UMC

UM5003

PRELIMINARY

Voice Synthesizer

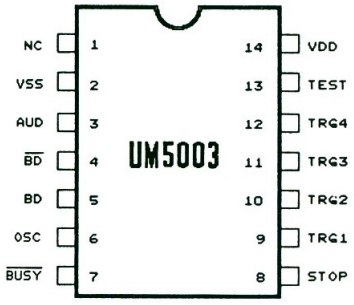
Features

- Single power supply can operate from 2.4V — 5.5V
- Typical 3 second speech duration
- Built-in on-chip ROM with capacity up to 20 separate words
- 4 speech sections. Each section contains maximum 7 words
- Direct drive piezo buzzer
- Audio current output by D/A converter
- Provides level/edge trigger mode control for all sections
- Repeat function can be up to 16 times for each selected section
- Re-triggerable for all trigger-in pins
- CDS trigger function
- Directly drives LED which flashes at 0, 3, and 6 Hz rate (Based on 6 KHz sampling rate) selected by mask option
- Stop pulse issued from stop pin after every section by mask option, depending on user's application.
- Mask options for:
  - — Speech data for words
  - — Various word combinations for every section
  - — Repeat times up to 16 times
  - — Mute intervals (maximum 5 sec.) for every section
  - — Edge or level trigger mode for every section
  - — The generation of stop pulse is optional
  - — LED flash rate or BUSY
  - — Stop mode : Immediately stops or stops at the end of section
- Cascade function can extend the speech duration by 3 x N seconds with N pieces of UM5003
- Parallel function can increase the number of sections by 4 x N with N pieces of UM5003
- Cascade function can trigger melody chip at the end of speech
- Clock frequency is adjustable by external resistor, sampling rates range from 3KHz to 10KHz
- Built-in key debouncing circuit
- Automatic power down

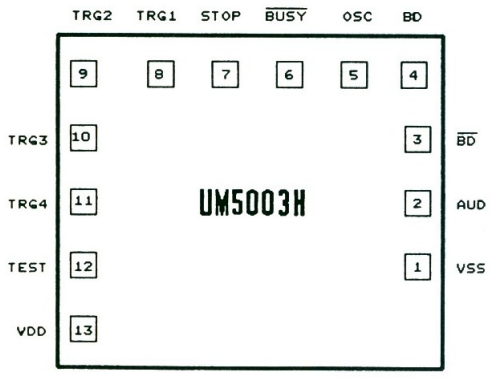
General Description

The UM5003 is a single-chip voice synthesizing CMOS VLSI that can synthesize voice up to 3 seconds. It contains most of the necessary circuitry, therefore it can be applied to various voice systems with minimum external parts. Speech data and control modes can be programmed by changing single mask during the device fabrication.

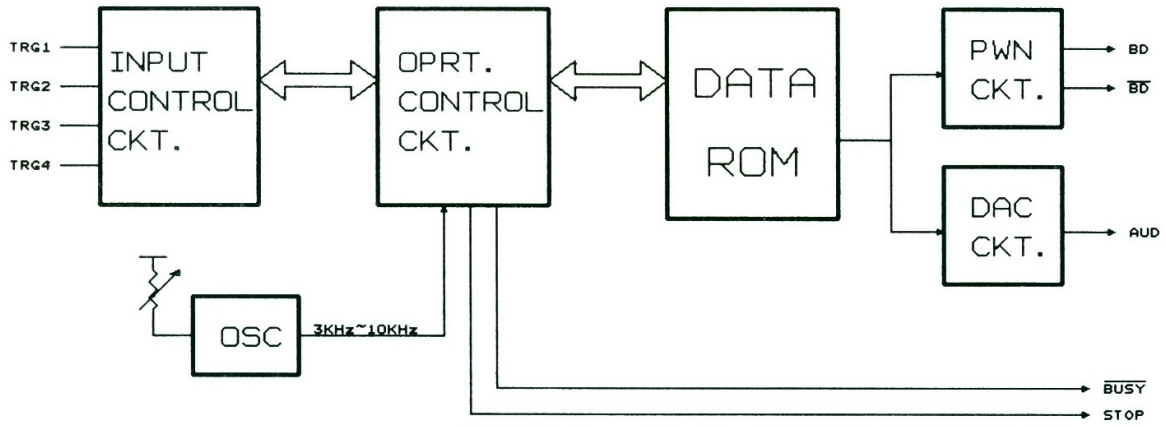
Pin Configuration



Pad Configuration



Block Diagram



Absolute Maximum Ratings

DC Supply Voltage . . . . . .–0.3V to +7V

Input Voltage . . . . . .VSS – 0.3V to VDD + 0.3V

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

Storage Temperature . . . . . .–50°C to + 125°C

*Comments

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

DC Electrical Characteristics (Temp. = 25°C)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Operating Voltage	VDD	2.4	4.5	5.5	V	
Operating Current	Iop	–	–	3.0	mA	VDD = 4.5V
Standby Current	Isb	–	0.5	2	uA	All I/O Pull Low VDD = 3.0V
Input Voltage (TRG1— TRG4)	Vih	2.4	3.0	–	V	VDD = 3.0V
	Vil	–	0.0	–	V	
Input Current (TRG1— TRG4)	Iih	–	–	5	uA	VDD = 4.5V, Vin = 4.5V
	Iil	–	0.0	–	uA	VDD = 4.5V, Vin = 0.0V
AUD Output Current	Ioc	–1.7	–2.0	–2.4	mA	VDD = 4.5V, Vout = 0.7V
Output Current (BD & $\overline{BD}$)	Idrive	–	–	–4.5	mA	VDD = 4.5V, Voh = 4.0V
	Isink	4.5	–	–	mA	VDD = 4.5V, Vol = 0.5V

