

# **NSP2.0**

## **Data Sheet**

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## 1. General Description

NSP2.0 series are advanced Voice IC with embedded Flash to implement Voice Assistance applications. It provides hardware I2C, UART and firmware One-Wire, Two-Wire interface to communicate with host MCU, and support In-System-Program (ISP) to update content with high data transition rate; Besides, NSP2.01G series support up to 1.0 Watt (@ 5.5V) amplifier to drive speaker directly, which is suitable for all the voice assistance applications.

The NSP2.0 series include 6 part numbers with different durations, shown as below selection guide:

| Part No.    | Package | Duration (S) |       | V <sub>DD</sub> (V) | LVR (V) | Voice CH | ISP | Audio Output (8Ω, THD+N < 1%) |      | MCU I/F     |                      |
|-------------|---------|--------------|-------|---------------------|---------|----------|-----|-------------------------------|------|-------------|----------------------|
|             |         | 12KHz        | 16KHz |                     |         |          |     | 3.3V                          | 5.5V | H/W         | F/W                  |
| NSP2080A    | SOP8    | 96           | 72    | 2.0~5.5             | 1.9     | 2        | V   | 0.2W                          | 0.5W | I2C<br>UART | One-Wire<br>Two-Wire |
| NSP2170A    |         | 177          | 133   |                     |         |          |     |                               |      |             |                      |
| NSP2340A    |         | 420          | 315   |                     |         |          |     |                               |      |             |                      |
| NSP2080A01G | SOP16   | 96           | 72    |                     |         |          |     | 0.4W                          | 1.0W |             |                      |
| NSP2170A01G |         | 177          | 133   |                     |         |          |     |                               |      |             |                      |
| NSP2340A01G |         | 420          | 315   |                     |         |          |     |                               |      |             |                      |

## 2. Features

- Operating voltage : 2.0~5.5V
- Operating temperature : -40°C ~ 85°C
- Interface with MCU : UART 、 I2C ( Slave ) 、 Two-Wire 、 One-Wire
- Audio output :
  - NSP2080A ~ 2340A: PWM Output, 0.5 Watt @ 5.5V (THD + N < 1%, 8Ω)
  - NSP2080A01G ~ 2340A01G: Push-Pull Amplifier 1.0 Watt @ 5.5V (THD + N < 1%, 8Ω)
- Provide ISP (In System Program) to update content from Host MCU
- Voice channel : 2-ch Voice
- Low Voltage Reset (LVR)
- Low Standby current : <= 2uA
- Flash Data Retention : 10-Year
- Flash Program/Erase Cycling Endurance : 100K
- Package form : SOP8 、 SOP16

- Package is Halogen-free, RoHS-compliant and TSCA-compliant

### 3. PIN Description

NSP2080A / NSP2170A / NSP2340A

| Pin Name     | I/O   | Function   |
|--------------|-------|--|
| BP00<br>BP01 | I/O   | <ul style="list-style-type: none"> <li>● General input / output pins</li> <li>● BP00, BP01 share with ICPCLK and ICPDATA</li> <li>● Each pin can be set as I2C 、 UART 、 Two-Wire 、 One-Wire interface</li> </ul> |
| VDD          | Power | Positive power supply  |
| REG          | Power | Internal regulator, 0.1uF capacitor is needed  |
| VSS          | Power | Negative power supply  |
| PWM+         | O     | PWM driver positive output to drive speaker directly   |
| PWM-         | O     | PWM driver negative output to drive speaker directly   |
| /RESET       | I     | IC reset input, low active   |

NSP2080A01G / NSP2170A01G / NSP2340A01G

| Pin Name     | I/O   | Function   |
|--------------|-------|--|
| BP00<br>BP01 | I/O   | <ul style="list-style-type: none"> <li>● General input / output pins</li> <li>● BP00, BP01 share with ICPCLK and ICPDATA</li> <li>● Each pin can be set as I2C 、 UART 、 Two-Wire 、 One-Wire interface</li> </ul> |
| VDD          | Power | Positive power supply  |
| REG          | Power | Internal regulator, 0.1uF capacitor is needed  |
| VSS          | Power | Negative power supply  |
| SPKP         | O     | Positive speaker signal amplified output   |
| SPKN         | O     | Negative speaker signal amplified output   |
| /RESET       | I     | IC reset input, low active   |
| VDDA         | Power | Positive power supply for amplifier  |
| VSSA         | Power | Negative power supply for amplifier  |
| SPKVDD       | Power | Positive power supply for speaker driving  |
| SPKVSS       | Power | Negative power supply for speaker driving  |
| RGAIN        | I     | Gain control pin   |

## 4. Electrical Characteristics

### 4.1 Absolute Maximum Ratings

| Parameter       | Symbol           | Conditions | Rated Value                                  | Unit |
|-----------------|------------------|------------|--|------|
| Input Voltage   | V <sub>IN</sub>  | All Inputs | V <sub>SS</sub> -0.3 to V <sub>DD</sub> +0.3 | V    |
| Storage Temp.   | T <sub>STG</sub> | -          | -55 to +150                                  | °C   |
| Operating Temp. | T <sub>OPR</sub> | -          | -40 to +85                                   | °C   |

Noted: 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

(V<sub>DD</sub> – V<sub>SS</sub> = 4.5V, T<sub>A</sub> = 25° C, No Load unless otherwise specified)

NSP2080A / NSP2170A / NSP2340A

| 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                                       | -                   | 5    | -                   | mA   |
| Standby Current (STOP)           | I <sub>DD1</sub> | No load                                       | -                   | -    | 1                   | 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<br>BP00, BP01 | R <sub>PH</sub>  | V <sub>DD</sub> = 4.5V                        | 105K                | 150K | 195K                | Ω    |
| Output Current<br>BP00, BP01     | I <sub>OL</sub>  | V <sub>DD</sub> = 3V, V <sub>OUT</sub> = 0.4V | 8                   | -    | -                   | mA   |
|                                  | I <sub>OH</sub>  | V <sub>DD</sub> = 3V, V <sub>OUT</sub> = 2.6V | -4                  | -    | -                   | mA   |

