

SM563

4-Bit Single-Chip Microcomputer (LCD Driver)

DESCRIPTION

The SM563 is a CMOS 4-bit single-chip microcomputer incorporating 4-bit parallel processing function, ROM, RAM, I/O ports, serial interface, timer/counter in a single chip.

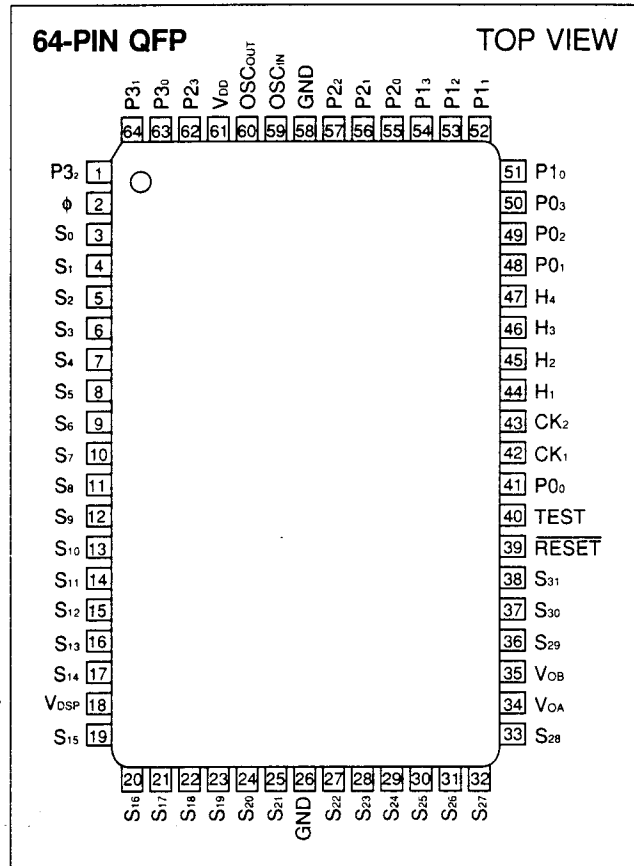
It provides 5 kinds of interrupt and subroutine stack function using the RAM area. Provided with a 128 segments LCD drive circuit, this microcomputer is applicable to Low power system with multiple LCD segments.

