◆ Description

SC040 is a 40 Sec. PWM or **DAC** voice output with high quality speech ,2 input pin and 6 I/O pin simple speech.40 Sec. Voice Length at 6 KHz sampling and 4 bit hardware compression. Built-in oscillator for system clock without an external resistor. Maximum 64 voice groups. One Group contain several steps(voice section); Maximum 700 steps for all the Groups. User selectable 8bit / 5bit / 4 bit data compression. Support three mode trigger function (Stand Alone, Serial Trigger Mode, CPU Command Mode). Easy use development system is for function selection and voice combination . PC download the ROM code by the USB Port .

◆ Functions

- MAX voice file : 700
- MAX Groups : 64
- MAX Step : 700
- Signal step mute length : 0.64 s (6k sample rate)
- Operating Voltage range: 2.4V ~ 5V
- Total Voice Duration : 40” (240K Samples)
- Input pin : 2
- I/O pin : 6
- Voice output : PWM and DAC
- Sequential Key : TG1 -> 32 Groups.
  TG2 -> 21 Groups.
  TG5~TG12-> 1 Group
- Debounce time : 50 us or 10 ms
- On/Off function : only for TG1 & TG2
- Trigger mode (for all Input pins) :
  - Key Stand-alone Trigger Mode :
    A. Edge/Level
    B. Hold/Unhold
    C. Retrigger/Irretrigger

  - Serial Trigger Mode :
    Combinations of TG1 and TG5 to trigger maximum 64 Voice Group.

- CPU Command Mode :
  User command through TG1,TG2,TG5 & TG6 with serial CPU Interface to control the Multi-Playback function.

- **Output status** (for each Output pin):
  A. Stand by Status. (High/Low Status)
  B. Busy Low Active.
  C. Busy High Active.
  D. LED Flash at 6 Hz.
  E. LED Flash at 3 Hz.
  F. LED Flash at 1.5 Hz.
  G. LED Flash at 0.75 Hz.

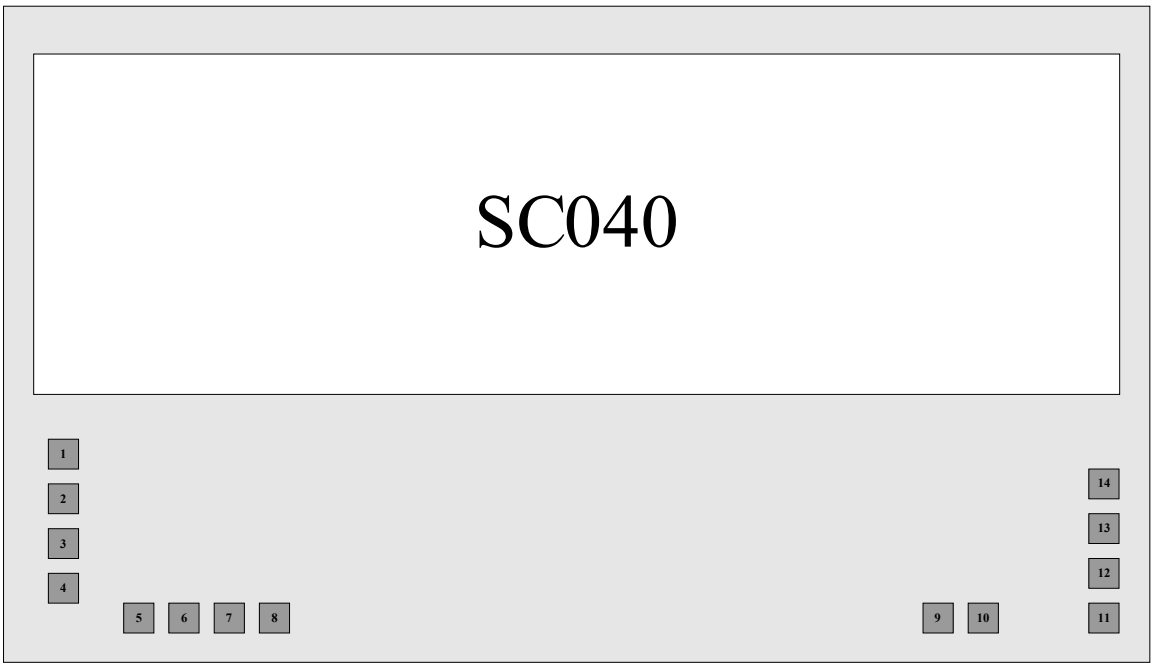
- **Play rate level** :

  SC040 can provide different play rate in one code as follow

Play rate(K)	Play rate(K)
3	6
3.2	6.4
3.31	6.85
3.42	7.38
3.55	8
3.69	8.72
3.84	9.6
4	10.66
4.17	12
4.36	13.71
4.57	16
4.8	19.2
5.05	24
5.33	
5.64	

◆ SC040 Pad Location

CHIP SIZE: (0, 0) (1730,1196) **UM**



NO	PAD NAME	X	Y	NO	PAD NAME	X	Y
1	TG2	-755	-224	8	TG12	-320	-507
2	TG1	-755	-314	9	VSS	192	-507
3	TG5	-755	-404	10	VSS	281	-507
4	TG6	-755	-494	11	PWM2	759	-529
5	TG7	-590	-507	12	PWM1	759	-412
6	TG8	-500	-507	13	VDD5	794	-325
7	TG11	-410	-507	14	VDD	794	-240

◆ PIN Descriptions

PIN NAME	I/O	Function
TG1	INPUT	Key Stand-alone Trigger Mode : TG1 is used to trigger the maximum 32 Voice Group one by one sequentially.
		Serial Trigger Mode : TG1 is used to trigger the maximum 64 Voice Group.
		CPU Command Mode : TG1 is used as Data Input Pin (DIO1).
TG2	INPUT	Key Stand-alone Trigger Mode : TG2 is used to trigger the maximum 21 Voice Group one by one sequentially.
		CPU Command Mode : TG2 is used as Clock Pin (CLK).
TG5	INPUT	Key Stand-alone Trigger Mode : TG5 is used trigger Only One Group.
		Serial Trigger Mode : TG5 is used to trigger the maximum 64 Voice Group
		CPU Command Mode : TG5 is used as Data Input Pin (DIO2).
		As a RESET PIN
	OUTPUT	As Output PIN , Output the BUSY or Flash Signal .
TG6	INPUT	Key Stand-alone Trigger Mode : TG6 is used trigger Only One Group.
		CPU Command Mode . TG6 is used as Selected Pin (CS).
	OUTPUT	As Output PIN , Output the BUSY or Flash Signal.
TG7	INPUT	Key Stand-alone Trigger Mode : TG7 is used trigger Only One Group.
	OUTPUT	As Output PIN , Output the BUSY or Flash Signal.
TG8	INPUT	Key Stand-alone Trigger Mode : TG8 is used trigger Only One Group.
	OUTPUT	As Output PIN , Output the BUSY or Flash Signal.
TG11	INPUT	Key Stand-alone Trigger Mode : TG11 is used trigger Only One Group.
	OUTPUT	As Output PIN , Output the BUSY or Flash Signal.
TG12	INPUT	Key Stand-alone Trigger Mode : TG12 is used trigger Only One Group.
	OUTPUT	As Output PIN , Output the BUSY or Flash Signal.
PWM1	OUTPUT	As a PWM PIN , can Directly drive the Speaker .
PWM2	OUTPUT	As a PWM PIN , can Directly drive the Speaker .
		As a DAC PIN , 8 bit D/A Current Output.
VDD5	INPUT	Power Supply PIN
VDD	INPUT	Power Supply PIN , Connected with VDD5 @ 2.4~3.6 V Working Voltage.
		Power Supply PIN , Connected with a 0.1 uF to VSS. @3.6~5V Working Voltage.
VSS	INPUT	Connected to Ground.

