

# **NSP (Flash) Data Sheet**

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## 1. General Description

NSP series is an advanced 1-ch Voice IC that equips with Nuvoton 8-bit 65C02 core, embedded Flash and new algorithm to implement Voice Prompt applications with high level of sound quality. NSP series provide SOP8 and SOP14 with 2 I/Os protocol to communicate with host MCU.

The NSP family contains following chips built-in different size of embedded Flash, shown as below:

Part No.	Package	Duration (S)		V <sub>DD</sub> (V)	LVR (V)	Audio	LVR	WDT
		8KHz	12KHz			PWM		
NSP080A	SOP8	94	63	2.0~5.5	1.9	13-bit	Yes	Yes
NSP081A	SOP8	94	63	2.0~5.5	1.9	13-bit	Yes	Yes
NSP170A	SOP8	155	103	2.0~5.5	1.9	13-bit	Yes	Yes
NSP171A	SOP8	155	103	2.0~5.5	1.9	13-bit	Yes	Yes
NSP340A	SOP8	337	225	2.0~5.5	1.9	13-bit	Yes	Yes
NSP341A	SOP8	337	225	2.0~5.5	1.9	13-bit	Yes	Yes
NSP481A	SOP8	458	305	2.0~5.5	1.9	13-bit	Yes	Yes
NSP080B	SOP14	94	63	2.0~5.5	1.9	13-bit	Yes	Yes
NSP170B	SOP14	155	103	2.0~5.5	1.9	13-bit	Yes	Yes
NSP340B	SOP14	337	225	2.0~5.5	1.9	13-bit	Yes	Yes
NSP480B	SOP14	458	305	2.0~5.5	1.9	13-bit	Yes	Yes
NSP650B	SOP14	701	467	2.0~5.5	1.9	13-bit	Yes	Yes
NSP960B	SOP14	944	629	2.0~5.5	1.9	13-bit	Yes	Yes

## 2. Features

- MCU: 8-bit 65C02
- Operating voltage: 2.0~5.5V
- Oscillator: builds in internal Rosc (TRIM)
  - Frequency deviation: +/-1.5%
- RAM: 384B
- NSP080B~960B has 4 bi-directional I/O pins
- Audio output: 13-bit PWM
- Voice channel: 1-ch Voice
- Provide ISP (In System Program) to update content from Host MCU
- Built-in Watch-Dog Timer (WDT)
- Low Voltage Reset (LVR)
- Package form: SOP8, SOP14

## 3. PAD Description

Pin Name	I/O	Function
BP00	I/O	<ul style="list-style-type: none"> <li>● General input/output pins.</li> <li>● Each pin can be set as Input or Output individually</li> <li>● For input pin, it can be set as pull-high</li> <li>● BP00, BP01 share with ICPCLK and ICPDATA</li> <li>● BP02, BP06, BP07 only support on NSP080B/170B/340B</li> <li>● BP13 support on NSP080B/170B/340B/480B/650B/960B</li> <li>● BP12, BP17, BP20 only support on NSP480B/650B/960B</li> </ul>
BP01		
BP02		
BP06		
BP07		
BP12		
BP13		
BP17		
BP20		
VDD	Power	Positive power supply
REG	Power	Internal regulator, 0.1uF capacitor is needed
VSS	Power	Negative power supply for oscillation, uP and peripherals
PWM+	O	PWM driver positive output to drive speaker directly
PWM-	O	PWM driver negative output to drive speaker directly
VDD_SPK	Power	Positive power supply for speaker driver
VSS_SPK	Power	Negative power supply for speaker driver
/RESET	I	IC reset input, low active

Note: Program pad includes BP00 (ICPCLK), BP01(ICPDATA), /RESET, VDD, VSS

## 4. Electrical Characteristics

### 4.1 Absolute Maximum Ratings

Parameter	Symbol	Conditions	Rated Value	Unit
Power Supply	VDD–VSS	-	-0.3 to +7.0	V
Input Voltage	VIN	All Inputs	VSS -0.3 to VDD +0.3	V
Storage Temp.	TSTG	-	-55 to +150	°C
Operating Temp.	TOPR	-	-20 to +85	°C

Note: Exposure to conditions beyond those listed under the Absolute Maximum Ratings table may adversely affect the life and reliability of the device.

