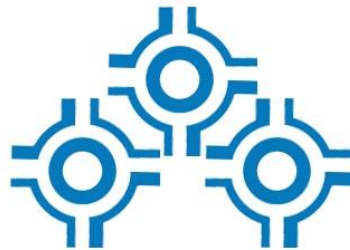


Smart NFC Choice for your Life



TNB132M IC Overview

(Document : 3AD - SDS - Rev 1.0a)



3ALogics

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27 – SEP – 2016

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■ NFC Introduction

What is NFC

Near field communication (NFC) is a set of standards for smart-phones and similar devices to establish radio communication with each other by touching them together or bringing them into proximity, usually no more than a few inches.

- Carrier frequency : 13.56Mhz
- Communication method :
Inductive coupling, Magnetic field energy
- Communication Distance (~ 10cm)
: Smart phone ~ 3cm
- Communication Speed
: 106, 212, 424, (848) kpbs

NFC 3 communication mode / 3 Actions

- | | |
|-------------------|----------------------------|
| - Reader / Writer | *Reading Tags |
| - Peer to Peer | *Making Connections |
| - Card Emulation | *Card in a phone |

Tag(Card) Reader / Writer (Terminal)

Multi-standard (ISO/IEC 14443, JIS X 6319-4/Felica, ISO/IEC 15693)

**Peer to Peer Communication (Device to Device)**

NFCIP-1, NFCIP-2 (ISO/IEC 18092, ISO/IEC 21481)



Touch / Tap / Close on

**Card Emulation (Secure Element)**

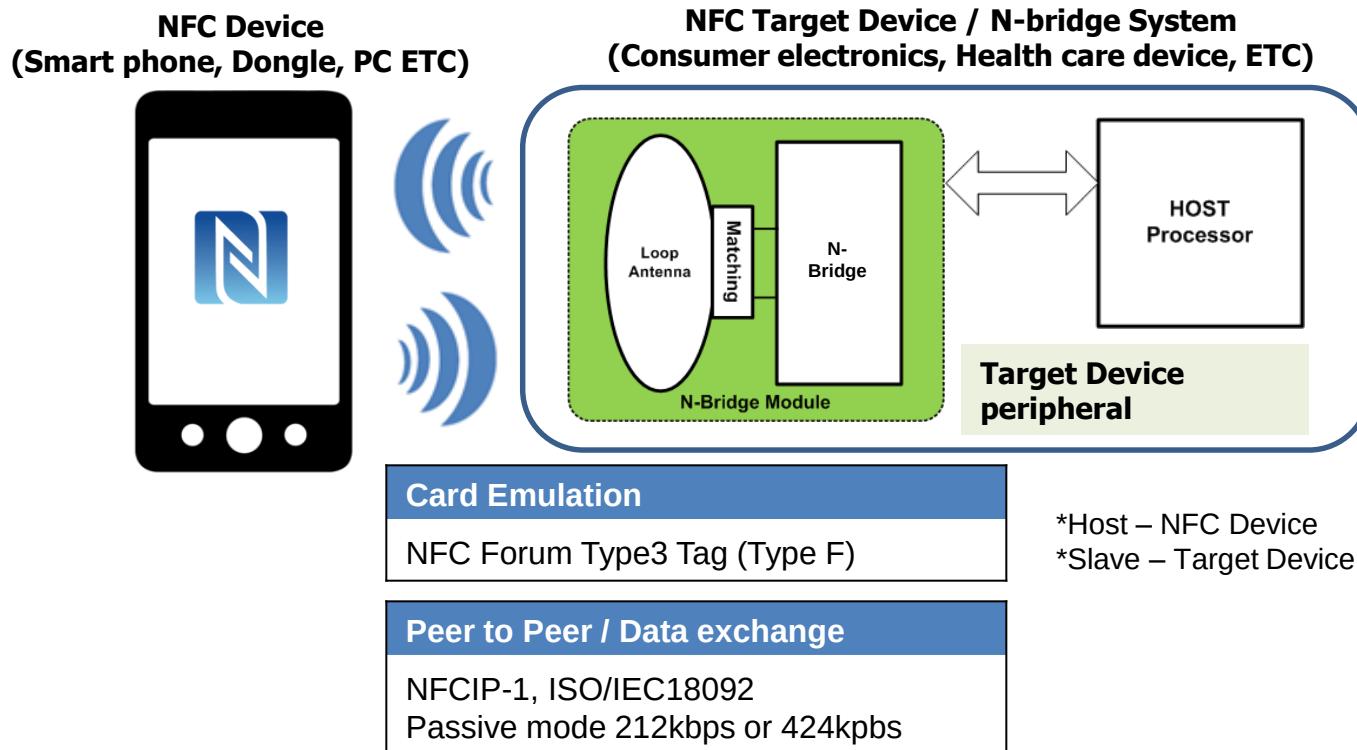
EMVCo, ISO/IEC 14443, JIS X 6319-4/Felica



Close communication

What is N-Bridge ? (Action of N-Bridge)

- ✓ **N-Bridge Concept** : Providing RF interface to RF communicate between NFC Device and Target Device
 - Active Type NFC TAG that has Host interface
 - SPI / I2C
 - Passive Type communication of Load modulation (None RF Generation)
- ✓ **N-Bridge Operating mode**
 - NFC Forum Tag Type3 mode (T3T mode)
 - NFC Data Exchange Protocol mode (NFC-DEP mode) / Peer to Peer target



■ N-Bridge Target Application / Target Device

N-Bridge Target Device/Application



- ✓ **Handover/Making connections**
: Bluetooth simple pairing, Wi-Fi set-up
- ✓ **Read/Write the information of Set device**
: Writing and reading information needed in Target device.
- ✓ **System Wake up**
: Wake up Sleep mode Target Device to NFC Host Device like a Smart phone.
*Target Device (Power save mode)

