Application Brief

Simplifying Your Design in TWS (True Wireless Stereo) Control With a Low-Cost MSPM0 MCU

After the advent of true wireless stereo (TWS), it is becoming more and more popular in the personal electronics market. Excluding the traditional wired audio transmission technology, TWS using Bluetooth technology to achieve wireless transmission, greatly improving the user experience. In addition to being easy to wear, a smart phone can provide rich functions such as audio control, volume adjustment, and noise reduction.

TWS system introduction

As Figure 1 shows, the TWS consists of a storage box and two earbuds. The box is used to store and charge the earbuds and control the status of TWS. The earbuds are mainly in charge of communication with the user to achieve information interaction.

The ear buds consist of a charger, gauge, Bluetooth SOC, and sensors. These components play the role of charging and monitoring the battery, interaction, and signal detection. The TWS box is the reserve energy of the earbuds and manages the power system of the TWS when the earbuds are stored in the box.

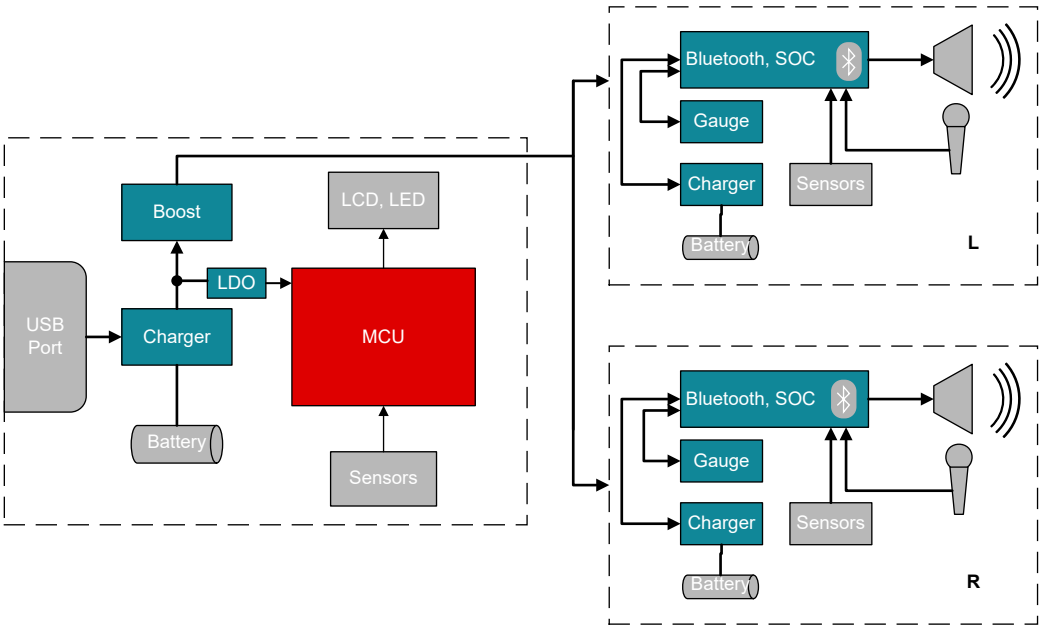

Figure 1. TWS System Block Diagram

Why is MSPM0 suitable for TWS application?

TI's scalable MSPM0 MCU portfolio features an Arm® Cortex®-M0+ core. The low-cost family with a maximum CPU speed of 32 MHz with 32-bit structure improves the processing ability of the MCU. The wide operation voltage from 1.62 V to 3.6 V allows use in low-voltage and low-power applications. 5-V tolerant I/O pins are needed for high voltage detection. For a long battery life, the MSPM0 has several low-power modes to save battery energy in TWS application. The standby mode consumes less than 1 µA. The smallest package of the 16-pin MCU is a 3-mm × 3-mm QFN with 4KB to 64KB flash memory with a pin-to-pin replacement option. A 12-bit fast SAR ADC with up to 4-Msps sample rate is integrated. 14-bit resolution is supported with oversampling technology for high precision in a gauge algorithm. Diverse peripheral communication interface like UART, I2C, and SPI are available.

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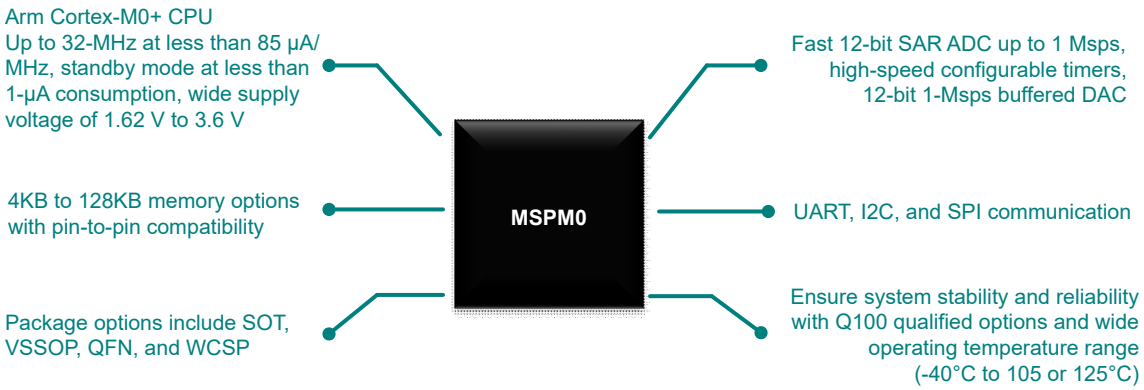

MSPM0 also have luxuriant development environment for designer. No matter your experience level or project complexity, TI's MSPM0 flexible SDK (software development kit) will fit your needs.

