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- (b) Working Register Increasing.
- (c) Step Jump by Working Register / Volume Status.

● **Three Mode Trigger IC :**

- Key Stand-alone Trigger Mode :
 - A. Edge/Level
 - B. Hold/Unhold
 - C. Retrigger/Irretrigger
- Serial Trigger Mode :
Combinations of TG1 and TG2 to trigger maximum 63 Voice Group.
- CPU Command Mode :
User command through TG1,TG2,TG3 with SPI 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.

H. PWM for LED Dimming Control.

● **Play rate level :**

APT540 can provide different play rate in one code as follow below
Reference Sample Rate.

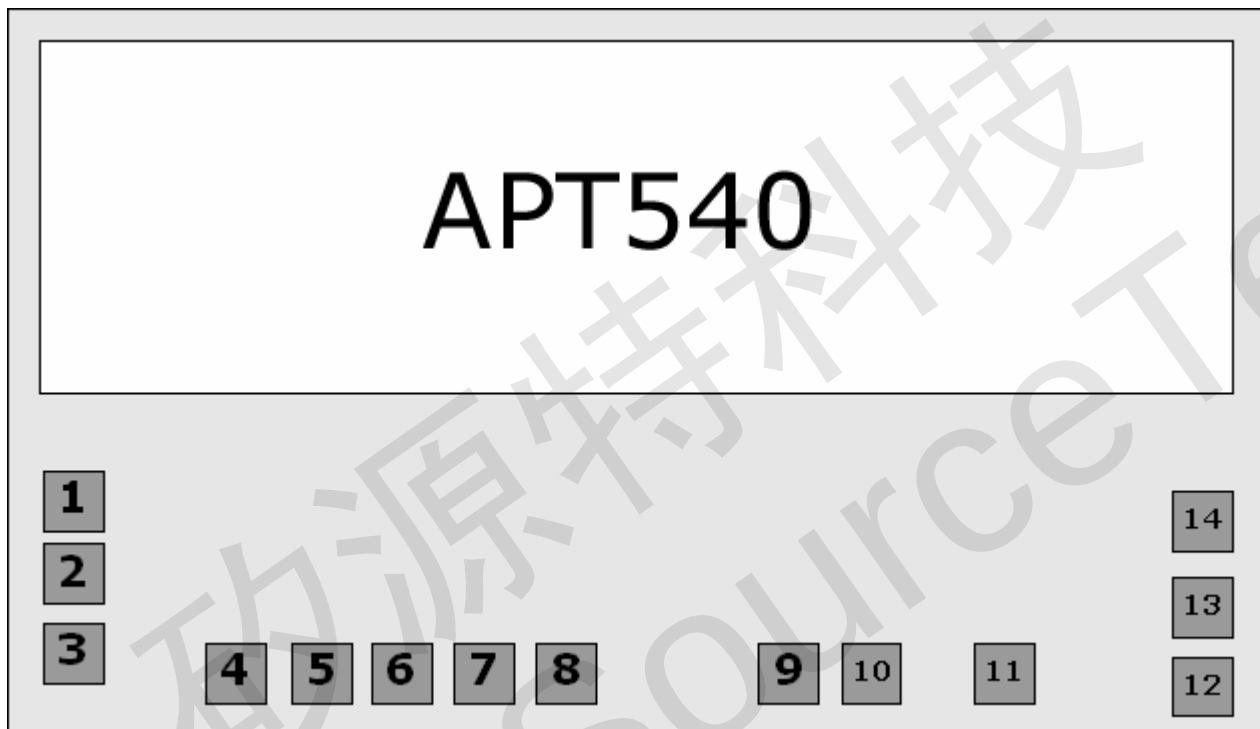
3K, 3.2K, 3.31K, 3.42K, 3.55K, 3.69K, 3.84K, 4K, 4.17K, 4.36K, 4.57K,
4.8K, 5.05K, 5.33K, 5.64K, 6K, 6.4K, 6.85K, 7.38K, 8K, 8.72K, 9.6K,
10.66K, 12K, 13.71K, 16K, 19.2K, 24K.



- **TG2 Low Reset**
- **TG3 Volume Control**

◆ **APT540 Pad Location**

CHIP SIZE: (0, 0) (1732,1235) UM



NO.	PAD NAME	X	Y	NO.	PAD NAME	X	Y
1	TG2/RSTB	-775	-327	8	TG8	-231	-526
2	TG1	-775	-417	9	VDDL	85	-533
3	TG3	-775	-507	10	VSS	172	-533
4	TG4	-591	-526	11	VSS	320	-533
5	TG5	-501	-526	12	PWM1	790	-550
6	TG6	-411	-526	13	VDD	790	-452
7	TG7	-321	-526	14	PWM2/DAC	790	-351

