Shanghai Fudan Microelectronics Group Company Limited

复旦微电子

FM11NT082C

NFC Dual Interface Tag & Channel IC

Datasheet

Oct. 2021

INFORMATION IN THIS DOCUMENT IS INTENDED AS A REFERENCE TO ASSIST OUR CUSTOMERS IN THE SELECTION OF SHANGHAI FUDAN MICROELECTRONICS GROUP CO., LTD PRODUCT BEST SUITED TO THE CUSTOMER'S APPLICATION; THEY DO NOT CONVEY ANY LICENSE UNDER ANY INTELLECTUAL PROPERTY RIGHTS, OR ANY OTHER RIGHTS, BELONGING TO SHANGHAI FUDAN MICROELECTRONICS GROUP CO., LTD OR A THIRD PARTY.
WHEN USING THE INFORMATION CONTAINED IN THIS DOCUMENTS, PLEASE BE SURE TO EVALUATE ALL INFORMATION AS A TOTAL SYSTEM BEFORE MAKING A FINAL DECISION ON THE APPLICABILITY OF THE INFORMATION AND PRODUCTS.
PURCHASERS ARE SOLELY RESPONSIBLE FOR THE CHOICE, SELECTION AND USE OF THE SHANGHAI FUDAN MICROELECTRONICS GROUP CO., LTD PRODUCTS AND SERVICES DESCRIBED HEREIN, AND SHANGHAI FUDAN MICROELECTRONICS GROUP CO., LTD ASSUMES NO LIABILITY WHATSOEVER RELATING TO THE CHOICE, SELECTION OR USE OF THE SHANGHAI FUDAN MICROELECTRONICS GROUP CO., LTD PRODUCTS AND SERVICES DESCRIBED HEREIN. UNLESS EXPRESSLY APPROVED IN WRITING BY AN AUTHORIZED SHANGHAI FUDAN MICROELECTRONICS GROUP CO., LTD REPRESENTATIVE, SHANGHAI FUDAN MICROELECTRONICS GROUP CO., LTD PRODUCTS ARE NOT RECOMMENDED, AUTHORIZED OR WARRANTED FOR USE IN MILITARY, AIR CRAFT, SPACE, LIFE SAVING, OR LIFE SUSTAINING APPLICATIONS, NOR IN PRODUCTS OR SYSTEMS WHERE FAILURE OR MALFUNCTION MAY RESULT IN PERSONAL INJURY, DEATH, OR SEVERE PROPERTY OR ENVIRONMENTAL DAMAGE.
FUTURE ROUTINE REVISIONS WILL OCCUR WHEN APPROPRIATE, WITHOUT NOTICE. CONTACT SHANGHAI FUDAN MICROELECTRONICS GROUP CO., LTD SALES OFFICE TO OBTAIN THE LATEST SPECIFICATIONS AND BEFORE PLACING YOUR PRODUCT ORDER. PLEASE ALSO PAY ATTENTION TO INFORMATION PUBLISHED BY SHANGHAI FUDAN MICROELECTRONICS GROUP CO., LTD BY VARIOUS MEANS, INCLUDING SHANGHAI FUDAN MICROELECTRONICS GROUP CO., LTD HOME PAGE (HTTP://WWW.FMSH.COM/).
PLEASE CONTACT SHANGHAI FUDAN MICROELECTRONICS GROUP CO., LTD LOCAL SALES OFFICE FOR THE SPECIFICATION REGARDING THE INFORMATION IN THIS DOCUMENT OR SHANGHAI FUDAN MICROELECTRONICS GROUP CO., LTD PRODUCTS.

Trademarks

Shanghai Fudan Microelectronics Group Co., Ltd name and logo, the “复旦” logo are trademarks or registered trademarks of Shanghai Fudan Microelectronics Group Co., Ltd or its subsidiaries in China.
Shanghai Fudan Microelectronics Group Co., Ltd, Printed in the China, All Rights Reserved.