NSP2080A01G / NSP2170A01G / NSP2340A01G

| 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                                       | -                   | 6.5  | -                   | mA   |
| Standby Current (STOP)           | I <sub>DD1</sub> | No load                                       | -                   | -    | 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<br>BP00, BP01 | R <sub>PH</sub>  | V <sub>DD</sub> = 4.5V                        | 105K                | 150K | 195K                | Ω    |
| Output Current<br>BP00, BP01     | I <sub>OL</sub>  | V <sub>DD</sub> = 3V, V <sub>OUT</sub> = 0.4V | 8                   | -    | -                   | mA   |
|                                  | I <sub>OH</sub>  | V <sub>DD</sub> = 3V, V <sub>OUT</sub> = 2.6V | -4                  | -    | -                   | mA   |

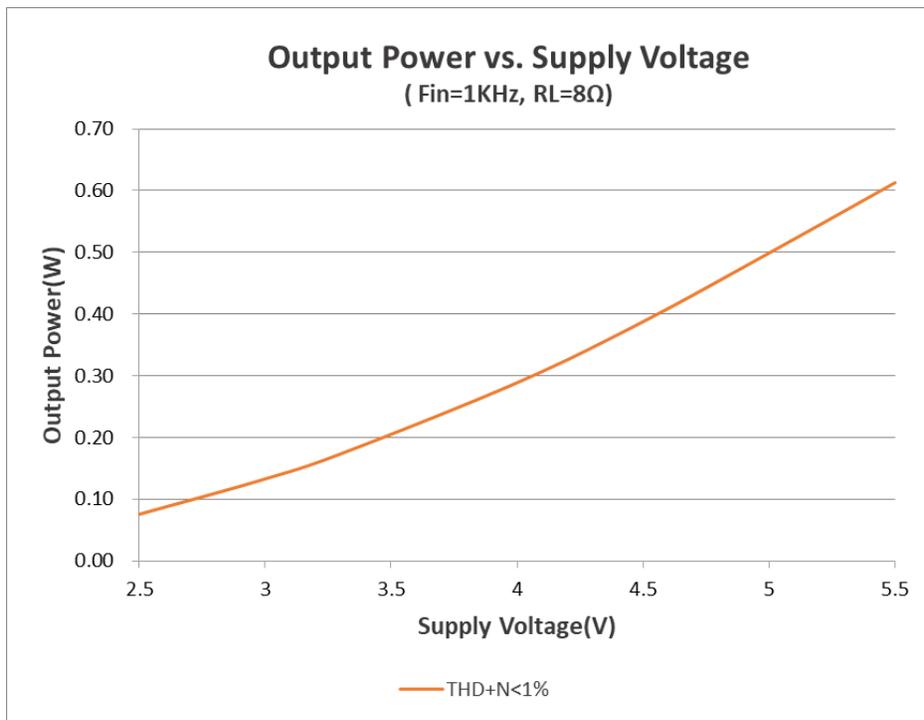
**4.3 A.C. Characteristics**

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

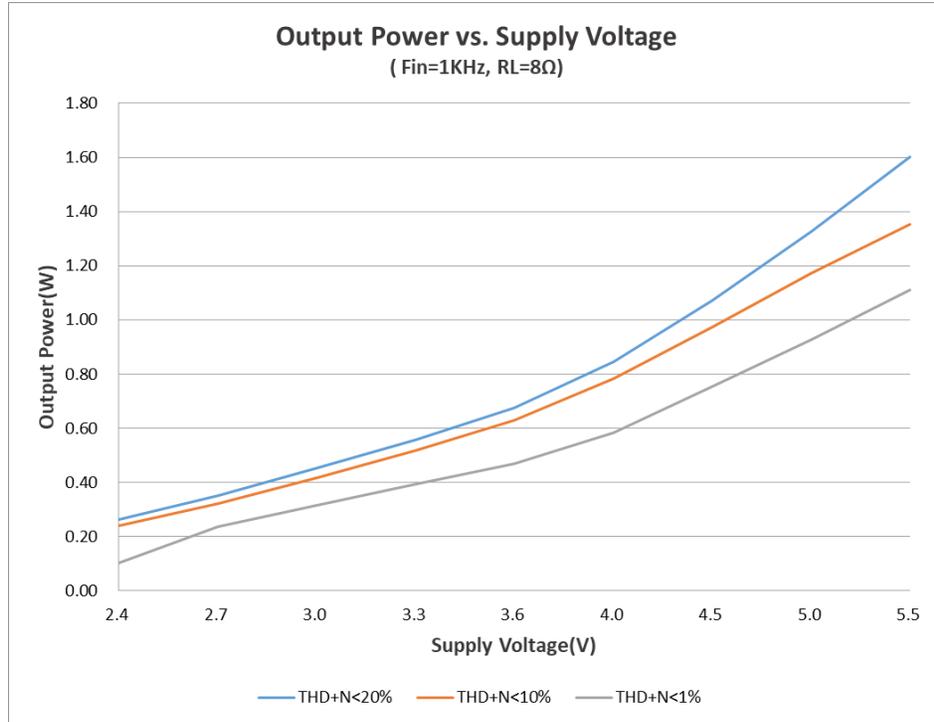
| Parameter                           | Sym          | Conditions                             | Min | Typ | Max | Unit |
|-------------------------------------|--------------|--|-----|-----|-----|------|
| Frequency Deviation by Voltage Drop | $\Delta F/F$ | (Fmax – Fmin)/Fmin<br>@VDD: 2.0 ~ 5.5V | -   | -   | 3   | %    |

**4.4 Output Power**

NSP2080A / NSP2170A / NSP2340A (Frequency Input = 1KHz Sine Wave, RL=8Ω)

