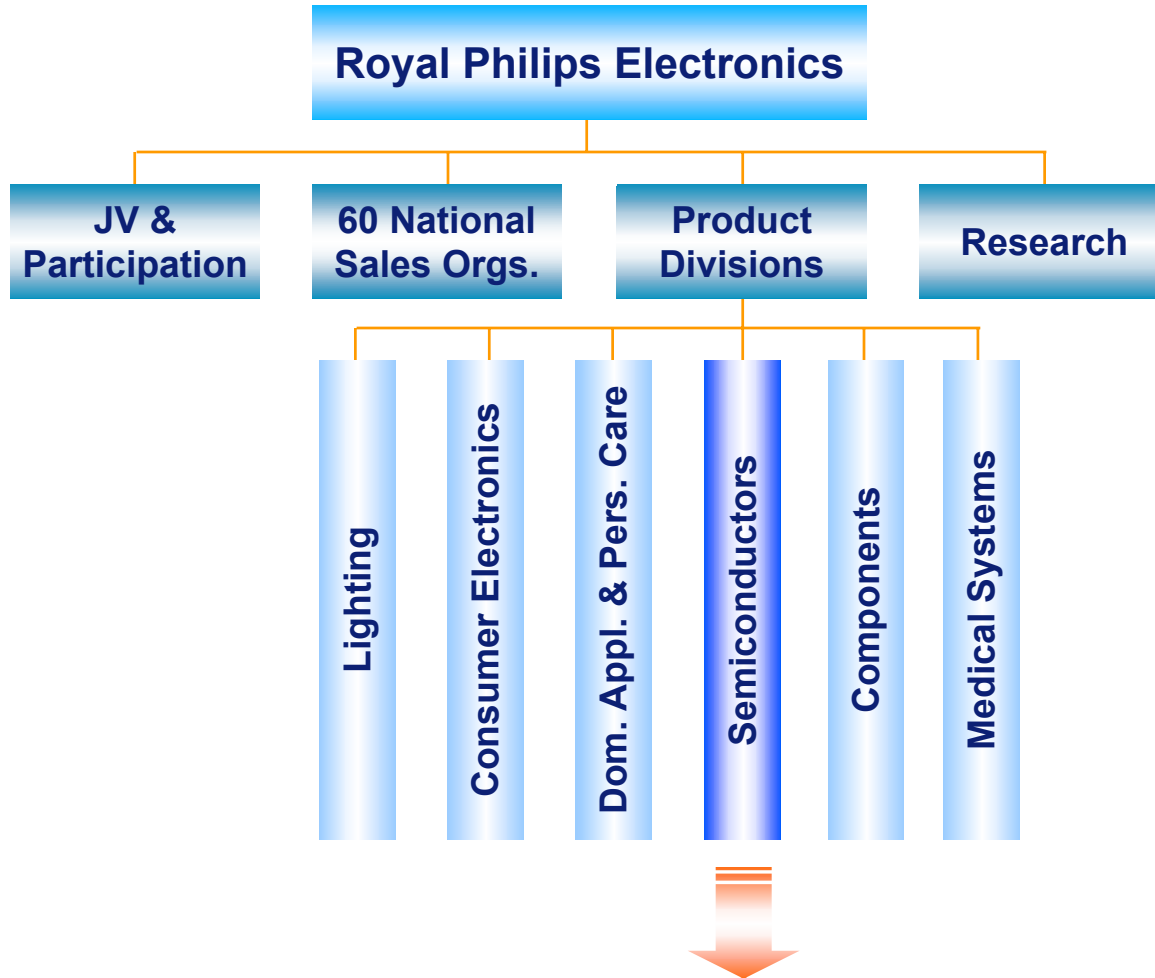


PHILIPS

P89LPC900 Family CMP NetSeminar

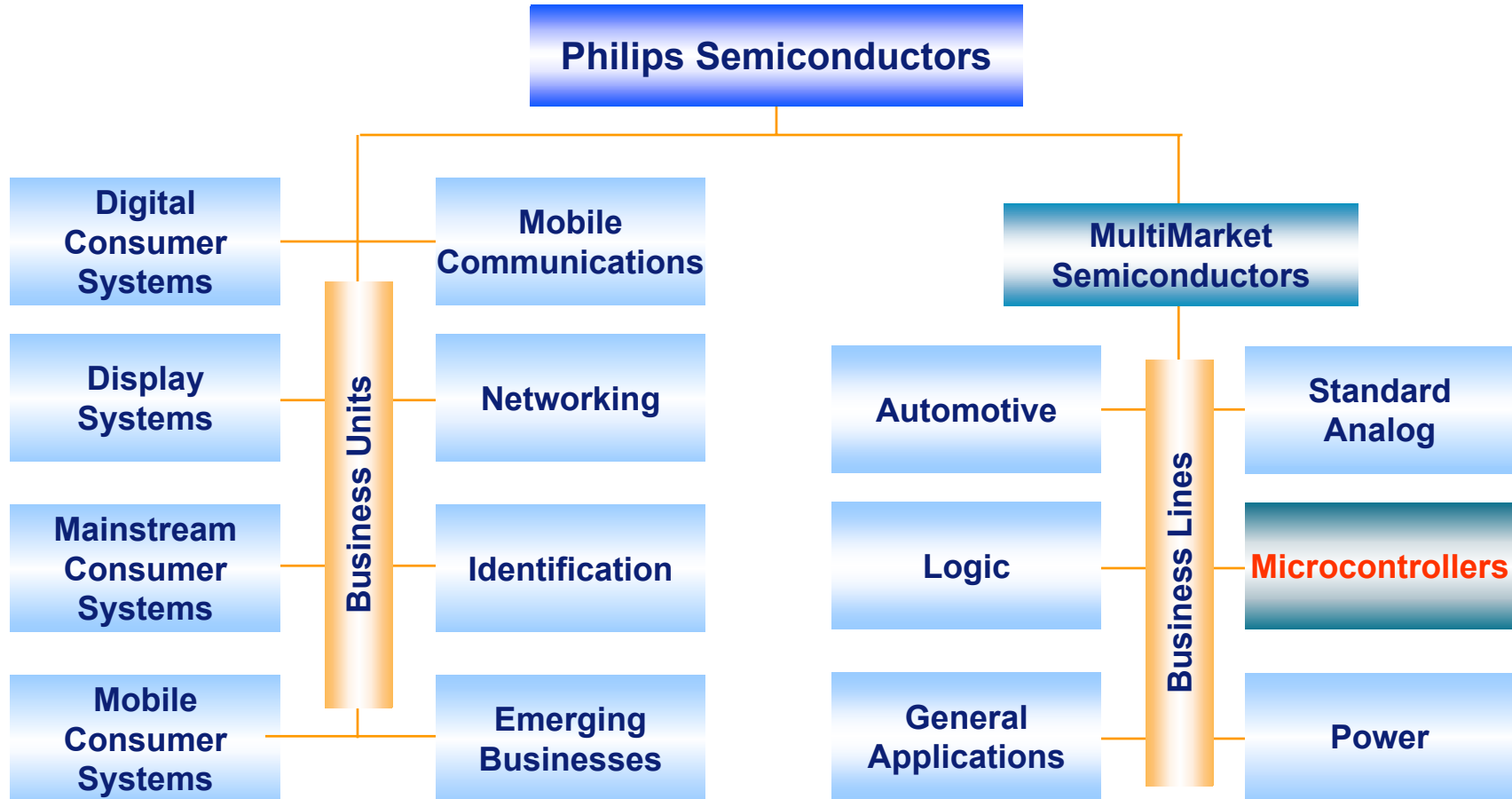
October 24th, 2002

Royal Philips at A Glance



- One of the world's biggest electronics companies
- Europe's largest electronics company, EUR 32.3 billion in sales in 2001.
- Global leader in:
 - Television
 - Lighting
 - Medical equipment
 - One-chip TV products
- 186,000 employees in more than 60 countries.

Philips Semiconductors at A Glance



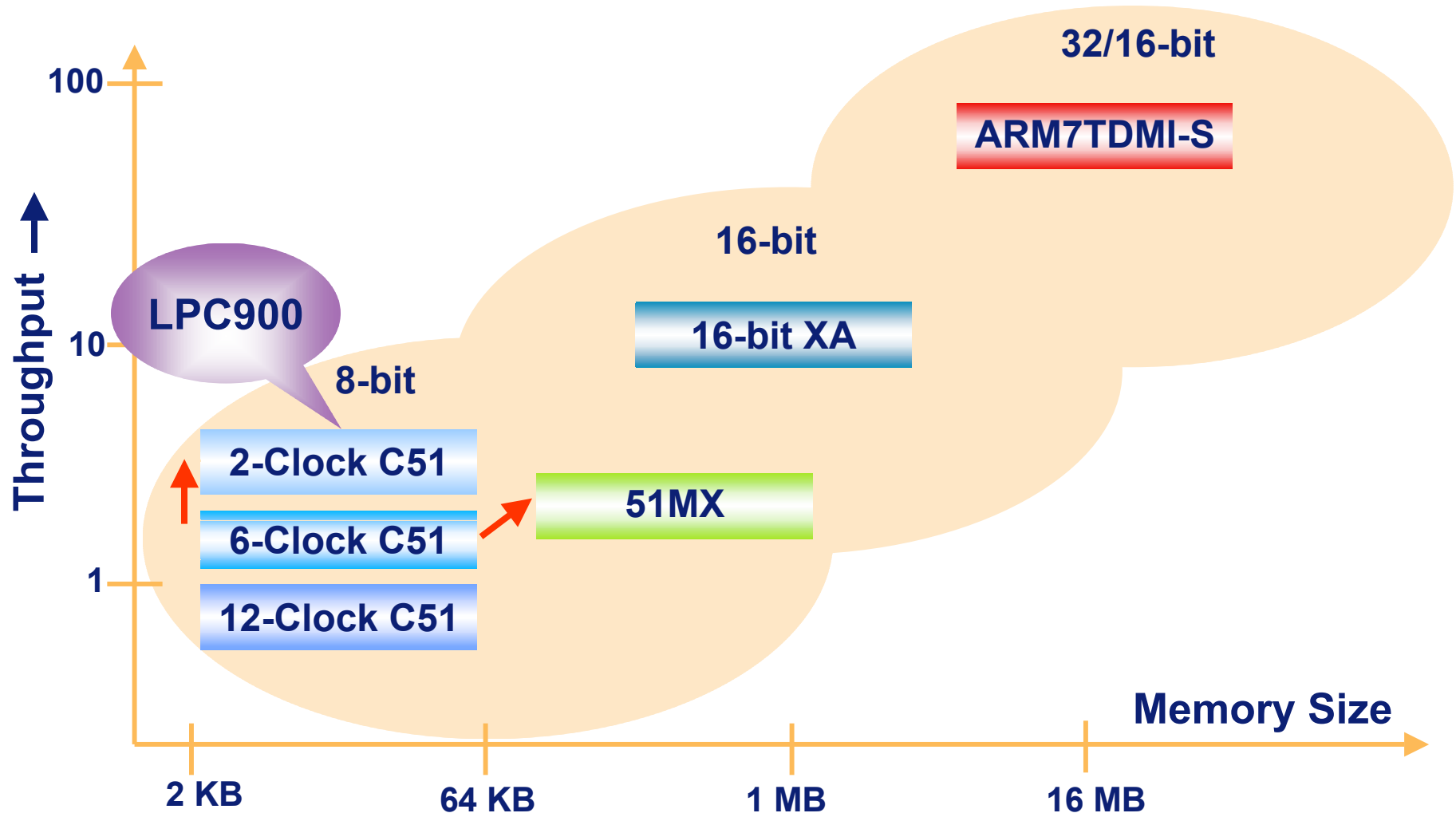
Website Address

<http://www.semiconductors.philips.com/microcontrollers/>

- Products
- Documentation
- Development support
- News and Events
- Sales Offices & Distributors

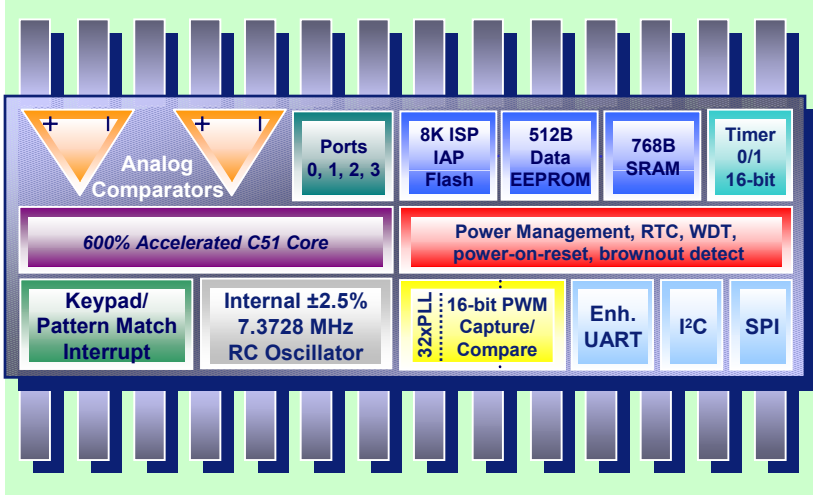
The screenshot shows the Philips Semiconductors website interface. At the top is a blue header with the Philips logo. Below it is a navigation bar with links for 'YOUR COUNTRY', 'CONSUMER PRODUCTS', 'PROFESSIONAL PRODUCTS', and a 'SEARCH' box. A secondary navigation bar lists 'PHILIPS SEMICONDUCTORS', 'News Center', 'Markets', 'Key Technologies', 'Products', 'Platforms', 'Jobs', and 'Company Profile'. The main content area is titled 'Microcontrollers' and features a large image of a microcontroller chip. To the left of the main content is a sidebar with a tree view of navigation options: 'Standard Products', 'Microcontrollers' (selected), 'Products', 'Documentation', 'Development support', 'News and Events', 'Product Selector', and 'Sales Offices & Distributors'. The 'Microcontrollers' section is expanded, showing a list of products: '80C51 8-bit microcontrollers', 'NEW! 80C51+ microcontrollers', and '51LPC Microcontrollers'. To the right of the main content is a 'News Center' section with three news items: 'Philips Introduces 80C51X2 Family', 'Philips embedded Flash memory', and 'Low power GreenChipII takes energy-efficiency to new heights'. At the bottom of the page is a footer with copyright information and links to 'Privacy Policy' and 'Terms of Use'.

