



Interactive Gen2

Bridging the Gap between Passive RFID, Sensors and Electronics

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28 July 2011

NXP / Multi-Applications without Compromise

AGENDA

Intro | Traditional & Next Gen RFID

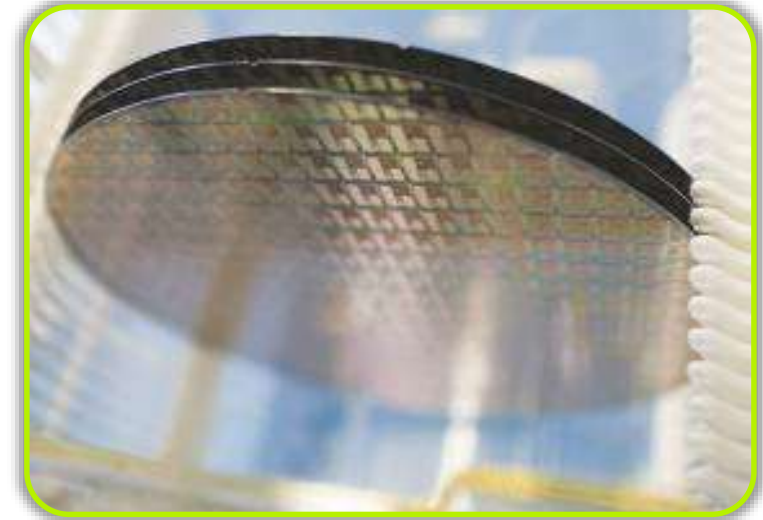
Sensor Supporting Platforms



NXP Semiconductors

NXP Semiconductors provides High Performance Mixed Signal and Standard Product solutions that leverage its leading RF, Analog, Power Management, Interface, Security and Digital Processing expertise.

- **Public company:** NASDAQ: NXPI
- **Net revenue:** \$4.4 billion in 2010
- **Footprint:**
 - Present in ~ 30 countries
 - Approximately 28,000 employees
 - Manufacturing facilities in Europe & Asia
 - R&D activities in Asia, Europe & the United States



NXP in your daily life

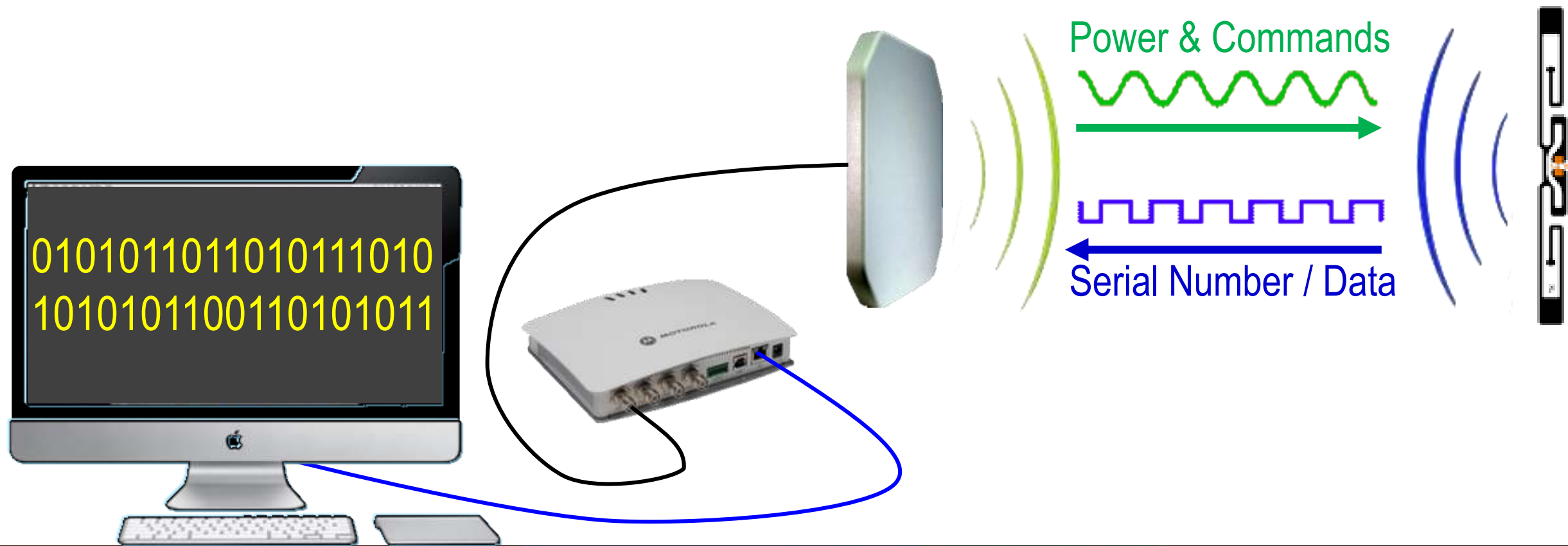


- In today's presentation, we will discuss concepts.
- Our Role
 - NXP researches, designs and commercializes HPMS ICs, inclusive of RFID ICs and sensors
- Partners Role
 - Partners provide end solutions and integration services