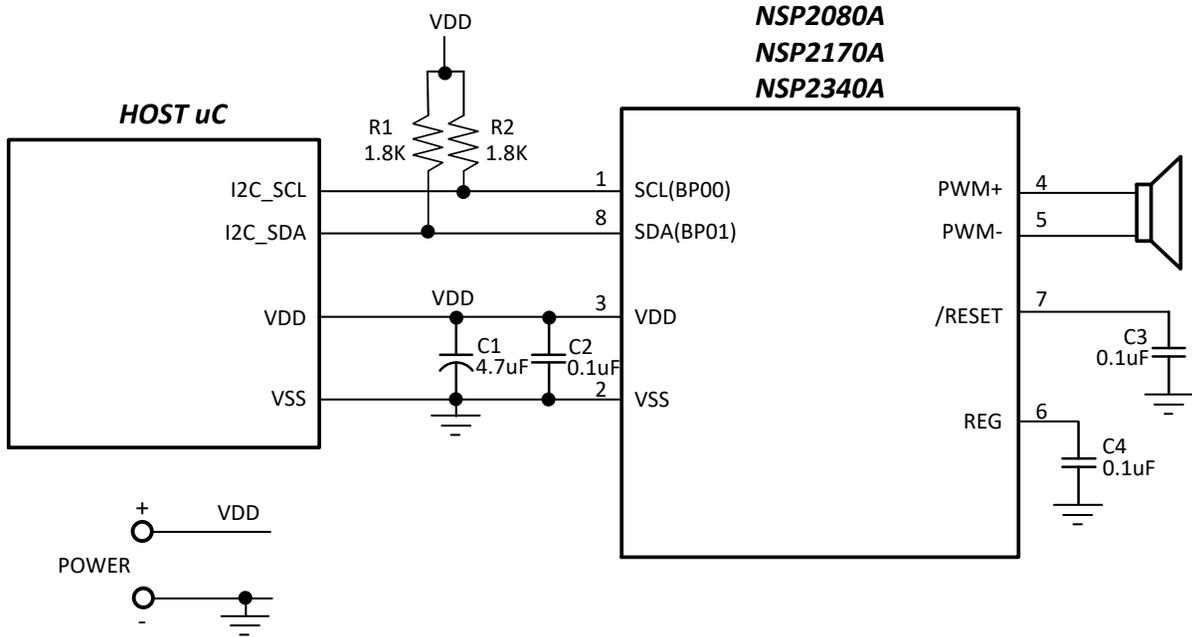


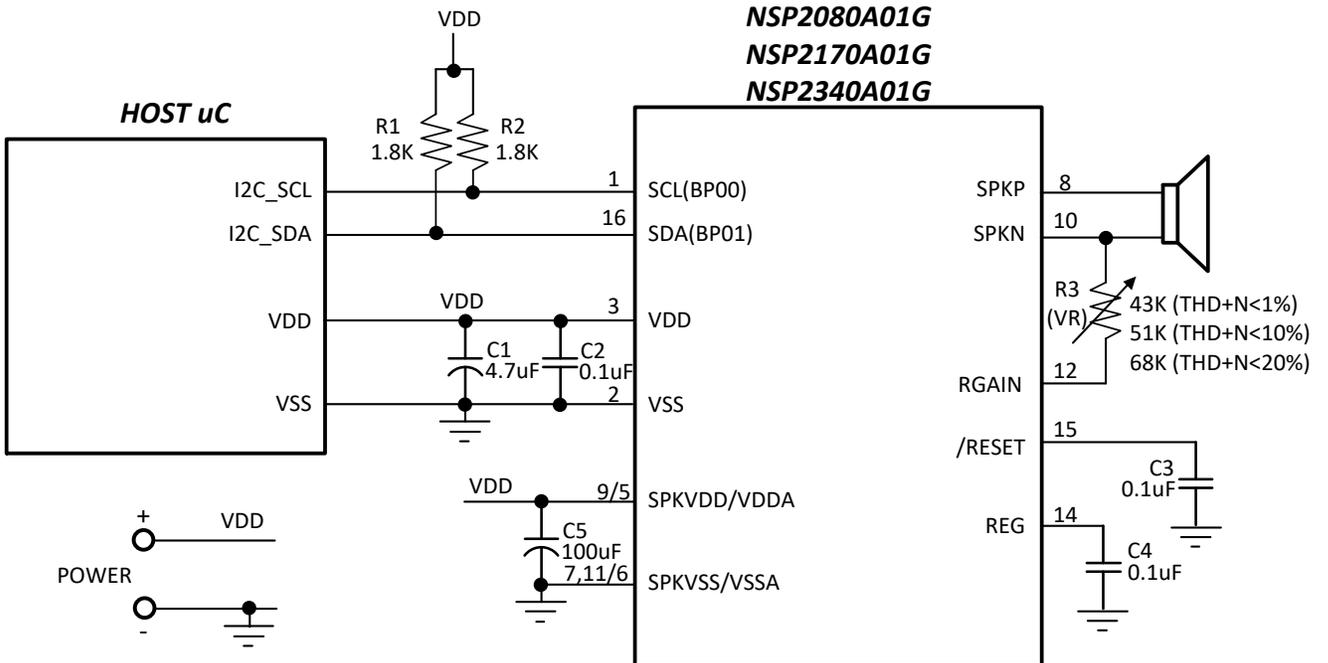
NSP2080A01G / NSP2170A01G / NSP2340A01G (Frequency Input = 1KHz, RL=8Ω)