SC040 Application Circuit

SC040 3V Stand-alone Mode

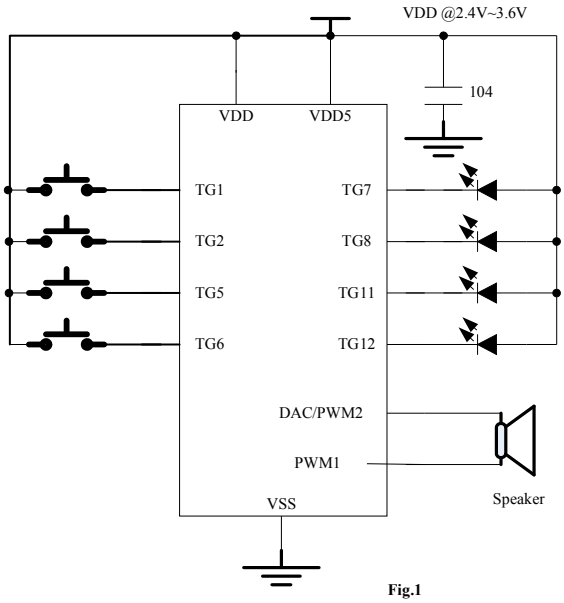


Fig.1

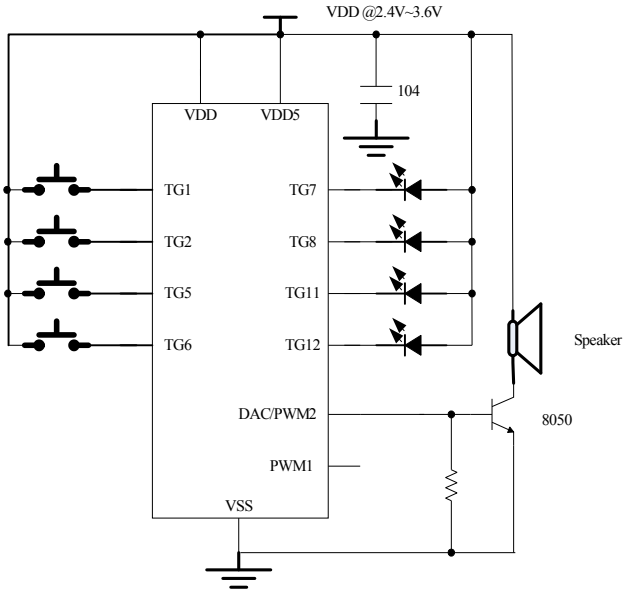


Fig.2

SC040 5V Stand-alone Mode

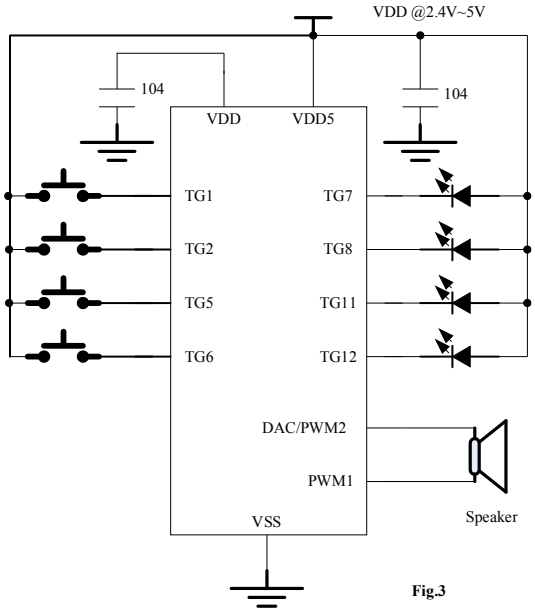


Fig.3

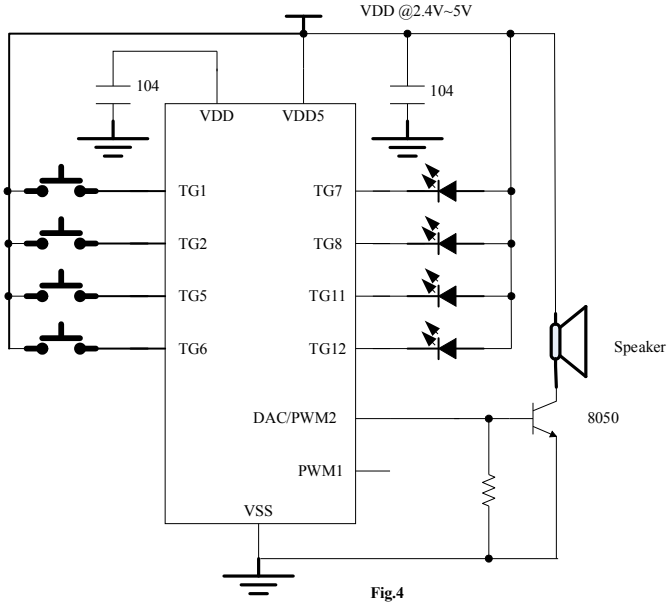


Fig.4

SC040 3V Serial Mode

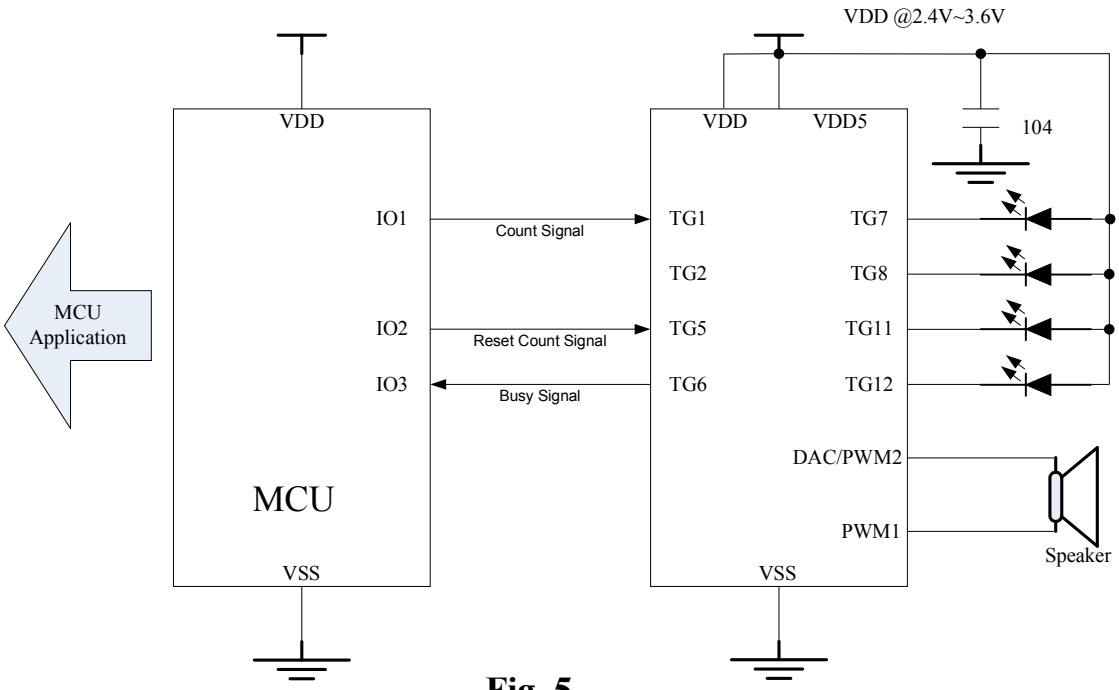


