PSoC® PROGRAMMABLE SYSTEM-ON-CHIP
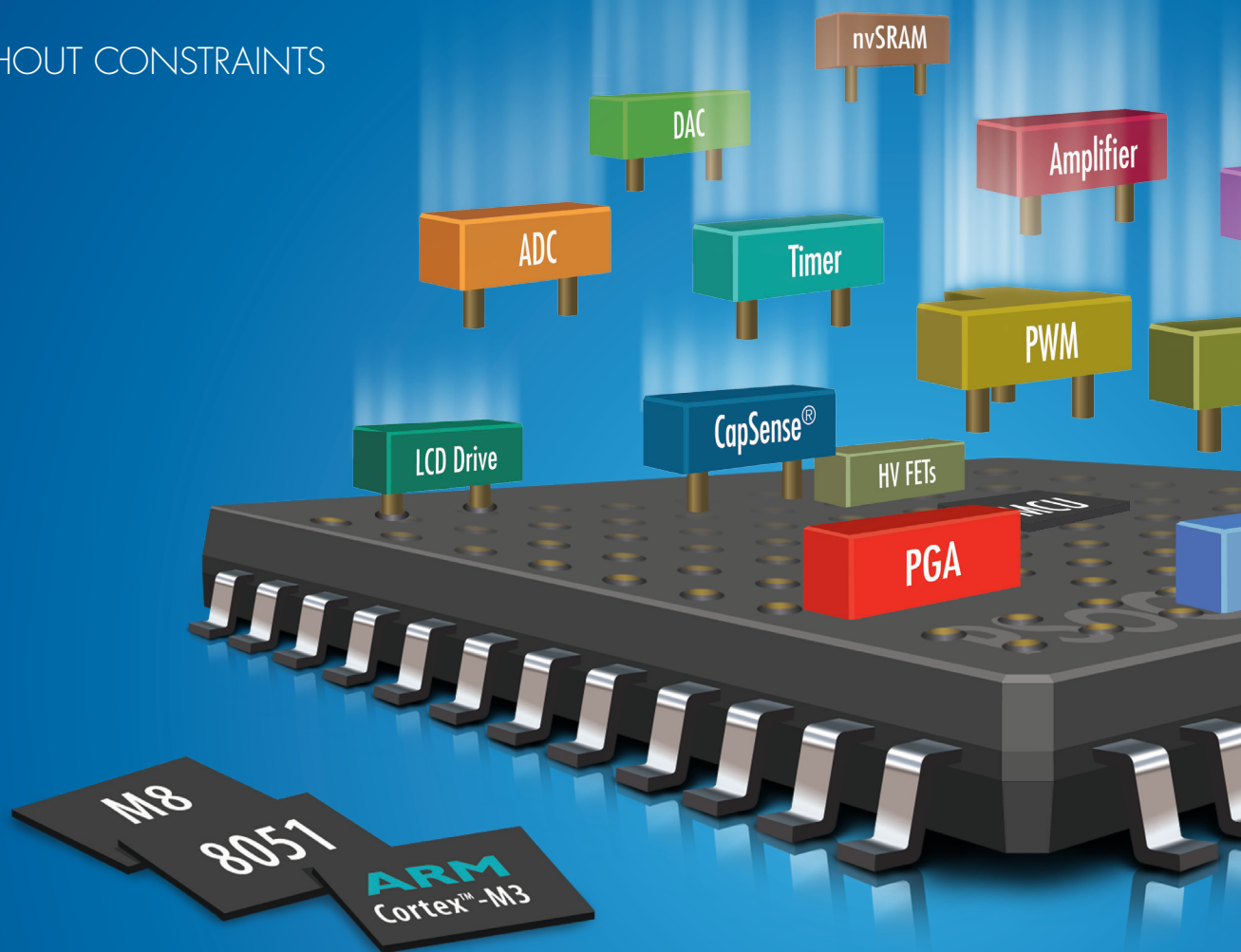
Higher Integration, Faster Time-To-Market, Greater Embedded Design Flexibility

DESIGN WITHOUT CONSTRAINTS

nvSRAM

DAC

Amplifier

ADC

Timer

PWM

CapSense®

LCD Drive

HV FETs

MCU

PGA

M8

8051

ARM
Cortex™-M3

CYPRESS
PERFORM

DESIGN FREEDOM.
BREAKTHROUGH TECHNOLOGY.

You're not waiting for the next big thing to come along. You're designing it. Cypress's PSoC® programmable system-on-chip platform gives you the freedom to imagine revolutionary new products and the capability to get to market faster than anyone else.

PSoC is a true **programmable embedded SoC** integrating configurable analog and digital peripheral functions, memory and a microcontroller on a single chip. With an extremely flexible visual embedded design methodology that includes preconfigured, user-defined peripherals and hierarchical schematic entry, you can change your mind as often as you want and stay on schedule. No more restarting projects from scratch. No more catalogs. No more limitations.