## 4.2 D.C. Characteristics

(VDD – VSS = 4.5V, TA = 25° C, No Load unless otherwise specified)

Parameter	Sym	Conditions	Min	Typ	Max	Unit
Operating Voltage	V <sub>DD</sub>		2.0	-	5.5	V
Operating Current	I <sub>OP1</sub>	No load	-	4	6	mA
Standby Current (STOP)	I <sub>DD1</sub>	No load	-	1	2	μA
Input Low Voltage	V <sub>IL</sub>	All input pins	V <sub>SS</sub>	-	0.3 V <sub>DD</sub>	V
Input High Voltage	V <sub>IH</sub>	All input pins	0.7 V <sub>DD</sub>	-	V <sub>DD</sub>	V
Pull High resistor BP0, BP1	RPH	VDD = 4.5V	90K 0.6M	150K 1M	210K 1.4M	Ω
Output Current BP0, BP1	I <sub>OL</sub>	V <sub>DD</sub> = 3V, V <sub>OUT</sub> = 0.4V	8	12	-	mA
	I <sub>OH</sub>	V <sub>DD</sub> = 3V, V <sub>OUT</sub> = 2.6V	-4	-6	-	mA
	I <sub>OL</sub>	V <sub>DD</sub> = 4.5V, V <sub>OUT</sub> = 1.0V	-	25	-	mA
	I <sub>OH</sub>	V <sub>DD</sub> = 4.5V, V <sub>OUT</sub> = 3.5V	-	-12	-	mA
Output Current PWM+ / PWM-	I <sub>OL1</sub>	RL= 8Ω	+250	-	-	mA
	I <sub>OH1</sub>	[PWM+]---[RL]----[PWM-]	-250	-	-	mA

## 4.3 A.C. Characteristics

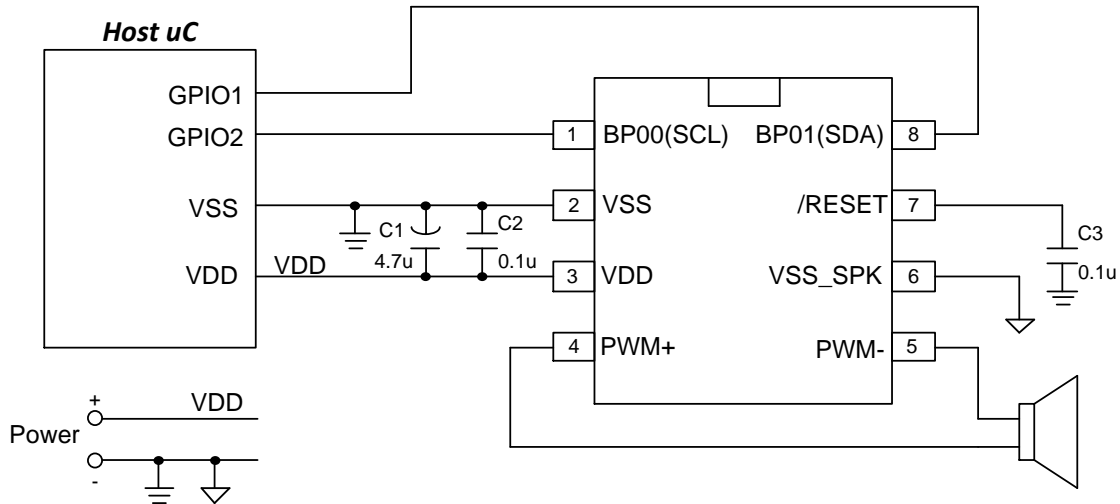
(VDD = 4.5V, TA = 25°C, No Load unless otherwise specified)

Parameter	Sym	Conditions	Min	Typ	Max	Unit
Frequency Deviation by Voltage Drop	ΔF/F	(Fmax – Fmin)/Fmin @VDD: 2.4 ~ 5.5V	-	2	-	%

