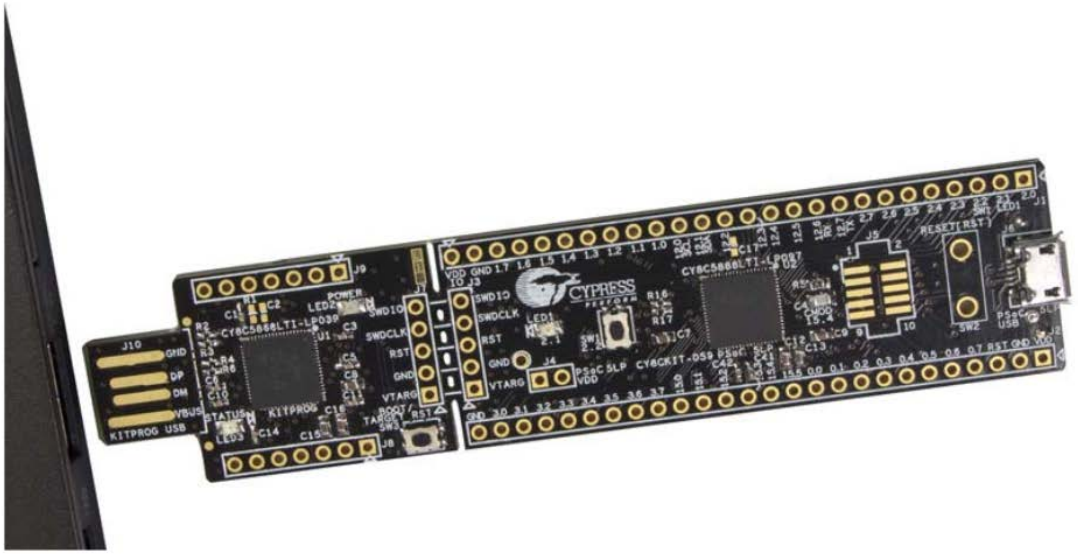
Introduction to PSoC 5LP



CY8CKIT-059 PSoC® 5LP Prototyping Kit Guide, Doc. #: 001-96498 Rev. *C

Agenda

- What is a PSoC?
- What is the PSoC 5LP Prototyping Kit?
- What can you do with it?
- How do you program it?
- Where can you go next?

What is a PSoC?

System **o**n **C**hip typically has

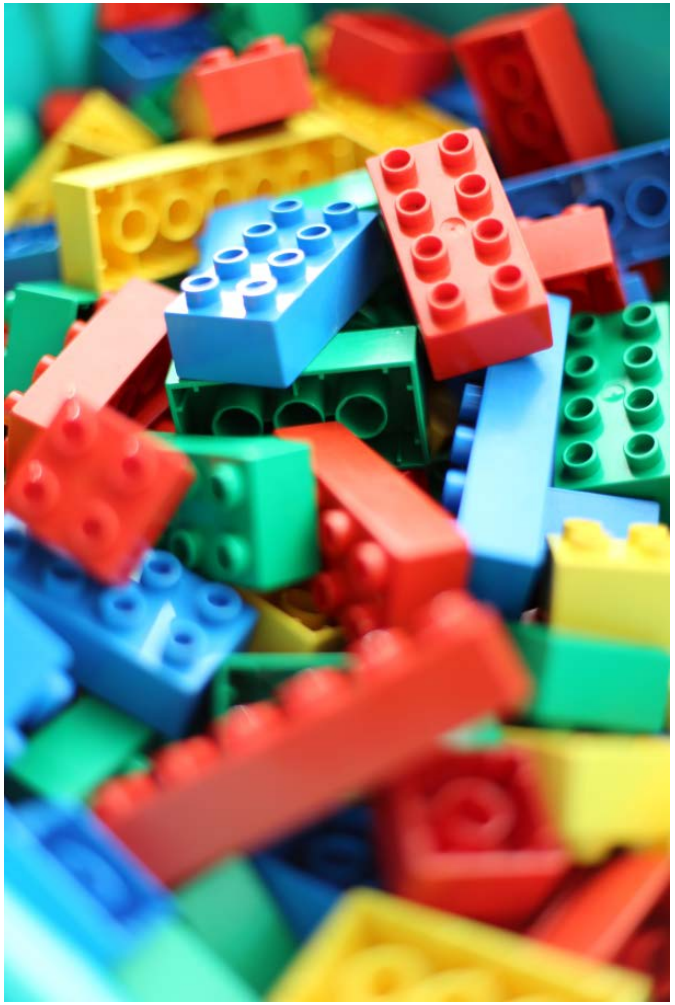
- CPU
- RAM
- Flash
- Clocking system
- Power management
- I/O
- Interrupt controller
- Communication bus interfaces
- ...