Philips MCU Core Roadmap

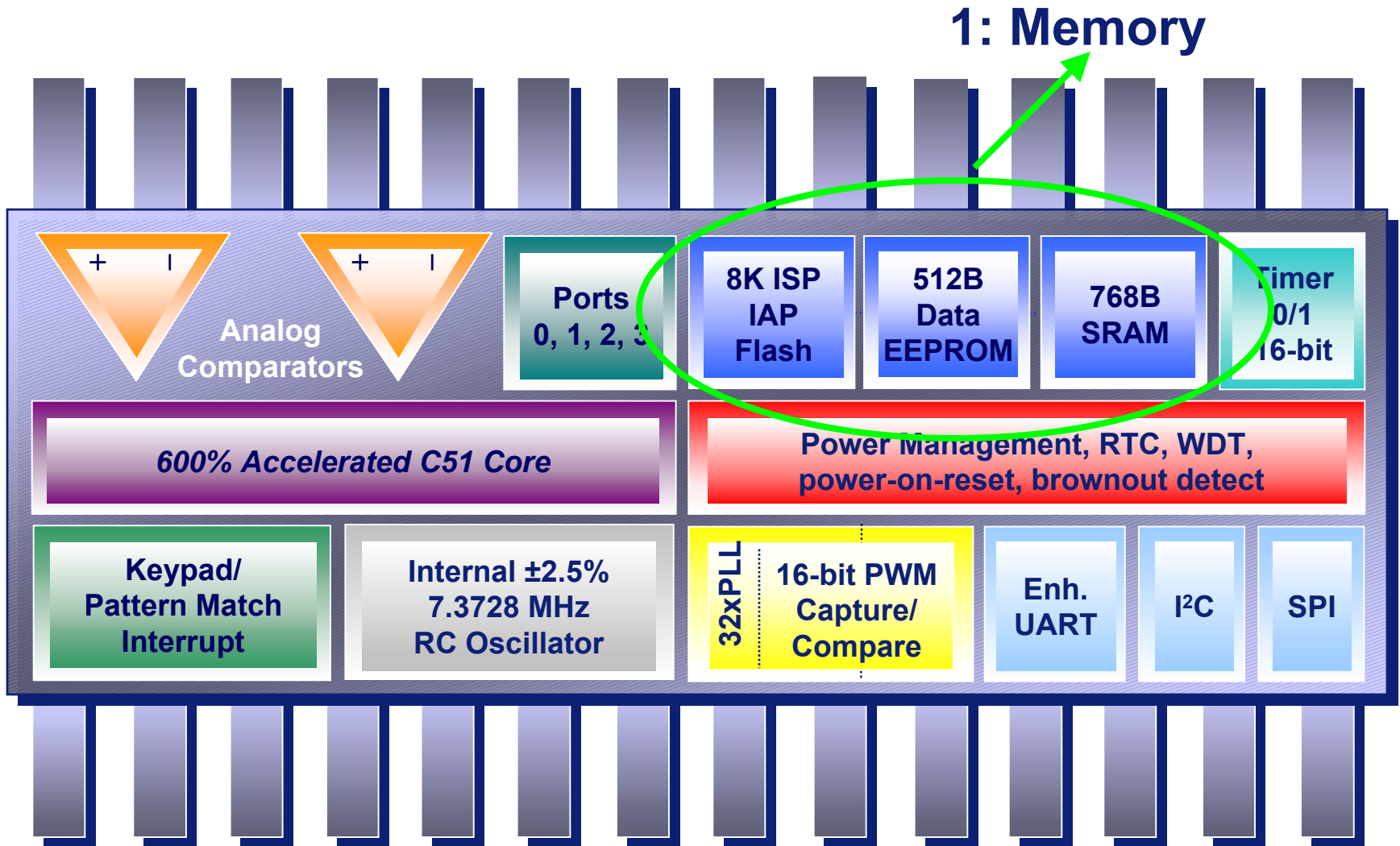


P89LPC932

Low-Power 3V Flash MCU

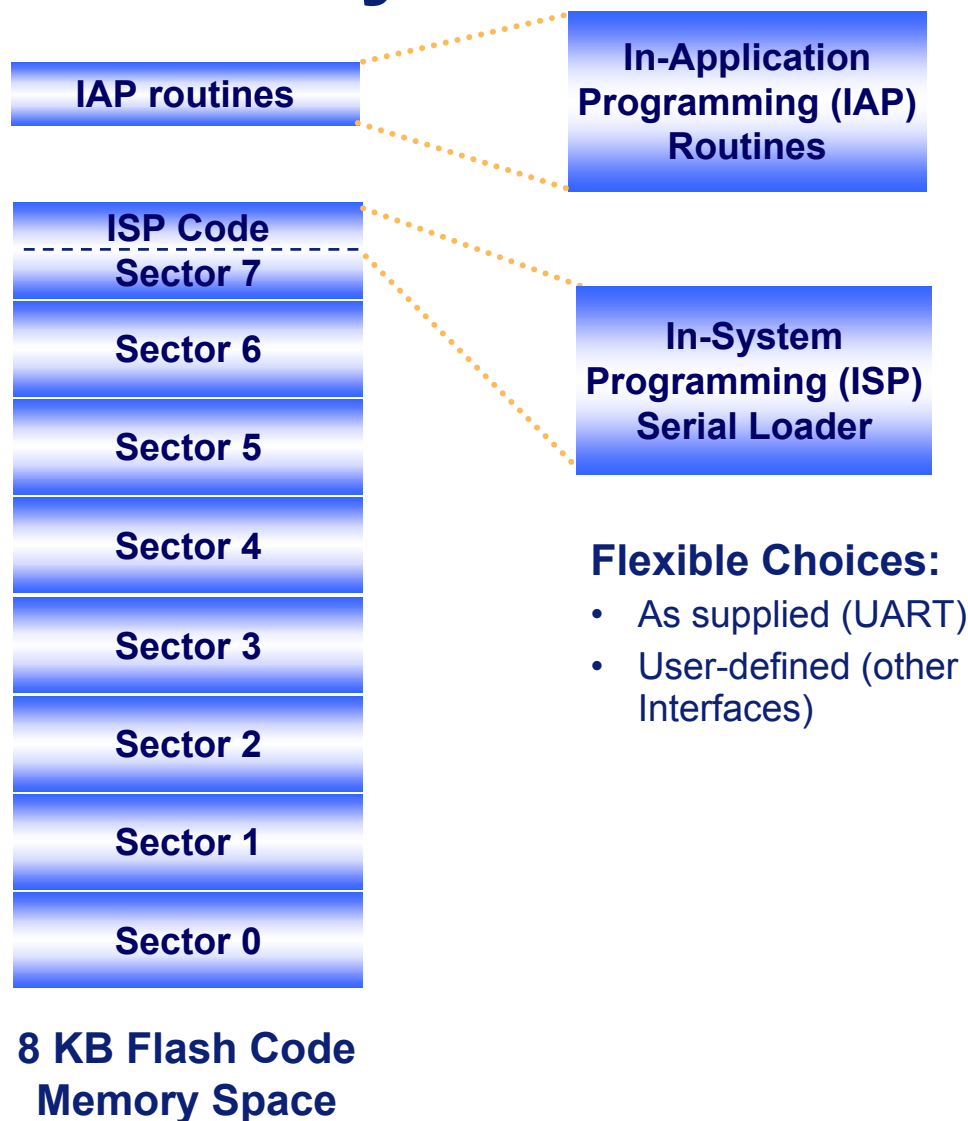


- 0.35μFlash Process
 - 8KB 3V Low-Power IAP/ISP Flash
 - 512B EEPROM
 - 768B SRAM
- 6x Accelerated 80C51 core
 - Improved speed, power & EMC
- Innovative peripherals
 - Enh. UART + Baudrate Generator
 - 3Mb/s SPI & 400 Kb/s I²C serial I/O
 - 16-bit Capture/Compare/PWM Unit
- Packages: TSSOP/PLCC/HVQFN28
- Low Cost Development
 - Starter kits (around \$50)
 - In-Circuit Debugger/Compiler All-in-one Package (under \$200)
 - Full Trace Emulation (under \$500)



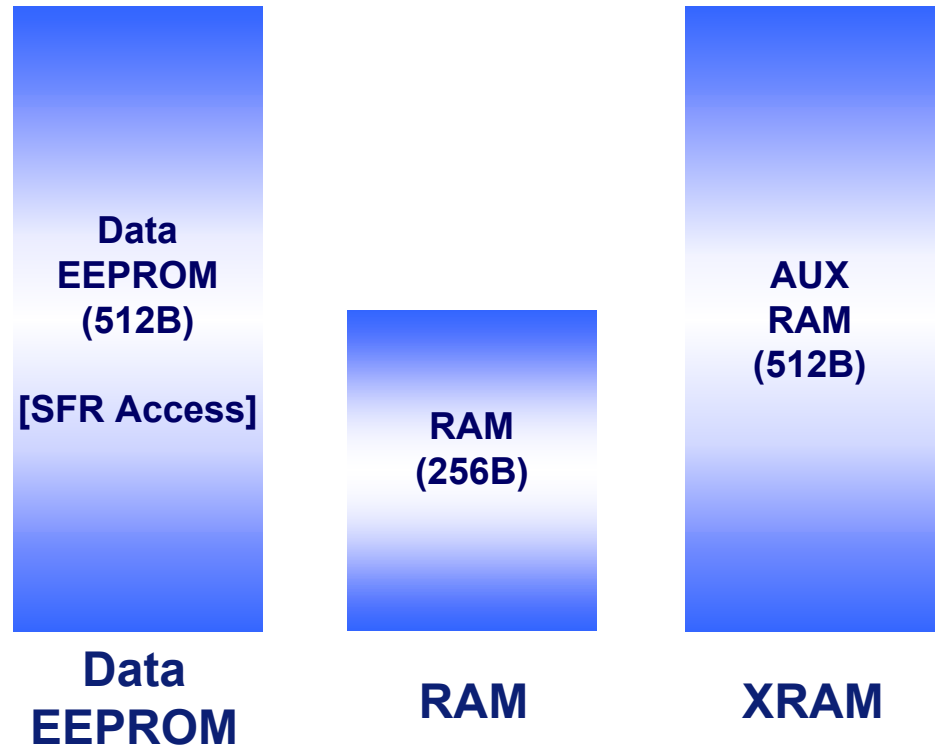
LPC932 Program Memory

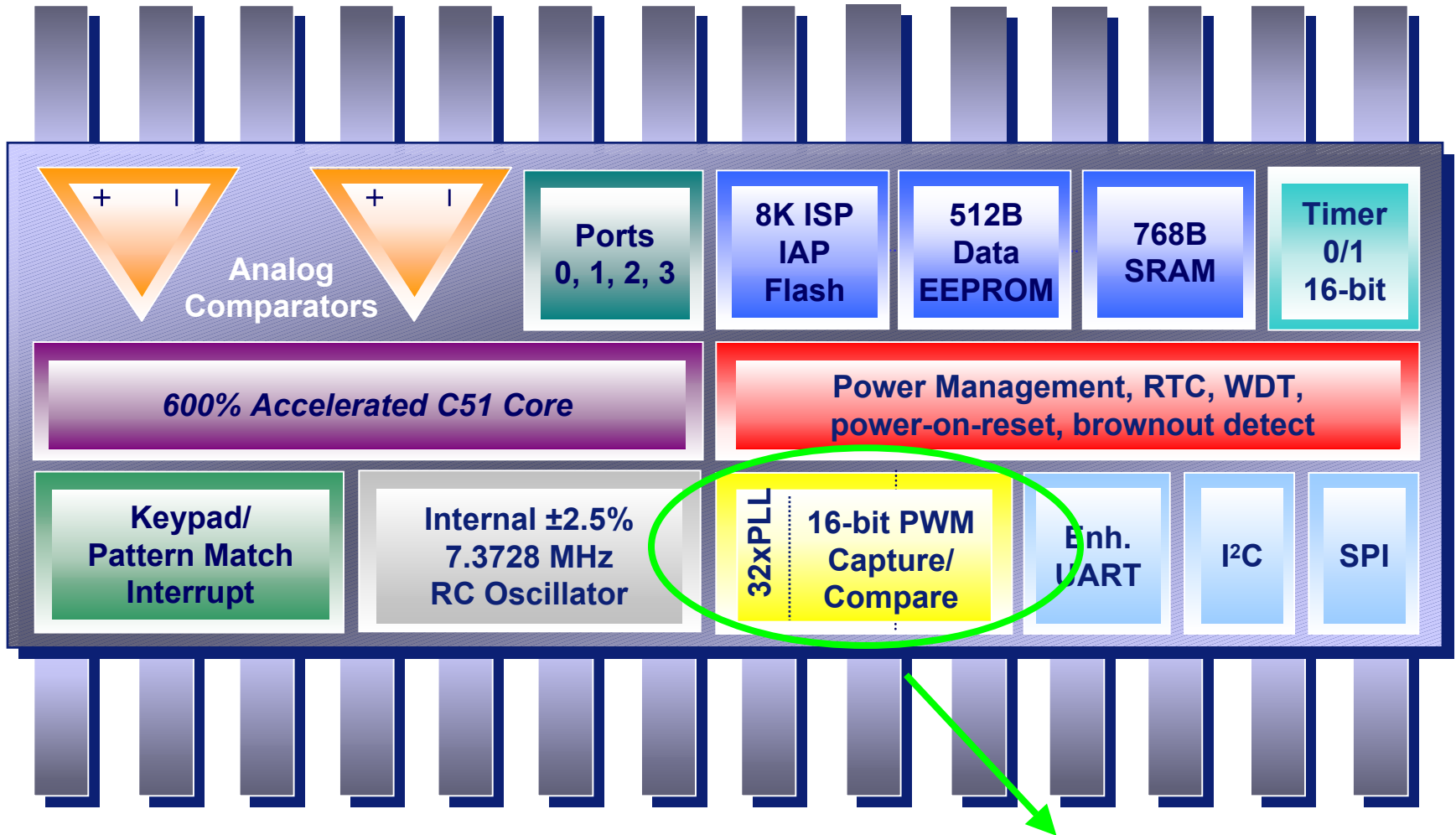
- Low-power 2.4V to 3.6V operating range.
- 8 sectors (1KB), 128 pages (64B).
- 2ms page write operation.
- 2ms page/sector/array erase operation.
- Individual security protection for each sector.



LPC932 Data Memory

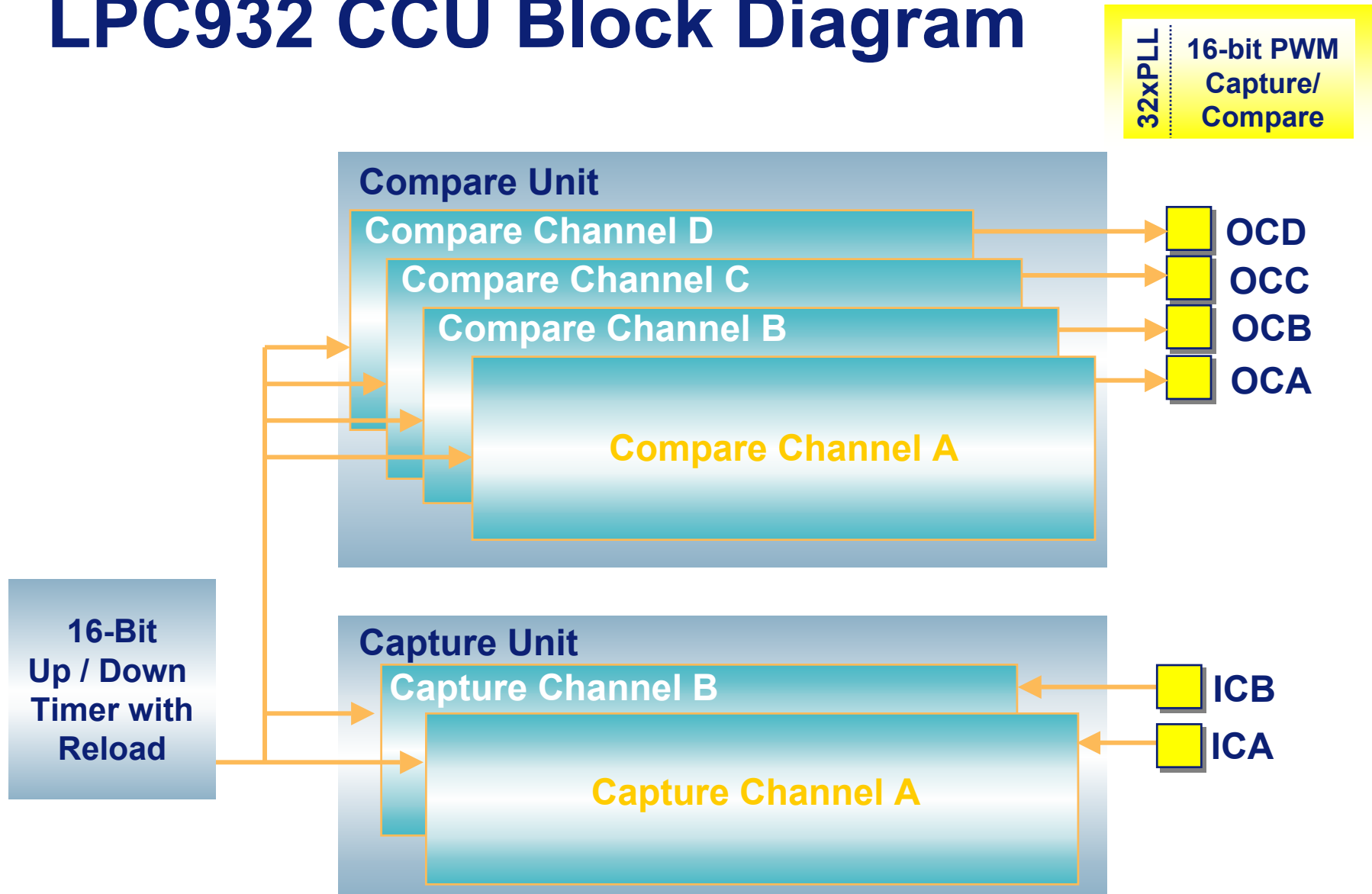
- 512B EEPROM
 - Byte read, Byte write, Byte erase.
 - Page fill (64B) and block fill (512B)
 - SFR Interface (Control, Address, Data)
- 256B Standard RAM
- 512B Auxiliary RAM





