# AX8 OTP 系列

## 产品规格书

4 I/O 单通道语音芯片

AX8020/AX8040/AX8080/AX8170

# 产品概观

AX8 系列为高性价比的语音芯片,具备有 20~170 秒(6K/4bits)的型号选择，简易应用上无需添加任何外部组件。此外，本系列可一次性烧写程序内容，提供人性化的编译接口，无需写程序代码，简化产品开发流程。

# 功能概述

(1.) 工作电压 : 2.0V~5.5V

(2.) 语音引擎 : 9bits PWM / 9bits DAC

(3.) 语音编码 : 4~9 bits, 共 8 阶压缩率

(4.) 最多支持 63 个群组(Group)和 3800 个功能格(Step)

(5.) 支持 SPI 控制模式(MCU mode)

(6.) 支持单线控制模式(Serial mode)

(7.) 支持低电量检测(LVD)和低电压复位(LVR)

(8.) 不同的触发型态选择

- ✧ Re-triggered / Irre-triggered.
- ✧ Level / Edge
- ✧ Hold / Un-hold.
- ✧ Voice Repeat / One-time voice.
- ✧ On / Off function.
- ✧ De-bounce time : 50us or 10ms

(9.) 可程序化输出状态

- ✧ 可选择固定频率的闪烁方式
- ✧ 可在语音内加入自定义的闪烁方式，包含渐明、渐暗效果(LED PWM)

(10.) 多样化播放速率选择

- ✧ 3.0KHz / 3.2KHz / 3.8KHz / 4KHz / 4.8KHz
- ✧ 6.0KHz / 6.4KHz / 8KHz / 9.6KHz / 12KHz
- ✧ 16KHz / 19.2KHz / 24KHz / 32KHz

(11.) 简易流程编成

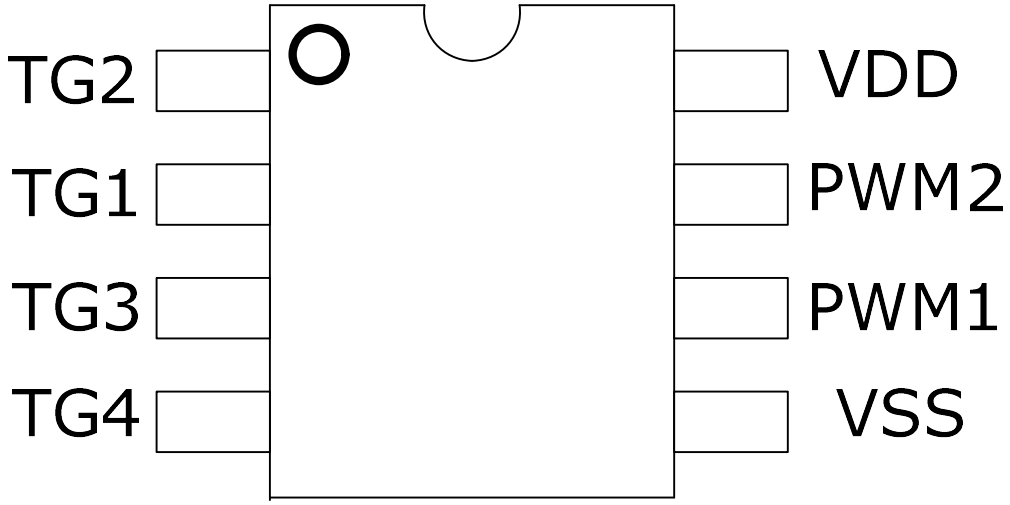
- ✧ 工作缓存器写入
- ✧ 工作缓存器累加
- ✧ 工作缓存器比较分支

# 母体比较表

| Body / 母体 | Duration/预估秒数 | IO counts / 界面数 |
|---|---|---|
| AX8020 | 20” @6K/4bits | 3 |
| AX8040 | 40” @6K/4bits | 4 |
| AX8080 | 80” @6K/4bits | 4 |
| AX8170 | 170” @6K/4bits | 4 |

