

Microcontroller with LCD Driver MN101C527/MN101C54C

■ Overview

MN101C527/MN101C54C is a single-chip microcontroller, with a C language oriented high speed 8-bit CPU core (AM10), equipped with a LCD panel driver and a charge pump circuit that generates the LCD driver voltage. It incorporates a high precision 10-bit A/D converter, multi-functional timer counters, serial interfaces and other peripheral functions. Having those functions, it is ideal for home appliances and audio-visual equipment. The microcontroller and the LCD driver have individual power supplies. This makes it possible to operate the microcontroller and the LCD panel with different voltage values. Thus making it especially suitable for portable equipment, which operates in low power.

Also, with the inclusion of the pump circuit, which generates the LCD voltages and the internal divided resistance, the number of components can be reduced.

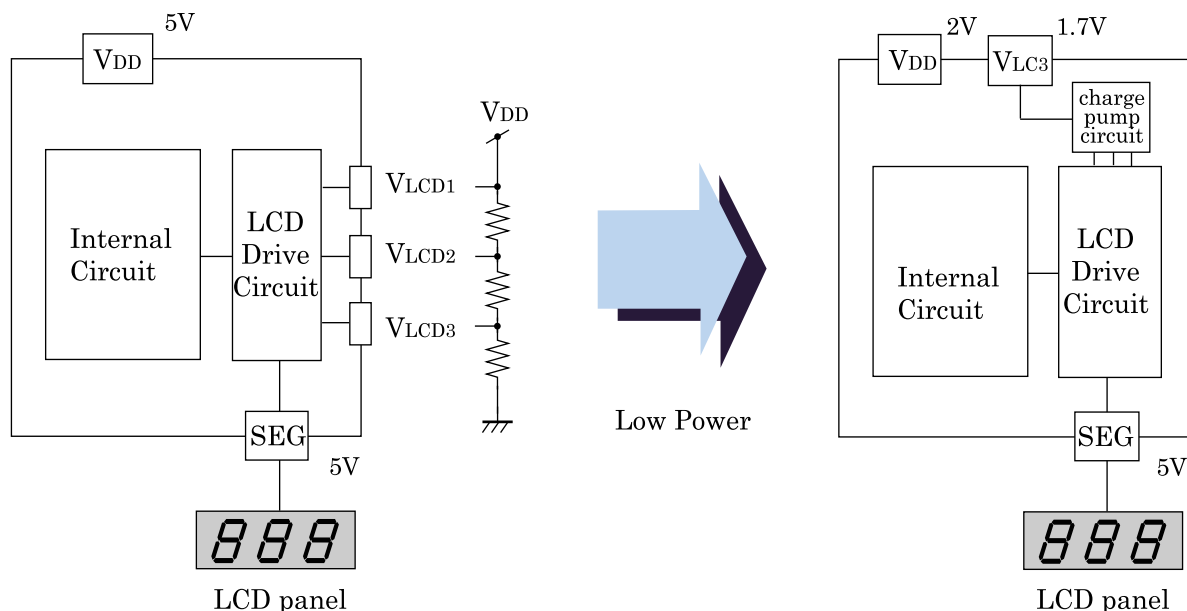
■ Features

- Microcontroller and LCD driver can operate with different voltage values.
- Free setting of LCD drive voltages (1.5 times to 3 times microcontroller voltage)
- Minimum operating speed 100ns (4.5 V to 5.5 V)
- Wide band operating power supply (2.0 V to 5.5 V)
- Minimum register set for simple architecture prepared.

■ Applications

- General home appliances , audio-visual equipment , health equipment

■ Block Diagram



! The products and specifications are subject to change without any notice. Please ask for the latest product standards to guarantee the satisfaction of your product requirements.

