NSP (OTP)

Data Sheet

For additional information or questions, please contact: Nuvoton Technology Corporation.

www.nuvoton.com

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Rev 1.1

1. General Description

NSP (OTP) series is an advanced 1-ch Voice IC that equips with Nuvoton 8-bit 65C02 core, embedded OTP (One Time PROM) and new algorithm to implement Voice Prompt applications with high level of sound quality. NSP (OTP) 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 OTP, shown as below:

Part No.	Package	Duration (Sec) (@ NM4)		Duration (Sec) (@MDM)		V_{DD} (V)	LVR (V)	Audio	LVR	WDT
		6KHz	10KHz	6KHz	10KHz			PWM		
NSP075A	SOP8	81	49	69	41	2.0~5.5	1.9	13-bit	Yes	Yes
NSP165A	SOP8	162	97	137	82	2.0~5.5	1.9	13-bit	Yes	Yes
NSP335A	SOP8	324	194	274	164	2.0~5.5	1.9	13-bit	Yes	Yes
NSP075B	SOP14	81	49	69	41	2.0~5.5	1.9	13-bit	Yes	Yes
NSP165B	SOP14	162	97	137	82	2.0~5.5	1.9	13-bit	Yes	Yes
NSP335B	SOP14	324	194	274	164	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%
- NSP075B~335B has 4 bi-directional I/O pins
- Audio output: 12-bit PWM
- Voice channel: 1-ch Voice
- Algorithm: 4-bit NM4, 5-bit MDM
- Built-in Watch-Dog Timer (WDT)
- Low Voltage Reset (LVR)
- Package form: SOP8, SOP14

3. PAD Description

Pin Name	I/O	Function
BP11 BP12	I/O	Interface with host MCU Share with ICPCLK and ICPDATA for program
BP07 BP10 BP13 BP17	I/O	General input/output pins controlled by MCU command Each pin can be set as Input or Output individually For input pin, it can be set as pull-high Only support on NSP075B/165B/335B (SOP14)
VPP	Power	Positive power supply for program
V33O	Power	Internal regulator, 0.1uF capacitor is needed
PWM+	O	PWM driver positive output to drive speaker directly
PWM-	O	PWM driver negative output to drive speaker directly
VDD	Power	Positive power supply
VDD_IO	Power	Positive power supply for GPIO
VDD_SPK	Power	Positive power supply for speaker driver Only support on NSP075B/165B/335B (SOP14)
VSS	Power	Negative power supply

4. Electrical Characteristics

4.1 Absolute Maximum Ratings

Parameter	Symbol	Conditions	Rated Value	Unit
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 +70	°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_{DD}		2.0	-	5.5	V
Operating Current	I_{OP1}	No load	-	8	10	mA
Standby Current (STOP)	I_{DD1}	No load	-	3	10	μA
Input Low Voltage	V_{IL}	All input pins	V_{SS}	-	0.3 V_{DD}	V
Input High Voltage	V_{IH}	All input pins	0.7 V_{DD}	-	V_{DD}	V
Output Current BP0	I_{OL}	V_{DD} = 3V, V_{OUT} = 0.4V	8	12	-	mA
	I_{OH}	V_{DD} = 3V, V_{OUT} = 2.6V	-4	-6	-	mA
	I_{OL}	V_{DD} = 4.5V, V_{OUT} = 1.0V	-	25	-	mA
	I_{OH}	V_{DD} = 4.5V, V_{OUT} = 3.5V	-	-12	-	mA
Output Current BP1	I_{OL}	V_{DD} = 3V, V_{OUT} = 0.4V	4	6	-	mA
	I_{OH}	V_{DD} = 3V, V_{OUT} = 2.6V	-4	-6	-	mA
	I_{OL}	V_{DD} = 4.5V, V_{OUT} = 1.0V	-	12	-	mA
	I_{OH}	V_{DD} = 4.5V, V_{OUT} = 3.5V	-	-12	-	mA
Output Current PWM+ / PWM-	I_{OL1}	RL= 8Ω	+250	-	-	mA
	I_{OH1}	[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

