FCC ID: NVP-04442F13LT1

Technical Description :

The brief circuit description is listed as follows :
- Y1 and associated circuit act as RF Oscillator and Receiver.
- U3(W5885120) and associated circuit act as Speech Decoder.
- U2(W55FXX) and associated circuit act as Flash Memory.
- U1(W55MID50) and associated circuit act as RFID Decoder and RF Energy Generator for the Tag.
- Tag IC(W55MID35) and associated circuit act as RFID Code Generator.

* The specification of RFID IC and Tag are attached after this page.

Antenna Used :

A permanent loop antenna wire has been used.

Winbond *MFID*^{WB} Transponder

W55MID35

Design Guide

Contents

General Description

MFID^{WB} (Magnetic Field Identification) is used in all areas of automatic data capture allowing contactless identification of objects using magnetic field. From ticketing to industrial automation and access control, the applications of MFID are burgeoning. In recent years automatic identification procedures have become very popular in many service industries, purchasing and distribution logistics, industry, manufacturing companies and material flow systems.

W55MID35 is one of Winbond *MFID*^{WB} (Magnetic Field Identification) series in *WinRF*^{WB} family that focus on toy and consumer related applications. W55MID35 provides multi-transponder recognition function for intelligent and smart toy applications.

Topically, 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. Regarding the *MFID*^{WB} Reader series, the W55MID50 supports multi-functional *MFID*^{WB} Reader solution.

W55MID35 provides total up to 243 different bonding-ID options in manufacture and 10-bit ID length in each bonding -ID. Till now the W55MID35 is the most cost effective solution on current anti-collision *MFID*^{WB} transponder 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	

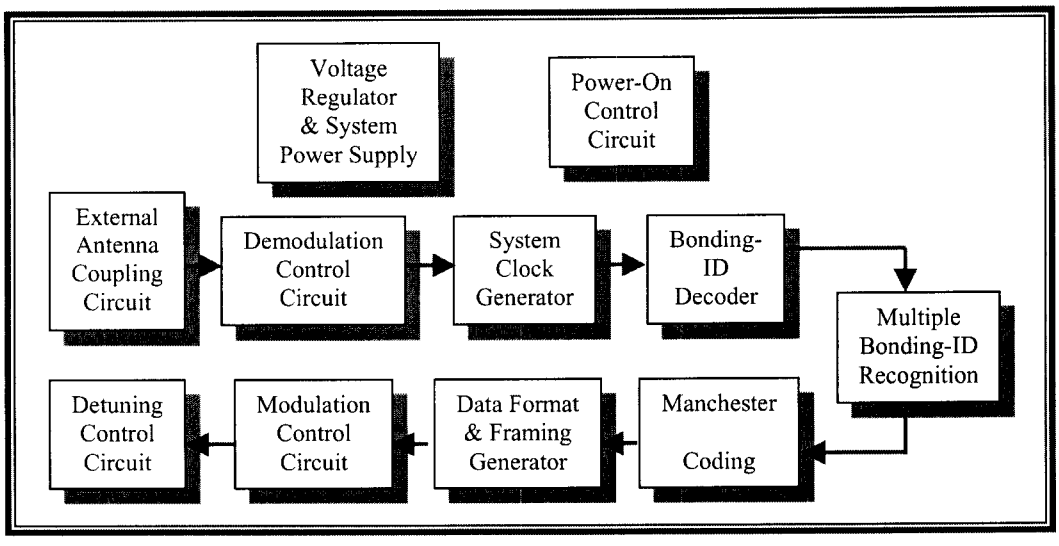
Features

2.1 W55MID35 Features List

- Magnetic field resonance frequency: 13.56MHz
- Data clock: 32KHz
- Anti-collision read-only bonding-ID transponder
- Provides up to 6 ~ 8 tags can be recognized in the same time and same Reader antenna
- Option of
  - ***Unique-ID***: ID can not be same
  - ***Repeated-ID***: ID can be same
- Inductive coupled power supply for no battery operation
- On-chip rectifier, voltage limiter, clock extraction
- 10bit bonding-ID length
- Manchester coding data format
- Provides total 243 bonding-ID options in ***Repeated-ID*** mode and total 64 bonding-ID options in ***Unique-ID*** mode
- Low power, low voltage operation
- Operating distance: 0 ~ 5cm (typ.)
- Operating temperature: 0 ~ 70 °C
- Package: Dice form
- Reference design PC board Size: 1.0x1.0cm^2 (with PCB antenna)
- Winbond patented "3-state Bonding Finger" for multiple bonding-ID option
- Minimize external component: capacitor and PCB antenna only

Architecture Overview

3.1 W55MID35 System Block Diagram



3.2 W55MID35 Functional Description

External Inductor Coupling Circuit

The external inductor coupling circuit is designed for 13.56MHz magnetic field resonance. The coupled center frequency will depend on equivalent inductor of external PCB inductor and a paralleled capacitor.

Voltage Regulator & System Power Supply

The voltage regulator generates the need of device power supply.

Power-On Control Circuit

System power-on control circuit initiates the device to get into initial state.

Demodulation Control Circuit

The demodulation control circuit demodulates the signal of command, which is magnetic field coupling from W55MID50 *MFID*^{WB} Reader system.

System Clock Generator

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

Bonding-ID Decoder

The Bonding-ID decoder circuit decodes the mapping location of IDs array, which indicates by external RS0, RS1, RS2, RS3, and RS4 the 3-state Bonding Finger (Winbond patented).

Multiple Bonding-ID Recognition

The multiple Bonding-ID recognition provides total up to 8 different customer-IDs and 10bit ID length can be recognize in the same time.

Data Format and Framing Generator

The data format and framing generator is in charge of the entire bonding-ID and command data into Winbond defined *MFID*^{WB} transponder data format.

Modulation Control Circuit

The modulation control circuit modulates the Winbond defined *MFID*^{WB} tag format into the magnetic field resonation.

3.3 W55MID35 Pad Description

Symbol	Pad No.	I/O	Functional Description
NC	1	--	Testing only, no connection
RS4	2	I	3-state bonding finger
RS3	3	I	3-state bonding finger
RS2	4	I	3-state bonding finger
RS1	5	I	3-state bonding finger
RS0	6	I	3-state bonding finger
VSS	7	Ground	Ground return path
COIL0	8	I/O	Coupling energy input and customer-ID output
COIL1	9	I/O	Coupling energy input and customer-ID output
NC	10	--	Testing only, no connection
VDD	11	Power	Power path
OPTION	12	I	Option of ***Unique-ID*** mode (set OPTION="1") or ***Repeated-ID*** mode (set OPTION="0")

Electronic Characteristics

4.1 W55MID35 Absolute Maximum Ratings

Parameter	Rating	Unit
Maximum Current in COIL	10	mA
Power Dissipation (T_a = 70°C)	100	mW
Ambient Operating Temperature	0 to +70	°C
Storage Temperature	-40 to +85	°C

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

4.2 W55MID35 DC Characteristics

(VDD-VSS = 4.5 V, Ta = 25°C; unless otherwise specified)

Parameter	Sym.	Conditions	Min.	Typ.	Max.	Unit
Operating Magnetic Field	f_{OP}	Field in resonation	-	13.56	-	MHz
Operating Voltage	V_{DD}	Field in resonation	3	-	5.5	V
Operating Temperature	Tamb	Ambient operating temp	0	25	70	°C
Operating Current	I_{OP}	f_{OP} = 13.56MHz	-	2	-	uA
Magnetic Resonat Voltage	V_M		6	-	9	V

4.3 W55MID35 Ordering Information

W55MID35 provides two types of package in shipment: dice form or wafer form

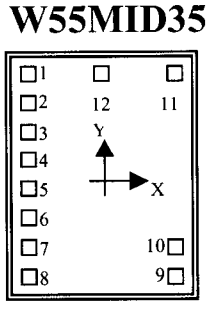
Part Number	Package	Remarks
W55MID35	Dice form	
W55MID35	Wafer form	MOQ required

4.4 W55MID35 Bonding Pad Information

Window : (xl = -465.000, yl = -540.000), (xh = 465.000, yh = 540.000)
Windows size : Width = 930.000, length = 1080.000

PAD NO	PAD NAME	X	Y
1	NC		
2	RS4	-377.500	317.500
3	RS3	-377.500	192.500
4	RS2	-377.500	67.500
5	RS1	-377.500	-57.500
6	RS0	-377.500	-182.500
7	VSS	-375.000	-315.000
8	Coil0	-375.000	-450.000
9	Coil1	375.025	-450.000
10	NC	380.025	-320.000
11	VDD	377.500	450.000
12	OPTION	-14.050	455.000

4.4.1 W55MID35 Bonding Pad Diagram



Winbond Electronics Corp.

Design Information

5.1 W55MID35 Bonding-ID List

W55MID35 provides bonding-ID option by using 5 bonding pads (RS4, RS3, RS2, RS1, and RS0), each pad can be chosen to connect "GND", "VDD", or left "Floating". The mapping table as listed below and each bonding-ID is constructed by 10-bit. Designer can refer to the ID mapping list to program Reader system uC for applications.

5.1.1 "*Repeated-ID*" mode: RS-pad vs. Bonding-ID List

The typical Tag ID detection cycle time is 128mS for each ID, for example, to detect 6 tags it just takes 768mS.

- RS-pad: Bonding "0 = GND" ➔ ID = "00"
- RS-pad: Bonding "1 = VDD" ➔ ID = "01"
- RS-pad: Bonding "X = Floating" ➔ ID = "10"

	RS4	RS3	RS2	RS1	RS0
Bonding	0	0	0	0	0
ID	00	00	00	00	00
Bonding	1	1	1	1	1
ID	01	01	01	01	01
Bonding	X	X	X	X	X
ID	10	10	10	10	10
:	:	:	:	:	:
:	:	:	:	:	:
:	:	:	:	:	:
:	:	:	:	:	:
Bonding	0	1	0	1	0
ID	00	01	00	01	00
Bonding	X	1	X	1	X
ID	10	01	10	01	10
Bonding	X	1	X	1	X
ID	10	01	10	01	10
Bonding	1	X	0	1	X
ID	01	10	00	01	10

5.1.2 "*Unique-ID*" mode: RS-pad vs. Bonding-ID List

There are total **64 ID groups** (Group-0 to group-63) in list and every group has different members of IDs, *user can choose any ID group's member in project But the same group's ID* ***Must Not*** *be appeared again in a project.*

The typical Tag ID detection cycle time is **2mS** for each ID, for example, to detect 6 tags it just takes 12mS.

