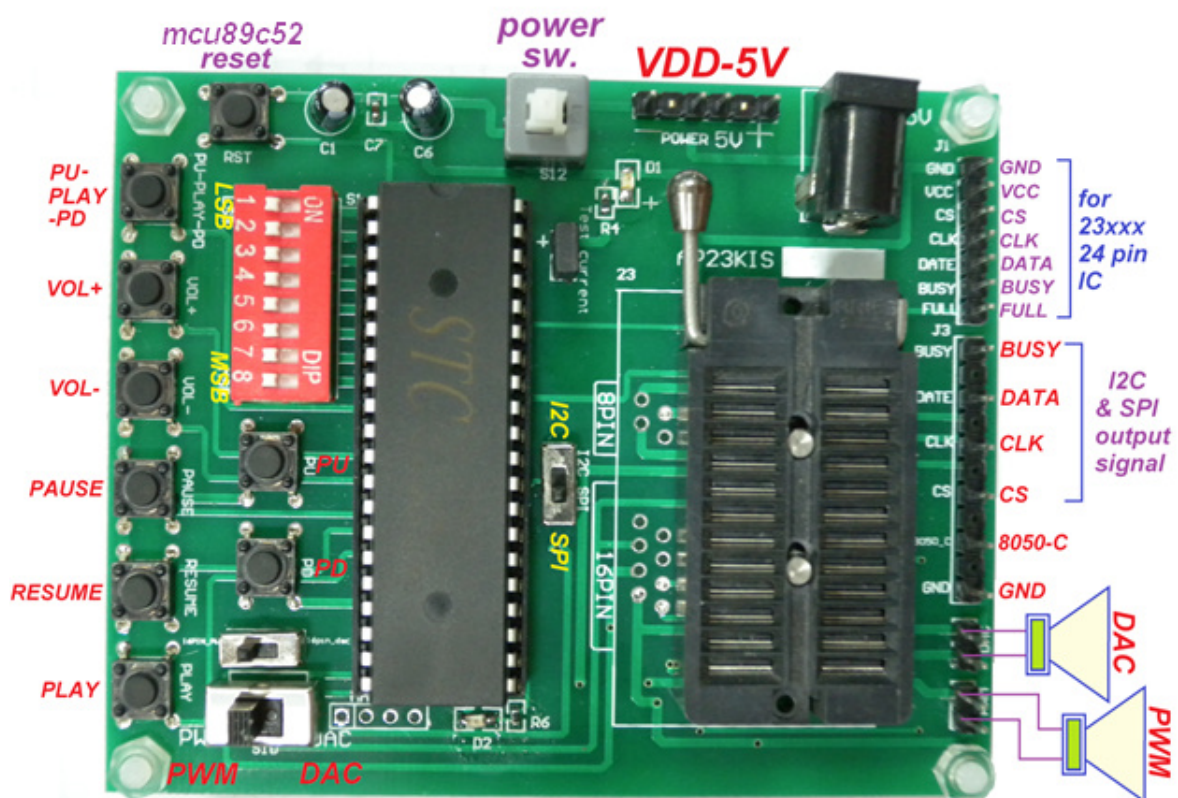


aP23KIS Demo Board user manual for aP23xxx I2C & SPI interface control

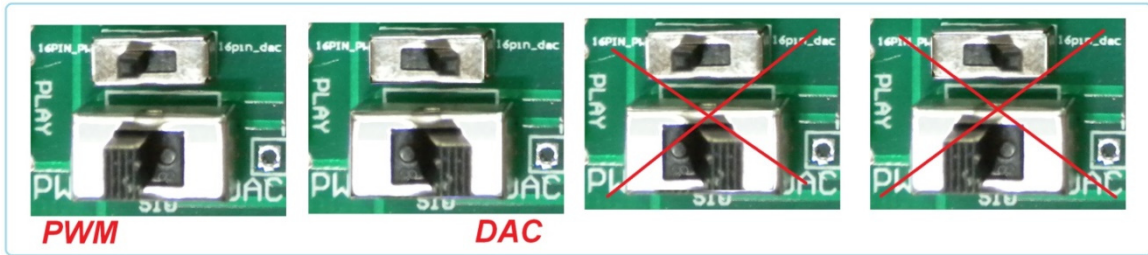
- Part no. : **aP23KIS**
- Pcb no. : 6601
- For body : aP23085, aP23170, aP23341, aP23682
- Mcu simulator the **I2C** & **SPI** interface control for aP23xxx family.
 AP23xxx 16 pin : Support I2C & SPI both
 AP23xxx 8 pin : Support I2C only



