

# DT1056/DT1057 DIGITALALKER™ Standard Vocabulary Kit

## General Description

The DIGITALALKER™ is a speech synthesis system consisting of several N-channel MOS integrated circuits. It contains a speech processor chip (SPC) and speech ROM and when used with external filter, amplifier, and speaker, produces a system which generates high quality speech including the natural inflection and emphasis of the original speech. Male, female, and children's voices can be synthesized.

The SPC communicates with the speech ROM, which contains the compressed speech data as well as the frequency and amplitude data required for speech output. Up to 128k bits of speech data can be directly accessed.

With the addition of an external resistor, on-chip debounce is provided for use with a switch interface.

An interrupt is generated at the end of each speech sequence so that several sequences or words can be cascaded to form different speech expressions.

The DT1056/DT1057 is a standard DIGITALALKER kit encoded with 131 separate and useful words (see the Master Word List Table I) and when used with the DT1050 Standard Vocabulary Kit, provides a library of 274 useful words. The words have been assigned discrete addresses, making it possible to output single words or words concatenated into phrases or even sentences.

The "voice" output of the DT1056/DT1057 is a highly intelligible male voice. The vocabulary is chosen so that it is applicable to many products and markets.

## Features

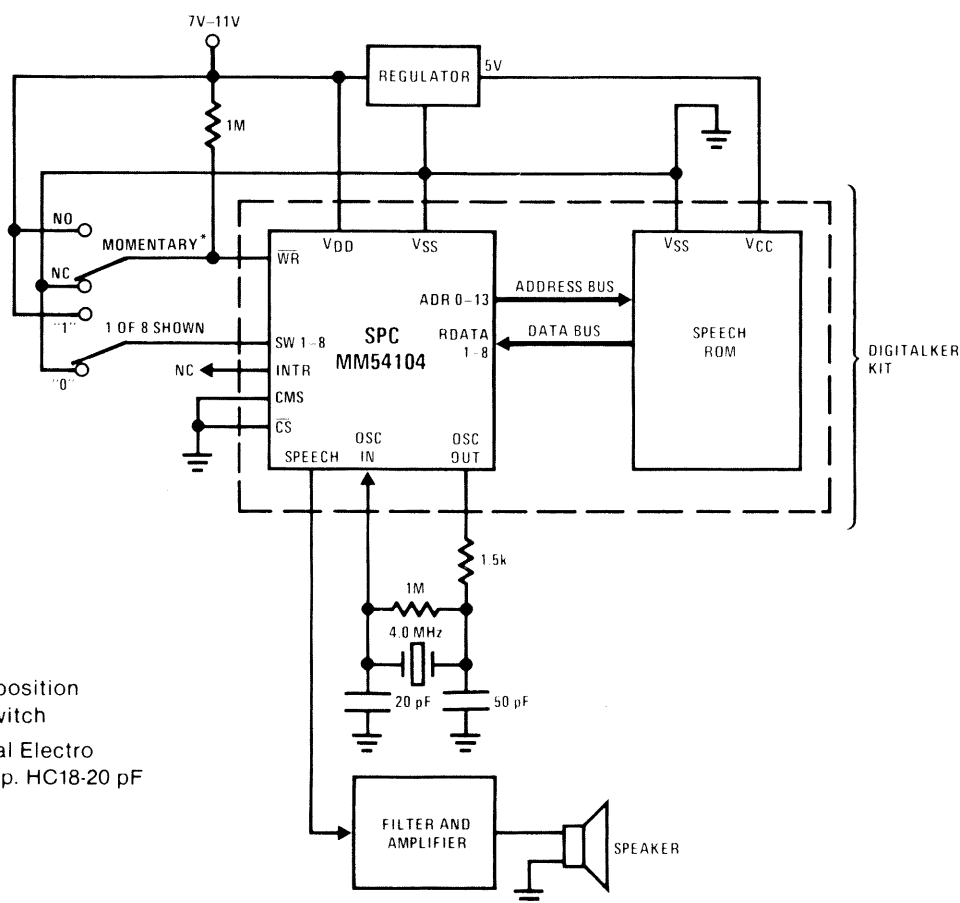
- Easily adaptable to DT1050 Standard Vocabulary Kit
- 131 useful words
- COPST™ and MICROBUS™ compatible
- Designed to be easily interfaced to other popular microprocessors
- Natural inflection and emphasis of original speech
- Addresses 128k bits of ROM directly
- TTL compatible
- On-chip switch debounce for interfacing to manual switches independent of a microprocessor
- Interrupt capability for cascading words or phrases
- Crystal controlled or externally driven oscillator
- Available in complete kit (DT1056) or speech ROMs only (DT1057)

## Applications

- |                      |                        |
|----------------------|------------------------|
| ■ Telecommunications | ■ Consumer products    |
| ■ Appliance          | ■ Clocks               |
| ■ Automotive         | ■ Language translation |
| ■ Teaching aids      | ■ Annunciators         |

## Typical Applications

Minimum Configuration Using Switch Interface



\* Single pole 2 position momentary switch  
 \*\* 4.0 MHz crystal Electro Dynamics Corp. HC18-20 pF

