SM3903

4-Bit Single-Chip Microcomputer (For Remote Control)

DESCRIPTION

The SM3903 is a CMOS 4-bit single-chip microcomputer incorporating 4-bit parallel processing function, carrier output circuit for remote control, ROM, RAM, 15-stage divider. Provided with 132 segments LCD drive circuit, this microcomputer is applicable to remote control system with a Low power consumption.

FEATURES

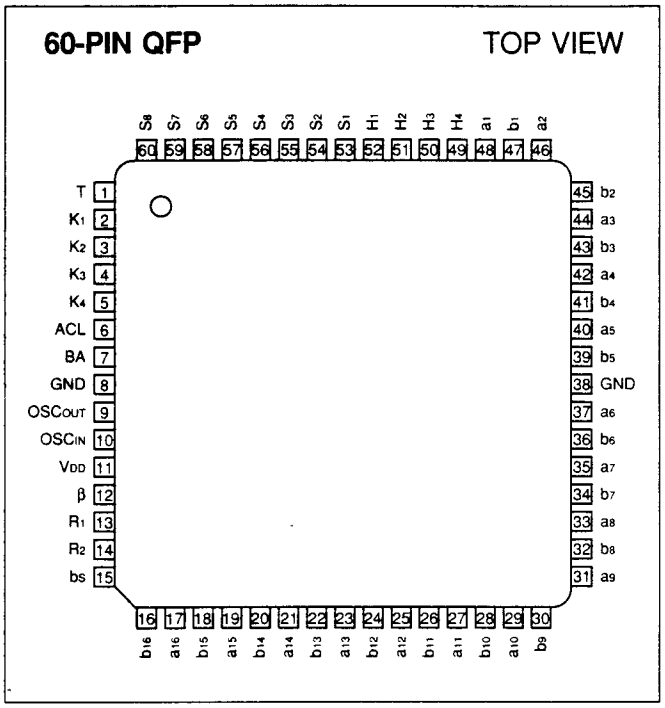
- ROM capacity : 2 772 x 8 bits
- RAM capacity : 128 x 4 bits (including 32 x 4 bits display RAM)
- Instruction sets : 49
- Subroutine nesting : 2 levels
- I/O Port :
  - Input 6
  - Output 10
  - 33 (Used as LCD segment output port)
  - 4 (Used as LCD common output port)
- Built-in main clock oscillator for system clock
- Signal generation for real time clock
- Built-in 15 stages divider circuit for real time clock
- Built-in carrier output circuit for remote control
- Built-in LCD driver : 132 segments (1/3 bias, 1/4 duty cycle)
- Built-in carrier output circuit for remote control

Carrier frequency	32.768 kHz
Bacic oscillation frequency (main clock)	32.768 kHz
Duty cycle	1/2

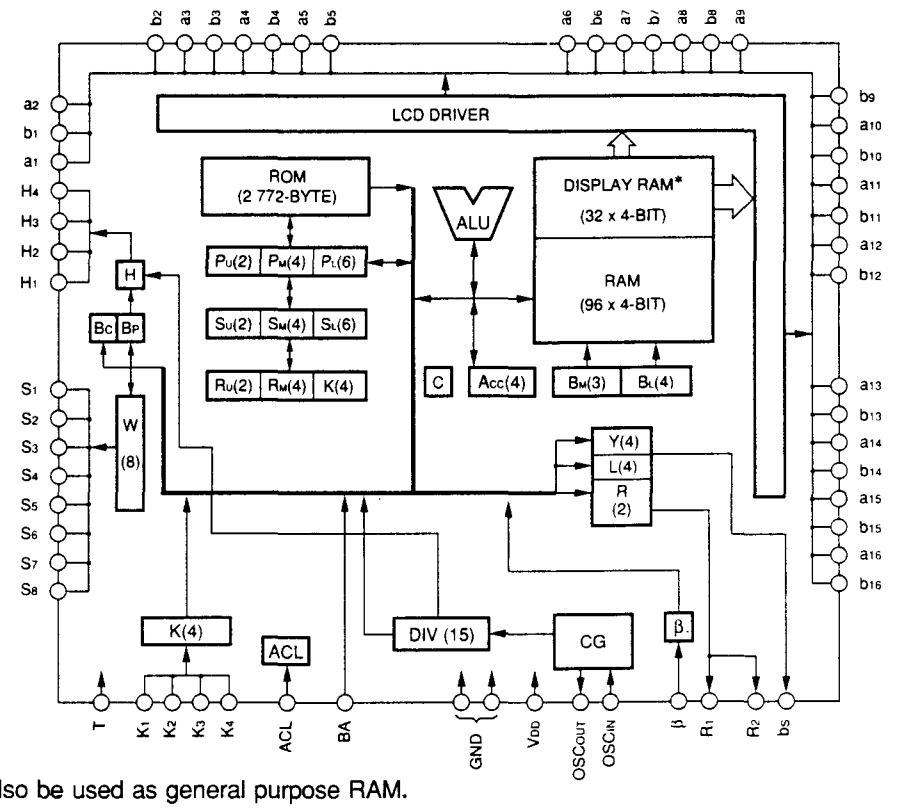
- Instruction cycle time : 61 µs (TYP., 32.768 kHz, at –3 V)
- Standby function
- Supply voltage : –2.6 to –3.2 V
- Package : 60-pin QFP(QFP060-P-1414)