Fig. 5

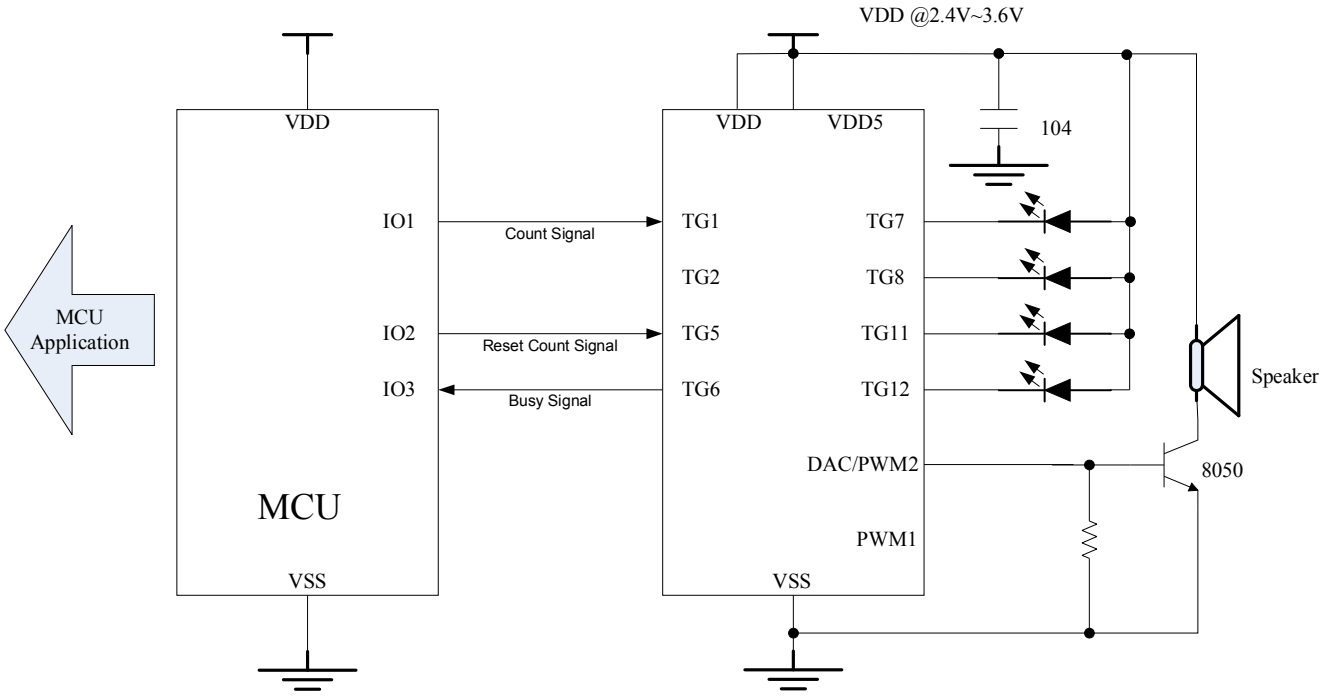


Fig. 6

SC040 5V Serial Mode

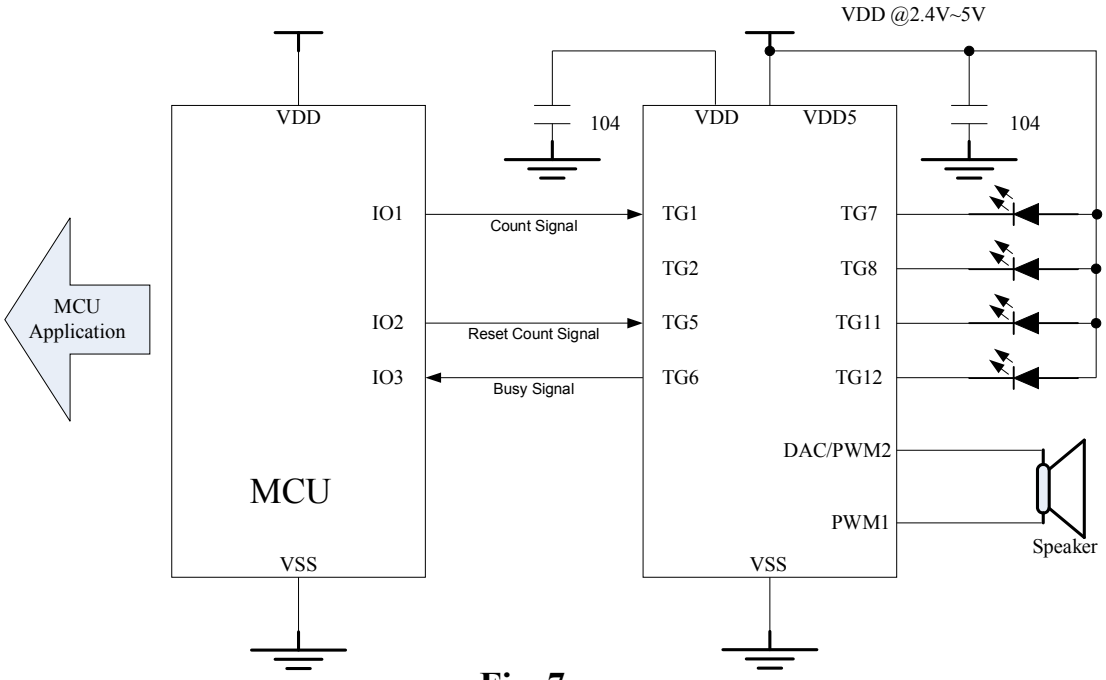


Fig. 7

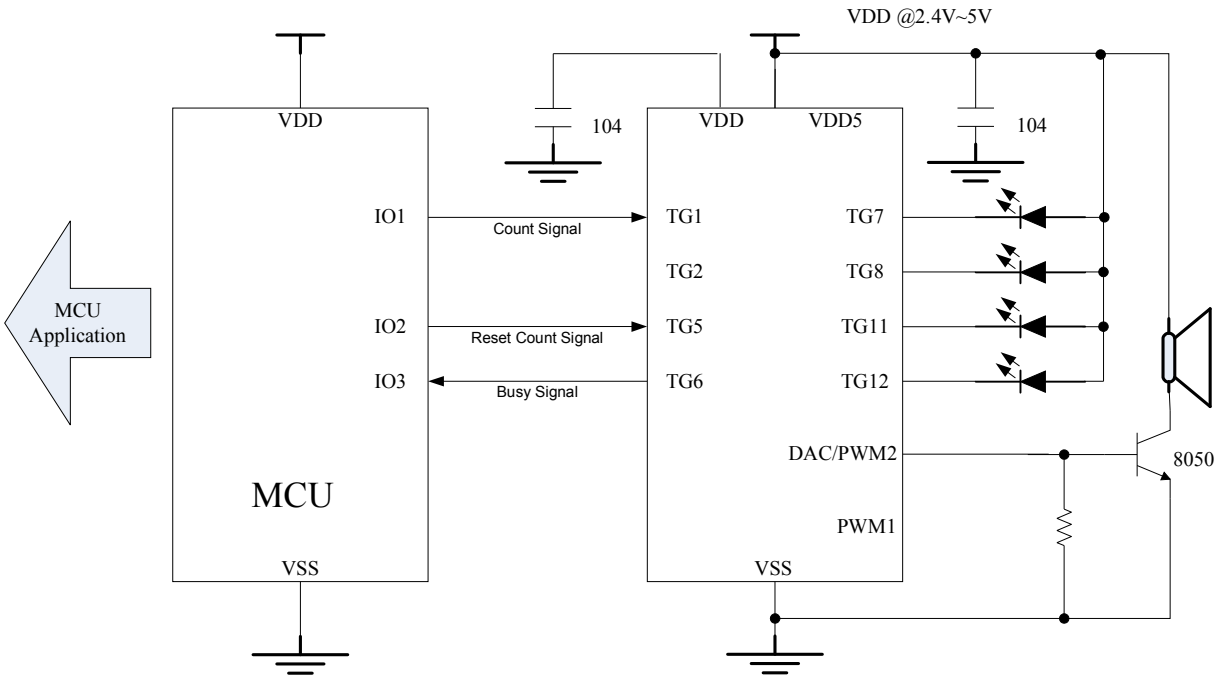


Fig. 8

SC040 3V CPU Mode

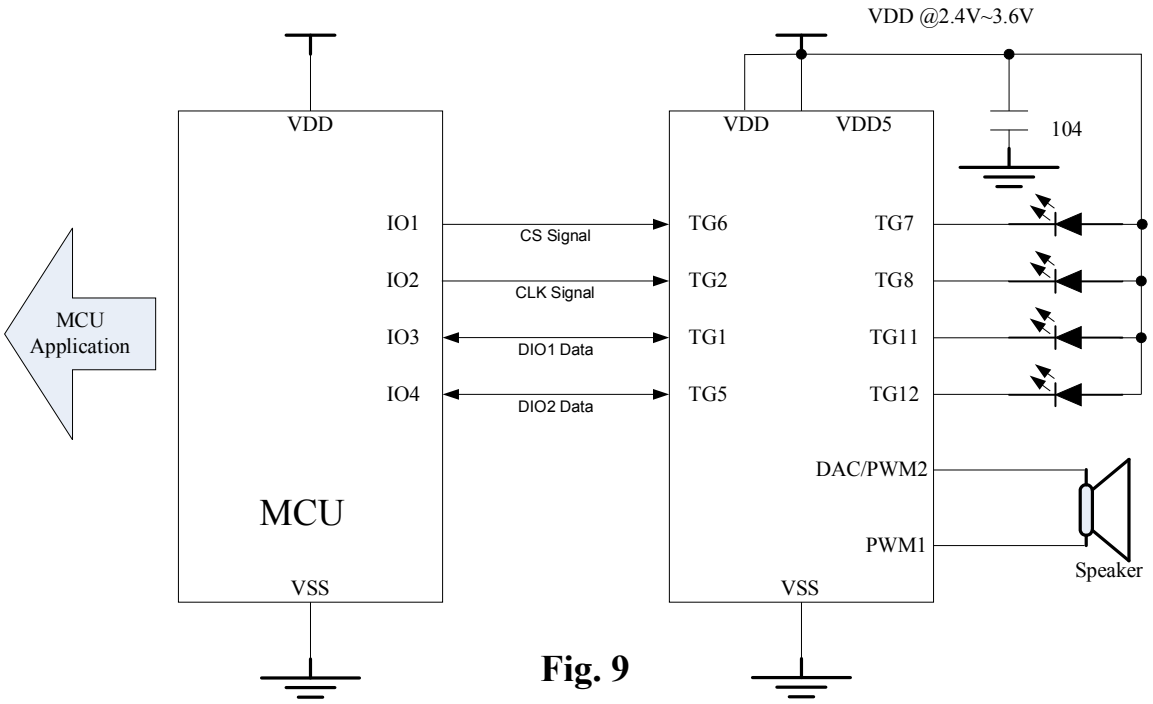


Fig. 9

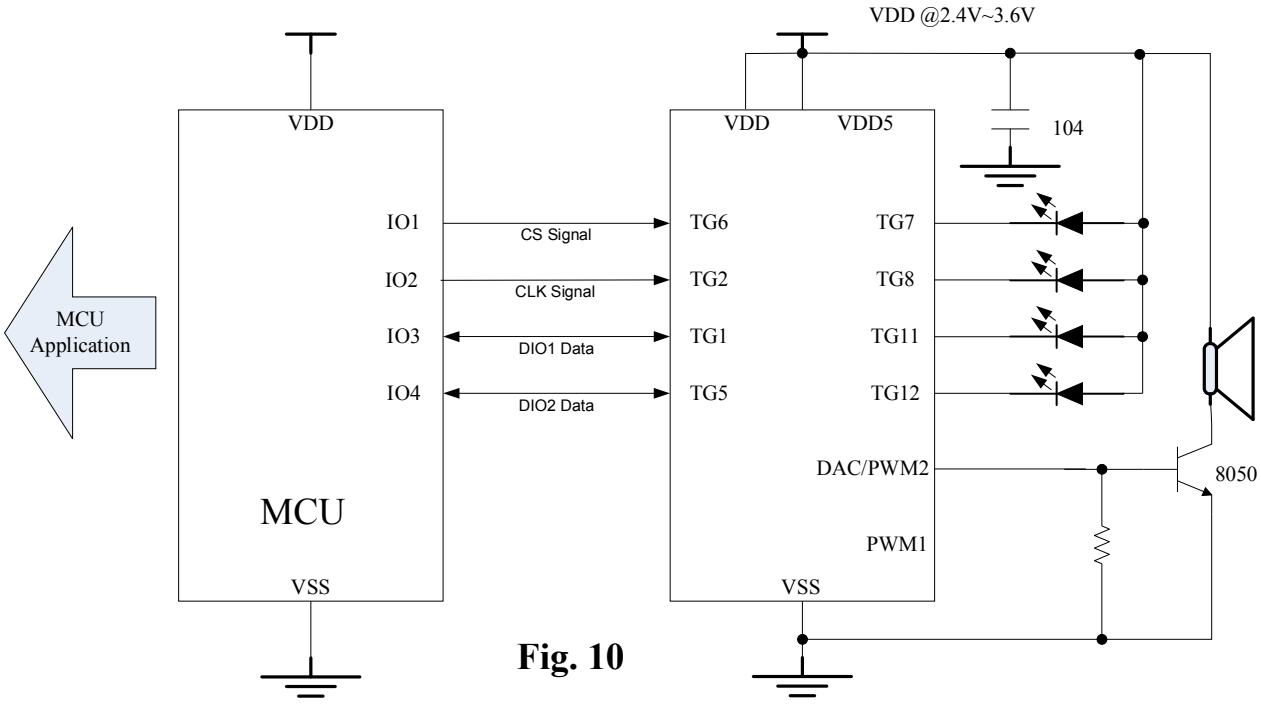


Fig. 10

SC040 5V CPU Mode

