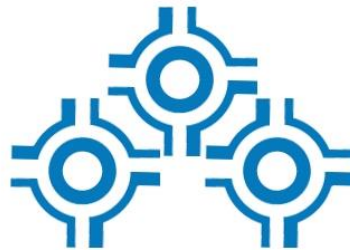


Smart NFC Choice for your Life



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)**

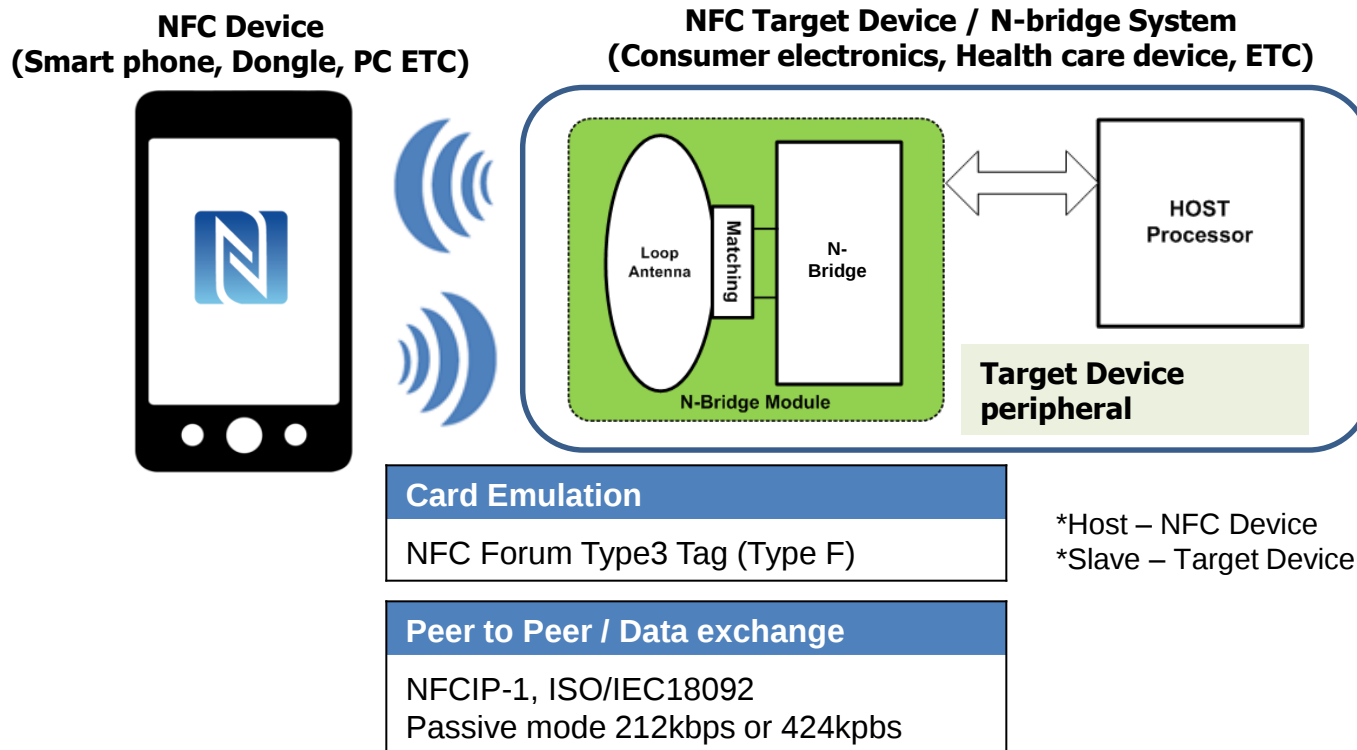
EMVCo, ISO/IEC 14443, JIS X 6319-4/Felica



