Votrax
1394 Rankin
Troy, MI. 48083

SC-01 SPEECH SYNTHESIZER
DATA SHEET

Votrax® CMOS Phoneme Speech Synthesizer

GENERAL DESCRIPTION

The SC-01 Speech Synthesizer is a completely self-contained solid state device. This single chip phonetically synthesizes continuous speech, of unlimited vocabulary, from low data rate inputs. Figure 1.

Speech is synthesized by combining phonemes (the building blocks of speech) in the appropriate sequence. The SC-01 Speech Synthesizer contains 64 different phonemes which are accessed by a 6-bit code. It is the proper sequential combination of these phoneme codes that creates continuous speech.

The SC-01 Speech Synthesizer is cost-effective, consumes minimal power and enables in-house product development without vendor dependency. Signals from the SC-01 are applied to an audio output device to amplify and distribute the synthesized speech. See Figure 2.

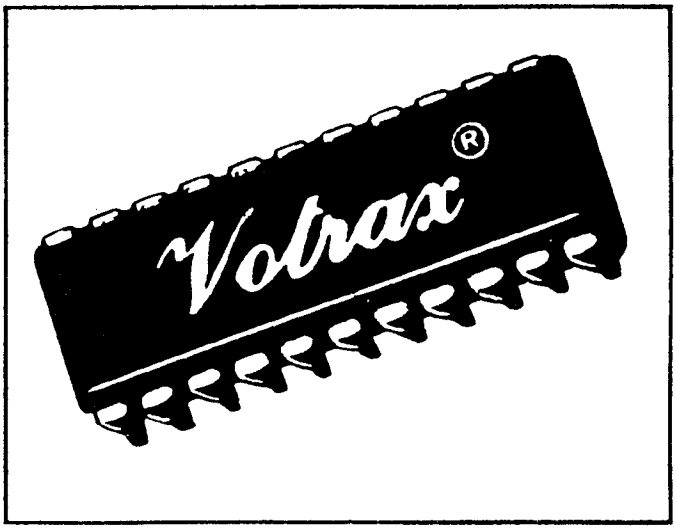

Figure 1. Votrax® SC-01 Speech Synthesizer

FEATURES

- Single CMOS chip
- 70 bits per second
- 22 pin package
- 9 ma. current drain
- Wide voltage supply range
- Latched 5V. compatible inputs
- Digital pitch level inputs
- Automatic inflection
- On-chip master clock circuit
- Optional external master clock
- Variety of voice effects
- Sound effects
- Customer product security

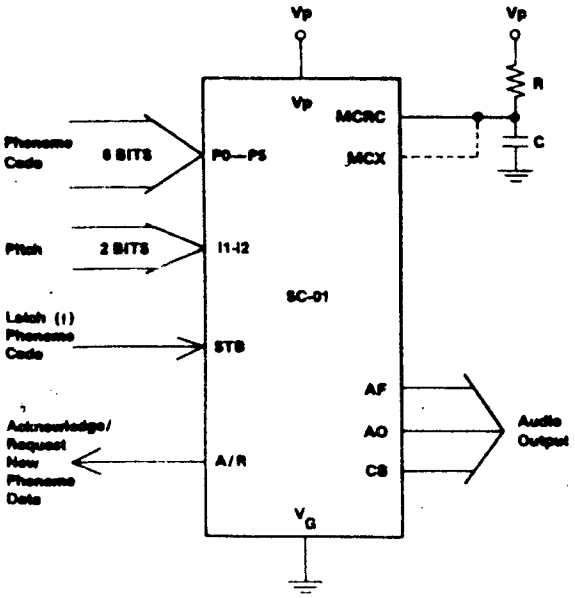

Figure 2. SC-01 Flow Diagram

CMOS technology, which offers high input impedance and low power drain.

ELECTRICAL DESCRIPTION

The SC-01 Speech Synthesizer is a program-compatible with existing Votrax® phoneme synthesizers. It requires 70 bits of data per second for continuous speech production. The 6-bit phoneme codes are 5 volt logic compatible and are latched for data bus applications. A phoneme-construction algorithm and filters, within the chip, create the synthesized audio output.

example word demonstrate the phoneme use, i.e., sound to be pronounced.

Table 2 subdivides the 64 phoneme symbols into seven categories. Each category represents a different production feature. The first six categories are characterized by voiced, fricative (expired voice), and nasal sounds. The seventh category is characterized by phonemes with no sound output.

PHONEME PROGRAMMING

Manual Operations: Votrax® maintains a library of phonetically programmed words. Reference to this library and programming manuals will aid in word synthesis.

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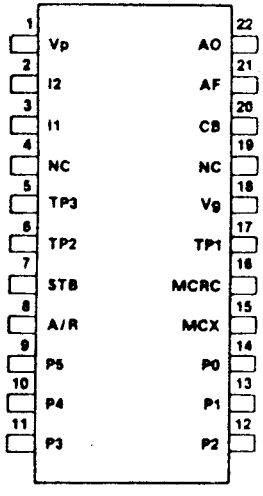
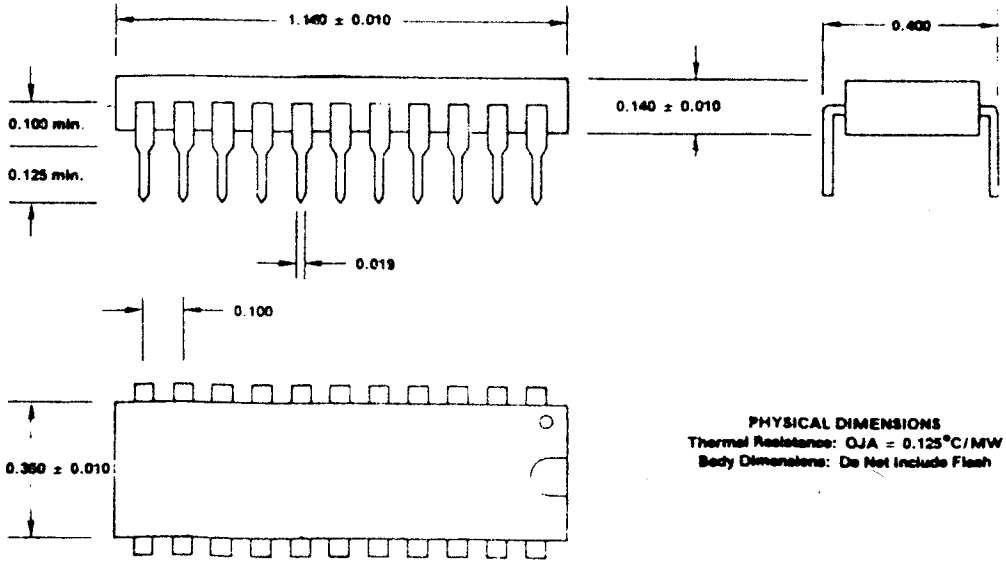


NC = No Connection
TPX = No Connection



PHYSICAL DIMENSIONS
Thermal Resistance: θJA = 0.125°C/MW
Body Dimensions: Do Not Include Flash

1-8 HEX
9-16 PHON
17-24 CAT
25-32 DUR
33- EXAMPLE

Table 1. Phoneme Chart

Phoneme Code	Phoneme Symbol	CAT	Duration (ms)	Example Word
00	EH3	V	59	jacket
01	EH2	V	71	enlist
02	EH1	V	121	heavy
03	PA0	NS	47	no sound
04	DT	FS	47	butter
05	A2	V	71	made
06	A1	V	103	made
07	ZH	VF	90	azure
08	AH2	V	71	honest
09	I3	V	55	inhibit
0A	I2	V	80	inhibit
0B	I1	V	121	inhibit
0C	M	N	103	mat
0D	N	N	80	sun
0E	B	VS	71	bag
0F	V	VF	71	van
10	CH*	F	71	chip
11	SH	F	121	shop
12	Z	VF	71	zoo
13	AW1	V	146	lawful
14	NG	N	121	thing
15	AH1	V	146	father
16	OO1	V	103	looking
17	OO	V	185	book
18	L	V	103	land
19	K	FS	80	trick
1A	J*	VF	47	judge
1B	H	F	71	hello
1C	G	VS	71	get
1D	F	F	103	fast
1E	D	VS	55	paid
1F	S	F	90	pass

Phoneme Code	Phoneme Symbol		Duration (ms)	Example Word
20	A	V	185	day
21	AY	V	65	day
22	Y1	V	80	yard
23	UH3	V	47	mission
24	AH	V	250	mop
25	P	FS	103	past
26	O	V	185	cold
27	I	V	185	pin
28	U	V	185	move
29	Y	V	103	any
2A	T	FS	71	tap
2B	R	V	90	red
2C	E	V	185	meet
2D	W	V	80	win
2E	AE	V	185	dad
2F	AE1	V	103	after
30	AW2	V	90	salty
31	UH2	V	71	about
32	UH1	V	103	uncle
33	UH	V	185	cup
34	O2	V	80	for
35	O1	V	121	aboard
36	IU	V	59	you
37	U1	V	90	you
38	THV	VF	80	the
39	TH	F	71	thin
3A	ER	V	146	bird
3B	EH	V	185	get
3C	E1	V	121	be
3D	AW	V	250	call
3E	PA1	NS	185	no sound
3F	STOP	NS	47	no sound

'T' must precede 'CH' to produce CH sound.
'D' must precede 'J' to produce J sound.

Table 2. Phoneme Categories According to Production Features

Voiced		V			VF 'Voiced' Fricat.	VS 'Voiced' Stop	FS Fricative Stop	F Fricative	N Nasal	NS No Sound
E	EH	AE	UH	OO1	Z	B	T	S	M	PA0
E1	EH1	AE1	UH1	R	ZH	D	DT	SH	N	PA1
Y	EH2	AH	UH2	ER	J	G	K	CH	NG	STOP
Y1	EH3	AH1	UH3	L	V		P	TH		
I	A	AH2	O	IU	THV			F		
I1	A1	AW	O1	U				H		
I2	A2	AW1	O2	U1						
I3	AY	AW2	OO	W						

SIGNAL DESCRIPTION (See Figures 4 and 5)

Phoneme 6-Bit Selection Code (PØ-P5): Data input is to six pins. Latching is controlled by the strobe (STB) signal.

Strobe (STB): Latching occurs on rising edge of strobe signal.

Inflection Level Setting (I1, I2): Instantaneously sets pitch level of voiced phonemes.

Acknowledge/Request ($\bar{A}$/R): Acknowledges receipt of phoneme data (signal goes from high to low one master clock cycle following active edge of STB signal). Also indicates timing out of old phoneme concurrent with request for new phoneme data (signal goes from low to high).

NOTE

If external phoneme timing is desired, phoneme requests can be ignored. However, best speech is realized with internal timing.

Master Clock Resistor-Capacitor (MCRC): This input determines the internal master clock frequency. Select R-C values for 720 kHz to achieve standard phoneme timing. Connect this input to MCX when using internal clock; ground when using external clock.

NOTE

Varying clock frequency varies voice and sound effects. As clock frequency decreases, audio frequency decreases and phoneme timing lengthens. Figures 6 and 7 illustrate manual and DAC (Digital to Analog Converter) voice variation schematics, respectively.

Master Clock External (MCX): Allows control by an external clock signal.

NOTE

Ground MCRC during MCX operation.

Audio Output (AO): Supplies analog signal to audio output device.

Audio Feedback (AF): Used with Class A or Class B transistor audio amplifiers for added stability.

Class B (CB): Current source for Class B transistor audio amplifier.

Table 3. Timing Specifications

CHARACTERISTIC	SYMBOL	MIN	TYP	MAX	UNIT
Input Setup Time (P_I to STB)	T_S	450			NS
Input Hold Time (P_I to STB)	T_H	Ø			NS
Rise Time of STB Edge (.8V to 4V)	T_{RS}			1ØØ	NS
A/R Width ($\bar{A}$/R Connected to STB) *	T_{ARW}	1	1.3	2	µs
STB Width	T_{SW}	2ØØ			NS
STB Low*	T_{SL}				NS
Propagation Delay (STB to A/R after T_{ARW})	T_{DAR}			5ØØ	NS
A/R Rise Time (Capacitive load = 3Øpf)	T_{RAR}			1ØØ	NS
A/R Fall Time (Capacitive load = 3Øpf)	T_{FAR}			1ØØ	NS
Time from $\bar{A}$/R Request to STB Service)	T_{ARS}	Ø		500	µs
Time of Phoneme Duration +	T_{PH}	47	1Ø7	25Ø	MS

+ Dependent on Master Clock frequency: 720kHz

* Strobe must remain low (72x Master Clock Period) before rising edge

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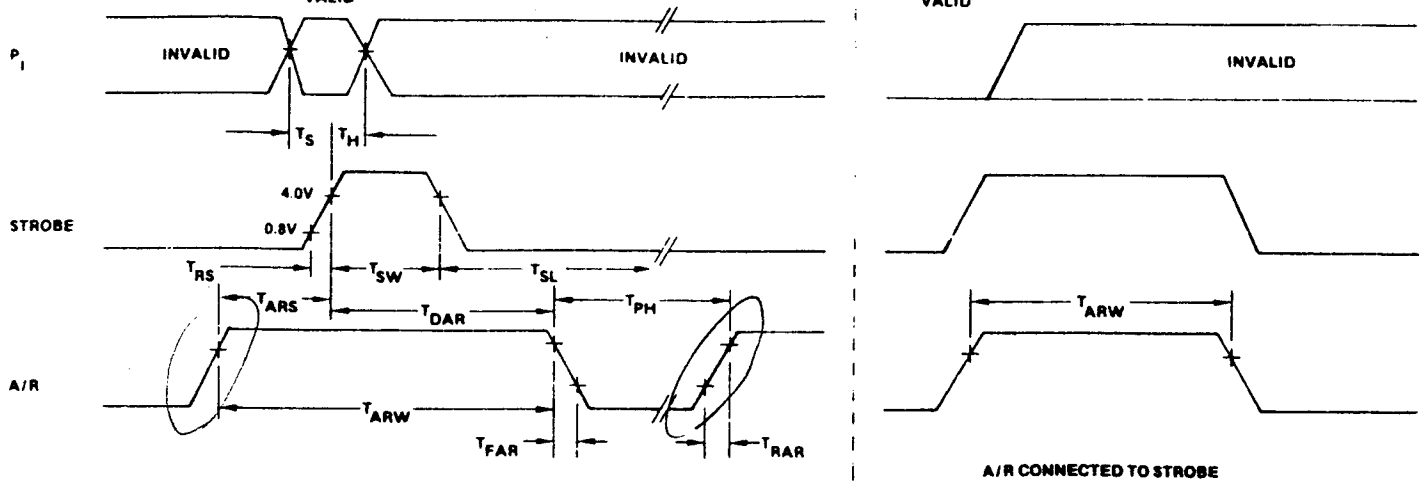