EXPANDING PSoC ARCHITECTURES

Cypress's breakthrough **PSoC 3 and PSoC 5** architectures extend the world's only programmable embedded system design platform, shattering your design limitations. Take advantage of high-precision programmable analog including 12-bit SAR and 20-bit delta-sigma ADCs, a digital logic library with dozens of drop-in peripherals, best-in-class power management and rich connectivity resources. Implement your 8-, 16-, or 32-bit designs with the high-performance 8051 or advanced ARM® Cortex™-M3 processors.

Cypress's **PSoC 1** architecture provides access to truly programmable analog and digital resources on a single chip. PSoC 1 is Cypress's entry-level PSoC family that provides a single-chip solution for your application.

With Cypress's PSoC programmable system-on-chip, the possibilities are endless. It's breakthrough design without constraints.

Cypress introduces PSoC 5LP ARM Cortex-M3 devices, designed to offer 0.5 V startup with integrated boost, 300 nA low leakage Hibernate mode and more than twenty programmable analog components including best-in-class ADCs.

PSoC: ONE PLATFORM, THREE ARCHITECTURES
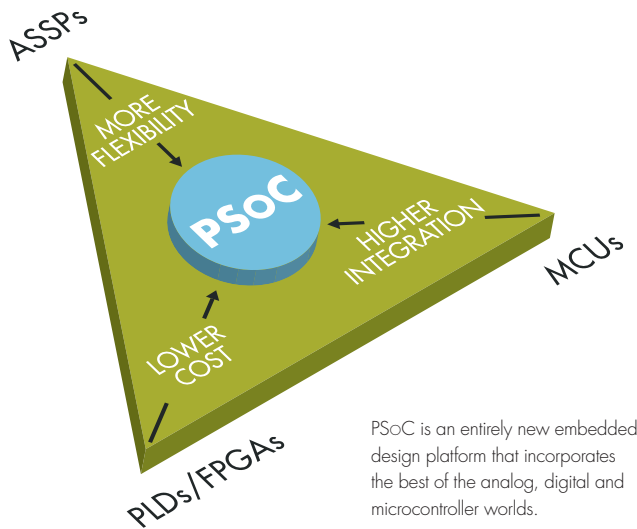
PSoC is an entirely new embedded design platform that incorporates the best of the analog, digital and microcontroller worlds.

Cypress's scalable PSoC platform **adapts to your design needs**, so you don't have to constantly change your design to accommodate different MCU architectures.

Using PSoC's flexible design software, you can create custom chips in hours rather than months, at a fraction of the cost of traditional processes. Create the mix of peripherals you want on your chip, select whichever pin you want, and you're done—at least until someone changes the specs. Even then, with PSoC, you only have to add or change a block to accommodate late alterations. You don't have to start from scratch or go back to the catalog to select a new MCU or discrete peripherals. Sure, change orders will still be annoying, but with PSoC, there won't be a major delay to your project schedule.

PSoC 1

Get performance and flexibility with our entry-level PSoC portfolio, which provides an MCU combined with on-chip programmable analog, digital peripherals, and input/output interfaces. Easy-to-use design software makes creating embedded solutions fast, with little or no code required.
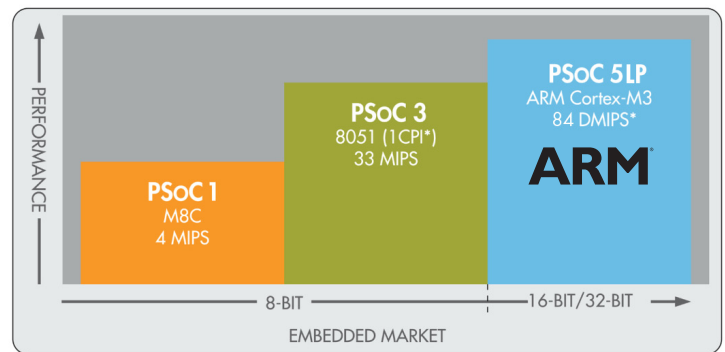
PSoC 3

A single-cycle, pipelined 8-bit 8051 core and high-performance programmable blocks provide unmatched analog and digital BOM integration with the flexibility to handle late design changes anywhere in the design process.

PSoC 5

Larger, more complex applications are easily handled by the PSoC 5 architecture, with its 32-bit 67 MHz ARM Cortex-M3 processor. Incorporate more complex applications like audio, video, and motor control—anything you can imagine.

INTRODUCING PSoC 5LP

The ARM Cortex-M3 based 32-bit PSoC 5LP series of low-power programmable system on chip devices offer unmatched precision analog and the flexibility to design custom system on chips with the easy to use PSoC® Creator™ software. This improves innovation and shortens design schedules.

