IS22C020

ISSI®

16 to 20 SEC INSTANT VOICE ROM

FEATURES

- Voice length at:
  - 8 KHz sampling is 16 seconds
  - 6 KHz sampling is 20 seconds
- Silence compression saves memory
- Four trigger pins, S1 to S4 for eight sections
- SBT pin play-all or sequential play-all
- 15 ms debounce suitable for CDs
- IRP interrupt pin stops playback at once
- STP stop pulse generated at playback end
- BUSY signal for CPU control
- Two LEDs flash at 3 Hz

- 2.4V to 6V single power supply operation
- Low standby current (<5 μA at 3V)
- Auto power-down
- Built-in oscillator, D/A converter, EPROM
- ADPCM data compression
- Optional pop noise elimination function
- C_{OUT} pin drives speaker with a transistor
- Development tool support
- V_{OUT1} and V_{OUT2} drives buzzer directly
- Sampling rate determined by an external resistor
- Holdable and unholdable triggering option
- Industrial temperature available

GENERAL DESCRIPTION

The IS22C020 is a high-quality voice synthesizer with capacity from 16 to 20 seconds. A proprietary ADPCM algorithm is used. The audio message is stored in a 512K bit on-chip one-time programmable memory.

The IS22C020 eliminates the need for complicated circuitry in voice playback but still achieves high voice quality. Sounds such as human speech, animal sounds, musical sounds, and even special effects can be synthesized. Devices can be cascaded to achieve longer voice duration. Two devices can be configured in parallel in order to achieve signal mixing without an external mixer so speech can be mixed with background music each from one of two different chips.

The instant programming nature of the IS22C020 gives a very short turn around time free of NRE charges usually required with conventional voice ROMs. Users now can add a voice synthesis function as an additional feature to their products even when production volume is small. As a result, initial investment is minimal and the risk in the product development phase is reduced.

The IS22C020 provides wide voltage operating range from 2.4V to 6.0V. A pair of PWM output pins, V_{OUT1} and V_{OUT2}, provide direct drive to a buzzer. Voice quality is comparable to a speaker output and power consumption is much lower. This facilitates button battery applications such as greeting cards.

A current output pin, C_{OUT}, enables the device to drive a speaker through a low cost NPN transistor. No complex filtering or amplifier circuit is needed. An automatic ramp-up and ramp-down function eliminates undesired noise at the beginning and end of playback.

Up to eight sections are available and accessible through the S1 to S4 trigger pins. The SBT trigger pin can be programmed to playback all eight sections or sequentially from section 1 to 8. An interrupt pin (IRP), stop pulse (STP) or BUSY signals provide handshaking with μP or other IS22C020 devices. All trigger pins give 15 ms debounce time and are ideal for CDS applications. Two LED drivers are available, flashing on and off approximately at 3 Hz. The internal voltage compensated oscillator requires only one external resistor. Different sampling frequencies are determined by the external oscillator resistor value.

Programmable Options

The IS22C020 provides programmable user specified control functions. They include:

- Non-sequence or Sequence play-all

- Unholdable or Holdable trigger

- STOP or BUSY signal selection

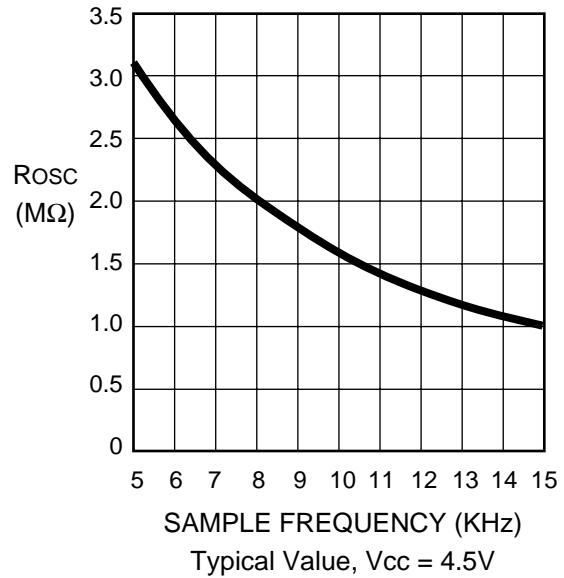- Automatic ramp-up and ramp-down or no ramp-up or ramp-down