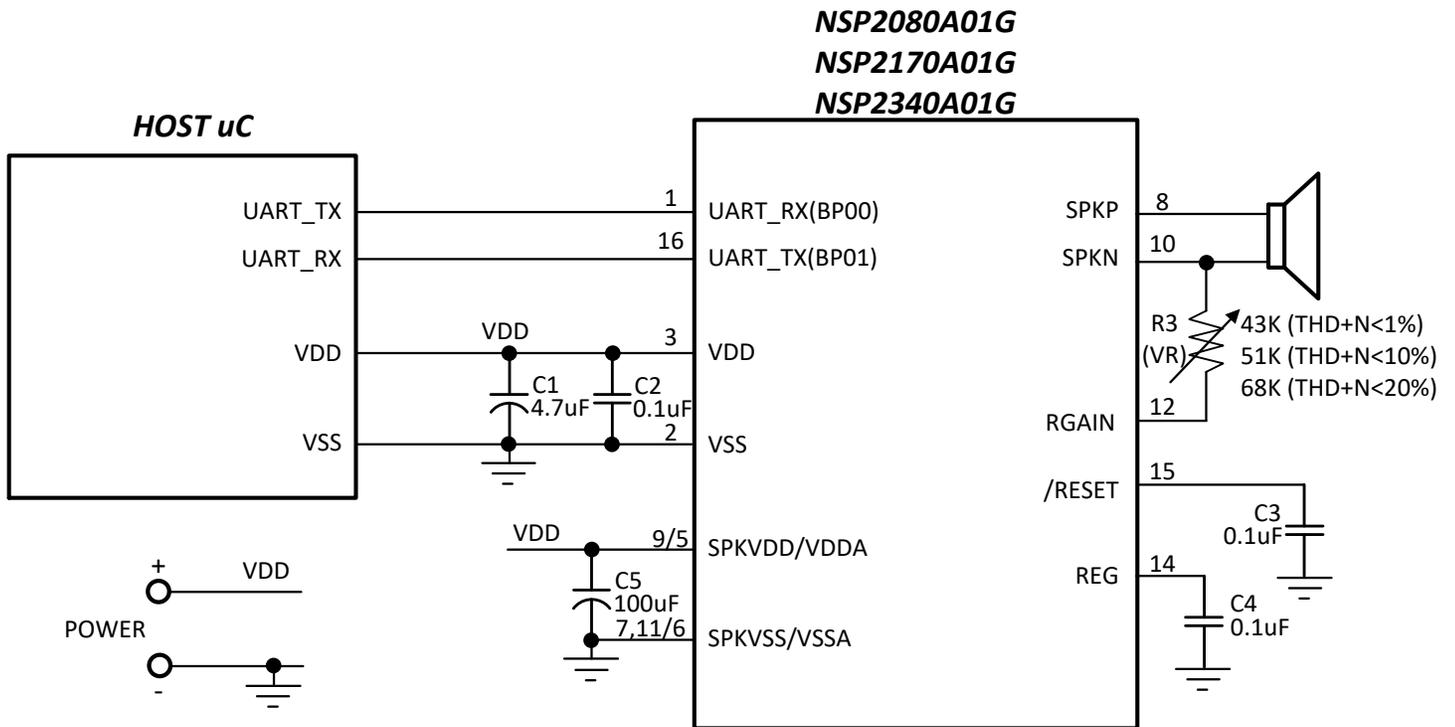
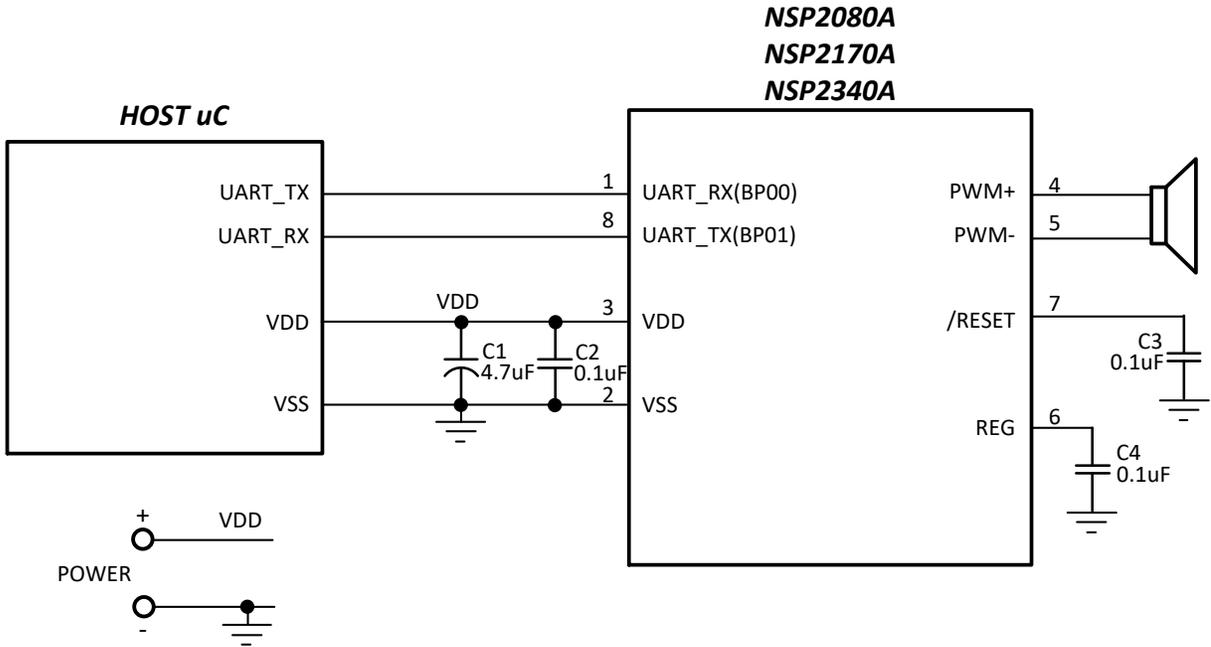
## 5. Typical Application Circuit

