

ULE: The Network Nodes – Addressing the technology solution

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Introduction

ULE (Ultra Low Energy) is the ideal technology solution for home control and automation services and devices. Based on the mature and proven ETSI-standard DECT (Digital Enhanced Cordless Telecommunications) technology, ULE is positioned at the forefront of competing technologies in home automation given its superior range, exceptional security, high capacity, video/audio capabilities, low cost of ownership and interference-free dedicated licensed-exempt spectrum.

This paper focuses on the function of the Network Nodes in the Home Network, and takes a look at DSP Group's proposition for addressing this market.

To find out more on the technology itself, please see ULE: A technology overview.

The DECT-ULE Network

The Concentrator:

If you would like to read more on the solution for base and/or gateway development, please see ULE: The Concentrator – Addressing the technology solution.

The Network Nodes:

While it is possible to use regular DECT chipsets to implement ULE sensors or actuators, an optimized chipset for ULE will provide much better performance in terms of battery life and response time.

DSP Group has developed a specific SoC with all the important key driving factors for ULE devices in mind. With DHX91, DSP Group offers a dedicated chip which is optimized for sensors and actuators when it comes to current-saving applications and fast reaction times. To illustrate this we take a ULE sensor which could be a smoke sensor or gas detector, as such sensors will be in hibernation mode for most of the time to save energy. While being in hibernation mode the sensor must be able to wake up from external events (trigger) or internal events (i.e. timer). When triggered the device needs to wake up extremely fast to keep latency constraints of applications as well as to save energy by going back to sleep quickly right after. Such and similar use cases were taken into account when developing the DHX91 ULE processor.

As well as the regular DECT and ULE functions which have been tested in a range of different interoperability events with other ULE manufacturers, a sensor/actuator (SA) facilities unit has been integrated. This special function allows for the integration of sensor and actuator technology applications on one chip, without the need for an additional MCU.

Some of the special functions of the SA unit can be described here, by way of examples. All these functions are also available to users in sleep mode. In this mode the SA unit can carry out measurements and control functions autonomously, without processor intervention, with very low current consumption, and wake up the processor within 10ms if an event requires this.

