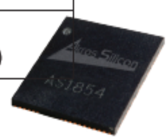
INTRODUCTION

As a part of enterprise-wide energy efficiency policies and initiatives such as the .eu EuP Lot6 and .eu Code of Conduct, there has been an industry movement toward lower-power, standby-mode implementations for energy conservation.

Lot6: Ecodesign Requirements for Standby Mode and Off Mode of Electrical Household and Office Equipment

Power consumption shall not exceed in:	Yr 2010	Yr 2014
Off Mode	1.00 W	0.50 W
Standby Mode(s) (when using status display)	1.00 W (2.00 W)	0.50 W (1.00 W)



Such initiatives can only be met at the platform level by leveraging the network-managed power modes of the AS18x4.

As an example during idle times, the network management software can put the IP phone into a sleep mode, where the IP phone stays connected to the PSE but is mostly shut down for <1W in standby. Subsequent wake up of the IP phone can then be handled intelligently by phone "off hook" signals, ambient light sensors, or proximity/motion detectors. Such an on-demand approach to power modes can realize substantial energy savings, especially when considered in the context of the volume of active phones that otherwise operate in regular power modes twenty four hours per day, seven days per week.

NETWORK-INITIATED PD DEEP-SLEEP POWER SAVINGS

The network can signal the PD to go into sleep mode. The network command is interpreted by the microprocessor connected to the Ethernet PHY/MAC, which then commands the AS18x4 to enter the sleep mode via the I^2C control or hardware based GPIO controls.

POWER STATES OF THE AS18X4

1. "OFF" mode: RB pin is pulled low, everything shuts down for lowest power state – power consumption ~50mW

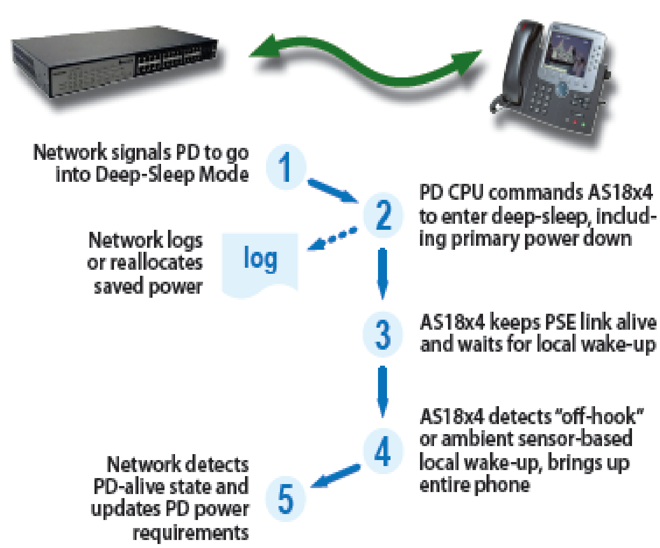
2. "DEEP-SLEEP" mode: MODE pin pulled low, primary converter shutdown, PD and 3.3V LDO active – power consumption < 1W.
   - AS18x4 enters low power state while maintaining a link to the PSE for faster turn-on applications.

3. "STANDBY" mode: PD & Primary converter (Vout1) active with no-load, other rails shutdown for lower power operation – power consumption < 1W.

4. A "wake up" signal (from a lifted handset, or light/activity sensor) can trigger the AS18x4 to power up into the normal mode of operation, by releasing the RB/MODE pins.

The primary side RB/MODE pins can be controlled by the uP via I^2C GPIO registers or hardware GPIO controls.