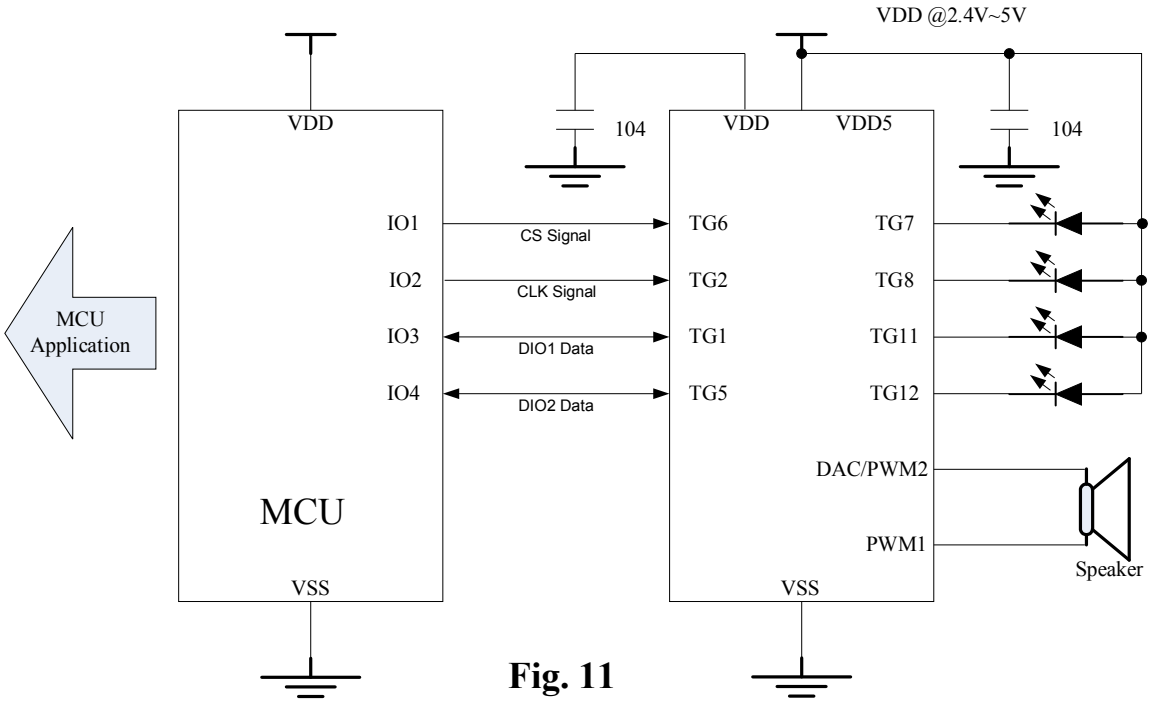


Fig. 11

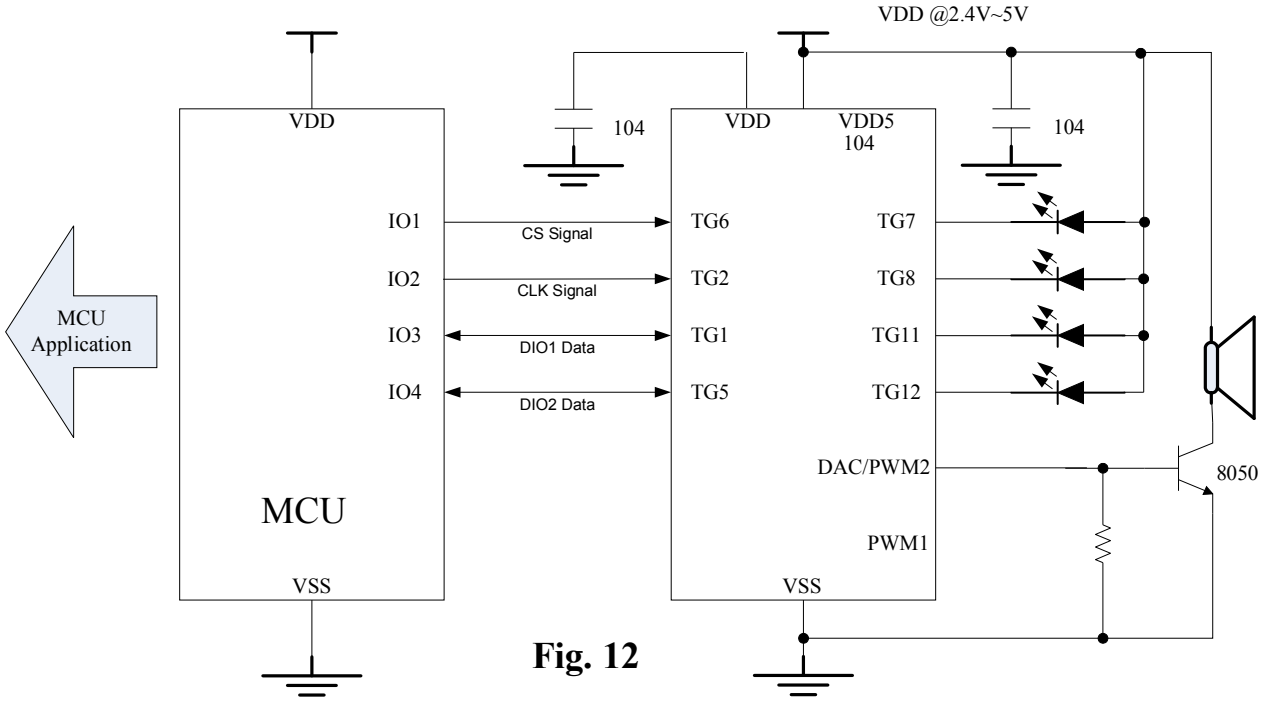
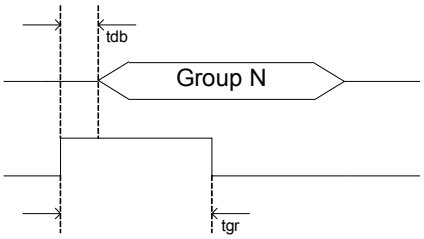


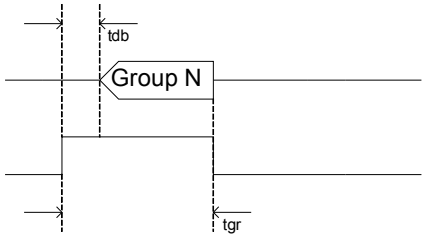
Fig. 12

◆ SC040 Trigger Timing

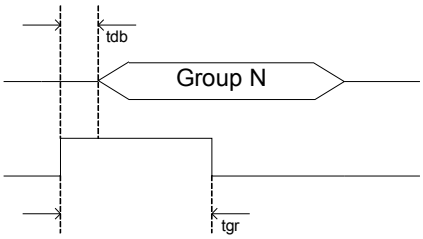
(a) Trigger Pulse Width < Group Length
Option Setting = Edge / Unhold