FEATURES

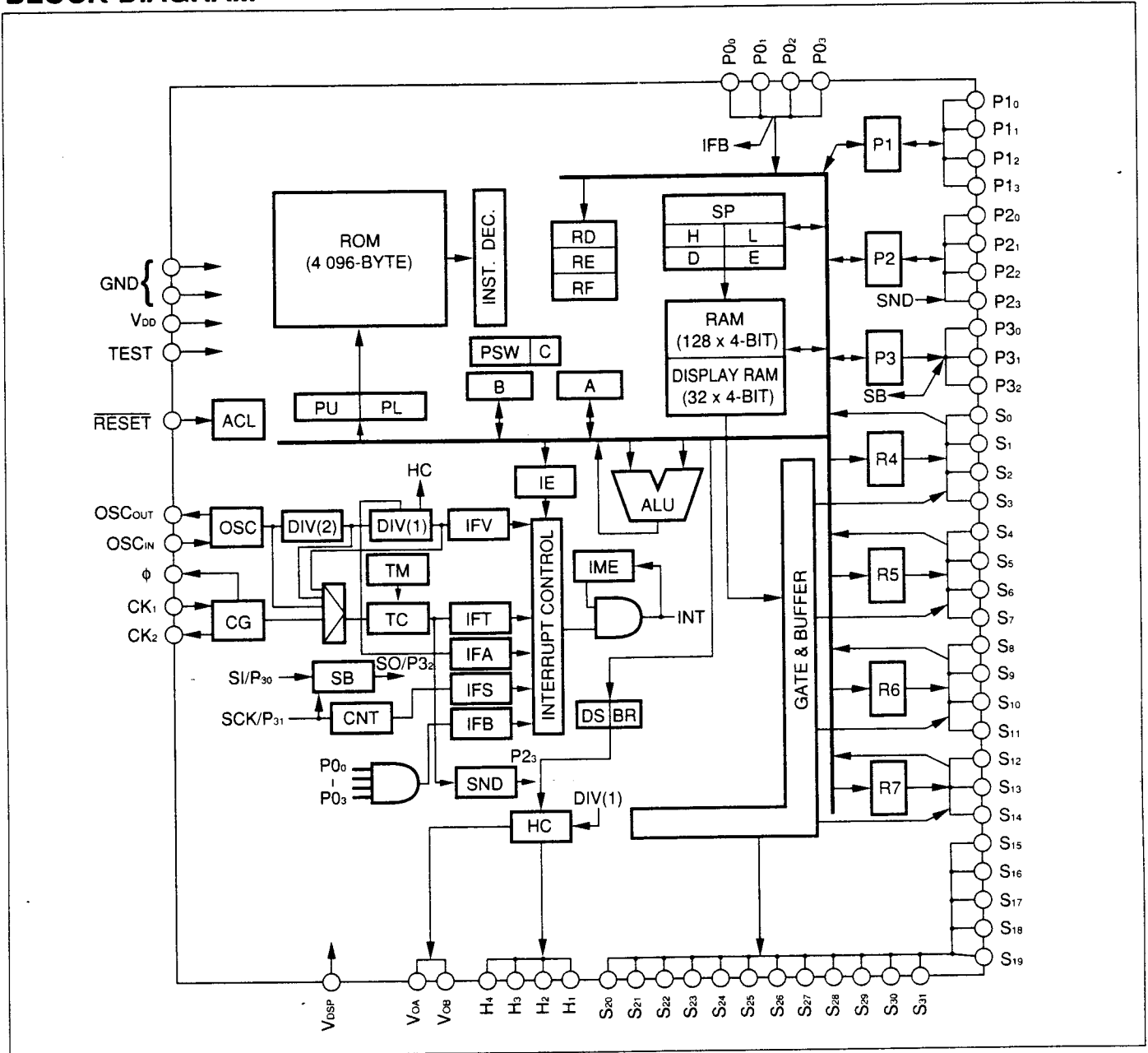
- ROM capacity : 4 096 x 8 bits
- RAM capacity : 160 x 4 bits (including 32 x 4 bits display RAM)
- Instruction sets : 98
- A RAM area is used as stack area
- I/O port :

Input	4
Input/output	11
	+15 (also used as LCD segment port)
- Interrupts :
 - Internal interrupt x 4 (timer/counter, f4 signal, serial I/O, divider overflow)
 - External interrupt x 1 (P0 signal)
- Timer/counter : 8 bits x 1
- Serial interface : 8 bits x 1
- Built-in main clock oscillator for system clock
- Built-in sub clock oscillator for real time clock
- Built-in 15 stages divider for real time clock
- Built-in LCD driver : 128 segments, 1/3 bias, 1/4 duty cycle (If LCD drive circuit is used, a crystal oscillator circuit needs to be constituted between OSC_{IN} and OSC_{OUT})
- Instruction cycle time : 6.67 μ s (at 3V), 2 μ s (at 5V)
- Buzzer output
- Standby function
- Supply voltage : 2.7 to 5.5 V
- Package : 64-pin QFP (QFP064-P-1420)

PIN CONNECTIONS



BLOCK DIAGRAM



Nomenclature

- | | | | |
|---------------|-----------------------------|------------|--------------------------------|
| A, B | : Accumulators | IME | : Interrupt master enable F/F |
| ACL | : Auto clear | P1-P3 | : Registers |
| ALU | : Arithmetic logic unit | PL, PU | : Program counters |
| BR, DS | : Common signal control F/F | PSW | : Program status word register |
| CG | : Clock generator | R4-R7 | : General-purpose registers |
| DIV | : Divider | RD, RE, RF | : Mode registers |
| D, E, H, L | : General-purpose registers | SB | : Shift register |
| HC | : Common signal circuit | SP | : Stack pointer |
| IE | : Interrupt enable F/F | TC | : Count register |
| IFA, IFB | : Interrupt requests | TM | : Modulo register |
| IFS, IFT, IFV | | | |

