Cypress Stepping up to the IoT Stage

Ming Lin | Senior Global Product Manager
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Time Flies…

2003

Embedded System

2008

Smart Grid
Smart Home
IoT

2013

Cloud Security
Wearable Ecosystem

Today

Embedded in Tomorrow
Who is Cypress

Cypress + Spansion = New $1.6B company

No. 1 in SRAMs, No. 1 in NOR Flash
No. 3 in MCUs and memories for the automotive market
First to market USB Type-C controllers with Power Delivery
PSoC® BLE\(^1\) solution to drive traction in IoT\(^2\), wearables
Traveo® MCUs: First to market ARM®-based 3-D Graphics controller for automotive cluster (dashboard) displays
Technology leadership in Power Management ICs (PMICs)

Cypress at a Glance

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<table>
<thead>
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<tbody>
<tr>
<td>Founded</td>
<td>1982</td>
</tr>
<tr>
<td>Listed</td>
<td>NASDAQ (CY)</td>
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<tr>
<td>Headquarters</td>
<td>San Jose, California</td>
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<tr>
<td>2015 Revenue</td>
<td>$1.63B</td>
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<tr>
<td>2015 Non-GAAP Income</td>
<td>$70.53M</td>
</tr>
<tr>
<td>Headcount</td>
<td>6,793</td>
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<tr>
<td>2015 Revenue by Ship-to Geography</td>
<td>US (15%), EUR (14%), JPN (30%), APAC (41%)</td>
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Cypress delivers high-performance programmable solutions that accelerate customer time-to-market and provide exceptional system value

1 Bluetooth® Low Energy: A standard adopted in 2010 for short-range, low-power wireless applications that communicate state or control information
2 Internet of Things
What Happened with Spansion/Fujitsu

No. 1 in SRAM, No. 1 in nvSRAM, No. 1 in F-RAM™
30+ years memory and 15 years of PSoC experience

No. 1 in Flash Memory for Embedded Markets
No. 2 in Japan MCU, well-positioned in Analog

SYNERGISTIC MARKETS: AUTOMOTIVE, INDUSTRIAL, CONSUMER, COMMUNICATIONS

Global Embedded Systems Leader

Memory for Embedded Systems: SRAM and Flash + MCU, Analog, SoC, USB, Touch = Market Leadership in Embedded Systems
What Happened with Broadcom IoT

Acquisition accelerates embedded system connectivity with “2018 wireless technology”
Three main wireless standards, Wi-Fi, Bluetooth, ZigBee on state-of-the-art, low-power 40-nm and 28-nm CMOS processes

Broad product portfolio for embedded processing
Low-power ARM-based PSoC with programmable analog and digital enables rapid embedded system design
Highest-performance ARM Cortex®-M4 MCU devices with advanced connectivity (Ethernet, CAN-FD, USB Type-C)
Broadest memory selection from any supplier

STRONG AND COMPLETE PORTFOLIO

Acquisition adds state-of-the-art wireless connectivity for next-generation Automotive, Industrial and Internet of Things embedded systems
## Where Are We Playing At

<table>
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<tr>
<th>Mobile Devices</th>
<th>Internet of Things</th>
<th>Consumer Electronics</th>
<th>PC Interfaces</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Products:</strong></td>
<td><strong>Products:</strong></td>
<td><strong>Products:</strong></td>
<td><strong>Products:</strong></td>
</tr>
<tr>
<td>CapSense, USB,</td>
<td>PSoC, ARM® MCUs,</td>
<td>PSoC, ARM® MCUs,</td>
<td>PSoC, ARM® MCUs,</td>
</tr>
<tr>
<td>Async SRAM, NOR</td>
<td>Energy-Harvesting PMIC,</td>
<td>PMICs, Trackpad, CapSense,</td>
<td>USB, CapSense, nvSRAM,</td>
</tr>
<tr>
<td>Flash</td>
<td>USB, CapSense, Wireless (BLE), F-RAM, Async SRAM,</td>
<td>USB, Wireless (BLE), Async SRAM, NOR Flash,</td>
<td>F-RAM, Sync SRAM,</td>
</tr>
<tr>
<td></td>
<td>NOR Flash, Clocks</td>
<td>NOR Flash, NAND Flash</td>
<td>NAND Flash, NVDIMM</td>
</tr>
</tbody>
</table>

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<tr>
<th>Automotive</th>
<th>Industrial / Medical</th>
<th>Networking and Servers</th>
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<tbody>
<tr>
<td><strong>Products:</strong></td>
<td><strong>Products:</strong></td>
<td><strong>Products:</strong></td>
</tr>
<tr>
<td>MCUs, PSoC, PMICs, USB, TrueTouch, CapSense, Wireless (BLE), F-RAM, Async SRAM, NOR Flash, NAND Flash</td>
<td>PSoC, ARM® MCUs, TrueTouch, CapSense, USB, Wireless (BLE), nvSRAM, F-RAM, Sync SRAM, Async SRAM, NOR Flash, NAND Flash</td>
<td>MCUs, PSoC, CapSense, USB, Wireless, nvSRAM, Sync SRAM, Async SRAM, NOR Flash, NAND Flash, Clocks, AGIGARAM NVDIMM</td>
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</table>
Home appliances are becoming intelligent, connected, and energy-efficient.

