

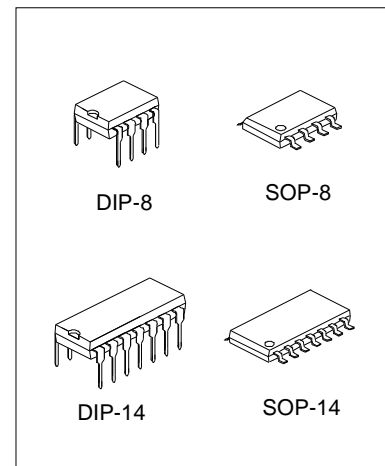
DTMF GENERATOR WITH MICRO-PROCESSOR INTERFACE

DESCRIPTION

The SC9200 tone generators are designed for μC interfaces. They can be instructed by a μC to generate 16 dual tones and 8 single tones from the DTMF pin. The SC9200A/AS provides a serial mode whereas the SC9200B/BS contains a selectable serial/parallel mode interface for various applications

FEATURES

- * Operating voltage: 2.0V~5.5V
- * Serial mode for the SC9200A/AS
- * Serial/parallel mode for the SC9200B/BS
- * Low standby current
- * Low total harmonic distortion
- * 3.58MHz crystal or ceramic resonator



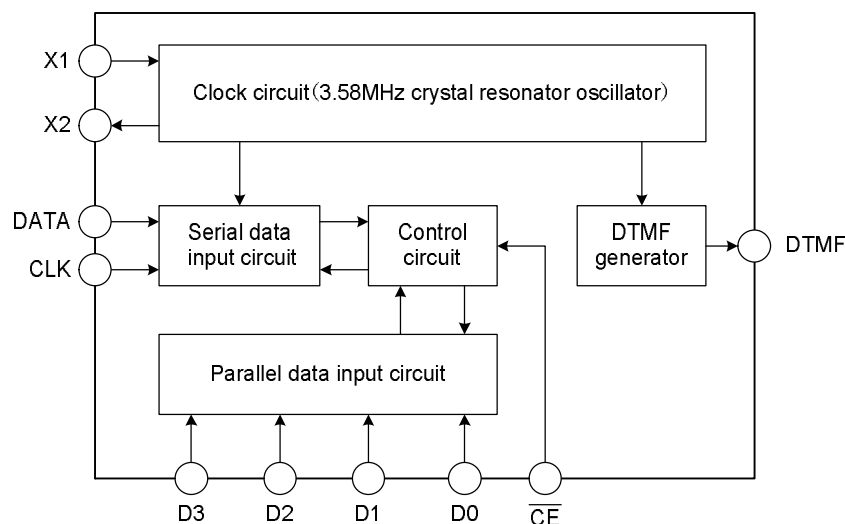
APPLICATIONS

- * Security systems
- * Home automation
- * Remote control through telephone lines
- * Communication system, etc.

ORDERING INFORMATION

Part No.	Package
SC9200A	DIP-8-300-2.54
SC9200B	DIP-14-300-2.54
SC9200AS	SOP-8-225-1.27
SC9200BS	SOP-14-225-1.27

BLOCK DIAGRAM

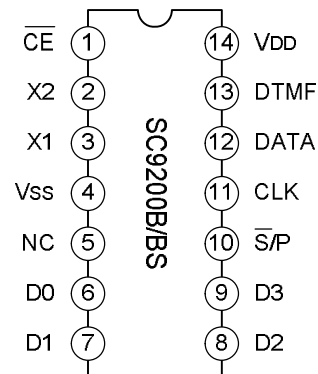
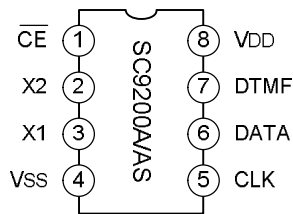


ABSOLUTE MAXIMUM RATING

Characteristic	Symbol	Ratings	Unit
Supply Voltage	V _{SS}	-0.3~6	V
Input Voltage	V _{IN}	V _{SS} -0.3~V _{DD} +0.3	V
Storage Temperature	T _{stg}	-50~125	°C
Operating Temperature	T _{opr}	-20~75	°C

