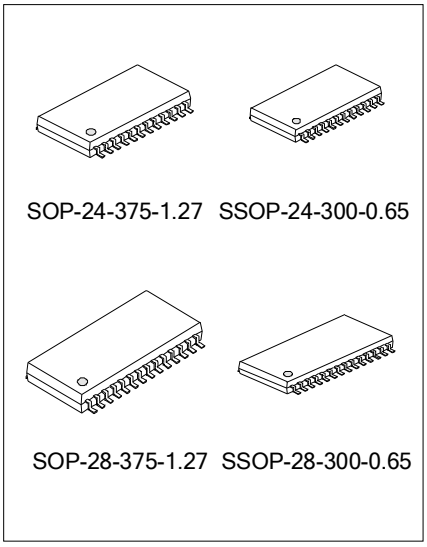
8-BIT MCU FOR REMOTE CONTROLLER(40K ROM)

DESCRIPTION

SC65D02C40 is a multifunction infrared remote controller integrating many electrical appliances and many code formats (do not support LCD display).

This chip is based on 8-bit MCU SC65X designed by Silan company. It provides built-in 8K program memory and 32K data memory.

Its assistant PC design software can produce the required remote controller data which need to mask to ROM by set the code formats and input the initial data automatically, thus reduce the design cycle and improve the reliability and efficiency.



FEATURES

* Built-in hundreds of different code formats for remote controllers and it can control many household applications.
* Single chip which composes the system only need a few components.
* CMOS technology, operating voltage is 2.0V-3.6V and the quiescent power dissipation is less than 2uA.
* SC65X main processor, built-in 8K ROM and 32K ROM.
* Provide independent hardware code sending module, carrier frequency and duty can be set flexibly. (the carrier frequency range is 17.2K-188K)
* The pins used for keypress function are 16 at most, and it can support 64 keys.
* External 4MHZ crystal oscillator. The operating frequency of hardware code sending module is 4MHZ, and the operating frequency of the other parts (including MCU) is 1MHz.
* Provide well software as well as good reliability and development period is short.

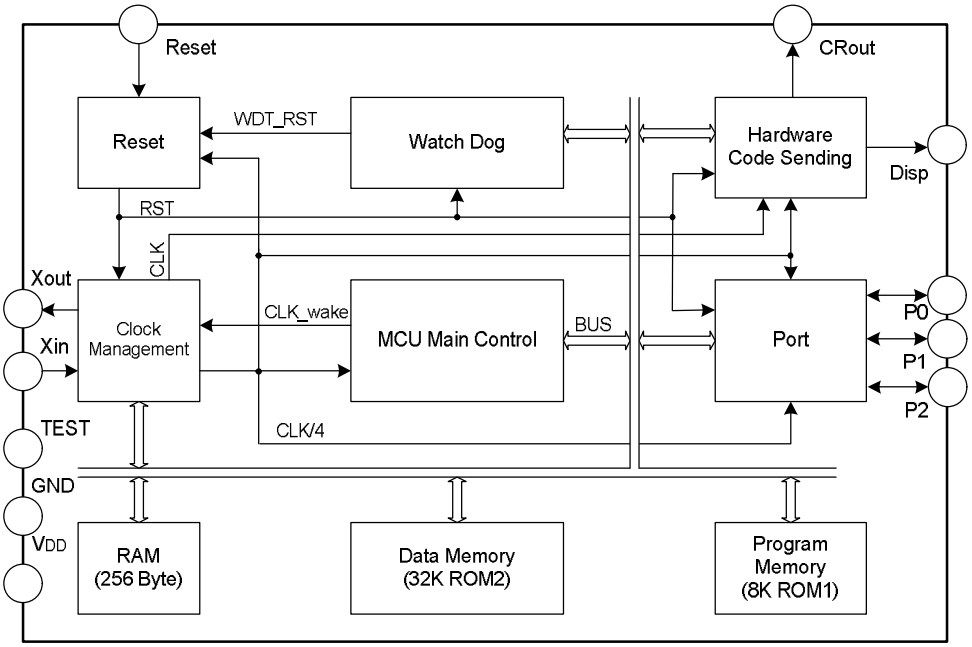
ORDERING INFORMATION

Device	Package
SC65D02C40	SSOP-24-300-0.65
SC65D02C40A	SOP-24-375-1.27
SC65D02C40B	SOP-28-375-1.27
SC65D02C40C	SSOP-28-300-0.65

APPLICATIONS

* Infrared transmitting remote controller
* TV remote controller
* Video Recorder remote controller
* VTR, laser phonograph and acoustics remote controllers.

BLOCK DIAGRAM



BUS: Including address bus, data bus and read/write chip selection signal.

