Notification about the transfer of the semiconductor business

The semiconductor business of Panasonic Corporation was transferred on September 1, 2020 to Nuvoton Technology Corporation (hereinafter referred to as "Nuvoton"). Accordingly, Panasonic Semiconductor Solutions Co., Ltd. became under the umbrella of the Nuvoton Group, with the new name of Nuvoton Technology Corporation Japan (hereinafter referred to as "NTCJ").

In accordance with this transfer, semiconductor products will be handled as NTCJ-made products after September 1, 2020. However, such products will be continuously sold through Panasonic Corporation.

Publisher of this Document is NTCJ.
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Nuvoton Technology Corporation Japan

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MN101C97 Sriese

8-bit Single-chip Microcontroller

■ Overview

The MN101C series of 8-bit single-chip microcomputers incorporate multiple types of peripheral functions.
This chip series is well suited for camera, VCR, MD, TV, CD, LD, printer, telephone, home automation, pager, air conditioner, PPC, remote control, fax machine, music instrument and other applications.

This LSI brings to embedded microcomputer applications flexible, optimized hardware configurations and a simple efficient instruction set. The MN101C97D has an internal 64 KB of ROM and 1 KB of RAM. Peripheral functions include 7 external interrupts, 13 internal interrupts including NMI, 8 timer counters, 2 sets of serial interfaces, A/D converter, watchdog timer, buzzer output, and remote control output. The configuration of this microcomputer is well suited for application as a system controller in a camera, timer selector for VCR, CD player, or MD.

With two oscillation system (max. 8 MHz/32 kHz) contained on the chip, the system clock can be switched to high frequency input (high speed mode), or to low frequency input (low speed mode).

The system clock is generated by dividing the oscillation clock. The best operation clock for the system can be selected by switching its frequency by software. High speed mode has the normal mode which is based on 2-cycle clock (fosc/2) and the double speed mode which is based on the same cycle clock with fosc.

A machine cycle (min. instructions execution) in the normal mode is 250 ns when fosc is 8 MHz, and when fosc is 4 MHz, a machine cycle is 500 ns. A machine cycle in the double speed mode is 125 ns when fosc is 8 MHz, and 250 ns when fosc is 4 MHz. The package are 48-pin TQFP and 44-pin QFP.

■ Product Summary

This datasheet describes the following model of MN101C97 series. These products have identical function.
However, MN101C97D is described mainly.

Model	ROM Size	RAM Size	Classification	Package
MN101C97A	32 KB	1 KB	Mask ROM version	QFP044-P-1010F TQFP048-P-0707B
MN101C97D	64 KB	1 KB	Mask ROM version	QFP044-P-1010F TQFP048-P-0707B
MN101CF97D	64 KB	1 KB	Flash EEPROM version	QFP044-P-1010F TQFP048-P-0707B

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■ Features

- ROM Size:
  MN101C97D, MN101CF97D 65536 × 8 bit
  MN101C97A 32768 × 8 bit

- RAM Size: 1024 × 8 bit

- Package:
  TQFP48 (7mm square, 0.5mm pitch)
  QFP44 (10mm square, 0.8mm pitch) *Under planning

- Machine Cycle:
  <Mask ROM version MN101C97A / MN101C97D>
  High speed mode <fs = fosc / 1>
  0.125 µs / 8 MHz (2.7 V to 3.6 V)
  0.250 µs / 4 MHz (1.8 V to 3.6 V)
  High speed mode <fs = fosc / 2>
  0.250 µs / 8 MHz (2.2 V to 3.6 V)
  0.500 µs / 4 MHz (1.8 V to 3.6 V)
  Low speed mode <fs = fx / 2>
  62.5 µs / 32 kHz (1.8 V to 3.6 V)

  <Flash EEPROM version MN101CF97D>
  High speed mode <fs = fosc / 1>
  0.250 µs / 4 MHz (2.2 V to 3.6 V)
  0.270 µs / 3.7 MHz (2.0 V to 3.6 V)
  0.500 µs / 2 MHz (1.8 V to 3.6 V)
  High speed mode <fs = fosc / 2>
  0.250 µs / 8 MHz (2.2 V to 3.6 V)
  0.500 µs / 4 MHz (1.8 V to 3.6 V)
  Low speed mode <fs = fx / 2>
  62.5 µs / 32 kHz (1.8 V to 3.6 V)

