Nuvoton *MFID* Reader

W55MID50

Data Sheet

The information described in this document is the exclusive intellectual property of
Nuvoton Technology Corporation and shall not be reproduced without permission from Nuvoton.

Nuvoton is providing this document only for reference purposes of *MFID* based system design. Nuvoton
assumes no responsibility for errors or omissions.
All data and specifications are subject to change without notice.

For additional information or questions, please contact: Nuvoton Technology Corporation.
www.nuvoton.com

Table of Contents

General Description

Nuvoton *MFID* (Magnetic Field Identification) series 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.

W55MID50 is one of series in Nuvoton *MFID* family that supports multi-functional Reader solution and especially focus on toy, security, and consumer related applications. The applications with Nuvoton *MFID* Tag series such as W55MID10 that provides read-only mask ROM-ID version transponder for mass production solution in toy industrial, meanwhile W55MID15 provides the other solution for manufacture option, which is 243 bonding-ID selection transponder. Besides the single tag transponder application, W55MID35 offers multi-transponder recognition function for intelligent and smart toy applications.

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

1.1 W55MID50 Features

- ❑ Magnetic field resonance frequency: 13.56 MHz
- ❑ Data clock: 22 ~ 66 KHz
- ❑ 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)
- ❑ Nuvoton patented "Automatic Reader Transmission Power Adjustment" for Reader optimum transmission power adjust
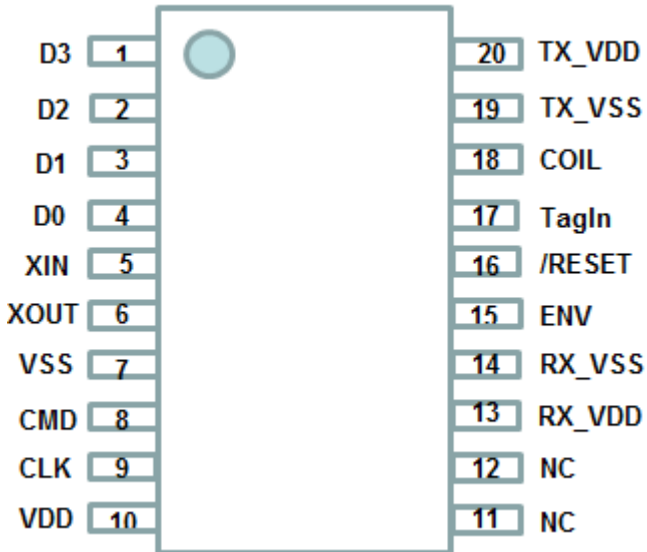
Minimize external components
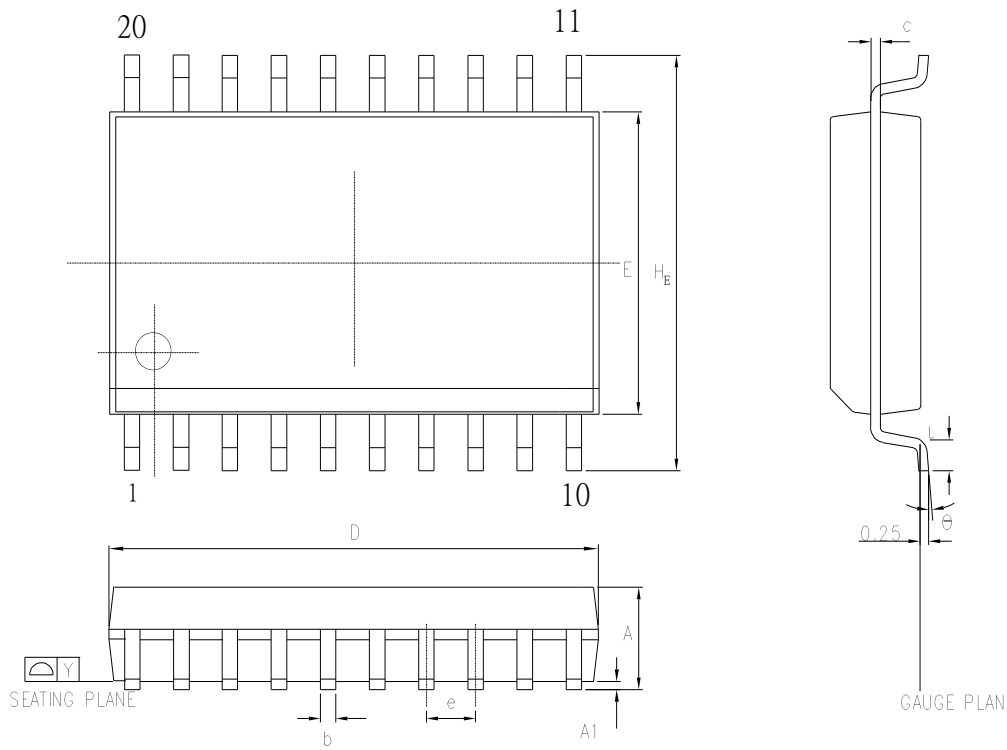
1.2 W55MID50 Pin Description

