASH-based memory, Java

MICROCONTROLLER
Ultra-low power (0.2uA)
Ultra-low voltage (0.9V)
Flash & ROM
Field Programmable
Development Tools

Watches
Timing
Sensor interfaces
Human interface

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DESIGN, DEVELOPMENT IN ASICentrum

EM6819

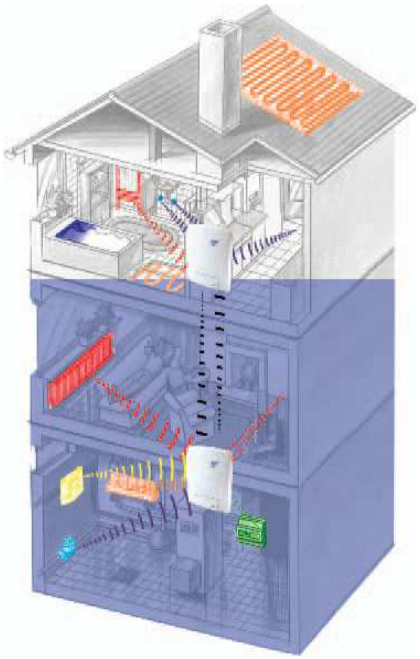
8bit, FLASH ultra low-power microcontroller family

Ideal solution for battery operated applications

Categories of Battery Operated Applications

Periodic action's applications

- Fire Alarms
- Medical Monitoring Devices
- Sports Activity Monitors
- Radio controlled Clocks
- Intelligent Sensors
- Data Loggers
- Heating Cost Meters
- Water / Electricity Metering



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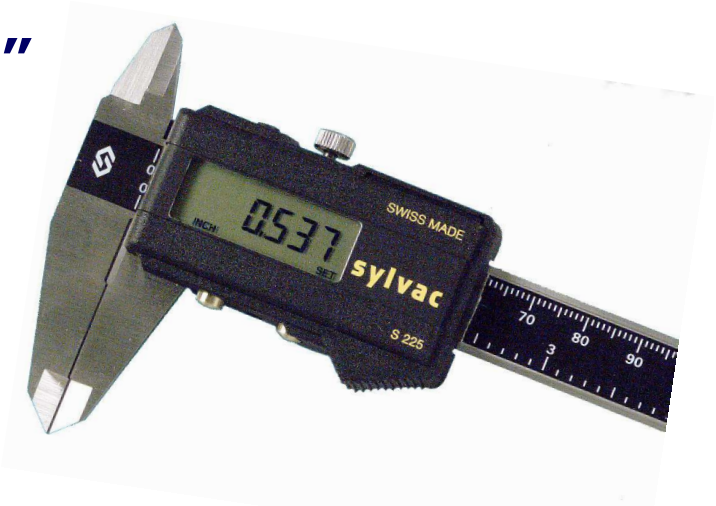
Categories of Battery Operated Applications

Applications "On Demand Actions"

- Intelligent Terminals
- Card Readers
- Measurement Devices
- Multi-meters
- Scales
- Motor Control and Monitoring
- LCD Driver for plastic card



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Categories of Battery Operated Applications

Common to the large majority of applications:

- **Significant periods of inactivity**
  - **Importance of low standby power consumption**

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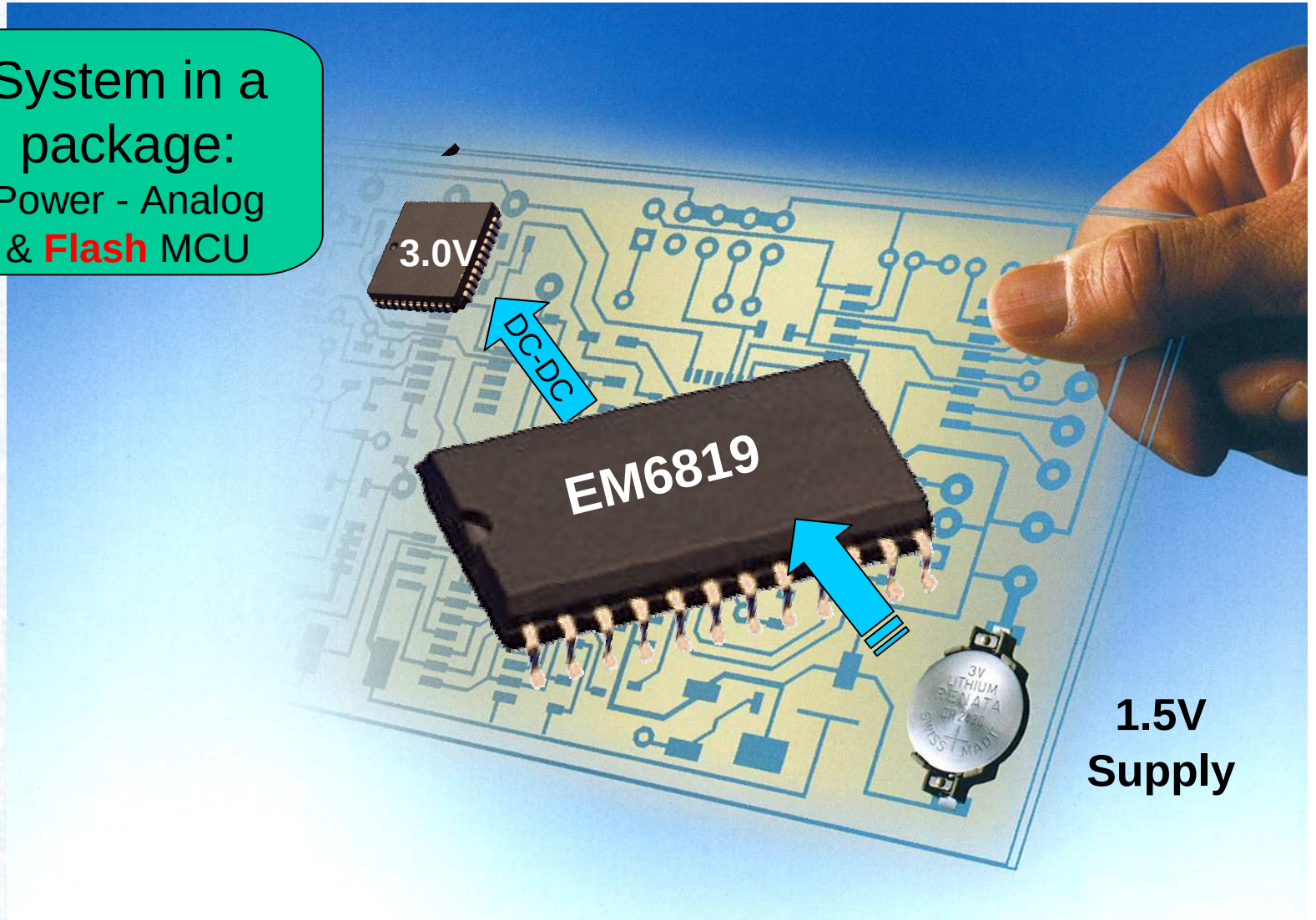
EM6819 microcontroller family