Silence Compression

If a particular sound sequence includes periods of silence, the IS22C020 will automatically compress the silence to save memory space. This compression will not affect playback of the sound sequence.
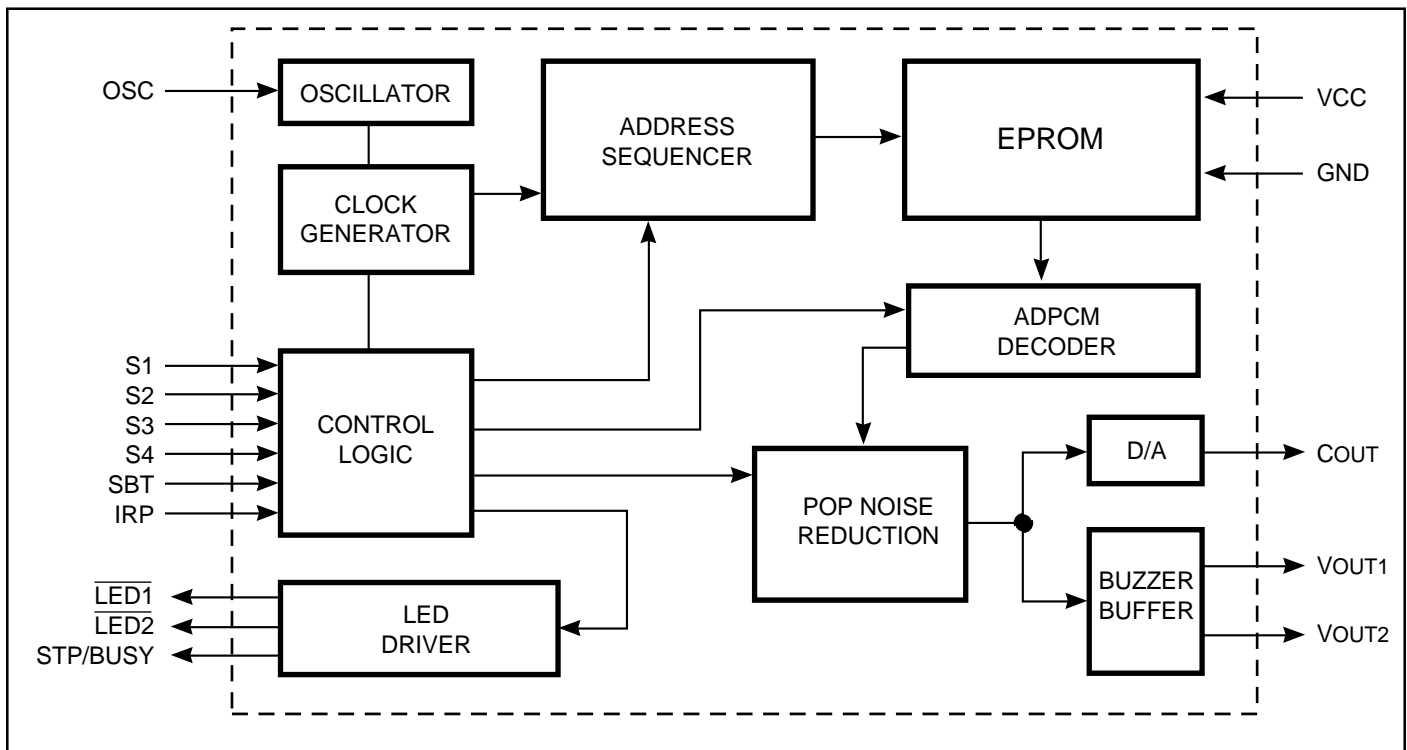
SEGMENT DECODE

	1	2	3	4	5	6	7	8
S1	H	L	L	L	H	L	L	H
S2	L	H	L	L	H	H	L	L
S3	L	L	H	L	L	H	H	L
S4	L	L	L	H	L	L	H	H

SAMPLE FREQUENCY

SAMPLE FREQUENCY (KHz)
Typical Value, Vcc = 4.5V

BLOCK DIAGRAM

PIN CONFIGURATIONS
16-Pin DIP and SOP

```
          ┌───────┐
LED1 □  1 ●       16 □ IRP
VOUT1 □  2        15 □ SBT
VOUT2 □  3        14 □ S4
 GND □  4        13 □ S3
STP/BUSY □ 5     12 □ VCC
LED2 □  6        11 □ S2
COUT □  7        10 □ S1
 OSC □  8         9 □ VPP
          └───────┘
```
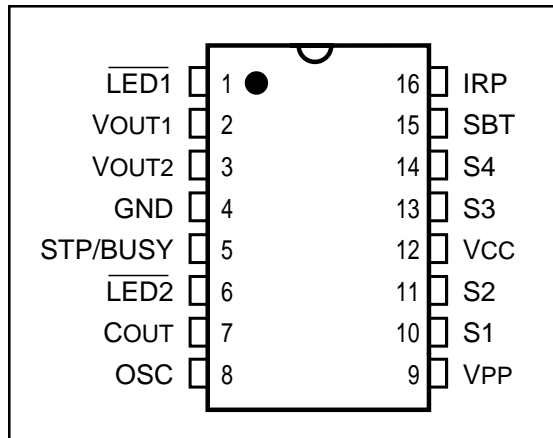
PIN DESCRIPTIONS