Typical Network Initiated PD Deep-Sleep Power Mode



THE AKROS SOLUTION

There are several key design aspects of the AS18x4 for network-initiated power-down modes and sensor-based energy optimization:

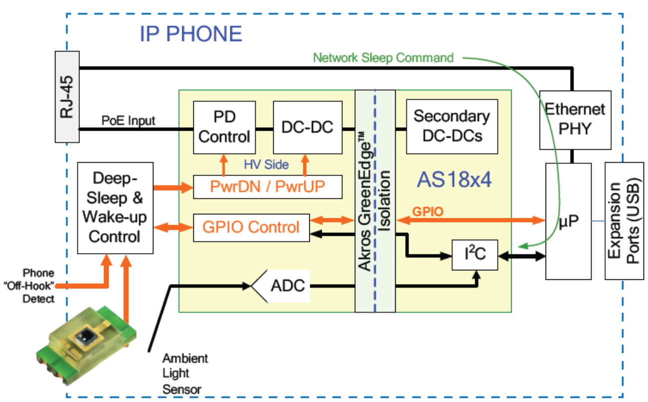
– Communication and GP I/O channels across the *isolation* barrier for intelligent control (from sensors on the primary side to microprocessors on the secondary side and vice versa)

– Primary side Sleep/Wakeup Inputs for enabling/disabling the DC/DC converters (achieving significant energy savings)

– Built-in ADC support to enable a full range of signal processing for sensor-based input (e.g. ambient light levels)

– I^2C serial communications to allow for easy interfacing to a system microcontroller (for autonomous control)

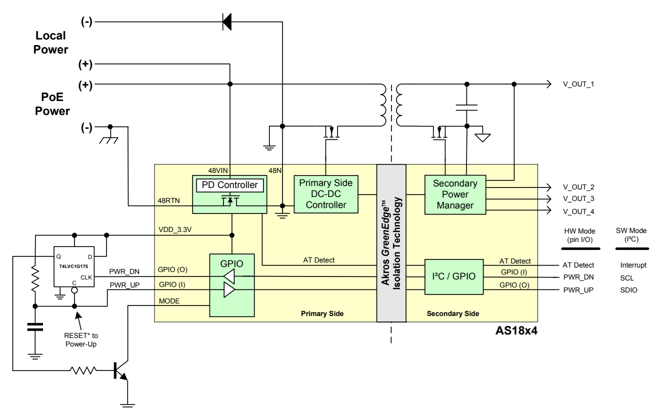
ENERGY SAVING DEEP-SLEEP & WAKEUP ON AS18X4



The AS18x4 can be put to sleep from the primary side by activating the control signal (RB/MODE) for OFF/SLEEP modes. The advantage of the AS18x4 is that it has isolated GPIO control lines that can be activated from the secondary side digital pins or I2C register control. In the case of secondary side initiated Deep-Sleep, the uP on the secondary side can send a signal via the GPIO control to the primary side external Sleep Control circuit which can in turn drives the Sleep control signal (MODE). When this pin is activated the AS18x4 will shut down the secondary power supplies and put the primary side in a low power mode and stays connected to the PSE.

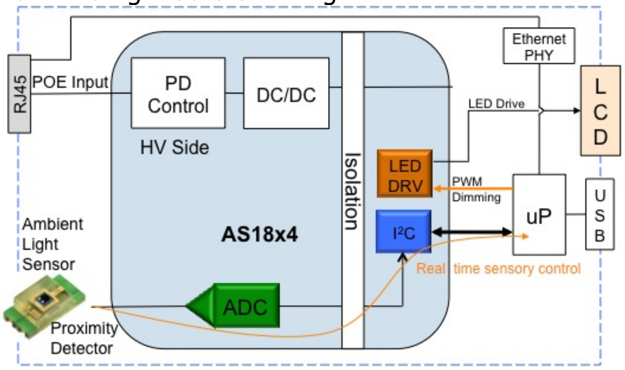
The Sleep circuit has an input for wakeup that can be a push button signal or an autonomous sensory detector like a proximity detector. When these sensor signals get activated the Sleep Control circuit releases the MODE signal allowing the AS18x4 to return back to normal mode. A primary-side LDO is available to power the sensor and control circuit in this mode.

Below schematic shows actual implementation details of the Deep-Sleep mode. The “reset” node is controlled via system specific wake-up mechanism like a sensor or phone-off hook.



If the uP initiated an OFF state (RB control pin) then this will power down the entire system. After the OFF state is released, either through a mechanical switch/relay or an external timer the system will power back up and the PD re-classifies itself with the PSE. This mode is quite useful in the case that the system looses control, the excepton handler in the uP recoginizes this conditon and can initiate a system wide reset. One of the most useful methods to detect this is the timeout on the internal Watch Timer of the AS18x4.