Figure 4. Timing Diagram

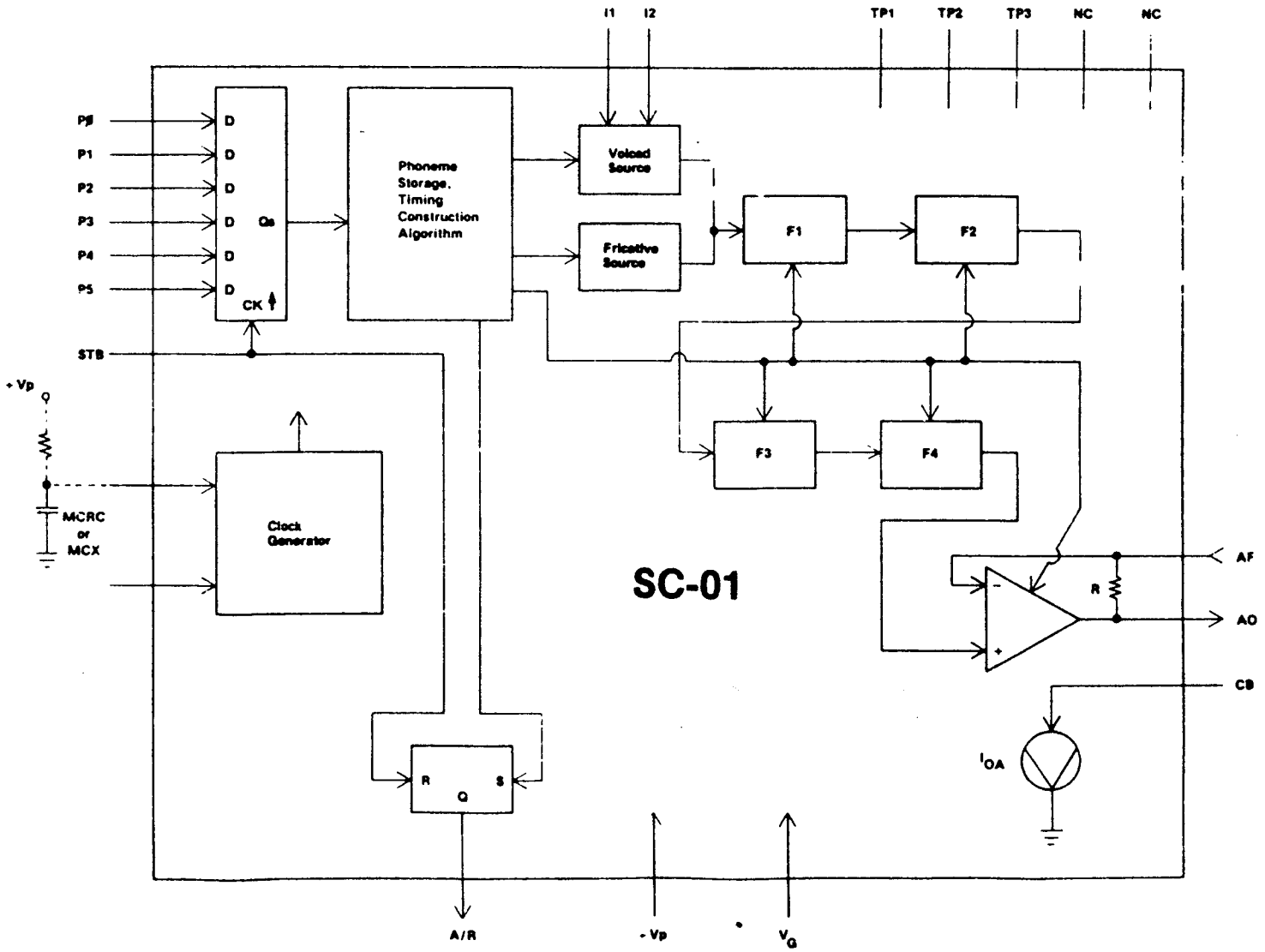

Figure 5. SC-01 Block Diagram

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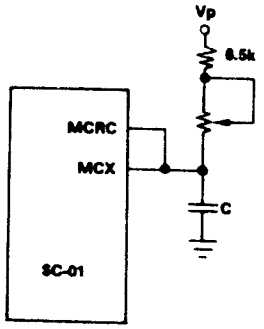


Figure 6. Variable Voice by Potentiometer Control

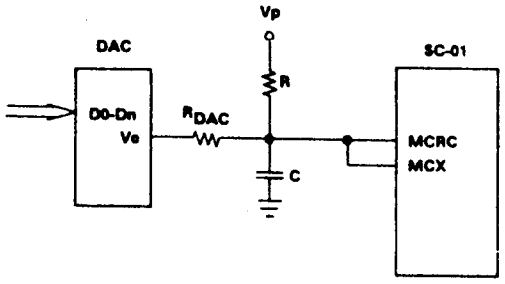


Figure 7. Variable Voice by DAC Current Injection

TYPICAL APPLICATIONS

General: The SC-01 Speech Synthesizer is easily designed into systems ranging in complexity from ROM/counters to microprocessor controllers.

Single Message System: See Figure 8. When the counter is released (START is TRUE), the message is clocked out of the ROM by the A/R signal. The system must be stopped when DONE is TRUE. Note: When using A/R tied to STB, connect a .01 uf capacitor to TP3 to insure power up reset of SC-01.

NOTE

Data at address Ø must be a pause phoneme code.

Multiple Message, Fixed Block Size: See Figure 9. Message address block is loaded into the counter. The message is then clocked out of the ROM by the A/R signal.

NOTE

Message Block = 2^n maximum.

Multiple Message, Variable Block Size: See Figure 10. The microprocessor loads phonemes into a data bus. The A/R signal generates an interrupt request for each new phoneme.

CONNECTING THE AUDIO OUTPUT DEVICE

Audio Output: The AO signal has a maximum peak to peak voltage swing of .26 times Vp, depending upon the phoneme selected, and the AO signal is D.C. biased.

Class A Amplifier: See Figure 11. For a single transistor amplifier, the selection of R, C, or R_s values depends upon the value of Vp and the desired audio level.

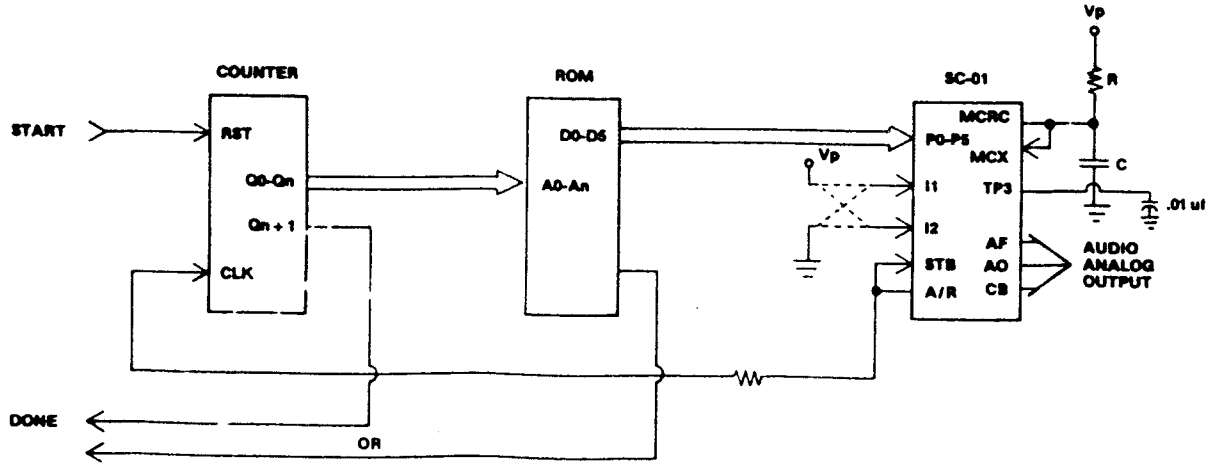


Figure 8. Single Message System

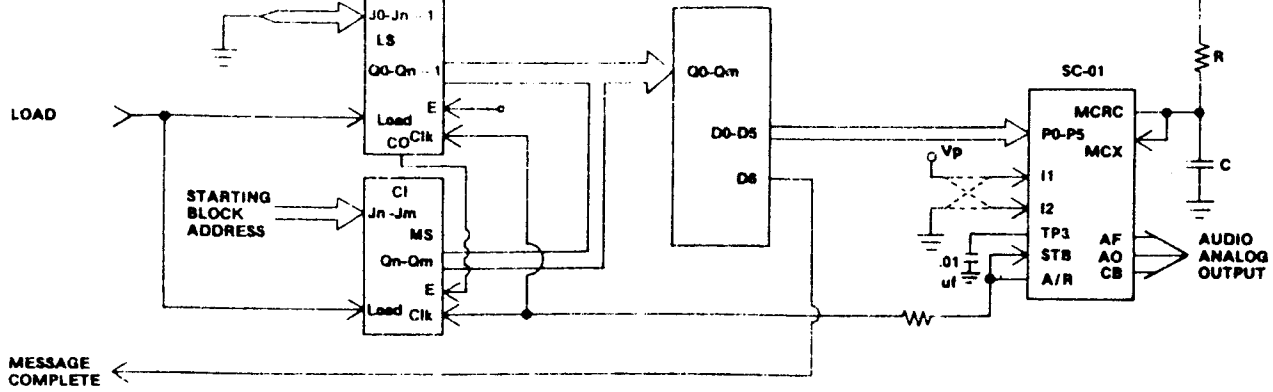


Figure 9. Multiple Message, Fixed Block Size

Class B Amplifier: See Figure 12. A current source (CB) is required for this push-pull amplifier.

NOTE

Minimum power is consumed when speech is inactive. When Vp = +12.0 volts and R_s = 40 ohms, the bias current drain is approximately 3.5 milliamps.

Controlling Audio Output Power: See Figure 13. A resistor or potentiometer from the speaker to ground can be used to control the audio output power.

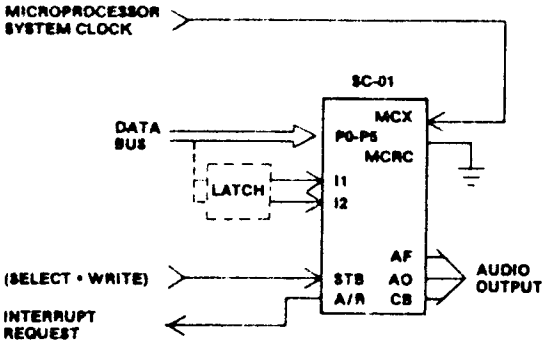


Figure 10. Multiple Message, Variable Block Size

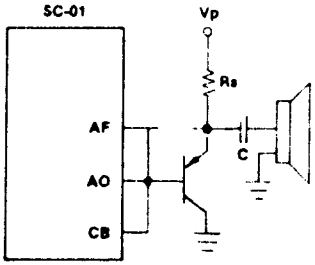


Figure 11. Class A Amplifier

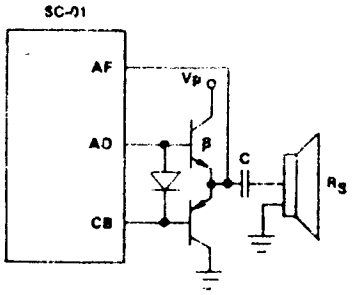


Figure 12. Class B Amplifier*

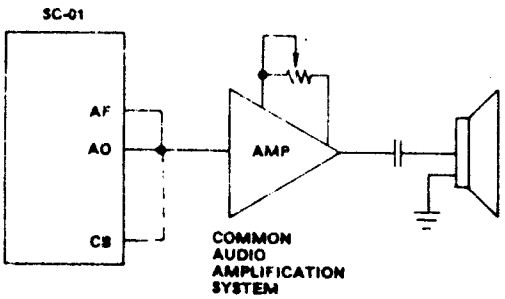


Figure 13. Controlling Audio Output Power

*For Class B Amplifier: (β) x (R_S min.) = 81.6 x (Vp) where β is beta or current gain of transistor. The AO line is protected by an internal series current limiting resistor of 90 ohms maximum. If more current is required of the SC-01, then the above formula

CHARACTERISTIC	MIN	MAX	UNIT
Output Voltage (AH Phoneme)	.18 x Vp	.26 x Vp	Vp-p
Output Bias Current ** (.6V< CB< Vp)	3.5	7.3	mA

ELECTRICAL CHARACTERISTICS: T_o = Ø to 7Ø°C, Vp = 7 to 14 V_{DC}

CHARACTERISTIC		MIN	TYP	MAX	UNIT
Digital Input Impedance		1 meg.			Ohm
Input Capacitance (P_I, STB)				3	pf
Input Capacitance (I1, I2, MCX)				8	pf
Digital Input Logic "Ø" (except I1, I2, MCX)		V_G - Ø.5		V_G + Ø.8	V_{DC}
Digital Input Logic "Ø" (MCX)				V_G + 1.Ø	V_{DC}
Digital Input Logic "Ø" (I1, I2)				.2 x Vp	V_{DC}
Digital Input Logic "1" (except I1, I2, MCX)		V_G + 4.Ø		Vp + Ø.5	V_{DC}
Digital Input Logic "1" (I1, I2)		.8 x Vp			V_{DC}
Digital Input Logic "1" (MCX)		4.6			V_{DC}
Digital Output Logic "Ø" (I sink = Ø.8mA)				V_G+Ø.5	V_{DC}
Digital Output Logic "1" (I source = Ø.5mA)		Vp–Ø.5			V_{DC}
Power Supply Current	Vp = 9V		9.1		mA
	Vp = 9V**		11	18	mA
	Vp = 14V**		18	27	mA
*Master Clock Frequency			720K		Hz
MCX Input Duty Cycle		60:40		40:60	%
Master Clock Resistor Value (MCRC)***		6.5k			Ohm
Master Clock Capacitor Value (MCRC)***				300	pf

**Variable*

***With CB, AF, AO connected for Class B audio amplifier (see APPLICATION NOTES)*

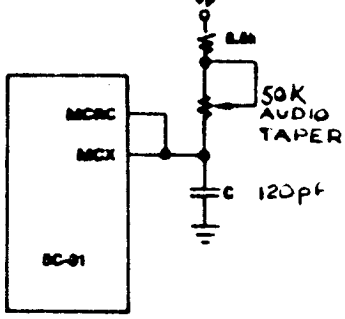
****Frequency of Master Clock* ≃ 1.25 / RC

Note: TP1, TP2 must be left open for normal operation.

RATING	SYMBOL	VALUE	UNIT
Power Supply Voltage	Vp	20	V_{DC}
Power Dissipation at 25°C	P_{DM}	650	mW
Derating Above 25°C		5	mW °C
Operating Ambient Temperature	T_o	0 to 70	°C
Storage Temperature	T_{STG}	−55 to 125	°C
Input Voltage	V_{INM}	−0.5 to Vp+0.5	V_{DC}
DC Current Max. Above Vp+0.5V	I_{INM}	1.0	ma
Lead Temperature (soldering 10 sec.)	T_L	300	°C

* *Operation above these limits could damage the device.*

NORMAL OPERATING CONDITIONS: $7v \leq Vp \leq 14v$, $0°C \leq T_o \leq 70°C$



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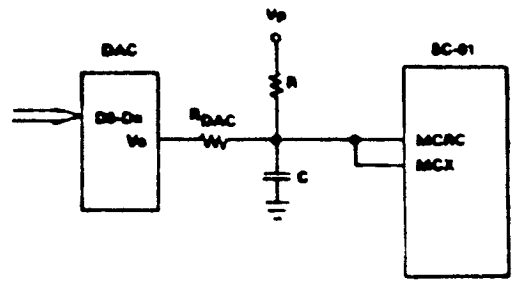