PIN DESCRIPTION

SYMBOL	I/O	CIRCUIT TYPE	FUNCTION
P0 ₀ -P0 ₃	I	Pull up	Acc←P0 ₀ -P0 ₃
P1 ₀ -P1 ₃	I/O	Pull up	I/O selectable by instructions
P2 ₀ -P2 ₃	I/O	Pull up	I/O selectable independently Sound output only when P2 ₃ pin is used as an output
P3 ₀ -P3 ₃	I/O	Pull up	Serial interface I/O by setting the mode register RE
S ₀ -S ₁₄	O or I/O		Selectable between segment ports and I/O ports through an RC register
S ₁₅ -S ₃₁	O		Display RAM contents output as LCD segment signals
H ₁ -H ₄	O		4-value output capability; used for LCD common output
TEST	I	Pull down	For test (connected to GND normally)
RESET	I	Pull up	Auto clear
φ	O		System clock output
CK ₁ , CK ₂			For system clock oscillation
OSC _{IN} , OSC _{OUT}			For clock oscillation
V _{DSP} , V _{OA} , V _{OB}			Power supply for LCD driver
V _{DD} , GND			Power supply for logic circuit

ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	RATING	UNIT	NOTE
Supply voltage	V _{DD}	-0.3 to +7	V	1
	V _{DSP}	-0.3 to +7	V	
Input voltage	V _{IN}	-0.3 to V _{DD} +0.3	V	1
Output voltage	V _{OUT}	-0.3 to V _{DD} +0.3	V	1
Output current	I _{OUT}	20	mA	2
Operating temperature	T _{OPR}	-20 to +70	°C	
Storage temperature	T _{STG}	-55 to +150	°C	

NOTES :

1. The maximum applicable voltage on any pin with respect to GND.
2. Sum of current from (or flowing into) output pins.

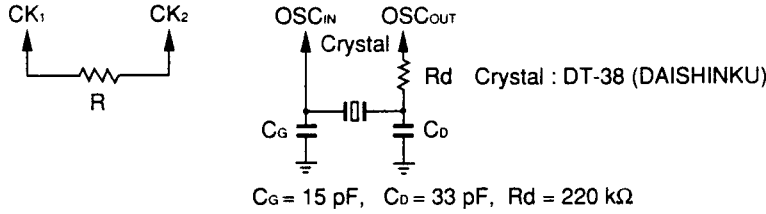
RECOMMENDED OPERATING CONDITIONS

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNIT	NOTE
Supply voltage	V _{DD}		2.7		5.5	V	
	V _{DSP}		2.7		V _{DD}	V	
Basic oscillation frequency	f	V _{DD} = 2.7 to 5.5 V	250		600	kHz	1
		V _{DD} = 4.5 to 5.5 V	250		2 000		
Instruction cycle	t	V _{DD} = 2.7 to 5.5 V	6.7		16	μs	
		V _{DD} = 4.5 to 5.5 V	2		16		
Crystal oscillation frequency	f _{osc}			32.768		kHz	

NOTE :

1. Frequency fluctuation : ± 30%

Oscillation Circuit



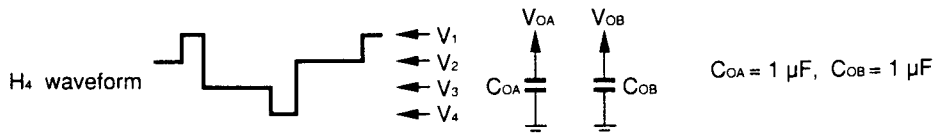
DC CHARACTERISTICS

($V_{DD} = 2.7 \text{ to } 5.5 \text{ V}$, $T_a = -20 \text{ to } +70^\circ\text{C}$)