- RS-pad: Bonding "0 = GND" ➔ ID = "00"
- RS-pad: Bonding "1 = VDD" ➔ ID = "01"
- RS-pad: Bonding "X = Floating" ➔ ID = "10"

Group	RS4	RS3	RS2	RS1	RS0
0	0	0	0	0	0
0	0	0	0	0	x
0	0	0	0	x	0
0	0	0	0	x	x
0	0	0	x	0	0
0	0	0	x	0	x
0	0	0	x	x	0
0	0	0	x	x	x
0	0	x	0	0	0
0	0	x	0	0	x
0	0	x	0	x	0
0	0	x	0	x	x
0	0	x	x	0	0
0	0	x	x	0	x
0	0	x	x	x	0
0	0	x	x	x	x
1	0	0	0	0	1
1	0	0	0	x	1
1	0	0	x	0	1
1	0	0	x	x	1
1	0	x	0	0	1
1	0	x	0	x	1
1	0	x	x	0	1
1	0	x	x	x	1
2	0	0	0	1	0
2	0	0	0	1	x
2	0	0	x	1	0
2	0	0	x	1	x
2	0	x	0	1	0
2	0	x	0	1	x
2	0	x	x	1	0
2	0	x	x	1	x
3	0	0	0	1	1
3	0	0	x	1	1
3	0	x	0	1	1

Group	RS4	RS3	RS2	RS1	RS0
5	0	0	1	0	1
5	0	0	1	x	1
5	0	x	1	0	1
5	0	x	1	x	1
6	0	0	1	1	0
6	0	0	1	1	x
6	0	x	1	1	0
6	0	x	1	1	x
7	0	0	1	1	1
7	0	x	1	1	1
8	0	1	0	0	0
8	0	1	0	0	x
8	0	1	0	x	0
8	0	1	0	x	x
8	0	1	x	0	0
8	0	1	x	0	x
8	0	1	x	x	0
8	0	1	x	x	x
9	0	1	0	0	1
9	0	1	0	x	1
9	0	1	x	0	1
9	0	1	x	x	1
10	0	1	0	1	0
10	0	1	0	1	x
10	0	1	x	1	0
10	0	1	x	1	x
11	0	1	0	1	1
11	0	1	x	1	1
12	0	1	1	0	0
12	0	1	1	0	x
12	0	1	1	x	0
12	0	1	1	x	x
13	0	1	1	0	1
13	0	1	1	x	1
14	0	1	1	1	0

Group	RS4	RS3	RS2	RS1	RS0
16	1	0	0	0	0
16	1	0	0	0	x
16	1	0	0	x	0
16	1	0	0	x	x
16	1	0	x	0	0
16	1	0	x	0	x
16	1	0	x	x	0
16	1	0	x	x	x
17	1	0	0	0	1
17	1	0	0	x	1
17	1	0	x	0	1
17	1	0	x	x	1
18	1	0	0	1	0
18	1	0	0	1	x
18	1	0	x	1	0
18	1	0	x	1	x
19	1	0	0	1	1
19	1	0	x	1	1
20	1	0	1	0	0
20	1	0	1	0	x
20	1	0	1	x	0
20	1	0	1	x	x
21	1	0	1	0	1
21	1	0	1	x	1
22	1	0	1	1	0
22	1	0	1	1	x
23	1	0	1	1	1
24	1	1	0	0	0
24	1	1	0	0	x
24	1	1	0	x	0
24	1	1	0	x	x
24	1	1	x	0	0
24	1	1	x	0	x
24	1	1	x	x	0
24	1	1	x	x	x

3	0	x	x	1	1
4	0	0	1	0	0
4	0	0	1	0	x
4	0	0	1	x	0
4	0	0	1	x	x
4	0	x	1	0	0
4	0	x	1	0	x
4	0	x	1	x	0
4	0	x	1	x	x

14	0	1	1	1	x
15	0	1	1	1	1

25	1	1	0	0	1
25	1	1	0	x	1
25	1	1	x	0	1
25	1	1	x	x	1
26	1	1	0	1	0
26	1	1	0	1	x
26	1	1	x	1	0
26	1	1	x	1	x
27	1	1	0	1	1
27	1	1	x	1	1

Group	RS4	RS3	RS2	RS1	RS0
28	1	1	1	0	0
28	1	1	1	0	x
28	1	1	1	x	0
28	1	1	1	x	x
29	1	1	1	0	1
29	1	1	1	x	1
30	1	1	1	1	0
30	1	1	1	1	x
31	1	1	1	1	1
32	x	0	0	0	0
32	x	0	0	0	x
32	x	0	0	x	0
32	x	0	0	x	x
32	x	0	x	0	0
32	x	0	x	0	x
32	x	0	x	x	0
32	x	0	x	x	x
33	x	0	0	0	1
33	x	0	0	x	1
33	x	0	x	0	1
33	x	0	x	x	1
34	x	0	0	1	0
34	x	0	0	1	x
34	x	0	x	1	0
34	x	0	x	1	x
35	x	0	0	1	1
35	x	0	x	1	1
36	x	0	1	0	0
36	x	0	1	0	x
36	x	0	1	x	0
36	x	0	1	x	x
37	x	0	1	0	1
37	x	0	1	x	1
38	x	0	1	1	0
38	x	0	1	1	x
39	x	0	1	1	1

Group	RS4	RS3	RS2	RS1	RS0
40	x	1	0	0	0
40	x	1	0	0	x
40	x	1	0	x	0
40	x	1	0	x	x
40	x	1	x	0	0
40	x	1	x	0	x
40	x	1	x	x	0
40	x	1	x	x	x
41	x	1	0	0	1
41	x	1	0	x	1
41	x	1	x	0	1
41	x	1	x	x	1
42	x	1	0	1	0
42	x	1	0	1	x
42	x	1	x	1	0
42	x	1	x	1	x
43	x	1	0	1	1
43	x	1	x	1	1
44	x	1	1	0	0
44	x	1	1	0	x
44	x	1	1	x	0
44	x	1	1	x	x
45	x	1	1	0	1
45	x	1	1	x	1
46	x	1	1	1	0
46	x	1	1	1	x
47	x	1	1	1	1
48	1	x	0	0	0
48	1	x	0	0	x
48	1	x	0	x	0
48	1	x	0	x	x
48	1	x	x	0	0
48	1	x	x	0	x
48	1	x	x	x	0
48	1	x	x	x	x
49	1	x	0	0	1
49	1	x	0	x	1

Group	RS4	RS3	RS2	RS1	RS0
50	1	x	0	1	0
50	1	x	0	1	x
50	1	x	x	1	0
50	1	x	x	1	x
51	1	x	0	1	1
51	1	x	x	1	1
52	1	x	1	0	0
52	1	x	1	0	x
52	1	x	1	x	0
52	1	x	1	x	x
53	1	x	1	0	1
53	1	x	1	x	1
54	1	x	1	1	0
54	1	x	1	1	x
55	1	x	1	1	1
56	x	x	0	0	0
56	x	x	0	0	x
56	x	x	0	x	0
56	x	x	0	x	x
56	x	x	x	0	0
56	x	x	x	0	x
56	x	x	x	x	0
56	x	x	x	x	x
57	x	x	0	0	1
57	x	x	0	x	1
57	x	x	x	0	1
57	x	x	x	x	1
58	x	x	0	1	0
58	x	x	0	1	x
58	x	x	x	1	0
58	x	x	x	1	x
59	x	x	0	1	1
59	x	x	x	1	1
60	x	x	1	0	0
60	x	x	1	0	x
60	x	x	1	x	0
60	x	x	1	x	x

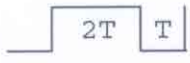
49	1	x	x	0	1
49	1	x	x	x	1

61	x	x	1	0	1
61	x	x	1	x	1
62	x	x	1	1	0
62	x	x	1	1	x
63	x	x	1	1	1

5.2 W55MID35 Timing and Waveform

5.2.1 W55MID35 Data Format

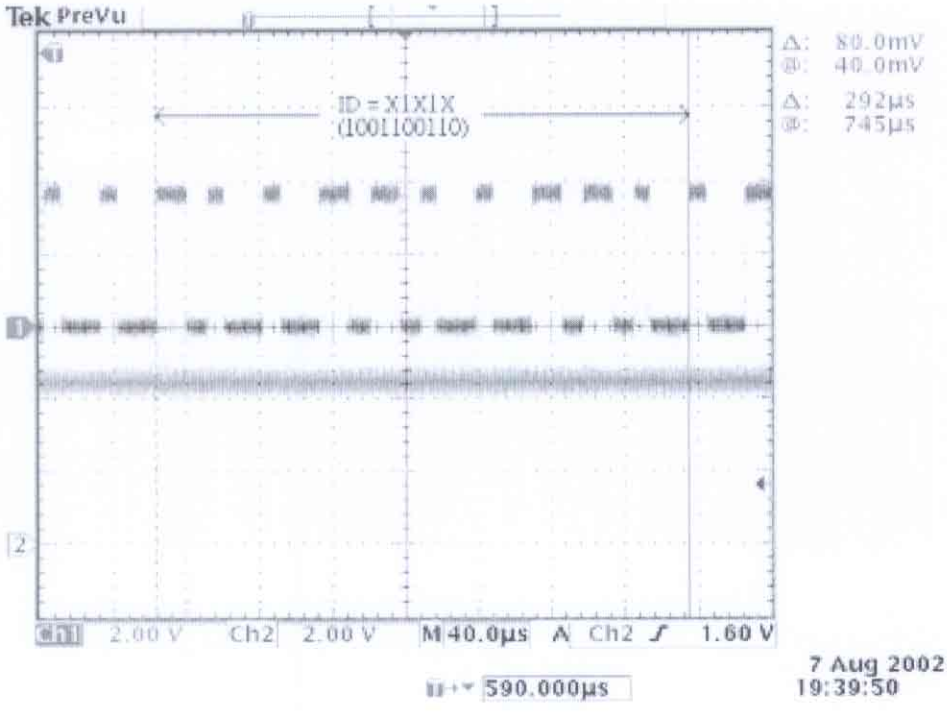
"0" ☞ 

"1" ☞ 

** "**T**" (8us < T < 12us) will be depended on different coupling energy from MFID Reader system.

5.2.2 W55MID35 Data Waveform

The detection of 10-bit Bonding-ID = **10 0110 01 10** vs. the RS-pad bonding of **"X1X1X"**.



5.3 W55MID35 Demo Board and Schematic

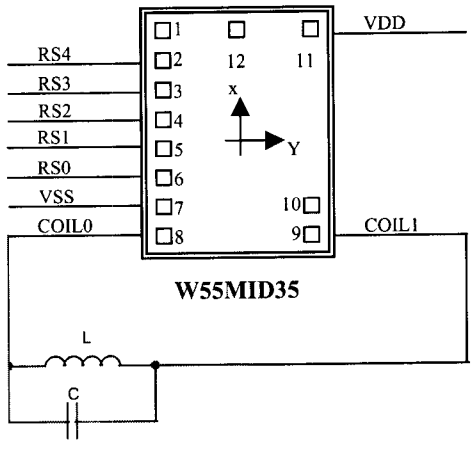
This W55MID35 application schematic is subject to modify for target specification evaluation. Some component's reference values are based on the system specification evaluation only, which values will be modified once the application is different.

