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**SC9308**

# AUDIO SYSTEM CONTROL MCU WITH ANALOG RADIO FUNCTION

## DESCRIPTION

SC9308 is a SOC based on Silan's 8-bit MCU SC65X for analog radio DFR control with low voltage low power consumption. Built-in LCD driver which can drive max. 4X14 segments display, 31 configurable I/O ports and three 8-bit counters, two of which can be combined to achieve 16 timing length; Built-in real time clock ensures the system uninterrupted counting when it is in sleep state; 11 interrupt sources, including four external interrupts, enabling the system to respond quickly to internal or external events. Multi-mode optional serial communication circuits greatly increase the system's scalability. Built-in 3.2MHz RC oscillator with external 75KHz oscillator can achieve the perfect balance between power and speed. In high speed application, it can extend external high frequency crystal through PC.4/5 pin, maximum up to 6MHz.

QFP44-10 x10-0.8
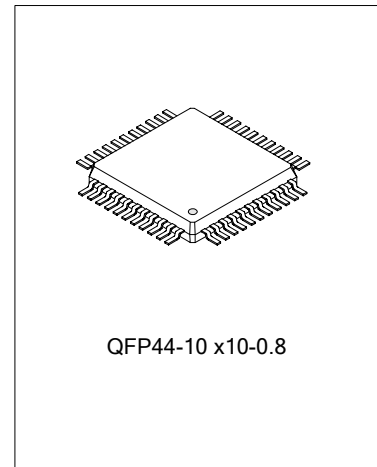
## APPLICATIONS

* Widely applied in portable audio control system with LCD.

## ORDERING INFORMATION

| Part No. | Package | Marking |
|----------|---------|---------|
| SC9308 | COB44 | No |
| SC9308P | QFP-44-10×10-0.8 | SC9308P |

## FEATURES

* Memory
  384-byte data memory
  8K-byte program memory (OTP)
* I/O  configuration
  General-purpose I/O:  17 pins with pull up resistor;
  SEG:  also can be used as I/O.
* LCD controller/driver
  Drive 7 words display max.
  14 SEG x 4 COM
  Display mode:  duty, bias can be programmable
* 8-bit timer/counter T0/T1/T2
  Timing time can be set by program
  External events counting
  Arbitrary clock frequency output
  T0/T1 can be 16-bit counter
* Operating voltage range: 3.0~3.6V

* Clock source
  External clock source:  75KHz Crystal
  Built-in RC oscillator:  3.2MHz;
  Extension Crystal:  2~6MHz($V_{DD}$>2.4V@4MHz)
* RTC
  Year/month/day display
  Provide BCD code data directly
  Leap year auto adjust
  Timing alarm
* Local oscillator frequency counting circuit
  Local oscillator:
  FM frequency range:  30MHz~150MHz
  AM frequency range:  0.5MHz~30MHz
  Counter: 16-bit, gate time 1/4/8ms
* Built-in voltage reference
  $V_{REF}$=1.23V$\pm$5%

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## FEATURES (Continued)