ABSOLUTE MAXIMUM RATING (Unless otherwise specified, T_{amb}=25°C)

Characteristics	Symbol	Value	Unit
Supply Voltage	V_{DD}	-0.3 ~ 6.0	V
Input Voltage	V_{IN}	-0.3~V_{DD}+0.3	V
Output Current of Code Sending End	I_{OUT}	10	mA
Power Dissipation	P_D	500	mW
Storage Temperature	T_{stg}	-40~+125	°C
Operating Temperature	T_{opr}	-20~+75	°C

DC ELECTRICAL CHARACTERISTICS（Unless otherwise specified, T_{amb}=25°C, V_{DD}=3.0V）

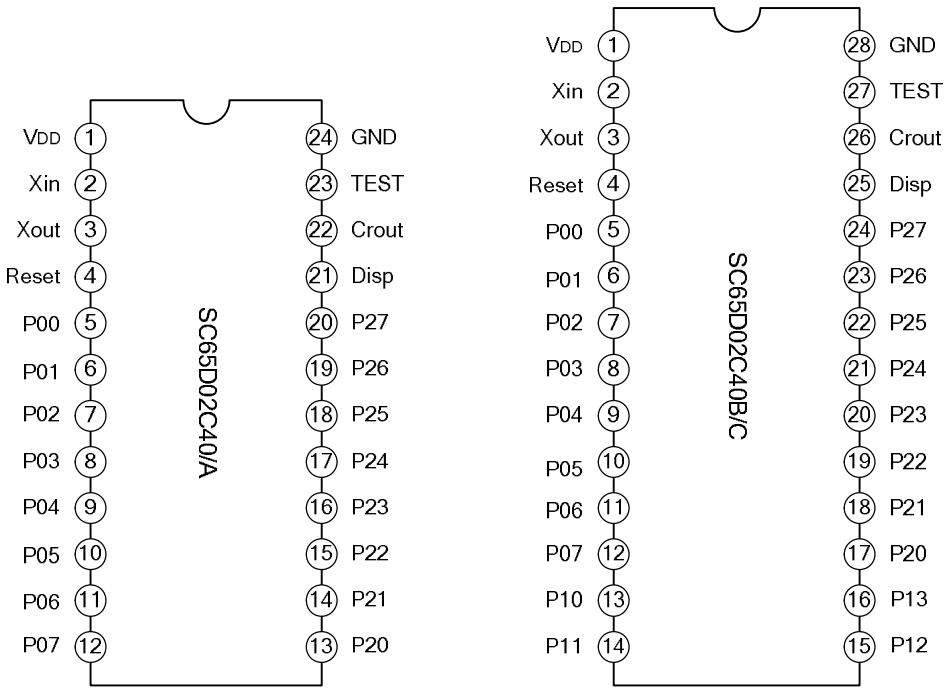
Characteristics	Symbol	Test conditions	Min.	Typ.	Max.	Unit
Supply Voltage	V_{DD}	All functions	2	--	6	V
Operating Current	I_{DD}	--	--	--	1	mA
Quiescent Dissipation Current	I_{DS}	Oscillator stops	--	0	2	μA
Input Pull-up/Pull-down Resistor	R	--	50	100	150	KΩ
High Level Input Voltage	V_{IH}	--	0.7V_{DD}	--	V_{DD}	V

(To be continued)

(Continued)

Characteristics	Symbol	Test conditions		Min.	Typ.	Max.	Unit
Low Level Input Voltage	V_{IL}	--		0	--	0.3V_{DD}	V
High Level Output Current	I_{OH}	V_{OH}=2.7V	CRout	--	3.9	--	mA
			Disp	--	3.9	--	
			P0/P1/P2	--	3.2	--	
Low Level Output Current	I_{OL}	V_{OL}=0.3V	CRout	--	1.7	--	mA
			Disp	--	1.7	--	
			P0/P1/P2	--	0.8	--	