## Absolute Maximum Ratings\*

Storage Temperature Range	- 65°C to + 150°C	Voltage at Any Pin	12V
Operating Temperature Range	0°C to 70°C	Operating Voltage Range, $V_{DD}-V_{SS}$	7V to 11V
$V_{DD}-V_{SS}$	12V	Lead Temperature (Soldering, 10 seconds)	300°C

## DC Electrical Characteristics\* $T_A = 0^\circ\text{C to } 70^\circ\text{C}$ , $V_{DD} = 7\text{V}-11\text{V}$ , $V_{SS} = 0\text{V}$ , unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Units
$V_{IL}$	Input Low Voltage		- 0.3		0.8	V
$V_{IH}$	Input High Voltage		2.0		$V_{DD}$	V
$V_{OL}$	Output Low Voltage	$I_{OL} = 1.6 \text{ mA}$			0.4	V
$V_{OH}$	Output High Voltage	$I_{OH} = - 100 \mu\text{A}$	2.4		5.0	V
$V_{ILX}$	Clock Input Low Voltage		- 0.3		1.2	V
$V_{IHx}$	Clock Input High Voltage		5.5		$V_{DD}$	V
$I_{DD}$	Power Supply Current				45	mA
$I_{IL}$	Input Leakage				$\pm 10$	$\mu\text{A}$
$I_{ILX}$	Clock Input Leakage				$\pm 10$	$\mu\text{A}$
$V_S$	Silence Voltage			$0.45 V_{DD}$		V
$V_{OUT}$	Peak to Peak Speech Output	$V_{DD} = 11\text{V}$		2.0		V
$R_{EXT}$	External Load on Speech Output	$R_{EXT}$ Connected Between Speech Output and $V_{SS}$	50			$\text{k}\Omega$

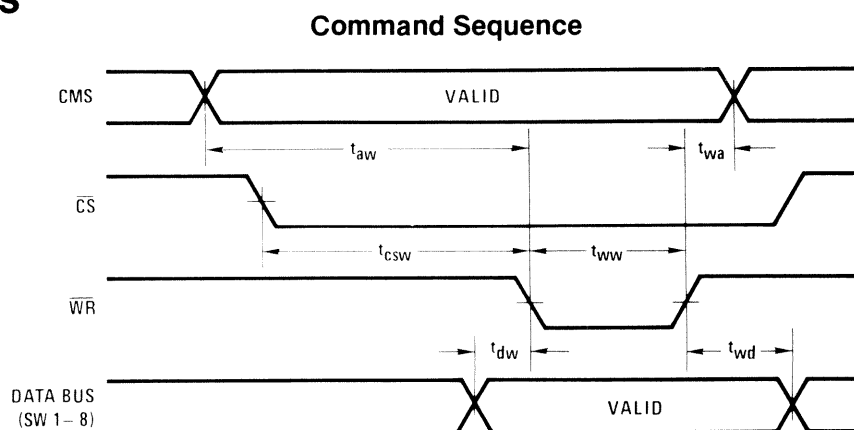
## AC Electrical Characteristics\* $T_A = 0^\circ\text{C to } 70^\circ\text{C}$ , $V_{DD} = 7\text{V}-11\text{V}$ , $V_{SS} = 0\text{V}$ , unless otherwise specified.

Symbol	Parameter	Min	Max	Units
$t_{aw}$	CMS Valid to Write Strobe	350		ns
$t_{csw}$	Chip Select ON to Write Strobe	310		ns
$t_{dw}$	Data Bus Valid to Write Strobe	50		ns
$t_{wa}$	CMS Hold Time after Write Strobe	50		ns
$t_{wd}$	Data Bus Hold Time after Write Strobe	100		ns
$t_{ww}$	Write Strobe Width (50% Point)	430		ns
$t_{red}$	$\overline{\text{ROMEN}}$ ON to Valid ROM Data		2	$\mu\text{s}$
$t_{wss}$	Write Strobe to Speech Output Delay		410	$\mu\text{s}$
$f_t$	External Clock Frequency	3.92	4.08	MHz

Note: Rise and fall times (10% to 90%) of MICROBUS signals should be 50 ns maximum.

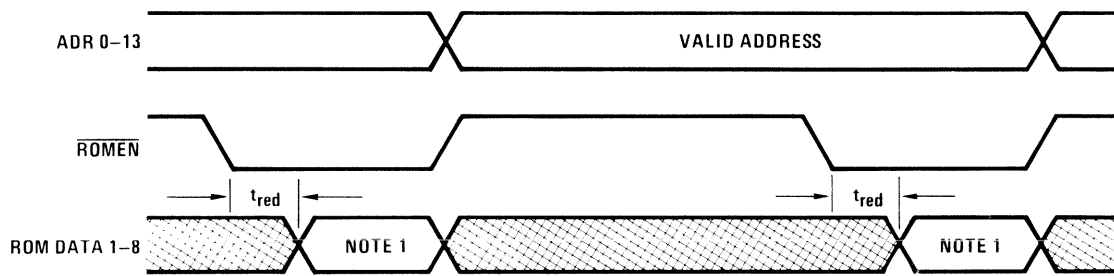
\*SPC characteristics only. ROM characteristics covered by separate data sheet for MM52164.

