THE DIFFERENTIATION DILEMMA

Embedded systems are rapidly advancing with innovative features added at each new product generation. Your competition is not standing still, so why should you? The key to rising above the noise in a crowded market is differentiation, and here are three ways to help your products stand out:

MAKE IT SMARTER

Embedded systems use sensors to collect information about the world around them and use that data to learn and make more intelligent decisions.

MAKE IT EASY TO USE

Enhanced user interfaces, such as touch and graphic displays, can improve the user experience. They also replace bulky buttons with sleek and cool designs.

MAKE IT CONNECT

Wireless connectivity such as Bluetooth® Low Energy can connect your application to a smartphone app and to the cloud, enabling features such as remote control, data analytics, and over-the-air updates.

CONSUMER

WHITE GOODS

MEDICAL
PSOC 4 MICROCONTROLLERS

Your Problem Solver on Chip

PSOC 4 has tackled some of the complex portions of embedded system design making it easier for you to get your product to market. Functions such as analog sensor integration, capacitive touch, and wireless connectivity have been integrated and optimized in PSOC 4 to “just work” so you don’t have to.

ANALOG SENSOR INTEGRATION TO MAKE YOUR APPLICATION SMARTER
PSOC 4 allows you to customize your own analog front end to interface to any analog sensor with programmable analog blocks such as opamps, comparators, ADC and DACs. PSOC 4 can also eliminate the need for external analog components, saving you time and money.

CAPACITIVE TOUCH TO MAKE YOUR APPLICATION EASY TO USE
You can improve the usability and sleekness of your product by adding features such as capacitive touch buttons and sliders, proximity detection, and liquid-level sensing. Cypress’ CapSense® solution in PSOC 4 devices is the industry’s leading capacitive-sensing solution with state-of-the-art noise immunity and water rejection.

WIRELESS CONNECTIVITY TO CONNECT YOUR APPLICATION
Bluetooth Low Energy (BLE) is built into PSOC 4 and includes all BLE profiles and APIs for easy deployment. With an integrated balun for antenna matching, PSOC 4 BLE simplifies RF board design and reduces PCB footprint. With example projects and development kits, you can get BLE connectivity up and running in a matter of minutes.
PS0C 4 DELIVERS ULTIMATE MIXED-SIGNAL FLEXIBILITY

Achieve ultimate flexibility in your design with Cypress’ software-defined peripherals embedded in the PS0C 4 architecture. Configure these peripherals using pre-built library functions or create your own using the programmable architecture inside of PS0C 4 devices:

**CAPACITIVE SENSING**
Cypress’ CapSense is the industry-leading capacitive-sensing solution for touch, proximity sensing, and liquid-level sensing applications. CapSense is a dedicated peripheral found across the entire PS0C 4 portfolio.

**INDUCTIVE SENSING**
MagSense™ is Cypress’ reliable contact-less metal-sensing for applications such as buttons (touch-over-metal), proximity detection and measurement, rotary and linear encoders, spring based position detection and other applications.

**WIRED AND WIRELESS CONNECTIVITY**
Wired connectivity interfaces, such as CAN and USB, are available in the PS0C 4 portfolio. For wireless connectivity, Bluetooth Low Energy is also available.

**SMART I/O**
The Smart I/O block is a fabric of switches and LUTs that allows Boolean functions to be performed in signals being routed to the pins of a GPIO port. The Smart I/O can perform logical operations on input pins to the chip and on signals going out as outputs.

**PROGRAMMABLE ANALOG BLOCKS**
Customize your analog front end to interface to any analog sensor through programmable analog blocks, which are composed of an assortment of opamps, comparators, ADCs, and DACs, enabling complex analog signal flows.

**SERIAL COMMUNICATION BLOCKS (SCB)**
Can be configured as serial communication interfaces like I2C, UART, SPI, or LIN.

**UNIVERSAL DIGITAL BLOCKS (UDB)**
Programmable digital blocks that can be configured as timing-critical coprocessors that simplify firmware and ISR handling by replacing “bit-banging” firmware.

**T/C/PWM**
Blocks that can be configured as timers, counters, pulse-width modulators or quadrature decoders.

**SEGMENT LCD DRIVE**
PS0C 4 uses full digital methods to drive LCD segments requiring no generation of internal LCD voltages.
Incorporate a slick graphics display to your next... Add an audio subsystem with an I2S interface and Serial Communication Blocks (SCBs).

Digital sensors can easily be connected via the... Audio Processing

CapSense + Programmable Analog Blocks

Universal Digital Block

Motor control and Power Conversion

Inductive Sensing Technology

On-chip Bluetooth® Low Energy

Inductive and capacitive sensing

Divide and Square Root compute accelerators

Intelligent analog features plus programmable digital blocks, USB 2.0

Entry-level features plus programmable analog blocks, up to 1 MSPS ADC, CAN

Entry-level family with CapSense

www.cypress.com/PSoc4
PSOC 4000 FAMILY
Entry-Level Family

The PSOC 4000 family is a cost-optimized, entry-level family of microcontrollers. The PSOC 4000 family delivers the industry’s best capacitive-sensing technology, CapSense, to implement buttons, sliders, and proximity sensors.