NSP075A/165A/335A

3.3V < VDD < 5.5V

Host uC

GPIO1	5	BP11(SCL)	VPP	6	
GPIO2	7	BP12(SDA)	V33O	4	C3 0.1u
VDD — VDD	8	VDD			
C1 4.7u / C2 0.1u			PWM+	1	
VSS	2	VSS	PWM-	3	

Power + VDD
−

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

2.0V < VDD < 3.6V

Host uC

GPIO1	5	BP11(SCL)	VPP	6	
GPIO2	7	BP12(SDA)	V33O	4	VDD
VDD — VDD	8	VDD			
C1 4.7u / C2 0.1u			PWM+	1	
VSS	2	VSS	PWM-	3	

Power + VDD
−

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

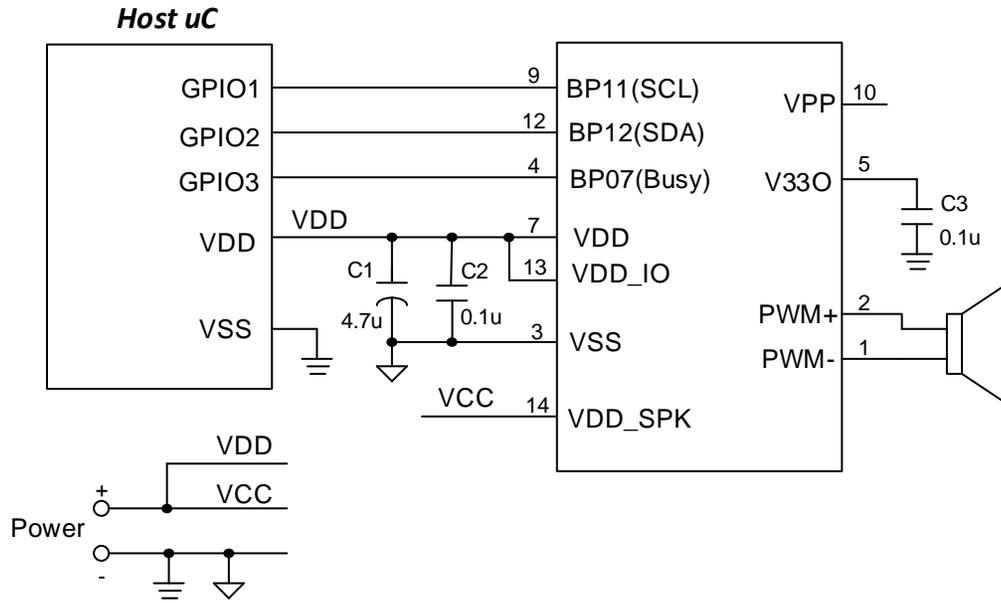*Release Date: Jan. 2021*
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NSP075B/165B/335B
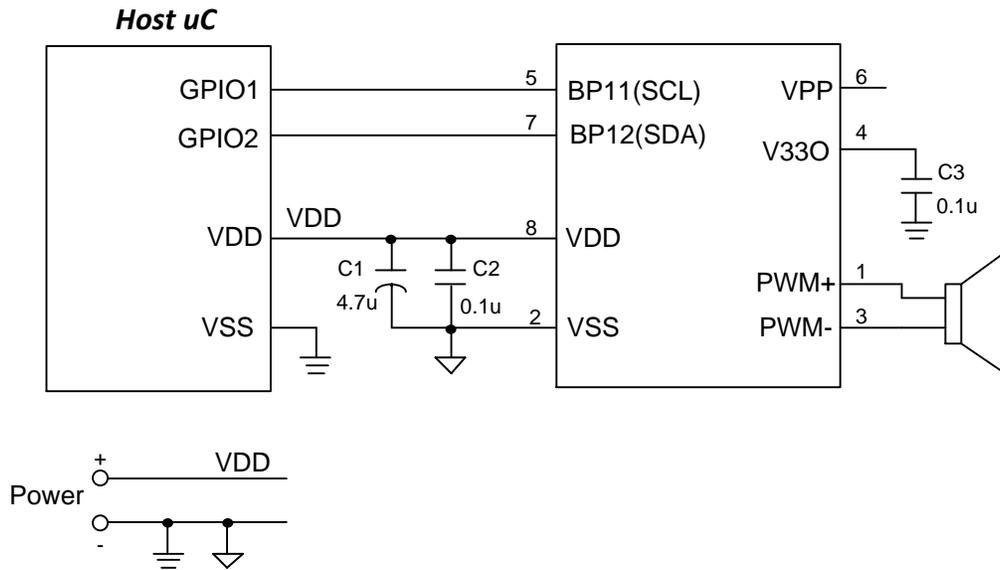
3.3V < VDD < 5.5V