PIN CONFIGURATION



PIN DESCRIPTIONS

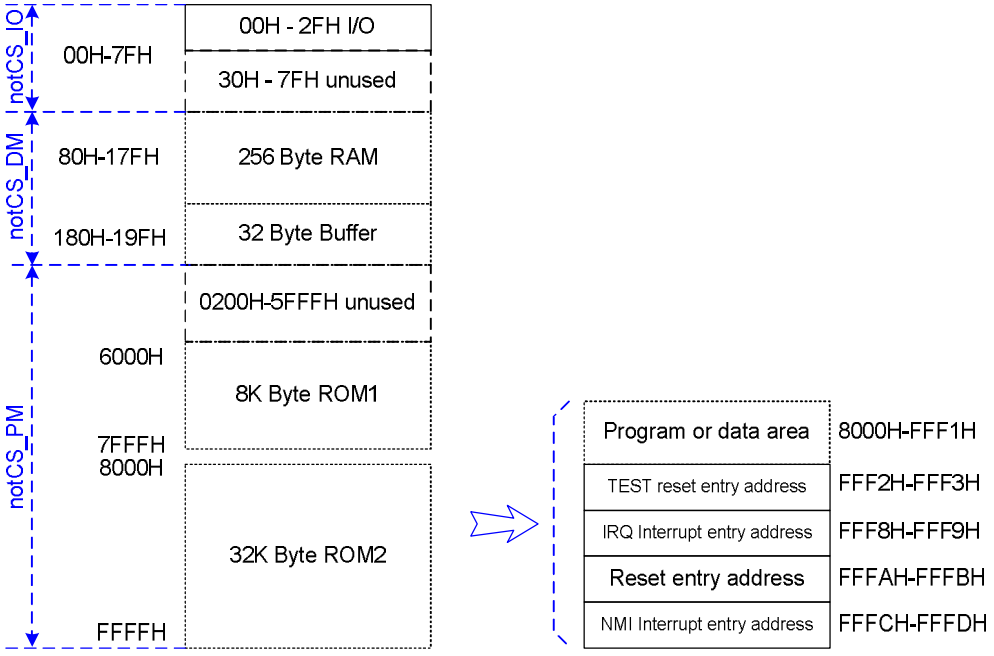
Pin no.	I/O	Functions
V_{DD}	--	Power Supply
Xin	I	Oscillator input pin
Xout	O	Oscillator output pin
Reset	I	System reset, and low active (Pull-up internally)
P00～P07	I/O	I/O port used for keyboard scan input/output.
P10～P13	I/O	I/O port used for keyboard scan input/output.
P20～P27	I/O	I/O port used for keyboard scan input/output.
Disp	O	LED code sending indicator(light at high level)
CRout	O	Code format of remote controller output pin.
Test	I	Test pin(Connect to V_{DD} when in normal use)
GND	--	Ground

FUNCTION DESCRIPTIONS

1. Memory

- ✧ Program memory (ROM1): 8K x 8Bit, address space is 6000H—7FFFH, used for store the MCU main control program (mainly key scan, carrier and code sending control).
- ✧ Data memory (ROM2): 32K x 8Bit, address space is 8000H—FFFFH, mainly used to store the code data of remote controller.
- ✧ RAM: 256Byte x 8Bit, address space is 0080H—017FH. Where 80H – FFH can be as stack in MCU design. Set the first address of the stack before use, and when enter the stack, the address is move downward, while go out of the stack, the address move upward.

2. MEMORY&IO Space Assignment



MCU address space assignment

3. Special functional register list

Address	Name	I/O	Descriptions
00H	IRQ_Mask	R/W	Irq interrupt mask register (8Bit, when the corresponding bit is 0, open; while is 1, close)
01H	IRQ_Int	R/W	Irq source register, 8 bits, readable and can be cleared when write (unused)
02H	NMI_Mask	R/W	NMI interrupt mask register (When Bit0 is 0 open, is 1 close—default)
03H	NMI_Int	R/W	NMI source register, 1bit, readable and can be cleared when write (unused)

(To be continued)

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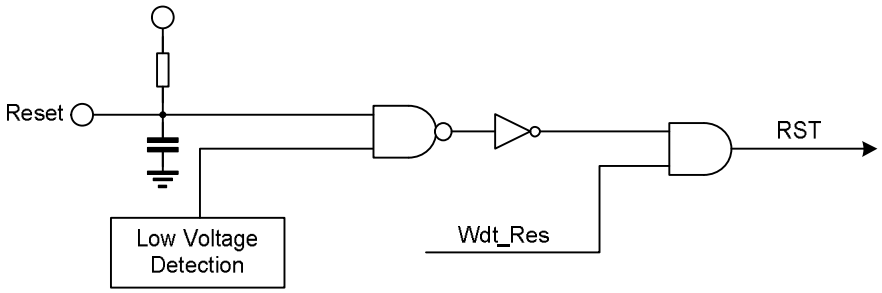
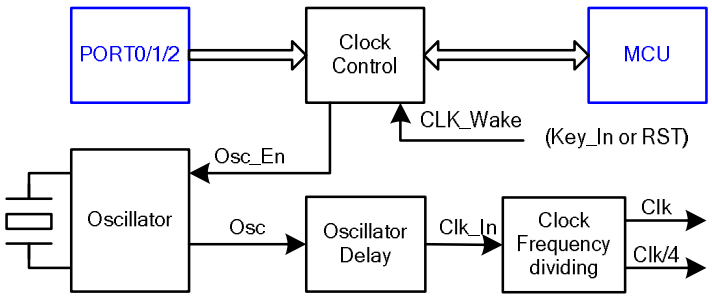
Address	Name	I/O	Descriptions
04H	Wdt_Ctrl	R/W	Bit[1: 0]: WDT frequency pre-dividing set bit; Bit[7: 2]: unused
05H	Wdt_ClrA	W	WDT clear register A combined with Wdt_ClrB to carry out the clear operation.
06H	Sleep_Ctrl	W	Bit0: System sleep control bit (when is 1, the system enter SLEEP mode)
07H	Special_Flag	R	bit0: System sleep, bit1: WDT overflow flag register
08H	Bit_Ctrl	R/W	Bit[5: 0]: Bit operation control register
09H	Wdt_ClrB	W	WDT clear register B combined with Wdt_ClrA to carry out the clear operation.
10H	Osc_En	W	Bit1: Oscillator enable control. (Default the oscillator is open after reset, and can be closed by program)
11H	P0_Ctrl	R/W	P0 input/output direction control register (1: input; 0: output)
12H	P0_Data	R/W	P0 8-bit data register.
13H	P1_Ctrl	R/W	P1 input/output direction control register (1: input; 0: output)
14H	P1_Data	R/W	P1 8-bit data register.
15H	P2_Ctrl	R/W	P2 input/output direction control register (1: input; 0: output)
16H	P2_Data	R/W	P2 8-bit data register.
1AH	Disp_Data	W	Key indicator light output control register.