PSOC 4000 FAMILY SERIES BLOCK DIAGRAM

PSOC 4000 FAMILY FEATURES AT A GLANCE

<table>
<thead>
<tr>
<th>Feature</th>
<th>PSOC 4000</th>
<th>PSOC 4000S</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max CPU Speed</td>
<td>16 MHz</td>
<td>48 MHz</td>
</tr>
<tr>
<td>Flash (KB)</td>
<td>8 - 16</td>
<td>16 - 32</td>
</tr>
<tr>
<td>SRAM (KB)</td>
<td>2</td>
<td>2 - 4</td>
</tr>
<tr>
<td>ADC</td>
<td>10-bit 58 sps Del-Sig</td>
<td>10-bit 11.6 Ksps Single-Slope</td>
</tr>
<tr>
<td>Comparators</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Timers / Counters / PWMs</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>Serial Interfaces (I²C/SPI/JA)</td>
<td>1 (I²C)</td>
<td>2</td>
</tr>
<tr>
<td>CapSense Blocks</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Max GPIO</td>
<td>20</td>
<td>36</td>
</tr>
<tr>
<td>Packages</td>
<td>28-pin SSOP 48-pin TQFP 24-pin QFN 40-pin QFN 16-pin QFN 32-pin TOFP 16-pin SOIC 32-pin QFN 8-pin SOIC 24-pin QFN 16-ball WLCSP 25-ball WLCSP</td>
<td></td>
</tr>
</tbody>
</table>

APPLICATION EXAMPLE: COFFEE MACHINE

PSOC Enables:
- Liquid-tolerant capacitive touch interface for buttons and sliders
- Proximity detection
- LED control
- Door lock control
The PSoC 4100 family adds intelligent analog integration through programmable analog blocks. Programmable analog blocks include analog-to-digital converters (ADCs), digital-to-analog converters (DACs), low-power comparators, and operational amplifiers (opamps). The PSoC 4100BL includes an integrated Bluetooth Low Energy radio and subsystem.

**APPLICATION EXAMPLE: INDUCTION COOKTOP**

**PSoC Enables:**
- Liquid-tolerant capacitive touch interface for buttons and sliders
- Proximity detection
- Humidity and temperature-sensing interface via integrated analog front end
- Induction coil IGBT driver control
- Other control and interface functions such as fan control, segment LCD, and Piezo speaker
PSOC 4200 FAMILY
Programmable Digital Family

The PSOC 4200 family boosts the flexibility and performance of the PSoc 4 portfolio by adding programmable, Universal Digital Blocks (UDBs). UDBs can be configured to set-up custom digital interfaces, state machines, and custom logic functions. The PSOC 4200BL includes an integrated Bluetooth Low Energy radio and subsystem.

**PSOC 4200 FAMILY BLOCK DIAGRAM**

**PSOC 4200 FAMILY FEATURES AT A GLANCE**

<table>
<thead>
<tr>
<th></th>
<th>PSOC 4200</th>
<th>PSOC 4200DS</th>
<th>PSOC 4200M</th>
<th>PSOC 4200L</th>
<th>PSOC 4200BL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max CPU Speed</td>
<td>48 MHz</td>
<td>48 MHz</td>
<td>48 MHz</td>
<td>48 MHz</td>
<td>48 MHz</td>
</tr>
<tr>
<td>Flash (KB)</td>
<td>16 - 32</td>
<td>32 - 64</td>
<td>32 - 128</td>
<td>64 - 256</td>
<td>128 - 256</td>
</tr>
<tr>
<td>SRAM (KB)</td>
<td>4</td>
<td>8</td>
<td>4 - 8</td>
<td>8 - 32</td>
<td>16 - 32</td>
</tr>
<tr>
<td>ADC</td>
<td>12-bit</td>
<td>12-bit</td>
<td>12-bit</td>
<td>12-bit</td>
<td>12-bit</td>
</tr>
<tr>
<td>1Mps SAR</td>
<td></td>
<td></td>
<td>1Mps SAR</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Opamps</td>
<td>2</td>
<td>0</td>
<td>4</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Comparators*</td>
<td>4</td>
<td>2</td>
<td>6</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Timers / Counters /</td>
<td>4</td>
<td>4</td>
<td>8</td>
<td>8</td>
<td>4</td>
</tr>
<tr>
<td>PWMs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Serial Interfaces</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>(I2C/SPI UART)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CapSense Blocks</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>BLE</td>
<td>No</td>
<td>0</td>
<td>No</td>
<td>No</td>
<td>4.1 / 4.2</td>
</tr>
<tr>
<td>Universal Digital</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>8</td>
<td>4</td>
</tr>
<tr>
<td>Blocks</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>USB Full Speed</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Device Controller</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CAN Controller</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Max GPIO</td>
<td>36</td>
<td>21</td>
<td>55</td>
<td>98</td>
<td>36</td>
</tr>
<tr>
<td>Packages</td>
<td>48-pin TQFP</td>
<td>28-pin SSOP</td>
<td>68-pin QFN</td>
<td>56-pin QFN</td>
<td></td>
</tr>
<tr>
<td></td>
<td>44-pin TQFP</td>
<td>25-ball WLCSP</td>
<td>64-pin QFN</td>
<td>35-ball WLCSP</td>
<td></td>
</tr>
<tr>
<td></td>
<td>40-pin QFN</td>
<td></td>
<td>124-pin BGA</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>28-pin SSOP</td>
<td></td>
<td>68-ball WLCSP</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>56-pin QFN</td>
<td></td>
<td>76-ball WLCSP</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Maximum number of comparators (dedicated low-power comparators + comparators configured using opamps)

