

FCC ID: RS4-40484

Technical Description :

The brief circuit description is listed as follows :

- CON1 and CON2 act as Loop Antennas.
- Q2 – Q7 and associated circuit act as RF Amplifier.
- U2 W55MID50 acts as RFID Reader.
- Y1 and associated circuit act as 13.56 MHz Oscillator.
- U1 W588D003 acts as MCU with Voice Synthesizer.
- U5 W55X40 acts as Flash Memory.
- U3 GPY0030A acts as Audio Amplifier.
- U4 GPY0029B and associated circuit act as 3.3V Voltage Regulator.
- SW1 acts as Control Key.

Antenna Used :

Two loop antennas have been used.



General Description

Winbond *MFID^{WB}* (Magnetic Field Identification) series W55MID50 supports selectable multi-level transmission power, programming base Control Register (CR) for W55MID15 single-tag ID or W55MID35 multi-tag IDs data recognition, serial-mode or parallel-mode uC interface, and power-down mode. The W55MID50 especially focus on toy, security, and consumer related applications.

The system applications with Winbond *MFID^{WB}* Tag series such as W55MID15 provides the single-tag bonding-ID solution for manufacture, which has 243 bonding-IDs can be selected for use. Besides the single-

tag transponder, W55MID35 provides multi-tag transponder recognition function for intelligent and smart toy applications. Typically, 6 ~ 8 tags can be recognized in the same time as well as are located in the same reader antenna area. A special application for smart toy, W55MID35 supports both *Repeated-ID* mode and *Unique-ID* mode in operation.

W55MID50 provides a wide variety of applications for toy, security, and consumer market meanwhile the W55MID50 is the most cost effective solution for current *MFID^{WB}* related application market.

1.1 W55MIDxx Series Selection Guide

W55MID Series Selection Guide

	W55MID15	W55MID35	W55MID50	W55MID20	W55MID55
Category	Single-tag	Multi-tag	Reader	R/W-tag	R/W-Reader
Frequency	13.56MHz			13.56MHz	
ID type	Bonding-ID		X	Programmable-ID	X
# of available IDs	243 IDs		X	Infinite	X
ID length	10-bit		X	64-bit	X
Anti-collision	X	5 ~ 8 Tags	X	5 ~ 8 Tags	X
TX power	X		4-level option	X	4-level option
uC interface	X		Serial/Parallel	X	Serial/Parallel
Package	Dice form		Dice/SOP-20	Dice form	Dice/SOP-20
E/S	Now			Apr. 2003	
Production	Jan./E, 2003			May, 2003	



