

Cost-Effective MCU MSPM0 Designs for Air Purifier Applications



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Introduction

In the health-conscious world of today, indoor air quality has become a top priority, driving the widespread adoption of smart air purifiers in homes, offices, and public spaces. These devices play a crucial role in filtering pollutants, ranging from dust and PM2.5, which makes for cleaner, safer breathing environments.

In every efficient air purifier is a microcontroller (MCU) that orchestrates sensor readings, fan speed regulation, and human interface. Depending on the complexity of the design, several MCUs work together to complete the different tasks from basic motor control to advanced wireless communication.

The low-power, cost-efficient ARM Cortex-M0-based MSPM0 are increasingly favored in air purifier designs due to the balance of performance and energy efficiency. These MCUs integrate essential analog peripherals (ADCs, comparators, PWM controllers) while consuming minimal power, which is critical for always-on residential and portable purifiers.

Use Case 1: Air Purifier in Smart Home Appliances

Figure 1 shows the typical block diagram of a residential air purifier:

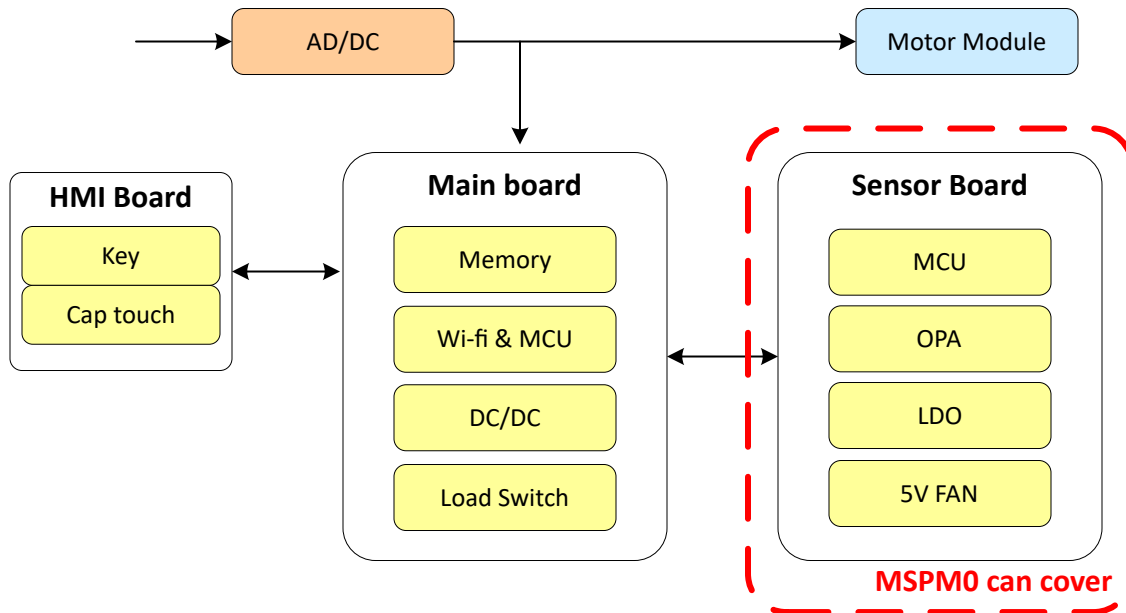


Figure 1. Smart Home Air Purifier Block Diagram

Industrial air purifiers such as small home appliance EEs typically adopt a three-PCB architecture for optimized functionality and manufacturing efficiency:

Use an HMI board with capacitive touchscreen for user interaction, a main control board handling Wi-Fi™ connectivity and fan motor operations, and a rear-mounted sensor board that our MSPM0 is preferred for hosting particulate sensors (PM2.5/dust) to avoid self-pollution interference.

Key MSPM0 features in the sensor board:

- High analog performance: integrating a 12-bit ADC and OPA for real-time air quality monitoring
- Sufficient digital performance: hardware timers for precise fan control
- Low cost: reduces BOM through on-chip analog peripherals
- Small package option

Use Case 2: Air Purifier in Industry

For commercial and public space air purification systems (for example, airports, offices), the architecture is inherently simpler than residential smart appliances. In these implementations, MSPM0 MCU typically serves dual critical functions: regulating DC/DC power conversion modules (buck/boost through power IC or dedicated components driven by PWMs, verifying stable 12V/2.5V rail generation for filtration subsystems and direct-driving thermoelectric cooler (TEC) modules through PWMs.

Key MSPM0 features here:

- Sufficient digital performance: Timers or GPIOs for buck-boost control and TEC driver
- Low cost
- Small package option