- Clock Gear Circuit Embedded:
  The operation speed of system clock can be changed by switching the dividing ratio of the oscillation clock.
  (1, 2, 4, 8, 16, 32, 64, 128 dividing)

- Oscillation Circuit:
  2 channels oscillation circuits (High-speed / Low-speed)

- Operation Modes:
  NORMAL mode (High-speed mode)
  SLOW mode (Low-speed mode)
  HALT mode (High-speed / Low-speed mode)
  STOP mode
  The operation clock can be switched in each mode.

- ROM Correction:
  Maximum of 3 parts in a program

- Operation Voltage: 1.8 V to 3.6 V

- Operation Temperature: –40°C to + 85°C

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■ Features (Continued)

- Memory bank:
  Data memory space expansion by bank form (64 KB/2 bank)
  Bank for source address / Bank for destination address

- Interrupts: 20 interrupts
  <External Interrupt> Rising/ falling edge can be specified.
  IRQ0 - External Interrupt (Noise filter connectable)
  IRQ1 - External Interrupt (Noise filter connectable)
  IRQ2 - External Interrupt (Both edges selectable)
  IRQ3 - External Interrupt (Both edges selectable)
  IRQ4 - External Interrupt (Both edges selectable)
  IRQ5 - External Interrupt (Both edges selectable)
  IRQ6 - External Interrupt (Key scan interrupt only)
  <Timer Interrupt>
  TM0IRQ - Timer 0 interrupt (8-bit timer)
  TM1IRQ - Timer 1 interrupt (8-bit timer)
  TM2IRQ - Timer 2 interrupt (8 bit timer)
  TM3IRQ - Timer 3 interrupt (8-bit timer)
  TM6IRQ - Timer 6 interrupt (8-bit timer)
  TM7IRQ - Timer 7 interrupt (16-bit timer)
  T7OC2IRQ - Timer 7 interrupt (16-bit timer)
  TBIRQ - Time base timer interrupt
  <Serial Interface Interrupt>
  SC0RIRQ - Serial 0 interrupt (UART reception)
  SC0TIRQ - Serial 0 interrupt (UART transmission, Synchronous)
  SC3IRQ - Serial 3 interrupt (Single master IIC, Synchronous)
  <Watchdog Timer Interrupt>
  NMI - Watchdog timer overflow
  <A/D Conversion End Interrupt>
  ADIRQ - A/D conversion end

- A/D Converter: 10 bit × 8 channels

- Timer Counter: 8 timers
  All timer counters generate Interrupt.
  Timer 0 - 8-bit timer
  Square wave output, PWM output, Event count, Simple pulse width measurement
  Added pulse (2-bit) PWM output, Remote control carrier output
  Clock source: fosc, fosc/4, fosc/16, fosc/32, fosc/64, fs/2, fs/4, fx, external clock
  Square wave output and PWM output can be output to the large current pin, P51 (TM0O).
  Timer 1 - 8-bit timer
  Square wave output, Event count, Cascade connection to timer 0
  Clock source: fosc, fosc/4, fosc/16, fosc/64, fosc/128, fs/2, fs/8, fx, external clock, timer 7 output
  Usable as UART baud rate timer
  Timer 2 - 8-bit timer
  Square wave output, PWM output, Event count, Simple pulse width measurement
  Clock source: fosc, fosc/4, fosc/16, fosc/32, fosc/64, fs/2, fs/4, fx, external clock
  Added pulse (2-bit) PWM output
  Square wave output and PWM output can be output to the large current pin, P52 (TM2O).
  Usable as UART baud rate timer

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■ Features (Continued)