# 封装脚位图

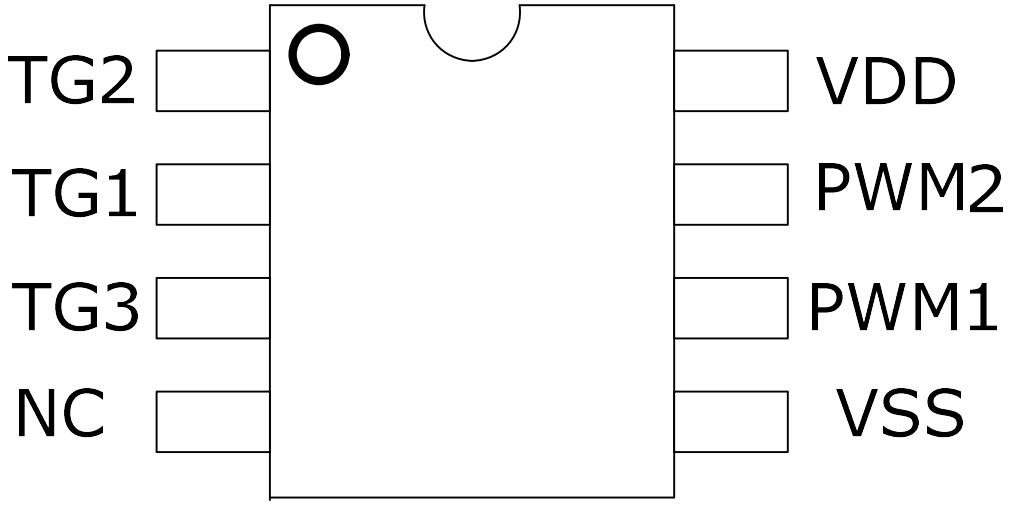
AX8080 / AX8040




# 脚位说明

| Pin Name | Write Pin | MCU Mode | Description |
|---|---|---|---|
| VDD | VDD | VDD | 电源供应脚 |
| VSS | VSS | VSS | 接地脚 |
| PWM1 | SCK | PWM1 | PWM |
| PWM2 | PWM2 | PWM2 | PWM / DAC |
| TG1 | MOSI | DI | Tigger1 / LED PWM3 / SPI DI |
| TG2 | VPP | SCK | Tigger2 / Pause & Resume / LED PWM2 / Reset(Low active) / SPI CLOCK |
| TG3 | MISO | DO | Tigger3 / Volume Control / LED PWM1 / SPI DO |
| TG4 | CSb | CS | Tigger4 / Volume Control / LED PWM3 / SPI CS (Optional) |

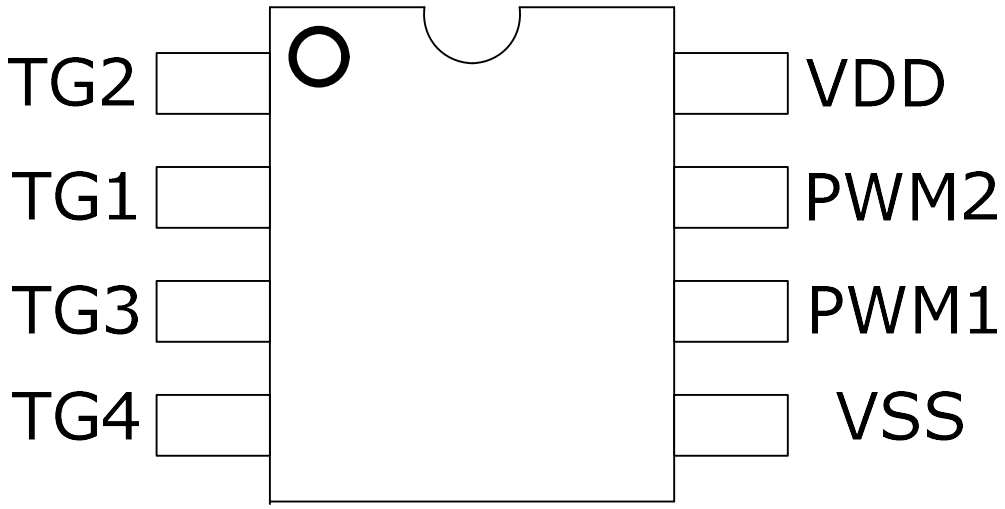
AX8020 SOP8-AA




## 脚位说明

| Pin Name | Write Pin | MCU Mode | Description |
|---|---|---|---|
| VDD | VDD | VDD | 电源供应脚 |
| VSS | VSS | VSS | 接地脚 |
| PWM1 | SCK | PWM1 | PWM |
| PWM2 | PWM2 | PWM2 | PWM |
| TG1 | MOSI | DI | TG1 / Volume Control / LED PWM3 / SPI DI |
| TG2 | VPP | SCK | TG2 / Low active RESET / LED PWM2 / SPI CLOCK |
| TG3 | MISO | DO | TG3 / Volume Control / LED PWM1 / SPI DO |