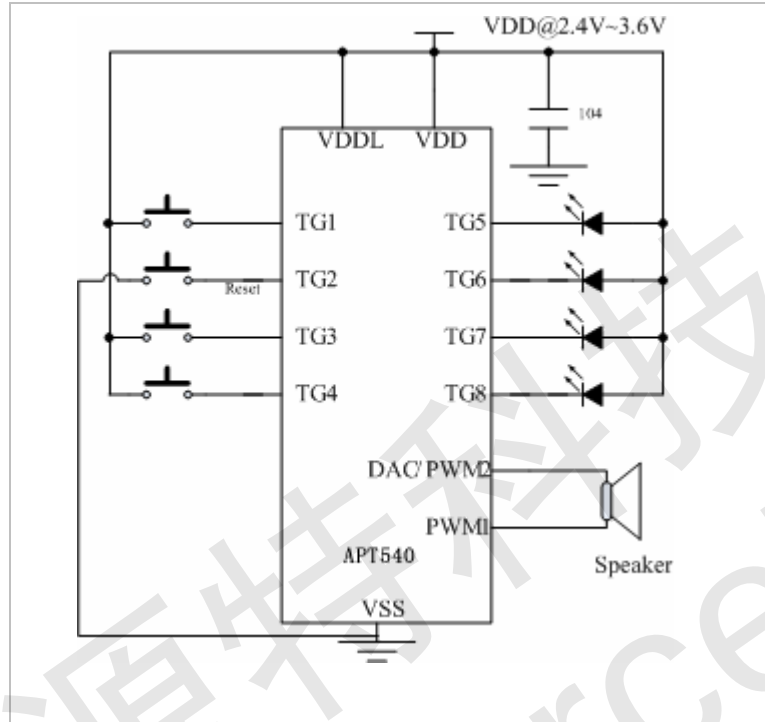


◆ APT540 PIN Description

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 63 Voice Group.
		CPU Command Mode : TG1 is used as Data Input Pin (DI).
	OUTPUT	As Output PIN , Output the BUSY or Flash Signal.
TG2/RSTB	INPUT	Key Stand-alone Trigger Mode : TG2 is used to trigger the maximum 21 Voice Group one by one sequentially.
		Serial Trigger Mode : TG2 is used to trigger the maximum 63 Voice Group
		CPU Command Mode : TG2 is used as Clock Pin (SCK).
TG3	INPUT	Key Stand-alone Trigger Mode : TG3 is used trigger Only One Group.
		CPU Command Mode : TG3 is used as Clock Pin (DO).
	OUTPUT	As Output PIN , Output the BUSY or Flash Signal.
TG4	INPUT	Key Stand-alone Trigger Mode : TG4 is used trigger Only One Group.
	OUTPUT	As Output PIN , Output the BUSY or Flash Signal.
TG5	INPUT	Key Stand-alone Trigger Mode : TG5 is used trigger Only One Group.
	OUTPUT	As Output PIN , Output the BUSY or Flash Signal.
TG6	INPUT	Key Stand-alone Trigger Mode : TG6 is used trigger Only One Group.
	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.
PWM2	OUTPUT	As a PWM PIN , can Directly drive the Speaker .
		As a DAC PIN , 8 bit D/A Current Output.
PWM1	OUTPUT	As a PWM PIN , can Directly drive the Speaker .
VDD	INPUT	Power Supply PIN , Connected with a 0.1 uF to VSS.
VDDL	INPUT	Power Supply PIN , Connected with VDDL @ 2.4~4.5 V Working Voltage.
		Power Supply PIN , Connected with a 0.1 uF to VSS. @3.6~5V Working Voltage.
VSS	INPUT	Connected to Ground.