Timer 3 - 8-bit timer
Square wave output, Event count, Cascade connection to timer 2
Clock source: fosc, fosc/4, fosc/16, fosc/64, fosc/128, fs/2, fs/8, fx, external clock
Timer 6 - 8-bit timer
One minute meter is available when combined with the timer base timer.
Clock source: fosc, fs, fx, time base output ($1/2^7$ or $1/2^{13}$)
Timer 7 - 16-bit timer (Double buffer composition)
Square wave output and PWM output (Duty/Cycle continuous changeable) can be output to the large current pin, P53 (TM7O).
Event count, Pulse width measurement, Input capture, Remote control carrier output
Clock source: 1/1, 1/2, 1/4 or 1/16 of fosc, fs or external clock.
Timer base timer
Clock source: fosc, fx
Interrupt generation cycle: fosc, $fosc/2^7$, $fosc/2^8$, $fosc/2^9$, $fosc/2^{10}$, $fosc/2^{12}$, $fosc/2^{13}$, $fosc/2^{14}$, $fosc/2^{15}$, fx, $fx/2^7$, $fx/2^8$, $fx/2^9$, $fx/2^{10}$, $fx/2^{12}$, $fx/2^{13}$, $fx/2^{14}$, $fx/2^{15}$
Watchdog timer
Error detection cycle: selectable from $fs/2^{16}$, $fs/2^{18}$, and $fs/2^{20}$.

- Buzzer output, Inverted Buzzer output:

Output frequency can be selected from $fosc/2^9$, $fosc/2^{10}$, $fosc/2^{11}$, $fosc/2^{12}$, $fosc/2^{13}$, $fosc/2^{14}$, $fx/2^3$, $fx/2^4$

- Remote control carrier output:

Based on timer 0 and timer 7 output, a remote control carrier with duty cycle of 1/2 or 1/3 can be output.

- Clock output:

Fosc output or fs output is available.

- Serial Interface: 2 channels

Serial interface 0 : 3 channel type synchronous / Full duplex UART
Transfer clock: fosc/2, fosc/4, fosc/16, fosc/64, fs/2, fs/4, timer 1 (or timer 2) output, timer 2 output/2, timer 2 output/8
At UART, timer 1 (or timer 2) is used as a baud rate timer
MSB/LSB can be selected as the first bit to be transferred.
Any transfer size from 1 to 8 bits can be selected.
Parity check, parity addition, overrun and framing error detection.
Usable as 2 channel type serial interface.
Serial 0 I/O (SBO0, SBI0, SBT0) can be switched to either P10 to P12 or P43 to P45.
Serial interface 3 : 3 channel type synchronous / Single Master IIC Interface
IIC communication for single master (9-bit transfer)
Transfer clock: fosc/2, fosc/4, fosc/16, fosc/64, fs/2, fs/4, timer 1 (or timer 2) output
MSB/LSB can be selected as the first bit to be transferred.
Any transfer size from 1 to 8 bits can be selected.

- External Interrupt: 7 interrupts

Edge selectable (rising edge, falling edge)	× 2 sets
Noise filter connectable (IRQ0, IRQ1)	
Edge selectable (rising edge, falling edge, both edges) (IRQ 2,3,4,5)	× 4 sets
Key scan interrupt only (IRQ6)	× 1 set

- LED driver: 6 pins (44-pin QFP package are 4 pins)

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■ Features (Continued)

- I/O port: 48 pin TQFP package

I/O port	38 ports
Ports also used as LED (large current) driver ports	6 port
Ports also used as A/D input	8 ports
Port also used as remote control carrier output	1 port
Ports also used as timer output	3 ports
Ports also used as timer I/O	5 ports
Ports also used as buzzer output	2 ports
Ports also used as key interrupt input	8 ports
Ports also used as external interrupt input	6 ports
Ports also used as serial interface ports	9 ports
Special function pins	10 ports
Analog reference voltage input pin	1 port
Mode setting pins	2 ports
Reset input pin	1 port
Oscillator pins	4 ports
Power supply pins	2 ports

- I/O port: 44 pin QFP package

I/O port	34 ports
Ports also used as LED (large current) driver ports	4 ports
Ports also used as A/D input	8 ports
Port also used as remote control carrier output	1 port
Ports also used as timer output	3 ports
Ports also used as timer I/O	5 ports
Ports also used as buzzer output	2 ports
Ports also used as key interrupt input	7 ports
Ports also used as external interrupt input	6 ports
Ports also used as serial interface ports	9 ports
Special function pins	10 ports
Analog reference voltage input pin	1 port
Mode setting pins	2 ports
Reset input pin	1 port
Oscillator pins	4 ports
Power supply pins	2 ports

