Smart NFC Choice for your Life

Bridge N™

TNB133M IC Overview

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

3alogics Inc.

18 – OCT - 2016

info@3alogics.com

■ 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.

- Carrie frequency : 13.56Mz
- 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)

Touch / Tap / Close on

Peer to Peer Communication (Device to Device)
NFCIP-1, NFCIP-2 (ISO/IEC 18092, ISO/IEC 21481)

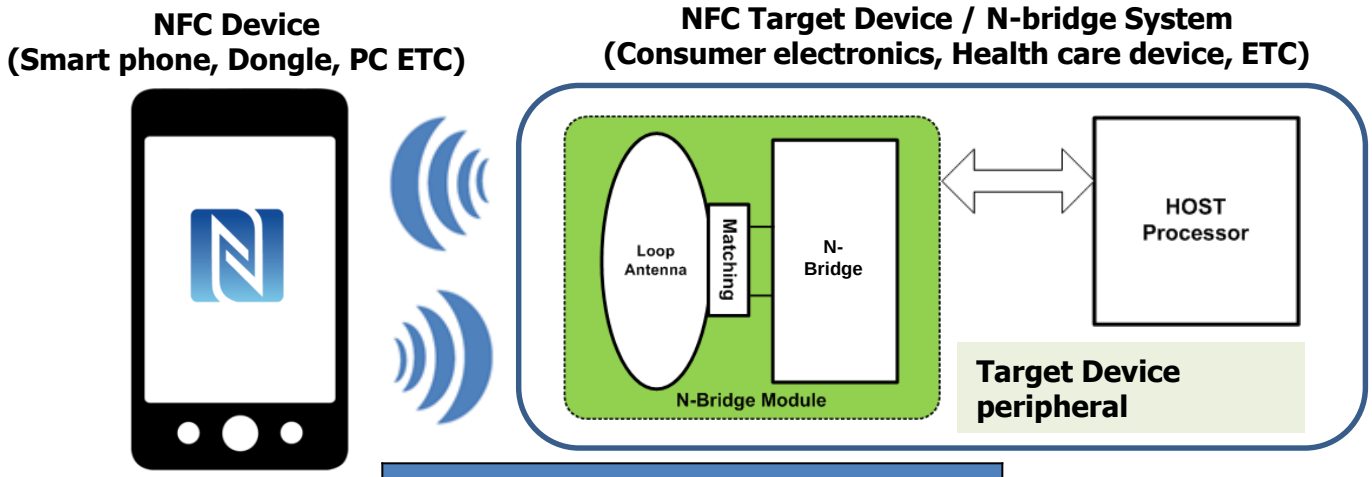
Card Emulation (Secure Element)
EMVCo, ISO/IEC 14443, JIS X 6319-4/Felica

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



Card Emulation
NFC Forum Type3 Tag (Type F)

Peer to Peer / Data exchange
NFCIP-1, ISO/IEC18092 Passive mode 212kbps or 424kpbs

*Host – NFC Device
*Slave – Target Device

■ 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 TNB133M	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 TNB133M	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 TNB133M	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