2: CCU

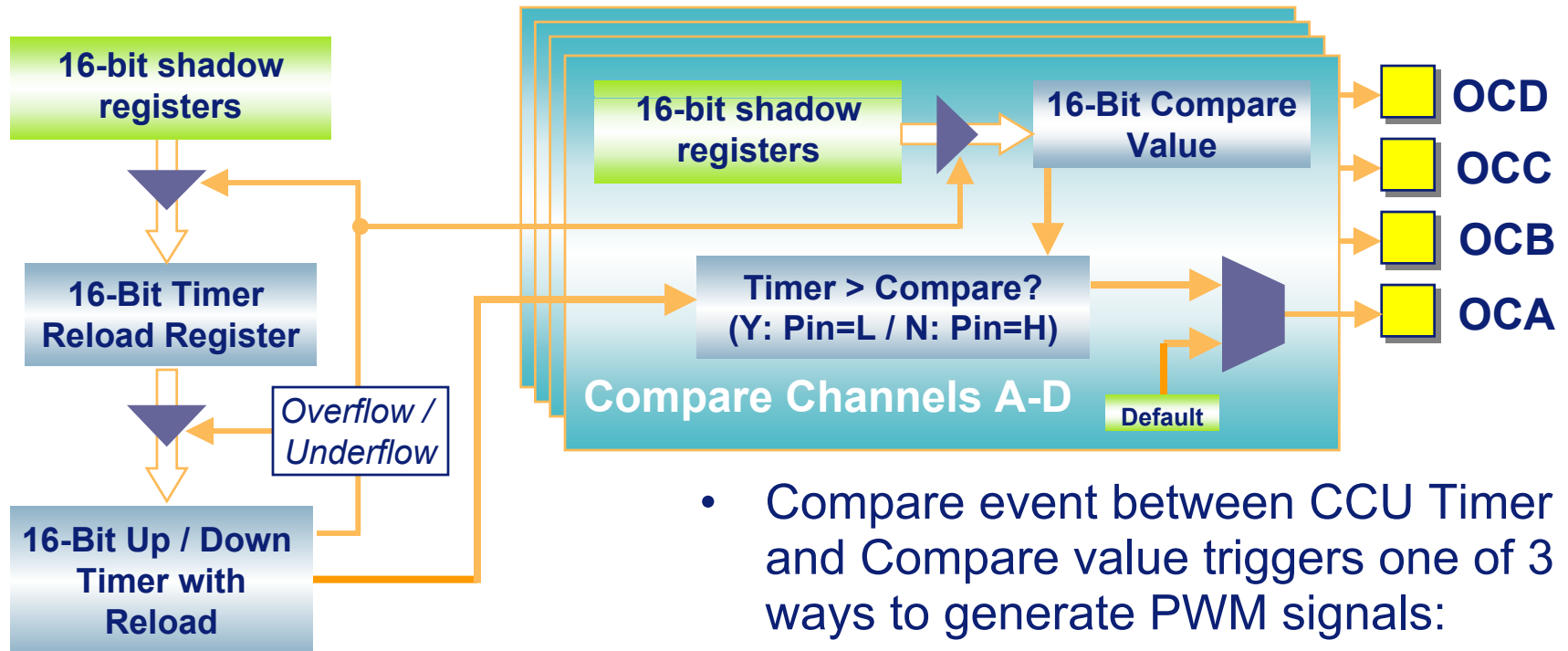
LPC932 CCU Block Diagram



Compare Unit Block Diagram

How to generate PWM signals

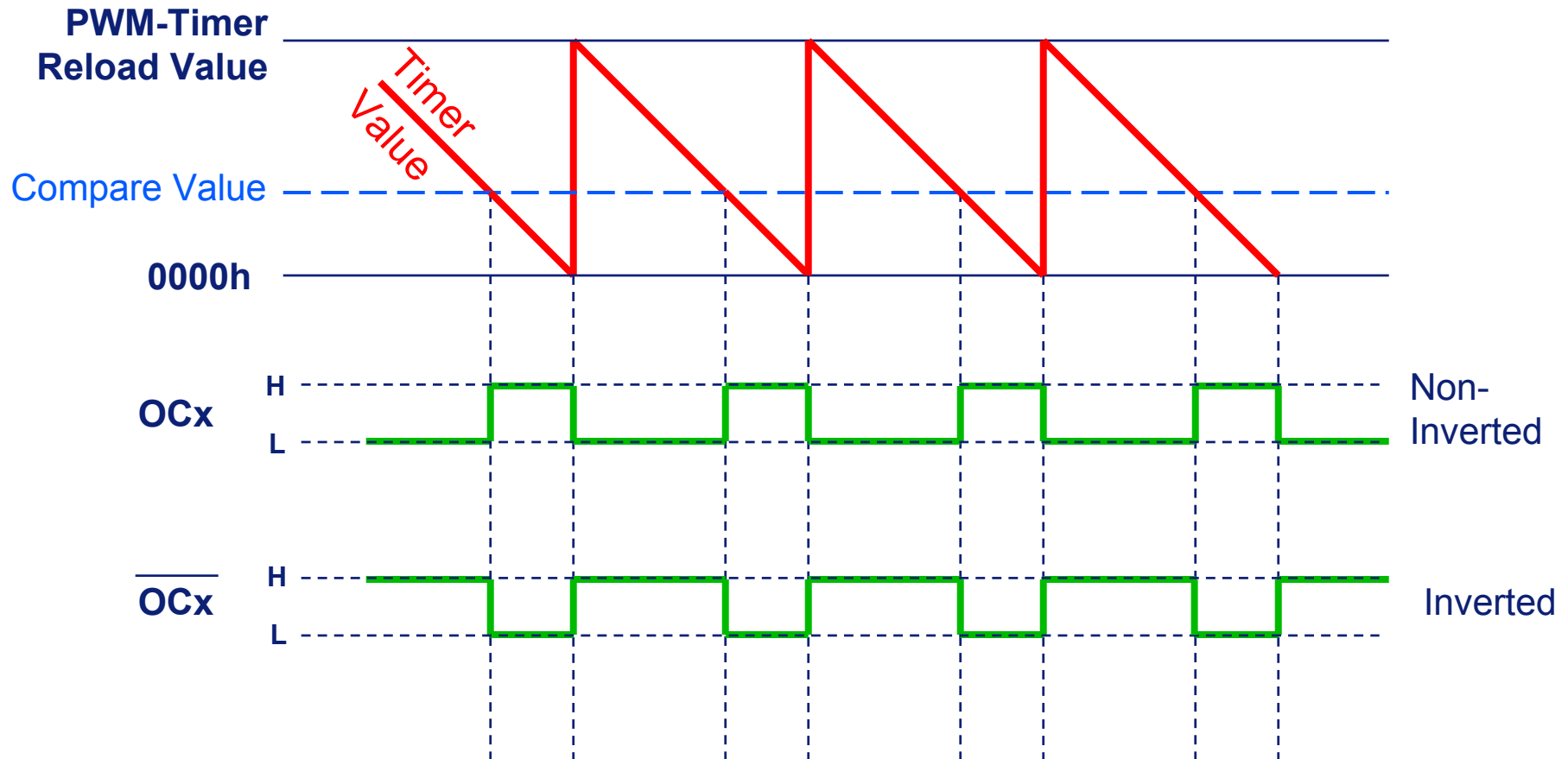
32xPLL 16-bit PWM
Capture/
Compare



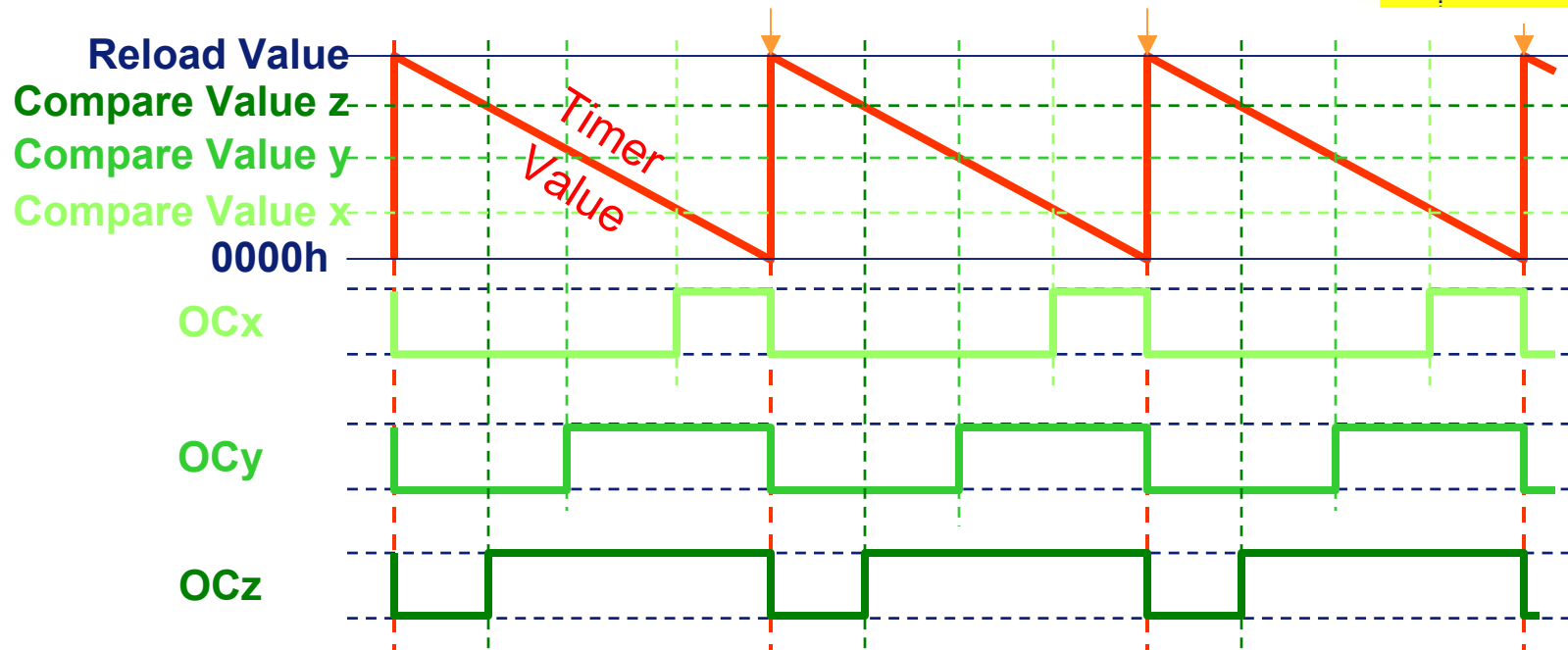
- Compare event between CCU Timer and Compare value triggers one of 3 ways to generate PWM signals:
 - Asymmetrical PWM
 - Symmetrical PWM
 - “Alternate Output Mode”

Asymmetrical PWM

32xPLL
16-bit PWM
Capture/
Compare



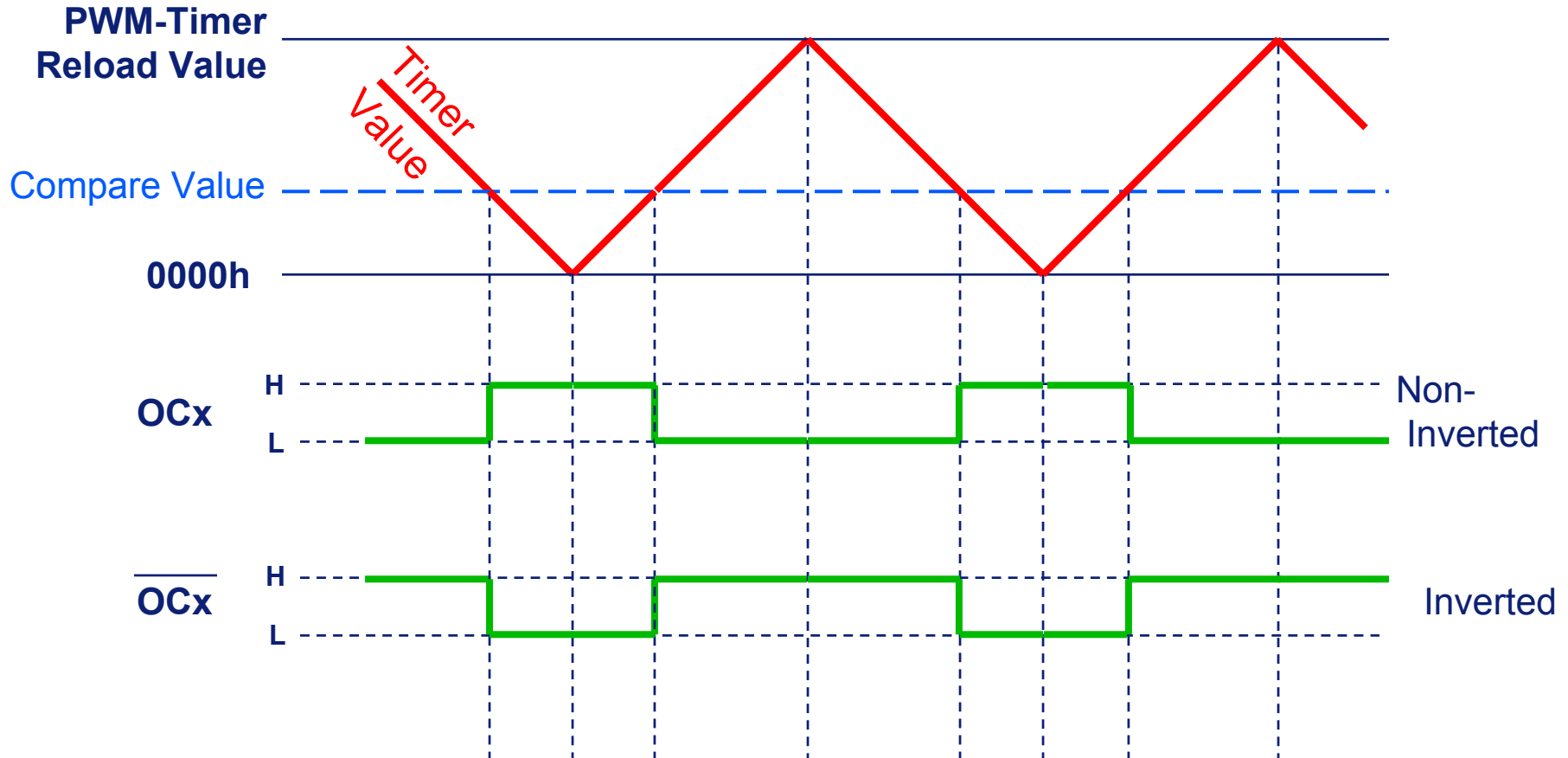
Asymmetrical PWM usage



- Used for Stepper Motor Control, Dimming lights, generating analog outputs with a simple filter.
- Also known as edge-aligned PWM.