ELECTRICAL CHARACTERISTICS

Characteristics	Symbol	Test Conditions		Min.	Typ.	Max.	Unit
		V _{DD}	Conditions				
Operating Voltage	V _{DD}	--	Serial	1.8	--	5.5	V
			Parallel	2.0			
Operating Current	I _{DD}	2.5V	S/P, \overline{CE} =V _{DD} , \overline{CE} =V _{SS} , No load	--	240	2500	μA
		5.0V		--	950	3000	
Low Input Voltage	V _{IL}	--	--	V _{SS}	--	0.2V _{DD}	V
High Input Voltage	V _{IH}	--	--	0.8V _{DD}	--	V _{DD}	V
Standby Current	I _{STB}	2.5V	S/P, \overline{CE} =V _{DD} , No load	--	--	1	μA
		5.0V		--	--	2	
Pull-high Resistance	R _P	2.5V	V _{OL} =0V	120	180	270	kΩ
		5.0V		45	68	100	
DTMF Output Delay Time (Parallel Mode)	t _{DE}	5V	--	--	t _{UP} +6	t _{UP} +8	ms
DTMF Output DC Level	V _{TDC}	2V~5.5V	DTMF Output	0.45V _{DD}	--	0.75V _{DD}	V
DTMF Sink Current	I _{TOL}	2.5V	V _{DTMF} =0.5V	-0.1	--	--	mA
DTMF Output AC Level	V _{TAC}	2.5V	Row group, R _L =5kΩ	0.12	0.15	0.18	V _{rms}
Column Pre-emphasis	ACR	2.5V	Row group=0dB	1	2	3	dB
DTMF Output Load	R _L	2.5V	t _{HD} ≤-23dB	5	--	--	kΩ
Tone Signal Distortion	t _{HD}	2.5V	R _L =5kΩ	--	-30	-23	dB
Clock Input Rate (Serial Mode)	f _{CLK}	--	--	--	100	500	kHz
Oscillator Starting Time (When \overline{CE} is low)	t _{UP}	5.0V	The time from \overline{CE} falling edge to normal oscillator operation	--	--	10	ms
System Frequency	f _{OSC}	--	Crystal=3.5795MHz	3.5759	3.5759	3.5831	MHz

PIN CONFIGURATION

PIN DESCRIPTION

Pin NO.		Pin Name	Description
DIP-8 SOP-8	DIP-14 SOP-14		
1	1	$\overline{\text{CE}}$	Chip enable, active low.
2	2	X2	The system oscillator consists of an inverter, a bias resistor, and the required load capacitor on chip. The oscillator function can be implemented by Connect a standard 3.579545MHz crystal to the X1 and X2 terminals.
3	3	X1	
4	4	VSS	Negative power supply.
	5	NC	No connection.
	6~9	D0~D3	Data inputs for the parallel mode. When the IC is operating in the serial mode, the data input terminals (D0~D3) are included with a pull-high resistor. When the IC is operating in the parallel mode, these pins become floating.
	10	$\overline{\text{S/P}}$	Operation mode selection input $\overline{\text{S/P}} = \text{"H"}$: Parallel mode $\overline{\text{S/P}} = \text{"L"}$: Serial mode
5	11	CLK	Data synchronous clock input for the serial mode. When the IC is operating in the parallel mode, the input terminal (CLK) is included with a pull-high resistor. When the IC is operating in the serial mode, this pin becomes floating.
6	12	DATA	Data input terminal for the serial mode. When the IC is operating in the parallel mode, the input terminal (DATA) is included with a pull-high resistor. When the IC is operating in the serial mode, this pin becomes floating.
7	13	DTMF	Output terminal of the DTMF signal.
8	14	VDD	Positive power supply, 2.0V~5.5V for normal operation.

FUNCTIONAL DESCRIPTION

The SC9200 are DTMF generators for μ C interfaces. They are controlled by a μ C in the serial mode.