Figure 7. Variable Voice by DAC Current Injection

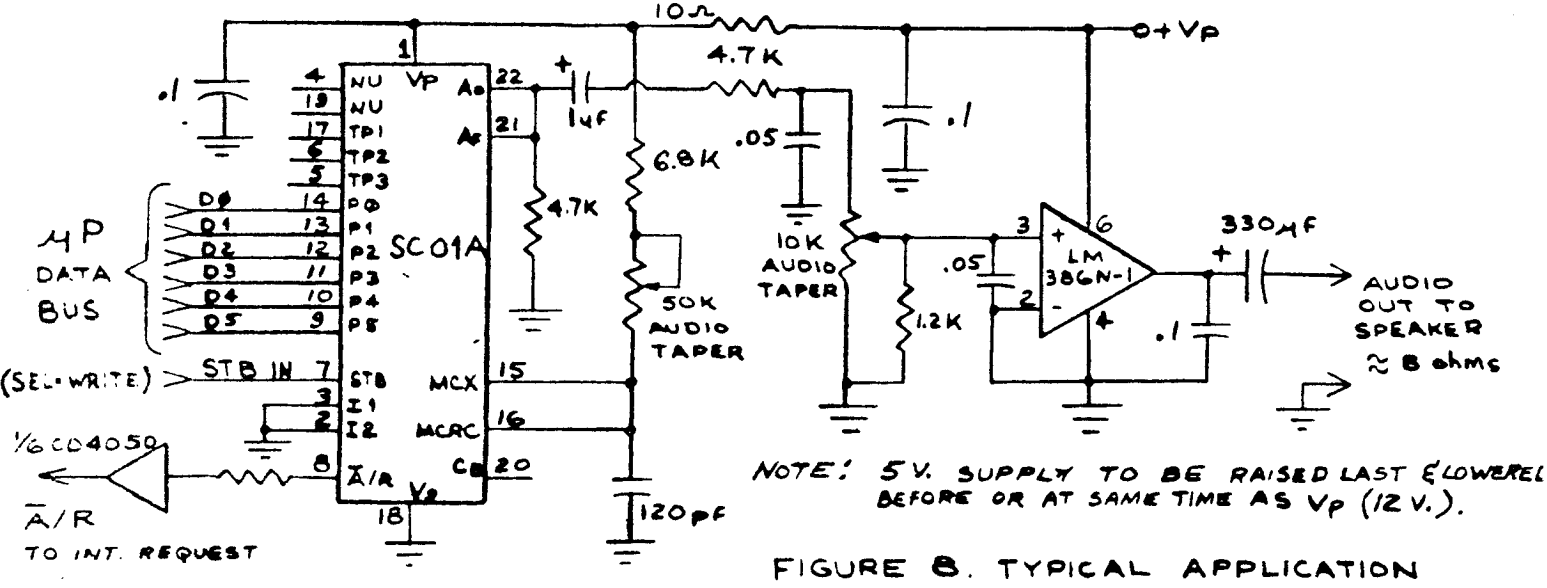

FIGURE 8. TYPICAL APPLICATION

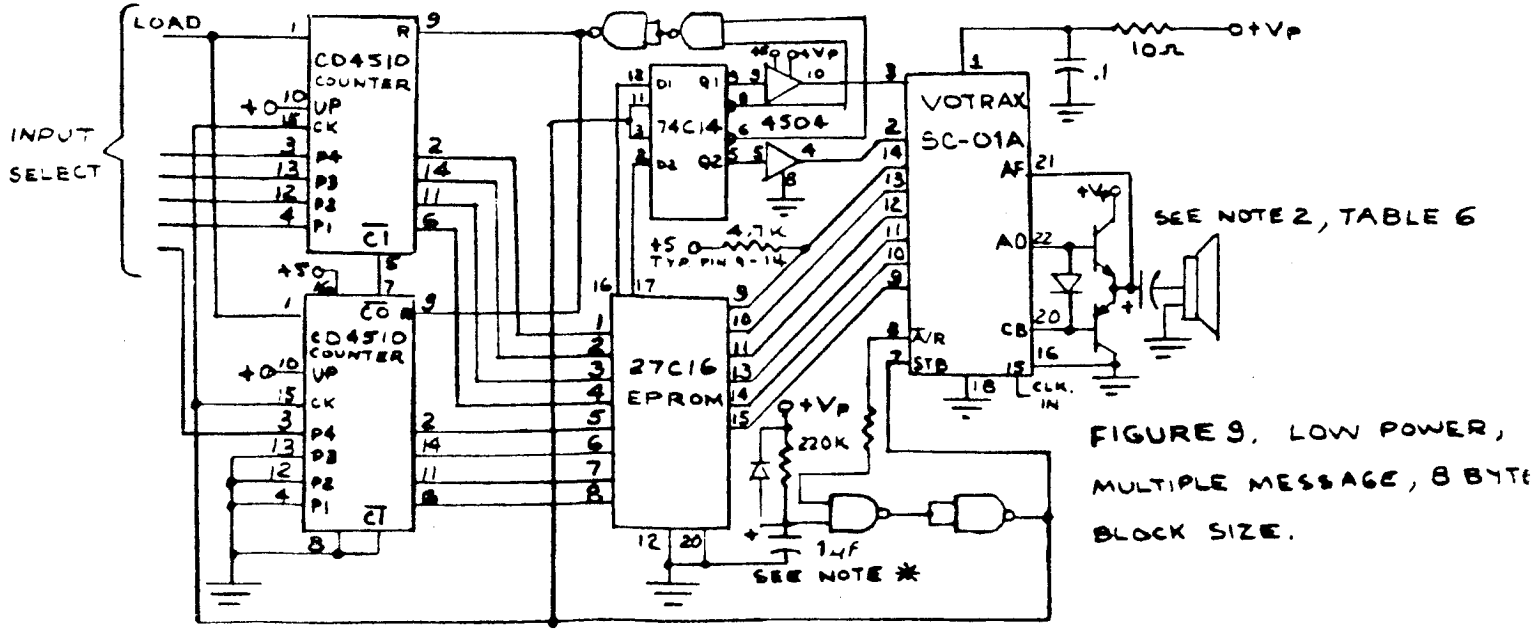

FIGURE 9. LOW POWER, MULTIPLE MESSAGE, 8 BYTE BLOCK SIZE.

NOTE * : CIRCUIT USES A/R LINE AS STROBE. R-C PROVIDES AN INITIAL

Votrax®
A Division of Federal Screw Works
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FEATURES

- Single CMOS chip
- 70 bits per second
- 22 pin package
- 9 ma. current drain
- Wide voltage supply range
- Latched 5V. compatible inputs
- Digital pitch level inputs
- Automatic inflection
- On-chip master clock circuit
- Optional external master clock
- Variety of voice effects
- Sound effects
- Customer product security

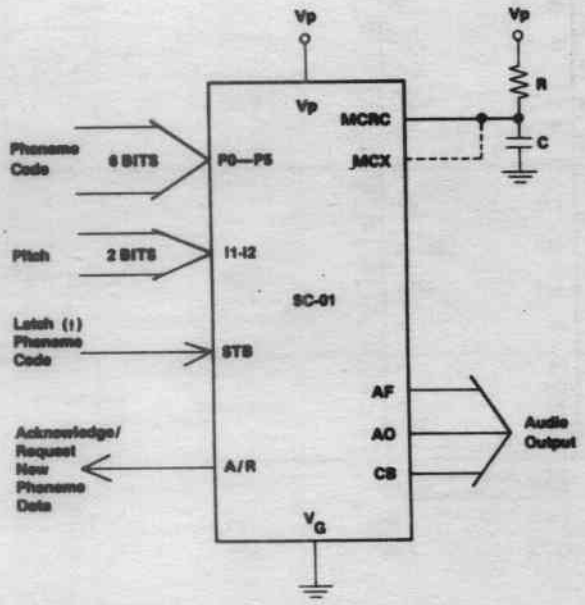

Figure 2. SC-01 Flow Diagram

PHYSICAL DESCRIPTION

The SC-01 Speech Synthesizer is a 22 pin Large Scale Integrated Circuit which contains all the circuitry necessary to generate phonetically synthesized speech. The SC-01 is fabricated using CMOS technology, which offers high input impedance and low power drain.

ELECTRICAL DESCRIPTION

The SC-01 Speech Synthesizer is a program-compatible with existing Votrax® phoneme synthesizers. It requires 70 bits of data per second for continuous speech production. The 6-bit phoneme codes are 5 volt logic compatible and are latched for data bus applications. A phoneme-construction algorithm and filters, within the chip, create the synthesized audio output.

PHONEME DESCRIPTION

Table 1 lists the 64 phonemes produced by the SC-01. Each phoneme code is accompanied by its symbol, average duration time, and an example. The underlined segments of the example word demonstrate the phoneme use, i.e., sound to be pronounced.

Table 2 subdivides the 64 phoneme symbols into seven categories. Each category represents a different production feature. The first six categories are characterized by voiced, fricative (expired voice), and nasal sounds. The seventh category is characterized by phonemes with no sound output.

PHONEME PROGRAMMING

Manual Operations: Votrax® maintains a library of phonetically programmed words. Reference to this library and programming manuals will aid in word synthesis.

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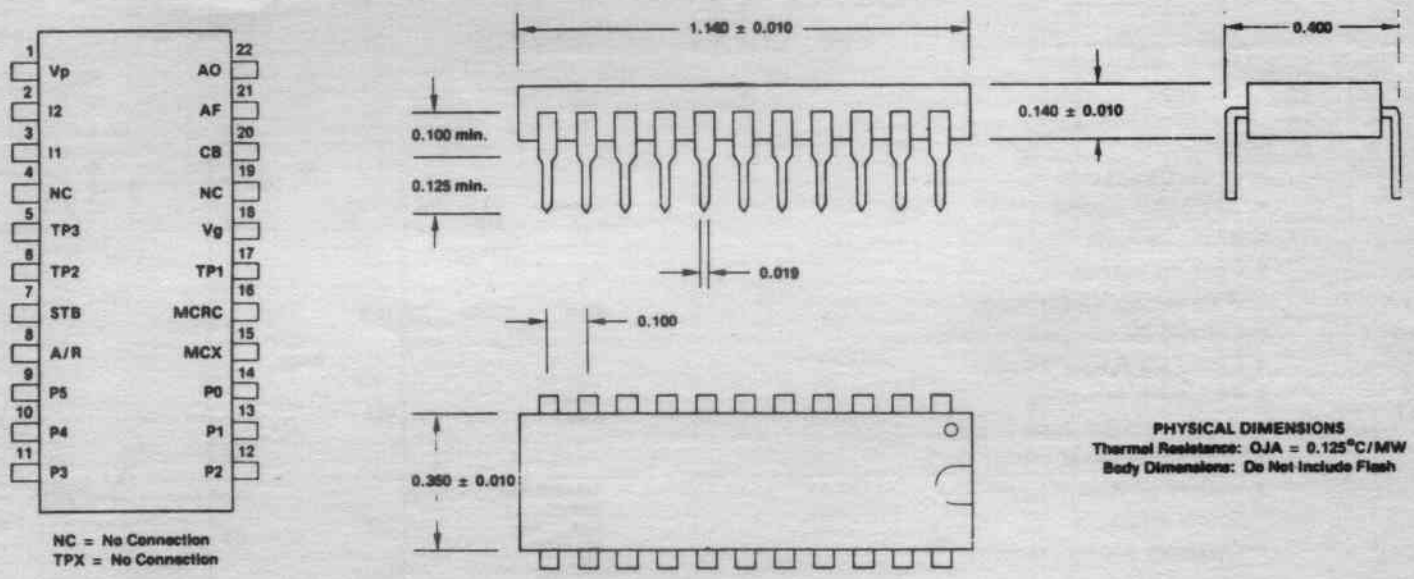

Figure 3. SC-01 Footprint and Outline Dimensions

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Phoneme Code	Phoneme Symbol	Duration (ms)	Example Word
00	EH3	59	jacket
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04	DT	47	butter
05	A2	71	made
06	A1	103	made
07	ZH	90	azure
08	AH2	71	honest
09	I3	55	inhibit
0A	I2	80	inhibit
0B	I1	121	inhibit
0C	M	103	mat
0D	N	80	sun
0E	B	71	bag
0F	V	71	van
10	CH*	71	chip
11	SH	121	shop
12	Z	71	zoo
13	AW1	146	lawful
14	NG	121	thing
15	AH1	146	father
16	OO1	103	looking
17	OO	185	book
18	L	103	land
19	K	80	trick
1A	J*	47	judge
1B	H	71	hello
1C	G	71	get
1D	F	103	fast
1E	D	55	paid
1F	S	90	pass

Phoneme Code	Phoneme Symbol	Duration (ms)	Example Word
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21	AY	65	day
22	Y1	80	yard
23	UH3	47	mission
24	AH	250	mop
25	P	103	past
26	O	185	cold
27	I	185	pin
28	U	185	move
29	Y	103	any
2A	T	71	tap
2B	R*	90	red
2C	E	185	meet
2D	W	80	win
2E	AE	185	dad
2F	AE1	103	after
30	AW2	90	salty
31	UH2	71	about
32	UH1	103	uncle
33	UH	185	cup
34	O2	80	for
35	O1	121	aboard
36	IU	59	you
37	U1	90	you
38	THV	80	the
39	TH	71	thin
3A	ER	146	bird
3B	EH	185	get
3C	E1	121	be
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/D/ must precede /J/ to produce J sound.

Table 2. Phoneme Categories According to Production Features

Voiced					'Voiced' Fricat.	'Voiced' Stop	Fricative Stop	Fricative	Nasal	No Sound
E	EH	AE	UH	OO1	Z	B	T	S	M	PA0
E1	EH1	AE1	UH1	R	ZH	D	DT	SH	N	PA1
Y	EH2	AH	UH2	ER	J	G	K	CH	NG	STOP
Y1	EH3	AH1	UH3	L	V		P	TH		
I	A	AH2	O	IU	THV			F		
I1	A1	AW	O1	U				H		
I2	A2	AW1	O2	U1						
I3	AY	AW2	OO	W						

SIGNAL DESCRIPTION (See Figures 4 and 5)

Phoneme 6-Bit Selection Code (PØ-P5): Data input is to six pins. Latching is controlled by the strobe (STB) signal.

Strobe (STB): Latching occurs on rising edge of strobe signal.

Inflection Level Setting (I1, I2): Instantaneously sets pitch level of voiced phonemes.

Acknowledge/Request ($\bar{A}$/R): Acknowledges receipt of phoneme data (signal goes from high to low one master clock cycle following active edge of STB signal). Also indicates timing out of old phoneme concurrent with request for new phoneme data (signal goes from low to high).

NOTE

If external phoneme timing is desired, phoneme requests can be ignored. However, best speech is realized with internal timing.

Master Clock Resistor-Capacitor (MCRC): This input determines the internal master clock frequency. Select R-C values for 720 kHz to achieve standard phoneme timing. Connect this input to MCX when using internal clock; ground when using external clock.

NOTE

Varying clock frequency varies voice and sound effects. As clock frequency decreases, audio frequency decreases and phoneme timing lengthens. Figures 6 and 7 illustrate manual and DAC (Digital to Analog Converter) voice variation schematics, respectively.

Master Clock External (MCX): Allows control by an external clock signal.

NOTE

Ground MCRC during MCX operation.

Audio Output (AO): Supplies analog signal to audio output device.

Audio Feedback (AF): Used with Class A or Class B transistor audio amplifiers for added stability.

Class B (CB): Current source for Class B transistor audio amplifier.

Table 3. Timing Specifications

CHARACTERISTIC	SYMBOL	MIN	TYP	MAX	UNIT
Input Setup Time (P_I to STB)	T_S	450			NS
Input Hold Time (P_I to STB)	T_H	Ø			NS
Rise Time of STB Edge (.8V to 4V)	T_{RS}			100	NS
A/R Width ($\bar{A}$/R Connected to STB) +	T_{ARW}	1	1.3	2	µs
STB Width	T_{SW}	200			NS
STB Low*	T_{SL}				NS
Propagation Delay (STB to A/R after T_{ARW})	T_{DAR}			500	NS
A/R Rise Time (Capacitive load = 30pf)	T_{RAR}			100	NS
A/R Fall Time (Capacitive load = 30pf)	T_{FAR}			100	NS
Time from $\bar{A}$/R Request to STB Service)	T_{ARS}	Ø		500	µs
Time of Phoneme Duration +	T_{PH}	47	107	250	MS

+ Dependent on Master Clock frequency: 720kHz

* Strobe must remain low (72x Master Clock Period) before rising edge

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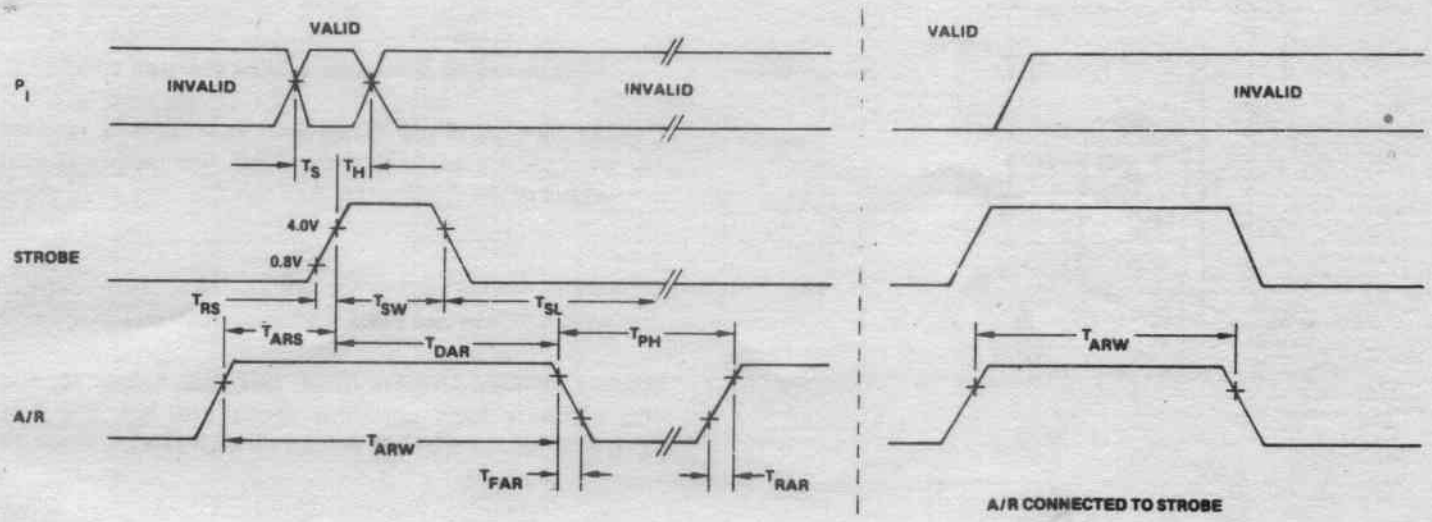