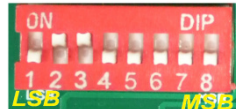
1. ADAPTER **5V** or POWER SUPPLY **5V**
2. Select slide sw. [**I2C**] or [**SPI**] control



3. DAC or PWM select :

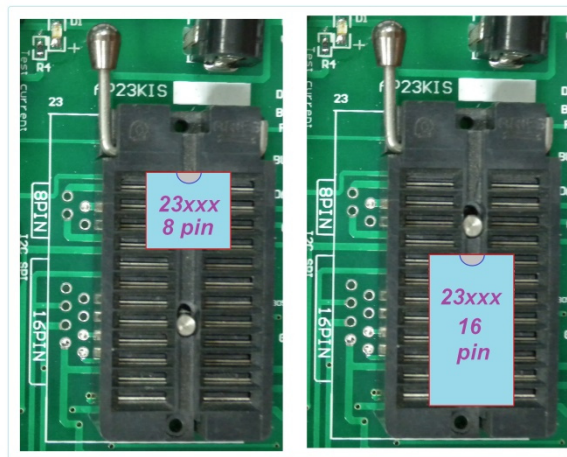


4. Set up message address [DIP SW. x 8] :



ex: address-6

5. Insert aP23xxx IC [8 pin] or [16 pin] to TEXTTOOL :



6. Power sw. = [ON]

7. Key x 8 : PU-PLAY-PD , VOL+ , VOL- , PAUSE , RESUME , PLAY , PU , PD

7a. PU-PLAY-PD key :

7a1. PWM : send command [**PU1** = 101001xxxxxxxx] to aP23xxx IC
& wake up ic without RampUp

DAC : send command [**PU2** = 101010xxxxxxxx] to aP23xxx IC
& wake up ic with RampUp about 160ms

7a2. Send command [**PLAY** = 100110-0000000110] to aP23xxx IC
& start playing [sound-06] & busy-H [or busy-L]

7a3. Detect out1 pin = **busy-H to busy-L** [or busy-L to busy-H] Loop [7a3]

- 23xxx 8 pin : out1 pin-5 [SBT]
- 23xxx 16 pin : out1 pin-8 [out1]

7a4. PWM : send command [**PD1**= 101101xxxxxxxx] to aP23xxx IC
& IC shut down without RampDown

DAC : send command [**PD2**= 101110xxxxxxxx] to aP23xxx IC
& IC shut down with RampDown about 160ms

7b. VOL+ key : volume level control [ADD +1]

- Sound playing send command [**VOL++** = 010010xxxxxxxxxx]
- 7c. **VOL- key** : volume level control [DEC -1]
 Sound playing send command [**VOL--** = 010101xxxxxxxxxx]
- 7d. **PAUSE key** :
 Sound playing send command [**PAUSE** = 011001xxxxxxxxxx]
- 7e. **RESUME key** :
 Sound playing send command [**RESUME** = 011010xxxxxxxxxx]
-

- 7f. **PU key** : only wake up IC & no play
- PWM : send command [**PU1** = 101001xxxxxxxxxx] to aP23xxx IC & wake up ic without RampUp
 - DAC : send command [**PU2** = 101010xxxxxxxxxx] to aP23xxx IC & wake up ic with RampUp about 160ms

- 7g. **PD key** : stop play & IC shut down
- PWM : send command [PD1= 101101xxxxxxxxxx] to 23xxx IC & IC shut down without RampDown
 - DAC : send command [PD2= 101110xxxxxxxxxx] to aP23xxx IC & IC shut down with RampDown about 160ms

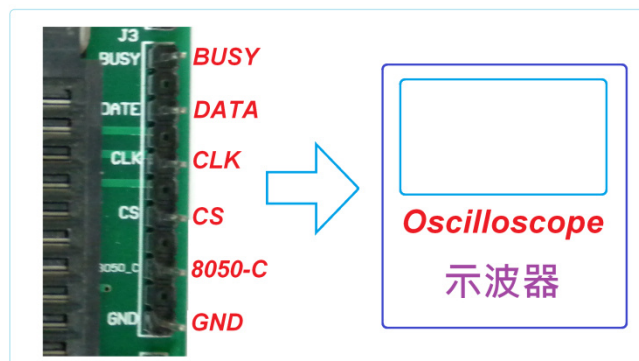
7h. PLAY key :