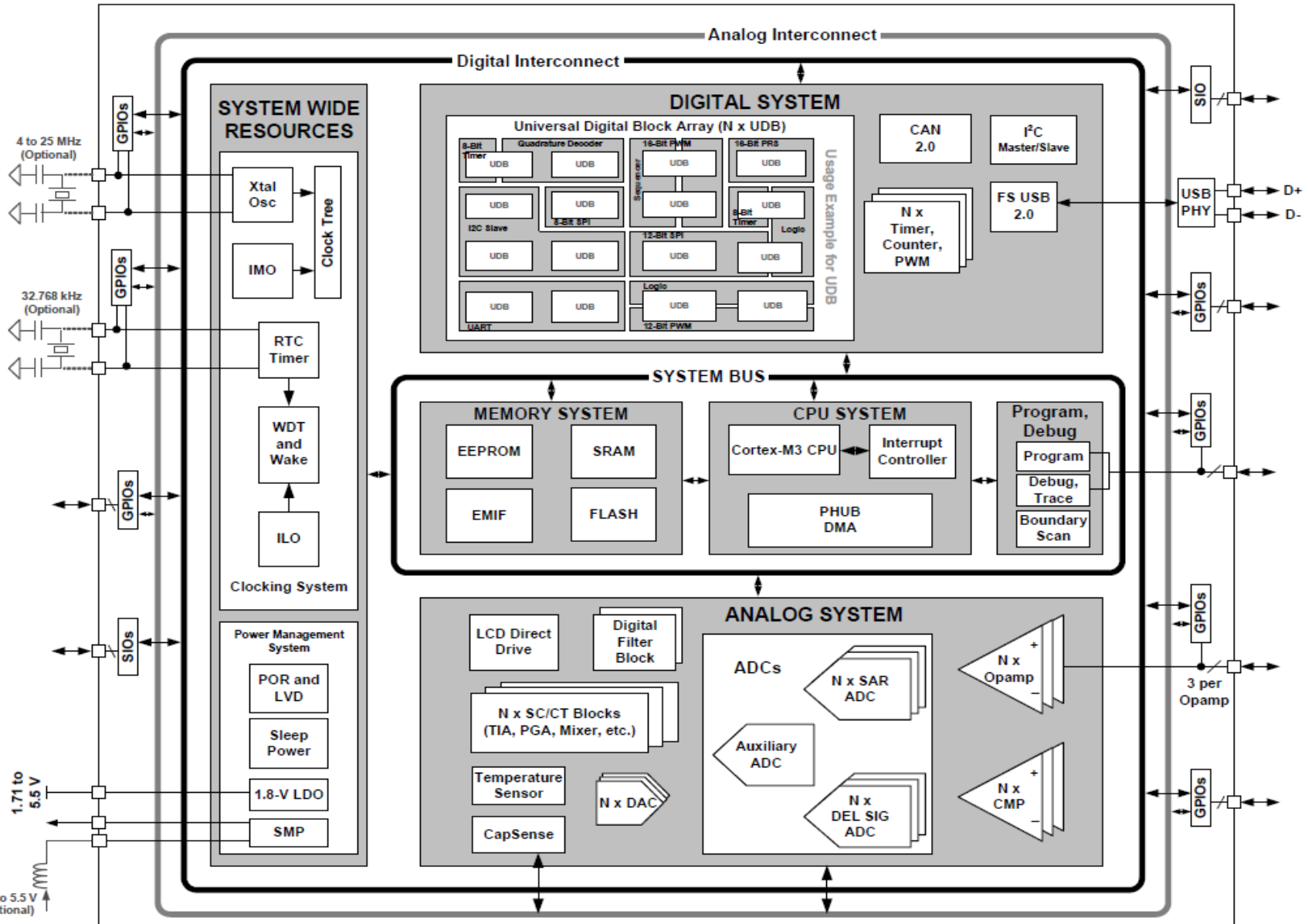
on a single IC!

What is a PSoC?

