

# W562XXX Data Sheet



## 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

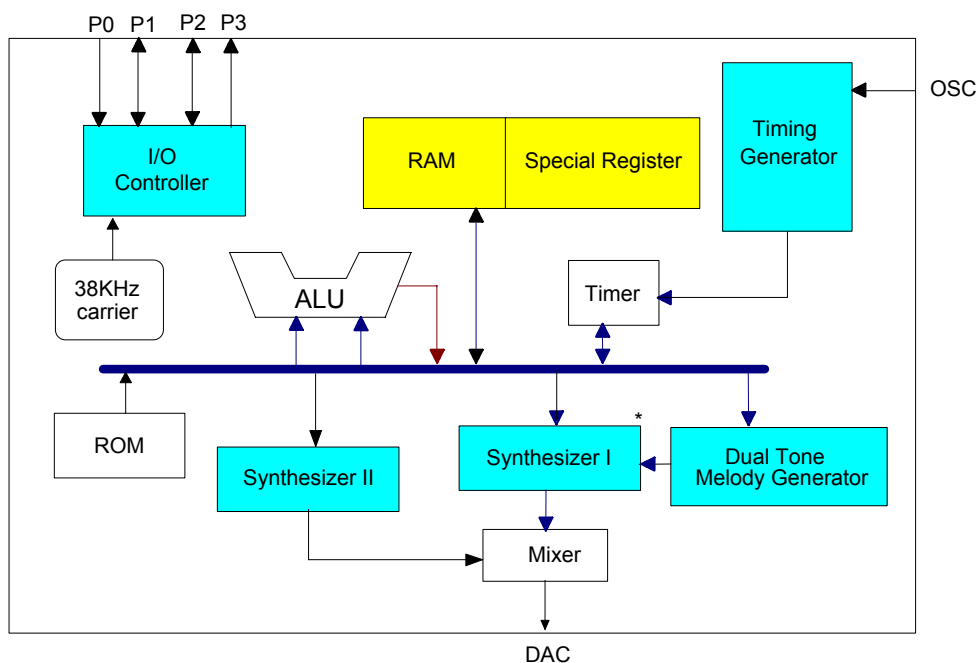


- ICE & ROM chips use different Rosc. Rosc for mass production should check “W562 Freq vs R.pdf” file for more details.
- Wide operating voltage range: 2.4 to 5.5 volts
- Low power consumption ( $V_{DD} = 5$  Volt)
  - Standby current  $< 1 \mu A$
  - Operating current  $< 1$  mA
- Main oscillator: 3 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 Fosc = 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<br>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

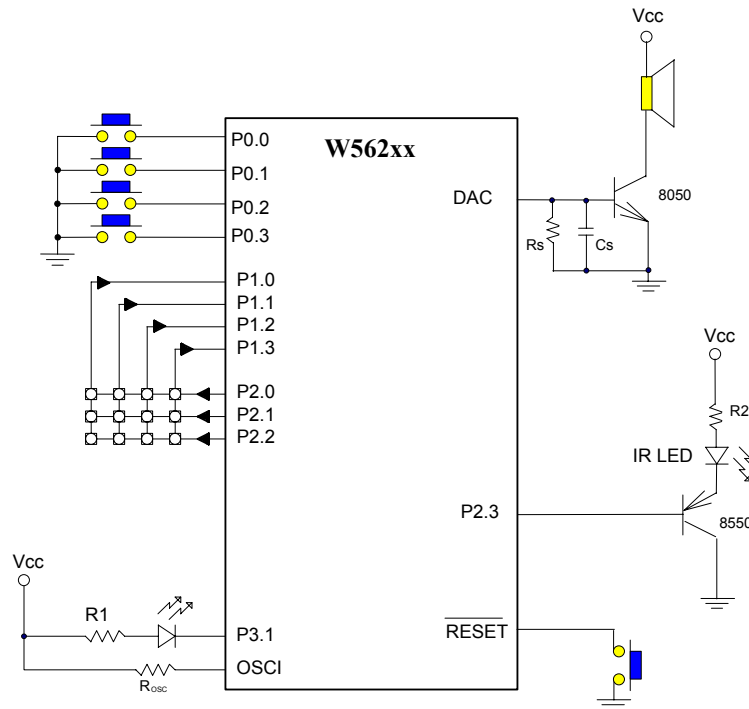
(V<sub>DD</sub>-V<sub>SS</sub> = 3.0V, F<sub>m</sub> = 3 MHz, T<sub>A</sub> = 25° C; unless otherwise specified)

| 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



\* R<sub>osc</sub> = 1.2 MΩ, R<sub>s</sub> = 330 - 680 Ω, R2 = 10 Ω, R1 = 220 Ω, C<sub>s</sub> = 0.1 μF

It is suggested to add 0.1μF capacitor between V<sub>DD</sub> and V<sub>SS</sub> for increasing the stability on Power-On-Rest condition.

**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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