Flexible Hybrid Electronics Solutions for Wearable Sensor Systems

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What is a Flexible Hybrid System (FHS)?

Flexible Hybrid System
“Combination of flexible printed materials and flexible silicon-based ICs to create a new class of flexible electronics.”

Printed Electronics
- Sensors & Displays
- Low Cost
- Large Format
- Roll-To-Roll or Screen Print

Flexible FleX-ICs
High Performance, High Density
Sensor System Configurations


Sensor System Configurations

- Sensor
- Signal Processing
- Data Processing
- Comm
- User Display
FleXform-ADC™ Development Kit

FleXform Kits provide:

- “Out-of-the-box” proof of FHE feasibility
- User printable FHE with on-board FleX-ADC
- Integration Board and Software
- Enables printed device demonstrations
- Fully supported by ASI flexible technology integration team for design and manufacturing.

**Kit Availability:**
- Limited initial release 2/23/15
- Now accepting pre-orders for March deliveries.
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FleX-RFIC™ Features

- IP-X™ TTO (Tag Talks Only) 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
FleX-RFIC Block Diagram

- Traditional RFID tags only communicate a static tag value
- With the integration of a 2-wire I2C communication interface, the FleX-RFIC can use the RFID transmission protocol to also transmit data
FleX-RFIC Physical Characteristics

- Die Size: 2.4mm X 2.4mm
- Pin Count: 24
- Pad Opening: 190um X 190um
- Pad Pitch: 300um
- Thickness: 24-60um
- Flexible: Yes
- Conformal: Yes
- Mass: ~0.23mg
FleX™ Commercial Silicon-on-Polymer (SoP) Process

- Technology: TowerJazz CS18/13 PD-SOI CMOS
- Interconnect: 4-level Aluminum
- Flexibility: FleX Silicon-on-Polymer

Silicon-on-Polymer (SoP) converts single crystalline semiconductors into flexible semiconductors.

Standard CMOS Wafer  Handle Silicon Removed  Polymer Substrate Applied  SoP Wafer
Printed Antenna and Electrical Interconnects

- 5mil (127um) thick PET substrate
- Screen printed using a nanoparticle-based conductive ink
- Electrical interconnects from FleX-RFIC to antenna printed using a conductive epoxy

Pad Pitch 300um
Test Methodology and Results

- Skyetek SkyeModule M9 RFID Reader Dev Kit with Patch Antenna
- Continuous operation with logging of interrogation time and count of transmissions
FleX-RFIC versus Rigid IC

- Built and tested versions of the RFID tag with printed antenna using both a traditional rigid IC and a fully flexible FleX-RFIC
- Both versions operated successfully but the reliability advantages of the FleX-RFIC in flexible or conformal applications is evident
What’s Next for the FleX-RFIC?

• FleX-RFIC Silicon Optimization (Currently in Fab)
  » Internal oscillator frequency tuning for data rate control
  » Passive version that can draw power directly from the reader

• Printed Antenna Optimization
  » Centered to protocol frequency

• FleX System Integration
  » FleX-RFIC + FleX-MCU™ + FleX-ADC™ integrated into a single system to support data collection, data processing and data transmission

• FleX ASIC Development
  » FleX-RFIC + FleX-MCU + FleX-ADC integrated into a single flexible ASIC to support all 3 functions in a single die for lower power and smaller total footprint

• Add support for additional RF communication protocols
Flexible Electronic Products and Services

Corporate Headquarters – Boise, Idaho, USA
- Engineering – Design, Process, Modeling
- FleX™ Silicon-on-Polymer™ Manufacturing and Assembly
- Test & Characterization Cleanroom
- Sales, Marketing, Administration
- Privately held small business founded in 2001

Product Lines
- FleX™ – IC, SoP, FHS (Flexible ICs)
- Design and System Integration Services – Conventional & Flexible
- Custom Wafer Fabrication (TowerJazz & Cypress)

2007 Supplier of the Year
Thank You!

For more information, please contact us at:

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