Traditional UHF RFID

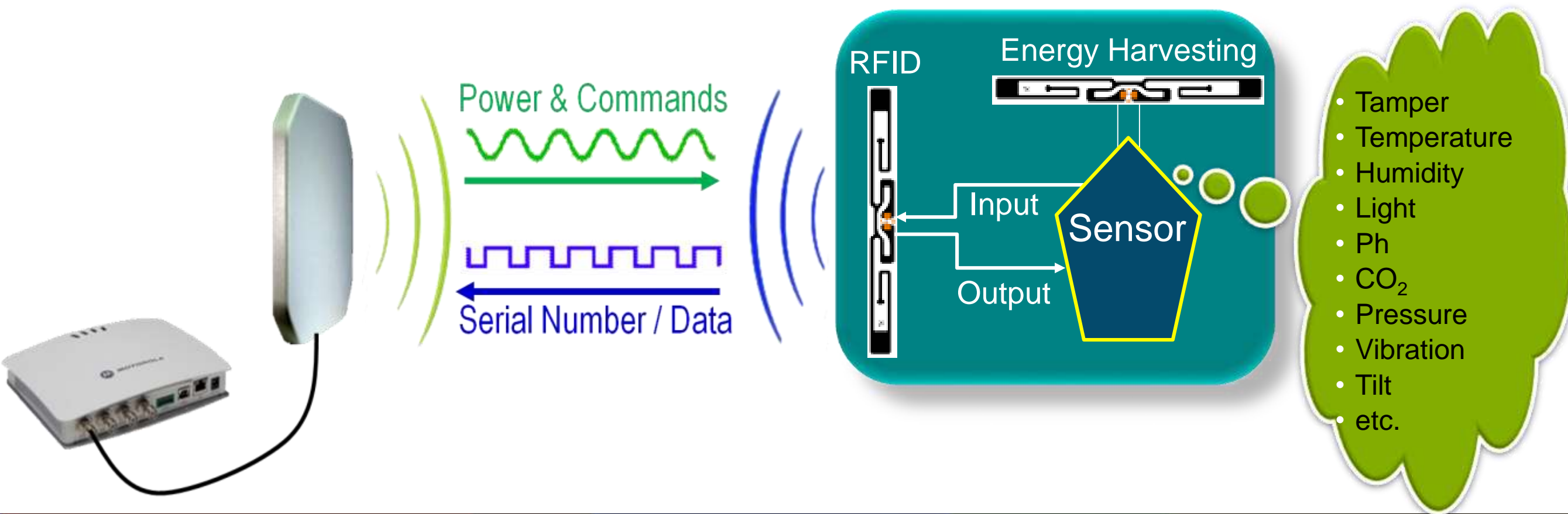
We're all well acquainted with conventional UHF RFID where the tag is queried and it responds accordingly.

But now let's take this to the next level, with the same infrastructure.



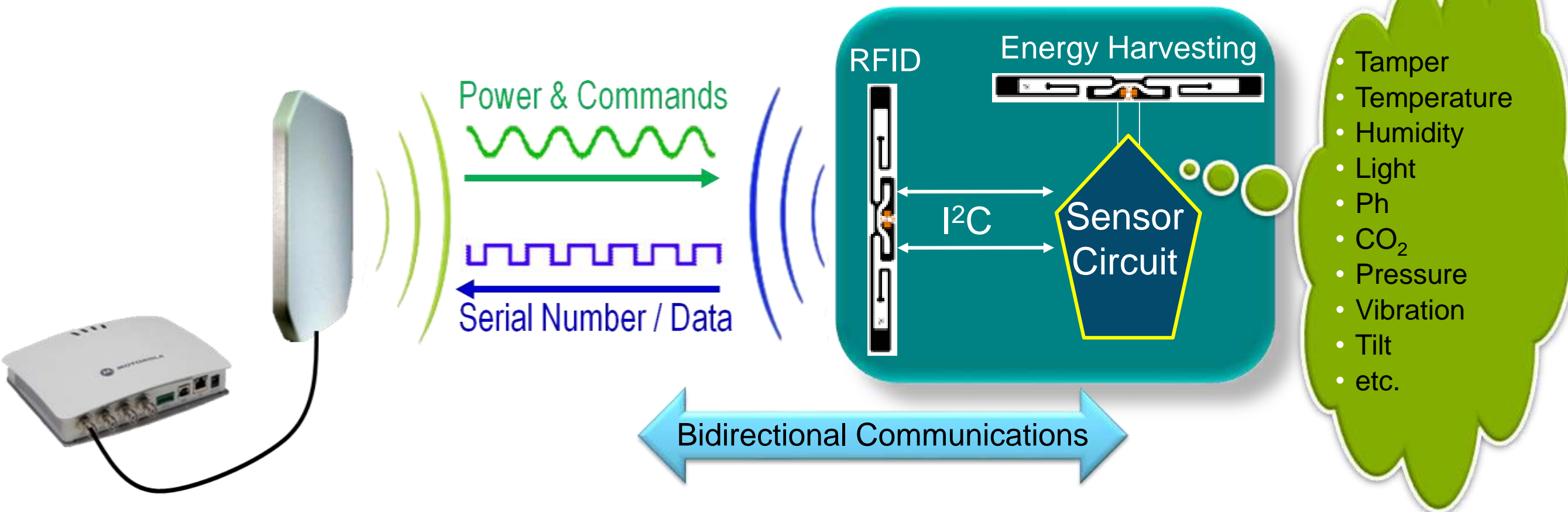
Threshold Detection with UHF RFID | UCODE G2i “+” Series

- ▶ UCODE G2iL+ & G2iM+ series ICs add a digital input / output to RFID
- ▶ Input enables tamper or level detection for simple digital sensors – state change is transmitted via RF to reader, along with device's unique s/n
- ▶ Output may be used as digital switch to assert a remote action
- ▶ Use cases may include alerts if bearing temperature threshold is exceeded