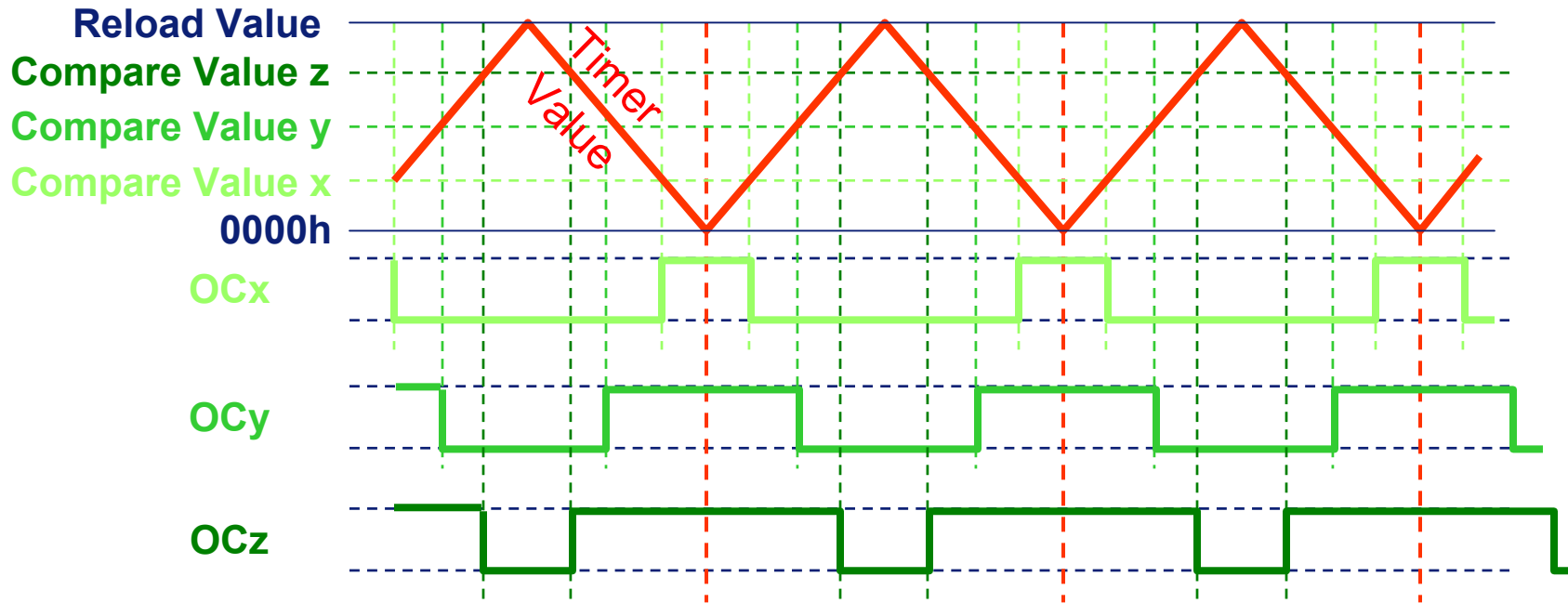
Symmetrical PWM

32xPLL 16-bit PWM
Capture/
Compare



Symmetrical PWM usage

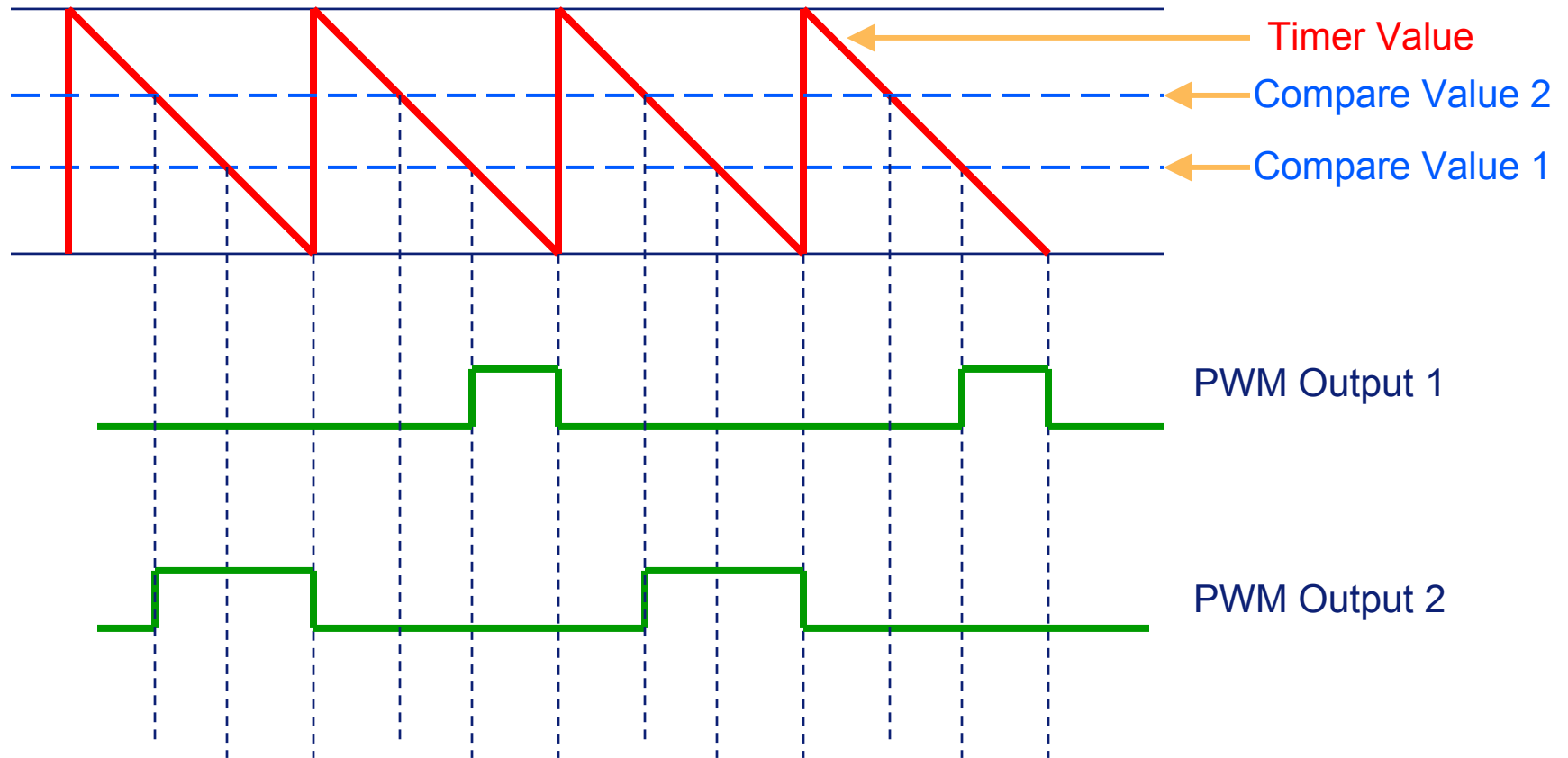
32xPLL 16-bit PWM
Capture/
Compare



- Used for motor control
- Also known as center-aligned PWM

Alternate Output Mode

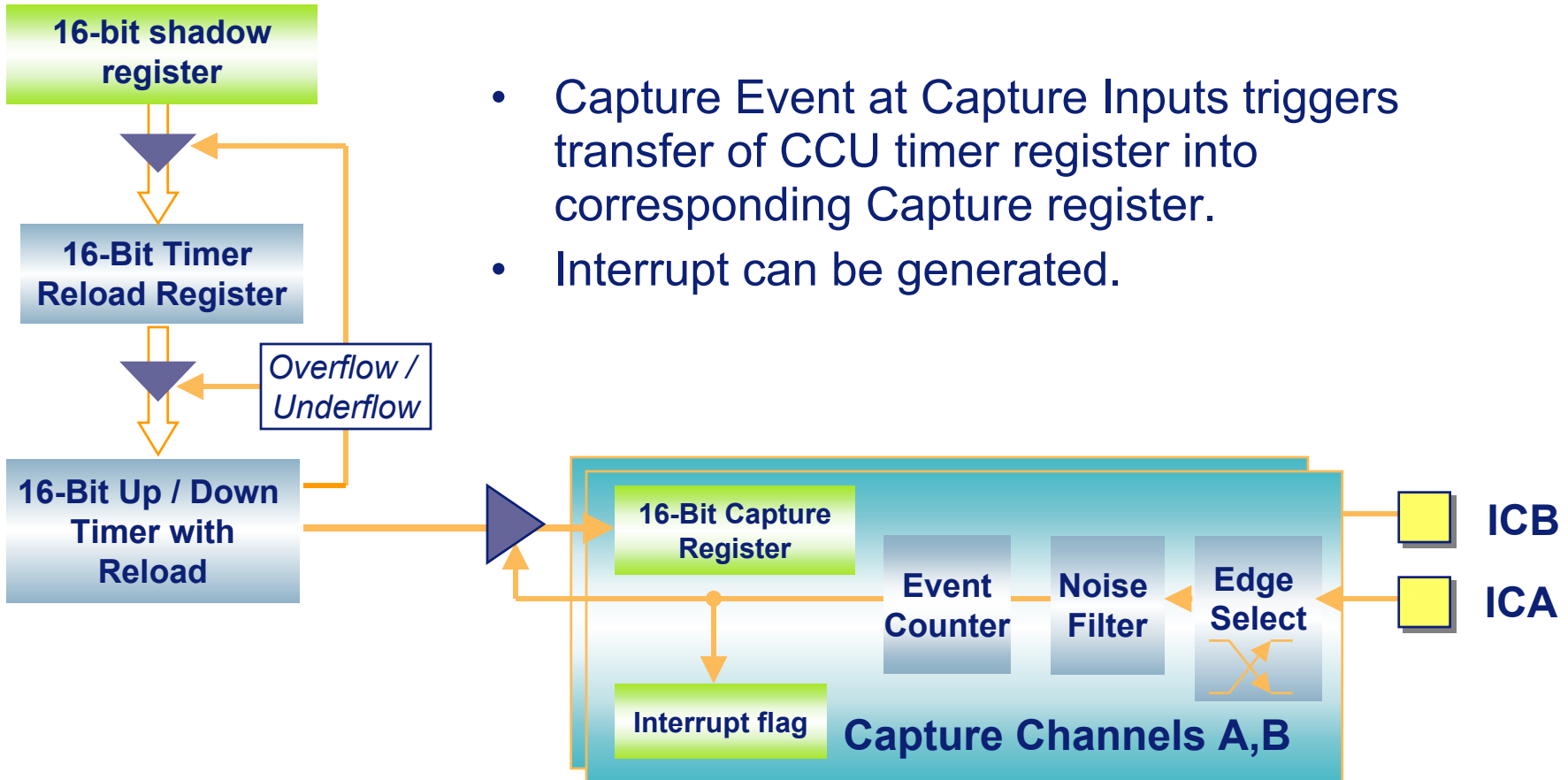
32xPLL
16-bit PWM
Capture/
Compare



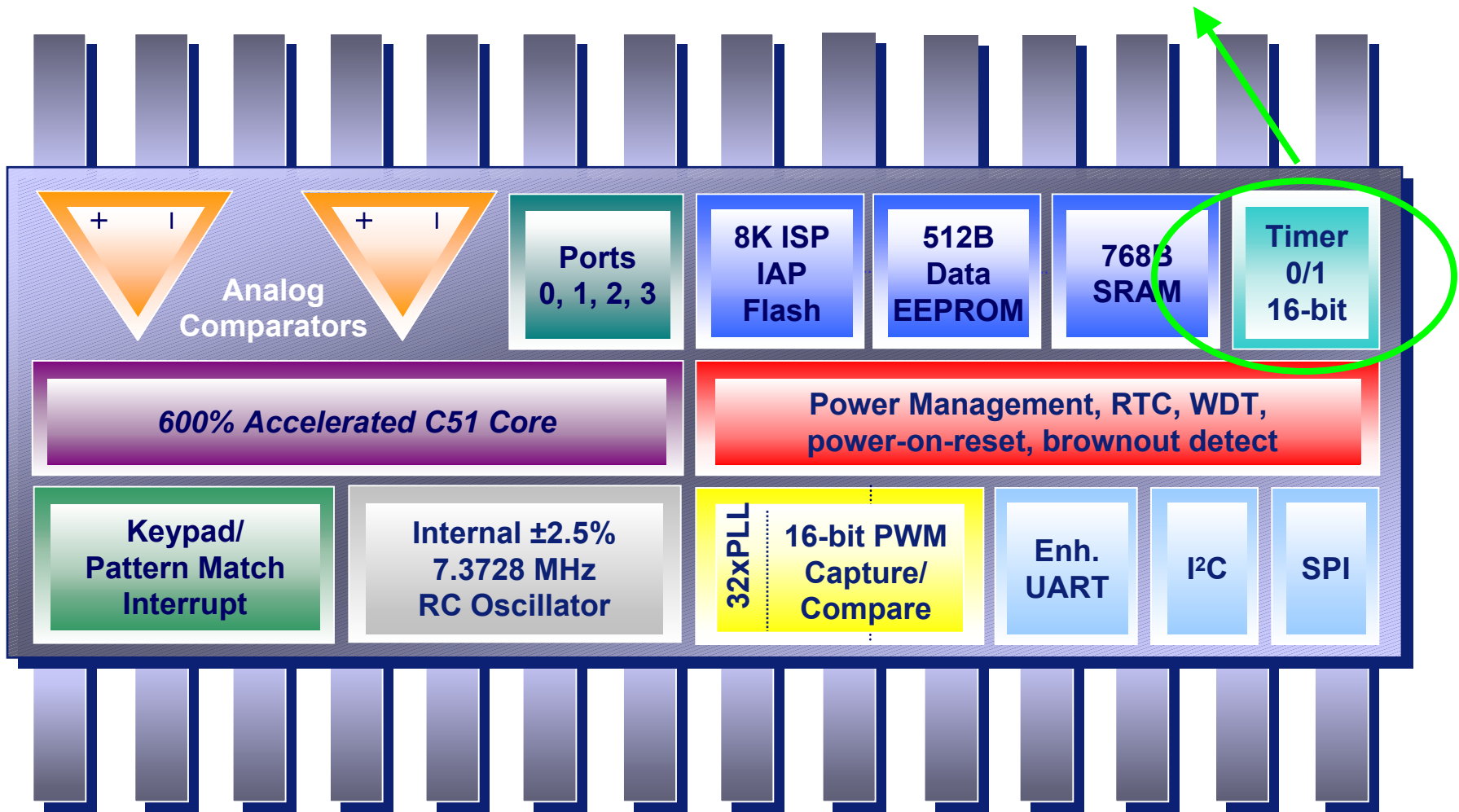
Capture Unit Block Diagram

How to evaluate external signals

32xPLL 16-bit PWM
Capture/
Compare



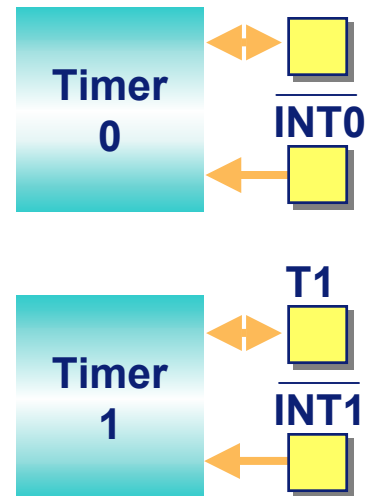
3: Timer



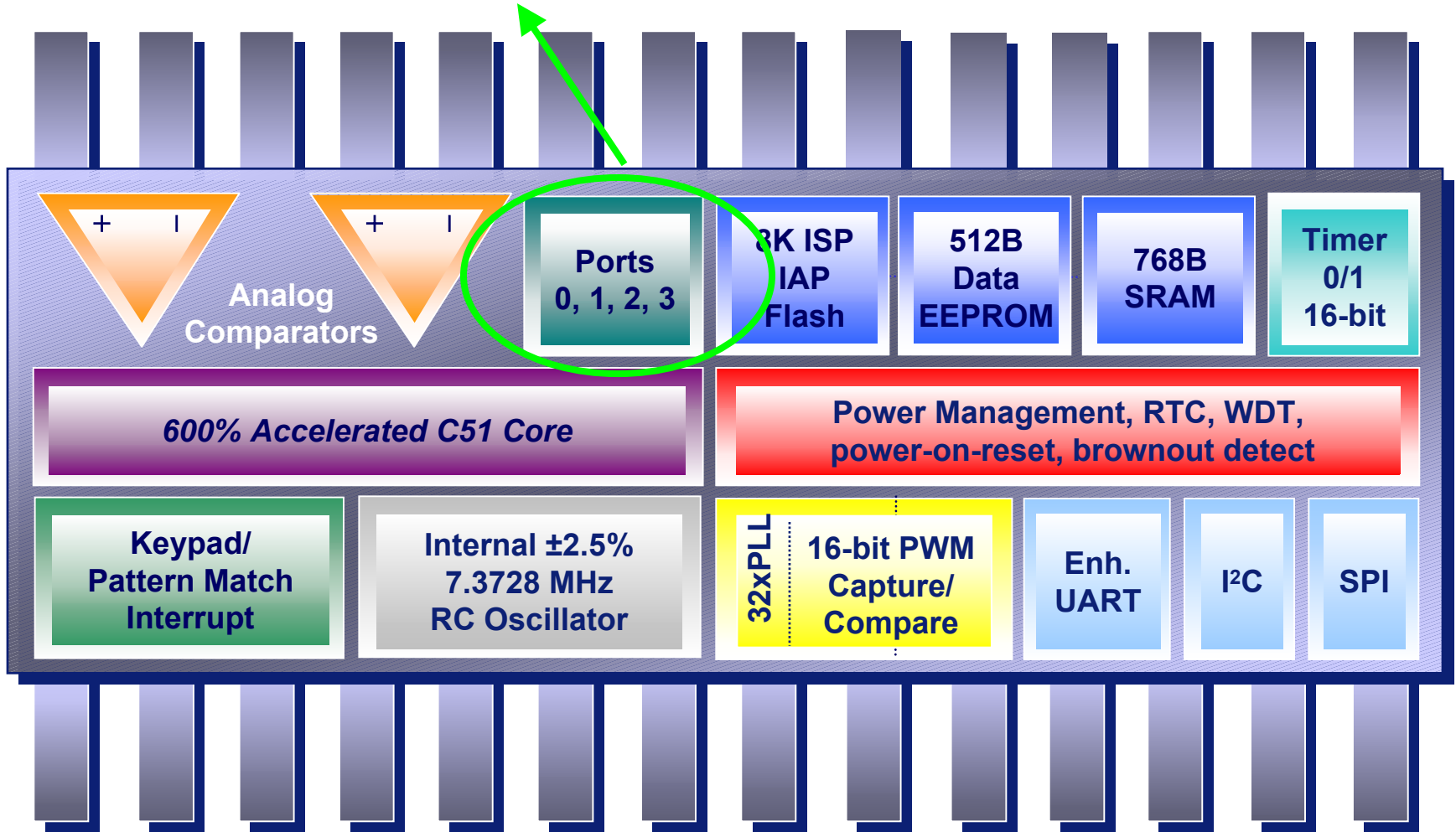
Timer 0 / Timer 1

Timer
0/1
16-bit

- Two 16-bit timers as known from 80C51 architecture.
- Count input/toggle output available for both timers.
- Timer operation can be gated with INT0 / INT1 pins.
- Standard operating modes:
 - Mode 0: 8-bit Timer / Counter with 5-bit Prescaler
 - Mode 1: 16-bit Timer / Counter
 - Mode 2: 8-bit Timer / Counter with Auto Reload
 - Mode 3: T0 = Two 8-bit Timers
- New Mode 6: Simple 8-bit PWM signal generation
 - Similar to Mode 2, but reload value represents PWM signal duty cycle