The magnetic field coupling energy strength is subject to the appropriate values of coupling inductor (L1) and capacitor (C1).

5.3.1 W55MID35 Application Schematic:

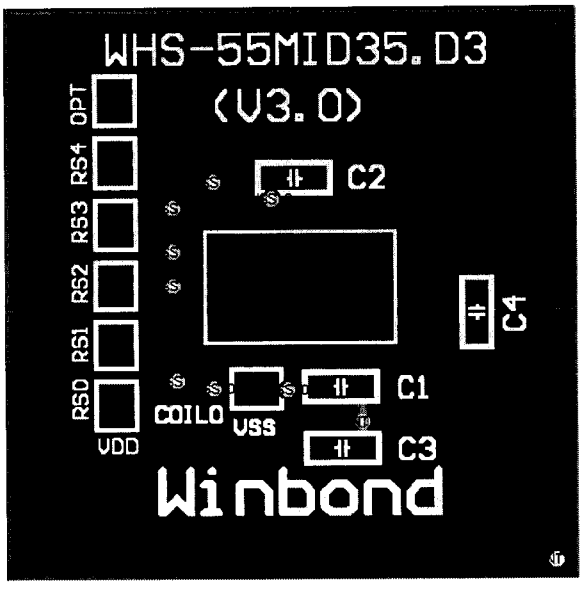
The value of "L" will depend on PCB coil layout and the value of "C" needs to fine-tune and matches the magnetic field center frequency f_{OP} = 13.56MHz.

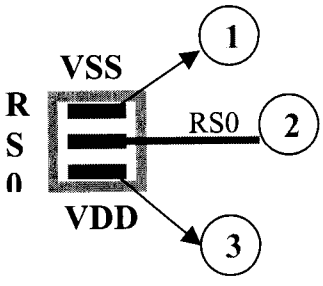
$$fop = \frac{1}{2\pi\sqrt{LC}} = 13.56MHz$$



5.3.2 W55MID35 Demo Board

PCB size: 2cm x 2cm





1. Soldering ❶ and ❷:
RS0 pad Bonding "0 = GND" ➔ ID = "00"
2. Soldering ❷ and ❸:
RS0 pad Bonding "1 = VDD" ➔ ID = "01"
3. No soldering:
RS0 pad Bonding "X = Floating" ➔ ID = "10"

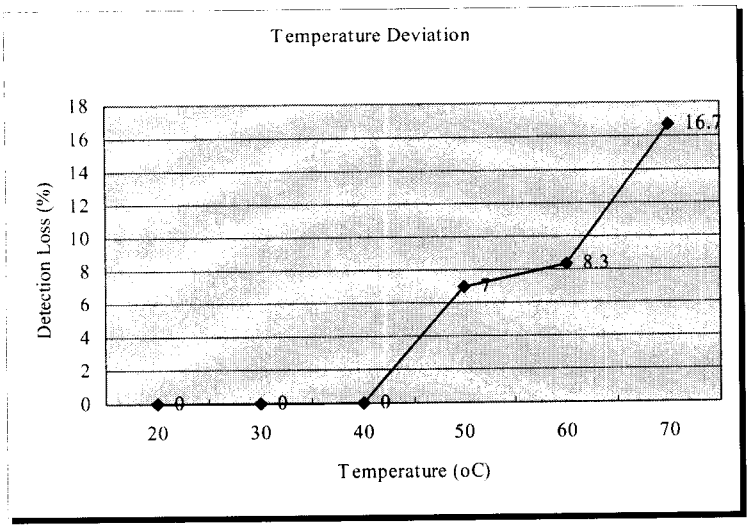
5.4 W55MID35 Detection Performance Testing

5.4.1 Temperature Deviation Testing

The Temperature Deviation testing of W55MID35 is based on the size 20mm x 20mm square shape PCB, and the matching cap. value: 72pF with 5% component accuracy deviation. @ VDD = 4.5V. (Scale of chamber temperature is in °C)

The chamber temperature from 20 °C ~ 70 °C

Temperature (°C)	20	30	40	50	60	70
Detection Loss (%)	0	0	0	7	8.3	16.7

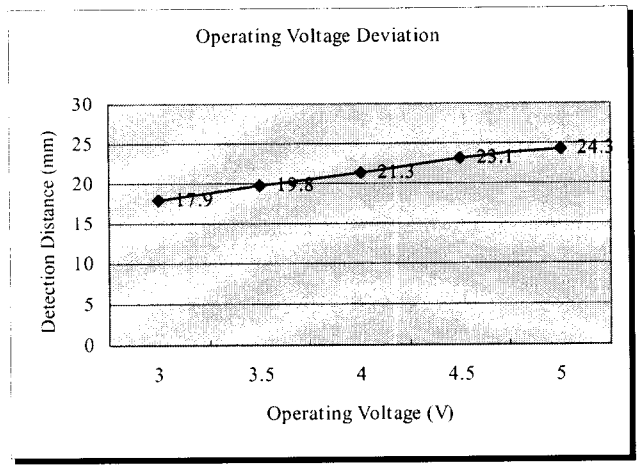


5.4.2 Operating Voltage Deviation Testing

The Operating Voltage Deviation testing of W55MID35 is based on the size 20mm x 20mm square shape PCB, and the matching cap. value: 72pF with 5% component accuracy deviation and @ 25 °C chamber temperature.

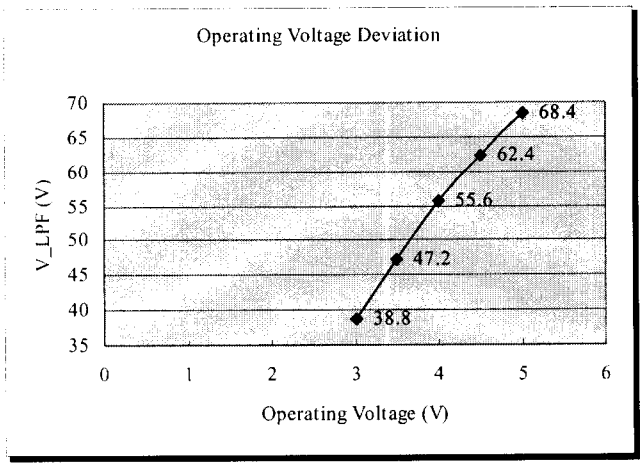
The Operating Voltage range from 3.0V ~ 5.0V

Operating (V)	3	3.5	4	4.5	5
Distance (mm)	17.9	19.8	21.3	23.1	24.3



The Operating Voltage range from 3.0V ~ 5.0V

Operating (V)	3	3.5	4	4.5	5
V_LPF (V)	38.8	47.2	55.6	62.4	68.4



5.4 W55MID35 uC Programming Sample Coding

W55MID35 uC programming sample coding is provided by Winbond *MFID*^{WB} FAE design in supporting team. The major purpose is just focus on helping of designer who would like to use Winbond *MFID*^{WB} series and have application with Winbond uC or speech/melody controller series.

5.5 W55MID35 Design Guide Document History

Revision	Date	Description
A0	2002/9/15	Preliminary version.
A1	2002/12/31	Bonding diagram update
A2	2003/2/7	Application schematic update

Winbond Electronics Corp.

Headquarters
No. 4, Creation Rd. III,
Science-Based Industrial Park,
Hsinchu, Taiwan
TEL: 886-3-5770066
FAX: 886-3-5792697
http://www.winbond.com.tw/
Voice & Fax-on-demand: 886-2-27197006

Taipei Office
11F, No. 115, Sec. 3, Min-Sheng East Rd.,
Taipei, Taiwan
TEL: 886-2-27190505
FAX: 886-2-27197502

Winbond Electronics (H.K.) Ltd.
Rm. 803, World Trade Square, Tower II,
123 Hoi Bun Rd., Kwun Tong,
Kowloon, Hong Kong
TEL: 852-27513100
FAX: 852-27552064

Winbond Electronics North America Corp.
Winbond Memory Lab.
Winbond Microelectronics Corp.
Winbond Systems Lab.
2727 N. First Street, San Jose,
CA 95134, U.S.A.
TEL: 408-9436666
FAX: 408-5441798

Note: All data and specifications are subject to change without notice.

Winbond Electronics Corp.

Winbond *MFID*^{WB} Reader

W55MID50

Design Guide

Contents

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. Topically, 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	

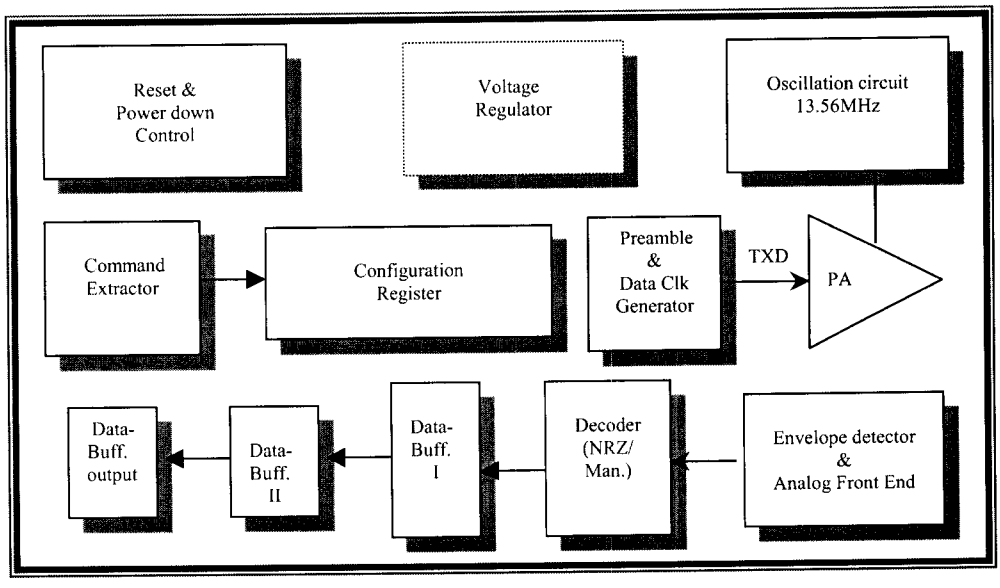
Features

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 ≥ 1Mbps
- Low power, low voltage operation
- Supports power-down mode ≤ 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: 2.0x2.0cm^2 (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 resonation. 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.