DC Electrical Characteristics (Continued)

Temp. = 25°C

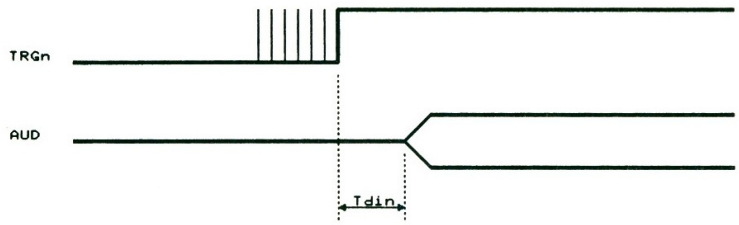
Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Output Current (STOP)	Ioh	–	–	-1.5	mA	VDD = 4.5V, Vout = 4.0V
	Iol	1.8	–	–	mA	VDD = 4.5V, Vout = 0.5V
Output Current ($\overline{BUSY}$)	Ioh	-100	–	-20	uA	VDD = 3.0V, Vout = 1.2V
	Iol	4.0	–	9.0	mA	VDD = 3.0V, Vout = 0.5V
Frequency Stability	$\Delta F/F$	–	–	5	%	$\frac{Fosc(4.5V) - Fosc(4.0V)}{Fosc(4.5V)}$
Frequency Variation	$\Delta F/F$	–	–	15	%	VDD = 4.5V

AC Characteristics

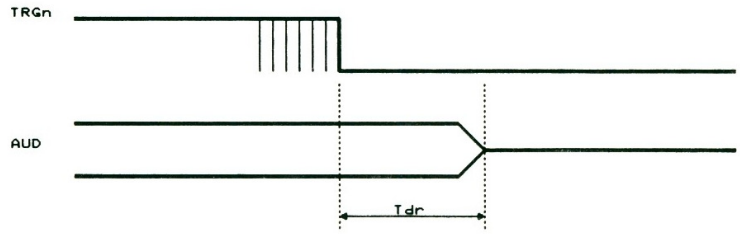
Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
STOP Pulse Width	Twsp	18	18.6	19	ms	Typ. Fs = 6.0KHz
Debounce Time (TRG1 - TRG4) (KEY ON)	Tdin	7	8	9	ms	Typ. Fs = 6.0KHz
Debounce Time (TRG1 - TRG4) (KEY RELEASE)	Tdr	27	30	33	ms	Typ. Fs = 6.0KHz

Timing Waveforms

(1) Input Pin Key-in Debounce

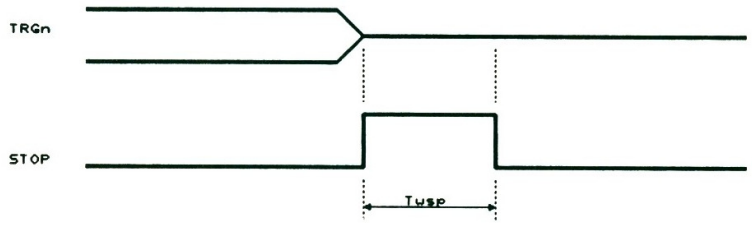


(2) Input Pin Key-release Debounce



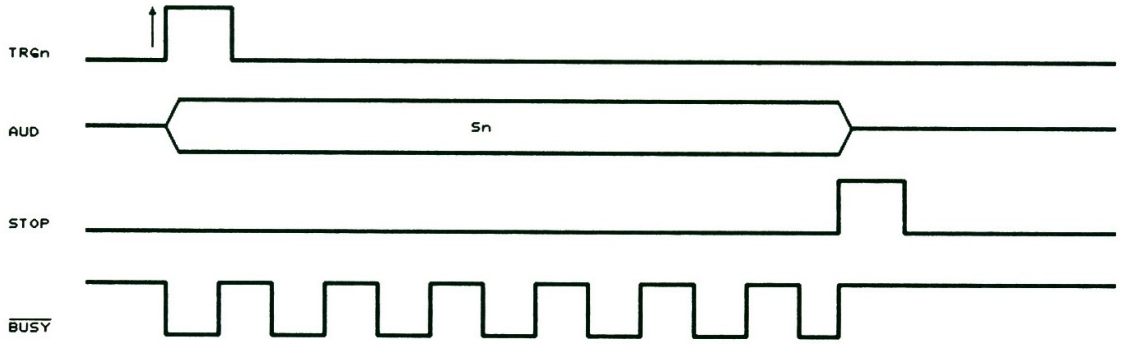
Timing Waveforms (Continued)

