Winbond Electronics Corp.

ADPCM VOICE SYNTHESIZER (ROM-LESS Power Speech II)

GENERAL DESCRIPTION

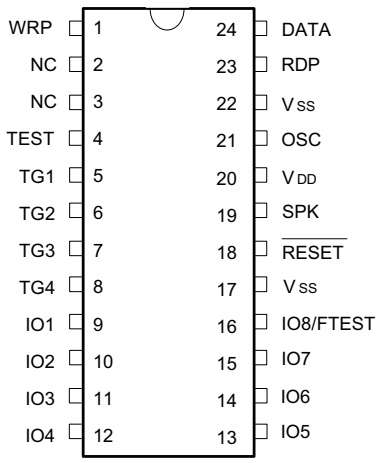
The W52900 is a CMOS IC used solely for the purpose of demonstrating the W529xx series PowerSpeech II products.

The W52900 is a 4-bit ADPCM and/or 8-bit PCM ROMless voice synthesizer that provides basic PowerSpeech instructions and a number of more powerful commands, including basic ALU operations, data move, branch, and random number generation. When used with a Winbond OTP or flash EPROM, the W52900 allows users to create demonstration devices quickly and easily.

FEATURES

- ROMless structure, used with Winbond OTP or serial flash EPROM for demonstration
- 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 edges
- Two trigger input debounce times (160 to 320 μS or 20 to 40 mS) can be set
- Eight 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
- Eight general-purpose registers: R0 to R7
- 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/Random
- System clock uses 1.5 MHz frequency
- Total of 256 label entries available for programming
- Packaged in 24-pin skinny DIP