### 5.1 Connect to Host uC by I2C Interface

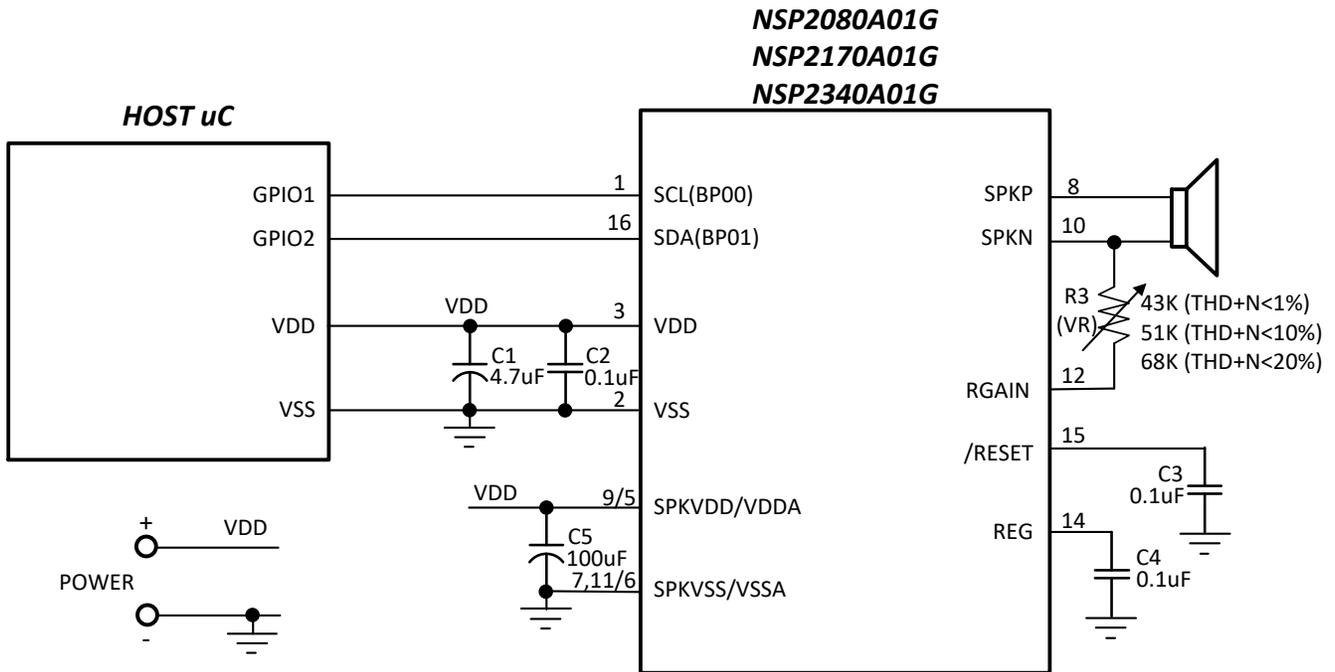
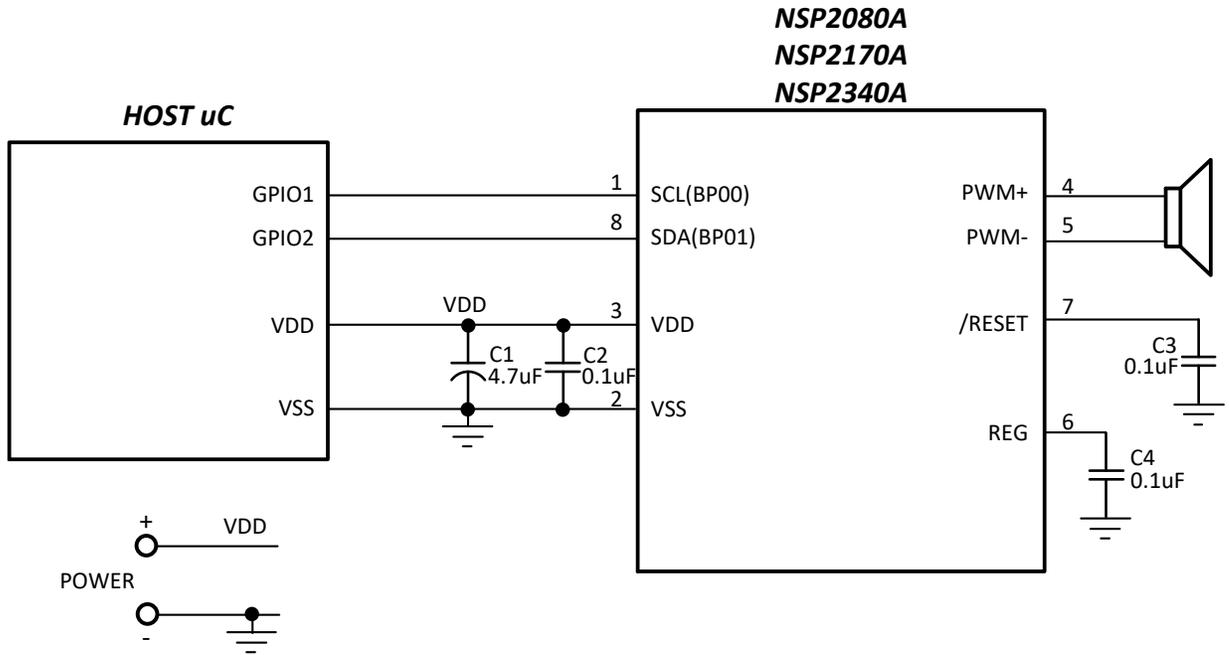




