ZERO POWER WIRELESS SENSORS
Energy Harvesting-based Power Solutions

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Zero Power Sensors Overview

» Energy can be harvested from almost any environment:
  » Light, vibration, flow, motion, pressure, magnetic fields, RF, etc.

» Energy Harvesting applications include:
  » Permanently powered wireless sensors,
  » Hybrid & Active RFID, data logging and access control

» Self-Powered Systems need reliable energy storage:
  » Must have energy storage because EH Transducer energy source is not always available
  » Self-Powered devices enable inaccessible remote placement and lower installation costs
  » High battery cycle life enables extended operation – no more service calls

» Ideal storage solution is a highly-efficient, eco-friendly, energy storage device that lasts the life of the product
Zero Power Wireless Sensor Diagram

Power Transducer
- Photovoltaic
- Thermoelectric
- Piezoelectric
- Inductive
- RF

System Payload
- Microcontroller
- RF Wireless
- Powered Actuator
- Sensor Interfaces
- Optional MCU + Radio

Energy Processing & Storage
- Power Conversion & Conditioning
- Power Management
- Energy Storage
- EnerChip EH™
  - CBC-915 &
  - CBC3150 CCEH

Sensors & Actuators
- (temperature, pressure, occupancy, spray, etc.)

Logos:
- CYMBET CORPORATION
- POWER FORUM
- AVNET electrons marketing
Microchip XLP Solar EH Kit

» EH Application development platform
» XLP 16-bit PIC24F16KA102 MCU
» PICtail daughter boards including Wireless
EH for TI MSP430 LaunchPad Kit

- Semi Passive Tag Monitors Temperature Aberrations
  - Connects to Eval-10 Solar Harvesting Board
  - Easily Programmable for testing
  - EH power source allows for permanent power with no battery replacement
  - 100’s of hours of run time with minutes of exposure to >200 Lux of indoor lighting
EVAL-09 Universal Energy Harvesting Kit

Thermoelectric Generator (TEG) or RF Induction or Photovoltaic Cell or Electromagnetic or Piezoelectric Generator

Various Transducer Interface Electronics

Energy Processor CBC915

EnerChip Energy Storage

CC2500 Radio

MSP430 with Temperature Sensor

Available at www.avnetexpress.avnet.com keyword Eval-09
Semi Passive RF Tag Applications

- Cold-chain time/temperature monitoring
- Smart patches – medical
  - Blood glucose monitoring
  - Body temperature
  - Moisture, pH, oxygen
- Service tags
  - Equipment calibration and servicing indicators
- Low duty cycle real-time locating systems
RF Charging and Comms - TI and Cymbet

- **PaLFI EnerChip RF Tag**
  - Data Logging, Line-End Programming, mailbox function, communication through MCU (read & write), passive wake-up via air or push button
  - EnerChip Battery charge function
  - Secure and encrypted communication
EH Medical Applications

» Wireless Patient Monitoring:
  » Rechargeable micro-power source powers wireless sensors
  » Eliminates wires & battery replacement

» Patient ID & Tracking:
  » Small size enables Active-RFID & RTLS
  » Utilize near-field recharging

» Smart Patches & Dressings:
  » Administer medicine & monitor wound condition - temp, moisture, PH, etc.
EH Building Automation

» HVAC sensors – occupancy, temp, humidity, CO2
» Lighting Controls – Window light, room light, shade controls
» Security – occupancy, intrusion detect, motion sensors, noise sensors, proximity, etc.
» Utility monitoring, meter reading & off-peak control
EH-based Zero Power Evaluation Kits

- EVAL-09 Universal EH Transducer Using Energy Processor
- EVAL-11 Near-Field RF Induction Charging
- TI eZ430-RF2500-SEH Kit
- EnerChip CBC3150 CCEH
- EVAL-10 Solar CCEH Kit
- EnerChip EP CBC915 Energy Processor
- CBC050 EnerChips
- Microchip XLP Solar EH Kit

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keyword: Eval-09, Eval-10, EVAL-11