PIN CONFIGURATION



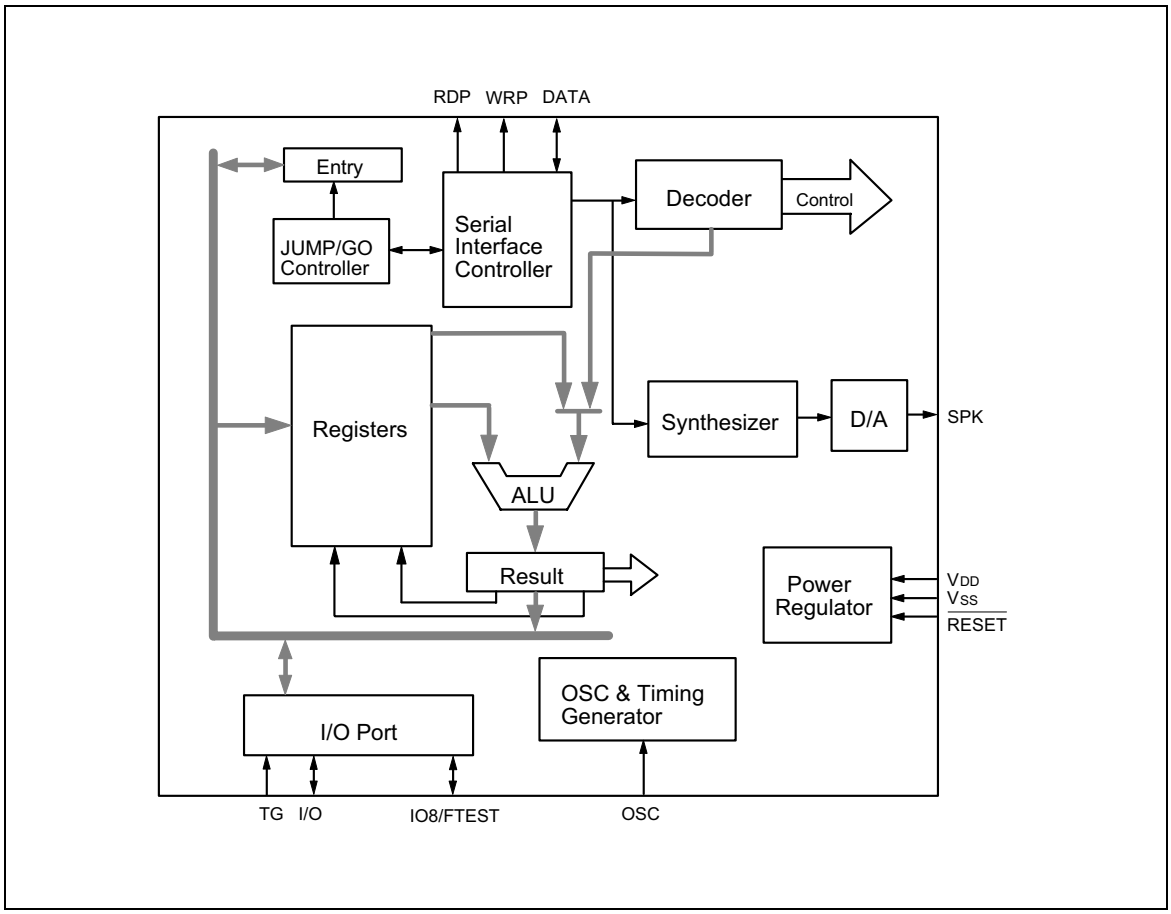
PIN DESCRIPTION

NO.	NAME	I/O	DESCRIPTION
1	WRP	O	Write clock output pin for serial interface
2	NC	-	Not connected
3	NC	-	Not connected
4	TEST	I	Test pin, internally pulled low
5	TG1	I	Direct trigger input 1, internally pulled high
6	TG2	I	Direct trigger input 2, internally pulled high
7	TG3	I	Direct trigger input 3, internally pulled high
8	TG4	I	Direct trigger input 4, internally pulled high
9	IO1	I/O	SCAN/LED/STOP/INPUT multiplexed pin 1
10	IO2	I/O	SCAN/LED/STOP/INPUT multiplexed pin 2
11	IO3	I/O	SCAN/LED/STOP/INPUT multiplexed pin 3
12	IO4	I/O	SCAN/LED/STOP/INPUT multiplexed pin 4
13	IO5	I/O	SCAN/LED/STOP/INPUT multiplexed pin 5
14	IO6	I/O	SCAN/LED/STOP/INPUT multiplexed pin 6
15	IO7	I/O	SCAN/LED/STOP/INPUT multiplexed pin 7
16	IO8/FTEST	I/O	LED/STOP/INPUT multiplexed pin 8 or frequency test pin

Pin Description, continued

NO.	NAME	I/O	DESCRIPTION
17	VSS	-	Negative power supply
18	$\overline{\text{RESET}}$	I	Reset; functions as POR; low active
19	SPK	O	Current type output for speaker
20	VDD	-	Positive power supply
21	OSC	I	Oscillator input, connect ROSC to VDD
22	VSS	-	Negative power supply
23	RDP	O	Read clock output pin for serial interface
24	DATA	I/O	Bidirectional data pin for serial interface

BLOCK DIAGRAM



FUNCTIONAL DESCRIPTION

Trigger Inputs

The W52900 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 by the rising or falling edge. 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 that 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 8 Ω speaker through the amplification of a low-power NPN transistor with a β of 120 to 160 (an 8050D transistor is usually appropriate).

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			

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.

$\overline{\text{RESET}}$

This is an active low reset input with an internal pull-high resistance. If customers turn the W52900 off and then on again without discharging the V_{DD} to ground level, the chip may function abnormally, causing unpredictable operation. Users may reset the W52900 by sending a pulse through the $\overline{\text{RESET}}$ 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 of the device.