(3) Stop Signal Pulse Width

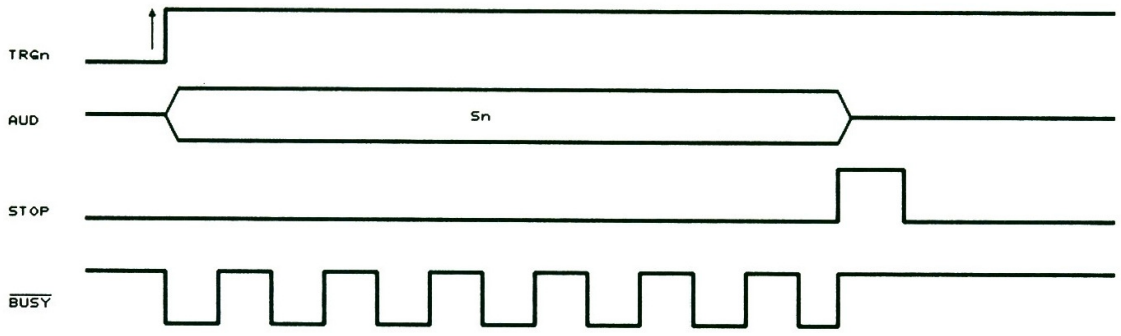


(4) Edge Trigger Mode

(a). Trigger Signal Returning to Zero



(b). Trigger Signal Non-returning to Zero

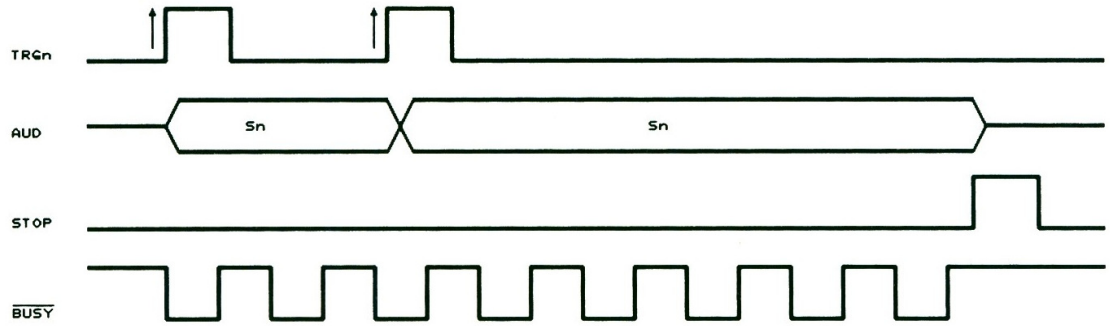


* TRn (n : 1 ~ 4)

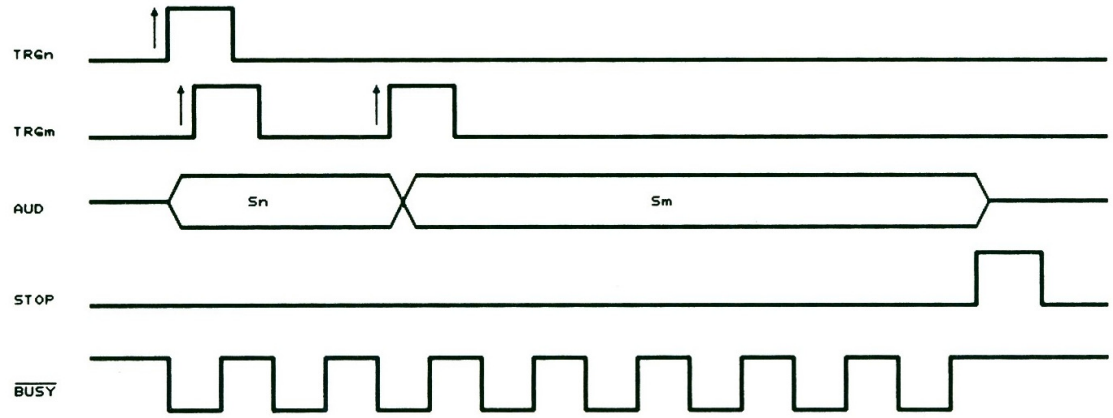
Timing Waveforms (Continued)

■ Re-Triggerable

(c). Retriggering the Same Trigger Pin



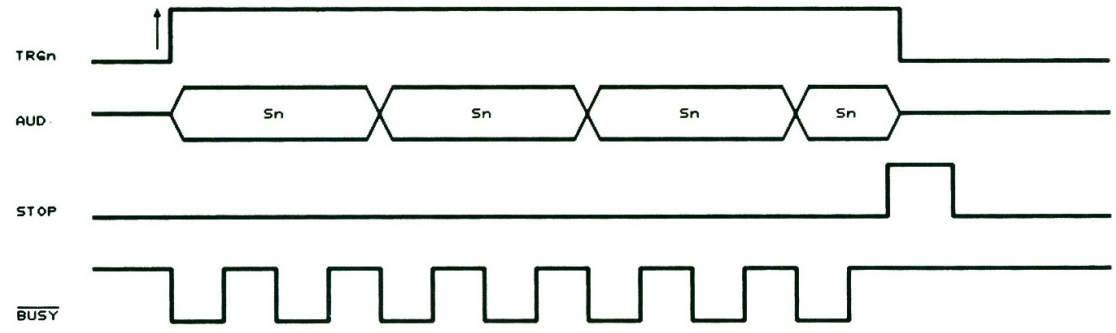
(d). Retriggering Different Trigger Pin



* In re-triggerable mode, last section will overwrite the previous section.