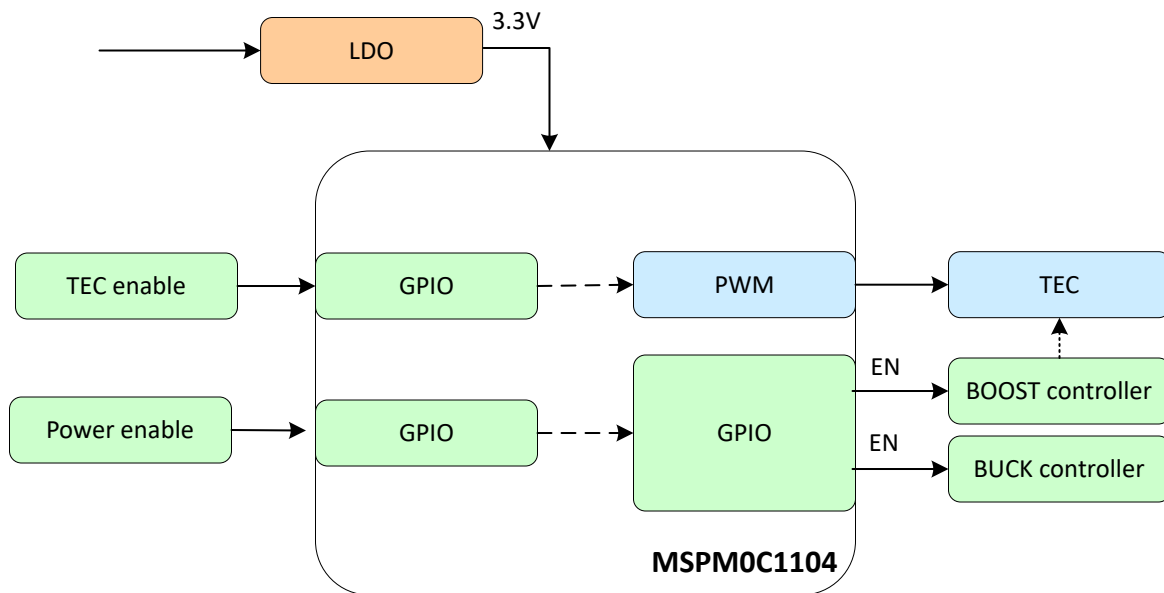


Figure 2. Industry Air Purifier Block Diagram

Use Case 3: Air Purifier in Automatic Applications

In vehicular applications, the system architecture requires:

1. High voltage module control: MSPM0 management of high voltage systems through integrated PWMs for DC/DC converters.
2. Cooler or filter driver through PWM with gate driver.
3. System monitor: voltage, current and temperature are detected by MCU through ADCs due to automotive regulatory requirements.
4. Real-time communication interaction is also required through the LIN.
5. Sometimes, MSPM0 is also required to serve as EEPROM to store the data.

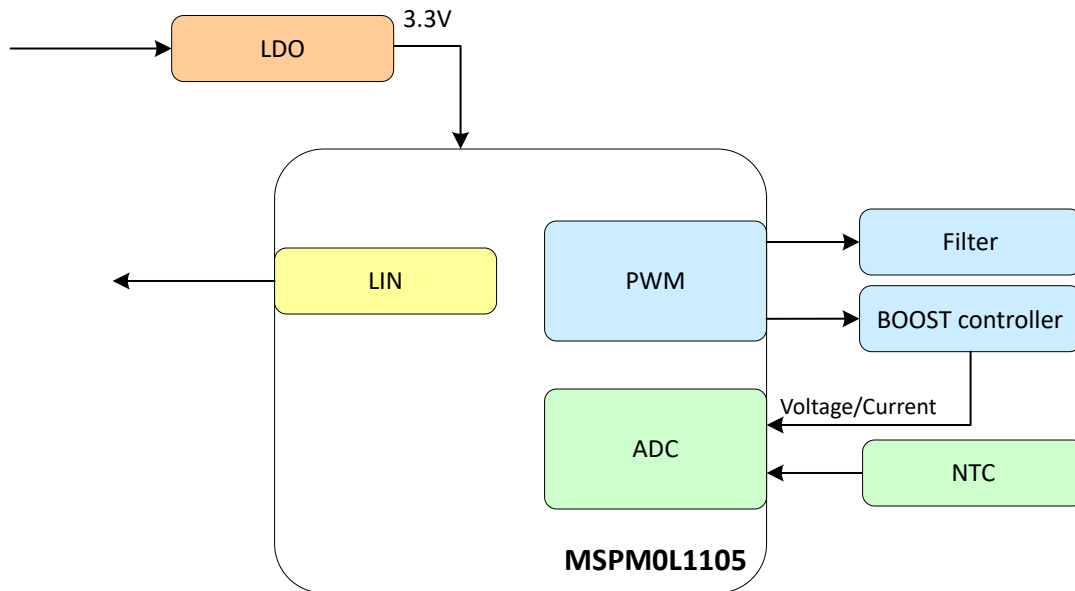


Figure 3. Typical Application of MSPM0 in a Capsule Coffee Machine

Key MSPM0 features include:

- Sufficient digital performance: Timers or GPIOs for buck-boost control and TEC and filter drivers
- LIN, CAN auto hardware peripherals for communication
- Couple ASIL-B version device supported
- Small package options

Summary

This application brief describes how the Arm® Cortex® -M0+ microcontrollers MSPM0 series from TI can be designed in air purifier for sensor or control board by explaining the special requirements of MCU in the whole system and showing the features of MSPM0 devices.

Start Using MSPM0 MCU

Select a low-cost MSPM0 LaunchPad™ development kit today to begin evaluating the device for the air purifier application. MSP Academy provides MSPM0 code samples and interactive online training. See the following related resources for more information.

- Texas Instruments, [MSPM0 overview page](#), product page.
- Texas Instruments, [MSPM0 Software Development Kit](#), software development kit.
- Texas Instruments, [MSPM0 Academy](#), documentation.
- Texas Instruments, [MSPM0C1104 LaunchPad](#)
- Texas Instruments, [MSPM0C1106 LaunchPad](#), development kit.
- Texas Instruments, [MSPM0L1306 LaunchPad](#), development kit.

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