4. Reset Module



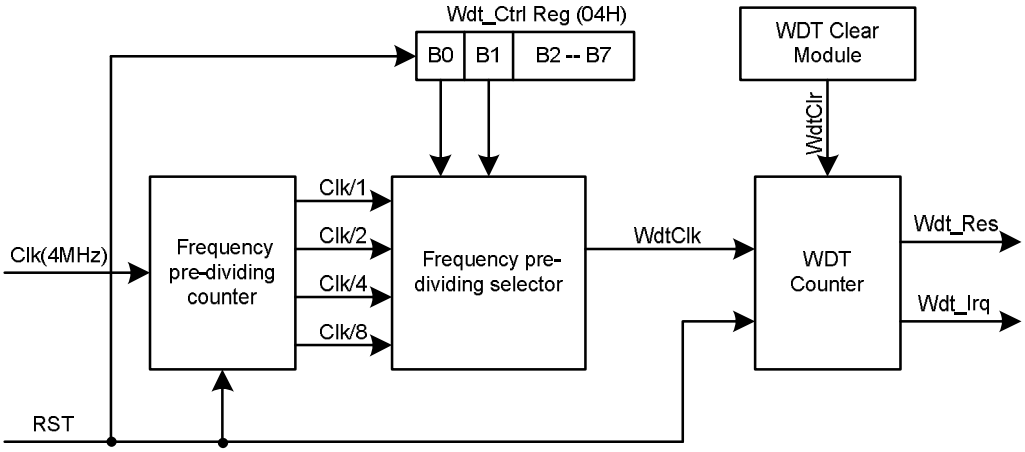
- ✧ Wdt_Res: Reset signal when the watch dog overflows.
- ✧ The low voltage detection circuit detects the supply voltage in real time. When it is lower than a certain value, the circuit will still in reset state, thus to avoid the unstable working state.

5. Clock Management



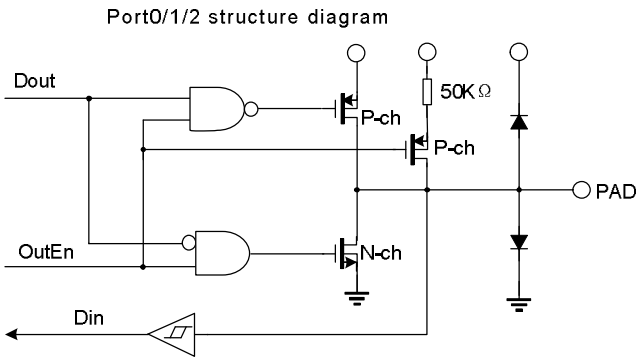
- ✧ External 4MHz oscillator.
- ✧ This module outputs 4MHz and 1MHz two frequency signal. The operating frequency of hardware code sending module is 4MHZ, and the operating frequency of the other parts (including MCU) is 1MHz.
- ✧ An output delay circuit can remove the unstable clock signal when the oscillator starts, thus to improve the system reliability.
- ✧ Controllable oscillator can reduce the power dissipation and prolong the battery's life-span. That is when the remote controller is in the standby state, the system clock will be closed by shutting off the oscillator, and it will restart when reset or a key is pressed.

6. Watch Dog



- ✧ The watch dog (WDT) adopts independent counter. It mainly used to monitor the program, generate reset signal after the counter overflows to avoid dead etc. error state.
- ✧ WDT counter has 23 bits, when WDT counting to 3/4 cycle, Wdt_Irq interrupt occurs, and generate the Wdt_Res reset signal after overflows. (The default latency time is 262 ms; and the max. latency time is 2097 ms.)
- ✧ The watch dog is open all the time, in the system running cause, it will be cleared within the timing cycle of watch dog by program, thus to avoid generating unwanted watch dog overflow reset.