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

2.0V < VDD < 3.6V

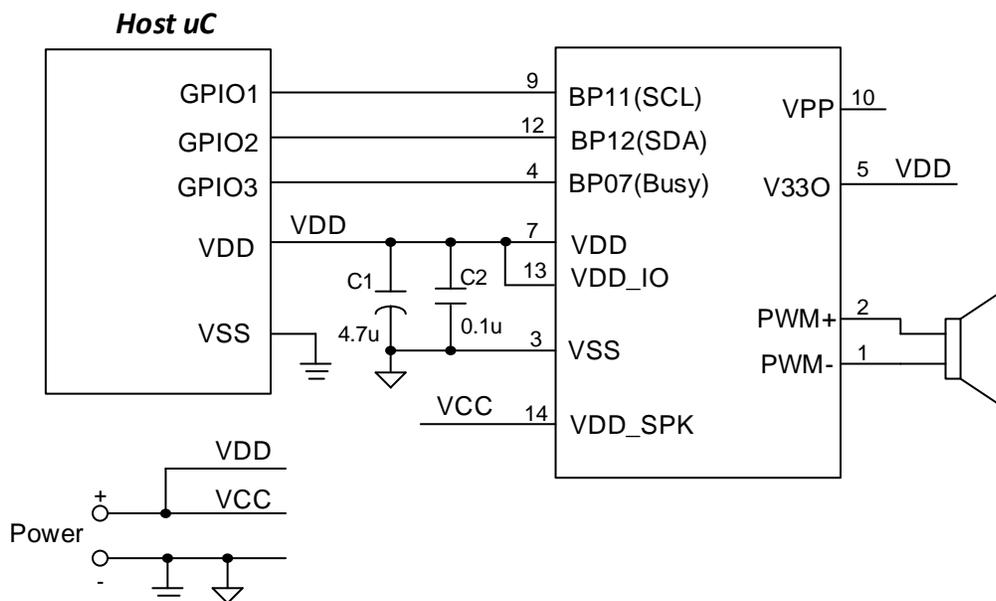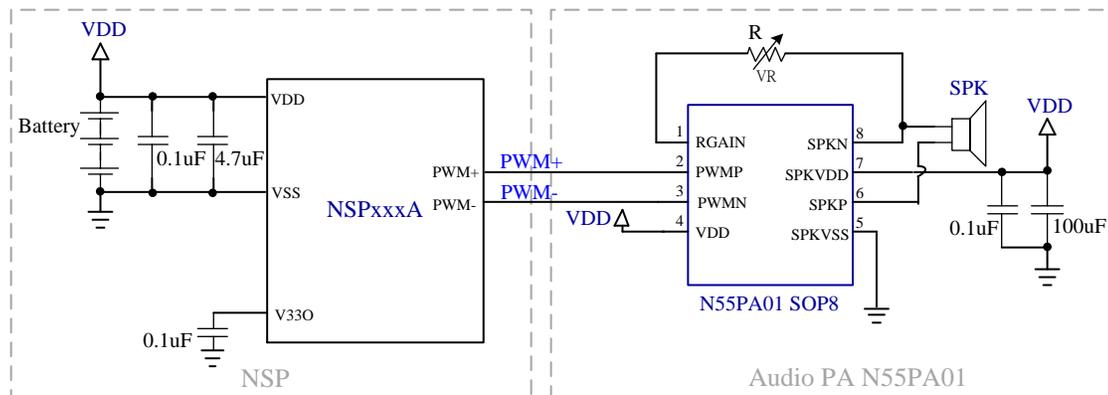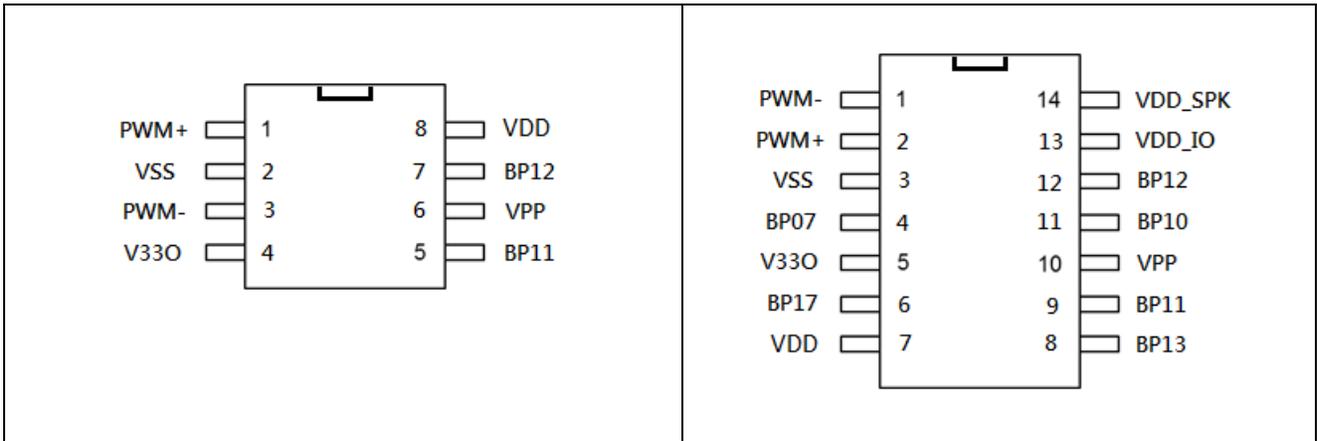**Note:** C1 and C2 need to be close to the NSP chip layout.

