



**American Semiconductor Inc.**

# 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)

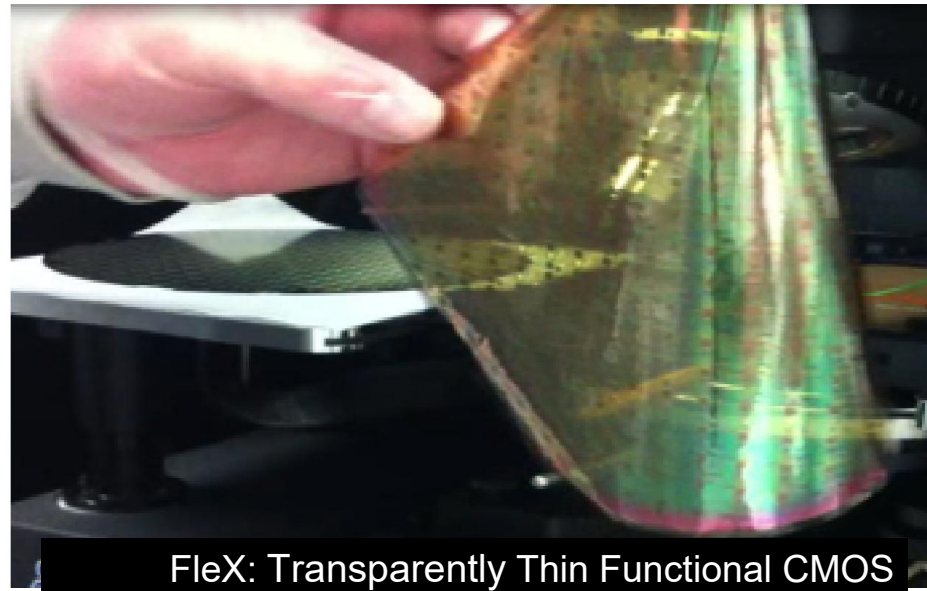
Wednesday 3:55-5:40



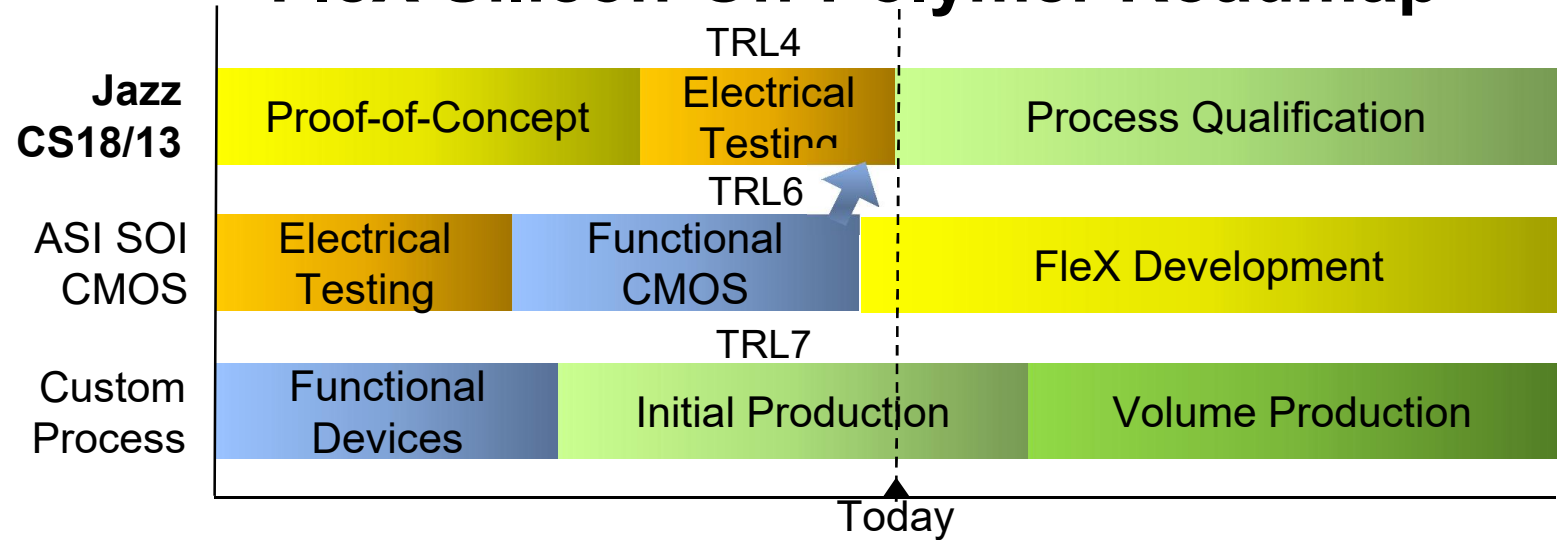
# Our greatest industry challenge: Creating & Introducing successful products