- **Driverlib** optimized for size and speed, advanced control
- **TI Drivers** for greater abstraction and simplicity
- **FreeRTOS** and non-RTOS options
- **Application-specific library** for special design

Intuitive graphical configuration tools let designer simplify configure device, resolve conflicts and generate code in minutes. Start with EVM board and third-party ecosystem like CCS, Keil, IAR help you quickly evaluate your design.

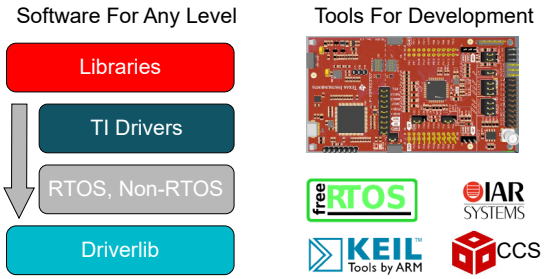

Figure 2. Software and Tools

What can MSPM0 do in TWS applications?

In the TWS application, the box needs to control the charging cycle and report the battery information to the customer using an LED to indicate the status of box and earbuds. Like the block diagram in Figure 3, in this application, MSPM0 uses I2C for battery charging control. For power monitoring, internal 12- or 14-bit ADC can implement this function by measuring the voltage of the battery and calculating the SOC (status of charge) of the battery. General-purpose I/O is used for interrupt detection from micro-switches and hall sensors, controlling power sequencing, and LEDs. When the box is idle, MSPM0 could control all the peripherals in a sleep mode and itself be in a low-power mode to decrease the total power consumption to save battery life.

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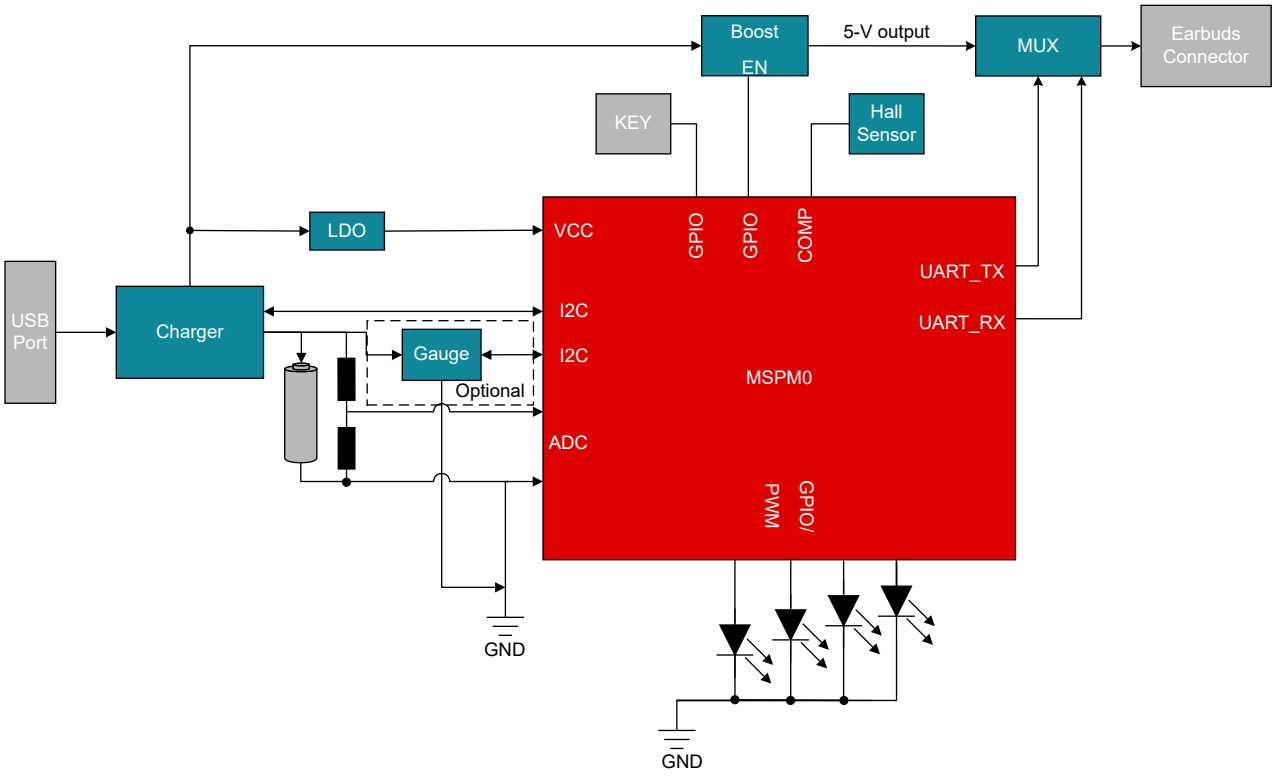

Figure 3. Block Diagram With MSPM0 MCU

Key feature requirements for MCU in this application:

- Low power consumption and low cost with small package
- Communication peripherals (I2C and UART)
- General-purpose I/O intrusion detection and control
- General timer
- 12- or 14-bit fast SRA ADC

Implement functions on MSPM0 TWS application:

- TWS open, close, and earbuds-in-place detection
- Power system management: battery monitor, charging control and indication and etc.
- Communicate with Bluetooth in earbuds

References:

To quickly evaluate the MSPM0 MCUs in a TWS application, order the MSPM0 LaunchPad development kit and start your design.

- MSPM0 landing page
- MSPM0 Academy
- LP-MSPM0L1306 LaunchPad development kit

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