Nuvoton Technology Corporation (NTC) was founded to bring innovative semiconductor solutions to the market. NTC was spun-off as a Winbond Electronics affiliate in July 2008 and went public in September 2010 on the Taiwan Stock Exchange (TSE). Nuvoton Technology focuses on the developments of microcontroller, microprocessor, smart home and cloud security IC and has strong market share in Industrial, Consumer and Computer markets. Nuvoton owns a wafer fab, featuring customized processes for analog and power products. Besides in-house IC products, the wafer fab also provides part of its capacity for foundry services. Nuvoton Technology provides products with a high performance/cost ratio for its customers by leveraging flexible technology, advanced design capability, and integration of digital and analog technologies. Nuvoton values long term relationships with its partners and customers and is dedicated to continuous innovation of its products, processes, and services. The company has established subsidiaries in the USA, China, Israel, and India, Singapore, Korea and Japan to strengthen regional customer support and global management. For more information, please visit https://www.nuvoton.com
Microcontrollers

NuMicro® Ecosystem

NuMicro Ecosystem
Microcontroller Platform
Key Feature Selection:
Automotive / Industrial Control / Security / Low Power / Optical Transceiver / Home Appliance

IoT Platform
GUI Platform
Digital Platform
Development Platform

NuMicro® Product Selection Guide
List of Abbreviations, Acronyms, Codes

NuMicro® Automotive Family

| M0A23 CAN Series | NEW
| NUC131U CAN Series

NuMicro® Family Arm® Cortex®-M23 MCUs

| M2351 Series
| M2354 Series
| M251 Series
| M252 Series
| M253 Series | NEW
| M254/ M256/ M258 Series | NEW
| M261/ M262/ M263 Series

NuMicro® Family Arm® Cortex®-M0 MCUs

| M030G/ M031G Series | NEW
| M031 Series
| M032 Series
| M031BT Series
| M032BT Series | NEW
| M071 Series | NEW
| Mini51 Series
| M051 Series
| NUC029 Series
| NUC121 Series
| NUC130 CAN Series
| Nano100 Series

Family Arm® Cortex®-M4 MCUs

| M451 Series
| M460 Series | NEW
| M471 Series | NEW
| M480 Series
| NUC505 Series

NuMicro® Family Arm9 MPUs

| NUC970/ 980 Series
| N9H Series
| N329 Series

NuMicro® Family 8051 MCUs

| MS51 Industrial Control Series (1T)
| ML51 Low Power Series (1T)
| ML54 Low Power LCD Series (1T)
| ML56 Low Power Touch Key Series (1T)
| N76E Series (1T)
| N76E Series (4T)
| Standard 8051 Series
Nuvoton - a Leading Microcontroller Platform Provider

Nuvoton provides a comprehensive ecosystem from product selection and development to mass production, to shorten our partner’s design cycles and accelerate time-to-market.

From the core of NuMicro ecosystem, Nuvoton provides a rich product portfolio from 8051, Cortex-M0/ M23/ M4 to Arm9-based microcontroller, offering over 600 parts for selection. To provide an easy development experience, Nuvoton builds a development platform with multiple IDEs including Arm Keil, IAR Embedded Workbench and NuEclipse. The development tools, BSPs, development kits, debuggers and programmers are also included to boost project development.

Nuvoton offers rich reference designs and an integral IoT platform to realize innovative ideas in various fields. Customers could easily implement IoT projects with the Nuvoton low-power or IoT secure microcontroller on Nuvoton IoT platform, which supports multi-OS with multi-platform, and available for multi-connection to multi-cloud.

As a microcontroller platform provider, Nuvoton has been devoted to supporting our customers worldwide by our digital platform. Nuvoton’s digital platform can meet various needs including but not limited to product selection, product resources, product purchasing, sales/technical support, and knowledge-based learning.

NuMicro® Ecosystem
NuMicro® Ecosystem - Microcontroller Platform

Cortex® M23
- IoT Security

Cortex® M4
- High Performance
- Low Power
- Security

Cortex® M0
- High Performance
- Ultra Low Power
- General

Arm 9™
- Industrial Control
- HMI

8051
- Industrial Control
- Low Power

Frequency

<table>
<thead>
<tr>
<th>Frequency</th>
<th>8051</th>
<th>Cortex®-M0</th>
<th>Cortex®-M23</th>
<th>Cortex®-M4</th>
<th>Arm 9™</th>
</tr>
</thead>
<tbody>
<tr>
<td>300 MHz</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>192 MHz</td>
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<td>72 MHz</td>
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<td>64 MHz</td>
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<td>48 MHz</td>
<td></td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>24 MHz</td>
<td>ML56</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16 MHz</td>
<td>M56</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

Over 600 parts ready for selection

Operating Voltage: 1.8V-3.3V, 1.8V-2.5V, 2.0V-3.3V
Connectivity: USB, CAN, Ethernet

- Automotive
- Low Power
- TrustZone
Key Feature Selection: Automotive Microcontroller

The NuMicro® automotive microcontrollers pass the AEC-Q100 standards and are suitable for automotive applications. Nuvoton automotive microcontrollers are embedded with Cortex-M0 and Cortex-M4, up to 3 sets of CAN. The operating frequency ranges from 48 to 192 MHz, and the Flash size ranges from 32 to 512 Kbytes.

NuMicro® automotive microcontroller provides a comprehensive system solution with high performance and high reliability for Body Control, ADAS, Networking, and Automotive Lighting.

Multiple IDEs are supported, including the free-to-use Keil MDK Nuvoton Edition, IAR EWARM, and NuEclipse.

<table>
<thead>
<tr>
<th></th>
<th>M0A23</th>
<th>NUC1311</th>
<th>NUC131U</th>
<th>NUC230/240</th>
<th>M453</th>
<th>M483</th>
<th>M487</th>
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<tr>
<td>Core</td>
<td>Cortex-M0</td>
<td>Cortex-M0</td>
<td>Cortex-M0</td>
<td>Cortex-M0</td>
<td>Cortex-M4</td>
<td>Cortex-M4</td>
<td>Cortex-M4</td>
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<tr>
<td>Speed (MHz)</td>
<td>48</td>
<td>50</td>
<td>50</td>
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<td>72</td>
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<td>192</td>
</tr>
<tr>
<td>Flash (Kbytes)</td>
<td>32</td>
<td>68</td>
<td>68</td>
<td>128</td>
<td>256</td>
<td>256</td>
<td>512</td>
</tr>
<tr>
<td>LIN</td>
<td>2</td>
<td>-</td>
<td>3</td>
<td>3</td>
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<tr>
<td>CAN</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Operating Temperature (°C)</td>
<td>-40 ~ 125</td>
<td>-40 ~ 105</td>
<td>-40 ~ 105</td>
<td>-40 ~ 105</td>
<td>-40 ~ 105</td>
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<td>-40 ~ 105</td>
</tr>
<tr>
<td>AEC-Q100</td>
<td>2022 Q1</td>
<td>-</td>
<td>✔️</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>
Nuvoton technology is a leading microcontroller provider in industrial control industry. With the high quality and longevity, Nuvoton is an indispensable partner of industrial control customers.

- **Longevity**: Full commitment to ensuring supply continuity and stability for as long as 10 years.
- **High manufacturing quality**: NuMicro products are made by tier-one foundry, package, and testing partners to achieve the high and stable product quality.
- **Extended operating temperature grades**: from -40 to 105°C for all new microcontroller product and -40 to 85°C for all new MPU product.
- **IEC 60730 Class B Certified Software Test Library (STL) supported**

### Industrial Control Field

<table>
<thead>
<tr>
<th>Industrial Control Field</th>
<th>NuMicro Series Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>LED Lightening</td>
<td>[Arm9] NUC980 (Large LED Advertising Display)  [M4] M480/ M460 (Mini LED Local Dimming Control)</td>
</tr>
<tr>
<td>[M0] NDA102 (DALI)</td>
<td>[8051] M551 (LED Control Module)</td>
</tr>
<tr>
<td>Industrial Connectivity</td>
<td>[Arm9] NUC980 (Ethernet 10/100, CAN)  [M4] M480 (Ethernet 10/100, CAN), M460 (Ethernet 10/100, CAN-FD)</td>
</tr>
<tr>
<td>[M23] M2351/ M2354 (Trustzone, CAN)</td>
<td>[M0] M0A23 (CAN)/ M0A21(UART)  [8051] M551 (UART)</td>
</tr>
<tr>
<td>[M0] M0A23 (CAN Converter)/ M032/ M031 (Sensor module)</td>
<td>[8051] M551/ ML51 (Sensor Module)/ M254/ M256/ M258 (Com-seg LCD, Touch Key)</td>
</tr>
<tr>
<td>Grid Infrastructure</td>
<td>[Arm9] NUC980 (Data Collector)  [M4] M480 (Smart Circuit Breaker)</td>
</tr>
<tr>
<td>Smart Building</td>
<td>[Arm9] NUC980 (Fire Controller)  [M4] M480 (Electronic Whiteboard)</td>
</tr>
<tr>
<td>[M23] M254/ M256/ M258 (Thermostat)/ M2351/ M2354 (Smart Speaker)</td>
<td>[M0] M031BT/ M032BT (BLE5.0)  [8051] ML51 (Smoke Detector)/ ML54/ ML56 (Thermostat)</td>
</tr>
<tr>
<td>[M0] M0A21/ M0A23/ M071/ NUC131/ NUC230/ NUC029/ NUC162</td>
<td>[8051] M551/ ML51</td>
</tr>
</tbody>
</table>
Key Feature Selection: Microcontroller with Security

Nuvoton has dedicated to enhancing for the security of microcontrollers, the NuMicro® M2351 series is the first Arm® Cortex®-M23 based MCUs that has been both PSA Certified™ Level 1 (Feb. 2019), Level 2 (Jul. 2020) and PSA Functional API Certified (Feb. 2019).

To strengthen the security of microcontroller with software execution security, storage security, and connectivity security, Nuvoton has been developing a series of hardware and software mixture technologies to achieve the security targets of NuMicro products, which covers:

- All valuable attests in a microcontroller for protection are well identified.
- All potential security threats in a microcontroller for mitigation are well addressed.
- All potential security flaws in a microcontroller in terms of hardware and software are well avoided.

M235x IoT Security MCU portfolio also supports FreeRTOS, RT-Thread and Mbed OS 6.x for easy implementation of an IoT device and its connection to varied cloud services.

**Targeted Applications:** Smart Home, Smart City, Smart Building, Smart Transportation, Smart Agriculture, Smart Metering, Environment Surveillance (CCTV), Mobile POS, IoT Devices.

<table>
<thead>
<tr>
<th>Security Technology</th>
<th>Item</th>
<th>NuMicro Series Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>M251</td>
</tr>
<tr>
<td>Secure Boot ROM</td>
<td>Secure Bootloader (based on ECDSA signature)</td>
<td>☑️</td>
</tr>
<tr>
<td></td>
<td>Secure firmware update (OTA)</td>
<td>☑️</td>
</tr>
<tr>
<td></td>
<td>Driver APIs</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Debug Authentication (temporarily unlock)</td>
<td></td>
</tr>
<tr>
<td>Security Reference Code / Lib / Tool</td>
<td>TrustZone reference code</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Key Generation Tool</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Firmware image signing Tool</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Key/Certificate provisioning service</td>
<td></td>
</tr>
<tr>
<td>Isolation</td>
<td>Peripheral privileged mode</td>
<td></td>
</tr>
<tr>
<td></td>
<td>TrustZone partition for Cortex-M</td>
<td></td>
</tr>
<tr>
<td>Flash Memory Protection</td>
<td>Flash Lock (read protection)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>eSecure Only Memory</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dual bank (with bank swap)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Flash Write Protection</td>
<td></td>
</tr>
<tr>
<td>Crypto Processors</td>
<td>DES/3DES</td>
<td></td>
</tr>
<tr>
<td></td>
<td>AES-256</td>
<td></td>
</tr>
<tr>
<td></td>
<td>AES CCM, GCM and GMAC</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ECC (Key generation, EC DH, ECDSA)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>RSA-4096</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Side Channel Attacks mitigation of AES, RSA, ECC</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SHA1/SHA2-256</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SHA2-512, HMAC-512</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SM2/SM3 (Chinese national cryptography standard)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>TRNG</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cryptographic key store with chip level Active Shield</td>
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</tr>
<tr>
<td>Device Identity</td>
<td>Unique ID</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Customer Unique ID</td>
<td></td>
</tr>
<tr>
<td>Anti-Tamper</td>
<td>Tamper Pin Detection</td>
<td></td>
</tr>
<tr>
<td></td>
<td>RTC backup registers</td>
<td></td>
</tr>
<tr>
<td>Environment Sensor</td>
<td>Temperature sensors</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Clock monitor</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Voltage glitch detection</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Diagnostics Status Monitor</td>
<td></td>
</tr>
<tr>
<td>Platform Security</td>
<td>Lifecycle Management</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Firmware Version Counter</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Debug Port Management (DPM)</td>
<td></td>
</tr>
</tbody>
</table>

*2020 Q4 End*
Key Feature Selection: Low Power Microcontroller

Power consumption is a significant factor for microcontroller selection especially in a battery-powered application as IoT devices. In addition to consider the power consumption in different power modes, the wake-up time is also vital for the application in power mode switching.

