SS0837 *OTP 4-bit Microcontroller with LCD Driver*

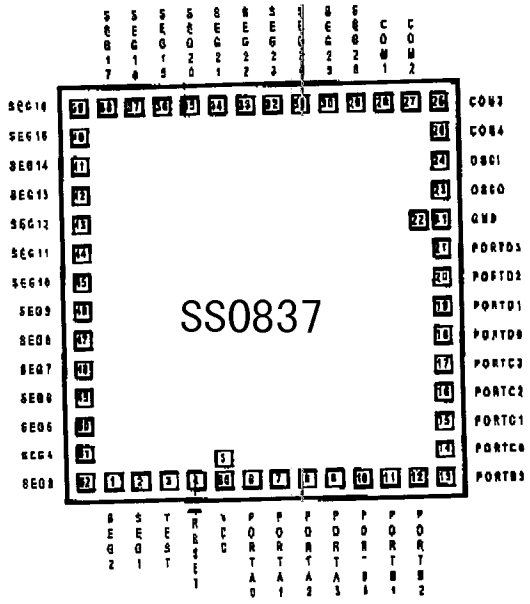
Features

- SS0837-based single-chip 4-bit microcontroller with LCD driver
- ROM: 2048 × 16 bits
- RAM: 256 × 4 bits (Data memory)
- Operation voltage: 2.4V - 3.4V (Typical 3.0V)
- 16 CMOS I/O pins
  - CMOS or Open Drain (option setting)
- 4 level subroutine nesting (including interrupts)
- Two 8-bit timer/counter with pre-divider circuit
- Oscillator warm-up timer
- 4 priority interrupt sources:
  - External interrupt (falling edge)
  - Timer0 interrupt
  - Timer1 interrupt
  - PortB interrupt (falling edge)
- Oscillator
  - 32.768KHz crystal or 262K RC (option setting)
- Instruction cycle time:
  - 4/32.768KHz (= 122μs) for 32.768KHz OSC clock
  - 4/262KHz (≈ 15μs) for 262KHz OSC clock
- LCD driver:
  - 4 × 26 (1/4 duty, 1/3 bias or 1/3 duty , 1/2 bias)
- Two low power operation modes : HALT or STOP mode
- Built-in alarm generator carrier frequency:
  - 2KHz or 4KHz (option setting)
- Low power consumption (Iop < 30μA, 32.768KHz, 3V)
- Bonding option for multi-code software
- Available in CHIP FORM

General Description

SS0837 is a single-chip microcontroller integrated with an 4-bit CPU core, SRAM, timer, alarm generator, LCD driver, I/O port, and program ROM.

Pad Configuration



Absolute Maximum Rating*

DC Supple Voltage . . . . . -0.3V to +7.0V

Input Voltage . . . . . -0.3V to V_{DD}+0.3V

Operating Ambient Temperature . . . -10°C to +60°C

Storage Temperature . . . . . -55°C to +125°C

***Comments**

Stresses above those listed under **"Absolute Maximum Ratings"** may cause permanent damage to this device. These are stress ratings only. Functional operation of this device under these or any other conditions above those indicated in the operational sections of this specification is not implied or intended. Exposure to the absolute maximum rating conditions for extended periods may affect device reliability.

DC Electrical Characteristics (V_{DD} = 3.0V, GND = 0V, T_A = 25°C, Fosc = 32.768KHz, unless otherwise specified)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Operating Voltage	V_{DD}	2.5	3	3.4	V	
Operating Current	I_{OP}		20	30	µA	All output pins unload execute NOP instruction
Standby Current	I_{SB1}		15	25	µA	All output pins unload (HALT mode) exclude LCD current
Standby Current	I_{SB2}			1	µA	All output pins unload (STOP mode) LCD off, no current
Low-voltage detected	V_{LV}	1.7	2.0	2.3	V	
Input High Voltage	V_{IH}	0.7 × V_{DD}		V_{DD} + 0.3	V	PORTA, PORTB, PORTC, PORTD
Input Low Voltage	V_{IL}	GND - 0.3		0.2 × V_{DD}	V	PORTA, PORTB, PORTC, PORTD
Output High Voltage	V_{OH1}	2.3			V	PORTA, PORTB, PORTC (I_{OH} = 15µA)
Output Low Voltage	V_{OL1}			0.2	V	PORTA, PORTB, PORTC (I_{OL}= 300µA)
Output High Voltage	V_{OH2}	2.1			V	BD/$\overline{BD}$ (set PA.1and PA.2 to be ALARM output), I_{OH} = 2mA
Output Low Voltage	V_{OL2}			0.9	V	BD/$\overline{BD}$ (set PA.1and PA.2 to be ALARM output), I_{OL} = 2mA
Output High Voltage	V_{OH3}	2.8			V	SEGx, I_{OH} = 3µA , SEG1 - 4 to be output port (for reference only)
Output Low Voltage	V_{OL3}			0.2	V	SEGx, I_{OL} = 3µA , SEG1 - 4 to be output port (for reference only)
Output High Voltage	V_{OH4}	2.8			V	COMx, I_{OH} = 8µA (for reference only)
Output Low Voltage	V_{OL4}			0.2	V	COMx, I_{OL} = 8µA (for reference only)
LCD Lighting	I_{LCD}		6.5	7.5	µA	HALT mode

Note:

1. Operation frequency vs. I_{SB1}

   I_{SB1X} = (Frequency/32.768KHz) * I_{SB1}*0.8

2. Operation frequency vs. I_{OP}

   I_{OPX} = (Frequency/32.768KHz) * I_{OP}*0.8

3. HLM vs. I_{OP}, I_{SB1} and I_{SB2}

   If HLM = 1, I_{OPX} = I_{OP}*2, I_{SB1X} = I_{SB1}*2, I_{SB2X} = I_{SB1}*2

AC Characteristics (V_{DD} = 3.0V, GND = 0V, T_A = 25°C, Fosc = 32.768KHz , unless otherwise specified)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Oscillation Start Time	T_{STT}		2	5	s	
Halt Time	T_{HTT}		0		s	I_{DD} reduces to Isb1 after instruction executing
Stop Time	T_{SPT}		0		s	I_{DD} reduces to Isb2 after instruction executing
Frequency Stability	|Δ F|/F			1	PPM	|F(3.0)-F(2.4)|/F(3.0), crystal oscillator (for reference only)
Frequency Variation	|Δ F|/F			10	PPM	C1 = 5 - 25P (for reference only)

AC Characteristics (V_{DD} = 3.0V, GND = 0V, T_A= 25°C, Fosc= 262KHz, unless otherwise specified)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Oscillation Start Time	T_{STT}			2	ms	
Halt Time	T_{HTT}		0		s	I_{DD} reduces to Isb1 after instruction executing
Stop Time	T_{SPT}		0		s	I_{DD} reduces to Isb3 after instruction executing
Frequency Stability	|Δ F|/F			10	%	|F(3.0)-F(2.4)|/F(3.0), RC oscillator (for reference only)
Frequency Variation	|Δ F|/F			15	%	variation caused by process variation (for reference only)

Typical RC oscillator Resistor vs. Frequency: (for reference only)