## Timing Waveforms



## Timing Waveforms (Continued)

### ROM Data Timing



**Note 1:** ROM Data 1-8 can go valid any time after ADR0-13 changes, however it must be valid within the  $t_{red}$  spec and remain valid until  $\overline{ROMEN}$  goes high.

## Functional Description

The following describes the function of all SPC input and output pins.

**Note:** In the following descriptions, a low represents a logic 0 (0.4V nominal), and a high represents a logic 1 (2.4V nominal).

### INPUT SIGNALS

**Chip Select ( $\overline{CS}$ ):** The SPC is selected when  $\overline{CS}$  is low. It is only necessary to have  $\overline{CS}$  low during a command to the SPC. It is not necessary to hold  $\overline{CS}$  low for the duration of the speech data.

**Data Bus (SW 1-8):** This is an 8-bit parallel data bus which contains the starting address of the speech data.

Data bus inputs SW 1-SW 8 accept an 8-bit binary address which is the address of the word which is to be "spoken" from the DIGITALKER output. See the Master Word List (Table I) for the complete listing of words and their respective addresses. If the entire word list is not used, unused inputs must be connected to  $V_{SS}$ .

**Command Select (CMS):** This line specifies the two commands to the SPC.

CMS	Function
0	Reset interrupt and start speech sequence
1	Reset interrupt only

**Write Strobe ( $\overline{WR}$ ):** This line latches the starting address (SW 1-SW 8) into a register. On the rising edge of the  $\overline{WR}$ , the SPC starts execution of the command specified by CMS. The command sequence is shown in the timing waveform section. If a command to start a new speech sequence is issued during a speech sequence, the new speech sequence will be started immediately. When connecting  $\overline{WR}$  to a switch, it must be a single pole 2 position switch as shown on page 1.

**ROM Data (RDATA 1-8):** This is an 8-bit parallel data bus which contains the speech data from the speech ROM.

### OUTPUT SIGNALS

**Interrupt (INTR):** This signal goes high at the completion of any speech sequence. It is reset by the next valid command. It is also reset at power up.

**ROM Address (ADR 0-ADR 13):** This is a 14-bit parallel bus that supplies the address of the speech data to the speech ROM.

**ROM Enable ( $\overline{ROMEN}$ ):** For low power applications, this line can be used to drive a transistor that switches the supply for static speech ROMs. See ROM Data Timing.

**Speech Output (Speech Out):** This is the analog output that represents the speech data. See frequency response section.

### INPUT/OUTPUT SIGNALS

**Clock Input/Output (OSC IN, OSC OUT):** These two pins connect the main timing reference (crystal) to the SPC.

### PHRASE QUALITY

In normal human speech, the brain puts durations of silence between the words to make the sentence flow smoothly. Since several durations of silence are provided in the Master Word List, the actual quality of any phrase can be significantly improved by adding durations of silence (also assigned addresses) between the words. As one thinks about how the phrase is actually spoken, one might assume the approximate duration of silence between each word, and insert the closest duration of silence from the word list. A hint in this area would be that for words beginning with the letters, K, T, P, B, D, and G insert 80 milliseconds silence prior to the words, and for words ending in the same letters as above, 40 milliseconds silence following the word is recommended.

# Functional Description (Continued)

TABLE I. DT1056/DT1057\* MASTER WORD LIST

Word	8-Bit Binary Address		Word	8-Bit Binary Address		Word	8-Bit Binary Address	
	SW 8	SW 1		SW 8	SW 1		SW 8	SW 1
ABORT	0	00000000	FARAD	0	01011100	PER	0	10111000
ADD	0	00000001	FAST	0	01011101	PICO	0	10111001
ADJUST	0	00000010	FASTER	0	01011110	PLACE	0	10111010
ALARM	0	00000011	FIFTH	0	01011111	PRESS	0	10111011
ALERT	0	00000100	FIRE	0	01110000	PRESSURE	0	10111100
ALL	0	00000101	FIRST	0	01110001	QUARTER	0	10111101
ASK	0	00000110	FLOOR	0	01110010	RANGE	0	10111110
ASSISTANCE	0	00000111	FORWARD	0	01110011	REACH	0	10111111
ATTENTION	0	00001000	FROM	0	01110100	RECEIVE	0	11000000
BRAKE	0	00001001	GAS	0	01110101	RECORD	0	11000001
BUTTON	0	00001010	GET	0	01110110	REPLACE	0	11000010
BUY	0	00001011	GOING	0	01110111	REVERSE	0	11000011
CALL	0	00001100	HALF	0	01111000	ROOM	0	11001000
CAUTION	0	00001101	HELLO	0	01111001	SAFE	0	11001010
CHANGE	0	00001110	HELP	0	01111010	SECURE	0	11001100
CIRCUIT	0	00001111	HERTZ	0	01111011	SELECT	0	11001111
CLEAR	0	00010000	HOLD	0	01111100	SEND	0	11010000
CLOSE	0	00010001	INCORRECT	0	01111101	SERVICE	0	11010001
COMPLETE	0	00010010	INCREASE	0	01111110	SIDE	0	11010100
CONNECT	0	00010011	INTRUDER	0	01111111	SLOW	0	11010101
CONTINUE	0	00010100	JUST	0	10000000	SLOWER	0	11010110
COPY	0	00010101	KEY	0	10000001	SMOKE	0	11010111
CORRECT	0	00010110	LEVEL	0	10000010	SOUTH	0	11010110
DATE	0	00010111	LOAD	0	10000011	STATION	0	11010111
DAY	0	00011000	LOCK	0	10000100	SWITCH	0	11100000
DECREASE	0	00011001	MEG	0	10000101	SYSTEM	0	11100001
DEPOSIT	0	00011010	MEGA	0	10000110	TEST	0	11100010
DIAL	0	00011011	MICRO	0	10000111	TH (NOTE 2)	0	11100011
DIVIDE	0	00011100	MORE	0	10001000	THANK	0	11101000
DOOR	0	00011101	MOVE	0	10001001	THIRD	0	11101010
EAST	0	00011110	NANO	0	10001010	THIS	0	11101100
ED (NOTE 1)	0	00011111	NEED	0	10001011	TOTAL	0	11101111
ED (NOTE 1)	0	01000000	NEXT	0	10001100	TURN	0	11110000
ED (NOTE 1)	0	01000001	NO	0	10001101	USE	0	11110001
ED (NOTE 1)	0	01000010	NORMAL	0	10001110	UTH (NOTE 3)	0	11110100
EMERGENCY	0	01000011	NORTH	0	10001111	WAITING	0	11110101
END	0	01000100	NOT	0	10100000	WARNING	0	11111100
ENTER	0	01000101	NOTICE	0	10100001	WATER	0	11111101
ENTRY	0	01000110	OHMS	0	10100010	WEST	0	11111110
ER	0	01000111	ONWARD	0	10100011	SWITCH	0	11111111
EVACUATE	0	01010000	OPEN	0	10101000	WINDOW	1	00000000
EXIT	0	01010001	OPERATOR	0	10101001	YES	1	00000001
FAIL	0	01010010	OR	0	10101010	ZONE	1	00000010
FAILURE	0	01010011	PASS	0	10101011			