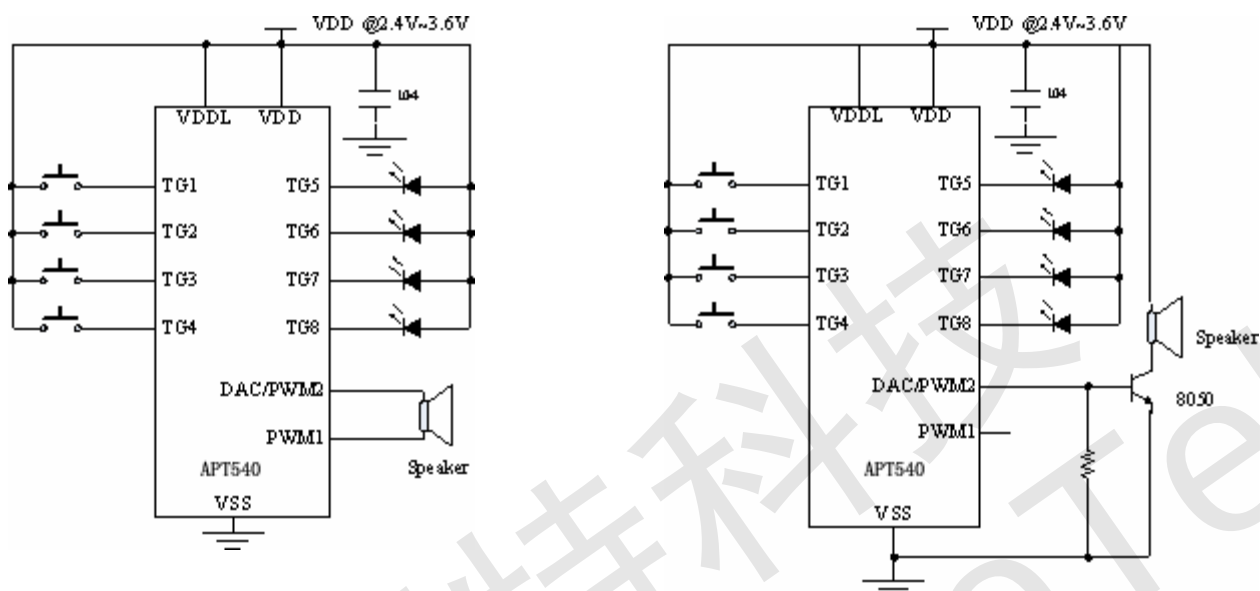
◆ TG2 Low Reset



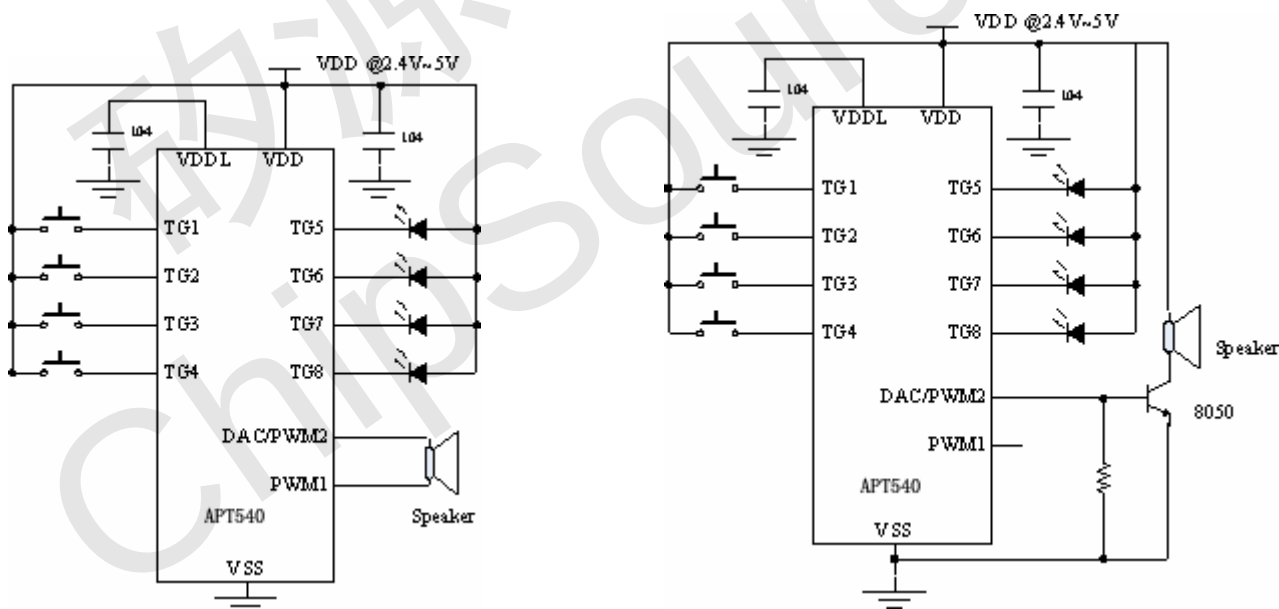


◆ APT540 Application Circuit

APT540 3V Stand-alone Mode