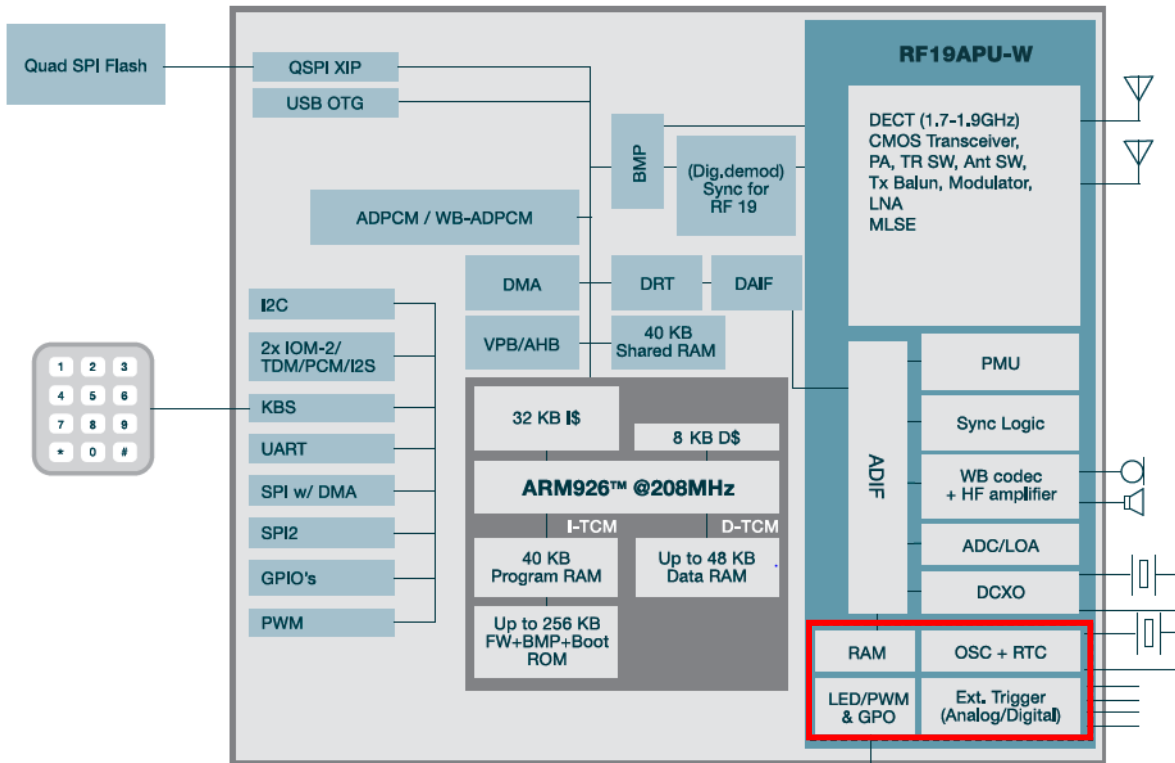


Diagram 1: Block circuit diagram: DHX91 (the SA unit is formed from the blocks surrounded by the red frame)

Sensor Conditioning Module:

The Sensor Conditioning Module (SCM) is an analog configurable circuit which is integrated into the SA, and which, with two amplifiers and two comparators can carry out the most widely differing sensor applications. The SCM is optimized for extremely low current consumption (~ 3uA). Here is a representation of the complete SCM with all its components:

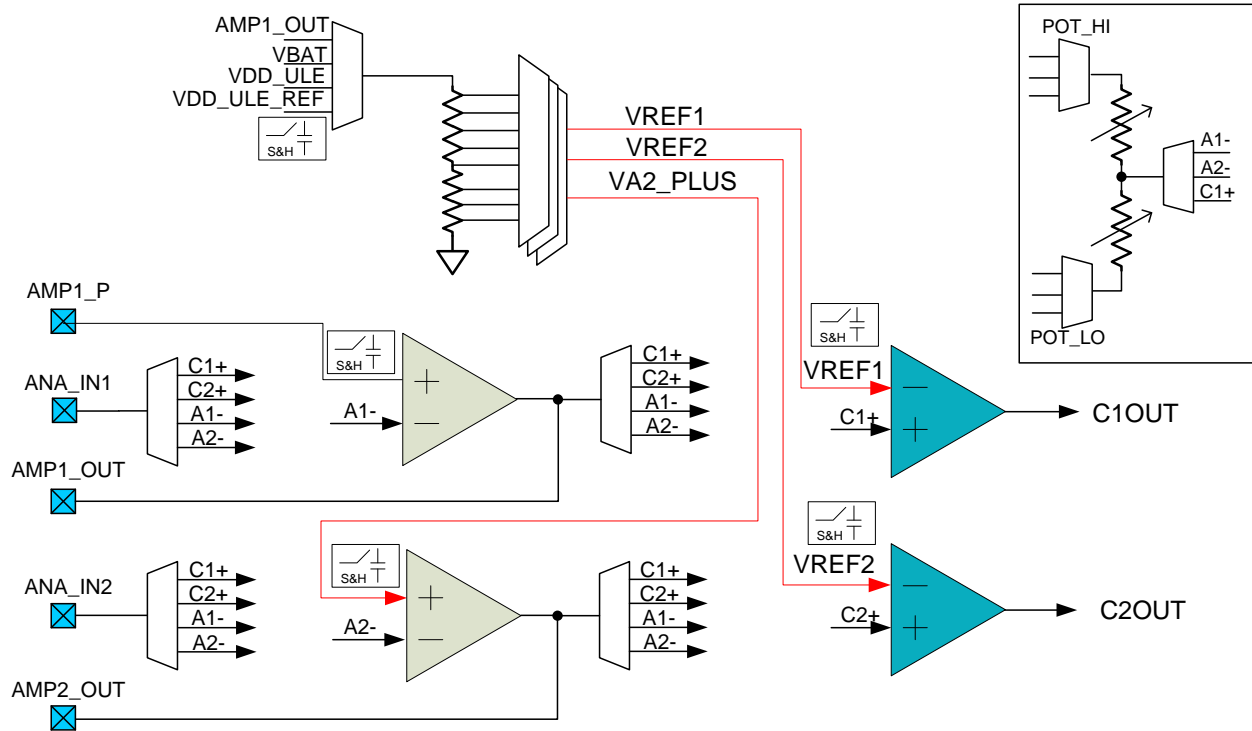


Diagram 2: Block circuit diagram of the SCM: Sensor Conditioning Module

An example application of the SCM as a passive infrared sensor (PIR)

A PIR sensor reacts to temperature changes by making use of pyro electricity on its receiver surface. If an object moves in the area being monitored, the heat difference between the object and its surroundings is converted into voltage. The two amplifiers wired in series, AMP1 and AMP2, have a filtering and amplifying function. The output signal is measured by two comparators against two reference voltages, which define the threshold value. The frequency range for movement recognition moves between 0.1 Hz to 10 Hz, and the signal amplification lies between 60dB and 70dB.

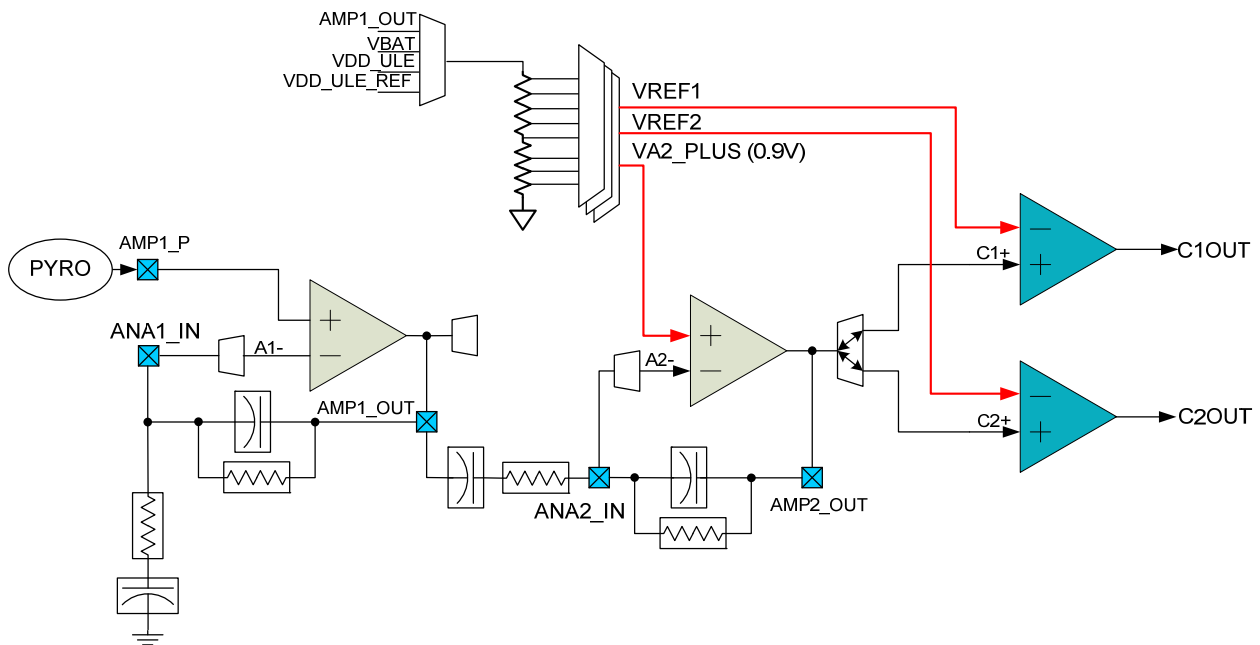


Diagram 3: Example of a circuit: PIR (Passive Infrared Sensor)

An example of an application for a smoke alarm

An LED and a photodiode in the interior of a smoke alarm convert light into voltage. Since there is no direct line of sight between the LED and the photodiode, under normal circumstances the photodiode will not produce any voltage. If smoke penetrates into the smoke alarm, the light from the LED is reflected onto the photodiode, and a voltage is produced.