□ MN101C527

Type	MN101C527
ROM (×8-bit)	16 K
RAM (×8-bit)	1.5 K
Package	LQFP064-P-1414, TQFP064-P-1010B
Minimum Instruction Execution Time	0.1 μs (at 4.5 V to 5.5 V, 20 MHz) 0.25 μs (at 2.7 V to 5.5 V, 8 MHz) 125 μs (at 2.0 V to 5.5 V, 32 kHz)
Interrupts	• RESET • Watchdog • External 0 • External 1 • External 2 • External 4 (key interrupt dedicated) • Timer 0 • Timer 1 • Timer 2 • Timer 3 • Timer 6 • Timer 7 (2 systems) • Timer 8 • Time base • Serial 0 (2 systems) • A/D conversion finish
Timer Counter	<p>Timer counter 0 : 8-bit × 1 (square-wave/8-bit PWM output, event count, generation of remote control carrier, simple pulse width measurement) (square-wave/PWM output to large current terminal P50 possible)</p> <p>Clock source 1/2, 1/4 of system clock frequency; 1/1, 1/4, 1/16, 1/32, 1/64 of OSC oscillation clock frequency; 1/1 of XI oscillation clock frequency; external clock input</p> <p>Interrupt source coincidence with compare register 0</p> <p>Timer counter 1 : 8-bit × 1 (square-wave output, event count, synchronous output event)</p> <p>Clock source 1/2, 1/8 of system clock frequency; 1/1, 1/4, 1/16, 1/8192, 1/32768 of OSC oscillation clock frequency; 1/1 of XI oscillation clock frequency; external clock input</p> <p>Interrupt source coincidence with compare register 1</p> <p>Timer counter 0, 1 can be cascade-connected.</p> <p>Timer counter 2 : 8-bit × 1 (square-wave output, additional pulse type 10-bit PWM output, event count, synchronous output event, simple pulse width measurement) (square-wave/PWM output to large current terminal P52 possible)</p> <p>Clock source 1/2, 1/4 of system clock frequency; 1/1, 1/4, 1/16, 1/32, 1/64 of OSC oscillation clock frequency; 1/1 of XI oscillation clock frequency; external clock input</p> <p>Interrupt source coincidence with compare register 2</p> <p>Timer counter 3 : 8-bit × 1 (square-wave output, event count, generation of remote control carrier, serial 0 baud rate timer)</p> <p>Clock source 1/2, 1/8 of system clock frequency; 1/1, 1/4, 1/16, 1/64, 1/128 of OSC oscillation clock frequency; 1/1 of XI oscillation clock frequency; external clock input</p> <p>Interrupt source coincidence with compare register 3</p> <p>Timer counter 2, 3 can be cascade-connected.</p> <p>Timer counter 6 : 8-bit freerun timer</p> <p>Clock source 1/1 of system clock frequency; 1/1, 1/4096, 1/8192 of OSC oscillation clock frequency; 1/1, 1/4096, 1/8192 of XI oscillation clock frequency</p> <p>Interrupt source coincidence with compare register 6</p> <p>Timer counter 7 : 16-bit × 1 (square-wave/16-bit PWM output [cycle / duty continuous variable], event count, synchronous output event, pulse width measurement, input capture) (square-wave/PWM output to large current terminal P51 possible)</p> <p>Clock source 1/1, 1/2, 1/4, 1/16 of system clock frequency; 1/1, 1/2, 1/4, 1/16 of OSC oscillation clock frequency; 1/1, 1/2, 1/4, 1/16 of external clock input frequency</p> <p>Interrupt source coincidence with compare register 7 (2 lines)</p>

■ Timer Counter (Continue)	Timer counter 8: 16-bit × 1 (square-wave/16-bit PWM output [duty continuous variable], event count, pulse width measurement, input capture) (square-wave/PWM output to large current terminal P53 possible)	
	Clock source	1/1, 1/2, 1/4, 1/16 of system clock frequency; 1/1, 1/2, 1/4, 1/16 of OSC oscillation clock frequency; 1/1, 1/2, 1/4, 1/16 of external clock input frequency
	Interrupt source	agreement with compare register 8
	Timer counters 7, 8 can be cascade-connected. (square-wave output, input capture, pulse width measurement is possible as a 32-bit timer.)	
■ Time base timer (one-minute count setting)	Clock source	1/1 of OSC oscillation clock frequency; 1/1 of XI oscillation clock frequency
	Interrupt source	1/128, 1/256, 1/512, 1/1024, 1/8192, 1/32768 of clock source frequency
	Watchdog timer	
	Interrupt source	1/65536, 1/262144, 1/1048576 of system clock frequency