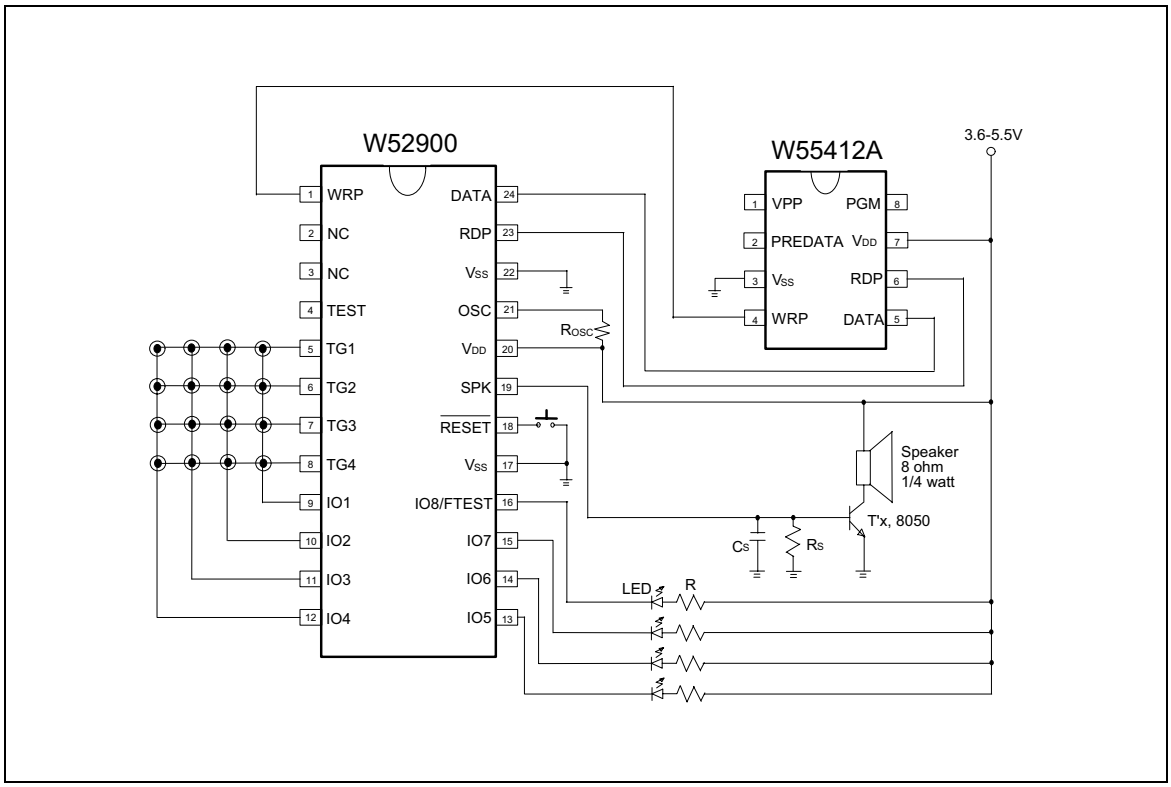
DC CHARACTERISTICS

(T_A = 25° C, V_{SS} = 0 V)

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} = 5 V, No Playing	-	-	1	µA
Operating Current	I_{OP1}	V_{DD} = 3 V, No Load	-	-	400	µA
	I_{OP2}	V_{DD} = 5 V, No Load	-	-	800	
Input Current for TGn	I_{IN}	V_{DD} = 3 V, V_{IN} = 0 V	-	-	-3	µA
SPK (D/A Full Scale)	I_O	V_{DD} = 4.5 V, R_L = 100 Ω	-4.0	-5.0	-6.0	mA
Output Current for IOn	I_{OL}	V_{DD} = 3 V, V_{OUT} = 0.4 V	1	-	-	mA
	I_{OH}	V_{DD} = 3 V, V_{OUT} = 2.7 V	-0.5	-	-	
Oscillation Frequency	F_{OSC}	R_{OSC} = Typ.	1.35	1.5	1.65	MHz
Oscillation Frequency Deviation by Voltage Drop.	$\left\lvert\frac{\Delta F_{OSC}}{F_{OSC}}\right\rvert$	$\left\lvert\frac{F(3\ V) - F(2.4\ V)}{F(3\ V)}\right\rvert$	0	4	7.5	%
Input Debounce Time	T_{DEB1}	F_{OSC} = 1.5 MHz	20	30	40	mS
	T_{DEB2}		160	240	320	µS

Note: R_{OSC} = Typ. = 120 KΩ.