\* DT1056 is a complete kit including MM54104 SPC; DT1057 is SSR5 and SSR6 speech ROMs only.

**Note 1:** "ED" is a suffix that can be used to make any present tense word become a past tense word. The way we say "ED," however, does vary from one word to the next. For that reason, we have offered 4 different "ED" sounds. It is suggested that each "ED" be tested with the desired word for best quality results. Address 31 "ED" or 32 "ED" should be used with words ending in "T" or "D," such as exit or load. Address 34 "ED" should be used with words ending with soft sounds such as ask. Address 33 "ED" should be used with all other words.

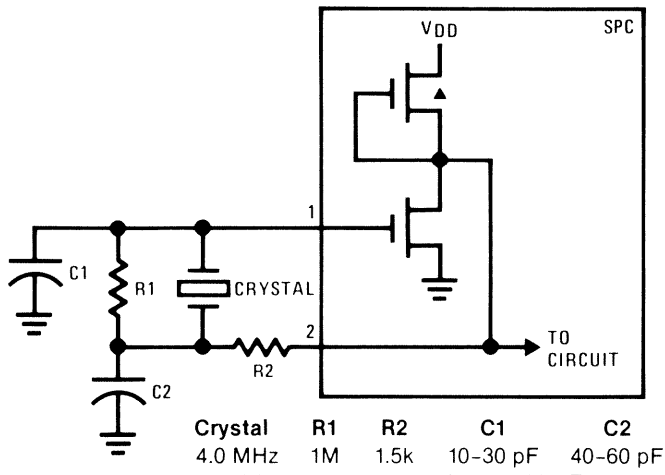
**Note 2:** "TH" is a suffix that can be added to words like six, seven, eight to form adjective words like sixth, seventh, eighth.

**Note 3:** "UTH" is a suffix that can be added to words like twenty, thirty, forty to form adjective words like thirtieth, fortieth, etc.

**Note 4:** Address 130 is the last legal address in this particular word list. Exceeding address 130 will produce pieces of unintelligible invalid speech data.

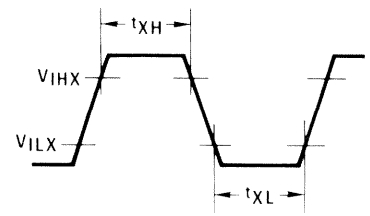
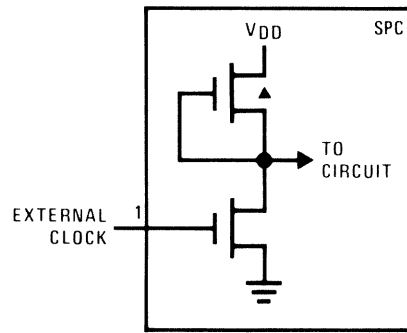
# Crystal Circuit Information