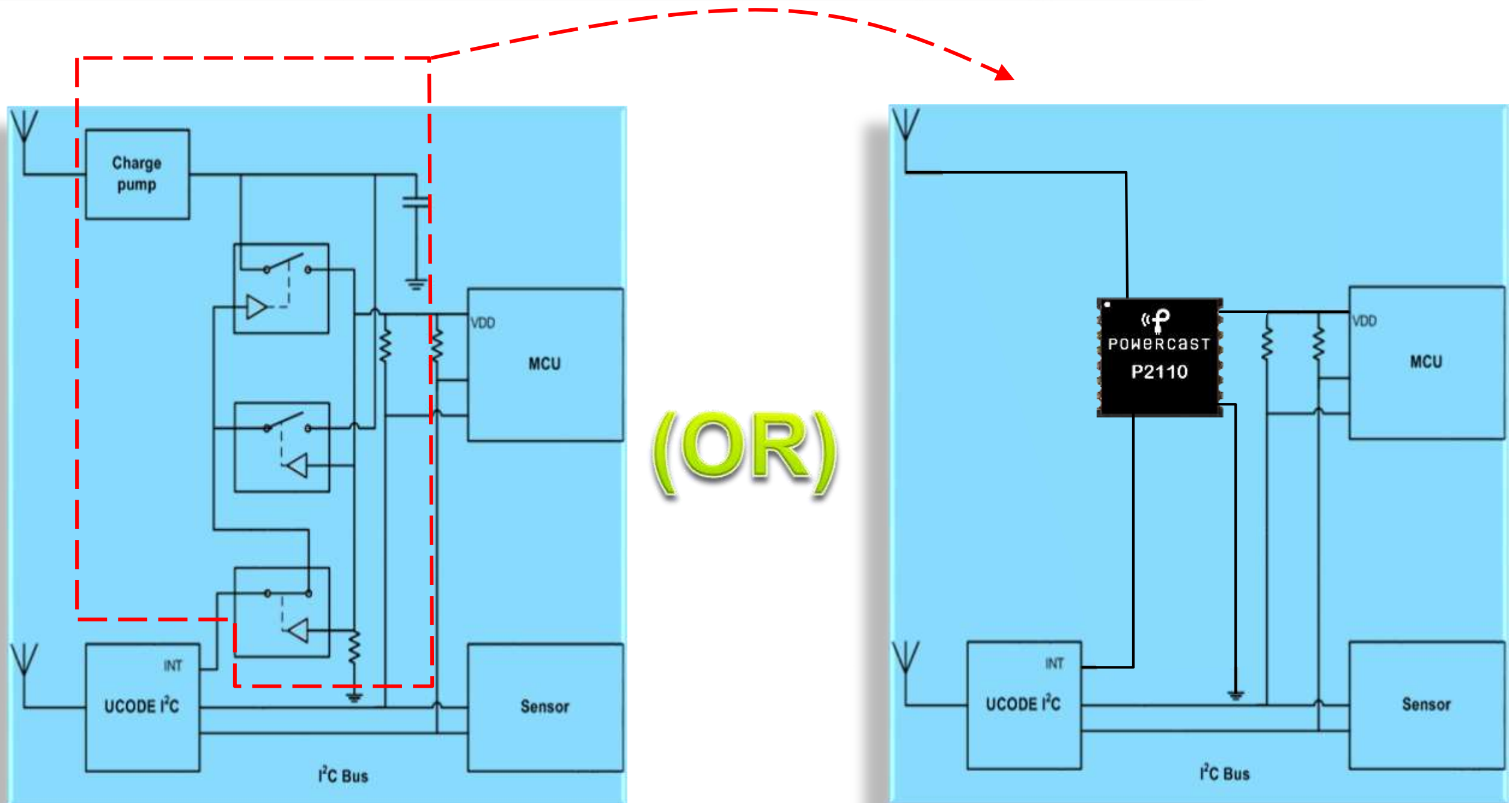


Interactive UHF RFID | UCODE I²C

- ▶ UCODE I²C adds an I²C serial interface to traditional UHF RFID
- ▶ Enables bidirectional communications between sensors / electronics and the traditional RF interface
- ▶ Sensors may use similar resonant antennas as those used for the RFID component, to harvest energy for sensor circuits

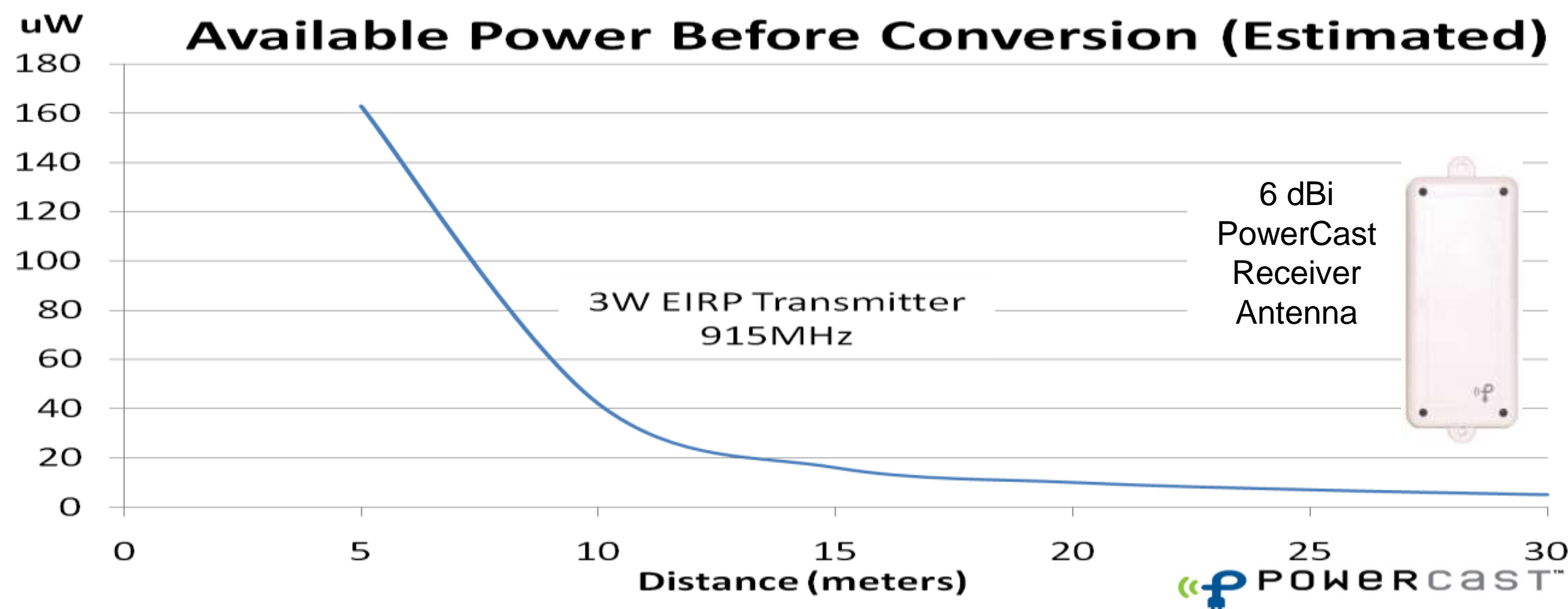


Passive Wireless Energy Harvesting Block Diagram



Power Harvesting

- ▶ Similar to antennas used for passive RFID ICs, a second antenna may be used to harvest energy for ancillary low power sensors / circuits.
- ▶ Charge pumps, multipliers or a harvesting receiver such as that offered by PowerCast, may be required to boost voltage.
- ▶ See demo for relative power meter readings and exemplary LED operation.