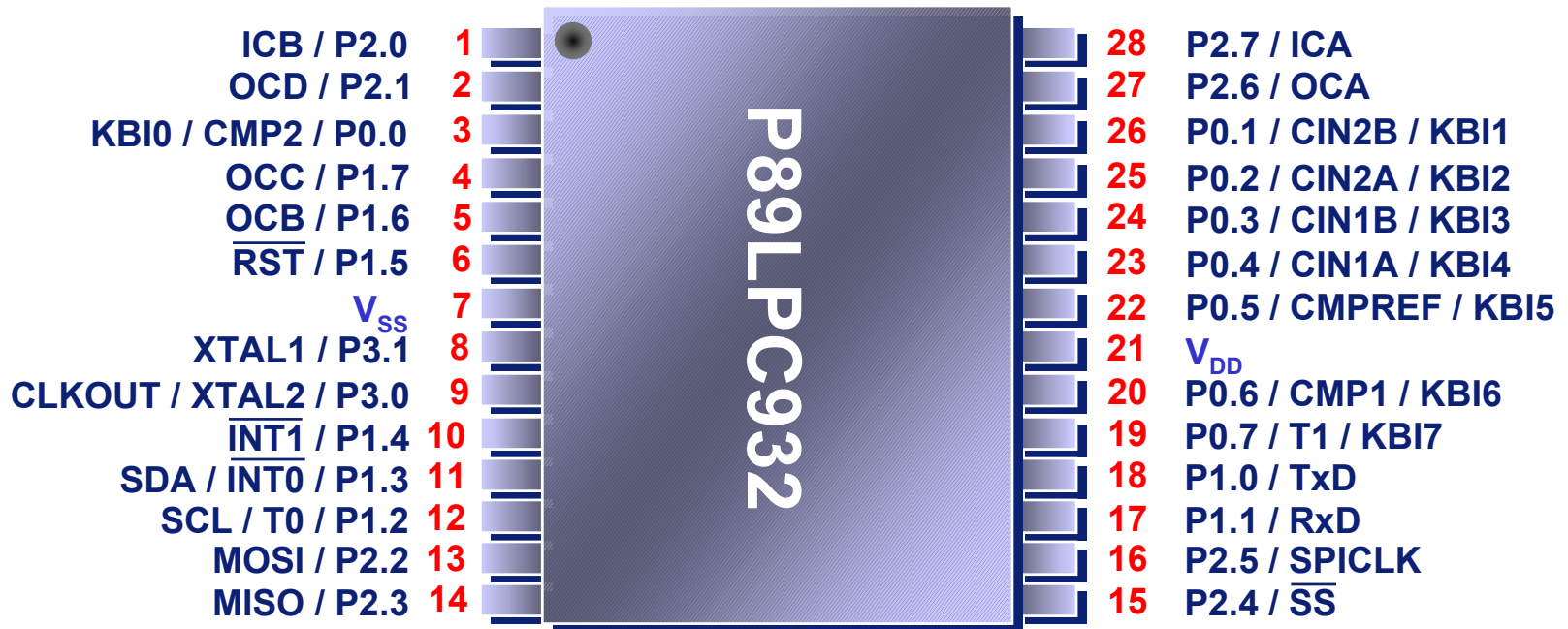
4: I/O Ports

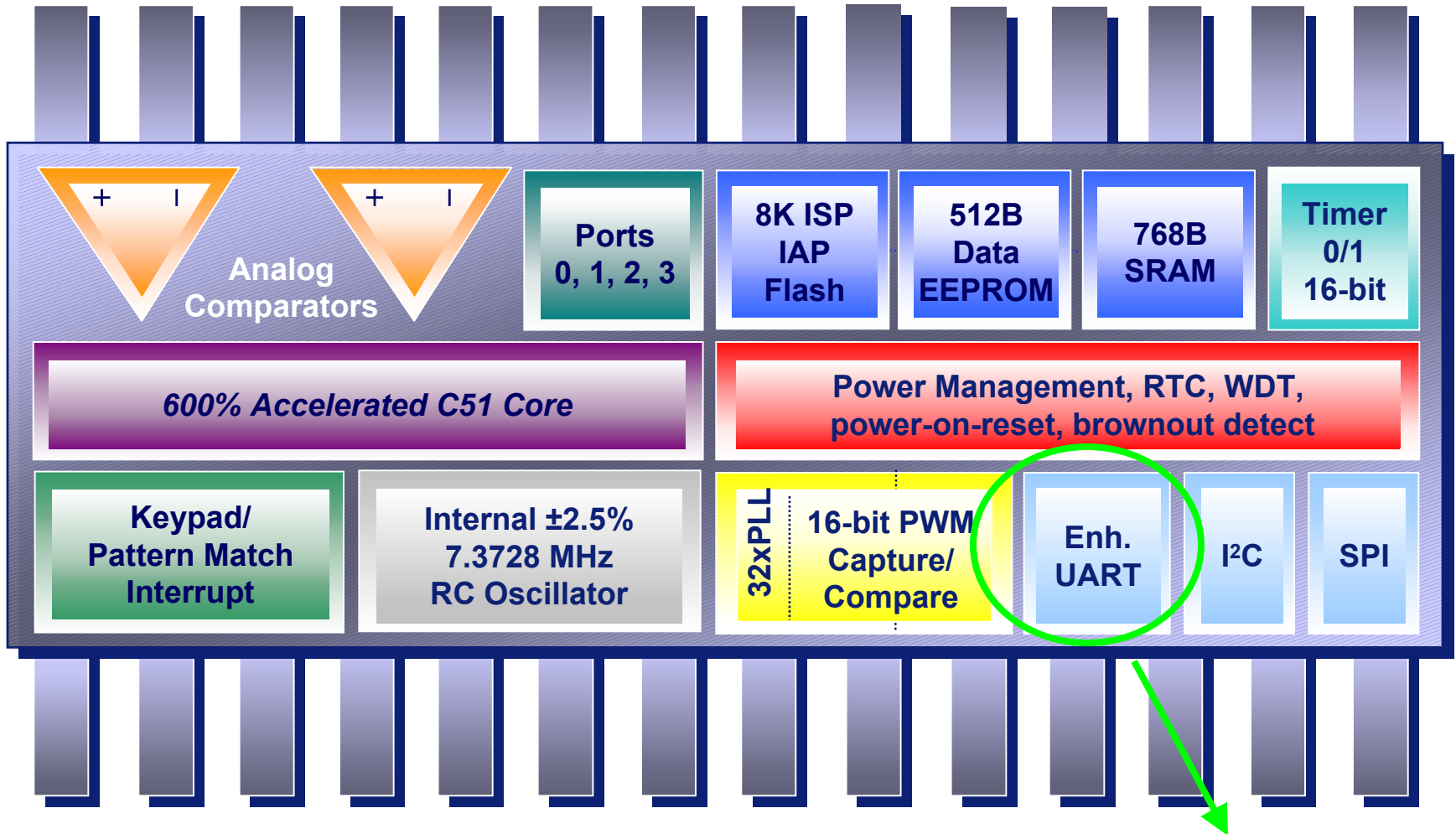


Programmable I/O Ports

Ports
0, 1, 2, 3

- All I/O pins except three support four output modes:
Quasi-bidirectional, Push-Pull, Input Only, Open drain
- 20mA sink current/pin (80mA overall limit)
- Slew-rate controlled pin output drivers (10ns rise/fall time)



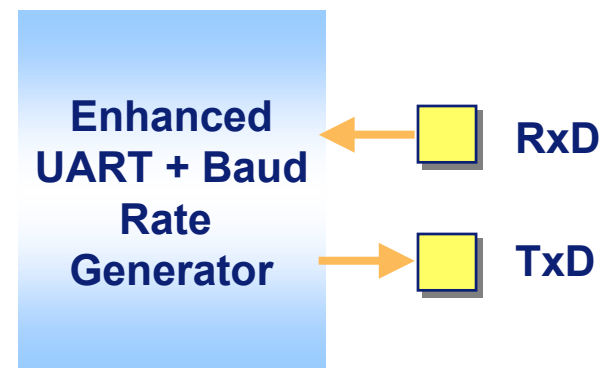


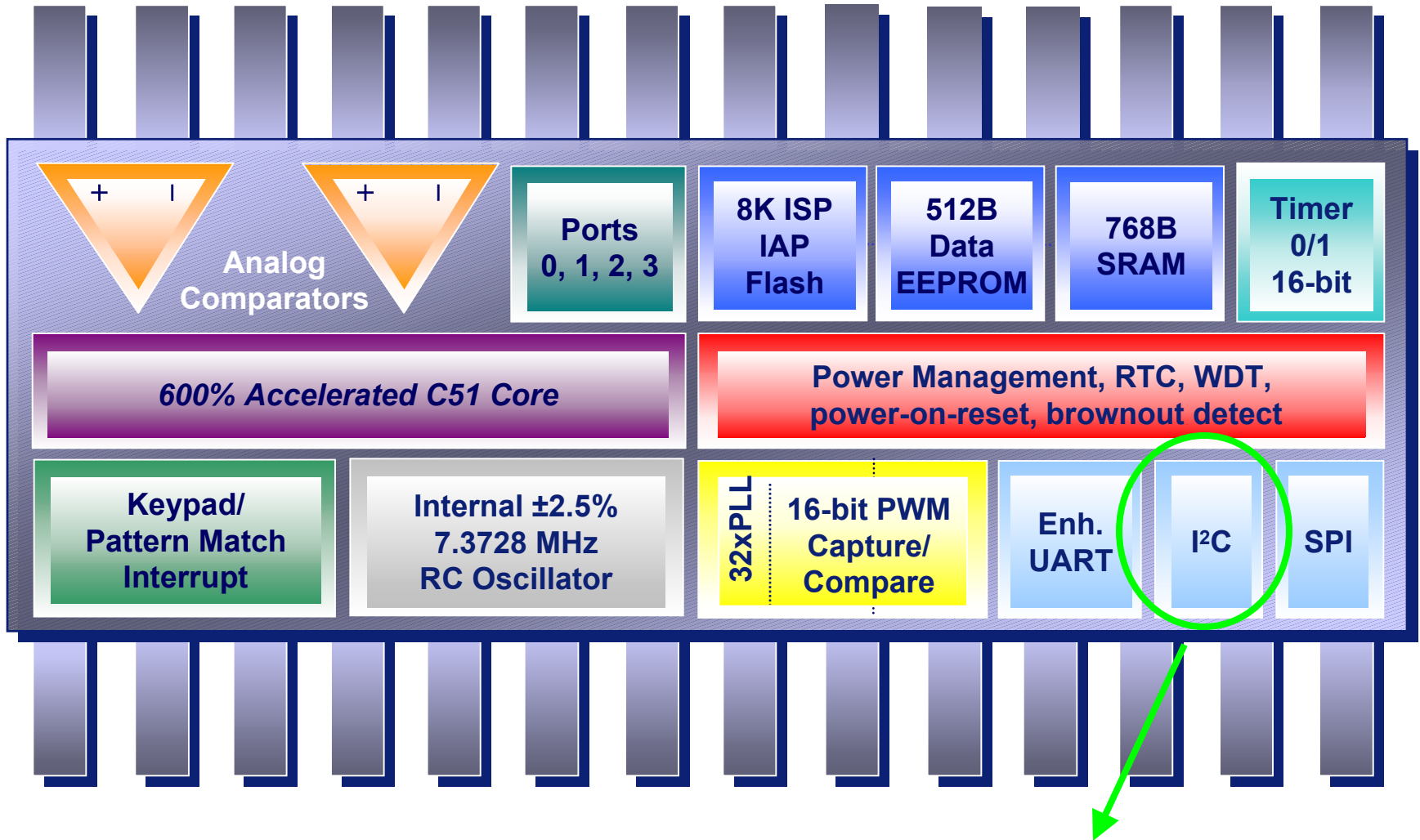
5: Enhanced UART+ BRG

Enhanced UART with Integrated Baud Rate Generator

Enh.
UART

- Dedicated high-accuracy Baud Rate Generator
 - None of the on-chip timers needed for UART operation
- Break character detection
- Framing error detection
- Overrun error detection
- Transmit can be Double-Buffered
 - Allows Serial I/O 'back-to-back' byte transmission
- Transmit interrupt control (begin or end of stop bit)
- Option to split Tx/Rx interrupt
 - Enables easy Full-Duplex Serial I/O



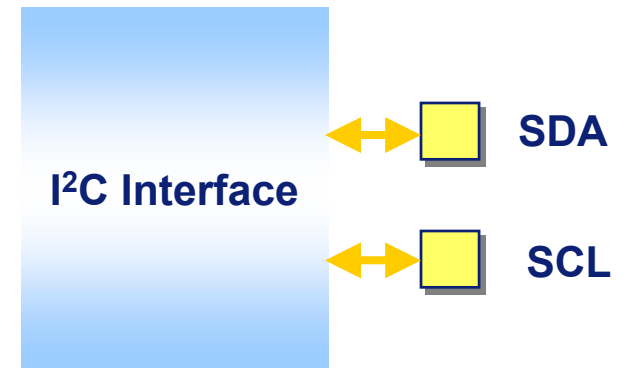


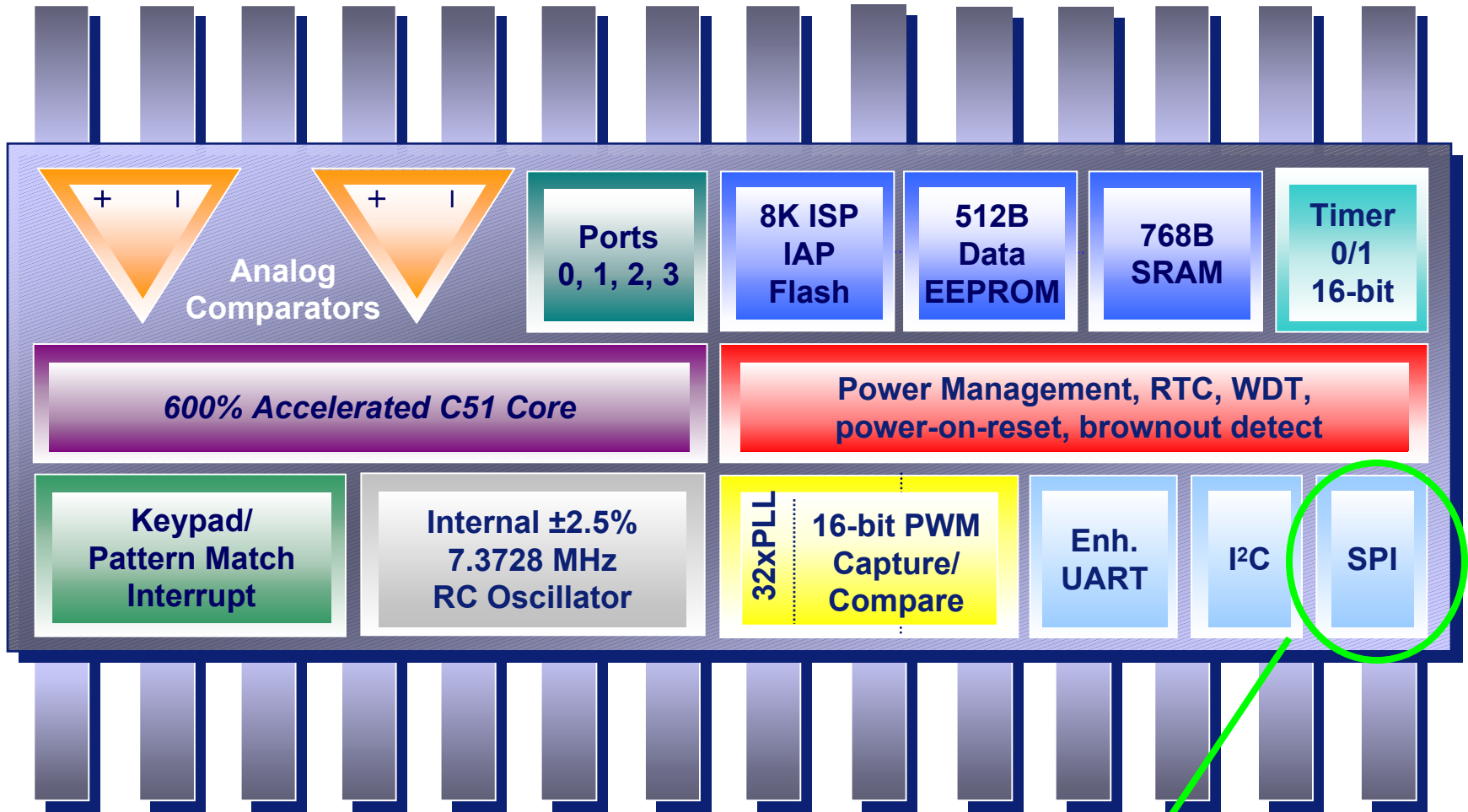
6: I²C Interface

I²C Interface

I²C

- Byte-oriented I²C interface
- 7-bit addressing
- Speed up to 400kbit/s
- Four operation modes
 - Master Transmitter mode
 - Master Receiver mode
 - Slave Transmitter mode
 - Slave Receiver mode
- Used for communication with other I²C-equipped devices



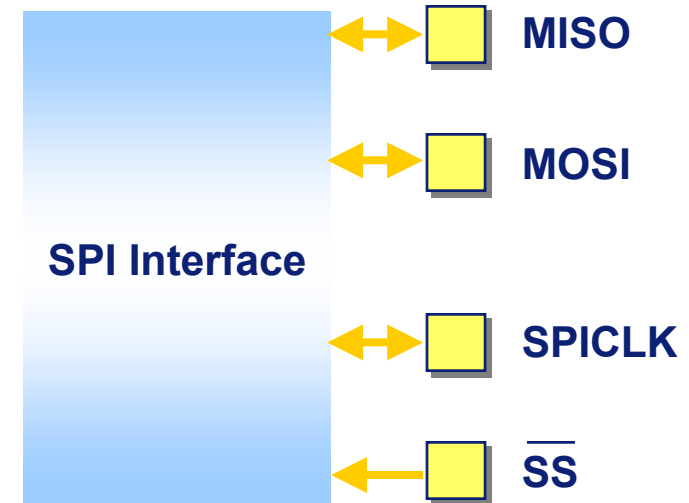


7: Serial Peripheral Interface

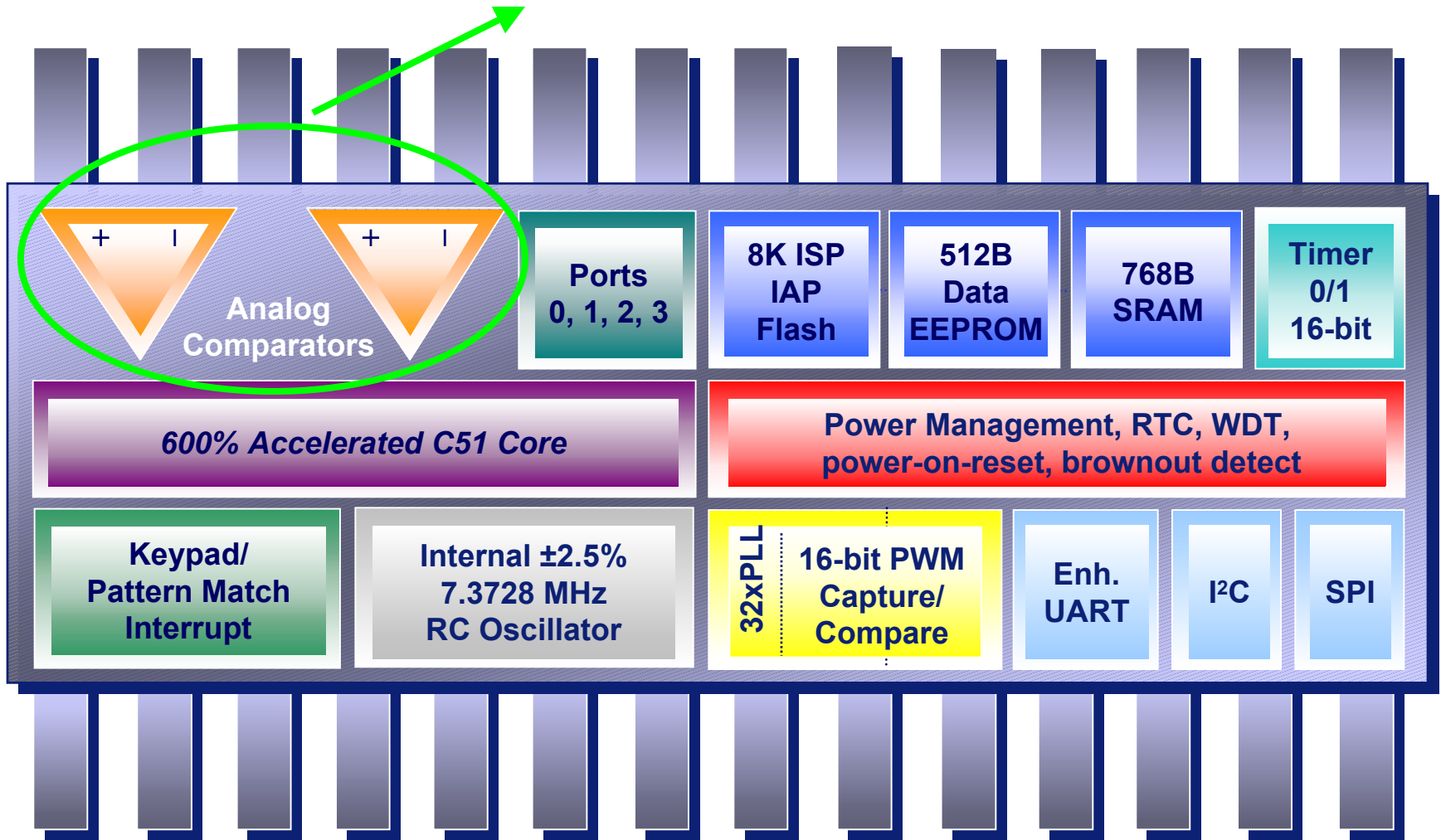
Serial Peripherals Interface (SPI)