(5) Level Trigger Mode

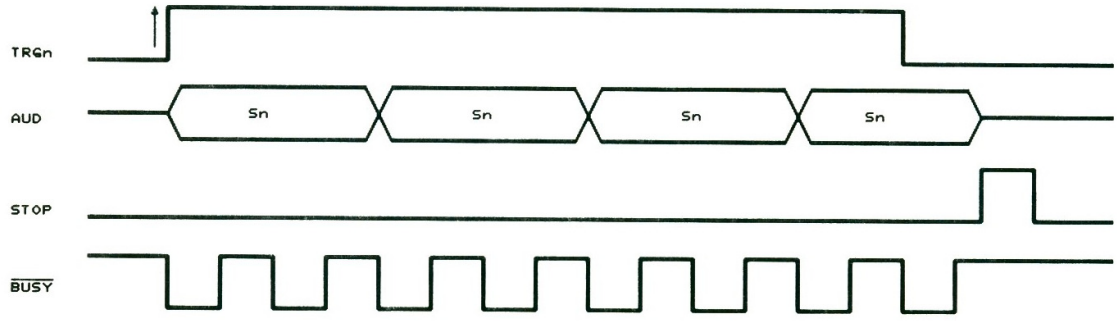
(a) Stop mode: Immediately Stops



* TRn (n : 1 ~ 4)
* TRm (m : 1 ~ 4)

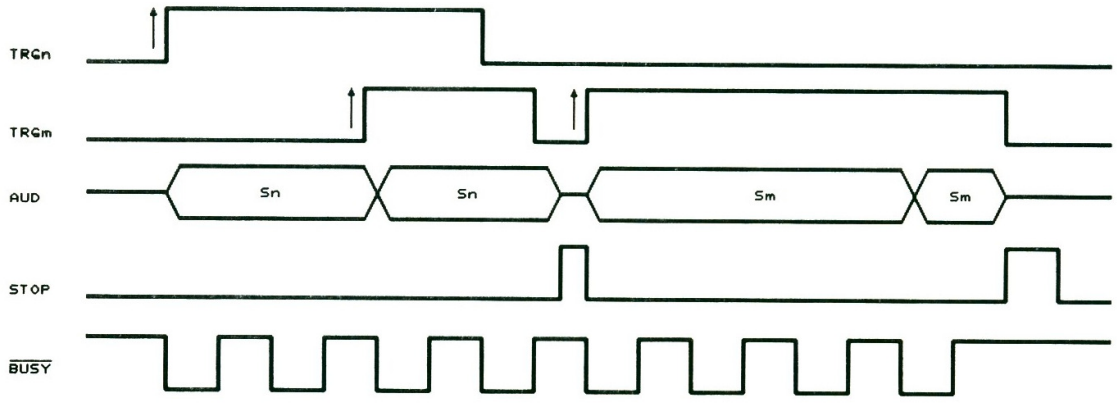
Timing Waveforms (Continued)

(b) Stop mode: Stops after last section outputs

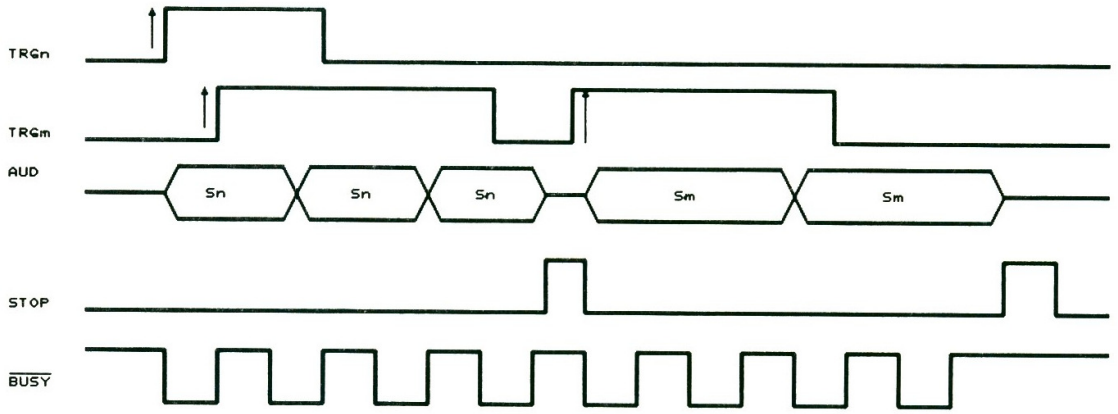


■ **Re-Triggerable**

(c) Stop mode: Immediately Stops



(d) Stop mode: Stops after last section outputs



* TRn (n : 1 ~ 4)
* TRm (m : 1 ~ 4)

Pin and Pad Descriptions

Pin No.	Pad No.	Designation	Description
1		NC	No connection
2	1	VSS	Negative power supply
3	2	AUD	Audio current output
4 5	3 4	$\overline{BD}$ BD	Piezo buzzer driver tri-state output. When no sound outputs, these two pins will remain floating.
6	5	OSC	RC oscillator input. Changing the value of external pull high resistor achieves the following: Oscillator frequencies from 348KHz to 1280KHz Sampling rates from 3KHz to 10KHz
7	6	$\overline{BUSY}$	Speech BUSY denotation and direct drive LED
8	7	STOP	Stop pulse output (ACTIVE HIGH)
9 ~ 12	8 ~ 11	TRG1 ~ TRG4	Trigger-in for 6 sections (Floating low) (With built-in pull low resistor)
13	12	TEST	For Testing (Normally open)
14	13	VDD	Positive power supply

Functional Description

Word Combination

- Maximum 20 words

Built-in ROM code can be separated up to 20 partitions called words. The duration of all words can range from 0 sec. to maximum 3 sec. (typical 6K sampling rate) of speech capacity.