Sensor Application Examples



Perishable Logistics



- Temperature
- Humidity
- CO₂
- O₂
- C₂H₄ Ethylene
- pH
- light
- impact

Slaughterhouses



- Temperature
- pH

"Smart Spaces"



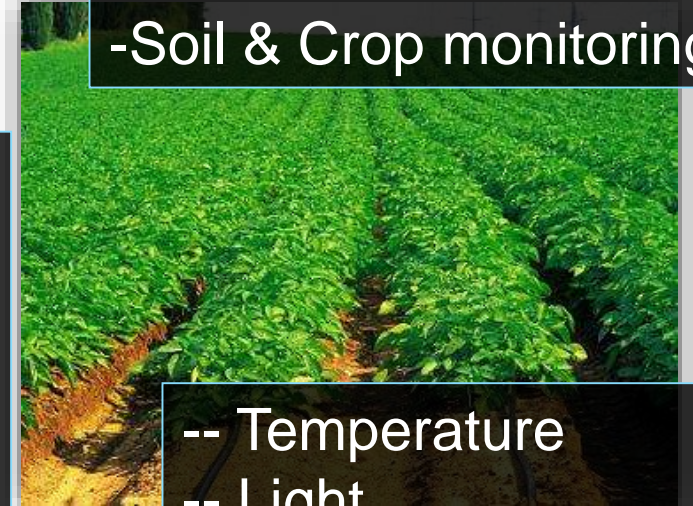
- Temperature
- Light (visible)
- Humidity
- CO₂
- Pressure
- Flow
- Presence
- VOC's
- CO

Medical monitoring



- Temperature
- pH
- glucose
- pCO₂/pO₂
- Flow
- Pressure

-Soil & Crop monitoring

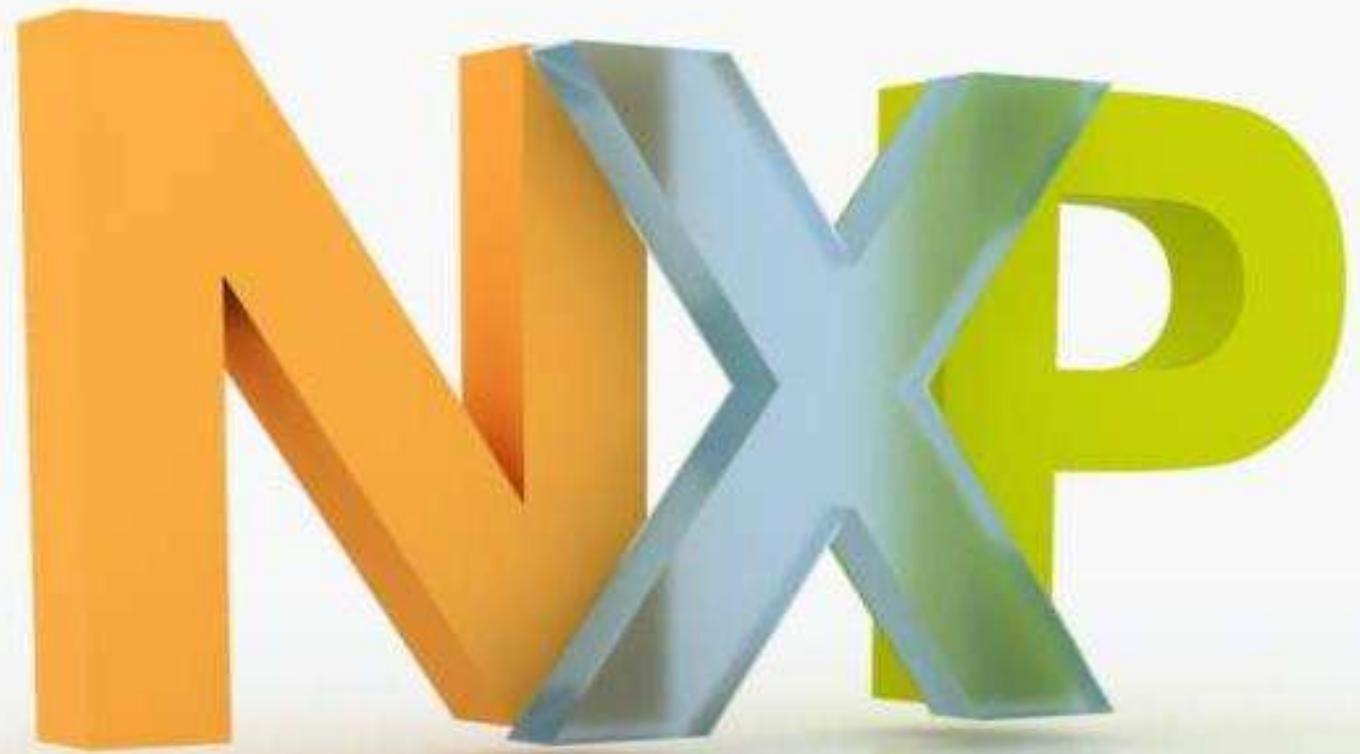


- Temperature
- Light
- Humidity/moisture
- pH

-Construction monitoring



- Temperature
- pH
- Humidity/moisture



New *UCODE P²C* and *i-Series* Products for Sensor Applications

Multi-Applications without Compromise

- ▶ G2iL: **G**en2 / **i**-Series / **L**ess memory
- ▶ Key attributes:
 - ▶ Ultra high sensitivity
 - ▶ TID/UTID: 64-bits
 - ▶ EPC Memory: 128-bits
 - ▶ Block write, read protect, range reduction, product status flag
 - ▶ Applications: High sensitivity, low memory such as retail apparel or FMCG





Read Protect feature allows for consumer privacy

- The EPC and / or TID number can be hidden



Real Read Range Reduction (4R) enhances consumer privacy

- Read range can be reduced to a few inches / cm



Conditional Real Read Range Reduction

- Activation of 4R based on tag tamper alarm condition (open/short)



Product Status Flag for production control and theft deterrence

- To identify stolen items
- To indicate if device passed process / quality control points

- ▶ G2iL+: **G**en2 / **i**-Series / **L**ess memory / **+** enhanced features
- ▶ Key attributes:
 - ▶ Ultra high sensitivity
 - ▶ TID/UTID: 64-bits
 - ▶ EPC Memory: 128-bits
 - ▶ Block write, read protect, range reduction, product status flag; tamper, digital switch, battery function
 - ▶ Applications: High sensitivity, low memory such as retail apparel or FMCG. Also for apps with special tamper features & battery assist.