Nuvoton devotes to offer the low-power microcontroller solutions with robust security for various application scenarios. The ML51 series has exclusive low-power run mode with less than 15 µA; the ML54/ML56 series has exclusive power down current with less than 2 µA with LCD panel display on; the Power-Down mode of Nano100 series is less than 2 µA; the wake-up time from Fast Wake-up Power-Down mode of M251 series is 10 µS; the M254/M256/M258 series consume less than 2 µA while finishing all touch keys scanning; the Deep Power-Down mode of M251 is less than 1.5 µA and less than 1 µA of M480 Series. Furthermore, there are additional DC-DC mode for M261 and M2351 series to halve the power consumption in LDO mode.

<table>
<thead>
<tr>
<th>Low-power Application</th>
<th>NuMicro Series Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ML51</td>
</tr>
<tr>
<td>Core</td>
<td>8051</td>
</tr>
<tr>
<td>Operating Frequency (MHz)</td>
<td>24</td>
</tr>
<tr>
<td>Flash (Kbytes)</td>
<td>16 - 64</td>
</tr>
<tr>
<td>SRAM (Kbytes)</td>
<td>1 - 4</td>
</tr>
<tr>
<td>Smoke Sensor</td>
<td>O</td>
</tr>
<tr>
<td>Glucose Meter</td>
<td>△</td>
</tr>
<tr>
<td>GPS Tracker</td>
<td>△</td>
</tr>
<tr>
<td>Handheld Meter</td>
<td>△</td>
</tr>
<tr>
<td>Wireless Keyboard/ Mouse</td>
<td>△</td>
</tr>
<tr>
<td>Smart Lock</td>
<td>O</td>
</tr>
<tr>
<td>Oximeter</td>
<td>O</td>
</tr>
</tbody>
</table>
Key Feature Selection: **Optical Transceiver Microcontroller**

Nuvoton serves a total solution of Optical Transceiver from Datacom to Telecom, or even from current optical transmission scenarios to new WDM (Wavelength Division Multiplexing) scenarios in 5G Fronthaul.

Both NuMicro M030G and NuMicro M031G series have a built-in temperature sensor, package selections of small size including QFN24 and QFN33, and 2 sets of strong I²C, which fully meet the requirement of traditional Optical Transceiver Module applications: (1) precise temperature measurement, (2) small form factor and (3) an I²C interface for communication. Moreover, to implement the Pilot Tone Modulation in WDM for OAM (Operation Administration and Maintenance) data transmission, NuMicro M031G series is also equipped with a Hardware Manchester Codec with CRC and 1 set of DAC supporting “Auto Data Generation” function.

- **Hardware Manchester Codec** with CRC:
  to encode and decode the low-frequency dither signal

- **DAC with Auto Data Generation Function**:
  to generate the smooth sine waveform up to 500 kHz 32 points for the output of Pilot Tone Modulation

- **Accurate Temp. Sensor**:
  with ±1.6°C deviation from 0 °C to 70 °C and ± 2 °C deviation from - 40 °C to 105°C

- **Small Package**:
  QFN24 3x3 mm / QFN33 4x4 mm

- **Strong I²C**:
  supports 1 MHz Slave mode and non-stretch mode

*Only for M031G*

<table>
<thead>
<tr>
<th>Optical Transceiver Application</th>
<th>NuMicro Series Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M030G</td>
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<tr>
<td>Core</td>
<td>Cortex-M0</td>
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<tr>
<td>Operating Frequency (MHz)</td>
<td>48</td>
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<tr>
<td>Flash (Kbytes)</td>
<td>32</td>
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<tr>
<td>SRAM (Kbytes)</td>
<td>4</td>
</tr>
<tr>
<td>Hardware Manchester Codec</td>
<td>-</td>
</tr>
<tr>
<td>DAC with Auto Data Generation</td>
<td>-</td>
</tr>
<tr>
<td>Temperature Sensor</td>
<td>⬤</td>
</tr>
<tr>
<td>Package</td>
<td>QFN24</td>
</tr>
<tr>
<td>Scenario</td>
<td>General Purpose</td>
</tr>
</tbody>
</table>
Key Feature Selection: **Microcontroller for Smart Home appliances**

- To enhance the quality of life, Smart Home Appliances have become trendy. Nuvoton microcontrollers integrate demand for Smart Home Appliances System. We provide the critical features of 2.5V to 5.5V operating voltage, packages with more than 0.5 mm wide pin pitch, a software library of self-test, and functional safety for IEC-60730 Class B. We also provide more robust anti-interference protection circuits of Electrostatic discharge (ESD) and Electrical fast transients (EFT).

- Nuvoton provides a rich product portfolio for Smart Home Appliance, including MS51 and ML51 series based on 8051, M071 series based on Cortex-M0, M251 series based on Cortex-M23, M471 series based on Cortex-M4, and N9H series based on Arm9.

- Nuvoton microcontroller has multi-function features to meet various applications.
  - Master control: M071 and M471 series
  - Display with COM/SEG LCD: ML54 and M254 series
  - Display with TFT LCD: N9H series
  - Touch-key with COM/SEG LCD: ML56 and M256/ M258 series
  - Wireless with infrared receiver: M471 series
  - Wireless with BLE 5.0: M031BT/ M032BT series
  - Security with the crypto engine: M261 series

- **Target applications:** Smart Small Appliance, White Good, Health Care Appliance, Smart Home.

<table>
<thead>
<tr>
<th>Home Application</th>
<th>M551/ML51</th>
<th>M251/M252</th>
<th>M071</th>
<th>M471</th>
<th>ML54/ML56</th>
<th>M254/M256/M258</th>
<th>N9H</th>
<th>M031BT/M032BT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Application</td>
<td>Master control</td>
<td>Master control</td>
<td>Master control</td>
<td>Master control</td>
<td>Display + Touch</td>
<td>Display + Touch</td>
<td>Display</td>
<td>Bluetooth</td>
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<td>8051</td>
<td>Cortex-M23</td>
<td>Cortex-M0</td>
<td>Cortex-M4</td>
<td>8051</td>
<td>Cortex-M23</td>
<td>Arm9</td>
<td>Cortex-M0</td>
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<td>Operating Frequency (MHz)</td>
<td>24</td>
<td>48</td>
<td>72</td>
<td>72 / 120</td>
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<td>48</td>
<td>200/240/300</td>
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<tr>
<td>Flash (KB)</td>
<td>16 - 64</td>
<td>32 - 256</td>
<td>32 - 256</td>
<td>64 - 512</td>
<td>16 - 64</td>
<td>64 - 128</td>
<td>64 - 512</td>
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<tr>
<td>SRAM (KB)</td>
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<td>8 - 32</td>
<td>8 - 20</td>
<td>32 - 64</td>
<td>1 - 4</td>
<td>16</td>
<td>8 - 96</td>
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<tr>
<td>IEC-60730 Class B STL</td>
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<td>✔</td>
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<td>5V operating voltage</td>
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<td>&gt;0.5mm Pin pitch</td>
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<tr>
<td>Low power</td>
<td>✔ ML51 only</td>
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<td>Display</td>
<td>COM/SEG LCD</td>
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<td>✔</td>
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<tr>
<td>Touch-key</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td></td>
</tr>
<tr>
<td>BLE 5.0</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td></td>
</tr>
<tr>
<td>Infrared Receiver</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td></td>
</tr>
</tbody>
</table>
NuMicro Ecosystem - IoT Platform

Support multi-OS with multi-platform; Provide multi-connection to multi-cloud.

Nuvoton offers a comprehensive IoT platform, which supports multi-OS with multi-platform and provides multi-connection to multi-cloud. The NuMaker-IoT-M487, NuMaker-PFM-M2351, NuMaker-IoT-M2354, NuMaker-IoT-M263A, NuMaker-M031BTYE and NuMaker-M032BTAI are excellent for being a node device with sensors and connectivity. Besides, the NuMaker-IoT-NUC980, NuMaker-RTU-NUC980(Chili) and NuMaker-IoT-M487 are fit for being a gateway.

Nuvoton links all aspects of the IoT platform to facilitate IoT innovation. NuMicro IoT platform supports Linux, Arm MbedOS, Amazon FreeRTOS, AliOS Things, Azure RTOS and RT-thread RTOS on selected NuMaker platform with embedded crypto accelerators to boost communication performance and strengthen connectivity security. Besides, the NuMaker platform can connect to various cloud services, such as Amazon Web Service (AWS), Pelion Device Management, Alibaba Cloud, Allxon, Qinglianyun and Microsoft Azure via various connectivity options including Ethernet, Wi-Fi, NB-IoT, and LTE.
<table>
<thead>
<tr>
<th>NuMaker Board</th>
<th>OS / RTOS</th>
<th>IP Connectivity</th>
<th>Non-IP Connectivity</th>
<th>Clouds</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Ethernet</td>
<td>Wi-Fi</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>NB-IoT CAT-M1</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>NB-IoT SIMCOM 720E</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>LTE</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>CAT-Q 5G</td>
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</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>NB-IoT ECM</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>LoRa</td>
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</tr>
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<td>SX1276</td>
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<td></td>
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<td>BLE 5.1</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>ARM Polarion DM</td>
<td></td>
</tr>
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<td></td>
<td></td>
<td></td>
<td>Amazon AWS</td>
<td></td>
</tr>
<tr>
<td></td>
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<td></td>
<td>Aliaba Cloud</td>
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</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Microsoft Azure</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>The Things Network</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Alibaba</td>
<td></td>
</tr>
<tr>
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<td>Tencent</td>
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</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>TinyTIE</td>
<td></td>
</tr>
<tr>
<td>NuMaker-</td>
<td>Linux</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Hot-NUC980</td>
<td></td>
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</tr>
<tr>
<td>RT-Thread</td>
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<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>NuMaker-</td>
<td>Linux</td>
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<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>RTU-NUC980(Chili)</td>
<td></td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>RT-Thread</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>NuMaker-</td>
<td>Linux</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>LoRaG-NUC980</td>
<td></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>MbedOS</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Amazon FreeRTOS</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>NuMaker-IoT-M487</td>
<td></td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td></td>
<td>AOS Things</td>
<td>✓</td>
<td>✓</td>
<td></td>
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<tr>
<td></td>
<td>RT-Thread</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Azure RTOS</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>NuMaker-IoT-M2354</td>
<td>MbedOS</td>
<td>✓</td>
<td>✓</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>NuMaker-IoT-M263A</td>
<td>MbedOS</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>NuMailer LoRaD-M251</td>
<td>MbedOS/Non-OS</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>NuMailer-</td>
<td>Non-OS</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>M031BYE</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>NuMailer-</td>
<td>Non-OS</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>M032BTAI</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NuStamp ACK-</td>
<td>Non-OS</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

*1 US915/EU868 Bands  *2 US915/EU915/US915/CH476 Bands  *3 Support on Mbed Studio  *4 Non-OS is NuLoRa Node  *5 Aisea Connect Kit (MMC)  *6 Software as a Service (SaaS)
NuMicro Ecosystem - GUI Platform

Nuvoton provides rich GUI platform resources, the platforms support Qt, LVGL, and emWin (use-in-free) graphic libraries that help users create modern GUIs. In addition, we provide application templates, online videos, and forum to help users speed up their product development.