■ N-Bridge Use case (Example)

Camera/mp 3player BT Speaker



- To Register Device ID and customer information and other information in Target Device
- To Transmit pictures, video, voice and music information wanted via Bluetooth or Wi-Fi in Handover mode by NFC Touch
- To check battery, memory capacity, etc in smart phone
- To check information of defect of Target device and request for repair in smart phone

Home appliances



- To Register Device ID and customer information and other information in Target Device
- To control Target Device by smart phone. (New menu, equipment reservation, device control, etc)
- To check ECO (Power consumption, etc) information in smart phone
- To check information of defect of Target device and request for repair in smart phone

Printer Business equipment



- To Register Device ID and customer information and other information in Target Device
- To Output information wanted to mark or output in Handover mode with printer or Projector, etc by NFC Touch
- To check variable such as ink and lamp life of projector, etc in smart phone
- To check information of defect of Target device and request for repair in smart phone

Health care device



- To Register Device ID and customer information and other information in Target Device
- To check health information, and store and manage them in server or memory by smart phone.
- To control operation by smart phone.
- To check information of defect of Target device and request for repair in smart phone

ESL/E-paper



- To Register Device ID and customer information and other information in Target Device
- To control price information(display information) by smart phone
- To check price information, and store and manage them in server by smart phone

3alogics NFC Solution

Application	NFC function	Direction	Host Interface	Recommend		Remark
				IC	Module	
Traceability (History/record management)	Tag	NFC Device --> OD	X	Commercial NFC Tag IC	TAG	
BT paring / Wi-Fi setup	Tag	NFC Device --> OD	X	Commercial NFC Tag IC	TAG	*Mobile Printer
BT paring / Wi-Fi setup System Wake up	Tag emulator & RF detection	NFC Device --> OD	O	TNB131M TNB132M	NTM	*BT portable speaker
BT paring / Wi-Fi setup System Wake up	Tag emulator & RF detection Or P2P passive target	NFC Device --> OD	O	TRH033M-S	ATM	
Payment	R/W	OD --> RF Payment Card	O	TRH033M-S	ATM	
Personal authentication	R/W	OD --> ID Card	O	TRH033M-S	ATM	
Device Initializing	P2P active target or P2P passive target	NFC Device --> OD	O	TNB131M TNB132M	NTM	
Data exchange transmission/reception & reception/transmission (Master & Slave)	P2P initiator & target	OD <--> NFC Device	O	TRH033M-S	ATM	*Smart rice cooker
Data exchange reception/transmission (Slave)	P2P target	NFC Device --> OD	O	TNB131M TNB132M	NTM	

√ NTM : Normal Type Module – cost effective / ATM : Advanced Type Module

√ NFC Device : Smart phone / OD : Other device, Target Device

3alogics N-Bridge Solution - IC

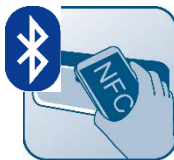
Parametric Table

Product Code	Package	Operating Temperature	Power supply (Typ.)	Memory	Resonance Cap.	RF Protocols	Host Interface
TNB131M	TQFN16 (3mm X 3mm)	-40 ~ 85°C	1.8V/3.3V	256Byte N-Bridge RAM	23.5pF	NFC Type3	I2C/SPI
TNB132M	XQFN8 (1.6mm X 1.6mm)	-40 ~ 85°C	3.3V	64Byte N-Bridge RAM 1KByte EEPROM	50pF	NFC Type3	I2C
TNB133M	QFN16 (4mm X 4mm)	-40 ~ 85°C	1.8V/3.3V	Em-MCU(Flip8051) 2KB Xdata RAM 5KByte Code EEPROM 1KB N-Bridge EEPROM	46pF	NFC Type3	I2C UART
TNB134M	QFN32 (5mm X 5mm)	-40 ~ 85°C	1.8V/3.3V	Em-MCU(8051) 2KB Xdata RAM 15KByte Code EEPROM 1KB N-Bridge EEPROM	23.5pF	NFC Type5	I2C