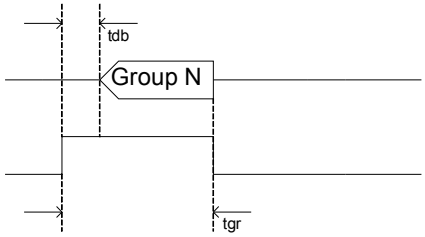
(b) Trigger Pulse Width < Group Length
Option Setting =Edge / Hold



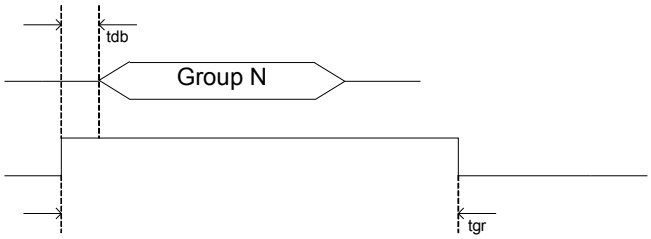
(c) Trigger Pulse Width < Group Length
Option Setting = Level / Unhold



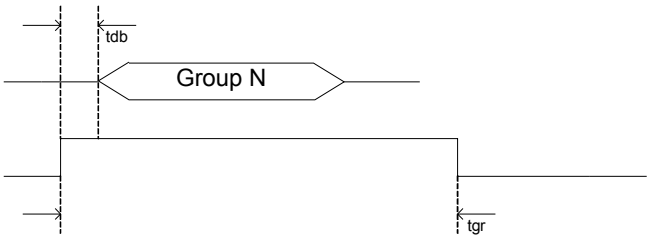
(d) Trigger Pulse Width < Group Length
Option Setting = Level / Hold