Nuvoton MPUs built-in high-capacity DDR reduces circuit design difficulty and manufacturing cost. Support mono, gray, and color OLED and LCD modules, resolution up to 1024x768 in 16M colors. Moreover, the MPUs integrate 2D graphic accelerator, H.264, and JPEG codec to speed up graphics processing and improve users’ experience of HMI applications. Users can choose bare metal (no OS), RTOS, or Linux to be the OS according to the required.

Nuvoton GUI platforms are suitable in industrial control, smart building, smart appliance, medical device, charging pile, and consumer product with LCD HMI required.

<table>
<thead>
<tr>
<th></th>
<th>CPU Core (MHz)</th>
<th>RAM Size</th>
<th>LCD Resolution &amp; Interface</th>
<th>Hardware Accelerator</th>
<th>NuMaker Platform</th>
<th>Onboard LCD Size (resolution)</th>
<th>Storage</th>
<th>Peripheral</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>N9H30 Series</strong></td>
<td>Arm9 300MHz</td>
<td>MCP DDR 64 MB</td>
<td>1024x768 Parallel RGB / MPU / SPI</td>
<td>2D GFX JPEG Codec</td>
<td>NK-N9H30</td>
<td>7&quot; (800x480)</td>
<td>SPI NOR / NAND</td>
<td>Ethernet / UART / RS485 / SD Card / CAN / USB</td>
</tr>
<tr>
<td><strong>N9H26 Series</strong></td>
<td>Arm9 240 MHz</td>
<td>MCP DDR 64 MB</td>
<td>1024x768 Parallel RGB / MPU / SPI</td>
<td>2D GFX JPEG Codec</td>
<td>NK-N9H26</td>
<td>5&quot; (800x480)</td>
<td>SPI NOR</td>
<td>UART / SD Card / USB</td>
</tr>
<tr>
<td><strong>N9H20 Series</strong></td>
<td>Arm9 200MHz</td>
<td>MCP DDR 32 MB</td>
<td>1024x768 Parallel RGB / MPU / SPI</td>
<td>2D GFX JPEG Codec</td>
<td>NK-N9H20</td>
<td>4.3&quot; (480x272)</td>
<td>SPI NOR / NAND</td>
<td>UART / SD Card / USB</td>
</tr>
<tr>
<td><strong>M480 Series</strong></td>
<td>Cortex-M4 192 MHz</td>
<td>160 KB</td>
<td>480x272 MPU / SPI</td>
<td></td>
<td>NK-M487D</td>
<td>3.2&quot; (320x240)</td>
<td>SPI NOR</td>
<td>Ethernet / UART / RS485 / SD Card / CAN / USB</td>
</tr>
<tr>
<td><strong>M032 Series</strong></td>
<td>Cortex-M0 72 MHz</td>
<td>96 KB</td>
<td>320x240 SPI</td>
<td></td>
<td>NK-M032</td>
<td>2.4&quot; (320x240)</td>
<td>SPI NOR</td>
<td>UART / RS485</td>
</tr>
</tbody>
</table>
NuMicro® Ecosystem - Development Platform

Nuvoton provides a comprehensive development platform to assist our customer to achieve rapid development, high-capacity mass production, and easy upgrade.

<table>
<thead>
<tr>
<th>Development Kit</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>NuMake Series</strong></td>
</tr>
<tr>
<td>Comprehensive peripherals, rapid practice your idea.</td>
</tr>
<tr>
<td>- Designed for IoT/ HMI development: NuMaker-IoT, NuMaker-emWin, RDK,...</td>
</tr>
<tr>
<td>- Designed for general purpose development: NuMaker-IC Part No.</td>
</tr>
<tr>
<td><strong>NuTiny Series</strong></td>
</tr>
<tr>
<td>- Simple board design with high flexibility.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Board Support Package (BSP)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Offers rich sample code: Device usage, USB Device Classes, CAN, Ethernet, etc. With the unified API names of all NuMicro products and Nuvoton Code Generator, customer could easily start or migrate a NuMicro project.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>IDE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>armKEIL</strong></td>
</tr>
<tr>
<td><strong>NuEclipse</strong></td>
</tr>
<tr>
<td>Offers multiple IDEs for customers, including free-to-use Arm Keil (for M0/ M23 project, and $385/yr for M4/ M7 project), IAR Embedded Workbench (32 KB free), and NuEclipse within the GNU Eclipse framework which can be free-to-use in NuMicro M0/ M4/ M23 projects.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Debugger &amp; Programmer</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Nu-Link2-Pro</strong></td>
</tr>
<tr>
<td>Nu-Link2-Pro Debug Adapter is a USB debugger/ programmer and can be applied to the development of NuMicro products. The original feature of Nu-Link is supported with higher performance. Furthermore, it supports embedded trace microcell (ETM) function, multi-path bridge communication, and signal monitor for advanced debugging requirements. Besides, it supports off-line programming which can be triggered by a button or the automatic IC programming system.</td>
</tr>
<tr>
<td><strong>Nu-Link-Gang</strong></td>
</tr>
<tr>
<td>The Nu-Link-Gang Programmer is designed for mass-production in the customer site. With flexible programming option which can offline programming 4 chips simultaneously or individually, fit for automatic IC programming system.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Development Tool (NuTool)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PinConfig Tool</strong></td>
</tr>
<tr>
<td>To configure I/O with multi-functions and generate OrCAD library.</td>
</tr>
<tr>
<td><strong>PinView Tool</strong></td>
</tr>
<tr>
<td>A monitoring and visualization tool that can immediately show the current status of I/O pins.</td>
</tr>
<tr>
<td><strong>Clock Configure Tool</strong></td>
</tr>
<tr>
<td>Check the clock tree and generate the clock initiate code.</td>
</tr>
<tr>
<td><strong>ICP Tool</strong></td>
</tr>
<tr>
<td>Mass-production programming tool with code encryption, protect IP of customer.</td>
</tr>
<tr>
<td><strong>ISP Tool</strong></td>
</tr>
<tr>
<td>Provides sample code for end-product firmware update.</td>
</tr>
<tr>
<td><strong>CodeGenerator</strong></td>
</tr>
<tr>
<td>Code generating for NuMicro M251/ M252/ NUC126 projects with the initial peripheral, pin, and clock configurations.</td>
</tr>
</tbody>
</table>
NuMicro® Ecosystem - Digital Platform

As a microcontroller platform provider, Nuvoton has been devoted to supporting our customers worldwide by our digital platform. Nuvoton's digital platform can meet various needs including but not limited to product selection, product resources, product purchasing, sales/technical support, and knowledge-based learning.

nuvoton.com is the core of the digital platform where most of your needs could be fulfilled. It provides products selection, products information, development, and mass production. At Nuvoton’s website you can find all needed resources, documents, board support packages, and software tools:

- Product Selection
- Product Information
- Resource Download
  - Documents
  - BSP
  - Software Tools

Sample & buy

For customers who need to receive products faster, our eStore can help. Shopping at the official eStore, Nuvoton Direct, is quick and easy. Besides Nuvoton Direct, other online shopping channels are also available.

- Nuvoton Direct - Official eStore
- Tmall - Official eStore for China region
- TechDesign - Partner Channel
- Digikey - Disti. Channel

Knowledge-based learning

Nuvoton team constantly produces contents with great insights. We deliver reference applications and tech articles in different languages, channels, and forms.

- Facebook - Nuvoton NuMicro
- Twitter - NuvotonMCU
- LinkedIn - Nuvoton Technology
- WeChat - @nuvoton.mcuc
- YouTube Channel - Nuvoton NuMicro
- Bilibili Channel
- Tech blog

Online support

Need talking to a real person? Ask questions any time you want and we will do our best to answer. Feel free to reach our online chat on nuvoton.com or Nuvoton Direct. Besides, Nuvoton-owned forums are great for further discussions.

- NuForum https://forum.nuvoton.com
- 21ic Forum http://bbs.21ic.com
- nuvoton-mcu.com
- Tech/Sales Online Chat
  Visit nuvoton.com or Nuvoton Direct
# List of Abbreviations, Acronyms & Codes

<table>
<thead>
<tr>
<th>Abbreviation/Code of Chip Specification</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACMP</td>
<td>Analog Comparator</td>
</tr>
<tr>
<td>EMAC</td>
<td>Ethernet MAC</td>
</tr>
<tr>
<td>LP UART</td>
<td>Low-power UART</td>
</tr>
<tr>
<td>OPA</td>
<td>OP Amplifier</td>
</tr>
<tr>
<td>PDMA</td>
<td>Peripheral Direct Memory Access</td>
</tr>
<tr>
<td>QSPI</td>
<td>Quad SPI</td>
</tr>
<tr>
<td>RTC</td>
<td>Real-Time Clock</td>
</tr>
<tr>
<td>RTC (V\textsubscript{tur})</td>
<td>The RTC could be powered via VBAT pin when power off or in Power-Down mode.</td>
</tr>
<tr>
<td>SPI Master</td>
<td>Master mode used only for this SPI.</td>
</tr>
<tr>
<td>USB</td>
<td>USB Full Speed</td>
</tr>
<tr>
<td>USB FS</td>
<td>USB High Speed</td>
</tr>
<tr>
<td>USB HS</td>
<td>On-The-Go (OTG)</td>
</tr>
<tr>
<td>O</td>
<td>USB Device</td>
</tr>
<tr>
<td>D</td>
<td>USB Host</td>
</tr>
<tr>
<td>H</td>
<td>Allows to act as a USB host or device but not OTG</td>
</tr>
<tr>
<td>H/D</td>
<td>Programmable Serial I/O</td>
</tr>
<tr>
<td>VAI</td>
<td>Voltage Adjustment Interface</td>
</tr>
<tr>
<td>USCI</td>
<td>Universal Serial Control Interface Controller</td>
</tr>
<tr>
<td></td>
<td>USCI supports UART, SPI and I\textsubscript{C} mode.</td>
</tr>
<tr>
<td>XOM</td>
<td>eXecute-Only Memory</td>
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</table>

## Code of Chip Package

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<thead>
<tr>
<th>Package</th>
<th>Pin</th>
<th>Size (mm)</th>
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<tbody>
<tr>
<td>A QFN</td>
<td>68</td>
<td>8 x 8</td>
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<tr>
<td>B MSOP</td>
<td>10</td>
<td>3 x 3</td>
</tr>
<tr>
<td>C WLCSP</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>D TSSOP</td>
<td>14</td>
<td>4.4 x 5.0</td>
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<td>E TSSOP</td>
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<td>4.4 x 9.7</td>
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<tr>
<td>F TSSOP</td>
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<td>4.4 x 6.5</td>
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<td>G QFN</td>
<td>24</td>
<td>3 x 3</td>
</tr>
<tr>
<td>H LQFP</td>
<td>176</td>
<td>24 x 24</td>
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<tr>
<td>I SOP</td>
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<td>4 x 5</td>
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<tr>
<td>J LQFP</td>
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<td>K LQFP</td>
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<td>14 x 14</td>
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<td>L LQFP</td>
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<td>7 x 7</td>
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<td>M LQFP</td>
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<tr>
<td>N QFN</td>
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<td>7 x 7</td>
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<td>O SOP</td>
<td>20</td>
<td>300 mil</td>
</tr>
<tr>
<td>P LQFP</td>
<td>32</td>
<td>7 x 7</td>
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<tr>
<td>R LQFP</td>
<td>64</td>
<td>10 x 10</td>
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<tr>
<td>S LQFP</td>
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<td>7 x 7</td>
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<tr>
<td>T QFN</td>
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<td>4 x 4</td>
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<tr>
<td>U SOP</td>
<td>28</td>
<td>300 mil</td>
</tr>
<tr>
<td>V LQFP</td>
<td>100</td>
<td>14 x 14</td>
</tr>
<tr>
<td>W Wafer</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>X QFN</td>
<td>20</td>
<td>3 x 3</td>
</tr>
<tr>
<td>Y QFN</td>
<td>48</td>
<td>5 x 5</td>
</tr>
<tr>
<td>Z QFN</td>
<td>33</td>
<td>5 x 5</td>
</tr>
</tbody>
</table>
**NuMicro® Automotive Family**

The NuMicro Automotive/CAN microcontroller is a new microcontroller product line which provides high performance with the capability to withstand up to 125 °C ambient temperature, qualified by AEC-Q100 grade 2, with built-in Controller Area Network(CAN) 2.0 B interface that designed for automotive applications.