System in a package:
Power - Analog
& **Flash** MCU



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EM6819 microcontroller – basic features

VDD range:
- 0.9V up to 3.6V (no external components)

GPNVM (General Purpose Non Volatile Memory)
- 17kB program memory shared with up to 12kB data

DC-DC up converter:
- 2V 2.4V 2.8V or 3.15V @ 50mA

ADC:
- True 10Bits 8 channels (succ. approx. 110 kSamples/s)

Oscillators:
- Crystal type: 32kHz Crystal or 4MHz resonator
- Fully internal RC type: 8kHz - 2MHz - 15MHz – External clock

3 general purpose I/O ports
- 24 multi-configurable ports for a maximum of flexibility

Misc:
- Temp. sensor, Op-amp/Comp, SCWK, Brownout and start-up Power check

Small package:
- die, TSSOP8 up to TSSOP32

Tools:
- ISP and Debug on Chip

Price:
- approx. 0,35 EUR (10kpcs, TSSOP8 package)

EM6819 microcontroller

Operating modes (typical consumptions @ 3V -40°C up to 85°C)

Active (150uA @ 2MHz, 1.7mA @ 15MHz)

- Full circuit functionality

Standby (3uA @ 32kHz, 15uA @ 2MHz)

- CPU in HALT mode, wake-up with IRQ / Event
- IRQ; CPU branches to IRQ vector
- Event; CPU continues at instruction following the HALT instruction

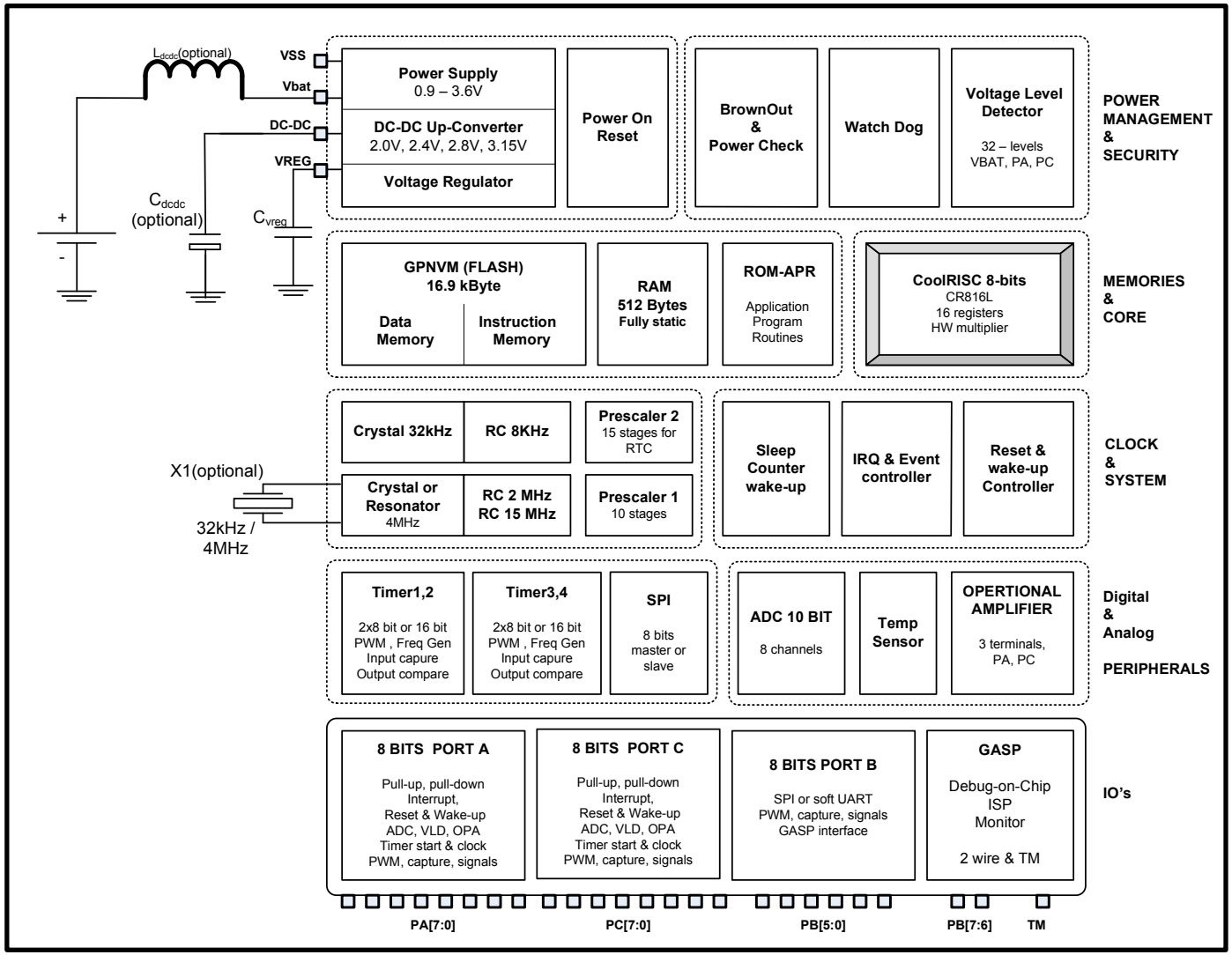
Sleep (1uA)

- CPU in HALT mode, periphery not clocked except for Sleep Counter Wake-up (SCWK) function if enabled.
- Wake up by IRQ (Port A , Port C, VLD, Sleep counter, Opamp, GASP)
- Wake-up by Event (Sleep counter, GASP)
- Need only 300us to resume from sleep mode to active mode

Power down (0.2uA)