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

1.3 W55MID50 Package Information

SOP20 (300mil) Pin Assignment

D3	1		20	TX_VDD
D2	2		19	TX_VSS
D1	3		18	COIL
D0	4		17	TagIn
XIN	5		16	/RESET
XOUT	6		15	ENV
VSS	7		14	RX_VSS
CMD	8		13	RX_VDD
CLK	9		12	NC
VDD	10		11	NC

SOP20 (300mil) Package Dimension

Control demensions are in milmeters .

SYMBOL	DIMENSION IN MM		DIMENSION IN INCH	
	MIN.	MAX.	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 BSC	
H_E	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

System Description

2.1 W55MID50 System Block Diagram
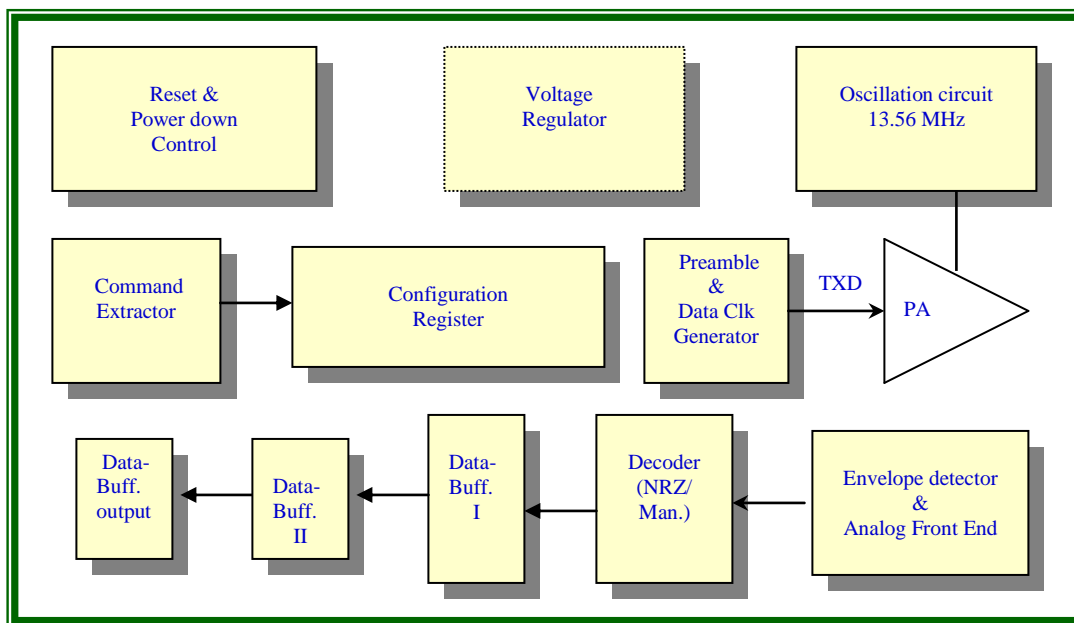
2.2 W55MID50 Functional Description

Transmission Power Amplifier (PA)

It provides 4 different selectable transmission power for Reader chip to support *MFID* Tag's radiation power supply. The external inductor coupling circuit is designed for 13.56 MHz 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 MFI^B 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 13.56 MHz 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.Electronic Characteristics

3.1 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.

