Product Overview

MSPM0Lx22x Microcontrollers Enabling Low-Power Display and Security Designs

More and more applications such as flow meters, thermostats, and thermometers are requiring LCD display features to help HMI interaction, including energy infrastructure, building automation, medical and healthcare, test and measurement, and more. Featuring ultra-low-power LCD controller, VBAT auxiliary supply, dual-bank Flash, abundant security features like PSA-L1 certification and AES256 encryption with KeyStore, ARM® Cortex®-M0+ 32-bit MSPM0Lx22x microcontrollers from Texas Instruments help enable ultra-low power and high-reliability designs for HMI and security applications.

Figure 1. Different Display Applications

Key Features and Benefits

- **Core and operating characteristics**
  - Arm® Cortex®-M0+ 32-bit CPU with frequency up to 32MHz
  - Extended temperature range: –40°C to 125°C
  - Wide supply voltage range: 1.62V to 3.6V
- **Dual-bank flash**
  - 128KB / 256KB flash, organized into two main banks to support field firmware updates, with address swap support provided between the two main banks
- **User interface**
  - Ultra-low power segmented LCD controller supporting up to 8x51 / 4x55 LCD displays with 7 different modes depending on customer use cases
- **Low power**
  - Optimized low-power modes
    - RUN: 105µA/MHz (CoreMark)
    - STOP: 54µA at 32kHz
    - STANDBY: 1.1µA (VBAT) with 32kHz, LFXT, RTC, SRAM and registers fully retained
    - SHUTDOWN: 80nA with IO wake-up
  - VBAT island (auxiliary supply)
    - Independent supply with dedicated VBAT pin
    - Real-time clock (RTC)
    - Tamper detection with timestamp
    - Independent watchdog timer
    - Scratch pad memory
    - 32B backup memory
    - Up to 5 GPIOs supplied by VBAT pin1
- **Reliable security**

  - PSA-L1 Certified for IoT (Internet of Things) security
  - Flash and SRAM memory with ECC (Error Correction Code)
  - AES accelerator and Secure Key Storage for up to four AES keys
  - Flexible firewalls for protecting code and data
  - True random number generator (TRNG)
  - Cyclic redundancy checker (CRC-16, CRC-32)
- **High-performance analog peripherals**
  - 12-bit 1.68Msps ADC, up to 26 external channels
  - High-speed (32ns) / low-power (min 0.7µA) comparator (COMP) with 8-bit reference DAC
  - Configurable 1.4V or 2.5V internal shared voltage reference
  - Integrated temperature sensor
- **Intelligent digital peripherals**
  - 7-channel DMA controller
  - 15-channel event fabric signaling system
  - Six timers supporting up to 18 PWM outputs, all operational down to STANDBY mode
    - One 16-bit advanced timer with dead band
    - One 32-bit general-purpose timer
    - Four 16-bit general-purpose timers
  - Window-watchdog timer
- **Abundant communication interfaces**
  - Five UART modules, with two supporting LIN, IrDA, DALI, smart card and Manchester
  - Three I2C modules supporting SMBus / PMBus and wakeup from STOP mode, with two supporting up to FM+ (1Mbit/s)
  - Two SPI modules supporting up to 16Mbit/s
- **High-accuracy integrated oscillator**
  - Internal 4MHz to 32MHz oscillator with up to ±1.2% accuracy