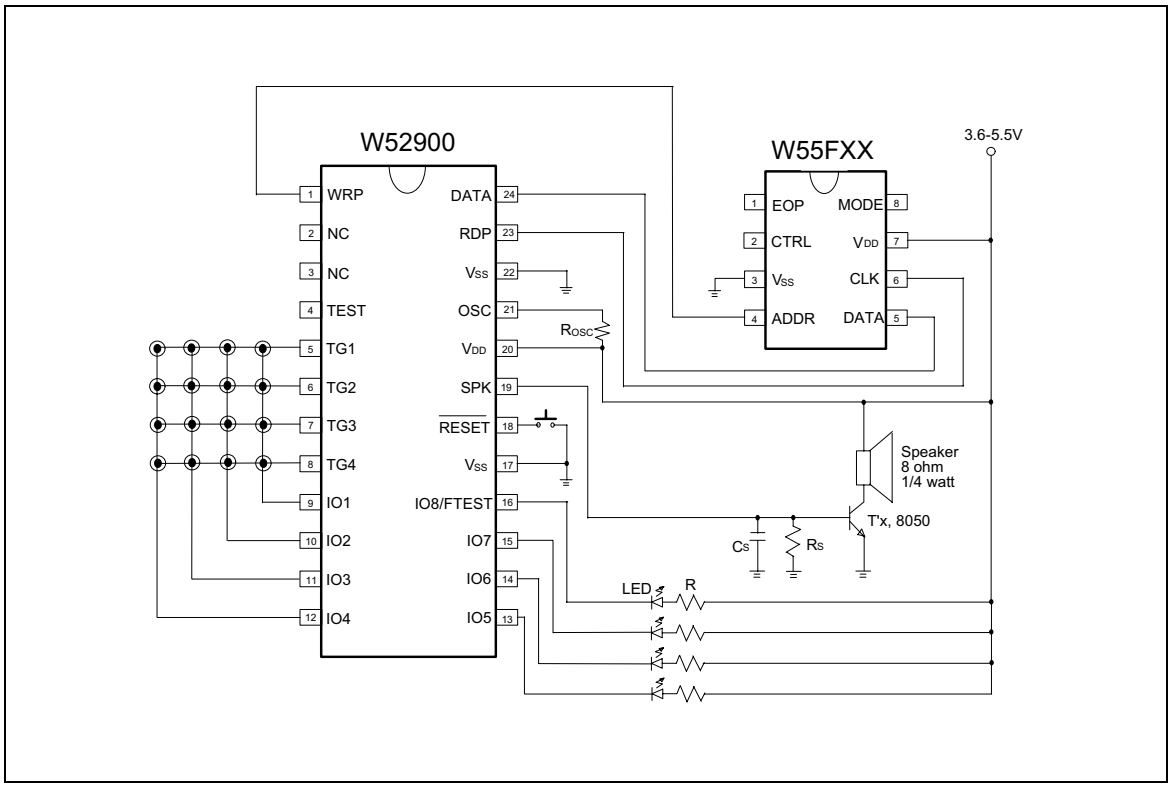
TYPICAL APPLICATION CIRCUIT_(I)



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 750 Ω.
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. R is used to limit the current on the LED.
7. Typical Rosc is 120 KΩ.

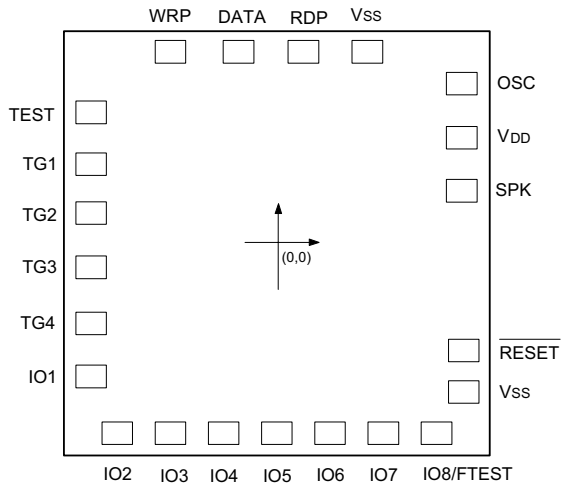
TYPICAL APPLICATION CIRCUIT_(II)



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 750 Ω.
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. R is used to limit the current on the LED.
7. Typical ROSC is 120 KΩ.

BONDING PAD DIAGRAM



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