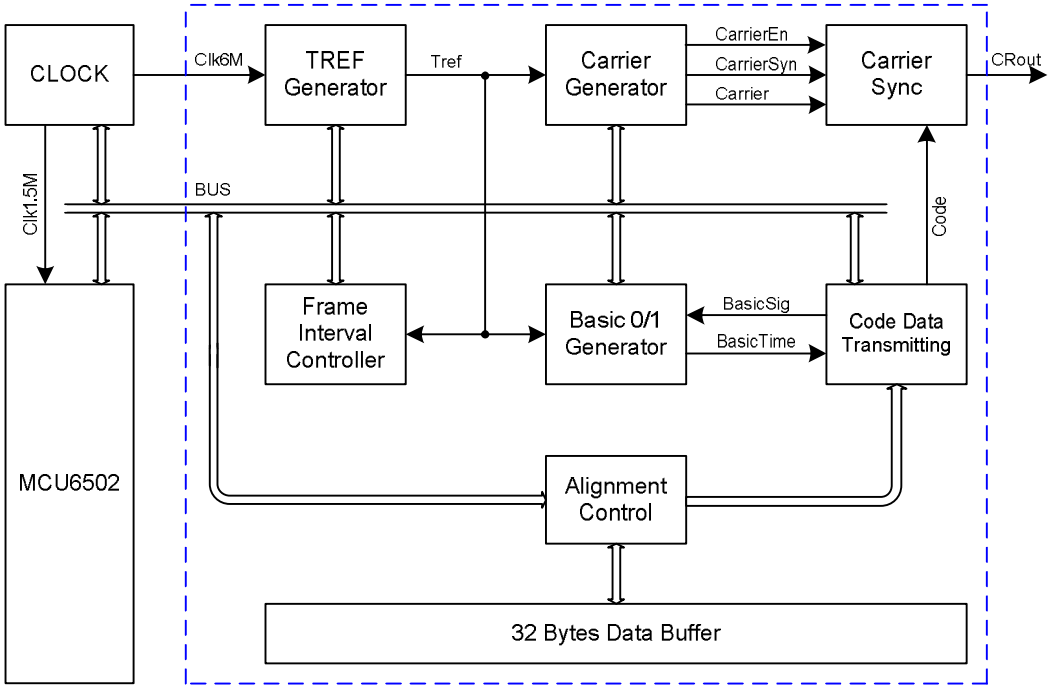
7. Port



- ✧ The chip designs Port0/2[7: 0] 2 groups 8-bit bidirectional ports, Port1 [3: 0] 1 group 4-bit bidirectional port, mainly used for key matrix and also can be used as jumper.

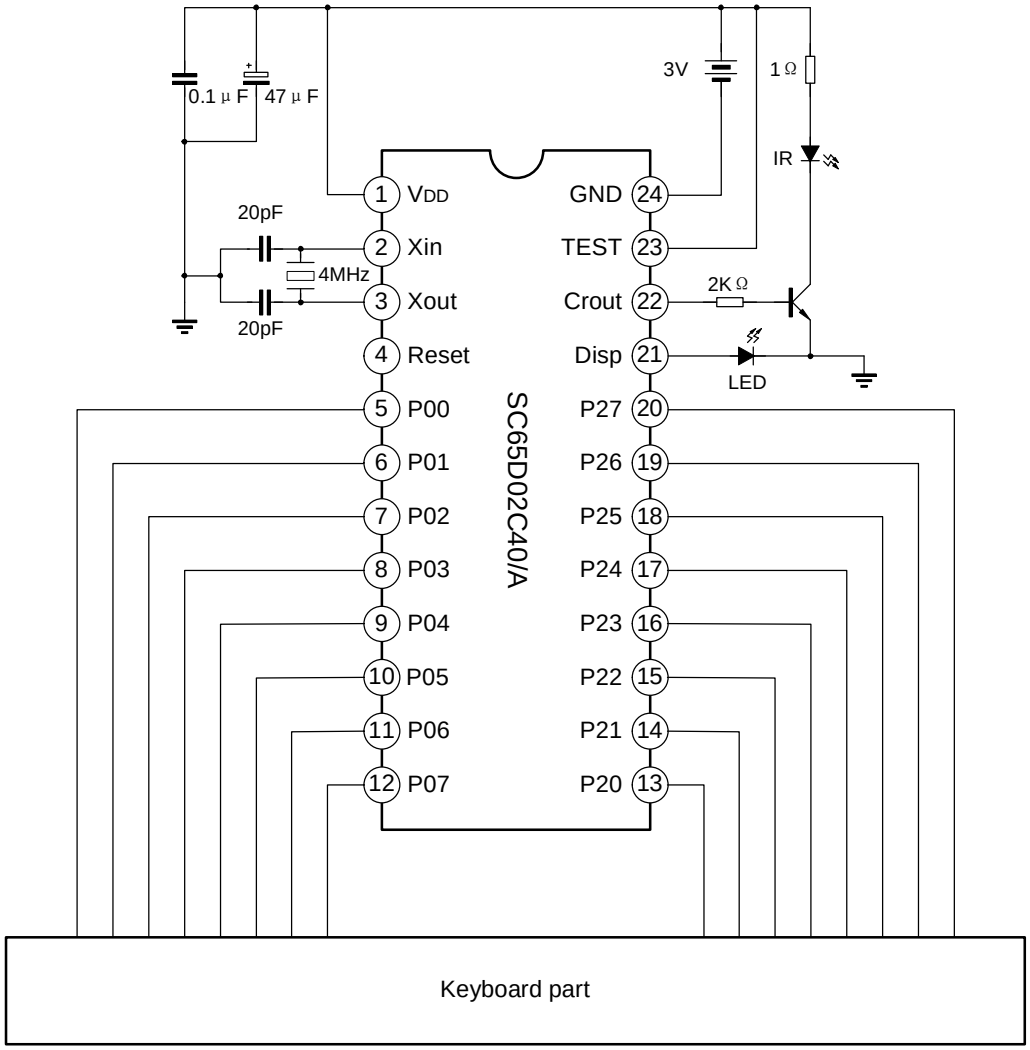
- ✧ Every port has a direction control register and a data register, and the register address and illustration refer to the register list.
- ✧ Where the capacity of N pipe is over that of P pipe, that is the low level output capacity is over the high level output capacity, thus to support double keys or more keys.