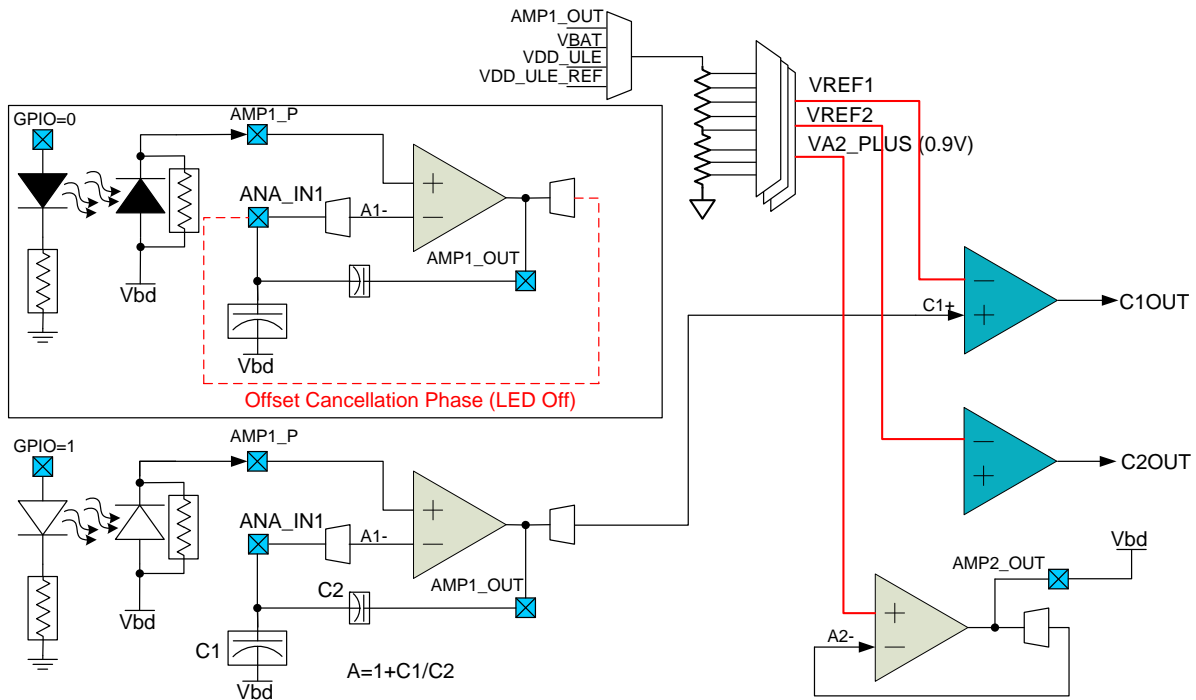


Diagram 4: Example of a circuit: Smoke alarm

Detection takes place in two phases:

- In the first phase the LED is off, and therefore AMP1_P, ANA_IN1 and AMP1_OUT are short-circuited. This causes C1 and C2 to discharge.
- In the second phase the LED is switched on briefly. If any smoke present leads to reflections, then, in the proportion of the two capacitors C1 and C2, the input voltage is amplified by AMP1. The threshold value for recognition is set by the voltage VREF1.

But, in addition to the SCM, the SA unit has other functions to offer. For example, the counter units can be used to count pulses, and, when reaching a pre-configured number of events, it wakes up the system. An important point to note is the integrated “Debounce” module, which only forwards “genuine” events to the counter. In a similar way, periodic events can also be used to wake up the system. It is even possible for events over a defined period to be counted, and for the system only to be woken up when a defined number of events have taken place in the selected time period. PWN signals can also be generated, which are even available in the sleep mode.