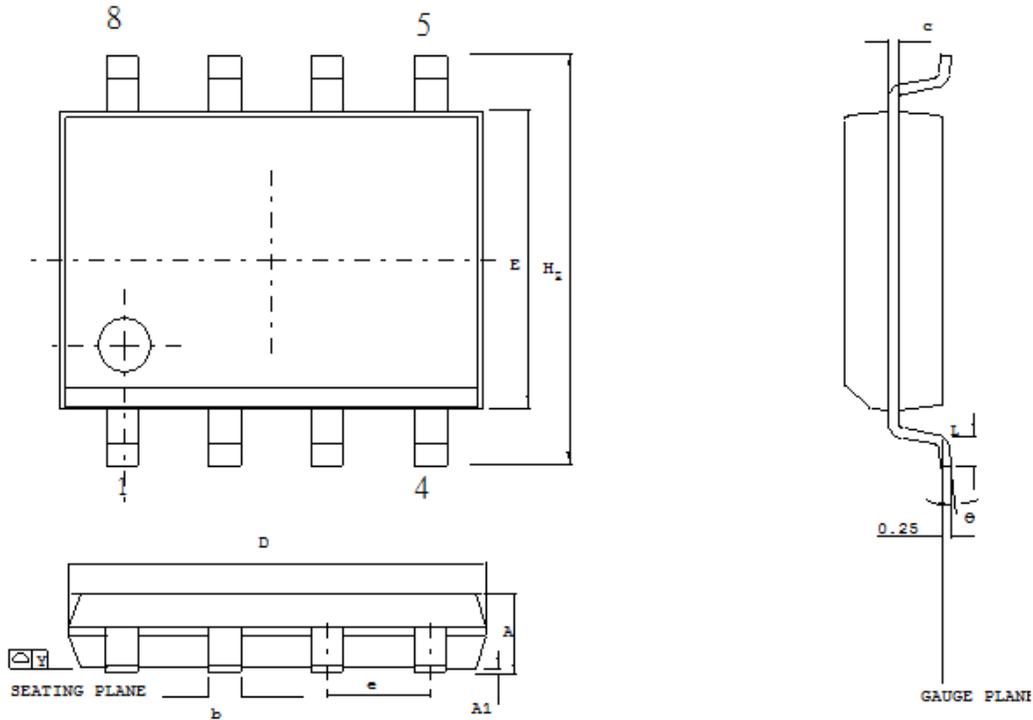### NSP (OTP) Application with N55PA01

6. Package Information

6.1 Pin Assignment

NSP075A/165A/335A	NSP075B/165B/335B
SOP8 (150 mil)	SOP14 (150 mil)

6.2 Package Dimension

SOP8, 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	4.80	5.00	0.188	0.196
e	1.27 BSC		0.050 BSC	
H$_2$	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
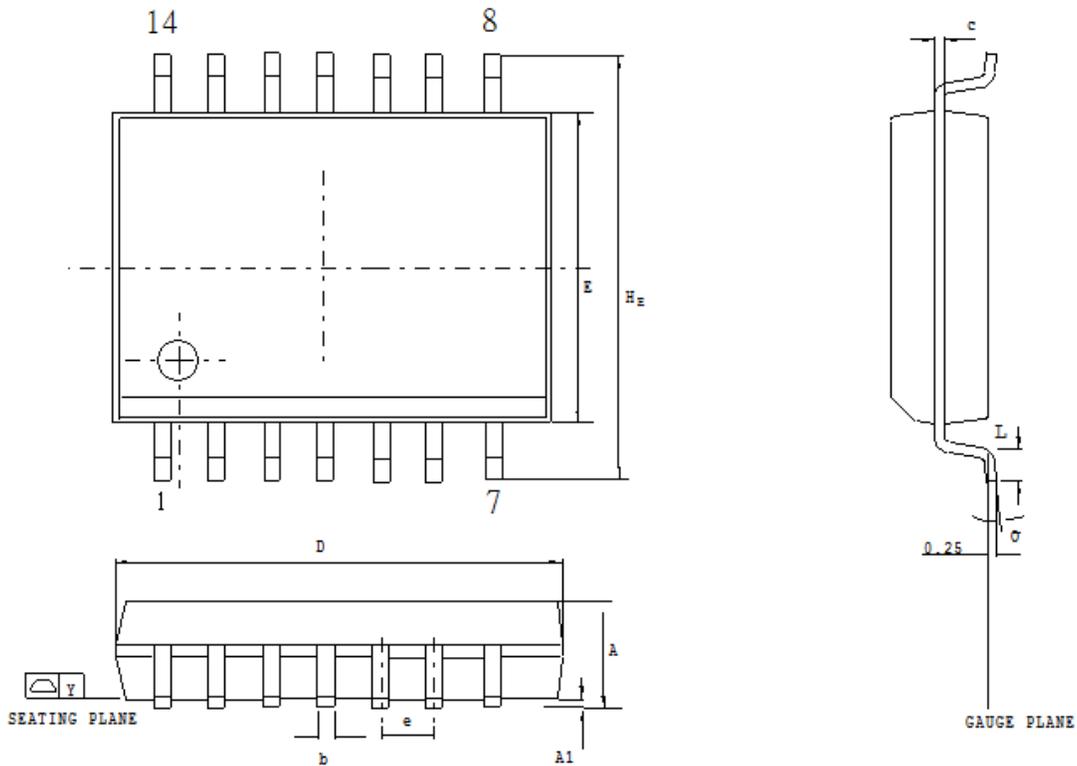
Control demensions are in milmeters .

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	
H E	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
NSP075A/165A/335A	E	Package: SOP8 (150mil)	Blank
NSP075B/165B/335B	E	Package: SOP14 (150mil)	Blank

8. Revision History

Version	Date	Substantial Changes	Page
Rev 0.1	Nov.2019	Preliminary Initial Release	All
Rev 1.0	Feb.2020	First establishment	All
Rev 1.1	Jan.2021	Update PSG and Update SOP14 Pin Assignment Update Application Circuit with N55PA01	3, 8

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