Contents

CONTENTS 3
1 DESCRIPTION 4
2 PRODUCT OVERVIEW 5
2.1 INTRODUCTION 5
2.2 FEATURES 5
2.2.1 Contactless Interface 5
2.2.2 Contact Interface 6
2.2.3 Dual Interface 6
2.2.4 EEPROM 6
2.2.5 Security Features 6
2.3 BLOCK DIAGRAM 7
2.4 PIN INFORMATION 7
2.4.1 TDFN10 7
2.4.2 SOP8 8
3 CHARACTERISTICS 9
3.1 LIMITING VALUES 9
3.2 RECOMMENDED OPERATING CONDITIONS 9
3.3 ELECTRIC CHARACTERISTICS 9
3.3.1 Pin electric characteristics 9
3.3.2 Chip electric characteristics 10
3.3.3 I2C AC characteristics 10
3.4 MEMORY CHARACTERISTICS 11
4 PACKAGE OUTLINE 12
4.1 TDFN10 12
4.2 SOP8 13
5 ORDERING INFORMATION 14
REVISION HISTORY 16
SALES AND SERVICE 17

1 Description

FM11NT082C is a NFC Dual interface tag and channel IC developed by Fudan Microelectronics Company in accordance with ISO/IEC14443-A protocol. Please contact Fudan Microelectronics Company to provide more documents to support the detailed design and development.

2 Product Overview

2.1 Introduction

The FM11NT082C（Short for NT082C） is the second generation ISO/IEC14443-A compliant NFC dual interfaces tag and channel IC designed by Shanghai Fudan Microelectronics.The chip integrates the channel function of the first generation chip FM11NC08 and the dual-interface tag function of FM11NT081D. Users can switch between them by changing the configuration bit. The main difference between them is the functionality of the contactless interface and it is the same for the contact interface. In dual-interface mode, users can temporarily switch to channel mode by changing the registers which can be used in real-time data transmission. When the transmission completed, the chip will be turned back to dual-interface mode after power on again. This function can be used for fireware updating and other special applications with off-chip MCU. For convenience, in the following chapter, NT082C in dual interface mode will be shorted to NT, and NT082C in channel mode will be shorted to NC in the following chapter.

In NC mode, embedded FIFO can be used to provide a contactless channel for the off-chip MCU which has only contact interface, so that the MCU can transmit real-time data with the contactless reader or the NFC mobile phone. With this channel, MCU can emulate itself as an NFC FORUM T2T tag or T4T tag or other custom format NFC tag.

In NT mode, embedded EEPROM can be used for non-real-time data interaction between off-chip MCU and NFC smart phone or reader. For example, configuration information data of the electronic deivce is written into the EEPROM by NFC mobile phone, and then read when the off-chip MCU is ready. Or the LOG files of the MCU are written into the EEPROM periodically, and the NFC smart phone can read the LOG files without the device being powered on.

NT082C's contactless interface has authentication function between reader and tag for security verification. The reader's authentication to the tag can be used for the anti-counterfeiting and original verification of electronic products, as well as regional sales management. The tag's authentication to the reader can be used to enable special functions or the access control of the storage space.

NT082C solves the problem of the poor performance when reading multiple tags of ISO14443 protocol innovatively. With the help of high-power reader and anti-collision algorithm, NT082C can complete writing and reading of more than 100 tags simultaneously. Thanks to the advantages of higher data transmission rate of ISO14443 protocol, NT082C can be used for large volume data transmission such as configuration of MCU's parameters of multiple devices.

NT082C supports energy harvesting function of the contactless field.

2.2 Features

2.2.1 Contactless Interface

- ISO/IEC14443-A compatible
- Field frequence: 13.56MHz
- Two channel mode: ISO14443-3 mode、ISO14443-4 mode
- Data rates: 106Kbps
- 16bit CRC for data integrity
- 7 bytes UID, anti-collision cascade level 2
- Fast anti-collision

- Fast data initialization
- Energy harvesting function

2.2.2 Contact Interface

- Zero standby power consumption
- Operating voltage for contact interface: 2.2V~3.6V
- Contact interface: I2C
- Data rate for I2C: up to 1Mbps

2.2.3 Dual Interface

- Shared 32 bytes FIFO for dual interfaces
- Dual interface arbitration:
  - first come first served
  - contact interface first
  - contactless interface first
  - no priority
- Switching between NT mode and NC mode temporarily by writing register
- Switching between NT mode and NC mode fixedly by writing EEPROM configuration word