$\overline{LED1}$	Drives First LED Flash at 3 Hz (Active LOW)
V_{OUT1}	PWM Audio Signal Output for Buzzer
STP/BUSY	Generate Busy Signal or 30 ms Pulse after Voice Playback
GND	Ground
V_{OUT2}	Compliment PWM Audio Signal Output for Buzzer
$\overline{LED2}$	Drives Second LED Flash at 3 Hz (Active LOW)
C_{OUT}	Current Output from Internal DAC for Speaker Playback
OSC	Oscillator Resistor Pin to Control Sampling Frequency
V_{PP}	Program Power Supply, No Connect during Playback
S1-S4	Input Switches, Internal Pull LOW, Active HIGH
SBT	One Key or Sequential Trigger, Internal Pull LOW, Active HIGH
IRP	Interrupt to Stop Playback, Internal Pull LOW, Active HIGH
Vcc	Power Supply Voltage

BONDING DIAGRAM

```
      ┌─────────────────────┐
  [5] │  ┌──────────┐   [4] │
  [6] │  │          │   [3] │
  [7] │  └──────────┘   [2] │
      │  ┌──────────┐   [1] │
  [8] │  │          │   [NC]│
  [9] │  │          │   [16]│
 [10] │  │          │   [15]│
 [11] │  │          │   [14]│
 [12] │  └──────────┘   [13]│
   Y  └─────────────────────┘
   ↑
   └→X
   (0,0)
```
Note: Substrate must be connected to GND

Pad size = 95 μm x 95 μm
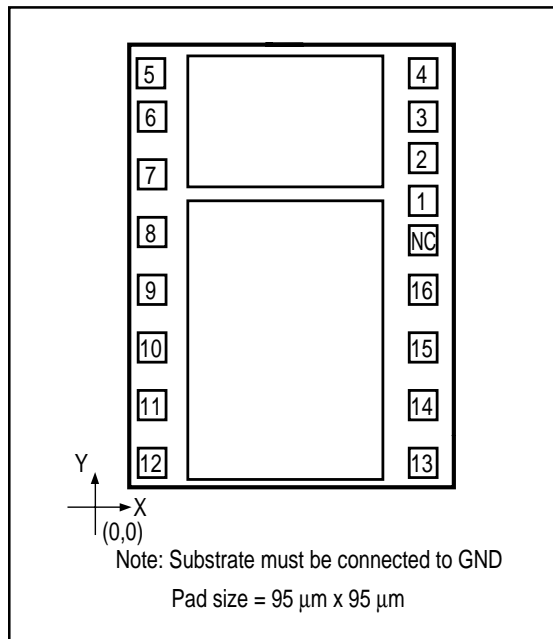
Note: Programming requires connection to pins 4, 5, 6, 8, 9, 12, 15, and 16.

BONDING PARAMETERS

Pin	Name	X	Y
1	$\overline{LED1}$	3288.75	1200
2	V_{OUT1}	3288.75	1459
3	V_{OUT2}	3288.75	1687
4	GND	3288.75	1894
5	STP	86.25	1875
6	$\overline{LED2}$	86.25	1635
7	C_{OUT}	86.25	1440
8	OSC	86.25	1027
9	V_{PP}	86.25	742
10	S1	86.25	465
11	S2	86.25	270
12	Vcc	86.25	82
13	S3	3288.75	88
14	S4	3288.75	296
15	SBT	3288.75	502
16	IRP	3288.75	742

ABSOLUTE MAXIMUM RATINGS[1]

Symbol	Parameter	Value	Unit
V_{TERM}	Terminal Voltage with Respect to GND	−0.5 to +7.0	V
T_{BIAS}	Temperature Under Bias	−40 to +85	°C
T_{STG}	Storage Temperature	−55 to +125	°C

Notes:

1. Stress greater than those listed under ABSOLUTE MAXIMUM RATINGS may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability.

DC CHARACTERISTICS

Symbol	Parameter Description	Test Conditions	Min.	Typ.	Max.	Unit
V_{CC}	Operating Voltage		2.4	3.0	6.0	V
V_{IH}	Input HIGH Voltage	Vcc = 3.0V	2.5	3.0	3.5	V
V_{IL}	Input LOW Voltage	Vcc = 2.0V	−0.3	0	0.3	V
I_{OH}	V_{OUT} HIGH Operating Current	Vcc = 3.0V, Vout = 3.0V	—	−12	—	mA
I_{OL}	V_{OUT} LOW Operating Current	Vcc = 3.0V, Vout = 0V	—	12	—	mA
I_{CO}	C_{OUT} Operating Current	Vcc = 3.0V, Vcout = 0.7V	—	−2	—	mA
I_{STPH}	STP HIGH Operating Current	Vcc = 3.0V, Vstp = 3.0V	—	−5	—	mA
I_{STPL}	STP LOW Operating Current	Vcc = 3.0V, Vstp = 0V	—	5	—	mA
I_{LED}	LED Output Current	Vcc = 2.2V – 6.0V	6	8	10	mA
I_{SB}	Standby Current	Vcc = 3.0V, I/O Open	—	1	5	μA
I_{OP}	Operating Current	Vcc = 3.0V, I/O Open	—	—	100	μA
$\Delta F/F$	Frequency Stability	1 − F_{OSC}(3.5V)/F_{OSC}(3.0V)	—	—	5	%