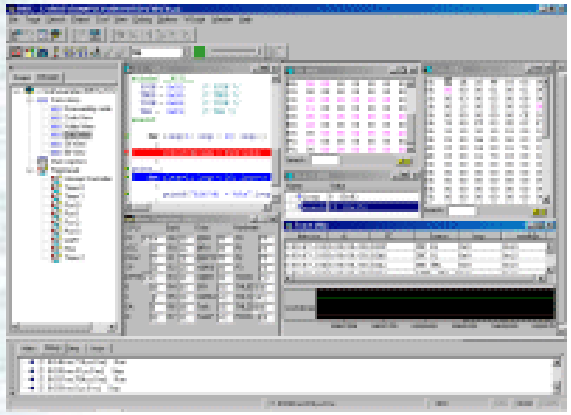
- CPU and periphery in reset state
- Locking IO configuration during power down (direction, drive, pull)
- Wake-up by PortA input change

EM6819 Microcontroller : Block Diagram



EM6819's tools

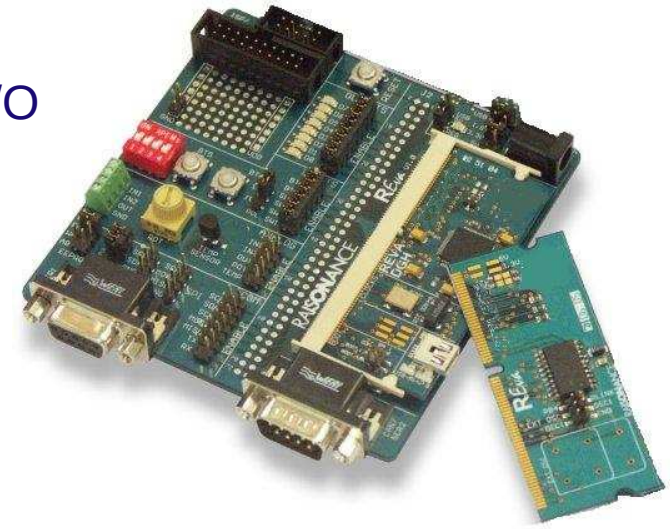
In collaboration with our third party « Raisonance »



RIDE: fully featured IDE from editing to compiling, linking, debugging

On-Chip Debugging **DoC**
In-system programming **ISP**

REva+ : starter-kits Digital and analog I/O evaluation features including on-board LEDs, buttons, switches, external analog connector, temperature sensor and potentiometer



RLink: for in-circuit debugging and in-system programming

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EM6819 family

	Part number	Flash code (KWords)	max NVM data (KB)	RAM (B)	VDD range (V)	DC/DC converter	GPIOs pins	Digital communication	Clock speed	Internal oscillator	8bit Timers	PWM (up to channel)	10bit ADC (up to channel)	Temp. Sensor	Additional analog	Additional digital	self write for software update	Debug On Chip / ISP	Package(s) Note 1
2K word Flash (5.6kByte)	EM6819F2-B006	2	4	256	0.9 - 3.6	-	04 to 12	SPI SW-UART / I2C	15MHz	RC 8kHz 2MHz 15MHz	4	4	-	-	PwrCk Brown-Out VLD	SCWUP WD	✓	✓	SO08 TSSOP16
	EM6819F2-B000	2	4	512	0.9 - 3.6	-	12 to 24	SPI SW-UART / I2C	15MHz	RC 8kHz 2MHz 15MHz Crystal 32kHz - 4Mhz	4	4	8	✓	PwrCk Brown-Out OPAMP VLD	SCWUP WD	✓	✓	TSSOP16-20-28 QFN20
	EM6819F2-A000	2	4	512	0.9 - 3.6	✓	12 to 20	SPI SW-UART / I2C	15MHz	RC 8kHz 2MHz 15MHz Crystal 32kHz - 4Mhz	4	4	8	✓	PwrCk Brown-Out OPAMP VLD	SCWUP WD	✓	✓	TSSOP20-28 QFN20
	EM6819F2-B300	2	4	512	1.8 - 5.5	-	16 to 24	SPI SW-UART / I2C	15MHz	RC 8kHz 2MHz 15MHz Crystal 32kHz - 4Mhz	4	4	6	✓	PwrCk Brown-Out OPAMP VLD	SCWUP WD	✓	✓	TSSOP20-28
4K word Flash (11.5kByte)	EM6819F4-B005	4	8	256	0.9 - 3.6	-	04 to 12	SPI SW-UART / I2C	15MHz	RC 8kHz 2MHz 15MHz	4	4	4	-	PwrCk Brown-Out OPAMP VLD	SCWUP WD	✓	✓	SO08 TSSOP16
	EM6819F4-A005	4	8	256	0.9 - 3.6	✓	08 to 12	SPI SW-UART / I2C	15MHz	RC 8kHz 2MHz 15MHz	4	4	4	-	PwrCk Brown-Out OPAMP VLD	SCWUP WD	✓	✓	TSSOP16-20 QFN20
	EM6819F4-A000	4	8	512	0.9 - 3.6	✓	12 to 24	SPI SW-UART / I2C	15MHz	RC 8kHz 2MHz 15MHz Crystal 32kHz - 4Mhz	4	4	8	✓	PwrCk Brown-Out OPAMP VLD	SCWUP WD	✓	✓	TSSOP20-28 QFN20-32
	EM6819F4-B000	4	8	512	0.9 - 3.6	-	12 to 24	SPI SW-UART / I2C	15MHz	RC 8kHz 2MHz 15MHz Crystal 32kHz - 4Mhz	4	4	8	✓	PwrCk Brown-Out OPAMP VLD	SCWUP WD	✓	✓	TSSOP16-20-28
	EM6819F4-B100	4	8	512	1.8 - 3.6	-	12 to 24	SPI SW-UART / I2C	15MHz	RC 8kHz 2MHz 15MHz Crystal 32kHz - 4Mhz	4	4	8	✓	PwrCk Brown-Out OPAMP VLD	SCWUP WD	✓	✓	TSSOP16-20-28 QFN20
	EM6819F4-B300	4	8	512	1.8 - 5.5	-	16 to 24	SPI SW-UART / I2C	15MHz	RC 8kHz 2MHz 15MHz Crystal 32kHz - 4Mhz	4	4	6	✓	PwrCk Brown-Out OPAMP VLD	SCWUP WD	✓	✓	TSSOP20-28
8K word Flash (16.9kByte)	EM6819F6-B004	6	12	512	0.9 - 3.6	-	04 to 24	SPI SW-UART / I2C	15MHz	RC 8kHz 2MHz 15MHz	4	4	8	✓	PwrCk Brown-Out OPAMP VLD	SCWUP WD	✓	✓	SO08 TSSOP16-20-28
	EM6819F6-A000	6	12	512	0.9 - 3.6	✓	12 to 24	SPI SW-UART / I2C	15MHz	RC 8kHz 2MHz 15MHz Crystal 32kHz - 4Mhz	4	4	8	✓	PwrCk Brown-Out OPAMP VLD	SCWUP WD	✓	✓	TSSOP20-28 QFN20-32
	EM6819F6-B100	6	12	512	1.8 - 3.6	-	12 to 24	SPI SW-UART / I2C	15MHz	RC 8kHz 2MHz 15MHz Crystal 32kHz - 4Mhz	4	4	8	✓	PwrCk Brown-Out OPAMP VLD	SCWUP WD	✓	✓	TSSOP16-20-28
	EM6819F6-A100	6	12	512	1.8 - 3.6	✓	12 to 24	SPI SW-UART / I2C	15MHz	RC 8kHz 2MHz 15MHz Crystal 32kHz - 4Mhz	4	4	8	✓	PwrCk Brown-Out OPAMP VLD	SCWUP WD	✓	✓	TSSOP20-28 QFN20-32
	EM6819F6-B300	6	8	512	1.8 - 5.5	-	16 to 24	SPI SW-UART / I2C	15MHz	RC 8kHz 2MHz 15MHz Crystal 32kHz - 4Mhz	4	4	6	✓	PwrCk Brown-Out OPAMP VLD	SCWUP WD	✓	✓	TSSOP20-28