2.2.4 EEPROM

- 8K bits EEPROM totally
- 888 bytes available for user application
- Endurance: 1,000,000 cycles
- Data retention: 20 years

2.2.5 Security Features

- Manufacturer programmed 7 bytes UID
- CC area is OTP which only support one time written and the data can not be reversed
- Read-only lock function of the storage area
- Security certification based on algorithm
- Active silence function of the NFC interface
- Secure user data area's access authority can be controlled by the algorithm and it's size can be adjusted after authenticated by the algorithm

2.3 Block diagram

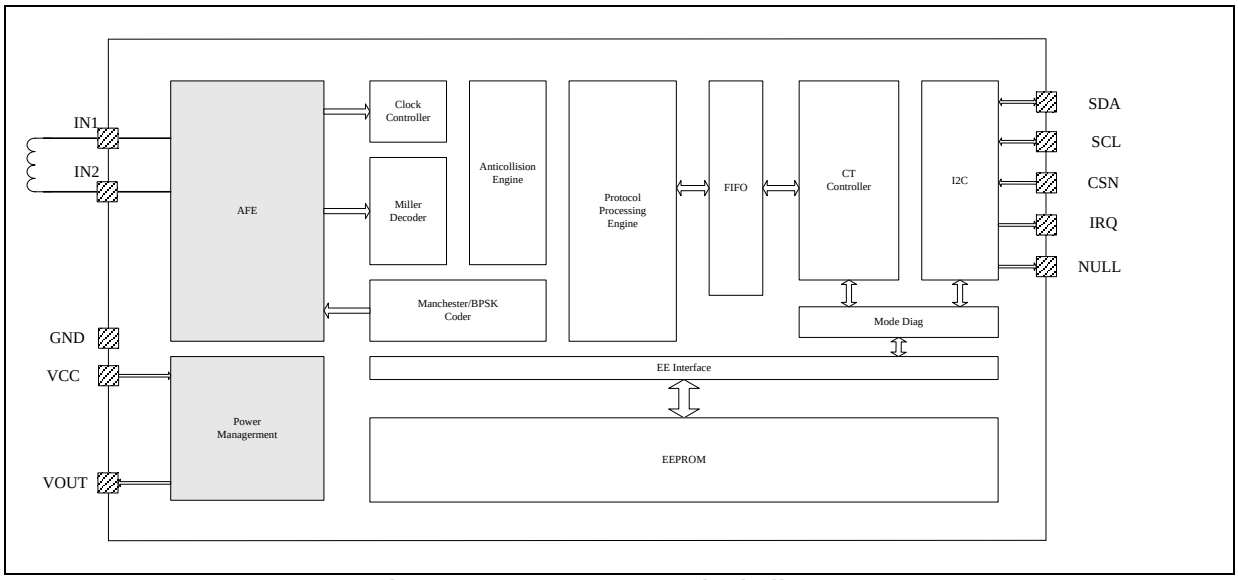


Figure 2-1 FM11NT082C Block diagram

2.4 Pin information

2.4.1 TDFN10

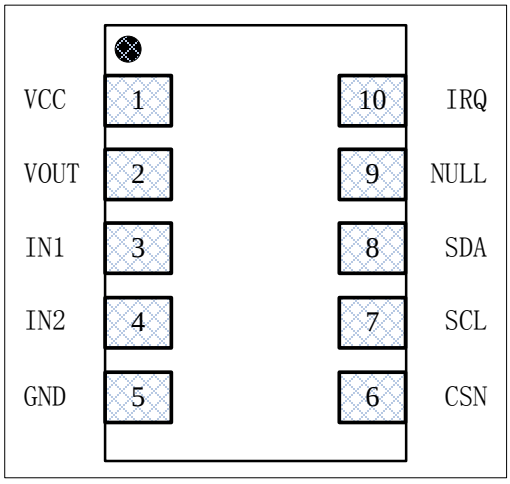


Figure 2-2 TDFN10 Pin assignment(Top view)