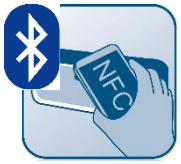
Parametric Table

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 / TNB133M

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



TNB133M

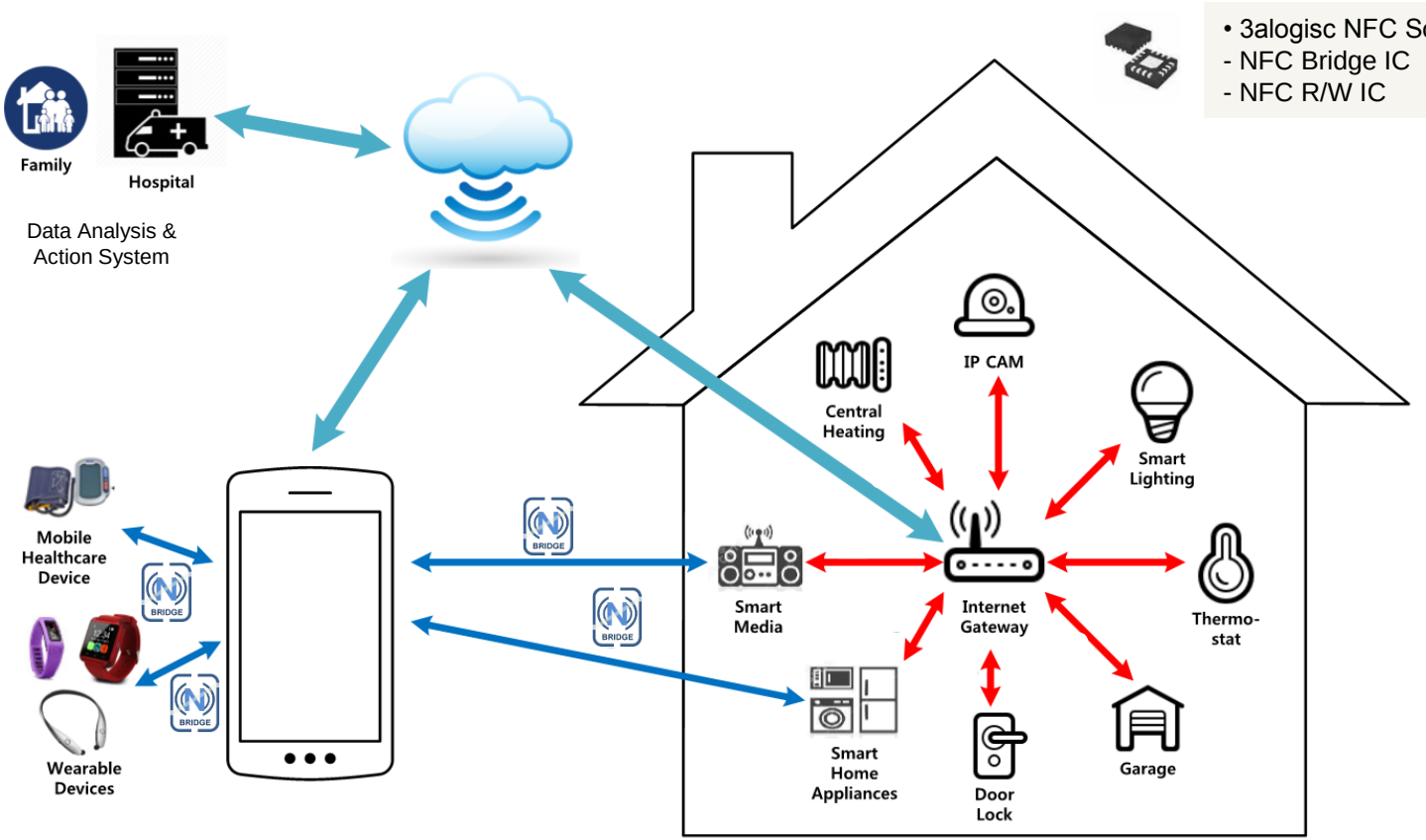
- IoT - NFC Sensor module

TNB134M

- Cold Chain

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

NFC in the IoT



TNB133M Overview

Feature

Basic information
- NFC Forum Type3 NFC Bridge Tag Controller

Basic functions
- Embedded CPU Flip8051-Cyclone
- 4ch 12bit-ADC with sense trigger interface
- On chip 5KB EEPROM Program memory
- On chip 2KB SRAM Data memory
- On chip 1KB EEPROM Data memory
- On chip 1KB SRAM Type3 Tag Memory
- 3-Channel Dynamic Memory Access(DMA)
  [Data EEPROM, Data SRAM, TAG SRAM]
- I2C Master & Serial interface(UART)
- PWM for sensing trigger
- Energy Harvesting about 10mW
  (depending on external RF power and Antenna condition)
- Internal 1.8V LDO
- Analog RF field detection
- Integrated RF tuning capacitor
- Integrated Sensor Interface
  (Resistance Control & Current Control Sensor Driver)

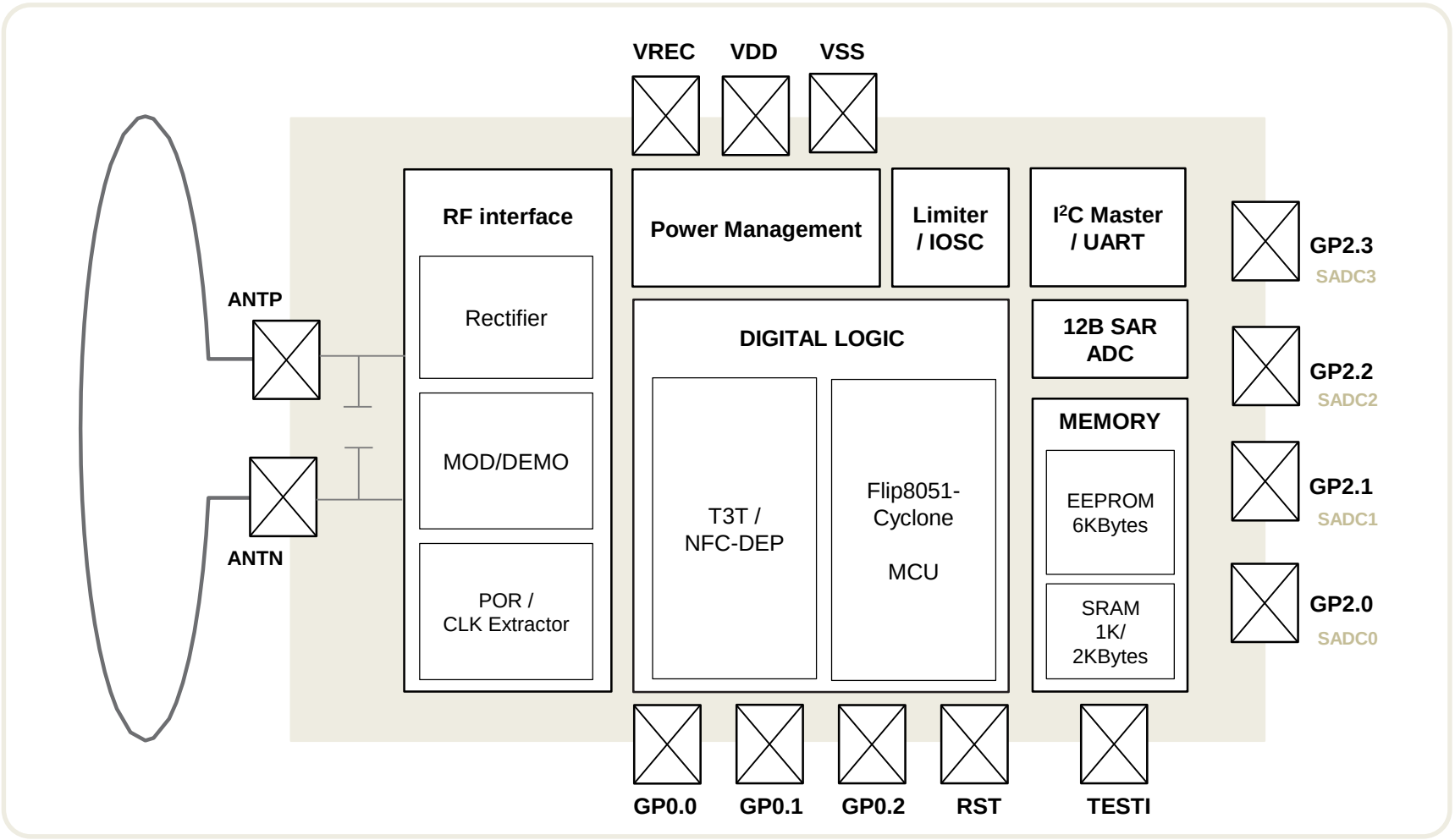
Power consumption minimization
- Optimized Logic and internal gated low frequency clock
- Minimized leakage and stand-by current