Figure 4. Timing Diagram

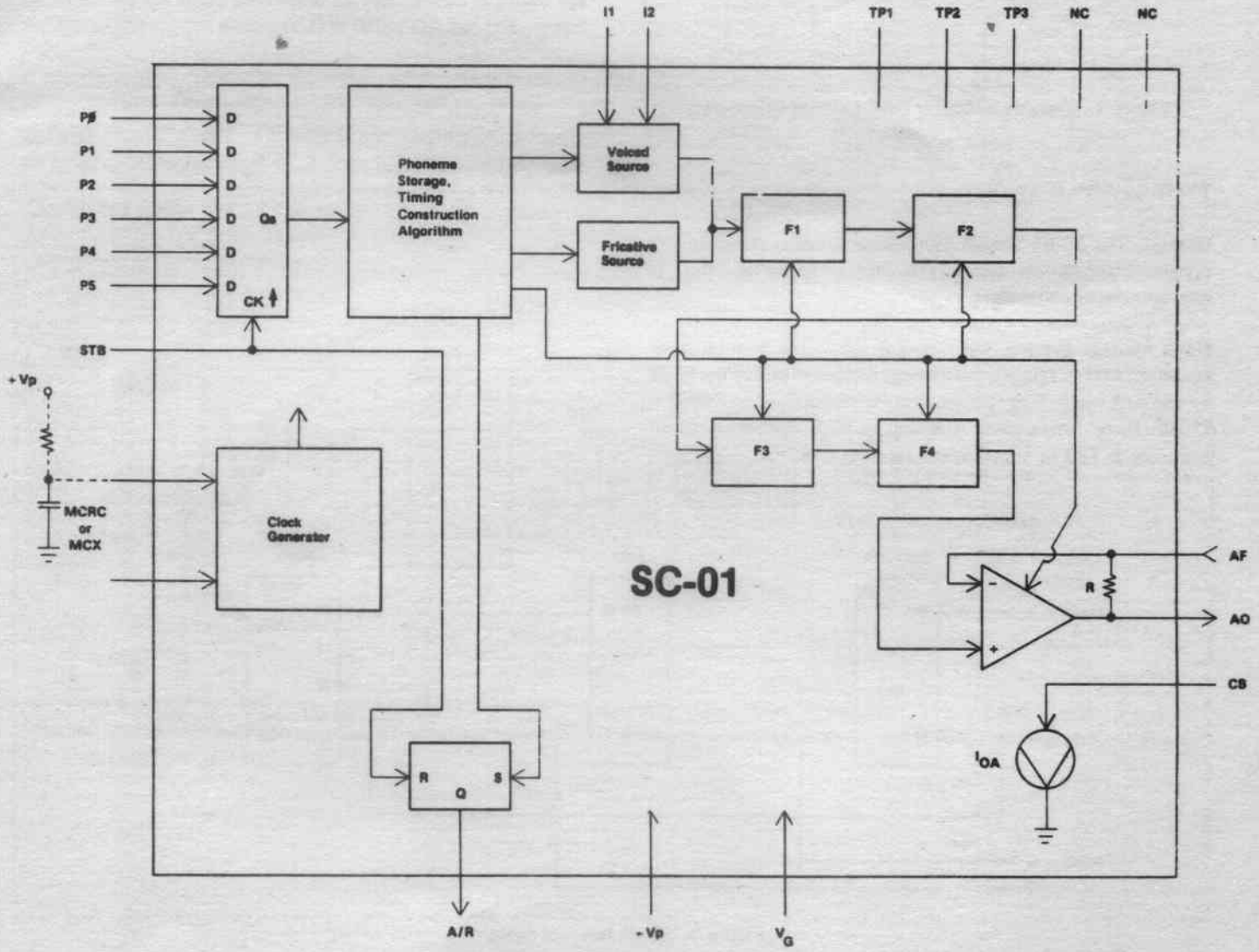

Figure 5. SC-01 Block Diagram

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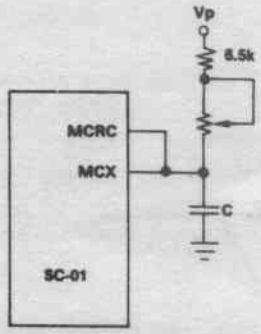

Figure 6. Variable Voice by Potentiometer Control

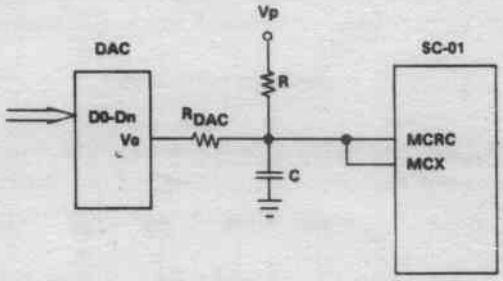

Figure 7. Variable Voice by DAC Current Injection

TYPICAL APPLICATIONS

General: The SC-01 Speech Synthesizer is easily designed into systems ranging in complexity from ROM/counters to microprocessor controllers.

Single Message System: See Figure 8. When the counter is released (START is TRUE), the message is clocked out of the ROM by the A/R signal. The system must be stopped when DONE is TRUE. Note: When using A/R tied to STB, connect a .01 uf capacitor to TP3 to insure power up reset of SC-01.

NOTE

Data at address Ø must be a pause phoneme code.

Multiple Message, Fixed Block Size: See Figure 9. Message address block is loaded into the counter. The message is then clocked out of the ROM by the A/R signal.

NOTE

Message Block = 2^n maximum.

Multiple Message, Variable Block Size: See Figure 10. The microprocessor loads phonemes into a data bus. The A/R signal generates an interrupt request for each new phoneme.

CONNECTING THE AUDIO OUTPUT DEVICE

Audio Output: The AO signal has a maximum peak to peak voltage swing of .26 times Vp, depending upon the phoneme selected, and the AO signal is D.C. biased.

Class A Amplifier: See Figure 11. For a single transistor amplifier, the selection of R, C, or R_s values depends upon the value of Vp and the desired audio level.

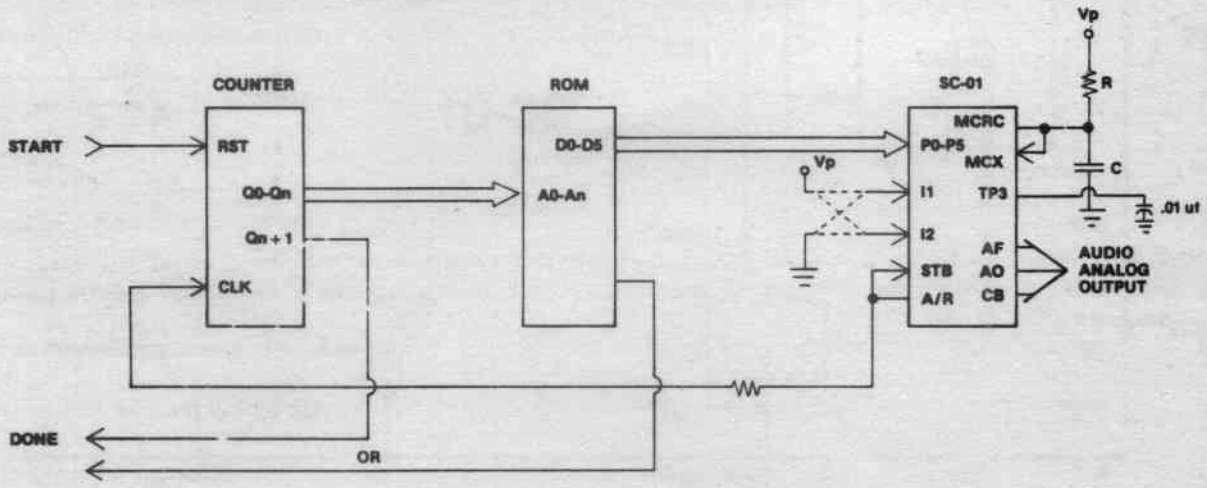

Figure 8. Single Message System

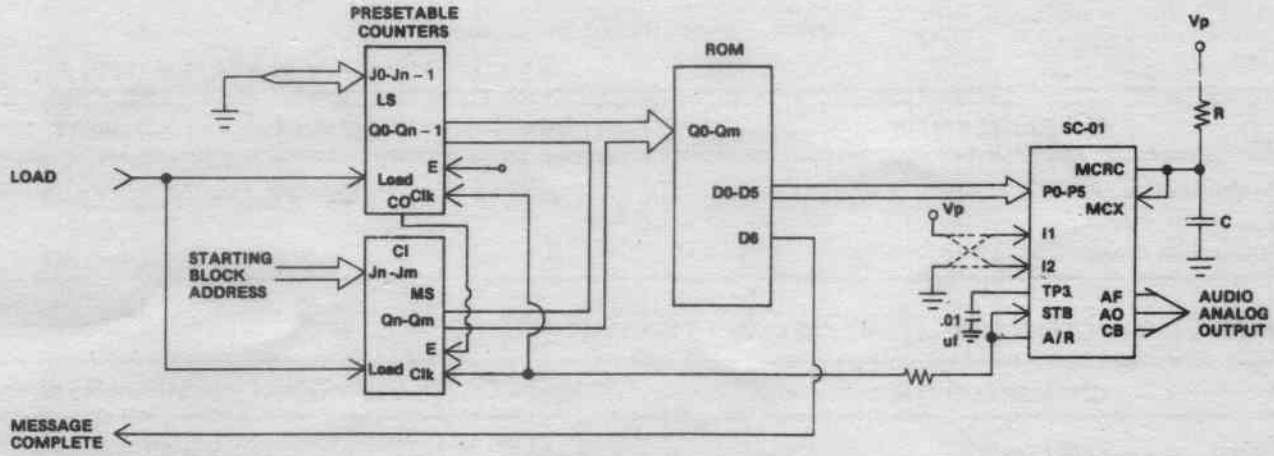

Figure 9. Multiple Message, Fixed Block Size

Class B Amplifier: See Figure 12. A current source (CB) is required for this push-pull amplifier.

NOTE

Minimum power is consumed when speech is inactive. When Vp = +12.0 volts and R_s = 40 ohms, the bias current drain is approximately 3.5 milliamps.

Controlling Audio Output Power: See Figure 13. A resistor or potentiometer from the speaker to ground can be used to control the audio output power.

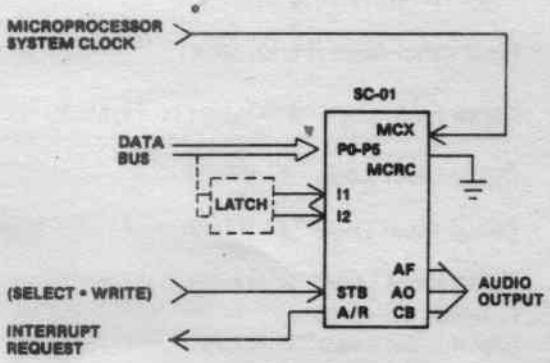

Figure 10. Multiple Message, Variable Block Size

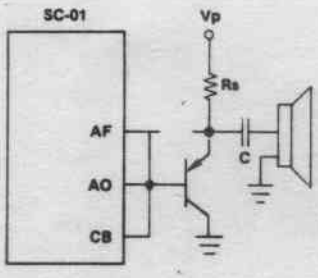

Figure 11. Class A Amplifier

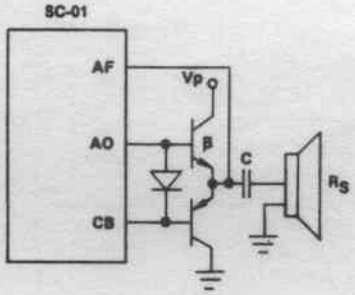

Figure 12. Class B Amplifier*

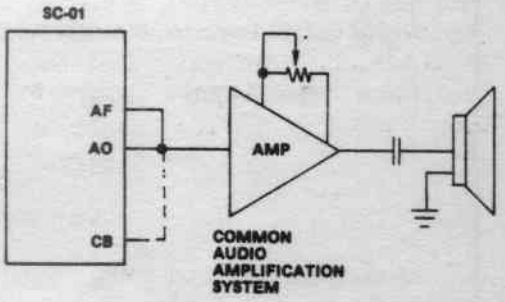

Figure 13. Controlling Audio Output Power

*For Class B Amplifier: (β) x (R_S min.) = 81.6 x (Vp) where β is beta or current gain of transistor. The AO line is protected by an internal series current limiting resistor of 90 ohms maximum. If more current is required of the SC-01, then the above formula indicates distortion will occur.

Table 4. Analog Output Specifications

CHARACTERISTIC	MIN	MAX	UNIT
Output Voltage (AH Phoneme)	.18 x Vp	.26 x Vp	Vp-p
Output Bias Current ** (.6V < CB < Vp)	3.5	7.3	mA

ELECTRICAL CHARACTERISTICS: T_o = Ø to 70°C, Vp = 7 to 14 V_{DC}

CHARACTERISTIC		MIN	TYP	MAX	UNIT
Digital Input Impedance		1 meg.			Ohm
Input Capacitance (P_1, STB)				3	pf
Input Capacitance (I1, I2, MCX)				8	pf
Digital Input Logic "Ø" (except I1, I2, MCX)		V_G - Ø.5		V_G + Ø.8	V_{DC}
Digital Input Logic "Ø" (MCX)				V_G + 1.Ø	V_{DC}
Digital Input Logic "Ø" (I1, I2)				.2 x Vp	V_{DC}
Digital Input Logic "1" (except I1, I2, MCX)		V_G + 4.Ø		Vp + Ø.5	V_{DC}
Digital Input Logic "1" (I1, I2)		.8 x Vp			V_{DC}
Digital Input Logic "1" (MCX)		4.6			V_{DC}
Digital Output Logic "Ø" (I sink = Ø.8mA)				V_G+Ø.5	V_{DC}
Digital Output Logic "1" (I source = Ø.5mA)		Vp–Ø.5			V_{DC}
Power Supply Current	Vp = 9V		9.1		mA
	Vp = 9V**		11	18	mA
	Vp = 14V**		18	27	mA
*Master Clock Frequency			720K		Hz
MCX Input Duty Cycle		60:40		40:60	%
Master Clock Resistor Value (MCRC)***		6.5k			Ohm
Master Clock Capacitor Value (MCRC)***				300	pf

**Variable*

***With CB, AF, AO connected for Class B audio amplifier (see APPLICATION NOTES)*

****Frequency of Master Clock* ≃ 1.25 / RC

Note: TP1, TP2 must be left open for normal operation.

Table 5. Absolute Maximum Ratings

ABSOLUTE MAXIMUM RATINGS *

RATING	SYMBOL	VALUE	UNIT
Power Supply Voltage	Vp	20	V_{DC}
Power Dissipation at 25°C	P_{DM}	650	mW
Derating Above 25°C		5	mW °C
Operating Ambient Temperature	T_o	Ø to 7Ø	°C
Storage Temperature	T_{STG}	−55 to 125	°C
Input Voltage	V_{INM}	−Ø.5 to Vp+Ø.5	V_{DC}
DC Current Max. Above Vp+Ø.5V	I_{INM}	1.Ø	ma
Lead Temperature (soldering 1Ø sec.)	T_L	3ØØ	°C

* *Operation above these limits could damage the device.*

NORMAL OPERATING CONDITIONS: $7v \leq Vp \leq 14v$, $0°C \leq T_o \leq 70°C$

PHONETIC SPEECH DICTIONARY for the SC-01 SPEECH SYNTHESIZER

500 Stephenson Highway, Troy, MI 48084
(800) 521-1350 (313) 588-0341

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INTRODUCTION

VOTRAX® Speech Synthesis Technology produces each of the 45 basic speech sounds, called phonemes. This handy dictionary gives you quick access to the VOTRAX® phoneme sequences used to create approximately 1400 words. Because VOTRAX® speech synthesis uses these basic phonetic sounds, you may program virtually any word in the English language by learning to use and combine the various phoneme codes.

This dictionary is intended for use with the SC-01 Speech Synthesizer. It can also serve as a guide for programming any product containing a VOTRAX® synthesizer.

GENERAL DESCRIPTION OF THE SC-01 CHIP

The SC-01 Speech Synthesizer is a completely self-contained solid state device. This single chip phonetically synthesizes continuous speech, of unlimited vocabulary, from low data rate inputs.

Speech is synthesized by combining phonemes (the building blocks of speech) in the appropriate sequence. The SC-01 Speech Synthesizer contains 64 different phonemes which are accessed by a 6-bit code. It is the proper sequential combination of these phoneme codes that creates continuous speech.

PHONEME DESCRIPTION

Table 1 lists the 64 phonemes produced by the SC-01. Each sound is represented by its VOTRAX® phoneme code and is accompanied by its phoneme symbol and an example. The underlined segments of the example word demonstrate the phoneme use, i.e., sound to be pronounced.

Table 2 provides the phoneme sequences used to produce vowels in the group called dipthongs, (2 vowel sounds in sequence, identified as a single sound, e.g., the long "i" vowel).