Table 2-1 TDFN10 Pin description

Pin No.	Pin Name	Description
1	VCC	Power supply of the contact interface
2	VOUT	Regulated voltage output for energy harvesting
3	IN1	RF antenna connection pin
4	IN2	RF antenna connection pin

5	GND	Ground
6	CSN	I2C chip-selection, low-effective
7	SCL	I2C clock input
8	SDA	I2C data
9	NULL	-
10	IRQ	Interrupt output, low-effective

2.4.2 SOP8

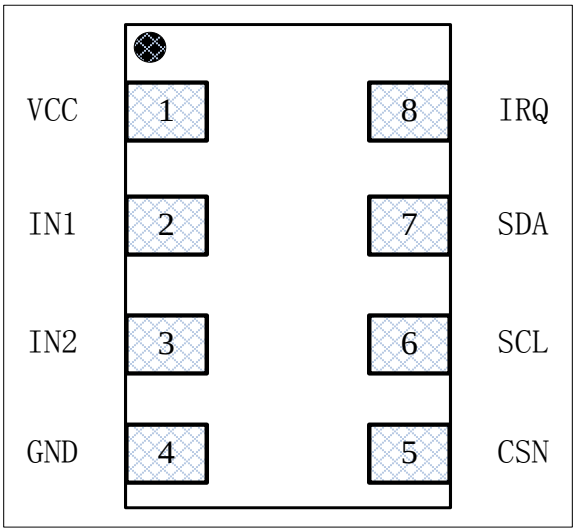


Figure 2-3 SOP8 Pinning assignment(Top view)

Table 2-2 SOP8 Pin description

Pin No.	Pin Name	Description
1	VCC	Power supply of the contact interface
2	IN1	RF antenna connection pin
3	IN2	RF antenna connection pin
4	GND	Ground
5	CSN	I2C chip-selection, low-effective
6	SCL	I2C clock input
7	SDA	I2C data
8	IRQ	Interrupt output, low-effective

3 Characteristics

3.1 Limiting Values

Table 3-1 limiting parameters【1】

Parameter	min	max	unit
Storage temperature	-55	+125	°C
max input current（IN1 to IN2; peak）	-	±30	mA
ESD（HBM）	-	±2000	V
ESD（CDM）	-	±1000	V

**Note:* chip will be permanently damaged if applied condition exceeds the limiting values.
**Note: MIL 883 E HBM。*

3.2 Recommended operating conditions

Table 3-2 recommended operating conditions

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
T_A	operating temperature		-40	+25	+85	°C
H_A	antenna RF field strength		1.5		7.5	A/M
VCC	VCC supply voltage	RF field present	1.65	3.3	3.6	V
		No RF field	2.2	3.3	3.6	V

3.3 Electric Characteristics

3.3.1 Pin electric characteristics

Table 3-3 Pin electric characteristics

Symbol	Parameter	Conditions	min	typ	max	unit
f_i	RF input frequency	【1】	13.553	13.56	13.567	MHz
C_i	input resonant capacitor	between in IN1 and IN2		50		pF
Digital input pins						
V_{IL}	input low voltage		0		0.3Vcc	V
V_{IH}	input high voltage		0.7Vcc		Vcc	V
I_{leak}	input leakage current				1	uA
Digital output pin						
VOH	output high voltage	Vcc=3.3V，I_O=4mA	0.7 Vcc		Vcc	V
VOL	output low voltage	Vcc=3.3V，I_O=4mA	0		0.3 Vcc	

open-drain output pins						
VOL	output low voltage	Vcc=3.3V，I_O=4mA	0		0.3 Vcc	

Note【1】: Bandwidth according to ISM specification

3.3.2 Chip electric characteristics

Table 3-4 chip electric characteristics

Symbol	Parameter	Conditions	min	typ	max	unit
I_{SB1}	contact interface standby current	25°，VCC=3.3V，SSN/CSN high			100	nA
I_{SB2}	contact interface static current	25°，VCC=3.3V，SSN/CSN low，no data communication		35		uA
I_{EE_WR}	contact interface writing EEPROM	25°，VCC=3.3V，I2C SCL 400KHz		150		uA
V_{out}	VOUT output voltage	-40~85°	1.5【1】	3.3	3.6	V
I_{out}	VOUT maximum output current	-40~85°		10【2】		mA

Note【1】: The voltage on VOUT pin is affected by the relative position of the tag and reader antenna greatly.