APT540 5V Stand-alone Mode





APT540 3V Serial Mode

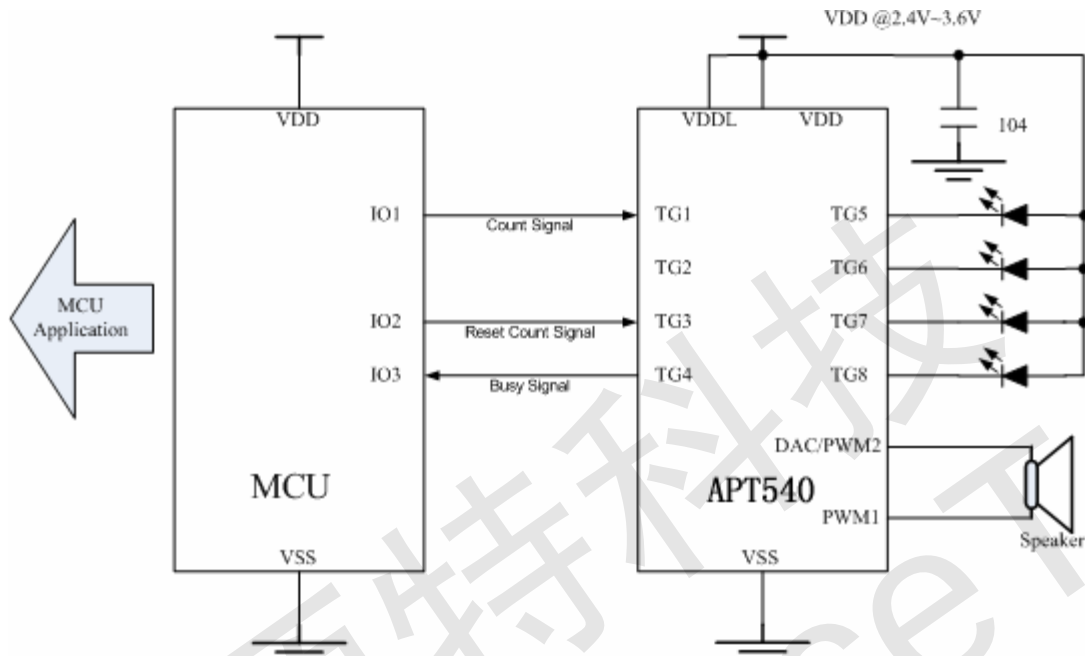


Fig. 5

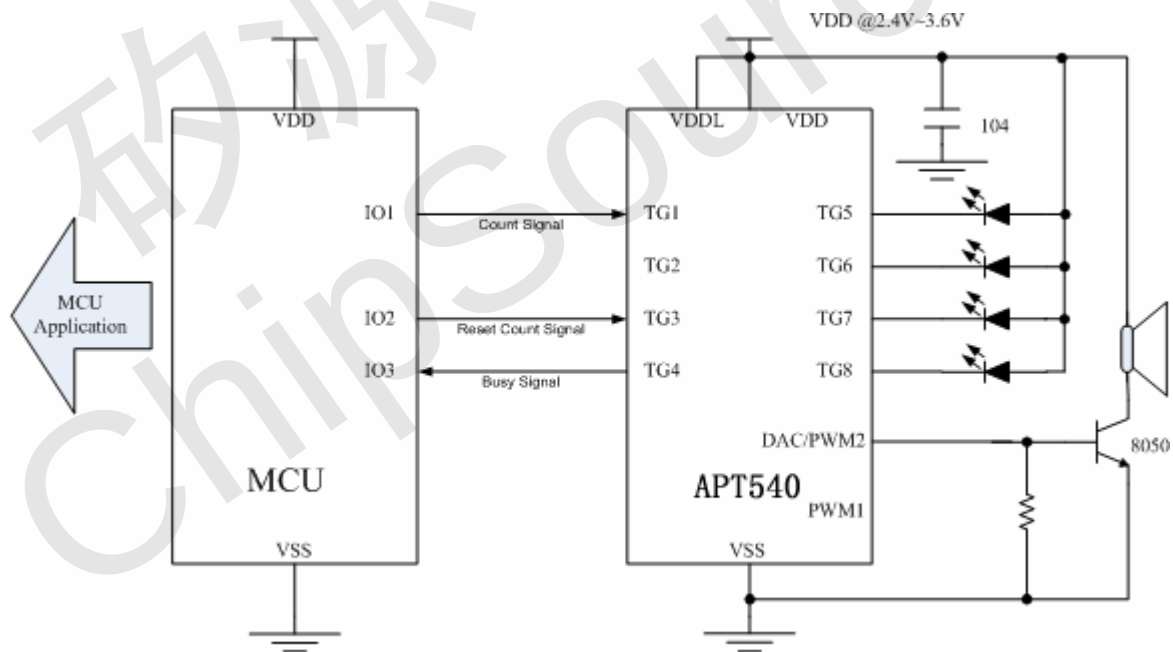


Fig. 6



Fig. 7

