MW8113

UHF RFID Tag Chip Datasheet

Version: V1.0
30 Dec 2022

1. General Description

MW8113 is MaxWave's UHF passive tag product with proprietary intellectual property. It's compatible with EPC GS1 GEN2V2 and ISO 18000-6C standards. Good performance and group consistency make MW8113 well suitable for inventory management applications such as asserts inventory, logistics management.

MW8113 supports all mandatory commands include full-function lock, kill and access commands. The product provides convenient configuration for EPC and User memory size, pre-locked TID with even parity check protection.

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2. Key Features

- EPC Gen2V2 and ISO/IEC 18000-6C compliant
- Supports all mandatory commands and some optional commands:
  - ✧ Mandatory command: Select, Query, QueryRep, QueryAdjust, Ack, NAK, Req_Rn, Read, Write, Kill, Lock(full function)
  - ✧ Optional commands: Access, BlockWrite
- Frequency Range: 840MHz-960MHz
- Read sensitivity: -20dBm
- Write sensitivity: -16dBm
- Memory
  - ✧ Maximum 128-bit EPC
  - ✧ 96-bit TID factory locked, with even parity protection
  - ✧ Shared 32-bit Kill Password and Access Password
  - ✧ Maximum 32-bit User Memory
  - ✧ Possible mapping modes of EPC and User Memory: 96+32, 112+16, 128+0(default)
- Writing result auto-confirmation
- Programmable back-scatter strength
- Application environments auto matching
- Robust NVM architecture and design to prevent ghost ID
- Block Write (32 bit) on even addresses
- Easily configuration for EPC and User memory size
- No less than 10-year data retention in 85℃ environment
- Minimum 100K write cycle endurance

3. Block Diagram

The MW8113 consists of three major blocks: Analog part, Digital part and NVM.

Analog part senses the RF wave through off-chip antenna and extracts power for whole tag, also the demodulator circuit extracts baseband signal and passes down to Digital part, the modulator transmits data back to the Reader, the OSC generates system clock and the POR provides power-on-reset signal for digital part.

The digital section includes the state machines (FSM), Decoder, Encoder and NVM interface controller. FSM guides all digital blocks processing sequence, Decoder and Encoder process UHF RFID baseband protocol and handle communication with the NVM through NVM interface.

The NVM contains the EPC and user data, provides reading, writing function and retains data when power off.