Tag Tamper alarm to indicate manipulation of tag

- Chip senses if a tag is ripped, torn, cut or removed from its original position



Data transfer for ease of device configuration

- Hardwired output of data received via the RF interface



Digital switch to activate / deactivate an electronic device

- Activation / deactivation of certain features or entire electronic device



Battery mode to boost Read and Write range

- More than 35m read and write range when connected to external power supply

- ▶ G2iM: **G**en**2** / **i**-Series / **M**ore memory
- ▶ Key attributes:
 - ▶ Ultra high sensitivity
 - ▶ TID/UTID | XTID: 96-bits | 112-bits
 - ▶ EPC Memory: 256-bits
 - ▶ User Memory: 512-bits
 - ▶ Block write, read protect, range reduction, product status flag
 - ▶ Applications: High sensitivity, extended memory & concealed memory.



- ▶ G2iM & G2iM+: **Gen2** / **i-Series** / **M**ore memory / **+** enhanced features
- ▶ Key attributes:
 - ▶ Ultra high sensitivity
 - ▶ TID/UTID | XTID: 96-bits | 112-bits
 - ▶ EPC Memory: Scalable from 128 to 448-bits
 - ▶ User Memory: Scalable from 640 to 320-bits
 - ▶ Block write, read protect, range reduction, product status flag; tamper / conditional read reduction, digital switch, battery function
 - ▶ Applications: High sensitivity, extended memory & concealed memory.





Block Write feature allows for fast initialization

- The data can be written in blocks of 32-bit



Read Protect feature allows for consumer privacy

- The EPC and / or TID number can be hidden



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Segmented User Memory

- Allows flexible configuration of User memory (up to three segments)
- Selectable EPC memory size – in exchange with User Memory

G2i+ Tag Tamper Sensor



Product Feature

- IC sends alarm if label is manipulated
- Indication if label is ripped, torn, cut or removed

Customer Benefit

- Shrinkage detection in the fitting room and on the shop floor
- Detection of label relocation

Un-tampered tag. loop closed.



Tampered tag. loop open.



G2i Series Conditional Read Range Reduction Sensor



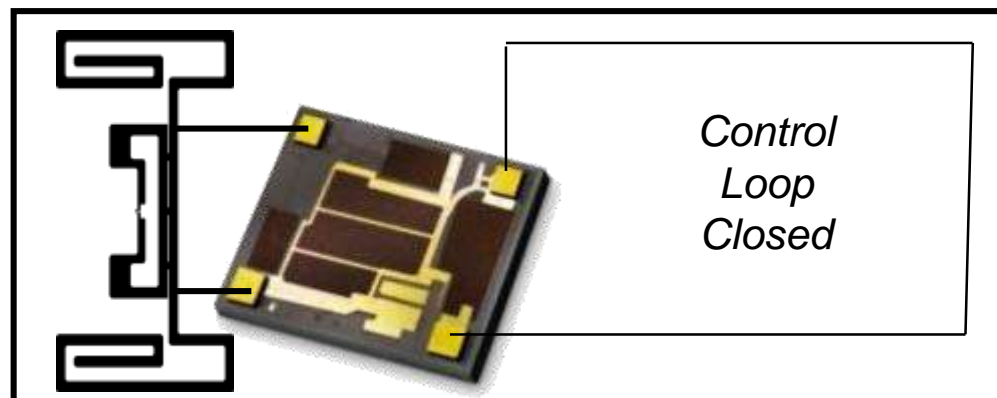
Product Feature

- Automatic activation of 4R (Real Read Range Reduction) based on predefined condition (tamper loop open or closed)

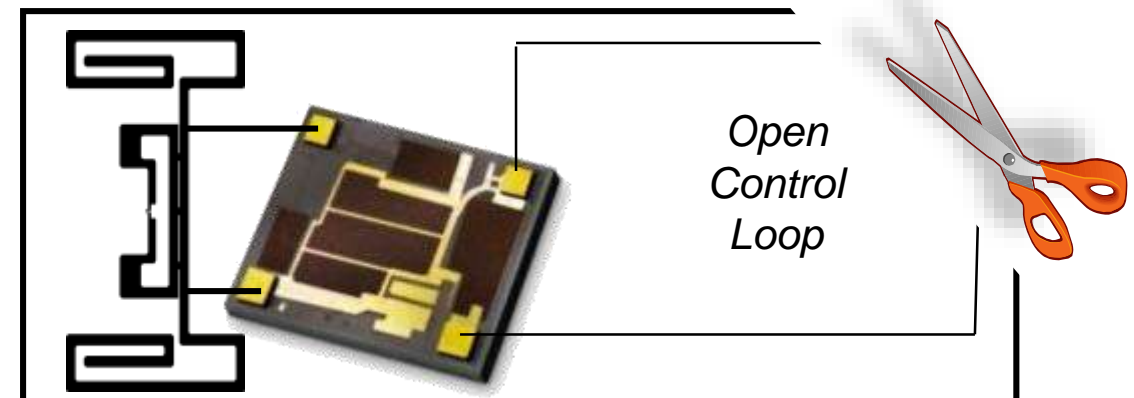
Customer Benefit

- Consumer privacy - tag cannot be read from distance
- Shop owners can read information without the need to change setting of tag