The NuMicro Automotive/CAN microcontroller is based on the Arm® Cortex®-M0 core with built-in 16 to 68 Kbytes Flash, supports rich communication interfaces (such as LIN, UART, SPI, I2C... etc.), and comes with DAC, ADC, comparator and other rich analog interfaces.

Qualified by AEC-Q100 grade 2

**Potential Application:** Reverse Parking Assistance, Automotive lighting, Body control module, Head Up Display, etc.

NuMicro® CAN/Automotive series MCUs are composed of the following product series.

M0A23 Series: Up to 125 °C, 48 MHz, up to 32 KB Flash, CAN/LIN interface, PDMA, DAC, ACMP

NUC131U Series: Qualified by AEC-Q100 grade 2, 50 MHz, up to 68 KB Flash, CAN/LIN interface, up to 6 UART

---

**M0A23 Series**

NuMicro® M0A23 based on the Arm® Cortex®-M0 core which is designed for automotive applications, provides up to 32 KB Flash, CAN/LIN interface and high stability with the capability to withstand up to 125 °C ambient temperature.

**Potential Applications:** automotive, lighting, industrial communication, industrial Automation, power control, etc.

---

**M0A23 Series**

**Key Features:** Hardware Divider, up to 125°C, LIN/CAN interface, PDMA, UART with the One-Wire

---

**Table:**

<table>
<thead>
<tr>
<th>Part No.</th>
<th>System</th>
<th>Memory</th>
<th>Timer</th>
<th>Analog</th>
<th>Connectivity</th>
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Microcontrollers

NuMicro® Automotive Family

NUC131U Series

The NuMicro® NUC131SD2AEU is a 32-bit Arm® Cortex®-M0 based microcontroller running up to 50 MHz with built-in Controller Area Network(CAN) 2.0 B interface, up to 68 KB Flash and qualified by AEC-Q100 grade 2

Potential Applications: automotive, lighting, industrial communication, industrial Automation, Radar, etc.

- **NUC131U Series**

  **Key Features:** Hardware Divider, LIN/CAN interface, 6 set of UARTs, 24 channels of 100 MHz PWMs

<table>
<thead>
<tr>
<th>Part No.</th>
<th>System</th>
<th>Memory</th>
<th>Timer</th>
<th>Analog</th>
<th>Connectivity</th>
<th>Package</th>
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- **Part No.**
  - NUC131LD2AEU
  - NUC131SD2AEU

- **System**
  - Operating Frequency (MHz)
  - Memory
    - LDROM Flash (KB)
    - PROM Flash (KB)
    - Data Flash (KB)
    - SRAM (KB)
    - Timer (32-bit)
    - PWM (16-bit)
    - ADC (12-bit)
  - UART
  - LIN
  - SPI
  - I²C
  - CAN

- **Package**
  - Package Type
  - Package Size: LQFP 48, 64

- **Status**
  - Mass Production
  - EVB
  - MP Programmer
  - AEC-Q100

- **Tool**
  - NK-NUC131U
  - NLG-NUC131L
  - NK-NUC131U
  - NLG-NUC131S
NuMicro® Family Arm® Cortex®-M23 Microcontrollers

Offers the next industry standard for secure IoT devices

The NuMicro® M23 Family is based on the Arm® Cortex®-M23 core and is empowered by the Arm® TrustZone® for Armv8-M architecture. With TrustZone® implemented, memory and peripherals could be divided into secure and non-secure worlds to achieve data integrity, firmware update and operation security. In addition, TrustZone® for Armv8-M provides the key benefit of context switching between secure and non-secure worlds by hardware for faster transitions and greater power efficiency.

In addition to the security capability, NuMicro® M23 Series inherits the standard set of Cortex-M0+ as the ultra-low power microprocessor in a tiny footprint.

With the two key features of security and ultra-low power, NuMicro® M23 is built for small, energy-sipping IoT and embedded products. With the capability of the small-sized and low-power devices, NuMicro M23 provides security, enhanced efficiency, performance and scalability for deployment even in the most constrained contexts.

M2351 Series

The rise of the internet of things (IoT) era has increased awareness for the integration of physical worlds into digital systems. While the digitization of our everyday lives leads to efficiency improvements and economic benefits, it has also caused pressure on system designers who are now required to come up with innovative IoT products capable of performing secure connection and data exchange with low power consumption. Since security and power consumption are both key requirements for IoT applications, Nuvoton has developed the NuMicro® M2351 Series, which excels in supporting the proliferation of intelligent connected devices. The NuMicro® M2351 microcontroller series is based on the Arm® Cortex®-M23 core with TrustZone® for Armv8-M architecture, which elevates the traditional firmware security to a new level of robust hardware security.

The low power M2351 series microcontroller operates at up to 64 MHz, with up to 512 Kbytes Flash in dual bank mode, supporting secure firmware Over-The-Air (OTA) update and up to 96 Kbytes SRAM. Furthermore, the M2351 series also provides high-performance connectivity peripheral interfaces such as UART, SPI, I²C, GPIOs, USB and ISO 7816-3 for smart card readers. Its secure and efficient power management features strengthen the innovation of IoT security.

*For more information, please visit https://m2351.nuvoton.com
Potential Applications: Smart Meters, Gaming Software IP Protection, Smart City, Smart Wearable Devices, Medical Devices, IoT Devices with Secure Connection, Collaborative Secure Software Development Models, etc.

Key Features: TrustZone® for Armv8-M Technology, 8 regions MPU_NS (for non-secure world) and 8 regions MPU_S (for secure world), Hardware Crypto Accelerators, CRC calculation unit, Up to 6 tamper detection pins, Arm® Platform Security Architecture (PSA) and Trusted Base System Architecture-M (TBSA-M) supported, Multiple power modes.

M2354 Series

The NuMicro M2354 series is a product portfolio of NuMicro Secure IoT MCU family based on Arm Cortex-M23 TrustZone, covering secure key storage protected by tamper-resistant physical shield, Flash memory protection lock, and secure control unit. It focuses on physical attack protection and certification for Arm PSA Level 2 even for Arm PSA Level 3. The M2354 series is quite competitive for those devices that need more secure, fast computing and low power in the IoT market.

The major challenge for IoT devices that are connected to cloud or other devices by network communication is Security, so the IoT devices must meet some security requirements to protect firmware, software and secure assets from being stolen or modified by an attacker. “Execution”, “Storage”, and “Connectivity” are the three important targets for secure IoT devices.

The ultra low power M2354 series microcontroller operates at up to 96 MHz frequency, with up to 1 Mbytes embedded Flash memory in dual bank mode, supporting secure OTA (Over-The-Air) firmware update and up to 256 Kbytes embedded SRAM. Following the M2351 series, it also provides high-performance connectivity peripheral interfaces such as UART, SPI, I²C, GPIOs, USB and ISO 7816-3 for smart card reader. On top of all, the countermeasures of mitigation for the side-channel attacks of cryptos and fault injection attacks of voltage and clock tampering elevate an Armv8-M TrustZone application system with physical security enhanced.
Key Features: Tamper-resistant key storage in Flash and SRAM, Up to 8 Com. x 40 Seg. LCD controller, TrustZone for Armv8-M Technology, 8 regions MPU_NS (for normal world) and 8 regions MPU_S (for secure world), Hardware Crypto Accelerators, CRC calculation unit, Up to 6 tamper detection pins, Arm Platform Security Architecture (PSA Certified Level 2 /Level 3) supported, Multiple power mode.
## M251/M252 Series

The NuMicro® M251/M252 is a low power series embedded with the Arm® Cortex®-M23 core for Armv8-M architecture, supporting wide operating voltage built-in 16~256 Kbytes embedded Flash, 8~32 Kbytes embedded SRAM and 4 Kbytes Flash loader memory for In-System Programming (ISP). The M251/M252 series integrates PSIO (Programmable Serial I/O) that is capable of emulating various serial communication protocols including: UART, SPI, I2C...etc. Also Real Time Counter (RTC), 840 kSPS ADC, DAC, Analog Comparator, Operational Amplifier, VAI (Voltage Adjustable Interface), USB 2.0 FS device (Crystal-less), ISO-7816-3, and rich peripherals, supports fast wake-up via communication interfaces.

### Potential Applications
Suitable for limited battery-powered device such as Wearable Device, IoT Node Device, Portable Medical Device, Smart Home Appliance, Alarm and Security Monitoring, Mobile Payment Smart Card Reader, GPS Data Collector, Wireless Communication (Zigbee, LoRa...etc.) Module, Electronic Shelf Label (ESL), RFID, Smart Heat/Water/Gas Meters, etc.

#### M251 Series

**Key Features:** Up to 8-channel PSIO that is capable of emulating various serial communication protocols. Ultra-low power consumption with 138 µA/MHz (Normal Run Mode), 60 µA/MHz (Idle Mode), 2.5 µA (Power Down, RTC on, RAM retention) and 1.5 µA (Power Down, RTC off, RAM retention).

<table>
<thead>
<tr>
<th>Part No.</th>
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<th>Timer</th>
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<th>Connectivity</th>
<th>Security</th>
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## M252 Series

**Key Features:** USB 2.0 full speed device Crystal-less and up to 8-channel PSIO capable of emulating various serial communication protocols. Ultra-low power Consumption with 138 µA/MHz (Normal Run Mode), 60 µA/MHz (Idle Mode), 2.5 µA (Power Down, RTC on, RAM retention) and 1.5 µA (Power Down, RTC off, RAM retention).

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## M253 Series

The NuMicro M253 series 32-bit microcontroller is based on Arm® Cortex®-M23 core using Armv8-M architecture. It provides one CAN FD and Crystal-less USB 2.0 FS interface, running up to 48 MHz and features up to 128 Kbytes Flash, 16 Kbytes SRAM.

**Potential Applications:** Suitable for automotive application, Industrial automatic application, and battery management system.

## M253 Series

**Key Features:** USB 2.0 full speed device interface with up to 17 configurable endpoints, 5 virtual COM ports, and one set of CAN FD interface, supporting up to 64 bytes per message.
### M254/M256/M258 Series

The NuMicro M254/M256/M258 series are low-power microcontroller platforms with COM/SEG LCD driver based on Arm® Cortex®-M23 core at Armv8-M architecture. M256/M258 series support capacitive touch sensing function. M258 series is with USB 2.0 full speed device. They run up to 48 MHz with 64/128 Kbytes embedded Flash memory and 16 Kbytes embedded SRAM, 4 Kbytes Flash loader memory (LDROM) for In-System Programming (ISP).

**Potential Applications:** Suitable for limited battery-powered device such as Portable Medical Device, Smart Home Appliance, Alarm and Security Monitoring, Thermostat, Temperature Logger Smart Heat/Water/Gas Meters, etc.

#### M254 Series

**Key Features:** A 8x44, 6x46, 4x48 COM/SEG LCD is available on M254 series. The COM/SEG LCD driver is built-in charge-pump, supports 3 ~ 5V LCD panel, with selectable bias voltage (1/2, 1/3, 1/4) and duty (1/4, 1/6, 1/8).

<table>
<thead>
<tr>
<th>Part No.</th>
<th>System</th>
<th>Memory</th>
<th>Timer</th>
<th>Analog</th>
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### M256 Series

**Key Features:** Supports 8x44, 6x46, 4x48 COM/SEG LCD driver and capacitive touch sensing function, integrated up to 14 touch-keys with single-scan or programmable periodic key-scans.

<table>
<thead>
<tr>
<th>Part No.</th>
<th>System</th>
<th>Memory</th>
<th>Timer</th>
<th>Analog</th>
<th>Connectivity</th>
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### M258 Series

**Key Features:** Supports 8x40, 6x42, 4x44 COM/SEG LCD driver, capacitive touch sensing function, and a crystal-less USB 2.0 full speed device with Battery Charging Detection v1.2 (BC 1.2) profile.

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M261/M262/M263 Series

The NuMicro® M261/M262/M263 series is low power microcontroller based on the Arm® Cortex®-M23 core for Armv8-M architecture. It runs at up to 64 MHz with 512 Kbytes Flash in dual bank mode supporting Over-The-Air (OTA) firmware update and 96 Kbytes SRAM. It also supports low supply voltage from 1.8V to 3.6V and operating temperature from -40°C to 105°C.