1. Serial mode (SC9200)

The SC9200 employ a data input, a 5-bit code, and a synchronous clock to transmit a DTMF signal. The relationship between the digital codes and the tone output frequency is shown in Table 1 as for the control timing diagram, refer to *Figure 1*.

Table 1: Digits vs. input data vs. tone output frequency (serial mode)

Digit	D4	D3	D2	D1	D0	Tone Output Frequency (Hz)
1	0	0	0	0	1	697+1209
2	0	0	0	1	0	697+1336
3	0	0	0	1	1	697+1477
4	0	0	1	0	0	770+1209
5	0	0	1	0	1	770+1336
6	0	0	1	1	0	770+1477
7	0	0	1	1	1	852+1209
8	0	1	0	0	0	852+1336
9	0	1	0	0	1	852+1477
0	0	1	0	1	0	941+1336
*	0	1	0	1	1	941+1209
#	0	1	1	0	0	941+1477
A	0	1	1	0	1	697+1633
B	0	1	1	1	0	770+1633
C	0	1	1	1	1	852+1633
D	0	0	0	0	0	941+1633
--	1	0	0	0	0	697
--	1	0	0	0	1	770
--	1	0	0	1	0	852
--	1	0	0	1	1	941
--	1	0	1	0	0	1209
--	1	0	1	0	1	1336
--	1	0	1	1	0	1477
--	1	0	1	1	1	1633
DTMF OFF	1	1	1	1	1	--

*Notes: The codes not listed in Table 1 are not used D4 is MSB.

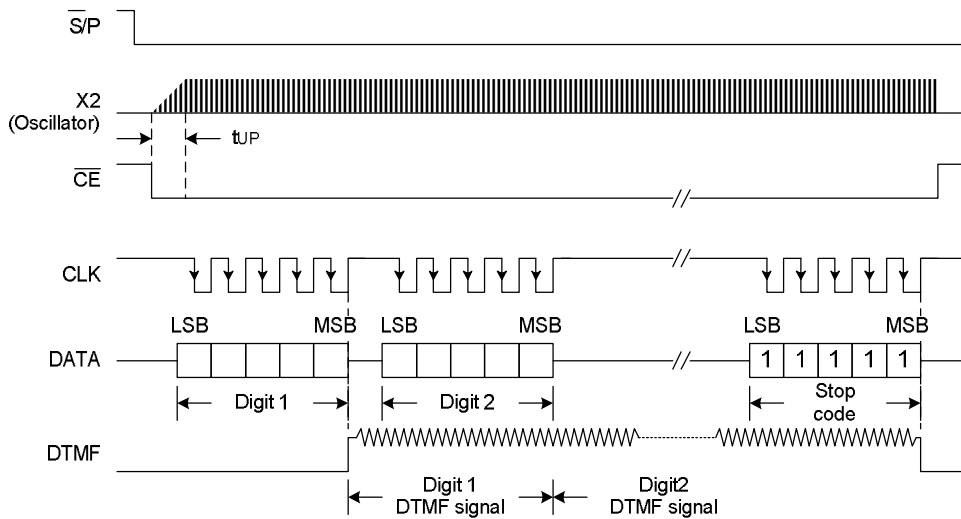


Figure 1

2. Parallel mode (SC9200B/BS)

The SC9200B/BS provides four data inputs D0~D3 to generate their corresponding DTMF signals. The $\overline{S/P}$ has to be connected high to select the parallel operation mode. Then the input data codes should be determined. Finally, the \overline{CE} is connected low to transmit the DTMF signal from the DTMF pin.