8. Hardware code transmitting

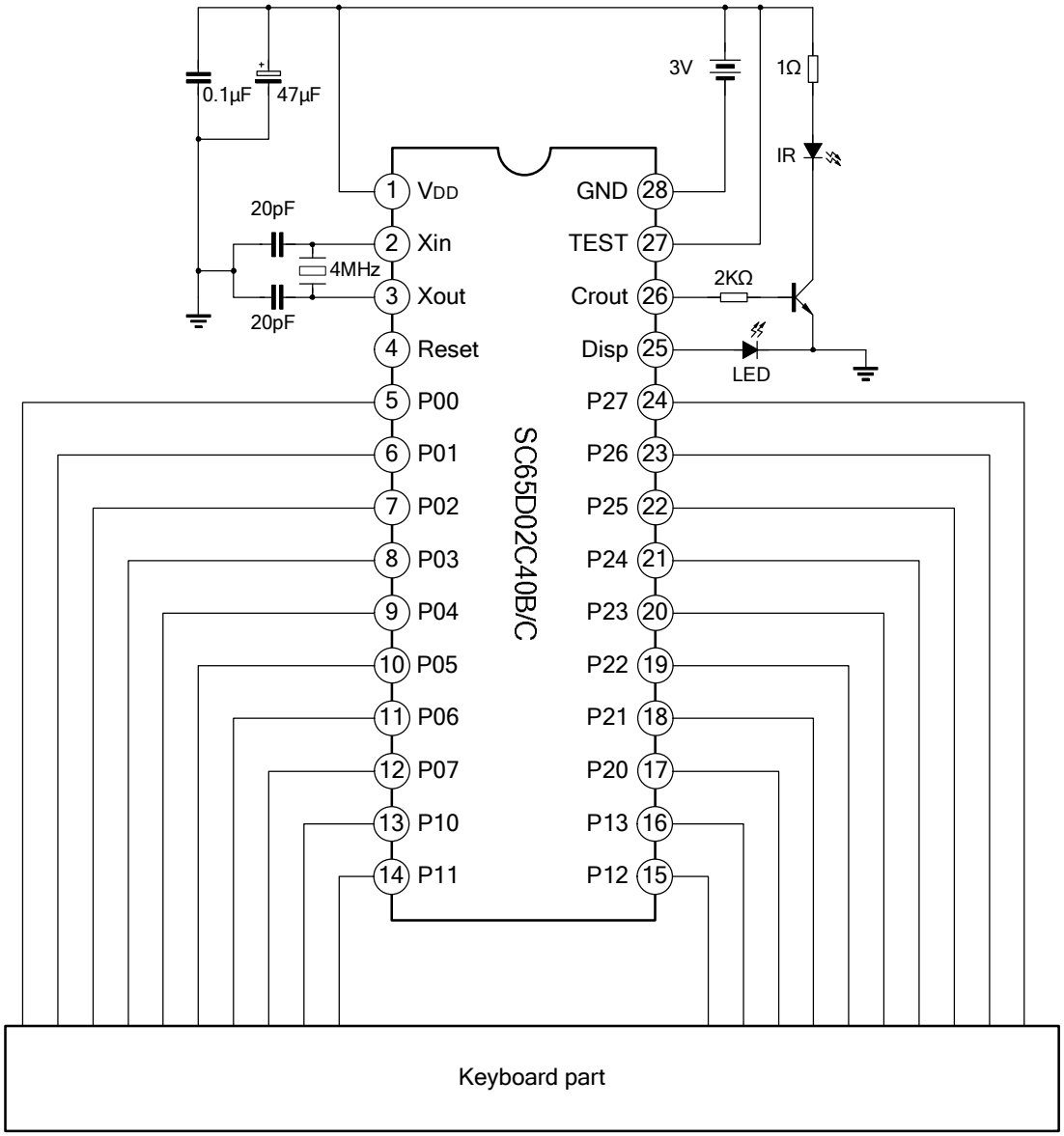


- ✧ The hardware code transmitting combines with the code definition and code transmitting program to complete the data's capture, decode, carrier processing and wave output.
- ✧ TREF module: used to generate the minimum time unit of code transmitting.
- ✧ Basic 0/1 generator: used to generate the basic time of high/low level when transmit the code.
- ✧ Carrier generator: used to generate the carrier signal.