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

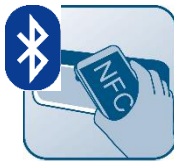
Parametric Table

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

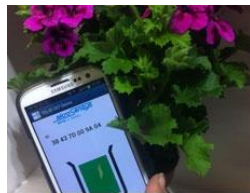
TNB131M / TNB132M

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



TNB133M

- IoT - NFC Sensor module



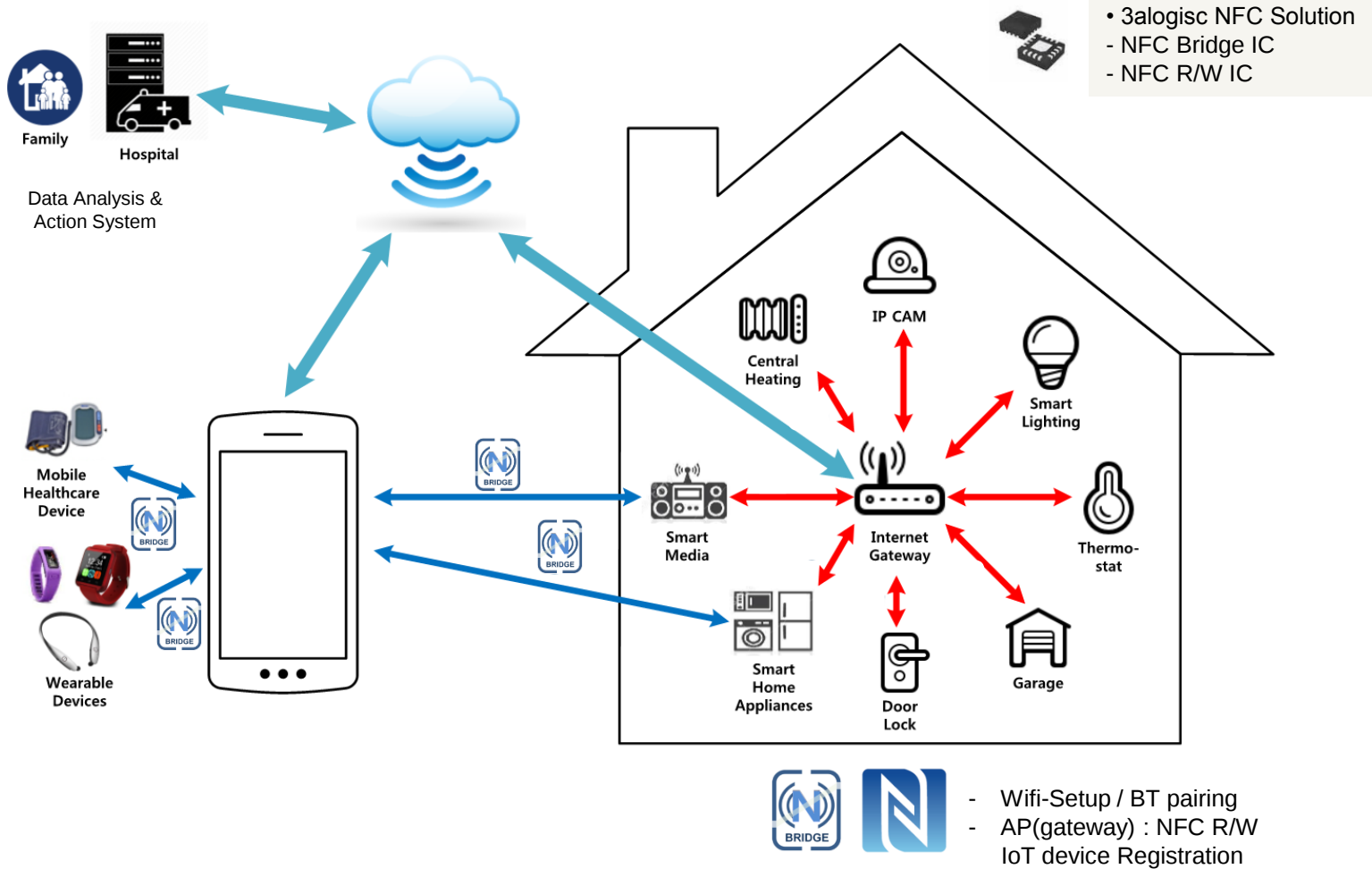
TNB134M

- 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

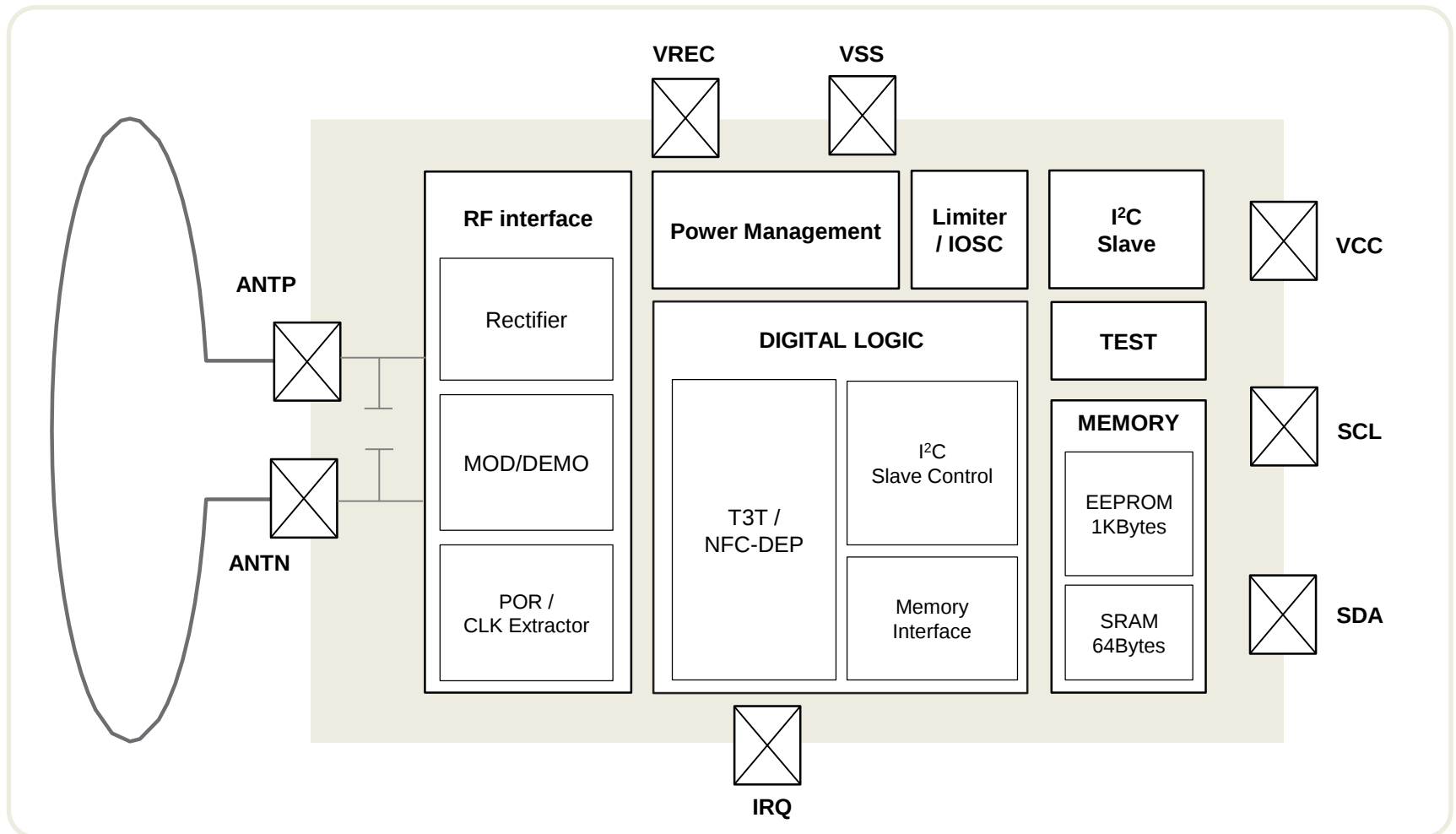
- Optimized Logic and internal gated low frequency clock
- Minimized leakage and stand-by current

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

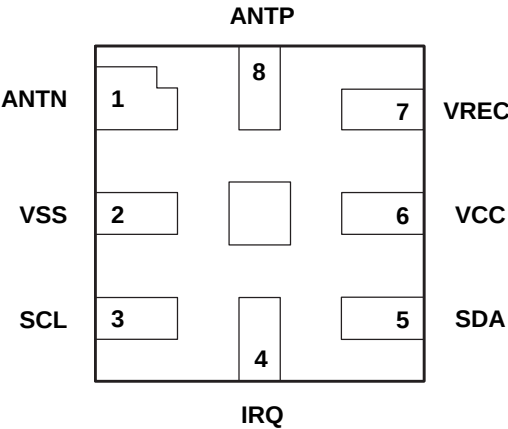
Frequency		13.56MHz
Protocol		ISO/IEC 18092 (JIS 6319-4)
Operating Temperature		-40 ~ 85°C
Power		1.7 ~ 3.6V
Host interface		I ² C
NFC mode		Type 3 TAG
Modulation		Load modulation
Memory	Type	SRAM / EEPROM
	Size	64byte / 1Kbyte
Data rate		212 / 424kbps (Selective data rate)
Special feature		Host Wake-up 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

