Panasonic
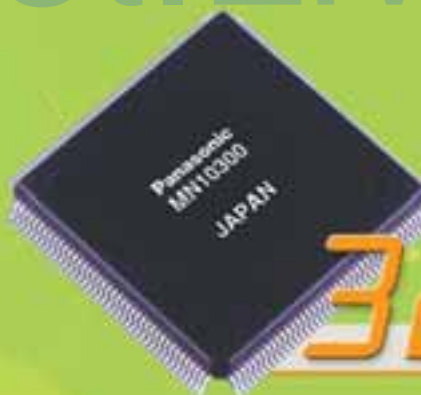
ideas for life

Microcomputer Family
AM Series

8-bit AM1 Series

16-bit AM2 Series

32-bit AM3 Series

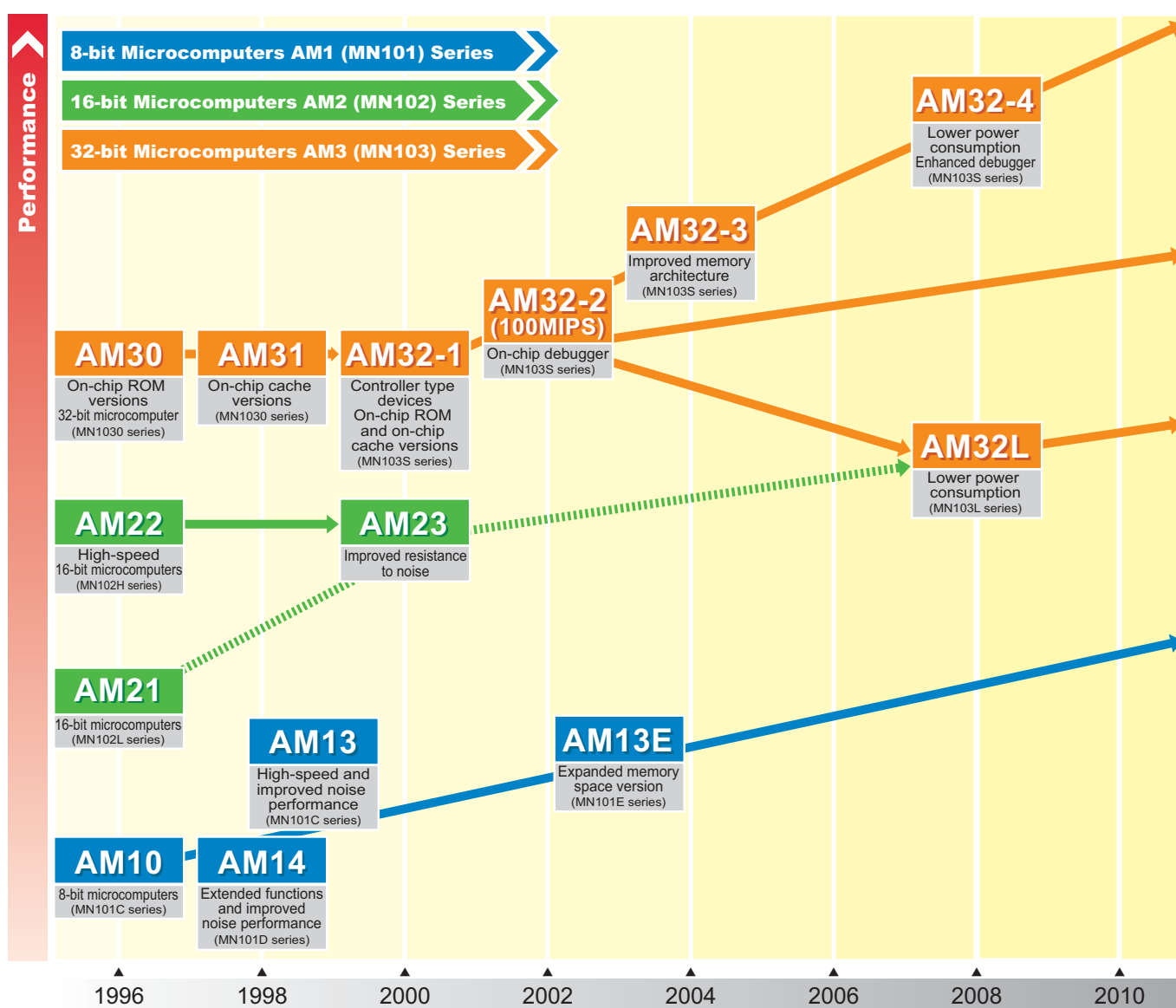**Delivers Improved Performance and Cost Savings**

Unified Microcomputer Architecture

Common architecture shared by 8-, 16-, and 32-bit models

The products of a rigorous analysis of embedded device software and system needs, the Panasonic AM1 (MN101), AM2 (MN102), and AM3 (MN103) Series signal a new concept in microcomputer design.

With 8-, 16-, and 32-bit models that share a unified architecture, these microcomputers combine high performance with low power consumption in a package that supports C-language programming for a fast, efficient development cycle. They feature a single development environment and are suitable for a wide range of applications, including high-performance embedded controllers and key devices in multimedia hardware.

Performance

8-bit Microcomputers AM1 (MN101) Series

16-bit Microcomputers AM2 (MN102) Series

32-bit Microcomputers AM3 (MN103) Series

AM32-4
Lower power consumption
Enhanced debugger
(MN103S series)

AM32-3
Improved memory architecture
(MN103S series)

AM32-2 (100MIPS)
On-chip debugger
(MN103S series)

AM30
On-chip ROM versions
32-bit microcomputer
(MN1030 series)

AM31
On-chip cache versions
(MN1030 series)

AM32-1
Controller type devices
On-chip ROM and on-chip cache versions
(MN103S series)

AM32L
Lower power consumption
(MN103L series)

AM22
High-speed 16-bit microcomputers
(MN102H series)

AM23
Improved resistance to noise

AM21
16-bit microcomputers
(MN102L series)

AM13
High-speed and improved noise performance
(MN101C series)

AM13E
Expanded memory space version
(MN101E series)

AM10
8-bit microcomputers
(MN101C series)

AM14
Extended functions and improved noise performance
(MN101D series)

1996 1998 2000 2002 2004 2006 2008 2010

Small ROM Sizes
Simpler Structure for Faster Execution

1

CONTENTS

Description

- C Language Oriented Microcomputer
- Microcomputer with Flash-memories
- Microcontrollers with Improved Resistance to Noise

8-bit AM1 (MN101) Series

- C Language Oriented Architecture
- High-Speed Extended Memory Space Series (MN101E Series)
- Series Lineup (8-bit microcomputer product lineup development plans)
- AM1 (MN101) 8-bit Single-chip Microcontroller Series Specifications

16-bit AM2 (MN102) Series

- C Language Oriented Architecture
- High Performance, Low Power Consumption
- Built-in Multiplier
- Application to DVD-system
- Series Lineup (16-bit microcomputer product lineup development plans)
- AM2 (MN102) 16-bit Single-chip Microcontroller Series Specifications

32-bit AM3 (MN103) Series

- C Language Oriented Architecture
- High Performance, Greater Efficiency
- Multimedia Support
- Low Power Series (MN103L Series)
- Series Lineup (32-bit microcomputer product lineup development plans)
- AM3 (MN103) 32-bit Single-chip Microcontroller Series Specifications

Development Environments

- PanaXSeries®
- Optimizing C Compilers
- DebugFactory® Builder
- PanaX NEO On-Board Debugging Environment
- In-Circuit Emulator
- New MN103L Series In-Circuit Emulators
- MN101C/E Series In-Circuit Emulators
- Flash Programmer (PX-FW2)
- Products of Business Partners
- Development Support Tools
- Business Partner

Technical Information

C Language Oriented Architecture

C

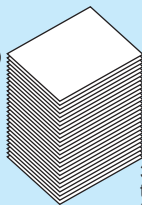### Develop systems efficiently in C
Program development is 3-10 times faster

Past — Assembler program
Syntax dependent on the microcomputer

```
        cmp (ram1),(ram2)
        bgt $label
        mov (ram5),r0
        sub (ram4),r0
        jmp $label2
label   mov (ram5),r0
        add (ram4),r0
label2  mov r0,(ram3)
```
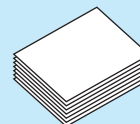
3-10 times the development time

Future — C language program
Easy to read

```
if(a>b)
   c=d+e;
else
   c=d-e;
```

The C programming language makes it easier and faster to program large systems, but generates more code than assembler. Larger code size in turn means higher ROM costs and slower execution speed. Panasonic eliminates this tradeoff with its C language-oriented microcomputers, which combine a true microcomputer architecture with a highly optimized C compiler to achieve unprecedented code efficiencies. This combination minimizes the size of the resulting code while retaining the threefold to tenfold development speed advantage afforded by the C programming language. The approach yields efficient system development in C over the entire range of 8-, 16-, and 32-bit microcomputers.

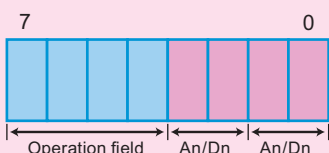# C Language Oriented Microcomputer for

[Higher Performa

High Performance

High

Single-cycle execution for higher throughput

New instruction code assignments
Basic instructions (register-to-register operations, load/store operations) fit within a single byte.

```
7                          0
```
Operation field | An/Dn | An/Dn

An : Address register field   Dn : Data register field

Conventional code assignment for general register instruction
Because register field take up six bits, it is impossible to fit the instruction into a single byte.

```
15              8 7                0
```
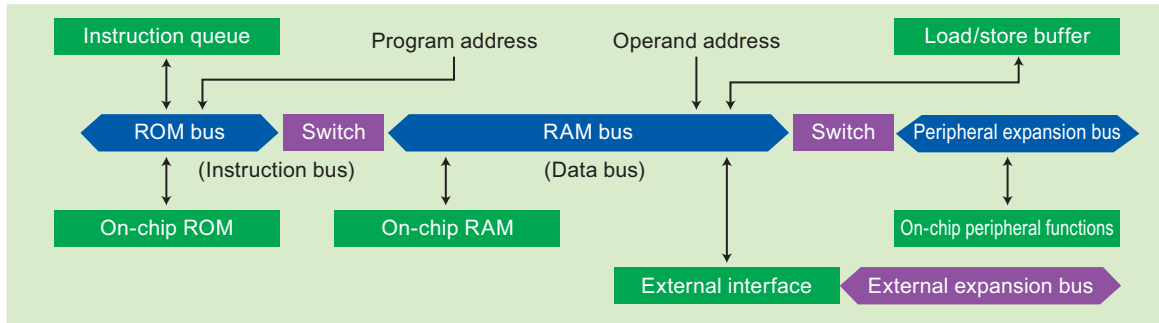Operation field | GRn | Operation field | GRn
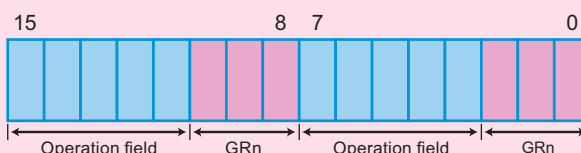
GRn : General register field

The register set represents a careful balancing of hardware needs against C compiler code generation efficiency. From the eight available registers, the instruction format requires four bits to specify registers. As a result, the architecture assigns the basic instructions most frequently used in C code to single bytes. The compiler uses register optimization techniques to maximize the efficiency of register usage. Finally, a high-performance pipeline executes these instructions at the rate of one every machine cycle.

Low Power Consumption

Low

Optimized internal bus design lowers power consumption
AM1 (MN101), AM2 (MN102) bus conversion

Instruction queue	Program address	Operand address		Load/store buffer

ROM bus — Switch — RAM bus — Switch — Peripheral expansion bus

(Instruction bus) (Data bus)

On-chip ROM — On-chip RAM — On-chip peripheral functions

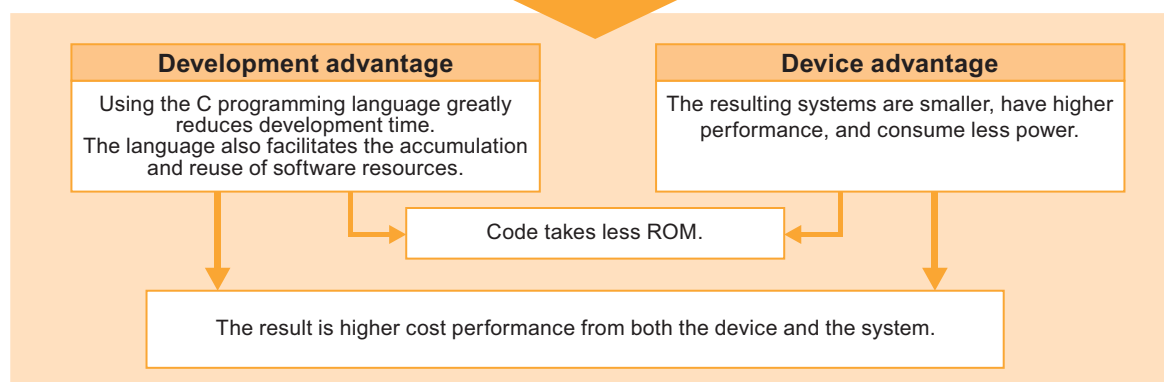External interface — External expansion bus

The CPU features separate buses for instructions and data, and even provides a separate bus for expanding the latter for use with on-chip peripheral functions.

nce] + [Faster Development]

We Match Your Needs. You Don't Have to Match Ours.

Result : Greatly Reduced System Costs

Using an AM Series C language oriented microcomputers

Development advantage

Using the C programming language greatly reduces development time.
The language also facilitates the accumulation and reuse of software resources.

Device advantage

The resulting systems are smaller, have higher performance, and consume less power.

Code takes less ROM.

The result is higher cost performance from both the device and the system.

These C language oriented microcomputers (the AM Series) offer twin advantages to system development. First, they permit program development in C, a language that cuts development time. Secondly, they help reduce system costs by fitting programs into smaller ROM spaces. The result is higher cost performance from systems that are smaller, have higher performance, and consume less power.
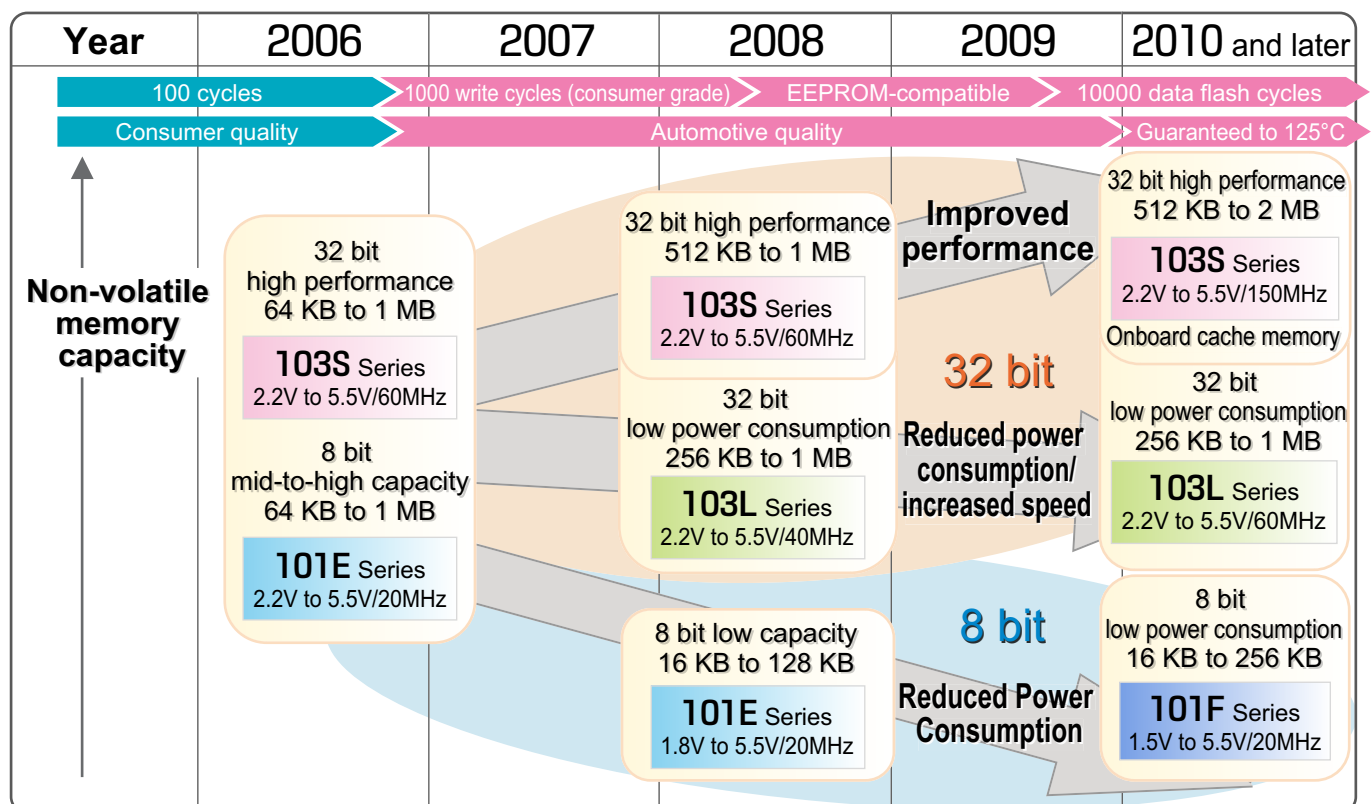
Microcomputer with Flash-memories

The World Microcomputers with Flash Memory Expands

Road Map of Microcomputers with Flash Memory

As the development period of equipment becomes shorter, it is increasingly necessary that system control microcomputers be equipped with flash memory that can be substituted for the mask ROM. This is because conventional microcomputers are unable to meet the customers' requirements, for example, to rewrite the program after the microcomputer is mounted on the equipment and to shorten the lead time after the ROMs have been ordered.

Microcomputers with flash memory allow the programs to be rewritten even after being mounted on the equipment. This helps reduce the equipment system development period.
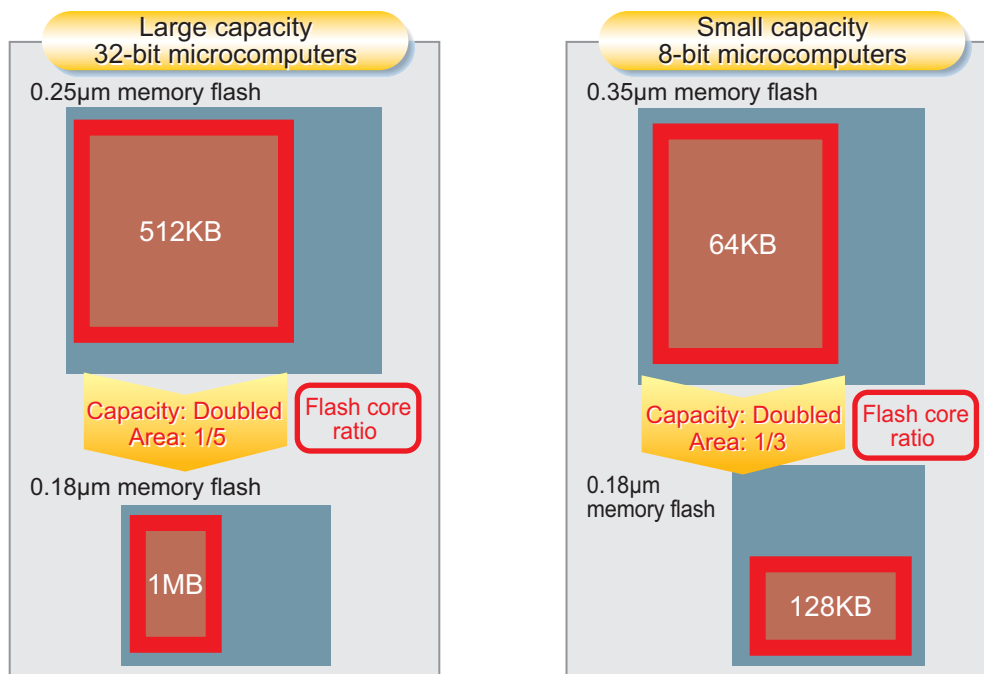
Features of our microcomputers with flash memory are not limited to this. They also help make audio equipment and household electrical appliances more sophisticated and compact, and consume less power.

Year	2006	2007	2008	2009	2010 and later

100 cycles → 1000 write cycles (consumer grade) → EEPROM-compatible → 10000 data flash cycles

Consumer quality → Automotive quality → Guaranteed to 125°C

Non-volatile memory capacity

2006
32 bit
high performance
64 KB to 1 MB
103S Series
2.2V to 5.5V/60MHz

8 bit
mid-to-high capacity
64 KB to 1 MB
101E Series
2.2V to 5.5V/20MHz

2008
32 bit high performance
512 KB to 1 MB
103S Series
2.2V to 5.5V/60MHz

32 bit
low power consumption
256 KB to 1 MB
103L Series
2.2V to 5.5V/40MHz

8 bit low capacity
16 KB to 128 KB
101E Series
1.8V to 5.5V/20MHz

Improved performance

32 bit
Reduced power consumption/ increased speed

8 bit
Reduced Power Consumption

2010 and later
32 bit high performance
512 KB to 2 MB
103S Series
2.2V to 5.5V/150MHz
Onboard cache memory

32 bit
low power consumption
256 KB to 1 MB
103L Series
2.2V to 5.5V/60MHz

8 bit
low power consumption
16 KB to 256 KB
101F Series
1.5V to 5.5V/20MHz

Our 0.18µm Flash Core Opens The Way to Tomorrow

The world's smallest memory cell technology used in microcomputer onboard flash memory achieves a 10 to 1 surface ratio reduction (for flash area: 1MB).