4R activation on, closed loop



4R activation on, open loop





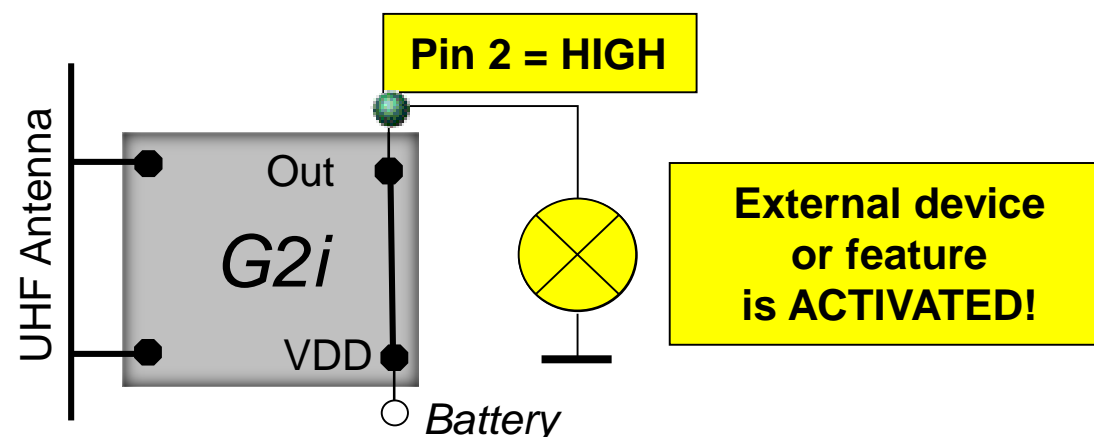
Product Feature

- IC responds to commands to enable/disable a contact (e.g. open or close a switch/contact) with an external supply
- May be set/reset repeatedly (32-bit PWD protected)

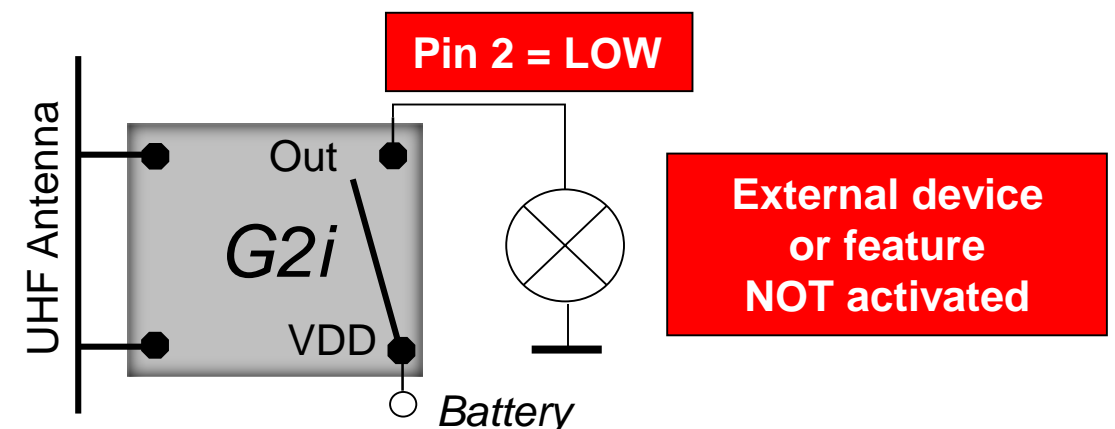
Customer Benefit

- Enabling/disabling specific features of certain device models
- Theft prevention:
 - Enabling of the entire device only after purchase at the POS, locking of device throughout the supply chain

Activation of device / feature



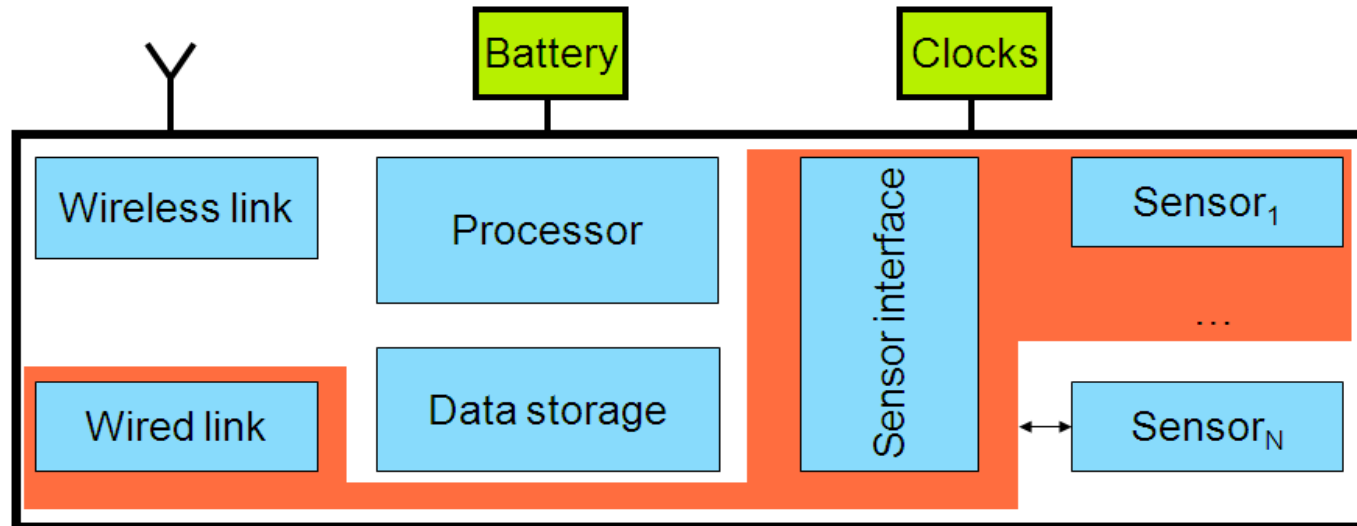
De-activation of device / feature



- ▶ I²C: Bridging wireless Gen2 RF to micros via multi-master I²C serial bus
- ▶ Key attributes:
 - ▶ I²C & RF data interface (independently enabled)
 - ▶ TID/UTID: 96-bits
 - ▶ EPC Memory: 160-bits
 - ▶ User Memory: 3,328-bits
 - ▶ High capacity memory, dual analog front end, read protect, interrupt flag, bidirectional I²C, RF / I²C bridge, digital switch
 - ▶ Applications: Sensors | embedded electronic devices | enablement | provisioning | commissioning | customization | high memory apps