Features

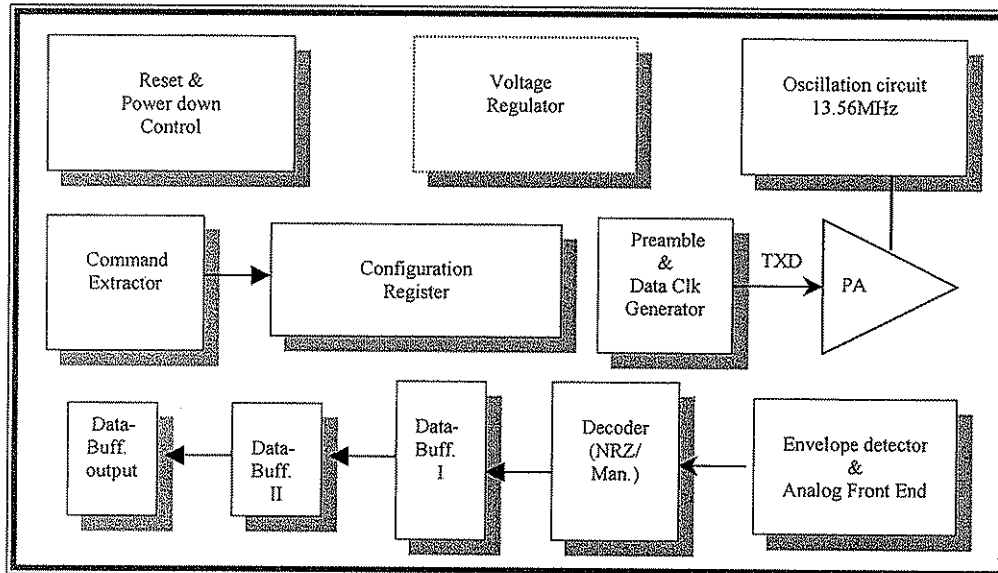
2.1 W55MID50 Features List

- Magnetic field resonance frequency: 13.56MHz
- Data clock: 22 ~ 66KHz
- Inductive coupled power supplies for transponder's no battery operation
- On-chip rectifier, voltage limiter, clock extraction, power management, uC interface
- Provides NRZ and Manchester coding data format
- Adjustable 4-level of Reader transmission power selection
- Provides serial and parallel mode uC interface
- uC data output rate \geq 1Mbps
- Low power, low voltage operation
- Supports power-down mode \leq 1uA
- Operating distance: 0 ~ 10cm
- Operating voltage: 2.4V ~ 5.5V
- Operating temperature: 0 ~ 70 °C
- Package: Dice form, PDIP-20, SOP-20
- Reference design PC board Size: 2.0x2.0cm² (without PCB antenna)
- Winbond patented "Automatic Reader Transmission Power Adjustment" for Reader optimum transmission power adjust
- Minimize external components



Architecture Overview

3.1 W55MID50 System Block Diagram



3.2 W55MID50 Functional Description

Transmission Power Amplifier (PA)

It provides 4 different selectable transmission power for Reader chip to support *MFID^{WB}* Tag's radiation power supply. The external inductor coupling circuit is designed for 13.56MHz magnetic field resonance. The coupled center frequency will depend on equivalent value of external PCB inductor and capacitor.

Envelope Detector & Analog Front End

The major function of this unit provides *MFID^{WB}* Tag's data can be extracted.

Voltage Regulator

The voltage regulator generates the system needs of device power supply.

W55MID50 Design Guide



Configuration Register

System configuration register controls the all functional settings of W55MID50 such as Tag data format, Tag detection cycle, output data format, and PA transmission power selection.

Reset and Power-down Control

The function of system power-down control mode is normally used for power consumption saving.

Crystal Oscillation

The 13.56MHz system clock generator generates the need of device system clock.

Decoder NRZ/Manchester

This unit is in charge of Tag data format decoder, which can provide Tag-ID data format decoding of NRZ or Manchester.

Data Buffer and Output

This unit buffers the Tag-ID data, which is under de-frame processing.

3.3 W55MID50 Pad/Pin Description

Symbol	PAD No.	PIN No. (PDIP-20, SOP-20)	I/O	Functional Description
D3	1	1	O	Data output #3
D2	2	2	O	Data output #2
D1	3	3	O	Data output #1
D0	4	4	O	Data output #0
XIN	5	5	I	Connect to external 13.56MHz oscillator
XOUT	6	6	O	Connect to external 13.56MHz oscillator
VSS	7	7	GND	Digital power return path
CMD	8	8	I/O	R/W configuration register
CLK	9	9	I	Command R-W/ Read data clock
VDD	10	10	Power	Power path
RX_VDD	11	13	Power	Power path of Rx
RX_VSS	12	14	GND	Power return path of Rx
ENV	13	15	I	Envelope detector input
/RESET	14	16	I	Reset
TagIn	15	17	O	Indication of tag arrival
COIL	16	18	O	PA output to connect with PCB antenna
TX_VSS	17	19	GND	Power return path of PA
TX_VDD	18	20	Power	Power path of PA



1. GENERAL DESCRIPTION

The W588Dxxx is a powerful embedded microprocessor (uP) dedicated to speech and melody synthesis applications. This series chips are suitable for plush toys, educational Q&A toys, or interactive application. W588Dxxx can synthesize multi-channel speech and melody. 3-track of synthesized speech can be in different kinds of format, for example ADPCM and MDPCM. Regarding synthesized melody, W588Dxxx can provide 2-track of Tone melody (T-melody), or 3-track of High-Quality melody (HQ-melody) that can emulate the characteristics of musical instruments. In general speaking, W588Dxxx series can accomplish multi-tasking requirements easily and make toys with more complicated than traditional *PowerSpeech*.