Note【2】: The maximum output current of VOUT pin is related to the field intensity emitted by the reader, the antenna size of the tag, and the relative position of the tag and reader antenna. For NFC mobile phones, the maximum current rectified from the field is generally around 10mA.

3.3.3 I2C AC characteristics

Working condition: $T_{BA\,B}$= -40°C ~ +85°C，V_{BCCB} = +2.2V ~ +3.6V，CL = 100 pF（Unless otherwise stated）. See "Note 2" for test conditions.

Table 3-5 I2C AC characteristics

Symbol	Parameter	Standard(400kHz)			Fast(1MHz)			Unit
		Min	Typ	Max	Min	Typ	Max	
t_{BLOWB}	clock pulse low voltage time	1.3			0.5			us
t_{BHIGHB}	clock pulse high voltage time	0.6			0.32			us
$t_{BI\,B\ \ 1}$	noise rejection time			80			80	ns
t_{BAAB}	SCL low to SDA valid	0.1		0.9			0.45	us
$t_{BBUF\,B\,1}$	bus idle time between 2	1.3			0.5			us

	commands							
$t_{BHD.STAB}$	START condition hold time	0.6			0.25			us
$t_{BSU.STAB}$	START condition setup time	0.6			0.25			us
$t_{HD.DATB}$	data hold time	0			0			ns
$t_{BSU.DATB}$	data setup time	100			50			ns
t_{BRB}	input rise time			300			120	ns
t_{BFB}	input fall time			300			120	ns
$t_{BSU.STOB}$	STOP condition setup time	0.6			0.25			us
t_{BDHB}	data output hold time	100			100			ns
t_{BWRB}	EEPROM write time			10			10	ms

Note:

【1】 These parameters are determined by the feature test and has not been 100% tested.

【2】 Test conditions of AC parameters:

RL (to VCC): 1.3 kΩ

Input pulse's voltage: 0.3 VCC ~ 0.7 VCC

Input rise/fall time: ≤ 50 ns

Input/output reference voltage: 0.5 VCC

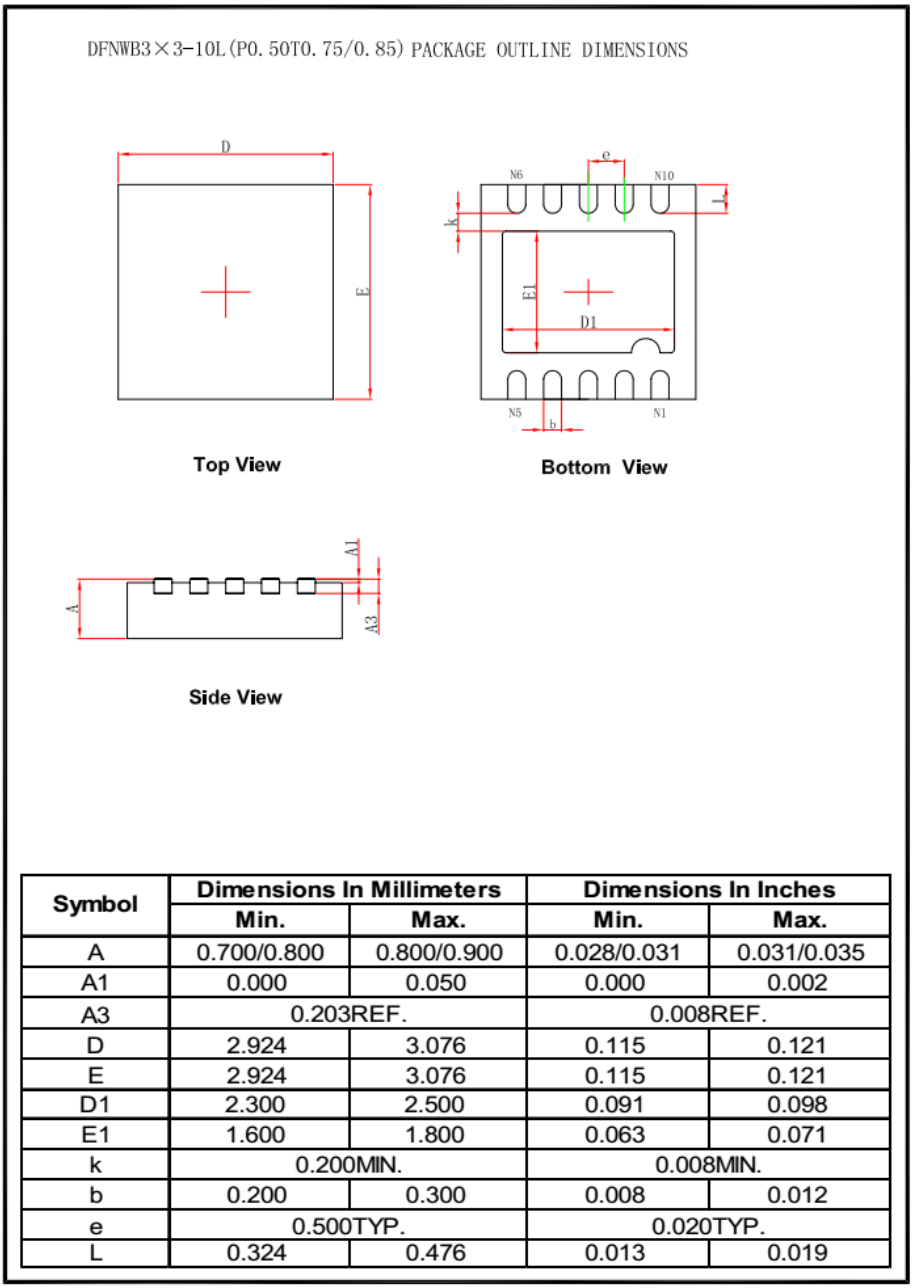
3.4 Memory characteristics

Table 3-6 Memory characteristics

Symbol	Parameter	Conditions	min	typ	max	unit
t_{ret}	data retention	55°	20			yrs
$N_{endu(W)}$	endurance	25°	1,000,000			cycle