- 4 sections

Each section can have a different combination of words (the display sequence of words). The maximum number of words that one section can contain is 7. The total words that can be used by 4 sections are 20.

- Mute interval

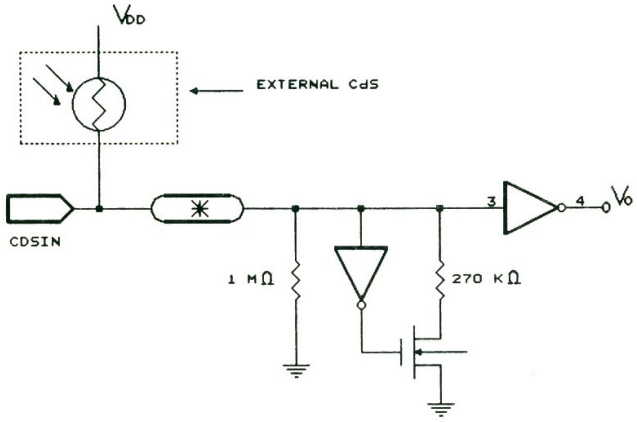
User can add a mute interval at the end of every word, if needed. The range of duration for the mute interval is 0 sec. to 5 sec. (typical 6K sampling rate)

CDS Trigger Function

To turn on trigger by CDS its resistor must be less than 200KΩ. To turn off trigger CDS resistor must be over 1MΩ.