The PSoC platform offers unparalleled design flexibility and a wide performance range for your 8-, 16-, or 32-bit designs.

FEATURE	PSoC 1	PSoC 3	PSoC 5LP
INTERFACE	SPI, UART, GPIO FS-USB,I²C	PSoC 1, plus: CAN, I²S	Same as PSoC 3
INPUTS	Sensors, CapSense, touchscreen, analog	PSoC 1, plus: precision analog	PSoC 3, plus: high-speed analog
OUTPUTS	LCD segment drive LED control, motor control, analog buffers	PSoC 1, plus: LED drive, advanced motor control	PSoC 3, plus: QVGA LCD control
PROCESSING	M8 24 MHz	8051 67 MHz	ARM® Cortex™-M3 processor 67 MHz

*DMIPS = Dhrystone MIPs
*CPI = Cycles per instruction

THE PERFORMANCE PILLARS: FLEXIBILITY, INTEGRATION, PROGRAMMABLE ANALOG
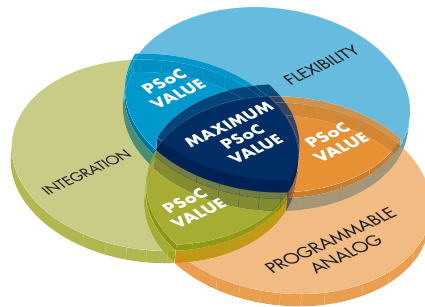
A BETTER WAY TO DESIGN: Whether you take advantage of just one or all of PSoC's three pillars of performance, you'll realize significant design benefits.

Cypress's PSoC programmable system-on-chip removes the barriers you face with fixed-function MCUs and discrete analog/digital components by providing an unparalleled combination of flexibility, integration, and analog functionality.

FLEXIBILITY

You work in an environment where change is the only constant. Programmable analog and digital blocks in PSoC give you the flexibility to adapt to changing requirements quickly and easily, while designing products that specifically meet market demands.
- Add new features
- Differentiate your products
- Tune and adjust your designs during debug/system bring-up

INTEGRATION

Unmatched integration makes PSoC the fastest way to reduce the size, weight, and power requirements of your product. Dynamic reconfiguration lets you reduce testing costs by enabling dynamically configurable board self-tests. Additionally, one PSoC integrates as many as 100 peripheral functions, so you can:
- Reduce BOM costs
- Maximize functionality
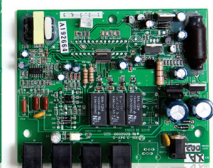- Improve reliability
- Streamline manufacturing

PROGRAMMABLE ANALOG

Developing embedded systems with advanced analog sensing, monitoring, and control is simple with PSoC's built-in, high-precision programmable analog features and powerful visual embedded design tool. Build custom analog subsystem or analog front-end circuit with unmatched precision analog. The PSoC solution includes a broad portfolio of preconfigured and characterized user components for:
- CapSense® capacitive touch sensing
- Voltage monitoring
- Environmental sensing
- Fan/motor control
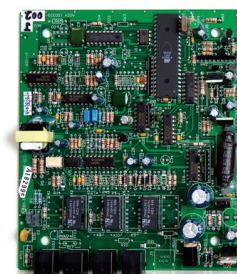
WITH DISCRETE COMPONENTS   WITH PSoC

INTEGRATION: In this communications product, PSoC technology reduced the BOM from 12 ICs to 3 by integrating FSK detection, voltage monitoring, DTMF, and ringtone generation.

PSoC BUILDS SYSTEM VALUE

SAVE MONEY ON DEVELOPMENT AND MANUFACTURING

- Reduce R&D costs and cycle time with technology that doesn't force you to lock in design specifications up front.
- Eliminate or reduce debugging and minimize coding, with pre-characterized, pre-verified modules and components.
- Reuse designs across platforms.
- Cut manufacturing, assembly, and test costs by shrinking PCBs.

MAKE MORE MONEY, FASTER

- Get to market *fast* with feature-rich products that sell at a premium.
- Get to market *first*, capturing higher-margin early-adopters and selling more units over time.

PROTECT YOUR INVESTMENT AND YOUR ASSETS

- Future-proof your products with field-upgradable PSoC technology, reducing costly, troublesome service calls.
- Create competitive barriers to entry with scalable designs.
- Protect your IP by making your designs harder to reverse-engineer.

The more innovative the design, the more likely it is to be copied. Unlike discrete components, or fixed-function peripherals, PSoC devices integrate and conceal key analog and digital components within a single chip. Thus, they are harder to reverse-engineer, making copying prohibitively expensive.