* A/D converter

4-channels with 8-bit conversion precision

External reference voltage selectable

Battery voltage monitor

* UART serial communication interface

2-line Asynchronous communication

Communication speed can be selected flexibly

Quick interrupt response

* Interrupt source

5 external interrupts, maskable

6 internal interrupts, maskable

## BLOCK DIAGRAM
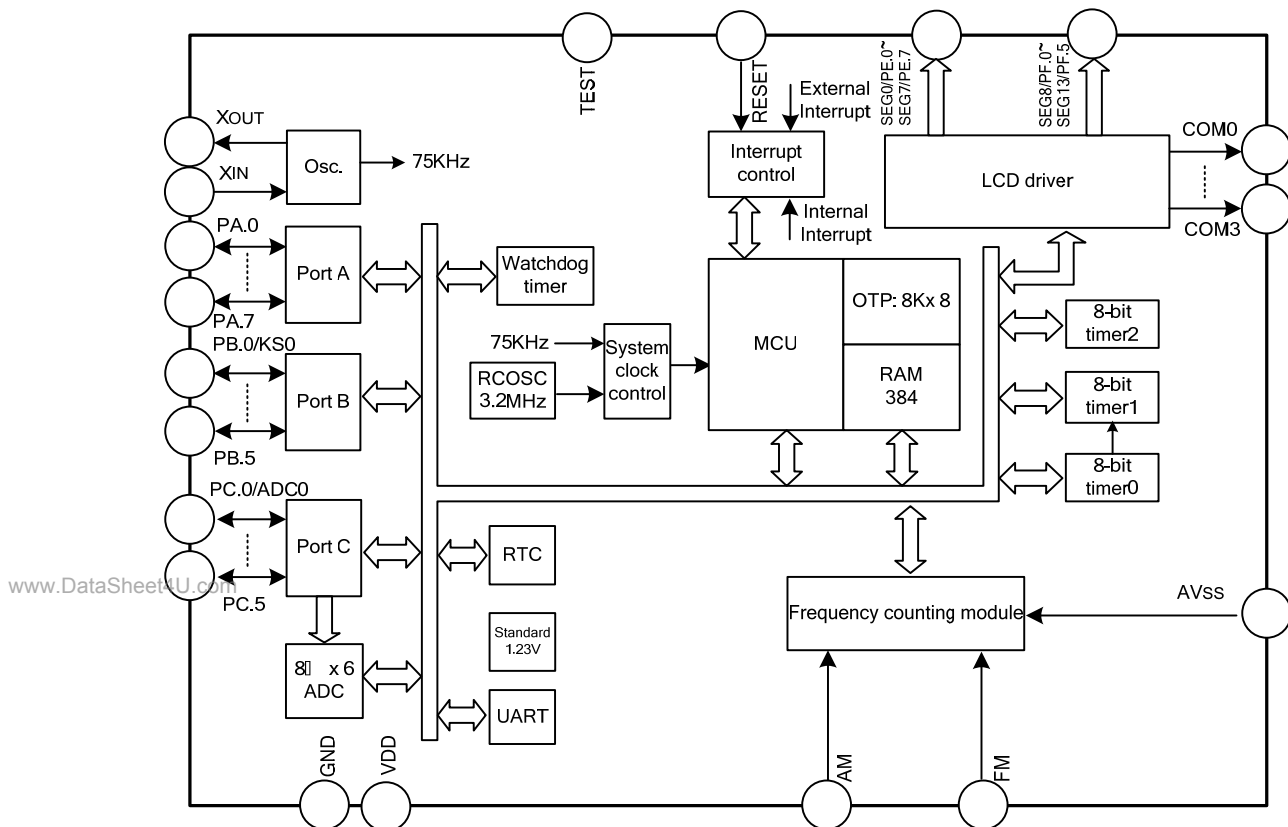


Note: $V_{PP}$ pin can be diplexed as RESET, when program the OTP memory, this pin is connected to 12V voltage.

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## ABSOLUTE MAXIMUM RATINGS

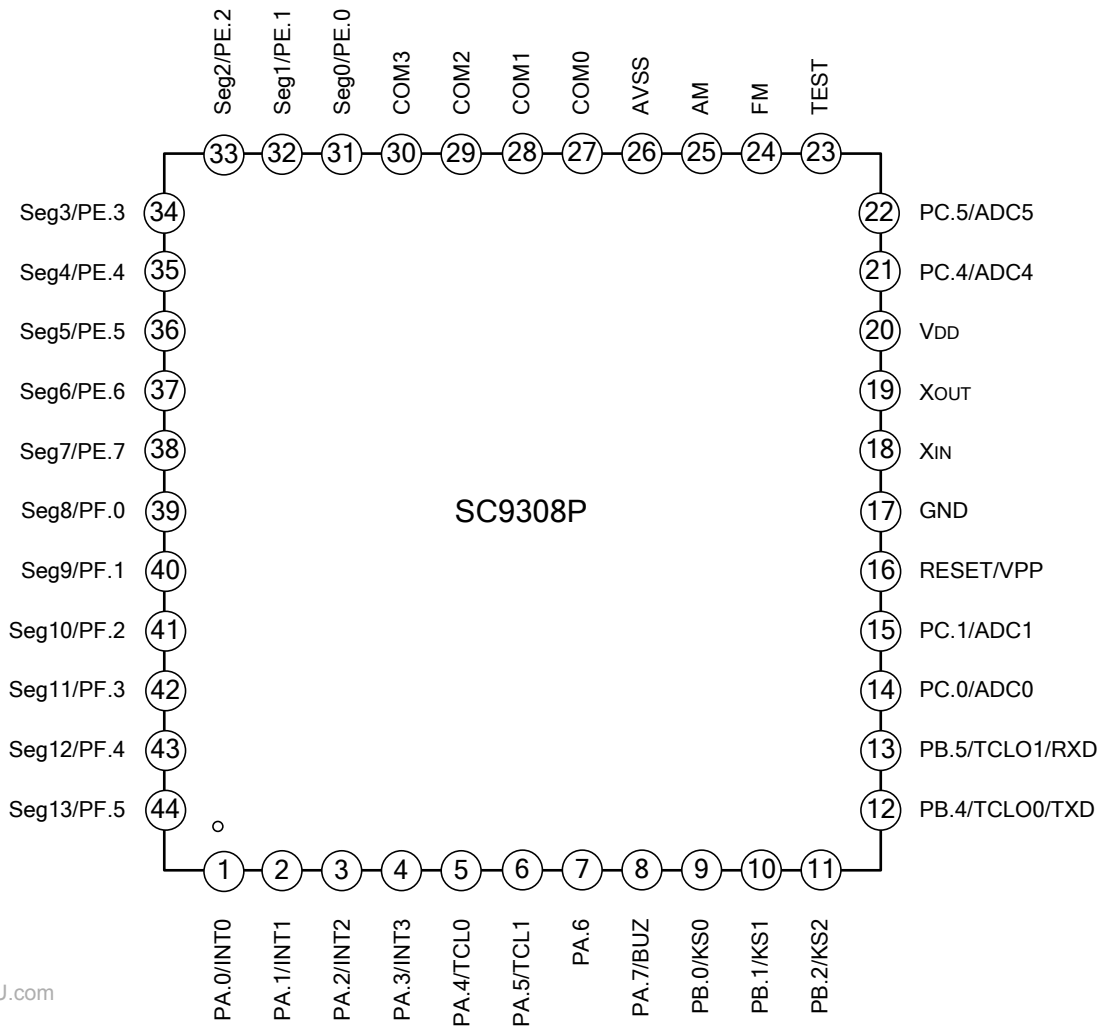| Characteristics | Symbol | Ratings | Unit |
|---|---|---|---|
| Supply Voltage | $V_{DD}$ | -0.3~5.5 | V |
| Input Voltage (All The I/O Pins) | $V_{I1}$ | -0.3~$V_{DD}$+0.3 | V |
| Input Voltage (RESET) | $V_{I1}$ | -0.3~$V_{DD}$+0.3 | V |
| Output Voltage | $V_O$ | -0.3~$V_{DD}$+0.3 | V |
| Output High Level Current | $I_{OH}$ | -15 | mA |
| Output Low Level Current | $I_{OL}$ | 30 | mA |
| Operating Ambient Temperature | $T_{amb}$ | -20~+75 | °C |
| Storage Temperature | $T_{STG}$ | -40~+125 | °C |