- 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



## 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

Announced at

**LOPE-C**

June 13, 2013

**FleX-MCU™**

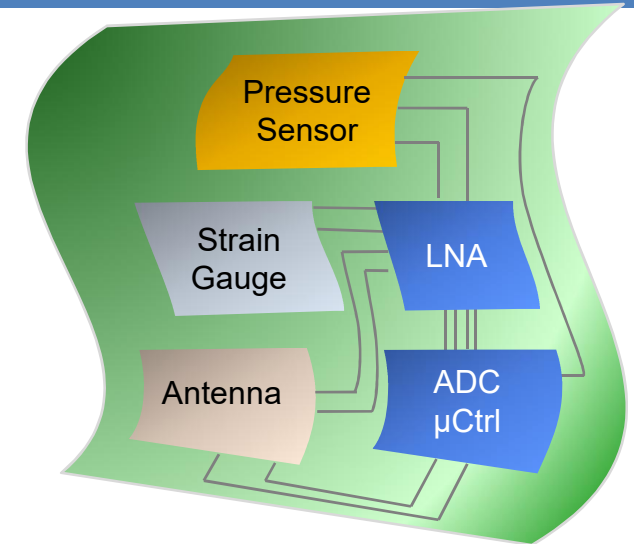
Announced at

**SEMICON<sup>®</sup>**  
West2013

July 13, 2013

**FleX-ADC™**

**FleX-RFIC™**



Flexible Hybrid Integration

Printed Circuits & Sensor Design

Printed Electronics Fabrication

## 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 I<sup>2</sup>C communication

**Available 2014**

## Flex-RFIC™



### Product Overview

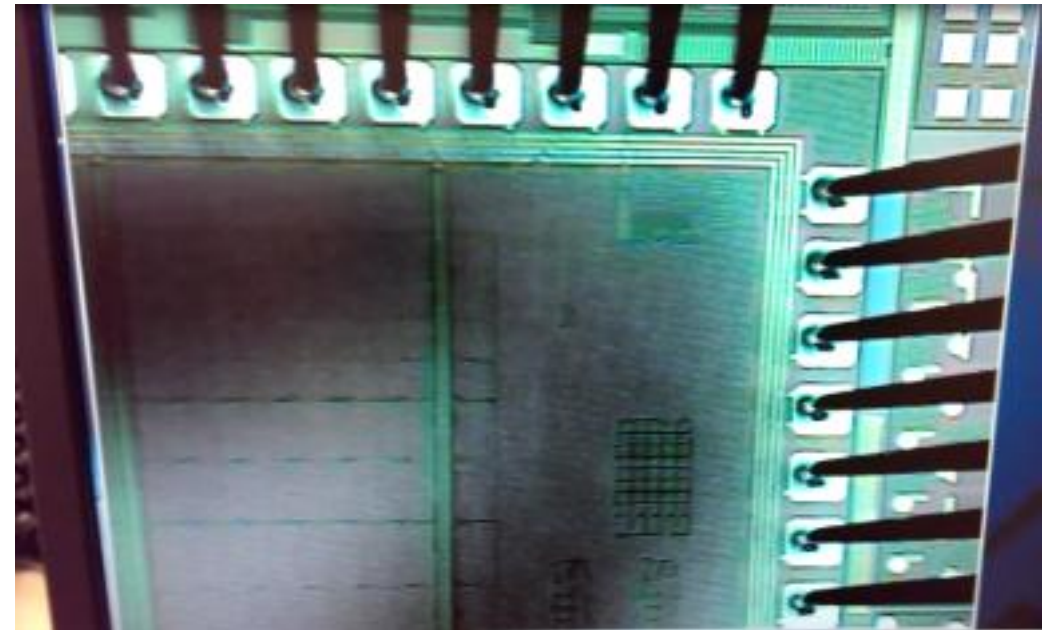
- IP-X™ TTO protocol
- Programmable via 2-wire I<sup>2</sup>C interface
- 860-960MHz (UHF)
- 64-bit unique identification (UID) including 16-bit CRC
- 0.1m–10m read range
- 64kpbs or 256kpbs
- Anti-collision protocol