Key Application

- Smart home appliances
- NFC Application (NFC Forum SIGs)
  - Health-care
  - Consumer electronics
  - Data logger
  - Sensor application

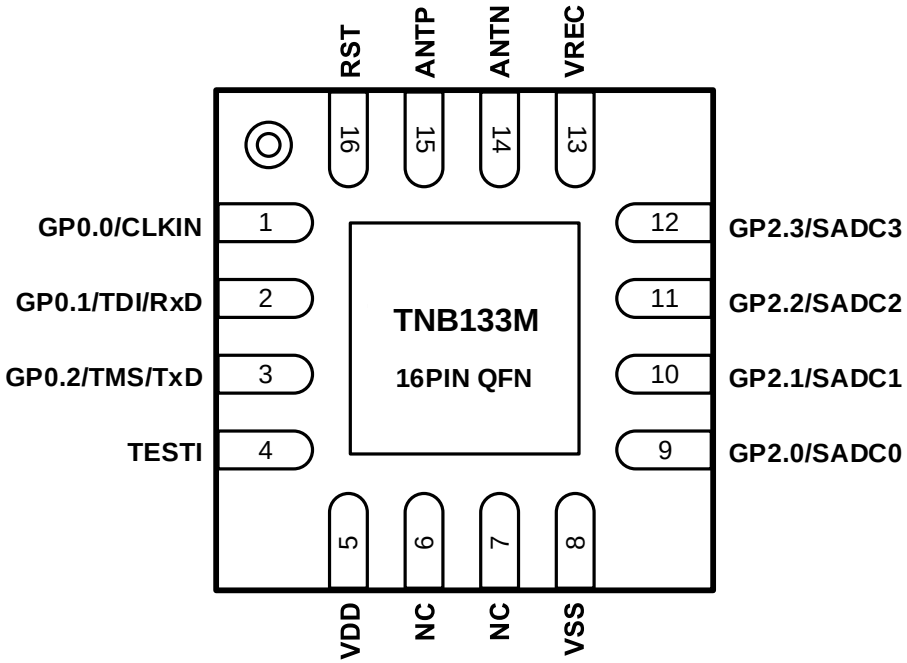
Frequency		13.56MHz
Protocol		ISO/IEC 18092 (JIS 6319-4)
Operating Temperature		-40 ~ 85°C
Power		Harvesting Power 1.8 ~ 3.3V DC
Interface		I2C / UART
NFC mode		Type 3 tag emulation
Modulation		Load modulation
Memory	**Type**	EEPROM / SRAM
	Size	5KB Program, 1KB data / 2KB data, 1KB Tag
Data rate		212 kbps
Special feature		Analog RF field detection Energy Harvesting
Integrated capacitor		RF tuning capacitor
Packaging		QFN16 (4mm X 4mm) Bumped die – 14pads
Resonance Capacitance		46pF

TNB133M Block Diagram



TNB133M PIN Information

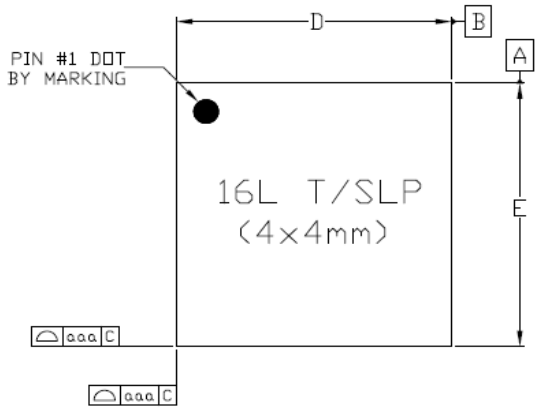
TNB133M uses 16pin QFN package. (4mm X 4mm)



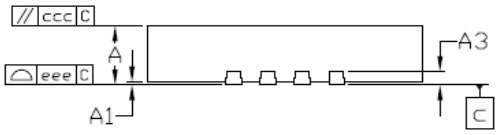
[Transparent top view]

#	Name	Dir.	Description
1	GP0.0/CLKIN	IO	GPIO0.0/TEST MCU Clock in
2	GP0.1/TDI/RxD	IO	GPIO0.1/TEST Data in /UARTRX *Pull-up
3	GP0.2/TMS/TxD	IO	GPIO0.2/TEST Mode select /UARTTX *Pull-up
4	TESTI	I	IC TEST Mode select (Active high)
5	VDD	PWR	1.8V regulator output / Logic Power & IO Power
6	NC	.	No Connection
7	NC	.	No Connection
8	VSS	GND	Ground
9	GP2.0/SADC0	IO	GPIO2.0/ADC input0, with sensing resistor1/I2C SCL/TNBTest Clk In(0.5 ~ 5.0K)
10	GP2.1/SADC1	IO	GPIO2.1/ADC input1, with sensing resistor1/I2C SDA/TNBTest Data In (0.5 ~ 5.0K)
11	GP2.2/SADC2	IO	GPIO2.2/ADC input2, with sensing resistor2//TNBTest out2 (10 ~ 200K)
12	GP2.3/SADC3	IO	GPIO2.3/ADC input3, with sensing resistor2/UARTTX/TNBTest out1 (10~ 200K)
13	VREC	PWR	Rectifier output / Harvesting Power
14	ANTN	I	Antenna negative input
15	ANTP	I	Antenna positive input
16	RST	I	IC RESET

