



## DUAL-TONE MELODY WITH VOICE SYNTHESIZER (BandDirector™ Series)

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## 1. GENERAL DESCRIPTION

The W562xxx is one of the derivatives of the BandDirector™ family. It consists of a 4-bit  $\mu$ C, two voice synthesizers, one Dual-Tone Melody generator, 38 KHz carrier output for IR transmission and one ROM shared ROM.

The multi-tasking operation for voice synthesis and Dual-Tone Melody generation is implemented by dedicated H/W that can output the speech voice in parallel with the background music. The 4 bit kernel, which executes instructions of up to 12 KIPS (Kilo-Instructions Per Second) can offer customers a great deal of flexibility to achieve various kind of program controls for different applications.

In addition, the W562xxx's user-friendly development environment can effectively reduce your design period and help you easily tool your project by yourself with the W56xxx ICE and emulation kit.

There are 9 kinds of W562xxx IC bodies. (See table below).

PART NO.	W562S08	W562S10	W562S12	W562S15	W562S20	W562S25	W562S30
Duration	8 sec	10 sec	12 sec	15 sec	20 sec	25 sec	30 sec
ROM Size	256 Kbit	288 Kbit	320 Kbit	480 Kbit	576 Kbit	672 Kbit	768 Kbit
PART NO.	W562S40	W562S50	W562S60	W562S80	W562S99	W562M02	
Duration	40 sec	50 sec	60 sec	80 sec	100 sec	120 sec	
ROM Size	1216 Kbit	1376 Kbit	1536 Kbit	2304 Kbit	2688 Kbit	3072 Kbit	

Note: The voice durations are estimated by 6.4 KHz sampling rate

Possible applications are:

- Programmed voice synthesis with background music or speech.
- I/O interactive voice synthesis to accompany background music or speech.
- Q&A games.
- Edutainment toys.
- Remote toys.

## 2. FEATURES

- Multi-engine processor parallel management with  $\mu$ C, speech and Dual-Tone Melody.
  - $\mu$ C // (Synthesizer1 or Dual-Tone Melody) // Synthesizer2 (//: in parallel )
  - $\mu$ C, with basic ALU, 64-nibble RAM (including 8 working registers) and an 8-bit timer.
    - The W561 & W562 user RAM initialization value is not constant. It is random. So, user must initial constant value.
  - Synthesizer1 capable of voice syntheses with Sample rate @ 4.8/6/8/12 KHz
  - Synthesizer2, same as synthesizer1.
  - Dual-tone Melody D/A output with 3 level volume control