## 5. Typical Application Circuit

### Voice Prompt Application:

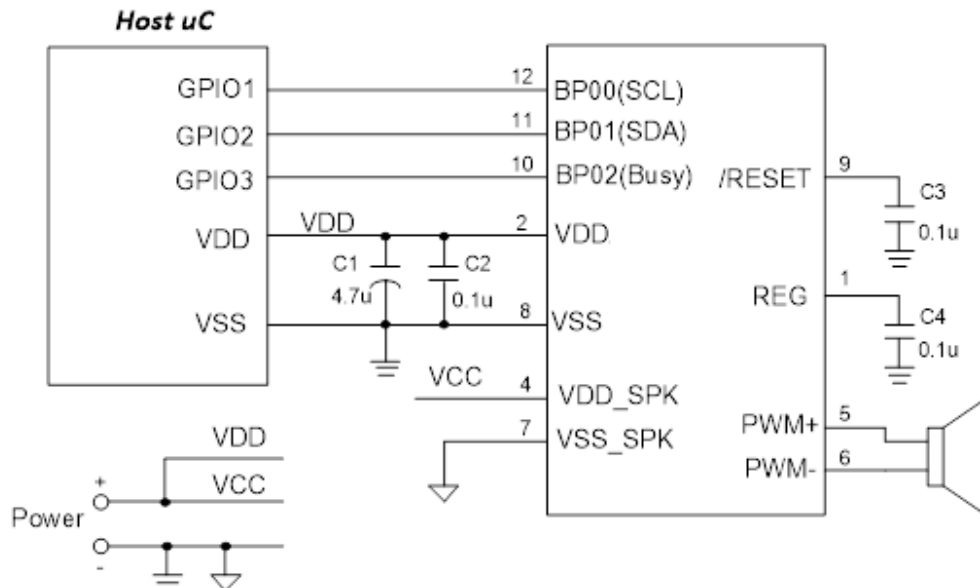
#### (1) NSP080A/081A/170A/171A/340A/341A/481A



Note: C1 and C2 need to be close to the NSP chip layout.

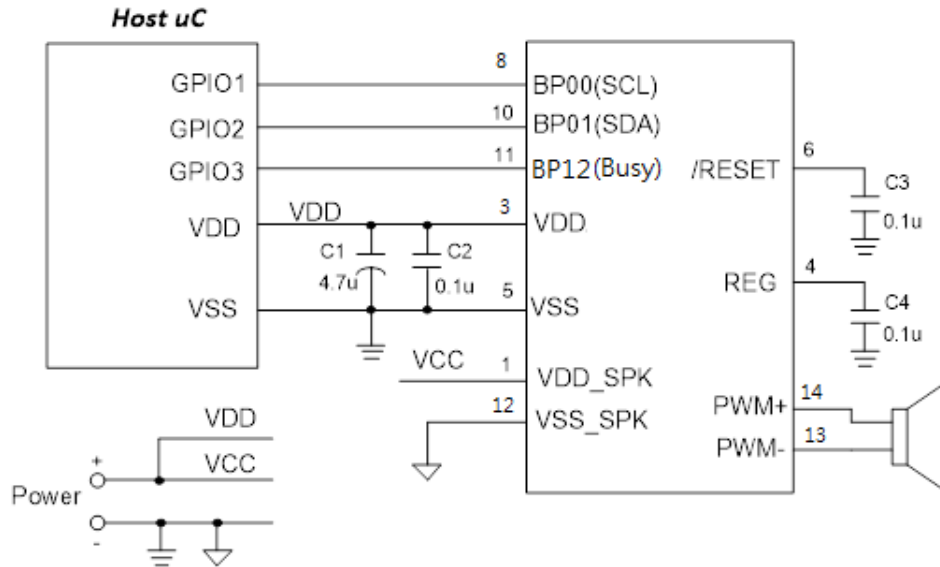
### Voice Prompt Application:

#### (1) NSP080B/170B/340B



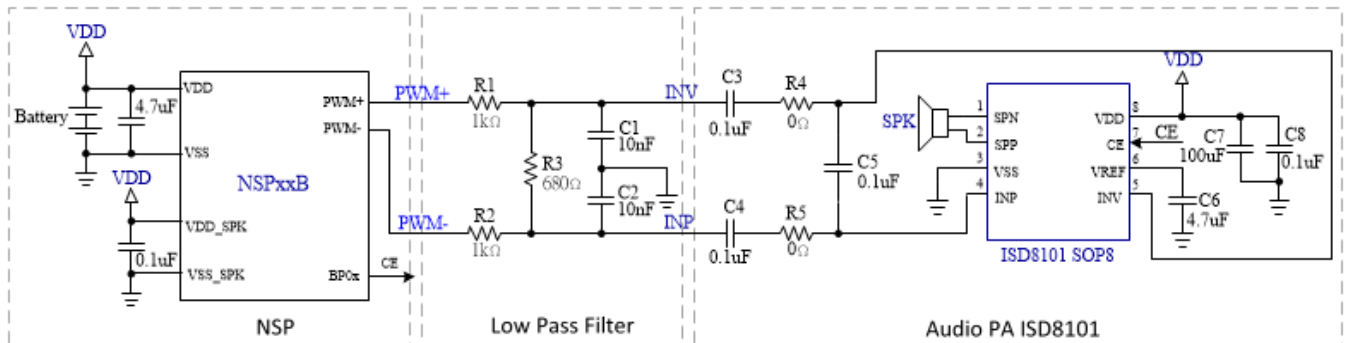
Note: C1 and C2 need to be close to the NSP chip layout.