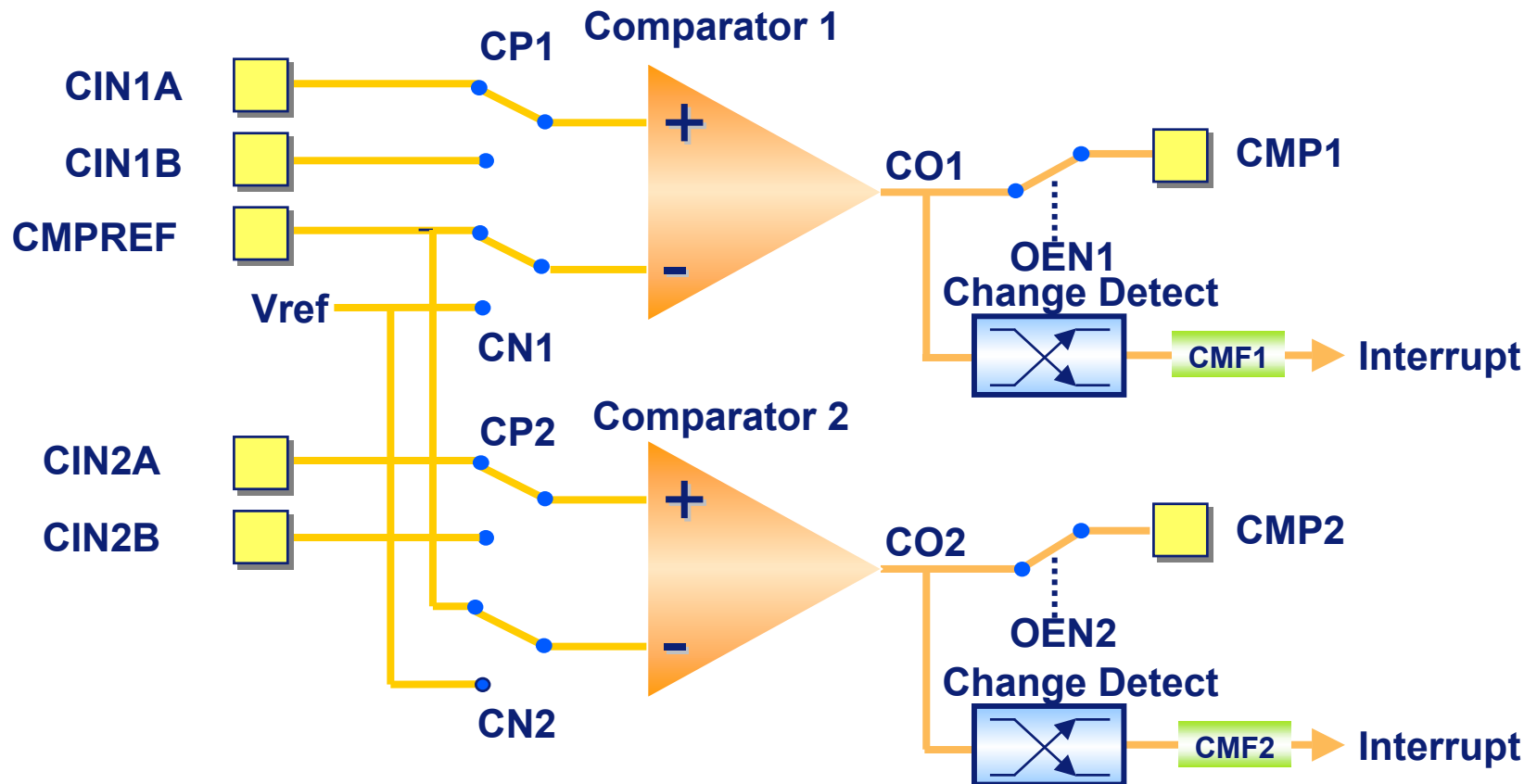
- High-speed serial communication interface
- Full-duplex, synchronous communication bus with two operation mode
 - Master mode
 - Slave mode
- Speed up to 3Mbit/s
- Used for communication with other SPI-equipped devices