When our microcomputers equipped with a 0.18µm flash memory are compared to those with a conventional 0.25µm flash memory, the ROM capacity is doubled while the area is reduced to one fifth, providing excellent cost-effectiveness.
This is achieved through our 0.18µm flash core being developed using the world's smallest class memory cell technology.

Large capacity
32-bit microcomputers

0.25µm memory flash

512KB

Capacity: Doubled
Area: 1/5

Flash core ratio

0.18µm memory flash

1MB

Small capacity
8-bit microcomputers

0.35µm memory flash

64KB

Capacity: Doubled
Area: 1/3

Flash core ratio

0.18µm
memory flash

128KB

* As of Novemver 2005

High-Performance Worthy to be Called "Eco-microcomputers"

Lower Power Consumption

Large capacity microcomputers

High-speed processing of internal 60 MHz with
achieving industry-leading levels of
low power consumption
• 180 mW (60 MHz/3.0 V) .... 1 mA/MHz

Small capacity microcomputers

Performance at the maximum level in the 8-bit class
with low power consumption
• 18 mW (20 MHz/3.0 V) .... 0.3 mA/MHz
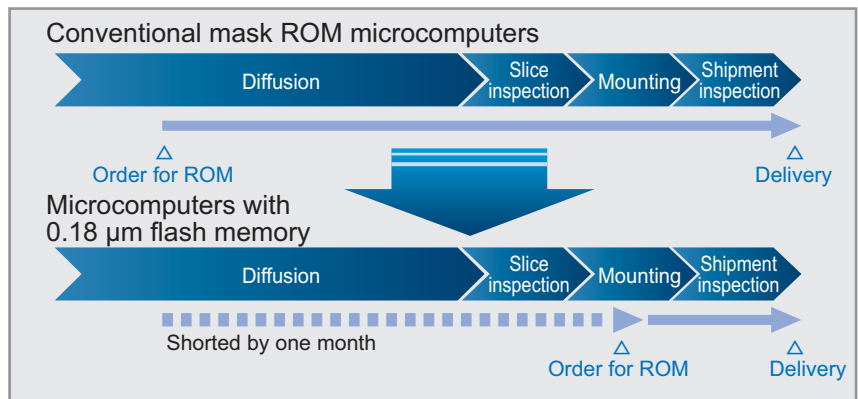• Minimum instruction execution time 50 ns(2.7 V to 3.6 V)

Shorter Lead Time Reduces Development Risks

Shipment with ROM Data Written in A Short Lead Time

Shortens the lead time from receipt of ROM data to shipment by one month

Microcomputers with flash memory reduce the lead time by approximately one month compared to the conventional mask ROM by installing ROM data immediately during mounting.

It is also possible to write the programs in our production lines or at our business partners.

Conventional mask ROM microcomputers

| Diffusion | Slice inspection | Mounting | Shipment inspection |

△ Order for ROM

△ Delivery

Microcomputers with 0.18 µm flash memory

| Diffusion | Slice inspection | Mounting | Shipment inspection |

Shorted by one month

△ Order for ROM

△ Delivery

More Diversified and Convenient Program Environment

Simple Rewriting Program Development

Simplifies development for users' original rewriting program (e.g. writing to PC) using JEDEC compliant command format

- Supports rewriting using JEDEC compliant command format
- Provides samples of rewriting programs
- Rewriting from the serial port specified by users is possible without any special tools.
- Optimal for rewriting at shipment lines or service departments

For conventional microcomputers with flash memory, it was necessary to create a complicated waveform using the software to rewrite the built-in flash memories.

New microcomputers with a 0.18µm flash memory are able to rewrite programs using the JEDEC compliant command format, so the rewriting program can be created easily. We can also provides samples of rewriting programs.

- Conventional microcomputers

Needs complicated waveform using software

| MCU core | Built-in flash memory |

- Microcomputers with 0.18 µm flash memory

Uses JEDEC compliant command format

| MCU core | Built-in flash memory |

Command
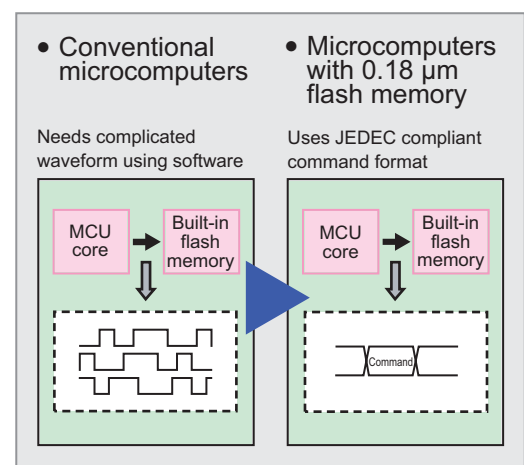
Secure Guard of Important Software

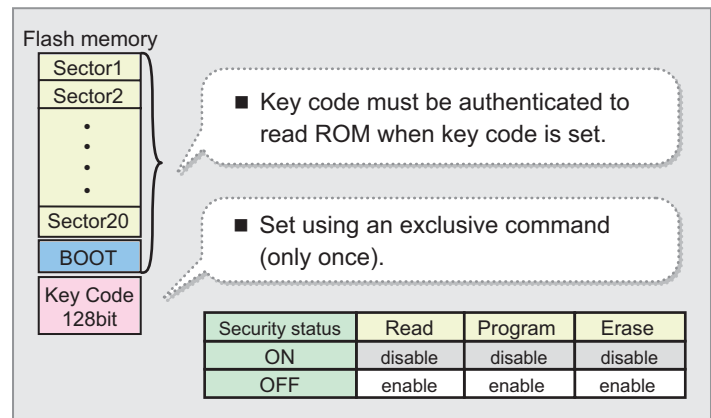# Reliable Security Function

Equipped with a protection function to prevent unauthorized access to ROM code

- A key code (128 bits) storage area is provided.
- Only one setting of key code is available.
- The key code must be authenticated using an exclusive command to read the ROM data.
- Shipment is possible with security information set.

The 0.18μm flash core has a 128 bit key code. Writing this key code prevents the ROM data from being read by third parties.

The key code can be written only once. The flash memory with a key code written to it cannot be accessed unless the key code is authenticated.

Accordingly, persons that do not have the key code cannot read the ROM data using programming various tools. Executing instructions from the CPU or reading ROM data via executed commands are, of course, possible without the key code.

Flash memory

Sector1
Sector2
•
•
•
Sector20
BOOT
Key Code 128bit

■ Key code must be authenticated to read ROM when key code is set.

■ Set using an exclusive command (only once).

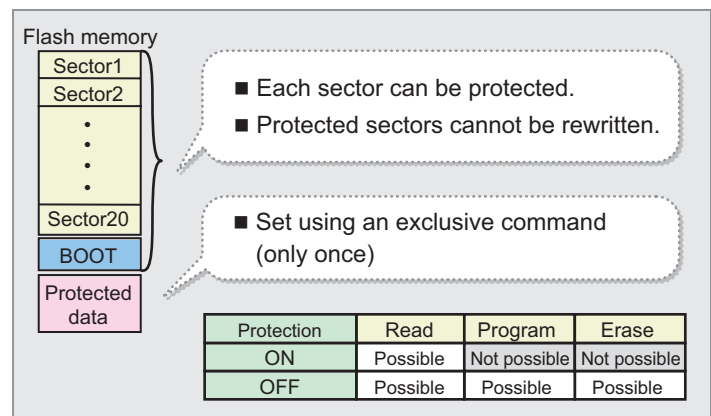| Security status	Read	Program	Erase
ON	disable	disable	disable
OFF	enable	enable	enable

Protection Function

The writable area is limited to protect data even when the microcomputer has runaway.

- A protected data storage area is provided.
- Each sector is protected using an exclusive command (only once).
- Shipment is possible with protect data set.
- The protected sector cannot be rewritten.

The 0.18μm flash core has a protection function. This function prevents the flash memory being rewritten accidentally even when the microcomputer has runaway.

Once the protection for the protection data area is set to [ON], each sector can be protected. The protection data area can be written only once.

The protected sector cannot be rewritten, so the memory data will not be damaged even when the program has runaway.

Flash memory

Sector1
Sector2
•
•
•
Sector20
BOOT
Protected data

■ Each sector can be protected.
■ Protected sectors cannot be rewritten.

■ Set using an exclusive command (only once)

Protection	Read	Program	Erase
ON	Possible	Not possible	Not possible
OFF	Possible	Possible	Possible

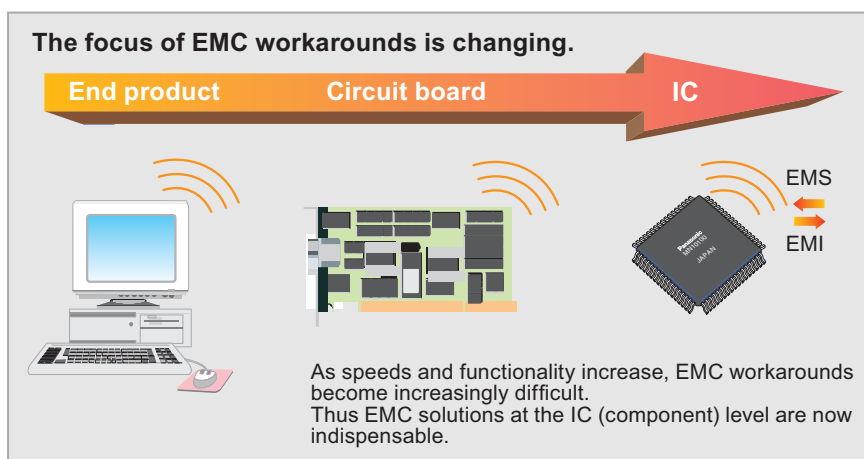# Microcontrollers with Improved Resistance to Noise

Why is Electromagnetic Compatibility (EMC) So Important Now?

The IC, as the center of control in modern electronic equipment, plays a crucial role supporting progress in this equipment. As the functionality provided by the latest electronic equipment continues to advance, even higher integration levels and even higher speeds are required in their ICs. At the same time, the popularity of portable electronic equipment has led to demands for further miniaturization and lower operating voltages. To respond to these needs and demands, IC fabrication processes have moved to ever finer feature sizes, progressing in tandem with other IC developments.

Due to these advances, IC malfunctions due to noise is becoming a significant issue, and inadequate electromagnetic compatibility (EMC: the ability to operate in the presence of noise) is now the focus of much concern.

Since EMC problems largely depend on the PCB design, until now, EMC problems have been seen as an issue for end product design, and workarounds have largely focused on the end product. However, due to the lower voltages and higher speeds of the latest equipment, it has become harder then ever to distinguish between noise and normal signals. At the same time, the increasing functionality of advanced ICs has made analyses related to EMC more difficult, and this in turn makes workarounds in the end product harder to achieve.

With today's shorter product cycles, the time and effort required to achieve the required EMC at the end product level has become a significant factor, and improved resistance to noise at the independent IC level is becoming increasingly important.

The focus of EMC workarounds is changing.

End product Circuit board IC

EMS
EMI

As speeds and functionality increase, EMC workarounds become increasingly difficult.
Thus EMC solutions at the IC (component) level are now indispensable.

EMC Standards for ICs

In Japan, EMC standards for electronic equipment as end products are regulated by a variety of laws covering electromagnetic radiation and consumer products. Radio Low, Electrical Appliance and Material Control Low, or similar laws are in force around the world, such as the IEC regulations on electronic equipment that have been in force in Europe since 1996.

In contrast, EMC standards for electronic device such as ICs are still at the stage where the IEC is working on the standardization of test procedures. Although evaluation procedures have been standardized for EMI, study has only just begun on electromagnetic susceptibility (EMS).

In addition to EMI measurement in conformance with the standards being developed, Panasonic is also developing evaluation methods for EMS such as those described below and preparing an environment that will allow independent evaluation of ICs.

Panasonic's Original Noise Immunity Evaluation Methods

Panasonic models the noise entering an IC as being of two types: conductive noise and radiation noise, and aims at standardization with common programs and noise evaluation boards that improve observability to eliminate dependence on the user's mounting boards and software.

Test	DC line noise test	Loop radiation noise test
Presumed noise	Direct noise from the power supply or IC pins	Indirect noise transmitted across space
Overview	Noise waveform V_N — Noise simulator — Oscillator circuit — DC power supply — IC — LED — The IC is monitored for incorrect operation.	Noise waveform V_N — Current — Radiation probe — Noise simulator — Electromagnetic field — Oscillator circuit — DC power supply — IC — LED — The IC is monitored for incorrect operation.

EMS Countermeasures (EMS: Electromagnetic Susceptibility)

Technologies for reduced EMS for improved noise immunity characteristics

Causes of IC Malfunctions

The ICs used in electronic equipment are subject to a wide range of noise sources. These include power supply noise, electrostatic noise (ESD), radio noise, and spark noise from high-voltage components in the vicinity.

These noise signals enter the end product through power supply lines and the chassis, affect the PCBs the ICs are mounted on, and finally impinge on the ICs.

The following phenomena are thought to cause IC malfunctions in this type of environment.

(1) Noise is superimposed on the input signals, the IC is unable to distinguish between noise and the actual input signals, and as a result, the IC malfunctions.

(2) Power supply level fluctuations cause internal signal levels to fluctuate and the IC to malfunction.
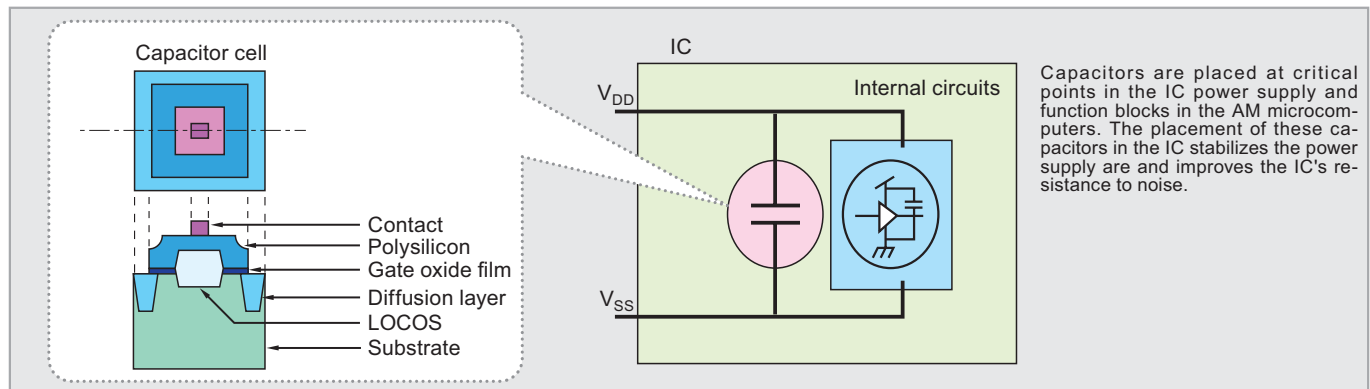
■ What is the noise that enters ICs?
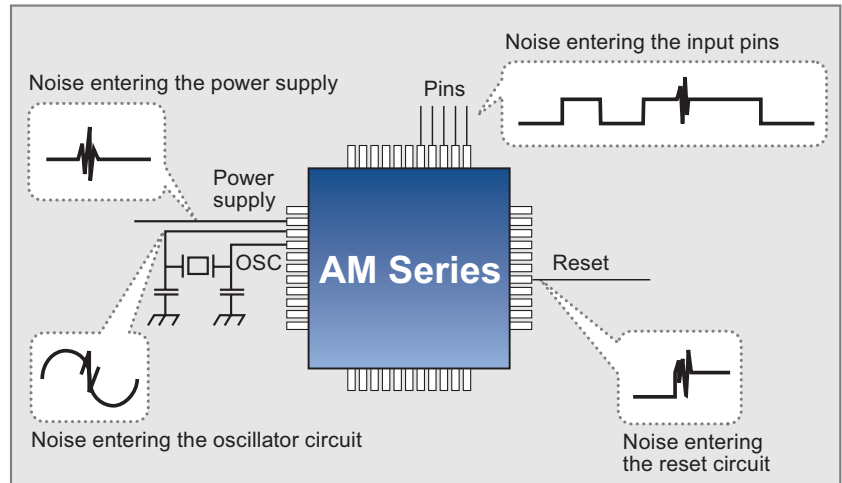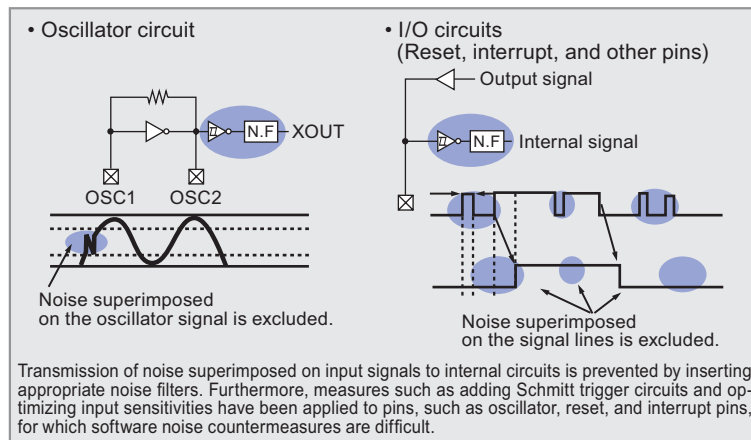

Enhancements to Noise Immunity Characteristics

Panasonic has enhanced the noise immunity of the AM microcomputers based on the following points.

(1) Improved immunity to noise superimposed on input signals: Strengthening the ability to reject noise on the oscillator, reset, and interrupt signal pins.

(2) Improved immunity to power supply fluctuations: Fabricating capacitors internally on the chip itself to both improve power supply stability and to suppress fluctuations in the power supply levels.

(3) AM microcomputer operating mode stabilization: Additional failsafe measures have been implemented to handle rare and unexpected malfunctions.
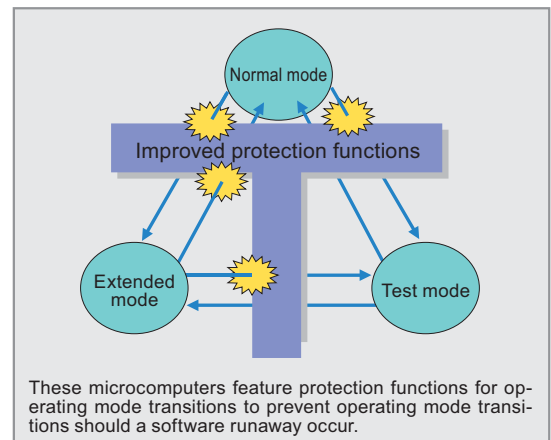
■ Improved resistance to power supply noise

Capacitors are placed at critical points in the IC power supply and function blocks in the AM microcomputers. The placement of these capacitors in the IC stabilizes the power supply are and improves the IC's resistance to noise.

■ Improved resistance to input signal noise

Transmission of noise superimposed on input signals to internal circuits is prevented by inserting appropriate noise filters. Furthermore, measures such as adding Schmitt trigger circuits and optimizing input sensitivities have been applied to pins, such as oscillator, reset, and interrupt pins, for which software noise countermeasures are difficult.

■ Improved protection functions

These microcomputers feature protection functions for operating mode transitions to prevent operating mode transitions should a software runaway occur.

# EMI Countermeasures (EMI: Electromagnetic Interference)

Reduction of extraneous radiation using EMI suppression technology

Causes of EMI Emission in Electronic Equipment

ICs used in electronic equipment handle digital signals and generate harmonic currents. It is thought that the PCBs, wiring harnesses, and chassis in application systems act as antennas and radiate these high-frequency signals to the surrounding environment.

Of these, the supply currents associated with internal logic operation show little attenuation, since these are upper harmonics of a fundamental that is the operating frequency, and as a result can easily cause problems.
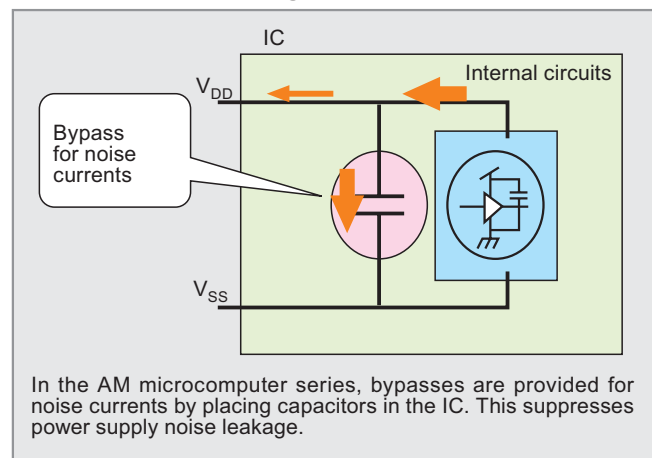
■ **EMI generation mechanisms**
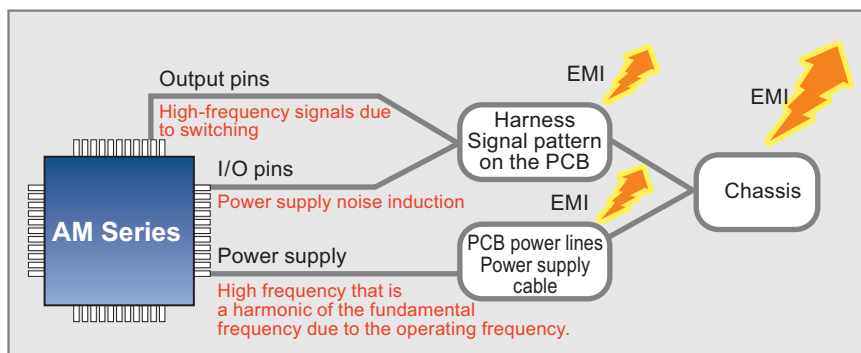
EMI Reduction Measures

The following EMI reduction measures are implemented in the AM microcomputers.