Transition point of inverter $= \frac{V_{DD}}{2}$

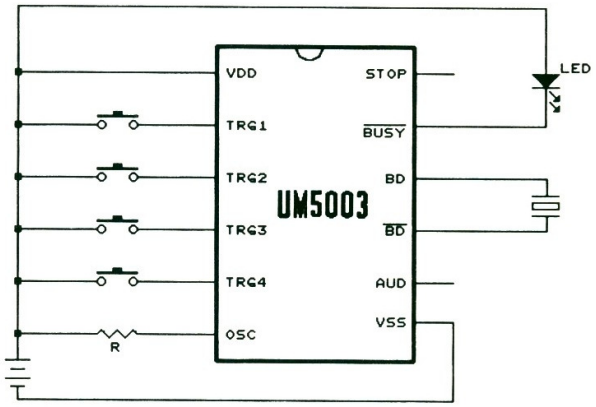
CDS Trigger Circuit



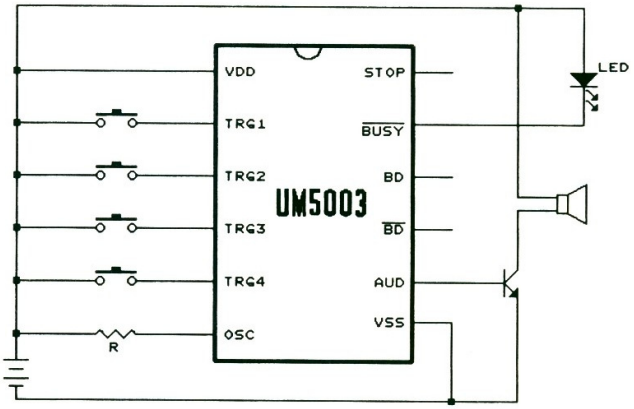
Application Circuits

(1) Typical Applications

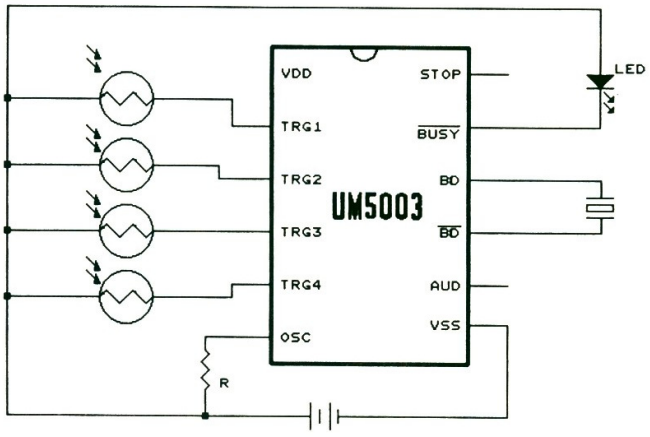
(a) Buzzer output



(b) Speaker output



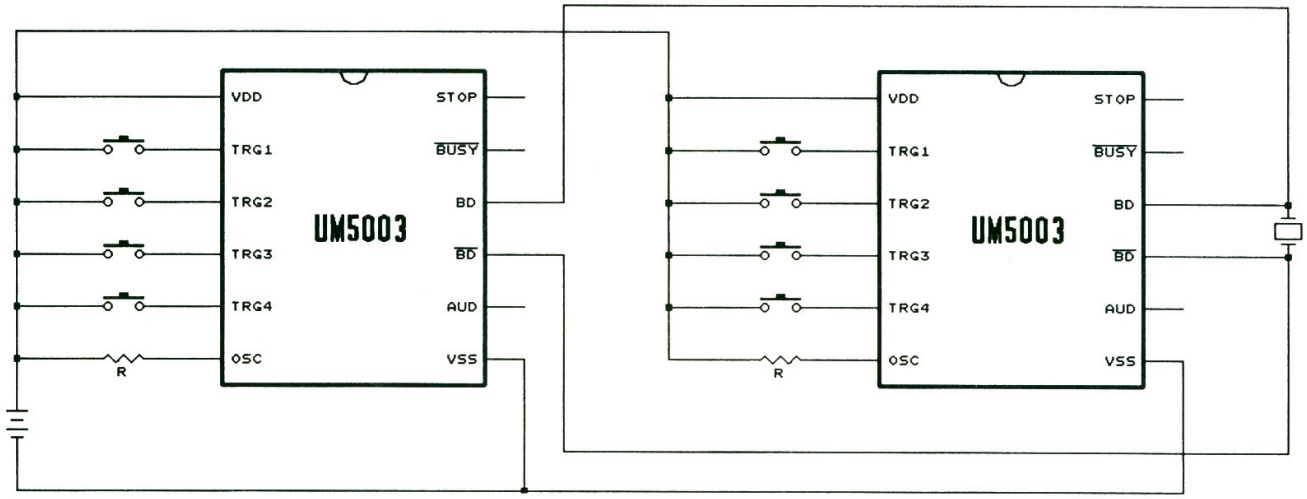
(c) CDS function



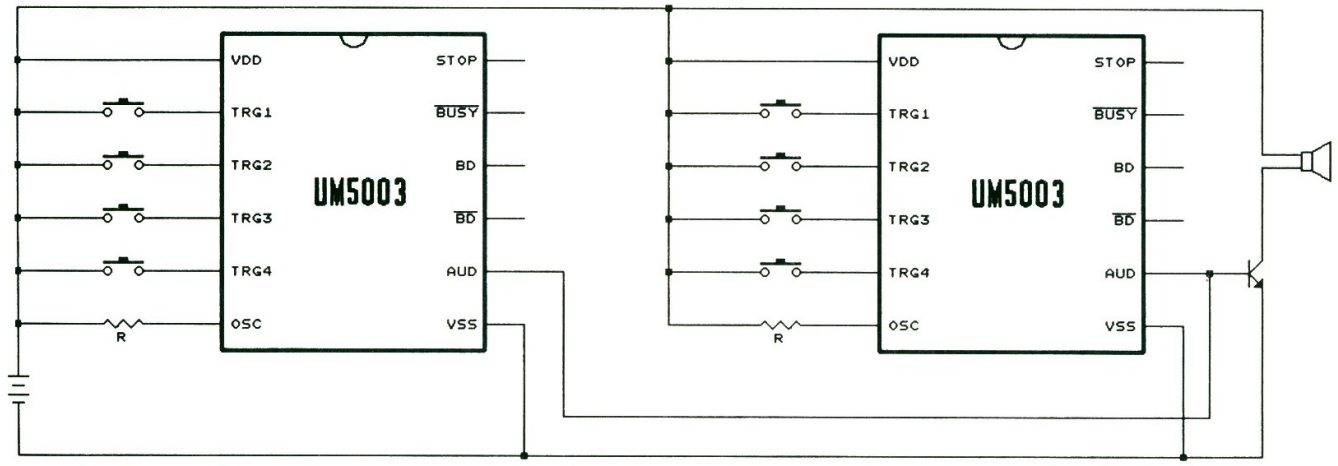
Application Circuits (Continued)