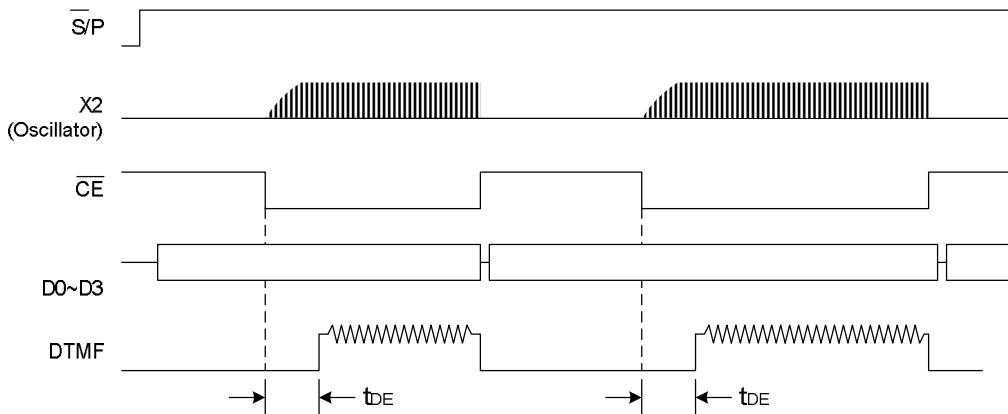
The TDE time (about 6ms) will be delayed from the \overline{CE} falling edge to the DTMF signal output.

The relationship between the digital codes and the tone output frequency is illustrated in Table 2. As for the control timing diagram, see Figure 2.

When the system is operating in the parallel mode, D0~D3 are all in the floating state. Thus, these data input pins should not float.

Table 2: Digits vs. input data vs. tone output frequency (parallel mode)

Digit	D3	D2	D1	D0	Tone Output Frequency
1	0	0	0	1	697+1209
2	0	0	1	0	697+1336
3	0	0	1	1	697+1477
4	0	1	0	0	770+1209
5	0	1	0	1	770+1336
6	0	1	1	0	770+1477
7	0	1	1	1	852+1209
8	1	0	0	0	852+1336
9	1	0	0	1	852+1477
0	1	0	1	0	941+1336
*	1	0	1	1	941+1209
#	1	1	0	0	941+1477
A	1	1	0	1	697+1633
B	1	1	1	0	770+1633
C	1	1	1	1	852+1633
D	0	0	0	0	941+1633

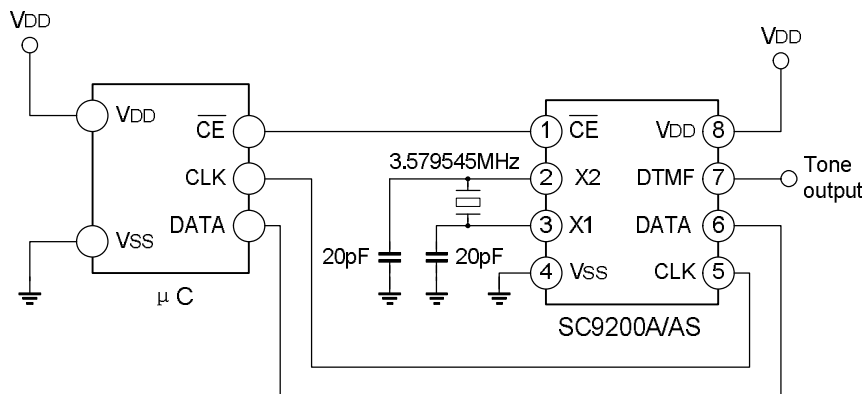


*Note: The data (D0~D3) should be ready before the \overline{CE} becomes low.