## ELECTRICAL CHARACTERISTICS (Unless otherwise specified, $T_{amb}$=25 °C, $V_{DD}$=3.3V)

| Characteristics | Symbol | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Operating Voltage | $V_{DD}$ | | 3.0 | 3.3 | 3.6 | V |
| Quiescent Current | $I_{Q1}$ | OSC 75KHz stop, CPU Clk stop | | | 1 | μA |
| | $I_{Q2}$ | OSC=75KHz,CPU Clk=75KHz Sleep (Note 1) | | 5.5 | | μA |
| Operating Current | $I_{DD}$ | OSC=75KHz,CPU Clk=3.2MHz, all the modules start | | 1.7 | 3.0 | mA |
| Input High Voltage | $V_{IH1}$ | PA/B/C | 2.4 | - | | V |
| | $V_{IH2}$ | PE/F | 2.0 | - | | |
| Input Low Voltage | $V_{IL1}$ | PA/B/C | | - | 1.0 | V |
| | $V_{IL2}$ | PE/F (Note2) | | - | 1.0 | |
| Output High Voltage | $V_{OH1}$ | $V_{DD}$=3V,PA/B/C,$I_{OH}$=-1mA | 2.8 | | | V |
| | $V_{OH2}$ | $V_{DD}$=3V,PE/F,$I_{OH}$=-1mA | 2.5 | | | |
| Output Low Voltage | $V_{OL1}$ | $V_{DD}$=3V,PA/B/C,$I_{OH}$=1mA | | | 0.2 | V |
| | $V_{OL2}$ | $V_{DD}$=3V,PE/F,$I_{OH}$=1mA | | | 0.2 | |
| Input High Leakage Current | $I_{LIH}$ | $V_{IN}$=$V_{DD}$, all the input pins | | | 1 | μA |
| Input Low Leakage Current | $I_{LIL}$ | $V_{IN}$=0V,all the input pins | | | 1 | |
| 75KHz Crystal Oscillator Feedback Resistor | $R_{osc}$ | $V_{DD}$ =3.0V,$X_{IN}$=$V_{DD}$, $X_{OUT}$=0V | 3000 | 6000 | 9000 | KΩ |
| Pull-Down Resistor | $R_{L1}$ | $V_{DD}$=3.0V,$V_{IN}$(FM/AM)=$V_{DD}$ | 9 | 10.5 | 12 | KΩ |
| | $R_{L2}$ | $V_{DD}$=3.0V,Test = $V_{DD}$ | | 83 | | |
| Pull-Up Resistor | $R_{H1}$ | $V_{DD}$=3.0V,$V_{IN}$(=0,PA/B/C | | 25 | | KΩ |
| | $R_{H2}$ | $V_{DD}$=3.0V,Vreset = 0 | | 67 | | |

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Note

1. Only 75KHz crystal oscillator and RTC are working.

2. CMOS input, when input voltage is 1.6V, the state of read port is uncertain.

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## PIN CONFIGURATION



Pin layout for SC9308P (44-pin package):

Top side (pins 33–23):
- 33: Seg2/PE.2
- 32: Seg1/PE.1
- 31: Seg0/PE.0
- 30: COM3
- 29: COM2
- 28: COM1
- 27: COM0
- 26: AVSS
- 25: AM
- 24: FM
- 23: TEST

Left side (pins 34–44):
- 34: Seg3/PE.3
- 35: Seg4/PE.4
- 36: Seg5/PE.5
- 37: Seg6/PE.6
- 38: Seg7/PE.7
- 39: Seg8/PF.0
- 40: Seg9/PF.1
- 41: Seg10/PF.2
- 42: Seg11/PF.3
- 43: Seg12/PF.4
- 44: Seg13/PF.5

Right side (pins 22–12):
- 22: PC.5/ADC5
- 21: PC.4/ADC4
- 20: VDD
- 19: XOUT
- 18: XIN
- 17: GND
- 16: RESET/VPP
- 15: PC.1/ADC1
- 14: PC.0/ADC0
- 13: PB.5/TCLO1/RXD
- 12: PB.4/TCLO0/TXD

Bottom side (pins 1–11):
- 1: PA.0/INT0
- 2: PA.1/INT1
- 3: PA.2/INT2
- 4: PA.3/INT3
- 5: PA.4/TCL0
- 6: PA.5/TCL1
- 7: PA.6
- 8: PA.7/BUZ
- 9: PB.0/KS0
- 10: PB.1/KS1
- 11: PB.2/KS2