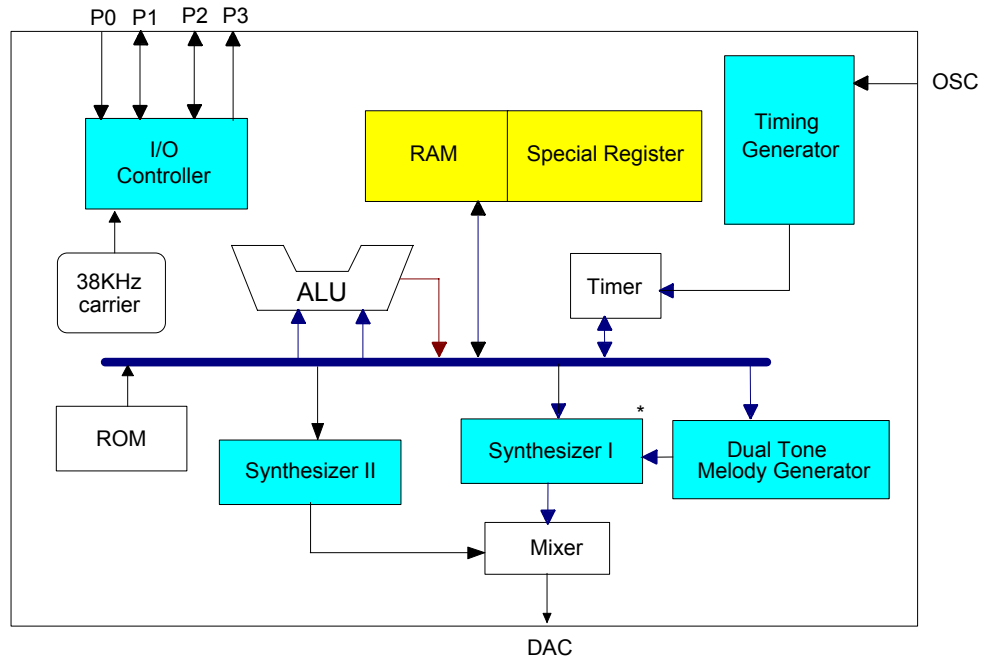


- ICE & ROM chips use different Rosc. Rosc for mass production should check “W562 Freq vs R.pdf” file for more details.
- Wide operating voltage range: 2.4 to 5.5 volts
- Low power consumption ( $V_{DD} = 5$  Volt)
  - Standby current  $< 1 \mu A$
  - Operating current  $< 1$  mA
- Main oscillator: 3 MHz, Ring oscillation
- Input/ Output port
  - Port for input only: 1 port/ 4 pins
  - Input/ Output ports: 2 ports/ 8 pins
  - Port for output only: 1 port/ 4 pins
  - Can offer a direct row and column matrix of up to 72 ( $8 \times 9$ ) keys
- Interrupts
  - Internal interrupts: Timer
  - External interrupts: TG (port 0, port1), POI (Power On Initialization)
  - Priority: POI  $>$  TG  $>$  Timer
- Melody + Voice outputs for DAC
- TG interrupt provided
  - Share TG interrupt for Port0/Port1 input
  - Global TG interrupt enable controlled (bit3 of the IER register)
  - Individual interrupt enable controlled (PER0 and PER1 registers)
- Built-in 8 bit programmable down count timer
  - One of two internal clock frequencies can be selected
  - Desired Timer interval = (preset value+1) \*  $1/F_T$( $F_T$ : 32 Hz or 32 KHz dependent on the bit0 of the MODE register, at  $F_{osc} = 3$  MHz)
- A total of around 64,000 instructions can be used in the program
- Powerful instruction set:
  - Arithmetic: ADD, ADDC, SUB, SUBC, INC, DEC, SETB, CLRB
  - Logic Operation: AND, OR, XOR, NOT
  - Shift & Rotate: RORC, ROLC, SHRC, SHLC
  - Data move: LD, LDR, MV
  - Branch: JP, JB0, JB1, JB2, JB3, JZ, JNZ, JC, JNC, JBZ1, JBZ2, CJNE, CJE, DJNZ, DJZ
  - Subroutine: CALL, RTN, RTI
  - Others: NOP, END, EN INT, DIS INT, PLAY CH1, PLAY CH2, STOP CH1, STOP CH2



- 8-level STACK shared by CALL, Timer, Synthesizer and TG
- Multi-tasking operation via interrupt for automatic voice segment concatenation
  - Melody or Speech voice can be easily concatenated with symbol "+"
  - Example: PLAY CH1, H4 + Melody1 + Speech1 + Speech2 + Melody2 + T4  
The DAC of the W562xxx will play Melody1, Speech1, Speech2 and Melody2 sequentially
- The length of the voice segment is unlimited
- Speech section control
  - Sample rate control (4.8K/6K/8K/12K)
  - Example: PLAY CH2, H4 + speech1\_S + T4; S: define the sample rate
- Melody section control
  - Background music D/A output bits selectable for volume control (6/7/8)
  - Example: PLAY CH1, H4 + Melody\_xxB + T4; B: define the melody output bits
- Dual-Tone melody with
  - XM3: Triple harmonic effect
  - 3 kinds of percussion effects
  - 6 beats
  - 41 pitches from G3# to C7
  - 16 kinds of tempo
  - The number of the score and note are unlimited
- Provide IR 38 KHz carrier
  - TXF.0 = 0/1 disable/enable IR carrier
  - TXF.1 = 0/1 output carrier with P2.3 low/high active
- Provides ICE (In Circuit Emulation) system for easy debugging
  - Free Run
  - Stop Run
  - Program Reset
  - Step Into
  - Step Over
  - Go To Cursor
  - Break point
  - Register read/ modify