**APPLICATION EXAMPLE: USB DIGITAL MICROPHONE**

PSOC Enables:
- High-performance USB audio streaming using DMA and precision clocks, allowing up to 24-bit 96-kHz stereo
- Up to eight I2S audio channels using Universal Digital Blocks (UDBs)
- Capacitive-touch interface
- Battery management with programmable analog front end
- LEDs with TCPWM
The PSoC 4500 Family adds compute capability and abundant analogs to the 32-bit Arm Cortex-M0/M0+ PSoC 4 Portfolio of products to enable efficient and integrated solutions. This family includes the PSoC 4500 S-Series that features divide and square-root compute accelerators, dual 12-bits ADCs for high-performance motor control and power conversion solutions.

The PSoC 4700 Family adds advanced sensing technologies to the 32-bit Arm Cortex-M0/M0+ PSoC 4 Portfolio of products to enable innovative next-generation solutions. This family includes the PSoC 4700 S-Series that features, MagSense™, an advanced inductive sensing technology for highly reliable human machine interfaces, fully waterproof interfaces and other new, innovative solutions.

**APPLICATION EXAMPLE: WASHING MACHINE**

**PSoC Enables:**
- Sleek, futuristic user interfaces with metallic overlays and inductive-sensing rotary knobs
- Superior performance with best-in-class noise immunity
- Simplified production with AutoTuning™ algorithms to compensate for manufacturing variations
- Reduced system cost with a highly integrated solution

![Washing Machine Diagram](www.cypress.com/PSoC4)
PSOC CREATOR IDE

PSOC Creator is an Integrated Design Environment (IDE) that enables concurrent hardware and firmware editing, compiling and debugging of PSoC 4 systems. Applications are created using schematic capture and over 150 pre-verified, production-ready peripheral Components.

1. Explore the library of 150+ PSoC Components
2. Drag and drop Component icons to complete your hardware system design in the main design workspace (e.g., use the BLE Component for Bluetooth Smart designs)
3. Configure Components using the Component Configuration Tools
4. Access Component datasheets directly from the Component Configuration Tools
5. Co-design your application firmware and hardware in the PSoC Creator
6. Use a Getting Started App Note:
   - Getting Started with PSoC 4 (AN79953)
   - Getting Started with PSoC 4 BLE (AN91267)
   - Getting Started with CapSense (AN64846)
PSOC 4 DEVELOPMENT KIT EXAMPLES

Make It Smarter

INTELLIGENT ANALOG KITS

- $25 PSOC 4 M-Series Pioneer Kit (CY8CKIT-044)

.Make It Connected

BLUETOOTH® LOW ENERGY (BLE) KITS

- PSoC 4 BLE Modules* with PCB or external antenna
- $15 (CY8CKIT-143-A)
- $20 (CY8CKIT-141)

- $20 PSOC 4100S Plus Prototyping Kit (CY8CKIT-149)

Make It Easy To Use

HMI KITS FOR CAPACITIVE AND INDUCTIVE SENSING

- $49 PSoC 4 BLE Pioneer Kit (CY8CKIT-042-BLE-A)

- $49 PSoC 4700 Inductive Sensing Evaluation Kit (CY8CKIT-148)

- $20 CySmart BLE USB Dongle (CY5677)

- $30 PSoC 4700 Inductive Sensing Coil Breakout Board

PSOC 4 Kit Selector: www.cypress.com/psoc4kits

* Modules can be used independently or with PSOC Pioneer kits
PSOC 101 Video Training

Cypress offers a wide array of step-by-step video tutorials to help you through various design challenges. Check them out at http://www.cypress.com/video-library/PSoC.

Join the PSOC 4 Online Community

The Cypress online community enables you to engage and collaborate with both Cypress experts and other embedded engineers around the world. You can also access knowledge base articles (KBAs) for instant access to information that can help you solve common design problems.

ABOUT CYPRESS

Cypress is the leader in advanced embedded system solutions for the world’s most-innovative automotive, industrial, home automation and appliances, consumer electronics and medical products. Cypress’ programmable and general-purpose microcontrollers, analog ICs, wireless and USB-based connectivity solutions and reliable, high-performance memories help engineers design differentiated products and get them to market first. To learn more, go to www.cypress.com.