Target Application

TNB131M / TNB132M

- BT pairing
- Wi-Fi Setup
- ESL
- Consumer electronics



TNB133M

- IoT - NFC Sensor module



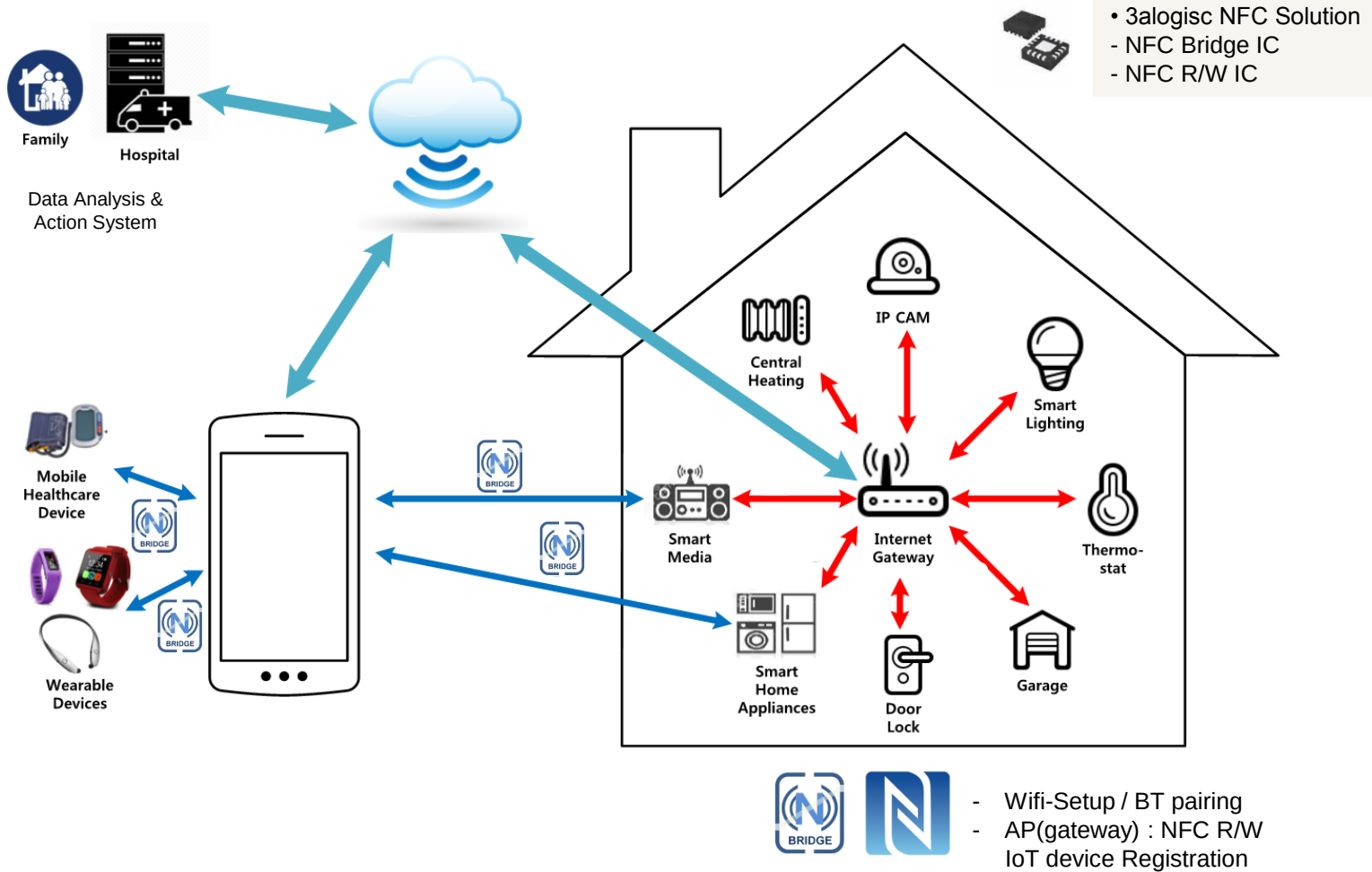
TNB134M

- Cold Chain



3alogics N-Bridge Solution – Application (NFC in the IoT)

NFC in the IoT



TNB132M Overview

Feature

Basic information

- Embedded 1KByte-EEPROM(User 976Bytes, System 48Bytes)
- Embedded 64Byte SRAM for Fast Bridge Mode
- NFC Forum Type3 Dynamic Tag
- 1.7 ~ 3.6V operation voltage, 8pin XQFN Package
- NFC Forum tag type 3 bridge at 212/424kbps with host processor
- Stand alone NFC Forum Type3 Tag at 212/424kbps
- Selective data rate (212/424kbps)
- Host wakeup interrupt by external RF field
- Analog RF field detection
- Integrated RF tuning capacitor
- Internal 6.78MHz Oscillator

Functions for microprocessor interface

- I2C slave (up to 400KHz)
- IRQ output to advise tag status monitoring

Energy Harvesting

- Rectifier power out(VREC) up to 20mw, Not regulated
- Depending on external RF and antenna condition

Power consumption minimization

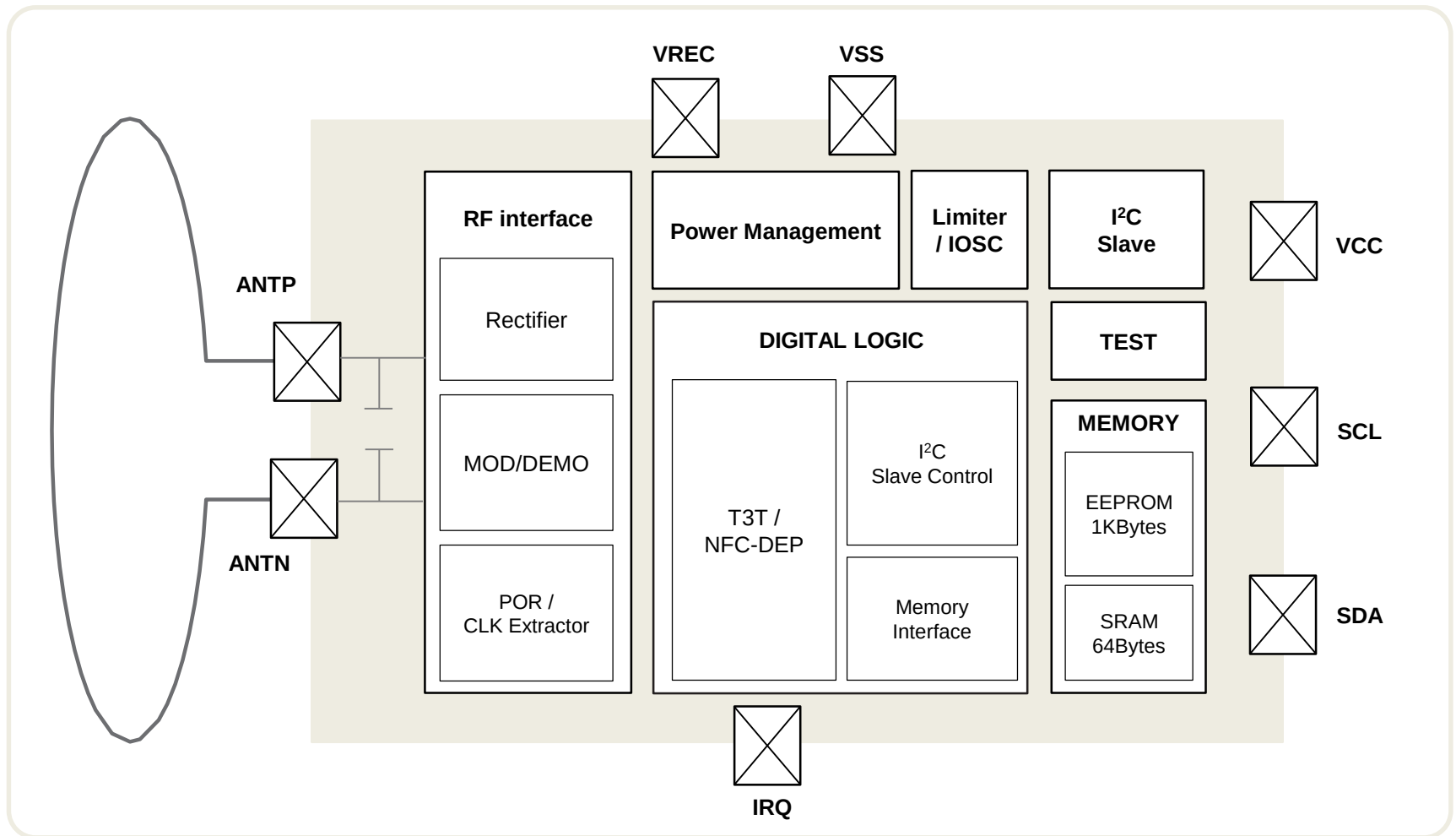
- Optimized Logic and internal gated low frequency clock
- Minimized leakage and stand-by current