- ✧ Carrier sync module: deal with key code envelope and carrier, and transmit the key code.
- ✧ Frame interval controller: used for producing the time interval between frames.
- ✧ Code transmitting control module: used for data management of 32 bytes buffer.
- ✧ Code data transmitting module: used for producing output key code envelope.

TYPICAL APPLICATION CIRCUI (PIN24)

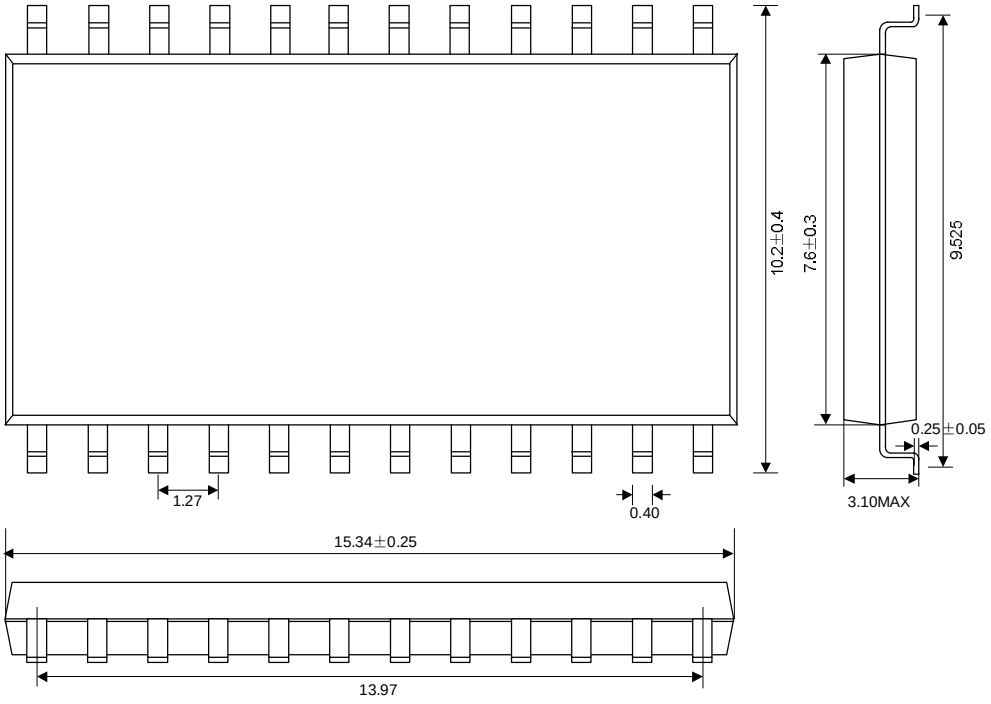


TYPICAL APPLICATION CIRCUI (PIN28)