The W588Dxxx provides at most 8 input pins & 24 bi-directional I/Os, maximum 512 bytes RAM, IR carrier, Serial Interface Management, and 32KHz-Divider for more and more sophisticated applications, such as interactive toys, cartridge toys and final count down function. 3 LED output pins with 256-level control means that numerous combination of RGB colors may result in a versatility of colorful effects. W588Dxxx has two kinds of power saving modes: one is Slow mode and the other is STOP mode. In addition, W588Dxxx also provides PWM mode output to save power during playback and Watch Dog Timer to prevent latch-up situation occurring.

ITEM	W588D003	W588D006	W588D009	W588D012	W588D015
*Duration	4 sec.	6 sec.	12 sec.	15 sec.	19 sec.
ITEM	W588D020	W588D025	W588D030	W588D035	W588D040
*Duration	25 sec.	29 sec.	32 sec.	44 sec.	50 sec.
ITEM	W588D045	W588D050	W588D055	W588D060	W588D070
*Duration	53 sec.	58 sec.	62 sec.	66 sec.	86 sec.
ITEM	W588D080	W588D100	W588D120	W588D150	W588D170
*Duration	100 sec.	118 sec.	134 sec.	169 sec.	203 sec.
ITEM	W588D210	W588D260	W588D300	W588D350	W588D400
*Duration	237 sec.	271 sec.	313 sec.	358 sec.	407 sec.

Note:

*: The duration time is based on 5-bit MDPCM at 6 KHz sampling rate. The firmware library and program code have been excluded from user's ROM space for the duration estimation.