LCD BACklight auto-dimming



Another example of an energy-saving platform implementation is display auto-dimming based on ambient light input.

The AS18x4 provides a seamless way to implement the auto-dimming function, because all the building blocks that are needed are already built in. The ambient light sensor (ALS) is connected to the ADC input on the primary side of the AS18x4. The AS18x4 digitizes this data as an 8-bit number, transmits it across the isolation barrier and makes it available in an I^2C register in real time. The integrated isolation, built-in ADC, and I^2C communication support enables the system microprocessor to read the ambient light sensor data read from the ADC via I^2C and adjust the desired PWM dimming signal for appropriate energy savings display illumination.

For IP phones utilizing displays with backlights, monitoring the ambient light levels and automatically adjusting the display backlight brightness appropriately can realize energy savings. In dark environments, for example, less backlighting is needed for display readability.

In another application a proximity detector connected to the ADC on the primary side of the AS18x4, can be used to trigger the dimming of the LCD (to say 60% reduction in screen brightness) after a predetermined time of no activity by using timers on the uP. When activity is triggered again, the brightness can be bought back up to 100%, saving significant energy.

CONCLUSION

The AS18x4 has been designed to enable network energy management with autonomous sensory control. The adaption to environmental changes through the use of simple external sensors like ambient light sensors or proximity detectors achieve signification energy savings and provide our customers with highly differentiated and flexible energy saving solutions while minimizing the overall carbon footprint of next generation products.

CONTACT INFORMATION

Akros Silicon, Inc.
275 Turn Pike Drive
Folsom, CA. 95630
USA

Tel: (916) 351-8100
Fax: (916) 351-8102
Email inquiries: marcom@akrossilicon.com
Website: www.akrossilicon.com

IMPORTANT NOTICES

Legal Notice

Reference Design Policy

This document is provided as a design reference and Akros Silicon assumes no responsibility or liability for the information contained in this document. Akros reserves the right to make corrections, modifications, enhancements, improvements and other changes to this reference design documentation without notice.

Reference designs are created using Akros Silicon's published specifications as well as the published specifications of other device manufacturers. This information may not be current at the time the reference design is built. Akros Silicon and/or its licensors do not warrant the accuracy or completeness of the specifications or any information contained therein.

Akros does not warrant that the designs are production worthy. Customer should completely validate and test the design implementation to confirm the system functionality for the end use application. Akros Silicon provides its customers with limited product warranties, according to the standard Akros Silicon terms and conditions.

For the most current product information visit us at www.akrossilicon.com

Life Support Policy

LIFE SUPPORT: AKROS' PRODUCTS ARE NOT DESIGNED, INTENDED, OR AUTHORIZED FOR USE AS COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS. NO WARRANTY, EXPRESS OR IMPLIED, IS MADE FOR THIS USE. AUTHORIZATION FOR SUCH USE SHALL NOT BE GIVEN BY AKROS, AND THE PRODUCTS SHALL NOT BE USED IN SUCH DEVICES OR SYSTEMS, EXCEPT UPON THE WRITTEN APPROVAL OF THE PRESIDENT OF AKROS FOLLOWING A DETERMINATION BY AKROS THAT SUCH USE IS FEASIBLE. SUCH APPROVAL MAY BE WITHHELD FOR ANY OR NO REASON.

"Life support devices or systems" are devices or systems which (1) are intended for surgical implant into the human body, (2) support or sustain human life, or (3) monitor critical bodily functions including, but not limited to, cardiac, respirator, and neurological functions, and whose failure to perform can be reasonably expected to result in a significant bodily injury to the user. A "critical component" is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

Substance Compliance

With respect to any representation by Akros Silicon that its products are compliant with RoHS, Akros Silicon complies with the Restriction of the use of Hazardous Substances Standard ("RoHS"), which is more formally known as Directive 2002/95/EC of the European Parliament and of the Council of 27 January 2003 on the restriction of the use of certain hazardous substances in electrical and electronic equipment. To the best of our knowledge the information is true and correct as of the date of the original publication of the information. Akros Silicon bears no responsibility to update such statements.