The NuMicro® M261/M262/M263 series provides multiple power modes for diverse operating scenarios, such as Power-down Mode, Fast Wake-up Power-down Mode, Low Leakage Power-down Mode, Ultra Low Leakage Power-down Mode, Standby Power-down Mode and Deep Power-down mode. The power consumption is 97 μA/MHz (LDO Mode) and 45 μA/MHz (DC-DC Mode) in Normal Run Mode, 2.8 μA in Standby Power-down Mode, and less than 2 μA in Deep Power-down Mode.

The NuMicro® M262 series is based on NuMicro® M261 series. It integrates USB 2.0 full speed OTG transceiver, USB 1.1 Host Controller and USB 2.0 full speed Device Controller with crystal-less function.

The NuMicro® M263 series is based on NuMicro® M262 series. It supports one set of CAN Bus 2.0B controllers. This CAN Bus can be set to be one of six paired I/Os by PinConfigure tool.

Potential Applications: Suitable for limited battery-powered devices, such as IoT Node Device, Portable Medical Device, Smart Home Appliance, Security Alarm Monitoring, Wireless Sensor Node Device, Electronic Payment Smart Card Reader, Wireless Communication (Zigbee, LoRa, Thread, etc.) Module, Smart Door Lock, etc.

• M261/M262/M263 Series

Key Features: 512 Kbytes Flash in dual bank mode for OTA, USB 2.0 full speed OTG, CAN Bus 2.0B, SDHC 2.0, Secure Boot function, Hardware Crypto Engine, one 16-channel 12-bit 3.76 MSPS SAR ADC, two 12-bit 1 MSPS voltage type DAC, two rail-to-rail analog comparators (ACMP), temperature sensors, low voltage reset, and Brown-Out Detector to enhance product performance.

The NuMicro® M262 series is based on NuMicro® M261 series. It integrates USB 2.0 full speed OTG transceiver, USB 1.1 Host Controller and USB 2.0 full speed Device Controller with crystal-less function.

The NuMicro® M263 series is based on NuMicro® M262 series. It supports one set of CAN Bus 2.0B controllers. This CAN Bus can be set to be one of six paired I/Os by PinConfigure tool.

Potential Applications: Suitable for limited battery-powered devices, such as IoT Node Device, Portable Medical Device, Smart Home Appliance, Security Alarm Monitoring, Wireless Sensor Node Device, Electronic Payment Smart Card Reader, Wireless Communication (Zigbee, LoRa, Thread, etc.) Module, Smart Door Lock, etc.

• M261/M262/M263 Series

Key Features: 512 Kbytes Flash in dual bank mode for OTA, USB 2.0 full speed OTG, CAN Bus 2.0B, SDHC 2.0, Secure Boot function, Hardware Crypto Engine, one 16-channel 12-bit 3.76 MSPS SAR ADC, two 12-bit 1 MSPS voltage type DAC, two rail-to-rail analog comparators (ACMP), temperature sensors, low voltage reset, and Brown-Out Detector to enhance product performance.

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• M261/M262/M263 Series

Key Features: 512 Kbytes Flash in dual bank mode for OTA, USB 2.0 full speed OTG, CAN Bus 2.0B, SDHC 2.0, Secure Boot function, Hardware Crypto Engine, one 16-channel 12-bit 3.76 MSPS SAR ADC, two 12-bit 1 MSPS voltage type DAC, two rail-to-rail analog comparators (ACMP), temperature sensors, low voltage reset, and Brown-Out Detector to enhance product performance.

The NuMicro® M262 series is based on NuMicro® M261 series. It integrates USB 2.0 full speed OTG transceiver, USB 1.1 Host Controller and USB 2.0 full speed Device Controller with crystal-less function.

The NuMicro® M263 series is based on NuMicro® M262 series. It supports one set of CAN Bus 2.0B controllers. This CAN Bus can be set to be one of six paired I/Os by PinConfigure tool.
The NuMicro<sup>®</sup> M030G/M031G 32-bit microcontroller series is designed for Optical Transceiver Module applications, both of the M030G and the M031G series have a built-in temperature sensor with ±2°C deviation from -40°C to 105°C. The M031G series is equipped with a Hardware Manchester Codec and 1 set of DAC with “Auto Data Generation” function to generate the smooth sine waveform up to 500kHz for Optical Transceiver Module with the function of pilot tone modulation. The M030G/M031G series runs up to 48/72 MHz and features 64 Kbytes Flash, 4/8 Kbytes SRAM, 2.7V ~ 3.6V operating voltage, and -40°C to 105°C operating temperature.

The M030G/M031G series provides plenty of peripherals including 2 sets of I²C supporting 1 MHz Slave Mode, internal voltage reference, up to 16 channels of 1.4 MSPS 12-bit SAR ADC and 4 sets of 12-bit DAC. Both M030G/M031G series provide the QFN 24-pin (3x3 mm) and QFN 33-pin (4x4 mm) small form factor package.

### M030G/M031G Series

The NuMicro<sup>®</sup> M030G/M031G 32-bit microcontroller series is designed for Optical Transceiver Module applications, both of the M030G and the M031G series have a built-in temperature sensor with ±2°C deviation from -40°C to 105°C. The M031G series is equipped with a Hardware Manchester Codec and 1 set of DAC with “Auto Data Generation” function to generate the smooth sine waveform up to 500kHz for Optical Transceiver Module with the function of pilot tone modulation. The M030G/M031G series runs up to 48/72 MHz and features 32/64 Kbytes Flash, 4/8 Kbytes SRAM, 2.7V ~ 3.6V operating voltage, and -40°C to 105°C operating temperature.

The M030G/M031G series provides plenty of peripherals including 2 sets of I²C supporting 1 MHz Slave Mode, internal voltage reference, up to 16 channels of 1.4 MSPS 12-bit SAR ADC and 4 sets of 12-bit DAC. Both M030G/M031G series provide the QFN 24-pin (3x3 mm) and QFN 33-pin (4x4 mm) small form factor package.

### Specific Applications:
Optical Transceiver Module

- **M030G Series**

  **Key Features:** Build-in Temperature Sensor, 1MHz Slave Mode I²C, QFN24/33 Small Form Factor Package

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<th>Clock</th>
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**M031G Series**

**Key Features:** Hardware Manchester Codec, 1 set of DAC with Auto Data Generation Function, Build-in Temperature Sensor, 1MHz Slave Mode I^2^C, QFN24/33 Small Form Factor Package

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# M031 Series

The NuMicro® M031 series is based on the Arm® Cortex®-M0 core, designed for 1.8V to 3.6V industrial applications. It features high performance and plenty of peripherals, such as 2 MSPS ADC and up to 144 MHz PWM. It also supports IEC-60730 safety specifications. The M031 series supports built-in 16 to 512 Kbytes Flash and 2 to 96 Kbytes SRAM.

## Potential Applications

Industrial Control, High-Precision Meter, Wireless Charger, HMI, IoT Node Device, Security System, Motor Control, Communication System, etc.

## Key Features

Configurable up to 10 UART, 144 MHz PWM, 2 MSPS ADC, 24 MHz SPI, 1-wire UART, OPA, SPROM.

### Specifications

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The NuMicro® M032 series embedded with the Arm® Cortex®-M0 core, designed for 1.8V to 3.6V industrial applications. It equipped high performance and plenty peripheral, such as 2 MspS ADC, up to 144 MHz PWM. It also supports IEC60730 safety specifications and USB support FS Device mode (crystal-less). Built-in 16 to 512 Kbytes Flash, 2 to 96 Kbytes SRAM.

Potential Applications: Mouse, Keyboard, Gaming Monitor, HMI, IoT Node Device, Security System, Motor Control, Communication System, etc.

- **M032 Series**

**Key Features:** Configurable up to 10 UART, 144 MHz PWM, 2 MspS ADC, 24 MHz SPI, 1-wire UART, OTA, USB full speed (Crystal-less), SPROM.

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M031BT Series

The NuMicro® M031BT series is 32-bit microcontroller based on Arm® Cortex®-M0 core with built-in Bluetooth Low Energy 5.0 (BLE 5.0), designed for 1.8V~3.6V industrial applications. It equipped with high performance and plenty of peripherals, such as 2 Msps ADC, up to 96 MHz PWM. Built-in 64/128 Kbytes Flash, 8/16 Kbytes SRAM.

Potential Applications: IoT edge device, Personal healthcare device with wireless connectivity, Smart home appliance with remote control, Dual modes gaming keyboard/ mouse, Assess tracking devices, etc.

Key Features:
- Bluetooth Low Energy 5.0, 96 MHz PWM, 2 Msps ADC, 24 MHz SPI, Support 1-wire UART, Security Protection ROM (SPROM).

M032BT Series

The NuMicro® M032BT series is 32-bit microcontroller based on Arm® Cortex®-M0 core with built-in Bluetooth Low Energy 5.0 (BLE 5.0), designed for 1.8V~3.6V industrial applications. It equipped with high performance and plenty of peripherals, such as 2M sps ADC, up to 144MHz PWM. Built-in 256/512 Kbytes Flash, 64/96 Kbytes SRAM.

Potential Applications: Motor control and access device, IoT edge device, Personal healthcare device with wireless connectivity, Smart home appliances, etc.

Key Features: Bluetooth Low Energy 5.0, 144 MHz PWM, 2 Msps ADC, OTA, USB full speed (Crystal-less)
The NuMicro® M071 series microcontroller is 32-bit microcontroller based on Arm® Cortex®-M0 and is designed for HA applications with 0.65/0.8mm pin-pitch. The series provides 16 to 256 Kbytes Flash memory, 8 to 20 Kbytes SRAM, rich communication interfaces (such as USB, UART, SPI, I2C... etc.), and comes with ADC, comparator and other rich analog interfaces.

**Potential Applications:** Home appliance, Motor control, White goods, Industrial Control

**• M071 Series**

**Key Features:** Hardware Divider, VAI, RTC, EBI, PDMA

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Mini51 Series

The NuMicro® Mini51 series is based on the Arm® Cortex®-M0 core runs at up to 50 MHz with 4 to 32 Kbytes Flash memory and 2/4 Kbytes SRAM. The Mini51 series is equipped with plenty of ADC and PWM for different industrial applications, supporting Low Voltage Reset, Brown-Out Detector, 96-bit Unique ID, and 128-bit Unique Customer ID.

Potential Applications: Wireless Chargers, Home Appliances, Security/Alarms, Temperature Sensors, Motors, Industrial Control, etc.

• Mini51 Series

Key Features: Configurable Data Flash, 2 Kbytes ISP loader

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• Mini55 Series

Key Features: Supports Hardware Divider

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## Mini57 Series

**Key Features:** 2 Sample and Hold ADC, Programmable Gain Amplifier

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## Mini58 Series

**Key Features:** Configurable Data Flash

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M051 Series

The NuMicro® M051 series is based on the Arm® Cortex®-M0 core, equipped with plenty of resources and peripherals, such as 8 to 256 Kbytes Flash, 4 to 20 Kbytes SRAM, and 4/8 Kbytes Flash loader memory for In-System Programming (ISP), up to 20-channel ADC, and 14-channel PWM. It supports Low Voltage Reset, Brown-Out Detector, 96-bit Unique ID and 128-bit Unique Customer ID.

Potential Applications: Industrial Control, Security/Alarms, Temperature Sensors, Motors, etc.

- M051 Series

Key Features: 4 Kbytes Data Flash, Hardware Divider, 4x comparators

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### M0518 Series

**Key Features:** Configurable Data Flash, 24-channel 100 MHz PWM output, 6x UART

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### M0519 Series

**Key Features:** Hardware Divider, Dual ADC, 2x OPAs, 3x Comparators

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### M0564 Series

**Key Features:** Configurable Data Flash, Hardware Divider, Up to 8x UART, 144 MHz PWM output, 800 kSPS ADC

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NUC029 Series

The NuMicro® NUC029 series is designed for industrial applications supported by the robust noise immunity EFT features. It is based on the Arm® Cortex®-M0 core with 5V operating voltage. NUC029 series provides 16 to 256 Kbytes Flash, 2 to 20 Kbytes SRAM, and high performance peripherals such as 12-bit ADC, UART, PWM, SPI, I²C, etc. Specific parts support hardware divider, comparator, and USB 2.0 full speed device (Crystal-less).

