

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 ($f_{osc}/2$) and the double speed mode which is based on the same cycle clock with f_{osc} .

A machine cycle (min. instructions execution) in the normal mode is 250 ns when f_{osc} is 8 MHz, and when f_{osc} is 4 MHz, a machine cycle is 500 ns. A machine cycle in the double speed mode is 125 ns when f_{osc} is 8 MHz, and 250 ns when f_{osc} 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

■ 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

■ 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: f_{osc} , $f_{osc}/4$, $f_{osc}/16$, $f_{osc}/32$, $f_{osc}/64$, $f_s/2$, $f_s/4$, f_x , 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: f_{osc} , $f_{osc}/4$, $f_{osc}/16$, $f_{osc}/64$, $f_{osc}/128$, $f_s/2$, $f_s/8$, f_x , 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: f_{osc} , $f_{osc}/4$, $f_{osc}/16$, $f_{osc}/32$, $f_{osc}/64$, $f_s/2$, $f_s/4$, f_x , 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

■ Features (Continued)

Timer 3 - 8-bit timer

Square wave output, Event count, Cascade connection to timer 2

Clock source: f_{osc} , $f_{osc}/4$, $f_{osc}/16$, $f_{osc}/64$, $f_{osc}/128$, $f_s/2$, $f_s/8$, f_x , external clock

Timer 6 - 8-bit timer

One minute meter is available when combined with the timer base timer.

Clock source: f_{osc} , f_s , f_x , 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 (TM70).

Event count, Pulse width measurement, Input capture, Remote control carrier output

Clock source: $1/1$, $1/2$, $1/4$ or $1/16$ of f_{osc} , f_s or external clock.

Timer base timer

Clock source: f_{osc} , f_x

Interrupt generation cycle: f_{osc} , $f_{osc}/2^7$, $f_{osc}/2^8$, $f_{osc}/2^9$, $f_{osc}/2^{10}$, $f_{osc}/2^{12}$, $f_{osc}/2^{13}$, $f_{osc}/2^{14}$, $f_{osc}/2^{15}$, f_x , $f_x/2^7$, $f_x/2^8$, $f_x/2^9$, $f_x/2^{10}$, $f_x/2^{12}$, $f_x/2^{13}$, $f_x/2^{14}$, $f_x/2^{15}$

Watchdog timer

Error detection cycle: selectable from $f_s/2^{16}$, $f_s/2^{18}$, and $f_s/2^{20}$.

- Buzzer output, Inverted Buzzer output:

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

- 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:

f_{osc} output or f_s output is available.

- Serial Interface: 2 channels

Serial interface 0 : 3 channel type synchronous / Full duplex UART

Transfer clock: $f_{osc}/2$, $f_{osc}/4$, $f_{osc}/16$, $f_{osc}/64$, $f_s/2$, $f_s/4$, 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 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: $f_{osc}/2$, $f_{osc}/4$, $f_{osc}/16$, $f_{osc}/64$, $f_s/2$, $f_s/4$, 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)

■ Features (Continued)