## Typical Crystal Oscillator Network



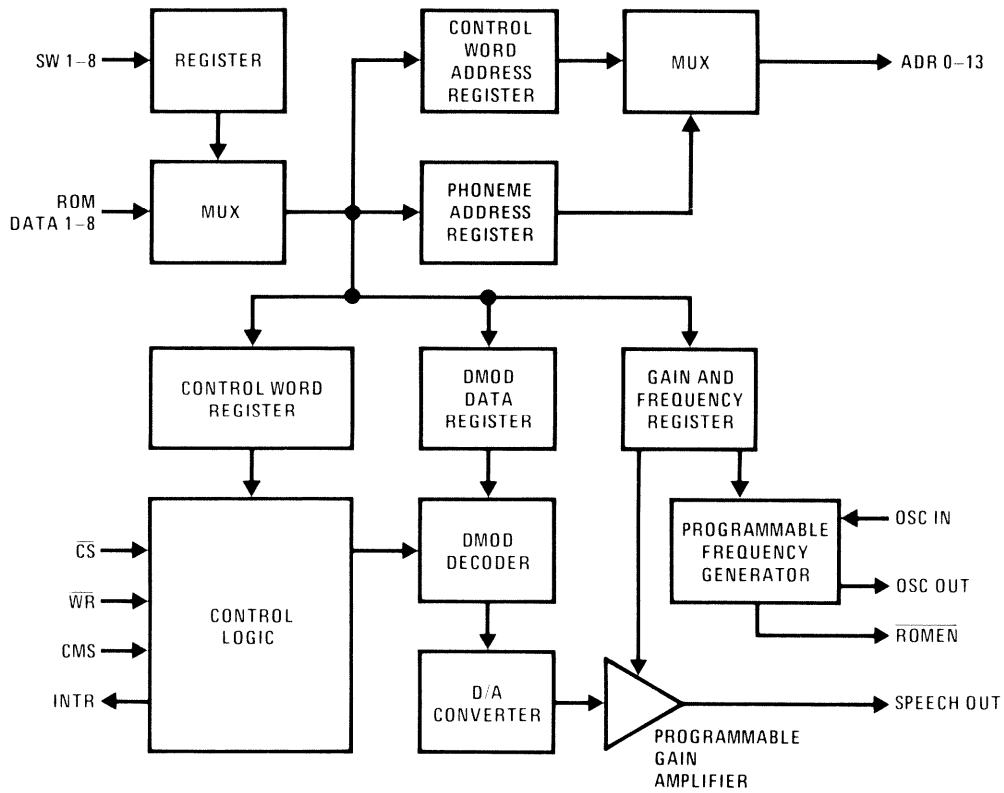
(4.0 MHz crystal manufactured by Electro Dynamics Corp. P/N HC18-20 pF)