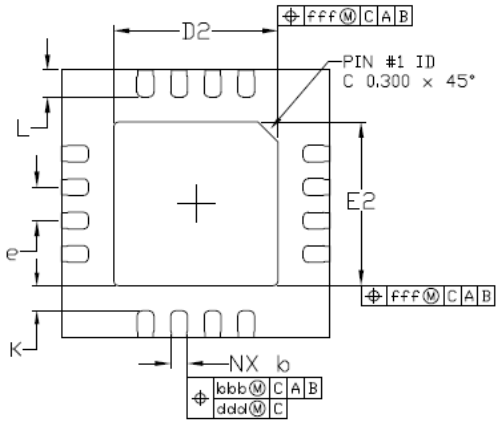
TNB133M Package Outline Dimension



TOP VIEW



SIDE VIEW



BOTTOM VIEW

Note :
1. All dimensions are In millimeters.
2. Dimensioning and Tolerancing per JEDEC m□-220

Dimensional Ref.			
REF.	min.	nom.	max.
A	0.700	0.750	0.800
A1	0.000	--	0.050
A3		0.0203 Ref.	
D	3.950	4.000	4.050
E	3.950	4.000	4.050
D2	2.400	2.450	2.500
E2	2.400	0.250	0.300
b	0.200	0.250	0.300
L	0.350	0.400	0.450
e		0.500 BSC	
K		0.200 MIN	

Dimensional Tol.	
aaa	0.10
bbb	0.10
ccc	0.10
ddd	0.05
eee	0.08
fff	0.10

TNB133M Electrical Characteristics

Operating condition range

Symbol	Parameter	MIN	TYP	MAX	UNIT
T_{op}	Operating temperature range	-40	+25	+85	℃
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, VCC=3.0V	Active mode, T=25°C (LDO+IO+RF+VDD Power)	-	1.9	-	mA

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	41.4	46	50.6	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

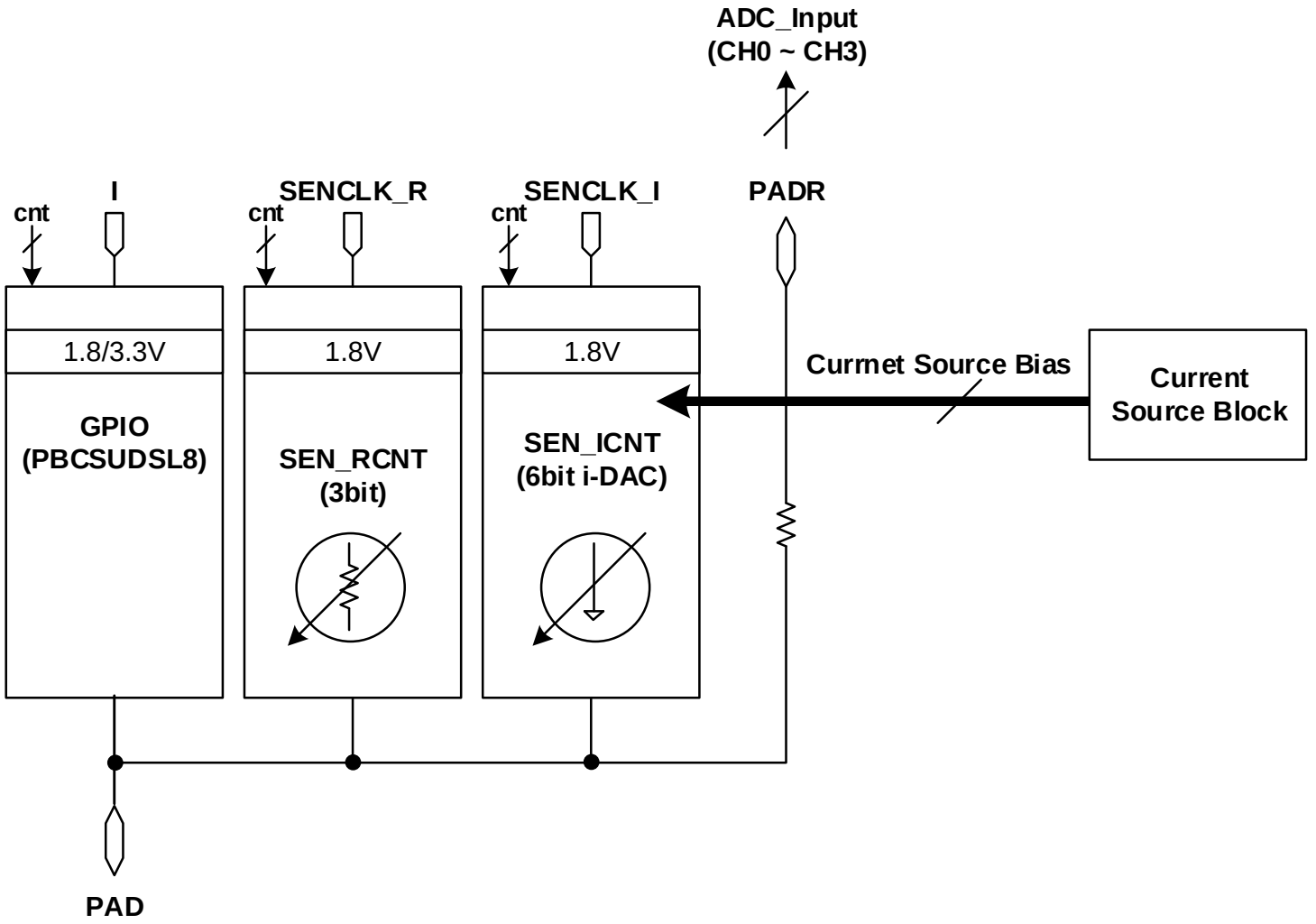
Integrated Capacitor – Resonance Capacitance