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

Electronic Characteristics

4.1 W55MID50 Absolute Maximum Ratings

Parameter	Rating	Unit
Maximum Current in COIL	10	mA
Power Dissipation (T_a = 70°C)	100	mW
Ambient Operating Temperature	0 to +70	°C
Storage Temperature	-40 to +85	°C

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

4.2 W55MID50 DC Characteristics

(VDD-VSS = 4.5 V, Ta = 25°C; unless otherwise specified)

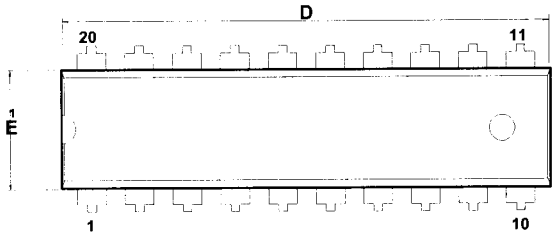
Parameter	Sym.	Conditions	Min.	Typ.	Max.	Unit
Operating Magnetic Field	f_{OP}	Field in resonation	-	13.56	-	MHz
Operating Voltage	V_{DD}	Field in resonation	3	-	5.5	V
Operating Temperature	Tamb	Ambient operating temp	0	25	70	°C
Operating Current	I_{OP}	f_{OP} = 13.56MHz	-	22	-	mA
Stand-by Current	I_{SB}	Power Down mode enter	-	0.7	1	uA
Sink Current	I_{SK}	VoL = 0.3VDD	-	10	-	mA
Source Current	I_{SR}	VoH = 0.7VDD	-	-6	-	mA

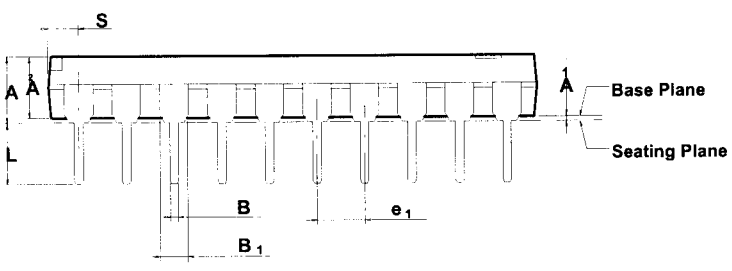
4.3 W55MID50 Ordering Information

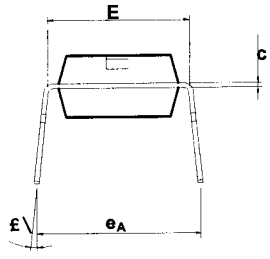
W55MID50 provides two types of package in shipment: Dice form, PDIP-20, SOP-20, and Wafer form.

Part Number	Package	Remarks
W55MID50	Dice form	
W55MID50	PDIP-20	
W55MID50	SOP-20	
W55MID50	Wafer form	MOQ required

4.4 W55MID50 Package (20L PDIP-300mil)

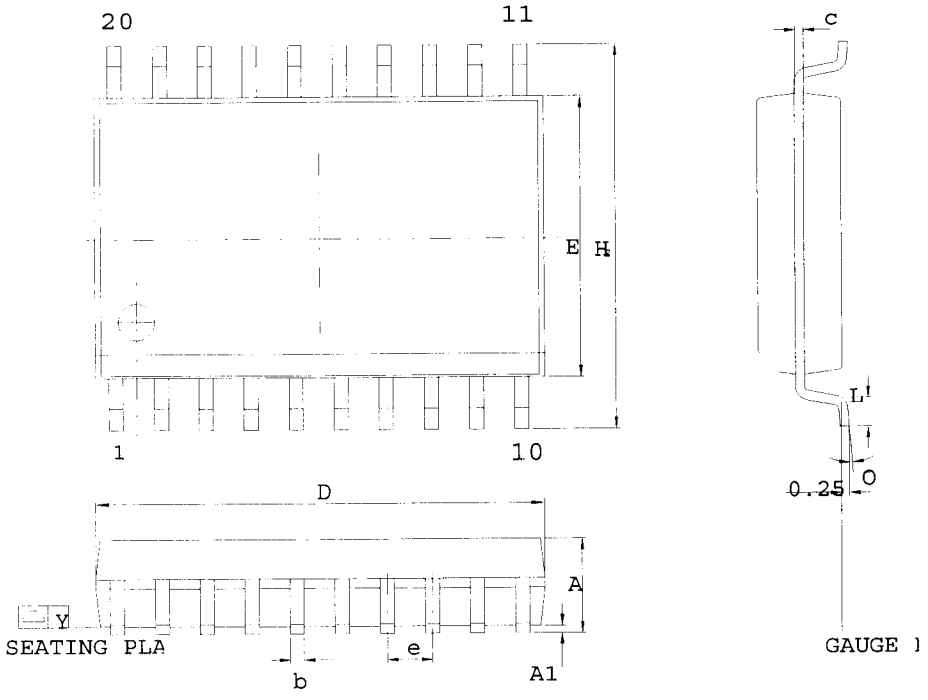






Symbol	Dimension in inch			Dimension in mm		
	Min	Nom	Max	Min	Nom	Max
A	---	---	0.175	---	---	4.45
A_1	0.010	---	---	0.25	---	---
A_2	0.125	0.130	0.135	3.18	3.30	3.43
B	0.016	0.018	0.022	0.41	0.46	0.56
B_1	0.058	0.060	0.064	1.47	1.52	1.63
c	0.008	0.010	0.014	0.20	0.25	0.36
D	---	1.026	1.040	---	20.06	26.42
E	0.290	0.300	0.310	7.37	7.62	7.87
E_1	0.245	0.250	0.255	6.22	6.35	6.48
e_1	0.090	0.100	0.110	2.29	2.54	2.79
L	0.120	0.130	0.140	3.05	3.30	3.56
£\	0	---	15	0	---	15
e_A	0.335	0.355	0.375	8.51	9.02	9.53
S	---	---	0.075	---	---	1.91

4.5 W55MID50 Package (20L SOP-300mil)



Control demensions are in milmeters

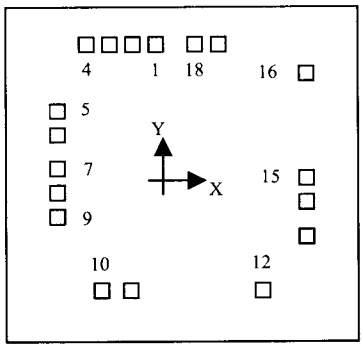
SYMBOL	DIMENSION I MIN.	MAX.	DIMENSION IN MIN.	MAX.
A	2.35	2.65	0.093	0.104
A1	0.10	0.30	0.004	0.012
b	0.33	0.51	0.013	0.020
c	0.23	0.32	0.009	0.013
E	7.40	7.60	0.291	0.299
D	12.60	13.00	0.496	0.512
e	1.27 BSC		0.050 BS	
H	10.00	10.65	0.394	0.419
Y	—	0.10	—	0.004
L	0.40	1.27	0.016	0.050
θ	0	8	0	8

4.6 W55MID50 Bonding Pad Information

4.6.1 W55MID50 Bonding Pad List

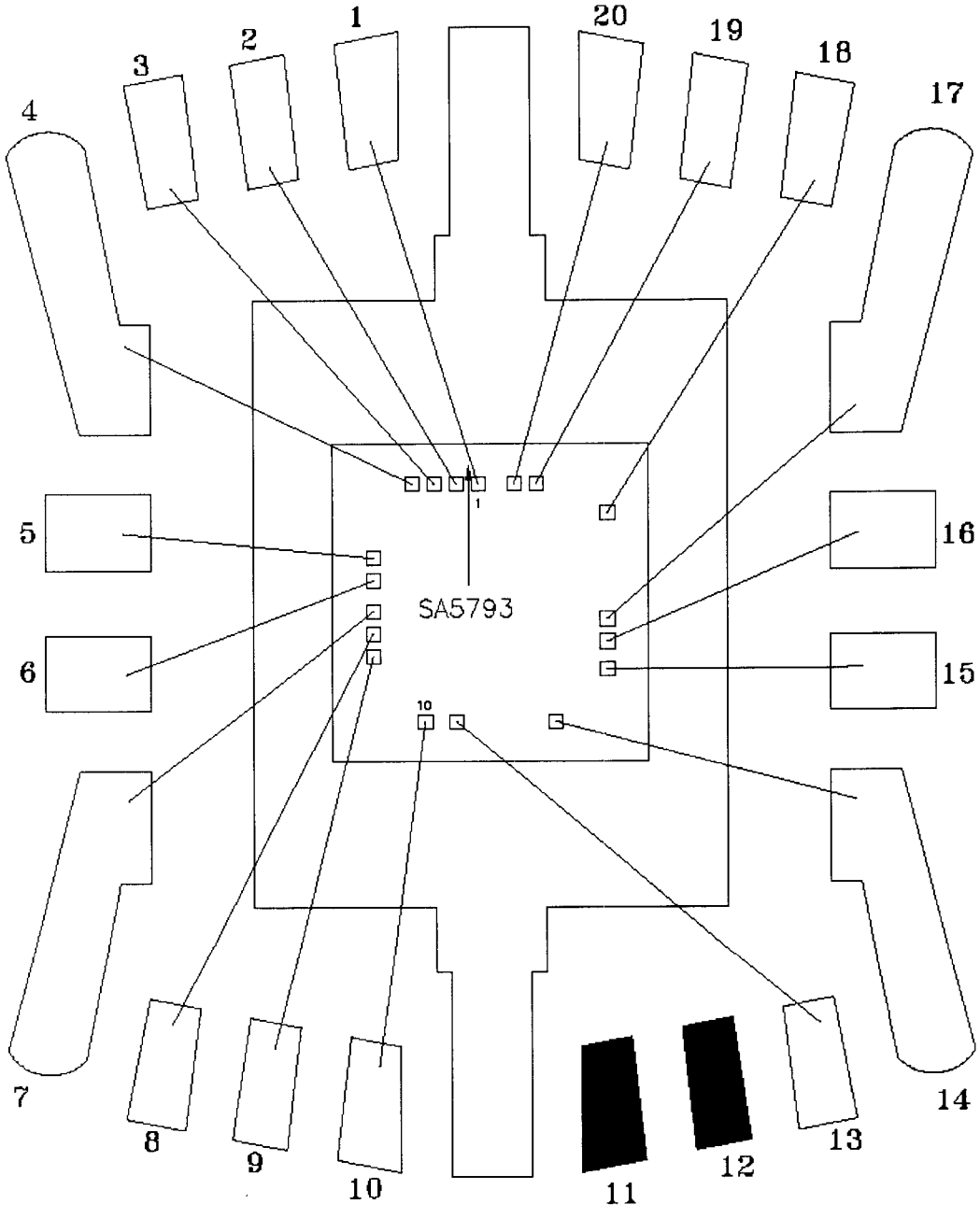
PAD NO	PAD NAME	PIN NO (PDIP-20/SOP-20)	X	Y
1	D3	1	-72.025	692.500
2	D2	2	-202.025	692.500
3	D1	3	-332.025	692.500
4	D0	4	-462.025	692.500
5	XIN	5	-692.250	259.525
6	XOUT	6	-692.250	129.525
7	VSS	7	-692.500	-50.700
8	CMD	8	-692.500	-180.700
9	CLK	9	-692.500	-310.700
10	VDD	10	-385.000	-692.500
**	NC	11		
**	NC	12		
11	RX_VDD	13	-198.325	-692.500
12	RX_VSS	14	385.000	-692.500
13	ENV	15	692.500	-385.000
14	/RESET	16	692.500	-224.775
15	TagIn	17	692.500	-94.775
16	COIL	18	692.500	519.325
17	TX_VSS	19	271.850	692.500
18	TX_VDD	20	141.850	692.500