PIN CONNECTIONS

60-PIN QFP TOP VIEW



BLOCK DIAGRAM



* Display RAM can also be used as general purpose RAM.

Nomenclature

ALU	: Arithmetic logic unit	W	: 8-bit shift register
Acc	: Accumulator	β	: Independent input register
ACL	: Auto clear circuit	B_M, B_L	: RAM address register
C	: Carry F/F	B_P, B_C	: Backplate signal generator circuit
P_U, P_M, P_L	: Program counter	H, L, Y	: 4-bit F/F
S_U, S_M, S_L	: Stack register of program counter	R	: Control register for remote control output
R_U, R_M, R_L	: Stack register of program counter	K	: Key input F/F
DIV	: Divider	CG	: Clock Generator

PIN DESCRIPTION

SYMBOL	I/O	CIRCUIT TYPE	FUNCTION
ai, bi	O		Segment output ports (i = 1 to 16)
bs			
H_1-H_4	O		Common output ports
S_1-S_8	O		Strobe output ports
T	I		Test input port (normally connected to GND)
K_1-K_4	I	pull-down	Key input ports
OSC_{IN}			Crystal oscillator
OSC_{OUT}			
BA, β	I	pull-up	Independent input ports
GND, V_{DD}			Power supply
R_1, R_2	O		Remote control carrier output
ACL	I	pull-down	Auto clear input port

ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	RATING	UNIT	NOTE
Supply voltage	V_{DD}	−3.5 to +0.3	V	1
	V_{IN}	V_{DD} to +0.3	V	
Operating temperature	T_{OPR}	0 to +50	°C	
Storage temperature	T_{STG}	−20 to +125	°C	

NOTE :

1. The maximum applicable voltage on any pin with respect to GND.

RECOMMENDED OPERATING CONDITIONS

PARAMETER	SYMBOL	RATING	UNIT
Supply voltage	V_{DD}	−3.2 to −2.6	V
Crystal oscillation frequency	fosc	32.768 (TYP.)	kHz

DC CHARACTERISTICS

(V_{DD} = −3.2 to −2.9 V, Ta = 25°C)