TABLE 1: PHONEME CHART

Phoneme Code	Phoneme Symbol	Duration (ms)	Example Word
ØØ	EH3	59	jacket
Ø1	EH2	71	enlist
Ø2	EH1	121	heavy
Ø3	PAØ	47	no sound
Ø4	DT	47	butter
Ø5	A2	71	made
Ø6	A1	103	made
Ø7	ZH	90	azure
Ø8	AH2	71	honest
Ø9	13	55	inhibit
ØA	12	80	inhibit
ØB	11	121	inhibit
ØC	M	103	mat
ØD	N	80	sun
ØE	B	71	bag
ØF	V	71	van
1Ø	CH*	71	chip
11	SH	121	shop
12	Z	71	zoo
13	AW1	146	lawful
14	NG	121	thing
15	AH1	146	father
16	001	103	looking
17	00	185	book
18	L	103	land
19	K	80	trick
1A	J*	47	judge
1B	H	71	hello
1C	G	71	get
1D	F	103	fast
1E	D	55	paid
1F	S	90	pass

/T/ must precede /CH/ to produce CH sound.

/D/ must precede /J/ to produce J sound.

TABLE 1: PHONEME CHART

Phoneme Code	Phoneme Symbol	Duration (ms)	Example Word
2Ø	A	185	day
21	AY	65	day
22	Y1	80	yard
23	UH3	47	mission
24	AH	250	mop
25	P	103	past
26	O	185	cold
27	I	185	pin
28	U	185	move
29	Y	103	any
2A	T	71	tap
2B	R	90	red
2C	E	185	meet
2D	W	80	win
2E	AE	185	dad
2F	AE1	103	after
30	AW2	90	salty
31	UH2	71	about
32	UH1	103	uncle
33	UH	185	cup
34	02	80	for
35	01	121	aboard
36	IU	59	you
37	U1	90	you
38	THV	80	the
39	TH	71	thin
3A	ER	146	bird
3B	EH	185	get
3C	E1	121	be
3D	AW	253	call
3E	PA1	185	no sound
3F	STOP	47	no sound

TABLE 2: DIPTHONG CHART

Phoneme Combination	Key Words
A1-AY-Y	fate, maid
AH1-EH3-Y	find, wide
UH3-AH2-Y	fight, white
AH1-I3-UH3-L	file, smile
01-UH3-Y	foy, boy
01-I3-UH3-L	foil, spoil
AH1-02-U1	found, cow
UH3-AH2-U1	foust, house
O1-U1	float, note
Y1-IU-U1	few, you, music
AY-I1	fear, beer

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Phonetic Programs

A	A1, AY, Y
a-2	UH2, UH3
able	A1, Y, B, UH3, L
abort	UH1, B, O2, O2, R, T
about	UH1, B, UH2, AH2, U1, T
above	UH1, B, UH1, UH3, V
accept	EH1, K, PAO, S, EH1, EH3, P, T
access	AE1, EH3, K, PAO, S, EH1, EH3, S
account	UH1, K, AH1, UH3, W, N, T
acid	AE1, EH3, S, I1 D
act	AE1, EH3, K, T
active	AE1, EH3, K, T, I1, V
actual	AE1, EH3, K, T, CH, U1, UH3, L
add	AE1, EH3, D
address	AE1, EH3, D, R, EH1, EH3, S
ade	(use "aid" program)
adjust	UH1, D, J, UH1, UH3, S, T
adjucent	UH1, D, J, A1, AY, S, EH3, N, T
advance	AE1, EH3, D, V, AE1, EH3, N, T, S
advise	AE1, EH3, D, V, AH1, EH3, Y, Z
affect	UH1, F, EH1, EH3, K, T
after	AE1, EH3, F, T, ER
again	UH1, G, A2, EH1, N
age	A1, AY, Y, D, J
agent	A1, Y, D, J, EH3, N, T
ahead	UH1, H, EH1, EH3, D
aid	A1, AY, Y, D
air	EH2, EH2, R
alarm	UH1, L, AH1, R, M
alert	UH1, L, ER, R, T
all	AW, L
allocate	AE1, UH3, L, UH2, K, A1, Y, T
allow	UH1, L, AH1, UH3, U1
alpha	AE1, AW2, L, F, UH1
already	AW, L, R, EH1, EH3, D, Y
also	AW, L, S, O1, U1
altitude	AE1, UH3, L, T, I2, T, IU, U1, U1, D
aluminum	UH1, L, IU, U1, M, I3, N, UH1, M
am	AE1, EH3, M

america	UH1, M, EH1, R, I3, K, UH2, UH3
amount	UH1, M, AH1, UH3, W, N, T
amp	AE1, EH3, M, P
amplify	AE1, EH3, M, P, L, I3, F, AH1, EH3, AY
an	AE1, EH3, N
and	AE1, EH3, N, D
angle	AE1, EH3, NG, G, UH3, L
another	UH1, N, UH1, UH3, THV, ER
answer	AE1, EH3, N, S, ER
any	EH2, EH2, N, Y
apostrophe	UH1, P, AH1, UH3, S, T, R, UH3, F, Y
approach	UH1, P, R, O1, U1, T, CH
approve	UH1, P, R, IU, U1, U1, V
approximate	UH1, P, R, AH1, K, PAO, S, EH3, M, I3, T
approximate-2	UH1, P, R, AH1, K, PAO, S, EH3, M, A2, Y, T
april	A1, Y, P, R, UH2, L
architect	AH1, R, K, UH2, T, EH3, EH2, K, T
are	(see "R" program)
area	EH1, EH3, R, Y, UH1
arrive	UH1, R, AH1, EH3, Y, V
arrow	EH1, EH3, R, O1, U1
article	AH1, R, T, EH3, K, UH3, L
as	AE1, EH3, Z
ASCII	AE1, EH3, S, K, Y
ask	AE1, EH3, S, K
assemble	UH1, S, EH1, EH3, M, B, UH3, L
asset	AE1, EH3, S, EH1, T
assign	UH1, S, AH1, EH3, Y, N
assist	UH1, S, I1, I3, S, T
associate	UH1, S, O1, SH, Y, A1, Y, T
associate-2	UH1, S, O1, SH, Y, I2, T
assume	UH1, S, IU, U1, M
at	AE1, EH3, T
ate	(see "eight" program)
attach	UH1, T, AE1, EH3, T, CH
attempt	UH1, T, EH1, EH3, M, P, T
attend	UH1, T, EH1, EH3, N, D
audio	AW, D, Y, O1, U1

august	AW2, AW2, G, EH2, S, T
authorize	AW2, AW2, TH, ER, AH1, Y, Z
automatic	AW2, AW2, DT, UH3, M, AE1, EH3, DT, I3, K
available	UH1, V, A1, Y, L, UH3, B, UH3, L
average	AE1, EH3, V, R, I1, D, J
avoid	UH1, V, O1, UH3, I3, AY, D
B	B, E1, Y
back	B, AE1, AE1, K
bad	B, AE1, AE1, D
badge	B, AE1, AE1, D, J
bag	B, AE1, AE1, G
balance	B, AE1, AH2, L, I3, N, DT, S
ball	B, AW2, AW1, L
band	B, AE1, EH3, N, D
bank	B, AE1, I3, NG, K
bar	B, AH1, UH3, R
base	B, A1, AY, Y, S
basic	B, A1, Y, S, I2, K
bat	B, AE1, EH3, T
batch	B, AE1, EH3, T, CH
bath	B, AE1, AE1, EH3, TH
battery	B, AE1, EH3, T, ER, Y
be	(use "B" program)
bed	B, EH1, EH3, D
been	B, EH1, EH3, N
beep	B, E1, Y, P
before	B, Y, F, O2, O2, R
begin	B, Y, G, I1, I3, N
bell	B, EH1, UH3, L
below	B, Y, L, UH3, O2, U1
bend	B, EH1, EH3, N, D
best	B, EH1, EH3, S, T
beta	B, A2, A2, AY, T, UH2
better	B, EH1, EH3, T, ER
between	B, Y, T, W, E1, Y, N
bid	B, I1, I3, D
big	B, I1, I3, G
bill	B, I1, I3, L
billion	B, I1, I3, L, Y, UH3, N
bin	B, I1, I3, N
binary	B, AH1, Y, N, EH3, EH3, ER, Y

birthday	B, ER, R, TH, D, A1, I3, Y
bit	B, I1, I3, T
bite	B, UH3, AH2, Y, T
black	B, L, AE1, EH3, K
blank	B, L, AE1, EH3, NG, K
blew	(use "blue" program)
blind	B, L, AH1, EH3, Y, N, D
block	B, L, AH1, UH3, K
blown	B, L, O1, U1, N
blue	B, L, IU, U1, U1
blur	B, L, ER, R
board	B, O1, O2, R, D
bolt	B, O2, O2, L, T
bond	B, AH1, UH3, N, D
book	B, OO1, OO1, K
bored	(use "board" program)
boss	B, AW1, AW2, S
bother	B, AH1, UH3, THV, ER
bottom	B, AH1, UH3, T, UH1, M
bought	B, AW1, AW2, T
box	B, AH1, UH3, K, PAO, S
brace	B, R, A1, Y, S
brain	B, R, A1, Y, N
brake	B, R, A1, Y, K
branch	B, R, AE1, EH3, N, T, CH
bravo	B, R, AH1, UH3, V, O1, U1
break	(use "brake" program)
bridge	B, R, I1, I3, D, J
brief	B, R, AY, Y, F
bright	B, R, UH3, AH2, Y, T
bring	B, R, I1, I3, NG
broke	B, R, O1, U1, K
brought	B, R, AW, T
brown	B, R, AH1, UH3, U1, N
bubble	B, UH1, UH2, B, UH3, L
budget	B, UH1, UH3, D, J, I2, T
bug	B, UH1, UH2, G
build	B, I2, I2, L, D
bus	B, UH1, UH2, S
business	B, I3, I3, Z, N, EH2, S
busy	B, I3, I2, Z, Y
but	B, UH1, UH2, T
button	B, UH1, UH3, T, EH3, N
buy	B, AH1, EH3, I3, Y

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by	B, AH1, EH3, I3, Y
bye	B, AH1, EH3, I3, Y
byte	(use "bite" program)
C	S, E1, Y
cable	K, A1, Y, B, UH3, L
calendar	K, AE1, UH3, L, I3, N, D, ER
calibrate	K, AE1, UH3, L, UH3, B, R, A1, Y, T
call	K, AW2, AW1, L
came	K, A1, AY, Y, M
can	K, AE1, EH3, N
cancel	K, AE1, EH3, N, S, UH3, L
capable	K, A1, Y, P, UH3, B, UH3, L
capacitor	K, UH2, P, AE1, EH3, S, EH3, T, ER
capacity	K, UH2, P, AE1, EH3, S, I3, DT, Y
car	K, AH1, UH3, R
card	K, AH1, R, D
care	K, EH3, EH3, ER
carpenter	K, AH1, R, P, I3, N, D, ER
carriage	K, EH2, EH3, R, I1, D, J
carry	K, EH2, EH3, R, Y
carton	K, AH1, R, T, I3, N
case	K, A1, AY, Y, S
cash	K, AE1, EH3, SH
cassette	K, UH1, S, EH1, EH3, T
cassette-2	K, A2, AY, S, EH1, EH2, T
category	K, AE1, EH3, DT, UH3, G, O1, R, Y
catalog	K, AE1, EH3, DT, UH3, L, AW2, AW2, G
caution	K, AW2, AW1, SH, UH3, N
cent	S, EH1, EH3, N, T
center	S, EH1, EH3, N, T, ER
centi	S, EH1. EH3, N, T, I1, I3
centigrade	S, EH1, N, T, I3, G, R, A1, Y, D
certify	S, R, R, T, I3, F, AH1, Y
change	T, CH, A1, AY, Y, N, D, J
character	K, EH1, R, EH1, K, T, ER
charge	T, CH, AH1, R, D, J
charlie	T, CH, AH1, R, L, Y
chart	T, CH, AH1, R, T

check	T, CH, EH1, EH3, K
cheer	T, CH, AY, I2, R
chip	T, CH, I1, I3, P
choice	T, CH, O1, UH3, I3, AY, S
circle	S, ER, R, K, UH3, L
circuit	S, R, R, K, I2, T
city	S, I1, T, Y
claim	K, L, A1, AY, Y, M
class	K, L, AE1, EH3, S
clean	K, L, E1, AY, N
clear	K, L, AY, I3, R
clerk	K, L, ER, K
clip	K, L, I1, I3, P
clock	K, L, AH1, UH3, K
close	K, L, UH3, O1, U1, Z
close-2	K, L, UH3, O2, U1, S
cloud	K, L, AH1, UH3, W, D
coarse	K, O1, O2, R, S
code	K, OO1, O2, U1, D
coin	K, O1, UH3, I3, AY, N
collar	K, AH1, UH3, L, ER
collect	K, UH1, L, EH1, K, T
colon	K, OO1, O2, U1, L, I2, N
color	K, UH2, UH2, L, ER
column	K, AH1, UH3, L, UH3, M
combine	K, UH2, M, B, AH1, EH3, Y, N
comma	K, AH1, UH3, M, UH1
command	K, UH2, M, AE, EH3, N, D
commerce	K, AH1, UH3, M, ER, S
commercial	K, UH1, UH3, M, ER, SH, UH3, L
communicate	K, UH2, M, Y1, IU, U1, N, I3, K, A1, Y, T
company	K, UH1, UH3, M, P, EH3, N, Y
compare	K, UH1, UH3, M, P, EH3, EH3, ER
compile	K, UH1, UH3, M, P, AH1, EH3, I3, UH3, L
complete	K, UH1, UH3, M, P, L, AY, Y, T
comply	K, UH1, UH3, M, P, L, AH1, EH3, Y
component	K, UH2, M, P, O2, O1, N, EH2, N, T
computer	K, UH1, M, P, Y1, IU, U1, T, ER

conceal	K, UH1, N, S, E1, AY, L
condense	K, UH1, N, D, EH1, EH3, N, S
condition	K, UH1, N, D, I1, I3, SH, UH3, N
confirm	K, UH1, N, F, ER, R, M
confuse	K, UH1, N, F, Y1, IU, U1, U1, Z
confusion	K, UH1, N, F, Y1, IU, U1, U1, ZH, UH3, N
congratulations	K, UH1, N, G, R, AE1, D, J, UH3, L, A1, AY, SH, UH3, N, Z
connect	K, UH1, N, EH1, EH3, K, T
console	K, AH1, UH3, N, S, O1, U1, L
console-2	K, UH1, N, S, O1, O2, L
consult	K, UH1, N, S, UH1, UH2, L, T
consume	K, UH1, N, S, IU, U1, U1, M
contain	K, UH3, UH3, N, T, A1, AY, Y, N
continue	K, UH1, N, T, I1, I3, N, Y1, IU, U1
contract	K, AH1, UH3, N, T, R, AE1, EH3, K, T
contrast	K, AH1, UH3, N, T, R, AE1, EH3, S, T
control	K, UH1, N, T, R, O1, O2, L
convenient	K, UH2, N, V, E1, N, AY, EH3, N, T
copper	K, AH1, UH3, P, ER
copy	K, AH1, UH3, P, Y
correct	K, O2, O2, R, EH1, EH3, K, T
correspond	K, O1, R, I3, S, P, AH1, AH2, N, D
cosine	K, O1, U1, S, AH1, Y, N
cost	K, AW2, AW1, S, T
could	K, IU, IU, OO1, D
count	K, AH1, UH3, W, N, T
country	K, UH1, N, T, R, Y
couple	K, UH3, UH1, P, UH3, L
courage	K, ER, R, I3, D, J
course	K, O1, O2, R, S
court	K, O1, O2, R, T
cover	K, UH1, UH3, V, ER
crane	K, R, A1, AY, Y, N
crash	K, R, AE1, EH3, SH
crease	K, R, E1, Y, S
create	K, R, Y, A1, Y, T
creation	K, R, Y, A1, Y, SH, UH3, N

credit	K, R, EH1, EH3, D, I1, T
crew	K, R, IU, U1, U1
critical	K, R, I1, T, I3, K, UH3, L
cross	K, R, AW, S
crowd	K, R, AH1, UH3, U1, D
cry	K, R, AH1, EH3, I3, Y
cue	(use "Q" program)
cup	K, UH1, UH2, P
curious	K, Y, ER, Y, UH1, S
current	K, ER, R, EH3, N, T
currency	K, ER, R, I2, N, DT, S, Y
curse	K, ER, R, S
curve	K, ER, R, V
customer	K, UH1, UH2, S, T, UH1, M, ER
cut	K, UH1, UH2, T
cycle	S, UH3, AH2, Y, K, UH3, L
D	D, E1, Y
daily	D, A1, AY, Y, L, Y
damage	D, AE1, EH3, M, I1, D, J
danger	D, A1, AY, Y, N, D, J, ER
dark	D, AH1, R, K
dash	D, AE1, EH3, SH
data	D, A1, Y, DT, UH1
date	D, A1, AY, Y, T
day	D, A1, I3, Y
dead	D, EH1, EH3, F
dealer	D, E1, AY, L, ER
dear	D, AY, I3, R
debit	D, EH1, EH3, B, I2, T
debt	D, EH1, EH3, T
december	D, Y, S, EH1, EH3, M, B, ER
decide	D, Y, S, AH1, EH3, Y, D
decimal	D, EH1, S, M, UH3, L
decision	D, Y, S, I1, ZH, UH3, N
decline	D, Y, K, L, AH1, EH3, Y, N
decrease	D, Y, K, R, E1, Y, S
deduct	D, Y, D, UH1, UH2, K, T
deep	D, E1, Y, P
deer	(use "dear" program)
defeat	D, Y, F, E1, AY, T
defend	D, Y, F, EH1, EH3, N, D
defensive	D, Y, F, EH1, EH3, N, S, I1, V
defer	D, E1, F, ER, R