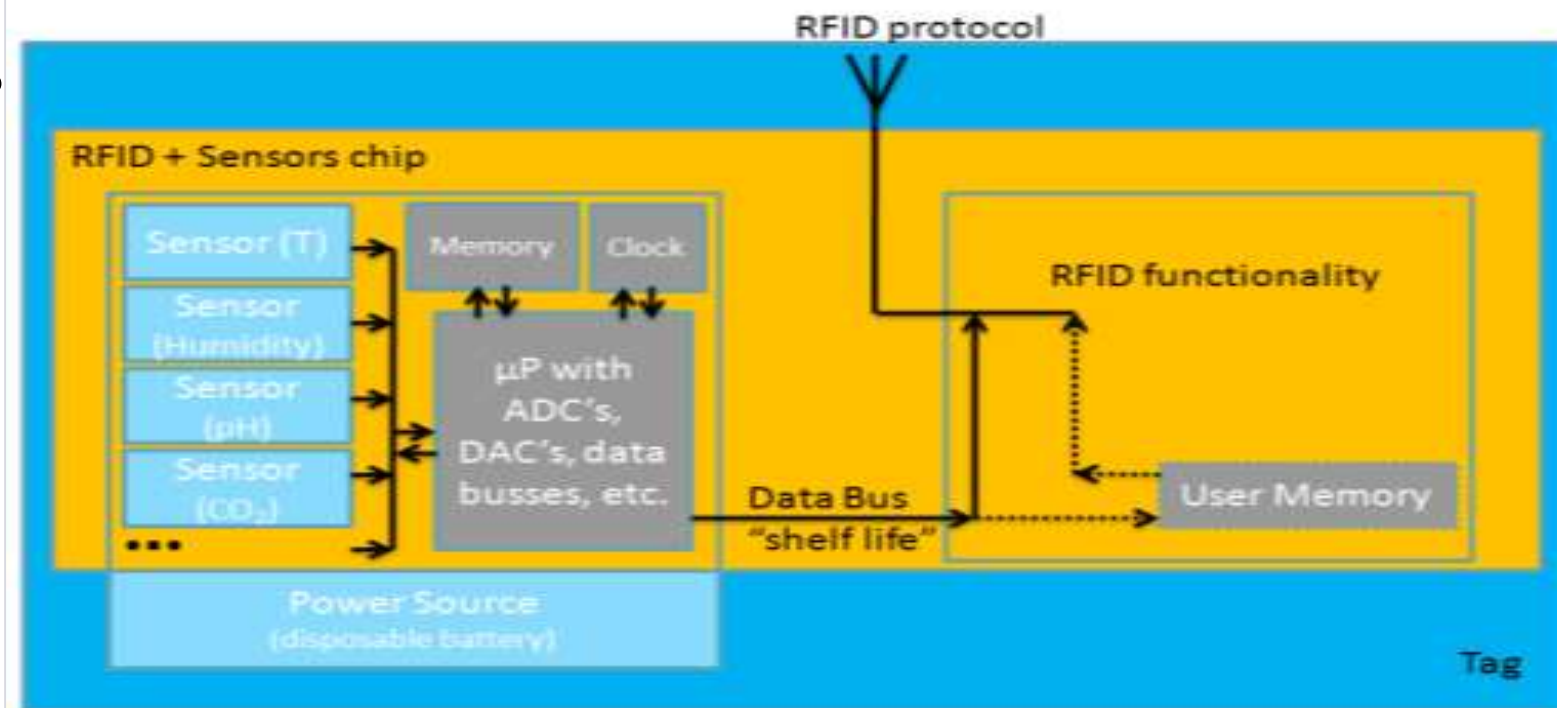
State-of-the-Art Multi-Sensor Systems



Typical Active Sensors Today

Future Passive Sensors

RFID + sensors block diagram



Taking RFID to the Next Level | HPMS

HIGH PERFORMANCE

Functional Performance

- Gain
- Speed, bandwidth, bit-rate
- Accuracy, resolution
- Linearity, dynamic range