Key Application

- Smart home appliances
or other applications with built-in microcontroller
- NFC Application (NFC Forum SIGs)
 - Health-care
 - consumer electronics
- Electronic Shelf Labels
- IoT Application / BT-pairing and Wi-Fi setup

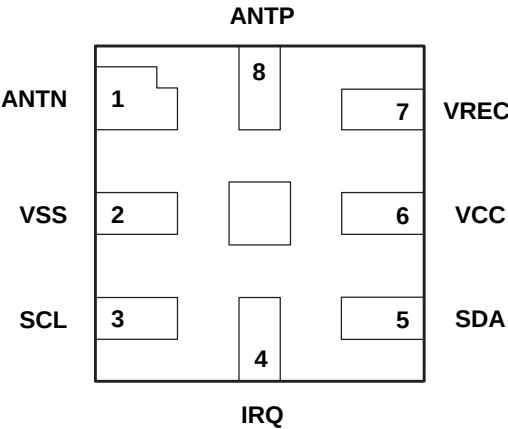
Frequency		13.56MHz
Protocol		ISO/IEC 18092 (JIS 6319-4)
Operating Temperature		-40 ~ 85°C
Power		1.7 ~ 3.6V
Host interface		I ² C
NFC mode		Type 3 TAG
Modulation		Load modulation
Memory	Type	SRAM / EEPROM
	Size	64byte / 1Kbyte
Data rate		212 / 424kbps (Selective data rate)
Special feature		Host Wake-up interrupt by External RF field *Analog RF field detection
Integrated capacitor		RF tuning capacitor Analog Rectifier output and Regulator capacitor
Packaging		XQFN8 (1.6mm X 1.6mm)
Resonance Capacitance		50pF

■ TNB132M Block Diagram



TNB132M PIN Information

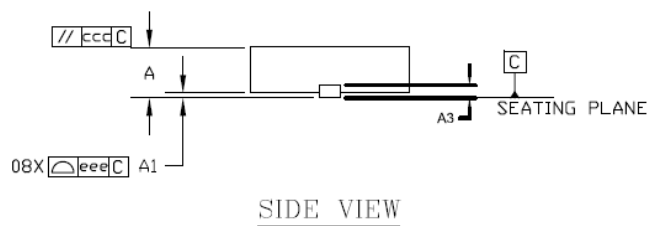
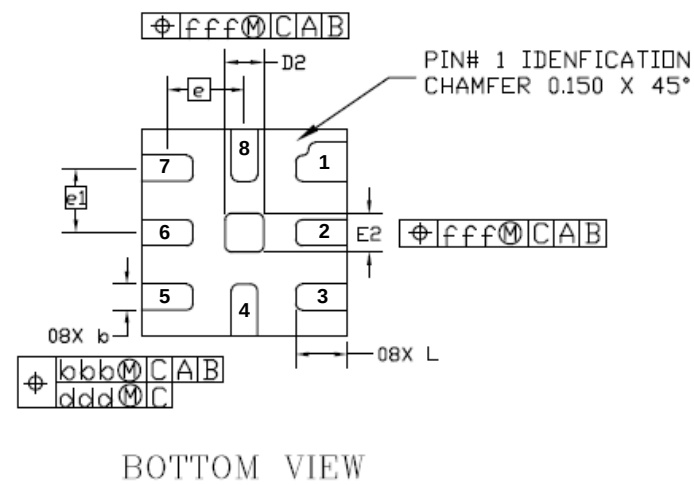
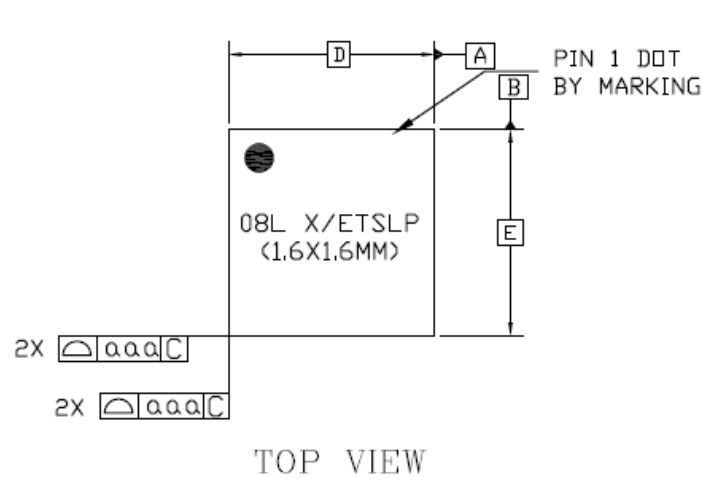
TNB132M uses 8pin XQFN package. (1.6mm X 1.6mm)