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## PIN DESCRIPTION

| Pin No. | Pin Name | Diplex pin | I/O | Pin Descriptions |
|---------|----------|------------|-----|------------------|
| 1 | PA.0 | INT0 | | |
| 2 | PA.1 | INT1 | | |
| 3 | PA.2 | INT2 | | |
| 4 | PA.3 | INT3 | | |
| 5 | PA.4 | TCL0 | | |
| 6 | PA.5 | TCL1 | | Universal input / output; |
| 7 | PA.6 | — | I/O | 8bit read/write; |
| 8 | PA.7 | BUZ | | Configurable bit operation. |
| 9 | PB.0 | KS0 | | |
| 10 | PB.1 | KS1 | | |
| 11 | PB.2 | KS2 | | |
| 12 | PB.4 | TCLO0 | | |
| 13 | PB.5 | TCLO1 | | |
| 14 | PC.0 | ADC0 | I/O | Universal input / output; |
| 15 | PC.1 | ADC1 | AD input | Configurable bit operation. |
| 16 | RESET | VPP | — | System reset pin |
| 17 | GND | — | — | Digital ground |
| 18 | XOUT | — | O | Low frequency oscillator output |
| 19 | XIN | — | I | Low frequency oscillator input |
| 20 | VDD | — | — | Digital power supply |
| 21 | PC.4 | ADC4 | | Universal input / output; Configurable bit |
| 22 | PC.5 | ADC5 | I/O AD input | operation. PC4/5 can also be used as high speed crystal interface; |
| 23 | TEST | — | — | Test enable pin, internal pull-down resistor |
| 24 | FM | — | I | FM signal input |
| 25 | AM | — | I | AM signal output |
| 26 | AVSS | — | — | Analog ground |
| 27~30 | COM0~COM3 | — | O | LCD display scan common signal |
| 31~38 | SEG0~7 | PE.0~7 | I/O | Segments scan signal output, maximum output 4-bit data each pin. Drive LCD screen together with COM signal. Can be as general-purpose input/output port. |
| 39~44 | SEG8~SEG13 | PF.0~5 | I/O | Segments scan signal output, maximum output 4-bit data each pin. Drive LCD screen together with COM signal. Can be as common input/output port. (Refer to LCD module description) |

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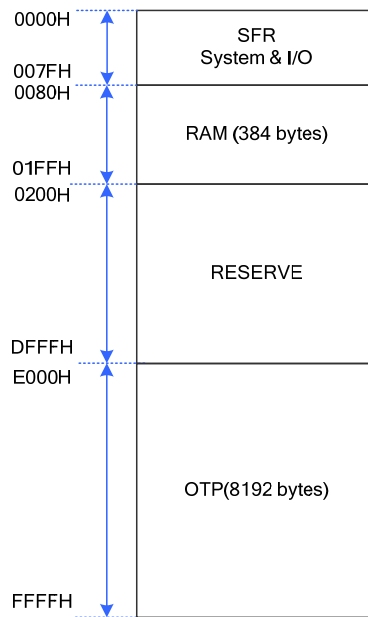
## SHARED PIN DESCRIPTION

| Pin no. | Shared pin | I/O | Descriptions |
|---------|-----------|-----|--------------|
| 12 | TXD | O | Serial communication data output |
| 13 | RXD | I | Serial communication data input |
| 1-4 | INT0-INT3 | I | External interrupt input |
| 5 | TCL0 | I | External counting pulse/clock input of timer 0 |
| 6 | TCL1 | I | External counting pulse/clock input of timer 1 |
| 8 | BUZ | O | Buzzer signal output |
| 9~11 | KS0-KS2 | I | Key scan input, can generate interrupt |
| 12 | TCLO0 | O | Frequency division output of timer 0 |
| 13 | TCLO1 | O | Frequency division output of timer 1 |
| 16 | VPP | — | High voltage pin, when download OTP, connects to 12V voltage |
| 31~38 | PE0~PE7 | I/O | General purpose I/O port PORTE |
| 39~44 | PF0~PF5 | I/O | General purpose I/O port PORTF |
| 21 | XIN4M | I | High frequency crystal input<ADC channel forbids> |
| 22 | XOUT4M | O | High frequency crystal output <ADC channel forbids> |

## FUNCTION DESCRIPTION

SC9308 has embedded SC65X core and 8K-byte OTP program memory, the data memory is 384-byte. Built-in RC oscillator generates 3.2MHz clock frequency, and after 1/2,1/4 divided frequency, It can also be used as system main clock together with external 75KHz crystal or extended high speed clock by PC4/5 to implement applications in different modes, thus to maximize reduce the power consumption. The built-in counting circuit can count the local oscillator signal frequency. In addition, it has three 8-bit counters T0/T1/T2. T0/T1 can be used separately and also be used as 16-bit counter. The built-in RTC module can provides powerful calendar/alarm functions, and provides 4 kinds of frequency BUZ signals. PA/B/C/E/F can provide max. 31 I/O ports, where PA/B has pull-up configuration and selectable open-drain output function, PC can be shared as ADC analog pin of ADC, PE/F can be used as LCD display data scan output. LCD driver can drive seven 8-segment display in maximum, and bias voltage 1/3 and 1/2 are selectable, duty is 1/2, 1/3, 1/4 programmable control to meet the various display requirements.