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deficit	D, EH1, F, I3, S, I1, T
degree	D, Y, G, R, E1, Y
delay	D, I1, L, EH3, A1, Y
delete	D, E1, L, E1, Y, T
deliver	D, Y, L, I1, V, ER
delta	D, EH2, EH3, L, T, UH1
demand	D, Y, M, AE1, EH3, N, D
demonstrate	D, EH1, M, UH3, N, S, T, R, A1, Y, T
deny	D, Y, N, AH1, EH3, Y
destroy	D, Y, S, T, R, O1, UH3, I3, AY
detail	D, E, T, EH3, A1, I3, UH3, L
determine	D, Y, T, ER, M, I1, N
device	D, Y, V, UH3, AH2, Y, S
dew	(use "do" program)
diagnostic	D, AH1, AY, I3, G, N, AH1, UH3, S, T, I3, K
dial	D, AH1, EH3, I3, UH3, L
dictionary	D, I1, I3, K, SH, UH3, N, EH3, EH3, ER, Y
did	D, I1, I3, D
die	D, AH1, EH3, Y
diet	D, AH1, EH3, AY, I2, T
differ	D, I1, I3, F, ER
difference	D, I1, F, R, EH3, N, DT, S
different	D, I1, F, R, EH3, N, T
digit	D, I1, D, J, I1, T
digital	D, I1, D, J, I3, T, UH3, L
dime	D, AH1, EH3, Y, M
diode	D, AH1, EH3, AY, O1, U1, D
direct	D, ER, EH1, EH3, K, T
directory	D, ER, EH1, EH3, K, T, ER, Y
dirt	D, ER, R, T
disagree	D, I1, S, UH1, G, R, E1, Y
disappear	D, I1, S, UH1, P, AY, I3, R
disconnect	D, I1, S, K, UH1, N, EH1, EH3, K, T
discuss	D, I1, I3, S, K, UH1, UH2, S
disk	D, I1, I3, S, K
display	D, I1, I3, S, P, L, A1, I3, Y
distance	D, I1, S, T, EH3, N, T, S
divide	D, I1, V, AH1, EH3, Y, D
dividend	D, I1, V, I1, D, EH1, EH3, N, D
division	D, I1, V, I1, ZH, UH3, N

do	D, IU, U1, U1
dock	D, AH1, UH3, K
doctor	D, AH1, UH3, K, T, ER
document	D, AH1, K, Y1, UH3, M, EH3, N, T
does	D, UH2, UH1, Z
dollar	D, AH1, UH3, L, ER
done	D, UH1, UH3, N
door	D, O1, O2, R
double	D, UH3, UH1, B, UH3, L
doubt	D, UH3, AH2, U1, T
down	D, AH1, UH3, U1, N
draft	D, R, AE1, EH3, F, T
draw	D, R, AW
drill	D, R, I1, I3, L
drink	D, R, I1, I3, NG, K
drive	D, R, AH1, EH3, Y, V
drop	D, R, AH1, UH3, P
drum	D, R, UH1, UH2, M
dry	D, R, AH1, EH3, I3, Y
due	(use "do" program)
dump	D, UH1, UH2, M, P
duration	D, ER, R, A1, Y, SH, UH3, N
during	D, ER, R, I1, NG
duty	D, IU, U1, U1, T, Y
dwell	D, W, EH1, EH3, L
E	E1, Y
each	E1, AY, T, CH
ear	E1, I2, R
early	ER, R, L, Y
earn	ER, R, N
east	E1, AY, S, T
easy	E1, AY, Z, Y
echo	EH1, EH3, K, O1, U1
edge	EH1, EH3, D, J
edit	EH1, EH3, D, I2, T
educate	EH1, D, J, U1, K, A1, Y, T
effect	UH1, F, EH1, EH3, K, T
efficient	E1, F, I1, SH, EH3, N, T
effort	EH2, EH3, F, ER, T
eight	A2, A2, Y, T
eighth	A2, A2, Y, DT, DT, TH

eighty	A2, A2, Y, T, Y
either	E1, Y, THV, ER
electric	EH3, L, EH1, K, T, R, I2, K
electrician	EH3, L, EH1, K, PAO, T, R, I1, SH, UH3, N
electronic	EH3, L, EH1, K, T, R, AH1, N, I2, K
elevator	EH1, L, UH3, V, A2, AY, D, ER
eleven	EH1, L, EH1, EH3, V, I2, N
eligible	EH1, L, UH3, D, J, EH3, B, UH3, L
eliminate	EH1, L, I1, M, I1, N, A1, Y, T
else	EH1, EH3, L, S
emit	Y, M, I1, I3, T
employ	EH1, EH3, M, P, L, O1, UH3, I3, AY
empty	EH1, EH3, M, P, T, Y
enable	EH1, N, A1, Y, B, UH3, L
enclose	EH1, EH3, N, K, L, O1, U1, Z
end	EH1, EH3, N, D
engine	EH1, EH3, N, D, J, I1, N
engineer	EH1, N, D, J, I2, N, AY, I1, R
endorse	EH1, EH3, N, D, O2, O2, R, S
english	I1, NG, G, L, I2, SH
enter	EH1, EH3, N, T, ER
entry	EH1, EH3, N, T, R, Y
epsilon	EH1, P, S, UH3, L, AH1, UH3, N
equal	Y, K, W, UH3, L
equipment	E1, K, W, IL, P, M, EH3, N, T
erase	E1, R, A1, Y, S
error	EH3, EH3, EH3, R, ER
escape	EH1, EH3, S, K, A1, AY, Y, P
escrow	EH1, EH3, S, K, R, O1, U1
establish	UH1, S, T, AE1, EH3, B, L, I2, SH
estate	EH1, EH3, S, T, A1, AY, Y, T
estimate	EH1, S, T, EH3, M, I3, T
exact	EH1, EH3, G, PAO, Z, AE1, EH3, K, T
examine	EH1, EH3, G, PAO, Z, AE1, EH3, M, I1, N
exceed	EH1, EH3, K, PAO, S, E1, Y, D
except	EH1, EH3, K, PAO, S, EH1, EH3, P, T
exchange	EH1, EH3, K, PAO, S, T, CH, A1, AY, Y, N, D, J
execute	EH1, EH3, K, PAO, S, UH3, K, Y1, IU, U1, T
exempt	EH1, EH3, G, PAO, Z, EH1, EH3, M, P, T
exit	EH1, EH3, G, PAO, Z, I1, I3, T
expect	EH1, EH3, K, PAO, S, P, EH1, EH3, K, T
expedite	EH1, EH3, K, PAO, S, P, EH1, EH3, D, UH3, AH2, Y, T
expend	EH1, EH3, K, PAO, S, P, EH1, EH3, N, D
experiment	EH1, K, PAO, S, P, EH1, R, UH3, M, EH3, N, T
exponent	EH1, K, PAO, S, P, O2, O2, N, EH3, N, T
express	EH1, EH3, K, PAO, S, P, R, EH1, S
extension	EH1, EH3, K, PAO, S, T, EH1, EH3, N, SH, UH3, N
F	EH1, EH2, F
face	F, A1, AY, Y, S
facility	F, UH2, S, I1, L, I3, T, Y
fact	F, AE1, EH3, K, T
fahrenheit	F, EH1, R, I2, N, H, UH3, AH2, Y, T
fail	F, A1, AY, I3, UH3, L
fall	F, AW, L
false	F, AW, L, S
familiar	F, UH1, M, I1, L, Y1, ER
far	F, AH1, UH3, R
farad	F, EH3, EH3, ER, AE1, EH3, D
fast	F, AE1, EH3, S, T
fault	F, AW, L, T
feat	(use "feet" program)
feature	F, E1, AY, T, CH, ER
february	F, EH1, B, Y1, IU, W, EH1, R, Y
federal	F, EH1, EH3, D, R, UH3, L
fee	F, E1, Y
feed	F, E1, Y, D
feet	F, E1, Y, T
female	F, AY, Y, M, A1, AY, UH3, L

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field	F, E1, AY, UH3, L, D
fifteen	F, I1, I3, F, T, E1, Y, N
fifth	F, I1, I3, F, TH
fifty	F, I1, I3, F, T, Y
file	F, AH1, EH3, I3, UH3, L
fill	F, I1, I3, L
final	F, AH1, Y, N, UH3, L
finance	F, AH1, *EH3*, Y, N, AE1, *EH3*, N, S
find	F, AH1, EH3, Y, N, D
finger	F, I1, I3, NG, G, ER
finish	F, I1, N, I1, SH
fire	F, AH1, EH3, AY, R
first	F, ER, R, S, T
fit	F, I1, I3, T
five	F, AH1, EH3, Y, V
fix	F, I1, I3, K, PAO, S
fixture	F, I1, I3, K, PAO, S, T, CH, ER
flash	F, L, AE1, EH3, SH
flat	F, L, AE1, EH3, T
flight	F, L, UH3, AH2, Y, T
flip	F, L, I1, I3, P
floor	F, L, O1, O2, R
flop	F, L, AH1, UH3, P
flow	F, L, O1, U1
fly	F, L, AH1, EH3, Y
fold	F, O2, O2, L, L, D
follow	F, AH1, AW2, L, O1, U1
food	F, U1, U1, D
foot	F, OO1, OO1, T
for	(use "four" program)
fore	(use "four" program)
force	F, O2, O2, R, S
foreman	F, O2, O2, R, M, EH2, N
forget	F, O2, O2, R, G, EH1, EH3, T
forgive	F, O2, O2, R, G, I1, I3, V
form	F, O2, O2, R, M
format	F, O2, O2, R, M, AE1, EH3, T
forty	F, O2, O2, R, T, Y
forward	F, O2, O2, R. W, ER, D
found	F, AH1, UH3, W, N, D
four	F, O1, O2, R
fourth	F, O1, O2, R, TH

fox trot	F, AH1, UH3, K, PAO, S, T, R, AH1, UH3, T
frame	F, R, A1, AY, Y, M
fraud	F, R, AW, D
free	F, R, E1, Y
french	F, R, EH1, EH3, N, T, CH
frequency	F, R, E1, K, W, EH3, N, DT, S, Y
frequent	F, R, E1, K, W, EH3, N, T
friday	F, R, AH1, EH3, Y, D, A1, I3, Y
fright	F, R, UH3, AH2, Y, T
from	F, R, UH1, UH3, M
front	F, R, UH3, UH1, N, T
fruit	F, R, IU, U1, T
fuel	F, Y1, IU, U1, UH3, L
full	F, OO1, L
function	F, UH1, UH2, N, K, SH, UH3, N
fund	F, UH1, UH2, N, D
furnace	F, ER, R, N, EH3, S
further	F, ER, R, THV, ER
future	F, Y1, IU, U1, T, CH, ER
G	D, J, E1, Y
gage	(use "gauge" program)
gain	G, A1, AY, Y, N
gait	(use "gate" program)
gallon	G, AE1, AH2, L, UH3, N
game	G, A1, AY, Y, M
gamma	G, AE1, *EH3*, M, *UH2*, *UH3*
gap	G, AE1, EH3, P
garage	G, UH1, R, AH1, UH3, ZH
gas	G, AE1, EH3, S
gate	G, A1, AY, Y, T
gauge	G, A1, AY, Y, D, J
general	D, J, EH1, EH3, N, ER, UH3, L
generate	D, J, EH1, N, ER, A1, Y, T
gentlemen	D, J, EH1, EH3, N, T, L, M, I2, N
german	D, J, ER, R, M, EH2, N
get	G, EH1, EH3, T
girl	G, ER, R, L
give	G, I1, I3, V
glass	G, L, AE1, EH3, S
glitch	G, L, I1, I3, T, CH
globe	G, L, O1, U1, B
go	G, OO1, O1, U1

golf	G, AW2, AW2, UH3, L, F
good	G, OO1, OO1, D
govern	G, UH1, UH3, V, ER, N
grade	G, R, A1, AY, Y, D
gram	G, R, AE1, EH3, M
grand	G, R, AE1, EH3, N, D
graph	G, R, AE1, EH3, F
grate	(use "great" program)
gray	(use "grey" program)
great	G, R, A1, Y, T
green	G, R, E1, Y, N
greet	G, R, E1, Y, T
grey	G, R, A1, AY, Y
grind	G, R, AH1, EH3, Y, N, D
grocery	G, R, O1, U1, S, ER, Y
ground	G, R, AH1, UH3, W, N, D
group	G, R, U1, U1, P
grow	G, R, O1, U1
guard	G, AH1, R, D
guarantee	G, EH1, R, I3, N, T, E1, Y
guess	G, EH1, EH3, S
H	A1, AY, Y, T, CH
had	H, AE1, EH3, D
half	H, AE1, EH3, F
halt	H, AW, L, T
hammer	H, AE1, EH3, M, ER
hand	H, AE1, EH3, N, D
handle	H, AE1, EH3, N, D, UH3, L
hang	H, AE1, I3, NG
happy	H, AE1, EH3, P, Y
hard	H, AH1, R, D
has	H, AE1, EH3, Z
have	H, AE1, EH3, V
he	H, E1, Y
head	H, EH1, EH3, D
hear	H, AY, I3, R
heart	H, AH1, UH3, R, T
heat	H, E1, AY, T
heavy	H, EH1, V, Y
height	H, UH3, AH2, Y, T
held	H, EH1, UH3, L, D
hello	H, EH1, UH3, L, UH3, O1, U1
help	H, EH1, EH3, L, P

henry	H, EH1, EH3, N, R, Y
her	H, ER
here	(use "hear" program)
hertz	H, R, R, T, S
hex	H, EH1, EH3, K, PAO, S
high	H, AH1, EH3, Y
his	H, I1, I3, Z
hold	H, O2, O2, L, L, D
hole	H, O1, U1, L
home	H, O1, U1, M
hook	H, OO1, OO1, K
host	H, O1, U1, S, T
hot	H, AH1, UH3, T
hotel	H, O1, U1, T, EH2, EH2, L
hour	AH1, UH3, W, ER
house	H, UH3, AH2, U1, S
how	H, AH1, O2, U1
human	H, Y1, IU, U1, U1, M, EH2, N
hundred	H, UH1, UH2, N, D, R, I3, D
hungry	H, UH1, UH2, NG, G, R, Y
I	AH1, EH3, I3, Y
idle	AH1, Y, D, UH3, L
idol	(use "idle" program)
if	I1, I3, F
immediate	I1, I3, M, E1, D, Y, EH3, T
important	I1, I3, M, P, O2, O2, R, T, EH3, N, T
improper	I1, I3, M, P, R, AH1, UH3, P, ER
improve	I1, I3, M, P, R, IU, U1, U1, V
in	I1, I3, N
inch	I1, I3, N, T, CH
include	I1, I3, N, K, L, IU, U1, U1, D
income	I1, I3, N, K, UH1, UH3, M
independent	I1, N, D, E1, P, EH2, EH3, N, D, EH3, N, T
index	I1, I3, N, D, EH1, EH3, K, PAO, S
india	I2, I3, N, D, Y, UH2
indicate	I1, N, D, I3, K, A1, Y, T
industrial	I1, I3, N, D, UH1, UH2, S, T, R, AY, UH3, L
inform	I1, I3, N, F, O2, O2, R, M
initial	I1, I3, N, I1, SH, UH3, L
inn	(use "in" program)