[Transparent top view]

#	Name	Dir.	Description
1	ANTN	I	Antenna negative input
2	VSS	GND	Ground
3	SCL	I	I2C – SCL
4	IRQ	O	N-Bridge interrupt request
5	SDA	I/O	I2C - SDA
6	VCC	PWR	External Power : 1.7 ~ 3.6V
7	VREC	PWR	Rectifier output : < 3.6V *Analog power generation & Field detection
8	ANTP	I	Antenna positive input

TNB132M Package Outline Dimension



NOTE:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M-1994.
2. DIMENSION "A" EXCLUDE BURR FOR ALL MAX PACKAGE

Dimensional Ref.			
REF.	min.	nom.	max.
A	-	-	0.400
	-	-	0.450
	0.400	0.450	0.500
A1	0.000	-	0.050
A3	0.127 REF		
D	1.600 BSC		
E	1.600 BSC		
D2	0.250	0.300	0.350
E2	0.250	0.300	0.350
b	0.150	0.200	0.250
e	0.600 BSC		
e1	0.500 BSC		
L	0.350	0.400	0.450

Dimensional Tol.	
aaa	0.050
bbb	0.100
ccc	0.050
ddd	0.050
eee	0.080
fff	0.050

TNB132M Electrical Characteristics

Operating condition range

Symbol	Parameter	MIN	TYP	MAX	UNIT
T_{op}	Operating temperature range	-40	+25	+85	°C
VDD	Analog/Digital Core and IO power supply	1.62	1.8	1.98	V
VREC	Harvesting Power	1.7	3.0	3.6	V

Current Consumption

Symbol	Parameter	TEST Conditions	MIN	TYP	MAX	UNIT
$I_{PWR-3.0V}$	Power Supply Current	Active mode, T=25°C @I2C, 100kHz / VCC = 3.0V	-	450	-	μA

RF Interface characteristics

Symbol	Parameter	MIN	TYP	MAX	UNIT
Vant_pk	Antenna input Voltage	-	-	10	Vpk-pk
VREC_op	IC Rectifier Operating Voltage	-	-	3.6	V
Cin	Internal resonance capacitance	45	50	55	pF

ASK Demodulator characteristics

Symbol	Parameter	MIN	TYP	MAX	UNIT
Amd	ASK modulation depth (10%) / downlink	-	-	30	%
RXsen	Rx Sensitivity	40	-	-	mV

Limiting characteristics

Symbol	Parameter	MIN	TYP	MAX	UNIT
VREC	Rectifier output voltage	-0.5	-	3.6	V
Tstg	Storage temperature	-55	-	125	°C
VESD	Electrostatic discharge voltage	-	2	-	kV

■ Integrated Capacitor – Resonance Capacitance

Product	Resonant frequency (MHz)	C _{IC} (pF)	C _{ext} (pF)	C _{con} (pF)	C _{ant} (pF)	C _{total} (pF)	Antenna Coil inductance (μH)
TNB132M	13.3	50	0	1	1	52	2.75
		50	0	1	3	54	2.65
		50	0	1	5	56	2.56
	13.56	50	0	1	1	52	2.65
		50	0	1	3	54	2.55
		50	0	1	5	56	2.46
	13.9	50	0	1	1	52	2.52
		50	0	1	3	54	2.43
		50	0	1	5	56	2.34