4.6.2 W55MID50 Bonding Pad Diagram



W55MID50

4.6.3 W55MID50 Bonding Pad and Package Diagram



Design Information

5.1 W55MID50 Configuration Register

5.1.1 Configuration Register Description and Setting

Bit no	Function	Description
CR7:CR6	Tag type selection	00: *W55MID15 01: W55MID10 10: W55MID35 11: Direct-mode
CR5:CR4	Tag detection cycle	00: *50msec 01: 100msec 10: 500msec 11: 5msec
CR3:CR2	Data output mode	00: *1-bit serial output (CMOS) 01: 1-bit serial output (Open-drain) 10: 4-bit parallel output (CMOS) 11: 4-bit parallel output (Open-drain)
CR1:CR0	Transmission power	00: *0dBm 01: 4dBm 10: 7dBm 11: 10dBm

(*: Power-on/Reset default setting)

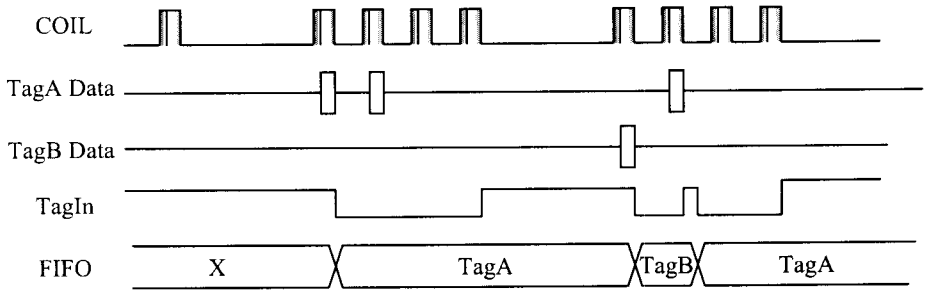
Tag type selection (CR7:CR6)
W55MID50 provides user selection of tag type.
W55MID10: single-tag mask ROM-ID
W55MID15: single-tag Bonding-ID (default setting)
W55MID35: multi-tag Bonding-ID
Direct-mode: provides direct path for uC getting tag-ID.

Tag detection cycle (CR5:CR4)
W55MID50 provides user selection of tag detection cycle.
The default setting is 50msec detection cycle.

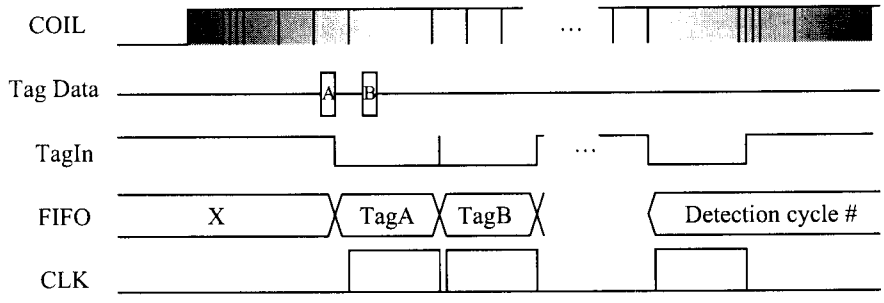
Data output mode (CR3:CR2)
W55MID50 provides four types of data output mode.
1-bit serial data output mode with CMOS setting (default setting).
1-bit serial data output mode with Open-drain setting
4-bit parallel data output mode with CMOS setting.
4-bit parallel data output mode with Open-drain setting.

Transmission power (CR1:CR0)
W55MID50 provides user selection of 4-level transmission power.
The default setting is 0dBm.

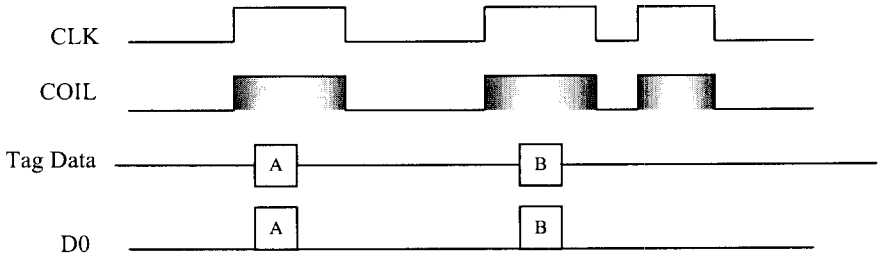
5.1.2 W55MID15-mode Operating Waveform



5.1.3 W55MID35-mode Operating Waveform



5.1.4 Direct-mode Operating Waveform



5.2 W55MID50 Command Description

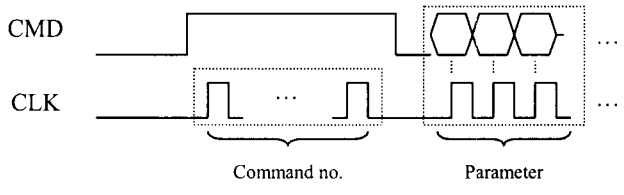
5.2.1 W55MID50 uC interface:

Pin Name	I/O	Functional Description
TagIn	O	Indication of tag arrival
CLK	I	Command R/W clock & Read data clock
CMD	I	R/W Configuration Register
D0	O	Data output #0
D1	O	Data output #1
D2	O	Data output #2
D3	O	Data output #3

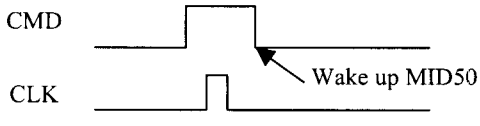
5.2.2 W55MID50 Command Description

Command	Description	Parameter Bits
1	Wake Up	0
2	Reload FIFO / Reset Output	0
3	Read Configuration Register	8
4	Write Configuration Register	8
5	Power Down	0