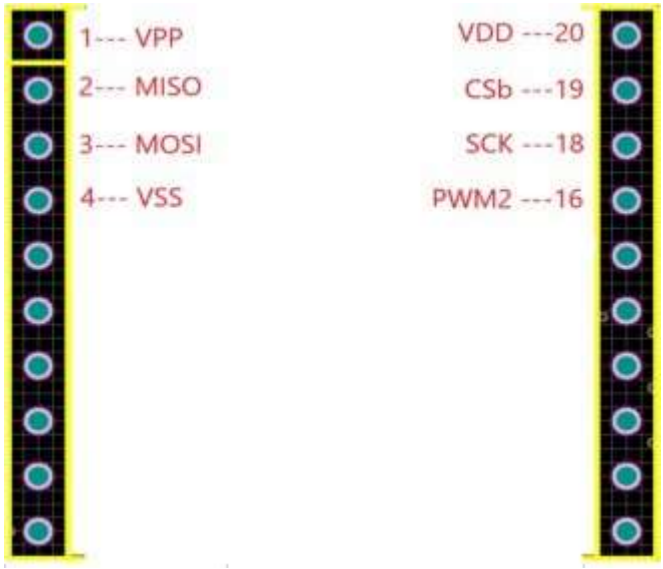
AX8170 SOP8-AA



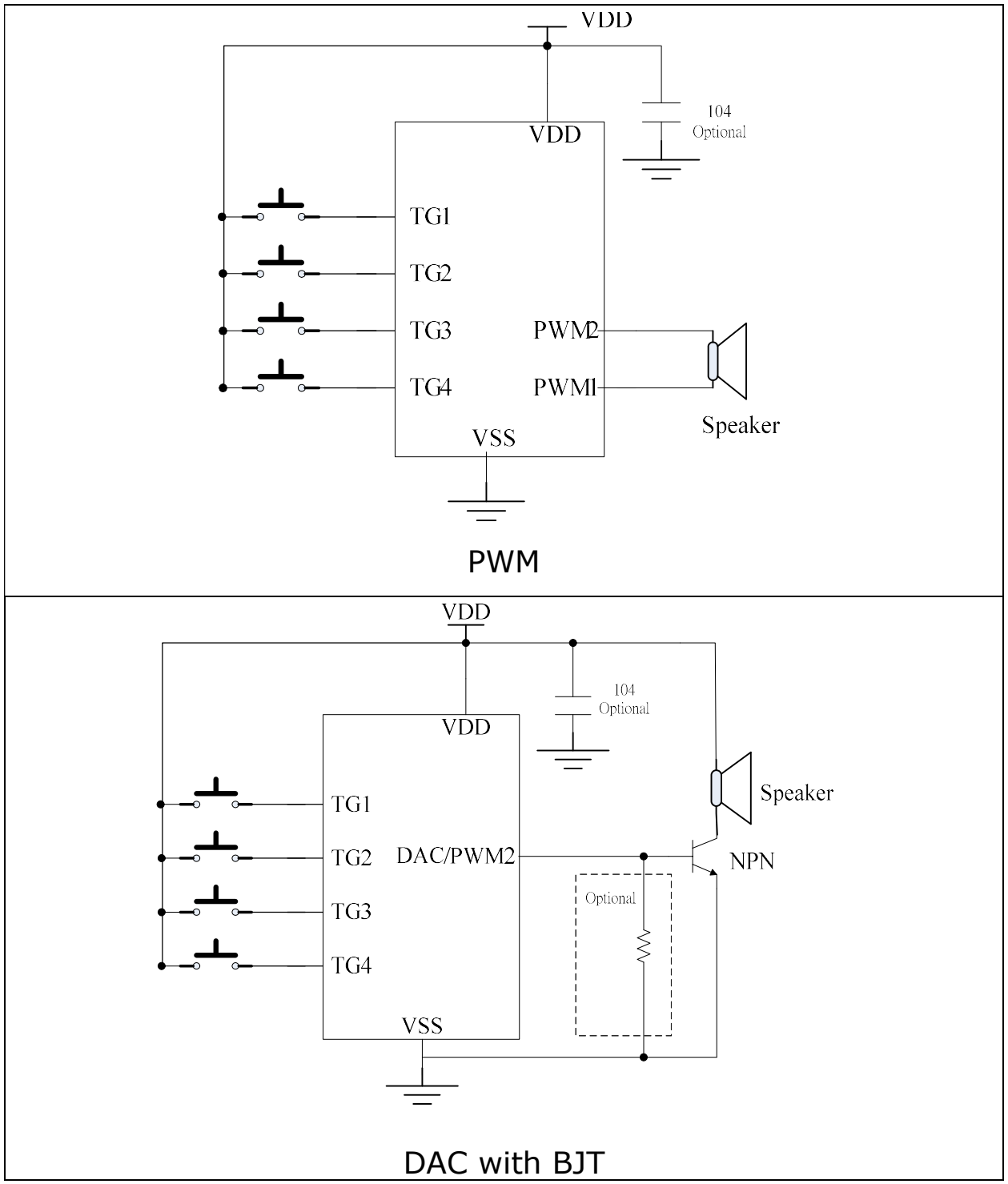

## 腳位說明

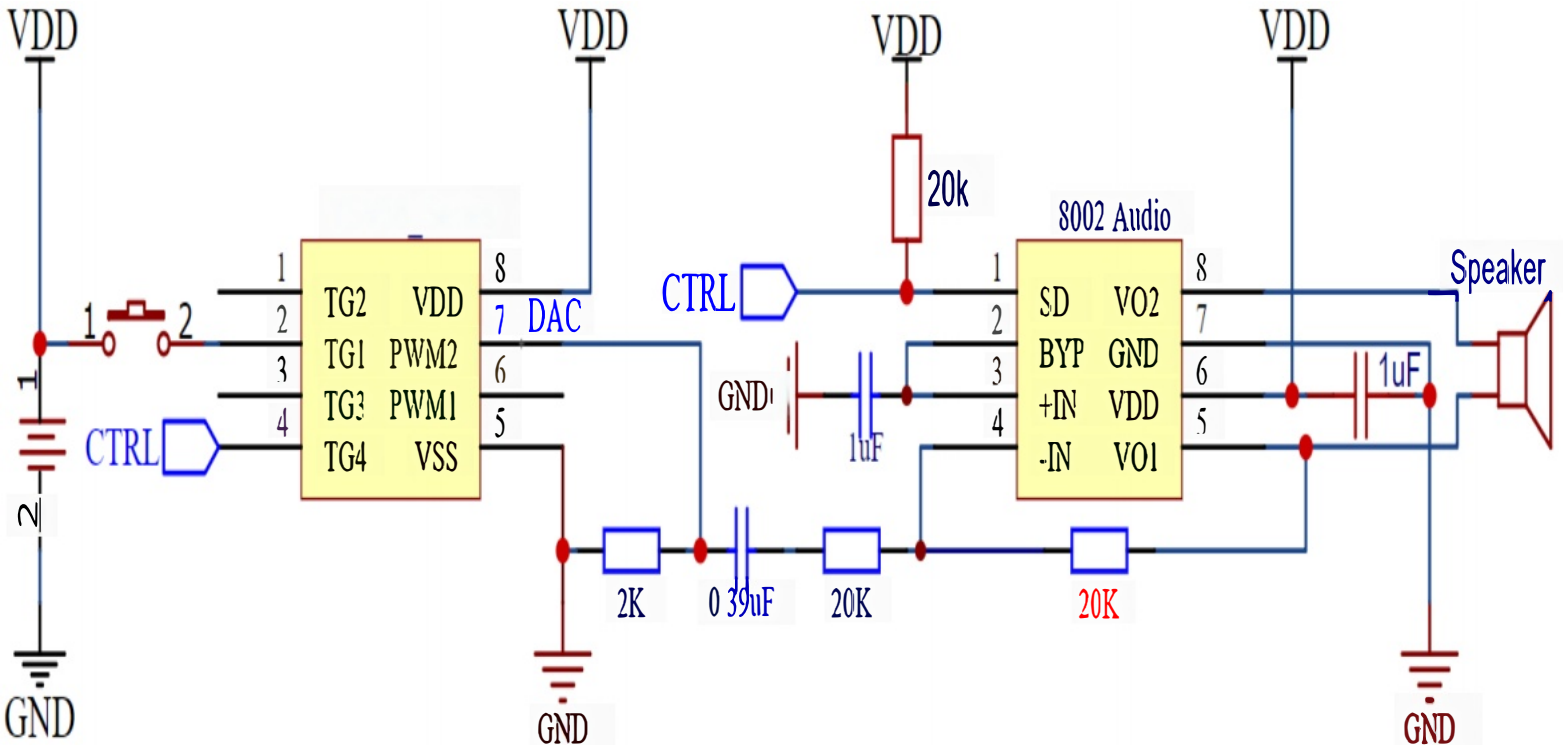
| Pin Name | Write Pin | MCU Mode | Description |
|---|---|---|---|
| VDD | VDD | VDD | 电源供应脚 |
| VSS | VSS | VSS | 接地脚 |
| PWM1 | SCK | PWM1 | PWM |
| PWM2 | PWM2 | PWM2 | PWM / DAC |
| TG1 | MOSI | DI | Tigger1 / LED PWM3 / SPI DI /SWI Input pin |
| TG2 | VPP | SCK | Tigger2 / Pause & Resume / LED PWM2 / Reset(Low active) / SPI CLOCK |
| TG3 | MISO | DO | Tigger3 / Volume Control / LED PWM1 / SPI DO |