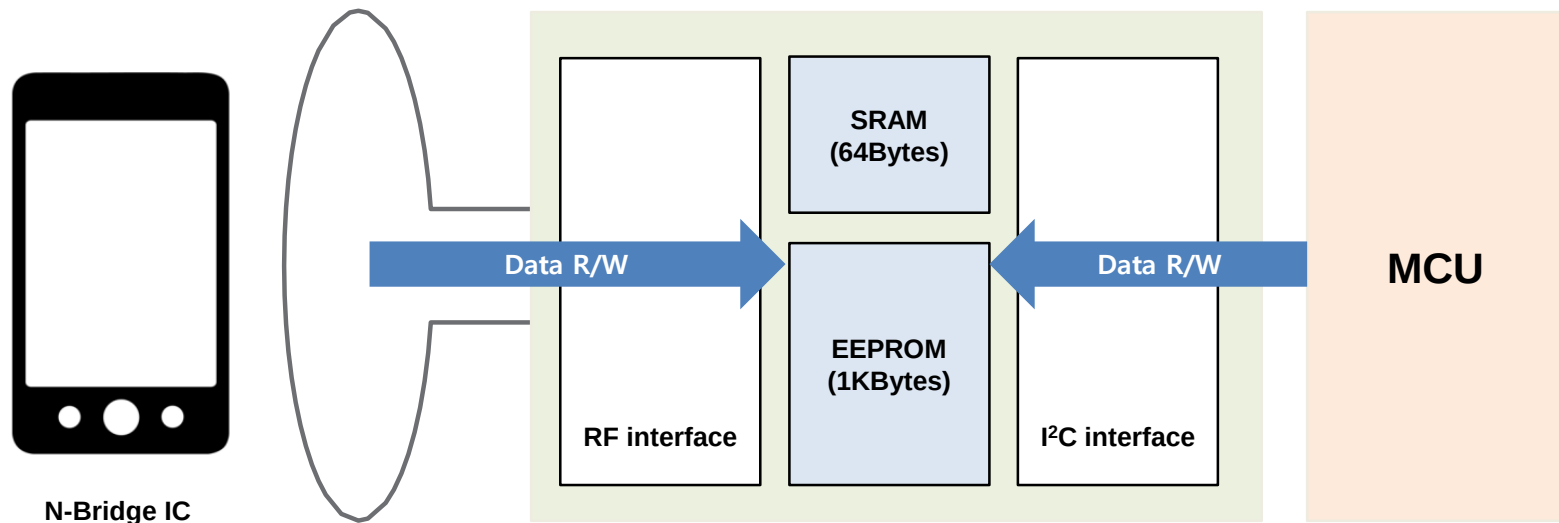
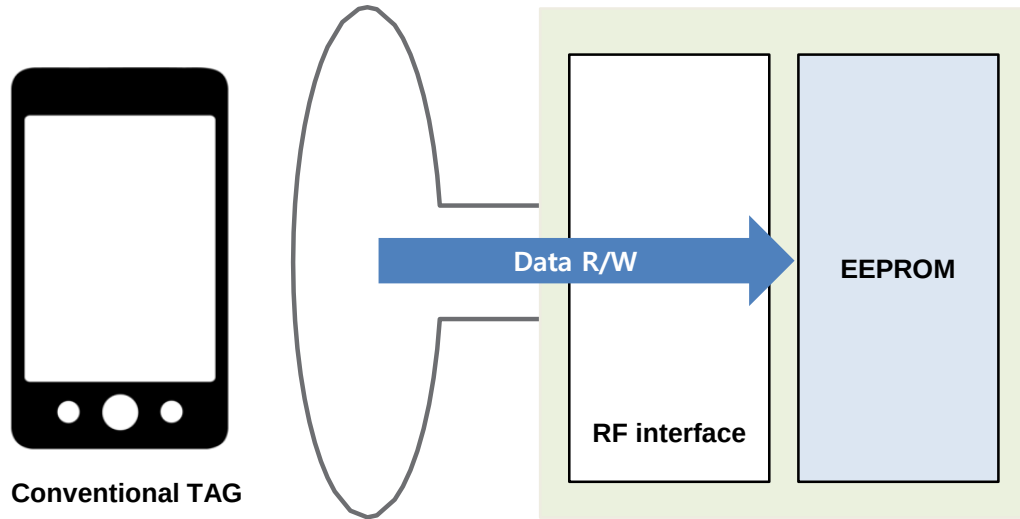
Integrated Capacitor Typ. : 50pF

@13.56MHz

L = 2.34 ~ 2.75μH

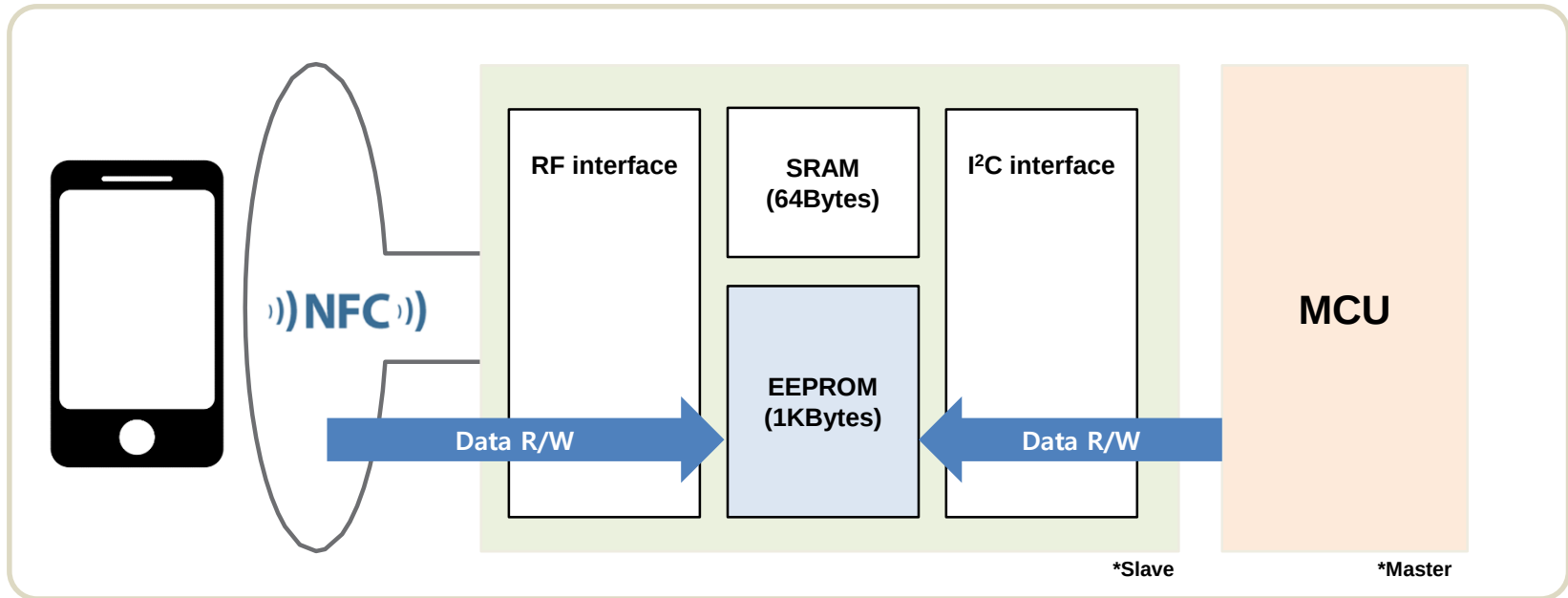
* Recommended Frequency : 13.6 ~ 13.8MHz