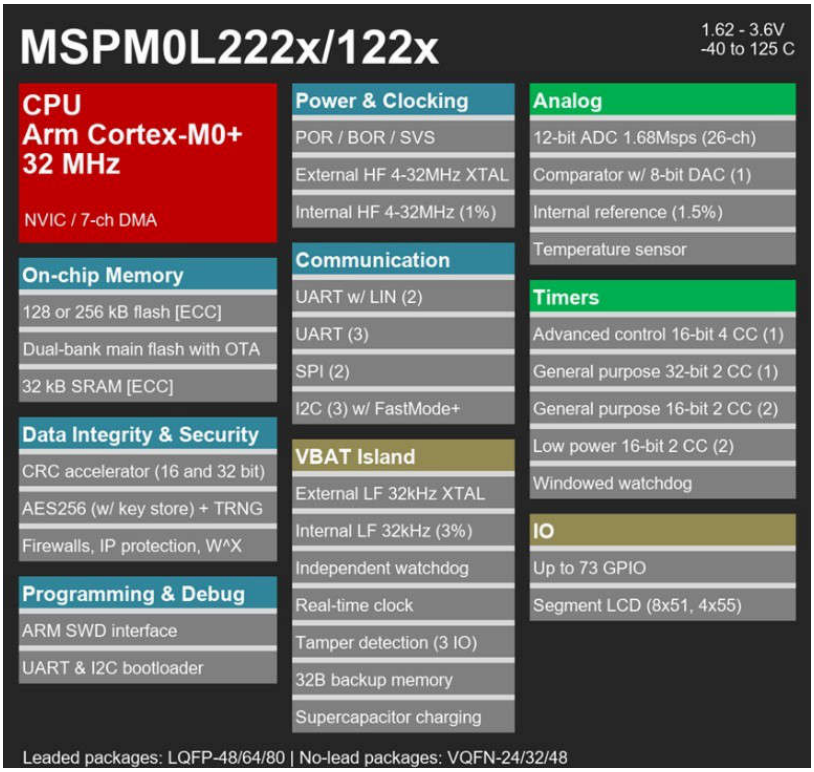
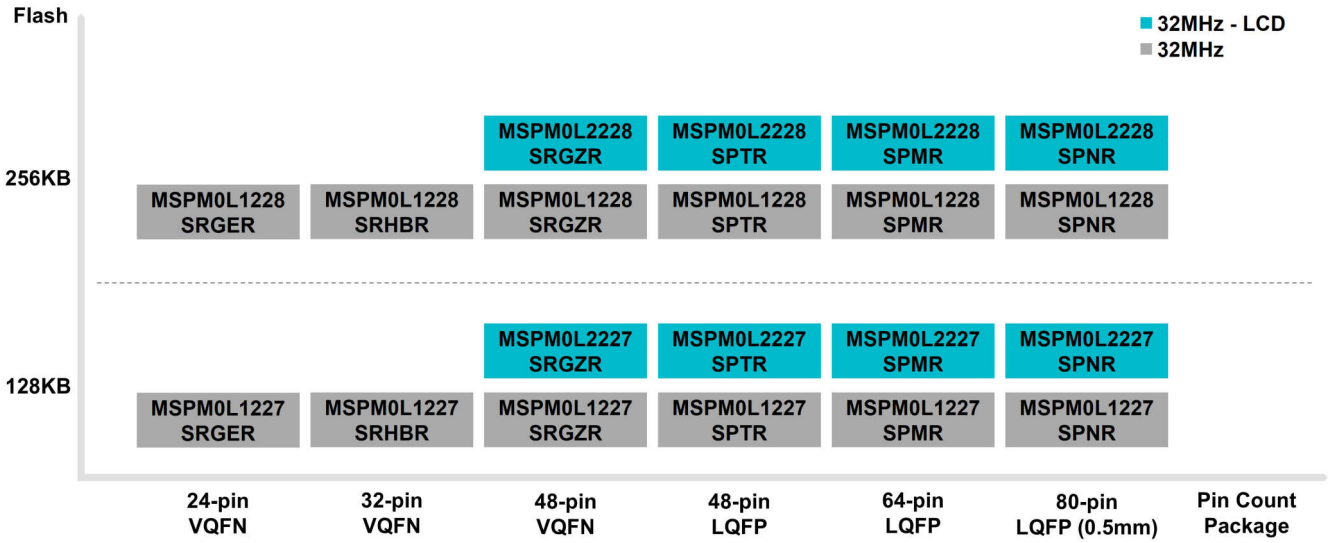


Figure 2. Block Diagram of MSPM0Lx22x Microcontrollers

Pin and Packaging Options

Figure 3 clearly shows the wide memory and package options of MSPM0Lx22x series microcontrollers for different requirements. With the same pin count and package, MSPM0Lx22x series is pin-to-pin with other series in MSPM0 family like MSPM0G350x series and MSPM0L130x series.



Note: VBAT pin is available in 48 pin+ packages for backup power domain.

Figure 3. Selection Table of MSPM0Lx22x Microcontrollers

Target Applications

- **Flow Meter**

  In this application, MSPM0L222x runs metering algorithm and control LCD display as the main MCU, and is able to connect with different types of sensors to implement various water meters like ultrasonic, mechanical and non-magnetic water meter. More details of main functions are listed below:

  – Connect AFE to get flow raw data
  – Run metering algorithm to calculate flow rate and volume
  – Upload data through M-Bus or RS485
  – Control LCD display to show real-time flow rate and volume
  – Drive buzzer to alarm in all fault conditions
  – Communicate with RF module to enable wireless connection function

  MSPM0L222x can benefit your flow meter applications featured with:

  – Ultra-low current consumption with RTC and LCD active for longer battery life
  – Rich communication interfaces for data logging and transmission
  – Dual-bank Flash and abundant security features for reliable OTA upgrade