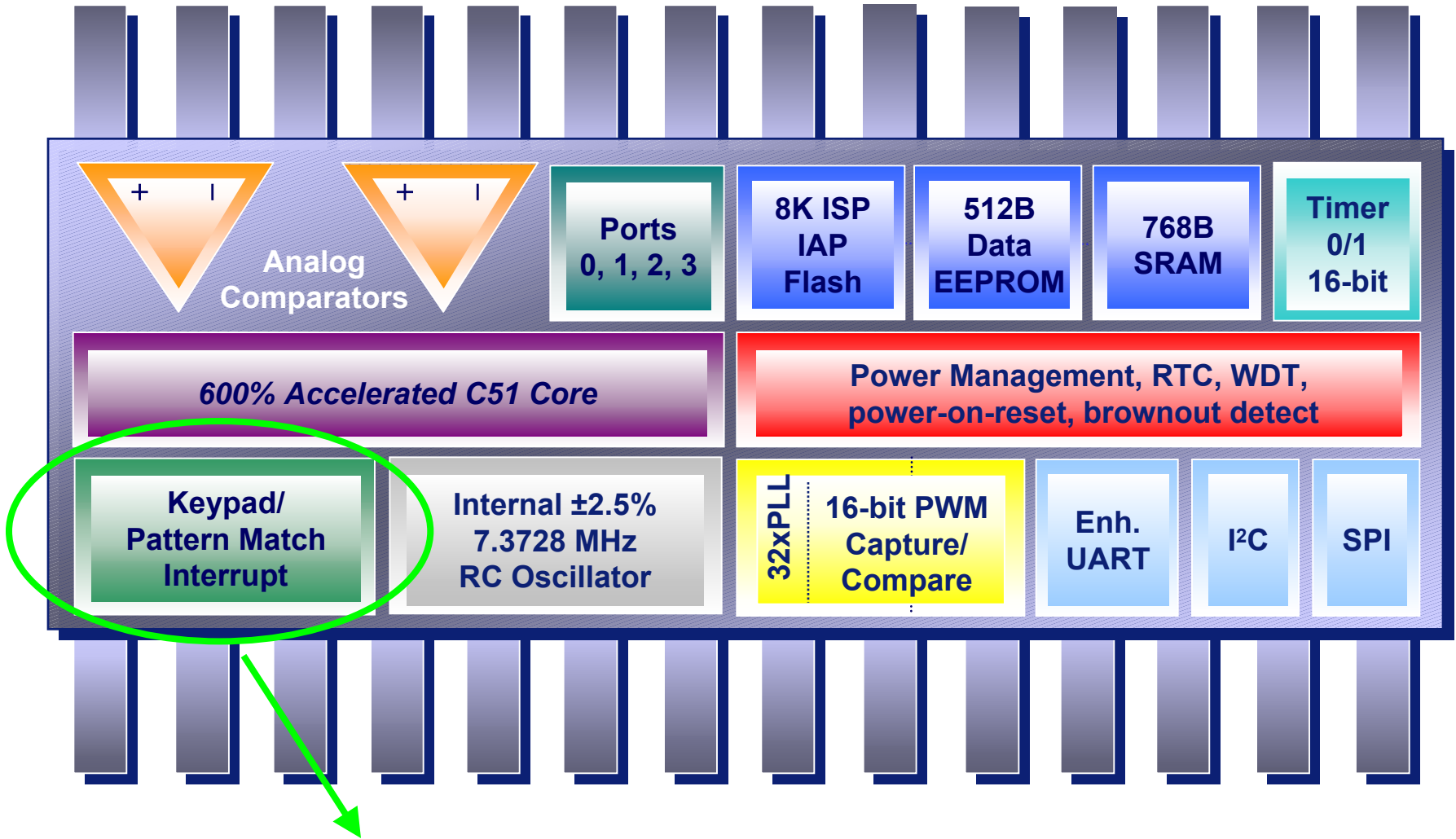


8: Analog Comparators



Comparators

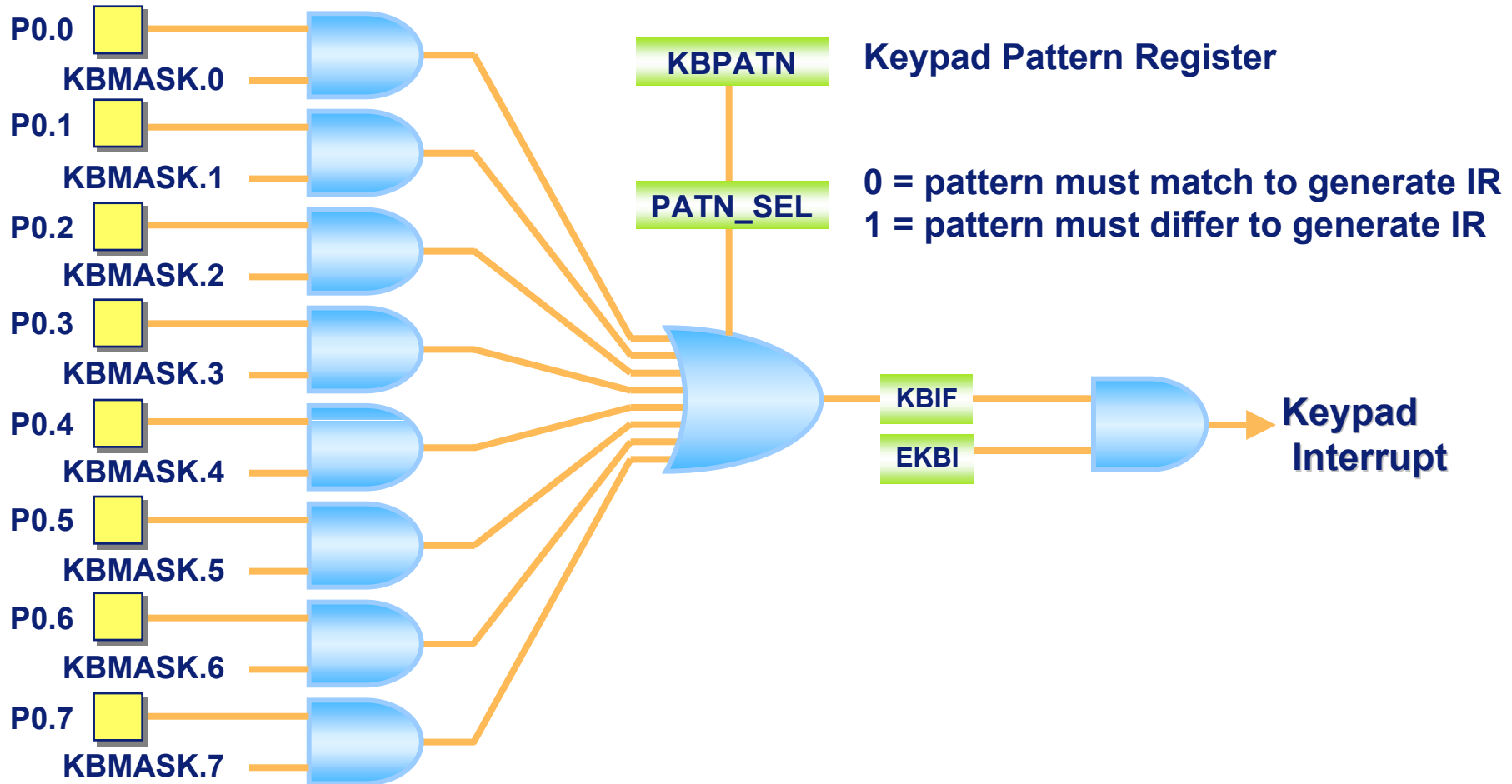


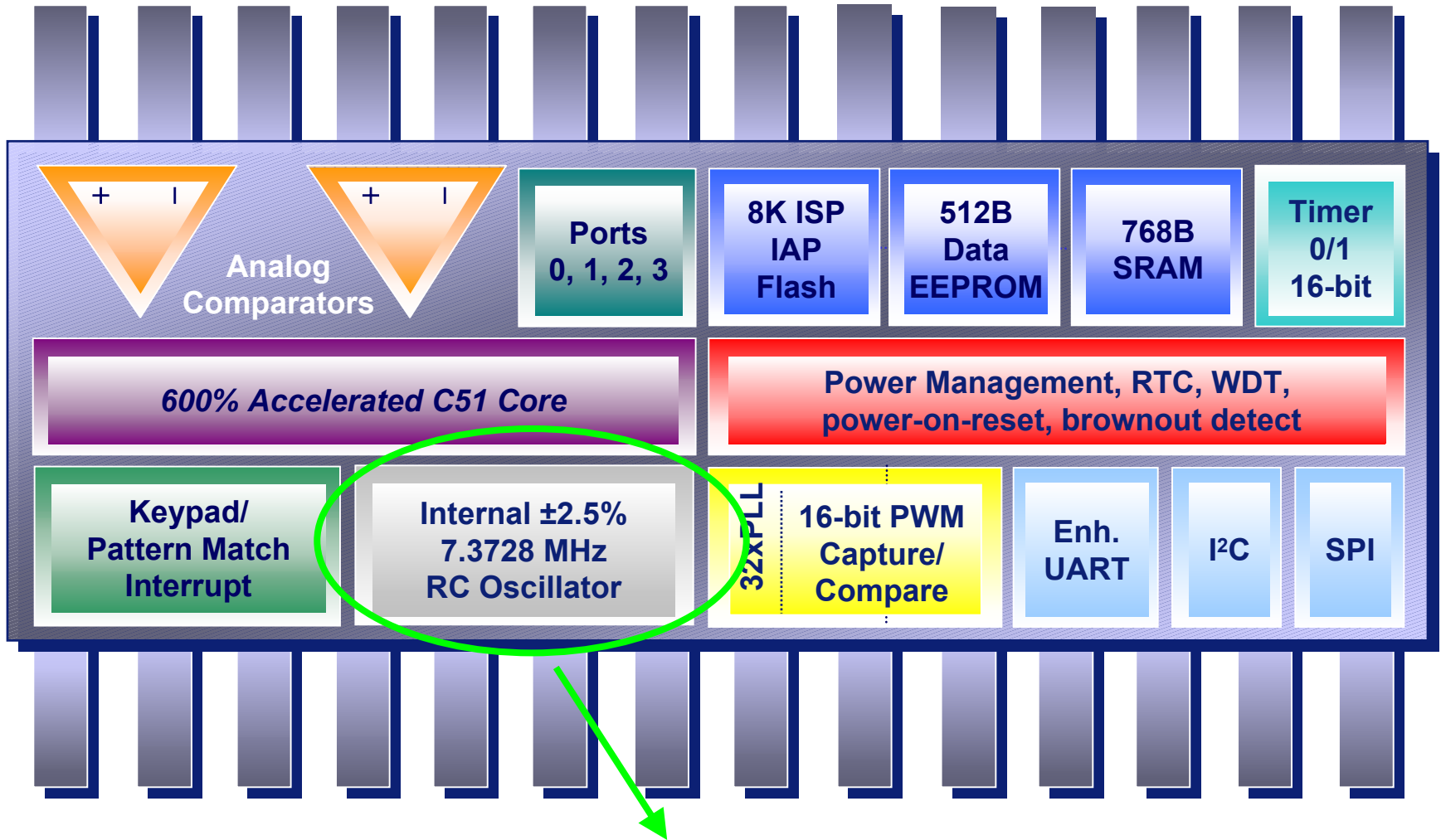


9: Keypad Interrupts

Keypad Interrupts

Keypad/
Pattern Match
Interrupt

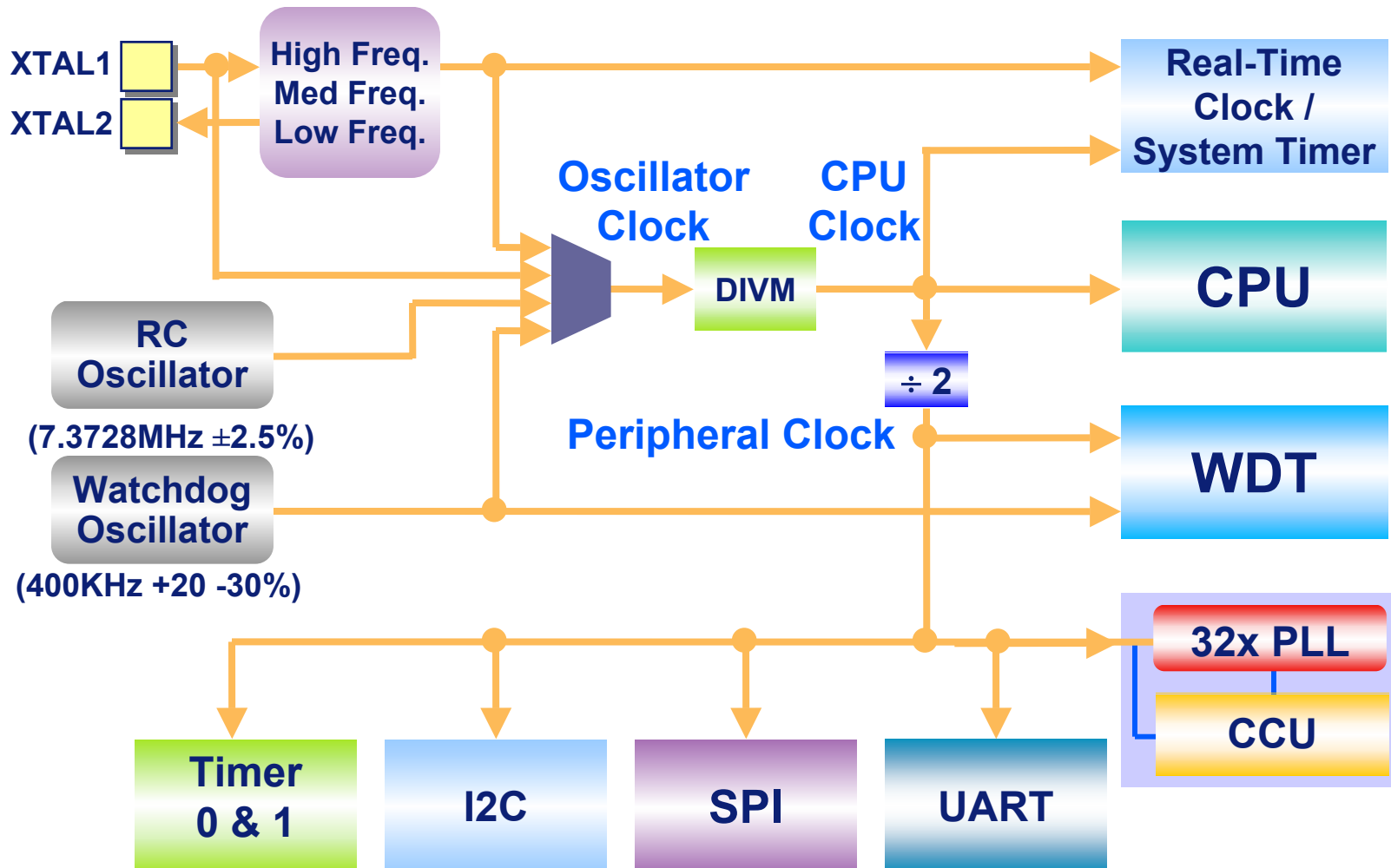


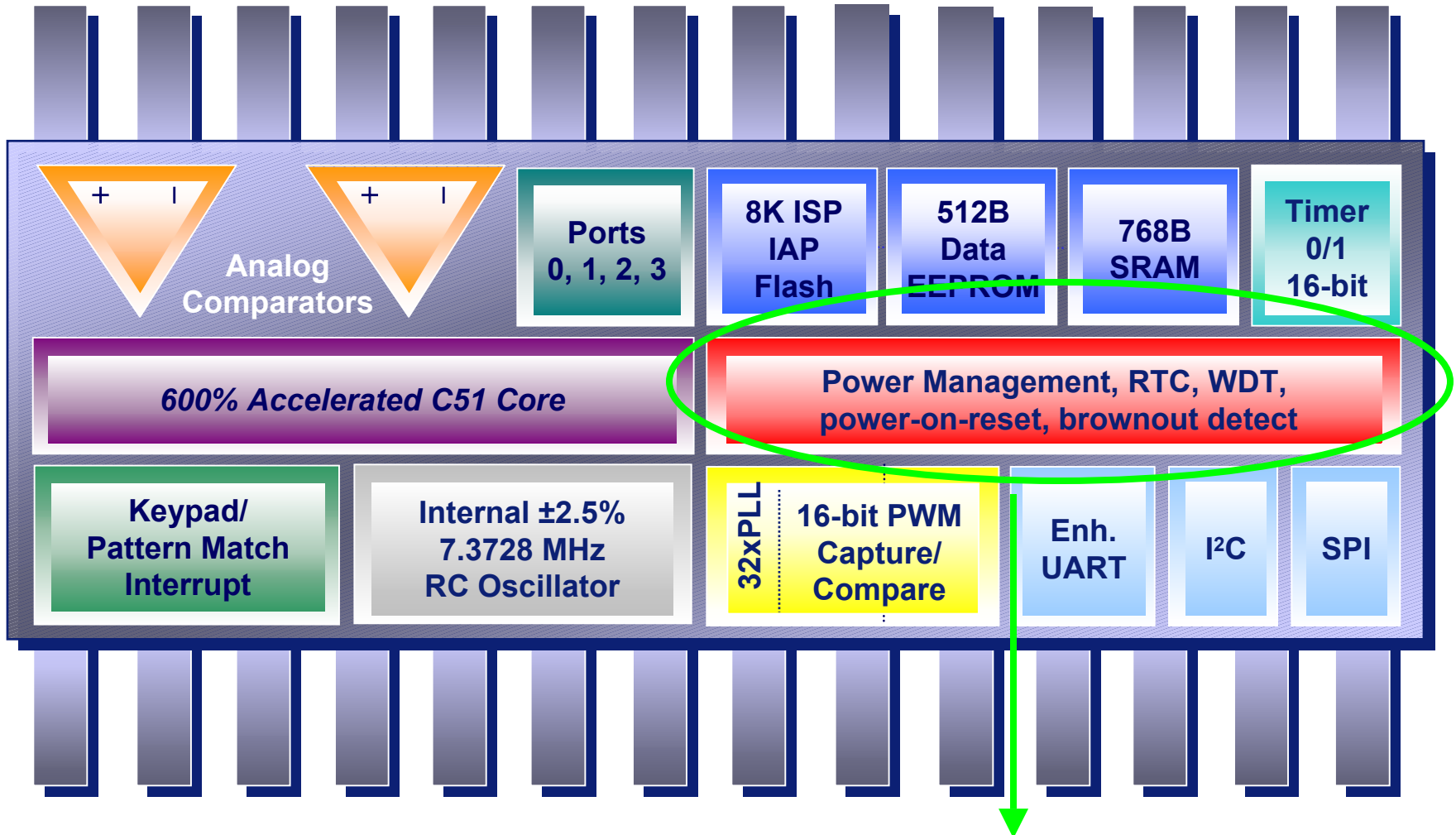


10: Clock Tree

Clock Tree and Clock Signals

Internal $\pm 2.5\%$
7.3728 MHz
RC Oscillator



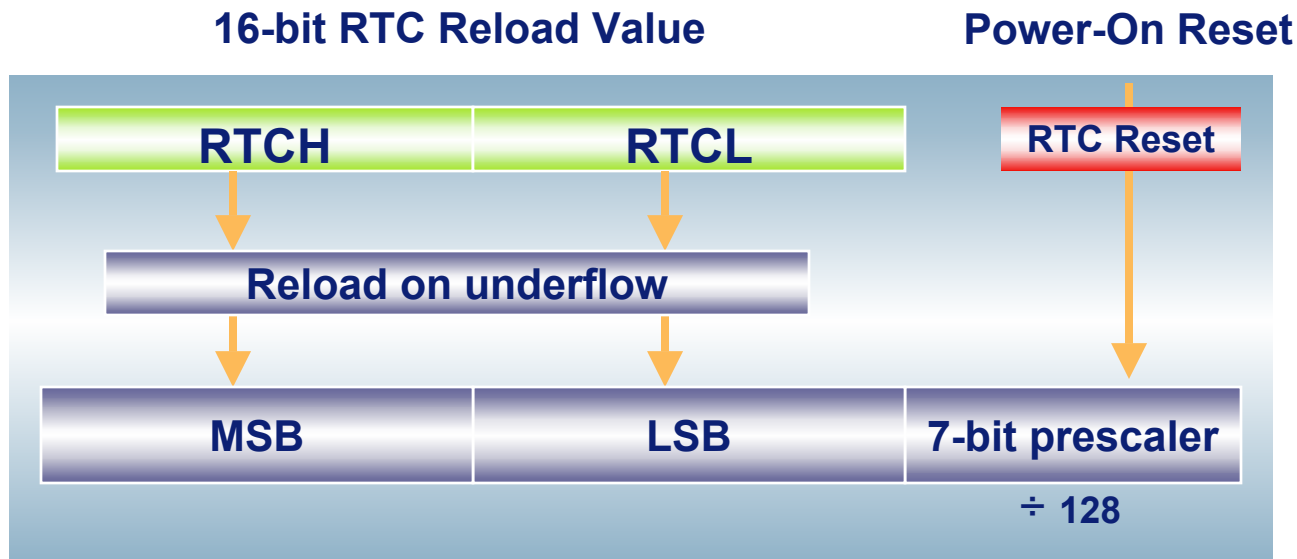


11: System Supervisory Functions

Real Time Clock / System Timer

Power Management, RTC, WDT,
power-on-reset, brownout detect

- 16-bit down-counter with 7-bit prescaler
- Can be used to wake up the device from Power-Down
- Can generate an interrupt on underflow



Power Management

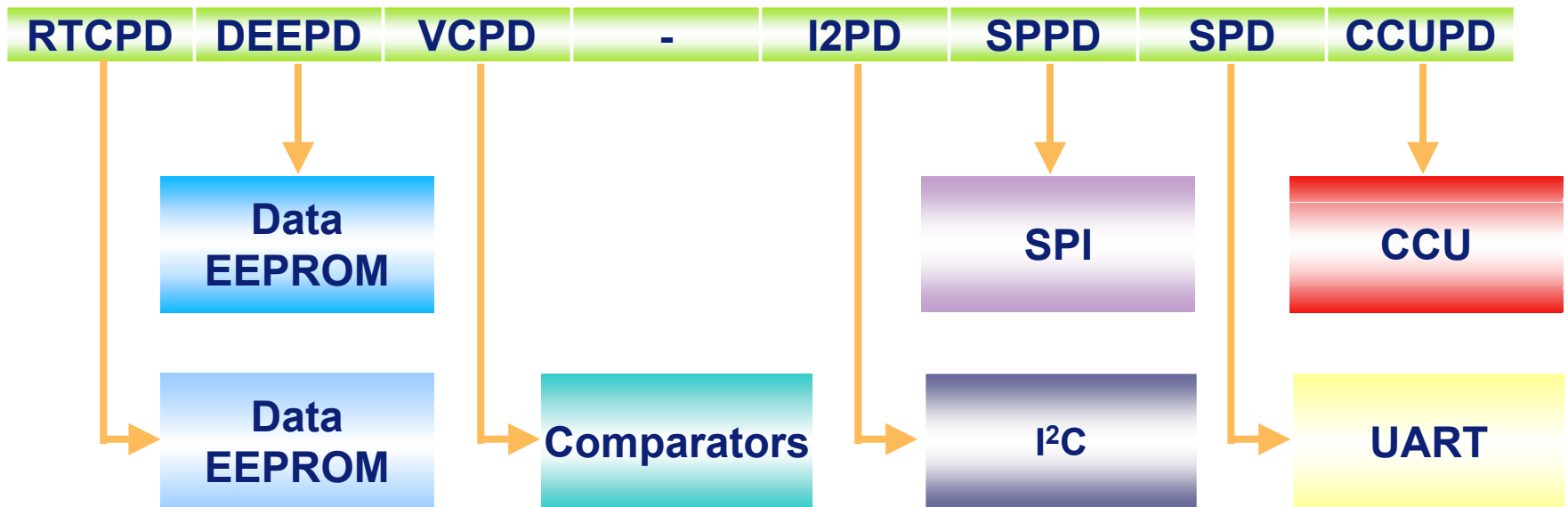
Power Management, RTC, WDT,
power-on-reset, brownout detect

Normal Mode	Core and Peripherals running, but individual peripherals can be powered down with PCONA.
Idle Mode	The core is turned off, peripherals still run or can be powered down with PCONA.
Power Down	Only System timer/ RTC, Comparators, BOD, WDT can still run (if enabled).
Total Power Down Mode	Only System timer / RTC and WDT can still run (if enabled).

Power Management

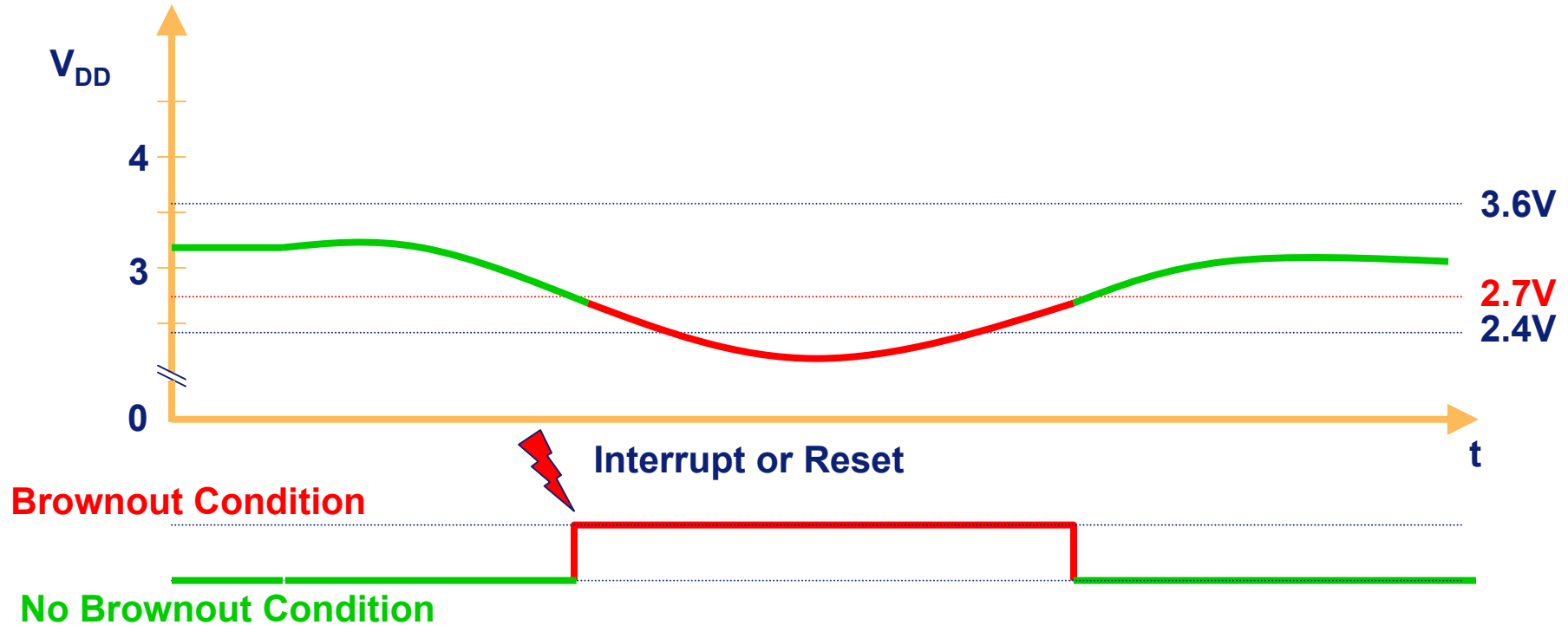
Power Management, RTC, WDT,
power-on-reset, brownout detect