- Interface and graphical display
- Appliance-to-cloud connectivity
- Liquid level detection
- Drum vibration analysis
- Motor control
- Inductive door lock
- Safety features
- Water pump control
Automotive

- Infotainment
- Cloud connectivity
- HVAC control
- Smartphone connectivity
- Headrest display/Media streaming
- Smart sensors
- Instrument clusters
- Powertrain
- Diagnostics and performance monitoring
- Car-to-car and car-to-infrastructure communication
- Event data recorders
- EV/HEV
- Body electronics
- Body electronics modules, lighting, and peripheral ECUs
- Driver assistance
Capacitive Sensing

Cypress’s CapSense technology is the industry’s No. 1 solution in sales by 4x over No. 2
Over 1B CapSense controllers have replaced more than 5B mechanical buttons
CapSense is everywhere, including smartphones, home appliances and printers

- **Touch Buttons:** 2003
- **Liquid Tolerance:** 2008
- **Noise Immunity:** 2010
- **Configurability:** 2011
- **1B Units Shipped:** 2013

- LG Chocolate Mobile Phone
- Whirlpool Dishwasher
- HP TouchSmart Printer
- Microsoft Arc Touch Mouse
- Samsung Galaxy Note 3

Cypress’s CapSense research and development begins with buttons and sliders
CapSense algorithms offer liquid tolerance, proximity sensing and improved noise immunity
SmartSense™ Auto-tuning revolutionizes CapSense design by removing manual tuning and improving noise immunity
CapSense Express™ offers configurable solutions that do not require firmware development
One-billionth CapSense controller shipped with stylus-activated buttons

**Garmin vivosmart Activity Tracker**

Cypress’s PSoC-based CapSense solutions enable the industry’s hottest new aesthetic and ergonomic product designs in next-generation wearable electronics products

**Water Tolerance in a Washing Machine**

CapSense’s industry-leading signal-to-noise ratio enables superior liquid tolerance, glove and stylus touch and proximity sensing, which detects an approaching finger without an actual touch
Cypress Enables the Lowest-Power and the Smallest WSN

With the world’s lowest-power Energy Harvesting solution...

Series solar cell, 1 cm², 2 µW @ 100 lux (lx)

To create the lowest-power WSNs powered by a tiny solar module.

Cypress Energy Harvesting PMIC realizes smallest and lowest-power solar powered WSN

Competitor BLE PCB Antenna
Cypress Provides a Complete BLE Solution

The only BLE supplier with end-to-end expertise in silicon, modules, software, kits and reference designs

Silicon

- QFN (128K, 256K)
- CSP (128K, 256K)

Modules

- EZ-BLE PSoC Module

Software and Kits

- PSoC Creator IDE
- BLE Pioneer Kit

Reference Designs

- Remote Control
- Touch Mouse
- EH² Beacon

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1 Chip-scale package (CSP) manufactured by Cypress subsidiary Deca Technologies Inc.
2 Energy harvesting
# PSoC and MCU Portfolio

## Programmable System-on-Chip (PSoC)

PSoC 6
- Cortex®-M7
- NDA Required, Contact Sales

PSoC 7
- Cortex®-M7
- NDA Required, Contact Sales

**PSoC 5LP**
- Cortex®-M3
- 80 MHz, 256KB Flash
- 20 PAB\(^1\), 30 PDB\(^2\), 72 I/Os

**PSoc 4**
- Cortex®-M0
- 48 MHz, 256KB Flash
- Up to 13 PAB\(^1\), 20 PDB\(^2\), 98 I/Os

**FM4-MCUs**
- Cortex®-M4
- 200 MHz, 2MB Flash, 190 I/Os

**FM3-MCUs**
- Cortex®-M3
- 144 MHz, 1.5MB Flash, 154 I/Os

**8FX**
- 8-bit RISC MCU
- 16 MHz, 32-50KB Flash

**FM0+ MCUs**
- Cortex®-M0+
- 40 MHz, 512KB Flash, 102 I/Os

## Flexible MCU (FM)

**PSoC Analog Coprocessor**
- CY8C4Ax
- 48 MHz, 32KB Flash
- Up to 12 PAB\(^1\), 11 PDB\(^2\), 38 I/Os

**FM4-LP MCUs**
- Cortex®-M4 and Cortex®-M0+
- NDA Required, Contact Sales

**FM0+ MCUs**
- Cortex®-M0+
- 40 MHz, 512KB Flash, 102 I/Os

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1 A programmable analog block that is configured using PSoC software to create analog front ends, signal conditioning circuits with opamps and filters

2 A programmable digital block that is configured using PSoC software to implement custom digital peripherals and glue logic
1. Explore the library of 60+ Components