NVM	Non Volatile Memory	PWM	Pulse Width Modulation
RAM	Random Access Memory	ADC	Analog to Digital Converter
GPIO	General Purpose Input Output	OPAMP	Operational Amplifier
SPI	Serial Peripheral Interface	PwrCk	Power Check on start-up
RC	Fully embedded RC Oscillator	VLD	Voltage Level Detector
Crystal	Oscillator on chip	ISP	In System Programming
WD	Digital Watch-dog	SCWUP	Sleep Counter Wake-Up

Note 1 : Ask for package & volume availability

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EM6420

Capacitive Touch Sensor Interface IC

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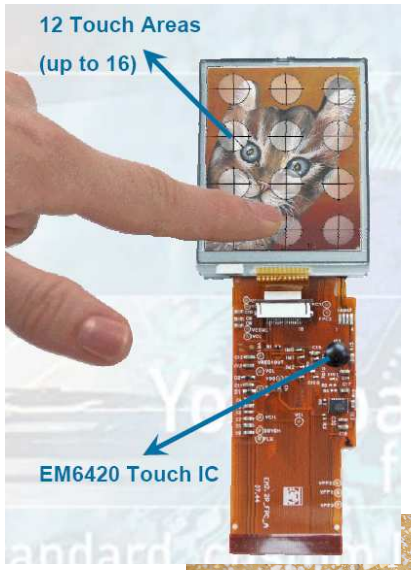
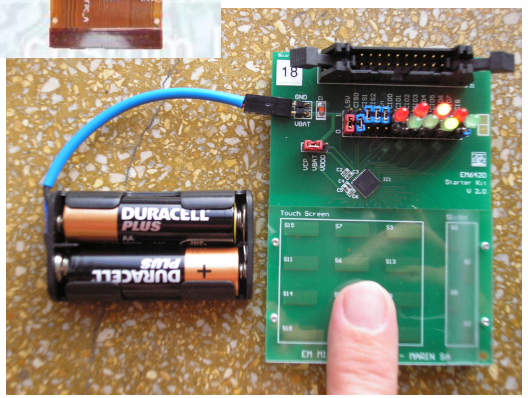
EM6420 Capacitive Touch Sensor Interface IC

Basic features:

Up to 16 analogue sensor inputs (or more in EM6420 chain connection)

- **User selectable communication interfaces : 4-wire SPI, I2C, 4bit parallel interface and 8-bit direct output**
- **User-selectable active edge IRQ output signal**
- **Active high enable input**
- **No software development and tuning required**
- **Development tools and documentations available**





Design Considerations:

The EM6420 is well suited for battery and mains powered applications where the following features are important :

- **Tamper proof applications**
- **Nice and clean designs**
- **Touch function to avoid buttons and keys**
- **Slider functions**
- **Hygienic issues, cleaning aspects**
- **Waterproof designs applications**
- **Mobile phones, cordless phones, PDA, keyboards**
- **White & brown goods**
- **Toys**
- **Lighting - Sliders for dimming**

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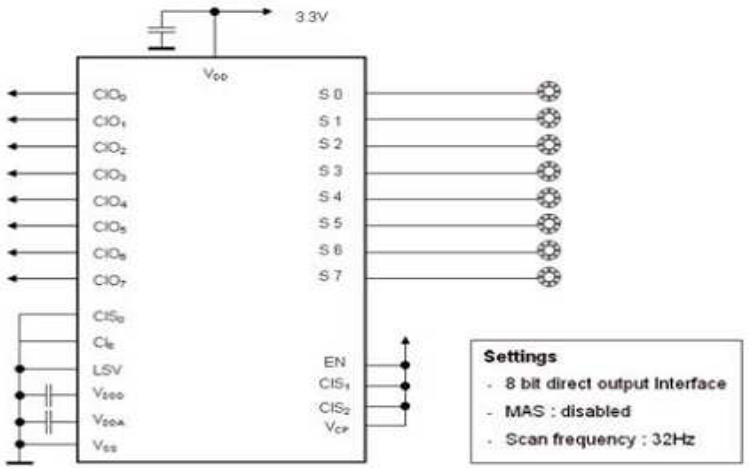
EM6420 Capacitive Touch Sensor Interface IC