- PCONA register can power-down unused peripherals



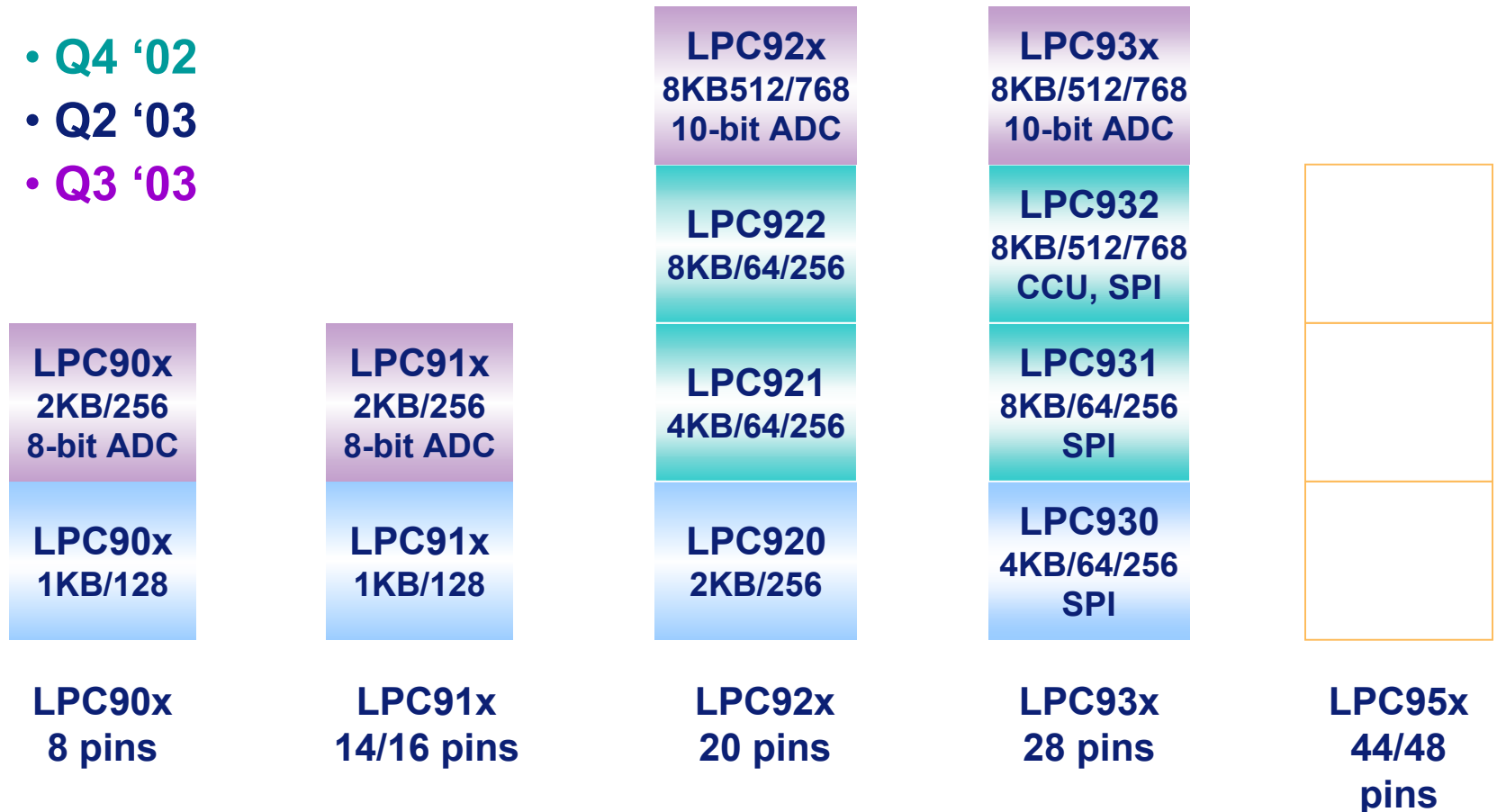
Brown-Out-Detect

- Determines if the operation voltage drops below a certain level

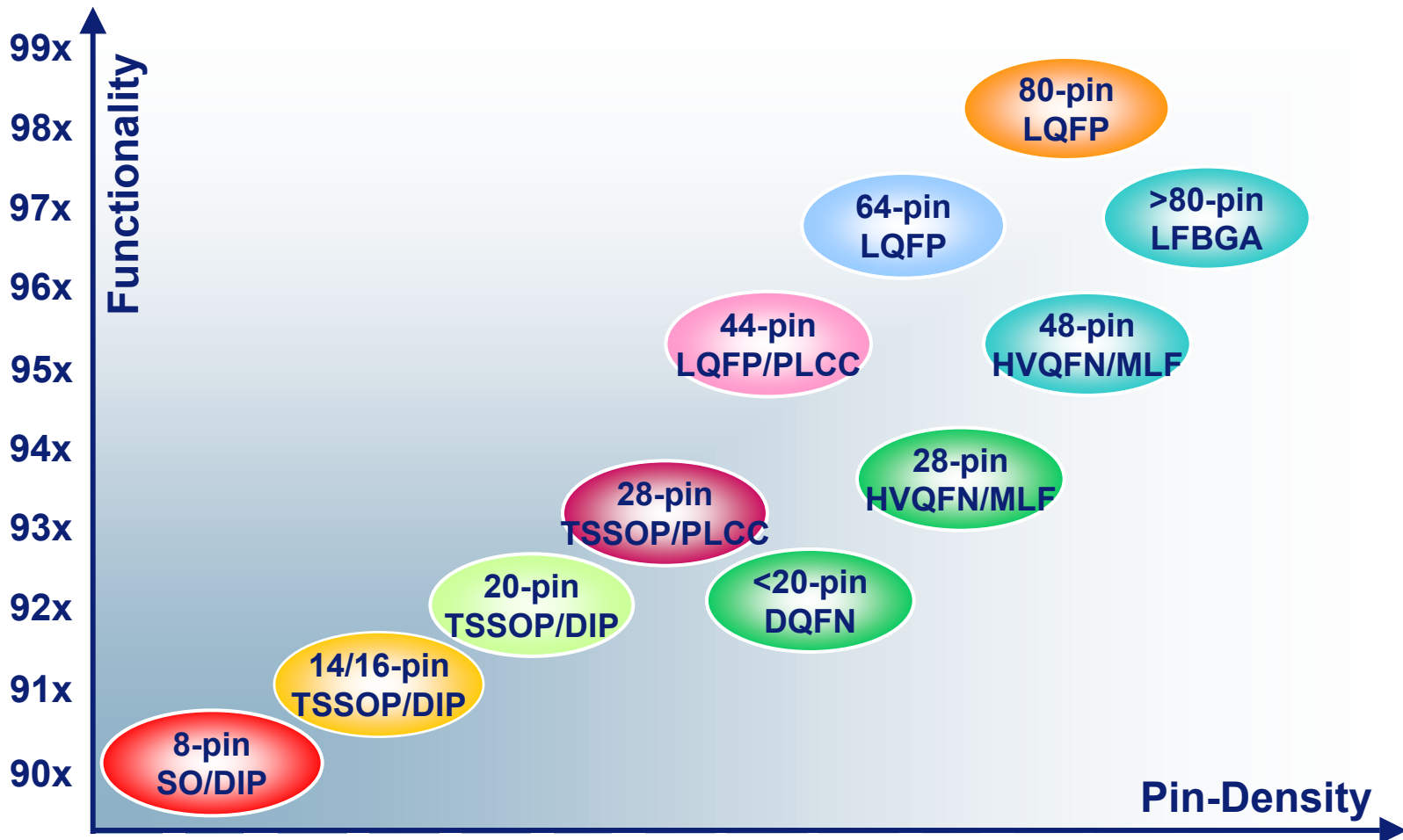


Planned LPC900 Family

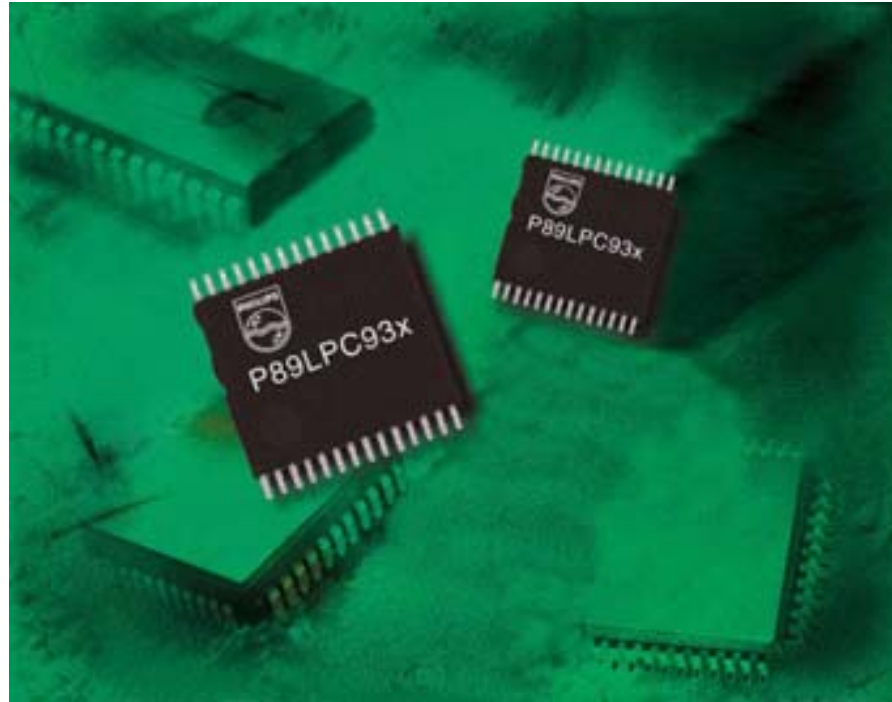
- Q4 '02
- Q2 '03
- Q3 '03



LPC900 Family – Package Trends



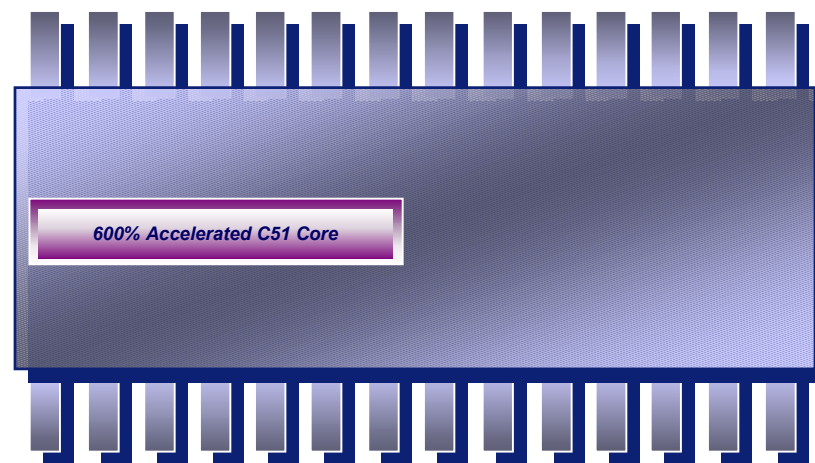
Summary



P89LPC932 – Low Power 3V Flash MCU

The Core:

- Real 6x Accelerated 80C51 Core
- Improved Speed, Power, & EMC
- 167ns Instruction Cycle Time @ 12MHz

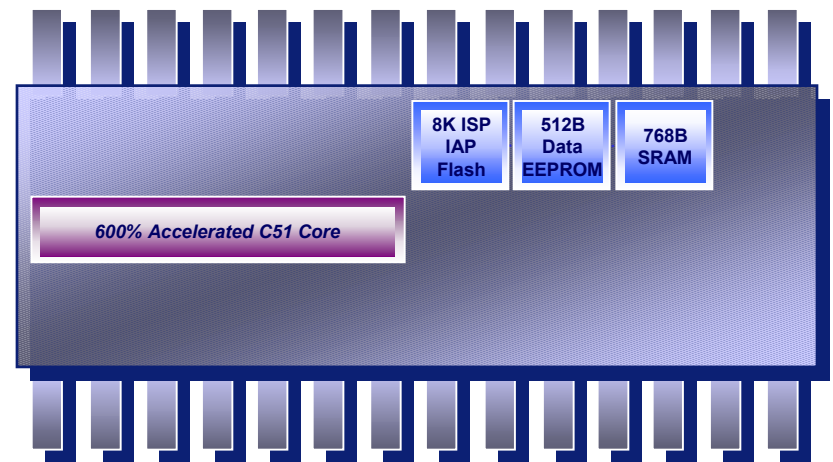


P89LPC93x

P89LPC932 – Low Power 3V Flash MCU

The Memory:

- Low-Power 3V Flash up to 8KB (0.35μ)
 - In-System / In-Application Programming (ISP/IAP)
 - 2ms Page Program/Erase
- 512Byte Data E²PROM
- Up to 768Byte SRAM

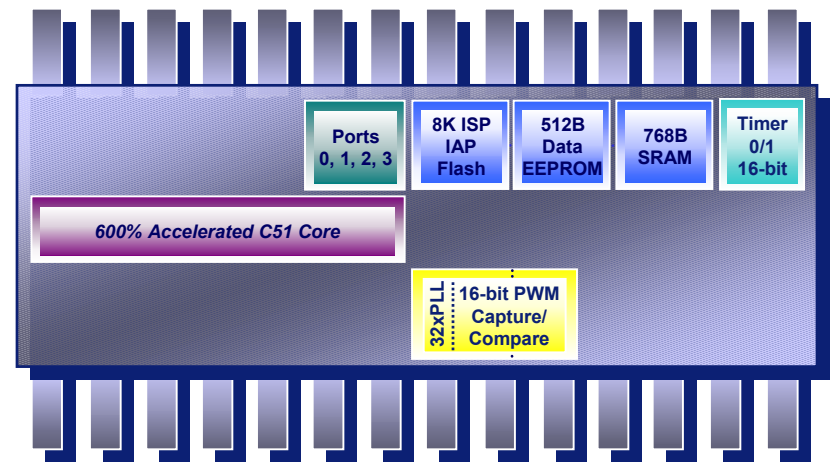


P89LPC93x

P89LPC932 – Low Power 3V Flash MCU

The Peripherals:

- Capture/Compare Unit
 - 4-channel, 0-16 bit PWM with 32x PLL
 - Up to 32KHz PWM with 10-bit resolution
 - 32MHz max. Timer
- Two 16-bit Timers 0/1 with 8-bit PWM option
- Four configurable I/O Ports

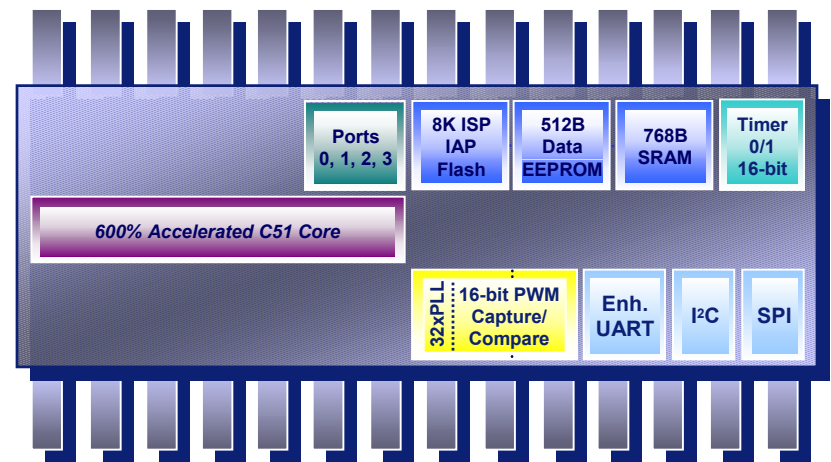


P89LPC93x

P89LPC932 – Low Power 3V Flash MCU

More Peripherals:

- Enhanced UART
 - Baud Rate Generator
 - Break Detection
 - LIN Support
- I2C Interface – 400 Kbit/s
- Serial Peripheral Interface – 3Mbit/s

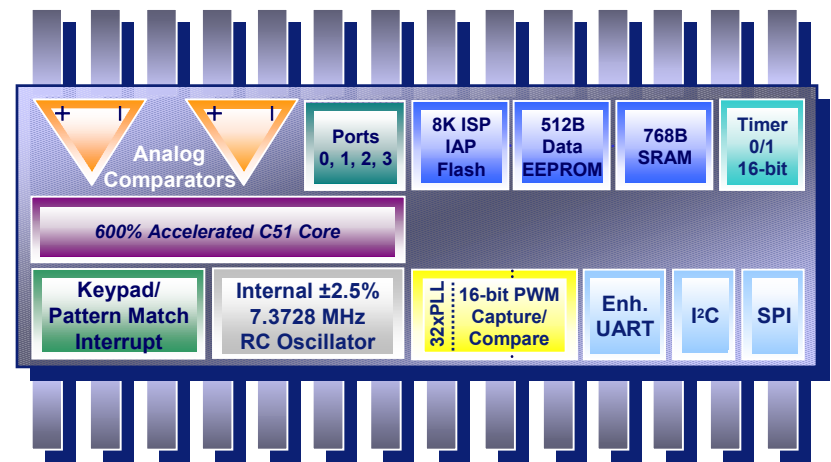


P89LPC93x

P89LPC932 – Low Power 3V Flash MCU

More Peripherals:

- Two Analog Comparators
- Keypad/Pattern Match Interrupt
- $\pm 2.5\%$ On-chip Oscillator
 - 7.3728MHz for Standard
 - Asynchronous Baud Rates

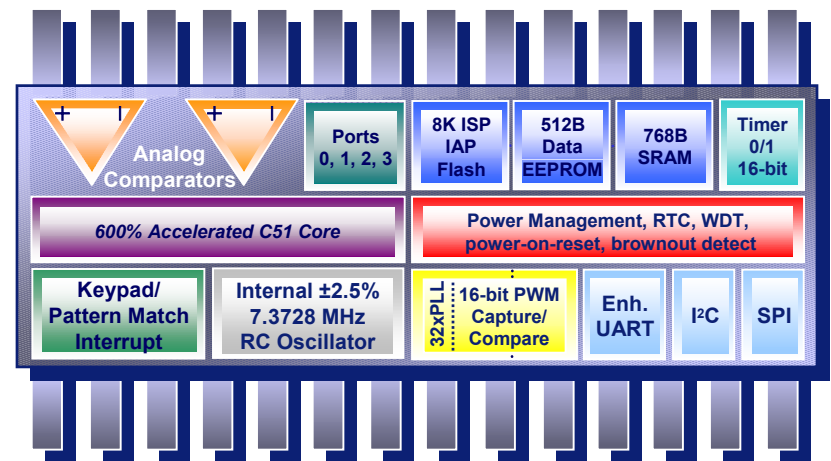


P89LPC93x

P89LPC932 – Low Power 3V Flash MCU

System-Supervisory:

- Flexible Power Management
- Real-Time Clock
- Watchdog Timer
- Power-on Reset
- Brown-out Detect

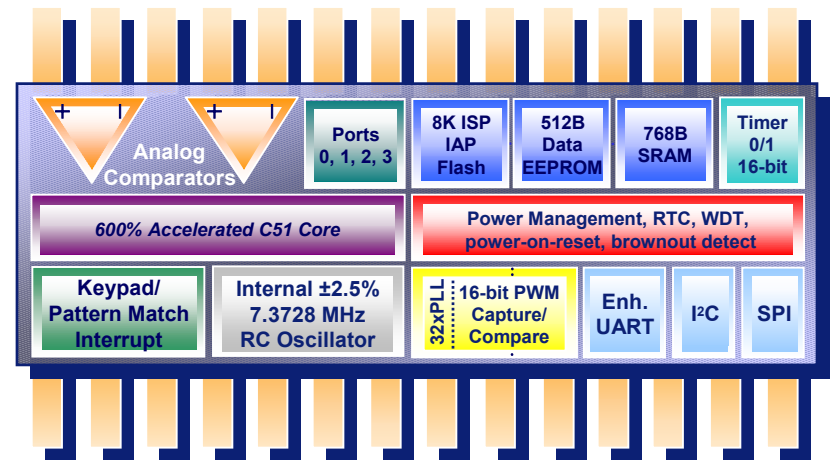


P89LPC93x

P89LPC932 – Low Power 3V Flash MCU

The Packages:

- 28-pin TSSOP & PLCC
- Up to 26-pin can be used for I/O!
- Consistent Packages / Pin-outs planned from 8 pins to 80 pins

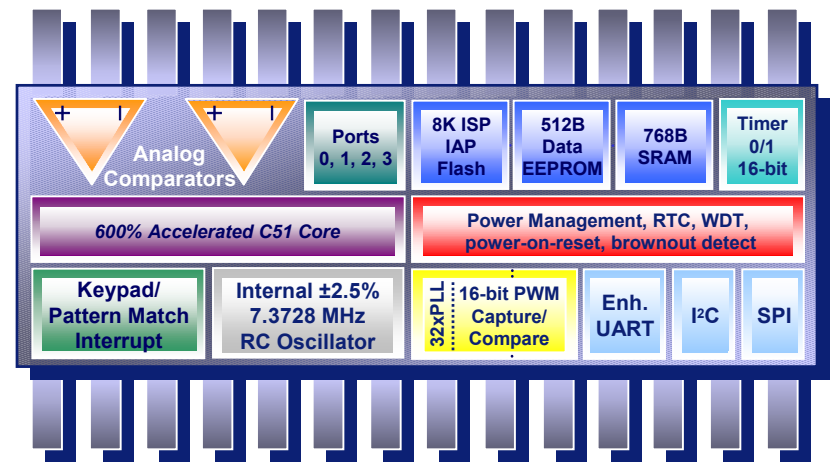


P89LPC93x

P89LPC932 – Low Power 3V Flash MCU

Philips LPC:

- Low Pin Count
- Low Power Consumption
- Low Part Count
- Low Part Cost



P89LPC93x

