ML63193 Preliminary

This version: Feb. 10,1999

4-Bit Microcontroller with Built-in Dot Matrix LCD Driver and Melody Circuit

GENERAL DESCRIPTION

The ML63193 is CMOS 4-bit microcontroller that guarantee operation at 0.9V.

With an internal dot matrix LCD driver (64SEG.× 16COM.), this device is well suited for applications having liquid-crystal display (LCD) such as games, toys, watches, remote controllers etc.

The ML63193 is masked-ROM device belonging to the M6318x series of the OLMS-63K family with an internal Oki's original CPU core nX-4/250.

The ML63Q190 is the flash EEPROM version of ML63193, ML63187 and ML63189B The ML63Q190 is used to evaluate the software development.

FEATURES

· Extensive instruction set

408 instructions:

Transfer, rotate, increment/decrement, arithmetic operations, compare, logic operations, mask operations, bit operations, ROM table reference, stack operations, flag operations, jump, conditional branch, call/return, control

· Wide variety of addressing modes

Indirect addressing mode for 4 types of data memory with current bank register, extra bank register, HL register and XY register

Data memory bank internal direct addressing mode

· Processing speed

2 clocks per machine cycle, with most instructions executed in 1 machine cycle Minimum instruction execution time $$: $61\mu s$ (@ 32.768kHz system clock)

: 1µs (@ 2MHz system clock)

· Clock generation circuit

Low-speed clock:

Crystal oscillation or RC oscillation selected with mask option (30kHz to 80kHz)

High-speed clock:

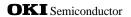
Ceramic oscillation or RC oscillation selected with software (2MHz max.)

· Program memory space

64K words

The basic instruction length is 16 bits per word.

The information contained herein can change without notice owing to product and/or technical improvements. Before using the product, please make sure that the information being referred to is up-to-date.



· Data memory space 2048 nibbles

· Stack level

Call stack level : 16 levels Register stack level : 16 levels

· Ports

Input ports:

Selectable as input pull-up resistor, input pull-down resistor or high impedance input.

I/O ports:

Selectable as input pull-up resistor, input pull-down resistor or high impedance input.

Selectable as p-channel open drain output, n-channel open drain output, high impedance output or CMOS output.

Can be interfaced to external devices having different power supplies.

Number of ports:

Input ports : 1 port \times 4 bits I/O ports : 5 ports \times 4 bits

· Melody output

Melody frequency : 529Hz to 2979Hz
Tone length : 63 varieties
Tempo : 15 varieties

Melody data : Stored in program memory

Buzzer driver signal output :4kHz

· LCD driver

Number of segments : 1024 segments max. (64seg.× 16com.)

Duty : Selectable as 1/1 to 1/16 duty

Bias : Selectable as 1/4 or 1/5 bias (internal voltage regulator)

Display modes:

Selectable as all-ON mode, all-OFF mode, power down mode, and normal display mode

Contrast : 16 levels

· Multiplier / divider circuit

Multiplier:

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(8 \text{ bits}) \times (8 \text{ bits}) \rightarrow \text{Product} (16 \text{bits})
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Divider

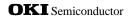
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(16 \text{ bits})/(8 \text{ bits}) \rightarrow \text{Quotient}(16 \text{ bits}), \text{Remainder}(8 \text{ bits})
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· System reset function

System reset by RESET pin

System reset by power-on detection

System reset by detection that low-speed clock has stopped oscillation



· Battery check

Function that detects battery low voltage

Selection of judgment voltage by software (LD1 and LD0 bit settings of BLDCON)

LD1	LD0	Judgement voltage (V)	Comments
0	0	1.05 ± 0.10	Ta=25°C
0	1	1.20 ± 0.10	Ta=25°C
1	0	1.80 ± 0.10	Ta=25°C
1	1	2.40 ± 0.10	Ta=25°C

· Power supply backup

Turning on the backup circuit (multiplied voltage circuit) enables operation at the low voltage of 0.9V.

· Timers and Counter

8-bit timer : 4 channels

Selectable as auto-reload mode, capture mode,

clock frequency measurement mode

Watchdog timer : 1 channel 100Hz timer : 1 channel

1/100 sec. Measurement possible

15-bit time-base counter :1 channel

1Hz, 2Hz, 4Hz, 8Hz, 16Hz, 32Hz, 64Hz, and 128Hz

signals can be read

· Serial port

Mode : Selectable as UART mode, synchronous mode UART communication speed : 1200 bps, 2400 bps, 4800 bps, 9600bps

Clock frequency in synchronous mode:

Internal clock mode (32.768kHz), External clock frequency

Data length :5 to 8 bits

· Shift register

Shift clock : System clock $\times 1$, $\times 1/2$,

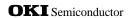
Timer 1 overflow (16-bit timer mode), External clock

Data length : 8 bits

· Interrupt factors

External interrupt : 4 factors Internal interrupt : 14 factors

· Operating temperature : - 20 to +70 $^{\circ}$ C



· Power supply voltage:

When using backup : 0.9V to 2.7V (30k to 80kHz operating frequency)

1.2V to 2.7V (300k to 500kHz operating frequency)

1.5V to 2.7V (200k to 1MHz operating frequency)

When using backup : 1.8V to 5.5V (200k to 2MHz operating frequency)

· Shipping products:

Package	Product
· Chip	ML63193-xxx
· 144-pin flat package (144LQFP)	
LQFP144-P-2020-0.50-K	ML63193-xxxGA
,	xxx indicates the ROM code number.

BLOCK DIAGRAM

Asterisks (*) indicate the secondary function of each port. Signal names enclosed by chain lines (------) indicate interface signals of the VDDI power supply system.