■ Communication - Conventional TAG VS N-Bridge



■ Communication Mode - Using EEPROM (Normal Mode)

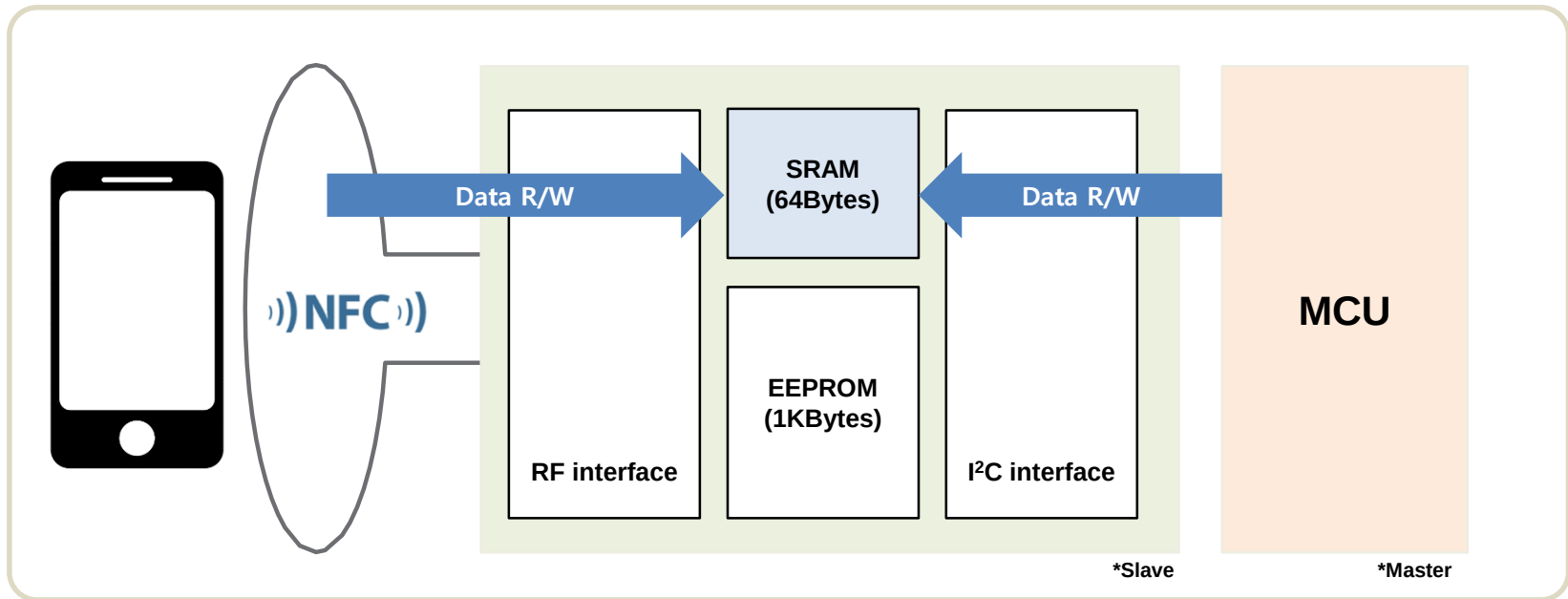
- Coupon data storage , NDEF data update ETC



	POWER		Data transfer	
	VREC	VCC	RF interface	I²C interface
Without RF	External Power supply	External Power supply	-	R/W
With RF	Harvesting	x	R/W	-
		External Power supply Or Harvesting Power	R/W	R/W
Data path	• Smart phone TX : NFC EEPROM Write → MCU I²C EEPROM Read • Smart phone RX : MCU I²C EEPROM Write → NFC EEPROM Read			