### 3. BLOCK DIAGRAM



### 4. PAD DESCRIPTION

NAME	I/O	DESCRIPTION
TEST	I	Test pin, internally pulled low
P0.0–P0.3	I	Interruptable input pins, internally pulled high
P1.0–P1.3	I/O	I/O multiplexed port1. Interruptable port if selected as input
P2.0–P2.3	I/O	I/O multiplexed port 2 P2.3 can be programmed as 38 KHz carrier output pin
P3.0–P3.3	O	Output port 3
Vss	-	Negative power supply
$\overline{\text{RESET}}$	I	Reset all, functions as POR (Power On Reset), internally pulled high
VDD	-	Positive power supply
OSC	I	Connect R <sub>osc</sub> to VDD to generate 3 MHz oscillator
DAC	O	Current output of mixing of the channel 1 and channel 2 for driving an external speaker



## 5. ELECTRICAL CHARACTERISTICS

### 5.1 Absolute Maximum Ratings

PARAMETER	SYMBOL	CONDITIONS	RATED VALUE	UNIT
Power Supply	V <sub>DD</sub> -V <sub>SS</sub>	-	-0.3 to +7.0	V
Input Voltage	V <sub>IN</sub>	All Inputs	V <sub>SS</sub> -0.3 to V <sub>DD</sub> +0.3	V
Storage Temp.	T <sub>STG</sub>	-	-55 to +150	°C
Operating Temp.	T <sub>OPR</sub>	-	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.

### 5.2 DC Characteristics

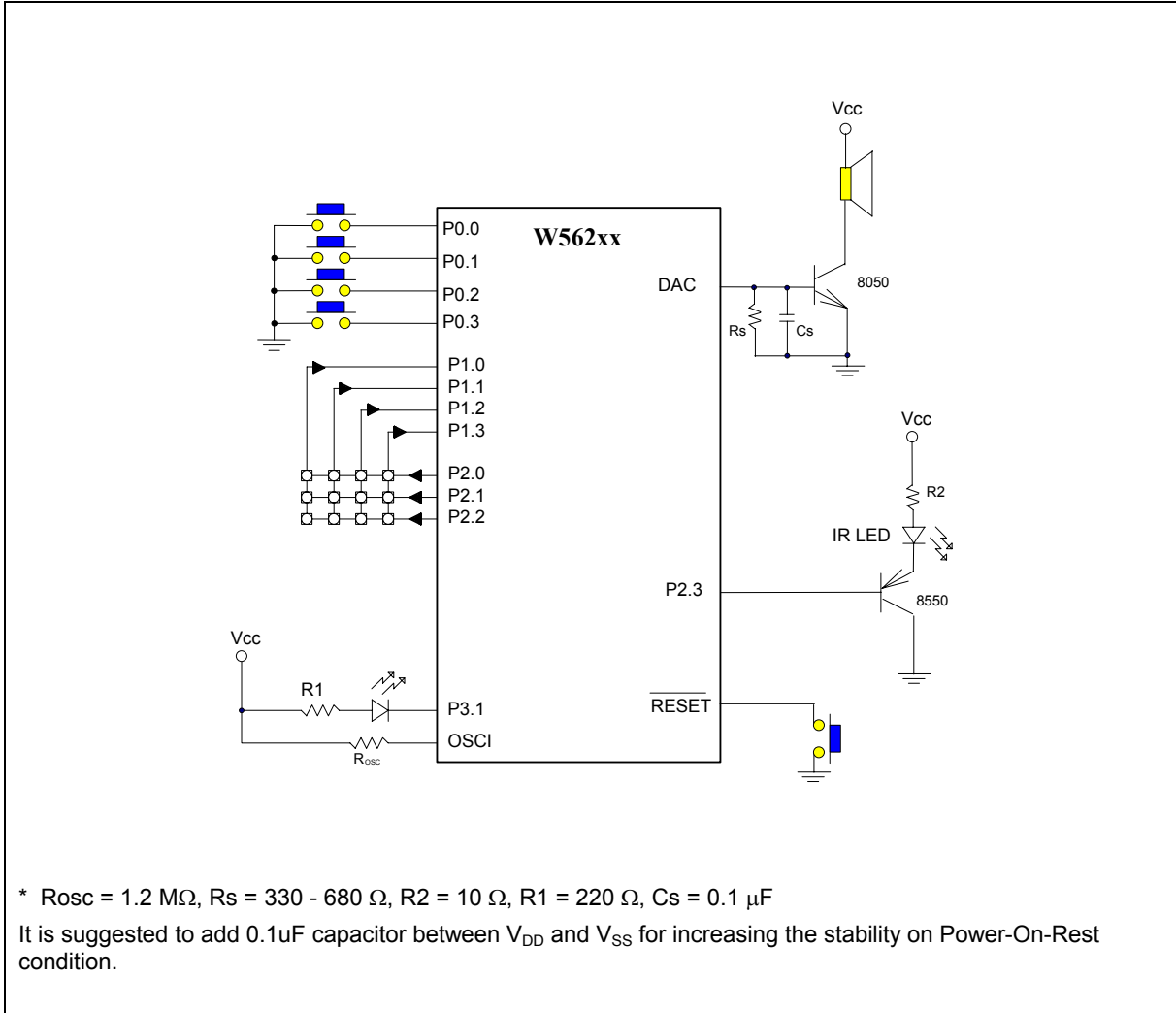
(V<sub>DD</sub>-V<sub>SS</sub> = 3.0V, F<sub>m</sub> = 3 MHz, T<sub>A</sub> = 25° C; unless otherwise specified)