• I/O port: 48 pin TQFP package

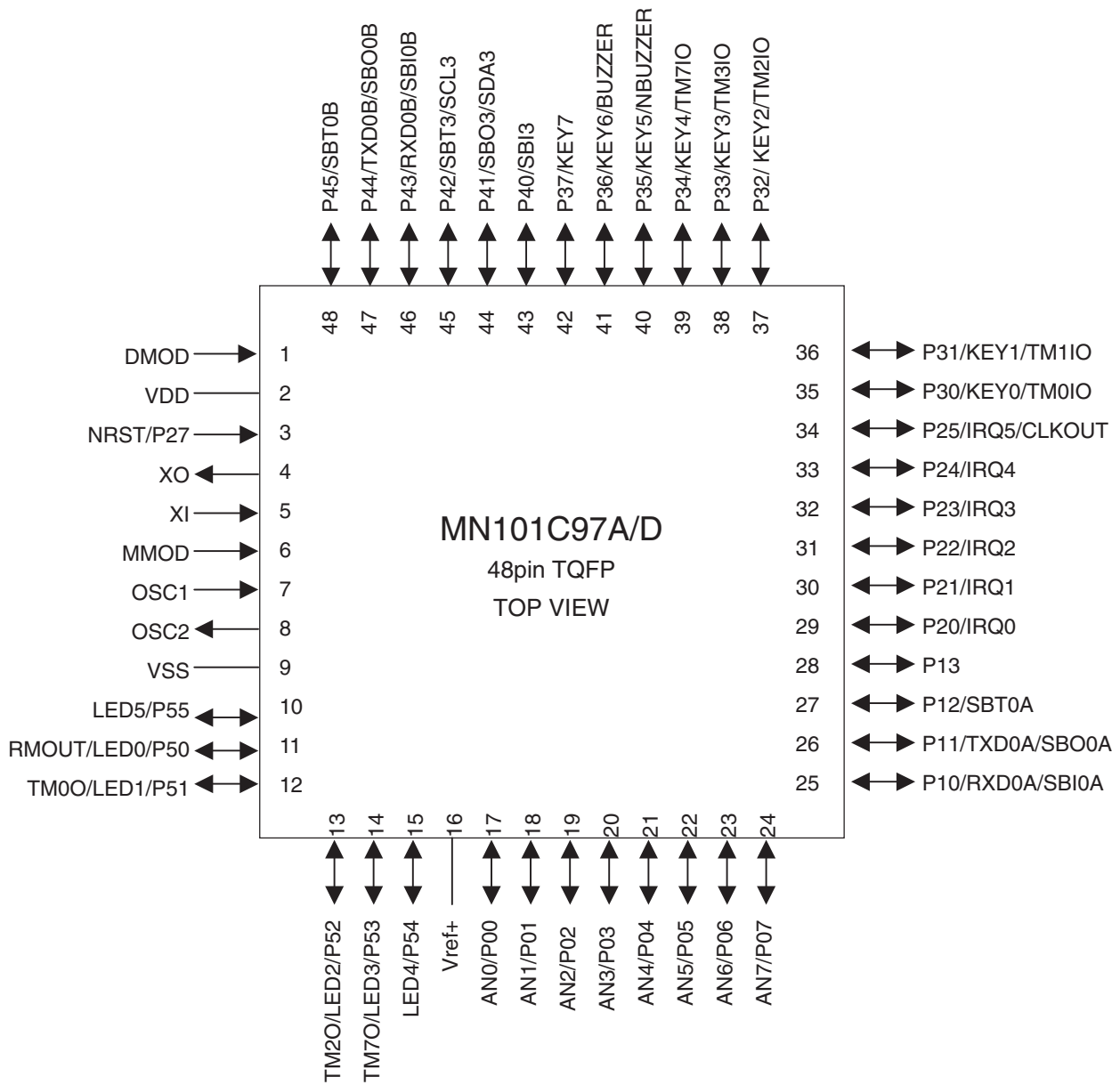
I/O port	38 ports
Ports also used as LED (large current) driver ports	6 port
Ports also used as A/D input	8 ports
Port also used as remote control carrier output	1 port
Ports also used as timer output	3 ports
Ports also used as timer I/O	5 ports
Ports also used as buzzer output	2 ports
Ports also used 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