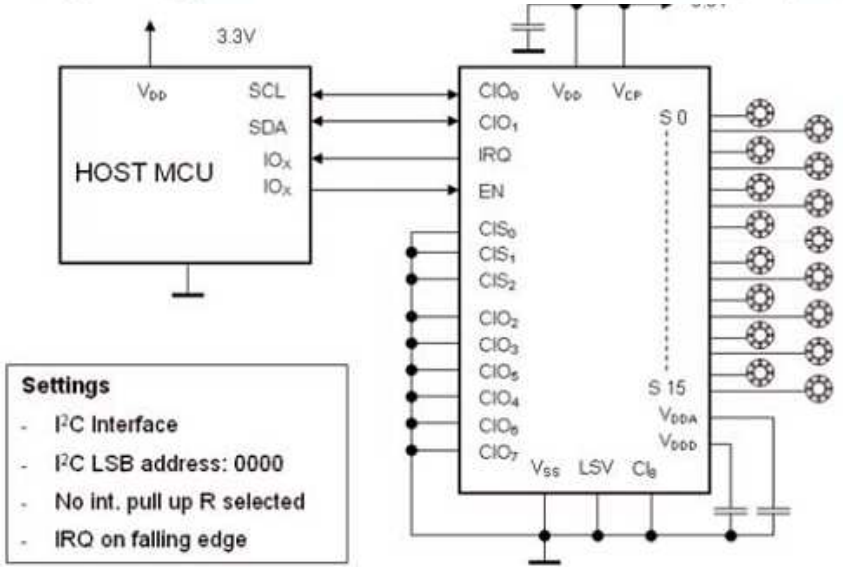
Electrical Characteristics:

Supply voltage:	**1.2V to 2.0V or 2.2V to 3.6V**
Power consumption active:	**8.5 µA @ 3.0 V**
Power consumption standby:	**5.5 µA @ 3.0 V**
Power consumption sleep:	**below 0.6 µA @ 3.0 V**
Nominal sensor capacitance:	**3 to 31 pF**
Sensors scan frequency:	**1 Hz to 128 Hz (frequency depending on number of sensors)**
Availability:	**Naked die or SMT package MLF40**

Typical Application in Stand Alone Mode and 8 Sensing Inputs



Typical Application with a Host MCU and 16 Sensing Inputs



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DESIGN, DEVELOPMENT IN ASICentrum

EM3027

Real Time Clock, Crystal Temperature Compensation, Battery Switchover

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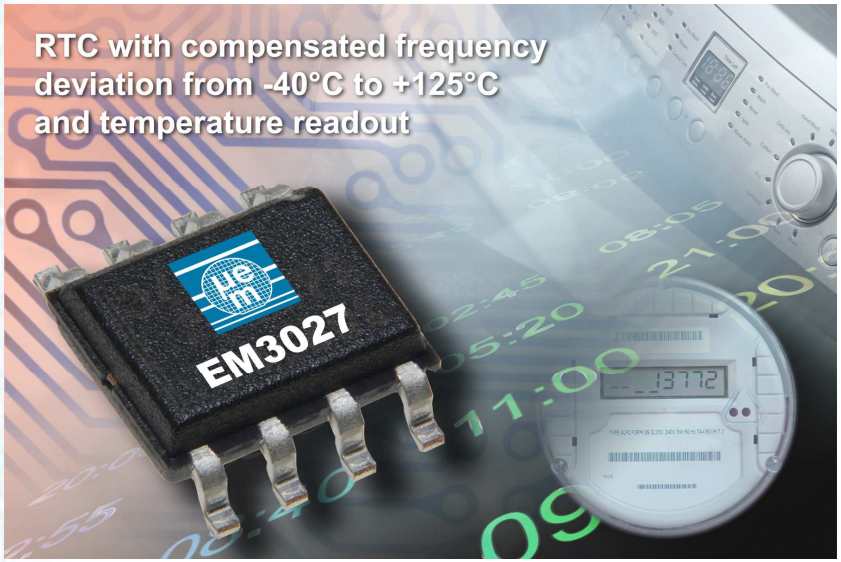
EM3027 – basic features

- Fully operational from 2.2 to 5.5V
- Supply current typically 600 nA at 1.4V
- Thermal compensated crystal frequency
- Oscillator stability 0.5 ppm / Volt
- Counter for seconds, minutes, hours, day of week, date months, years and alarm
- Leap year compensation
- 16-bits timer with 2 working modes
- Automatic supply switchover
- Serial communication via I2C or SPI
- *Thermometer readable by the host*
- Trickle charger to maintain battery charge
- Integrated oscillator capacitors
- Two EEPROM and 8 RAM data bytes for application
- Support for standard UL1642 for Lithium batteries
- Extended temperature range: -40°C to +125°C
- Packages: TSSOP8, TSSOP14

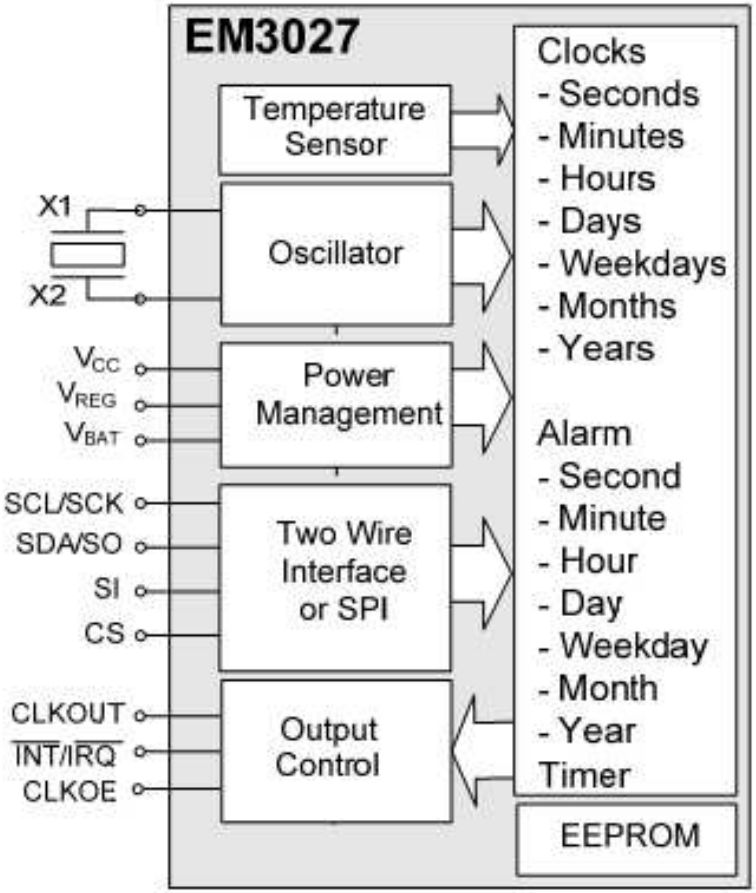
EM3027 Real Time Clock device

Typical Applications

- Utility meters
- Battery operated and portable equipment
- Consumer electronics
- White/brown goods
- Pay phones
- Cash registers
- Personal computers
- Programmable controller systems
- Automotive systems
- Data loggers