(2) NSP480B/650B/960B



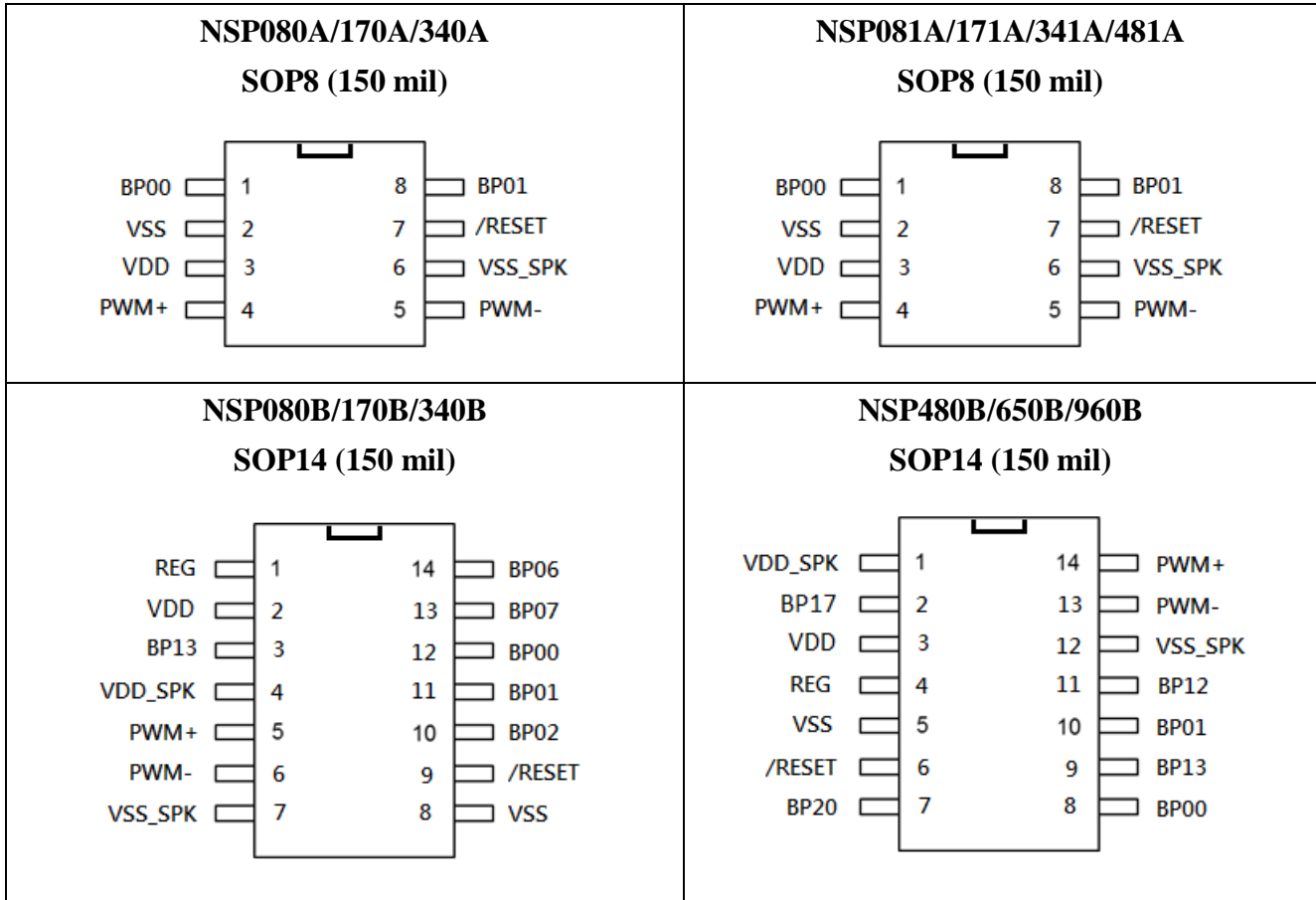
Note: C1 and C2 need to be close to the NSP chip layout.