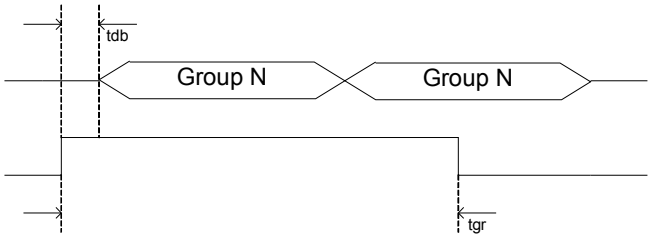
(e) Trigger Pulse Width > Group Length
Option Setting = Edge / Unhold



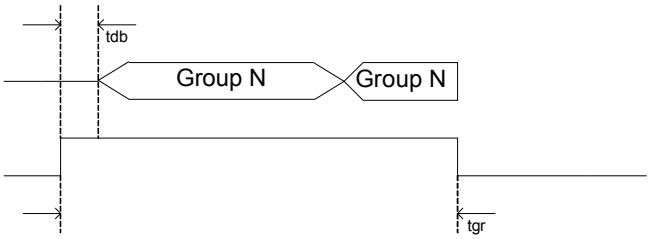
(f) Trigger Pulse Width >Group Length
Option Seeting = Edge / Hold



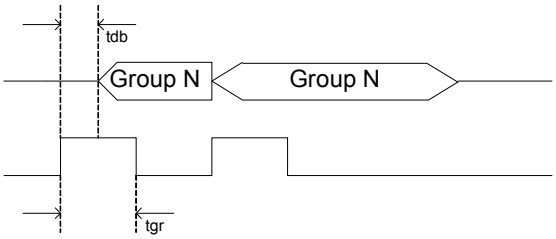
(g) Trigger Pulse Width > Group Length
Option Setting = Level / Unhold