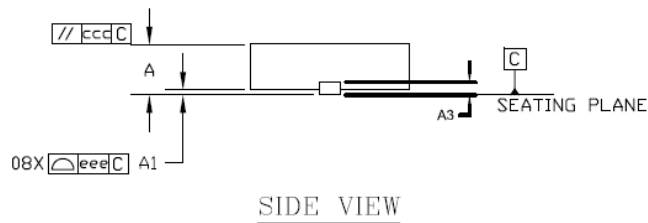
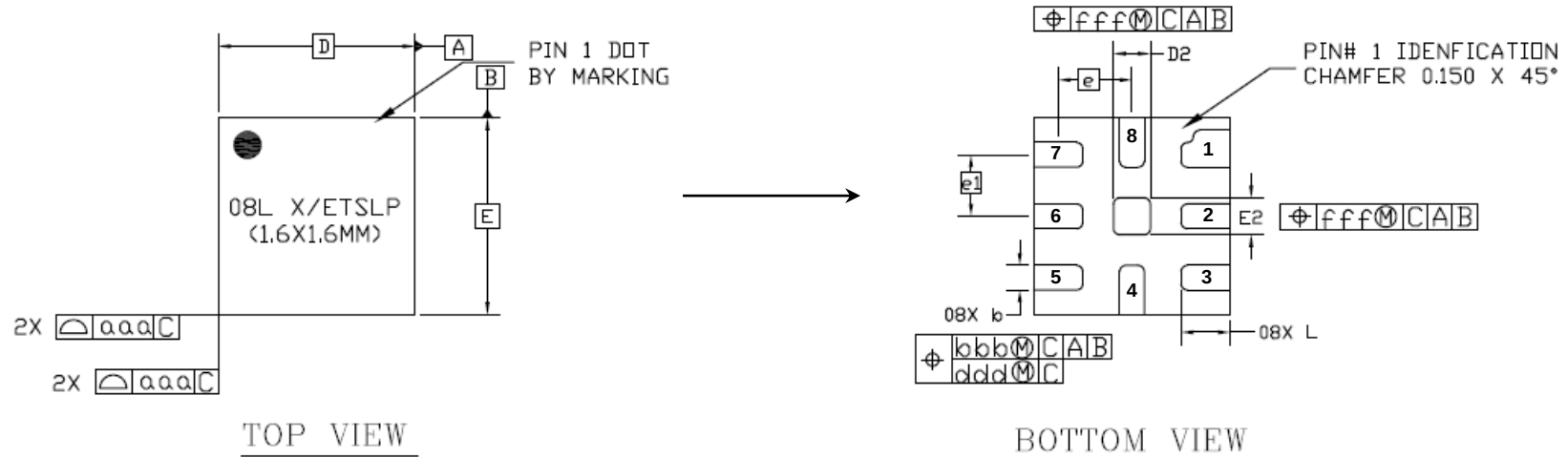
TNB132M uses 8pin XQFN package. (1.6mm X 1.6mm)