AC SWITCHING CHARACTERISTICS

Symbol	Parameter Description	Typ.	Unit
t_{DD}	Debounce Delay	15	ms
t_{ST}	Stop Pulse Width	30	ms

OPERATING RANGE

Range	Ambient Temp.	Vcc
Commercial	0°C to +70°C	2.4V to 6.0V
Industrial	−40°C to +85°C	2.4V to 6.0V

SWITCHING WAVEFORMS
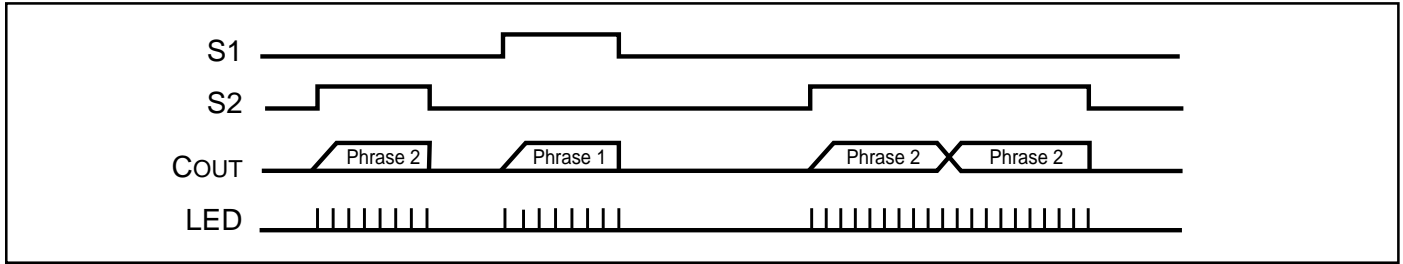
S1 to S4 SEGMENT TRIGGERS. PULSE TRIGGERED.

a. Trigger is shorter than a phrase output   b. Trigger is longer than a phrase output

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VP002-1C
10/01/98
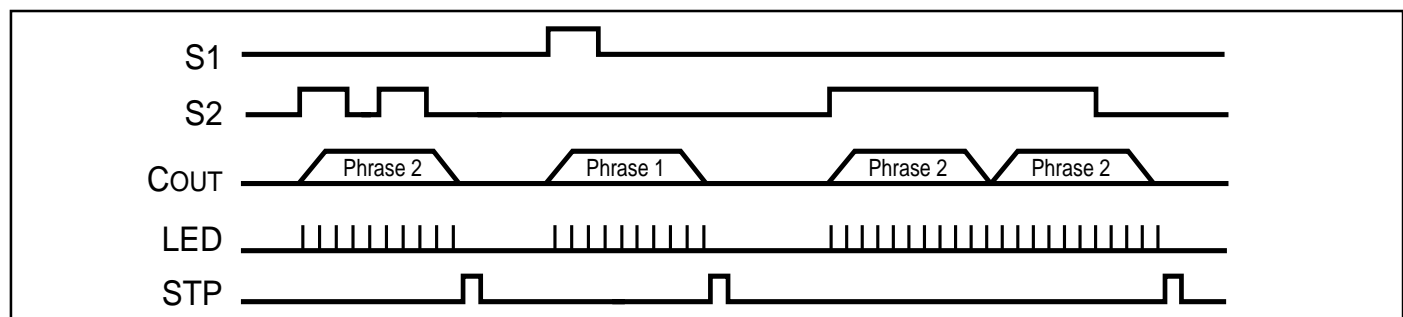
LEVEL TRIGGERED