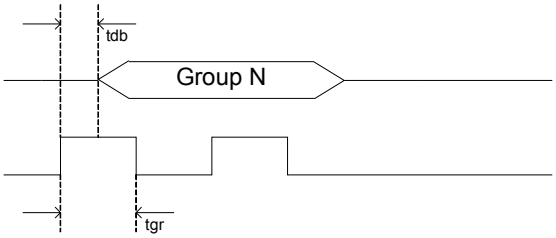
(h) Trigger Pulse Width > Group Length
Option Setting = Level / Hold



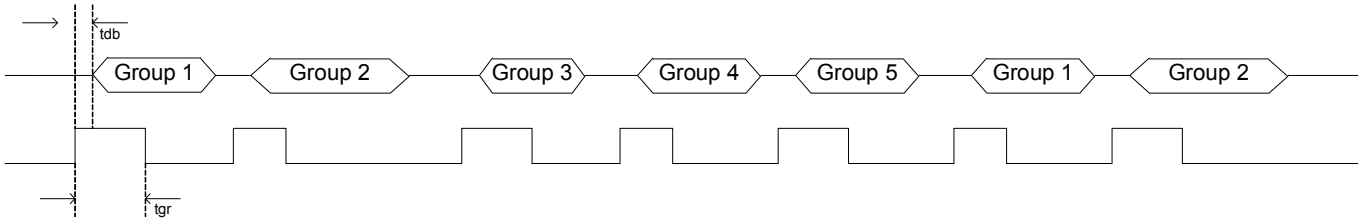
(i) Option Setting = Retrigger



(j) Option Setting = Irretrigger



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



◆ SC040 Trigger Voice Combination Example

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”)

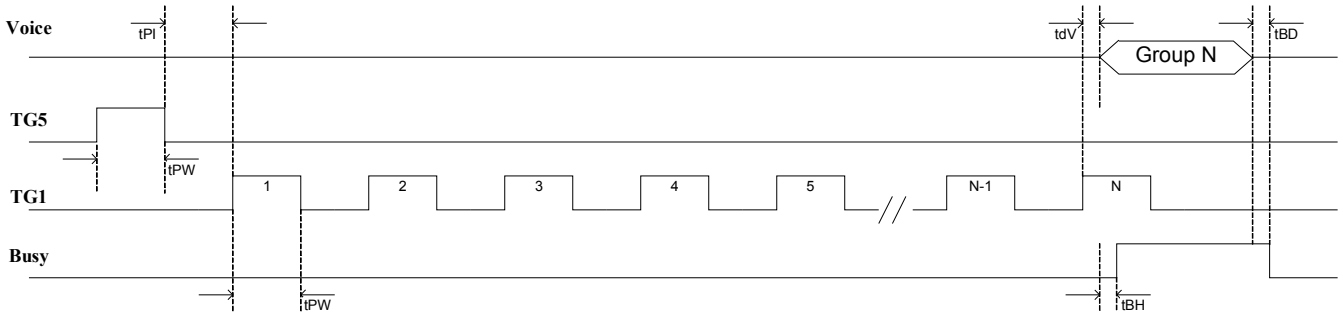
Group1 = Step1 + Step 2
Group 2 = Step3 + Step 4 + Step 5
Group 3 = Step 6 + Step 7

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” (40”-8” = 32” space are free , can add more Voice File)