[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

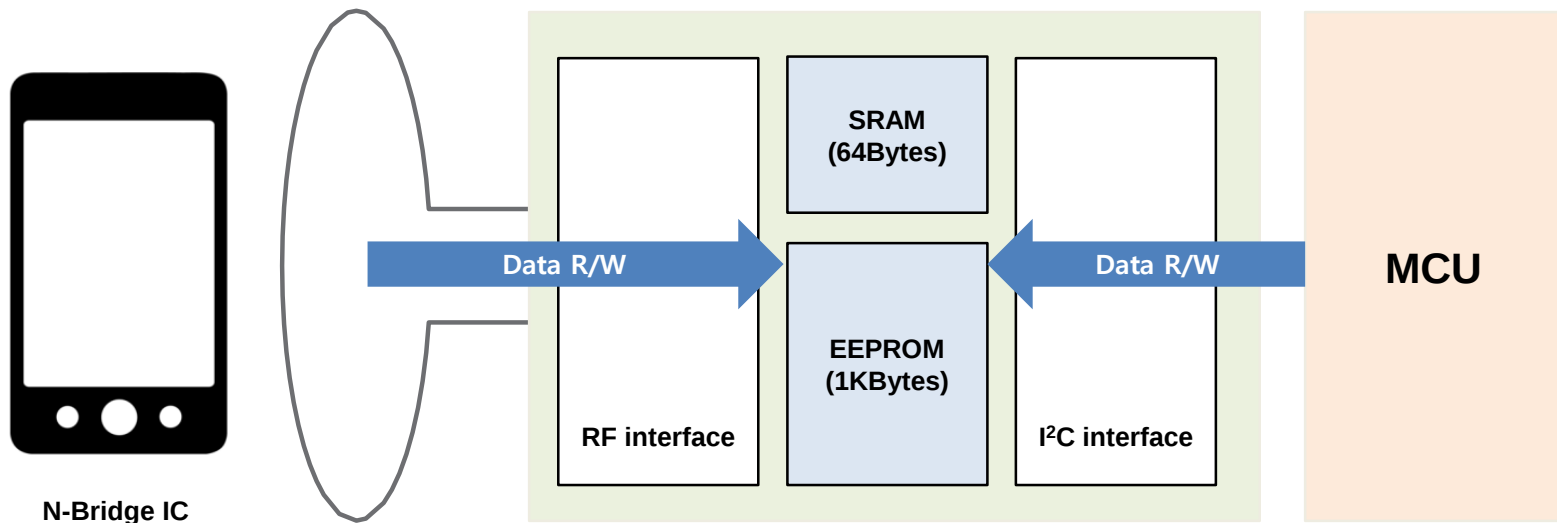
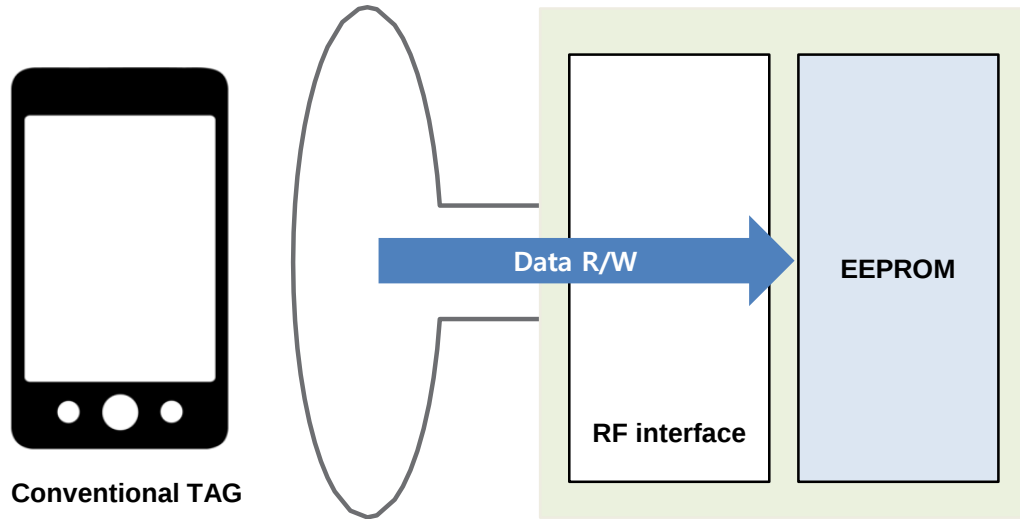
Integrated Capacitor Typ. : 50pF