Potential Applications: Industrial Control, High-precision Meters, HMI, Motor Control, Communication Systems, etc.

- **NUC029 Series**

  **Key Features:** 5V industrial control, Robust noise immunity EFT 4.4 kV, strong ESD up to HBM 8 kV.

| Part No.   | System Voltage | System Operating Temperature (min) | System Operating Temperature (max) | System Operating Temperature (max) | System Operating Frequency (MHz) | System Memory | Timer/Counter | Analog | Connectivity | Security | Package Type | Package Size | Status Tool | EPROM Flash (KB) | APROM Flash (KB) | Data Flash (KB) | SRAM (KB) | PDMA (ch) | Timer/PWM | SPI | I²C | USCI | SPI/USB | USB FS Device | Package Type | Package Size | Status Tool |
|------------|----------------|----------------------------------|-----------------------------------|-----------------------------------|----------------------------------|----------------|--------------|--------|--------------|----------|--------------|-------------|-------------|----------------|----------------|----------------|-------------|-----------|----------|---------|------|------|-------|--------|----------------|--------------|-------------|-------------|
| NUC029FAE | 2.5            | -55 to 55                        | -40 to 105                        | 2.5                               | 24                               | 16             | 2            | 2      | 4            | 4        | SSOP20       | 4.4x6.5     | NT-NUC029F  |                |                |                |            |          |          |        |      |       |        |        |                |              |             |             |
| NUC029KGE | 2.5            | -55 to 55                        | -40 to 105                        | 2.5                               | 72                               | 256            | 20           | 5      | 4            | 4        | LQFP128      | 14x14       | NT-NUC029KGG |                |                |                |            |          |          |        |      |       |        |        |                |              |             |             |
| NUC029LAN | 2.5            | -55 to 55                        | -40 to 105                        | 2.5                               | 50                               | 64             | 4            | 4      | 8            | -        | LOFP48       | 7x7         | NT-NUC029LD  |                |                |                |            |          |          |        |      |       |        |        |                |              |             |             |
| NUC029LDE | 2.5            | -55 to 55                        | -40 to 105                        | 2.5                               | 50                               | 64             | 4            | 4      | 8            | -        | LOFP48       | 7x7         | NT-NUC029LD  |                |                |                |            |          |          |        |      |       |        |        |                |              |             |             |
| NUC029LEE | 2.5            | -55 to 55                        | -40 to 105                        | 2.5                               | 50                               | 64             | 4            | 4      | 8            | -        | LOFP48       | 7x7         | NT-NUC029LD  |                |                |                |            |          |          |        |      |       |        |        |                |              |             |             |
| NUC029LGE | 2.5            | -55 to 55                        | -40 to 105                        | 2.5                               | 50                               | 64             | 4            | 4      | 8            | -        | QFN48        | 7x7         | NT-NUC029LD  |                |                |                |            |          |          |        |      |       |        |        |                |              |             |             |
| NUC029NAN | 2.5            | -55 to 55                        | -40 to 105                        | 2.5                               | 50                               | 64             | 4            | 4      | 8            | -        | QFN48        | 7x7         | NT-NUC029NA  |                |                |                |            |          |          |        |      |       |        |        |                |              |             |             |
| NUC029SDE | 2.5            | -55 to 55                        | -40 to 105                        | 2.5                               | 50                               | 64             | 4            | 4      | 8            | -        | QFN48        | 7x7         | NT-NUC029SD  |                |                |                |            |          |          |        |      |       |        |        |                |              |             |             |
| NUC029SEE | 2.5            | -55 to 55                        | -40 to 105                        | 2.5                               | 50                               | 64             | 4            | 4      | 8            | -        | QFN48        | 7x7         | NT-NUC029SE  |                |                |                |            |          |          |        |      |       |        |        |                |              |             |             |
| NUC029SGE | 2.5            | -55 to 55                        | -40 to 105                        | 2.5                               | 50                               | 64             | 4            | 4      | 8            | -        | QFN48        | 7x7         | NT-NUC029SG  |                |                |                |            |          |          |        |      |       |        |        |                |              |             |             |
| NUC029TAN | 2.5            | -55 to 55                        | -40 to 105                        | 2.5                               | 50                               | 64             | 4            | 4      | 8            | -        | QFN48        | 7x7         | NT-NUC029TL  |                |                |                |            |          |          |        |      |       |        |        |                |              |             |             |
| NUC029ZAN | 2.5            | -55 to 55                        | -40 to 105                        | 2.5                               | 50                               | 64             | 4            | 4      | 8            | -        | QFN48        | 7x7         | NT-NUC029ZA  |                |                |                |            |          |          |        |      |       |        |        |                |              |             |             |
The NuMicro® NUC121 series is based on the Arm® Cortex®-M0 core with 32 to 256 Kbytes Flash, 8 to 20 Kbytes SRAM, and 4 Kbytes Flash loader memory for In-System Programming (ISP). This series is a standard USB series supporting crystal-less (except NUC123). 48 MHz high speed RC oscillator supports crystal-less USB transfer and 24-channel PWM/BPWM supports external components control. In addition, NUC121 series provides plenty of selections with up to 24-channel PWM and 20-channel ADC.

**Key Features:** Over 4 Kbytes ISP loader, USB 2.0 full speed device crystal-less (except NUC123). NUC125/NUC126 supports voltage adjustable interface (VAI) with individual I/O (1.8V to 5.5V) connecting to the external components allowing flexible for product design.

**Potential Applications:** USB Composite Devices, Gaming Mouse/ Keyboards/ Pads, USB Type-C Earphones, Industrial Automation, IoT devices, etc.

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### NUC125 Series

**Key Features:** Voltage Adjustable Interface from 1.8V to 5.5V, up to 12-channel ADC

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## NUC126 Series

**Key Features:** Up to 12-channel 144 MHz PWM, 800 kSPS 20-channel ADC, Hardware Divider.

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### NUC1262 Series

**Key Features:** Up to 10-channel LED Light Strip Interface (LLSI), Up to 24-channel 72MHz PWM, Up to 9-channel 50mA high sink current, 800kSPS 8-channel ADC, Support 10-channel PDMA

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### NUC130 CAN Series

The NuMicro® NUC130/131/140/230/240 series with CAN Bus is based on the Arm® Cortex®-M0 core with 32 to 128 Kbytes Flash memory, 4 to 16 Kbytes SRAM, and 4/8 Kbytes Flash loader memory for In-System Programming (ISP). This series is designed for CAN applications. It is equipped with a variety of peripherals for general connectivity functions such as LIN, USB 2.0 full speed device, UART, I²C, and ADC. In addition, the NUC130/131/140/230/240 series features Analog Comparator, Low Voltage Reset, and Brown-Out Detector.

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## Nano100 Series

The NuMicro® Nano100 series supports Ultra-Low power consumption. It is based on the Arm® Cortex®-M0 core with 16 to 128 Kbytes Flash, 4 to 16 Kbytes SRAM, and 4 Kbytes Flash loader memory for In-System Programming (ISP). The Nano series integrates COM/SEG LCD controller, RTC, ADC, DAC, USB 2.0 full speed device, ISO 7816-3, and rich peripherals, supporting fast wake-up via different interfaces.

**Key Features:** Ultra-low power and short wake-up time.

**Potential Applications:** Suitable for battery-powered devices such as Smart Wearable Devices, IoT Devices, Portable Medical Devices, Smart Home Appliances, Security Alarms Monitoring, Mobile Payment Smart Card Readers, GPS Data Collector, Wireless Communication (Zigbee, LoRa, etc.), Node Device, Electronic Shelf Label (ESL), RFID, Smart Heat/ Water/ Gas Meters, etc.

### Nano100 Series

**Key Features:** Ultra-low power: 200 μA/MHz (Normal), 75 μA/MHz (Idle), 2.5 μA (Power Down, RTC On, RAM retention) and 1 μA (Power Down, RAM retention) and less than 3.5 μs wake-up time

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<th>APROM Flash (KB)</th>
<th>Data Flash (KB)</th>
<th>SRAM (KB)</th>
<th>PDMA (ch)</th>
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● Nano102 Series

Key Features: Ultra-low power: 150 μA/MHz (Normal), 65 μA/MHz (Idle), 1.5 μA (Power Down, RTC On, RAM retention) and less than 3.5 μs wake-up time

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● Nano103 Series

Key Features: Ultra-low power: 180 μA/MHz (Normal), 75 μA/MHz (Idle), 2 μA (Power Down, RTC On, RAM retention)

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### Nano110 Series

**Key Features:** Integrates 4x40 & 6x38 COM/SEG LCD controller, ultra-low power: 200 μA/MHz (Normal), 75 μA/MHz (Idle), 2.5 μA (Power Down, RTC On, RAM retention) and 1 μA (Power Down, RAM retention) and less than 3.5 μs wake-up time.

### Nano112 Series

**Key Features:** Integrates 4x36 & 6x34 COM/SEG LCD controller, ultra-low power: 150 μA/MHz (Normal), 65 μA/MHz (Idle), 1.5 μA (Power Down, RTC On, RAM retention) and 0.65 μA (Power Down, RAM retention) and less than 3.5 μs wake-up time.
• **Nano120 Series**

**Key Features:** Integrates USB 2.0 FS device interface, ultra-low power: 200 μA/MHz (Normal), 75 μA/MHz (Idle), 2.5 μA (Power Down, RTC On, RAM retention) and 1 μA (Power Down, RAM retention) and less than 3.5 μs wake-up time

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• **Nano130 Series**

**Key Features:** Integrates both 4x40 & 6x38 COM/SEG LCD controller and USB 2.0 FS device interface, ultra-low power: 200 μA/MHz (Normal), 75 μA/MHz (Idle), 2.5 μA (Power Down, RTC On, RAM retention) and 1 μA (Power Down, RAM retention) and less than 3.5 μs wake-up time

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NuMicro® Family Arm® Cortex®-M4 Microcontrollers

The NuMicro Family Cortex-M4 based MCUs provide high performance system design with up to 90-240 DMIPS operating at up to 72-200 MHz. When executing from the embedded Flash memory, the power consumption can be lowered to 130 μA/MHz with dynamic power scaling function supported by the M480 series. EBI supports Intel 8080 panel. With emWin graphics library, designer can easily creates the outstanding graphical user interface.

The NuMicro Family Cortex-M4 based MCUs are composed of the following product series.

**M480 Series**: 192 MHz CPU, up to 512 KB of dual bank Flash memory, up to 160 KB of SRAM memory, SPI Master interface with XIP (eXecute-In-Place), and 16-bit 80QVGA LCD

- M481 Series – 192 MHz PWM, dual SDHC, dual 5 MSPS ADC, and dual 1 MSPS DAC.
- M482 Series – USB 2.0 Full Speed device/host/OTG with integrated OTG PHY and 1 KB data buffer, dual 5 MSPS ADC.
- M483 Series – Dual/Triple CAN 2.0B, dual USB supporting High Speed (HS) OTG and Full Speed (FS) OTG.
- M484 Series – USB 2.0 High Speed device/host/OTG with integrated OTG PHY and 4 KB data buffer, USB 2.0 Full Speed device/host/OTG with integrated OTG PHY and 1 KB data buffer.
- M485 Series – Hardware cryptography engine including ECC-256, AES-256, and SHA-512, random number generator, and dual USB 2.0 device/host/OTG.
- M487 Series – 10/100 Mbps Ethernet MAC with RMII/MDC/MDIO interface, hardware cryptography engine, dual CAN 2.0B, and dual USB 2.0 device/host/OTG.