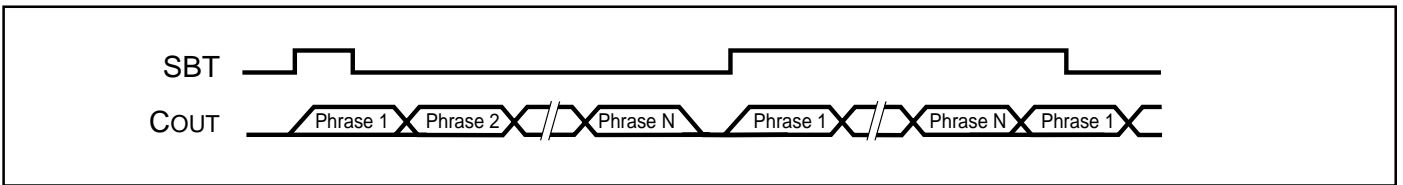a. Trigger is shorter than a phrase output   b. Trigger is longer than a phrase output
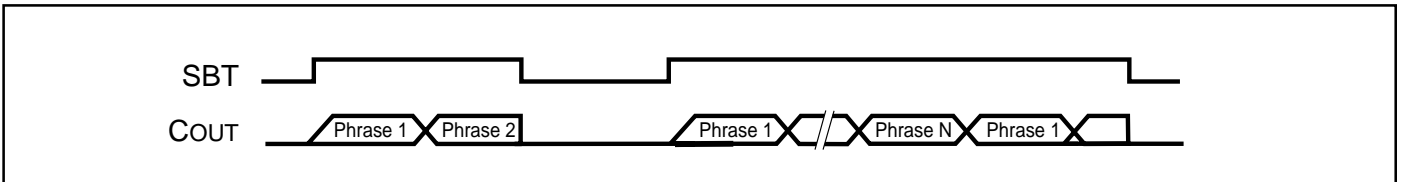

SWITCHING WAVEFORMS

SINGLE BUTTON TRIGGER, NONSEQUENTIAL (SBT)
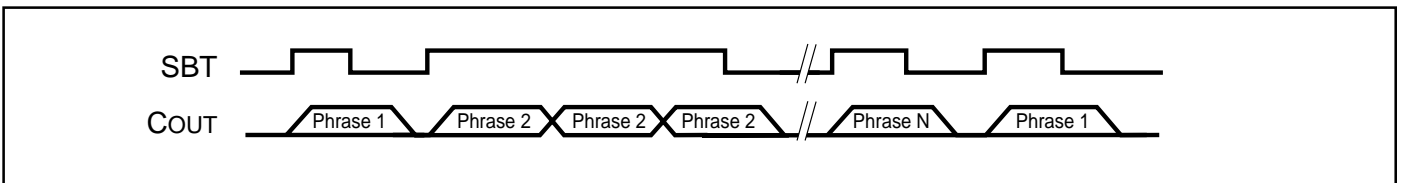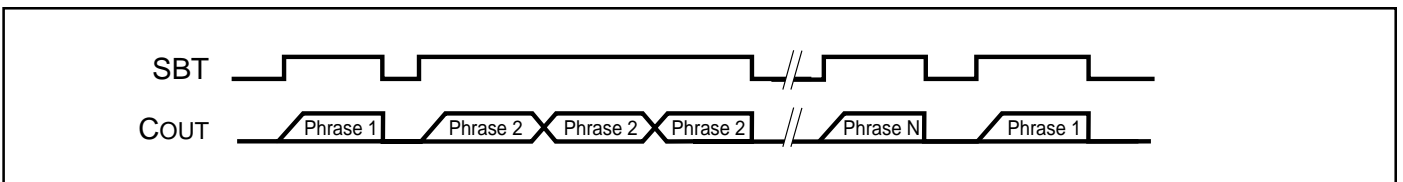**a. Pulse Triggered**