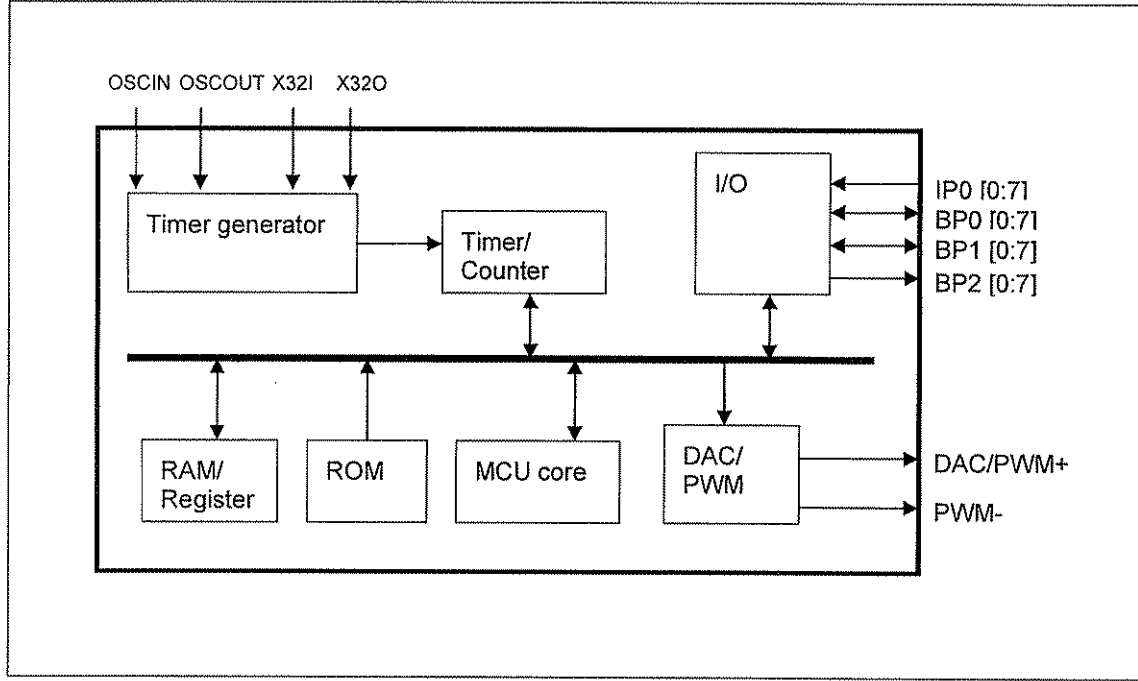
2. FEATURE

- Wide range of operating voltage:
 - 8 M Hz @ 3.0 volt ~ 5.5 volt
 - 6 M Hz @ 2.4 volt ~ 5.5 volt
- Provide power management to save current consumption:
 - 4 ~ 8 MHz system clocks, with Ring type or crystal type.
 - Slow mode to save power.
 - Stop mode for stopping all IC operations.
- F/W speech synthesis:
 - Multiple format parser that supports
 - ✓ 6-bit MDPCM, 5-bit MDPCM, 4-bit ADPCM, 8-bit Log PCM algorithm can be used
 - Pitch shippable ADPCM for voice changer application
 - Programmable sample rate
- F/W melody synthesizer
 - 2 tracks Tone melody which can emulate envelope of music instruments
 - 3 tracks High-Quality melody that can emulate characteristic of musical instruments
 - Voice melody can be implemented in 2 octaves
- Built-in 3 timers for speech/melody synthesis
 - 3 tracks speech
 - 1 speech channel plus dual-tone melody
 - 3 tracks High-Quality melody
- Harmonized synchronization among MIDI, Speech, LED, and Motor
- I/O configuration:
 - W588D003~D060: 16 I/O pins
 - W588D070~D260: 24 I/O pins
 - W588D300~D400: 8 input pins and 24 I/O pins
- Built-in IR carrier generation circuit for simplification firmware IR application
- Built-in IR receiver counting circuit for simplifying IR decoding
- Built-in 3 LED outputs with 256-level control of brightness.
- Built-in TimerG1 for general purpose applications
- Built-in Watch-Dog Timer (WDT) and Low Voltage Reset (LVR)
- Built-in 32 KHz crystal oscillator with divider for time-keeping application
- Provide serial interface
 - W55Fxx, W551Cxx
 - SPI flash
- Built-in Serial Interface Manager (SIM) in all W588Dxxx series
- 13-bit Current type digital-to-analog converters (DAC) to drive speaker output



- Direct-drive 12-bit PWM output to save power consumption
- Support **PowerScript™** for developing codes in easy way.
- Full-fledged development system
 - Source-level ICE debugger (Assembly & **PowerScript™** format)
 - **Ultra I/O™** tool for event synchronization mechanism
 - ICE system with USB port
 - User-friendly GUI environment
- Available package form:
 - COB is essential

4. BLOCK DIAGRAM



Notes:

1. IP0 is only providing in W588D300, W588D350 and W588D400.
2. BP2 isn't provided in W588D003 ~ W588D060.

W55X SPI FLASH MEMORY



1. GENERAL DESCRIPTION

The W55Xxx Serial Flash memories provide a storage solution for systems with limited space, pins and power. The W55Xxx series offers flexibility and performance well beyond ordinary Serial Flash devices. They are ideal for code download applications as well as storing voice, text and data. The devices operate on a single 2.7V to 3.6V power supply with current consumption as low as 5mA active and 1 μ A for power-down. All devices are offered in space-saving packages.

The W55X10/20/40/80/16 array is organized into 512/1024/2048/4096/8192 programmable pages of 256-bytes each. Up to 256 bytes can be programmed at a time using the Page Program instruction. Pages can be erased in groups of 16 (sector erase), groups of 256 (block erase) or the entire chip (chip erase). The W55X10/20/40/80/16 has 32/64/128/256/512 erasable sectors and 2/4/8/16/32 erasable blocks respectively. The small 4KB sectors allow for greater flexibility in applications that require data and parameter storage.

The Serial Peripheral Interface (SPI) consists of four pins (Serial Clock, Chip Select, Serial Data I/O and Serial Data Out) that support high speed serial data transfers up to 75MHz. A Hold pin, Write Protect pin and programmable write protect, with top or bottom array control features, provide further control flexibility. Additionally, the device can be queried for manufacturer and device type.