Programmable **S**ystem **o**n **C**hip

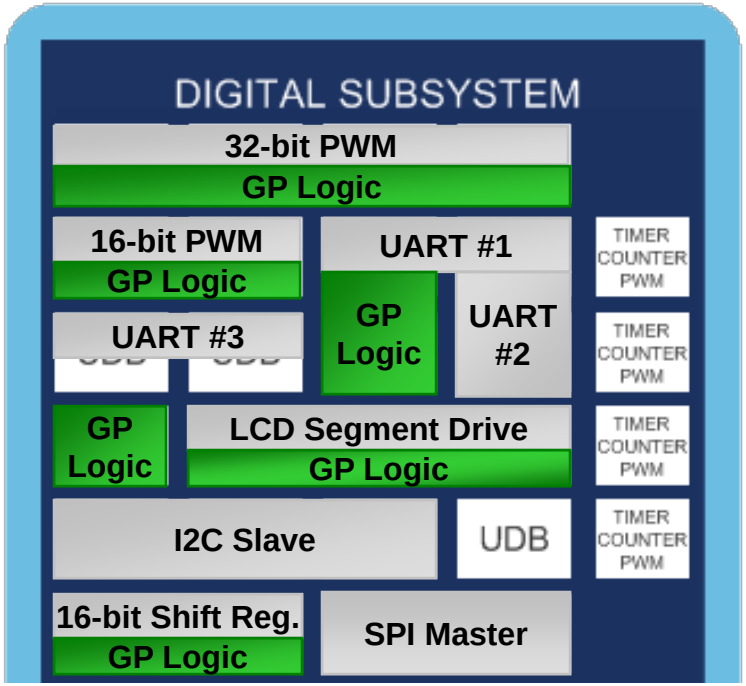
- Universal digital block array
- Analog subsystem
- Programmable routing




Analog Interconnect
Digital Interconnect
SYSTEM WIDE RESOURCES
DIGITAL SYSTEM
Universal Digital Block Array (N x UDB)
Usage Example for UDB
CAN 2.0
I²C Master/Slave
FS USB 2.0
N x Timer, Counter, PWM
SYSTEM BUS
MEMORY SYSTEM
EEPROM
SRAM
EMIF
FLASH
CPU SYSTEM
Cortex-M3 CPU
Interrupt Controller
PHUB DMA
Program, Debug
Program
Debug, Trace
Boundary Scan
ANALOG SYSTEM
LCD Direct Drive
Digital Filter Block
N x SC/CT Blocks (TIA, PGA, Mixer, etc.)
Temperature Sensor
N x DAC
CapSense
ADCs
N x SAR ADC
Auxiliary ADC
N x DEL SIG ADC
N x Opamp
N x CMP
3 per Opamp
Xtal Osc
IMO
Clock Tree
RTC Timer
WDT and Wake
ILO
Clocking System
Power Management System
POR and LVD
Sleep Power
1.8-V LDO
SMP
4 to 25 MHz (Optional)
32.768 kHz (Optional)
1.71 to 5.5 V
0.5 to 5.5 V (Optional)
GPIOs
SIOs
SIO
USB PHY
D+
D-

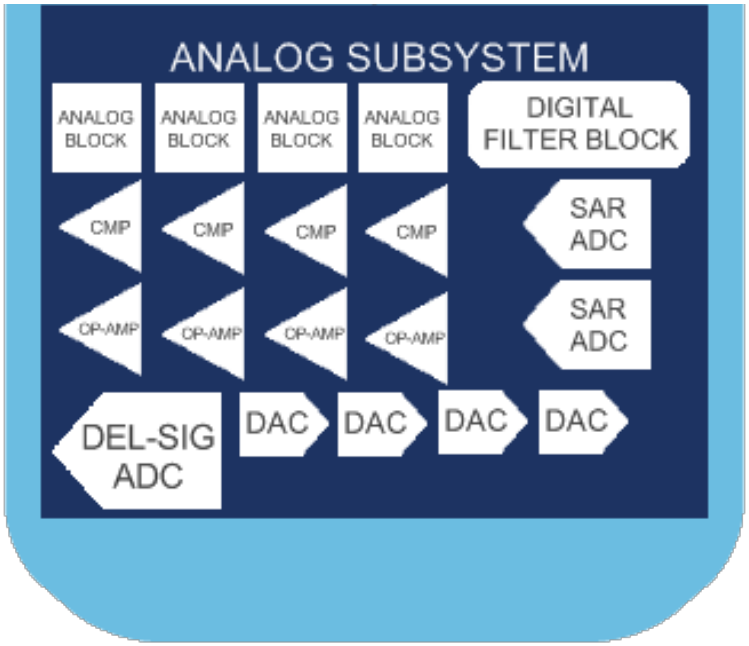
Universal Digital Block Array (UDB)