| TG4 | CSb | CS | Tigger4 / Volume Control / LED PWM3 / SPI CS (Optional) |

# Writer board slot location



# 应用线路图

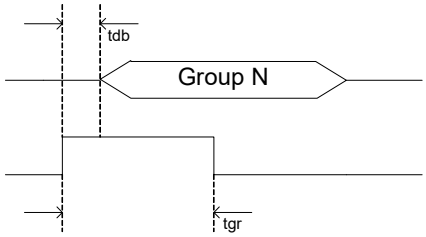

VDD
104
Optional
VDD
TG1
TG2
TG3
TG4
PWM2
PWM1
VSS
Speaker
PWM
VDD
104
Optional
VDD
TG1
TG2
TG3
TG4
DAC/PWM2
VSS
Speaker
NPN
Optional
DAC with BJT



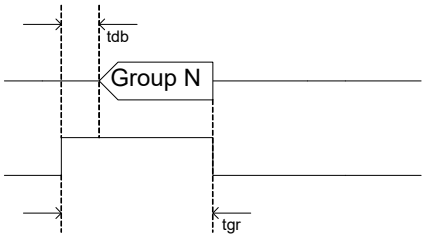

DAC with Audic Amplifier(8002)

# 按键触发模式

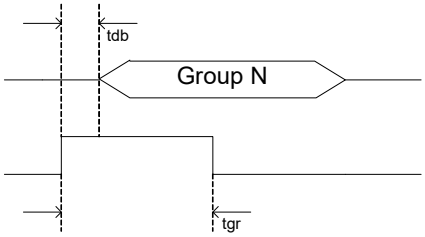
(a) Trigger Pulse Width < Group Length
Option Setting = Edge / Unhold