Block diagram



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EM7604

EM7604 - Very Low Power Crystal Oscillator 32.768kHz

EM7604 – basic features

- All-in-one-package solution
- Miniature ceramic package for SMD mounting
- Very low power consumption: typ. 300nA
- Very tight frequency tolerance
- Excellent oscillator stability: 0.2 ppm/V
- Wide supply voltage range: 1.2V to 5.5V
- Operating temperature range: -40°C to +85°C
- On request: extended temperature range: -40°C to +125°C
- Slow aging
- High shock and vibration resistance
- 100% lead free, RoHS compliant

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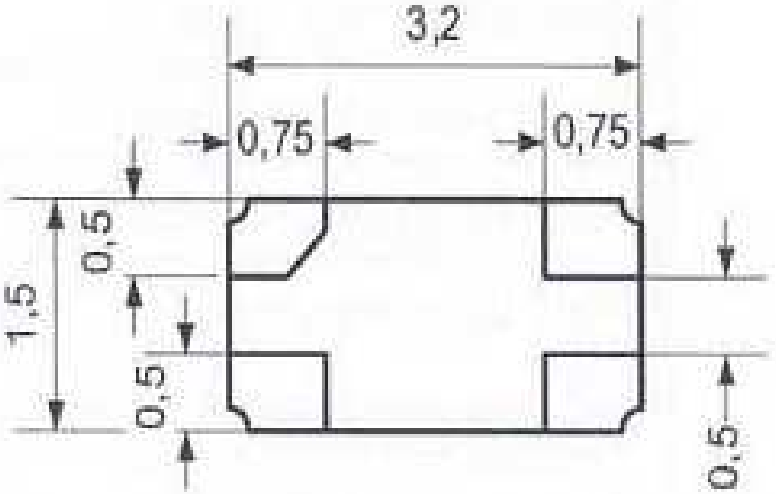
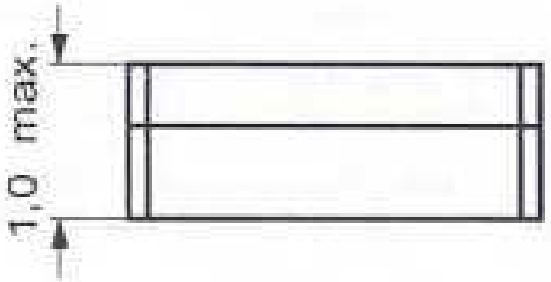
EM7604 – C7 Package

3.2 x 1.5 x 1.0 mm

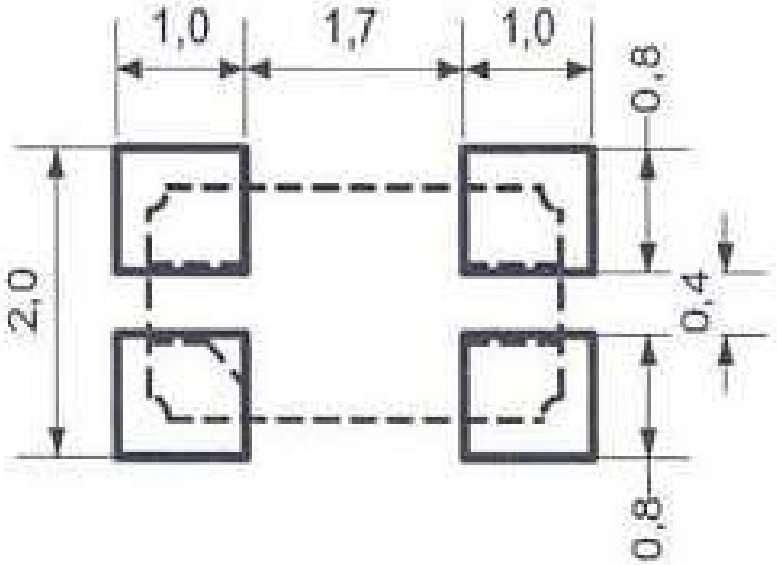
EM7604 – C7 Package dimension

Package:





Recommended Solder Pad:



All dimensions in mm typical

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EM9201

World's First Fully Integrated Single-Cell Battery 2.4 GHz Transceiver

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EM9201 - 2.4 GHz Transceiver

Low Voltage 2.4 GHz Transceiver compatible with Bluetooth low energy wireless technology

EM9201 – basic features

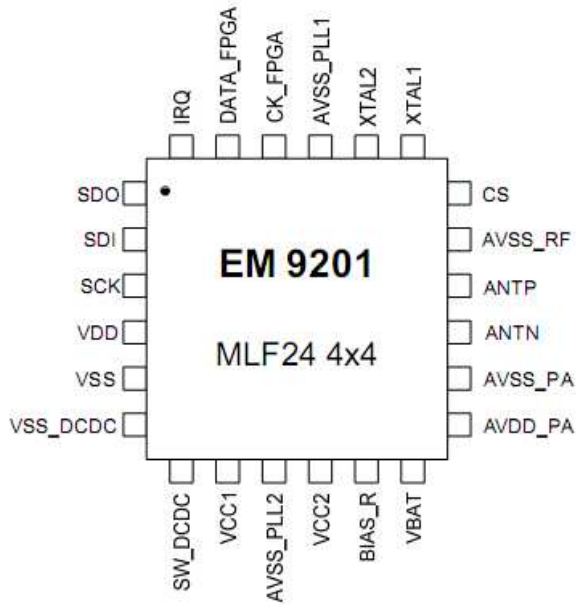
- **Single cell 1.5V battery operation (Alkaline AA, AAA)**
- **Operation down to VBAT = 0.8 V (for start-up --> 1.0V)**
- **3 V Lithium battery as alternative**
- **Bluetooth Low Energy-compliant GFSK modulation**
- **On air data rate configurable to 1Mb/s (or 2Mb/s in EM9202 version)**
- **Programmable RF output level: -20 dBm … + 4dBm in 8 steps**
- **No antenna matching elements needed through appropriate PCB antenna design**
- **200 Ω differential impedance of antenna port**
- **Low-cost 26MHz Xtal**
- **Current consumption (on VCC, VCC =2.1V, 2Mb/s)**
- **12.5 mA in RX**
- **11.5 mA in TX (0dBm output power)**
- **3.0 µA in sleep-mode (DC/DC running on RCosc)**
- **0.8 µA in power-down mode (3V version, DC/DC off)**
- **MLF24 package**