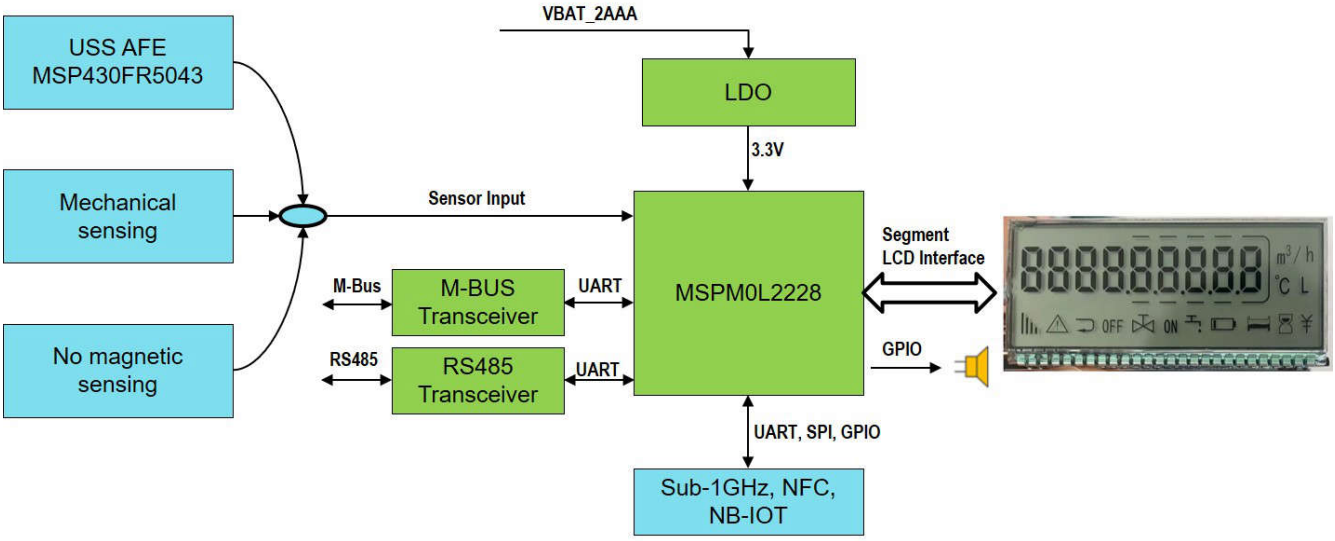


Figure 4. Water Meter Block Diagram

Thermostat

In this application, MSPM0L222x detects environment temperature and humidity and shows the result through LCD. MSPM0L222x also sends commands to air-conditioner to adjust the room temperature, humidity, and fan speed. More details of main functions are listed below:

- Measure room temperature and humidity
- Control LCD display to show real-time room environment
- Enable control function of air-conditioner for temperature, humidity and fan speed adjustment
- Communicate with RF module to enable wireless connection function

MSPM0L222x can also help realize ultra-low power consumption, multiple communications, and reliable OTA upgrade in this thermostat application.