3.2 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} = 13.56 MHz	-	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

3.3 W55MID50 Ordering Information

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

Part Number	Package	Remarks
W55MID50	Dice form	
W55MID50D20	PDIP-20	
W55MID50S20	SOP-20	
W55MID50	Wafer form	MOQ required

3.4 Application Schematic

WHS-55MID50V0.4PC
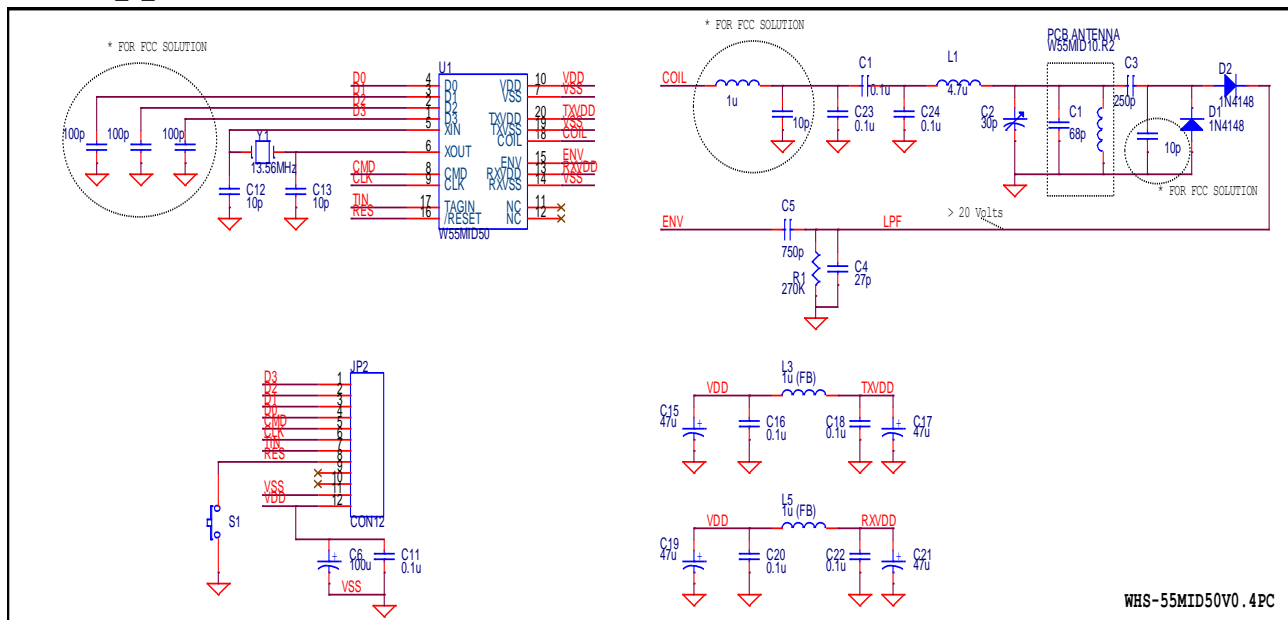
3.4 FAQ

Q. What "MFID" means?
A. "MFID" Magnetic Field Identification, which is a Nuvoton contactless identification chip product series. There are many application, architecture, and circuit design patented by Nuvoton.

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 13.553 MHz ~ 13.567 MHz 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 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 13.553 MHz ~ 13.567 MHz, therefore it is far away from 27 MHz and 2.45GHz.

There is no any interference with W55MIDseries.

3.5 W55MID50 Data Sheet Document History

Version	Date	Substantial Changes	Page
A1.0	2002/09/15	Preliminary version	A1.0
A1.1	2002/12/29	Pin functional description update	A1.1
A2.0	2003/02/07	General description update	A2.0
A3.0	2003/03/23	FCC compliance testing report	A3.0
A4.0	2005/08/15	Add Important Notice	A4.0
A5.0	2005/08/19	Application circuit modify to consistence with demo module board.	A5.0
A6.0	2009/03/06	Change company logo	A6.0
A7.0	2016/05/26	Add SOP20 Package Information and update package part no.	A7.0

Appendix

4.1 FCC Approval

Report No. 032H051FI

Test Report Certification

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

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   :   _____
(G i n n y P e n g)

Tested By   :   _____
(K e n H s u   )

Approved By   :   _____
(K e v i n W a n g)

Page : 2 of 22   Version:1.0

Important Notice

Nuvoton Products are neither intended nor warranted for usage in systems or equipment, any malfunction or failure of which may cause loss of human life, bodily injury or severe property damage. Such applications are deemed, "Insecure Usage".

Insecure usage includes, but is not limited to: equipment for surgical implementation, atomic energy control instruments, airplane or spaceship instruments, the control or operation of dynamic, brake or safety systems designed for vehicular use, traffic signal instruments, all types of safety devices, and other applications intended to support or sustain life.

All Insecure Usage shall be made at customer's risk, and in the event that third parties lay claims to Nuvoton as a result of customer's Insecure Usage, customer shall indemnify the damages and liabilities thus incurred by Nuvoton.