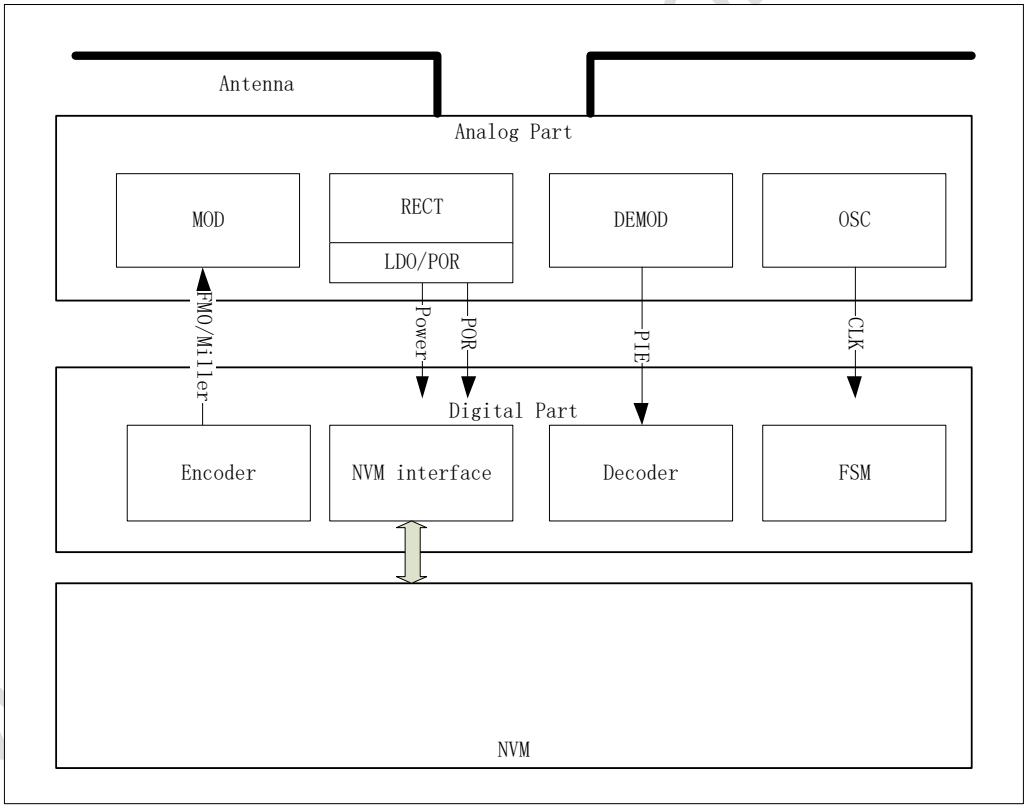

Figure 1:MW8113 Block diagram

4. Block Diagram

Bank	Address	Type	Content	Initial Value	Status
EPC（01）	00-0Fh	RAM	CRC-16		Read only
	10-14h	NVM	EPC length	00000b	R/W
	15h	ROM	UMI	1b	Read only
	16-1Fh	ROM		all 0	locked
	20-7Fh	NVM	EPC	TID_SN	R/W
	80-9Fh	NVM	EPC Option	All 0	R/W
TID（10）	00-07h	ROM	Class identifier	11100010b	RO
	08-13h	ROM	Mask designer identifier	100000111110b	RO
	14-1Fh	ROM	Tag version	000011110001b	RO
	20-2Fh	ROM	XTID header	2000h	RO
	30-5Fh	NVM	Serial Number	TID_SN	RO
Reserved（00）	00-1Fh	NVM	Shared Kill password	All 0	R/W
	20-3Fh	NVM	Shared Access password	All 0	R/W
	40-4Fh	NVM	Trimming control	16F0h	RO
	50-59h	NVM	reserved	0000001000b	Optimized
	5A-5Bh	NVM	Back-scatter strength	00	Optimized
	5C-5Fh	NVM	reserved		Optimized
	60-6Fh	NVM	System information		RO
	Note: Kill and Access password shares same physical memory, should be same value				
User（11）	00-1Fh	NVM	User	All 0	R/W

Table 1:MW8113 Memory map

Product	FACTORY DEFAULT PC WORD(HEX)	EPC VALUE PRE-PROGRAMMED AT THE FACTORY(HEX)
MW8113	0x4000	E283_E0F3_2000_xxxx_xxxx_xxxx_xxxx_xxxx

Table 2:MW8113 Initial EPC at Factory-Program

5. Pin Information and Bonding Reference

Pin Information:

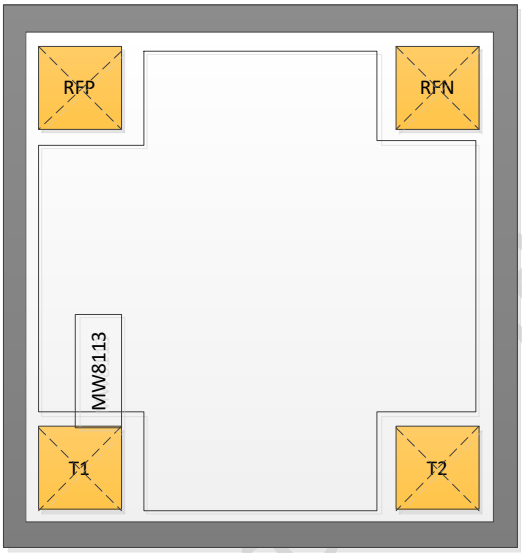

Figure 2:MW8113 Pin Information

Pin name	Description
RFP	Antenna connector 1
RFN	Antenna connector 2
T1	Test pin1, electrically isolated with tag
T2	Test pin2, electrically isolated with tag

Table 3:MW8113 Pin Information

Bonding Reference

Refer to Figure 3, differential RF input pin RFP and RFN should be bond to antenna, and test pad should be bond to dummy metal

There is a metal print of “MW8113” located near T1 pad, this sign can be used as bonding alignment

