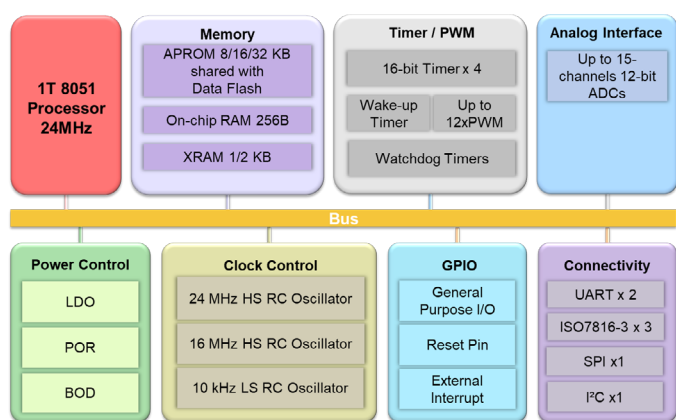# 8051 Industrial and Low Power MCUs

Nuvoton's MS/ML series features an **1T 8051 8bit microcontroller**. Both series have a wide supply voltage range and with their low power consumption they are especially good for low power applications like battery-powered devices.

The **MS51** industrial series microcontrollers is based on 1T 8051 core, running up to 24 MHz, with up to 32 Kbyte of Flash memory and up to 2 Kbyte of SRAM. The MS51 is equipped with special features such as up to 15 channels of 500k SPS 12-bit ADC, up to 12 channels of PWM with independent counters and GPIO supports 20 mA driving capability, also with ESD resistivity 8 kV and EFT resistivity 4.4 kV.

Key Features of the MS51 series:

- High precision 24 MHz allowing ±1 % deviation and one 10 kHz internal RC Oscillators
- 2.4V to 5.5V operating voltage
- Two full-duplex UART ports
- Up to three ISO7816-3 with UART function
- High immunity: 4.4 kV EFT & 8 kV ESD
- Compact but robust
- Up to 32KB Flash and 2KB SRAM
- Operating Temperature: -40°C to 105°C
- 10-33 pin packages

The **ML51** Series is a low power microcontroller but with a high performance 8-bit 8051 Processor. It is equipped with several powerful features, such as 12-bit ADC, comparators, internal voltage reference, and Direct Memory Access (DMA) controller. The ML51 also provides rich peripherals such as 2 sets of UART; 2 sets of smart card interface; 2 sets of I²C, and 2 sets of SPI.

Key Features of the ML51 Series:

- 80uA/MHz (Normal run mode)
- Operating voltage: 1.8V to 5.5V
- Touch key
- Low Power RTC and Internal analog comparator•
- CRC-8 checksum

	MS51 16K	MS51 32K	ML51 32K	
APROM (KB)	16	32	32	Increase crystal in function
SRAM (KB)	1	2	2	
XTAL in	X	V	V	Provide more UART interfaces
Max CPU Speed (MHz)	24	24	24	
UART/SPI/I²C	2/1/1	5/2/2	4/2/2	Provide more GPIO pins in the same package
GPIO	Up to 18	Up to 30	Up to 28	
16-bit Timer	4	4	4	
16-bit PWM	Up to 6-ch	Up to 12-ch	Up to 12-ch	PWM with independent timers
ADC (Max Sample Rate)	8ch x 12-bit (500 kSPS)	Up to 15 x 12-bit (500 kSPS)	8ch x 12-bit (500 kSPS)	
PDMA	---	---	V	Suitable for BMS application without AFE solution
Internal voltage reference	---	---	V	
IO sink current	15 mA	15 mA	20 mA	
Power down current (BOD off)	7 µA	7 µA	1 µA	32KB flash with smaller package size
Package	QFN20/TSSOP20	TSSOP20 ~ LQFP32	TSSOP28 ~ LQFP32	

Design-in Expertise and Service