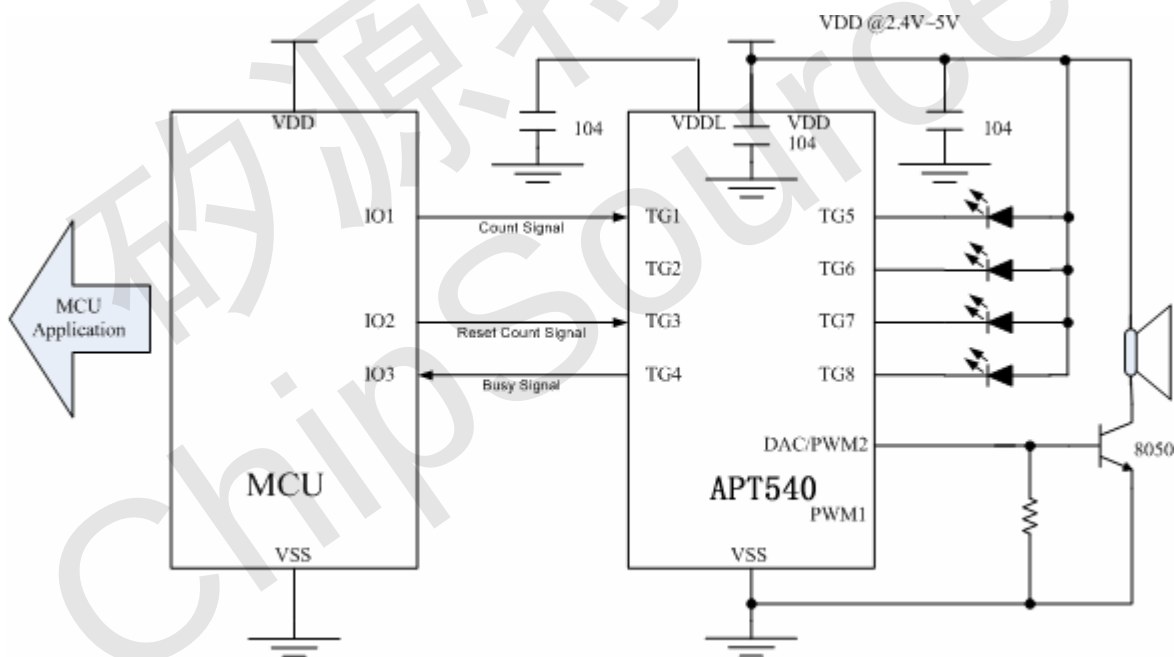


Fig. 8



APT540 3V CPU Mode

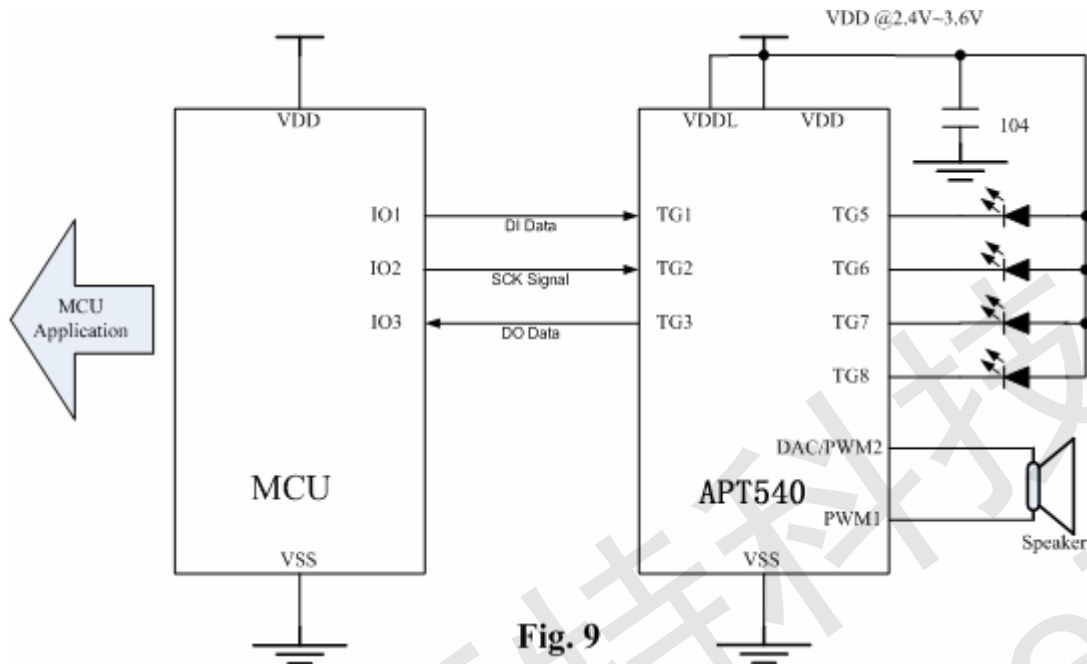


Fig. 9

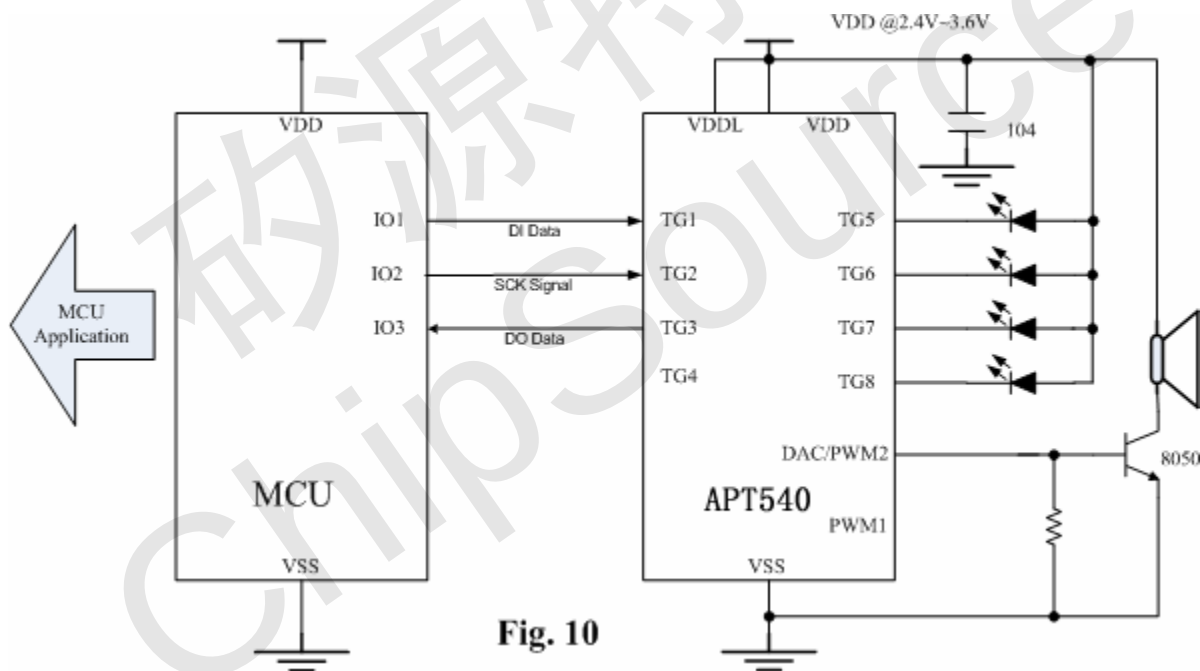