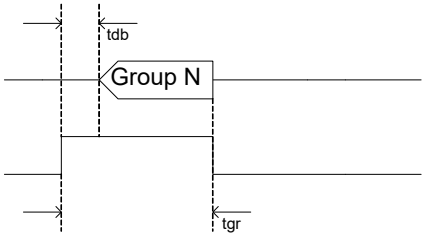

(b) Trigger Pulse Width < Group Length
Option Setting =Edge / Hold



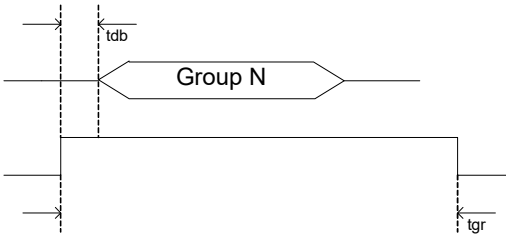

(c) Trigger Pulse Width < Group Length
Option Setting = Level / Unhold



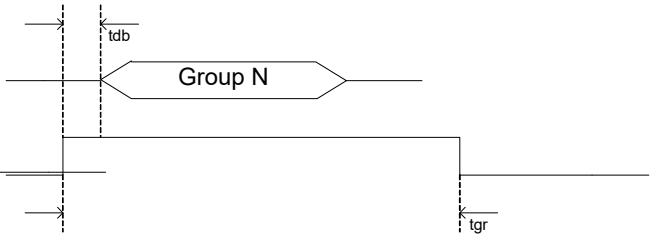

(d) Trigger Pulse Width < Group Length
Option Setting = Level / Hold



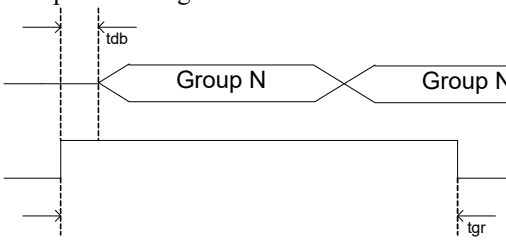

(e) Trigger Pulse Width > Group Length
Option Setting = Edge / Unhold



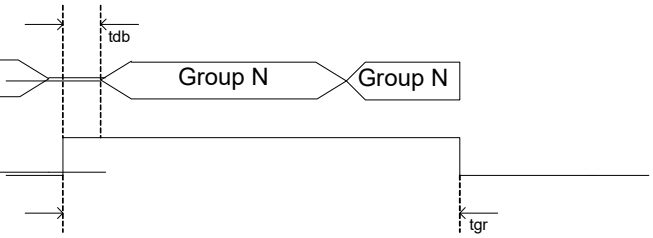

(f) Trigger Pulse Width >Group Length
Option Seeting = Edge / Hold



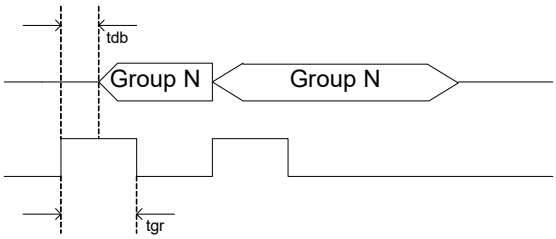

(g) Trigger Pulse Width > Group Length
Option Setting = Level / Unhold



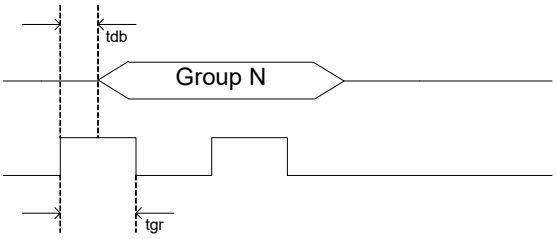

(h) Trigger Pulse Width > Group Length
Option Setting = Level / Hold



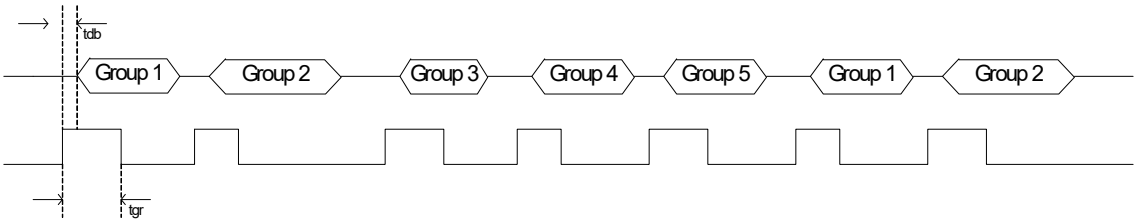
(i) Option Setting = Retrigger




(j) Option Setting = Irretrigger




(k) TG1 = Sequential Trigger & From Group1~Group5



# 触发语音组合案例

| Voice File | Description |
|---|---|
| Voice File A | Hello ( 1.5”) |
| Voice File B | Good Morning (3”) |
| Voice File C | John (1”) |
| Voice File D | Tom (1”) |
| Voice File E | Mary (1.5”) |
| | |
| | |

Group1 = Step1 + Step 2
Group 2 = Step3 + Step 4 + Step 5
Group 3 = Step 6 + Step 7

Group1 = Hello John
Group 2= Hello Tom Good Morning
Group 3 = Good Morning Mary

Step1 = Voice File A
Step 2 = Voice File C
Step 3 = Voice File A
Step 4 = Voice File D
Step 5 = Voice File B
Step 6 = Voice File B
Step 7 = Voice File E