(1) Improved decoupling capacitors: High-frequency noise leakage is suppressed by forming capacitors on the chip internal power supply lines.

(2) Current smoothing: IC internal peak currents were reduced by implementing gated clock circuits, optimizing the clock driver circuits, and other measures.

(3) Power supply isolation: Interference due to internal noise is prevented by isolating the CPU, I/O system, and analog system power supplies. Furthermore, the noise power itself is reduced by achieving both reduced power consumption and reduced EMS. In addition, it is now possible to create EMI countermeasures early in the IC design stage with EMI prediction technologies that use power supply current analysis technologies.

■ **Improved decoupling capacitors**

In the AM microcomputer series, bypasses are provided for noise currents by placing capacitors in the IC. This suppresses power supply noise leakage.

■ **Current smoothing**

Noise source countermeasures
(Suppressing instantaneous currents)

- Optimization of clock drive transistor sizes
  Actual delay simulation is used to determine the optimum size.
- Pin current capacity optimization

Low-voltage operation that achieves both reduced power consumption and reduced EMS in the AM microcomputer series reduces the power of the noise itself.
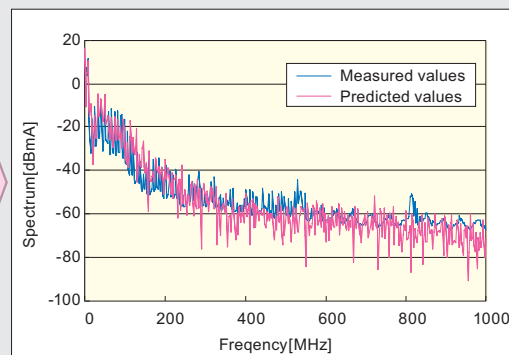
■ **EMI prediction technology based on EDA**

Power supply currents are calculated using single-chip simulation, and the EMI of the final product is predicted based on waveform analysis.
This allows the desired EMI characteristics to be built into the product from the design stage.
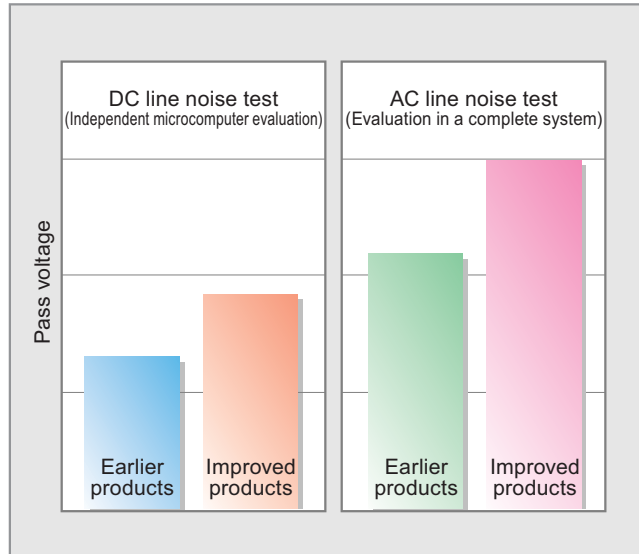
Examples of Improved EMC Performance

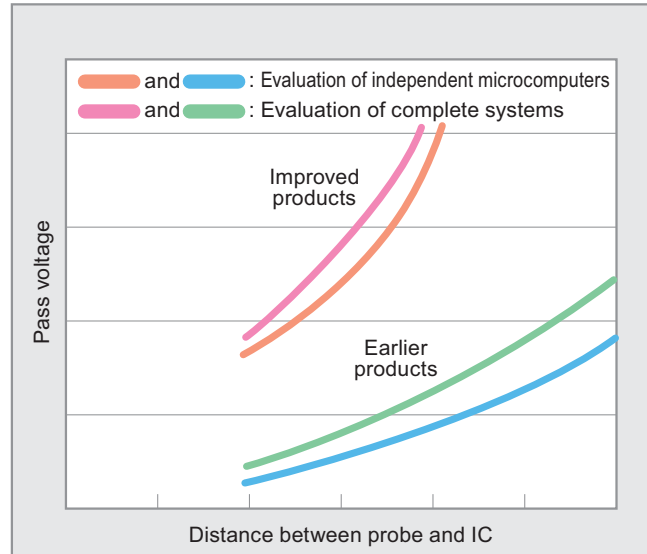## Achievement of both high noise immunity and low EMI

Examples of Improved Noise Immunity

Panasonic has achieved a significant improvement in noise immunity over earlier products. Despite progress in process feature sizes, Panasonic has achieved even further improvements in voltage handling capacity, and has assured better noise immunity than provided by earlier improved products, even in low-voltage process devices.

■ Power line noise test

DC line noise test
(Independent microcomputer evaluation)

AC line noise test
(Evaluation in a complete system)

Pass voltage

Earlier products | Improved products

Earlier products | Improved products

■ Loop radiation noise test

and : Evaluation of independent microcomputers
and : Evaluation of complete systems

Pass voltage

Improved products

Earlier products
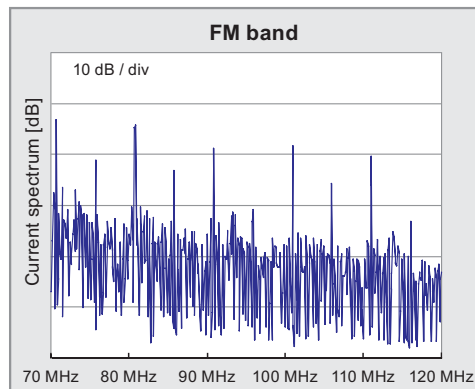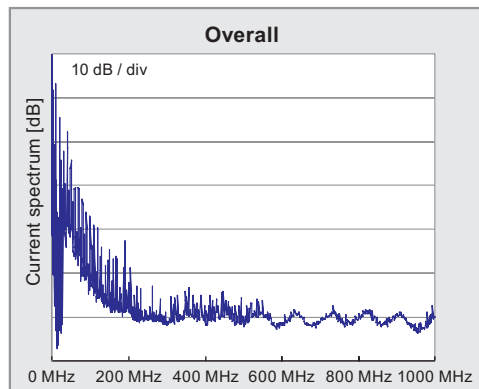
Distance between probe and IC

The DC line noise and loop radiation noise test methods were developed by Panasonic, and are based on two models, one for noise transmitted to the IC via conduction and one for noise transmitted to the IC via radiation.
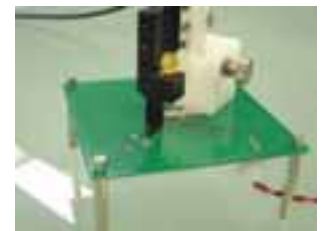To eliminate dependency of the test result on the application program, these tests are standardized with a common program that improves observability and a dedicated noise evaluation board.

Examples of Reduced EMI

■ Earlier products (Test results using the MP method)

Overall

10 dB / div

Current spectrum [dB]

0 MHz   200 MHz   400 MHz   600 MHz   800 MHz 1000 MHz

FM band

10 dB / div

Current spectrum [dB]
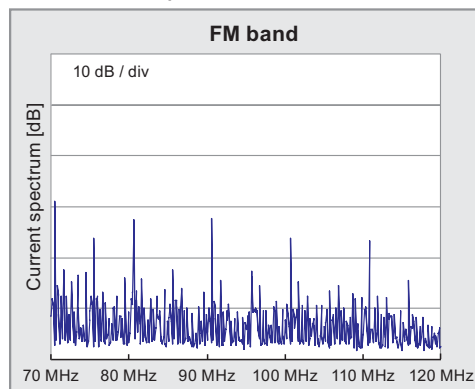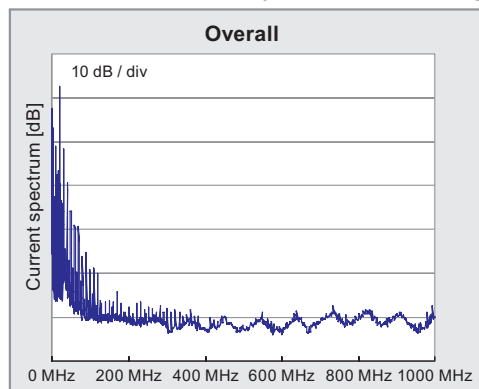
70 MHz   80 MHz   90 MHz   100 MHz   110 MHz   120 MHz

* The MP method is one of the IC EMI evaluation methods currently being considered by the IEC.
The IC power supply current is measured using a shielded loop antenna. (IEC61967-6)

EMI measurement test for the MP method

■ Improved version (Test results using the MP method)

Overall

10 dB / div

Current spectrum [dB]

0 MHz   200 MHz   400 MHz   600 MHz   800 MHz 1000 MHz

FM band

10 dB / div

Current spectrum [dB]

70 MHz   80 MHz   90 MHz   100 MHz   110 MHz   120 MHz

8-bit
AM1 (MN101) Series

C Language Development for 8-bit High-performance Microcomputers

The AM1 Series of 8-bit microcomputers allows short-time program development in the C programming language. Its half-byte instruction set and other architectural features yield ROM code sizes that are small enough to rival those achieved with assembly language.

These devices are compact and have low power consumptions, yet offer high-speed operation with a minimum instruction execution time of 100 ns (at 5 V,3 V)[1] and 50 ns(at 5 V, 3 V).[2]

These microcomputers are suitable for a wide range of applications demanding high cost performance. The MN101 Series consists of the MN101C, MN101D, and MN101E Series.

*1:MN101C Series, *2:MN101E Series

C Language Oriented Architecture

Programs in C the same size or smaller as those in assembler

Powerful architectural features such as a half-byte instruction set and handy addressing, plus aggressive code optimization mean that the C compiler can generate ROM code that is the same size or smaller as that produced using assembly language. (This conclusion is based on comparison with previous Panasonic microcomputers.)
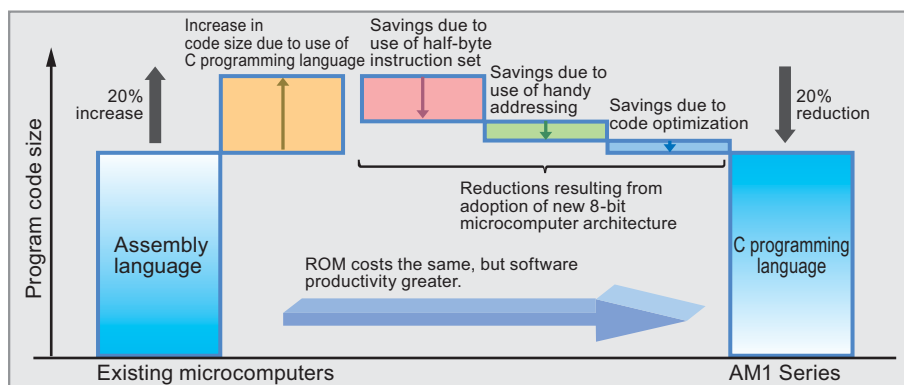

Half-byte Instruction Set

The Series adopts a variable-word length approach with basic instructions 1 byte long and extensions only 4 bits long. Since the resulting instruction set permits the specification of such operands as branch offsets and immediate values in units of four bits, instructions are shorter. Program sizes are therefore smaller.

Variable words length in half-byte (4-bit)

Instruction format
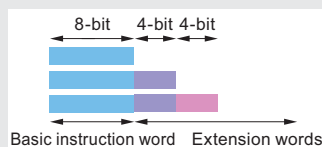
Instructions packed in storage
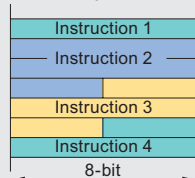
Conventional instruction formats
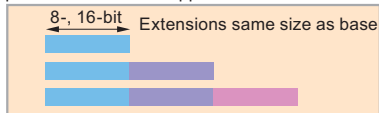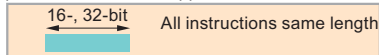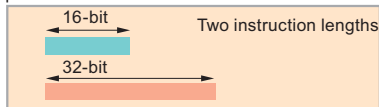
Handy Addressing

This technique focuses on the point that when variable data in memory is manipulated, load and store instructions will, in many cases, be to the same address. This technique allows the code size to be reduced by omitting the store instruction operand.

Reuse of address from immediately preceding instruction
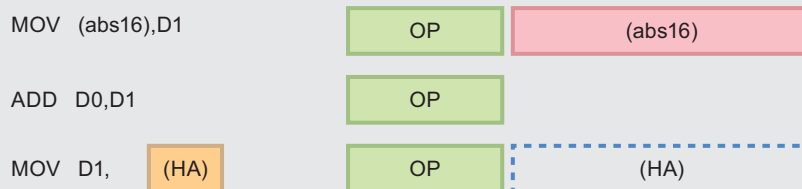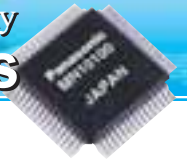
Evaluation of handy addressing performance in application code

Percentage of cases where handy addressing can be used

1390

117

Applicability ratio: 8.4%

| 0 | 200 | 400 | 600 | 800 | 1000 | 1200 | 1400 | [Number of instructions] |
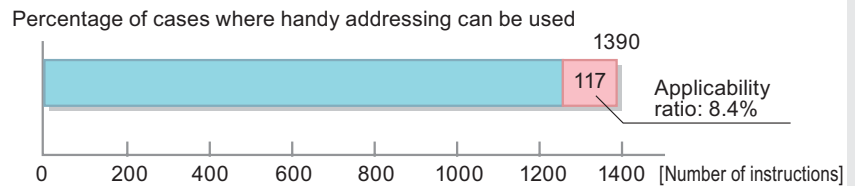
Object Code Generation Efficiency for Applications Written in C

Legend:
- AM1
- Company A
- Company B

Y-axis: 2.0, 1.8, 1.6, 1.4, 1.2, 1.0, 0.8, 0.6, 0.4, 0.2, 0

Application 1   Application 2   Application 3
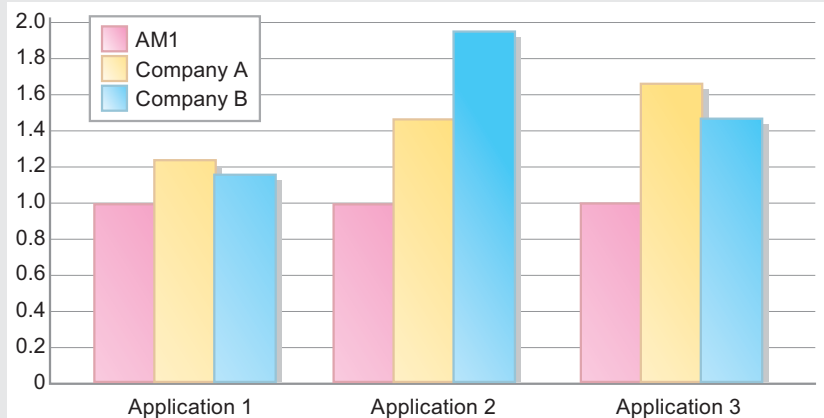
High-Speed Extended Memory Space Series (MN101E Series)

This series is upwardly compatible with the MN101C Series.

1 MB Linear Address Space

The 1 MB address space allows these microcontrollers to support more advanced and sophisticated systems.

	Memory space	Maximum on-chip ROM	Maximum on-chip RAM	Maximum internal clock frequency	Minimum instruction execution cycle
MN101C Series	256 KB	244 KB	11.75 KB	10 MHz	100 ns
MN101E Series	1 MB	944 KB	64 KB (Allocated in separate banks)	20 MHz	50 ns

Memory space (Y-axis): 1MB, 256KB, 64KB

AM13E

AM13

Clock frequency (Processing performance): 10MHz, 20MHz

14

Series Lineup (8-bit microcomputer product lineup development plans)

Models that respond to application needs

* For more information about product availability, see the specifications list.

Flash
Mask ROM
ROM (byte)

ADC Built-in Type

MN101CFB6G
MN101CB6x 128 K
32 K, 64 K, 124 K

MN101CFD0G
MN101CD0x 128 K
32 K, 64 K, 124 K

MN101C42x
8 K, 16 K

MN101C30x
24 K, 32 K

MN101CF95G
MN101C28x 128 K
32 K, 48 K, 64 K, 96 K

MN101C457
16 K

MN101C539
24 K

MN101CF61G
MN101C61x 128 K
64 K, 128 K

MN101CF97D
MN101C97x 64 K
32 K, 64 K

MN101CF91D
64 K

MN101CF62G
MN101C62x 128 K
64 K, 96 K

MN101CF94D
MN101C94A 64 K
32 K

MN101CF67G
MN101C67x 128 K
64 K, 128 K

MN101EF16x
MN101E16x 260 K, 512 K
256 K, 384 K

MN101EF34D
68 K

MN101CFA7D
MN101CA7A 64 K
32 K

MN101EF51A
32 K

MN101EF52A
32 K

ADC-DAC Built-in Type

MN101CF49K
MN101C49x 224 K
128 K, 160 K, 224 K

MN101CF77G
MN101C77x 128 K
32 K, 48 K, 64 K, 96 K

MN101EF01M
MN101E01x 384 K
192 K, 256 K, 320 K, 384 K

VTR Servo

MN101DF06Z
MN101D06x 224 K
96 K, 128 K, 160 K

MN101DF09G
MN101D09E 128 K
80 K

MN101DF07Z
MN101D07x 224 K
128 K, 160 K

MN101DF08G
MN101D08E 128 K
80 K

MN101DF10G
MN101D10x 128 K
96 K, 128 K

| 32pin | 42,44,48pin | 64pin | 80,84pin | 100pin | 112pin |

AM1 (MN101) Series

	42,44,48pin	64pin	80,84pin	100pin	112pin	128pin
Voice control				MN101EF30R / MN101E30x 928 K / 508 K, 928 K; MN101EF59R / MN101E59R 928 K / 928 K		
LCD Driver Built-in Type	MN101CF78A / MN101C78A 32 K	MN101EF58G / MN101EF32D 128 K / 64 K; MN101C48x 8 K, 16 K; MN101CF58D / MN101C58x 64 K / 24 K, 32 K; MN101CF84D / MN101C84A 64 K / 32 K; MN101CF73A / MN101C73A 32 K / 32 K; MN101CFA2D / MN101CA27 64 K / 16 K	MN101EF57G / MN101EF31x / MN101E31x 128 K / 64 K, 128 K / 64 K, 128 K; MN101C39C 48 K; MN101CF54D / MN101C54x 64 K / 32 K, 48 K; MN101CF66G / MN101C66x 128 K / 64 K, 128 K; MN101CF70D / MN101C70C 64 K / 48 K	MN101EF56G / MN101EF29G / MN101E29G 128 K / 128 K / 128 K; MN101C38x 32 K, 48 K; MN101CF57D / MN101C57x 64 K / 48 K, 64 K; MN101CF74G / MN101C74x 128 K / 96 K, 128 K		MN101EF46R / MN101E46x 928 K / 128 K, 508 K, 928 K
FL Driver Built-in Type		MN101CF87G / MN101C87x 128 K / 32 K, 64 K		MN101CFA3G / MN101CA3F 128 K / 96 K; MN101CF88G / MN101C88x 128 K / 64 K, 128 K		
USB Function	MN101EF35x / MN101E35x 32 K, 68 K / 32 K, 68 K			MN101CF93K / MN101C93K 224 K		
In-vehicle networking		MN101EF63G 128 K		MN101EF49N / MN101E49K 512 K / 256 K		

In addition to offering the usual choice of packages, number of pins, and on-chip memory capacity, the Series is expanding to add new models that incorporate peripheral functions specific to application needs. Examples of such functions include FL and LCD drivers.

Functional Enhancements to MN101D Series

● Enhanced multiply/divide: The Series now supports multiplication of two 16-bit operands and division of a 32-bit quantity by a 16-bit divisor.

● Multitasking support: The hardware supports automatic task switching for up to four tasks.
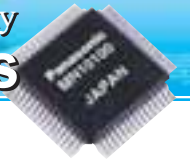
Major Application Areas

Home information appliances, audio-visual equipment, game machines, information and communications equipment, general home appliances, computer peripherals, health products etc.