## External Clock Input (4.0 MHz)

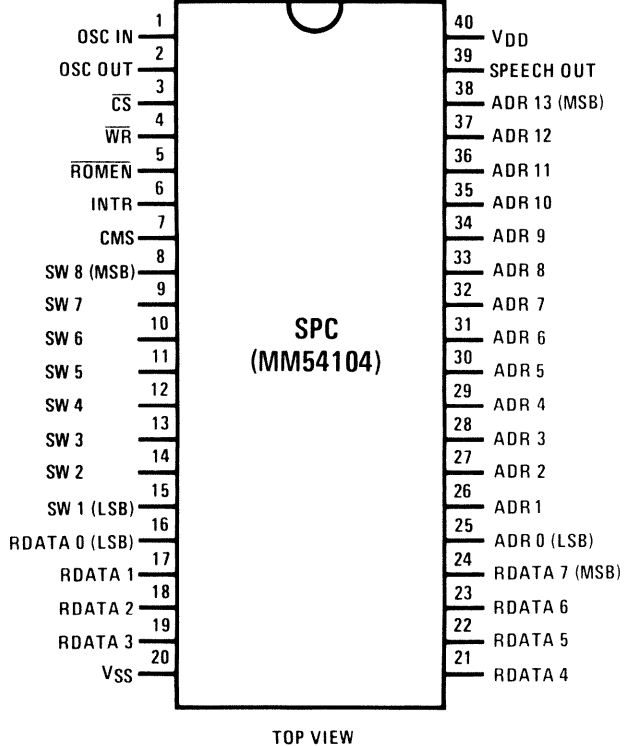


Timing	Min	Units
t <sub>XH</sub>	100	ns
t <sub>XL</sub>	100	ns

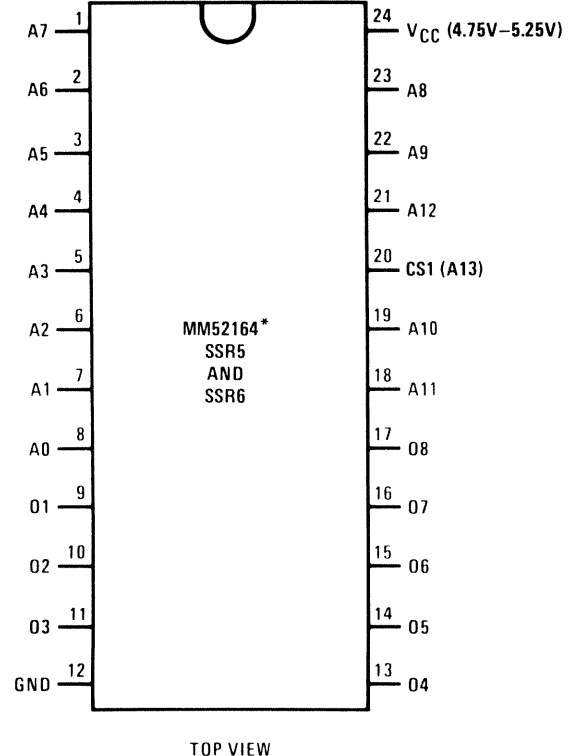
