

## ML63193

Preliminary

### 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. $\times$  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 )  
: 1 $\mu$ s ( @ 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 × 4 bits
    - I/O ports : 5 ports × 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:  
( 8 bits ) × ( 8 bits ) → Product ( 16bits )
  - Divider:  
( 16 bits ) / ( 8 bits ) → Quotient ( 16bits ), Remainder ( 8 bits )
- 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 × 1, × 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 °C



**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.