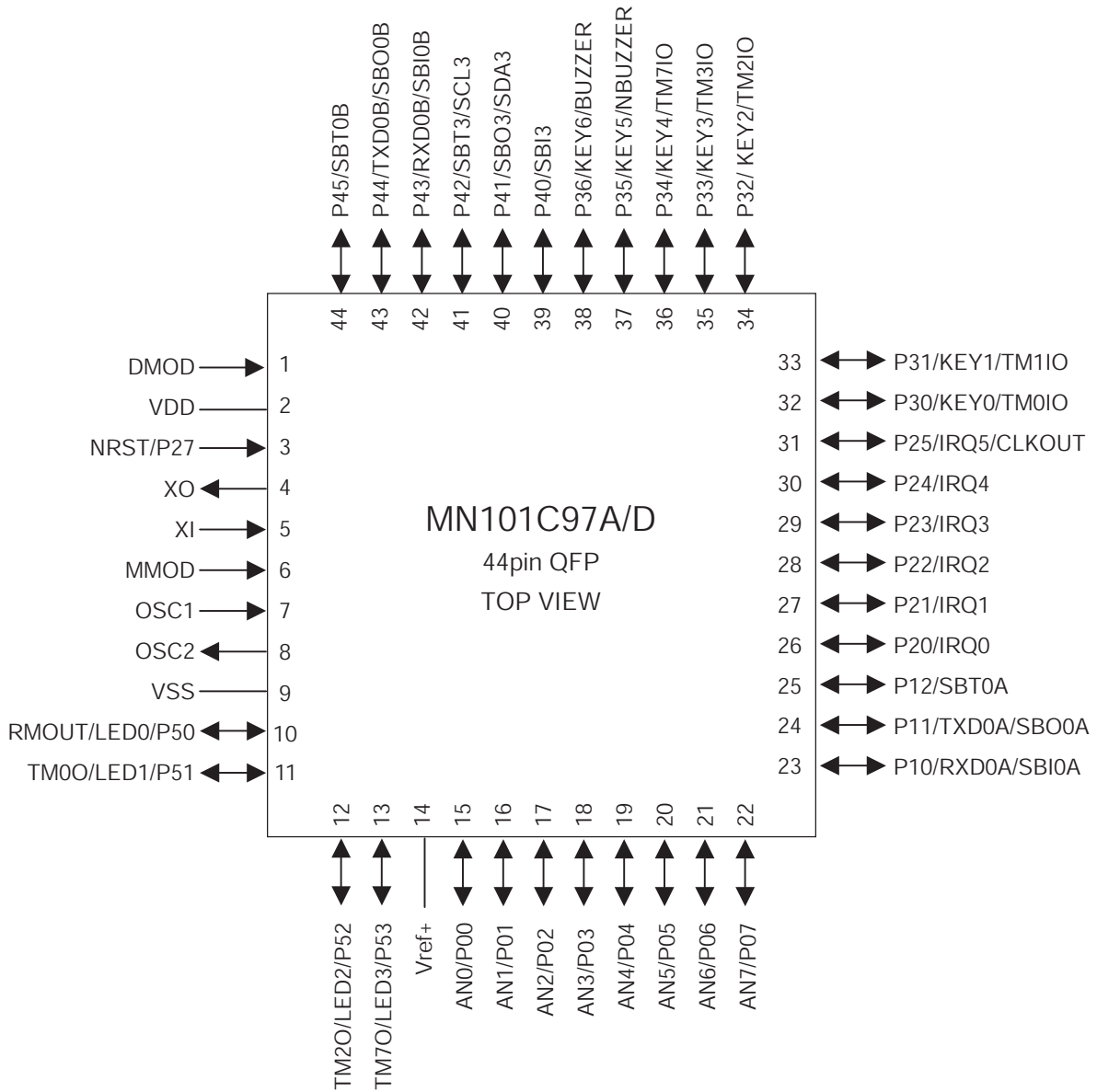
■ Pin Description

- TQFP048-P-0707B



■ Pin Description (Continued)

- QFP044-P-1010F



Request for your special attention and precautions in using the technical information and semiconductors described in this book

- (1) If any of the products or technical information described in this book is to be exported or provided to non-residents, the laws and regulations of the exporting country, especially, those with regard to security export control, must be observed.
- (2) The technical information described in this book is intended only to show the main characteristics and application circuit examples of the products. No license is granted in and to any intellectual property right or other right owned by Panasonic Corporation or any other company. Therefore, no responsibility is assumed by our company as to the infringement upon any such right owned by any other company which may arise as a result of the use of technical information described in this book.
- (3) The products described in this book are intended to be used for general applications (such as office equipment, communications equipment, measuring instruments and household appliances), or for specific applications as expressly stated in this book.
Consult our sales staff in advance for information on the following applications:
 - Special applications (such as for airplanes, aerospace, automotive equipment, traffic signaling equipment, combustion equipment, life support systems and safety devices) in which exceptional quality and reliability are required, or if the failure or malfunction of the products may directly jeopardize life or harm the human body.It is to be understood that our company shall not be held responsible for any damage incurred as a result of or in connection with your using the products described in this book for any special application, unless our company agrees to your using the products in this book for any special application.
- (4) The products and product specifications described in this book are subject to change without notice for modification and/or improvement. At the final stage of your design, purchasing, or use of the products, therefore, ask for the most up-to-date Product Standards in advance to make sure that the latest specifications satisfy your requirements.
- (5) When designing your equipment, comply with the range of absolute maximum rating and the guaranteed operating conditions (operating power supply voltage and operating environment etc.). Especially, please be careful not to exceed the range of absolute maximum rating on the transient state, such as power-on, power-off and mode-switching. Otherwise, we will not be liable for any defect which may arise later in your equipment.
Even when the products are used within the guaranteed values, take into the consideration of incidence of break down and failure mode, possible to occur to semiconductor products. Measures on the systems such as redundant design, arresting the spread of fire or preventing glitch are recommended in order to prevent physical injury, fire, social damages, for example, by using the products.
- (6) Comply with the instructions for use in order to prevent breakdown and characteristics change due to external factors (ESD, EOS, thermal stress and mechanical stress) at the time of handling, mounting or at customer's process. When using products for which damp-proof packing is required, satisfy the conditions, such as shelf life and the elapsed time since first opening the packages.
- (7) This book may be not reprinted or reproduced whether wholly or partially, without the prior written permission of our company.