Voice Prompt Application with ISD8101 PA: NSP080B/170B/340B/480B/650B/960B



**6. Package Information**

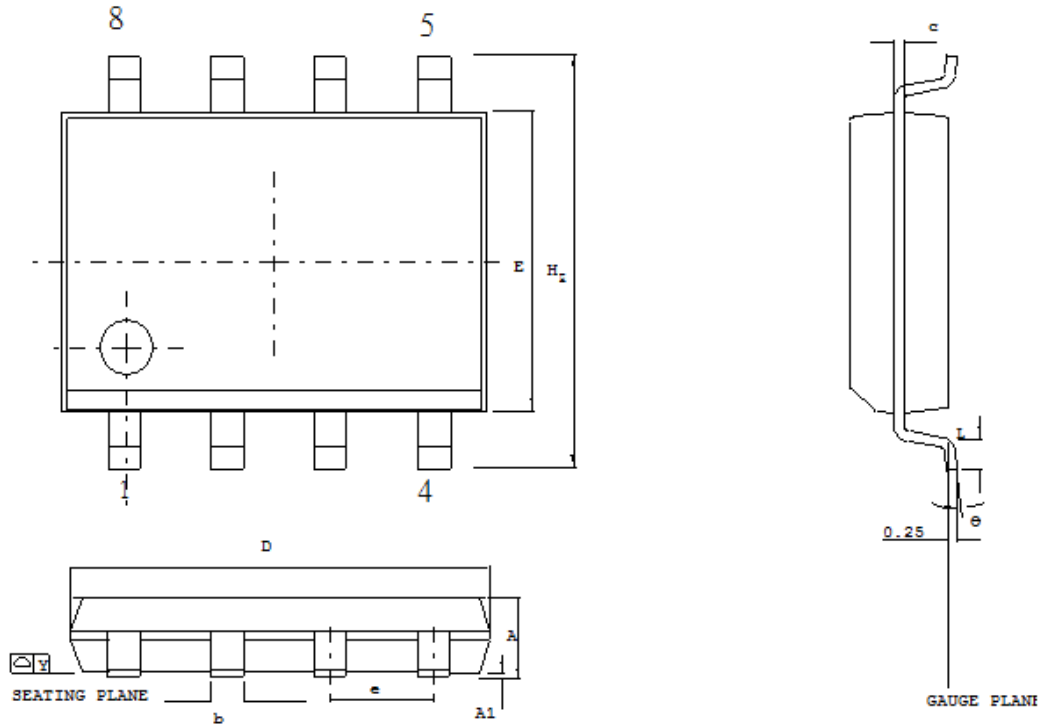
**6.1 Pin Assignment**





6.2 Package Dimension

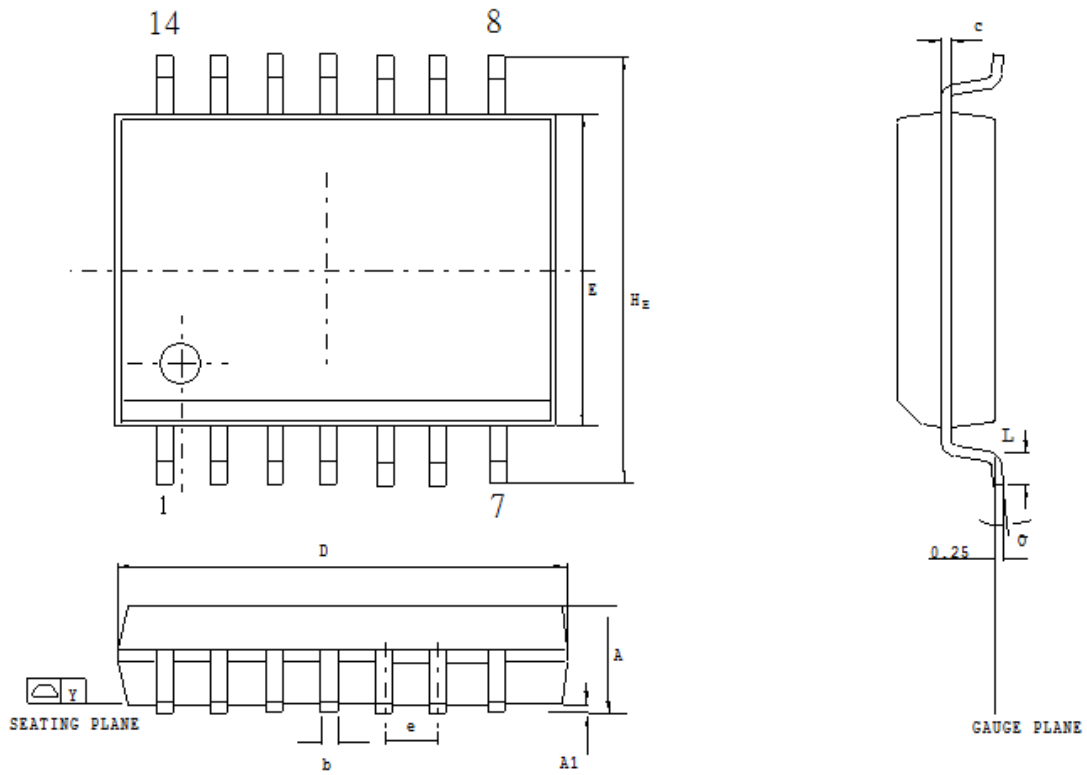
SOP8, 150 mil



Control dimensions are in milimeters .

SYMBOL	DIMENSION IN MM		DIMENSION IN INCH	
	MIN.	MAX.	MIN.	MAX.
A	1.35	1.75	0.053	0.069
A1	0.10	0.25	0.004	0.010
b	0.33	0.51	0.013	0.020
c	0.19	0.25	0.008	0.010
E	3.80	4.00	0.150	0.157
D	4.80	5.00	0.188	0.196
e	1.27 BSC		0.050 BSC	
H <sub>z</sub>	5.80	6.20	0.228	0.244
Y	—	0.10	—	0.004
L	0.40	1.27	0.016	0.050
θ	0	10	0	10

SOP14, 150 mil



Control demensions are in milmeters .

SYMBOL	DIMENSION IN MM		DIMENSION IN INCH	
	MIN.	MAX.	MIN.	MAX.
A	1.35	1.75	0.053	0.069
A1	0.10	0.25	0.004	0.010
b	0.33	0.51	0.013	0.020
c	0.19	0.25	0.008	0.010
E	3.80	4.00	0.150	0.157
D	8.55	8.75	0.337	0.344
e	1.27 BSC		0.050 BSC	
HE	5.80	6.20	0.228	0.244
Y	— 0.10		— 0.004	
L	0.40	1.27	0.016	0.050
θ	0	8	0	8

## 7. Ordering Information

Part No.	Shape	Type	Remark
NSP080A/170A/081A/171A/340A/341A/481A	E	Package: SOP8 (150mil)	Blank