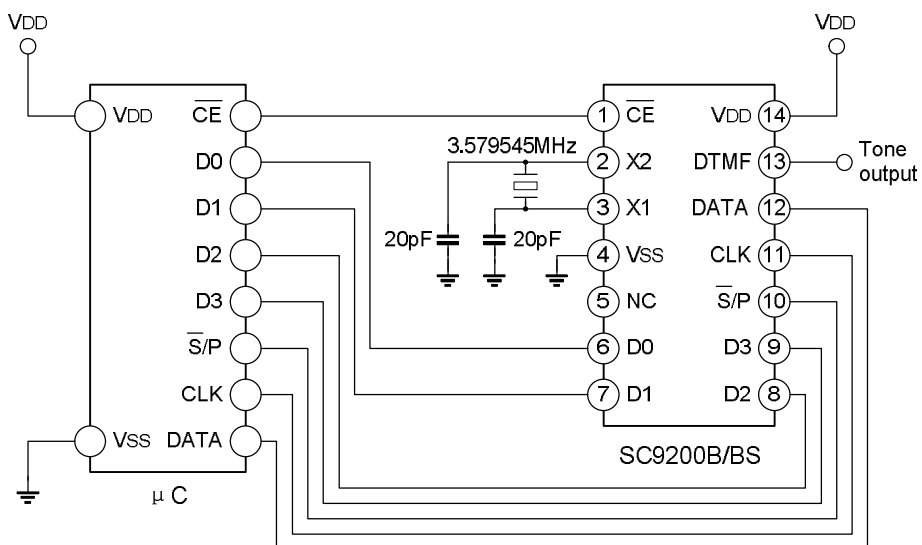
Figure 1

APPLICATION CIRCUIT

Serial mode



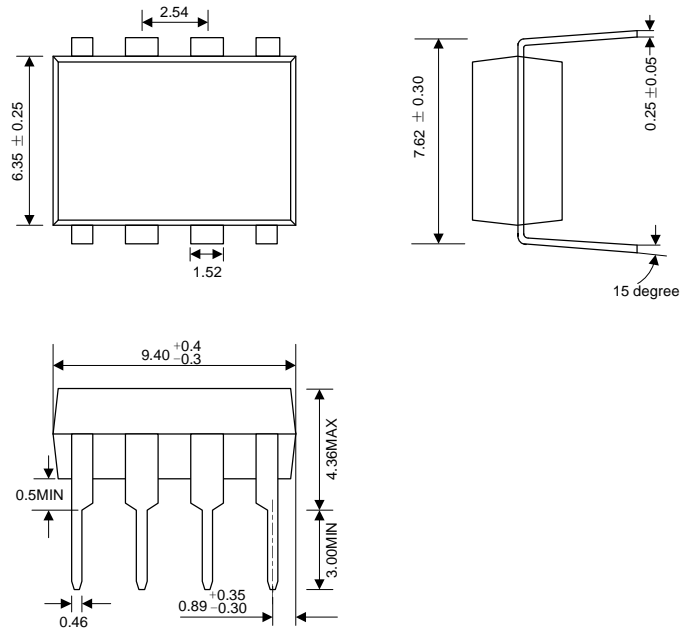
Serial/parallel mode



PACKAGE OUTLINE

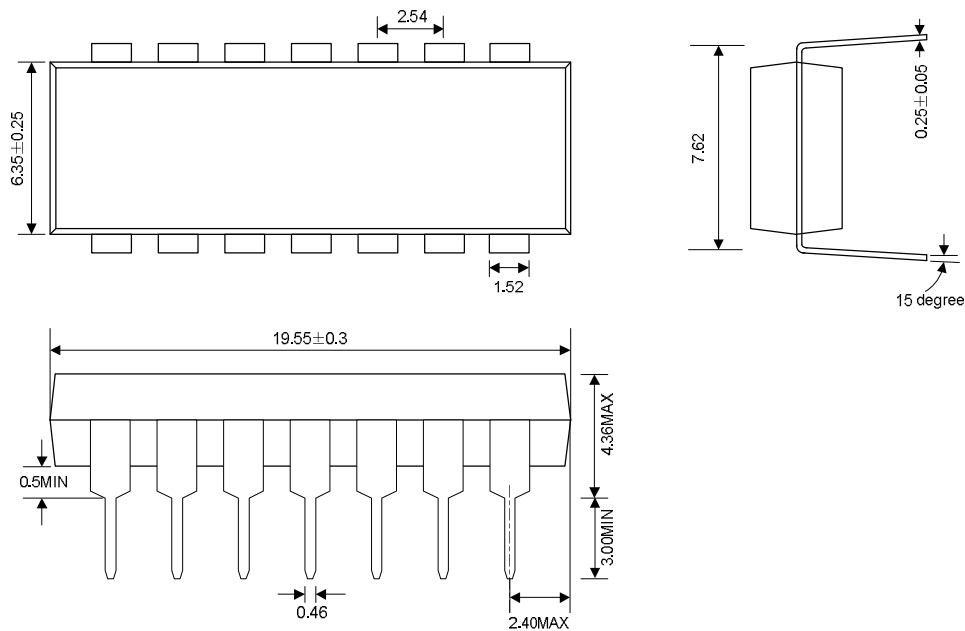
DIP-8-300-2.54

UNIT: mm



DIP-14-300-2.54

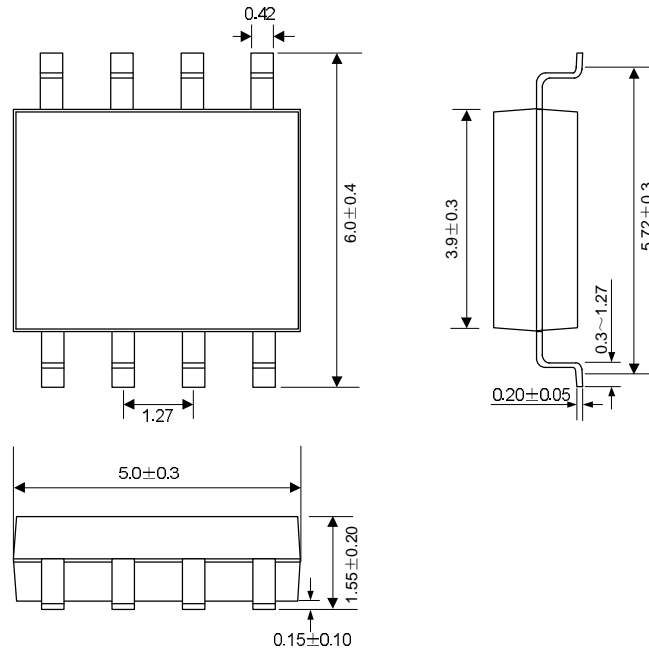