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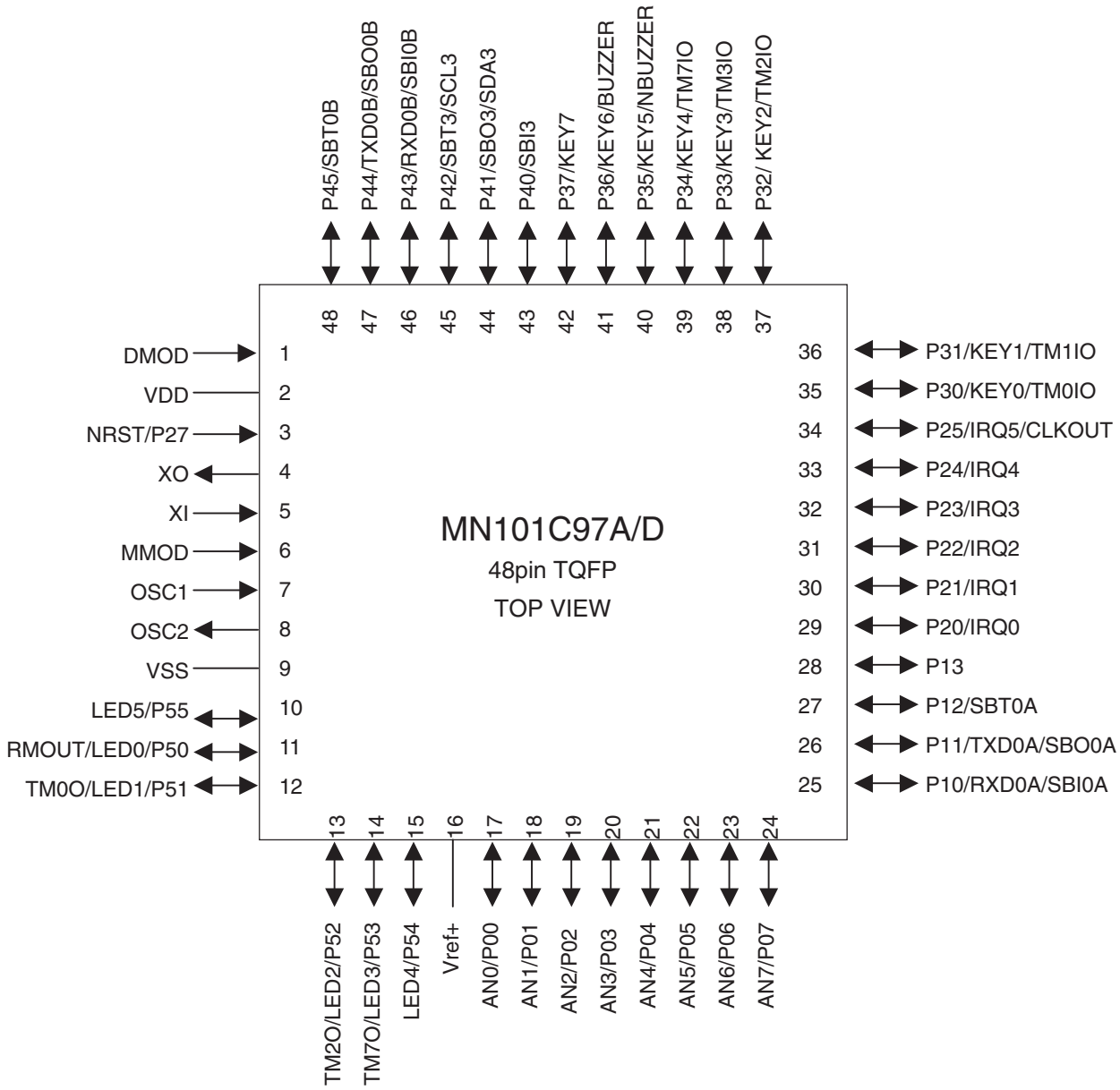
■ Pin Description