NSP080B/170B/340B/480B/650B/960B	E	Package: SOP14 (150mil)	Blank

## 8. Revision History

Version	Date	Substantial Changes	Page
A1.0	Sep.18.2018	Initial Release	All
A1.1	Sep. 30.2018	Update Product Selection Guide	3
A1.2	Nov.18.2018	Add NSP340A, SOP8 package	10-15
A2.0	Dec.27.2018	Update SOP8 as 2 I/O Add NSP080A/170A SOP8 package	All
A3.0	Jan.31.2019	Remove SOP20, LQFP48 and modify Features, Application Circuit for Voice Prompt Application	All
A4.0	May.20.2019	Update Pin Description, Application Circuit, Ordering Information	5,6,8,12
A5.0	Jul.18.2019	Add part no. NSP081A, NSP171A Update AP circuit	3,9,12 6,7
A5.1	Aug.2019	Update duration on Selection Guide	3
A6.0	Oct.2019	Add NSP341A/481A/650A/960A and NSP480B/650B/960B	All
A6.1	Nov.2019	Revise operation temperature as -20 to 85 degree C	4
A6.2	Nov. 2019	Update NSP480B/650B/960B SOP14 Pin Assignment	12
A6.3	Dec. 2019	Skip NSP650A/960A Update NSP480B/650B/960B SOP14 Pin Assignment	11
A6.4	Dec. 2019	Correct NSP081A/171A/341A/481A Pin Assignment Remove the section of MCU Protocol and Command List	8

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