■ AM1 (MN101) 8-bit Single-chip Microcontroller Series Specifications

Category	Part No.	Internal ROM Type	ROM (byte)	RAM (byte)	Minimum Instruction Execution Time (µs)/ Operationg Voltage (V)	Package	Number of I/O Ports [At single chip mode]	Interrupt Sources	8-bit Timer	16-bit Timer	19-bit Timer	Synchronous Type / UART	Synchronous Type / I²C	Synchronous Type	UART	I²C	A/D Converter (ch)	D/A Converter (ch)	Display Control Function
ADC Built-in Type	MN101C28A	M	32K	1.5K	0.1/4.5 - 5.5 125/2.0 - 5.5	LQFP080-P-1414A QFP084-P-1818E TQFP080-P-1212D	70	18	5	1	0	1	1	1	0	0	8	—	—
	MN101C28C		48K	2K															
	MN101C28D		64K																
	MN101C28F		96K	4K		LQFP080-P-1414A													
	MN101C28L			10K															
	MN101CP28D	E	64K	2K	0.1/4.5 - 5.5 125/2.3 - 5.5	LQFP080-P-1414A QFP084-P-1818E TQFP080-P-1212D													
	MN101CP28L		96K	10K		LQFP080-P-1414A													
	MN101C309	M	24K	1K	0.1/4.5 - 5.5 125/2.0 - 5.5	LQFP064-P-1414	54	17	5	1	0	1	0	1	0	0	8	—	—
	MN101C30A		32K	1.5K	0.1/4.5 - 5.5 125/2.0 - 5.5														
	MN101CP30A	E			0.1/4.5 - 5.5 125/2.7 - 5.5														
	MN101C425	M	8K	0.25K	0.1/4.5 - 5.5 0.477/2.0 - 5.5	QFP044-P-1010F	37	11	3	1	0	1	0	0	0	0	8	—	—
						SDIP042-P-0600C	36	11											
					0.1/4.5 - 5.5 125/2.0 - 5.5	TQFP048-P-0707B	39	12										
	MN101C427		16K	0.5K	0.1/4.5 - 5.5 0.477/2.0 - 5.5	QFP044-P-1010F	37	11											
						SDIP042-P-0600C	36												
					0.1/4.5 - 5.5 125/2.0 - 5.5	TQFP048-P-0707B	39	12										
	MN101CP427	E			0.1/4.5 - 5.5 0.238/2.7 - 5.5	QFP044-P-1010F	37	11											
						SDIP042-P-0600C	36												
						TQFP048-P-0707B	39	12										
	MN101C457	M	16K	0.5K	0.1/4.5 - 5.5	QFP044-P-1010F	37	11	3	1	0	1	0	0	0	0	8	—	—
	MN101CP427	E			0.1/4.5 - 5.5 0.238/2.7 - 5.5														
	MN101C539	M	24K	0.5K	0.1/4.5 - 5.5 62.5/2.0 - 5.5	TQFP048-P-0707B	40	14	3	1	0	1	0	0	0	0	8	—	—
	MN101CP539	E			0.1/4.5 - 5.5 62.5/2.7 - 5.5														
	MN101C61D	M	64K	3K	0.1/2.5 - 3.6 0.2/2.1 - 3.6 125/1.8 - 3.6	TQFP080-P-1212D	68	25	7	1	0	1	1	1	0	0	6	—	—
	MN101C61G																		
	MN101CF60G	F	128K	12K	0.1/2.5 - 3.0 0.2/2.2 - 3.0 125/2.2 - 3.0														
	MN101CF61G				0.1/2.7 - 3.6 0.2/2.7 - 3.6 125/2.7 - 3.6														
	MN101C62D	M	64K	2K	0.1/4.5 - 5.5 0.25/2.7 - 5.5 62.5/2.0 - 5.5	LQFP080-P-1414A	68	25	6	2	0	2	1	0	0	0	8	—	—
	MN101C62F		96K	4K															
	MN101CF62G	F	128K	10K	0.1/4.5 - 5.5 0.25/2.7 - 5.5 62.5/2.5 - 5.5														
	MN101C67D	M	64K	6K	0.1/2.5 - 3.6 0.2/2.1 - 3.6 62.5/1.8 - 3.6	TQFP080-P-1212D	69	26	6	1	0	2	1	1	0	1	7	—	—
	MN101C67G		128K	10K															
	MN101CF67G	F			0.1/2.7 - 3.6														
	MN101CF91D	F	64K	4K	0.1/2.7 - 3.6 62.5/2.7 - 3.6	TQFP048-P-0707B	37	26	6	2	0	2	1	0	0	0	6	—	—
	MN101C94A	M	32K	1K	0.1/4.5 - 5.5 0.238/2.7 - 5.5 0.477/2.0 - 5.5	QFP044-P-1010F	37	13	5	1	0	1	0	0	0	0	8	—	—
	MN101CF94D	F	64K	2K	0.1/4.5 - 5.5 0.238/2.7 - 5.5 0.477/2.5 - 5.5														
	MN101CF95G	F	128K	6K	0.1/2.7 - 3.6 62.5/2.7 - 3.6	TQFP080-P-1212D	67	30	7	2	0	3	2	0	0	0	11	—	—
	MN101C97A	M	32K	1K	0.5/1.8 - 3.6 62.5/1.8 - 3.6	QFP044-P-1010F △ TQFP048-P-0707B	38	20	5	1	0	1	1	0	0	0	8	—	—
	MN101C97D		64K																
	MN101CF97D	F																	
	MN101CA7A	M	32K	2K	0.1/2.7 - 3.6 62.5/1.8 - 3.6	TQFP048-P-0707B	35	22	5	1	0	1	1	0	0	1	8	—	—
	MN101CFA7D	F	64K			TQFP048-P-0707B ○													
	MN101CB6A	M	32K	1K	0.1/2.7 - 3.6 0.125/1.8 - 3.6 100/1.8 - 3.6	SSOP032-P-0300B	17	15	5	1	0	1	0	0	0	0	5	—	—
	MN101CB6D		64K	2K															
	MN101CB6G		124K																
	MN101CFB6G	F	128K			SSOP032-P-0300B ▲													
	MN101CD0A	M	32K	1K	0.1/2.7 - 3.6 0.125/1.8 - 3.6 100/1.8 - 3.6	SSOP032-P-0300B	23	18	5	1	0	1	0	0	0	0	5	—	—
	MN101CD0D		64K	2K															
	MN101CD0G		124K																
	MN101CFD0G	F	128K			SSOP032-P-0300B ▲													
	MN101E16K	M	256K	12K	0.059/2.7 - 3.6 30.6/2.7 - 3.6	LQFP100-P-1414 QFP100-P-1818B	85	27	9	1	0	3	2	0	0	0	8	—	—
	MN101E16Y		384K	20K		QFP100-P-1818B													
	MN101EF16K	F	260K	16K		LQFP100-P-1414 QFP100-P-1818B													
	MN101EF16Z		512K	30K		QFP100-P-1818B													

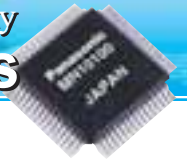| Category	Part No.	Internal ROM Type	ROM (byte)	RAM (byte)	Minimum Instruction Execution Time (μs)/Operationg Voltage (V)	Package	Number of I/O Ports [At single chip mode]	Interrupt Sources	8-bit Timer	16-bit Timer	19-bit Timer	Serial Interfaces Synchronous Type / UART	Synchronous Type / I²C	Synchronous Type	UART	I²C	A/D Converter (ch)	D/A Converter (ch)	Display Control Function
ADC Built-in Type	MN101EF34D	F	64K+4K	4K	0.042/2.2 - 5.5 / 62.5/2.2 - 5.5	TQFP048-P-0707B	39	28	6	3	0	2	1	0	0	0	8	—	—
	MN101EF51A	F	32K	1K	0.05/2.7 - 5.5 / 0.125/1.8 - 5.5	QFP044-P-1010F ▲ / TQFP048-P-0707B ○	36	19	5	2	0	2	1	0	0	0	12	—	—
	MN101EF52A	F	32K	1K	0.05/2.7 - 5.5 / 0.125/1.8 - 5.5	TQFP032-P-0707A ▲ / UBGA036-P-0404AE ▲	24	17	5	2	0	1	1	0	0	0	8	—	—
ADC-DAC Built-in Type	MN101C49G	M	128K	4K	0.1/4.5 - 5.5 / 62.5/2.0 - 5.5	LQFP100-P-1414 / QFP100-P-1818B	88	23	6	1	0	2	1	1	0	0	8	4	—
	MN101C49H		160K	6K															
	MN101C49K		224K	10K															
	MN101CF49K	F	224K	10K	0.1/4.5 - 5.5 / 0.12/4.5 - 5.5														
	MN101CP49K	E	224K	10K	0.1/4.5 - 5.5 / 0.25/3.0 - 5.5														
	MN101C77A	M	32K	1.5K	0.1/2.5 - 3.6 / 0.2/2.1 - 3.6 / 62.5/1.8 - 3.6	LQFP064-P-1414	53	22	5	1	0	2	1	0	0	1	7	2*	—
	MN101C77C		48K	3K		LQFP064-P-1414 / TQFP064-P-1010C													
	MN101C77D		64K	6K		LQFP064-P-1414													
	MN101C77F		96K	6K															
	MN101CF77G	F	128K	6K	0.1/2.7 - 3.6	LQFP064-P-1414 / TQFP064-P-1010C													
	MN101E01J	M	192K	10K	0.0625/3.0 - 3.6 / 62.5/3.0 - 3.6	QFP100-P-1818B	84	27	7	1	0	3	2	0	0	0	8	1	—
	MN101E01K		256K	10K															
	MN101E01L		320K	14K		LQFP100-P-1414 / QFP100-P-1818B													
	MN101E01M		384K	20K															
	MN101EF01M	F	384K	24K	0.0625/3.0 - 3.6														
USB Function	MN101C93K	M	224K	6K	0.125/3.0 - 3.6 / 62.5/3.0 - 3.6	LQFP100-P-1414	84	26	5	2	0	2	1	0	0	0	12	—	SEG 47 COM 4
	MN101CF93K	F	224K	6K	0.167/3.0 - 3.6 / 62.5/3.0 - 3.6														
	MN101E35A	M	32K	4K	0.042/2.2 - 3.6 / 0.0625/3.0 - 3.6 / 62.5/2.2 - 3.6	TQFP048-P-0707B	37	29	6	3	0	2	1	0	0	0	8	—	—
	MN101E35D		68K	4K															
	MN101EF35A	F	32K	4K															
	MN101EF35D		64K+4K	4K															
VTR Servo	MN101D06F	M	96K	3K	0.14/4.0 - 5.5 / 61/2.2 - 5.5	QFP100-P-1818B	77	31	1	6	1	1	0	1	0	1	13	—	—
	MN101D06G		128K	4K														1	
	MN101D06H		160K	5K															
	MN101DF06Z	F	224K	6K	0.14/4.0 - 5.5 / 61/2.5 - 5.5														
	MN101D07G	M	128K	4K	0.14/4.0 - 5.5 / 61/2.2 - 5.5	LQFP112-P-2020	87	31	1	6	1	1	0	1	0	1	14	1	—
	MN101D07H		160K	5K															
	MN101DF07Z	F	224K	6K	0.14/4.0 - 5.5 / 61/2.5 - 5.5														
	MN101D08E	M	80K	2K	0.14/4.0 - 5.5 / 61/2.5 - 5.5	LQFP080-P-1414A	57	26	2	3	1	0	0	1	0	1	11	—	—
	MN101DF08G	F	128K	4K															
	MN101D09E	M	80K	2K	0.14/4.0 - 5.5 / 61/2.5 - 5.5	QFP100-P-1818B	57	26	2	3	1	0	0	1	0	1	11	—	—
	MN101DF09G	F	128K	4K															
	MN101D10F	M	96K	2.5K	0.14/4.0 - 5.5 / 61/2.5 - 5.5	QFP100-P-1818B	77	27	2	3	1	0	0	2	0	1	12	—	—
	MN101D10G		128K	3.5K															
	MN101DF10G	F	128K	4K															
FL Driver Built-in Type	MN101C87A	M	32K	1.5K	0.1/4.5 - 5.5 / 0.25/2.7 - 5.5 / 62.5/2.0 - 5.5	LQFP064-P-1414	52	21	5	1	0	1	1	0	0	0	8	—	SEG 8 - 16 DGT 18 - 10
	MN101C87D		64K	2K															
	MN101CF87G	F	128K	4K	0.1/4.5 - 5.5 / 0.25/2.7 - 5.5 / 62.5/2.5 - 5.5														
	MN101C88D	M	64K	2K	0.1/4.5 - 5.5 / 0.25/2.7 - 5.5 / 62.5/2.0 - 5.5	QFP100-P-1818B	88	23	5	1	0	2	1	0	0	0	8	—	SEG 35 - 43 DGT 18 - 10
	MN101C88G		128K	4K															
	MN101CF88G	F	128K	10K	0.1/4.5 - 5.5 / 0.25/2.7 - 5.5 / 62.5/2.5 - 5.5														
	MN101CA3F	M	96K	4K	0.1/4.5 - 5.5 / 0.25/2.7 - 5.5 / 62.5/2.0 - 5.5	QFP100-P-1818B	89	30	6	2	0	2	1	0	1	0	8	—	SEG 35 - 43 DGT 18 - 10
	MN101CFA3G	F	128K	10K	0.1/4.5 - 5.5 / 0.25/2.7 - 5.5 / 62.5/2.5 - 5.5														

[Internal ROM type] M:Mask ROM , E:EPROM , F:FLASH
[Package] ○ :under planning , ▲:under development , △:ES(Engineering Sample) available (All packages are lead (Pb) free.)
[*] Serves as AD pin, as well

Category	Part No.	Internal ROM Type	ROM (byte)	RAM (byte)	Minimum Instruction Execution Time (μs)/ Operationg Voltage (V)	Package	Number of I/O Ports [At single chip mode]	Interrupt Sources	8-bit Timer	16-bit Timer	19-bit Timer	Serial Interfaces Synchronous Type / UART	Serial Interfaces Synchronous Type / I²C	Serial Interfaces Synchronous Type	Serial Interfaces UART	Serial Interfaces I²C	A/D Converter (ch)	D/A Converter (ch)	Display Control Function
LCD Driver Built-in Type	MN101C38A	M	32K	1.5K	0.1/4.5 - 5.5 0.25/2.7 - 5.5 125/2.0 - 5.5	LQFP100-P-1414 QFP100-P-1818B	57	14	3	1	0	1	0	1	0	0	8	—	SEG 52 COM 4
	MN101C38C	M	48K	2K	0.1/4.5 - 5.5 0.25/2.7 - 5.5 125/2.0 - 5.5	LQFP100-P-1414 QFP100-P-1818B	57	14	3	1	0	1	0	1	0	0	8	—	SEG 52 COM 4
	MN101CP38C	E	48K	2K	0.1/4.5 - 5.5 0.25/2.7 - 5.5 125/2.3 - 5.5	LQFP100-P-1414 QFP100-P-1818B	57	14	3	1	0	1	0	1	0	0	8	—	SEG 52 COM 4
	MN101C39C	M	48K	2K	0.1/4.5 - 5.5 125/2.0 - 5.5	TQFP080-P-1212D	61	14	3	1	0	1	0	1	0	0	8	—	SEG 28 COM 4
	MN101CP39C	E	48K	2K	0.1/4.5 - 5.5 125/2.3 - 5.5	TQFP080-P-1212D	61	14	3	1	0	1	0	1	0	0	8	—	SEG 28 COM 4
	MN101C485	M	8K	0.5K	0.1/4.5 - 5.5 125/2.0 - 5.5	LQFP064-P-1414 TQFP064-P-1010B	47	12	3	1	0	1	0	0	0	0	8	—	SEG 25 COM 4
	MN101C487	M	16K	0.5K	0.1/4.5 - 5.5 125/2.0 - 5.5	LQFP064-P-1414 TQFP064-P-1010B	47	12	3	1	0	1	0	0	0	0	8	—	SEG 25 COM 4
	MN101CP487	E	16K	0.5K	0.1/4.5 - 5.5 125/2.3 - 5.5	LQFP064-P-1414 TQFP064-P-1010B	47	12	3	1	0	1	0	0	0	0	8	—	SEG 25 COM 4
	MN101C54A	M	32K	2K	0.1/4.5 - 5.5 0.25/2.7 - 5.5 62.5/2.0 - 5.5	LQFP080-P-1414A QFP084-P-1818E	65	19	5	2	0	1	0	1	0	0	8	—	SEG 32 COM 4
	MN101C54C	M	48K	2K	0.1/4.5 - 5.5 0.25/2.7 - 5.5 62.5/2.0 - 5.5	LQFP080-P-1414A QFP084-P-1818E	65	19	5	2	0	1	0	1	0	0	8	—	SEG 32 COM 4
	MN101CF54D	F	64K	2K	0.1/4.5 - 5.5 0.25/4.5 - 5.5 62.5/4.5 - 5.5	QFP084-P-1818E	65	19	5	2	0	1	0	1	0	0	8	—	SEG 32 COM 4
	MN101CP54C	E	48K	2K	0.1/4.5 - 5.5 0.25/2.7 - 5.5 62.5/2.3 - 5.5	LQFP080-P-1414A QFP084-P-1818E	65	19	5	2	0	1	0	1	0	0	8	—	SEG 32 COM 4
	MN101C57C	M	48K	2K	0.1/4.5 - 5.5 0.25/2.7 - 5.5 62.5/2.0 - 5.5	QFP100-P-1818B	83	24	5	2	0	1	0	1	0	0	16	—	SEG 47 COM 4
	MN101C57D	M	64K	2K	0.1/4.5 - 5.5 0.25/2.7 - 5.5 62.5/2.0 - 5.5	QFP100-P-1818B	83	24	5	2	0	1	0	1	0	0	16	—	SEG 47 COM 4
	MN101CF57D	F	64K	2K	0.1/4.5 - 5.5 0.25/2.7 - 5.5 62.5/2.5 - 5.5	QFP100-P-1818B	83	24	5	2	0	1	0	1	0	0	16	—	SEG 47 COM 4
	MN101C589	M	24K	1.5K	0.1/4.5 - 5.5 0.25/2.7 - 5.5 62.5/2.0 - 5.5	LQFP064-P-1414	49	18	5	2	0	1	0	0	0	0	8	—	SEG 24 COM 4
	MN101C58A	M	32K	1.5K	0.1/4.5 - 5.5 0.25/2.7 - 5.5 62.5/2.0 - 5.5	LQFP064-P-1414	49	18	5	2	0	1	0	0	0	0	8	—	SEG 24 COM 4
	MN101CF58D	F	64K	2K	0.1/4.5 - 5.5 0.25/4.5 - 5.5 62.5/4.5 - 5.5	LQFP064-P-1414	49	18	5	2	0	1	0	0	0	0	8	—	SEG 24 COM 4
	MN101CP58A	E	32K	1.5K	0.1/4.5 - 5.5 0.25/2.7 - 5.5 62.5/2.3 - 5.5	LQFP064-P-1414	49	18	5	2	0	1	0	0	0	0	8	—	SEG 24 COM 4
	MN101C66D	M	64K	2K	0.1/4.5 - 5.5 0.25/2.7 - 5.5 62.5/2.0 - 5.5	LQFP080-P-1414A QFP084-P-1818E	65	19	5	2	0	1	0	1	0	0	8	—	SEG 32 COM 4
	MN101C66G	M	128K	4K	0.1/4.5 - 5.5 0.25/2.7 - 5.5 62.5/2.0 - 5.5	LQFP080-P-1414A △ QFP084-P-1818E	65	19	5	2	0	1	0	1	0	0	8	—	SEG 32 COM 4
	MN101CF66G	F	128K	4K	0.1/4.5 - 5.5 0.25/2.7 - 5.5 62.5/2.5 - 5.5	LQFP080-P-1414A QFP084-P-1818E	65	19	5	2	0	1	0	1	0	0	8	—	SEG 32 COM 4
	MN101CP66D	E	64K	2K	0.1/4.5 - 5.5 0.25/2.7 - 5.5 62.5/2.3 - 5.5	LQFP080-P-1414A QFP084-P-1818E	65	19	5	2	0	1	0	1	0	0	8	—	SEG 32 COM 4
	MN101C70C	M	48K	2K	0.1/3.0 - 3.6 0.235/1.8 - 3.6 62.5/1.8 - 3.6	LQFP080-P-1414A	66	20	6	2	0	1	1	0	0	0	16	—	SEG 32 COM 4
	MN101CF70D	F	64K	4K	0.25/3.0 - 3.6 0.50/2.2 - 3.6 62.5/2.2 - 3.6	LQFP080-P-1414A ▲	66	20	6	2	0	1	1	0	0	0	16	—	SEG 32 COM 4
	MN101C73A	M	32K	1.5K	0.1/3.0 - 3.6 0.235/1.8 - 3.6 62.5/1.8 - 3.6	LQFP064-P-1414 TQFP064-P-1010C	55	24	5	2	0	2	1	0	0	0	12	—	SEG 32 COM 4
	MN101CF73A	F	32K	2K	0.1/3.0 - 3.6 0.235/2.2 - 3.6 62.5/2.2 - 3.6	LQFP064-P-1414 TQFP064-P-1010C	55	24	5	2	0	2	1	0	0	0	12	—	SEG 32 COM 4
	MN101C74F	M	96K	6K	0.1/3.0 - 3.6 0.235/1.8 - 3.6 62.5/1.8 - 3.6	LQFP100-P-1414 MLGA100-L-1010 QFP100-P-1818B	86	26	5	2	0	2	1	0	0	1	16	—	SEG 47 COM 4
	MN101C74G	M	128K	6K	0.1/3.0 - 3.6 0.235/1.8 - 3.6 62.5/1.8 - 3.6	LQFP100-P-1414 MLGA100-L-1010 QFP100-P-1818B	86	26	5	2	0	2	1	0	0	1	16	—	SEG 47 COM 4
	MN101CF74G	F	128K	6K	0.1/3.0 - 3.6 0.235/2.2 - 3.6 62.5/2.2 - 3.6	LQFP100-P-1414 MLGA100-L-1010 QFP100-P-1818B	86	26	5	2	0	2	1	0	0	1	16	—	SEG 47 COM 4
	MN101C78A	M	32K	1.5K	0.1/3.0 - 3.6 0.118/2.7 - 3.6 0.235/1.8 - 3.6 62.5/1.8 - 3.6	TQFP048-P-0707B	39	22	5	2	0	2	1	0	0	1	7	—	SEG 12 COM 4
	MN101CF78A	F	32K	1.5K	0.118/3.0 - 3.6 62.5/2.2 - 3.6	TQFP048-P-0707B	39	22	5	2	0	2	1	0	0	1	7	—	SEG 12 COM 4
	MN101C84A	M	32K	1K	0.1/4.5 - 5.5 0.25/2.7 - 5.5 62.5/2.0 - 5.5	LQFP064-P-1414	52	18	5	2	0	1	0	0	0	0	8	—	SEG 32 COM 4
	MN101CF84D	F	64K	2K	0.1/4.5 - 5.5 0.25/2.7 - 5.5 62.5/2.5 - 5.5	LQFP064-P-1414	52	18	5	2	0	1	0	0	0	0	8	—	SEG 32 COM 4
	MN101CA27	M	16K	0.5K	0.25/2.7 - 3.6 0.50/1.8 - 3.6 62.5/1.8 - 3.6	LQFP064-P-1414	25	8	3	0	0	0	0	0	0	0	—	—	SEG 32 COM 4
	MN101CFA2D	F	64K	2K	0.25/2.7 - 3.6 0.50/1.8 - 3.6 62.5/1.8 - 3.6	LQFP064-P-1414	25	8	3	0	0	0	0	0	0	0	—	—	SEG 32 COM 4
	MN101E29G	M	128K	6K	0.05/2.2 - 5.5	LQFP100-P-1414 QFP100-P-1818B	90	28	7	3	0	4	1	0	0	1	16	4	SEG 55 COM 4
	MN101EF29G	F	128K+4K	6K	0.05/2.2 - 5.5	LQFP100-P-1414 QFP100-P-1818B	90	28	7	3	0	4	1	0	0	1	16	4	SEG 55 COM 4