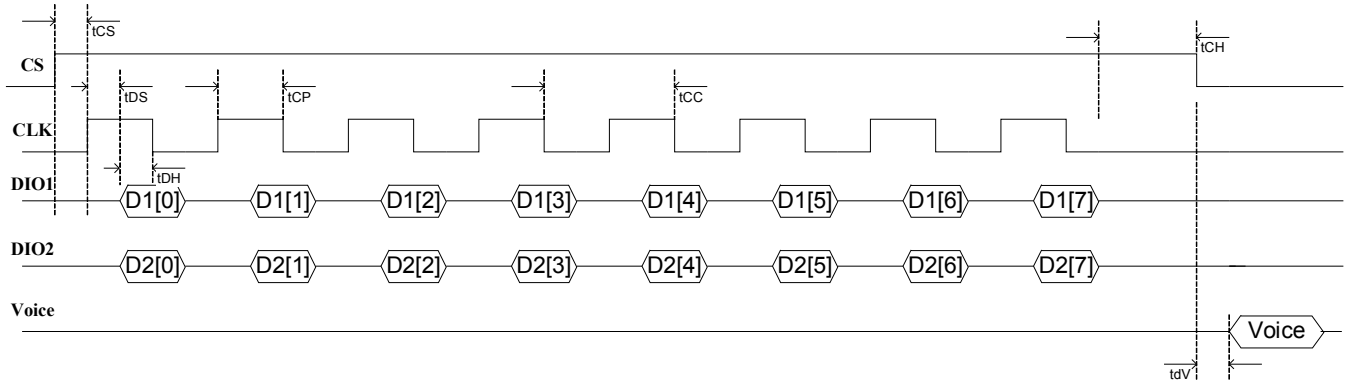
◆ SC040 Serial Mode Timing



TG1=Edge/Unhold/Retriger

TG5=Reset PIN

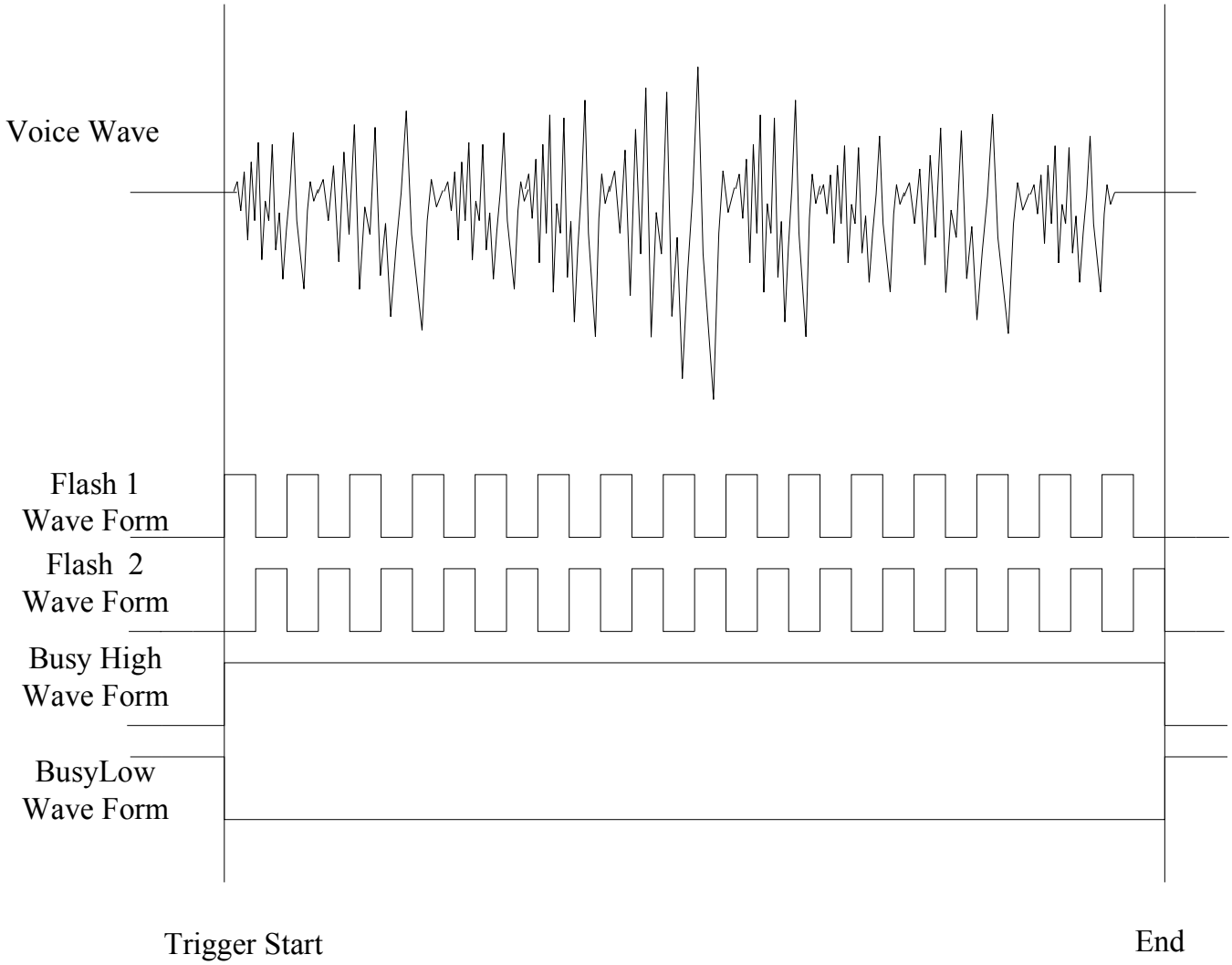
◆ SC040 CPU Mode Timing



Command	PIN	HEX	[7]	[6]	[5]	[4]	[3]	[2]	[1]	[0]	Description
START	DIO1	A5h	1	0	1	0	0	1	0	1	Wake up the chip
	DIO2	05h	0	0	0	0	0	1	0	1	
END	DIO1	81h	1	0	0	0	0	0	0	1	Power down the chip into standby status
	DIO2	05h	0	0	0	0	0	1	0	1	
RESET	DIO1	83h	1	0	0	0	0	0	1	1	Stop the Playback and wait a new command
	DIO2	03h	0	0	0	0	0	0	1	1	
PAUSE	DIO1	05h	1	0	0	0	0	1	0	1	Pause the Playback and hold at the Voice data
	DIO2	07h	0	0	0	0	0	1	1	1	
RESUME	DIO1	05h	0	0	0	0	0	1	0	1	Resume Playback from the previous Voice data
	DIO2	07h	0	0	0	0	0	1	1	1	

Play Address Command is generated by the Tool.

◆ SC040 Voice Wave & Output Status



◆ DC Electrical Characteristics

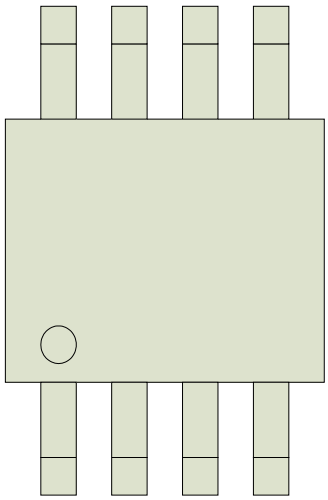
Item	Symbol	Min	Typ	Max	Unit	Condition
Operating voltage	VDD	2.4	**3.0**	5	V	
Standby current	Isb		**1**	5	uA	VDD=3V,no load
Operating current	Iop		**600**		uA	VDD=3V,no load
			1		mA	VDD=4.5V,no load
Drive current of Output	Iod		**10**		mA	VDD=3V VOUT=0.6V
Sink current of Output	Ios		**30**		mA	VDD=3V VOUT=2.4V
Drive current of Output	Iod		**10**		mA	VDD=3V(LDO ON) VOUT=0.6V
Sink current of Output	Ios		**15**		mA	VDD=3V(LDO ON) VOUT=2.4V
Drive current of PWM	Iod		**200**		mA	VDD=3V,VOUT=1.5V
Sink current of PWM	Ios		**200**		mA	VDD=3V,VOUT=1.5V

◆ AC Electrical Characteristics

Symbol	Characteristic	Rating			Unit
		Min.	Typ.	Max.	
tdb	Key Trigger debounce time (long)	14			ms
tdb	Key Trigger debounce time (short)	50			us
tgr	Key Trigger Pulse width				
tPW	Serial Mode Input Pulse Width	100			us
tPI	The interval of two pulse	100			us
tBH	Busy signal output hold time	400			us
tBD	Busy signal output delay time	400			us
tdV	Voice ouput delay time	400			us
tCS	Chip Select setup time	1			us
tDS	Data In setup time	1			us
tDH	Data In hold time	1			us
tCP	Clock Pulse Width	1			us
tCC	Clock Cycle time	2			us
tCH	Chip Select hold time	1			us

◆ SC040 Package Information

SC040-DIP8 SOP8



PIN	NAME
1	TG2/RST
2	TG1/DATA
3	TG5/ BUSY
4	VSS
5	PWM2/DAC
6	PWM1
7	VDD5
8	VDD

◆ Writer Mapping Description

Writer Pin : TG2,TG1,TG5,VSS,PWM2,PWM1,VDD5,VDD

OTP Writer Power Board Pin Mapping Table			
DIP 20	**PAD Name**	**TF040-SO8A**	**TF040-D14**
1 – VPP	**1-TG2**	**1-TG2**	**10-TG2**
2 – DIO1	**2-TG1**	**2-TG1**	**11-TG1**
3 – DIO2	**3-TG5**	**3-TG5**	**12-TG5**
4 – GND	**9-VSS, 10-VSS**	**4-VSS**	**5-VSS**
5 - TEST			
17 – RSTN			
18 – CLK	**11-PWM2**	**5-PWM2**	**1-PWM2**
19 – CS	**12-PWM1**	**6-PWM1**	**2-PWM1**
20 – VCC	**13-VDD5, 14-VDD**	**7-VDD5, 8-VDD**	**3-VDD5, 4-VDD**

◆ Writer Board Slot Location