Samsung portable media player

CT scan

HP printer

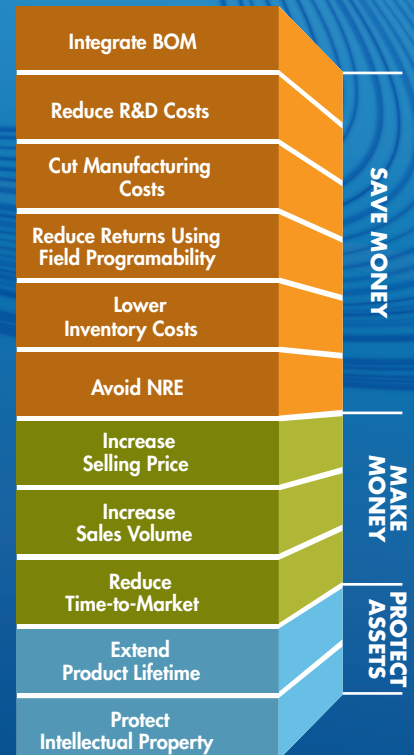eBike

Whirlpool washing machine

Cisco switches

MORE THAN 1 BILLION PSoC DEVICES SHIPPED

WITH THE PSoC PLATFORM YOU CAN:

SAVE MONEY
Integrate BOM
Reduce R&D Costs
Cut Manufacturing Costs
Reduce Returns Using Field Programability
Lower Inventory Costs
Avoid NRE

MAKE MONEY
Increase Selling Price
Increase Sales Volume
Reduce Time-to-Market

PROTECT ASSETS
Extend Product Lifetime
Protect Intellectual Property

PSoC technology helps you optimize and differentiate your design, shorten time-to-market and cut engineering costs to improve your profitability.

AWARD-WINNING PRODUCTS

EDN INNOVATION Honoring Excellence in Electronics FINALIST 2009

GOLDEN MOUSETRAP Best New Products AWARDS FINALIST

Cypress's PSoC technology has been recognized with many industry awards, including the EDN Innovation Award and Design News' "Golden Mousetrap."

PSoC: THE PROGRAMMABLE SYSTEM-ON-CHIP

INNOVATION STARTS HERE

Cypress's PSoC programmable system-on-chip platform provides a rich array of enabling technologies: analog and digital "building blocks," industry-standard processors and interfaces that give you the ability to create precisely the chip that you need.

With PSoC 1, PSoC 3, and PSoC 5LP, you choose virtual ICs from library of predefined and tested IP functions that free you to develop new features for your product and get to market faster, gaining a distinct competitive advantage in the market.

High-Precision Programmable Analog. Up to 20-bit precision with reference voltage accuracy better than ±0.1%, ideal for instrumentation and medical signal processing.

HV FETs. Drive up to four integrated FETs at 36 V/1 amp each for high-voltage applications.

Integrated LCD Drive Technology can drive up to 736 LCD segments with no external devices. PSoC's on-board voltage boost technology enables 2 V to 5 V LCD glass to be driven from a 0.5 V power source.

State-of-the-Art Power Management. Extremely wide 0.5 V to 5.5 V operating range, with several low-power modes. Multiple adjustable power and clock domains for ultimate flexibility.

CapSense components enable you to create stylish products with capacitive touch-sensing interfaces.
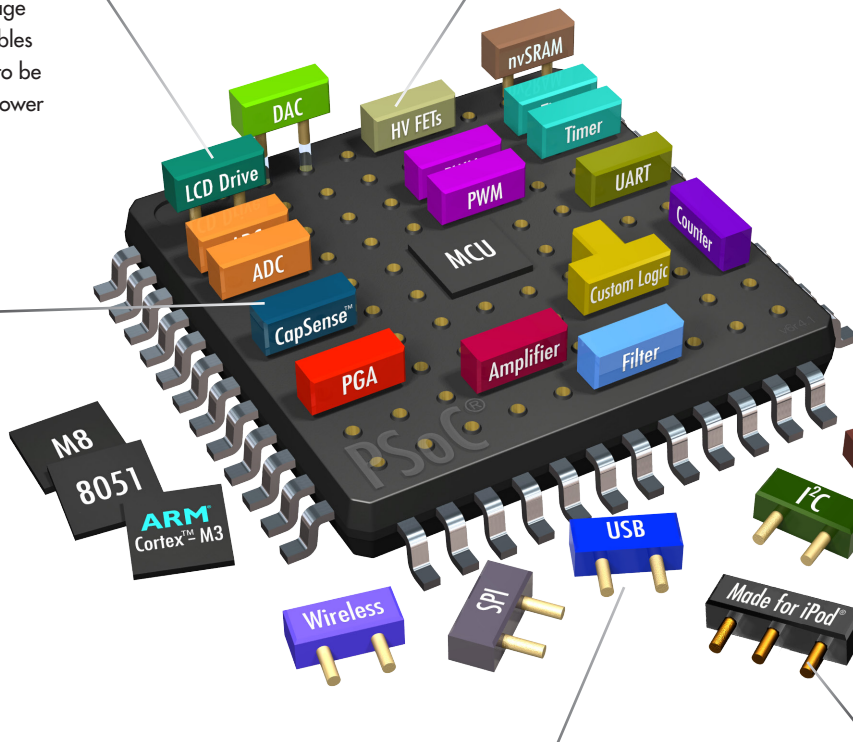
Controller Area Network (CAN) Support. PSoC supports this interface, which is commonly used in automotive and industrial markets.