Product	Resonant frequency (MHz)	C_{IC} (pF)	C_{ext} (pF)	C_{con} (pF)	C_{ant} (pF)	C_{total} (pF)	Antenna Coil inductance (μH)
TNB133M	13.3	46	0	1	1	48	**2.98**
		46	0	1	3	50	2.86
		46	0	1	5	52	2.75
	13.56	46	0	1	1	48	2.87
		46	**0**	**1**	**3**	50	**2.76**
		46	0	1	5	52	2.65
	13.9	46	0	1	1	48	2.73
		46	0	1	3	50	2.62
		46	0	1	5	52	**2.52**

Integrated Capacitor Typ. : 46pF
@13.56MHz
L = 2.52 ~ 2.98μH

* Recommended Frequency : 13.6 ~ 13.8MHz

TNB133M Sensing IO Architecture



■ Sensing IO MODE

Mode	GPIO	SEN_RCNT	SEN_ICNT	Description
GPIO Mode	O	X	X	- Normal GPIO - Sensor Interface (output mode) SENCLK output
RCNT Mode	X	O	X	- Sensor Interface SENCLK output ** NDEn = High ** Output : push pull
ICNT Mode	X	X	O	- Sensor Interface SENCLK output
ICNT Mode With Parallel R	X	X	O	- Sensor Interface SENCLK output ** SENI_PREN = High ** Parallel resistor enable (80k)

X : high impedance

GPIO X – input mode, RED/REU(Low)
RCNT X – ND_EN(low), SENCLK_R(Low), RCNT_EN(Low)
ICNT X – ICnt<3:0>(low), SENCLK_C(Low), ICNT_EN(Low)

GPIO – Resistor Control (GP2.0 ~ 2.3)

Name	Address		Value							
SENSRSEL1 (R/W)	0xC6	Bit	7-bit	6-bit	5-bit	4-bit	3-bit	2-bit	1-bit	0-bit
		Symbol	PREnCh1	LRSelCh1			PREnCh0	LRSelCh0		
		Access	RFU	r/w	r/w	r/w	RFU	r/w	r/w	r/w
		Reset	0	0	0	0	0	0	0	0

Number	Name	Description
7	PREnCh1	**P2.1 Parallel resistor enable (80k)**
6:4	LRSelCh1	**P2.1 Sensing low resistor select** 000 – 0.5k, 001 – 1.0k, 010 – 1.5k, 011 – 2.0k, 100 – 2.5k, 101 – 5.0k *Others : Open
3	PREnCh0	**P2.0 Parallel resistor enable (80k)**
2:0	LRSelCh0	**P2.0 Sensing low resistor select** 000 – 0.5k, 001 – 1.0k, 010 – 1.5k, 011 – 2.0k, 100 – 2.5k, 101 – 5.0k *Others : Open

Name	Address		Value							
SENSRSEL2 (R/W)	0xC7	Bit	7-bit	6-bit	5-bit	4-bit	3-bit	2-bit	1-bit	0-bit
		Symbol	PREnCh3	LRSelCh3			PREnCh2	LRSelCh2		
		Access	RFU	r/w	r/w	r/w	RFU	r/w	r/w	r/w
		Reset	0	0	0	0	0	0	0	0

Number	Name	Description
7	PREnCh3	**P2.3 Parallel resistor enable (80k)**
6:4	LRSelCh3	**P2.3 Sensing low resistor select** 000 – 10k, 001 – 25k, 010 – 50k, 011 – 80k, 100 – 100k, 101 – 200k *Others : Open
3	PREnCh2	**P2.2 Parallel resistor enable (80k)**
2:0	LRSelCh2	**P2.2 Sensing low resistor select** 000 – 10k, 001 – 25k, 010 – 50k, 011 – 80k, 100 – 100k, 101 – 200k *Others : Open

GPIO – Current Control (GP2.2 ~ 2.3)

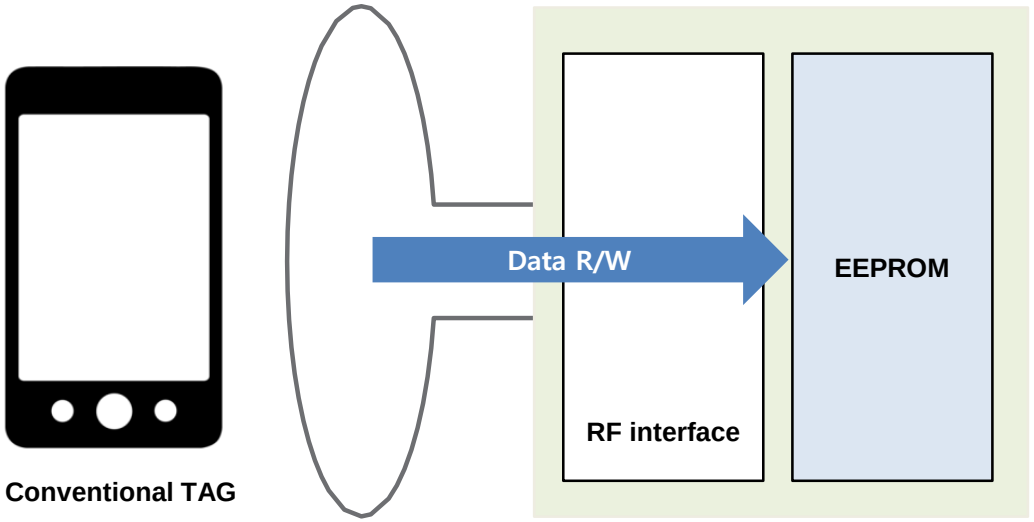
Name	Address		Value							
SENSCSEL3 (R/W)	0xDE	Bit	7-bit	6-bit	5-bit	4-bit	3-bit	2-bit	1-bit	0-bit
		Symbol	RFU		Drv_CCtrl2					
		Access	r/w	r/w	r/w	r/w	RFU	r/w	r/w	r/w
		Reset	0	0	0	0	0	0	0	0