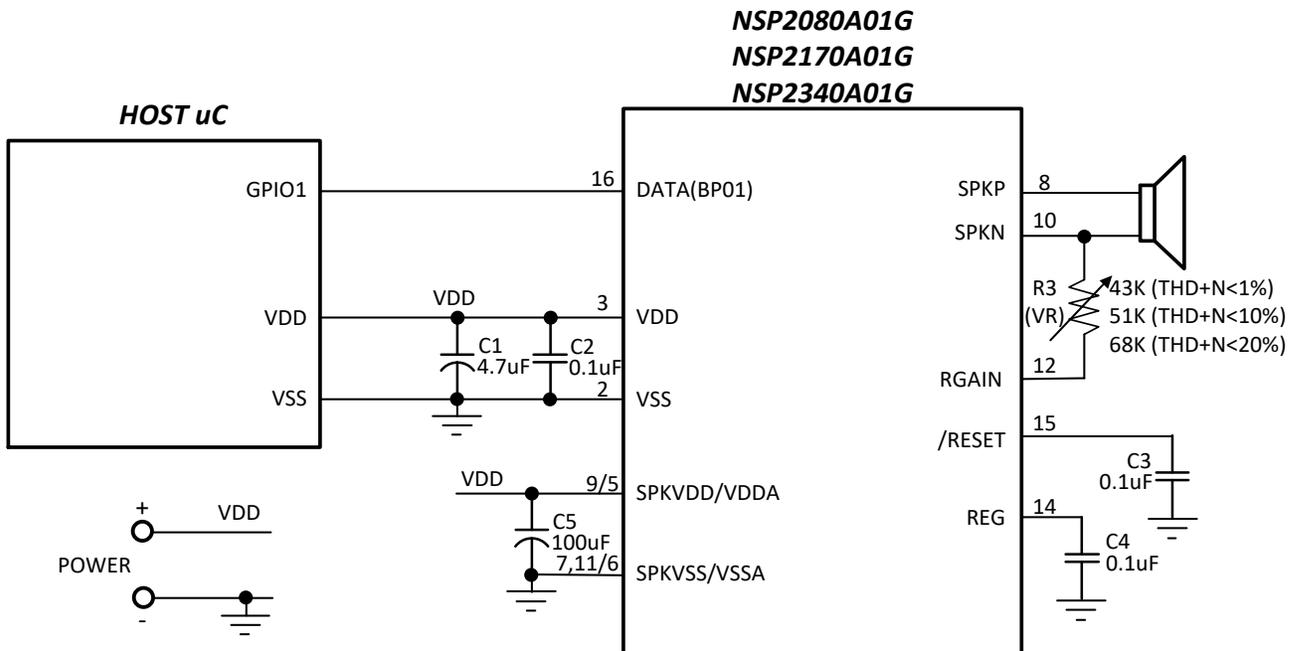
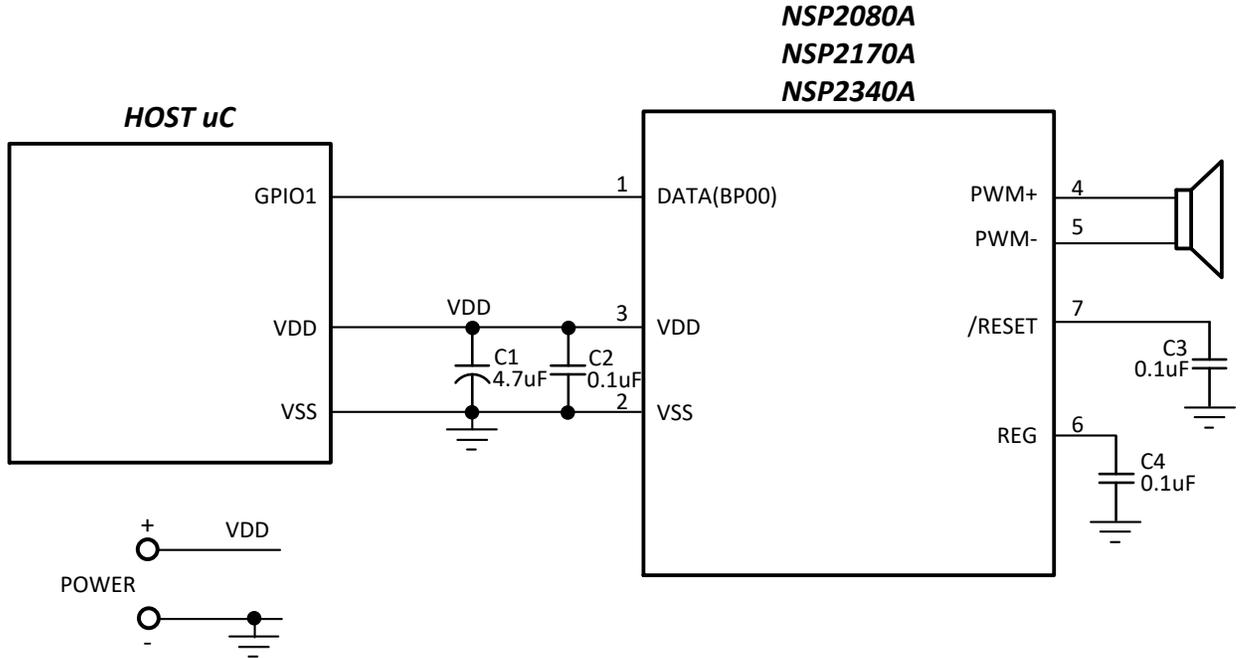
5.2 Connect to Host uC by UART Interface