2. Complete your hardware system design by dragging and dropping component icons

3. Configure Components using a component-specific configuration tool

4. Access component datasheets directly from the configuration tool for technical specification

5. Codesign your application firmware and hardware using the PSoC Creator IDE C-based compiler

6. Review the Components’ application note for usage guidelines
PSoC Creator simplifies analog front end design and saves time on debugging with:
Analog Components that are dragged and dropped as icons to create custom analog front ends
Starter projects, such as the ADC Differential Preamplifier and Dynamic Gain Switching Opamp, that accelerate development
Component Configuration Tools that simplify parameter configurations with a graphical user interface

PSoC 4 integrates analog front end designs to save BOM cost by delivering:
Discrete analog performance with a differential 1-Msps, 12-bit SAR ADC, and two high-performance opamps with ±1-mV-input offset voltage and 6-MHz gain bandwidth
A 1- to 36-channel analog multiplexer (AMUX) that can be flexibly configured to create custom AFE designs
A 5-V operating voltage that provides over 50% more analog input signal range vs. 3.3 V

PSoC 4 Programmable Analog Blocks

Opamp Component with Configuration Tool in PSoC Creator

CTBm = Continuous Time Block-mini
CMP = comparator

The opamp graphical Component Configuration Tool simplifies parameter configuration
Simplify design and debug with PSoC Creator and integrate glue logic ICs to save time and BOM cost
PSoc Creator Components integrate 60+ digital functions into a one-chip PSoC solution
PSoc Creator digital Components are dragged and dropped as icons to create custom glue logic solutions
PSoc Creator provides Component Configuration Tools to simplify parameter configurations with a graphical user interface

Offload traditional firmware-based CPU tasks to save power and increase reliability
Hardware-based state machines save CPU cycles by replacing firmware
Hardware-based logic provides deterministic monitoring for safety-critical tasks by replacing firmware
Hardware-based logic simplifies software design and ISR handling by replacing “bit-banging” firmware

Reconfigure programmable digital blocks to create multiple functions from the same blocks
Dynamic reconfiguration = changing hardware on the fly
Dynamically reconfigure serial communication blocks (e.g., a UART transfer followed by a SPI transfer in the same block)
Dynamically reconfigure timer/counter/PWM blocks

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**PSoc 4 Digital Blocks**

- UDB
- UDB
- TCPWM
- TCPWM
- SCB

UDB = Universal Digital Block
TCPWM = Timer/counter/PWM block
SCB = Serial communication block

**PSoc Components Integrate Digital Functions**

PSoc Creator integrates 60+ digital functions with Components, including: logic gates, flip-flops and lookup tables
A Universal Digital Block (UDB) is a programmable digital block containing:

- Two programmable logic devices (PLDs)
- One programmable data path with arithmetic logic unit
- Status and control registers

**PSoC Creator UDBs simplify the design of custom glue logic solutions using one of three methods:**

- Digital logic Components, which can be dragged and dropped as icons
- The graphical state machine editor
- The code editor, which accepts custom Verilog code

1. Use digital logic Components…

2. Or the graphical state machine editor…

3. Or the Verilog code in the code editor…

Three different design methods to create custom glue logic using UDBs in PSoC Creator

To program the UDB:

- PLD Chaining
- Clock and Reset Control
- Status and Control
- Data Path
- Data Path Chaining
- Digital Routing to the System AHB

1 Product terms; a product term is a logical conjunction of Boolean inputs
Cypress Core Competencies

Manufacturing Excellence
- Autoline converts wafers to tested, packaged units on tape & reel in 12 hrs
- Commitment to 4.3-week lead times with 99.5% on-time delivery
- Multiple qualified foundry + backend partners: Grace, TSMC, UMC, Hynix, Fujitsu

Quality & Reliability
- Cypress is committed to complete customer satisfaction + continuous improvement
- “Products and services shall be on time, at competitive costs, with zero defects” — T.J. Rodgers
- Support for multiple ISO standards; OHSAS 18001: 2007; Sony Green Partner

Programmability & Software
- 200+ software engineers on staff
- Programmability enables customization & fast time-to-market
- Integration reduces bills-of-material costs
- PSoC Creator IDE installs on a PC and enables concurrent HW/SW design
- Increasing focus on configurable, low-cost ARM cores and ecosystem

Process, Design & IP Portfolio
- Cypress has 7,154 patents
- First silicon in 0.7 days/mask layer
- SONOS and eCT Charge-Trap Embedded Flash Technologies
- World-class MirrorBit® NOR Flash memory technology

Customer Service
- Technical Support: 2.5-hour response time; rated at a Net Promoter Score of 81% by customers
- Reduced closure of quality cases to 18 days in 2014 from 27 days in 2012
- 8 a.m. to 5 p.m. live customer support in US, EU, Japan, China & Korea
- Cypress Document Manager with 70,000 documents makes finding collateral easy & fast
- Guaranteed response in online technical forums: www.cypress.com/forums
Thank you!