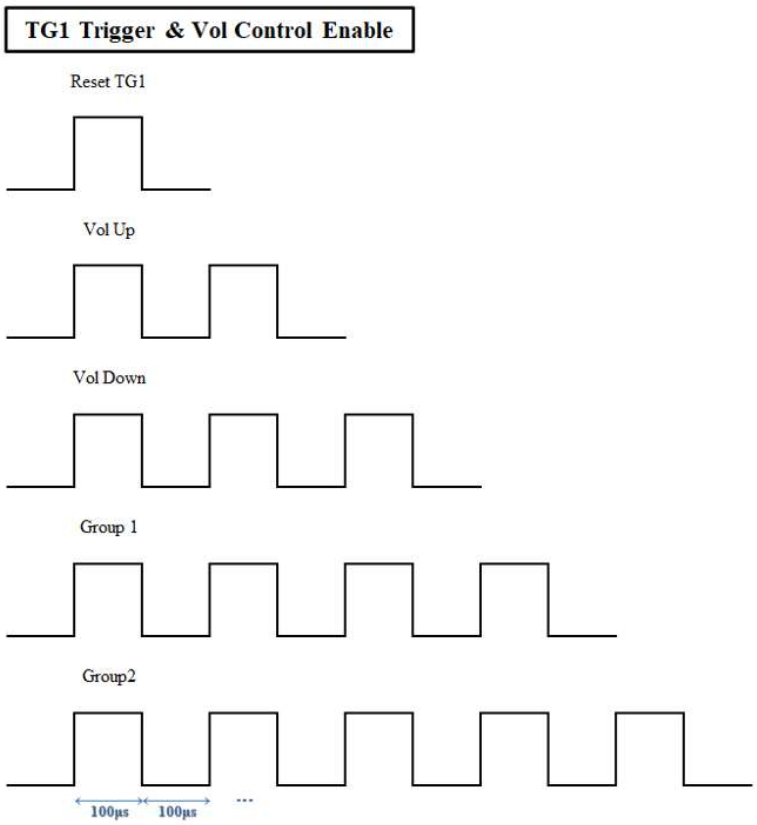
Total use 3 Group , 7 Steps
Voice duration= Hello + Good Morning + John + Tom + Mary
= 1.5” + 3” + 1” + 1” + 1.5”
= 8”
Total duration = 8”( 80”-8” = 72” space is free , can add more Voice File, If body=AX8080 )

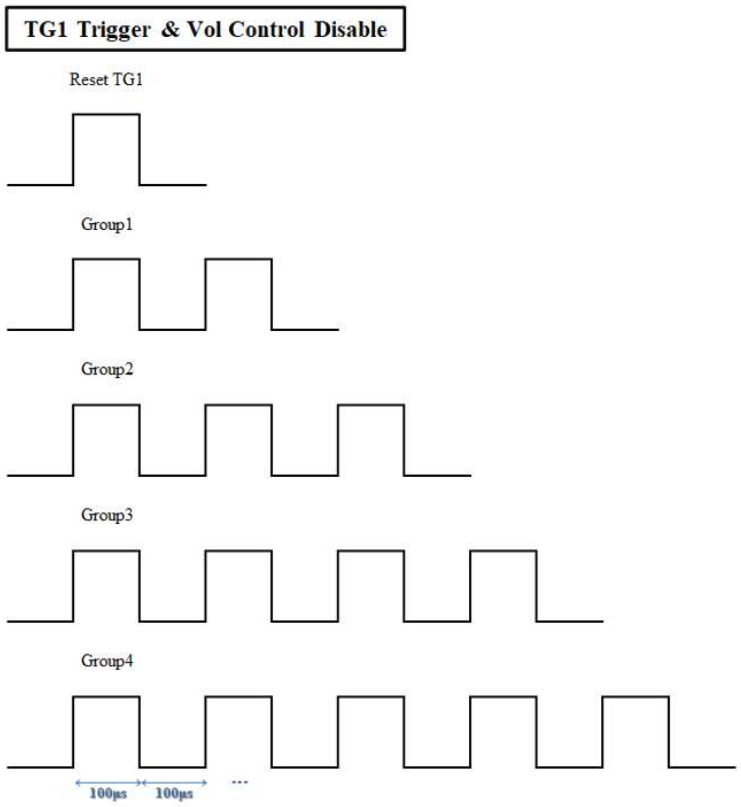
# MCU 模式指令表

| Command | PIN | Command Data | Clock Count | Description |
|---|---|---|---|---|
| Initial | TG1 | 0x1E5858 | 24 clk | Wake up the chip |
| | TG3 | | | |
| START | TG1 | 0x0A0140 | 24 clk | Wake up the chip |
| | TG3 | | | |
| STOP | TG1 | 0x0A0100 | 24 clk | Stop the chip (Enter sleep mode) |
| | TG3 | | | |
| PLAY | TG1 | 0x18+**Group Address Ex:0x00C8** | 24 clk | Play Voice Step Address |
| | TG3 | | | |
| PAUSE | TG1 | 0x1600 | 16 clk | Pause the Playback and hold the Voice data |
| | TG3 | | | |
| RESUME | TG1 | 0x1600 | 16 clk | Resume Playback from the previous Voice data |
| | TG3 | | | |
| Check PAUSE | TG1 | 0x2200 | | Check Voice is pause or not. DO.Bit3=1:PAUSE |
| | TG3 | Read 1 byte(Check **DO[3]** ) | | |
| Read Busy | TG1 | 0x2200 | 16 clk | Check Voice is Stop or Not |
| | TG3 | Read 1 byte(Check **DO[6]**) | | |
| Change Volume | TG1 | 0x0A05+**Volume(00~07)** **Ex: Volume = 5 ,** **DI = 0x0A0505** | 24 clk | |
| | TG3 | | | |
| Change Play Rate | TG1 | 0x0A06+**PR** **PR = 0x00~0x1D** **PlayRate = 96Khz/(32-PR)** | 24 clk | |
| | TG3 | | | |