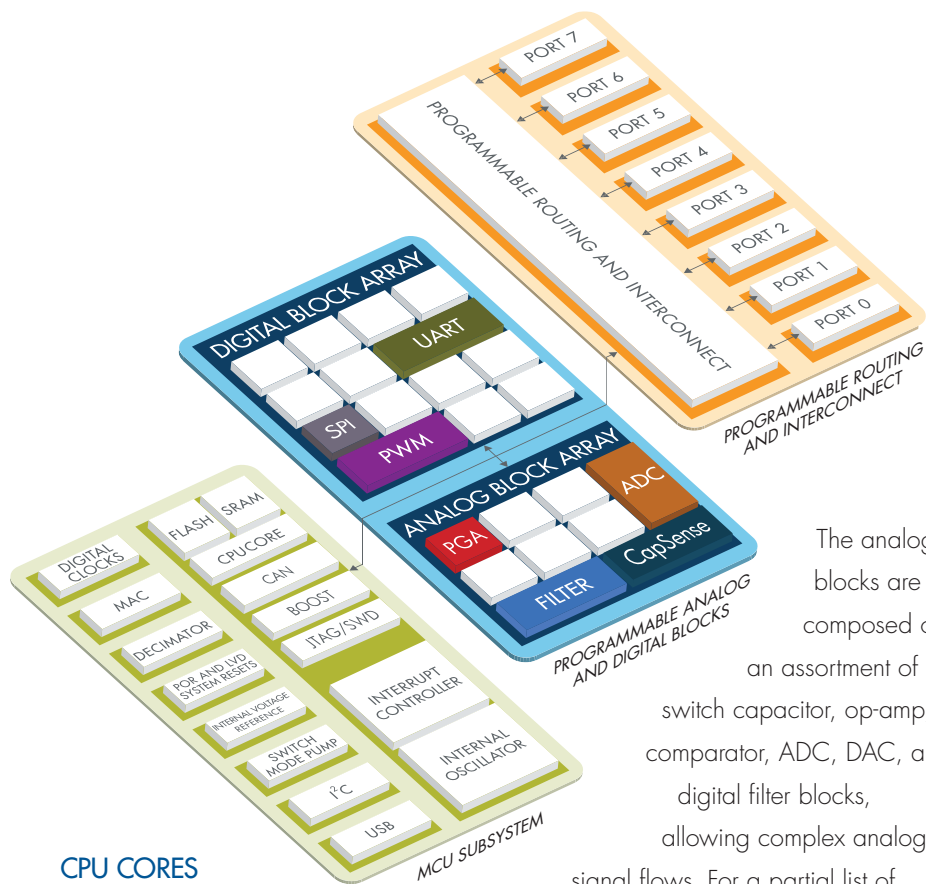**Full-Speed USB 2.0 support** enables embedded systems to communicate instantly with USB-enabled devices.

Made for iPod® (MFi) Support. Cypress provides a complete, PSoC-based development platform for MFi accessories.

THE PSoC PLATFORM

PROGRAMMABLE ANALOG AND DIGITAL BLOCKS

The union of programmable analog and digital circuitry is the basis of the PSoC platform. You configure these blocks using pre-built library functions or by creating your own. By combining several digital blocks, you can create 16-, 24-, or even 32-bit wide logic resources.

The analog blocks are composed of an assortment of switch capacitor, op-amp, comparator, ADC, DAC, and digital filter blocks, allowing complex analog signal flows. For a partial list of preconfigured functions included in PSoC software, see the sidebars on the next two pages. You can modify and personalize each function to your design.

MCU SUBSYSTEM

PSoC offers a sophisticated CPU subsystem with SRAM, EEPROM, and flash memory, multiple core options and a variety of essential system resources including:

- Internal main and low-speed oscillator
- Connectivity to external crystal oscillator for precision, programmable clocking
- Sleep and watchdog timers
- Multiple clock sources that include a PLL
- On-chip boost

PSoC devices also have dedicated communication interfaces like I²C, Full-Speed USB 2.0, CAN 2.0, and on-chip debugging capabilities using JTAG and Serial Wire Debug. The newest PSoC architectures offer industry-standard processors like the 8051, ISSP and ARM Cortex-M3 processors.

PROGRAMMABLE ROUTING AND INTERCONNECT

This frees you to re-route signals to user-selected pins, shedding the constraints of a fixed-peripheral controller. In most PSoC devices, any peripheral can be connected to any pin. Intuitive development tools allow to make the connections quickly.