■ Serial Interface	Serial 0 : synchronous type/UART (full-duplex) ×1	
	Clock source	1/2, 1/4 of system clock frequency; 1/2 pulse output of timer counter 3; 1/2, 1/4, 1/16, 1/64 of OSC oscillation clock frequency

■ I/O Pins	I/O	42	• Common use • Specified pull-up resistor available • Input/output selectable (bit unit) • Specified pull-down resistor partially selectable
	Input	7	• Common use • Specified pull-up resistor available • Specified pull-down resistor partially selectable

■ A/D Inputs	10-bit × 4-ch. (with S/H)
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■ LCD	• 24 segments • 4 commons • Static • 1/2, 1/3, or 1/4 duty LCD power supply separated from VDD (usable if $VDD \leq VLCD \leq 5.5 V$), built-in LCD power step-up circuit (3/2, 2 and 3 times) and built-in LCD shunt resistance
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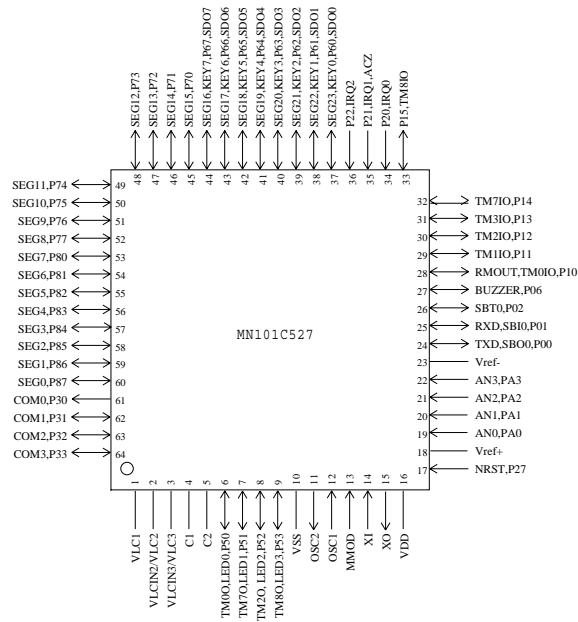
■ Special Ports	Buzzer output, remote control carrier signal output, high-current drive port
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■ Electrical Characteristics

Supply current

Parameter	Symbol	Condition	Limit			Unit
			min	typ	max	
Operating supply current	IDD1	$f_{osc} = 8 \text{ MHz}$, $VDD = 5 \text{ V}$		10	25	mA
	IDD2	$f_x = 32 \text{ kHz}$, $VDD = 3 \text{ V}$		30	100	μA
Supply current at HALT	IDD3	$f_x = 32 \text{ kHz}$, $VDD = 3 \text{ V}$, $T_a = 25^\circ\text{C}$			8	μA
	IDD4	$f_x = 32 \text{ kHz}$, $VDD = 3 \text{ V}$, $T_a = -40^\circ\text{C}$ to $+85^\circ\text{C}$			30	μA
Supply current at STOP	IDD5	$VDD = 5 \text{ V}$, $T_a = 25^\circ\text{C}$			2	μA
		$VDD = 5 \text{ V}$, $T_a = -40^\circ\text{C}$ to $+85^\circ\text{C}$			35	μA

Pin Assignment



LQFP064-P-1414

TQFP064-P-1010B

Support Tool

In-circuit Emulator	PX-ICE101C / D + PX-PRB101C52-M	
EPROM Built-in Type	Type	MN101CP52A [ES (Engineering Sample) available]
	ROM (× 8-bit)	32 K
	RAM (× 8-bit)	1.5 K
	Minimum instruction execution time	0.10 μs (at 4.5 V to 5.5 V, 20 MHz) 0.25 μs (at 2.7 V to 5.5 V, 8 MHz)
	Package	LQFP064-P-1414 , TQFP064-P-1010B