- Flexibility of a PLD/FPGA integrated with a CPU
- Provides access to pre-build components in PSoC Creator, fx:
  - UART
  - SPI
  - logic gates (AND, OR, NOR, etc)
  - quadrature decoders, and more.
- May also be used to implement additional:
  - I2C
  - timer
  - counter
  - PWM functions



Configurable Analog Subsystem

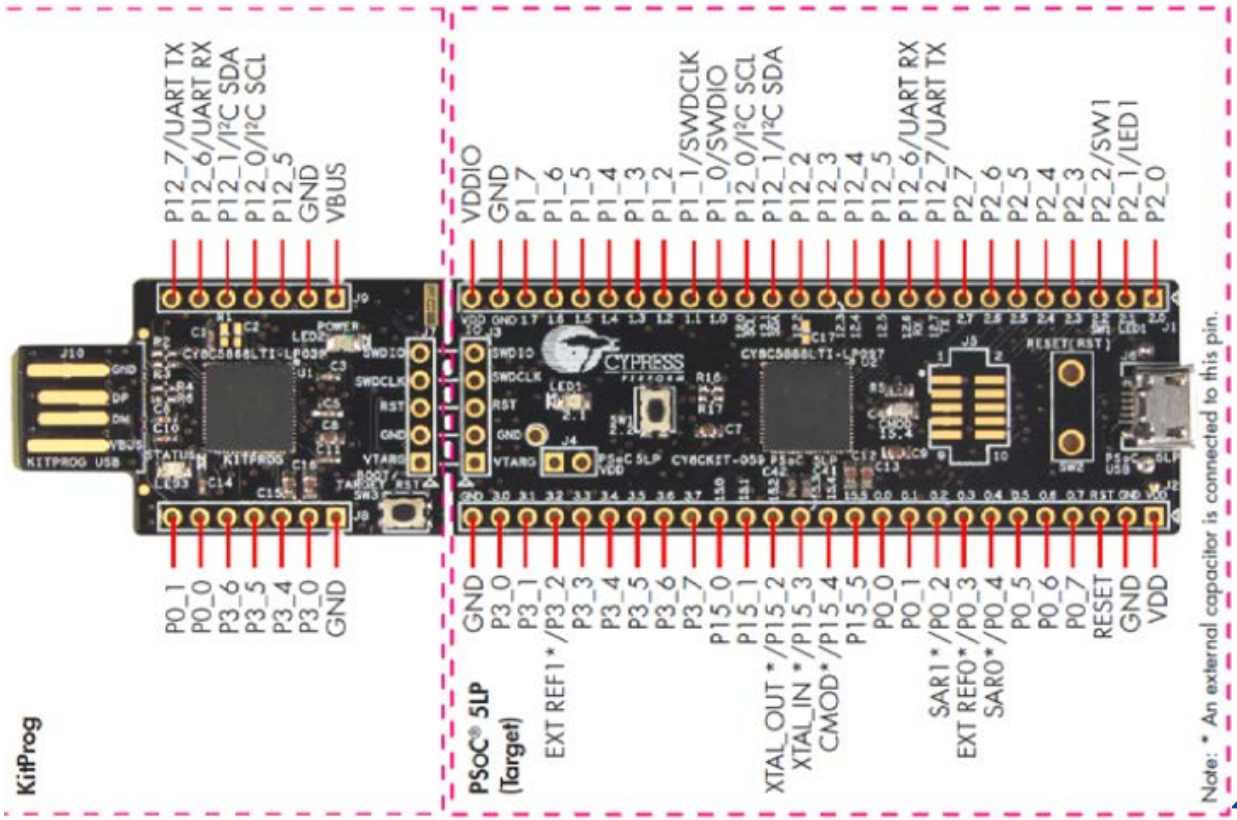
- Flexible Routing: All GPIO are Analog Input/Output
- Delta-Sigma ADC
- SAR ADC
- DACs
- Low Power Comparators
- OpAmps
- Programmable Analog Blocks
  - Configurable PGA (up to x50), Mixer, Trans-Impedance Amplifier, Sample and Hold
- Digital Filter Block: Implement HW IIR and FIR filters
- CapSense Touch Sensing enabled