Category	Part No.	Internal ROM Type	ROM (byte)	RAM (byte)	Minimum Instruction Execution Time (µs)/Operationg Voltage (V)	Package	Number of I/O Ports [At single chip mode]	Interrupt Sources	8-bit Timer	16-bit Timer	19-bit Timer	Serial Interfaces Synchronous Type / UART	Synchronous Type / I²C	Synchronous Type	UART	I²C	A/D Converter (ch)	D/A Converter (ch)	Display Control Function
LCD Driver Built-in Type	MN101E31D	M	64K	4K	0.05/2.2 - 5.5	LQFP080-P-1414A	70	23	7	2	0	3	1	0	0	1	12	—	SEG 41 COM 4
	MN101E31G	M	128K	6K	0.05/2.2 - 5.5														
	MN101EF31D	F	64K+8K	4K	0.05/2.7 - 5.5														
	MN101EF31G	F	128K+4K	6K	0.05/2.2 - 5.5														
	MN101EF32D	F	64K+8K	4K	0.05/2.7 - 5.5	LQFP064-P-1414	54	23	7	2	0	2	1	0	0	1	8	—	SEG 32 COM 4
	MN101E46G	M	128K	4K	0.1/2.2 - 3.6 0.125/1.8 - 3.6 61/1.8 - 3.6	TQFP128-P-1414C ▲	67	21	5	2	0	1	1	0	0	0	3	—	SEG 64 COM 32
	MN101E46N	M	508K	4K		TQFP128-P-1414C ○													
	MN101E46R		928K	6K															
	MN101EF46R	F	928K	8K		TQFP128-P-1414A △													
	MN101EF56G	F	128K	6K	0.05/2.7 - 5.5 0.1/1.8-5.5	LQFP100-P-1414 ○ QFP100-P-1818B ▲	90	34	7	3	0	3	1	0	0	0	24	4	SEG 55 COM 4
	MN101EF57G	F	128K	6K	0.05/2.7 - 5.5 0.1/1.8-5.5	LQFP080-P-1414A ▲ TQFP080-P-1212D ○	70	34	7	3	0	3	1	0	0	0	16	2	SEG 41 COM 4
	MN101EF58G	F	128K	6K	0.05/2.7 - 5.5 0.1/1.8-5.5	LQFP064-P-1414 ○ TQFP064-P-1010C ▲	54	34	7	3	0	3	1	0	0	0	12	—	SEG 32 COM 4
Voice control	MN101E30N	M	508K	8K	0.05/2.2 - 5.5	QFP100-P-1818B	85	30	7	3	0	4	1	0	0	1	12	5	SEG 55 COM 4
	MN101E30R		928K																
	MN101EF30R	F																	
	MN101E59R	M	928K	8K	0.05/2.2 - 5.5	QFP100-P-1818B	85	30	7	3	0	4	1	0	0	1	12	5	SEG 55 COM 4
	MN101EF59R	F																	
In-vehicle networking	MN101EF41N	F	512K	30K	0.05/3.0 - 3.6	QFP100-P-1818B ○	85	29	9	1	0	3	2	0	0	0	8	—	—
	MN101E49K	M	256K	12K	0.05/3.0 - 3.6 30.6/2.7 - 3.6	LQFP100-P-1414 ▲	85	29	9	1	0	3	2	0	0	0	8	—	—
	MN101EF49N	F	512K	30K		LQFP100-P-1414													
	MN101EF63G	F	128K	10K	0.05/2.7 - 5.5	TQFP064-P-1010C ▲	54	34	7	3	0	3	1	0	0	0	12	—	SEG 32 COM 4

[Internal ROM type] M:Mask ROM , E:EPROM , F:FLASH
[Package] ○ :under planning , ▲ :under development , △ :ES(Engineering Sample) available (All packages are lead (Pb) free.)

■Note on Naming

1: If the additional digits for customer ROM version, etc. should produce a device name exceeding 12 characters, we reduce it to 12 characters with the following schema.
The final device name is determined on delivery specification documents.

Full device name (13 or more characters)   Abbreviated name (12 characters)
MN101xxxxxx…   ⟶   MNBxxxxxx…

2: Operating voltage and frequency may vary depending on whether models feature built-in EPROM, built-in flash memory, or mask ROM.

16-bit
AM2 (MN102) Series
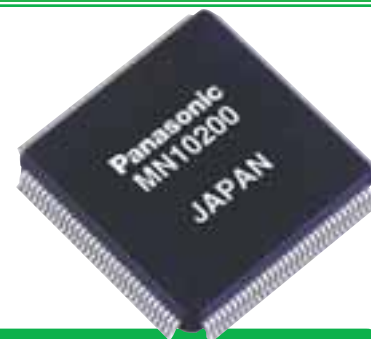
C Language Oriented 16-bit Single-chip Microcomputers

The AM2(MN102) Series of 16-bit microcomputers offers high-speed operation with a minimum instruction execution time of just 50 ns (at 40 MHz).
The C compiler generates ROM code that is only 20% larger than assembler code.
The Series continues to add new versions tailored for specific types of applications so as to bring the benefits of compactness and high performance to a wider range of applications.

C Language Oriented Architecture

Programs that are only 1.2 times the size of assembly versions

The register set represents a careful balancing of hardware needs against C compiler code generation efficiency. Eight avairable registers are egu ally divided by two for addresses and data respectively. The instruction format requires only four bits to specify a register pair. As a result, approximately 80% of the basic instructions fit within a single byte. The compiler then uses register optimization to maximize the efficiency of register usage. These enhancements mean that programs developed in C are only some 20% larger than their hand-coded assembly language equivalents.

Conventional code assignment for general register instruction

| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |

Operation field   GRn   Operation field   GRn
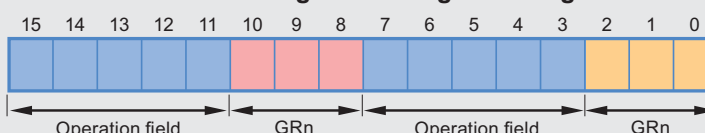
Basic instruction defined as two bytes.
Because each register field makes up three bits,
it is impossible to fit the instruction into a single byte.

AM2 Series instruction code assignments

| 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |

Operation field   An / Dn   An / Dn
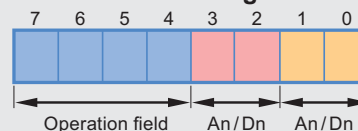
Basic instruction defined as single byte.
Since each register field takes two bits, basic instructions
(register-to-register operations, load/store operations) fit within a single byte.

High Performance, Low Power Consumption

Three-stage pipeline boosts throughput (Instruction speed: 50ns)

Instructions are executed in a three-stage pipeline: instruction fetch, decoding, and execution. The decoding stage performs two ALU operations in a single machine cycle so that it calculates operand addresses right at the decoding stage. The result is load/store instructions that take one machine cycle to execute. For branch instructions, calculating the branch target address during the decoding stage also allows execution in a minimum of two machine cycles. This increases the instruction execution efficiency and can reduce power consumption.

1 machine cycle

Time

Instruction 1   Instruction fetch   Decoding

Address calculation   Data calculation (execution)

Instruction 2   Instruction fetch   Decoding

Address calculation   Data calculation (execution)
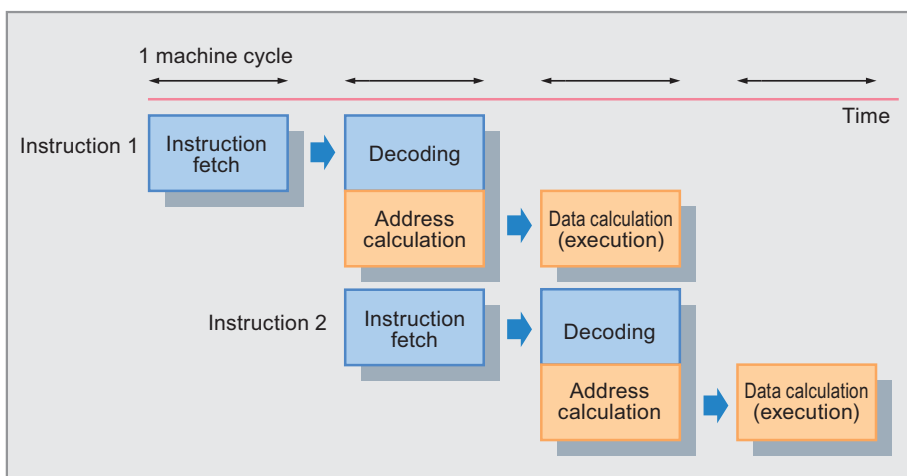
Built-in Multiplier

24-bit result from two 16-bit operands in a single cycle

The multiplier built into the AM22 (MN102H) CPU core produces a 24-bit result from two 16-bit operands in a single cycle and a 32-bit result in two cycles.

The saturation function provides multiply with saturation operations in only two cycles.
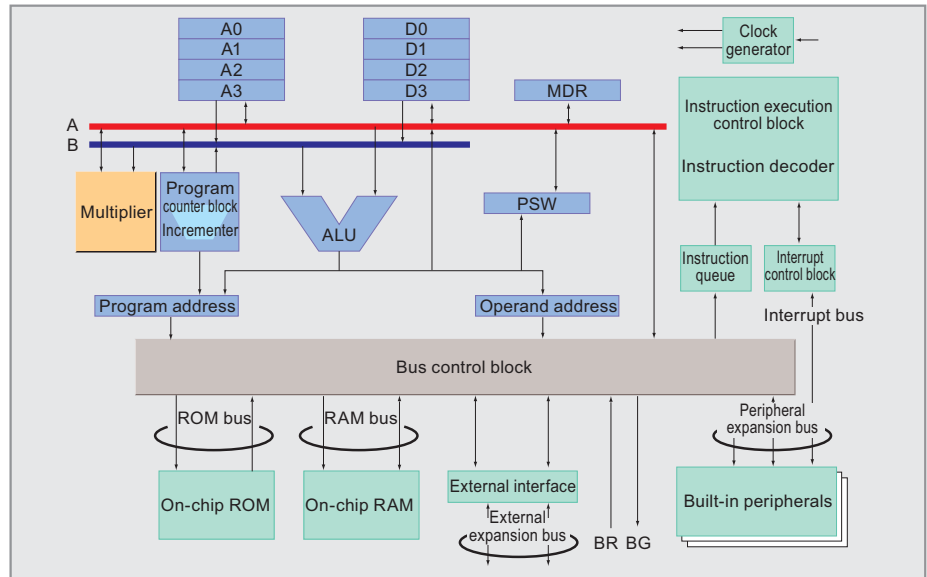
Application to DVD-system

Well-suited for DVD-ROM, DVD-RAM, DVD-Player
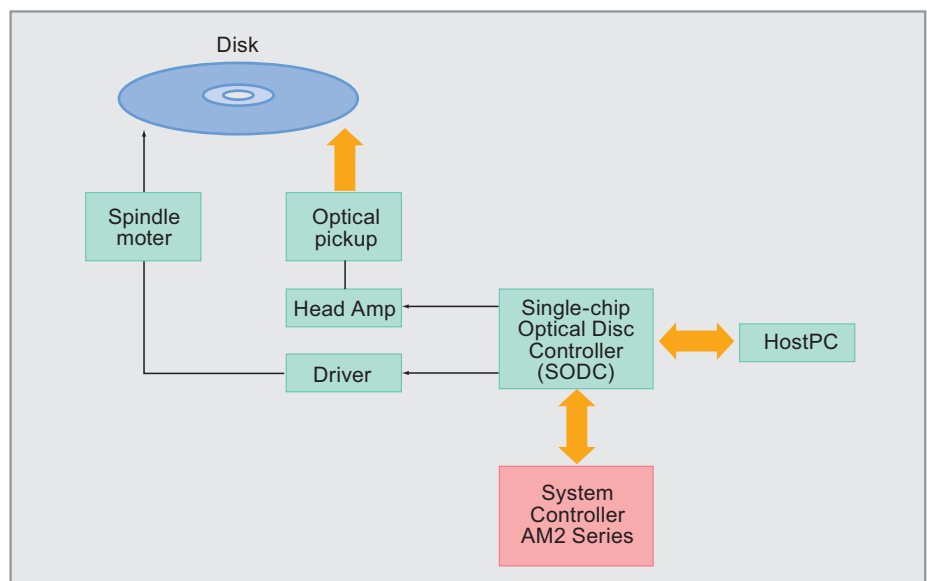
# Series Lineup (16-bit microcomputer product lineup development plans)

Support for ASIC versions

ADC Built-in Type

* For more information about product availability, see the specifications list.

Flash
Mask ROM
ROM (byte)

MN102H460B — 0 K

MN102LF59D
MN102L59D — 64 K

MN102HF60x
MN102H60x — 128 K, 256 K

ADC-DAC Built-in Type

MN102H950F — 0 K

MN102H730FGT — 0 K

MN102HF73x
MN102H73x — 128 K, 256 K

USB Function

MN102HF74G — 128 K
MN102H74x — 64 K, 128 K

| 64pin | 84pin | 100pin | 128pin | 160pin |
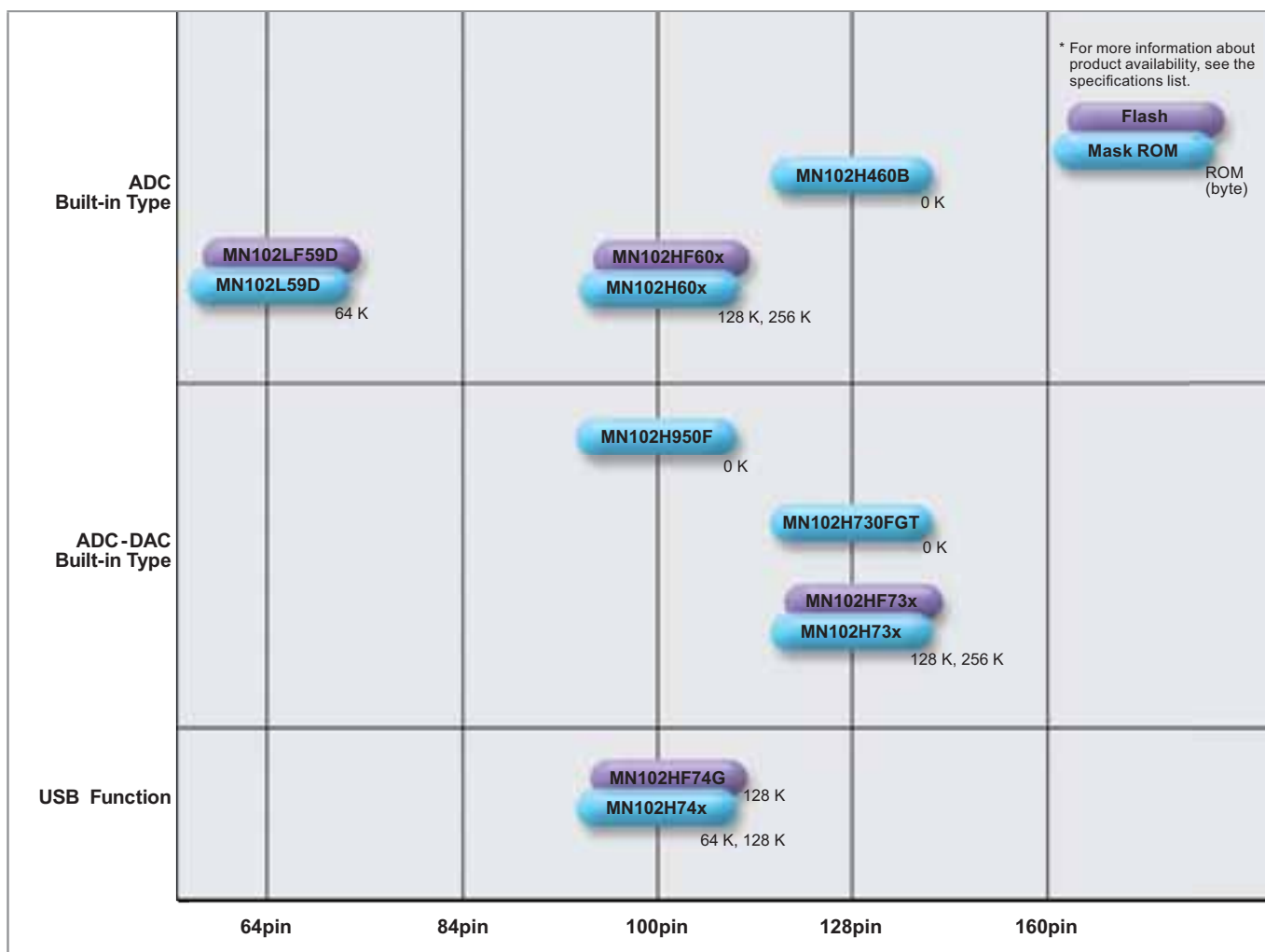
The lineup has expanded by offering application specific models with on-chip peripherals tailored to the needs of such specific applications. Those include audiovisual applications such as video cameras, information processing and telecommunications applications such as floppy disk drives, CD-ROM drives, printers, cellular phones, and control applications for motors and air conditioners. To permit application-specific IC (ASIC) development, the Series has a dedicated expansion bus, independent of the core's internal buses, that simplifies the task of designing the interface between the microcomputer core and the custom logic. This bus specification opens the door to the flexible addition of peripheral functions. Panasonic now provides a microcomputer core for ASIC applications that features this expansion bus as standard equipment.

Major Application Areas

Information and communications equipment, portable equipment, audio-visual equipment, computer peripherals, home appliances etc.
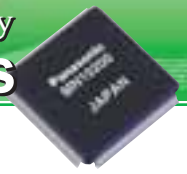
■ AM2 (MN102) 16-bit Single-chip Microcontroller Series Specifications

Category	Part No.	Internal ROM Type	ROM (byte)	RAM (byte)	Minimum Instruction Execution Time (μs)/Operationg Voltage (V)	Package	Number of I/O Ports	Interrupt Sources	8-bit Timer	16-bit Timer	24-bit Timer	Serial Interfaces				A/D Converter (ch)	D/A Converter (ch)
												Synchronous Type / UART	Synchronous Type / UART / I²C	Synchronous Type	I²C		
ADC Built-in Type	MN102H460B	—	—	4K	0.05/3.0 - 3.6 0.1/2.0 - 3.6	LQFP128-P-1818C TQFP128-P-1414B	63	54	16	5	1	3	2	0	0	12	—
	MN102H60G	M	128K	4K	0.058/3.0 - 3.6 62.5/3.0 - 3.6	LQFP100-P-1414 MLGA100-L-1010	82	50	10	6	0	0	2	3	0	8	—
	MN102H60K		256K	10K		LQFP100-P-1414											
	MN102HF60G	F	128K	4K		LQFP100-P-1414 MLGA100-L-1010											
	MN102HF60K		256K	10K		LQFP100-P-1414											
	MN102L59D	M	64K	2K	0.1/4.5 - 5.5	LQFP064-P-1414	52	24	9	3	0	2	0	0	0	12	—
	MN102LF59D	F															
ADC-DAC Built-in Type	MN102H730FGT	—	—	10K	0.058/3.0 - 3.6 62.5/3.0 - 3.6	TQFP128-P-1414B	66	50	10	5	0	2	2	0	0	12	4
	MN102H73G	M	128K	10K		TQFP128-P-1414A	105										
	MN102H73K		256K	12K													
	MN102HF73G	F	128K	10K		TQFP128-P-1414B											
	MN102HF73K		256K	12K													
	MN102H950F	—	—	10K	0.058/3.0 - 3.6 62.5/3.0 - 3.6	LQFP100-P-1414	63	47	10	5	0	2	2	0	0	12	4
USB Function	MN102H74D	M	64K	4K	0.0833/3.0 - 3.6 62.5/3.0 - 3.6	LQFP100-P-1414	77	54	10	4	0	2	2	0	0	8	—
	MN102H74G		128K														
	MN102HF74G	F															

[Internal ROM type] M:Mask ROM , E:EPROM , F:FLASH, —: External
[Package] ○ :under planning , ▲ :under development , △ :ES(Engineering Sample) available (All packages are lead (Pb) free.)

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1: If the additional digits for customer ROM version, etc. should produce a device name exceeding 12 characters, we reduce it to 12 characters with the following schema.
The final device name is determined on delivery specification documents.

