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.× 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 : 61µs (@ 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.

· 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

· 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 V_{DDI} power supply system.