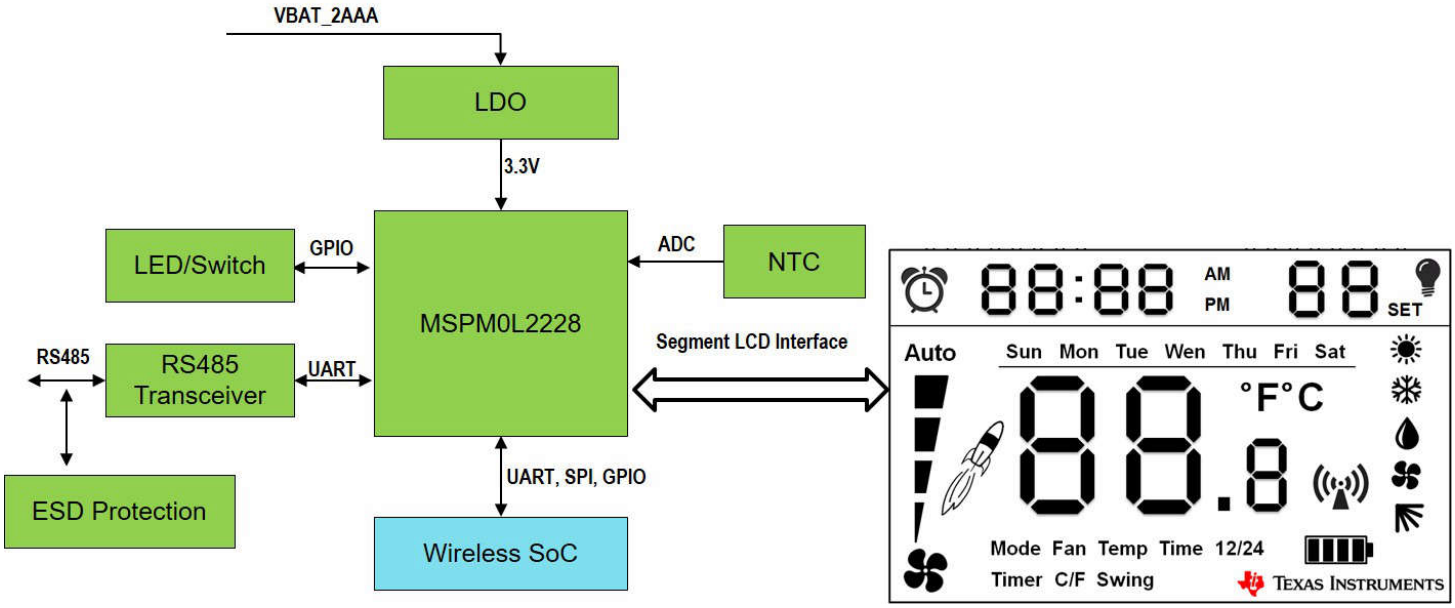


Figure 5. Thermostat Block Diagram

Motor Control

In this application, MSPM0L222x can drive different types of motors and communicate with other body modules. MSPM0L222x can also conduct over-current protection and general IO control. More details of main functions are listed below:

- Detect voltage, current, and temperature information
- Run motor control algorithm
- Output PWM to control the gate driver for further motor running
- Conduct housekeeping functions like IO control and communications with other body modules

MSPM0L222x can benefit your motor control applications featured with:

- Advanced timer supporting dead band and complementary PWM pair outputs
- Up to 26-channel 1.68Msps 12-bit ADC module with 11.1 ENOB for accurate current sampling
- High-speed comparator enabling zero-wait hardware over-current protection
- Abundant communication resources including 2 LIN, UART, SPI, and I2C
- Various motor control algorithm references

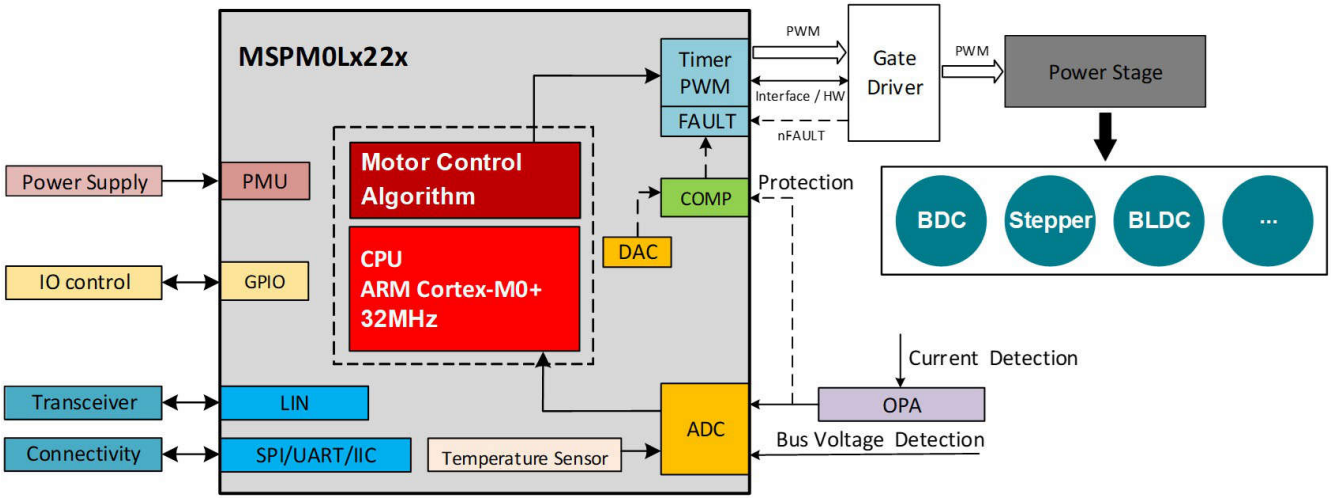


Figure 6. Motor Control Block Diagram

Hardware and Software Resources

- LP-MSPM0L2228
  - Evaluation board equipped with 256KB-Flash & LQFP80 (X)MSPM0L2228SPNR applying to whole MSPM0Lx22x series
- MSPM0-SDK
  - Abundant peripheral code examples including LCD, COMP, ADC, AES and more
  - Subsystem-level code examples, the building blocks for key functionality to accelerate development process
  - Application-level middleware for faster development like LIN library, EEPROM emulation library, Energy metrology library and more
- SYSCONFIG
  - Graphical configuration tool for easier, quicker generation of code, clock tree and more

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