• TQFP048-P-0707B



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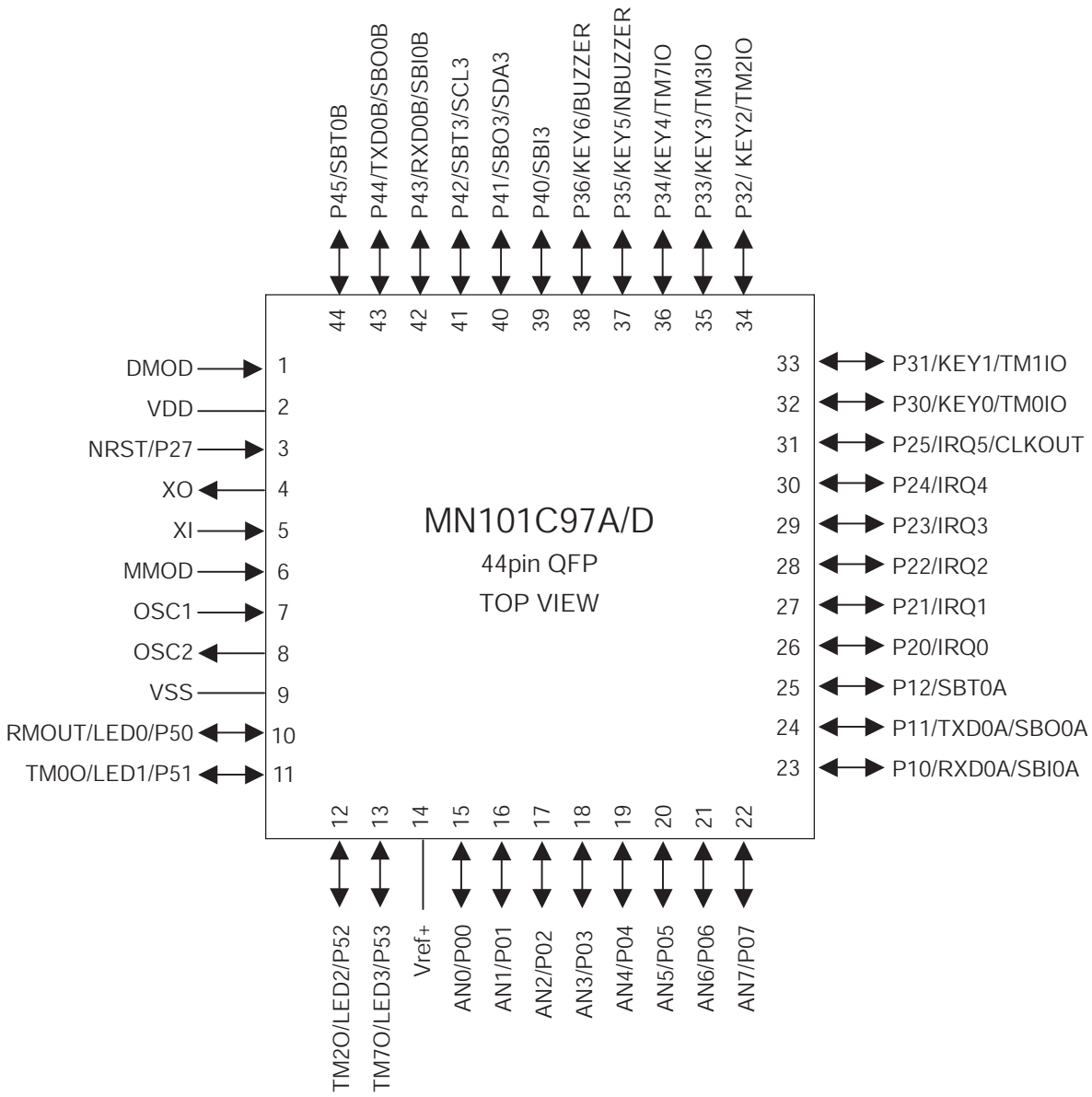
■ Pin Description (Continued)

• QFP044-P-1010F



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