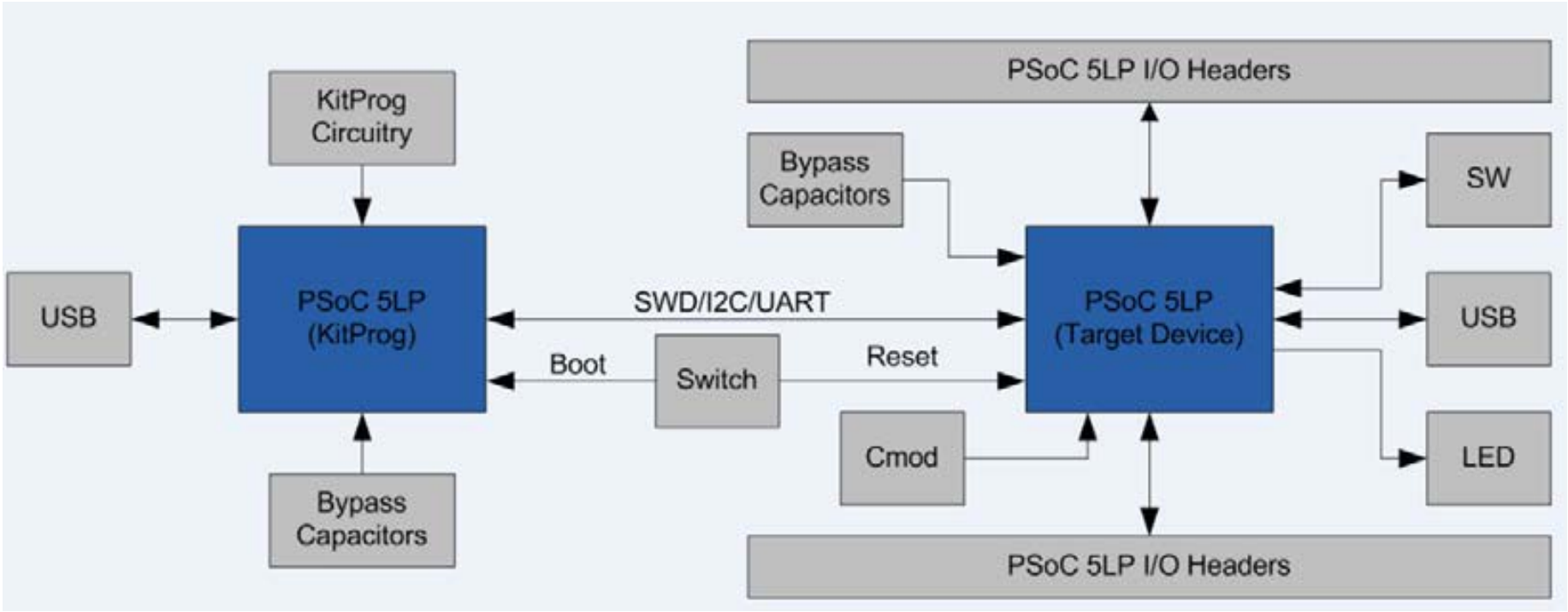
CY8CKIT-059 PSoC 5LP Prototyping Kit

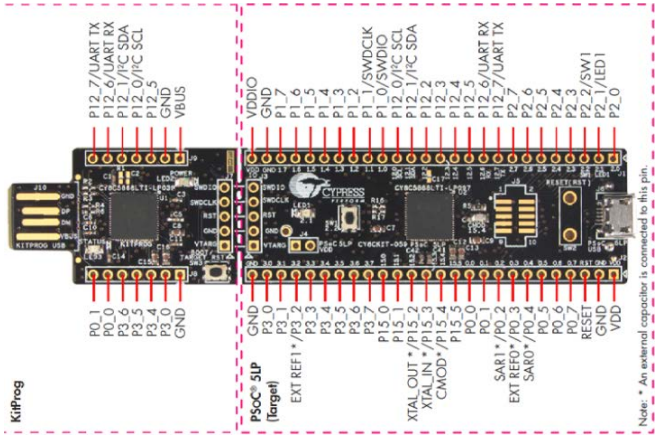
Information can be found in CY8CKIT-059 PSoC ® 5LP Prototyping Kit Guide.

There is a link on blackboard.



