NuMicro® Family

1T 8051 Microcontroller

# CM1003 Series
# Product Brief



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# 1 GENERAL DESCRIPTION

The NuMicro CM1003 series is an embedded Flash Memory type 1T 8051-based microcontroller. The instruction set is fully compatible with the standard 80C51 and performance enhanced. It supports 16/24 MHz core speed and features up to 64 KB of Flash Memory, 256 bytes of RAM and 4 KB of auxiliary RAM (XRAM), 4 KB of Flash loader memory (LDROM), 2.4V to 5.5V operating voltage, and -40°C to +105°C operating temperature.

The CM1003 series also provides plenty of peripherals including two 16-bit Timers, one 16-bit Timer2 with three-channel input capture mode, one Watchdog Timer, one Self Wake-up Timer, one 16-bit auto-reload Timer3 for general purpose or baud rate generator, two UARTs with frame error detection and automatic address recognition, three ISO 7816-3 interfaces, one SPI, one $I^2C$, six basic PWM output channels, six enhanced PWM output channels, 8-channel shared pin interrupt for all I/Os, and 15-channel 12-bit 500 ksps ADC with continuous mode. The peripherals are equipped with 24 sources with 4-level-priority interrupts capability.

Supported packages include TSSOP 20-pin, QFN 20-pin, QFN 33-pin and LQFP 48-pin.

For the development, Nuvoton provides the NuMaker evaluation board and Nuvoton Nu-Link debugger. The 3rd Party IDE such as Keil C51, IAR EW8051, and NuEclipse SDCC compilers are also supported.

| Product Line | UART | ISO 7816-3 | $I^2C$ | SPI | Timer | PWM | ADC |
|---|---|---|---|---|---|---|---|
| CM1003BF2AE<br>CM1003BF3AE<br>CM1003CF2AE<br>CM1003CF3AE | 2 | - | 1 | 1 | 4 | 6 | 8 |
| CM1003CJ3AE<br>CM1003DJ3AE<br>CM1003DL8AE | 2 | 3 | 1 | 1 | 4 | 12 | 15 |

Table 1-1 NuMicro CM1003 Series Key Features Support Table

The CM1003 series is suitable for a wide range of applications such as:

- Home Appliances
- LED Lighting Control
- Motor Control
- Industrial Automation

## 2 FEATURES

- **Operating Characteristics**
  - Voltage range: 2.4V to 5.5V
  - Temperature range: -40°C to +105°C
  - EFT 4.4 kV
  - ESD HBM 7 kV
- **Core**
  - Fully static design 8-bit high performance 1T 8051-based CMOS microcontroller, running up to 24 MHz
  - Instruction set fully compatible with MCS-51
  - 4-priority-level interrupts capability
  - Dual Data Pointers (DPTRs)
- **Memories**
  - Up to 64 KB Flash Memory
  - 256 bytes on-chip RAM and 4 KB auxiliary RAM (XRAM)
  - 4 KB Flash Memory for user program loader (LDROM)
  - 128 bytes security protection ROM (SPROM)
- **Clocks**
  - Default 16 MHz high-speed internal oscillator (HIRC) trimmed to ±1% (accuracy at 25°C, 3.3 V), ±2% in -20°C to +105°C, ±4% in -40°C ~-20°C。
  - Selectable 24 MHz high-speed internal oscillator (HIRC) trimmed to ±1% (accuracy at 25°C, 3.3 V) switch by software
  - 10 kHz low-speed internal oscillator (LIRC) calibrating to ±10% by software from high-speed internal oscillator
- **Power Management**
  - POR with 1.15V threshold voltage level
  - Supports BOD (4.4/3.7/2.7/2.2V falling edge)
  - LVR with 2.0V threshold voltage level
- **Timers**
  - Two 16-bit Timers/Counters 0 and 1
  - One 16-bit Timer2 with three-channel input capture mode and 9 input pins can be selected
  - One 16-bit auto-reload Timer3, supporting the clock source of UART0 and UART1
  - One Watchdog Timer
  - One 16-bit wake-up timer
- **PWM**
  - Up to 12 output pins can be selected.
  - Supports maximum clock source frequency up to 24 MHz
  - Up to four PWM modules, PWM0 module provides 6 output channels; PWM1 to PWM3 module provides 2 output channels.
  - Supports independent mode for PWM output
  - Supports complementary mode for 3 complementary paired PWM output channels
  - Supports 16-bit resolution PWM counter; PWM0 module with 8-bit resolution supporting Dead-time insertion and brake function.
- **Analog**
  - Up to 15 single-end channels of 12-bit 500 ksps SAR ADC
- **Communication interfaces**
  - Two UART interfaces
  - Three ISO 7816-3 interfaces, configurable as UART function, GPIO defined as UART2 ~ UART4.
  - One $I^2C$ interface supporting Master/Slave mode with up to 400 kbps transmission rate.
  - One SPI supporting Master/Slave mode.
- **Up to 46 I/Os with interrupt capability**
  - Schmitt trigger input / TTL mode selectable
  - I/O all supports interrupt capability
  - Supports INT0/INT1 interrupt pins
  - Supports wake-up function
- **Development Platform Support**
  - Arm Keil C51 and IAR EW8051 IDE support for debugging
  - Free GNU compiler with Eclipse IDE support
  - ICP (In Circuit Programmer) support for updating internal code via Nu-Link debugger
  - ISP (In System Programmer) support for updating internal code through UART, SPI, $I^2C$ peripheral interface
  - Pin Viewer for real time monitoring the status of all I/O pins
  - PinConfigure tool for pin assignment, initial code generation and OrCAD/Protel part generation
  - ClockConfigure tool for generating the initial source code of system clock
- **96-bit Unique ID (UID)**
- **128-bit Unique Customer ID (UCID)**
- **Package**
  - Package is Halogen-free, RoHS-compliant and TSCA-compliant.