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input	I1, I3, N, P, OO1, OO1, T
inquire	I1, I3, N, K, W, AH1, EH3, AY, R
insert	I1, N, S, R, R, T
inspect	I1, I3, N, S, P, EH1, EH3, K, T
install	I1, I3, N, S, T, AW, L
instead	I1, I3, N, S, T, EH1, EH3, D
instruct	I1, I3, N, S, T, R, UH1, UH2, K, T
instrument	I1, I3, N, S, T, R, UH1, M, EH1, EH3, N, T
insufficient	I1, N, S, UH2, F, I1, SH, EH3, N, T
insurance	I1, I3, N, SH, ER, R, EH3, N, T, S
interest	I1, N, T, R, EH1, S, T
interface	I1, I3, N, T, ER, F, A1, AY, Y, S
interpret	I1, I3, N, T, ER, P, R, EH3, T
interupt	I1, N, T, ER, UH3, UH1, P, T
intrude	I1, I3, N, T, R, IU, U1, U1, D
invalid	I1, I3, N, V, AE1, AW2, L, I1, D
invent	I1, I3, N, V, EH1, EH3, N, T
inventory	I1, N, V, EH1, N, T, O1, R, Y
invest	I1, I3, N, V, EH1, EH3, S, T
invoice	I1, I3, N, V, O1, UH3, I3, AY, S
irregular	I1, R, EH1, G, Y1, UH3, L, ER
is	I1, I3, Z
it	I1, I3, T
item	AH2, UH3, Y, D, UH3, M
J	D, J, EH3, A1, AY, Y
jack	D, J, AE1, EH3, K
january	D, J, AE1, EH3, N, Y1, UI, EH3, EH3, ER, Y
job	D, J, AH1, UH3, B
join	D, J, O1, UH3, I3, AY, N
jolt	D, J, O2, O2, L, T
joy	D, J, O1, UH3, I3, AY
judge	D, J, UH1, UH2, D, J
juliet	D, J, IU, U1, L, Y, EH2, EH3, T
july	D, J, UH1, L, AH1, EH3, Y
jump	D, J, UH1, UH2, M, P
june	D, J, IU, U1, U1, N
K	K, EH3, A1, AY, Y
keep	K, E1, Y, P
key	K, E1, Y
keyboard	K, AY, Y, B, O1, O2, R, D
kill	K, I1, I3, L
kilo	K, E1, AY, L, UH3, O2, U1
knew	(use "new" program)
knot	(use "not" program)
know	(use "no" program)
knowledge	N, AH1, UH3, L, I3, D, J
L	EH1, EH3, UH3, L
lab	L, AE1, EH3, B
labor	L, A1, Y, B, ER
language	L, AE1, EH3, NG, G, W, I1, D, J
lapse	L, AE1, EH3, P, S
large	L, AH1, R, D, J
last	L, AE1, EH3, S, T
late	L, A1, AY, Y, T
law	L, AW
lead	L, E1, Y, D
led	L, EH1, EH3, D
left	L, EH1, EH3, F, T
leg	L, EH1, EH3, G
legal	L, E1, G, UH3, L
lend	L, EH1, EH3, N, D
length	L, EH1, EH3, NG, TH
less	L, EH1, EH3, S
let	L, EH1, EH3, T
letter	L, EH1, EH3, T, ER
level	L, EH1, EH3, V, UH3, L
life	L, UH3, AH2, Y, F
light	L, UH3, AH2, Y, T
like	L, UH3, AH2, Y, K
lima	L, AY, Y, M, UH1
limit	L, I1, M I1, T
line	L, AH1, EH3, Y, N
linear	L, I2, I3, N, AY, Y, ER
link	L, I1, I3, NG, K
lip	L, I1, I3, P
liquid	L, I1, K, W, I1, D
list	L, I1, I3, S, T
listen	L, I1, I3, S, I2, N
little	L, I1, I3, T, UH3, L
load	L, UH3, O1, U1, D
loan	L, UH3, O1, U1, N

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local	L, 02, 02, K, UH3, L
lock	L, AH1, UH3, K
log	L, AW, G
long	L, AW, NG
look	L, 001, 001, K
loss	L, AW, S
lost	L, AW, S, T
lot	L, AH1, UH3, T
low	L, 01, U1
M	EH1, EH2, M
machine	M, UH2, SH, E1, Y, N
mail	(use "male" program)
maintenance	M, A1, Y, N, T, EH2, N, EH3, N, DT, S
make	M, A1, AY, Y, K
male	M, A2, A2, AY UH3, L
man	M, AE1, EH3, N
manage	M, AE1, EH3, N, I1, D, J
manual	M, AE1, EH3, N, Y1, U1, UH3, L
manufacture	M, AE1, EH3, N, Y1, U1, F, AE1, EH3, K, T, CH, ER
many	M, EH2, EH2, N, Y
map	M, AE1, EH3, P
march	M, AH1, R, T, CH
margin	M, AH1, UH3, R, D, J, I2, N
mark	M, AH1, R, K
market	M, AH1, R, K, EH3, T
match	M, AE1, EH3, T, CH
mature	M, UH1, T, CH, IU, ER
maximum	M, AE1, EH3, K, PAO, S, EH3, M, UH2, M
may	M, A1, I3, Y
me	M, E1, Y
measure	M, EH3, EH1, ZH, ER
meat	M, E1, AY, T
mechanical	M, UH1, K, AE1, EH3, N, I3, K, UH3, L
media	M, E1, AY, D, Y, UH1
medicine	M, EH2, EH3, D, I3, S, I1, N
medium	M, E1, D, AY, UH1, M
meet	(use "meat" program)
mega	M, EH1, EH3, G, UH2, UH3
member	M, EH1, EH3, M, B, ER
memory	M, EH1, EH3, M, ER, Y
men	M, EH1, EH3, N
merchandise	M, ER, T, CH, EH3, N, D, AH1, EH3, Y, Z
merge	M, ER, R, D, J
message	M, EH1, EH3, S, I2, D, J
metal	M, EH1, EH3, T, UH3, L
meter	M, E1, Y, T, ER
micro	M, UH3, AH2, AY, K, R, 01, U1
middle	M, I1, I3, D, UH3, L
mike	M, UH3, AH2, Y, K
mile	M, AH1, EH3, I3, UH3, L
mill	M, I1, I3, L
milli	M, I1, I3, L, UH3
million	M, I1, I3, L, Y, UH3, N
mini	M, I2, I2, N, Y
minus	M, AH1, Y, N, EH3, S
minute	M, I1, N, EH3, T
miscellaneous	M, I1, S, UH3, L, A1, AY, N, Y, UH3, S
miss	M, I1, I3, S
mistake	M, I1, I3, S, T, A1, AY, Y, K
mode	M, 01, U1, D
model	M, AH1, UH3, D, UH3, L
module	M, AH1, UH3, D, J, IU, U1, UH3, L
monday	M, UH3, UH1, N, D, A1, I3, Y
money	M, UH3, UH1, N, AY, Y
month	M, UH3, UH1, N, TH
more	M, 02, 02, R
morning	M, 02, 02, R, N, I1, I3, NG
most	M, 01, U1, S, T
motor	M, 01, U1, T, ER
mount	M, AH1, UH3, W, N, T
move	M, U1, U1, V
Mr.	M, I1, S, T, ER
Mrs.	M, I1, S, I2, Z
Ms.	M, I1, I3, Z
much	M, UH1, UH2, T, CH
multi	M, UH2, UH3, L, T, Y
multiple	M, UH1, L, T, EH3, P, UH3, L
multiply	M, UH1, L, T, I3, P, L, AH1, Y

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N	EH1, EH2, N
name	N, A1, AY, Y, M
nano	N, AE1, EH3, N, 01, U1
national	N, AE1, EH3, SH, UH3, N, UH3, L
native	N, A1, Y, T, I1, V
near	N, AY, I1, R
neat	N, E1, AY, T
neck	N, EH1, EH3, K
need	N, E1, Y, D
negative	N, EH1, G, EH3, T, I1, V
net	N, EH1, EH3, T
neutral	N, IU, U1, T, R, UH2, L
new	N, IU, U1, U1
next	N, EH1, EH3, K, PAO, S, T
nice	N, UH3, AH2, Y, S
nickel	N, I1, I3, K, UH3, L
night	N, UH3, AH2, Y, T
nine	N, AH1, EH3, Y, N
ninety	N, AH1, EH3, Y, N, T, Y
nineth	N, AH1, Y, N, DT, TH
no	N, 001, 01, U1
noise	N, 01, UH3, I3, AY, Z
none	N, UH1, UH3, N
noon	N, IU, U1, U1, N
normal	N, 02, 02, R, M, UH3, L
north	N, 02, 02, R, TH
not	N, AH1, UH3, T
note	N, 01, U1, T
nothing	N, UH1, TH, I1, I3, NG
notice	N, 01, U1, T, I1, S
notify	N, 01, U1, T, I1, F, AH1, EH3, Y
november	N, 01, U1, V, EH1, EH3, M, B, ER
now	N, AH1, UH3, U1
number	N, UH1, UH2, M, B, ER
nurse	N, ER, R, S
nut	N, UH1, UH2, T
O	02, 01, U1
oar	(use "or" program)
object	UH1, B, D, J, EH1, EH3, K, T
object-2	AH1, UH3, B, D, J, EH2, EH2, K, T

obligation	AH1, B, L, I3, G, A1, Y, SH, UH3, N
obsolete	AH1, UH3, B, S, UH3, L, AY, Y, T
october	AH1, UH3, K, T, O1, U1, B, ER
odd	AH1, UH3, D
of	UH1, UH3, V
off	AW, F
office	AW, F, I1, S
official	UH1, F, I1, SH, UH3, L
often	AW2, AW2, F, I3, N
ohm	O2, O2, U1, M
oil	O1, EH3, I3, UH3, L
old	O2, O2, L, L, D
omega	O1, U1, M, A1, Y, G, UH2
omit	O1, U1, M, I1, I3, T
on	AH1, UH3, N
once	W, UH1, N, T, S
one	W, UH1, UH2, N
only	O1, O2, N, L, Y
open	O1, P, I2, N
operable	AH1, UH3, P, ER, UH3, B, UH3, L
operate	AH1, UH3, P, ER, A1, Y, T
operator	AH1, UH3, P, ER, A1, Y, T, ER
option	AH1, UH3, P, SH, UH3, N
or	O2, O2, R
orange	O2, O2, R, I1, N, D, J
order	O2, O2, R, D, ER
ore	(use "or" program)
original	O2, R, I2, I3, D, J, I3, N, UH3, L
oscar	AH1, UH3, S, K, ER
other	UH1, UH3, THV, ER
ounce	AH1, UH3, W, N, S
out	UH3, AH2, U1, T
oven	UH1, V, I2, N
over	O1, O2, V, ER
oxygen	AH1, UH3, K, PAO, S, I3, D, J, I2, N
own	O1, U1, N
P	P, E1, Y
pack	P, AE1, EH3, K
package	P, AE1, EH3, K, I1, D, J
paid	P, A1, AY, Y, D

pain	P, A1, AY, Y, N
pane	(use "pain" program)
panel	P, AE1, EH3, N, UH3, L
papa	P, AH1, UH3, P, UH3, UH3
paper	P, A1, Y, P, ER
parcel	P, AH1, R, S, UH3, L
paren	P, EH3, EH3, ER, I2, N
part	P, AH1, R, T
partial	P, AH1, R, SH, UH2, L
pass	P, AE1, EH3, S
passed	(use "past" program)
past	P, AE1, EH3, S, T
pat	P, AE1, EH3, T
pattern	P, AE1, EH3, T, ER, N
pause	P, AW, Z
pay	P, A2, A2, AY, Y
pea	(use "P" program)
peace	(use "piece" program)
peak	P, E1, AY, K
peek	(use "peak" program)
percent	P, ER, S, EH1, EH3, N, T
period	P, I1, R, Y, UH2, D
permanent	P, ER, M, EH2, N, EH1, N, T
person	P, ER, S, UH1, N
personal	P, ER, S, UH3, N, UH2, L
personality	P, ER, S, UH3, N, AE1, UH3, L, I3, T, Y
phase	F, A1, AY, Y, Z
phone	F, O1, U1, N
pick	P, I1, I3, K
pico	P, E1, Y, K, O2, U1
piece	P, E1, Y, S
pint	P, AH1, Y, N, T
pipe	P, UH3, AH2, Y, P
place	P, L, A1, AY, Y, S
plain	(use "plane" program)
plan	P, L, AE1, EH3, N
plane	P, L, A1, AY, Y, N
plant	P, L, AE1, EH3, N, T
play	P, L, A1, I3, Y
please	P, L, E1, Y, Z
plot	P, L, AH1, UH3, T
plus	P, L, UH1, UH2, S

pocket	P, AH1, UH3, K, EH3, T
point	P, O1, UH3, I3, AY, N, T
poke	P, O1, U1, K
police	P, UH1, L, AY, Y, S
plain	(use "plane" program)
plan	P, L, AE1, EH3, N
plane	P, L, A1, AY, Y, N
plant	P, L, AE1, EH3, N, T
play	P, L, A1, I3, Y
please	P, L, E1, Y, Z
plot	P, L, AH1, UH3, T
plus	P, L, UH1, UH2, S
pocket	P, AH1, UH3, K, EH3, T
point	P, O1, UH3, I3, AY, N, T
poke	P, O1, U1, K
police	P, UH1, L, AY, Y, S
policy	P, AH1, UH3, L, I3, S, Y
poor	(use "pour" program)
pop	P, AH1, UH3, P
port	P, 02, 02, R, T
position	P, UH1, Z, I1, SH, UH3, N
positive	P, AH1, UH3, Z, I1, T, I1, V
possible	P, AH1, UH3, S, UH3, B, UH2, L
post	P, 01, U1, S, T
potential	P, 01, T, EH1, EH3, N, T, CH, UH3, L
pound	P, AH1, UH3, W, N, D
pour	P, 01, 02, R
power	P, AH1, UH3, W, ER
practice	P, R, AE1, EH3, K, T, I1, S
premium	P, R, AY, Y, M, Y, UH1, M
prepare	P, R, E1, P, EH1, EH3, R
press	P, R, EH1, EH3, S
pressure	P, R, EH1, SH, ER
prevent	P, R, Y, V, EH1, EH3, N, T
previous	P, R, Y, V, Y, UH1, S
price	P, R, UH3, AH2, Y, S
principal	(use "principle" program)
principle	P, R, I1, N, DT, S, UH3, P, UH3, L
print	P, R, I1, I3, N, T
prior	P, R, AH1, Y, ER
priority	P, R, AH1, Y, 01, R, I3, DT, Y

private	P, R, AH1, EH3, Y, V, I3, T
probe	P, R, 01, U1, B
problem	P, R, AH1, UH3, B, L, UH3, M
procedure	P, R, UH1, S, E1, D, J, ER
proceed	P, R, 01, S, E1, Y, D
process	P, R, AH1, UH3, S, EH1, EH3, S
produce	P, R, UH1, D, IU, U1, U1, S
product	P, R, AH1, UH3, D, UH1, UH2, K, T
progress	P, R, AH1, UH3, G, R, EH1, S
profession	P, R, UH1, F, EH1, EH3, SH, UH3, N
profit	P, R, AH1, UH3, F, I1, T
program	P, R, 01, G, R, AE1, EH3, M
project	P, R, AH1, UH3, D, J, EH2, EH2, K, T
PROM	P, R, AH1, UH3, M
promote	P, R, UH1, M, 01, U1, T
propose	P, R, UH1, P, 01, U1, Z
protect	P, R, UH1, T, EH1, EH3, K, T
public	P, UH1, UH3, B, L, I3, K
pull	P, 001, 001, L
pulse	P, UH1, UH2, L, S
punch	P, UH1, UH2, N, T, CH
purpose	P, R, R, P, EH2, S
purchase	P, R, R, DT, CH, I2, S
pure	P, Y1, IU, ER
push	P, 001, IU, SH
put	P, 001, 001, T
Q	K, Y1, IU, U1, U1
qualify	K, W, AW1, L, I1, F, AH1, EH3, Y
quantity	K, W, AH1, N, T, I3, T, Y
quart	K, W, 01, R, T
quarter	K, W, 01, R, T, ER
quebec	K, W, I1, B, EH1, EH3, K
question	K, W, EH1, EH3, S, T, CH, UH3, N
quick	K, W, I1, I3, K
quiet	K, W, AH1, EH3, AY, I2, T
quit	K, W, I1, I3, T
quiz	K, W, I1, I3, Z
quota	K, W, 01, 02, T, UH1
quote	K, W, 01, U1, T