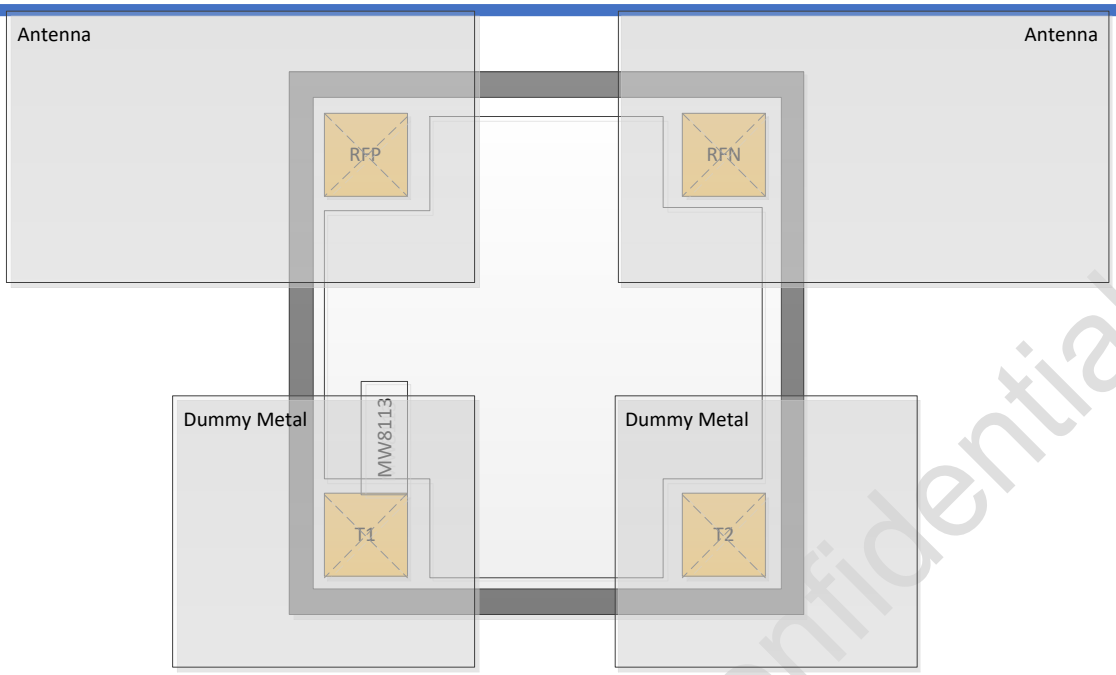

Figure 3: Bonding Reference

Note: MW8113 also support single-slit antenna bonding mode because the test pads T1 and T2 are electrically disconnected and therefore can be safely short to the RF pads, this bonding mode especially suit for very small size inlay design

6. Wafer Information

a) Wafer Specification

Item	Specification	Error
Wafer Diameter	8'' 200mm	N/A
Wafer Thickness	120um	±10%
Backside Material	Si	N/A
Backside Treatment	Ground and stress release	N/A
Scribe Line Width	25um	N/A
PAD Size	50 um X 50 um	N/A
Passivation Material	SiOx + SiNx	N/A
Passivation Thickness	1.75um	N/A
Al Pad Material	Al-99.5% Cu-0.5%	N/A

Table 4:wafer specification

b) Bump Specification

Item	Specification	Error
Bump Material	>99.9 pure Au	N/A
PI Spacer	10um	±1um
Bump Height	18um	±3um

Bump Size	56um*56um	±3um
Bump Variation	<5um	N/A

Table 5 :bump specification

c) Chip Specification

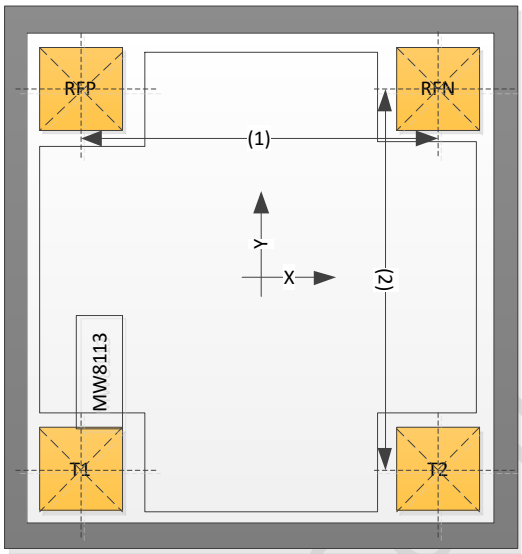

Figure 4: chip information

Item	value
1. PAD to PAD distance in X direction	451um
2. PAD to PAD distance in Y direction	481.8um
Chip size in X direction	541um
Chip size in Y direction	572um
PAD size	50um*50um

Table 6: chip information

7. RF Interface Characteristics and Limited Values

Parameter	Conditions	Min	Typ	Max	Unit
Input Frequency		840		960	MHz
Read sensitivity			-20		dBm
Write sensitivity			-16		dBm
Chip impedance Z	915MHz		11-202j[1]		Ω
Input Capacitance Cp			0.859[1]		pF
Write time/word			6		ms

[1] additional parasitic cap=100fF

Table 7: RF interface characteristics

Parameter	Condition	Min	Typ	Max	Unit
Ambient Temperature		-40		85	℃

Storage Temperature		-50		150	℃
Input Power				100	mW
ESD	HBM		2000		V

Table 8:limited values

8. Version History

Version	Release Date	Description
1.0	2022/12/30	Preliminary

Table 9: Version History