### MCU Address Space

MCU uses 16-bit address bus, the maximum addressing space is 64-kByte (0000H~FFFFH). The address assignment of memory space is as follows:

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```
0000H  ┌─────────────────┐
       │      SFR        │
       │  System & I/O   │
007FH  │                 │
0080H  ├─────────────────┤
       │                 │
       │  RAM (384 bytes)│
       │                 │
01FFH  │                 │
0200H  ├─────────────────┤
       │                 │
       │                 │
       │    RESERVE      │
       │                 │
DFFFH  │                 │
E000H  ├─────────────────┤
       │                 │
       │                 │
       │                 │
       │  OTP(8192 bytes)│
       │                 │
       │                 │
FFFFH  └─────────────────┘
```

SFR: Special function registers. This block includes system control, state register and the mapping of ports and display data block.

### Register Mapping Table

0000H~007FH is assigned to I/O and some function registers. Where 0000H~000FH is assigned to the core. Function registers and I/O ports configuration of used address space is as follows:

| Module | Register | I/O | Address | Function descriptions |
|---|---|---|---|---|
| **Used Address Space** | | | | |
| Interrupt Control | IRQIP | W/R | 00H | Maskable interrupt enable register |
| | IRQDP | W/R | 01H | Maskable interrupt source register |
| | NMIIP | W/R | 02H | Non-maskable interrupt enable register |
| | NMIDP | W/R | 03H | Non-maskable interrupt source register |
| | INTCON | W/R | 47H | Interrupt control register |
| | NMI is not used in the circuit, reserved. Forbid it by SEN instruction of program. | | | |
| Watchdog Timer | WDTCON | W/R | 04H | Watchdog timer setting and enable register |
| | WDT CLR0 | W | 09H | Watchdog clear register (write 53H, ACH to |
| | WDT CLR1 | W | 0AH | 09H，0AH, can clear WDT) |
| MCU control | MCU_SLP | W | 06H | MCU sleep control register |
| | MCU_STATUS | R | 07H | MCU state register |
| Bit Operation Control | BITCTRL | W/R | 08H | Bit operation address space selection register(refer to 《SC65X instructions》for details) |
| System Control | SYSCON | W/R | 45H | System function control register |
| Clock Control | CLKCON | W/R | 46H | System clock control register |
| Block Signal Selection Control | CLKSEL | W/R | 4BH | Block signal selection control register |

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| Module | Register | I/O | Address | Function descriptions |
|---|---|---|---|---|
| RTC Data and Control | RTC_CS | W/R | 30H | RTC control register |
| | YEARH | W/R | 31H | MSB of year data(BCD: 00~99) |
| | SECOND | W/R | 32H | Second data(BCD: 00~59) |
| | MIN | W/R | 33H | Minute data(BCD: 00~59) |
| | HOUR | W/R | 34H | Hour data(BCD: 00~23) |
| | DAY | W/R | 35H | Day data(BCD: 01~31) |
| | WEEK | W/R | 36H | Week data(BCD: 0~6) |
| | MON | W/R | 37H | Month data(BCD: 01~12) |
| | YEARL | W/R | 38H | LSB of year data(BCD: 00~99) |
| | MIN_ALARM | W/R | 39H | Minute alarm setting |
| | HOUR_ALARM | W/R | 3AH | Hour alarm setting |
| | DAY_ALARM | W/R | 3BH | Day alarm setting |
| | WEEK_ALARM | W/R | 3CH | Week alarm time setting |
| | CKO_CS | W | 3DH | BUZ signal control |
| TIMER2 | T2CON | W/R | 48H | Control register |
| | T2REF | W/R | 49H | Preassign register/capture register |
| TIMER0 | T0CON | W/R | 4CH | Control register |
| | T0REF | W/R | 4DH | Preassign register |
| TIMER1 | T1CON | W/R | 4EH | Control register |
| | T1REF | W/R | 4FH | Preassign register |
| UART | UART_BUF_ADDR | W/R | 62H | Transmitting/receiving data buffer |
| | SCON_ADDR | W/R | 63H | UART control register |
| | BRCON_ADDR | W/R | 64H | Baud rate control register |
| | BRTIMER_ADDR | W/R | 65H | Baud rate counting initial value setting register |
| Analog/Digital Converter | ADDATA | R | 50H | Conversion result of 8-bit storage |
| | ADCON | W/R | 51H | Analog/digital control and state |
| Local oscillator amply | PLLCON | W/R | 52H | Local oscillator input control register |
| Frequency counter | IFMOD | W/R | 55H | Frequency counting mode control register |
| | IFCNT0 | W/R | 56H | Low 8-bit of frequency counting data |
| | IFCNT1 | W/R | 57H | High 8-bit of frequency counting data |
| Port and Direction Control | TRISA | W/R | 59H | Direction control register of port A |