R	AH1, UH2, ER
rail	R, A1, AY, I3, UH3, L
rain	R, A1, AY, Y, N
raise	R, A1, AY, Y, Z
range	R, A1, AY, Y, N, D, J
radio	R, A1, Y, D, Y, 01, U1
rate	R, A1, AY, Y, T
ratio	R, A1, Y, SH, Y, 01, U1
reach	R, E1, Y, T, CH
read	R, E1, Y, D
ready	R, EH1, EH3, D, Y
real	R, E1, AY, L
reason	R, E1, Y, Z, UH1, N
rebate	R, E1, B, A1, Y, T
recall	R, E1, K, AW2, AW1, L
receipt	R, E1, S, AY, Y, T
receive	R, E1, S, E1, Y, V
record	R, E1, K, 02, 02, R, D
record-2	R, EH1, EH3, K, ER, D
red	R, EH1, EH3, D
reel	(use "real" program)
refer	R, E1, F, UH1, UH2, N, D
refuse	R, E1, F, Y1, IU, U1 U1, Z
register	R, EH1, D, J, I1, S, T, ER
regular	R, EH1, G, Y1, IU, L, ER
rein	(use "rain" program)
reject	R, E1, D, J, EH1, EH3, K, T
relay	R, E1, L, A1, I3, Y
release	R, E1, L, E1, AY, S
remain	R, E1, M, A1, AY, Y, N
remove	R, E1, M, U1, U1, V
repair	R, E1, P, EH2, EH2, R
repeat	R, E1, P, E1, AY, T
replace	R, E1, P, L, A1, AY, Y, S
report	R, E1, P, 02, 02, R, T
represent	R, EH1, P, R, I2, Z, EH1, EH3, N, T
request	R, E1, K, W, EH1, EH3, S, T
require	R, E1, K, W, AH1, EH3, AY, R
requisition	R, EH1, K, W, I2, Z, I1, SH, UH3, N
rescue	R, EH1, EH3, S, K, Y1, IU, U1

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resemble	R, E1, Z, EH1, EH3, M, B, UH3, L
reset	R, E1, S, EH1, EH3, T
resistor	R, E1, Z, I1, S, T, ER
respect	R, E1, S, P, EH1, EH3, K, T
respond	R, E1, S, P, AH1, UH3, N, D
responsible	R, I2, S, P, AH1, UH3, N, DT, S, UH3, B, UH3, L
rest	R, EH1, EH3, S, T
restrict	R, E1, S, T, R, I1, I3, K, T
result	R, E1, Z, UH1, UH2, L, T
resume	R, E1, Z, IU, U1, U1, M
retail	R, AY, E1, T, EH3, A1, I3, UH3, L
retain	R, E1, T, A1, AY, Y, N
return	R, E1, T, ER, R, N
revision	R, E1, V, I1, ZH, UH3, N
revolve	R, E1, V, AH1, UH3, L, V
ribbon	R, I2, I3, B, UH3, N
right	R, UH3, AH2, Y, T
romeo	R, 01, U1, M, Y, 01, U1
room	R, U1, U1, M
root	R, U1, U1, T
round	R, AH1, UH3, W, N, D
route	R, UH2, AH2, U1, T
row	R, 01, U1
run	R, UH1, UH3, N
rush	R, UH1, UH2, SH
S	EH1, EH2, S
safe	S, A1, AY, Y, F
sail	(use "sale" program)
salary	S, AE1, AH2, L, UH3, R, Y
sale	S, A1, A2, AY, UH3, L
same	S, A1, AY, Y, M
saturday	S, AE1, EH3, T, ER, D, A1, Y
save	S, A1, AY, Y, V
say	S, A1, I3, Y
scan	S, K, AE1, EH3, N
scent	(use "cent" program)
schedule	S, K, EH1, EH3, D, J, IU, U1, L
school	S, K, U1, U1, L
science	S, AH1, I3, Y, EH3, N, DT, S
score	S, K, O2, O2, R

scrap	S, K, R, AE1, EH3, P
screw	S, K, R, IU, U1, U1
sea	(use "C" program)
seat	S, E1, AY, T
second	S, EH1, EH3, K, UH1, N, D
secret	S, E1, K, R, I3, T
section	S, EH1, EH3, K, SH, UH3, N
security	S, EH1, EH3, K, Y, ER, I1, T, Y
see	(use "C" program)
seize	S, E1, Y, Z
select	S, UH1, L, EH1, EH2, K, T
sell	S, EH1, EH3, L
semi	S, EH1, M, AH1, Y
semicolon	S, EH1, M, AH1, Y, K, OO1, O1, L, I2, N
send	S, EH1, EH3, N, D
sent	(use "cent" program)
sentence	S, EH1, N, T, I2, N, DT, S
separate	S, EH1, EH3, P, UH1, R, A1, AY, T
separate-2	S, EH1, EH3, P, R, I2, T
september	S, EH1, EH3, P, T, EH1, EH3, M, B, ER
sequence	S, E1, K, W, EH1, EH3, N, S
serial	S, I1, R, Y, UH3, L
series	S, I1, R, Y, Z
service	S, ER, V, I1, S
set	S, EH1, EH3, T
seven	S, EH1, EH3, V, I2, N
seventh	S, EH1, EH3, V, I2, N, DT, TH
seventy	S, EH1, V, I2, N, D, Y
several	S, EH1, V, ER, UH3, L
sew	(use "so" program)
share	SH, EH3, EH3, ER
sharp	SH, AH1, R, P
shift	SH, I1, I3, F, T
ship	SH, I1, I3, P
shop	SH, AH1, UH3, P
short	SH, O2, O2, R, T
should	SH, IU, IU, IU, D
shunt	SH, UH1, UH2, N, T
shut	SH, UH1, UH2, T
side	S, AH1, EH3, Y, D
sierra	S, E1, I3, EH1, R, UH1

signal	S, I1, I3, G, N, UH3, L
silver	S, I1, I3, L, V, ER
single	S, I1, I3, NG, G, UH3, L
six	S, I1, I3, K, PAO, S
sixth	S, I1, I3, K, PAO, S, TH
sixty	S, I1, I3, K, PAO, T, Y
size	S, AH1, EH3, Y, Z
skin	S, K, I1, I3, N
sky	S, K, AH1, EH3, I3, Y
slang	S, L, AE1, EH3, NG
slash	S, L, AE1, EH3, SH
slave	S, L, A1, AY, Y, V
slip	S, L, I1, I3, P
slow	S, L, O1, U1
small	S, M, AW, L
smell	S, M, EH1, EH3, L
smile	S, M, AH1, EH3, I3, UH3, L
smoke	S, M, O1, U1, K
snow	S, N, OO1, O2, U1
so	S, OO1, O2, U1
soft	S, AW, F, T
sold	S, O2, O2, L, L, D
solid	S, AH1, UH3, L, I1, D
son	(use "sun" program)
some	(use "sum" program)
sorry	S, AW, R, Y
sort	S, O2, O2, R, T
sound	S, AH1, UH3, W, N, D
source	S, O1, O2, R, S
south	S, AH1, UH3, U1, TH
space	S, P, A1, AY, Y, S
spark	S, P, AH1, R, K
speak	S, P, E1, AY, K
special	S, P, EH1, EH3, SH, UH3, L
speed	S, P, E1, Y, D
speech	S, P, E1, Y, T, CH
spell	S, P, EH1, EH3, L
spend	S, P, EH1, EH3, N, D
split	S, P, L, I1, I3, T
spoon	S, P, U1, U1, N
spring	S, P, R, I1, I3, NG
square	S, K, W, EH1, R
stack	S, T, AE1, EH3, K
stair	(use "stare" program)

stand	S, T, AE1, EH3, N, D
standard	S, T, AE1, EH3, N, D, ER, D
star	S, T, AH1, UH3, R
stare	S, T, EH3, EH3, ER
start	S, T, AH1, R, T
state	S, T, A1, AY, Y, T
station	S, T, A1, Y, SH, UH3, N
status	S, T, AE1, EH3, T, I2, S
steal	(use "steel" program)
steel	S, T, E1, Y, L
step	S, T, EH1, EH3, P
stick	S, T, I1, I3, K
stock	S, T, AH1, UH3, K
stop	S, T, AH1, UH3, P
store	S, T, O2, O2, R
strait	(use "straight" program)
straight	S, T, R, A1, AY, Y, T
street	S, T, R, E1, Y, T
stress	S, T, R, EH1, EH3, S
string	S, T, R, I1, I3, NG
structure	S, T, R, UH1, K, T, CH, ER
style	S, T, AH1, EH3, AY, UH3, L
subject	S, UH1, UH2, B, D, J, EH1, EH3, K, T
substitute	S, UH1, UH3, B, S, T, I3, T, IU, U1, T
subtract	S, UH1, UH2, B, T, R, AE1, EH3, K, T
sufficient	S, UH1, F, I1, SH, EH3, N, T
suggest	S, UH1, UH2, G, D, J, EH1, EH3, S, T
suit	S, IU, U1, T
suite	S, W, AY, Y, T
sum	S, UH1, UH2, M
summary	S, UH2, UH2, M, ER, Y
summer	S, UH1, UH2, M, ER
sun	S, UH1, UH2, N
sunday	S, UH1, UH2, N, D, A1, I3, Y
super	S, IU, U1, P, ER
supply	S, UH2, P, L, AH1, Y
surface	S, ER, F, I2, S
surge	S, ER, R, D, J
surgery	S, ER, D, J, ER, Y

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surgical	S, ER, D, J, UH3, K, UH3, L
surplus	S, ER, P, L, UH1, S
suspend	S, UH1, S, P, EH1, EH3, N, D
sweep	S, W, E1, Y, P
sweet	(use "suite" program)
switch	S, W, I1, I3, T, CH
syntax	S, I1, N, T, AE1, EH3, K, PAO, S
system	S, I1, S, T, UH3, M
T	T, E1, AY, Y
table	T, A1, Y, B, UH3, L
tail	(use "tale" program)
tale	T, A1, Y, UH3, L
talk	T, AW, K
tangent	T, AE1, EH3, N, D, J, EH3, N, T
target	T, AH1, UH3, R, G, I2, T
tea	(use "T" program
team	T, E1, Y, M
technical	T, EH1, EH3, K, N, I3, K, UH3, L
tee	(use "T" program)
temperature	T, EH1, EH3, M, P, ER, UH1, T, CH, ER
ten	T, EH1, EH3, N
terminal	T, ER, M, EH3, N, UH2, L
test	T, EH1, EH3, S, T
than	THV, EH1, EH3, N
the	THV, UH1, UH3
then	(use "than" program)
theory	TH, AY, I2, R, Y
thin	TH, I1, I3, N
thing	TH, I1, I3, NG
think	TH, I1, I3, NG, K
third	TH, ER, R, D
thirteen	TH, ER, T, T, E1, Y, N
thirty	TH, ER, R, D, Y
thousand	TH, AH1, UH3, U1, Z, EH3, N, D
three	TH, R, E1, Y
threw	(use "through" program)
through	TH, R, IU, U1
thursday	TH, ER, R, Z, D, A1, I3, Y
ticket	T, I1, I3, K, EH3, T
till	T, I1, I3, L
time	T, AH1, EH3, Y, M

tire	T, AH1, EH3, AY, R
title	T, UH3, AH2, Y, T, UH3, L
to	(use "two" program)
today	T, U1, D, A1, I3, Y
toilet	T, O1, EH3, I3, L, I3, T
toll	T, O2, O2, OO1, L
tomorrow	T, U1, M, AH1, R, O1, U1
ton	T, UH1, UH2, N, N
tone	T, O1, U1, N
too	(use "two" program)
tool	T, U1, U1, L
total	T, O1, U1, T, UH3, L
touch	T, UH1, UH3, T, CH
towel	T, AH1, W, UH3, L
trace	T, R, A1, AY, Y, S
trade	T, R, A1, AY, Y, D
train	T, R, A1, AY, Y, N
transact	T, R, AE1, EH3, N, S, AE1, EH3, K, T
transfer	T, R, AE1, EH3, N, S, F, ER
transistor	T, R, AE1, N, Z, I1, S, T, ER
transmit	T, R, AE1, EH3, N, Z, M, I1, I3, T
transport	T, R, AE1, EH3, N, S, P, O2, O2, R, T
transportation	T, R, AE1, N, S, P, ER, T, A1, AY, SH, UH3, N
travel	T, R, AE1, EH3, V, UH3, L
triangle	T, R, AH1, I3, AE1, EH3, NG, G, UH3, L
trouble	T, R, UH3, UH1, B, UH3, L
truck	T, R, UH1, UH2, K
true	T, R, IU, U1, U1
trust	T, R, UH1, UH2, S, T
try	T, R, AH1, EH3, I3, Y
tuesday	T, IU, U1, U1, Z, D, A1, Y
tune	T, IU, U1, U1, N
turn	T, ER, R, N
twelve	T, W, EH1, EH3, UH3, L, V
twenty	T, W, EH1, EH3, N, T, Y
two	T, IU, U1, U1
type	T, UH3, AH2, Y, P

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U	Y1, IU, U1, U1
ultra	UH3, UH2, L, T, R, UH1
under	UH2, UH2, N, D, ER
uniform	Y1, IU, U1, N, I3, F, O1, R, M
until	UH2, UH2, N, T, I1, I3, L
up	UH1, UH2, P
urgent	R, R, D, J, I3, N, T
us	UH1, UH2, S
use	Y1, IU, U1, U1, Z
use-2	Y1, IU, U1, S
V	V, E1, AY, Y
vacant	V, A1, Y, K, EH3, N, T
valid	V, AE1, UH3, L, I1, D
vary	(use "very" program)
value	V, AE1, EH3, L, Y1, IU, U1
vendor	V, EH1, EH3, N, D, ER
vent	V, EH1, EH3, N, T
verify	V, EH1, R, I3, F, AH1, EH3, Y
very	V, EH1, R, Y
via	V, E1, AY, UH2, UH3
victor	V, I1, I3, K, T, ER
voice	V, O1, UH3, I3, AY, S
void	V, O1, UH3, I3, AY, D
volt	V. O2, O2, L, T
volume	V, AH1, UH3, L, Y1, IU, U1, M
W	D, UH1, B, UH3, L, Y1, IU, U1
wage	W, A1, AY, Y, D, J
wait	W, A1, AY, Y, T
want	W, AH1, UH3, N, T
was	W, UH1, UH3, Z
wash	W, AW, SH
water	W, AH1, UH3, T, ER
watt	W, AH1, UH3, T
wave	W, A1, AY, Y, V
way	(use "weigh" program)
we	W, E1, Y
weak	(use "week" program)
weapon	W, EH2, EH2, P, UH1, N
wear	(use "where" program)
wednesday	W, EH1, N, Z, D, A1, I3, Y
week	W, E1, Y, K

weigh	W, A2, A2, Y
weight	(use "wait" program)
went	W, EH1, EH3, N, T
west	W, EH1, EH3, S, T
wet	W, EH1, EH3, T
what	W, UH3, UH1, T
wheel	W, E1, Y, L
when	W, EH1, EH3, N
where	W, EH3, A2, EH3, R
which	W, I1, I3, T, CH
while	W, AH1, EH3, I1, UH3, L
whiskey	W, I1, I3, S, K, AY, Y
white	W, UH3, AH2, Y, T
who	H, IU, U1, U1
whole	(use "hole" program)
why	(use "Y" program)
will	W, I1, I3, L
window	W, I1, N, D, O1, U1
winter	W, I1, I3, N, T, ER
wire	W, AH1, EH3, AY, R
with	W, I1, I3, TH
withdraw	W, I1, I3, TH, D, R, AW
without	W, I1, I3, TH, UH2, AH2, U1, T
won	(use "one" program)
word	W, ER, R, D
work	W, ER, R, K
write	(use "right" program)
wrong	R, AW, NG
X	EH1, EH2, K, PAO, S
x-ray	EH1, EH2, K, PAO, S, R, A1, I3, Y
Y	W, AH1, EH3, I3, Y
yankee	Y1, AE1, EH3, NG, K, E1, Y
yard	Y1, AH1, R, D
year	Y1, AY, I3, R
yellow	Y1, EH1, EH3, L, O1, U1
yes	Y1, EH3, EH1, S
yesterday	Y1, EH3, EH1, S, T, ER, D, A1, I3, Y
yet	Y1, EH1, EH3, T

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you	(use "U" program)
your	Y, O2. O2, R
you're	(use "your" program)
Z	Z, E1, Y
zap	Z, AE1, EH3, P
zero	Z, AY, I1, R, O1, U1
zone	Z, O1, U1, N
zulu	Z, IU, U1, L, IU, U1

Prefixes

con...	K, UH1, N
dis...	D, I1, S
en...	EH1, N
in...	I1, N
non...	N, AH1, UH3, N
pre...	P, R, E1
re...	R, E1
un...	UH1, N

Suffixes

...d	D
...ed	I2, D
...er	ER
...es	I2, Z
...ful	F, UH3, L
...ing	I2, NG
...less	L, EH2, S
...ly	L, Y
...ment	M, EH3, N, T
...ness	N, EH3, S
...s	S
...t (...ed)	T
...tion (...sion)	SH, UH3, N
...teen	T, E1, Y, N
...ward	W, ER, D
...y	Y
...z (...es)	Z