Winbond
Electronics Corp.

ADPCM VOICE SYNTHESIZER
(PowerSpeech II)

GENERAL DESCRIPTION

The W529XX family comprises 4-bit ADPCM and 8-bit PCM voice synthesizers that provide basic *PowerSpeech* instructions and a number of more powerful commands, which include basic ALU operations, data move, branch, and random number generation.

The W529XX family includes the W52904, W52905, W52906, W52910, W52915, and W52920. The playback duration time of each of these products is shown below:

BODY	DURATION
W52902	6 sec.
W52904	12 sec.
W52905	20 sec.
W52906	30 sec.
W52910	40 sec.
W52915	60 sec.
W52920	80 sec.

Note: All playback lengths are estimated for typical applications.

FEATURES

- Powerful programmable speech synthesizer
- Wide operating voltage range: 2.4 to 5.5 volts
- Both 4-bit ADPCM and 8-bit PCM synthesis methods can be used
- Provides 4 trigger pins with separate control of falling/rising edge
- Two trigger input debounce times (160 to 320 μS or 20 to 40 mS) can be set
- 8 multiplexed pins can be set as SCAN, FTEST, LED, STOP, or INPUT
- Supports ALU operations, including
  - Branch decisions
  - Logic operations
  - Binary addition/subtraction
  - Data move
  - Bit operand
- Provides eight general purpose registers: R0 to R7
- Provides four special registers: EN, MODEn (n: 1, 2), OUTPUT, and ACC
- Maximum 32 matrix keys can be defined by H/W or S/W
- Provides random number generation by H/W
- Section control provided for each GO instruction
  - Variable frequency: 4.8/6/8/12 KHz
  - LED: ON/OFF
- Three LED flash types provided: 3 Hz, circular, and random
- System clock uses 1.5 MHz frequency
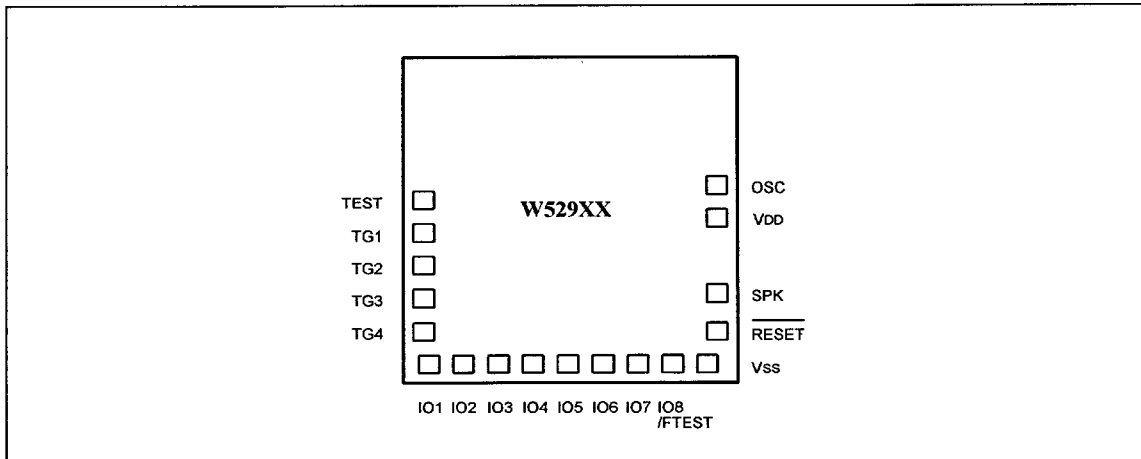- Total of 256 label entries available for programming

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PAD CONFIGURATION


```
TEST  □            W529XX         □  OSC
TG1   □                           □  VDD
TG2   □
TG3   □                           □  SPK
TG4   □                           □  RESET
      □ □ □ □ □ □ □ □             Vss
     IO1 IO2 IO3 IO4 IO5 IO6 IO7 IO8
                                /FTEST
```

PIN DESCRIPTION

NAME	I/O	DESCRIPTION
TEST	I	Test pin, internally pulled low
TG1	I	Direct trigger input 1, internally pulled high
TG2	I	Direct trigger input 2, internally pulled high
TG3	I	Direct trigger input 3, internally pulled high
TG4	I	Direct trigger input 4, internally pulled high
IO1	I/O	SCAN/LED/STOP/INPUT multiplexed pin 1
IO2	I/O	SCAN/LED/STOP/INPUT multiplexed pin 2
IO3	I/O	SCAN/LED/STOP/INPUT multiplexed pin 3
IO4	I/O	SCAN/LED/STOP/INPUT multiplexed pin 4
IO5	I/O	SCAN/LED/STOP/INPUT multiplexed pin 5
IO6	I/O	SCAN/LED/STOP/INPUT multiplexed pin 6
IO7	I/O	SCAN/LED/STOP/INPUT multiplexed pin 7
IO8/FTEST	I/O	LED/STOP/INPUT multiplexed pin 8 or frequency test pin
Vss	-	Negative power supply
$\overline{\text{RESET}}$	I	Reset; functions as POR; low active
SPK	O	Current type output for speaker
VDD	-	Positive power supply
OSC	I	Oscillator input, connect ROSC to VDD