CY8CKIT-059 PSoC 5LP Prototyping Kit





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Specs

https://www.flickr.com/photos/pvkr/sets/72157614800440079/

Specs

CPU Core	ARM Cortex-M3
Max. Operating Frequency (MHz)	80
SRAM (KB)	64
EEPROM (KB)	2
Flash (KB)	256
No. of SIO	8
No. of GPIOs	38
No. of DMA Channels	24
Dedicated ADC (#_ Max Resolution @ Sample Rate)	DelSig (1, 20-bit @ 180 sps) SAR (2, 12-bit @ 1000 ksps)
Dedicated DAC (#_ Max Resolution @ Sample Rate)	(4, 8-bit @ 8 msps)

Processor datasheet: http://www.cypress.com/part/cy8c5888lti-lp097

Specs

No. of Dedicated Comparators	4
No. of Dedicated Digital Filter Blocks	1
No. of Dedicated I2C	1
No. of Dedicated OpAmps	2
No. of Dedicated SPI	0
No. of Dedicated Timer/Counter/PWM Blocks	4
No. of Dedicated UART	0
No. of Programmable Analog Blocks	4
No. of Programmable Universal Digital Blocks	24
USB (Type)	Full-Speed
LCD Direct Drive (Yes/No)	Y
No. of USB IO	2

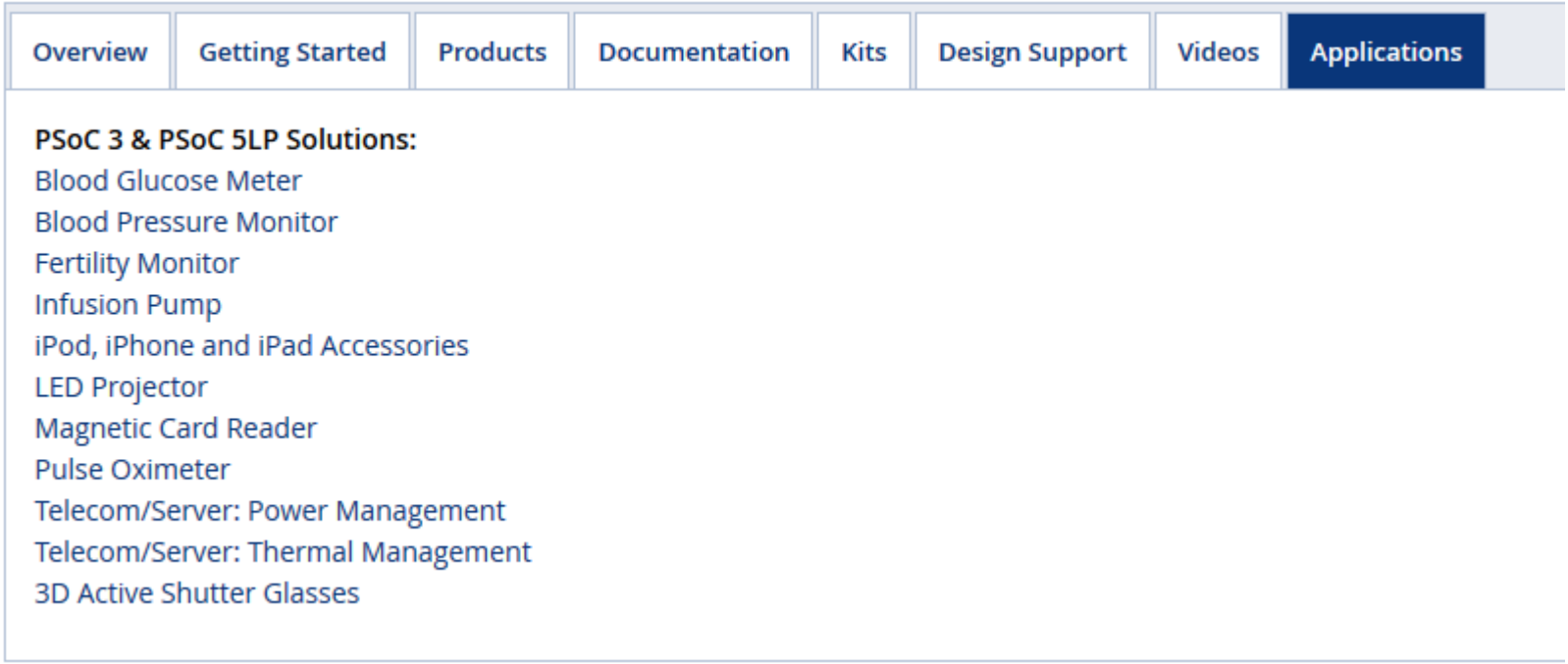
Processor datasheet: http://www.cypress.com/part/cy8c5888lti-lp097

What can you do with it?