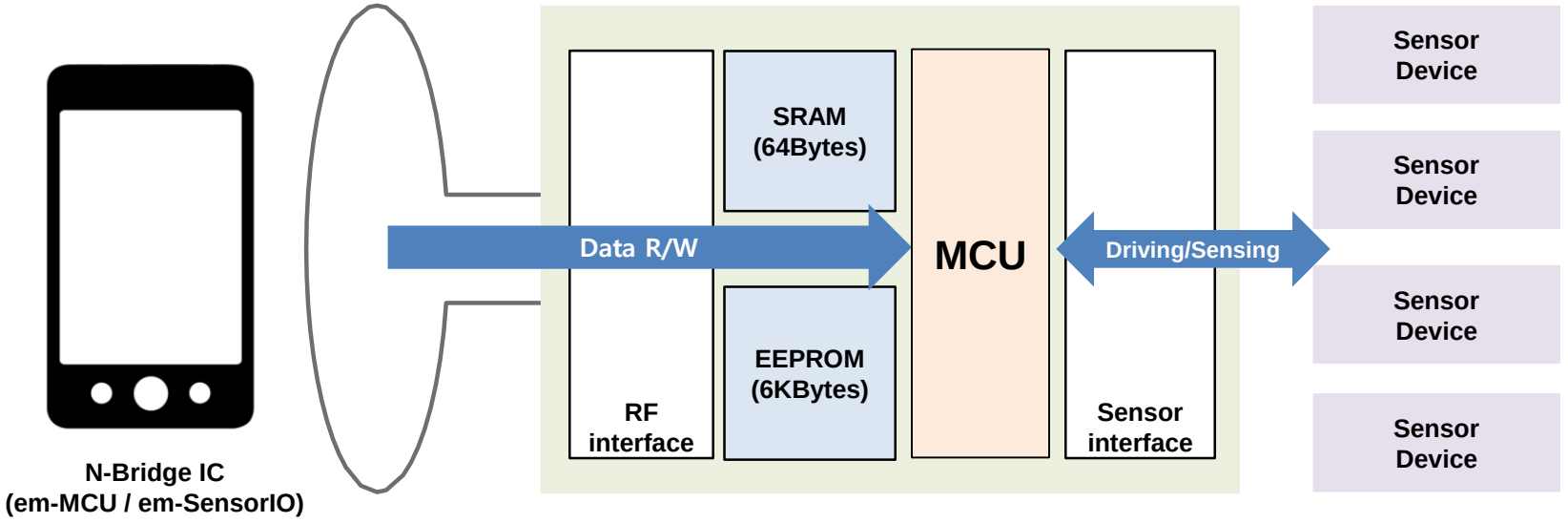
Number	Name	Description
5:0	Drv_CCtrl2	**P2.2 Drive Current Control** SENSISCON의 ILSBSel 01, 000000b(2uA) ~ 111111b(126uA) SENSISCON의 ILSBSel 10, 000000b(4uA) ~ 111111b(252uA) SENSISCON의 ILSBSel 11, 000000b(6uA) ~ 111111b(378uA)

Name	Address		Value							
SENSCSEL4 (R/W)	0xDF	Bit	7-bit	6-bit	5-bit	4-bit	3-bit	2-bit	1-bit	0-bit
		Symbol	RFU		Drv_CCtrl3					
		Access	r/w	r/w	r/w	r/w	RFU	r/w	r/w	r/w
		Reset	0	0	0	0	0	0	0	0

Number	Name	Description
5:0	Drv_CCtrl3	**P2.3 Drive Current Control** SENSISCON의 ILSBSel 01, 000000b(2uA) ~ 111111b(126uA) SENSISCON의 ILSBSel 10, 000000b(4uA) ~ 111111b(252uA) SENSISCON의 ILSBSel 11, 000000b(6uA) ~ 111111b(378uA)