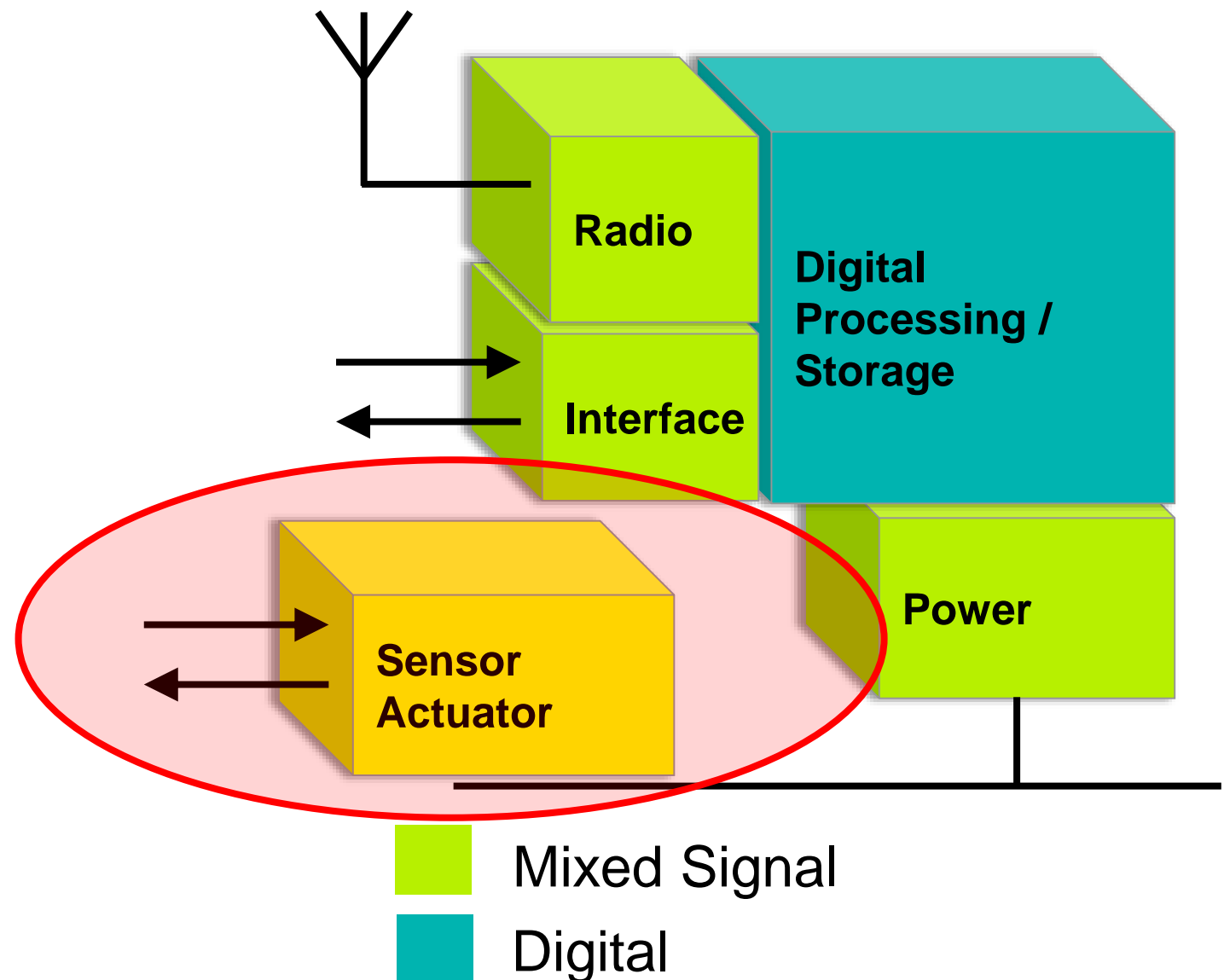
Efficiency

- Power
- Cost
- Autonomy

Robustness & Versatility

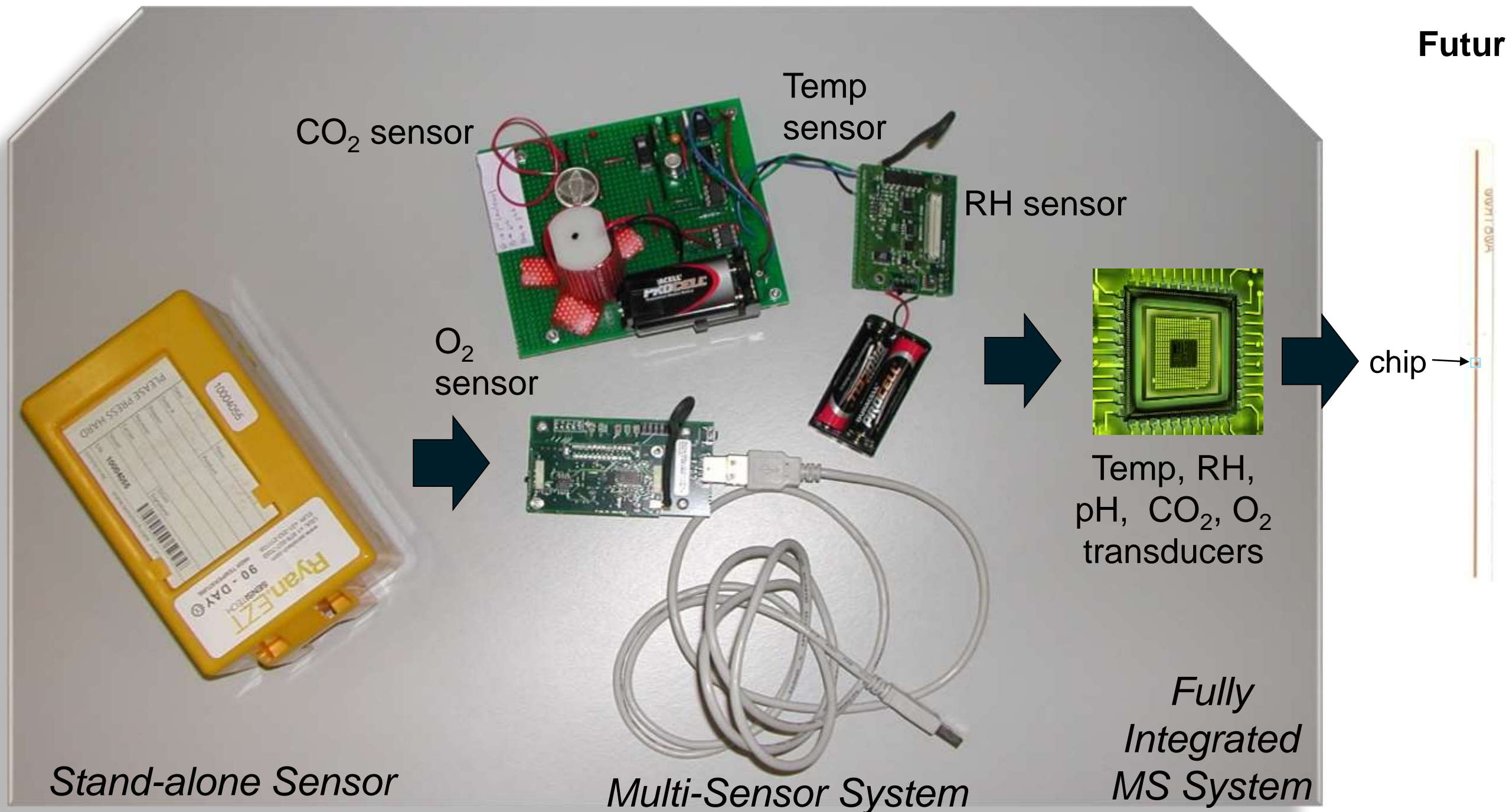
- Reliability
- Withstand harsh environments
- Flexibility
- Adaptability

MIXED SIGNAL | optimized analog & digital mix



Sensor Options | Today - Future

Future



Thank You...

For More Information, visit:
www.NXP-RFID.com



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