PSoC Is Everywhere!

What can you do with it?

- Temperature measurement, motor control, etc..
- PSoC4 - “100 Projects in 100 Days”: http://www.element14.com/community/thread/23736?start=0&tstart=0
- http://www.cypress.com/products/32-bit-arm-cortex-m3-psoc-5lp

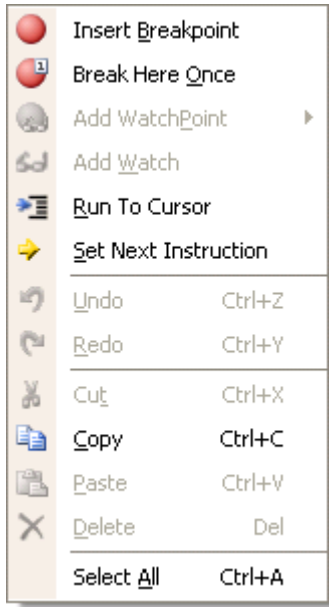


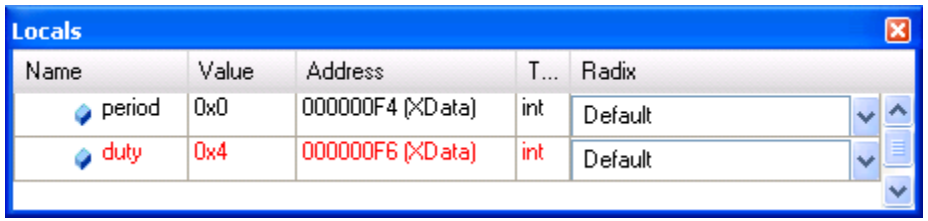
How do you program it?

- No C++ support, just plain C.
- Use the PSoC Creator to design the hardware and write the code.
- Use built in programmer and debugger: KitProg
- We will not use an operating system.
  - But Cypress says that the following OS'es are available, so you can experiment with them if you like:
    - embOS
    - FreeRTOS
    - Micrium uc/OS-III

Integrated debugger

- Control execution with menus, buttons and keys
- Full set of debug windows
  - Locals, register, call stack, watch (4), memory (4)
  - C source and assembler
  - Components
- Set breakpoints in Source Editor





Supported compilers

- Free Bundled compiler options
  - PSoC 4 / PSoC 5: GNU (Sourcery CodeBench Lite)
  - No code size restrictions, not board-locked, no time limit
  - Fully integrated including full debugging support

CodeSourcery

GNU

KEIL™ An ARM® Company

- Upgrade, more optimization/compiler-support options
  - PSoC 4 / PSoC 5: Keil RealView® Microcontroller Development Kit
  - Higher levels of optimization
  - Direct support from the compiler vendor

Where can you go next?

- PSoC:
  - Generally: http://www.cypress.com/psoc/
- PSoC 5:
  - Generally: http://www.cypress.com/products/32-bit-arm-cortex-m3-psoc-5lp
  - CY8CKIT-059: http://www.cypress.com/documentation/development-kitsboards/cy8ckit-059-psoc-5lp-prototyping-kit-onboard-programmer-and
  - http://www.cypress.com/part/cy8c5888lti-lp097
  - PSoC 5LP Architecture TRM: http://www.cypress.com/documentation/technical-reference-manuals/psoc-5lp-architecture-trm
  - CY8C58 Family datasheet: http://www.cypress.com/documentation/datasheets/psoc-5lp-cy8c58lp-family-datasheet-programmable-system-chip-psoc
- PSoC Creator:
  - Generally: http://www.cypress.com/psoccreator/
  - Training: http://www.cypress.com/?rID=40547
- PSoC Forum: http://www.cypress.com/?app=forum

Where can you go next?

- PSoC Application notes: http://www.cypress.com/?app=search&searchType=advanced&keyword=&rtID=76&id=1353&applicationID=0&l=0
- PSoC Blog Posts: http://www.cypress.com/search/all?f[0]=meta_type%3Atechnical_documents&f[1]=resource_meta_type%3Ablog_entry
- Digilent Pmod daughter cards: https://www.digilentinc.com/Products/Catalog.cfm?NavPath=2,401&Cat=9
- Code examples: http://www.cypress.com/documentation/code-examples/psoc-345-code-examples

Recap

- What is a PSoC?
  - Programmable System on Chip
- What is the PSoC 5LP Prototyping Kit?
  - Your hardware ☺
- What can you do with it?
  - Anything that an ordinary MCU can do, plus digital logic and analog.
- How do you program it?
  - From the PSoC Creator
- Where can you go next?
  - The interwebs..