b. Level Triggered

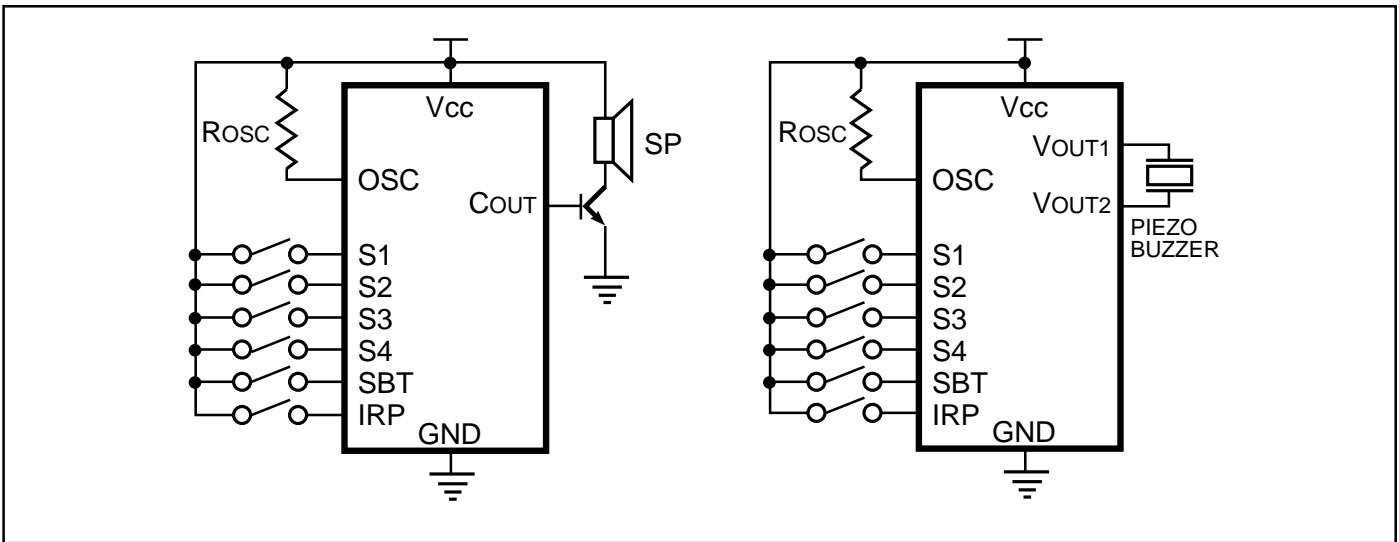### SINGLE BUTTON TRIGGER, SEQUENTIAL (SBT)
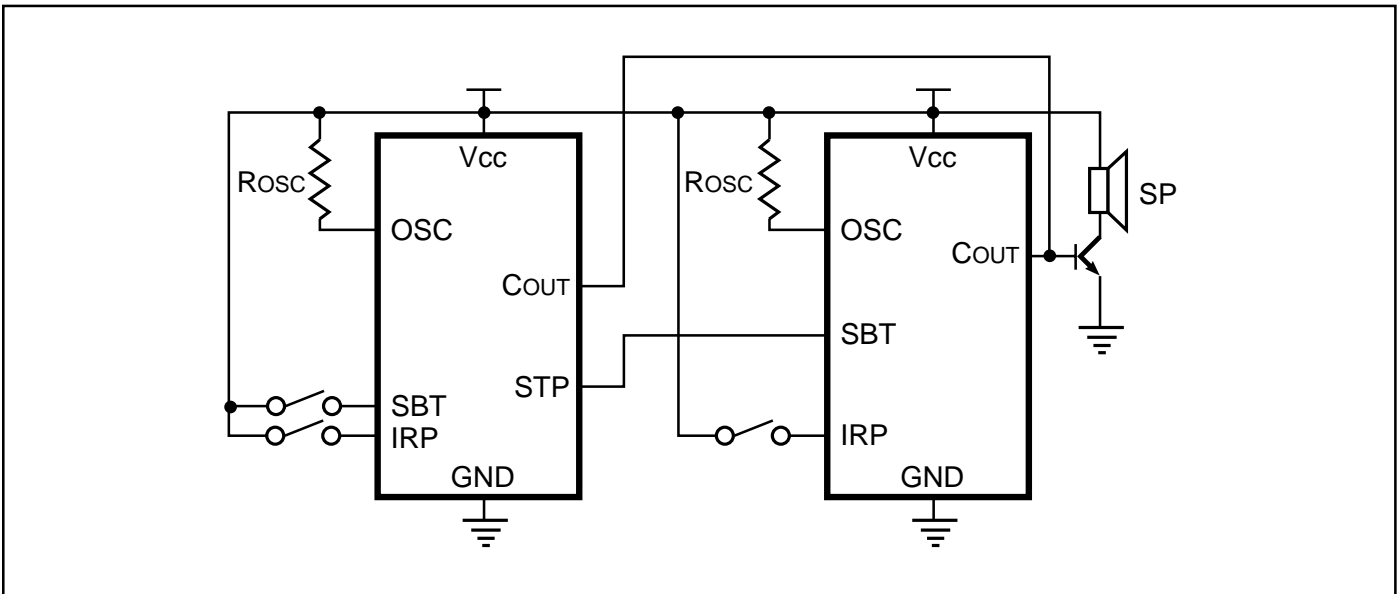**a. Pulse Triggered**