**5.3 Connect to HOST uC by Two-Wire Interface**



5.4 Connect to HOST uC by One-Wire Interface

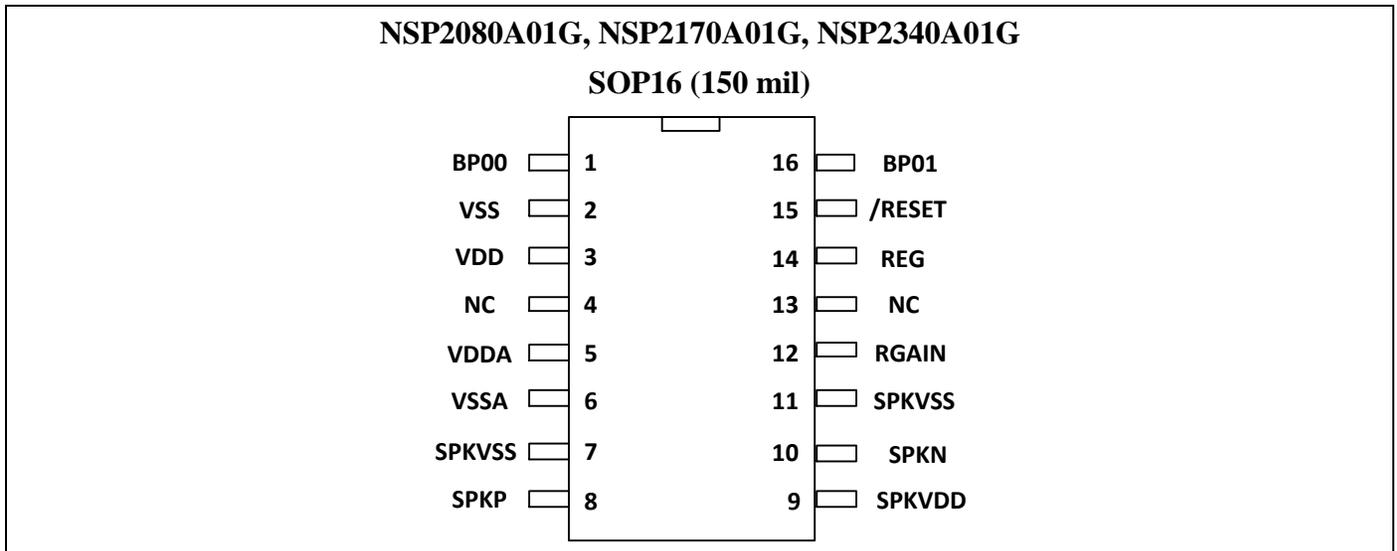
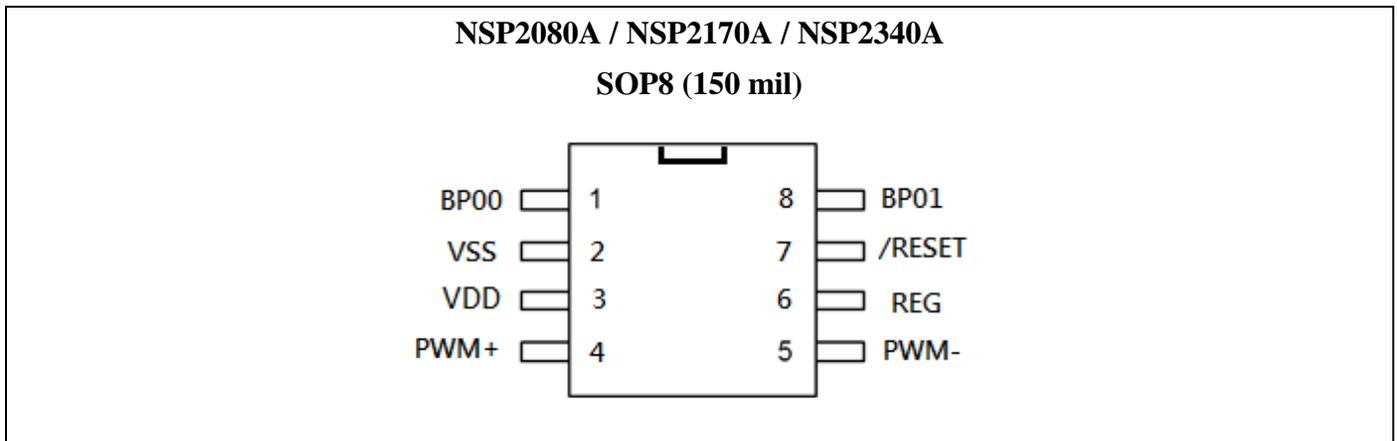


### 5.5 PCB Layout Notice

- The C1、C2、C4 and C5 connected to NSP2.0 chip as near as possible.