7h1. IC wake up :

- Send command [PLAY = 100110-0000000110] to aP23xxx IC
- start playing [sound-06] & busy-H [or busy-L]

7h2. IC SLEEP [no wake up] :

- Send command [PLAY = 100110-0000000110] to aP23xxx IC
- IC wake up --- PWM no Ramp , DAC with RampUp about 160ms
- start playing [sound-06] & busy-H [or busy-L]
- PS : play ended , ic no shut down

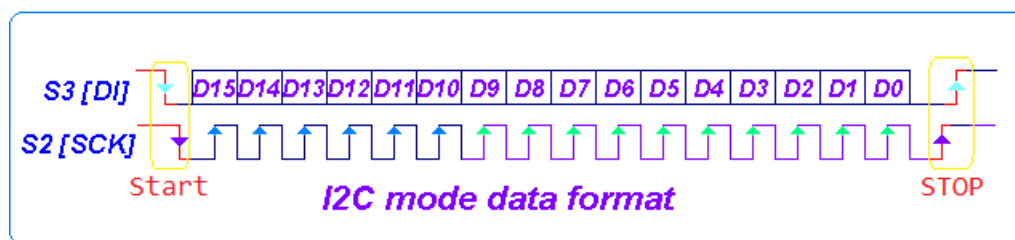


• **I2C mode interface control :**

I2C mode : S2 = SCLK // S3 = SDATA // SBT= busy-H																
	D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
PLAY	1	0	0	1	1	0	098h + address [A9~A0]									
PU1	1	0	1	0	0	1	0A4h + address don't care --- without Ramp-up									
PD1	1	0	1	1	0	1	0B4h + address don't care --- without Ramp-down									
PU2	1	0	1	0	1	0	0A8h + address don't care --- with Ramp-up									
PD2	1	0	1	1	1	0	0B8h + address don't care --- with Ramp-down									
VOL	0	1	0	0	0	1	0	0	0	0	0	0	VOL [3:0]			
VOL++	0	1	0	0	1	0	048h + address don't care									
VOL--	0	1	0	1	0	1	054h + address don't care									

1. Power on create — [stop condition], ex: PD1 or PD2
IC enter I2C mode & IC shut down

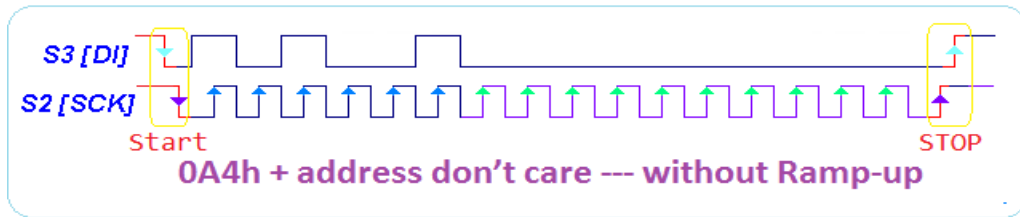
2. I2C mode data format :



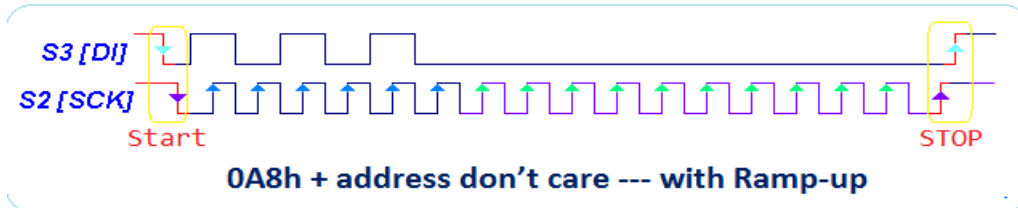
- 2a. START condition : S3[sdata] high to low + delay + S2[sclk] high to low
- 2b. D15~D10 : command bit
- 2c. D9~D0 : address bit
- 2d. SCK low to high [LATCH] the [DI]
- 2e. STOP condition : S2[sclk] low to high + delay + S3[sdata] low to high
- 2f. S3[sadat] change the data, must be S2[sclk]=low