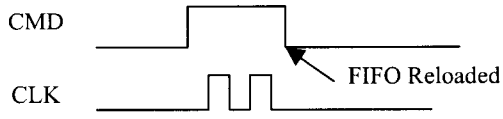
- **Control waveform**



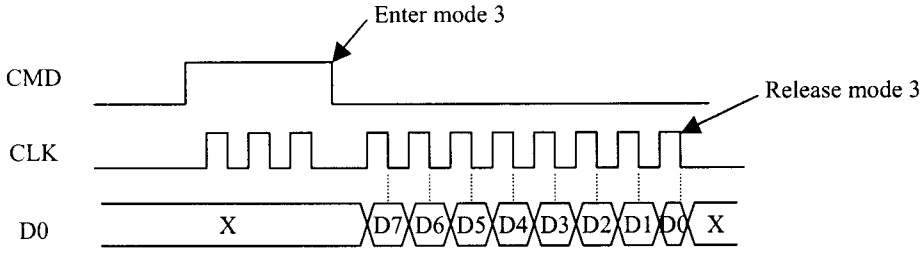
- **Wake Up (command #1) function**



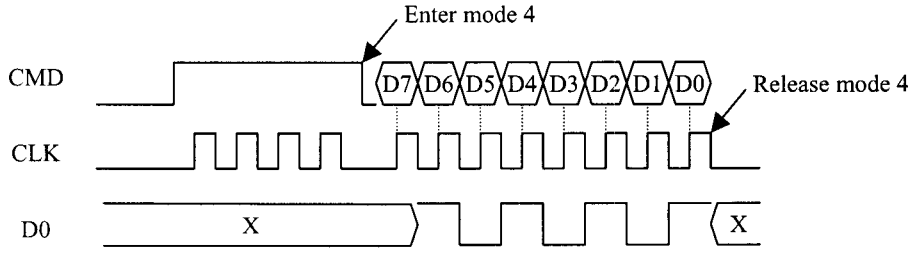
- **Reload FIFO (command #2) function**



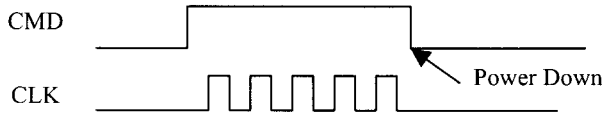
- **Read CR (command #3) function**



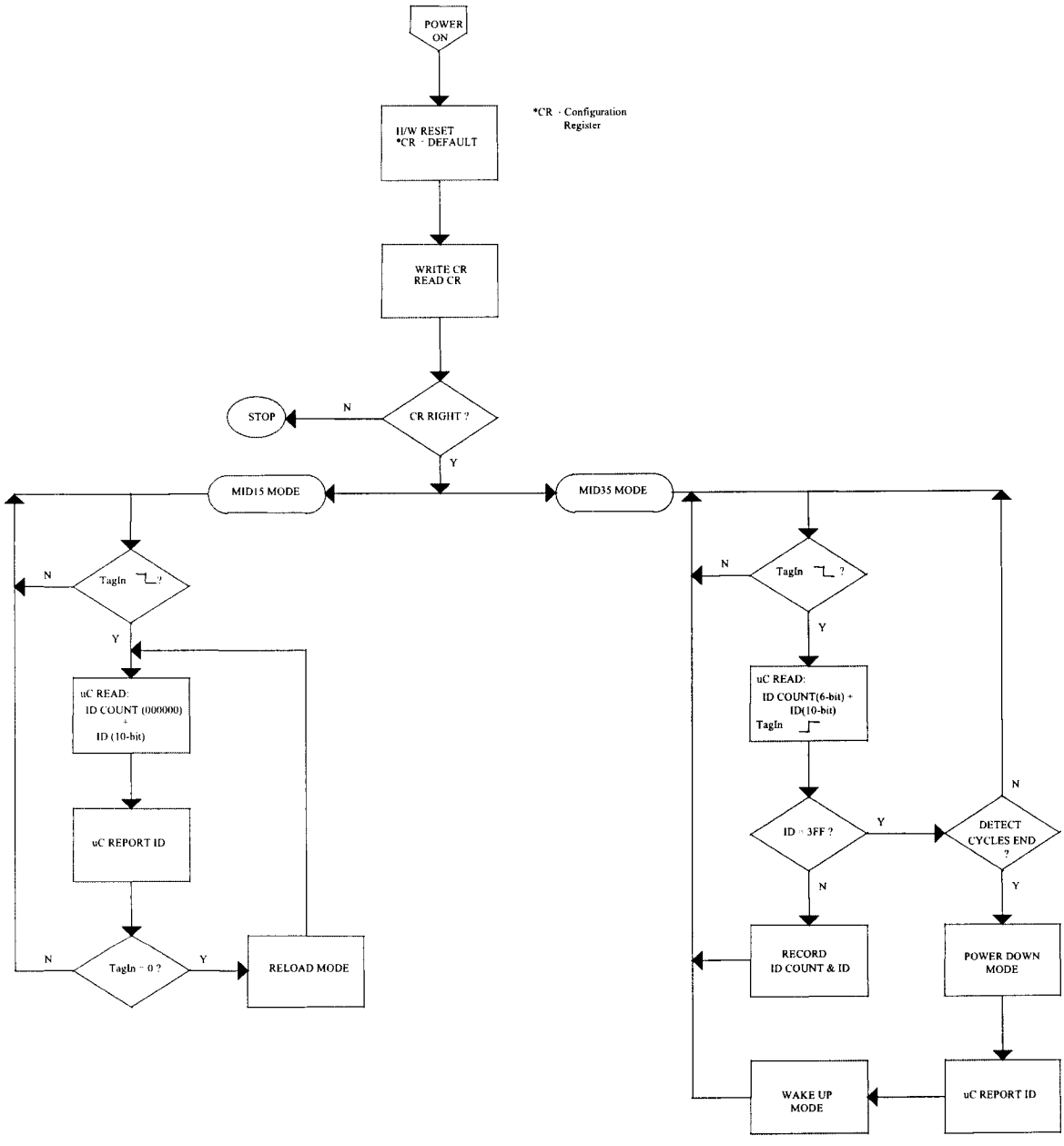
- **Write CR (command #4) function**



- **Power down (command #5) function**



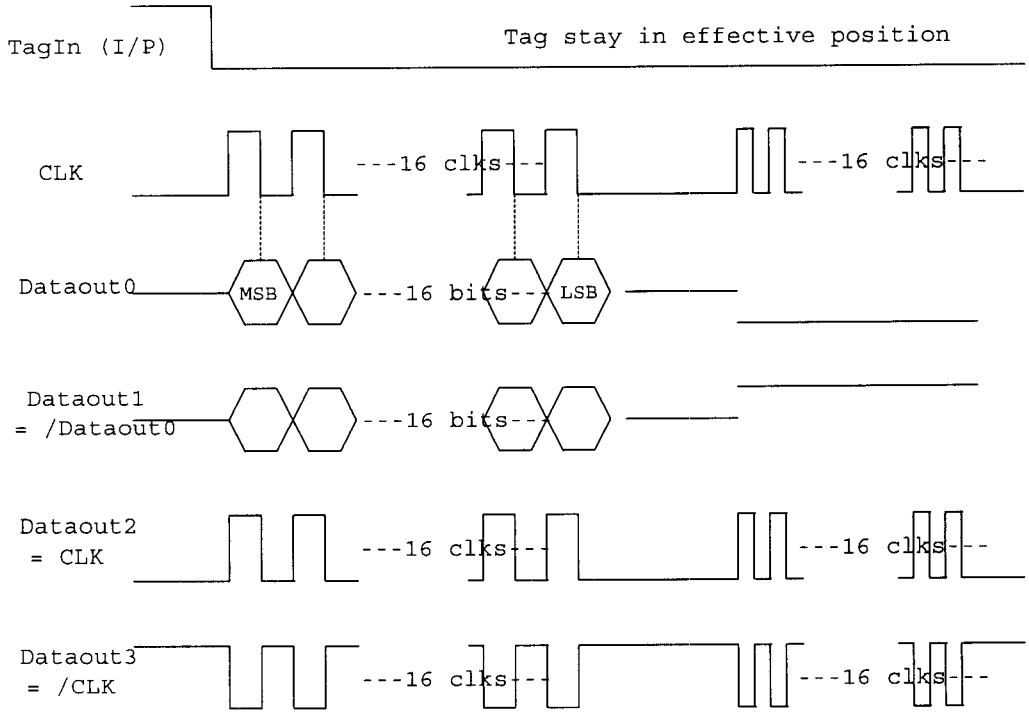
5.2.3 W55MID50 Programming Flow



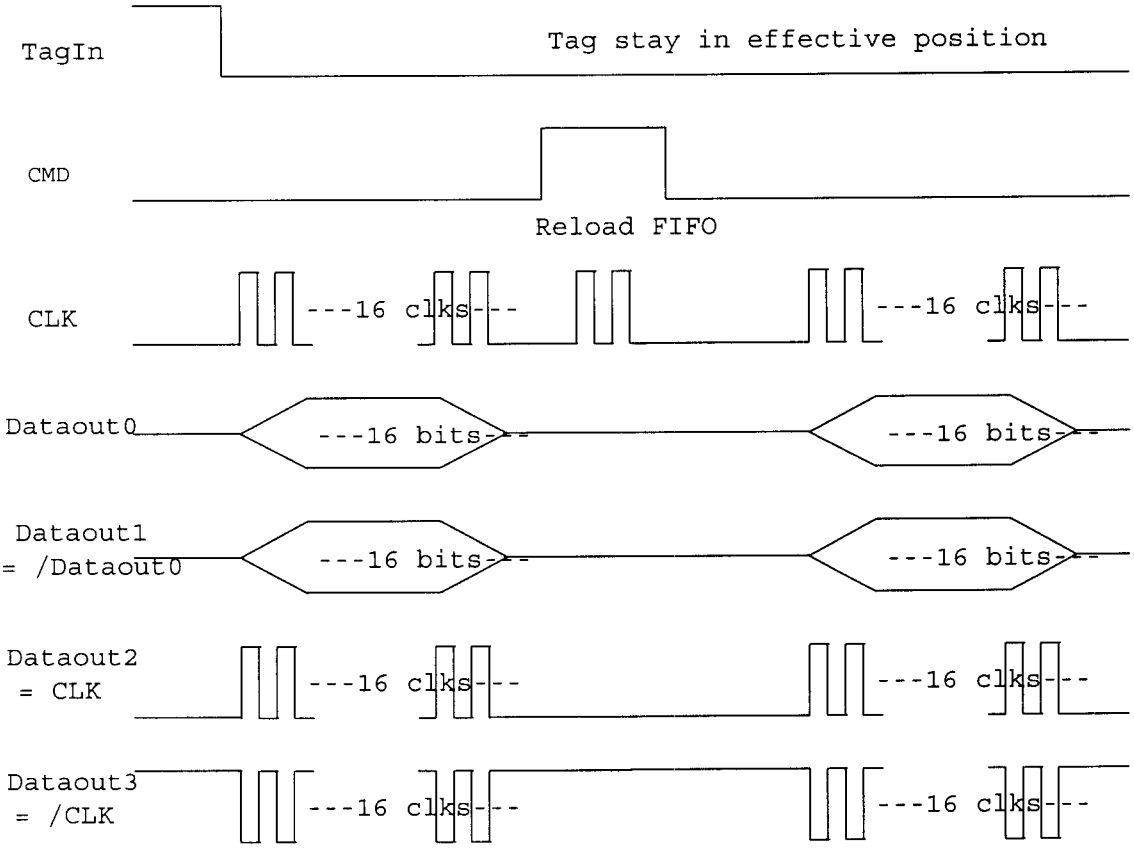
5.2.4 Get W55MID15 Data

5.2.4.1 Tag Data Ready

The 1st 16-CLKs can read out current Tag data. The 2nd 16-CLKs can't. The uC needs to enter "Reload FIFO / Reset Output" mode to get Tag data again. The first 6 bits will be all ' 0 '. The continuous 10 bits will be W55MID15 ID. Data will be ready at CLK falling-edge. MSB will be shifted out first. Following waveform is 1 bit serial output.