@13.56MHz

L = 2.34 ~ 2.75μH

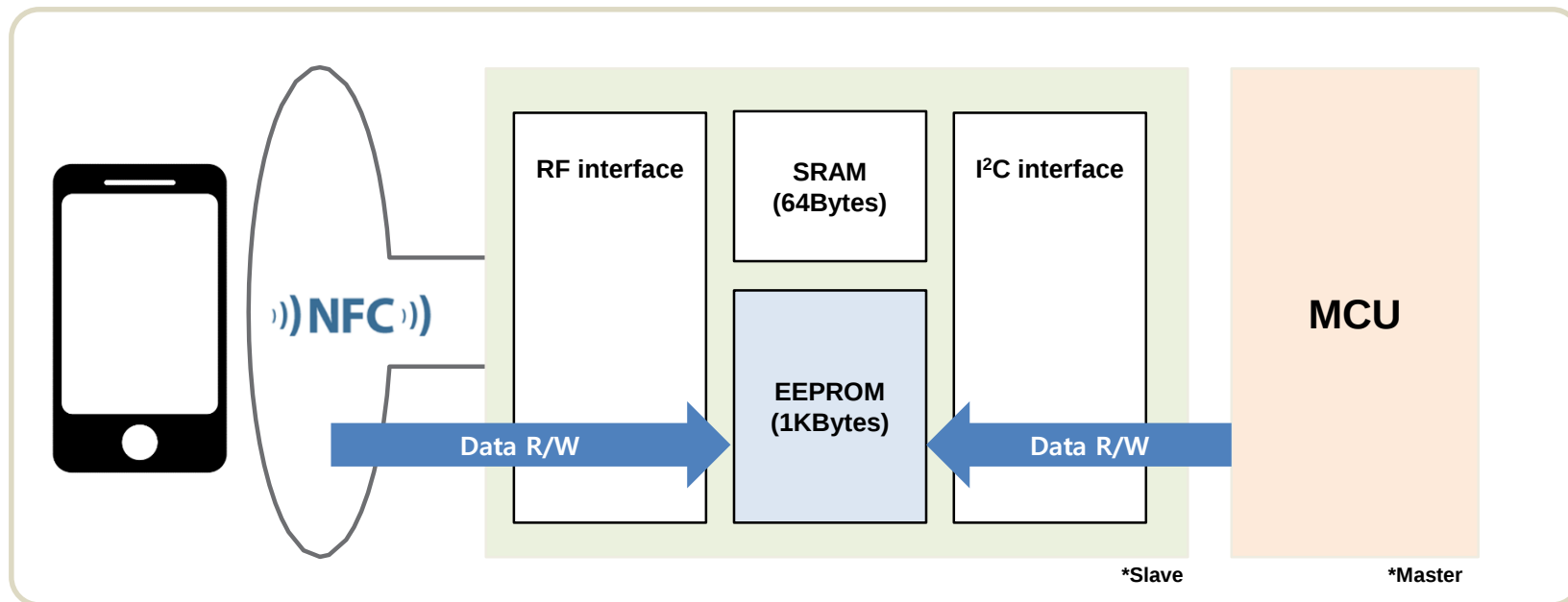
* Recommended Frequency : 13.6 ~ 13.8MHz

■ Communication - Conventional TAG VS N-Bridge



■ Communication Mode - Using EEPROM (Normal Mode)