b. Level Triggered

APPLICATION CIRCUITS

TYPICAL APPLICATION

CASCADE APPLICATION

APPLICATION CIRCUITS

PARALLEL APPLICATION
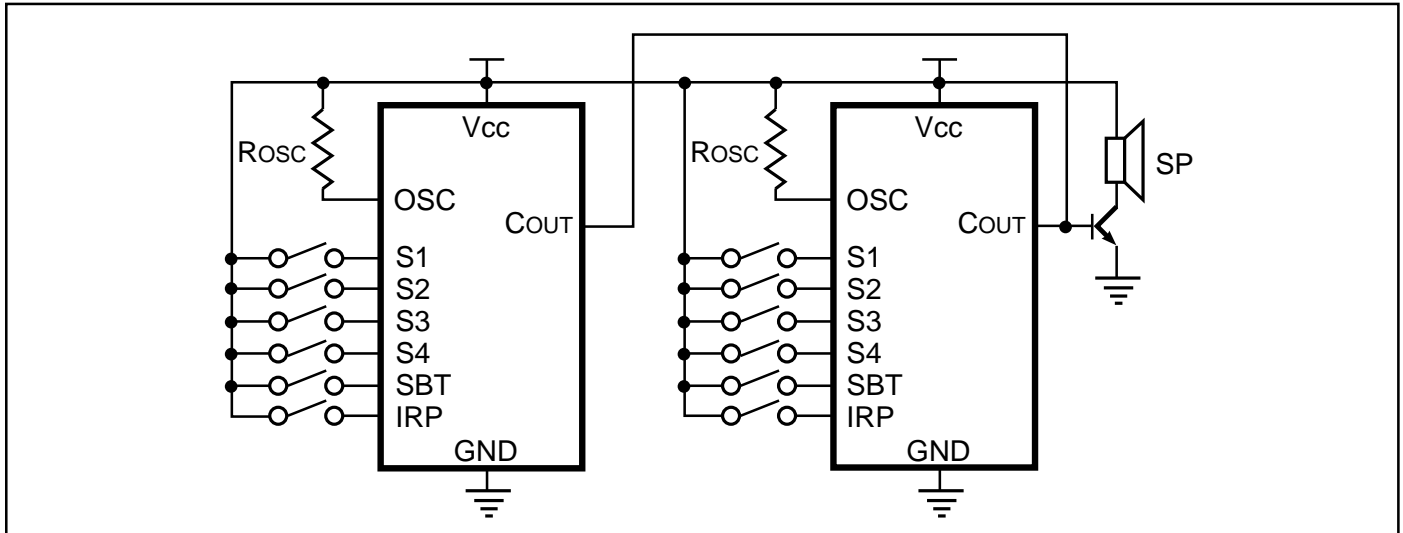
LED APPLICATION
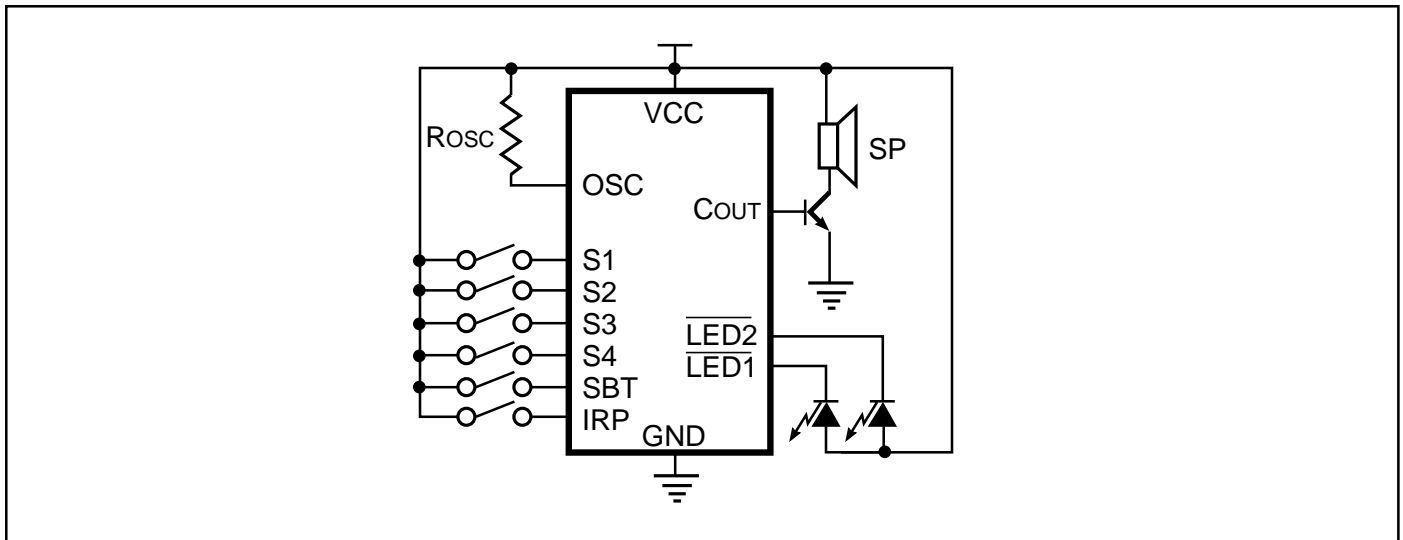
Notes:
The following are typical values:
1. R_{OSC} = 2 MΩ.
2. ß of N (NPN transistor) > 130.
3. SP = 8Ω. 1/4W.
4. Piezo buzzer resonant frequency = 1 KHz.