| Pin Count | 20 | 20 | 33 | 48 |
|---|---|---|---|---|
| Type | TSSOP | QFN | QFN | LQFP |
| I/O Pin | 18 | 18 | 30 | 46 |
| Lead Pitch | 0.65 | 0.4 | 0.4 | 0.5 |
| Dimensions (mm) | 4.4x6.5 | 3x3 | 4x4 | 7x7 |

# 3 BLOCK DIAGRAM

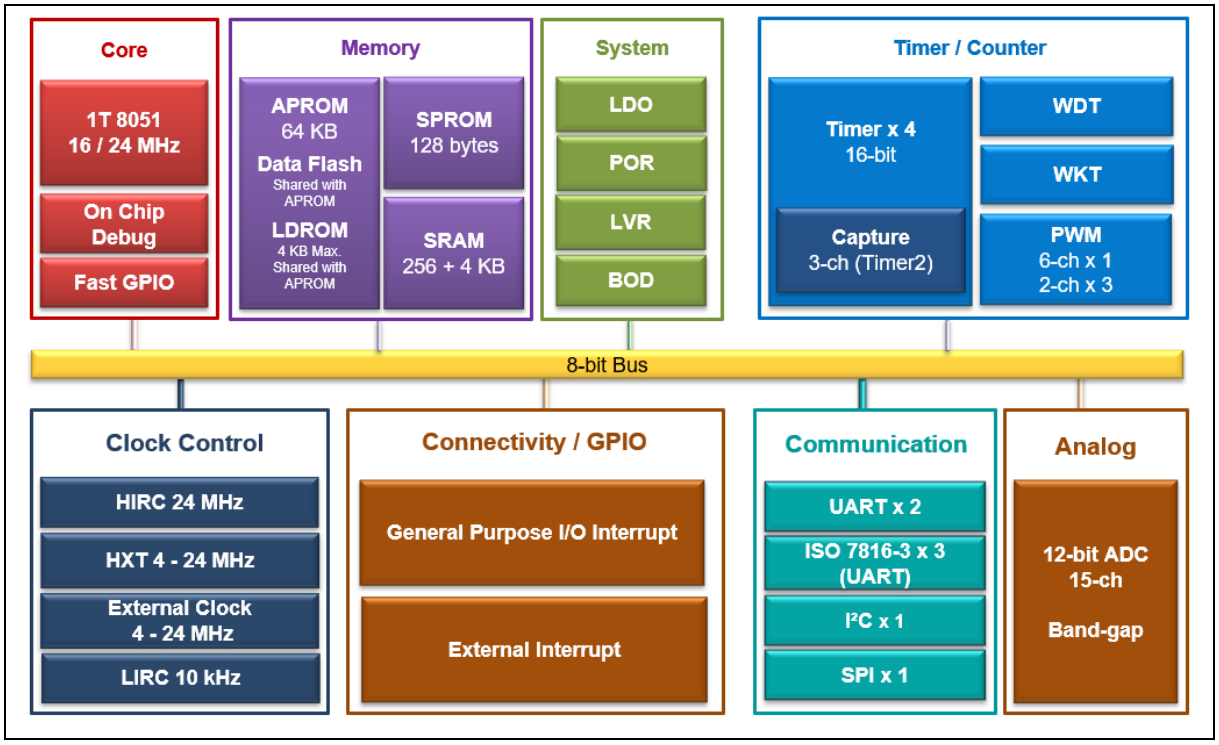


Figure 3-1 NuMicro CM1003 Series Block Diagram

# 4 PARTS INFORMATION

## 4.1 CM1003 Series Naming Rule

| C | M | 1 | 003 | C | J | 3 | A | E |
|---|---|---|---|---|---|---|---|---|
| NTNJ | Product Group | CPU Core | Device Family | Flash Size | Pin Count | Package Type | Version | Operation Temperature |
| C | M:MCU | 1:8051 | 003 | B: 16 KB<br>C: 32 KB<br>D: 64 KB | F: 20<br>J: 32/33<br>L: 48 | 2: TSSOP<br>3: QFN<br>8: LQFP | | E: -40°C ~ +105°C |