| | PORTA | W/R | 5DH | Data temporary storage register of port A |
| | TRISB | W/R | 5AH | Direction control register of port B |
| | PORTB | W/R | 5EH | Data temporary storage register of port B |
| | TRISC | W/R | 5BH | Direction control register of port C |
| | PORTC | W/R | 5FH | Data temporary storage register of port C |
| | APCON | W/R | 5CH | Port and A/D input diplex selection control |

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| Module | Register | I/O | Address | Function descriptions |
|---|---|---|---|---|
| Pull-up Configuration | PUA | W/R | 60H | I/O port pull-up mode selection register |
| | PUB | W/R | 61H | I/O port pull-up mode selection register |
| SEG Diplex Port | PORTE | W/R | 68H | Data temporary storage register of port E |
| | PORTF | W/R | 69H | Data temporary storage register of port F |
| | Refer to LCD module description for details. | | | |
| SEG Diplex Control | SEG_CTRL0 | W | 6BH | SEG0~3 pin configuration register |
| | SEG_CTRL1 | W | 6CH | SEG4~7 pin configuration register |
| | SEG_CTRL2 | W | 6DH | SEG8~11 pin configuration register |
| | SEG_CTRL3 | W | 6EH | SEG12~13 pin configuration register |
| 68－69H Unused | | | | |
| LCD Interface Control | LCDCON | W | 67H | LCD control register |
| | LCDPWR | W/R | 66H | LCD control register |
| | Display RAM | | | |
| | LCDREG0 | W/R | 72H | LCD display register 0 |
| | LCDREG1 | W/R | 73H | LCD display register 1 |
| | LCDREG2 | W/R | 74H | LCD display register 2 |
| | LCDREG3 | W/R | 75H | LCD display register 3 |
| | LCDREG4 | W/R | 76H | LCD display register 4 |
| | LCDREG5 | W/R | 77H | LCD display register 5 |
| | LCDREG6 | W/R | 78H | LCD display register 6 |
| | LCDREG7 | W/R | 79H | LCD display register 7 |

### Interrupt control

SC65X supports two kinds of interrupts: Non-maskable interrupt NMI; maskable interrupt IRQ. Where PRI of non-maskable interrupt NMI is higher than maskable interrupt IRQ. However, this circuit does not implement NMI <span>www.DataSheet4U.com</span> interrupt.

**1. Maskable interrupts**

SC9308 has 11 maskable interrupts in total without PRI; Setting IRQIP register to determine if the interrupt is enable. All the maskable interrupts use the same entry address FFF8H.

**2. Non-maskable interrupts(reserved)**

Non-maskable interrupt NMI, active high. Entry address is FFFCH/FFFDH. This circuit does not implement NMI function. There is no need to set NMIIP and NMIDP registers.

**3. External interrupts**

SC9308 has 4 IO input interrupts ExtInt0～3, input by PA0～3 pins; one is used for scan interrupt KSINT, shares one interrupt source with ExtInt2, corresponding to IRQDP.6. ExtInt3 and IF interrupt IRQIFC share one interrupt source, corresponding to IRQDP.7. In addition, RTC and Timer2 share one interrupt source.

### Watchdog Timer

Watchdog timer adopts independent counter. Watchdog (WDT) is mainly used for program monitor, after counting overflows, generates reset signal to avoid endless loop or other error execution state. When 75K crystal oscillator is operating, the longest overflow time is 873.6ms.

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### Operating mode control

SC9308 work in three modes: normal mode, sleep mode, and data maintained mode. Normal mode can be divided into high-speed mode and low-speed mode. Their difference is the system clock from different sources. The high speed mode system clock comes from internal RC oscillator or high speed oscillator extended by PC4/5, while the low speed mode system clock comes from external low speed oscillator.

After power on, CPU clock is provided by internal RC oscillator. When this oscillator is working, the internal reference module is needed to open. Select clock frequency or switch to the external low speed clock (75KHz) by setting system control register and clock control register.

The MCU enters sleep mode by setting SLEEP flag of MCU sleep control register MCU_SLP as 1. After the MCU enters sleep mode, external 75KHz oscillator still works, and CPU clock will be turned off. But it can still response to internal timer interrupt or external IO interrupt. The circuit enters sleep mode which can reduce the system standby power dissipation (75KHz crystal oscillator operating, when RTC enables at 3V operating voltage, typical power dissipation current <5$\mu$A). Reset, internal or external interrupt can wake up CPU and make it enter work in full speed.