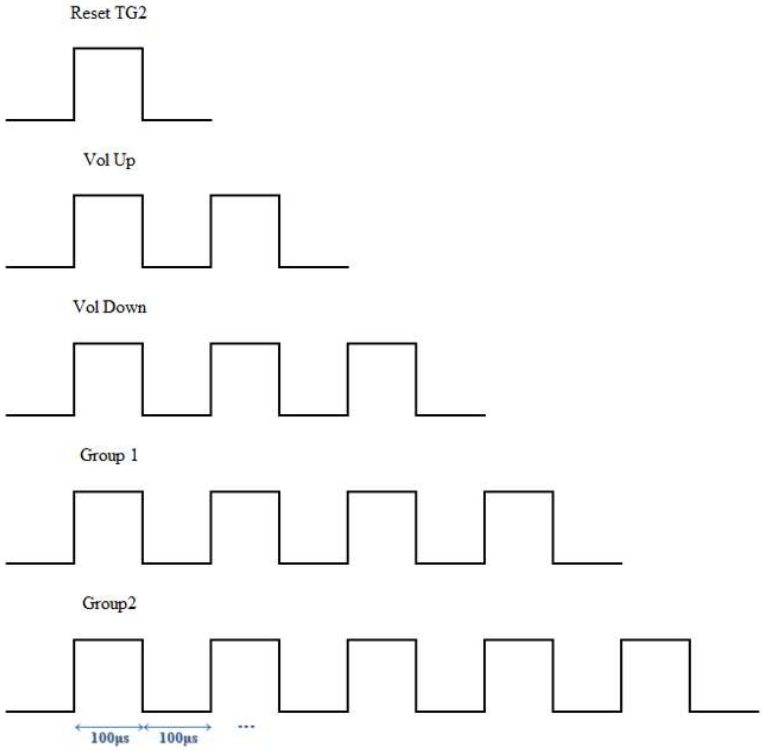
◆ Group Address is generated by the Tool.

# Pulse Mode Signal

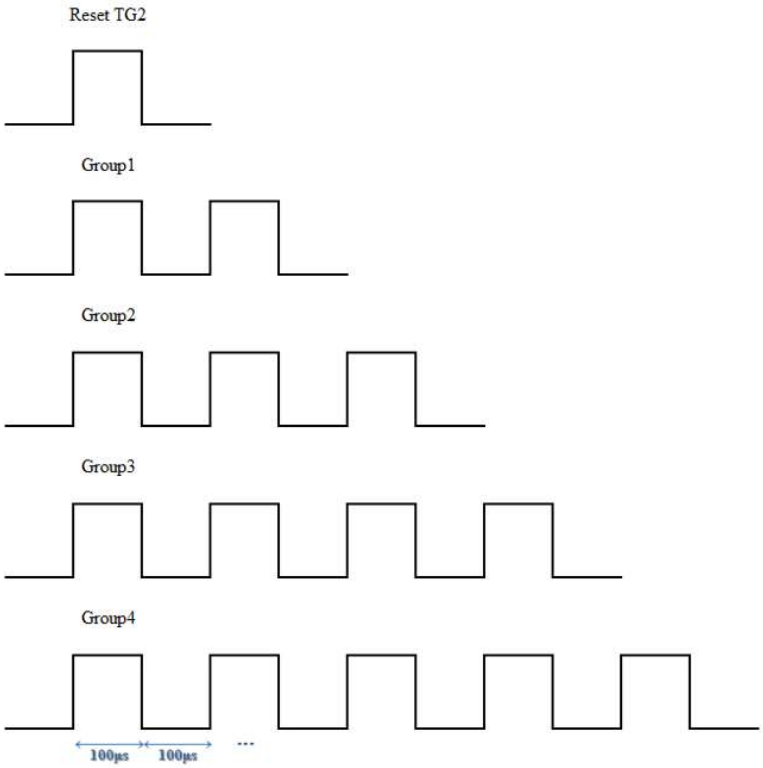


**TG2 Trigger & Vol Control Enable**




**TG2 Trigger & Vol Control Disable**



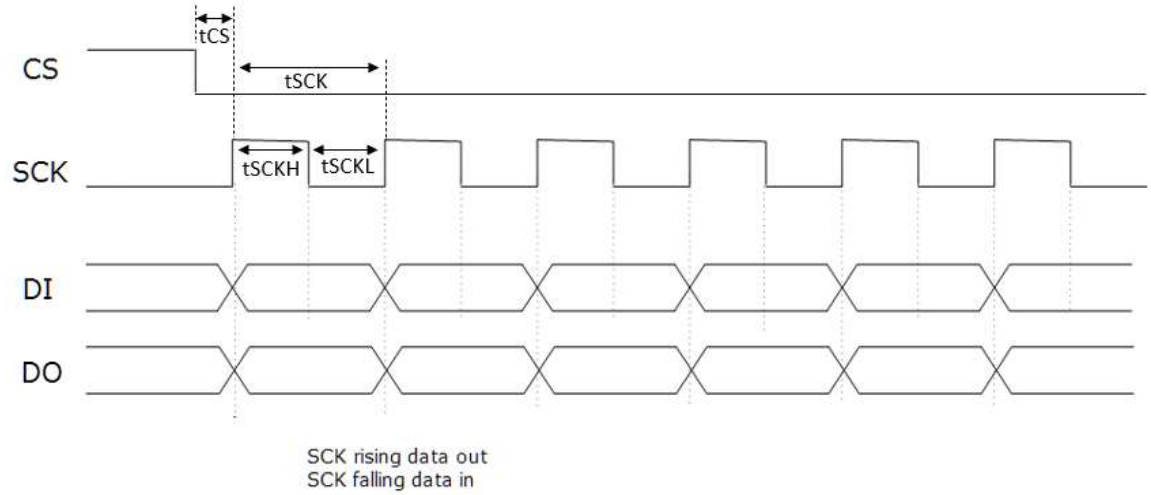
# MCU 模式时序图

TG4 – SPI CS in (Optional)