Full device name (13 or more characters)   Abbreviated name (12 characters)
MN102xxxxxx…   ⟶   MNPxxxxxx…

2: Operating voltage and frequency may vary depending on whether models feature built-in EPROM, built-in flash memory, or mask ROM.

32-bit
AM3 (MN103) Series

32-bit Lineup Accelerates Multimedia Performance

The AM3 (MN103) Series of 32-bit microcomputers covers a broad range of applications from equipment controllers through multimedia processing.

The combination of a C language oriented architecture and optimizing compiler delivers both high performance and lower power consumption.

To streamline the development of applications high in both performance and functionality, these devices incorporate the AM Series standard on-chip I/O bus (C-bus) and the extended calculation instruction function for adapting them for ASSP enhancement and ASIC microcomputer development.

The MN103 Series consists of the MN1030, MN103S, and MN103L Series.

C Language Oriented Architecture

Optimizing compiler generates highly efficient code

The optimizing compiler examines overall C program structure as it assigns variables to make most efficient use of the available registers. For frequently repeated loops, it preloads branch registers with the first instruction and the address of the next instruction. This small investment in additional hardware produces great advances in branch execution speed.

[Example: Dhrystone 2.1 benchmark]

Old approach   New approach

1206 cycle

25.6% — Savings due to compiler optimizations

17.1% — Speed-ups of branch instructions

7.3% — 1-cycle execution of 2-byte instructions

50% — Halving the cycles per instruction doubles the performance.
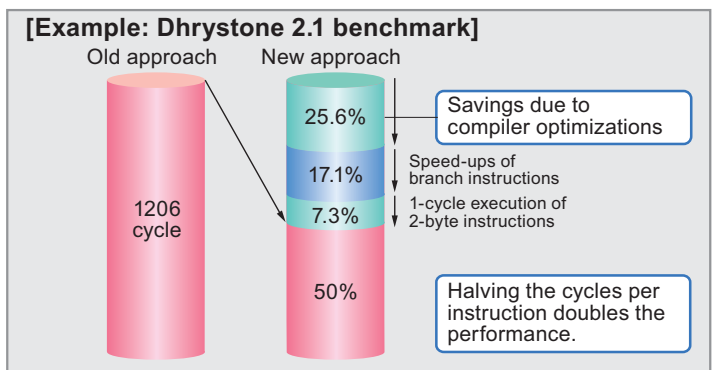
High Performance, Greater Efficiency

Variable word lengths of instructions, minimum of eight bits reduce program size

Cutting program size is always a major issue in embedded microcomputer applications. The AM3 (MN103) Series organizes registers by function and is thus able to adapt a variable instruction length approach with a minimum length of only 8 bits. Making the most frequently used instructions shorter and then maximizing register usage with an optimizing C compiler minimizes program size.

The AM3 (MN103) Series has eight basic registers available.

It also uses a Harvard architecture with separate instructions and data memory to boost throughput by eliminating conflicts between instruction fetches and data access.

Address registers	A0*	Data registers	D0*
	A1*		D1*
	A2*		D2*
	A3*		D3*
Stack pointer	SP	Processor status word	PSW
Program counter	PC	Branch registers	LIR
Multiply/divide register	MDR		LAR

AM3 Series basic registers
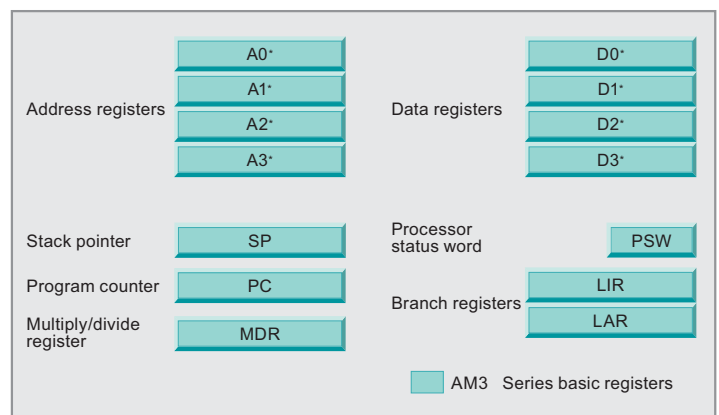
Multimedia Support

Mechanisms for increasing system-level performance

Function Expandability (MN103S Series)

The expansion interface allows the development to assign multiply and accumulate and other new instructions to reserved opcodes to provide high-speed processing of digital sound and image data. This flexibility opens the door to semicustom microcomputer systems with the high cost performance demanded of multimedia applications. In addition, the AM Series features an on-chip I/O bus, C-bus, for attaching I/O modules for the intended user application system. Standard across the entire Series, this bus greatly reduces development times for systems combining both performance and functionality.
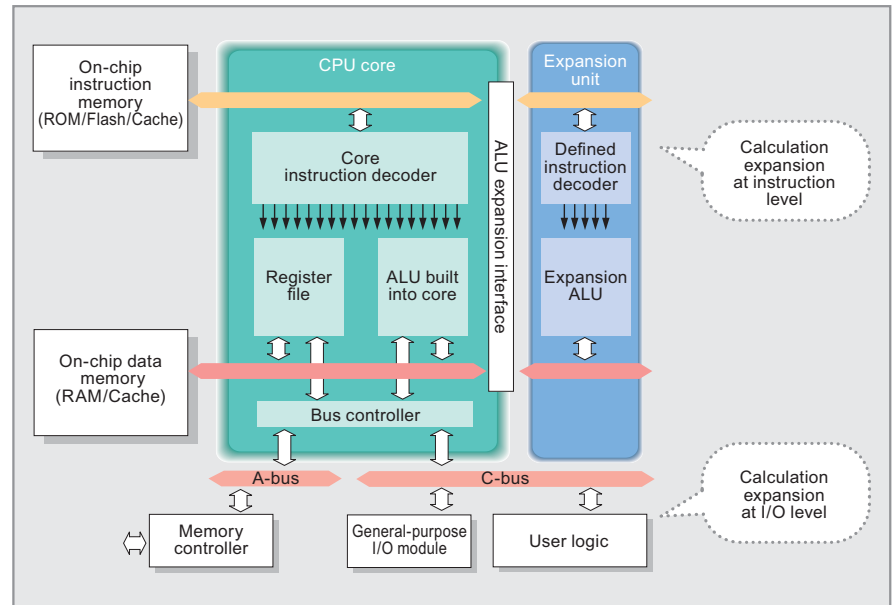
Low Power Series (MN103L Series)

Low power series offering instruction set compatibility with the MN103S Series

The MN103L Series features a simple architecture with a 3-stage pipeline that preserves instruction set compatibility in order to deliver optimal performance in the medium to low speed segment. Furthermore, it is able to deliver both high performance and low power consumption by implementing 32 expanded instruction functions that are shared with the CPU's internal operations, including 32 × 32 high-speed multiplication and multiply-and-accumulate operations.

The product also boosts the effectiveness of standby mode with POFF mode, which maximizes power savings during standby operation by controlling the power supply to shut off power to certain blocks, including the core.

After returning from POFF mode, the blocks that had been shut down are reset (initialized) and the program can continue executing from an instruction just after a mode setting instruction.

Series Lineup (32-bit microcomputer product lineup development plans)

AV control applications

Digital video cameras, digital still cameras, DVD players, Video cassette recorders, Audio

- MN103LF06N — 512 K
- MN103SFD0R / MN103SD0Q — 1 M / 768 K
- MN103SF73R / MN103SF73N — 1 M / 512 K
- MN103SFB9R / MN103SB9N — 1 M / 512 K
- MN103SF66R / MN103S97N — 1 M / 512 K
- MN103SF57G / MN103S57G — 128 K
- MN103SFD3R / MN103SD3P — 1 M / 640 K

Multiple invertor motor control

Air-conditioner compressors, Washing machines, refrigerators, ventilation fans

- MN103SFG5K — 256 K
- MN103SFC6K — 256 K
- MN103SFE4x / MN103SE4x — 128 K, 256 K / 64 K, 128 K, 256 K
- MN103SFE3K / MN103SE3K — 256 K

Invertor motor control

- MN103SFC2D / MN103SC2x — 64 K / 32 K, 64 K

USB Host Built-in type

- MN103SFE5P — 624 K
- MN103SFH7J / MN103SH7J — 192 K / 192 K
- MN103SG20L — 0 K
- MN103SFB5K — 256 K

In-vehicle networking

- MN103SFA2R — 1 M
- MN103LF03R / MN103LF04R — 1 M / 1 M

* For more information about product availability, see the specifications list.

Flash / Mask ROM

ROM (byte)

	44, 48pin	64pin	80, 84pin	100pin	128pin	144pin	256pin

The Series continues to grow in response to diversifying needs, including highly standardized versions for control applications and multifunction versions with enhanced on-chip functionality. Alongside the masked ROM versions are flash memory versions that drastically shorten turnaround times during software development.

Major Application Areas

Optical disc players, video CD players, digital still cameras, digital television systems, navigation systems, portable information devices, air conditioner compressors, washing machines, refrigerators, ventilation fans, etc.

■ AM3 (MN103) 32-bit Single-chip Microcontroller Series Specifications

Category	Part No.	Internal ROM Type	ROM (byte)	RAM (byte)	CPU Performance (MIPS/MHz) [Dhrystone2.1]	Minimum Instruction Execution Time (ns)/ Operating Voltage (V)	Package	Number of I/O Ports	Interrupt Sources	8-bit Timer	16-bit Timer	32-bit Timer	Motor Control PWM	Serial Interfaces Synchronous Type / UART	Synchronous Type / UART / I²C	I²C	A/D Converter	DMA Controller (ch)	Bus Interface
USB HOST	MN103SFB5K	F	256K	8K	38/48	16.7/2.7 - 3.6	LQFP064-P-1414	42	35	4	2	0	0	2	0	1	—	4	—
	MN103SFE5P	F	624K	32K	48/48	20.83/3.0 - 3.6	LQFP048-P2-0707A	27	48	6	2	0	0	4	0	2	—	5	—
	MN103SG20L	—	—	32K	48/48	20.83/3.0 - 3.6	QFP100-P-1818B ▲	44	59	6	2	0	0	5	0	3	—	5	Data: 16-bit
	MN103SFH7J	F	192K	8K	38/48	16.7/2.7 - 3.6	TQFP064-P-1010C	42	35	4	2	0	0	2	0	1	—	4	—
	MN103SH7J	M																	
AV control applications	MN103LF06N	F	512K	32K	38/40	25/2.6 - 3.6	LQFP100-P-1414 ▲ QFP100-P-1818B ▲	81	84	14	6	0	0	6	3	0	15-ch×1	4	Data: 8-bit/16-bit access
	MN103S57G	M	128K	16K	40/40	25/3.0 - 3.6	LQFP100-P-1414A	73	64	10	6	0	0	3	2	0	12-ch×1	4	Data: 8-bit/16-bit access
	MN103SF57G	F																	
	MN103SF73N	F	512K	32K	40/40	25/2.7 - 3.6	QFP100-P-1818B	82	71	10	6	0	0	2	3	0	8-ch×1	4	Data: 8-bit/16-bit access SDRAM interface supporting
	MN103SF73R		1024K																
	MN103S97N	M	512K	24K	40/40	25/2.7 - 3.6	MBGA255-C-1111A	195	106	16	12	0	0	7	0	1	25-ch×1	4	Data: 8-bit/16-bit/ 32-bit access
	MN103SF66R	F	1024K	40K															
	MN103SB9N	M	512K	32K	48/60	16.7/2.7 - 3.6	TQFP128-P-1414A	104	68	10	6	0	0	2	3	0	12-ch×1	4	Data: 8-bit/16-bit access SDRAM interface supporting
	MN103SFB9R	F	1024K																
	MN103SD0Q	M	768K	32K	48/60	16.7/2.7 - 3.6	UBGA257-P-1111A	195	116	8	12	0	0	11	0	2	32-ch×1	6	Data: 8-bit/16-bit access
	MN103SFD0R	F	1024K	40K															
	MN103SD3P	M	640K	40K	48/60	16.7/2.7 - 3.6	LQFP100-P-1414	82	82	13	6	0	0	5	3	0	8-ch×1	4	Data: 8-bit/16-bit access
	MN103SFD3R	F	1024K	64K															
Invertor motor control	MN103SC2A	M	32K	4K	48/60	16.7/4.5 - 5.5	QFP044-P-1010F	29	28	4	2	0	1	1	0	0	2unit 8-ch	—	—
	MN103SC2D		64K																
	MN103SFC2D	F																	
	MN103SFC6K	F	256K	40K	70/70	14.3/3.0 - 5.5	QFP100-P-1818B	81	56	12	6	0	2	3	1	0	3unit 20-ch	—	—
	MN103SE3K	M	256K	8K	48/60	16.7/4.5 - 5.5	QFP100-P-1818B	81	56	12	6	0	2	3	0	0	3unit 20-ch	—	—
	MN103SFE3K	F																	
	MN103SE4D	M	64K	4K	48/60	16.7/4.5 - 5.5	LQFP080-P-1414A	61	56	12	6	0	2	3	0	0	3unit 16-ch	—	—
	MN103SE4G		128K																
	MN103SE4K		256K	8K															
	MN103SFE4G	F	128K	4K															
	MN103SFE4K		256K	8K															
	MN103SFG5K	F	256K	12K	48/60	16.7/4.5 - 5.5	LQFP128-P-1818C	112	81	16	9	0	3	3	1	0	3unit 28-ch	—	—
In-vehicle networking	MN103LF03R	F	1024K	63.5K	38/40	25/2.7 - 3.6	LQFP128-P-1818C ▲ 109 / LQFP144-P-2020A ▲ 123 / QFP100-P-1818B ▲ 81		84	14	6	0	0	6	3	0	15-ch×1 / 8-ch×1	4	Data: 8-bit/16-bit access
	MN103LF04R	F	1024K	63.5K	38/40	25/2.7 - 3.6	LQFP128-P-1818C ▲ 104 / LQFP144-P-2020A ▲ 118		81	14	6	0	0	6	3	0	15-ch×1	4	Data: 8-bit/16-bit access
	MN103SFA2R	F	1024K	64K	48/60	16.7/2.7 - 3.6	LQFP100-P-1414 ▲	82	84	13	6	0	0	5	3	0	8-ch×1	4	Data: 8-bit/16-bit access

[Internal ROM type] M:Mask ROM , E:EPROM , F:FLASH, —: External

[Package] ○ :under planning , ▲ :under development , △ :ES(Engineering Sample) available (All packages are lead (Pb) free.)

■ Note on Naming

1: If the additional digits for customer ROM version, etc. should produce a device name exceeding 12 characters, we reduce it to 12 characters with the following schema.

The final device name is determined on delivery specification documents.

Full device name (13 or more characters)　　　Abbreviated name (12 characters)

MN<u>103</u>xxxxxx…　　　⟶　　　MN<u>Z</u>xxxxxx…

2: Operating voltage and frequency may vary depending on whether models feature built-in EPROM, built-in flash memory, or mask ROM.
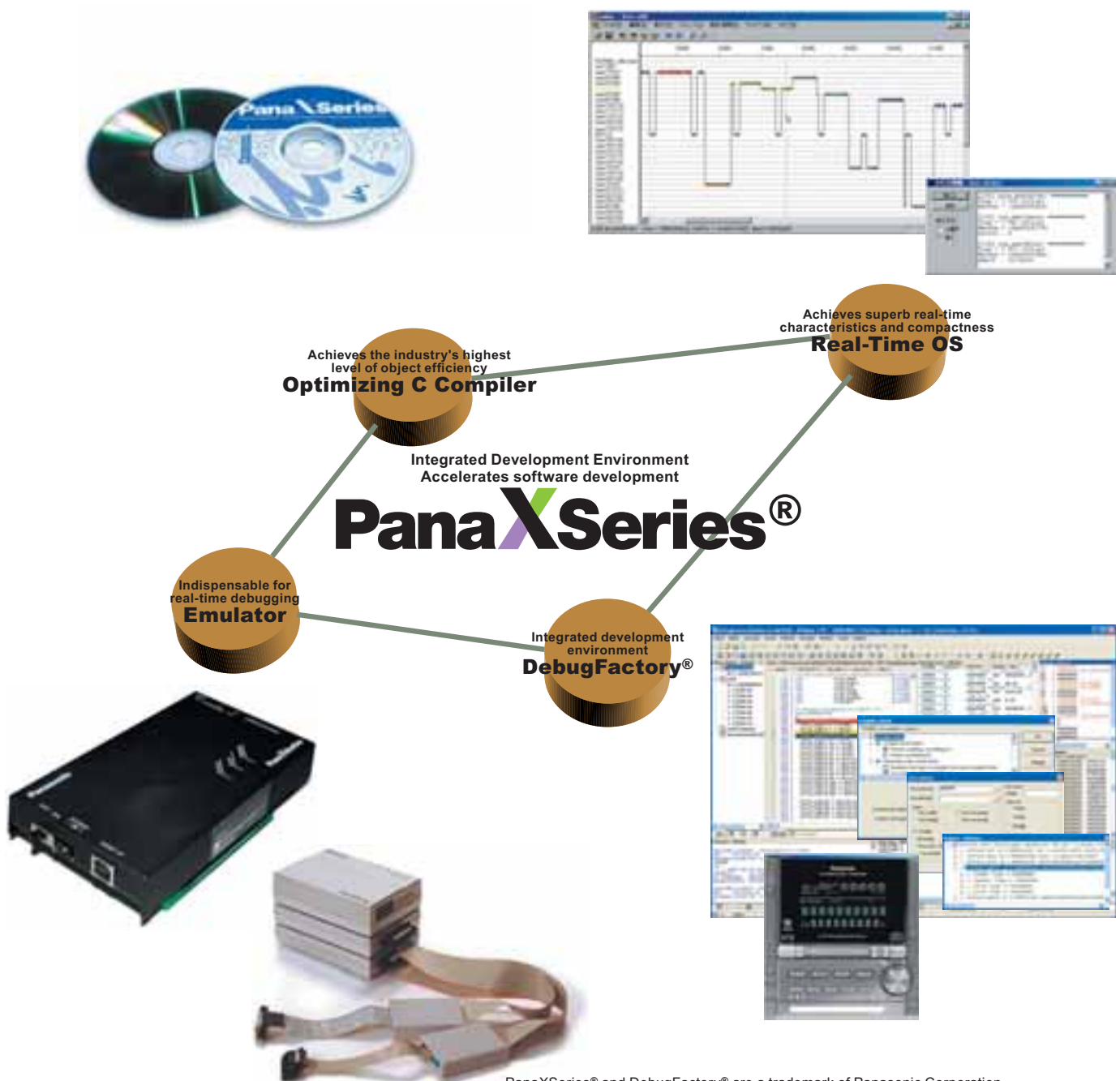
Development Environments
PanaXSeries®

PanaXSeries® Boosts up Your System Development with C Language

PanaXSeries® is Panasonic's cross (X) development support system.
This C program development tool presents a single development environment for developing 8 bit and 32 bit software.

Achieves the industry's highest level of object efficiency
Optimizing C Compiler

Achieves superb real-time characteristics and compactness
Real-Time OS

Integrated Development Environment
Accelerates software development

Pana X Series®

Indispensable for real-time debugging
Emulator

Integrated development environment
DebugFactory®

PanaXSeries® and DebugFactory® are a trademark of Panasonic Corporation.
The other corporation names, logotype and product names written in this book are trademarks or registered trademarks of their corresponding corporations.

Optimizing C Compilers

Compilers that achieve the industry's highest level of object efficiency

These compilers perform an extensive set of optimizations, including common subexpression elimination, induction variable elimination and replacement, optimal register allocation, and optimization of branch instruction and immediate address values at link time, and achieve the industry's highest level of generated code efficiency.

● AM1 (MN101) Series C Compiler

- The C compiler for the Panasonic 8-bit microcontrollers (AM1 series) improves code efficiency by extending and modifying parts of the ANSI C language specifications to take maximum advantage of the 8-bit microcontroller instruction set. This compiler also generates code that takes advantage of the AM1 series microcontrollers features such as half-byte instructions and handy addressing modes for efficient use of ROM space.
- This compiler supports functions, such as the char type bit field functions, that make effective use of 8-bit data.
- Furthermore, this compiler adds an inline assembler function that improves the interface between C code and assembler code. This makes it easy to integrate C and assembler code, and furthermore allows higher code efficiency C expressions to be used.

● AM3 (MN103) Series C Compiler and EC++ Compiler

- At the same time as providing speed optimizations such as inline function expansion (inlining), loop unrolling, and instruction scheduling, the compiler for the Panasonic 32-bit microcontrollers (AM3 series) also features improved size reduction optimizations such as tail merging to get the maximum performance from these 32-bit microcontrollers. In addition, this compiler also achieves faster processing of iterative programs and function calls by making effective use of the loop start instruction, special loop branch instructions, and highly functional subroutine call instruction provided by these 32-bit microcontrollers.
- Starting with version 4.0, this compiler also supports the EC++ language designed for embedded applications.
- EC++ is an object-oriented language for embedded processors that forgoes the features of C++ that may result in code bloat, and is a subset of C++.
- Additionally, Panasonic EC++ provides object-oriented language optimizations that reduce the size of the generated code making it possible for users to take advantage of object-oriented programming, even when developing software for embedded applications with severe memory resource limitations.