When system clock comes from external low speed oscillator, if this oscillator is closed by program, the circuit will enter data save mode. In this mode, RAM data is saved. The dissipation current is reduced to less than 1uA. External IO interrupt or reset can make the oscillator work again.

**Note:** The clock should be switch to 75KHz before entering the sleep mode. Turn off the power reference circuit and other relative circuits to reduce the power dissipation.

### Clock and Reset

SC9308 supports many selectable operating clocks. The clock source can be external 75KHz crystal oscillator, and can also be the clock generated by internal RC oscillator. When need high precision and high speed application, it can extend high frequency external oscillator through PC4/5. The structure is as follows:
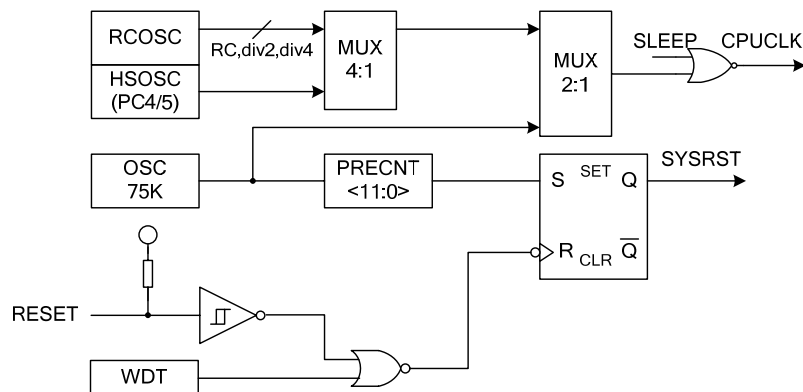
The system reset occurs when: internal watchdog counting overflows; external Reset pin input low level. The circuit jumps to the start address of the program from reset address FFFAH and begins working normally.

SC9308 has built in RC oscillator, and frequency of RC oscillator is about 3.2MHz when supply voltage is 3V. If you need to fast response to internal and external events without high precision, adopt RC oscillator as CPU clock to make the system process the events quickly. Due to RC oscillator will vary following the voltage and temperature, PC4/PC5 must be used to extend high-speed oscillator to satisfy the system requirements under the conditions that need high-precision timing or asynchronous communication, etc..

RC oscillator begins to work after reset, and CPU clock selects the RC oscillator.

### Real time Clock (RTC)

RTC module can provide powerful timing function. When it starts, it will work separately from CPU. It can provide minute, hour and year/month/day, etc. in BCD formats. Minute, hour, week, day alarm can be set, and the alarm function can be triggered by interrupt or inquiring the alarm flag by software. At the same time, it will generate 0.5s real time clock signal, which can trigger interrupt. This interrupt shares one channel with alarm interrupt. It is used together with INTCON register. At the same time, it provides 4 BUZ signals to driver the buzzer.

### Timer T0/T1/T2

SC9308 includes three 8-bit timers Timer0, Timer1 and Timer2. Where, T0 and T1 timers can be together used as 16-bit timer. When T0 or T1 are used separately, their functions are as follows:

➢ 8-bit programmable timing, generate interrupt after setting the time interval

➢ Arbitrary frequency output

➢ External clock frequency division

T0/T1/T2 has one control register and one pre-assignment register.

T2 timer has input capture except for the similar functions as T0/T1. capture signal input are all diplex with PA6 pin.

### UART

SC9308 has built-in full duplex async communication interface. Communication port with three modes: 8bit variable baud rate, 9bit fixed baud rate or variable baud rate communication.

➢ Tx pin diplex with PB4, RX pin diplex with PB5

➢ Baud rate presetting register can adjust baud rate freely

➢ Transmitting and receiving interrupt cooperation dual buffer can make sure the high speed communication stable and reduce the CPU load.

### 8-bit ADC

8-bit AD converter is mainly used for keyboard scan or electronic volume display. It has 4 input channels (PC0/1/4/5). Select a channel and input switch level by program and the result is stored in an 8-bit register. Conversion clock has 4 selectable clock sources. Input internal reference voltage through channel 6 of ADC to detect the battery voltage(together with internal standard voltage). PC4/5 can also be used to extend high frequency oscillator pin, if it is not connected to oscillator, do not effect ADC input channel. Adopt 75KHz clock, one AD conversion needs 12 clock cycles, and the typical conversion time of ADC is 160μs.

### Frequency counting module

This module mainly includes local oscillator signal amplifier and gate control counting two sections. FM or AM local oscillator signal is counted by a 16-bit counter after amplified. This counter gate control time can select 1/4/8ms, so the local oscillator frequency can be got easily according to the counter value and gate time, then display on LCD according to application requirements.