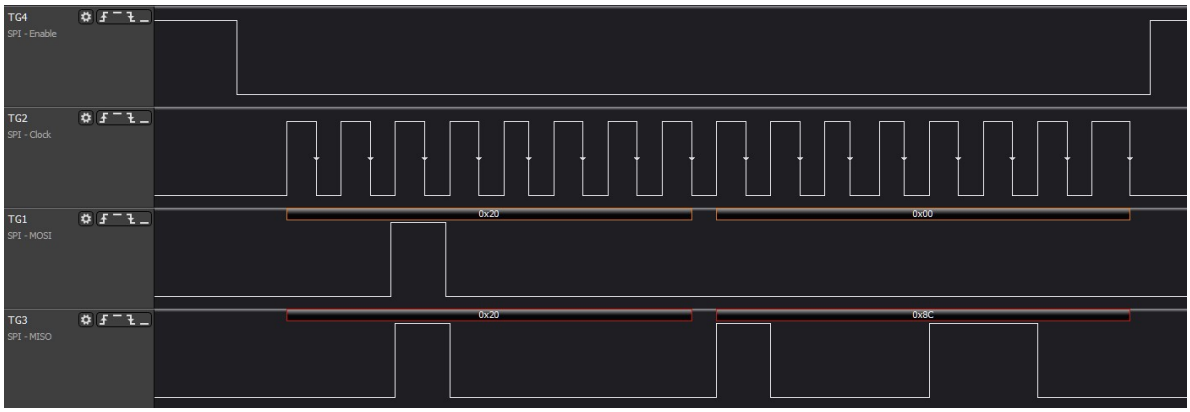
TG2 – SPI clock in (Frequency < 20 MHz，SCK)

TG1 – SPI data in (DI)

TG3 – SPI data out (DO)




范例 : 读取 ID = 0x20 , 0x00 (读入 0x8C)



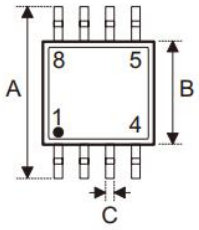

| Symbol | Characteristic | Min. | Unit |
|---|---|---|---|
| tCS | Chip Select setup time | 1 | us |
| tSCK | Clock Duty Width | 1 | us |
| tSCKH | Clock High Width | 500 | ns |
| tSCKL | Clock Low Width | 500 | ns |

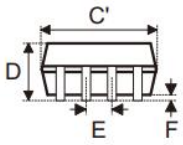
# 直流特性

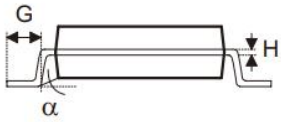
| Symbol | Parameter | Min | Typ | Max | Unit | Condition |
|---|---|---|---|---|---|---|
| VDD | Operating Voltage | 2.0 | | 5.5 | V | 1.536MHz |
| $I_{sb}$ | Standby current | | | 5 | uA | VDD = 3.0V |
| | | | | 5 | uA | VDD = 4.5V |
| $I_{OP}$ | Operating Current | | 0.6 | | mA | VDD = 3.0V , No Load |
| | | | 0.8 | | mA | VDD = 4.5V , No Load |
| $I_{IH}$ | Input Current | | 2 | | uA | VDD=3.0V , 1.5M Pull-low |
| | | | 5 | | uA | VDD=3.0V , 270K Pull-low |
| $I_{OH}$ | Output drive Current | | 7 | | mA | VDD=3.0V<br>TG voltage = 2.7V |
| $I_{OL}$ | Output sink Current | | 7 | | mA | VDD=3V<br>TG voltage = 0.3V |
| $I_{POH}$ | PWM output current | | 54 | | mA | VDD=3.0V , $V_{OH}$ = 2.7V |
| $I_{POL}$ | | | 67 | | mA | VDD=3.0V , $V_{OL}$ = 0.3V |
| $V_{IH}$ | Input high level | | 2 | | V | VDD=3.0V |
| $V_{IL}$ | Input low level | | 1 | | V | VDD=3.0V |
| △F/F | Frequency deviation by voltage drop | -1 | | 1 | % | $\frac{Fmax(5.0V) - Fmin(2.0V)}{Fmax(5.0V)}$ |

# 封装信息 (Package Information)

## 8-pin SOP (150mil) Outline Dimensions




| Symbol | Dimensions in inch | | |
|---|---|---|---|
| | Min. | Nom. | Max. |
| A | — | 0.236 BSC | — |
| B | — | 0.154 BSC | — |
| C | 0.012 | — | 0.020 |
| C′ | — | 0.193 BSC | — |
| D | — | — | 0.069 |
| E | — | 0.050 BSC | — |
| F | 0.004 | — | 0.010 |
| G | 0.016 | — | 0.050 |
| H | 0.004 | — | 0.010 |
| α | 0° | — | 8° |

| Symbol | Dimensions in mm | | |
|---|---|---|---|
| | Min. | Nom. | Max. |
| A | —F | 6.00 BSC | — |
| B | — | 3.90 BSC | — |
| C | 0.31 | — | 0.51 |
| C′ | — | 4.90 BSC | — |
| D | — | — | 1.75 |
| E | — | 1.27 BSC | — |
| F | 0.10 | — | 0.25 |
| G | 0.40 | — | 1.27 |
| H | 0.10 | — | 0.25 |
| α | 0° | — | 8° |