Optimizing Compiler Developments

【Object-oriented optimization examples】
- Direct call of virtual function optimization
- Allocation of constant objects to the constant area
- Elimination of unnecessary virtual function tables and member functions

V4.0
C++ compiler for embedded systems

V3.0
Speed optimizing compiler

【Speed optimization examples】
- Inline expansion
- Loop unrolling
- Instruction scheduling

V2.0
Code optimizing compiler

【Code optimization examples】
- Loop invariant code motion
- Induction variable optimization
- Eliminating common subexpressions
- Optimal register allocation

DebugFactory® Builder

Microcomputer software integrated development environment that supports debugging with a simulator

● User-Friendly Debugging Tools

The DebugFactory Builder provides efficient microcomputer software debugging by supporting, in a single application, the edit, build (make file generation and compilation), and debug sequence that is used repeatedly in debugging. For example, when you find a bug during debugging and want to change the source code, you can immediately change the source code in the debugging screen and then perform a build and reload operation with a single operation.
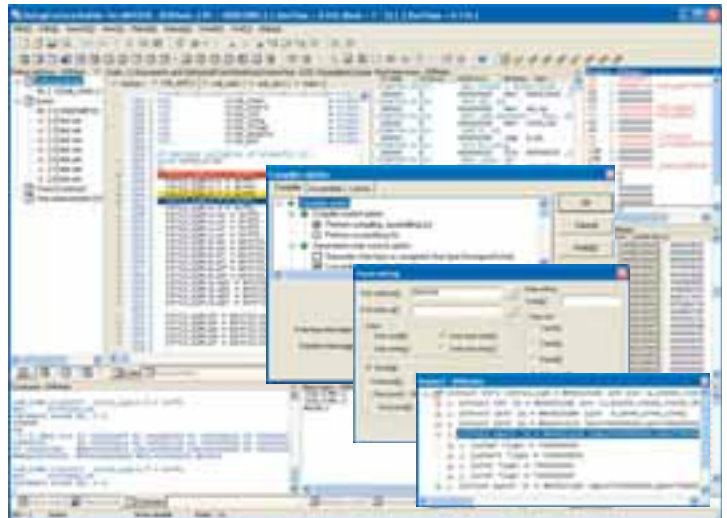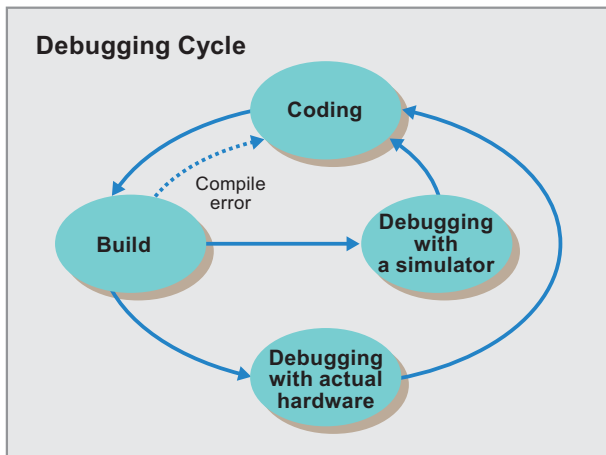
The DebugFactory Builder Screen

● Support Debugging with a Simulator

★There are certain microcomputer series for which simulation functions are not available.

Since the DebugFactory Builder includes a built-in instruction set simulator, microcomputer software can be debugged even if the hardware that is the debugging target is not available.

The DebugFactory Builder includes a visual tool that supports debugging with the instruction set simulator. This tool allows operations on the microcomputer, such as issuing interrupts or modifying memory, to be performed with icon operations, such as mouse clicks. This allows microcomputer software to be debugged on a personal computer as though one were using the actual hardware itself.

This tool can significantly speed up the product delivery period, since unit testing and integrated testing in advance of the availability of the hardware can be performed fully.

The DebugFactory Builder provides functions for performing automated unit tests and simplified system simulations without modifying the source code that will be embedded in the end product.

Example of a simulation debugging screen created with the panel tool included in the DebugFactory Builder.

- ●Panel tool
- ●Function swapping
- ●Memory access event
- ●Timer event
- ●File access

Support Functions for Debugging with a Simulator

PanaX NEO On-Board Debugging Environment

Ideal for debugging high-speed processors and actual machines

- PanaX NEO is a new debugging environment designed to take the place of previous on-board debugging environments.
- In addition to basic functionality equivalent to that offered by in-circuit emulators, including execution controls, events and breakpoints, and program downloading, semi-non-intrusive functions (such as the watch function) enable efficient real-time debugging. The optional data gathering unit enables real-time trace functinality such as program execution log acquisition.
- Standard host computer connectivity is via USB 2.0 (High Speed) and Ethernet 10Base-T/100Base-TX.

● AM32 (MN103S) Series

- Either JTAG boundary scan test pins or a dedicated serial interface (DWire32A) is used as the debugging control interface.
- For products with trace pins, a data gathering unit can be connected to enable real-time trace functionality.

<Applicable products>

- MN103S Series microcomputers with a debugging control interface (JTAG/DWire32A) and system ICs that include an AM32 core

On-board debugging environment	PanaXSeries®
	AM32 (MN103S)
Maximum operating frequency	The internal operating frequency of the microcontroller
Debugging control interfaces	JTAG/DWire32A
Events (hardware breakpoints)	Total for ROM and RAM: 4 points[1], Area, AND, and Sequential breakpoints
Trace capacity	512K frames[2][3]
Trace operating modes	Branch and delayed trigger[2]
Time measurements	Between arbitrary events, maximum, minimum
Trigger	Input, Output (Event, Signal Level)
Semi-non-intrusive functions[4]	Changes to/display of memory and I/O registers, trace data display (dump), watch, RAM monitor, changes to various settings
Debugger	DebugFactory® Builder
Host OS	Windows® 2000/XP(SP2 or later)/Vista
Host interfaces	USB 2.0 (High Speed), Ethernet 10BASE-T/100BASE-TX
Other features	Using execution address instead of fetch address in ROM event setting and display of trace data.

*1: Differences exist depending on the model used.
*2: For products with trace pins
*3: Depends on debugger settings and target program.
*4: May stop target program execution briefly.

In-Circuit Emulator

Provides non-disrupted development aid for high-speed devices

● **Real-time Emulation**

Integrated emulator circuits and high-density mounting technology combine to deliver high-speed, real-time emulation.

● **Powerful Event, Break and Trace Capabilities**
- H/W breakpoints can be used as events that trigger various debugging actions.
- These events can be combined with other events to form a complex pre-condition (e.g. SEQUENTIAL or AND)
- Various and useful trace operation modes, e.g. delayed triggered conditioned by the event.

● **Non-intrusive Debugging Functionality**

Without any interference to program execution, you can see contents of memory, display trace data and alter event, break and trace settings.

● **Low Voltage Devices are Supported**

MN103L Series In-Circuit Emulators

NEW

Introducing the newly released PX-ICE103L In-Circuit Emulator for the MN103L Series

● **Dramatically enhanced functionality compared to the PX-ICE103S, an in-circuit emulator for the MN103S**
- Enhanced basic functionality such as event and time measurement
- Expanded RAM monitor capacity
- C0 (command coverage) support
- High-accuracy profile (The sampling rate is about 100 times in comparison with ICE103S.)

● **USB 2.0 (High Speed) host interface**

● **Selection of target connection method to match target system**
- Flexible cable for versatile connectivity options
- Direct adapter connectivity for faithful replication of characteristics

● **Same operation as target device thanks to probe using actual chip (Microcomputer with Flash-memories)**

● **Simple model lineup**

	PX-ICE103L	PX-ICE103S
Maximum operating frequency *1	40 MHz	100 MHz
Emulation memory size (Byte)	On-chip ROM: 2 MB, On-chip RAM: 64 KB, Expansion RAM: 1 MB (2 MB)*2	On-chip ROM: 1 MB Expansion RAM: 4 MB
Events (H/W breakpoints)	ROM: 4 points; RAM: 8 points, Area, AND, Concurrent AND, Sequential, External input, Timeout	ROM: 4 points; RAM: 4 points, Area, AND, Sequential
Trace memory depth	128 K frames (1 M frames)*2	128 K frames
Trace operation modes	Normal, Jump, Event, Data, Delayed trigger, Multi, Cumulative trace	Normal, Jump, Event, Data, Delayed trigger
RAM monitor size	64 KB internal RAM + 1 KB other × 16 blocks Read/Write data support (with R/W detection function)	1 KB Read/Write data support (without R/W detection function)
Time measurments	Between any two events (breakpoints) (max. approx. 116,853 years) Maximum and minimum time measurement (max. 858 sec) Resolution: 25/50/100/200 ns	Between any two events (breakpoints) Maximum and minimum time measurement (max. 432 sec) Resolution: 25/50/100 ns
Trigger	Input (3-bit edge detection and 8-bit data detection) Output (Select either 2-bit event or 8-bit data)	Output (Event output, Data output)
C0 Coverage	Execution PC 512 K × 4 blocks	—
Non-intrusive functions *3	Display of trace raw data; Watch; RAM monitor; Alteration of event, break, and trace settings	
Semi-non-intrusive functions *4	Display and modification of memory and I/O registers, Display of trace data with disassemble list	
Debugger software	DebugFactory® Builder	
Host OS	Windows® 2000/XP(SP2 or later)/Vista	
Host interfaces	USB2.0 (High Speed)	PC card and PCI interface board
Other comments	Using execution address instead of fetch address for events, trace data display, coverage, etc.	

Note: The PX-ICE103S does not support the MN103L Series. The PX-ICE103L does not support the MN103S Series.

*1: Indicates internal operating frequency in microcomputer. Frequency may vary by model.
*2: Figures in parentheses represent options that can be specified at time of order.
*3: Does not interfere with target program execution.
*4: May stop target program execution briefly.

MN101C/E Series In-Circuit Emulators

● **PX-ICE101C/E Standard-edition In-Circuit Emulator**

The PX-ICE101C/E is the standard in-circuit emulator for the MN101C/E Series.

● **PX-ICE101C/E-PLUS Expanded Trace Memory Type In-Circuit Emulator**

This in-circuit emulator with expanded trace memory adds 1M frames to the trace memory offered on Panasonic's previous in-circuit emulator (PX-ICE101C/E).

● **PX-ICE101C/E-Lite Economy Type In-Circuit Emulator**

This in-circuit emulator is available at a lower cost than Panasonic's previous in-circuit emulator (PX-ICE101C/E).

• Lower cost due to partially reduced functionality and a design that integrates the in-circuit emulator and probe into a single unit

• USB 2.0 (High Speed) host interface

• Same model-specific probe board as Panasonic's previous in-circuit emulator (PX-ICE101C/E) (Contact Panasonic for more information on applicable products.)

PX-ICE101C/E-Lite

	Normal Type PX-ICE101C/E	Expanded Trace Memory Type PX-ICE101C/E-PLUS	Economy Type PX-ICE101C/E-Lite
Maximum Operating Frequency *1	20 MHz	24 MHz	
Emulation memory size (Byte)	944 KB for instruction / 64 KB for data		
Events (H/W breakpoints)	ROM: 16 points; RAM: 16 points Area, AND, and Sequential breakpoints		ROM: 2 points; RAM: 2 points Area, and Sequential breakpoints
Trace memory depth	32 K frames	1 M frames	2 K frames
Trace operation modes	Normal, Area, Delayed triggered, Multi		Normal, Delayed triggered
RAM monitor size	Internal RAM space + 128 KB		Installing no specialized hardware
Time measurments	Between any two events (breakpoints) and maximum time measurement		Maximum between arbitrary events (breakpoints)
Trigger	Input, Output (Event, Signal Level)		Output (Event, Signal Level Low)
Non-intrusive functions *2	Display of trace raw data, "Watch", "RAM monitor", Alteration to event, break and trace settings		Display of trace raw data, Alteration to event, break and trace settings
Semi-non-intrusive functions *3	Display and Modification of memory or I/O registers, Display of trace data with dis-assemble list		Display and Modification of memory or I/O registers, Display of trace data with dis-assemble list, "Watch", "RAM monitor"
Debugger software	DebugFactory® Builder		
Host OS	Windows® 2000/XP(SP2 or later)/Vista		
Host interfaces	PC card and PCI interface board		USB 2.0 (High Speed)
Other comments	Using execution address instead of fetch address in ROM event setting and display of trace data		

*1: Indicates internal operating frequency in microprocessor. It may be changed by part number.   *2: Does not interfere with execution of target program.
*3: May stop target program execution briefly.

Flash Programmer (PX-FW2)

Single unit supports both adapter-based parallel and onboard serial programming

• This is a tool for reading out or programming the contents of the flash memory in an AM Series microcomputer. This single unit supports both adapter-based parallel operation using a Programming adapter and onboard serial operation using the microcomputer's serial communications functions.

• May be connect to a computer via USB or printer port. (Printer port connection cable sold separately.)

• Data to be written can be loaded into the flash programmer in advance to allow programming to flash memory without the flash programmer being connected to the personal computer.
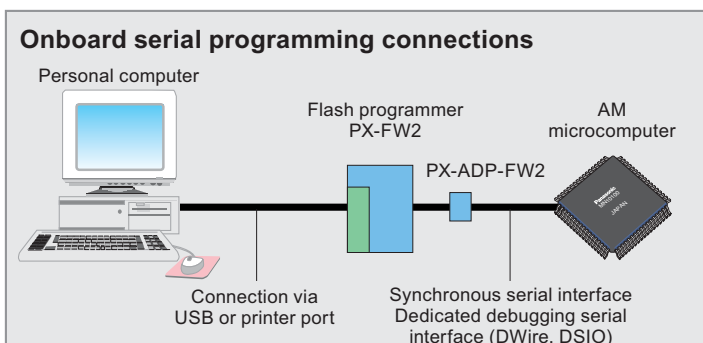
USB
UNIVERSAL SERIAL BUS

Onboard serial programming connections

Personal computer

Flash programmer
PX-FW2

AM
microcomputer

PX-ADP-FW2

Connection via
USB or printer port

Synchronous serial interface
Dedicated debugging serial
interface (DWire, DSIO)

AM3/AM1 Flash Microcomputer Development Support Tools

OBJECT
Microcomputer Research & Development

OBJECT Co., Ltd., provides a full range of development support tools for AM microcomputer evaluation and selection, embedded system development and failure analysis, and on-chip flash ROM programming.

AM3 / AM1 STARTER KIT Serial or DWire

■ Products include a trial version C compiler, debugger, and other software needed for evaluating AM3 and AM1 Series hardware and software performance.

■ The included trial version C compiler can be upgrade once.

■ Includes DebugFactory® Builder integrated development environment for debugging use.

■ Sophisticated sample programs are available on the OBJECT website for use in creating evaluation programs.

■ Host computer connectivity is via USB, eliminating the need for an external power supply.

AM1 STARTER KIT Serial   AM3/AM1 STARTER KIT DWire

Product name	AM1 STARTER KIT Serial	AM1 STARTER KIT DWire	AM3 STARTER KIT DWire
Host interface	USB1.1		
Supported microcomputer products	MN101C Series	MN101C / MN101E Series	MN103S Series
Microcomputer communications method	Synchronous serial	DWire8	DWire32A
Debugging monitor	Written to loader area	Linked to user program	
Debugging configuration	Debugging of microcomputer on-chip flash ROM		
Execution functions	Program load, Single step, Function step, Program execution, Come execution, Microcomputer reset		
Breakpoint functions	Pre-execution	ESC, Pre-execution, Software	
Data display/modification	Dump, Edit, Watch, Inspect		
Serial interface	9-pin D-sub × 2 (option: 1)	RS-232C driver only (no 9-pin D-sub)	
External expansion function	Included external expansion connector land for connecting all AM microcontroller pins (connector is not mounted).		

AM32L / AM1 Debug Probe DWire

■ This on-board debugger system supports the AM32L and AM1 Series on-chip debugger and the DWire interface.

■ Available mask ROM type products other than flash ROM type are effective not only during system development but also in the failure analysis of finished products.

■ Includes a full version C compiler.

■ Includes DebugFactory® Builder integrated development environment for debugging use.

■ Host computer connectivity is via USB, eliminating the need for an external power supply.

AM32L / AM1 Debug Probe DWire

Product name	AM1 Debug Probe DWire	AM32L Debug Probe DWire
Host interface	USB1.1	
Supported microcomputer products	MN101C / MN101E Series	MN103L Series
Microcomputer communications method	DWire8	DWire32L
Debugging monitor	Linked to user program	Uses microcomputer dedicated area (not linked to user program)
Debugging configuration	Debugging of microcomputer on-chip flash ROM	
Emulation memory	None	
Execution functions	Program load, Single step, Function step, Program execution, Come execution, Microcomputer reset	
Breakpoint functions	ESC, Pre-execution, Software break	
Data display/modification	Dump, Edit, Watch, Inspect	
Other functions	RAM monitor, Back trace, Non-intrusive	

AM3/AM1 Flash Microcomputer Development Support Tools

OBJECT
Microcomputer Research & Development

AM3 / AM1 On-Board Programmer DWire Type 1 or Type 2

■ Type 1 supports on-board write access by means of an AM microcomputer and the DWire interface.

■ Type 2 provides an upgrade to Type 1 functionality by adding an offline writing function.

■ A program matching evaluation has been completed, providing a guideline for reliability evaluation.

■ Key codes for different microcomputer models are supported, and security key codes can be created and edited. Key code files are compatible with the PX-FW2.

■ Target system connectivity is via a 5-pin, 2-row connector that is compatible with the PX-FW2 as well as the AM1 Debug Probe DWire.

■ Host computer connectivity is via USB, eliminating the need for an external power supply.

Type 1   Type 2

Product name	AM1 On-Board Programmer DWire Type 1	AM3 On-Board Programmer DWire Type 1	AM1 On-Board Programmer DWire Type 2	AM3 On-Board Programmer DWire Type 2
Host interface	USB1.1			
Supported microcomputer products	MN101C / MN101E Series	MN103S Series	MN101C / MN101E Series	MN103S Series
Microcomputer communications method	DWire8	DWire32A	DWire8	DWire32A
Control software	AMOBP Commander and model-specific package software			
Programming functions	Write, Read, Erase, Verify, Protect, Create/edit/write security key code			
Load program	Unnecessary			
Offline writing function	None		Provided	
Offline program memory	None		2 MByte; up to 4 programs can be saved	
Target support voltage	1.4 V to 5.0 V, automatic tracking		1.4 V to 5.0 V, automatic tracking (when using the target power supply, 3.3 V to 5.0 V)	
Unit power supply	USB bus power / AC adapter		USB bus power / AC adapter / Target power supply	

AM3 / AM1 On-Board Programmer UART

■ The AM3/AM1 On-Board Programmer UART supports RS232C-compliant on-board serial write access between the AM microcomputer and the host computer.

■ Product has been released as a 30-license volume package and as a single license. A single-license version is included in the package software for supported models.

■ Includes functionality for automatically detecting the target systems' microcomputer UART port and for automatically setting the optimal baud rate.

Product name	AM1 On-Board Programmer UART	AM3 On-Board Programmer UART
Supported microcomputer products	MN101C / MN101E Series	MN103S Series
Microcomputer communications method	UART (RS232C-compliant, Max. baud rate of 230400 bps, No hardware flow control, 8 data bits, 1 stop bit, even parity)	
Control software	AMOBP Commander and UART version compatible model-specific package software	
Programming functions	Write, Read, Erase, Verify, Protect, Create/edit/write security key code	
Boot program	Dedicated boot program included in the UART version model-specific package software is written to the target microcomputer.	

Notes

■ DebugFactory® is a registered trademark of Panasonic Corporation.

■ Specifications and product performance are subject to change without prior notification.

■ See OBJECT's website at http://www.object.co.jp/ for more detailed product specifications.

■ Please send inquiries via email to info@object.co.jp.

OBJECT CO., Ltd.

PARTNER-*Jet*/MN103

KMC

Kyoto Microcomputer's PARTNER-Jet is an excellent JTAG Emulator to meet the needs for today's embedded software development.

Based on high-speed and high-performance, PARTNER-Jet supports RTOS such as Linux, the latest devices including Multi-core and SMP system. Also, there are various models in PARTNER-Jet so user can choose the right one which meets their requirements. PARTNER-Jet is continuously evolving and it provides the better development environment to develop cutting-edge digital devices and home appliances.

Features:
- Ultra high download speed
  - 3 MByte/sec (Target memory)[*1]
  - 10 MByte/sec (Emulation memory)[*1]
- Huge trace memory (Max 8 Gbit)
- Supports Multi-core/ SMP CPUs
- Event Tracker function installed
- Supports Linux and T-Engine
- Supports high speed trace clock (200 MHz)[*1]
- Offers advanced features like real-time trace and hardware breaks

*1: Speed may vary with target board and CPU.

Supported CPU	Supported Compiler
AM33, AM34 based core / JTAG(16+20 pin)	exeGCC MN103, C compiler made by Panasonic, GNU C

Product Name	Interface		Trace Memory Size	CPU Support Expansion
	USB	LAN		
PARTNER-Jet Model 10	○	×	None	×
PARTNER-Jet Model 20	○	×	4.5 Mbit	○
PARTNER-Jet Model 30	○	○	18 Mbit	○
PARTNER-Jet Model 40	○	○	8 Gbit (Giga Trace)	○

○ is supported, × is not supported

PARTNER-Jet Model 40 supports Giga Trace and it will be a performance analyzer as well as a debugger

PARTNER-Jet Model 40 (Giga Trace) has 8 GBit of huge trace memory. This allows you to save several billions of instruction execution histories and CPU execution histories for approximately 10 seconds. Utilizing those execution histories, you can use it not only debugging but also analyzing the performance of the large block of process. PARTNER, the debugger software, is also evolved to handle the huge trace data and analyze the performance. Event Tracker, the new function and history window which shows execution history are collaborate tightly. Search function and statics function in history window are enhanced so that you can easily use those new functions.

Event Tracker

Event Tracker graphically displays the events and time frame occurred in the embedded software. It is a great tool to check the RTOS state transition such as process, task, thread. It can be used in Multi-core and SMP system.