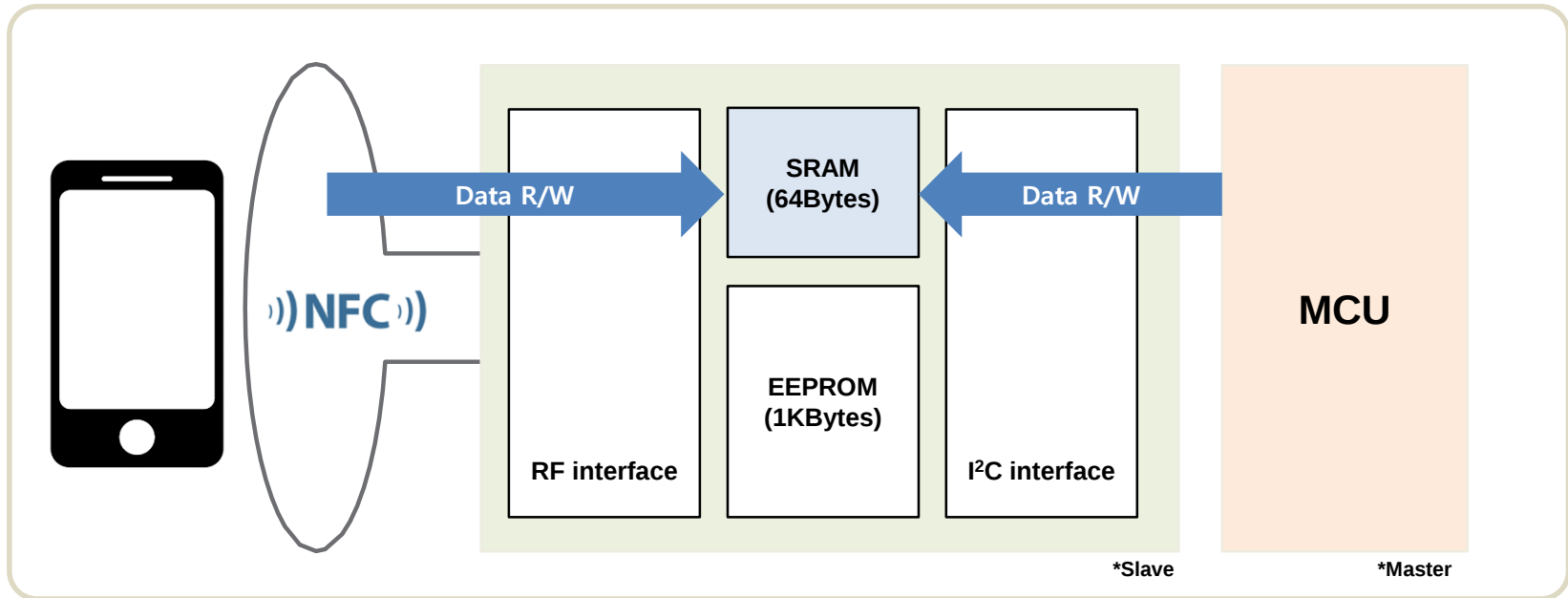
- Coupon data storage , NDEF data update ETC



	POWER		Data transfer	
	VREC	VCC	RF interface	I ² C 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			

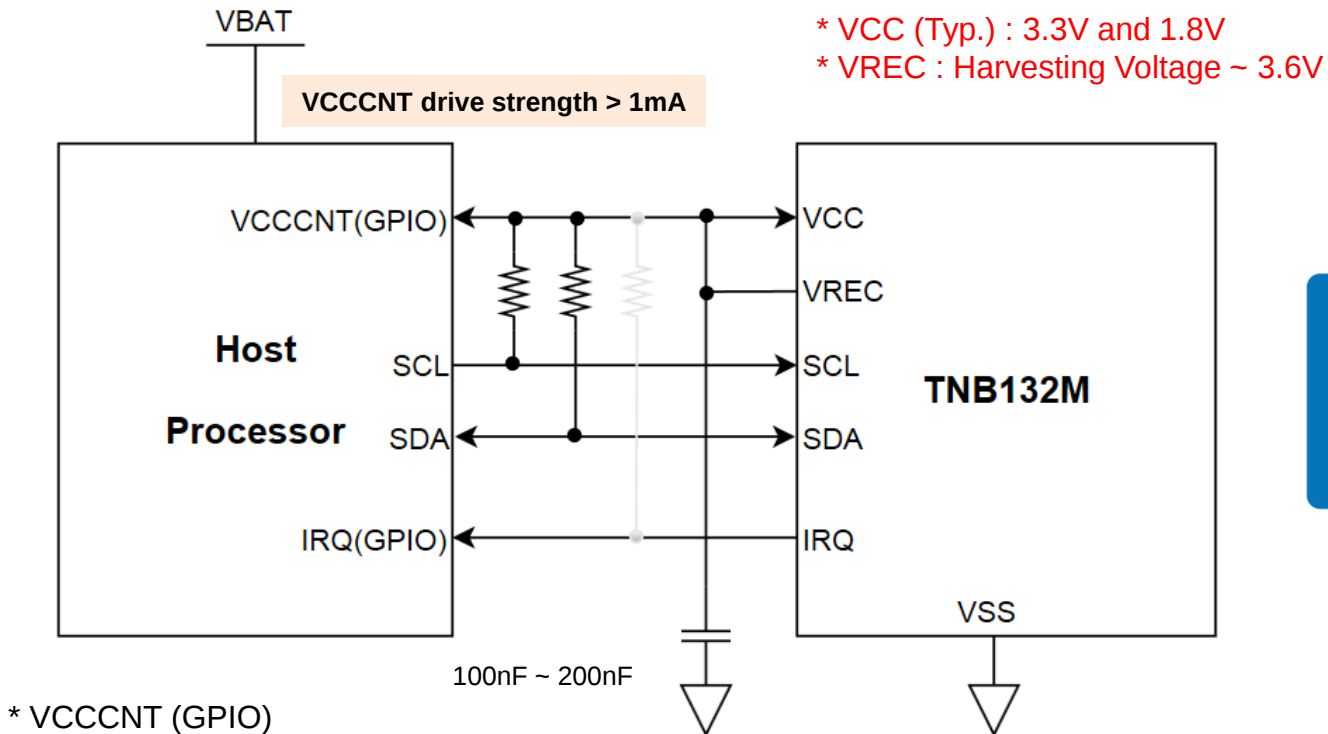
■ Communication Mode - Using SRAM (Fast Bridge mode)