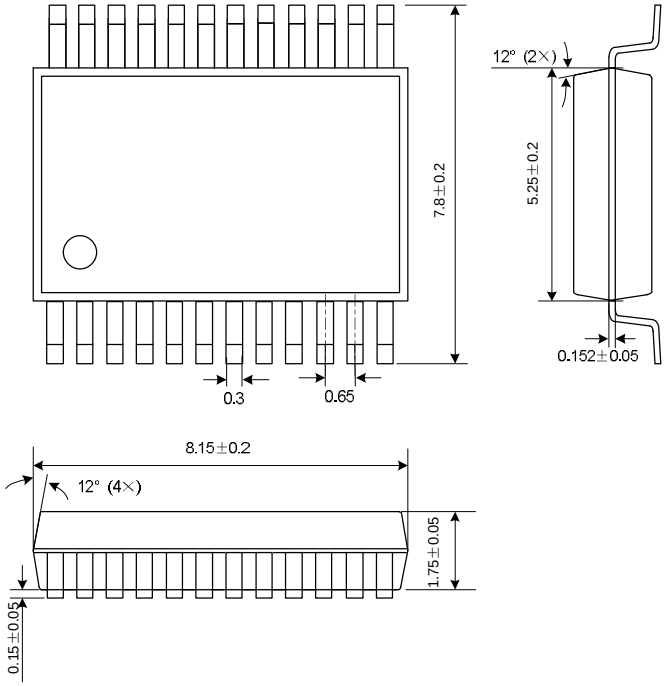


PACKAGE OUTLINE

SOP-24-375-1.27 Unit : mm

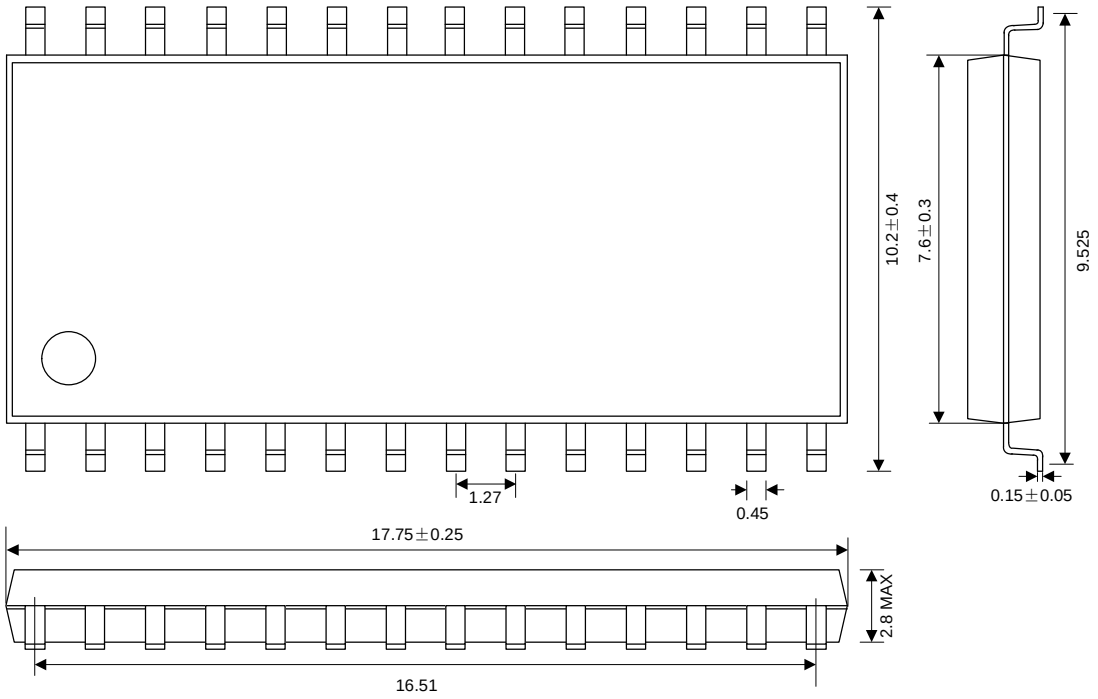


SSOP-24-300-0.65 Unit : mm

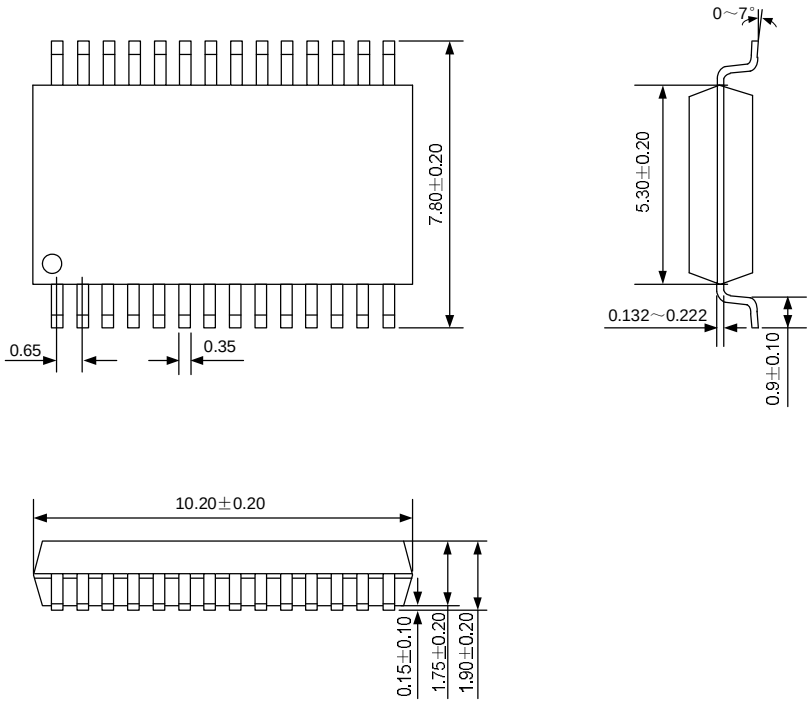


PACKAGE OUTLINE (Continued)

SOP-28-375-1.27 Unit : mm



SSOP-28-300-0.65 Unit : mm



HANDLING MOS DEVICES:

Electrostatic charges can exist in many things. All of our MOS devices are internally protected against electrostatic discharge but they can be damaged if the following precautions are not taken:

- Persons at a work bench should be earthed via a wrist strap.
- Equipment cases should be earthed.
- All tools used during assembly, including soldering tools and solder baths, must be earthed.
- MOS devices should be packed for dispatch in antistatic/conductive containers.