Collaborate History Function and Event Tracker Function

Embedded Linux support

PARTNER-Jet and PARTNER completely support virtual spaces on MMU and enable to debug Linux kernel to applications.[*2]
You can also debug the SMP-Linux running on multiple CPU system as if it is a single CPU system.[*2*3]
*2: Linux support package is needed for Linux debugging.
*3: Multi-core option is needed for multi-core debugging.

Multi-core CPU support

A single PARTNER-Jet with a single JTAG scan chain enables multiple debugging as if multiple JTAG Emulators are connected each CPU.[*3]
*3: Multi-core option is required for multi-core debugging.

Flash Support Group
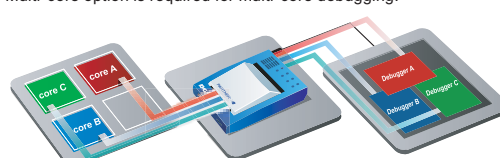
AF9708/09 FLASH PROGRAMMER

■ **Handles both serial and parallel programming**
Equipped with 32-,and 48-pin I/O DIP sockets and a serial write port, it supports a wide range of device including EPROM,EEPROM and flash EEPROM memory, alone or single-chipped into microcontrollers.

■ **High-speed programming:Up to 1 Mbit/3 s***
*:for x16-bit write.varies with device characteristics.

■ **Prompt support for new device**
Complete support for not only 5 V and 3.3 V devices, but also 1.8 V device. New socket adapters are also released rapidly.

■ **Latest algorithm S/W is offered by free.**
free offers on the WEB page.

■ **Large-capacity programming : Handles 64 Mbit buffer RAM**
* AF9708 : 16 Mbit

■ **High-speed data transfer : Equipped with 10BASE-T as standard for high-speed FTP transfer.**
* Not provides as standard equipment in AF9708

■ **Support Device (Individual parallel programmers)**
See the Flash Support Group, Inc. web site, http://www.j-fsg.co.jp

AF9723 GANG PROGRAMMER

■ **High-speed programming:Up to 1 Mbit/0.5 s***
* : When AF9845 GANG UNIT is used together

■ **High-Speed data transfer**
Supports speeds of up 1 Mbit in 1.8 s* through the AF9835 Ethernet unit and FTP transfer (10 BASE-5/10 BASE-T). The AF9835 can be simply mounted in a dedicated slot on the real panel of the AF9723 main unit.
* : For Binary files.

■ **Large-capacity programming:**
64 Mbit buffer RAM
Expandable to 256 Mbit with the AF9836RAM board.

■ **Prompt support for new device**
Complete support for not only 5 V and 3.3 V devices, but also 1.8 V devices. New socket adapters are also released rapidly.

■ **Latest algorithm S/W is offered by free.**
free offers on the WEB page.

■ **Support Device (Gang parallel programmers)**
See the Flash Support Group, Inc. web site, http://www.j-fsg.co.jp

In-Circuit Flash Programmer
NET IMPRESS Series

YOKOGAWA ◆
Yokogawa Digital Computer Corporation

The NET IMPRESS Series provides a high-speed, in-circuit programming environment for flash memory chips

The G-NETIMPRESS and the MegaNETIMPRESS in-circuit programmer are ideal for high-speed programming of high-capacity flash memory chips. They accommodate optimum programming environment for the flash programming on manufacturing lines, development sites, and maintenance.

G-NETIMPRESS

MegaNETIMPRESS

Product Features
■ High-capacity CompactFlash data storage
■ High-speed flash programming performance of 5 Mbps throughput to target
■ Remote control by computer (100BASE-TX compatible)
■ High-speed file downloading
■ One-touch key operation for triggering flash programming
■ Programming PASS/ERROR open collector output circuit
■ Simple operation using folder metaphor
■ Remote production line system control using driver software

Compatible CPUs
• AM1 Series (Interface support: Serial, DWire)
• AM2 Series (Interface support: Serial, DWire)
• AM3 Series (Interface support: Serial, DWire, JTAG)

* Supplied probe cable varies according to the target interface. For more information, contact Yokogawa Digital Computer Corporation.

Flash Programming on Production Lines

Support for both remote control from a PC and standalone operation let you deploy the solution that's right for your production line.

| Flash programming line utilizing remote PC control

Barcode reader   Ethernet

Probes

| Standalone line utilizing a manual press

Probes
External contact I/O cable

AF320/AC4P

Back of programmer

Start switch

External contact I/O connector
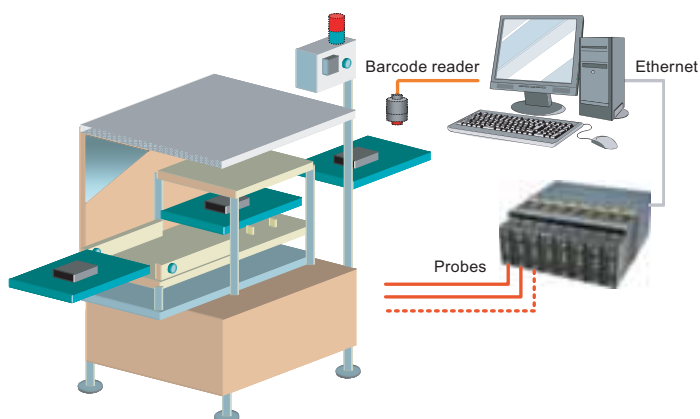
* Up to 8 programmers can be controlled simultaneously.
* The G-NETIMPRESS is recommended for use on simultaneous multiple programming lines.
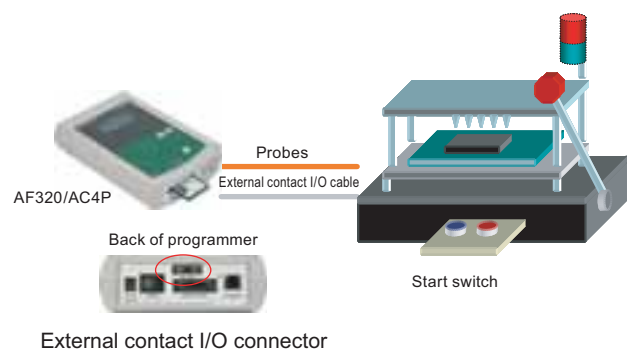
• Write smart trigger input
• PASS/ERROR open collector output function can be used with signal lights, etc.

Wave Technology Co., Ltd.
Parallel Gang Programmer

Flash Programming and Testing system Y1100-8

Y1100-8 speeds up programming and verifying of Flash Memory. It's as fast as the raw power of the device itself.

■ **At high-speed programs up to 8 devices, Flash Microcontroller or Flash Memory, simultaneously.**
Program time of 32 Mbit data is only 19 seconds.
Program time of 64 Mbit data is only 38 seconds.

■ **Allows high speed transfer data by network of Pre-installed MS-windows® XP.**
(Binary data transfer time for 8 Mbit is 7 seconds, Intel or Motorola Format data transfer time for 8 Mbit is 38 seconds.)

■ **Easy and comfortable operation with 6.5"TFT touch screen panel.**

■ **Supports various device packages**
In combination with Auto-Handler, productivity can be improved.

■ **Supports device's characteristic examination and analysis for a defect device, and allows to programming a serial number data for MAC address etc.**

■ **Supported Device(Gang parallel programmer)**
See the Wave Technology Co., Ltd. web site. http://www.y1000.com

■Development Support Tools

Please see the following Web site about information on the development tool.

Information on tool whole
        http://www.semicon.panasonic.co.jp/e-micom/support.html
Product support list
        http://www.semicon.panasonic.co.jp/e-micom/hardtool/tool_list.html
Inquiry
        http://www.semicon.panasonic.co.jp/e-micom/qa.html

●AM1 (MN101) Series of 8-bit Microcontroller

Tool Name	AM13 (MN101C) Series	AM13E (MN101E) Series
Compiler and Assembler	ANSI C compiler with extensions for 8-bit microcomputers (8-bit internal computation and bit fields within chars)	
Debugger	DebugFactory® Builder	
Emulator	In-circuit emulator supporting real-time debugging with 224 KB (944 KB) of ROM and 16 KB (64KB) of RAM, trace function,break functions, etc. ( ):MN101E Series	
On-board Debugger	On-board debugging environment offering real-time debugging using the actual device Effective solution for field debugging and final product evaluation, including analog characteristics	
	Manufactured by OBJECT Co., Ltd. Memory reference/modification, breakpoints, etc.	
Software Simulator	Tool for debugging without the actual machine (DebugFactory® Builder)	

●AM3 (MN103) Series of 32-bit Microcontroller

Tool Name	AM32 (MN103S) Series	AM32L (MN103L) Series
Compiler and Assembler	ANSI-compliant C compiler, EC++-compliant compiler	
Debugger	DebugFactory® Builder	
Emulator	In-circuit emulator capable of real-time debugging	
	Emulation function for 1 MB of on-chip ROM and up to 4 MB of expansion RAM, trace function, breakpoint functions, etc.	Emulation function for 2 MB of on-chip ROM, 64 KB of on-chip RAM, and 1 MB (max. 2 MB) of expansion RAM, trace function, breakpoint functions, coverage function, etc.
On-board Debugger	On-board debugging environment offering real-time debugging using the actual device Effective solution for field debugging and final product evaluation, including analog characteristics	
	Memory reference/modification, breakpoints, trace function, etc. (depends on device's on-chip functionality)	Manufactured by OBJECT Co., Ltd. Memory reference/modification, breakpoints, etc.
Software Simulator	Tool for debugging without the actual machine (DebugFactory® Builder)	

●Operating Environment

Tool Name	Windows® 2000/XP(SP2 or later)/Vista
Compiler and Assembler	○[1]
DebugFactory® Builder Emulator Flash Programmer (PX-FW2)	○

[1]: In a command prompt.

■Business Partner

●AM1 (MN101) Series of 8-bit Microcontroller

Tool Name	Model Number	Description	Developer
In-Circuit Emulator	Uni STAC MN101C series	Set consisting of in-circuit emulator for MN101C series plus Watchpoint debugger for Windows®. Target probe selections for emulation is option.	Sophia Systems Co., Ltd.
Parallel flash memory gang programmer	Y1100-8	Gang programmer that supports parallel write operations	Wave Technology Co., Ltd. Sales Department (or DEPT)
Flash on-board serial programmer	MegaNETIMPRESS AF420/AF320	General-purpose in-circuit programmer for flash microcomputer	Yokogawa Digital Computer Corporation Instruments Business Div.
Flash on-board serial programmer	AMOBP	General-purpose in-circuit programmer for flash microcomputer	OBJECT Co., Ltd.
Flash parallel /on-board programmer	AF9708/09/09C AF9723/23B(Gang) AF9101(On-board)	Parallel (independent write, gang)/Programmer that supports on-board serial write operations	Flash Support Group,Inc.
CPU Evaluation Board	AM1 STARTER KIT	This CPU evaluation board supports evaluation of AM1 (MN101C/E) applications over a USB connection and includes both a compiler and a debugger.	OBJECT Co., Ltd.
On-board Debugging Environment	AM1 Debug Probe	On-board debuggibg environment that supports debugging when connected to the AM1 (MN101C/E) microcontroller in a target system includes a device that already has debugger, compiler, and monitor routines downloaded and can be connected over a USB connection that does not require a separate power supply.	
Programming Adapter	TEF009 Series	The TEF009 Series programming adapter is sold by Flash Support Group, Inc. Which retailer carries the tool depends on which microcomputer you are using.	Flash Support Group,Inc.

●AM3 (MN103) Series of 32-bit Microcontroller

Tool Name	Model Number	Description	Developer
Compiler	GNU Pro	C/C++ compiler based on GNU gcc plus simulator/debugger.	Red Hat, Inc.
	exeGCC	C/C++ compiler for high-speed and compact embedded device development.	Kyoto Microcomputer Co., Ltd.
JTAG Emulator	PARTNER-Jet for MN103	High-speed JTAG Emulator that supports the latest development environment embedded RTOS including Linux and Multi-core/SMP.	Kyoto Microcomputer Co., Ltd.
Parallel flash memory gang programmer	Y1100-8	Gang programmer that supports parallel write operations	Wave Technology Co., Ltd. Sales Department (or DEPT)
Flash on-board serial programmer	MegaNETIMPRESS AF420/AF320	General-purpose in-circuit programmer for flash microcomputer	Yokogawa Digital Computer Corporation Instruments Business Div.
Flash on-board serial programmer	AMOBP	In-circuit programmer for flash microcomputer	OBJECT Co., Ltd.
Flash parallel /on-board programmer	AF9708/09/09C AF9723/23B(Gang) AF9101(On-board)	Parallel (independent write, gang)/Programmer that supports on-board serial write operations	Flash Support Group,Inc.
Programming Adapter	FLS344CSP-103SF33 (CSP 344pin) FLS360MBGA13-103SF33 (BGA 360pin)	Conversion adapter for connecting a MN103SF33N flash microcomputer to a Flash Programmer.	Sunhayato Corp.
Programming Adapter	TEF009 Series	The TEF009 Series programming adapter is sold by Flash Support Group, Inc. Which retailer carries the tool depends on which microcomputer you are using.	Flash Support Group,Inc.
CPU Evaluation Board	AM3 STARTER KIT	This CPU evaluation board supports evaluation of AM3 (MN103SFA5K) applications over a USB connection and includes both a compiler and a debugger.	OBJECT Co., Ltd.
On-board Debugging Environment	AM32L Debug Probe	On-board debugging environment offering debugging functionality through a connection with an AM32L (MN103L) microcomputer target system. Uses a USB connection that can also power the device and includes a debugger and compiler.	

●Package - Surface Mount Socket

Package code	Panasonic number	Remarks		Distributor
QFP044-P-1010	PRB-SKT44QF10			Panasonic Corporaion
QFP084-P-1818	PRB-SKT84QF18			
QFP100-P-1818	PRB-SKT100QF18	Plastic package exclusive use		

Package code	Panasonic number	Socket manufacturer catalog number		Distributor
TQFP032-P-0707	——	HQPACK032SA	NQPACK032SA	Tokyo Eletech Corporation It is possible to order by the Panasonic number.
SSOP032-P-0300	——	HSPACK32BK	NSPACK32BK	
QFP044-P-1010F	PRB-TET44QF10F[*1]	HQPACK044SA	NQPACK044SA	
QFH048-P-0707 TQFP048-P-0707B	PRB-TET48TH07	HQPACK048SD	NQPACK048SD	
	PRB-TET48TH07-SL	HQPACK048SD	NQPACK048SD-SL	
QFH064-P-1010	PRB-TET64TH10	HQPACK064SD	NQPACK064SD	
	PRB-TET64TH10-SL	HQPACK064SD	NQPACK064SD-SL	
LQFP064-P-1414	PRB-TET64LF14	HQPACK064SA160	NQPACK064SA160	
	PRB-TET64LF14-SL	HQPACK064SA160	NQPACK064SA160-SL	
QFH080-P-1212 TQFP080-P-1212	PRB-TET80TH12	HQPACK080SD	NQPACK080SD-ND	
	PRB-TET80TH12-SL	HQPACK080SD	NQPACK080SD-ND-SL	
LQFP080-P-1414	PRB-TET80LF14	HQPACK080SB160	NQPACK080SB	
	PRB-TET80LF14-SL	HQPACK080SB160	NQPACK080SB-SL	
LQFP100-P-1414	PRB-TET100LF14	HQPACK100SD	NQPACK100SD-ND	
	PRB-TET100LF14-SL	HQPACK100SD	NQPACK100SD-ND-SL	
QFP100-P-1818	PRB-TET100QF18	HQPACK100SB	NQPACK100SB	
	PRB-TET100QF18-SL	HQPACK100SB	NQPACK100SB-SL	
LQFP112-P-2020	PRB-TET112LF20	HQPACK112SB	NQPACK112SB	
	PRB-TET112LF20-SL	HQPACK112SB	NQPACK112SB-SL	
TQFP128-P-1414	PRB-TET128LF14	HQPACK128SE	NQPACK128SE	
	PRB-TET128LF14-SL	HQPACK128SE	NQPACK128SE-SL	
LQFP128-P-1818	PRB-TET128LF18	HQPACK128SD	NQPACK128SD	
	PRB-TET128LF18-SL	HQPACK128SD	NQPACK128SD-SL	
QFP160-P-2828	PRB-TET160QF28	HQPACK160SB	NQPACK160SB	
	PRB-TET160QF28-SL	HQPACK160SB	NQPACK160SB-SL	
QFP208-P-2828	PRB-TET208QF28H	HQPACK208SD306H	NQPACK208SD	

*1 : Lead-free package
-SL : Screw reinforcement from solder fixation + back of substrate

■Business Partner Contacts

Region	Business Partner	Tel/Fax	URL/E-mail

●Yokogawa Digital Computer Corporation

Region	Business Partner	Tel/Fax	URL/E-mail
U.S.A	Yokogawa Corporation of America 2 Dart Road Newnan, Georgia 30265 USA	Tel: +1-800-888-6400 +1-770-253-7000 Fax: +1-770-251-6427	URL: http://www.yokogawa-digital.com/en/ E-mail: info-ovs@yokogawa-digital.com
Germany	Hitex Development Tools GmbH Greschbachstr. 12, 76229 Karlsruhe, Germany	Tel: +49-721-9628-0 Fax: +49-721-9628-149	URL: http://www.hitex.de/ E-mail: info@hitex.de
UK, France	Ashling Microsystems Limited 11 avenue Charles de Gaulle 95700 Roissy en France	Tel: +33-1-43-41-06-37 Fax: +353-61-334477	URL: http://www.ashling.com E-mail: ashling.sales@nestgroup.net
Korea	Yokogawa Measuring Instruments Korea Corp. (YIK) City Air Terminal Bldg., 405-9, #159-6, Samsung-dong, Kangnam-ku, Seoul, 135-728, Korea	Tel: +82-2-551-0660 Fax: +82-2-551-0665	URL: http://www.yokogawa-yik.co.kr/
China	Yokogawa Shanghai Trading Co., Ltd. 3F Tower D Cartelo Crocodile Building, No.568 Tianshan W Road, Shanghai, 200335 China.	Tel: +86-21-6239-6363 Fax: +86-21-6880-4987 • Beijing Office Tel: +86-10-85221699 Fax: +86-10-85221677 • Guangzhou Office Tel: +86-20-28849908 Fax: +86-20-28849937 • Shenzhen Office Tel: +86-755-8373-4456 Fax: +86-755-8373-4457	URL: http://www.yokogawa.com/cn-ysh/
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Other Asia	Yokogawa Engineering Asia Pte. Ltd. 5 Bedok South Road, Singapore 469270, Singapore	Tel: +65-6241-9933 Fax: +65-6241-2606	URL: http://www.yokogawa.com/sg/ E-mail: YeongHong.Chen@sg.yokogawa.com
Japan, Other countries	Yokogawa Digital Computer Corporation 3rd floor, Keio-Fuchu 1-Chome Building 1-9 Fuchucho, Fuchu-shi, Tokyo, 183-8516, Japan	Tel: +81-42-333-6222 Fax: +81-42-352-6107	URL: http://www.yokogawa-digital.com/en/ E-mail: info-ovs@yokogawa-digital.com

●Sophia Systems Co.,Ltd.

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China & Hong Kong	Emdoor Electronic & Technology Co., Ltd. Room 506#, China Non-ferrous Metal Building 6013# Shennan Road Futian District Shenzhen China	Tel: +86-755-83474893 Fax: +86-755-83474895	URL: http://www.emdoor.com E-mail: info@emdoor.com
Singapore	Flash Technology No.61 Kaki Bukit Avenue 1 #04-15, Shun Li Industrial Park Singapore 417943	Tel: +65-6749-6168 Fax: +65 6749-6138	URL: http://www.flashtech.com.sg E-mail: flashsgp@pacific.net.sg
Taiwan	SuperLink 3F-8, 77 Shin-Tai-Wu Road Sec. 1, Shi-Shih Taipei Hsien Taiwan 221	Tel: +886-2-2698-34-56 Fax: +886-2-2698-35-35	URL: http://www.superlink.com.tw E-mail: sulin.huang@superlink.com.tw
India	Trident Infosol Pvt. Ltd. #3, 2nd Cross, Raja Ram Mohan Roy Extn., Off K.H. Road (Double Road) Bangalore India 560 027	Tel: +91-80-2224-5037 Fax: +91-80-2229-1566	URL: http://www.tridentinfosol.com E-mail: msashok@tridentinfosol.com
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North America	Sophia Systems USA 422 Peninsula Avenue San Mateo CA U.S.A 94401	Tel: +1-888-423-2305 Fax: +1-650-375-8666	URL: http://www.sophiasys.com E-mail: sales@sophiasys.com
France, Germany, Italy	Antycip 98 ter, Boulevard Hellos Boite, Postale 111-F Argenteuil Cedex France 95103	Tel: +33-1-39 61 14 14 Fax: +33-1-30 76 29 73	URL: http://www.antycip.fr E-mail: akkouche@antycip.fr
UK	Direct Insight St. James Road Brackley Northants England NN137XY	Tel: +44-1280-700262 Fax: +44-1280-700577	URL: http://www.directinsight.co.uk E-mail: david.pashley@directinsight.co.uk
Europe	Eastern Trade Georgenstr. 46 a 87719 Mindelheim Germany	Tel: +49-8261 7374 14 Fax: +49-8261 7372 62	URL: http://www.eastern-trade.com E-mail: info@easterntrade.de
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Technical Information

Panasonic Microcomputer Website

http://panasonic.net/sc/en/e-micom
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https://www.semicon.panasonic.co.jp/semi-spt/general/?lang=en&
* Registration requires a registry key or serial number from the product's CD-ROM packaging.

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