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BLOCK DIAGRAM
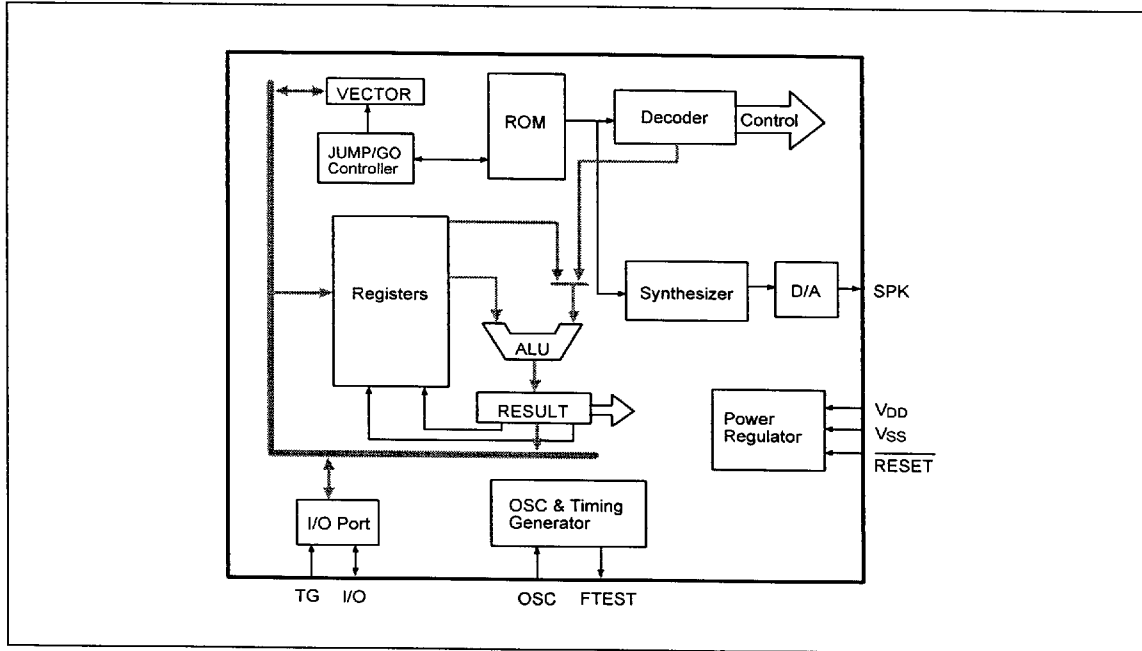
FUNCTIONAL DESCRIPTION

Trigger Inputs

The W529XX provides four direct trigger input pins that are pulled high internally. All of these trigger inputs can be independently defined to be enabled or disabled for the rising or falling edges. The debounce time of the trigger inputs can be set as 160 μS to 320 μS or 20 mS to 40 mS.

SPK Output

This pin is a current-type voice output, which is connected to the output of the internal D/A converter. The full-scale output of the 8-bit D/A convereter is 5 mA, which is sufficient to drive an external 8Ω speaker through the amplification of a low-power NPN transistor with a β of 120 to 160.

I/O Pin

The I/O pins, IO1 to IO8, are multiplexed for four different functions: SCAN/FTEST, LED, STOP, and INPUT. All of these pins can be defined independently as shown in the following table.

GROUP	IO8	IO7	IO6	IO5	IO4	IO3	IO2	IO1
0	INPUT/STOP				INPUT/LED			
1	FTEST/LED	SCAN/LED			SCAN/LED			
2	INPUT/LED				SCAN/STOP			
3	LED/STOP				LED/STOP			

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Oscillator

The oscillator is used to generate the system frequency of around 1.5 MHz. The OSC pin is connected directly to V_{DD} by an R_{OSC} resistor, which is used to provide a bias current for the oscillator.

RESET

This is an active low reset input with an internal pull-high resistance. If the W529XX is turned off and then on again without discharging the V_{DD} to ground level, the chip may function abnormally, causing unpredictable operation. The W529XX can be reset by sending a pulse through the RESET pin to restart the operation from the beginning.

ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	CONDITIONS	RATED VALUE	UNIT
Power Supply	V_{DD}–V_{SS}	-	-0.3 to +7.0	V
Input Voltage	V_{IN}	All Inputs	V_{SS} -0.3 to V_{DD} +0.3	V
Storage temp.	T_{STG}	-	-55 to +150	°C
Operating Temp.	T_{OPR}	-	0 to +70	°C

Note: Exposure to conditions beyond those listed under Absolute Maximum Ratings may adversely affect the life and reliability the device.