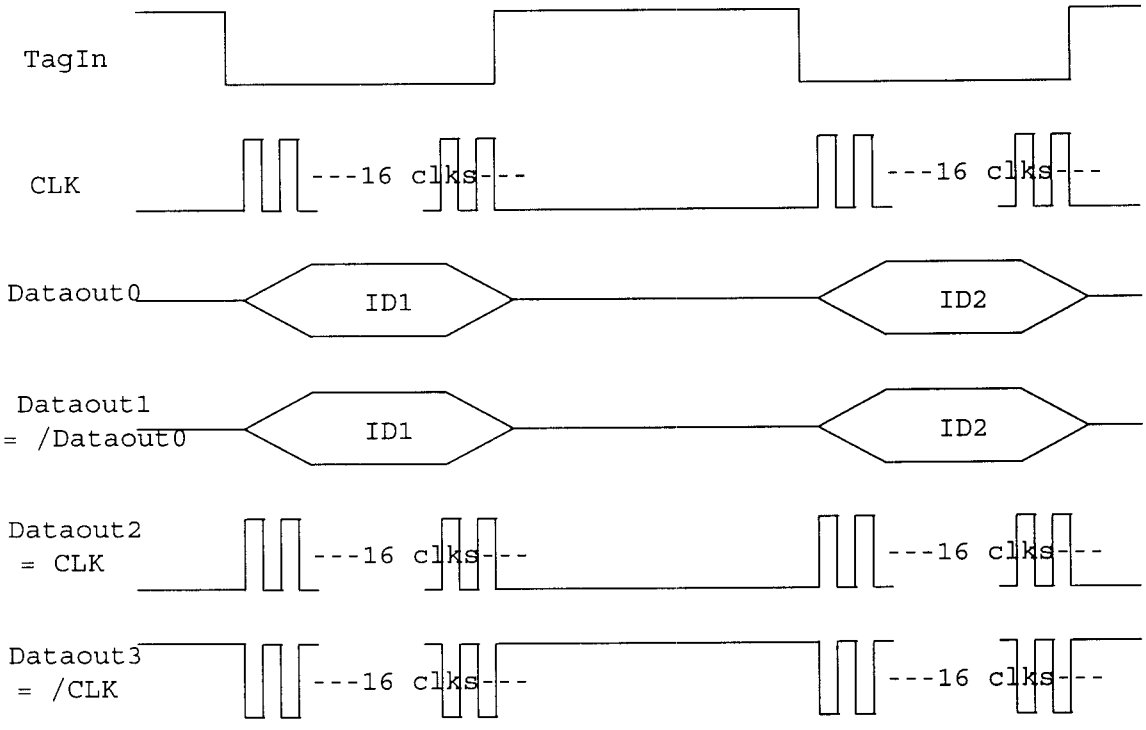


5.2.4.2 Reload FIFO / Reset Output

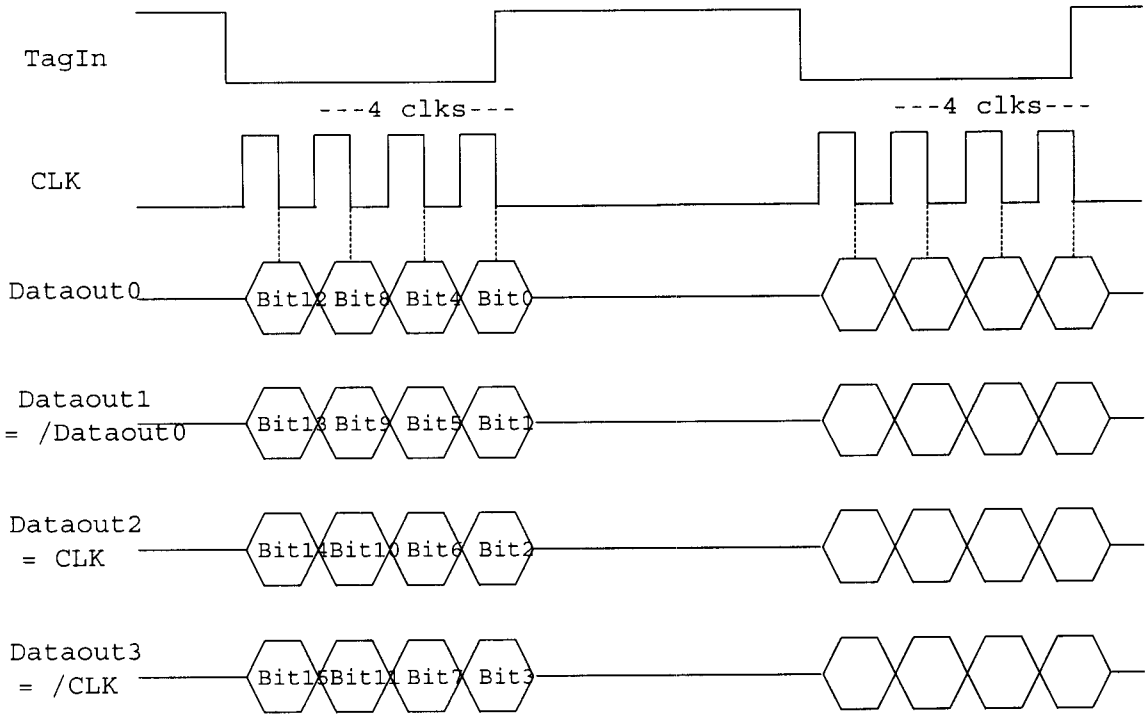


5.2.5 Get W55MID35 Data

5.2.5.1 1-bit serial output waveform

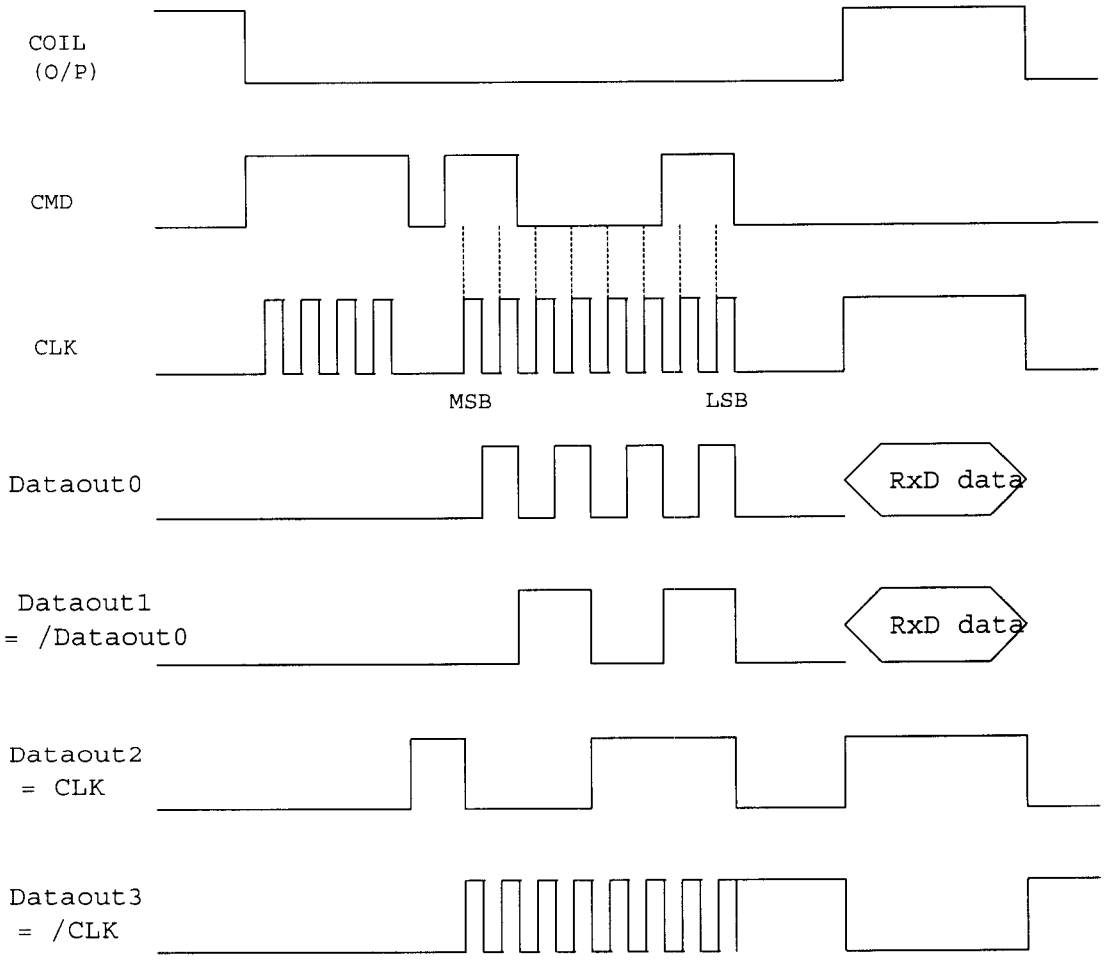


5.2.5.2 4-bit parallel output waveform



5.2.6 Direct-mode

uC can control W55MID50 TxD duration by entering Direct-mode. The W55MID50 can transmit power when COIL is keeping high and keeping low when COIL is low. The following waveform lets W55MID50 enter into Direct-mode and transmit max power.

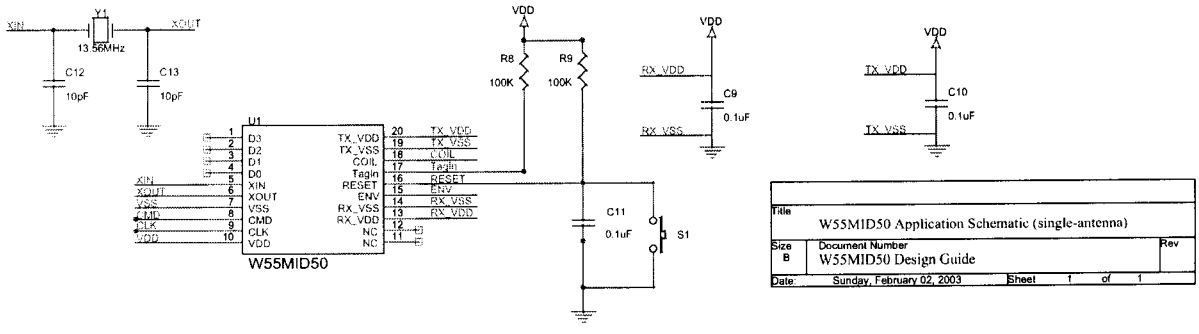


5.3 W55MID50 uC Programming Sample Coding

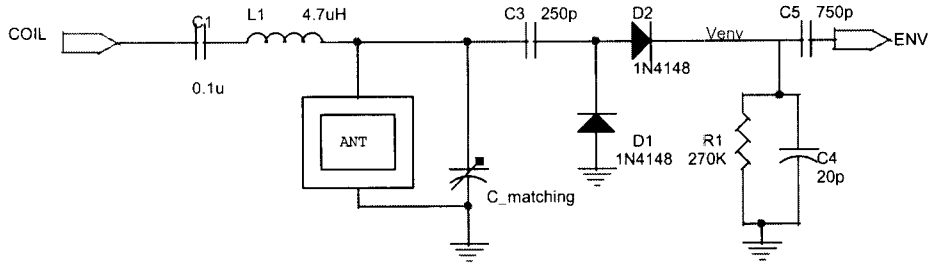
The W55MID50 uC programming sample coding is provided by Winbond *MFID*^{WB} FAE supporting team. The major purpose is just focus on helping of designer who would like to use Winbond *MFID*^{WB} series and have application with Winbond uC or speech/melody controller series.

5.4 W55MID50 Application Schematic:

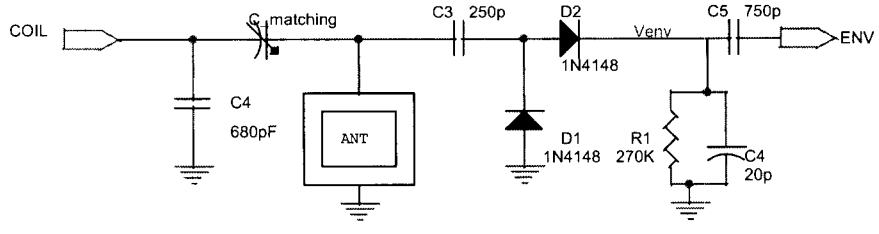
5.4.1 W55MID50 Application Schematic (single-antenna):



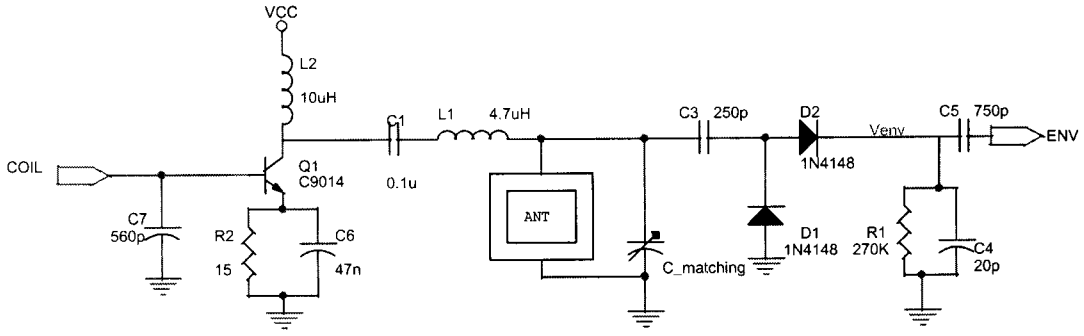
❑ **PCB Antenna Matching Circuit – 1: (Venv = 54V @VDD = 4.5V)**