CPU CORES

PSoC 1 – M8C
PSoC 3 – 8051
PSoC 5LP – ARM Cortex-M3

The PSoC platform consists of configurable analog and digital blocks, a CPU subsystem and programmable routing and interconnect. PSoC lets you plug in predefined and tested IP from the PSoC library of functions, or code your own. Either way, you have the flexibility to build innovation and competitive advantage into your products.

PSoC 1 – COST-OPTIMIZED PERFORMANCE

PSoC 1

The PSoC 1 architecture provides integrated, flexible, programmable system-on-chip functionality for embedded control applications at a remarkably economical price. With PSoC 1, you can program a wide range of analog, digital and communication peripherals, and quickly change designs to meet ever-changing system requirements.

PSoC technology is also the foundation of Cypress's several unique and innovative solutions such as CapSense® touch-sensing, TrueTouch™ touchscreen, Intelligent lighting control, and CyFi™ Low-Power RF for embedded wireless applications.

The complete PSoC solution optimizes for the lowest possible board space and power consumption while providing the quickest time to market.

	FEATURE	PSoC 1
CONFIGURABLE ANALOG/DIGITAL	ADC	1 Delta-Sigma (6- to 14-bit)
	Sample Rate	Up to 31 ksps (8-bit)
	Reference Voltage Accuracy	±1.53%
	DACs	Up to 2 (6- to 9-bit)
	PGA	x1 to x48
	LCD Segment Drive	Control/Drive
	Integrate Programmable Logic	No
	CapSense & Touchscreen	Up to 44 Buttons and 8 Sliders
MCU SUBSYSTEM	CPU	M8C
	CPU Performance	24 MHz, 4 MIPS
	Flash	4 KB to 32 KB
	SRAM	256 B to 2 KB
	Operating Range	1.0 V to 5.25 V
	Power Consumption (Active@6 MHz)	Active: 2 mA, Sleep: 3 µA
	Connectivity Resources	FS USB 2.0, I²C, SPI, UART
	BOOST	Boost startup from 1.1 V
PROGRAMABLE INTERCONNECT	Routing & Matrix	Manual Routing, Configurable
	Number I/O	Up to 64
TOOLS	Software Development Tools	PSoC Designer and third party compilers
	In-Circuit Emulation and Debug	Requires ICE Cube and FlexPods (Bond Out)

PSoC 3 & PSoC 5 – PERFORMANCE MULTIPLIED

PSoC 3 and PSoC 5 build on the original PSoC 1 architecture, adding a newly designed, high-precision programmable analog block with a breakthrough design methodology that simplifies the process of creating even the most complex systems.

PSoC 3

Featuring a high-performance 8-bit 8051 (1CPI) pipelined RISC core offering up to 67 MHz and 33 MIPS, the PSoC 3 architecture can run more than 10x faster than a standard 8051. PSoC 3 can handle dozens of data acquisition channels and analog inputs on every GPIO pin, with a high-performance configurable digital system supporting a wide range of communication interfaces.

PSoC 5LP

PSoC 5 architecture based PSoC 5LP adds the power of the ARM® Cortex™-M3 processor running up to 67 MHz at 83.75 DMIPS. An industry standard, the Cortex-M3 processor leverages the ARM Thumb®-2 instruction set architecture and is ideal for migrating 8- and 16-bit applications to the 32-bit world. You can now run the latest audio algorithms, as well as basic video processing. Even complex motor control algorithms requiring fast signal processing such as field-oriented control (FOC), high-performance waveform generation for brushless motors and high-performance sensor applications, are no problem.

PSoC 3-PSoC 5LP FUNCTIONS

PSoC 3 and PSoC 5 architectures include all of the functions of PSoC 1, plus:

ANALOG FUNCTIONS
- Delta-Sigma 8- to 20-bit
- SAR ADC (12-bits)
- Interlocking DAC
- Trans Impedance Amplifier

DIGITAL FUNCTIONS
- Digital Filter Block (DFB)
- Primitives like AND, OR, XOR, LUT, etc.
- Quadrature encoder for motor control
- Communications Interfaces
  - CAN
  - I²S
  - I²C
  - USB

ECOSYSTEM
Cypress's PSoC 3 and PSoC 5 solutions include industry-standard processors that make it easy to port your existing code to the PSoC design environment, while allowing you to tap into an established ecosystem of software tools and support.

