Flexible Product Demonstrations enabled with the FleX™ IC Development Kit

Flexible MCU, ADC and RFIC high-performance ICs provide needed capability for sophisticated flexible electronic products.

Session 16, Track C (Hybrid Flexible)
Wednesday 3:55-5:40
Our greatest industry challenge: Creating & Introducing successful products

- Flexible product development programs are critical
  - Commercial Businesses
  - Research Institutions and Universities
  - Government
- Low cost flexible electronics platform technology must be available
- A total system solution is required
  - Proven technology
  - Available technology
  - Technology supported by manufacturing
- Necessary technology is not available today, but we are getting closer...
- Development Kits can provide product designers the necessary platform
- Kit development and availability will be covered in this presentation
**2013 recap: Commercial Flexible IC Capability**

**FleX Silicon-On-Polymer Roadmap**

- **Jazz CS18/13**
- **ASI SOI CMOS**
- **Custom Process**

**Flexible High-performance Single Crystalline CMOS**

- Commercial foundry process for flexible IC’s (Industry First)
- Available today for ASIC prototypes (Industry First)
- Demonstrated system functionality (NASA RockSat June 2012)
2013 Flexible Hybrid System
Concept to Product

IC Design ➔ IC Fabrication ➔ IC FleX

Printed Circuits & Sensor Design ➔ Printed Electronics Fabrication

FleX-MCU™
Announced at LOPE-C June 13, 2013

FleX-ADC™
Announced at SEMICON® West 2013 July 13, 2013

FleX-RFIC™

Flexible Hybrid Integration

Pressure Sensor
Strain Gauge
LNA
Antenna
ADC µCtrl

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**FleX IC Chipset for Product Demonstration**

**FleX-MCU™**

**Product Overview**
- LP-MCU, 2.2M transistors
- Designed for SoP
- Physically flexible & conformal

**Product Features**
- RISC microcontroller
- ROM and SRAM
- UART, I2C and SPI communication
- Multiple programmable timers
- Multiple GPIO ports for sensor data collection

Available 2014

**FleX-ADC™**

**Product Overview**
- 8-bit ADC
- 2.5V
- FleX is flexible and conformal

**Product Features**
- 8-bit Successive Approximation ADC
- 8 input, 100k s/s
- Single and continuous
- 2-wire I²C communication

Available 2014

**FleX-RFIC™**

**Product Overview**
- IP-X™ TTO protocol
- Programmable via 2-wire I²C interface
- 860-960MHz (UHF)
- 64-bit unique identification (UID) including 16-bit CRC
- 0.1m–10m read range
- 64kbps or 256kbps
- Anti-collision protocol

Available 2014
• Tested before and after FleX processing
• Tests passing at up to 12MHz (limited by test environment, not silicon)
• ~2.2M transistors
• Over 275,000 passing digital test vectors
Flexible Hybrid System Demo

Industry First?
Dynamic test of flexible IC

Note:
Test Standards?
PRODUCTS are what our industry needs
Products require concept demonstrations
Capability is needed to enable product development
Dev_Kit is a platform for product developers

Dev_Kit Flexible development hardware
- FleX-MCU on a flexible demo board
- Standard connectors for interfacing to PC and prototyping boards
- Voltage regulators
- Serial EEPROM

Dev_Kit Software & Documentation
- C-compiler and assembler
- Product specifications
- User’s guide
- Data sheet
- Demonstration software
User prints or applies flexible sensors and/or displays.

User Flexible Display Region

User makes connections to from user device to existing printed pads.

Connections to printed pads made by user or ASI.

Software and Documentation
- C-compiler & Assembler
- EEPROM Programming
- User’s Guide & Specifications

Prototyping Board
- PC interface
- EEPROM for User Code
- Voltage Regulators

FleX-MCU
- 5mm X 5mm
- 8-bit RISC CPU
- 8KB SRAM, 2KB ROM
- UART, SPI, I2C
- 18 I/O – 2.5V CMOS

Ribbon Cable
- ZIF Connector
**FleX-MCU Dev_Kit #1 - Features**

**Dev_Kit #1**

- Fully flexible prototype platform
- Delivered to customer in “sheet” format
- “Sheet” compatible with multiple printing systems
- Format conducive to customer processing
- Can be cut from the sheet after processing by the customer
2015 FleX-MCU Dev_Kit #2

Added Features
- ADC
- RFIC
- Antenna

User Flexible Display Region

User Printable Sensor Region

FleX-ADC
8-bits
8 input channels
100ksps
I^2C comm to MCU

FleX-RFIC
915MHz
IP-X Protocol
I^2C comm to MCU

Printed Antenna

FlexTech Alliance
for Displays & Flexible, Printed Electronics
Special Thanks and Recognition

- Air Force Research Laboratory
- U.S. Department of Energy
- soligie
- 3M Electronics Markets Materials
- Johns Hopkins University
- TOWERJAZZ
- NBMC (Nano-Bio Manufacturing Consortium)
- Northwest Nazarene University