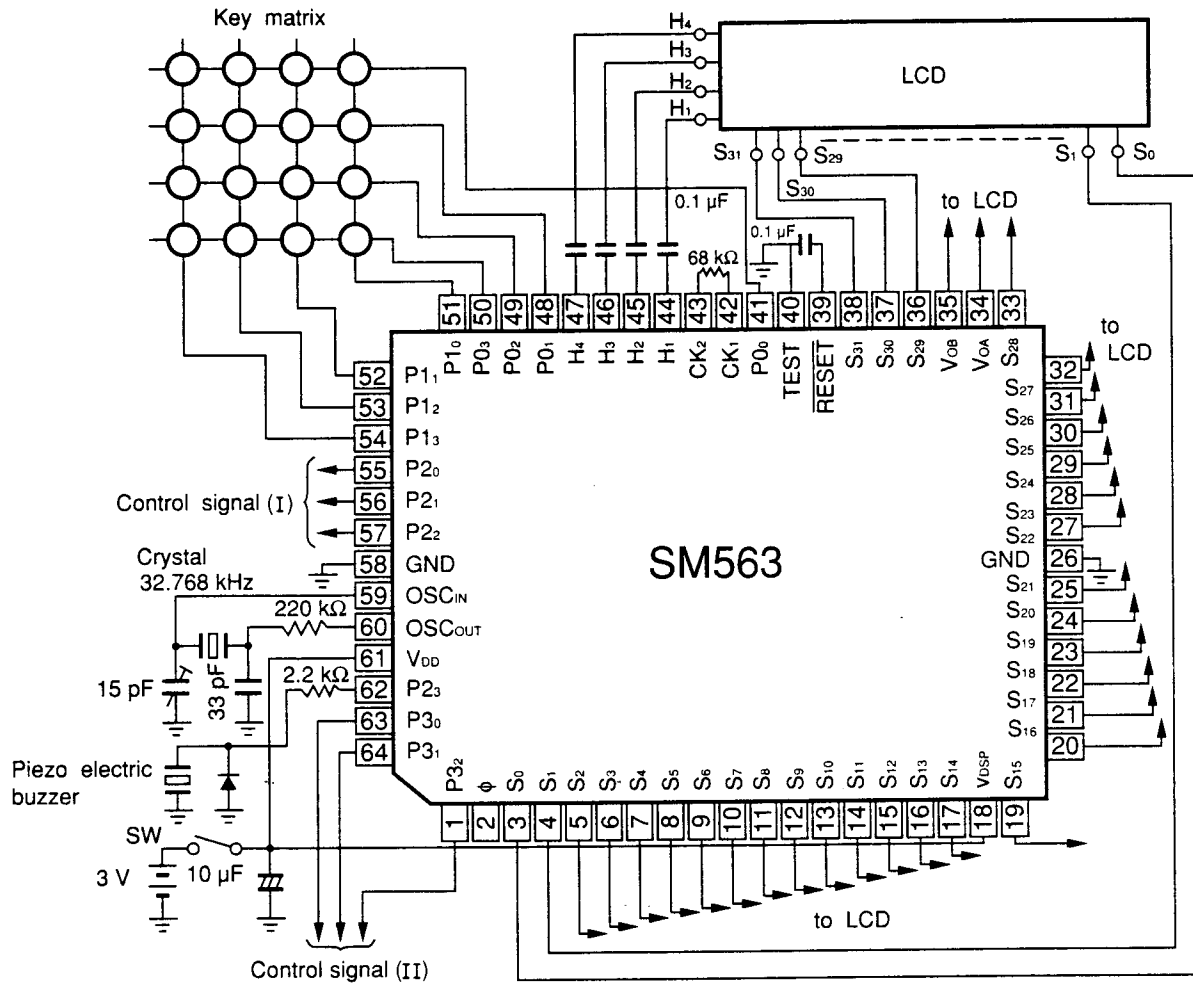
PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNIT	NOTE	
Input voltage	V_{IH1}		$0.7 \times V_{DD}$		V_{DD}	V	1	
	V_{IL1}		0		$0.3 \times V_{DD}$	V		
	V_{IH2}		$V_{DD} - 0.5$		V_{DD}	V	2	
	V_{IL2}		0		0.5	V		
Input current	I_{IH}	$V_{IN} = 0 \text{ V}$	$V_{DD} = 4.5 \text{ to } 5.5 \text{ V}$	2		200	μA	1
				20		200		
Output current	I_{OH1}	$V_{OH} = V_{DD} - 0.5 \text{ V}$	50			μA	3	
	I_{OL1}	$V_{OL} = 0.5 \text{ V}$	250			μA		
	I_{OH2}	$V_{OH} = V_{DD} - 0.5 \text{ V}$	5		250	μA	4	
	I_{OL2}	$V_{OL} = 0.5 \text{ V}$	500			μA		
	I_{OH3}	$V_{OH} = V_{DD} - 0.5 \text{ V}$	$V_{DD} = 4.5 \text{ to } 5.5 \text{ V}$	100			μA	5
	I_{OL3}	$V_{OL} = 0.5 \text{ V}$	$V_{DD} = 4.5 \text{ to } 5.5 \text{ V}$	0.5			mA	
Output impedance	R_c			5	20	$\text{k}\Omega$	6	
	R_s			10	40	$\text{k}\Omega$	7	
Output voltage	V_1	$V_{DSP} = 3.0 \text{ V}$ No load	2.7		3	V	8	
	V_2		1.7	2	2.3	V		
	V_3		0.7	1	1.3	V		
	V_4		0		0.3	V		
Supply current	I_{OP}	$f = 600 \text{ kHz}$, $V_{DD} = 3.0 \text{ V}$		0.4	1.5	mA	9	
	I_{SB}	Standby current $V_{DSP} = 3.0 \text{ V}$ $V_{DD} = 3.0 \text{ V}$		15	40	μA	10	
				8	20	μA	11	