4 Package outline

4.1 TDFN10

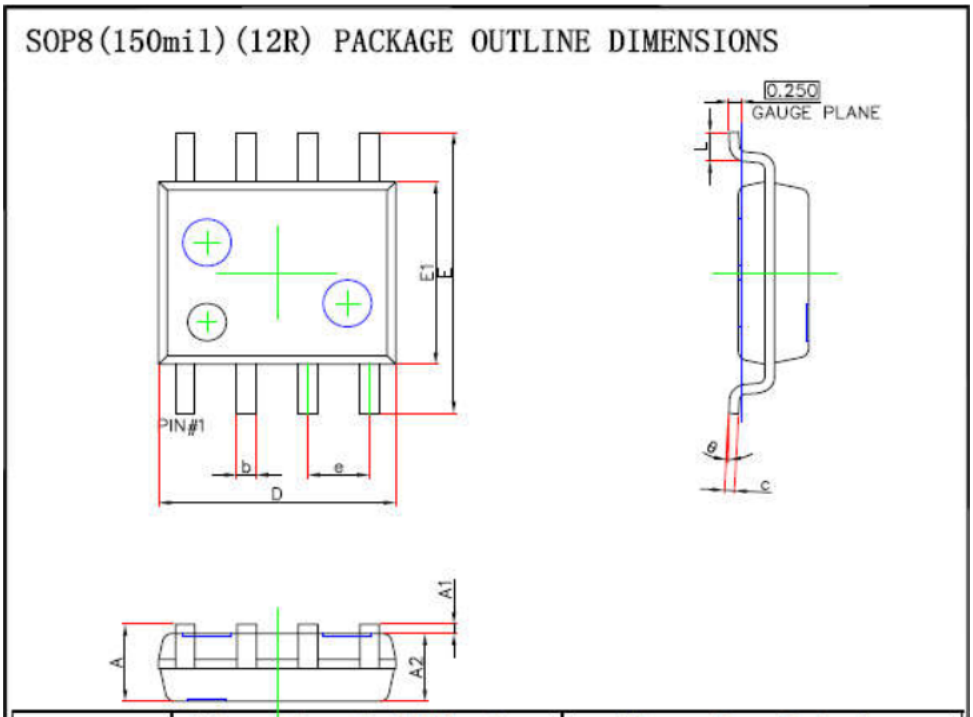


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	0.700/0.800	0.800/0.900	0.028/0.031	0.031/0.035
A1	0.000	0.050	0.000	0.002
A3	0.203REF.		0.008REF.	
D	2.924	3.076	0.115	0.121
E	2.924	3.076	0.115	0.121
D1	2.300	2.500	0.091	0.098
E1	1.600	1.800	0.063	0.071
k	0.200MIN.		0.008MIN.	
b	0.200	0.300	0.008	0.012
e	0.500TYP.		0.020TYP.	
L	0.324	0.476	0.013	0.019

Figure 4-1 TDFN10 Outline

Note：the thickness of this product is 0.75mm.

4.2 SOP8



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	1.450	1.750	0.057	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.007	0.010
D	4.700	5.100	0.185	0.201
E	5.800	6.200	0.228	0.244
E1	3.800	4.000	0.150	0.157
e	1.270(BSC)		0.050(BSC)	
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°

Figure 4-2 SOP8 Outline

5 Ordering information

Device number	Package	Packing
FM11NT082C-NTCI-DNC-T-G	TDFN10	Tape and Reel
FM11NT082C-NTCI-SO-T-G	SOP8	Tape and Reel

FM 11NT 08 2 X - XXX -XXX -T -G

Company name prefix

FM= Shanghai Fudan Microelectronics

Product family

11NT= Dual interface tag compliant to ISO/IEC14443

Product Memory

08= 8k bits EEPROM

Product version

2= Second generation chip

Interface type

C=Dual interface and channel chip

Subtypes

NTCI= Dual interface tag with I2C(support switch to NFC channel temporarily)

Package

DNC=TDFN10， SO=SOP8

Wrap

T= Tape and Reel

U= Tube

HSF code

G=ROHS Compliant, Halogen-free, Antimony-free

Revision history

Rev	Release date	Pages	Modifications
1.0	2021.10	18	Initial release

Sales and Service

Shanghai Fudan Microelectronics Group Co., Ltd.
Address: Bldg No. 4, 127 Guotai Rd, Shanghai City China.
Postcode: 200433
Tel: (86-021) 6565 5050 Fax: (86-021) 6565 9115

Shanghai Fudan Microelectronics (HK) Co., Ltd.
Address: Unit 506, 5/F., East Ocean Centre, 98 Granville Road, Tsimshatsui East, Kowloon, Hong Kong
Tel: (852) 2116 3288 2116 3338
Fax: (852) 2116 0882

Beijing Office
Address: Room 423, Bldg B, Gehua Building, 1 QingLong Hutong, Dongzhimen Alley north Street, Dongcheng District, Beijing City, China.
Postcode: 100007
Tel: (86-010) 8418 6608
Fax: (86-010) 8418 6211

Shenzhen Office
Address: Room.2306-2308, Building A7, Chuangzhi Cloud City, Liuxian Avenue, Xili Street, Nanshan District, Shenzhen, China.
Postcode: 518000
Tel: (86-0755) 8335 0911 8335 1011 8335 2011 8335 0611
Fax: (86-0755) 8335 9011

Shanghai Fudan Microelectronics (HK) Ltd Taiwan Representative Office
Address: Unit 1225, 12F., No 252, Sec.1 Neihu Rd., Neihu Dist., Taipei City 114, Taiwan
Tel : (886-2) 7721 1889
Fax: (886-2) 7722 3888

Shanghai Fudan Microelectronics (HK) Ltd Singapore Representative Office
Address : 47 Kallang Pudding Road, #08-06,The Crescent @ Kallang ,Singapore 349318
Tel : (65) 6443 0860
Fax: (65) 6443 1215

Fudan Microelectronics（USA）Inc.
Address : 97 E Brokaw Road, Suite 320,San Jose,CA 95112
Tel : (+1)408-335-6936

Web Site: http://www.fmsh.com/