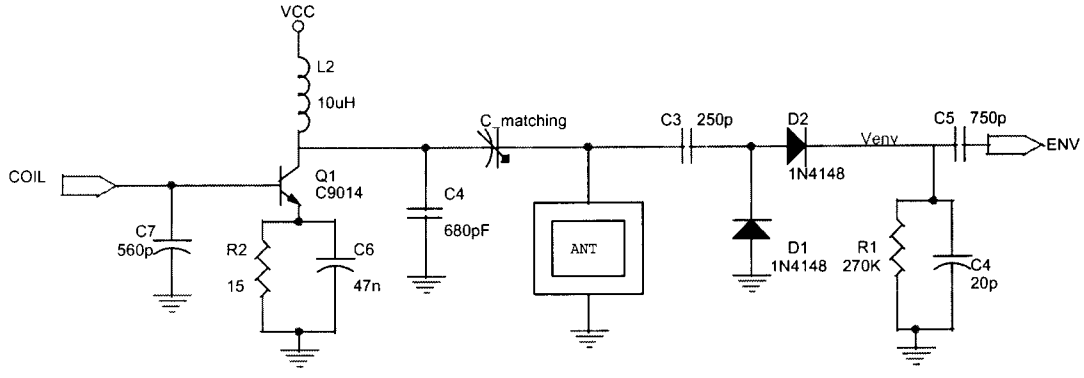
❑ **PCB Antenna Matching Circuit – 2: (Venv = 54V @VDD = 4.5V)**



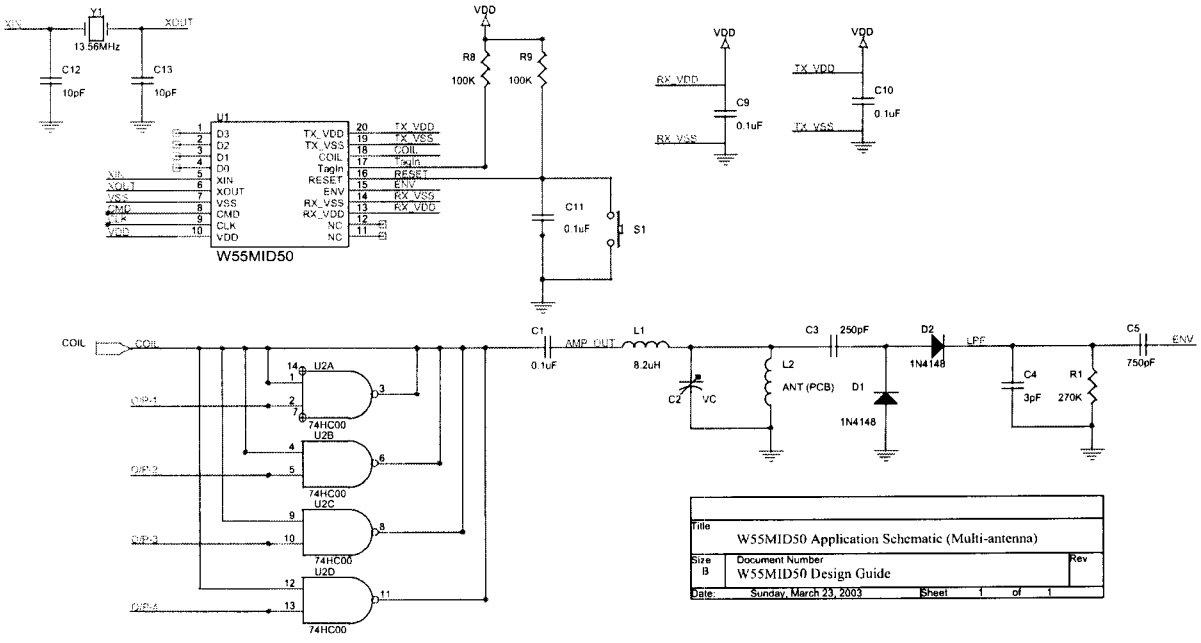
❑ **PCB Antenna Matching Circuit – 3 with Power Amp: (Venv = 86V @VDD = 4.5V)**



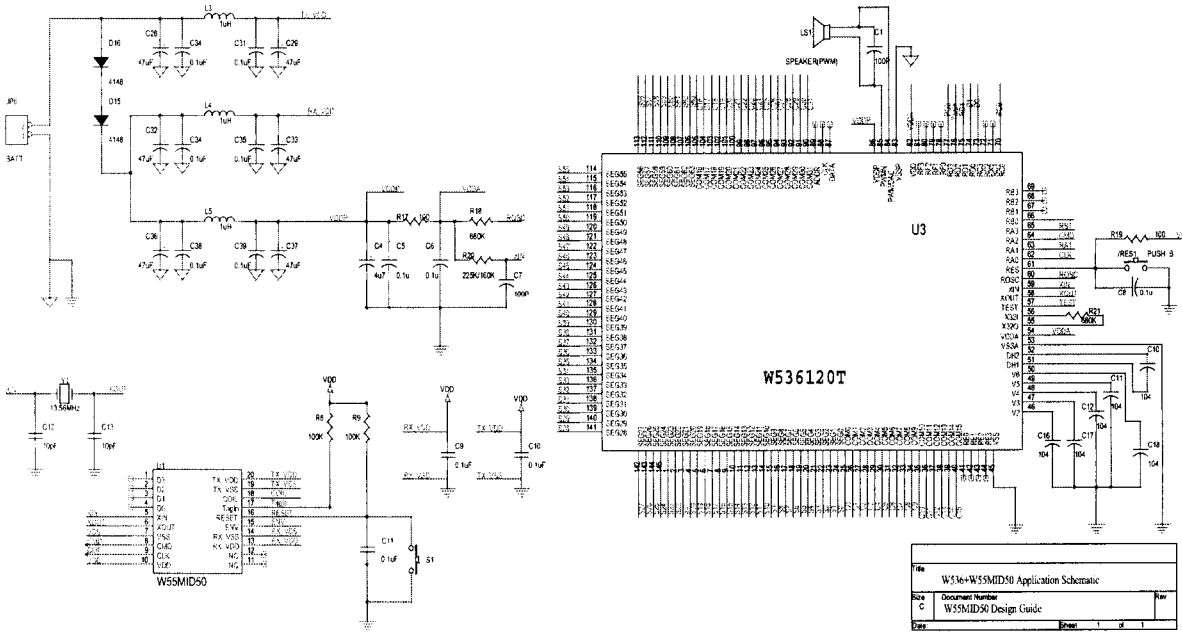
❑ **PCB Antenna Matching Circuit – 3 with Power Amp: (Venv = 80V @VDD = 4.5V)**



5.4.2 W55MID50 Application Schematic (Multi-antenna):



5.4.3 W536+W55MID50 Application Schematic:



5.5 FAQ

Q. What "MFID^{WB}" means?

A. "MFID^{WB}" Magnetic Field Identification, which is a Winbond contactless identification chip product series. There are many application, architecture, and circuit design patented by Winbond.

Q. What different between W55MID15 and W55MID35?

A. W55MID15 is a single-tag application without "Anti-collision" algorithm build-in. W55MID35 is a multi-tag application with "Anti-collision" algorithm build-in.

Q. What is the operating frequency?

A. Both W55MID15 and W55MID35 are operating on 13.553MHz ~ 13.567MHz ISM.

Q. Does W55MID50 Reader IC pass FCC compliance testing?

A. W55MID50 pass FCC compliance test of Section 15.209 and Section 15.225.

Q. How are W55MID15 and W55MID35 IDs generated?

A. W55MID15 and W55MID35 IDs are generated by manufacturing bonding option of pads RS0 ~ RS4.

Q. How many W55MID15 and W55MID35 IDs are generated?

A. There are total 243 bonding option IDs for W55MID15 and W55MID35.

Q. How are W55MID15 and W55MID35 IDs read?

A. W55MID50 is a function of MFID Reader IC. W55MID15 and W55MID35 automatically respond with its ID when it is coupled by magnetic resonance power from Reader.

Q. Is it possible to read multiple MFID^{WB} chips in the same magnetic area?

A. W55MID35 has been implemented by "Anti-collision" algorithm to allow more than one IDs can be simultaneously recognized in the same magnetic area.

Q. How many W55MID35 IDs can be simultaneously read in the same magnetic area?

A. Actually, there is no any limitation in total number of W55MID35 tags can be simultaneously read, if the Reader system can provide sufficient coupled magnetic resonance power to every W55MID35 tag,

Q. Does anything interfere with MFID chip readout operation?

A. W55MID series is operating on 13.553MHz ~ 13.567MHz, therefore it is far away from 27MHz and 2.45GHz. There is no any interference with W55MIDseries.

5.6 W55MID50 Design Guide Document History

Revision	Date	Description
A0	2002/9/16	Preliminary version.
A1	2002/12/29	Bonding diagram update
A2	2003/2/7	Application schematic update
A3	2003/3/27	Application schematic update & FCC compliance testing report

QuieTek Report No. 032H051FI

Test Report Certification

Test Date : Mar. 17, 2003
Report No. : 032H051FI

QuieTek Corporation
Accredited by NIST (NVLAP)
NVLAP Lab Code: 200347-0

Product Name	: MFID READER
Applicant	: Winbond Electronics Corp.
Address	: No. 9, Li Hsin Rd.,(PK31) Science-Based Industrial Park Hsinchu, Taiwan, R.O.C.
Manufacturer	: Winbond Electronics Corp.
Model No.	: W55MID50
FCC ID	: ID2-W55MID50
Rated Voltage	: DC 4.5V (Power by Battery)
Trade Name	: Winbond
Measurement Standard	: FCC Part 15 Subpart C Paragraph 15.225
Measurement Procedure	: ANSI C63.4:1992
Test Result	: Complied

NVLAP Lab Code: 200347-0

The Test Results relate only to the samples tested.
The test report shall not be reproduced except in full without the written approval of QuieTek Corporation.
This report must not be used to claim product endorsement by NVLAP any agency of the U.S. Government

Documented By : Ginny Peng (Ginny Peng)

Tested By : Ken Hsu (Ken Hsu)

Approved By : (Kevin Wang)

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Winbond Electronics Corp.

Headquarters
No. 4, Creation Rd. III,
Science-Based Industrial Park,
Hsinchu, Taiwan
TEL: 886-3-5770066
FAX: 886-3-5792697
http://www.winbond.com.tw/
Voice & Fax-on-demand: 886-2-27197006

Taipei Office
11F, No. 115, Sec. 3, Min-Sheng East Rd.,
Taipei, Taiwan
TEL: 886-2-27190505
FAX: 886-2-27197502

Winbond Electronics (H.K.) Ltd.
Rm. 803, World Trade Square, Tower II,
123 Hoi Bun Rd., Kwun Tong,
Kowloon, Hong Kong
TEL: 852-27513100
FAX: 852-27552064

Winbond Electronics North America Corp.
Winbond Memory Lab.
Winbond Microelectronics Corp.
Winbond Systems Lab.
2727 N. First Street, San Jose,
CA 95134, U.S.A.
TEL: 408-9436666
FAX: 408-5441798

Note: All data and specifications are subject to change without notice.