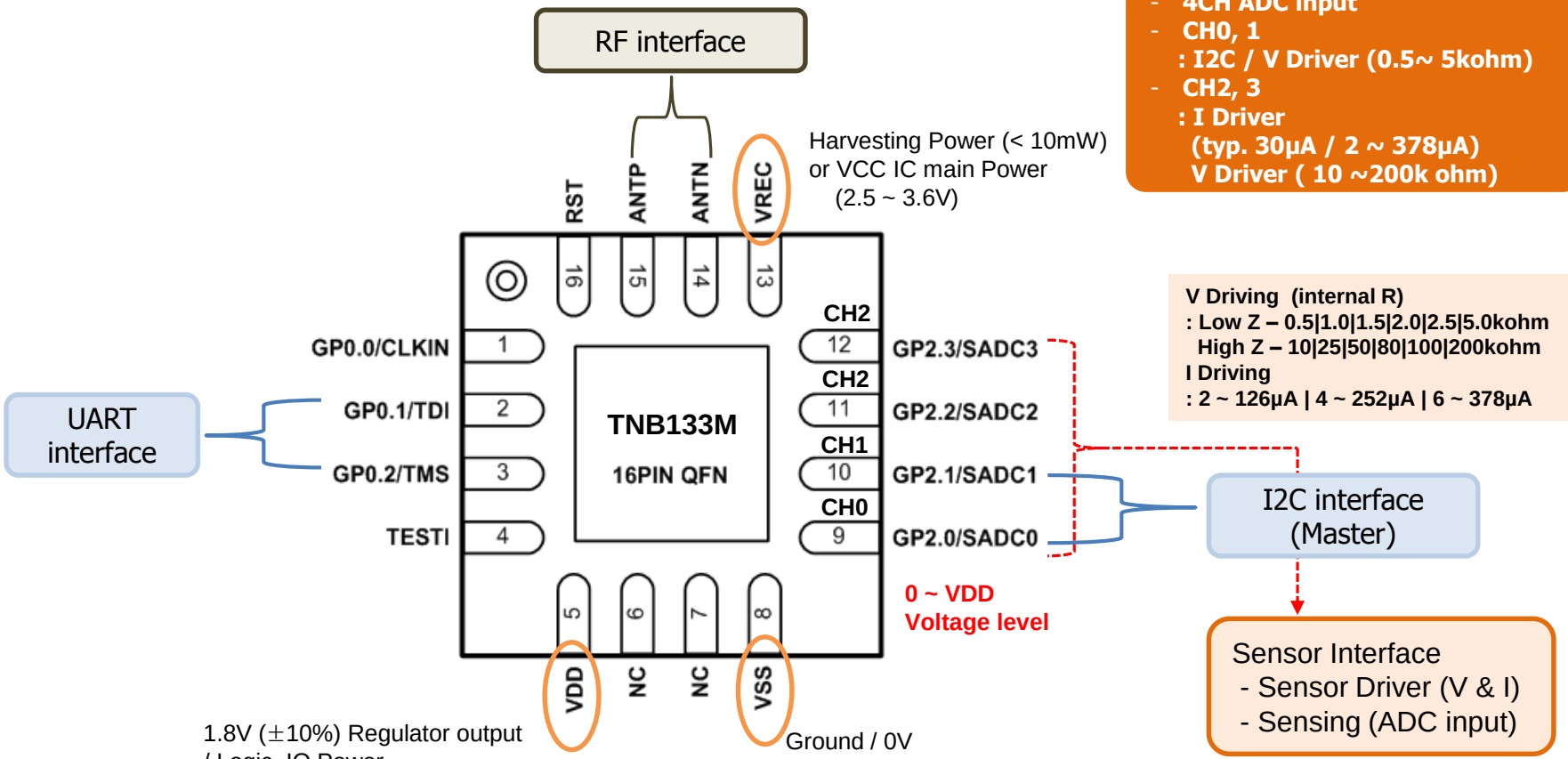
Communication - Conventional TAG VS N-Bridge (TNB133M)