(2) Parallel Applications

(a) Buzzer output



(b) Speaker output

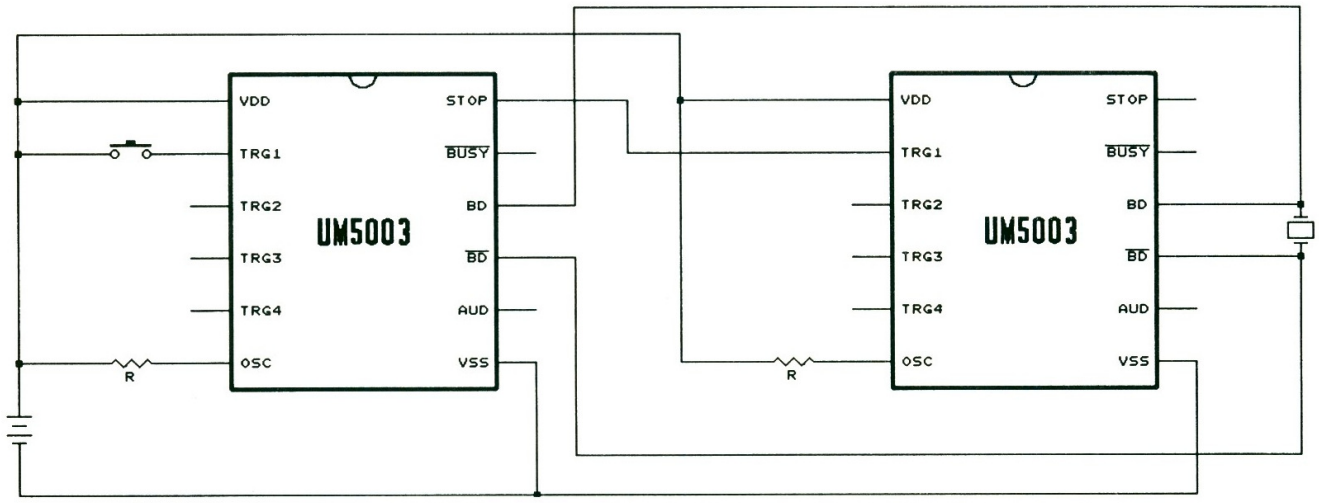


* Buzzer (BD, $\overline{BD}$) and speaker (AUD) output application cannot be used simultaneously

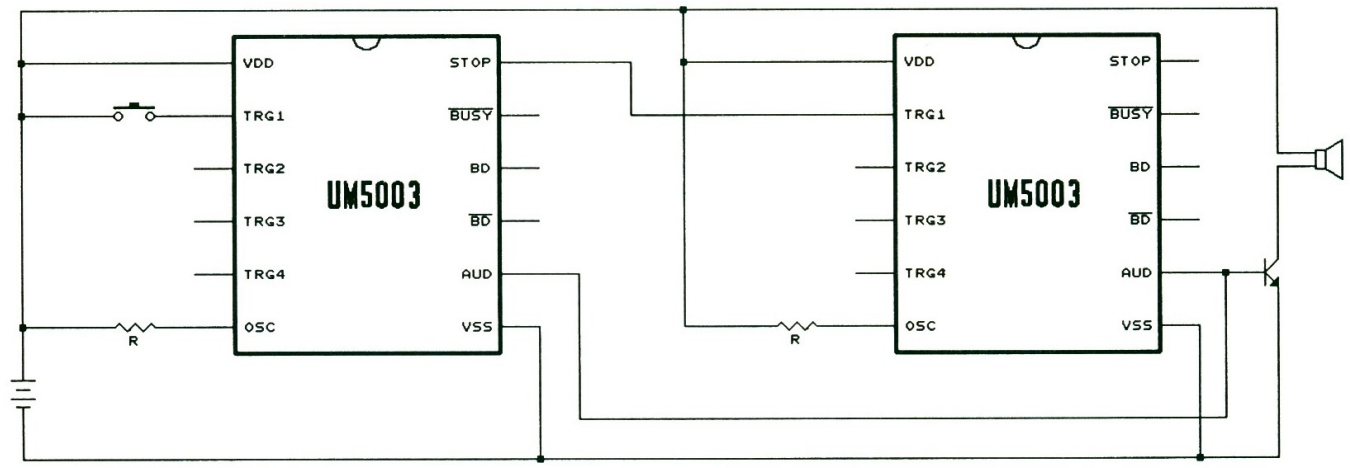
Application Circuits (Continued)