### I/O Port

SC9308 has 5 groups of I/O ports: PA, PB, PC, PE, PF. PA has 8 pins, where 4 pins are used for external interrupt input. PB has 5 pins, where 3 pins are used for key input interrupt. PC has 4 pins which are shared with ADC input channel. PE/PF are shared with SEG segments, and can also be used as common IO, 14 pins in total. So there are max. 31 pins can be used as IO pins.

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Ports PA/B configured three registers. Data register PORTx latches the output data, direction register TRISx controls the dataflow direction (set 1 to be output). PUA register and TRISA register can implement input pull-up or output open-drain of port A. PB has only 5 pins, port PC of PUB register is controlled by 3 registers, TRISC realizes direction selection, PORTC stores output data, APCON realizes the switch of analog channel and digital channel.

Register PORTx is readable/writable. When PORTx is set as output, read the last writing data of this register; when it is set as input, read the pin state.

## Display Driver

LCD module can drive maximum 14 SEG x 4 COM LCD board. It is mainly composed of the following parts:

➢ Control circuit
➢ 8 display data memory registers are all readable/writable
➢ 14 SEG outputs
➢ 4 COM outputs

Each SEG can be used as common I/O port.

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## CHIP TOPOLOGY

| 44 | 43 | 42 | 41 | 40 | 39 | 38 | 37 | 36 | 35 |

34
33
32
31
30
29
28
27

1
2
3
4
5
6
7
8
9
10
11

26
26²
25
24

12 13 14 15 16 17 18 19 20 21 22 23

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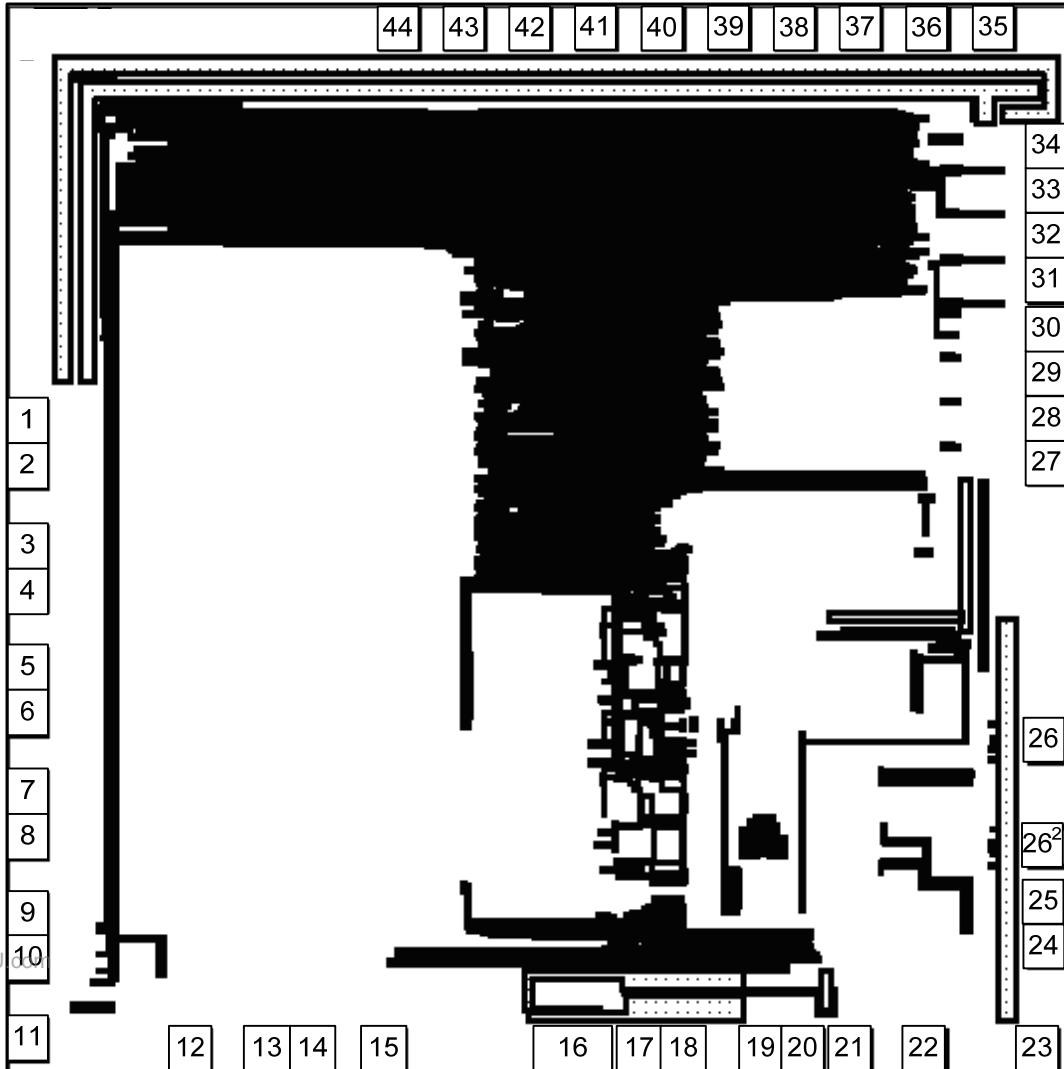
**KEY PAD COORDINATE1** (Die size: 2390* 2490   unit: μm)

| NO. | Symbol | X axis | Y axis | NO. | Symbol | X axis | Y axis |
|-----|--------|--------|--------|-----|--------|--------|--------|
| 1 | PA0 | -1198 | 261.76 | 24 | FM | 1198 | -914.25 |
| 2 | PA1 | -1198 | 161.76 | 25 | AM | 1198 | -814.25 |
| 3 | PA2 | -1198 | -15.2 | $26^2$ | AVSS | 1198 | -690.65 |
| 4 | PA3 | -1198 | -115.2 | 26 | AVSS | 1198 | -453.45 |
| 5 | PA4 | -1198 | -292.16 | 27 | COM0 | 1198 | 169.88 |
| 6 | PA5 | -1198 | -392.16 | 28 | COM1 | 1198 | 269.88 |
| 7 | PA6 | -1198 | -596.12 | 29 | COM2 | 1198 | 369.88 |
| 8 | PA7 | -1198 | -669.12 | 30 | COM3 | 1198 | 469.88 |
| 9 | PB0 | -1198 | -846.08 | 31 | SEG0 | 1198 | 576.32 |
| 10 | PB1 | -1198 | -946.08 | 32 | SEG1 | 1198 | 676.8 |
| 11 | PB2 | -1198 | -1123.04 | 33 | SEG2 | 1198 | 777.28 |
| 12 | PB4 | -814.03 | -1148 | 34 | SEG3 | 1198 | 877.76 |
| 13 | PB5 | -637.07 | -1148 | 35 | SEG4 | 1071.97 | 1148 |
| 14 | PC0 | -537.07 | -1148 | 36 | SEG5 | 916.58 | 1148 |
| 15 | PC1 | -360.11 | -1148 | 37 | SEG6 | 761.19 | 11489 |
| 16 | RESET | 82.82 | -1148 | 38 | SEG7 | 605.8 | 1148 |
| 17 | GND | 237.82 | -1148 | 39 | SEG8 | 450.41 | 1148 |
| 18 | XOUT | 337.82 | -1148 | 40 | SEG9 | 295.02 | 1148 |
| 19 | XIN | 525.04 | -1148 | 41 | SEG10 | 139.63 | 1148 |
| 20 | VDD | 625.04 | -1148 | 42 | SEG11 | -15.76 | 1148 |
| 21 | PC4 | 735.04 | -1148 | 43 | SEG12 | -171.15 | 1148 |
| 22 | PC5 | 912 | -1148 | 44 | SEG13 | -326.54 | 1148 |
| 23 | TEST | 1174.36 | -1148 | | | | |

Note 1:  The coordinate origin is in the middle of the die.

Note 2: The two pads marked with 26 in above table should be bounding to one pin.

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## TYPICAL APPLICATION DIAGRAM

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## PACKAGE OUTLINE

QFP-44-10x10-0.8                                                    Unit: mm

CAUTION
ELECTROSTATIC
SENSITIVE DEVICE
DO NOT OPEN OR HANDLE
EXPECT AT A STATIC-FREE
WORKSTATION

### MOS DEVICES OPERATE NOTES:

Electrostatic charges may exist in many things. Please take following preventive measures to prevent effectively the MOS electric circuit as a result of the damage which is caused by discharge:

- The operator must put on wrist strap which should be earthed to against electrostatic.
- Equipment cases should be earthed.
- All tools used during assembly, including soldering tools and solder baths, must be earthed.
- MOS devices should be packed in antistatic/conductive containers for transportation.

Note：Silan reserves the right to make changes without notice in this specification for the improvement of the design and performance.

Silan will supply the best possible product for customers.