

# Cypak ASIC: The Compliance Connection

### General

The CPK082 is a programmable Application Specific Integrated Circuit (ASIC) for integration in packaging and devices to monitor compliance. The CPK082 operates as an RFID Active Tag, with processor, memory, active management of up to 32 sensors

The ASIC is fully programmable and enables a variety of low cost applications requiring reliable data capture and storage while consuming very little power. The design accommodates the integration of printed sensors on paperboard, plastics, fabrics, and other substrates.

The CPK082 is a fully functional replacement for CPK081.

### Applications

The first applications for CPK082 are in Connected Healthcare. The ASIC is embedded in pharmaceutical packages and vital sign monitors to assist clients manage their compliance with therapies and provide data to professionals and carers.

Cypak supplies appropriate firmware to comply with ISO/IEEE standards and Continua Health Alliance guidelines.

Other applications include environmental monitoring, tamper seals, disposable biosensors, vital sign sensors, questionnaires, and touch sensors.

Many sensor logging devices can be implemented with little or no external circuitry.

### CPU and memory

CPK082 is built around a 8051 compatible programmable microprocessor. The 32 kByte EEPROM memory is programmed and erased by the CPU allowing reconfigurable software, and data logging into non-volatile memory.

### RFID

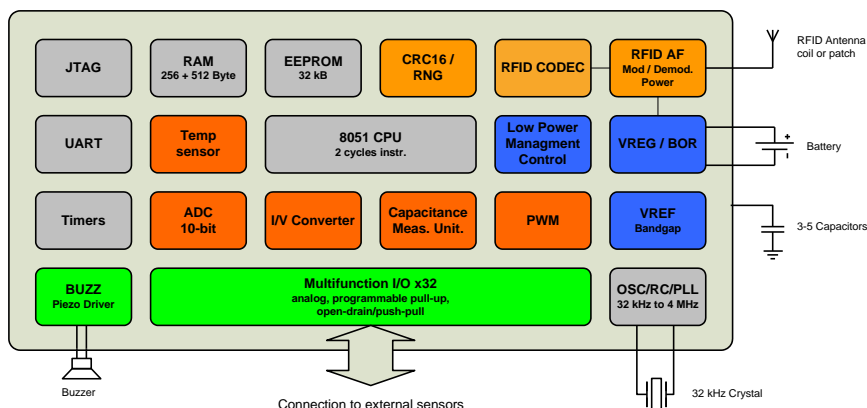
Soft radio techniques are used to support several RFID protocols on the same hardware. The radio interface and codec are implemented in hardware while higher layers are implemented as firmware run by the CPU. With firmware, the CPK082 supports Cypak

### Embedded features:

- Single chip with high level of integration
- RFID transceiver supporting Cypak CPI, ISO15693, ISO 14443 (NFC)
- 32 kBytes EEPROM memory
- 8051 compatible microprocessor
- Ultra low power operation
- 32 sensor I/Os
- Temperature and capacitance sensors

Close Proximity Interface (CPI), or standard HF RFID protocols such as ISO15693 or ISO14443-A. The latter enables Near Field Communication (NFC).

Antennas are connected directly to the chip. Cypak CPI enables low cost printable (carbon black) patch antennas. Coil antennas are used for standard HF RFID applications.



### Low Power

The design is very low power and features an advanced fail-safe power-on-reset and battery switch-over circuit. The ultra-low power consumption allows long operating time with small sized batteries. Power can also be extracted from the RF interface, enabling data capture after the battery has drained or a pure passive device. A battery discharge function enables total drain of the lithium cell batteries prior to disposal.

### Sensor Interface

The chip provides 32 configurable I/O channels for both analog and digital sensor interfacing. Digital configuration includes schmitt-triggered inputs with programmable pull-up or outputs with open-drain or push-pull drive.

# CPK082 – Product Brief

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## ADC and I/V-Converter

The chip includes a 10-bit ADC (SAR firmware controlled) which connects to any I/O or an internal I/V-converter. The latter enables direct current or resistance measurement, supply current monitoring and the temperature sensor. For high speed I/O scanning, it is possible to utilize the internal ADC comparator.

## Buzzer driver

The buzzer driver provides direct and powerful push-pull drive of an external piezo sounder. Extra ESD protection enables fail-safe assembly and operation. The outputs can be controlled directly or by the PWM for more accurate pitch.

## Clocks and timers

The chip hosts an internal RC oscillator (32 Khz) and supports an external crystal (32 Khz

watch crystal) for more accurate timing. An on-board PLL is used to step up the base clock source. Maximum CPU clock is 4 Mhz. Two programmable low power wakeup timers are available plus three standard 8051 timers.

## Capacitance Measurement Unit (CMU)

The CMU is a direct interface to external capacitive sensors such as touch buttons, proximity pressure sensors, etc.

## Packaging

The chip is available as naked die or in QFN56 package. For medication monitoring, standard modules with integrated battery and buzzer are available for mounting on paperboard or other material.

## Contact

Contact [sales@cypak.com](mailto:sales@cypak.com)

# Specifications

### Digital section

Microprocessor core  
RAM  
ROM  
EEPROM  
CRC  
Timers

8051/8032-compatible. 2 cycles/instruction  
256 bytes IDATA, 512 bytes XDATA  
2 kByte boot loader in ROM  
32 kBytes with byte read/write access  
Configurable CRC16 in hardware  
2 programmable low-power wakeup timers, 0-32 Khz and 1/64-1 Hz plus 3 standard 8051 timers  
Programmable and multiplexed with digital outputs  
16-bit pseudo random generator

PWM  
RNG

### Clock and oscillators

Crystal oscillator  
RC oscillator  
PLL

32kHz low-power oscillator with on-chip 2 x 12.5pF  
32kHz nominal (trim range  $\pm 30\%$ )  $\pm 0.05\%/^{\circ}\text{C}$   
Programmable x16, x32, x64, x128.

### Analog section

ADC  
Comparator  
Current to voltage converter  
Internal reference  
External reference input  
Integrated temperature sensor  
Capacitance measurement

10 bit programmable SAR  
On chip with programmable threshold  
0.15V/ $\mu\text{A}$ , 0-500 mV 8 bit DAC source  
1.22V, 40ppm/K (-20C - +60C)  
Yes  
PN diode on chip. 10 mV/ $^{\circ}\text{C}$  ( $\pm 10^{\circ}\text{C}$ )  
0-50pF

### Sensor IO

Number of channels  
Digital inputs  
Digital outputs

32 individually programmable analog/digital/in/out  
Schmitt-triggered with programmable pull-up.  
Programmable push-pull or open drain

### RFID interface

Supported protocols  
Antenna type  
Tuning capacitor

Cypak CPI, 14443-A, ISO15693  
External patch antenna (printable) or coil  
0 – 47.5pF programmable on chip

### Sounder interface

Driver

Push-pull, 3.3 V, two phase for external piezo sounder

### Power

Supply voltage  
Current coma mode  
Current sleep mode  
Current active mode

2.7 – 3.6 V  
Typ. 1.0  $\mu\text{A}$  (All oscillators off, BOR active)  
Typ. 3.0  $\mu\text{A}$  (Oscillators and wakeup timers active)  
Typ. 400  $\mu\text{A}/\text{MHz}$  (Program execution from EEPROM)