# SPC Block and Connection Diagrams



### Dual-In-Line Package

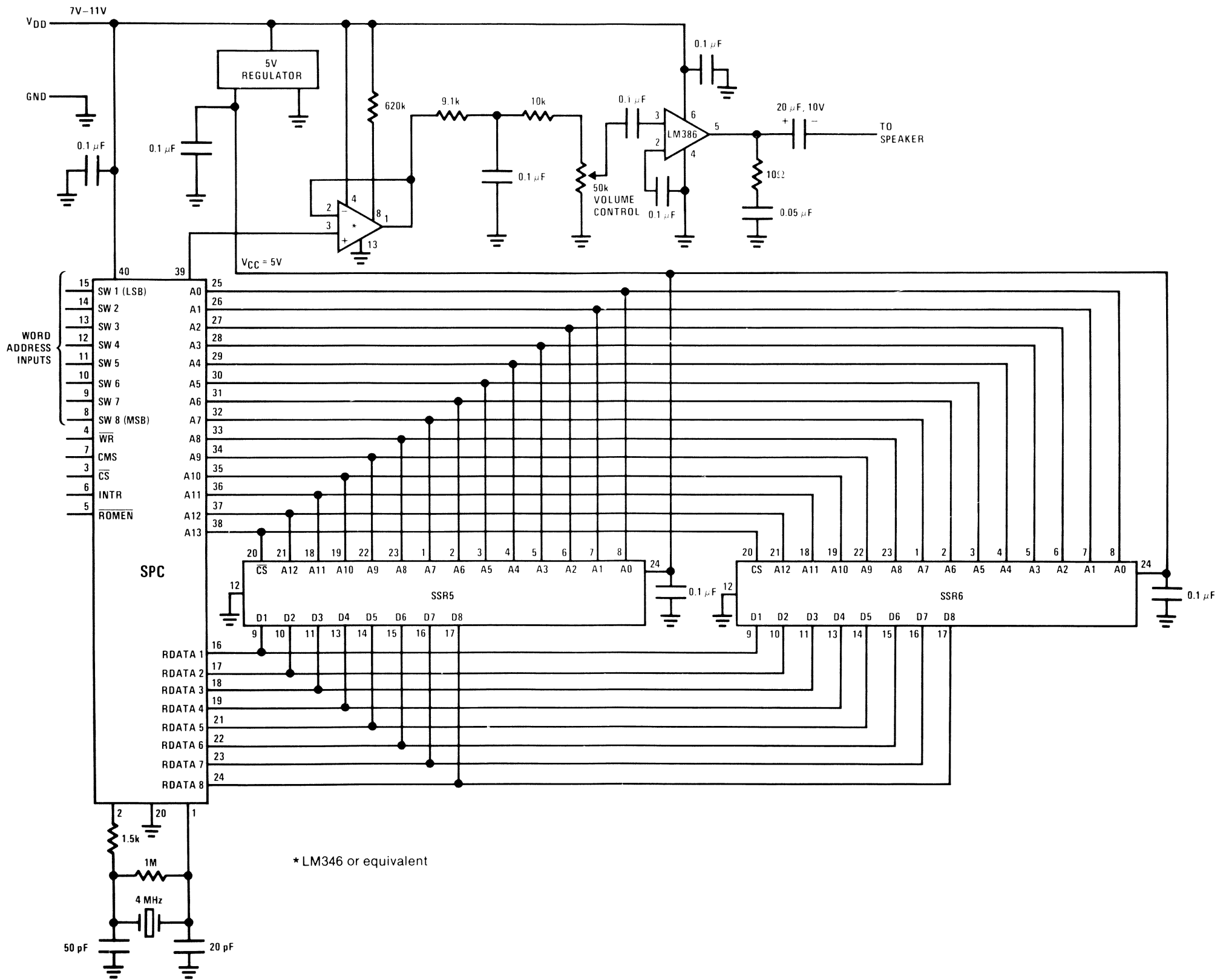


### Dual-In-Line Package



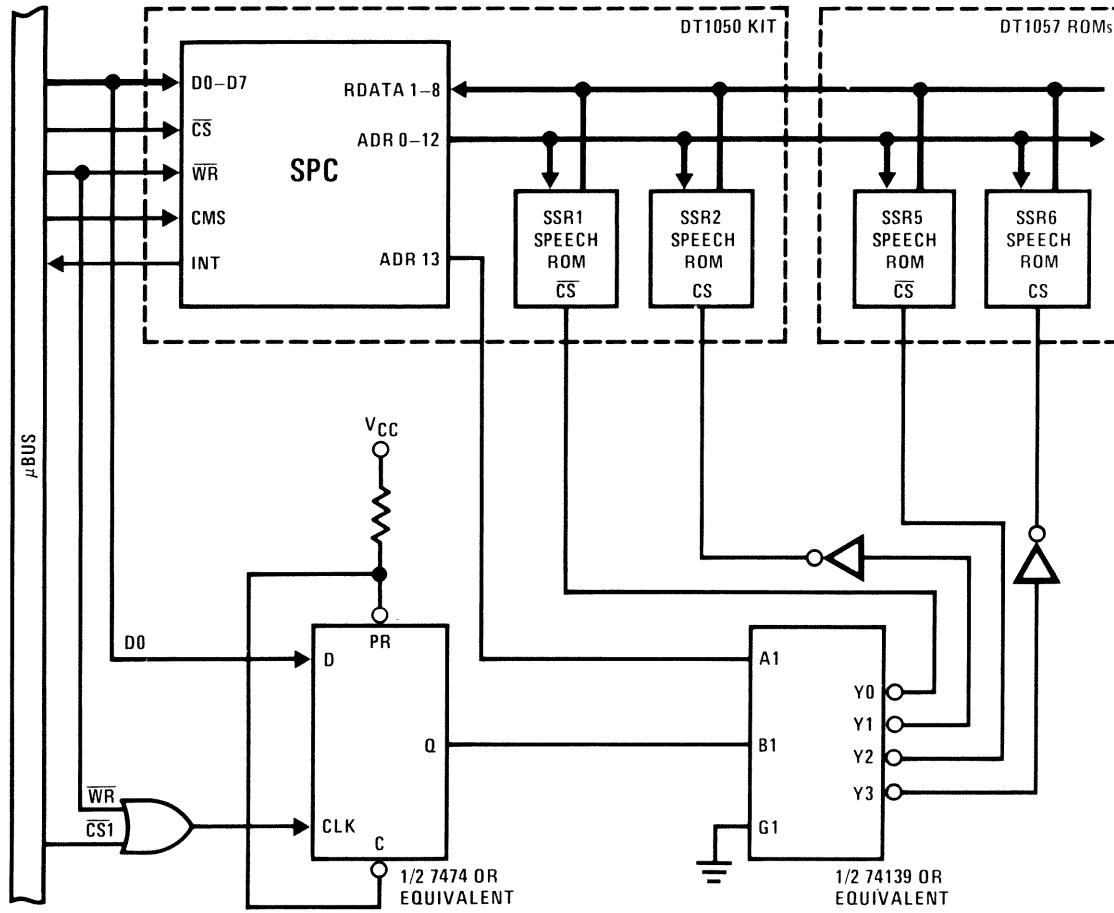
\* For specific ROM device information, see MM52164 data sheet.