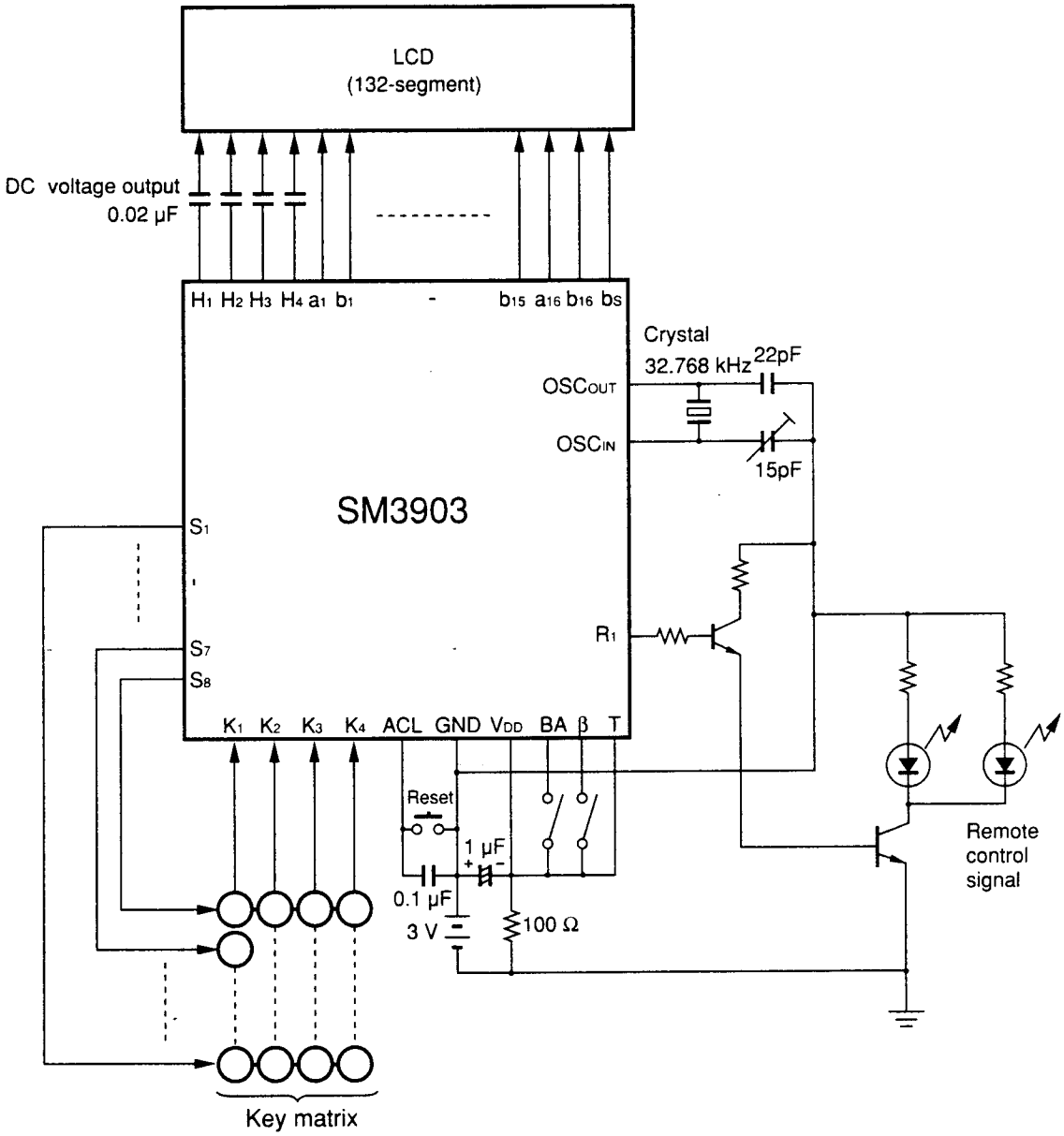
PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNIT	NOTE
Input voltage	V_{IH1}		− 0.6			V	1
	V_{IL1}				V_{DD}+0.6	V	
	V_{IH2}		− 0.3			V	2
	V_{IL2}				V_{DD}+0.3	V	
Input current	I_{IH}	V_{IN} = 0 V			15	μA	3
	I_{IL}	V_{IN} = V_{DD}			15	μA	4
Output voltage	V_{OH}	I_{OUT} = 50 μA to V_{DD}	− 0.5			V	5
	V_{OL}	I_{OUT} = 5 μA to GND			V_{DD}+0.5	V	
	V_{OA}	V_{DD} = −3.0 V No load	− 0.3	0	0	V	6
	V_{OB}		−1.3	−1.0	− 0.7	V	
	V_{OC}		−2.3	−2.0	−1.7	V	
	V_{OD}		−3.0	−3.0	−2.7	V	
Output current	I_{SO}	V_{OUT} = −0.2 V	100			μA	7
	I_{SIN}	V_{OUT} = V_{DD}+0.2 V	100			μA	
Supply current	I_{DA}	During full-range operation		40		μA	8
	I_{DS}	When system clock is stationary		12		μA	

NOTES :

1. Applied to pins K_1-K_4, β.
2. Applied to pins ACL, BA.
3. Applied to pins K_1-K_4.
4. Applied to pin β.
5. Applied to pins S_1-S_8.
6. Applied to pins a_1-a_{16}, b_1-b_{16}, b_5, H_1-H_4.
7. Applied to pins R_1, R_2.
8. No load condition when bleeder resistance is ON.

SYSTEM CONFIGURATION EXAMPLE

• **Remote control with LCD display**



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