(3) Cascade Applications

(a) Buzzer output



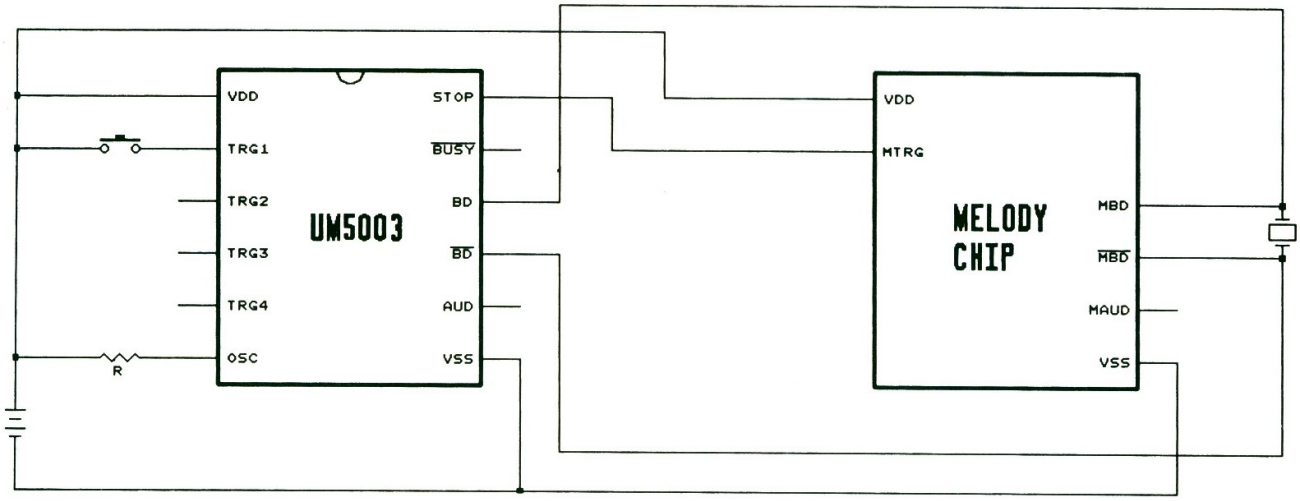
(b) Speaker output



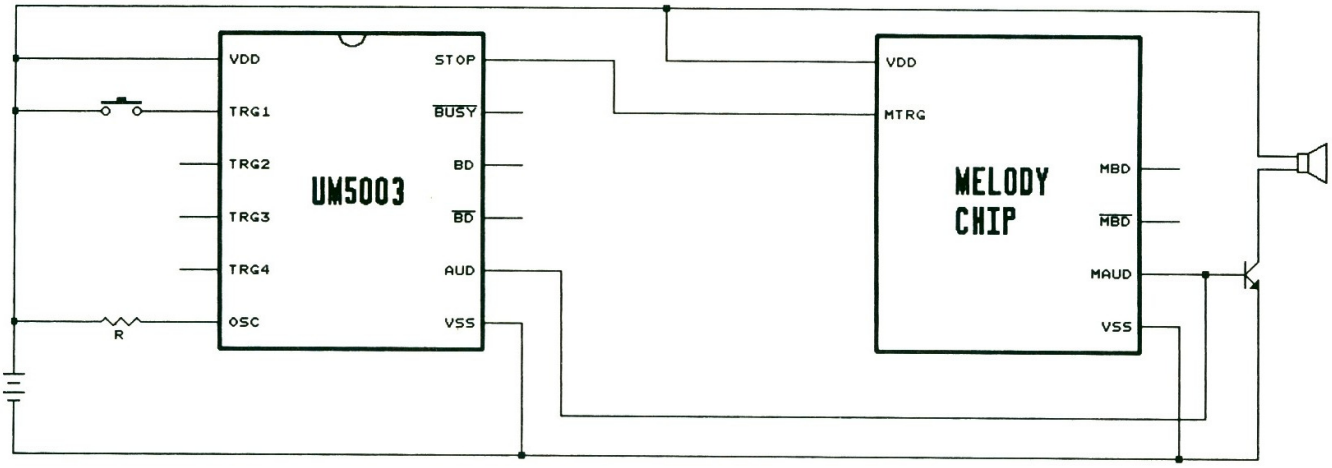
Application Circuits (Continued)

(4) Speech with Melody Applications

(a) Buzzer output*



(b) Speaker output



In the melody application with buzzer output, melody must have tri-state output

UM5003 STANDARD CODE LIST

UM5003-01 (Rosc = 430K) Normal Stop

ZOO

TG1 : Lion
(edge)
TG2 : Elephant
(edge)
[S] TG3 : Seal
(edge)
[S] TG4 : Cuckoo
(edge)

UM5003-02 (Rosc = 430K) Normal Stop

Farm

[S] TG1 : Horse
(edge)
[S] TG2 : Cow
(edge)
[S] TG3 : Sheep
(edge)
TG4 : Duck
(edge)

UM5003-03 (Rosc = 510K) Immediately Stop

Car

[S] TG1 : Starting
(edge)
[S] TG2 : Horn
(edge)
[S] TG3 : ABS
(edge)
[S] TG4 : 1 + 2 + 3
(level)

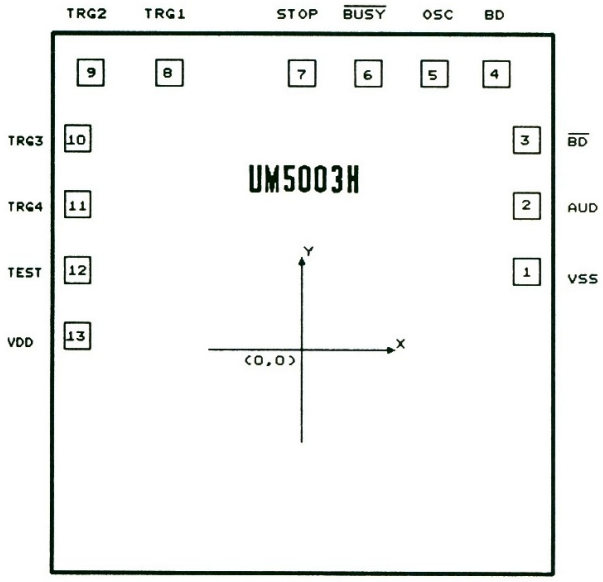
UM5003-05 (Rosc = 120K) Immediately Stop

RAP

TG1 : (level) TG2 : (edge) [S] TG3 : (edge) TG4 : (edge) [S]

[S] : STOPS

Bonding Diagram



* Substrate Connect to VDD

unit:um

Pad No.	Designation	X	Y
1	VSS	830	224
2	AUD	841	446
3	$\overline{BD}$	841	711
4	BD	746	1089
5	OSC	481	1089
6	$\overline{BUSY}$	216	1089
7	STOP	-49	1089
8	TRG1	-512	1089
9	TRG2	-777	1089
10	TRG3	-842	806
11	TRG4	-842	541
12	TEST	-841	276
13	VDD	-841	37

Ordering Information

Part No.	Package
UM5003H - XX	CHIP
UM5003 - XX	14 DIP

XX : Code Numbering Assigned Per Customer Specifications
X : 0 ~ 9, A ~ Z