NOTES :

- Applied to pins P0₀-P0₃, RESET, P1₀-P1₃, P2₀-P2₃, P3₀-P3₂ (during input mode).
- Applied to pins CK₁, TEST, OSC_{IN}.
- Applied to pin CK₂.
- Applied to pins P1₀-P1₃ (during output mode).
- Applied to pins P2₀-P2₃, P3₀-P3₂ (during output mode), ϕ .
- Applied to pins H₁-H₄.
- Applied to pins S₀-S₃₁.
- Applied to pins H₁-H₄, S₀-S₃₁.
- No load condition.
- No load condition when bleeder resistance is ON.
- No load condition when bleeder resistance is OFF.



SYSTEM CONFIGURATION EXAMPLE



Singlechip LH7xxxx '790 '789 '791 SMxxxx 'K series MCU Microcontroller MPU Microprocessor
ARM Advanced RISC Machines Databank LCD Controller LCD Driver Controllers Processors Portable
Low Power Low Voltage High Performance Power curve MIPS MIPS/Watt Execution Cycle Multiplier
High Speed Compact Handheld System on Chip System Integration Chip Integration Integration
Superchip Standard Cell Core Core based IC VHDL Verilog Synthesis Chip on Board COB Chip on Flex
COF Device on Board DOB Power Supply Controller Handy Products Development Tools Board Support
Software Tools Tools 2.10 Software Support Emulators Evaluation Boards ICE In-Circuit Emulators
ROM ICE SME Series Programmable User Configurable RTOS Real Time Operating Systems
Third Party Support Software Hardware Yokogawa Digital Cosmic Compiler C Language C Like
Assembler Linker Debugger Debug A/D D/A DAC Analog Digital 10-bit 4-bit 8-bit 16-bit 32-bit
Address bus Data Bus