3. IC wake up : send PU1/PU2

- 3a. PU1 = 0A4h + address don't care --- without Ramp-up --- for PWM



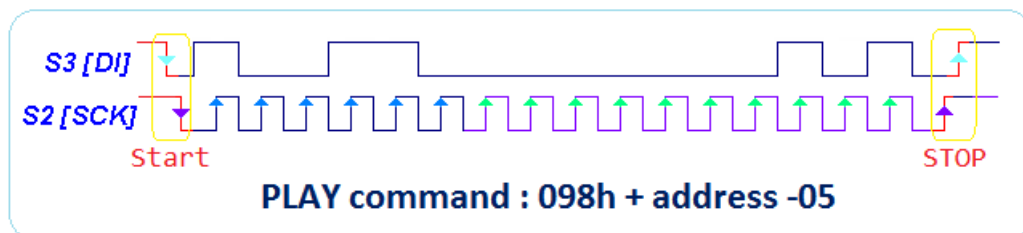
3b. $PU2 = 0A8h + \text{address don't care} \text{ --- with Ramp-up about } 160\text{ms} \text{ --- for DAC}$



4. PLAY command :

4a. **PLAY** command :

--- $SBT[8 \text{ pin}] / OUT1[16 \text{ pin}] : \text{set up [busy-H]}$



Play address-00 [1001-1000-0000-0000] = playing sw1.

Play address-01 [1001-1000-0000-0001] = playing sw2.

Play address-05 [1001-1000-0000-0101] = playing sw6.

Play address-11 [1001-1000-0000-1011] = playing sw12.

Send play command : playing sound & busy pin low to high

4b. **Stop play :**

4b1. Send PD1 or PD2 : stop play & IC shut down

4b2. Playing..... retrigger play [mute]

5. play ended & shut down :

5a. play ended : check busy pin high to low

Playing sound : busy pin = high

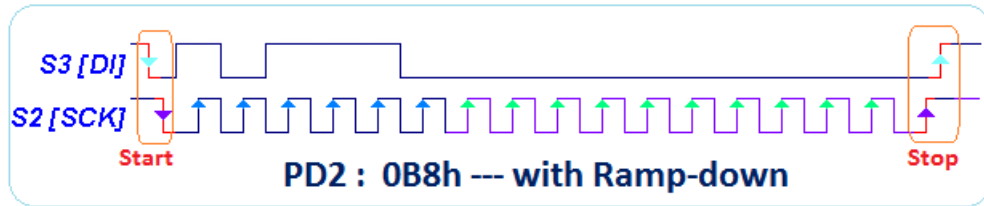
Play **ended** : busy pin --- High to Low