UNIT: mm



PACKAGE OUTLINE (Continued)

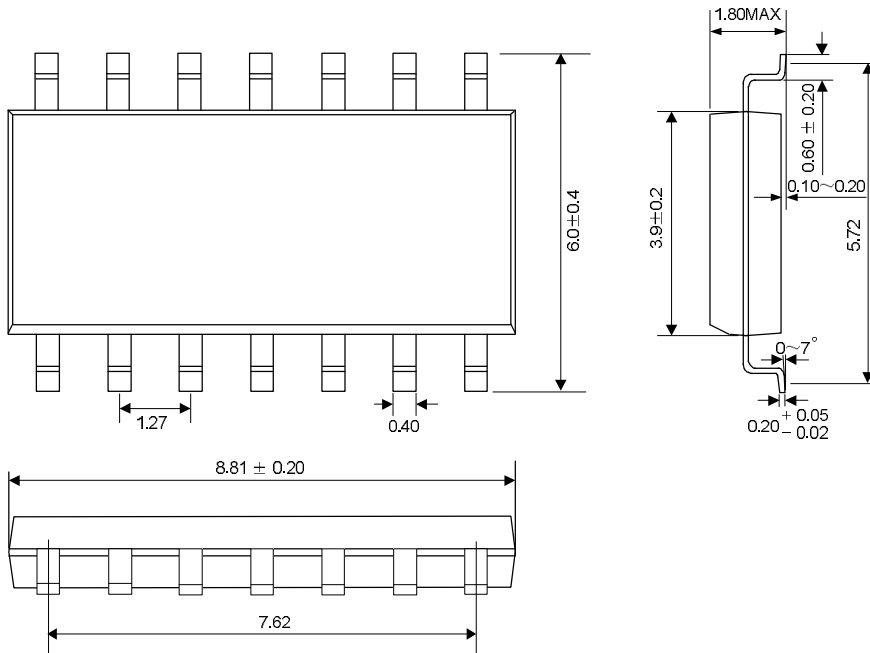
SOP-8-225-1.27

UNIT: mm



SOP-14-225-1.27

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.



ATTACHMENT

Revision History

Data	REV	Description	Page
2001.02.02	1.0	Original	
2003.12.04	2.0	Modify revision	