TNB133M Support Interface

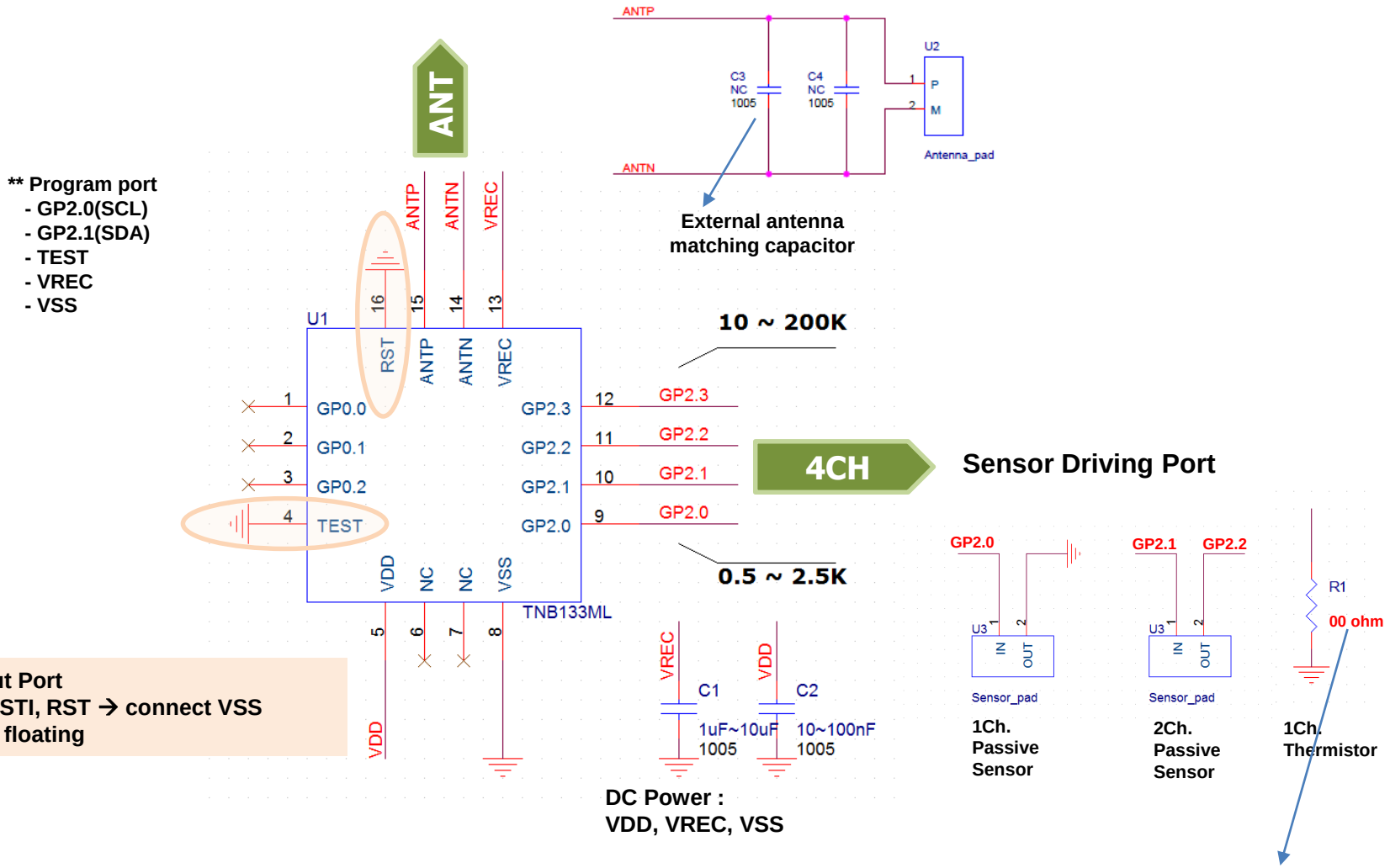
■ Supported Interfaces



* Power – VREC, VDD, VSS

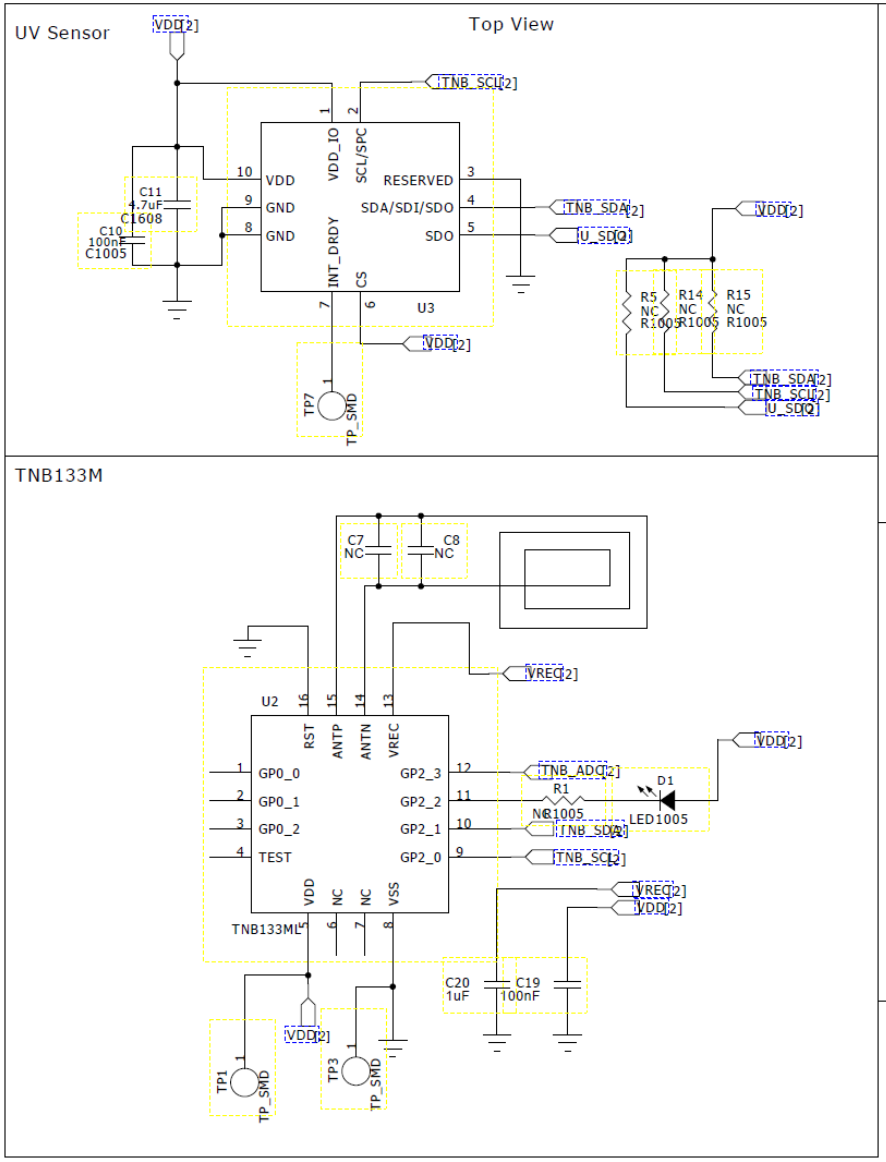
* NFC/RF and UART interface – Sensing data transmission

■ TNB133M Reference guide – schematic (TNB133M Single Module / Battery-less)



TNB133M REF Schematic(2/2)

TNB133M EVKIT – NBK-300IS Schematic



Thank You !

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Contact

3alogics Inc.
7th Floor, Hyundai-office Bldg.,3, Hwangsaeul-ro 240beon-gil,
Bundang-gu, Seongnam-si, Gyeonggi-do, Korea 13595
TEL : (82)-(31)-715-7117
FAX : (82)-(31)-719-7551
E-mail : info@3alogics.com
Homepage: http://www.3alogics.com

Printed in the Republic of Korea.

IT's NFC

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