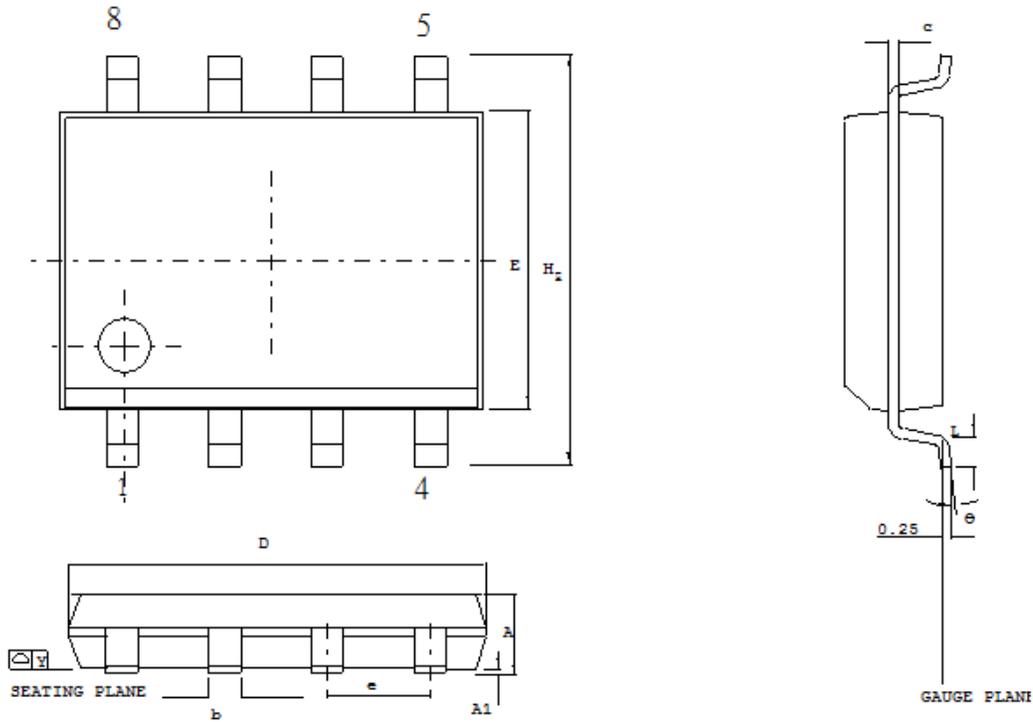
## 6. Package Information

### 6.1 Pin Assignment



### 6.2 Package Dimension

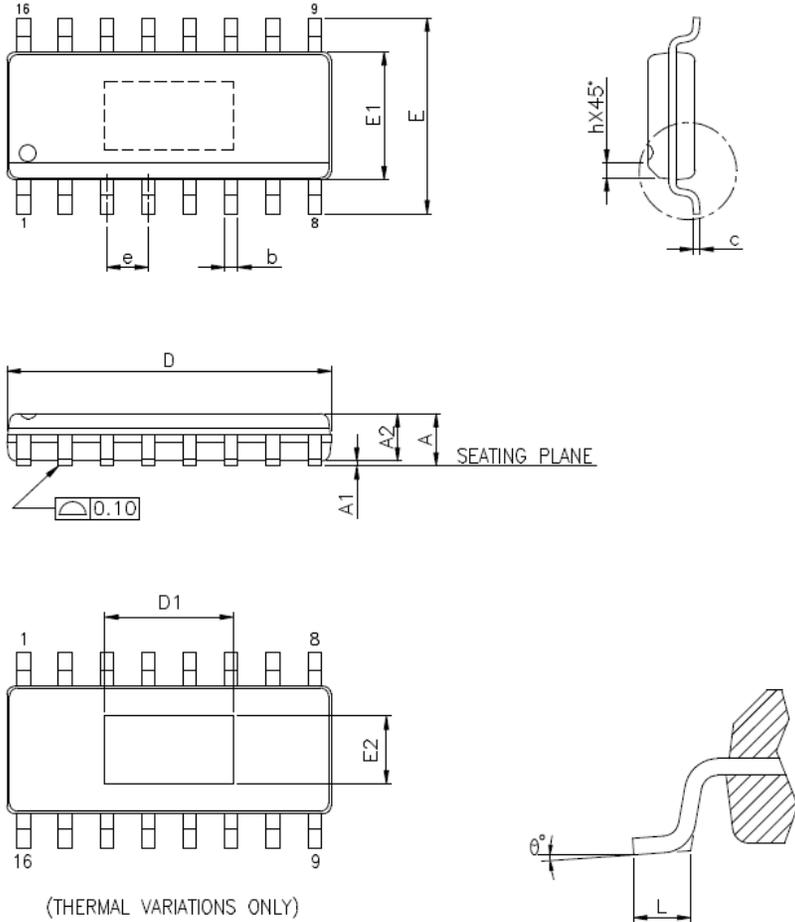
SOP8, 150 mil (NSP2080A / NSP2170A / NSP2340A)



Control dimensions are in millimeters

| Symbol               | Dimension ( mm ) |      | Dimension ( inch ) |       |
|----------------------|------------------|------|--------------------|-------|
|                      | Min.             | Max. | Min.               | Max.  |
| <b>A</b>             | 1.35             | 1.75 | 0.053              | 0.069 |
| <b>A1</b>            | 0.10             | 0.25 | 0.004              | 0.010 |
| <b>B</b>             | 0.33             | 0.51 | 0.013              | 0.020 |
| <b>C</b>             | 0.19             | 0.25 | 0.008              | 0.010 |
| <b>E</b>             | 3.80             | 4.00 | 0.150              | 0.157 |
| <b>D</b>             | 4.80             | 5.00 | 0.188              | 0.196 |
| <b>e</b>             | 1.27 BSC         |      | 0.050 BSC          |       |
| <b>H<sub>E</sub></b> | 5.80             | 6.20 | 0.228              | 0.244 |
| <b>Y</b>             | -                | 0.10 | -                  | 0.004 |
| <b>L</b>             | 0.40             | 1.27 | 0.016              | 0.050 |
| <b>θ</b>             | 0                | 10   | 0                  | 10    |

SOP16, 150 mil (NSP2080A01G / NSP2170A01G / NSP2340A01G)



Control dimensions are in millimeters

| Symbol | Dimension ( mm ) |      | Dimension ( inch ) |       |
|--------|------------------|------|--------------------|-------|
|        | Min.             | Max. | Min.               | Max.  |
| A      | —                | 1.75 | —                  | 0.069 |
| A1     | 0.10             | 0.25 | 0.004              | 0.010 |
| A2     | 1.25             | —    | 0.049              | —     |
| b      | 0.31             | 0.51 | 0.012              | 0.020 |
| c      | 0.10             | 0.25 | 0.004              | 0.010 |
| D      | 9.90 BSC         |      | 0.390 BSC          |       |
| E      | 6.00 BSC         |      | 0.236 BSC          |       |
| E1     | 3.90 BSC         |      | 0.154 BSC          |       |
| e      | 1.27 BSC         |      | 0.050 BSC          |       |
| L      | 0.40             | 1.27 | 0.016              | 0.050 |

|           |      |      |       |       |
|-----------|------|------|-------|-------|
| <b>h</b>  | 0.25 | 0.50 | 0.010 | 0.020 |
| <b>E2</b> | 1.68 | 2.56 | 0.066 | 0.101 |
| <b>D1</b> | 3.86 | 4.72 | 0.152 | 0.186 |
| <b>θ°</b> | 0    | 8    | 0     | 8     |

## 7. Ordering Information

| Part No.                                  | Shape                     | Type                    | Remark |
|---|---------------------------|-------------------------|--------|
| NSP2080A<br>NSP2170A<br>NSP2340A          | E: Tube<br>T: Tape & Reel | Package: SOP8 (150mil)  | Blank  |
| NSP2080A01G<br>NSP2170A01G<br>NSP2340A01G |                           | Package: SOP16 (150mil) |        |

## 8. Revision History

| Version | Date          | Substantial Changes                            | Page         |
|---------|---------------|--|--------------|
| A1.0    | May.25.2022   | Initial Release                                | All          |
| A1.1    | Dec.6.2022    | Modify PCB Layout Notice                       | 8            |
| A2.0    | Mar.27.2023   | Add NSP2080A01G, NSP2170A01G, NSP2340A01G      | All          |
| A2.1    | April.11.2023 | Modify Application Circuit, PCB layout notice, | 8,9,10,11,12 |

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