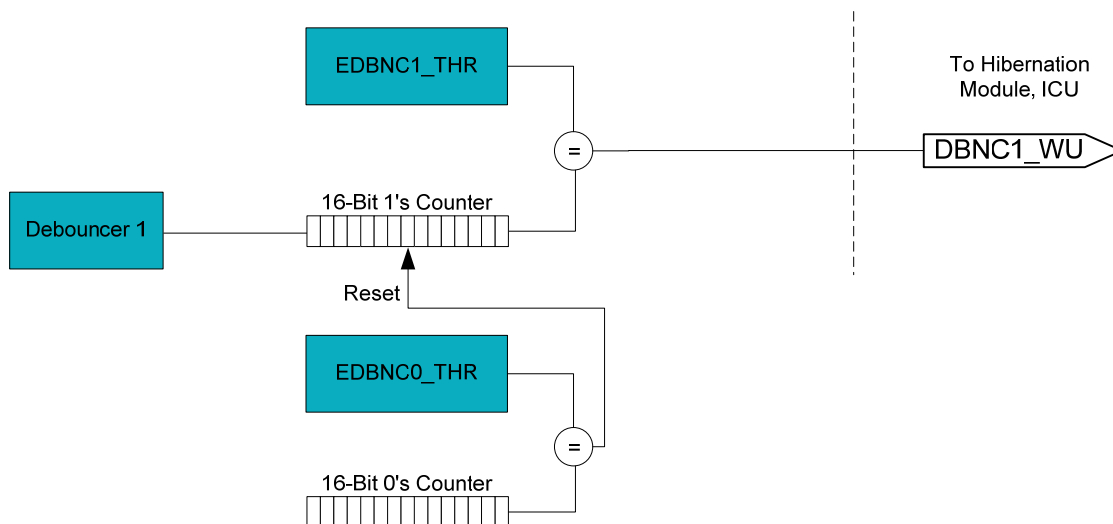


Diagram 5: Block circuit diagram: Counter Compare Unit

The examples described here represent only a small selection from the possibilities which the SA unit has to offer. All the functions can be varied and configured in wide ranges, which allows for an almost limitless number of applications to be realized.

Software:

DSP Group is as a system provider, offering full hardware and software reference design, and not simply as a chip manufacturer. All the integrated circuits are offered with an extensive software package. These contain the operating system (embedded or Linux), DECT Stack, ULE Stack, audio functions such as Codecs and echo suppressors, as well as extensive example applications.

About DSP Group

DSP Group[®], Inc. (NASDAQ: DSPG) is a leading global provider of wireless chipset solutions for converged communications. Delivering semiconductor system solutions with software and reference designs, DSP Group enables OEMs/ODMs, consumer electronics (CE) manufacturers and service providers to cost-effectively develop new revenue-generating products with fast time to market. At the forefront of semiconductor innovation and operational excellence for over two decades, DSP Group provides a broad portfolio of wireless chipsets integrating DECT/CAT-iq, ULE, Wi-Fi, PSTN, HDClear™, video and VoIP technologies. DSP Group enables converged voice, audio, video and data connectivity across diverse mobile, consumer and enterprise products – from mobile devices, connected multimedia screens, and home automation & security to cordless phones, VoIP systems, and home gateways. For more information, please visit www.dspg.com



DSP Group is a Promoter Member of the ULE Alliance

About CODICO

The COmponent DIstributing COmpany, better known as CODICO, is a name that stands for the design-in distribution of high-quality active and passive electronic components and interconnect systems.

CODICO is an independent, privately owned company with headquarters in Perchtoldsdorf, Austria, on the southern outskirts of Vienna. In addition to 17 sales offices in Germany, the international CODICO team consists of one office each in Denmark, Italy, France, United Kingdom and eight partner companies in Central and Eastern Europe. Backed by a high level of technical expertise, we place a key focus on design-in services for our customers. CODICO's core business thus consists of providing technical support from the initial development phase through to the end product, along with the sale of only high-quality electronic components.

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