



Application Note 001

Changes between Tmote Sky and Telos Revision A

(changes between Tmote Sky and Telos Revision B are listed at the end of this document)

Tmote Sky has a number of improvements over Telos Revision A. Tmote Sky includes more sophisticated hardware, a new microcontroller, and a variety of feature additions. They are described in this document.

Microcontroller: Texas Instruments MSP430 F1611

The MSP430 F1611 replaces the F149 on Revision A. The F1611 has 10kB of RAM (vs 2kB for Rev A) and 48kB of Flash (vs 60kB for Rev A). The F1611 includes a number of features that are not part of the F149. They include:

- Zero-power Brownout reset
- 2 12-bit DAC converters shared with ADC6 and ADC7
- Supply Voltage Supervisor
- DMA controller transfers data between memory and peripherals

Reduced Radio Startup Time

Tmote Sky features a larger 16MHz crystal oscillator for the CC2420 transceiver. This oscillator has an extremely low ESR value (guaranteed below 20Ω) and typically starts in less than 580ms. Tmote Sky also features a number of hardware improvements—the traces around the radio circuitry are carefully isolated and a guard ring prevents spurious emissions from exiting the printed circuit board.

Expanded Flash

The Atmel AT45DB 4Mbit data flash on Revision A has been replaced by the ST M25P80 8Mbit code flash on Tmote Sky. Both are serial flash chips that share the SPI bus with the radio. The M25P80 on Tmote Sky includes hardware support for write protection. When Tmote Sky is connected to the USB, the write protection bits may be reset and the flash may be written. When disconnected from the USB, the sectors protected by the flash's write protection bits may not be written since the physical write protect hardware pin is pulled low. The main difference between the AT45DB and the ST M25P80 is the size of an erase unit—entire 64kB sectors must be erased rather than 256 byte pages on the AT45DB.

Expansion

The 10-pin expansion connector of Revision A is unchanged in Tmote Sky. Tmote Sky adds three additional connectors. A six-pin IDC header is located next to the 10-pin connector and provides access to the Reset and User interrupts, as well as the ADC/DAC lines, a Timer capture, and a general digital I/O pin. A two-pin IDC header located beneath the USB is provided for the microcontroller's supply voltage supervisor. The connector contains SVS in and out pins. JTAG is provided via an 8-pin 2mm IDC header near the USB controller for use with external JTAG pods. JTAG may be used either through USB with an abstraction library on the host PC, or through any number of commercially available JTAG pods. A 2mm 8-pin to 14-pin JTAG converter is available from Moteiv upon request. More information about the expansion connectors is available in the Tmote Sky datasheet from www.moteiv.com.

Other Improvements

Tmote Sky features three mounting holes. If the SMA antenna connection is not used, the SMA mounting holes may be used for additional mounting support.

A User button is provided next to the Reset button. The User button is connected to an interrupt on the microcontroller and includes a debounce circuit.

The LEDs are located closer together and holes are provided in the printed circuit board for a light pipe to be attached and the board mated with a package.

The reset circuitry has been improved in Tmote Sky. To prevent spurious node resets when connected to USB, an i2c digital switch now controls access to the microcontroller's reset and JTAG pins. This circuitry prevents the USB controller from having direct access to the microcontroller's reset and JTAG pins.

The R14/R15/R16 jumpers are now located on the top side of the board for easier access.

Differences between Tmote sky and Telos Revision B

Tmote Sky has a slight change to the 8-pin JTAG connector on Telos Revision B that allows USB power to be routed to an auxiliary board. The USB power line is useful for systems that use rechargeable batteries and allows these batteries to be charged using the USB power whenever Tmote sky is connected to a PC.

Tmote Sky includes a jumper for using an external positive voltage reference next to the 10-pin expansion connector. The default setting is Revision B compatibility, but it can be moved to enable use of the external voltage reference.

Tmote Sky has an improved RF path and is FCC and IC certified for use in the United States and Canada. It is also RoHS compliant for European use.

There are no additional differences between Tmote sky and Telos Revision B.