MN101C54C

Type	MN101C54C
ROM (×8-bit)	48 K
RAM (×8-bit)	2 K
Package	QFP084-P-1818E
Minimum Instruction Execution Time	0.1 μs (at 4.5 V to 5.5 V, 20 MHz) 0.238 μs (at 2.7 V to 5.5 V, 8.38 MHz) 61 μs (at 2.0 V to 5.5 V, 32.768 kHz)
Interrupts	<ul style="list-style-type: none"> • RESET • Watchdog • External 0 • External 1 • External 2 • External 3 • External 4 (key interrupt dedicated) • Timer 0 • Timer 1 • Timer 2 • Timer 3 • Timer 6 • Time base • Timer 7 (2 systems) • Timer 8 (2 systems) • Serial 0 (2 systems) • Serial 2 • A/D conversion finish
Timer Counter	<p>Timer counter 0 : 8-bit × 1 (square-wave/8-bit PWM output, event count, generation of remote control carrier, simple pulse width measurement) (square-wave/PWM output to large current terminal P50 possible)</p> <p>Clock source 1/2, 1/4 of system clock frequency; 1/1, 1/4, 1/16, 1/32, 1/64 of OSC oscillation clock frequency; 1/1 of XI oscillation clock frequency; external clock input</p> <p>Interrupt source coincidence with compare register 0</p> <p>Timer counter 1 : 8-bit × 1 (square-wave output, event count, synchronous output event)</p> <p>Clock source 1/2, 1/8 of system clock frequency; 1/1, 1/4, 1/16, 1/8192, 1/32768 of OSC oscillation clock frequency; 1/1 of XI oscillation clock frequency; external clock input</p> <p>Interrupt source coincidence with compare register 1</p> <p>Timer counter 0, 1 can be cascade-connected.</p> <p>Timer counter 2 : 8-bit × 1 (square-wave output, additional pulse type 10-bit PWM output, event count, synchronous output event, simple pulse width measurement) (square-wave/PWM output to large current terminal P52 possible)</p> <p>Clock source 1/2, 1/4 of system clock frequency; 1/1, 1/4, 1/16, 1/32, 1/64 of OSC oscillation clock frequency; 1/1 of XI oscillation clock frequency; external clock input</p> <p>Interrupt source coincidence with compare register 2</p> <p>Timer counter 3 : 8-bit × 1 (square-wave output, event count, generation of remote control carrier, serial 0 baud rate timer)</p> <p>Clock source 1/2, 1/8 of system clock frequency; 1/1, 1/4, 1/16, 1/64, 1/128 of OSC oscillation clock frequency; 1/1 of XI oscillation clock frequency; external clock input</p> <p>Interrupt source coincidence with compare register 3</p> <p>Timer counter 2, 3 can be cascade-connected.</p> <p>Timer counter 6 : 8-bit freerun timer</p> <p>Clock source 1/1 of system clock frequency; 1/1, 1/4096, 1/8192 of OSC oscillation clock frequency; 1/1, 1/4096, 1/8192 of XI oscillation clock frequency</p> <p>Interrupt source coincidence with compare register 6</p> <p>Timer counter 7 : 16-bit × 1 (square-wave output, IGBT/16-bit PWM output (cycle / duty continuous variable), event count, synchronous output event, pulse width measurement, input capture) (square-wave/PWM output to large current terminal P51 possible)</p> <p>Clock source 1/1, 1/2, 1/4, 1/16 of system clock frequency; 1/1, 1/2, 1/4, 1/16 of OSC oscillation clock frequency; 1/1, 1/2, 1/4, 1/16 of external clock input frequency</p> <p>Interrupt source coincidence with compare register 7 (2 lines)</p> <p>Timer counter 8: 16-bit × 1 (square-wave/16-bit PWM output [duty continuous variable], event count, pulse width measurement, input capture) (square-wave/PWM output to large current terminal P53 possible)</p>

Timer Counter (Continue)	Clock source	1/1, 1/2, 1/4, 1/16, 1/128 of system clock frequency; 1/1, 1/2, 1/4, 1/16, 1/128 of OSC oscillation clock frequency; 1/1, 1/2, 1/4, 1/16 of external clock input frequency
	Interrupt source	coincidence with compare register 8 (2 lines)
Timer counters 7, 8 can be cascade-connected. (square-wave output, PWM, input capture, pulse width measurement is possible as a 32-bit timer.)		
Time base timer (one-minute count setting)		
	Clock source	1/1 of OSC oscillation clock frequency; 1/1 of XI oscillation clock frequency
	Interrupt source	1/128, 1/256, 1/512, 1/1024, 1/8192, 1/32768, of clock source frequency
Watchdog timer		
	Interrupt source	1/65536, 1/262144, 1/1048576 of system clock frequency