**Available 2014**

First  
Release

- 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

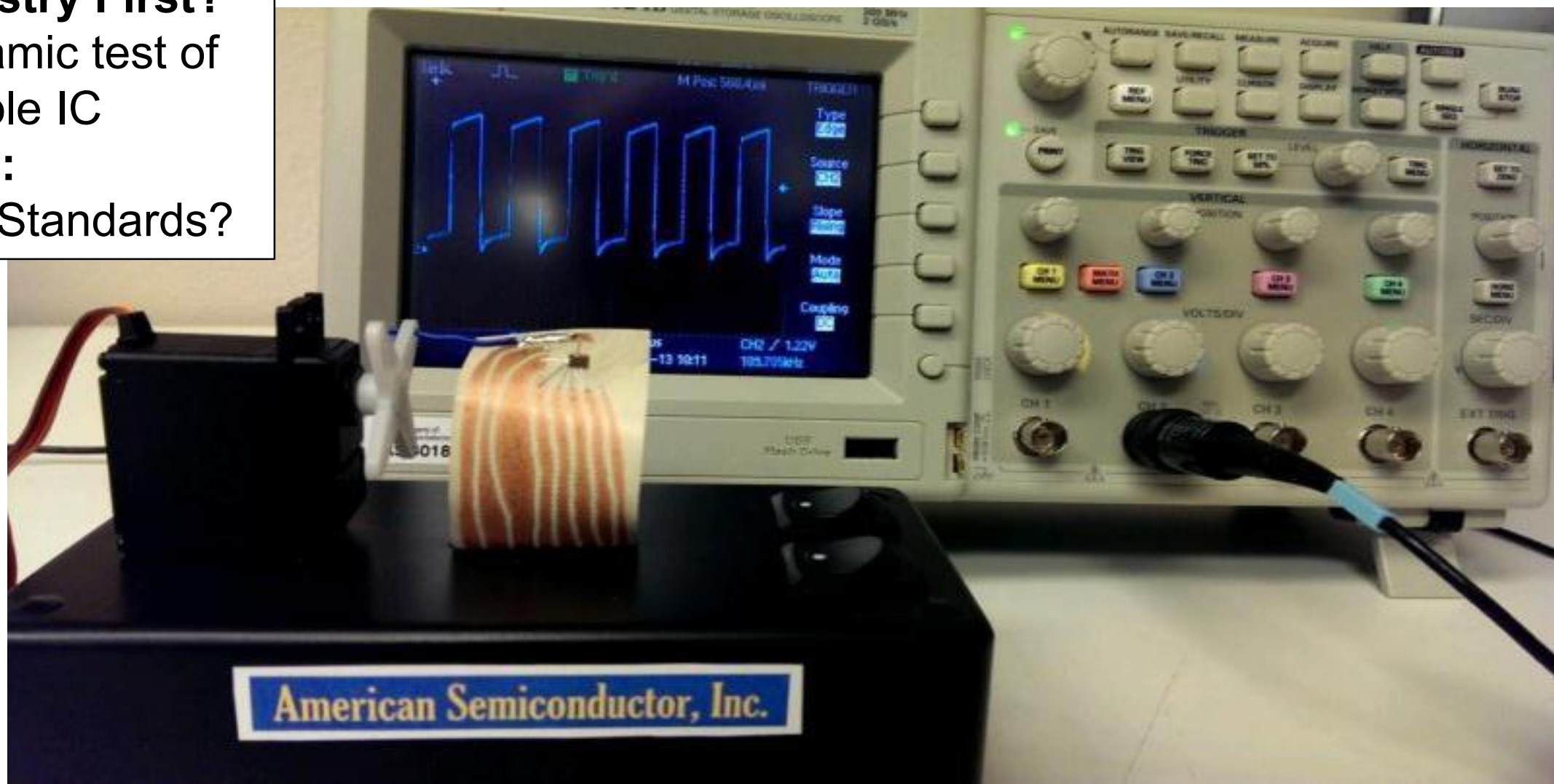
Block	Full Thickness	<i>FleX</i> Wafer
CPU - Opcodes	Pass	Pass
CPU - ALU	Pass	Pass
RAM - 8KB	Pass	Pass
ROM - 1KB	Pass	Pass
I/O Ports	Pass	Pass
Comm Peripherals	Pass	Pass
Timers / Counters	Pass	Pass