# Recommended Schematic Diagram

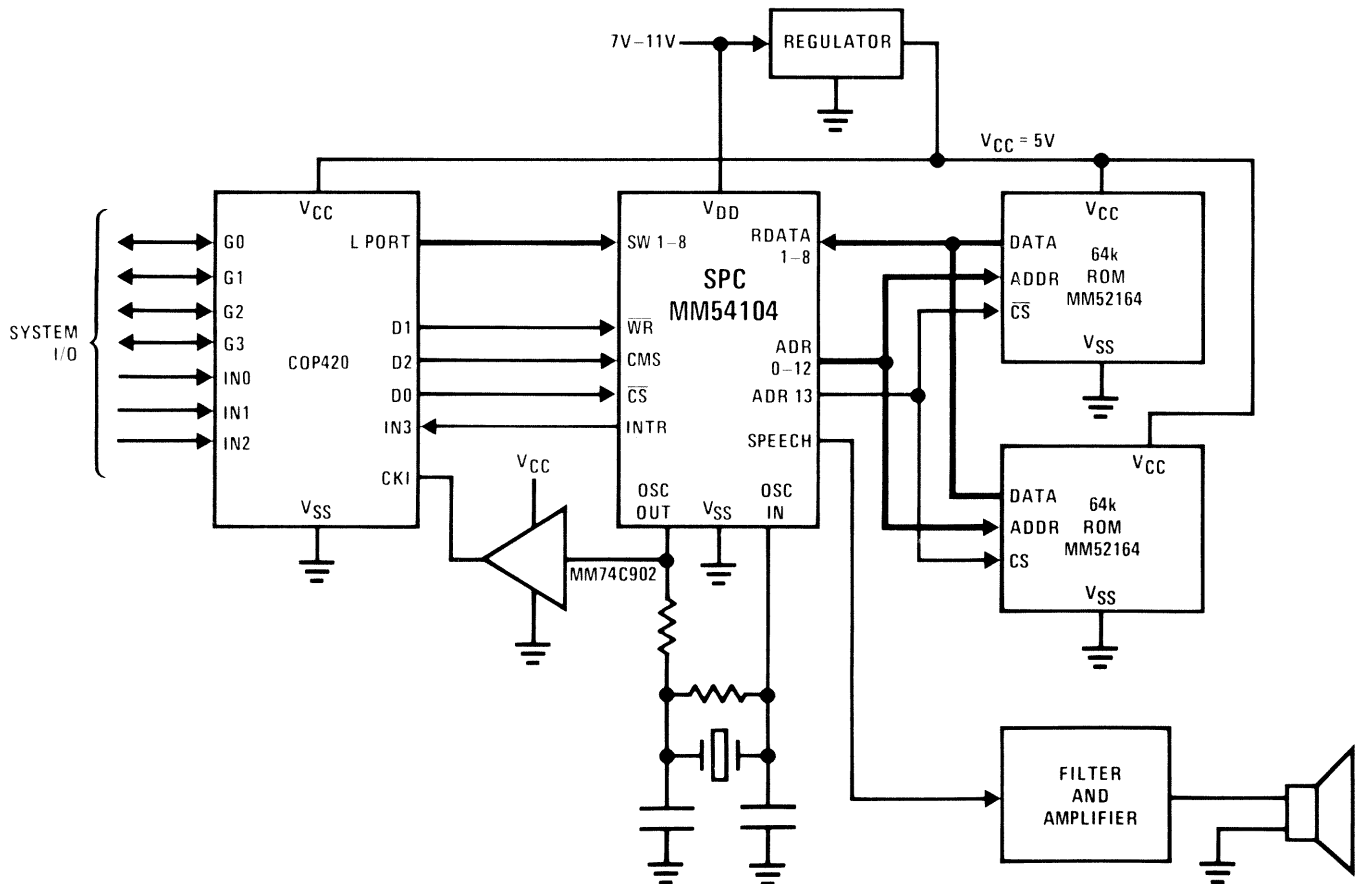


# Typical Applications (Continued)

## Integration of DT1057 ROMs and DT1050 Kit

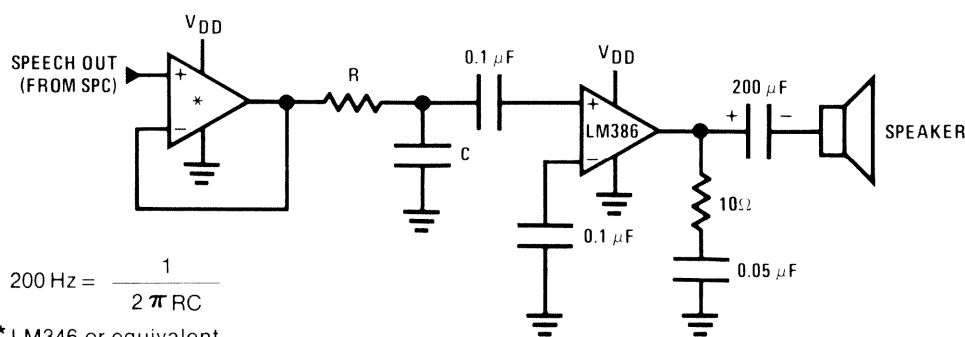


## DIGITAL TALKER System Using COP420 Interface



## Typical Applications (Continued)

### Minimum Filter Circuit

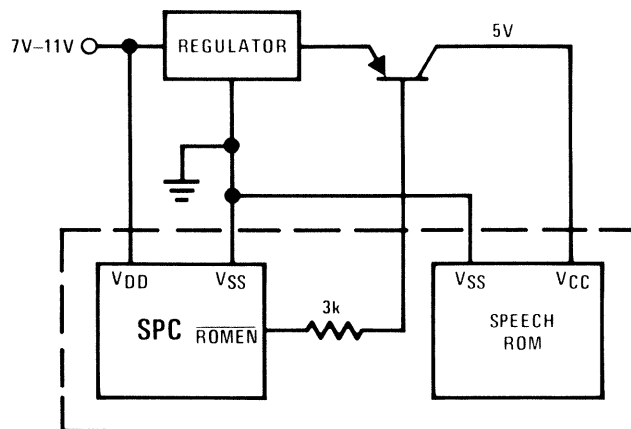


$$200 \text{ Hz} = \frac{1}{2 \pi RC}$$

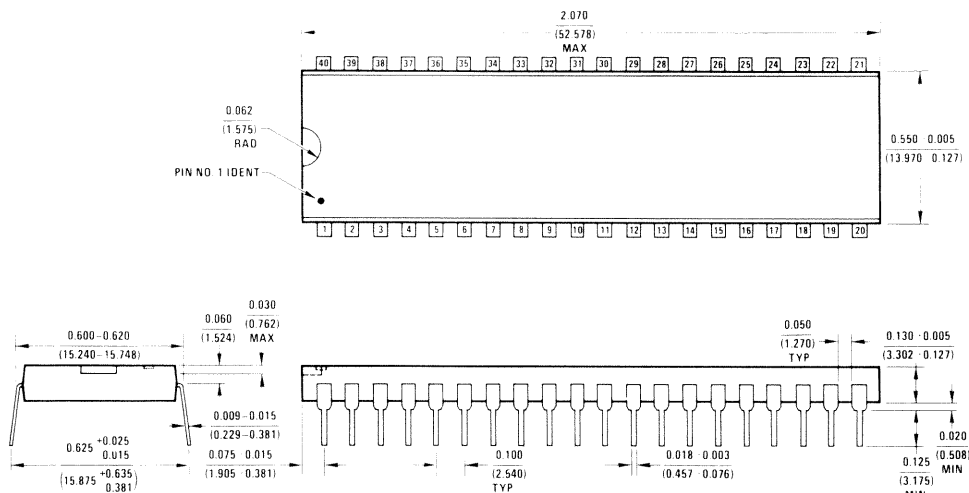
\* LM346 or equivalent

See MM54104 data sheet for additional filter information.

### Low Power Configuration Using Static ROM



## Physical Dimensions inches (millimeters)



### Molded Dual-In-Line Package (N) NS Package Number N40A

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