Part No.	Memory Size (bit)	Erase Mode	Data Access Time	Operation voltage (volt)	Package (8-Pin SOIC)
W55X10SG	1M	4K/64K/All	75MHz	2.7~3.6	150 mil
W55X20SG	2M	4K/64K/All	75MHz	2.7~3.6	150 mil
W55X40SG	4M	4K/64K/All	75MHz	2.7~3.6	208 mil
W55X80SG	8M	4K/64K/All	75MHz	2.7~3.6	208 mil
W55X16SG	16M	4K/64K/All	75MHz	2.7~3.6	208 mil

2. FEATURES

- **Family of Serial Flash Memories**
 - W55X10: 1M-bit / 128K-byte (131,072)
 - W55X20: 2M-bit / 256K-byte (262,144)
 - W55X40: 4M-bit / 512K-byte (524,288)
 - W55X80: 8M-bit / 1M-byte (1,048,576)
 - W55X16: 8M-bit / 2M-byte (2,097,152)
 - 256-bytes per programmable page
 - Uniform 4K-byte Sectors / 64K-byte Blocks
- **SPI with Single or Dual Outputs**
 - Clock, Chip Select, Data I/O, Data Out
 - Easily interfaces to popular microcontrollers
 - Optional Hold function for SPI flexibility
- **Data Transfer up to 150M-bits / second**
 - Clock operation to 75MHz
 - Fast Read Dual Output instruction
 - Auto-increment read capability
- **Flexible Architecture with 4KB sectors**
 - Sector Erase (4K-bytes)
 - Block Erase (64K-byte)
 - Page program up to 256 bytes <2ms
 - Up to 100,000 erase/write cycles
 - 20-year retention
- **Low Power Consumption, Wide Temperature Range**
 - Single 2.7 to 3.6V supply
 - 5mA active current, 1µA Power-down (typ)
 - -40° to +85°C operating range
- **Software and Hardware Write Protection**
 - Write-Protect all or portion of memory
 - Enable/Disable protection with /WP pin
 - Top or bottom array protection
- **Space Efficient Packaging**
 - 8-pin SOIC 150-mil (W55X10/20)
 - 8-pin SOIC 208-mil (W55X40/80/16)

W55X SPI FLASH MEMORY



5.1 Package Types

At the time this datasheet was published not all package types had been finalized. Contact Winbond to confirm availability of these packages before designing to this specification. The W55X10 and W55X20 are offered in an 8-pin plastic 150-mil width SOIC (package code SN) as shown in figure 1a. The W55X40, W55X80 and W55X16 are offered in an 8-pin plastic 208-mil width SOIC (package code SS) as shown in figure 1b. Package diagrams and dimensions are illustrated at the end of this datasheet.

5.2 Chip Select (/CS)

The SPI Chip Select (/CS) pin enables and disables device operation. When /CS is high the device is deselected and the Serial Data Output (DO) pin is at high impedance. When deselected, the device's power consumption will be at standby levels unless an internal erase, program or status register cycle is in progress. When /CS is brought low the device will be selected, power consumption will increase to active levels and instructions can be written to and data read from the device. After power-up, /CS must transition from high to low before a new instruction will be accepted. The /CS input must track the VCC supply level at power-up (see "Write Protection" and figure 20). If needed a pull-up resistor on /CS can be used to accomplish this.

5.3 Serial Data Output (DO)

The SPI Serial Data Output (DO) pin provides a means for data and status to be serially read from (shifted out of) the device. Data is shifted out on the falling edge of the Serial Clock (CLK) input pin.

5.4 Write Protect (/WP)

The Write Protect (/WP) pin can be used to prevent the Status Register from being written. Used in conjunction with the Status Register's Block Protect (BP2, BP1, and BP0) bits and Status Register Protect (SRP) bits, a portion or the entire memory array can be hardware protected. The /WP pin is active low.

5.5 HOLD (/HOLD)

The /HOLD pin allows the device to be paused while it is actively selected. When /HOLD is brought low, while /CS is low, the DO pin will be at high impedance and signals on the DIO and CLK pins will be ignored (don't care). When /HOLD is brought high, device operation can resume. The /HOLD function can be useful when multiple devices are sharing the same SPI signals. ("See Hold function")

5.6 Serial Clock (CLK)

The SPI Serial Clock Input (CLK) pin provides the timing for serial input and output operations. ("See SPI "Operations")

5.7 Serial Data Input / Output (DIO)

The SPI Serial Data Input/Output (DIO) pin provides a means for instructions, addresses and data to be serially written to (shifted into) the device. Data is latched on the rising edge of the Serial Clock (CLK) input pin. The DIO pin is also used as an output when the Fast Read Dual Output instruction is executed.