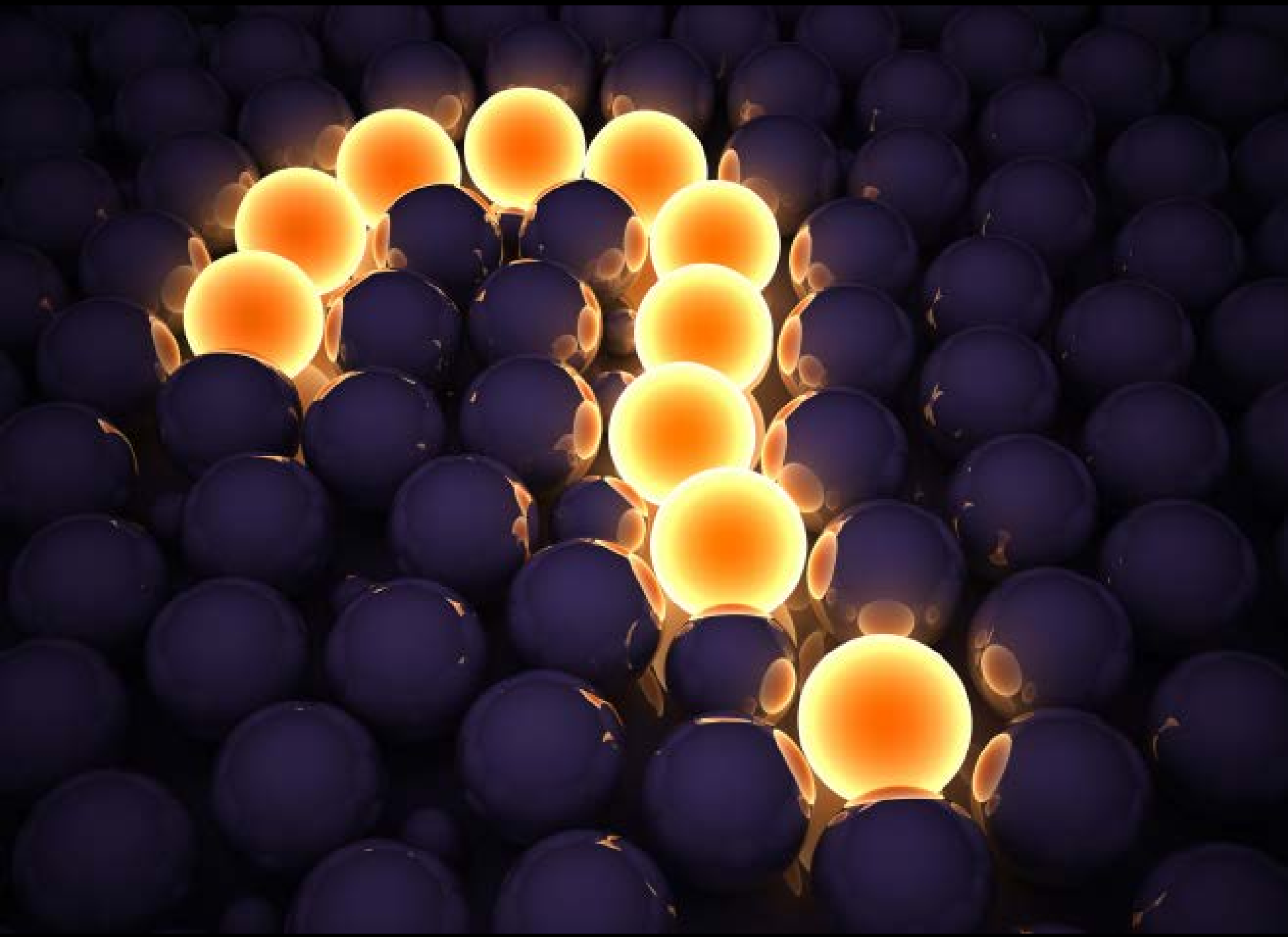


Image resources

- Cypress manuals and web site.
- Playing cards: https://www.flickr.com/photos/pvkr/sets/72157614800440079/
- Lego bricks: https://commons.wikimedia.org/wiki/File:Lego_dublo_arto_alanenpaa_3.JPG
- Question mark: https://wall.alphacoders.com/big.php?i=437563