EM9201

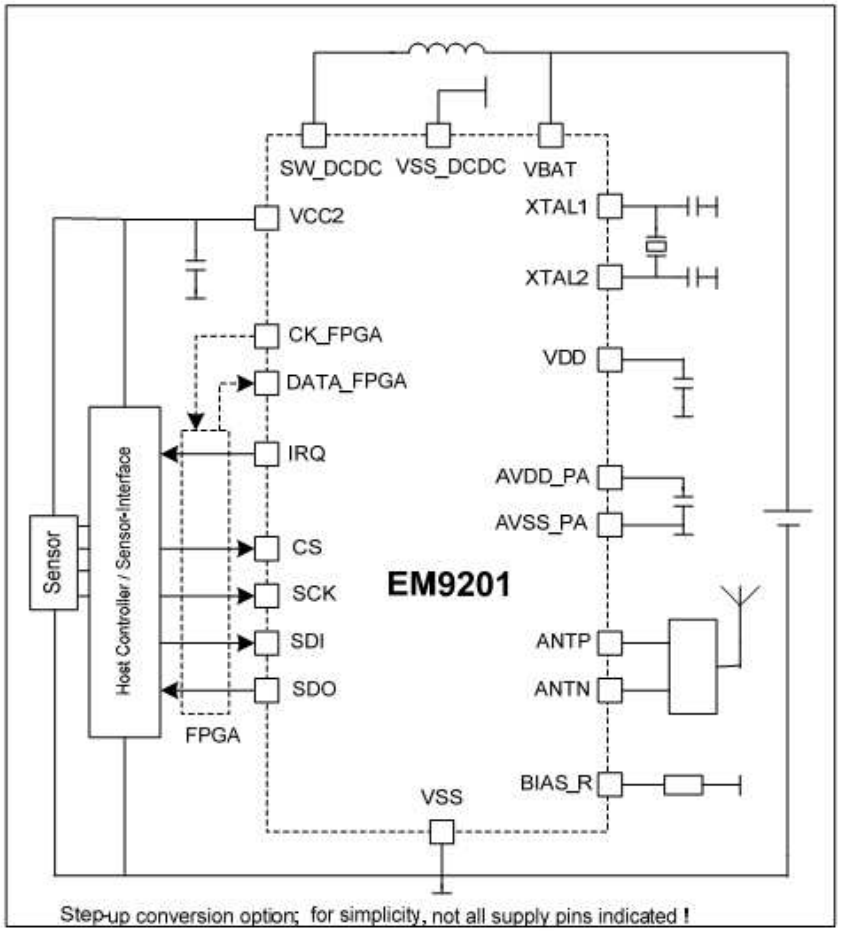
Applications examples:

- Remote sensing in general
- Wireless mouse, keyboard etc.
- Wireless sensors in watches
- Wireless sports equipment
- Alarm and security systems

Pin Assignment



Typical Application Schematic



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DESIGN, DEVELOPMENT IN ASICentrum

EM6869

8bit, FLASH ultra low-power microcontroller with 125kHz RFID transponder and UHF transmitter

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EM6869

Do you need to cut down your BOM?

- ***Even though a communication***  ***wireless is requested?***

- ***The NEW Innovative EM6869 is the right solution !***

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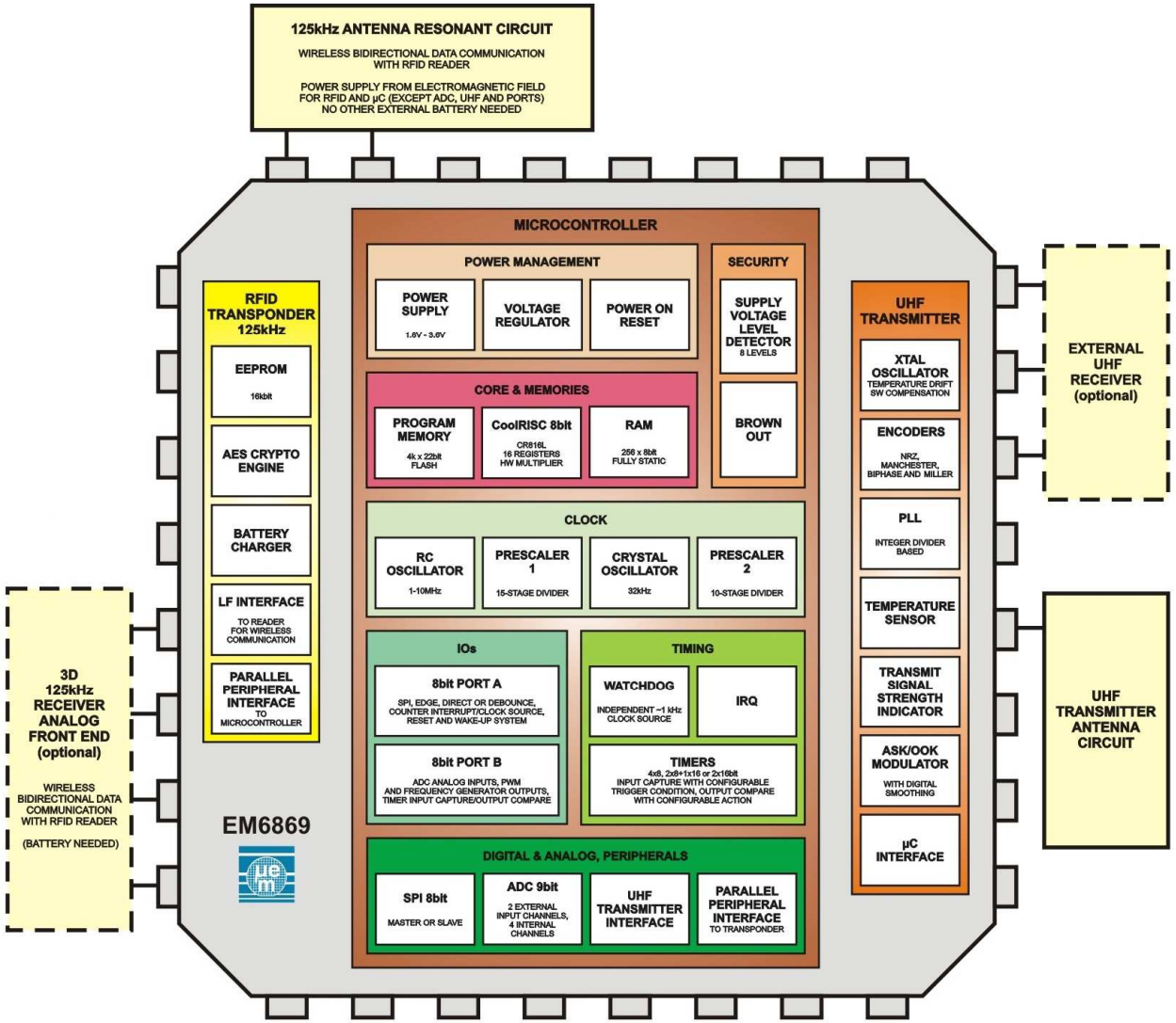
EM6869 microcontroller – basic features