APPLICATION CIRCUITS

CDS APPLICATION
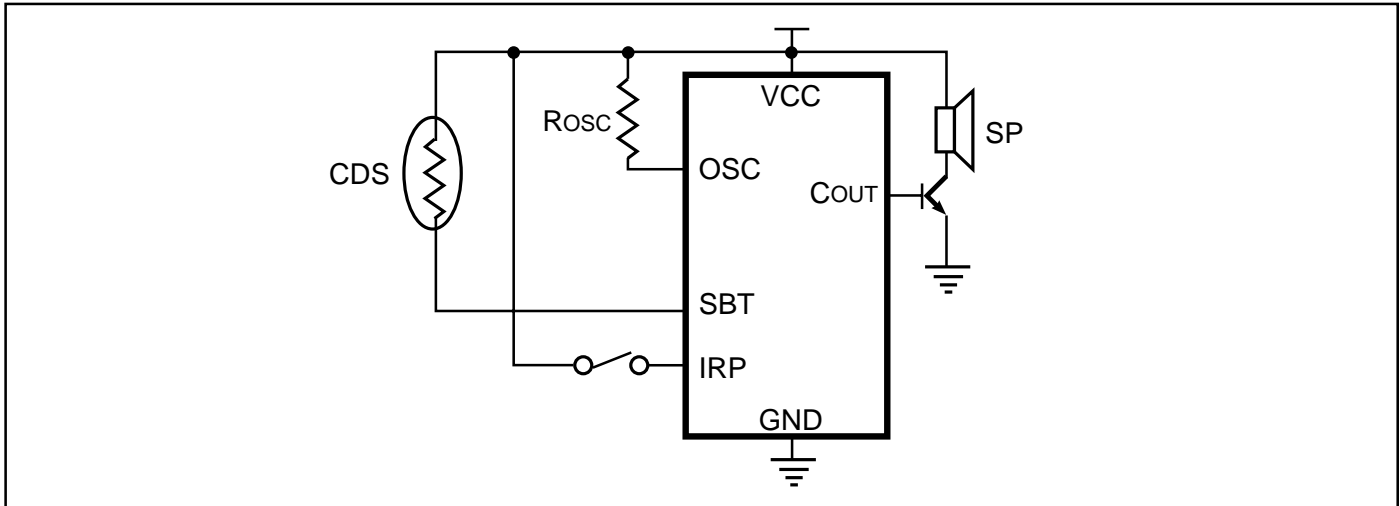
8-SEGMENT TRIGGER APPLICATION
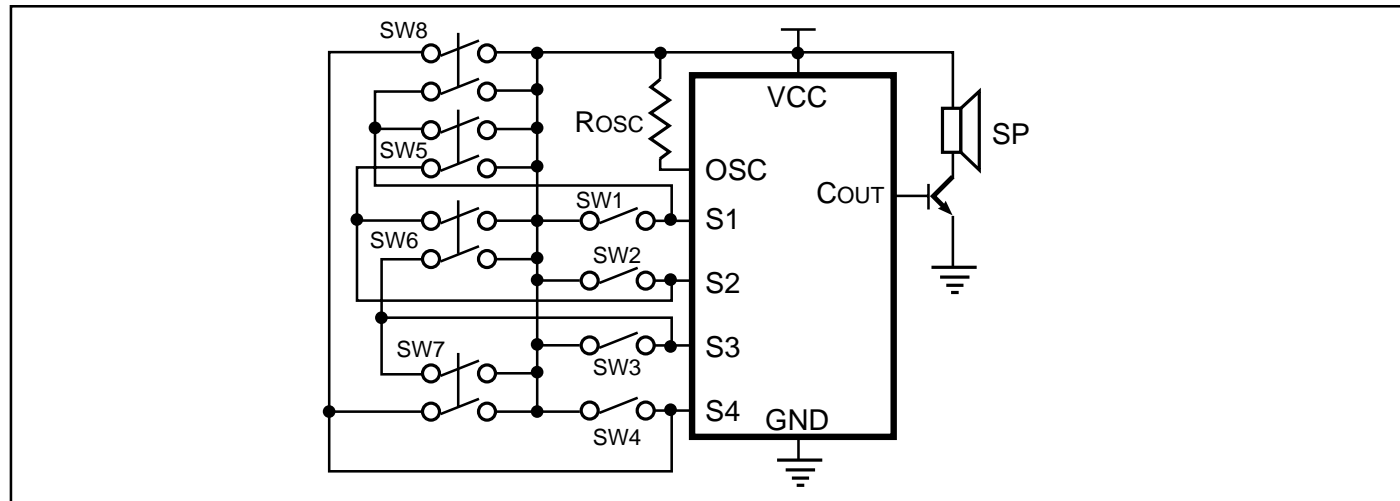
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3. SP = 8Ω. 1/4W.
4. Piezo buzzer resonant frequency = 1 KHz.

ORDERING INFORMATION

Commerical Range: 0°C to +70°C

Order Part No.	Package
IS22C020X	Unpackaged
IS22C020P	300-mil Plastic DIP
IS22C020S	300-mil Plastic SOP

Industrial Range: –40°C to +85°C

Order Part No.	Package
IS22C020XI	Unpackaged
IS22C020PI	300-mil Plastic DIP
IS22C020SI	300-mil Plastic SOP