- 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

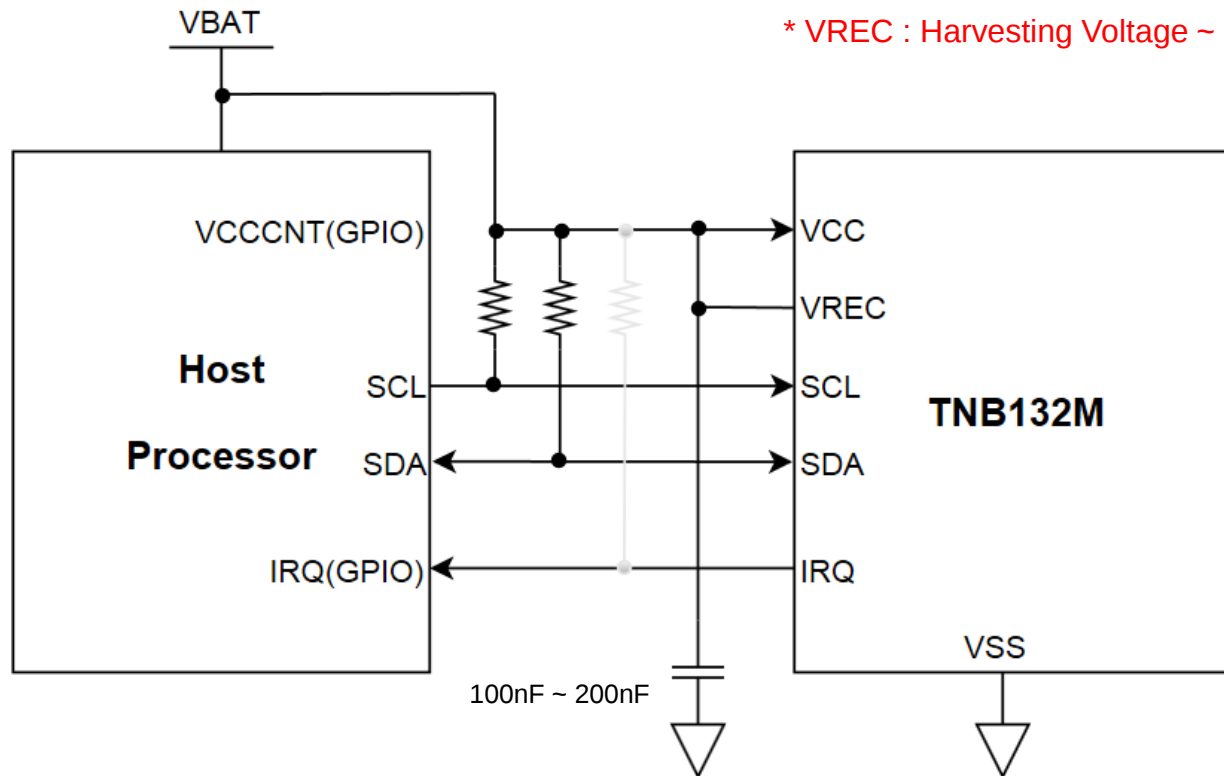


* VCCCNT (GPIO)
- NFC to I²C Communication
: input mode(High-Z) / RF detection
if. Using pull down Resistor – 47k ~ 100kohm

- 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

3alogics shall not be liable for the incidental or consequential losses of damage to tangible property and injury in connection with the use of this device. Although the examples in this guide have been tested with care, they may contain errors and they are not guaranteed for any particular purpose. 3alogics reserves rights to change any contents to this documents at anytime without any prior notice.

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