Fig. 10



APT540 5V CPU Mode

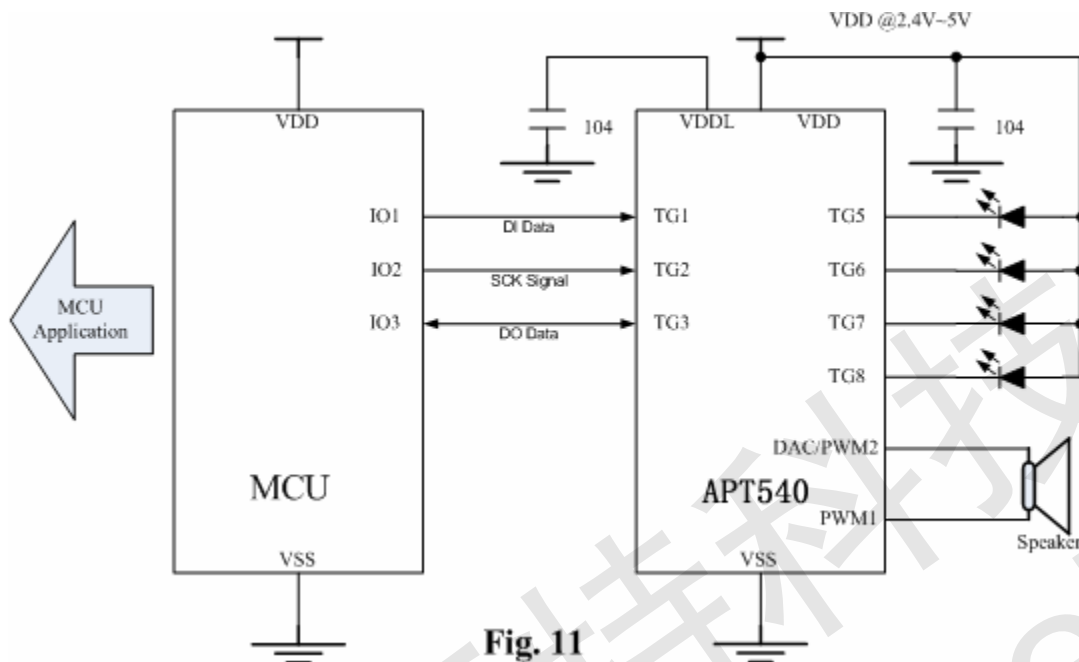


Fig. 11

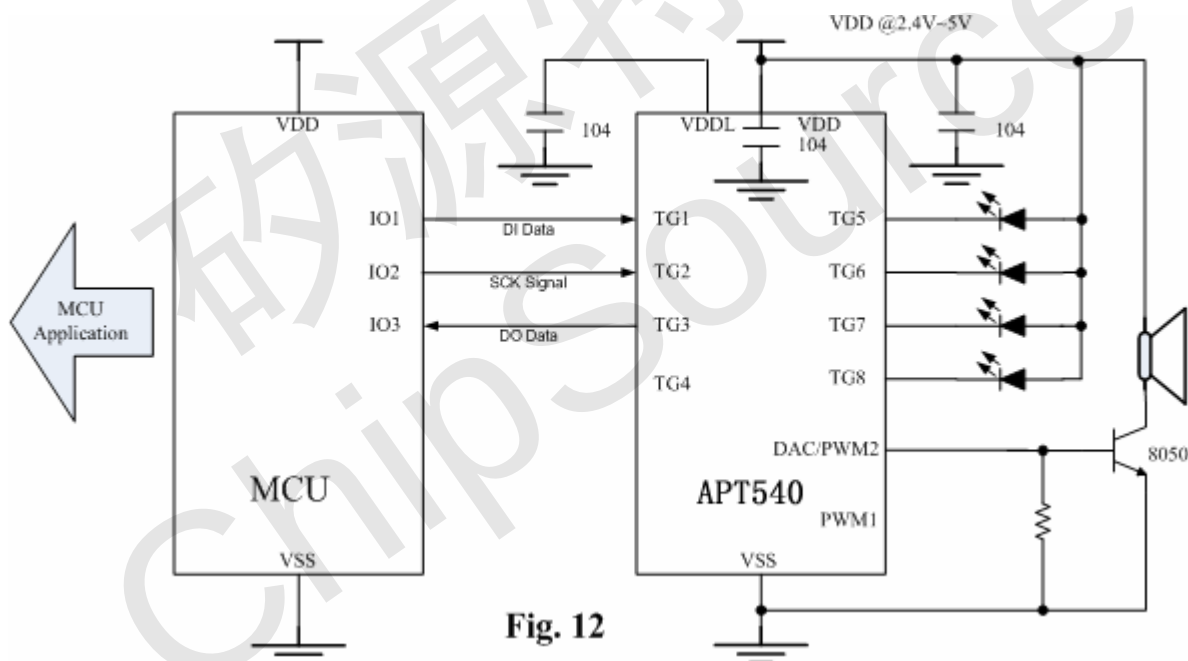
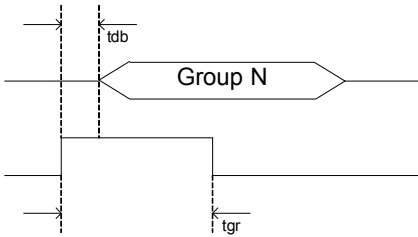