## Industry First?

Dynamic test of flexible IC

**Note:**  
Test Standards?



## 2014 *FleX*-MCU™ Development Kit

**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

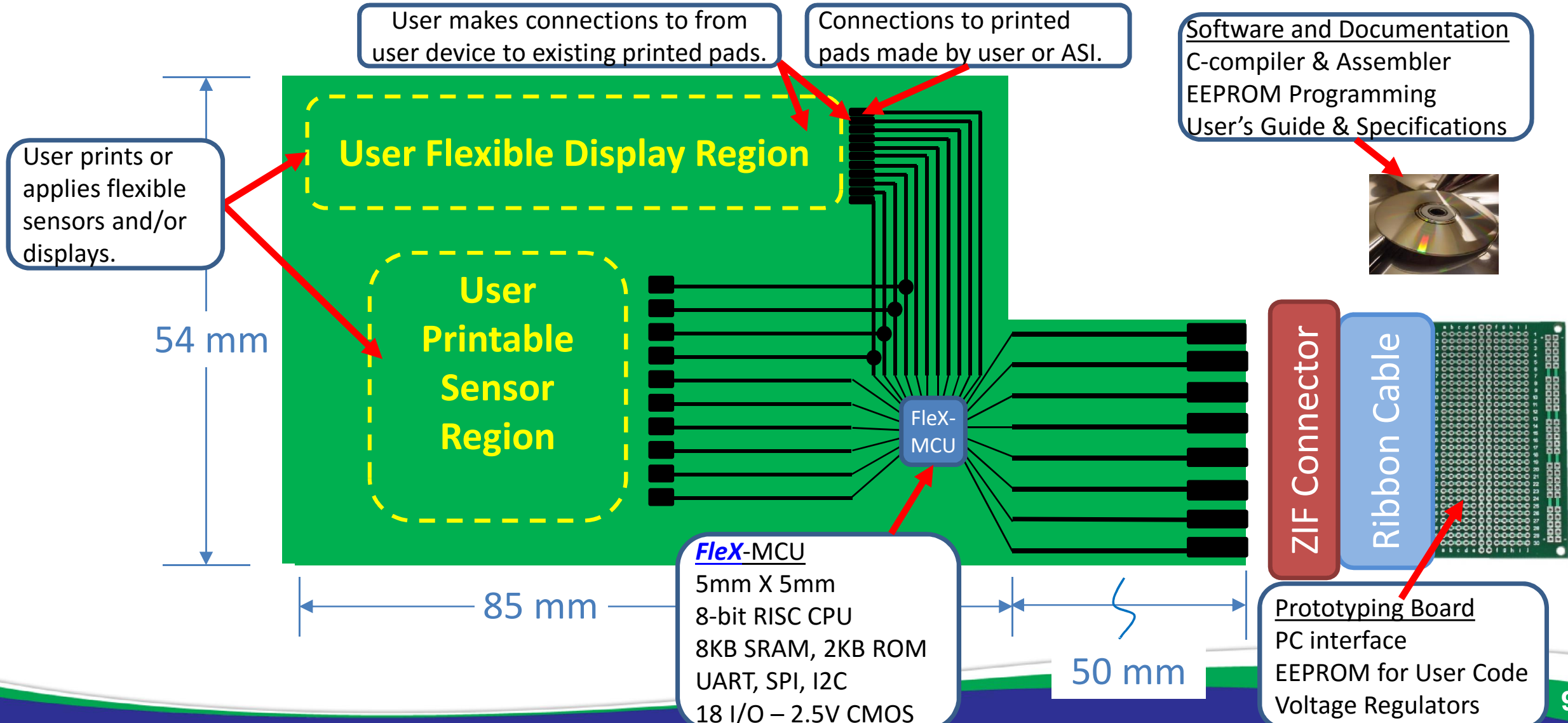
- FleX-MCU on a flexible demo board
- Standard connectors for interfacing to PC and prototyping boards
- Voltage regulators
- Serial EEPROM