RTOS
- Keil® RTX51Tiny™
- Micrium® µC/OS-II™
- Segger® embOS
- FreeRTOS

ARM CONNECTED

PSoC 3	PSoC 5LP
1 Delta-Sigma (12- to 20-bit)	1 Delta-Sigma (8- to 20-bit); 2-SAR ADCs (12-bit)
192 ksps (12-bit)	192 ksps (12-bit) Delta-Sigma; 1 Msps (12-bit) SAR ADC
±0.1%	±0.1%
Up to 4 (12-bit)*	Up to 4 (12-bit)*
x1 to x50	x1 to x50
Control + Drive (736 segments)	Control + Drive (736 segments)
Yes	Yes
Up to 62 Buttons and 12 Sliders	Up to 62 Buttons and 12 Sliders
Advanced 8051 (1CPI)	ARM Cortex-M3
67 MHz, 33 MIPS	67 MHz, 83.75 DMIPS
8 KB to 64 KB	64 KB to 256 KB
2 KB to 8 KB	16 KB to 64 KB
0.5 V to 5.5 V	0.5 V to 5.5 V
Active: 1.2 mA, Sleep: 1 µA, Hibernate: 200 nA)	Active: 3.1 mA, Sleep: 2 µA, Hibernate: 300 µA
FS USB 2.0, I²C, SPI, UART, CAN, LIN, I²S	FS USB 2.0, I²C, SPI, UART, CAN, LIN, I²S
Boost startup from 0.5 V	Boost startup from 0.5 V
Automatic; Any pin anywhere	Automatic; Any pin, anywhere
Up to 72	Up to 72
PSoC Creator and third party compilers/IDEs	PSoC Creator, third party compilers/IDEs, ARM Ecosystem Tools
On-chip JTAG, Debug and Trace; SWD, SWV	On-chip JTAG, Debug and Trace; SWD, SWV

* 12-bit resolution achieveable by using programmable mixed-signal resource on chip.

PSoC CREATOR™ – SOFTWARE FOR PSoC 3 AND PSoC 5LP

Cypress's PSoC Creator software is a state-of-the-art, easy-to-use IDE that introduces a game-changing, hardware and software co-design environment based on classical schematic entry—a revolutionary embedded design methodology.

With PSoC Creator, you can:
• Create and share user-defined, custom peripherals using hierarchical schematic design and Verilog entry

• Automatically place and route selected components and integrate simple glue logic normally residing in discrete muxes

• Trade-off hardware and software design considerations allowing you to focus on what matters: getting to market fast

PSoC Creator also allows you to tap into an entire tools ecosystem, with integrated compiler tool chains, RTOS solutions, and top production programmers to support both PSoC 3 and PSoC 5LP.

FOR HARDWARE ENGINEERS
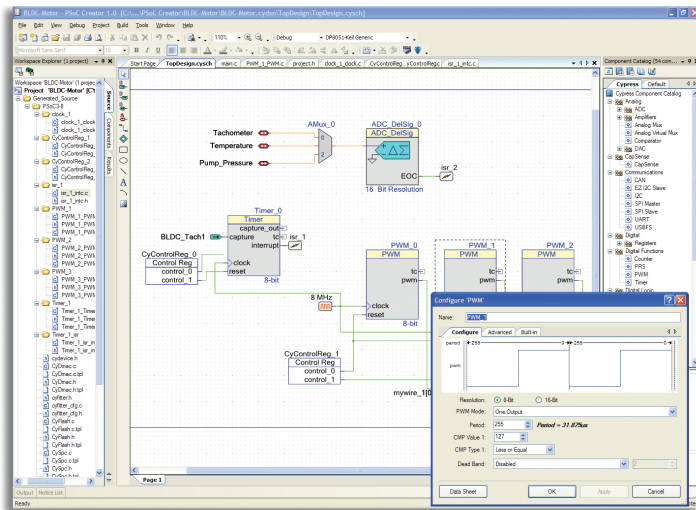
FOR SOFTWARE ENGINEERS
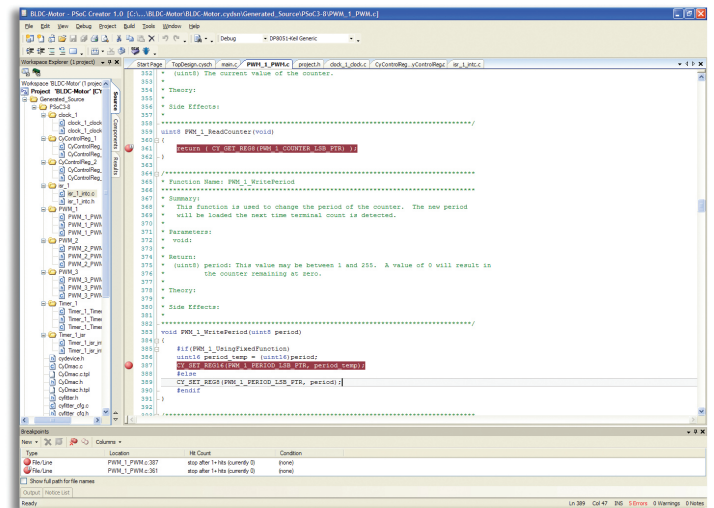
DESIGN IN FOUR EASY STEPS

1. CONFIGURE.
Choose the on-chip peripherals you need rather than settling for a device that has most of what you need but a lot of what you don't.