Fig. 12

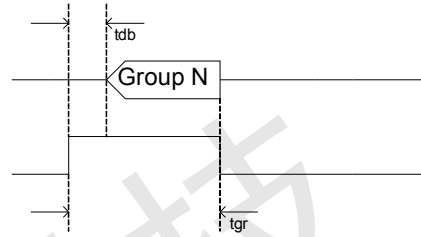


◆ APT540 Trigger Timing

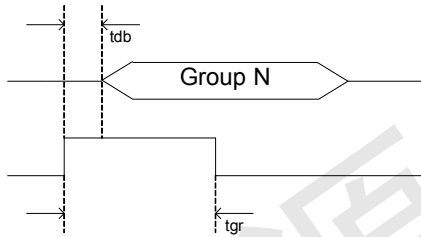
(a) Trigger Pulse Width < Group Length
Option Setting = Edge / Unhold



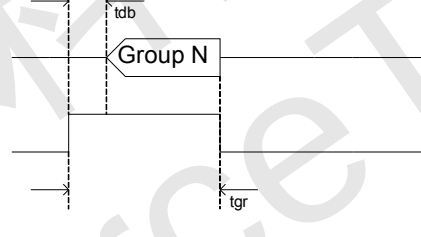
(b) Trigger Pulse Width < Group Length
Option Setting = Edge / Hold



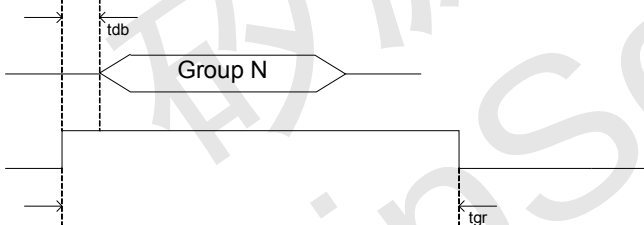
(c) Trigger Pulse Width < Group Length
Option Setting = Level / Unhold



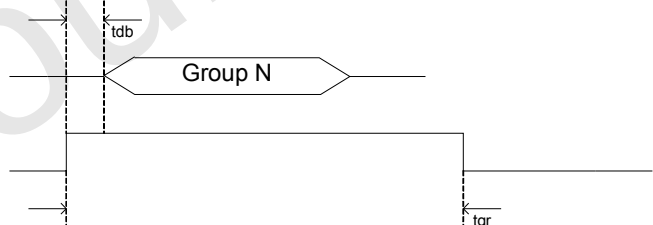
(d) Trigger Pulse Width < Group Length
Option Setting = Level / Hold



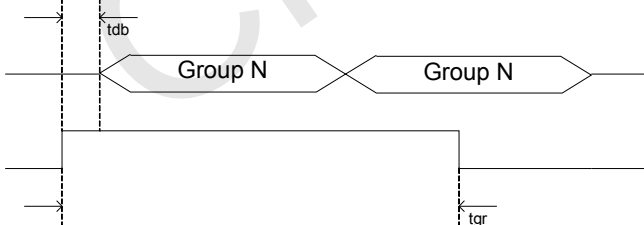
(e) Trigger Pulse Width > Group Length
Option Setting = Edge / Unhold



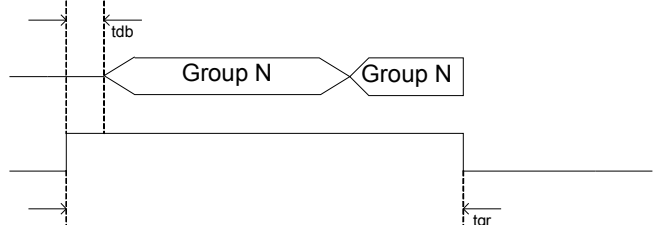
(f) Trigger Pulse Width > Group Length
Option Setting = Edge / Hold