### **Dev\_Kit** Software & Documentation

- C-compiler and assembler
- Product specifications
- User's guide
- Data sheet
- Demonstration software



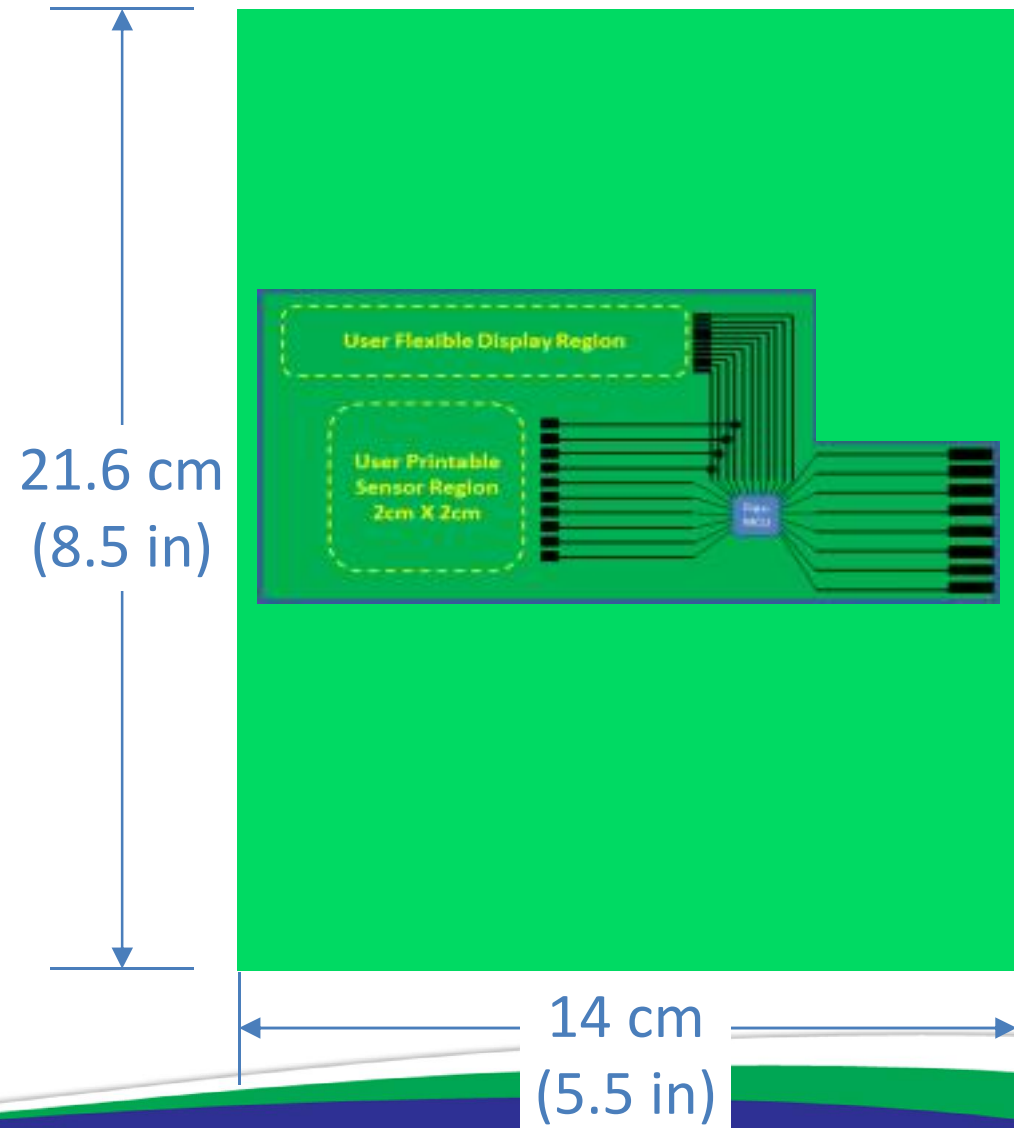
# 2014 *FleX*-MCU Dev\_Kit #1 - Features