DC CHARACTERISTICS

(T_A = 25° C, V_{SS} = 0V)

PARAMETER	SYM.	CONDITIONS	LIMITS			UNIT
			MIN.	TYP.	MAX.	
Operating Voltage	V_{DD}	-	2.4	4.5	5.5	V
Input Voltage	V_{IL}	All Input Pins	V_{SS} -0.3	-	0.3 V_{DD}	V
	V_{IH}		0.7 V_{DD}	-	V_{DD}	
Standby Current	I_{DD}	V_{DD} = 5V, No Playing	-	-	1	μA
Operating Current (except W52915, W52920)	I_{OP1}	V_{DD} = 3V, No Load	-	-	400	μA
	I_{OP2}	V_{DD} = 5V, No Load	-	-	800	
Operating Current (W52915, W52920)	I_{OP1}	V_{DD} = 3V, No Load	-	-	0.5	mA
	I_{OP2}	V_{DD} = 5V, No Load	-	-	1	
Input Current for TGn	I_{IN}	V_{DD} = 3V, V_{IN} = 0V	-	-	-3	μA
SPK (D/A Full Scale)	I_O	V_{DD} = 4.5V, R_L = 100 Ω	-4.0	-5.0	-6.0	mA
Output Current for IOn	I_{OL}	V_{DD} = 3V, V_{OUT} = 0.4V	0.8	-	-	mA
	I_{OH}	V_{DD} = 3V, V_{OUT} = 2.7V	-0.4	-	-	

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DC Characteristics, continued

PARAMETER	SYM.	CONDITIONS	LIMITS			UNIT
			MIN.	TYP.	MAX.	
Oscillation Frequency	FOSC	ROSC = Typ.	1.35	1.5	1.65	MHz
Oscillation Frequency Deviation by Voltage Drop	$\frac{\Delta FOSC}{FOSC}$	$\left\lvert \frac{F(3V) - F(2.4V)}{F(3V)} \right\rvert$	0	4	7.5	%
Input Debounce Time	TDEB1	FOSC = 1.5 MHz	20	30	40	mS
	TDEB2		160	240	320	μS

Note: ROSC = Typ. = 120 KΩ.

TYPICAL APPLICATION CIRCUIT
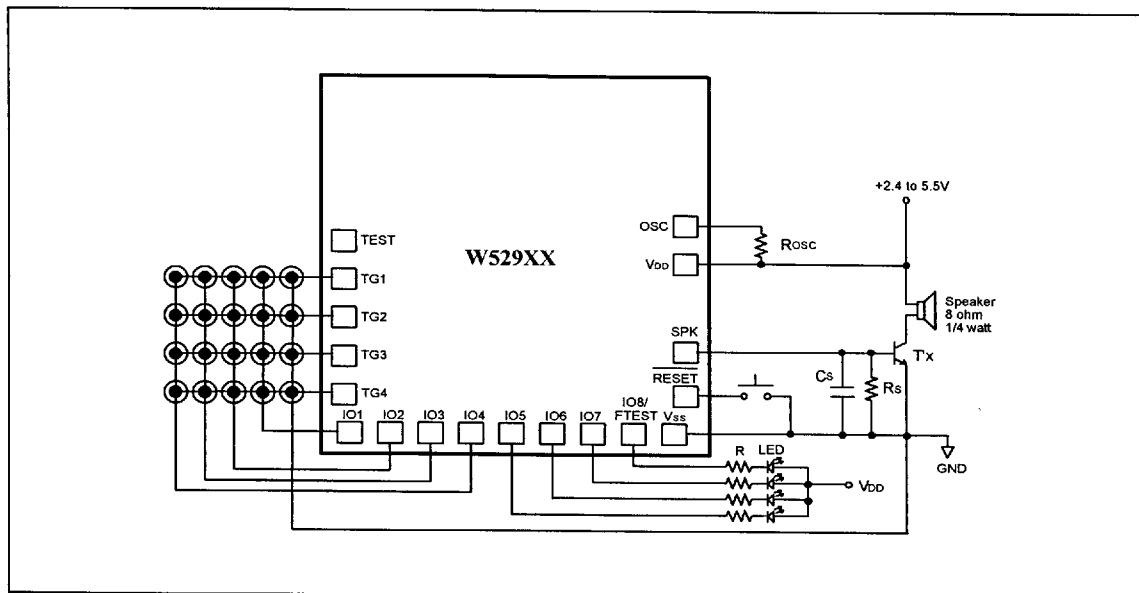
Notes:

1. In principle, the playing speed determined by ROSC should correspond to the sampling rate during the coding phase. The playing speed may be adjusted by varying ROSC, however.

2. Rs is an optional current-dividing resistor. If Rs is added, the resistance should be between 470 and 75Ω.

3. Cs is optional.

4. The DC current gain β of transistor 8050 ranges from 120 to 160.

5. All unused trigger pins can be left open because of their internal pull-high resistance.

6. Typical ROSC is 120 KΩ

7. R is used to limit the current on the LED.

8. No warranty on mass production.