## 4.2 CM1003 Series Selection Guide

| Part Number | Flash Memory (KB) | SRAM (KB) | LDROM (KB) [1] | I/O | Timer | PWM | Connectivity | | | | ADC (12-bit) | Package |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | ISO 7816-3 [2] | UART | SPI | I²C | | |
| **CM1003BF2AE** | 16 | 256+1K | 4 | 18 | 4 | 6 | - | 2 | 1 | 1 | 8-ch | TSSOP20 |
| **CM1003BF3AE** | 16 | 256+1K | 4 | 18 | 4 | 6 | - | 2 | 1 | 1 | 8-ch | QFN20 |
| **CM1003CF2AE** | 32 | 256+1K | 4 | 18 | 4 | 6 | - | 2 | 1 | 1 | 8-ch | TSSOP20 |
| **CM1003CF3AE** | 32 | 256+1K | 4 | 18 | 4 | 6 | - | 2 | 1 | 1 | 8-ch | QFN20 |
| **CM1003CJ3AE** | 32 | 256+4K | 4 | 30 | 4 | 12 | 3 | 2 | 1 | 1 | 15-ch | QFN33 |
| **CM1003DJ3AE** | 64 | 256+4K | 4 | 30 | 4 | 12 | 3 | 2 | 1 | 1 | 15-ch | QFN33 |
| **CM1003DL8AE** | 64 | 256+4K | 4 | 46 | 4 | 12 | 3 | 2 | 1 | 1 | 15-ch | LQFP48 |

**Note:**

1. ISP ROM programmable 1/2/3/4 KB Flash Memory for user program loader (LDROM) shared from ARPOM.
2. ISO 7816-3 configurable as UART function; GPIO defined as UART2 to UART4.

# 5 DEVELOPMENT PLATFORM

## 5.1 Programmer and Debugger

| | |
|---|---|
| Nu-Link | Basic full speed USB2.0 hardware debugger/programmer |
| Nu-Link-Pro | Advanced hardware debugger/programmer with programming counter |
| Nu-Link 2.0 | Advanced high speed USB2.0 hardware debugger/programmer with multi-functions |
| Nu-Link-Gang | Off-line hardware programmer supporting up to four chips programming for mass-production |
| ISP | In System Programmer, a software programming tool supporting UART/USB |
| ICP | In Chip Programmer, a software programming tool supporting Nu-Link programmer |

## 5.2 Development Environment

| | |
|---|---|
| Programming IDE | Keil MDK, IAR, NuEclipse SDCC |
| Software Package | Board Support Package (BSP), Sample Code |
| Development IDE | NuTool Pin-View, NuTool-PinView, NuTool-ClockConfig, NuConsole |

## 5.3 Evaluation Board

| **EVB NuMaker** | **Part Number** | **Feature** |
|---|---|---|
| NuMaker-CM1003CF2 | CM1003BF2AE<br>CM1003BF3AE<br>CM1003CF2AE<br>CM1003CF3AE | Support Expand Connector, Arduino Uno Interface |
| NuMaker-CM1003DL8 | CM1003CJ3AE<br>CM1003DJ3AE<br>CM1003DL8AE | |

# 6 REVISION HISTORY

| Date | Revision | Section | Description |
|---|---|---|---|
| 2025-05-21 | 1.00 | | Initial version. |
| 2025-10-11 | 2.00 | Section 2 | Modify the clock description in the section 2FEATURES |
| | | Section 3 | Update Figure 3-1 NuMicro CM1003 Series Block Diagram |
| | | Section 4.1 | Update 4.1CM1003 Series Naming Rule |
| | | Section 5.3 | Modify EVB NuMaker |
| | | | Merge the documents "PB_CM1003xF_EN_Rev1.01.docx" and "PB_CM1003xJ_CM1003xL_EN_Rev1.00.docx" |
| 2026-01-19 | 2.01 | Section 1, 2<br>4.2, 5.3 | Remove CM1003DJ8AE & LQFP32 |

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