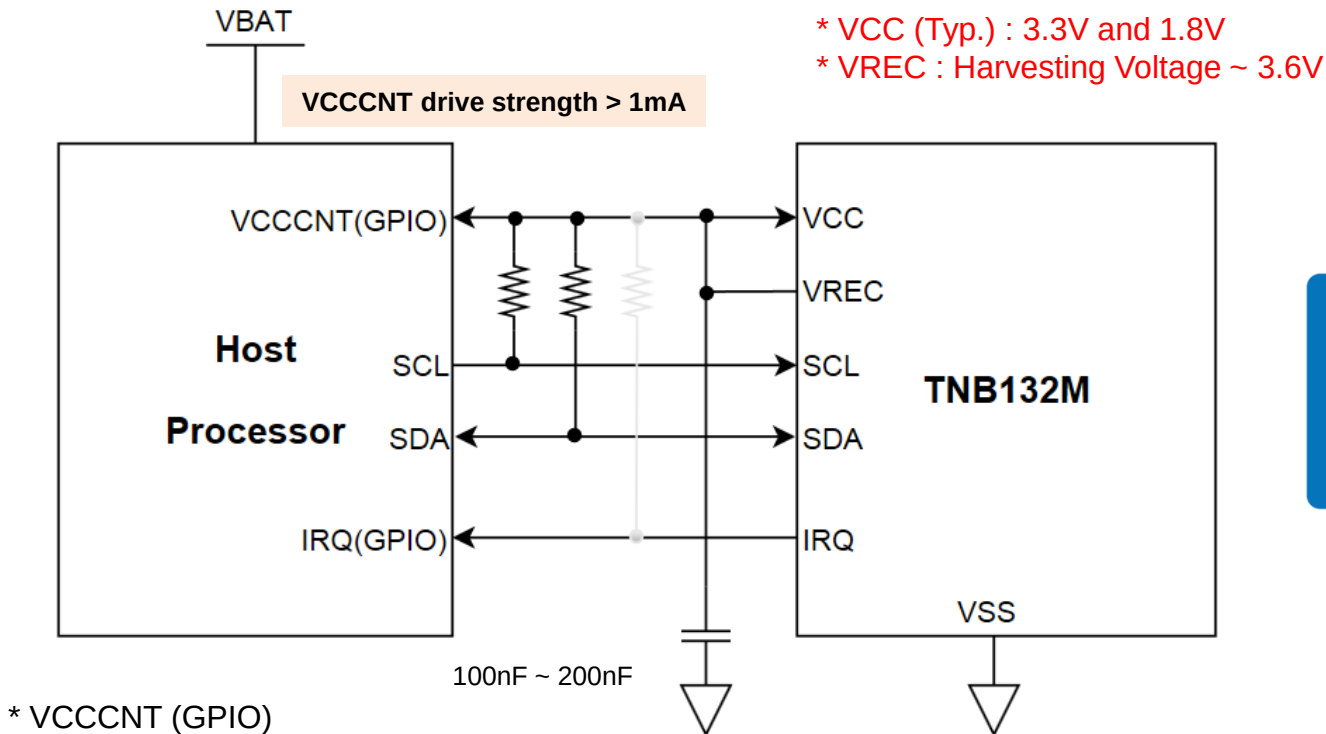
■ Communication Mode - Using SRAM (Fast Bridge mode)

- Host firmware update, image transmission ETC



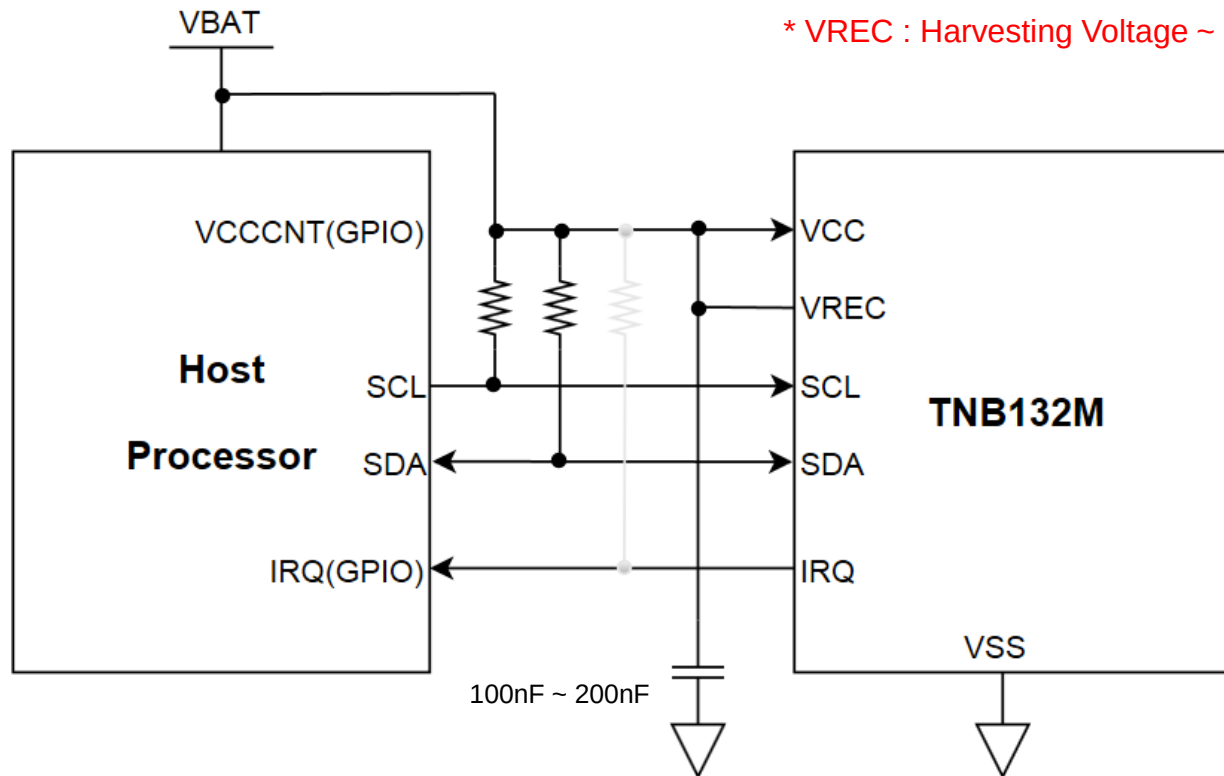
	POWER		Data transfer	
	VREC	VCC	RF interface	I²C interface
Without RF	External Power supply	External Power supply	-	R/W
With RF	Harvesting	x	R/W	-
		External Power supply Or Harvesting Power	R/W	R/W
Data path	• Smart phone TX : NFC SRAM Write → MCU I²C SRAM Read • Smart phone RX : MCU I²C SRAM Write → NFC SRAM Read			

■ Both-way Communication HW Configuration : Battery



- * VCCCNT (GPIO)
 - NFC to I²C Communication
 - : input mode(High-Z) / RF detection
 - if. Using pull down Resistor – 47k ~ 100kohm
 - I²C to NFC Communication
 - : Output mode / VCC supply
- * IRQ
 - Output to advise tag status monitoring

■ Energy Harvesting mode HW Configuration : Battery-less



Thank You !

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Disclaimer

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