PARAMETER	SYM.	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Operating Voltage	V <sub>DD</sub>	-	2.4	-	5.5	V
Standby Current	I <sub>DD1</sub>	No load, No Playing	-	-	1	μA
Operating Current (Ring Type)	I <sub>OP2</sub>	No load	-	-	1	mA
Input Low Voltage	V <sub>IL</sub>	All Input Pins	V <sub>SS</sub>	-	0.3 V <sub>DD</sub>	V
Input High Voltage	V <sub>IH</sub>	All Input Pins	0.7 V <sub>DD</sub>	-	V <sub>DD</sub>	V
Input Current for P0, P1, P2	I <sub>IN</sub>	V <sub>DD</sub> = 3V, V <sub>IN</sub> = 0V	-	-	-6	μA
Input Current for RESET	I <sub>IN1</sub>	V <sub>DD</sub> = 3V, V <sub>IN</sub> = 0V	-	-	-6	μA
Output Current of P1, P2, P3	I <sub>OL</sub>	V <sub>DD</sub> = 3V, V <sub>OUT</sub> = 0.4V	5	-	-	mA
	I <sub>OH</sub>	V <sub>DD</sub> = 3V, V <sub>OUT</sub> = 2.7V	-3	-	-	mA
DAC (D/A full Scale)	I <sub>DAC</sub>	V <sub>DD</sub> = 4.5V, R <sub>L</sub> = 100Ω	-4.0	-5.0	-6.0	mA
Pull-low Resistor	R <sub>PL</sub>	TEST Pin	100	-	-	KΩ

### 5.3 AC Characteristics

PARAMETER	SYM.	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Main-clock Frequency	F <sub>M</sub>	Ring type, R <sub>OSC</sub> = 1.2MΩ	2.7	3	3.3	MHz
Frequency Deviation by Voltage Drop for Ring Type Oscillator	$\frac{\Delta f}{f}$	$\frac{f(3V) - f(2.4V)}{f(3V)}$	-	-	10	%
Machine Cycle Time	T <sub>INS</sub>	One machine cycle	1/12	-	1/6	mS
POR Pulse Width	T <sub>POR</sub>	-	1	-	-	μS

## 6. APPLICATION CIRCUIT





## 7. REVISION HISTORY

REVISION	DATE	DESCRIPTION
A1	Oct-1998	Preliminary release.
A2	Dec-1998	Add BandDirector trade mark
A3	Feb-1999	Remove the 'preliminary' mark
A4	Jan-2001	In page 1, add statement "The W561&W562 user RAM initialization value is not constant. It is random."
A5	June 3, 2003	In page 2, add statement "ICE & ROM chips use different Rosc. Rosc for mass production should check "W562 Freq vs R.pdf" file for more details."



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