5b1 send next play command & playing new sound

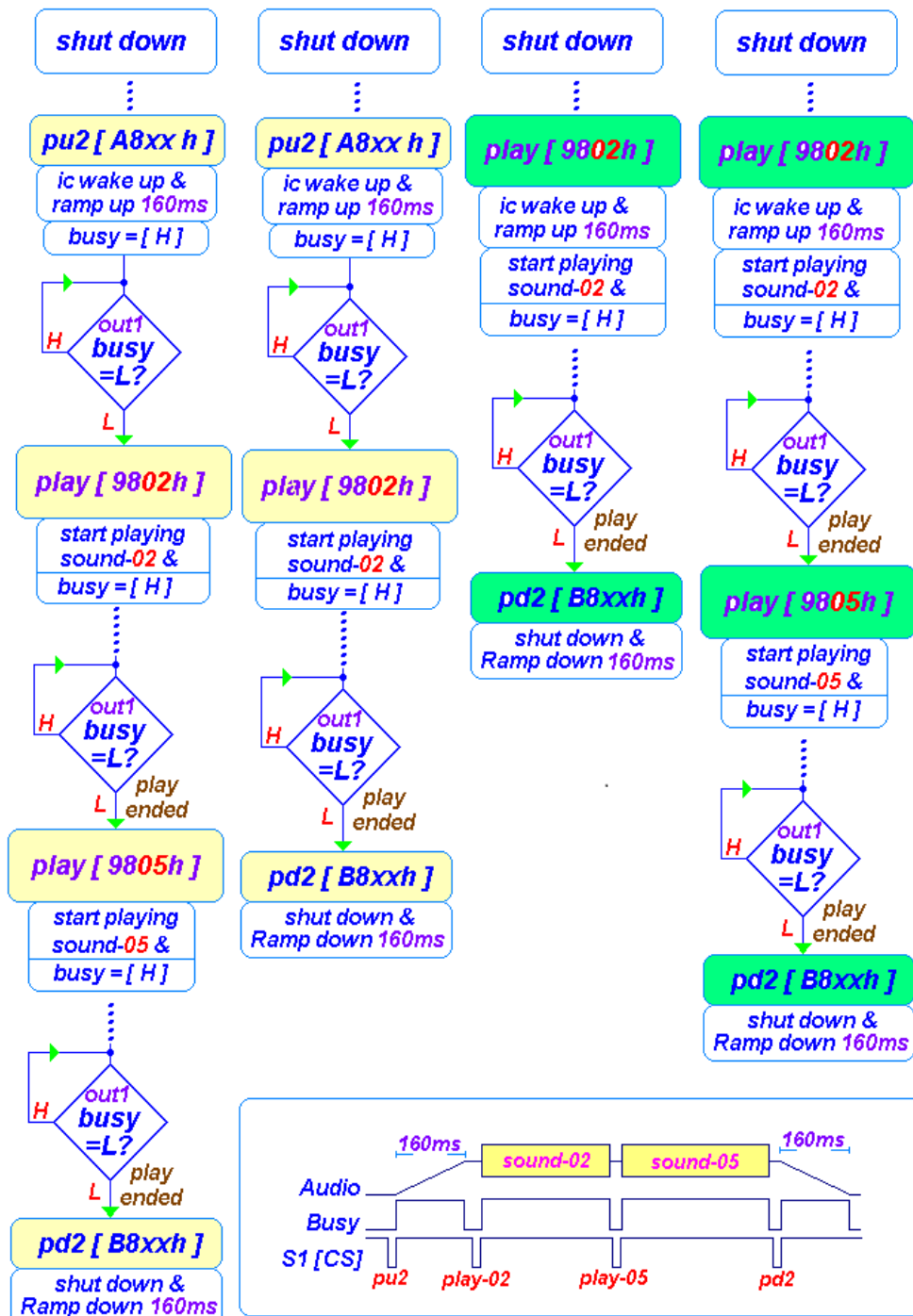
5b2. IC shut down : send PD1/PD2 stop play & ic shut down

PD1 : without Ramp down for PWM

PD2 : with Ramp down 160ms for DAC



6. Flow chart :

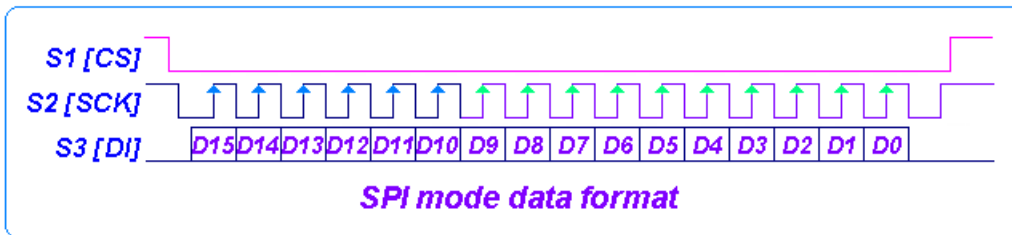


• **SPI mode interface control :**

SPI mode : S1 = CS // S2 = SCLK // S3 = SDATA//out1 = busy-H																
	D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0

PLAY	1	0	0	1	1	0	098h + address [A9~A0]						
PU1	1	0	1	0	0	1	0A4h + address don't care --- without Ramp-up						
PD1	1	0	1	1	0	1	0B4h + address don't care --- without Ramp-down						
PU2	1	0	1	0	1	0	0A8h + address don't care --- with Ramp-up						
PD2	1	0	1	1	1	0	0B8h + address don't care --- with Ramp-down						
VOL	0	1	0	0	0	1	0	0	0	0	0	0	VOL [3:0]
VOL++	0	1	0	0	1	0	048h + address don't care						
VOL--	0	1	0	1	0	1	054h + address don't care						