2. DEVELOP.
Write your C-based application using standard compilers and instruction sets. Maximize your portability and reuse.

3. DEBUG.
Take advantage of the powerful debug features that you've come to expect—JTAG, SWD, software breakpoints, etc.

4. REUSE.
Save and reuse your hardware and software designs as components or within enterprise-wide component libraries.

PSoC DESIGNER – IDE FOR PSoC 1

PSoC Designer™ is the revolutionary IDE that you can use to customize PSoC 1 to meet your specific application requirements in few simple steps:

- Drag-and-drop pre-characterized peripherals, called User Modules, in your design.
- Customize your design leveraging the dynamically generated API libraries of code.
- Debug and test your designs with the integrated debug environment including in-circuit emulation and standard software debug features.

PSoC Designer comes with a free C-based ImageCraft compiler.
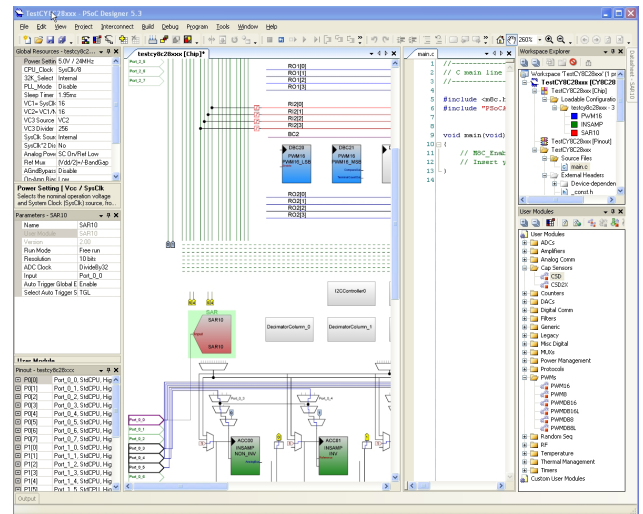
JUMP START YOUR DEVELOPMENT

Cypress offers a wide array of PSoC evaluation and development kits that enable you to quickly evaluate and prototype your designs. Features include capacitive touch-sensing, USB, voltage monitoring, and system management.

PSoC 1 DEVELOPMENT KIT (CY3210-PSoCEVAL1)

- Includes Evaluation board with LCD
- MiniProg1 Programming Unit
- CY8C29466 and CY8C27443 PSoC 1 Device Sample
- More information:
  www.cypress.com/go/CY3210-PSoCEval1

PSoC 3 DEVELOPMENT KIT (CY8CKIT-030)

- Includes PSoC 3 Development Board
- LCD Character Display
- More information:
  www.cypress.com/go/CY8CKIT-030

PSoC 5LP DEVELOPMENT KIT (CY8CKIT-050)

- Includes PSoC 5 Development Board
- LCD Character Display
- More information:
  www.cypress.com/go/CY8CKIT-050LP

CONTACT US

CYPRESS DEVELOPER COMMUNITY NETWORK. LEARN. CREATE.
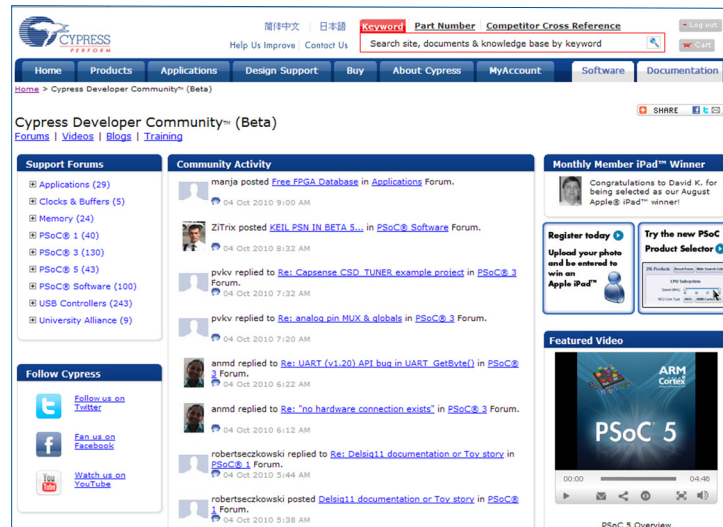
The Cypress Developer Community™ offers a rich set of tools to help you get the most out of your PSoC-based project. Post questions, solve problems, and network in one of our many forums. Watch demos, explore labs, and get trained with our videos. Learn new techniques from Cypress experts with blogs that are geared to the types of projects you are working on.

Go to www.cypress.com/go/community and join our fast-growing online community today!

Doc# 001-85251 Rev** Job line: 1212/JFMD/NITA/ALGE