Serial Interface	Serial 0 : synchronous type/UART (full-duplex) × 1	
	Clock source	1/2, 1/4 of system clock frequency; pulse output of timer counter 3; 1/2, 1/4, 1/16, 1/64 of OSC oscillation clock frequency
	Serial 2 : synchronous type × 1	
	Clock source	1/2, 1/4 of system clock frequency; pulse output of timer counter 3; 1/2, 1/4, 1/16, 1/32 of OSC oscillation clock frequency

I/O Pins	I/O	61	• Common use • Specified pull-up resistor available • Input/output selectable (bit unit)
	Input	4	• Common use • Specified pull-up resistor available

A/D Inputs	10-bit × 8-ch. (with S/H)
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LCD	• 32 segments • 4 commons • static • 1/2, 1/3, or 1/4 duty LCD power supply separated from VDD (usable if $VDD \leq VLCD \leq 5.5 V$), built-in LCD power step-up circuit (3/2, 2 and 3 times) and built-in LCD power shunt resistance
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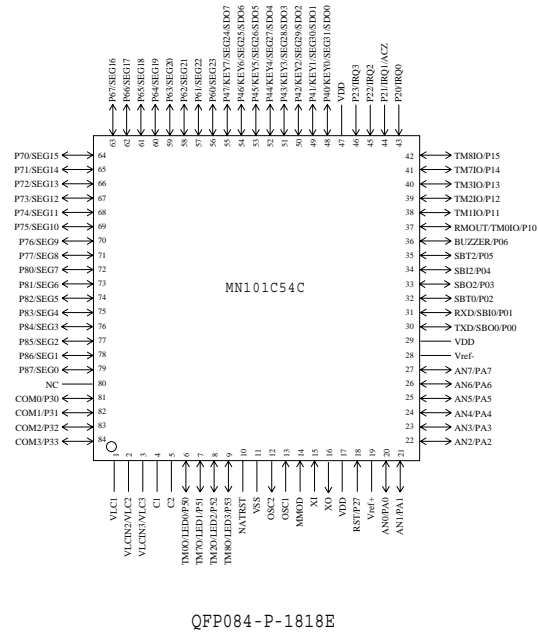
Special Ports	Buzzer output, remote control carrier signal output, high-current drive port
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Electrical Characteristics

Supply current

Parameter	Symbol	Condition	Limit			Unit
			min	typ	max	
Operating supply current	IDD1	$f_{osc} = 8.38 \text{ MHz}, VDD = 5 \text{ V}$		10	25	mA
	IDD2	$f_x = 32.768 \text{ kHz}, VDD = 3 \text{ V}$		30	100	μA
Supply current at HALT	IDD3	$f_x = 32.768 \text{ kHz}, VDD = 3 \text{ V}$		4	8	μA
	IDD4	$f_x = 32.768 \text{ kHz}, VDD = 3 \text{ V}, T_a = -40^\circ\text{C to } +85^\circ\text{C}$			t.b.f (30)	μA
Supply current at STOP	IDD5	$VDD = 5 \text{ V}, T_a = 25^\circ\text{C}$			1	μA
	IDD6	$VDD = 5 \text{ V}, T_a = -40^\circ\text{C to } +85^\circ\text{C}$			t.b.f (50)	μA

Pin Assignment



QFP084-P-1818E

Support Tool

In-circuit Emulator	PX-ICE101C / D + PX-PRB101C54-M	
Flash Memory Built-in Type	Type	MN101CF54D (under development)
	ROM (× 8-bit)	64 K
	RAM (× 8-bit)	2 K
	Minimum instruction execution time	0.25 μs (at 2.7 V to 5.5 V, 8 MHz) 125 μs (at 2.7 V to 5.5 V, 32 kHz)
	Package	LQFP080-P-1414A, QFP084-P-1818E, TQFP080-P-1212

Package