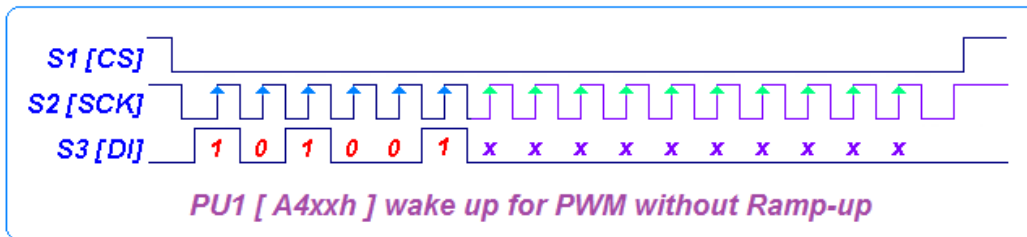
1. SPI mode data format :



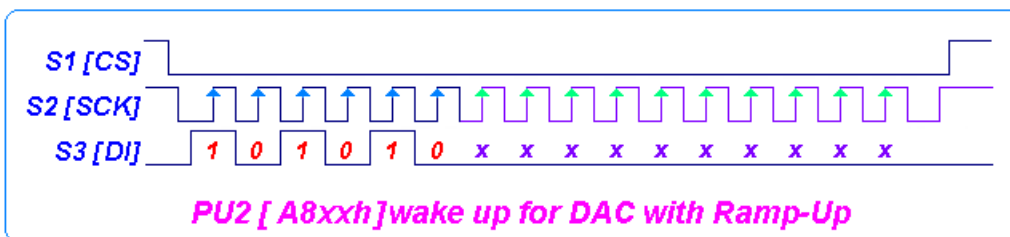
- 1a.. D15~D10 : command bit
- 1b.. D9~D0 : address bit
- 1d. SCK low to high [LATCH] the [DI]
- 1e. S3[sadat] change the data,must be S2[sclk]=low

2. IC wake up : send PU1/PU2

2a. PU1 = 0A4h + address don't care --- without Ramp-up --- for PWM



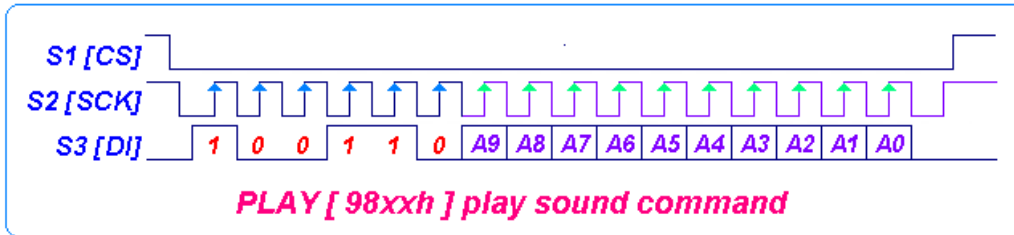
2b. PU2 = 0A8h + address don't care --- with Ramp-up about 160ms --- for DAC



3. PLAY command :

3a. PLAY command :

--- SBT [8 pin] / OUT1 [16 pin] : set up [busy-H]



Play address-00 [1001-1000-0000-0000] = playing sw1.
 Play address-01 [1001-1000-0000-0001] = playing sw2.
 Play address-05 [1001-1000-0000-0101] = playing sw6.
 Play address-11 [1001-1000-0000-1011] = playing sw12.
 Send play command : playing sound & busy pin low to high

3b. **Stop play :**

- Send PD1 or PD2 : stop play & IC shut down
- Playing..... retrigger play [mute]

4. play ended & shut down :

5a. play ended : check busy pin high to low

Playing sound : busy pin = high

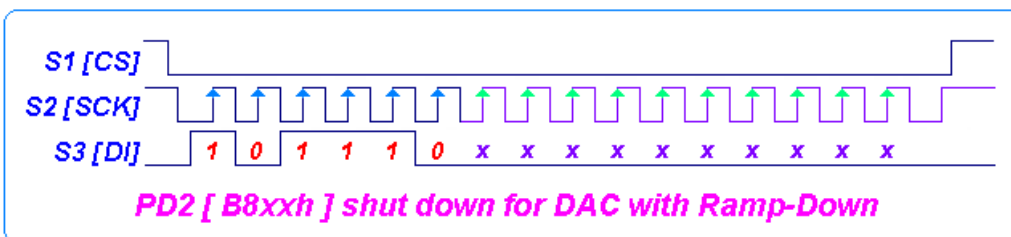
Play **ended** : busy pin --- High to Low