**M471 Series**: 72/120 MHz CPU, up to 512 Kbytes of dual bank Flash memory, up to 64 Kbytes of SRAM memory, an independent 32 Kbytes of data Flash, wide pin pitch packages, and certified IEC60730-1 Class B Software Test Library (STL)

- M471 V/K Series – 2 MSPS, 12-bit, up to 24 channels SAR ADC, and hardware Customize IR receiver interface
- M471 M/R1/S Series – 1 MSPS, 12-bit, up to 16 channels SAR ADC, USB 2.0 full speed device/host with integrated PHY

**M460 Series**: 200 MHz CPU, up to 1024 KB of dual bank Flash memory, up to 512 KB of SRAM memory, dual peripheral direct memory access (PDMA), programmable serial I/O (PSIO), hyper bus interface (HBI), certified IEC60730-1 Class B Software Test Library (STL), and SPI Master interface with XIP (eXecute-In-Place)

- M463 Series – Quad CAN-FD, USB High Speed (HS) OTG, both with integrated OTG PHY.
- M464 Series – USB High Speed device/host/OTG with integrated OTG PHY and 4 KB data buffer.
- M467 Series – 10/100 Mbps Ethernet MAC with RMII/MDC/MDIO interface, hardware cryptography engine, quad CAN-FD, USB High Speed (HS) OTG and USB Full Speed (FS) OTG, both with on-chip OTG PHY.

**M451 Series**: 72 MHz CPU, up to 256 KB of Flash memory, up to 32 KB of SRAM memory, and Quad-SPI interface

- M451 Series – 144 MHz PWM, 1 MSPS ADC, 1 MSPS DAC
- M452 Series – USB 2.0 Full Speed device/host/OTG with integrated OTG PHY.
- M453 Series – USB 2.0 Full Speed device/host/OTG with integrated OTG PHY, CAN 2.0B

**M480 Series**

The high performance, low power consumption, secure boot and hardware cryptography NuMicro® M480 series Arm® Cortex®-M4F microcontroller supports DSP instruction and integrated floating-point unit (FPU). The dynamic power consumption can be down to 175 or 130 μA/MHz and the standby current can be down to 1 μA. M480 series supports Secure Boot functionality, which provides a constant digital signature of system software for identification during boot up, to protect the integrity of Flash content from attack.

**Potential Applications**: Industrial Automation, Home Automation, Sensor Hub, IoT/IoT Gateway, Access Control, Ethernet Converter, Gaming Accessory, etc.

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### Key Features
- Configurable data flash, Voltage Adjustable Interface, 16+16 bytes UART FIFO for TX/RX, Dual 5 MSPS ADC, USB high speed device/host/OTG with on-chip PHY, Hardware Crypto Engine, 10/100 Mbps Ethernet, Intel 8080 on EBI, ICP/ISP/IAP

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**Microcontrollers**
- **NuMicro® Family Arm® Cortex®-M4 MCUs**

### System Memory Timer Analog Connectivity Security Crypto Package Status Tool
**M471 Series**

NuMicro M471 series is based on Arm® Cortex®-M4F microcontroller supports DSP instruction and integrated floating-point unit (FPU). The dynamic power consumption can be down to 370 µA/MHz and the standby current can be down to 1.6 µA.

Support multiple wide pin pitch packages, certified IEC60730-1 Class B Software Test Library (STL), high immunity characteristics including ESD (HBM) 8 KV and EFT 4.4 KV.

**Potential Applications:** White Goods, Small Home Application, Industrial Automation, Communication System, etc.

**Key Features:**
- Independent 32 Kbytes data flash
- Voltage Adjustable Interface
- 16+16 bytes UART FIFO for TX/RX
- 1.8 MSPS ADC
- USB full speed device/host/OTG with on-chip PHY, Intel 8080 on EBI, ICP/ISP/IAP

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**M460 Series**

The high performance, low power consumption, secure boot and keystore supported NuMicro® M460 series Arm® Cortex®-M4F microcontroller supports DSP instruction and integrated floating-point unit (FPU). The dynamic power consumption can be down to 130 µA/MHz and the standby current can be down to 1 µA. M460 series supports Secure Boot functionality, which provides a constant digital signature of system software for identification during boot up, to protect the integrity of Flash content from attack.

M460 series supports dual peripheral direct memory access (PDMA) design which could significantly increase the data transfer speed inside MCU and the whole system performance.

M460 series provide keystore function which could enhance the key security when encryption and decryption

**Potential Applications:** Smart Factory, Smart Building, Sensor Fusion, IoT/IoT Gateway, Energy Storage System, TFT LCD GUI Control, Ethernet Converter, Gaming Accessory, etc.

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**Key Features:** Configurable data flash, Voltage Adjustable Interface, 16+16 bytes UART FIFO for TX/RX, Triple 5 MSPS ADC, USB high-speed device/host/OTG with on-chip PHY, Hardware crypto engine, 10/100 Mbps Ethernet, Intel 8080 on EBI, ICP/ISP/IAP

### M451 Series

The high immunity NuMicro® M451 series based on the Arm® Cortex®-M4F core supports DSP instruction and integrated floating-point unit (FPU). The dynamic power consumption can be down to 430 μA/MHz and the standby current can be down to 1.6 μA.

**Potential Applications:** Industrial Automation, Home Automation, Motor Control, Communication Systems, USB Accessories, etc.

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M451 Series

The high immunity NuMicro® M451 series are based on the Arm® Cortex®-M4F core supports DSP instruction and integrated floating-point unit (FPU). The dynamic power consumption can be down to 430 μA/MHz and the standby current can be down to 1.6 μA.

**Potential Applications:** Industrial Automation, Home Automation, Motor Control, Communication Systems, USB Accessories, etc.
### Key Features:
Configurable Data flash, Voltage Adjustable Interface, 16+16 bytes UART FIFO for TX/ RX, 1 MSPS ADC, USB full speed device/ host/ OTG with on-chip PHY, Intel 8080 on EBI, ICP/ ISP.

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<tr>
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</tr>
</tbody>
</table>
NUC505 Series

The NuMicro® NUC505 series based on the Arm® Cortex®-M4F core supports DSP instructions and integrated floating-point unit (FPU). The dynamic power consumption can be down to 479 μA/MHz and the standby current can be down to 7 μA. NUC505 series supports internal Audio PLL and internal stereo 24-bit Sigma-Delta audio CODEC with Mic/ Line input and headphone output.

**Potential Applications:** Thermal Printers, GPS Trackers, Wireless Microphones, Security/ Alarms, etc.

**Key Features:** 128-bit Key for Code Protection, 64+64 bytes UART FIFO for TX/ RX, Dual USB, Audio PLL, 24-bit audio CODEC.

### NUC505 Series Part Numbers

<table>
<thead>
<tr>
<th>Part No.</th>
<th>System</th>
<th>Memory</th>
<th>Timer</th>
<th>Analog</th>
<th>Connectivity</th>
<th>Package</th>
<th>Status</th>
<th>Tool</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Operating Frequency (MHz)</td>
<td>Operating Voltage (min) (V)</td>
<td>Operating Voltage (max) (V)</td>
<td>Operating Temperature (min) (℃)</td>
<td>Operating Temperature (max) (℃)</td>
<td>GPIO</td>
<td>APROM Flash (KB)</td>
<td>Data Flash (KB)</td>
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<tr>
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<td>100</td>
<td>3</td>
<td>3.6</td>
<td>-40</td>
<td>85</td>
<td>25</td>
<td>√</td>
<td>2048</td>
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<tr>
<td>NUC505DLA</td>
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<td>3</td>
<td>3.6</td>
<td>-40</td>
<td>85</td>
<td>18</td>
<td>√</td>
<td>512</td>
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<td>3</td>
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<td>3.6</td>
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<td>25</td>
<td>√</td>
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<td>3.6</td>
<td>-40</td>
<td>85</td>
<td>52</td>
<td>√</td>
<td>2048</td>
</tr>
</tbody>
</table>
Nuvoton’s Arm9 Industrial network series offers LQFP packages stacked with 64 to 128 Mbytes DDR memory to reduce PCB size and EMI issues. Rich peripherals include 11 sets of UART, dual Ethernet, SDIO/ eMMC interface, NAND Flash interface, LCD controller, CAN Bus 2.0B interface, and USB 2.0 high speed host/ device controller, allowing flexibility for product design. The Arm9 Industrial network series also integrates the crypto engine which provides hardware acceleration for AES, ECC, RSA, and SHA functions.

**Boot Source:** SPI NOR, SPI NAND, NAND, SD, eMMC, USB

**Potential Applications:** Industrial Control, HMI, Industrial IoT Gateway, Network Printer, Smart Meter, and Smart Home Gateway applications.

<table>
<thead>
<tr>
<th>NUC970/980 Series</th>
<th>EBI</th>
<th>LCD</th>
<th>Crypto Engine</th>
<th>Linux</th>
</tr>
</thead>
<tbody>
<tr>
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<td>✓</td>
<td>-</td>
<td>AES/ECC/RSA/SHA</td>
<td>✓</td>
</tr>
<tr>
<td>NUC980DK</td>
<td>✓</td>
<td>-</td>
<td>AES/ECC/RSA/SHA</td>
<td>✓</td>
</tr>
<tr>
<td>NUC980DR</td>
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<td>-</td>
<td>AES/ECC/RSA/SHA</td>
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</tr>
<tr>
<td>NUC972DF</td>
<td>✓</td>
<td>✓</td>
<td>AES/ECC/SHA/DES/3DES</td>
<td>✓</td>
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<tr>
<td>NUC975DK</td>
<td>✓</td>
<td>-</td>
<td>AES/ECC/SHA/DES/3DES</td>
<td>✓</td>
</tr>
<tr>
<td>NUC976DK</td>
<td>✓</td>
<td>✓</td>
<td>AES/ECC/SHA/DES/3DES</td>
<td>✓</td>
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<tr>
<td>NUC977DK</td>
<td>✓</td>
<td>✓</td>
<td>AES/ECC/SHA/DES/3DES</td>
<td>✓</td>
</tr>
</tbody>
</table>

**Key Features:** MCP industrial DDR in LQFP package, Dual USB high speed host, Dual 10/100M Ethernet MAC.

### NUC970/980 Series

<table>
<thead>
<tr>
<th>Part No.</th>
<th>System</th>
<th>Memory</th>
<th>Timer</th>
<th>Analog</th>
<th>Connectivity</th>
<th>Security</th>
<th>Crypto</th>
<th>Crypto</th>
<th>Package</th>
<th>Status</th>
<th>Tool</th>
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<td>85℃</td>
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<td>H/L16</td>
<td>1 1 2 ✓</td>
<td>- ✓</td>
<td>2 -</td>
<td>LQFP16</td>
<td>24x24</td>
</tr>
<tr>
<td>NUC980DF71YC</td>
<td>300 MHz</td>
<td>3.63 V</td>
<td>-40℃</td>
<td>85℃</td>
<td>16 128 6 8 8 10 2 1 2 4 4 2</td>
<td>H/L16</td>
<td>1 1 2 ✓</td>
<td>- ✓</td>
<td>2 -</td>
<td>LQFP16</td>
<td>24x24</td>
</tr>
<tr>
<td>NUC980DK63YC</td>
<td>300 MHz</td>
<td>3.63 V</td>
<td>-40℃</td>
<td>85℃</td>
<td>92 64 6 8 8 10 2 1 2 4 4 2</td>
<td>H/L16</td>
<td>1 1 2 ✓</td>
<td>- ✓</td>
<td>2 -</td>
<td>LQFP16</td>
<td>24x24</td>
</tr>
<tr>
<td>NUC980DK71YC</td>
<td>300 MHz</td>
<td>3.63 V</td>
<td>-40℃</td>
<td>85℃</td>
<td>92 16 28 6 8 10 2 1 2 4 4 2</td>
<td>H/L16</td>
<td>1 1 2 ✓</td>
<td>- ✓</td>
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<td>85℃</td>
<td>40 16 64 6 5 2 8 2 - 2 2 2 1</td>
<td>H/L16</td>
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<td>✓ ✓</td>
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<td>146 56 6 4 8 11 2 - 2 2 2 -</td>
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<tr>
<td>NUC972DF71YC</td>
<td>300 MHz</td>
<td>3.63 V</td>
<td>-40℃</td>
<td>85℃</td>
<td>146 56 6 5 8 11 2 - 2 2 2 -</td>
<td>1 1 2 ✓</td>
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<td>LQFP16</td>
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<td>146 56 6 5 8 11 2 - 2 2 2 -</td>
<td>1 1 2 ✓</td>
<td>✓ ✓</td>
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<tr>
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<td>3.63 V</td>
<td>-40℃</td>
<td>85℃</td>
<td>80 56 6 4 4 10 2 - 2 2 1 2 -</td>
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<td>✓ ✓</td>
<td>1 16bit</td>
<td>LQFP16</td>
<td>24x24</td>
<td>✓</td>
</tr>
<tr>
<td>NUC977DK63YC</td>
<td>300 MHz</td>
<td>3.63 V</td>
<td>-40℃</td>
<td>85℃</td>
<td>87 56 6 4 8 2 - 2 2 1 2 -</td>
<td>1 1 1 ✓</td>
<td>✓ ✓</td>
<td>1 16bit</td>
<td>LQFP16</td>
<td>24x24</td>
<td>✓</td>
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</table>
N9H Series

The HMI emWin N9H series is based on the ARM926EJ-S core. CPU operates at up to 300 MHz respectively. Multi Chip Package (MCP) with SDRAM, size ranging from 2 to 128 Mbytes. The MCP could significantly reduces PCB size and electromagnetic interference (EMI) to minimize system design efforts and shorten the product design cycle time.