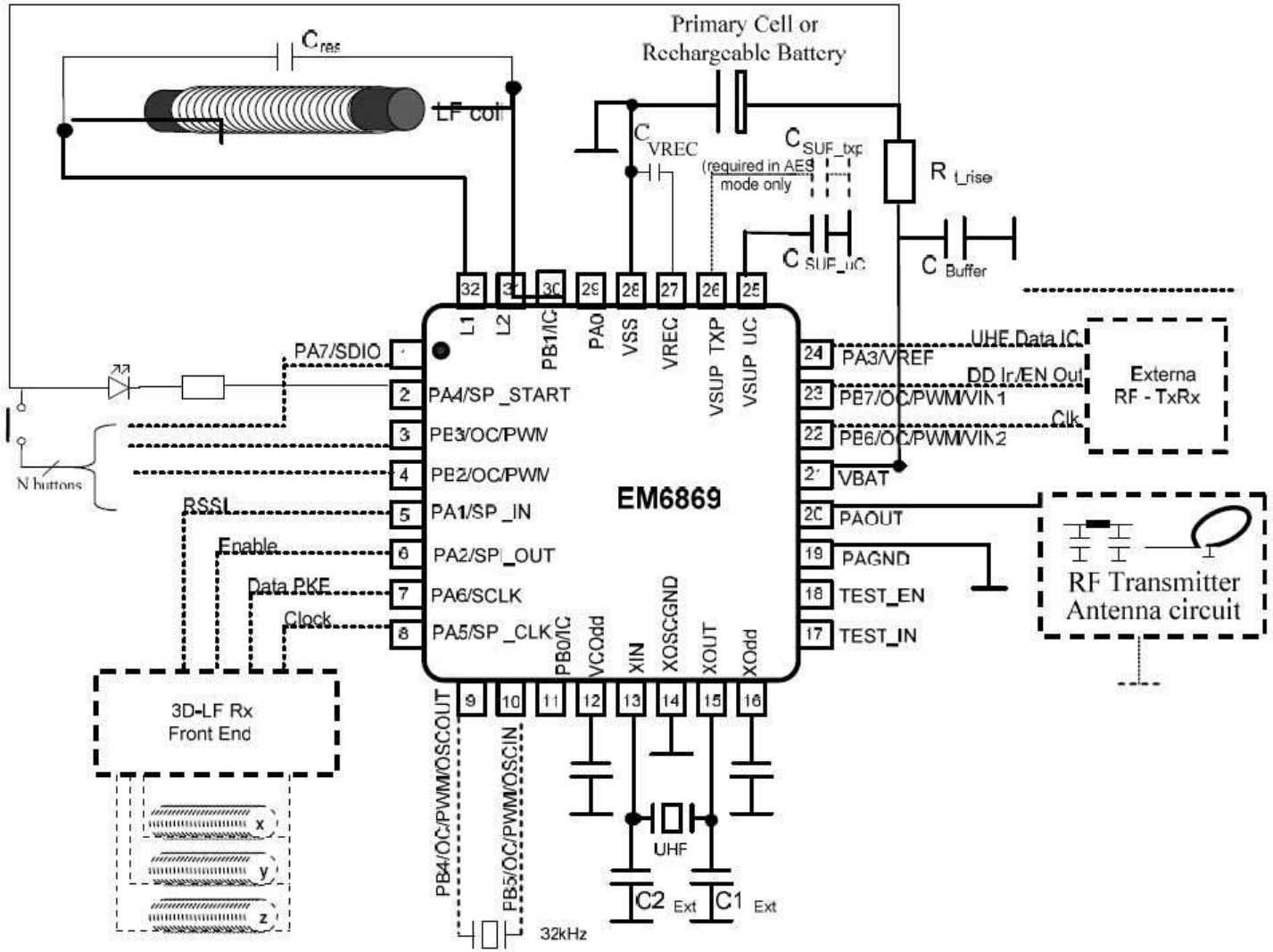
Low power 8bits MCU, Flash, 9bits ADC, EEPROM, LF transponder (125kHz), UHF transmitter (300M to 1GHz), Crystal 32kHz

◆ **Voltage range**	**1.8 to 3.6V, internal voltage regulator**
◆ **Supply current**	**typ. 200nA (in power down mode)**
◆ **Internal RC Oscillator**	**1MHz or 10MHz, factory pre-trimmed**
◆ **External Oscillator**	**32kHz watch type crystal**
◆ **Flash**	**4k Instructions (4092x22) → 11.2 Kbytes**
◆ **EEPROM**	**2 kByte non volatile memory**
◆ **SVLD**	**8 Supply voltage Levels from 1.9V to 2.6V**
◆ **Brown Out**	**Brownout Detection & Start-Up Power check**
◆ **ADC**	**2 channels 9bits ADC**
◆ **UHF Transmitter**	**300 to 1000 Mhz Output frequency, FSK/OOK (ASK), Manchester Encoder, –20dBm to +10dBm**
◆ **RFID Transponder**	**Battery-less 125kHz Crypt functionality, AES (open standard crypt - which can be also used by the MCU), transmission rate 4kbps, 2kBytes of free User Memory**

EM6869 – block diagram



EM6869 – typical application



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❖Questions & Answers

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THANK YOU FOR YOUR ATTENTION

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