5b1 send next play command & playing new sound

5b2. IC shut down : send PD1/PD2 stop play & ic shut down

PD1 : without Ramp down for PWM

PD2 : with Ramp down 160ms for DAC



• **Play command v.s. Load command :**

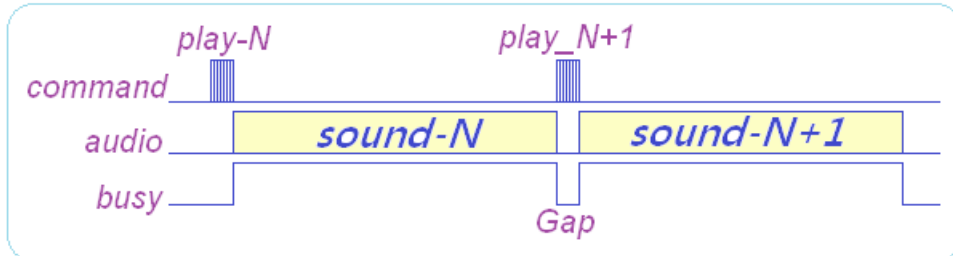
1. **play one times :**

play command = Load command

2. repeat playing :

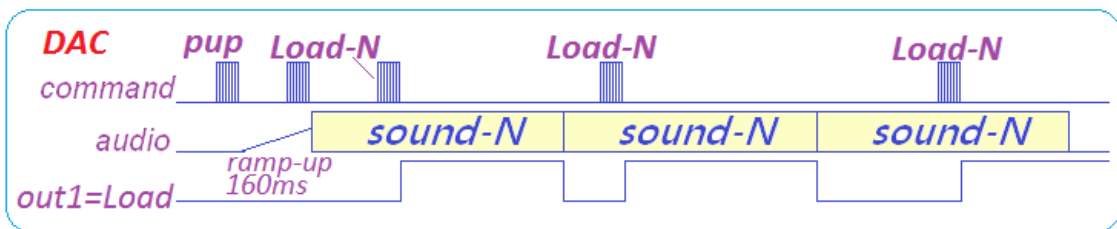
2a. play command repeat playing :

- 2a1. playing sound[N] & busy pin low to high
- 2a2. check play ended ? busy high to low
- 2a3. send play command address[N+1] & play sound[N+1]
- 2a4. loop play with [gap], gap time = $\text{clk} \times 16$ or [cs] time

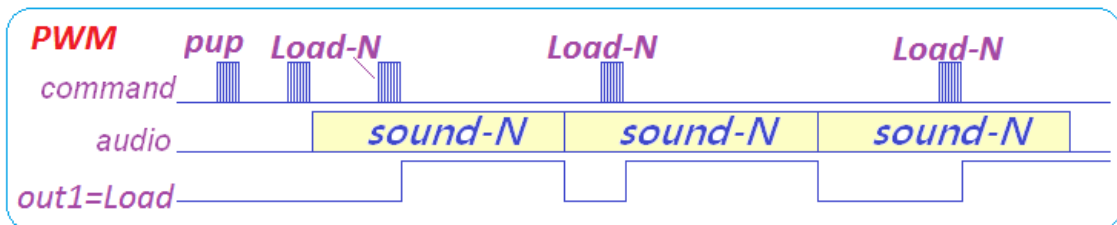


2b. LOAD command repeat playing :

- 2b1. Send pup command for Ic wake up
 PU1 : for PWM without Ramp-up
 PU2 : for DAC with Ramp-up 160ms
- 2b2. Send [LOAD] command & start play sound.....
- 2b3. Playing.....check Load output pin & send next load command
 & LOAD out1 pin low to high
- 2b3. Current sound play ended auto repeat playing
 & load out1 pin = high to low
- 2b4. Loop play : **no gap**
- 2b5 stop play : load play [mute] + send PD1/PD2 command for shut down



LOOP playing & no Gap



LOOP playing & no Gap