The N9H series Board Support Package (BSP) comes with licensed industrial leading emWin embedded graphical user interface (GUI) library, containing emWin library, samples, tools, and documents. Nuvoton licenses it from SEGGER to allow developers to create smooth, professional, high quality graphical user interface (GUI).

**Boot Source:** SPI NOR, NAND, SD, eMMC

**Potential Applications:** Industrial control, smart building, smart appliances, medical devices, chargingpile, and consumer products

**Key Features:** MCP Memory up to 128 Mbytes, LCD resolution up to 1024x768 24-bit RGB, free-to-use emWin graphic library.

<table>
<thead>
<tr>
<th>Series</th>
<th>CPU (MHz)</th>
<th>LCD</th>
<th>Video CODEC</th>
<th>Audio DAC</th>
<th>Ethernet</th>
<th>CAN</th>
<th>Operating Temp</th>
<th>Linux</th>
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</thead>
<tbody>
<tr>
<td>N9H20</td>
<td>200</td>
<td>16 / 24bit</td>
<td>JPEG</td>
<td>√</td>
<td>-</td>
<td>-</td>
<td>-20°C to 85°C</td>
<td>√</td>
</tr>
<tr>
<td>N9H26</td>
<td>240</td>
<td>24bit</td>
<td>JPEG H.264</td>
<td>√</td>
<td>√</td>
<td>-</td>
<td>-20°C to 85°C</td>
<td>√</td>
</tr>
<tr>
<td>N9H30</td>
<td>300</td>
<td>24bit</td>
<td>JPEG</td>
<td>-</td>
<td>√</td>
<td>√</td>
<td>-40°C to 85°C</td>
<td>√</td>
</tr>
</tbody>
</table>

**Part No.**

| N9H20K11N | 200 | 2.97 | 3.63 | -20 | 85 | 8 | 2 | 4 | 2 | 4 | 3 | 2 | 2 | 1 | 3 | H**1** | D**1** | - | - | - | 24bit | √ | JPEG | LQFP128 | 14x14 | √ | NK-N9H20 |
| N9H20K31N | 200 | 2.97 | 3.63 | -20 | 85 | 8 | 8 | 4 | 2 | 4 | 3 | 2 | 2 | 1 | 3 | H**1** | D**1** | - | - | - | 24bit | √ | JPEG | LQFP128 | 14x14 | √ | NK-N9H20 |
| N9H20K51N | 200 | 2.97 | 3.63 | -20 | 85 | 8 | 32 | 4 | 2 | 4 | 3 | 2 | 2 | 1 | 3 | H**1** | D**1** | - | - | - | 24bit | √ | JPEG | LQFP128 | 14x14 | √ | NK-N9H20 |
| N9H20R11N | 200 | 2.97 | 3.63 | -20 | 85 | 44 | 8 | 2 | 4 | 2 | 4 | - | - | 2 | 1 | 1 | 1 | H**1** | D**1** | - | - | - | 16bit | √ | JPEG | TQFP64-EP | 10x10 | √ | NK-N9H20 |
| N9H26K53N | 240 | 2.97 | 3.63 | -20 | 85 | 80 | 8 | 64 | 4 | 4 | 4 | 7 | 2 | 2 | 1 | 3 | H**2+D**1 | - | 1 | - | 24bit | √ | JPEG/ H.264 | LQFP128 | 14x14 | √ | NK-N9H26 |
| N9H30F63IEC | 300 | 2.97 | 3.63 | -40 | 85 | 146 | 56 | 64 | - | 5 | 4 | - | 8 | 11 | 2 | 2 | 2 | 2 | - | H**1+H/D**1 | 1 | 2 | 24bit | √ | JPEG | LQFP216 | 24x24 | √ | NK-N9H30 |
| N9H30F71IEC | 300 | 2.97 | 3.63 | -40 | 85 | 146 | 56 | 128 | - | 5 | 4 | - | 8 | 11 | 2 | 2 | 2 | 2 | - | H**1+H/D**1 | 1 | 2 | 24bit | √ | JPEG | LQFP216 | 24x24 | √ | - |
| N9H30K63IEC | 300 | 2.97 | 3.63 | -40 | 85 | 86 | 56 | 64 | - | 5 | 4 | - | 5 | 9 | 2 | 2 | 2 | 1 | 2 | - | H**1+H/D**1 | 1 | 1 | 1 | 16bit | √ | JPEG | LQFP128 | 14x14 | √ | NK-N9H30 |
N329 Series

Designed for cost-effective solutions targeting consumer electronics, the ARM926EJ-S based SoC is embedded with various hardware accelerators and useful peripherals. All part numbers come up with a unique Multi-Chip Package (MCP) in the LQFP footprint, which is ideal in terms of several key design factors: high performance, small dimension, much less EMI, high production yield, and lower BOM cost.

Boot Source: SPI NOR, NAND, SD, eMMC

Key Features: 2D GFX, H.264/ JPEG CODEC, LQFP MCP Memory up to 64 Mbytes, LCD Display, Built-in Audio CODEC.

<table>
<thead>
<tr>
<th>Part No.</th>
<th>System</th>
<th>Memory</th>
<th>Timer</th>
<th>Analog</th>
<th>Connectivity</th>
<th>Display</th>
<th>Package</th>
<th>Status</th>
<th>Tool</th>
</tr>
</thead>
<tbody>
<tr>
<td>N32903K5DN</td>
<td>200 2.97 3.63 -20 85 70 8 8 4 2 4 3 2 2 1 3 H1 D1 - 1 24bit √ JPEG</td>
<td>LQFP128 14x14</td>
<td>√</td>
<td>ND-N32905</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>N32905K5DN</td>
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<td>LQFP128 14x14</td>
<td>√</td>
<td>ND-N32905</td>
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<td></td>
</tr>
<tr>
<td>N32901R1DN</td>
<td>200 2.97 3.63 -20 85 34 8 32 4 2 4 2 1 2 1 - 2 H1 D1 - 1 - - √ JPEG</td>
<td>LQFP64 10x10</td>
<td>√</td>
<td>ND-N32905</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>N32903R5DN</td>
<td>200 2.97 3.63 -20 85 34 8 8 4 2 2 1 2 1 - 2 H1 D1 - 1 - - √ JPEG</td>
<td>TQFP64-EP 10x10</td>
<td>√</td>
<td>ND-N32905</td>
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<td></td>
</tr>
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<td>N32905R3DN</td>
<td>200 2.97 3.63 -20 85 34 8 32 4 2 4 2 1 2 1 - 2 H1 D1 - 1 - - √ JPEG</td>
<td>TQFP64-EP 10x10</td>
<td>√</td>
<td>ND-N32905</td>
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<tr>
<td>N32903U5DN</td>
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<td>√</td>
<td>ND-N32905</td>
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<tr>
<td>N32905U3DN</td>
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<td>LQFP128 14x14</td>
<td>√</td>
<td>ND-N32905</td>
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<tr>
<td>N32926U6DN</td>
<td>240 2.97 3.63 -20 85 80 8 64 4 4 4 7 2 2 1 3 H1 D1 - 1 24bit √ JPEG/H.264</td>
<td>LQFP128 14x14</td>
<td>√</td>
<td>ND-N32926</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
As a leading supplier of 8051 microcontrollers, Nuvoton offers a variety of products with a great price-performance ratio which is critical to the success of consumers and industrial products. The 8-bit microcontrollers are equipped with rich peripherals to meet various system requirements and are supported by the toolchain from world-leading tool makers for rapid product development.

ML51 low power series provides up to 64 Kbytes and 4 Kbytes SRAM. The operating current is 80 µA/MHz and the power-down current can be as low as 0.8 µA.

ML51 - Basic low power line
ML54 - Low power with an LCD driver line
ML56 - Low power with LCD driver and Touch key line

MS51 series is suitable for cost-conscious applications by being based on the 1T 8051 core and rich peripherals in various compact packages. GPIO is equipped with 20 mA high sink current. This series provides high immunity 8 kV ESD.

**MS51 Industrial Control Series (1T)**

Nuvoton’s compact 8-bit microcontroller MS51 series is suitable for cost-conscious applications by being based on the 1T 8051 core and rich peripherals in various compact packages.

**Potential Applications:** Industrial Control, Battery Packs, Home Appliances, LED Control, Consumer Devices, etc.

<table>
<thead>
<tr>
<th>Part No.</th>
<th>System</th>
<th>Memory</th>
<th>Timer</th>
<th>Analog</th>
<th>Connectivity</th>
<th>Security</th>
<th>Package</th>
<th>Status</th>
<th>Tool</th>
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<td>MS51BA9AE</td>
<td>16/24 2.4 5.5 -40 105 8</td>
<td>4 8</td>
<td>Shared with APROM 1K + 256 (B)</td>
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<td>4 5 5 2 - 1 1 128</td>
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<tr>
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<td>4 8</td>
<td>Shared with APROM 1K + 256 (B)</td>
<td>√</td>
<td>4 5 8 2 - 1 1 128</td>
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<tr>
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<td>16/24 2.4 5.5 -40 105 26</td>
<td>4 16</td>
<td>Shared with APROM 2K+256 (B)</td>
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<td>4 12 15 2 3 1 1</td>
<td>TSSOP28 4.4x9.7</td>
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NuMicro® Family 8051 MCUs

ML51 / ML54 / ML56 Low-power Series

NuMicro® ML51 series based on the 1T 8051 core is suitable for low power and high performance applications. The internal voltage reference and analog comparator can support portable devices, where power consumption is critical.

Key Features: The operating current can support 80 µA/MHz, 15 µA power consumption for low power run mode, 13 µA for low power idle mode, 0.8 µA (at 3.3V) for Power-down mode, 10 µs fast wake-up time, high immunity (8 kV ESD, 4 kV EFT), 20 mA large sink current, making this series also ideal for industrial applications.

Potential Applications: Industrial Control, Home Appliances, Thermostats, Smart Door Locks, HMI, Battery Packs, Medical Devices, etc.

● ML51 Low Power Series

<table>
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<tr>
<th>Part No.</th>
<th>System</th>
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<th>Timer</th>
<th>Analog</th>
<th>Connectivity</th>
<th>Security</th>
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ML51 / ML54 / ML56
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### ML56 Low Power Touch Key Series

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As a leading supplier of 8051 microcontrollers (MCUs), Nuvoton offers a variety of products with the best-in-class price/performance critical to the success of consumers and industrial products. The 8-bit MCU comes equipped with rich peripherals to meet various system requirements and is supported by the tool chain from world leading tool makers for rapid product development.

**Key Features:** N76E N79E series offer high-value features by integrating high resolution of ADC, power management circuit such as LDO, POR and BOD.

### N76E Series (1T)

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<th>Connectivity</th>
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## N79E Series (4T)

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<th>Connectivity</th>
<th>Display</th>
<th>Package</th>
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<th>Tool</th>
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The Nuvoton standard 8051 series is based on 6/12 cycle core structure, providing 22.1184 MHz internal oscillator (1% accuracy at 25°C, 5V), Data Flash configurable and high immunity (8 kV ESD, 4 kV EFT).

Potential Applications: Industrial Control, Power Management, etc.

Key Features: 16 to 64 Kbytes Flash, with sufficient IO, pin supports from 40 to 48. Standard line also includes energy management circuit such as LDO, POR, and BOD.

### N78E Series

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<th>Data Flash (Kbytes)</th>
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<th>ISP</th>
<th>INT</th>
<th>PWM (8-bit)</th>
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<th>Special Function</th>
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