# *FleX*-MCU Dev\_Kit #1 - Features

## Dev\_Kit #1

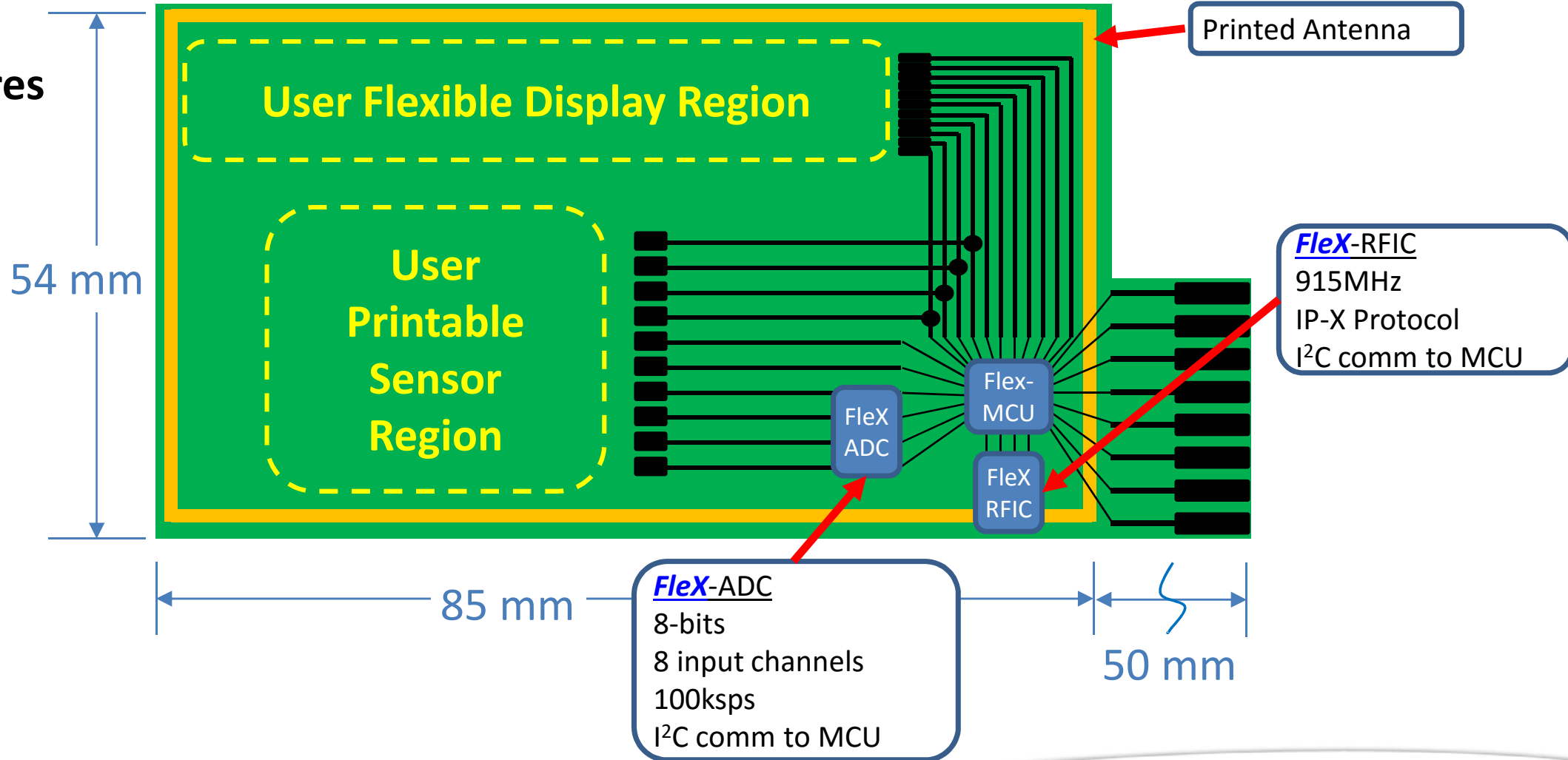
- Fully flexible prototype platform
- Delivered to customer in “sheet” format
- “Sheet” compatible with multiple printing systems
- Format conducive to customer processing
- Can be cut from the sheet after processing by the customer



# 2015 *Flex*-MCU Dev\_Kit #2

## Added Features

- ADC
- RFIC
- Antenna



# Special Thanks and Recognition