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

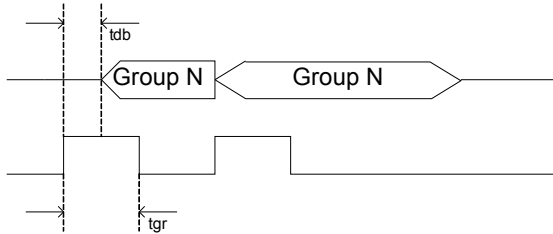


(h) Trigger Pulse Width > Group Length
Option Setting = Level / Hold

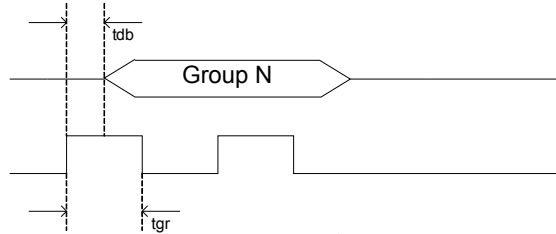




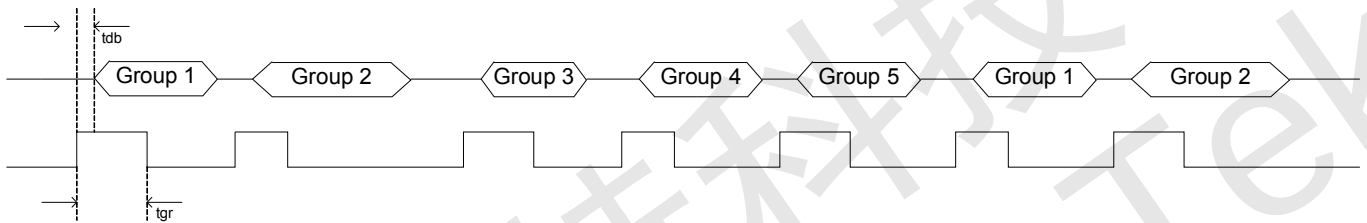
(i) Option Setting = Retrigger



(j) Option Setting = Irretrigger



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





◆ APT540 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'' (20''-8'' = 32'' space are free , can add more Voice File)



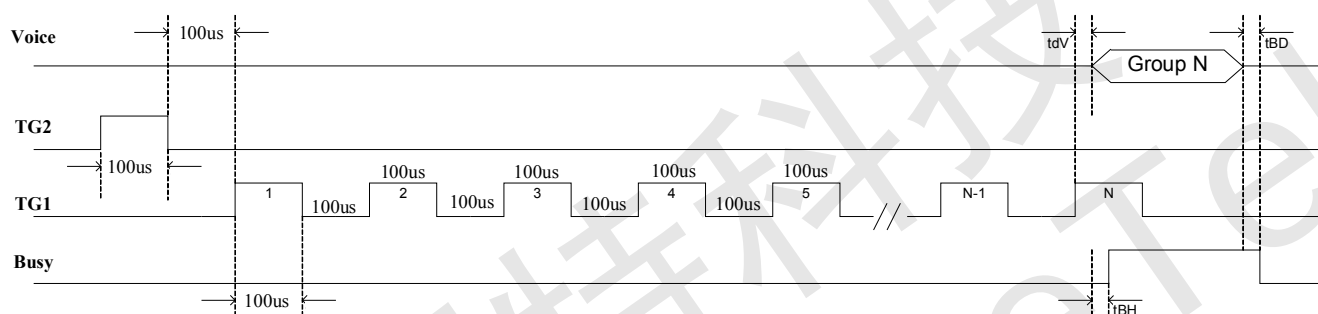
◆ APT540 Serial Mode Timing

TG1=Edge/Unhold/Retrigger

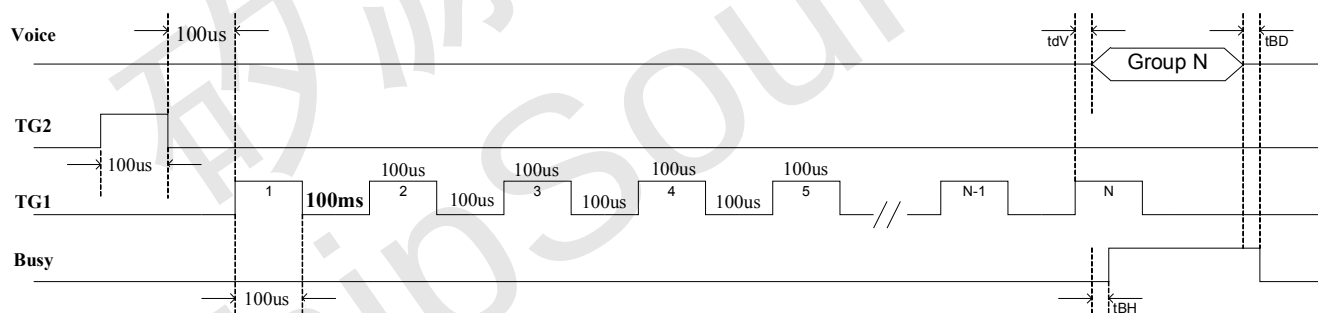
TG3=Reset PIN

※Tool : Controller Trigger

● PWM



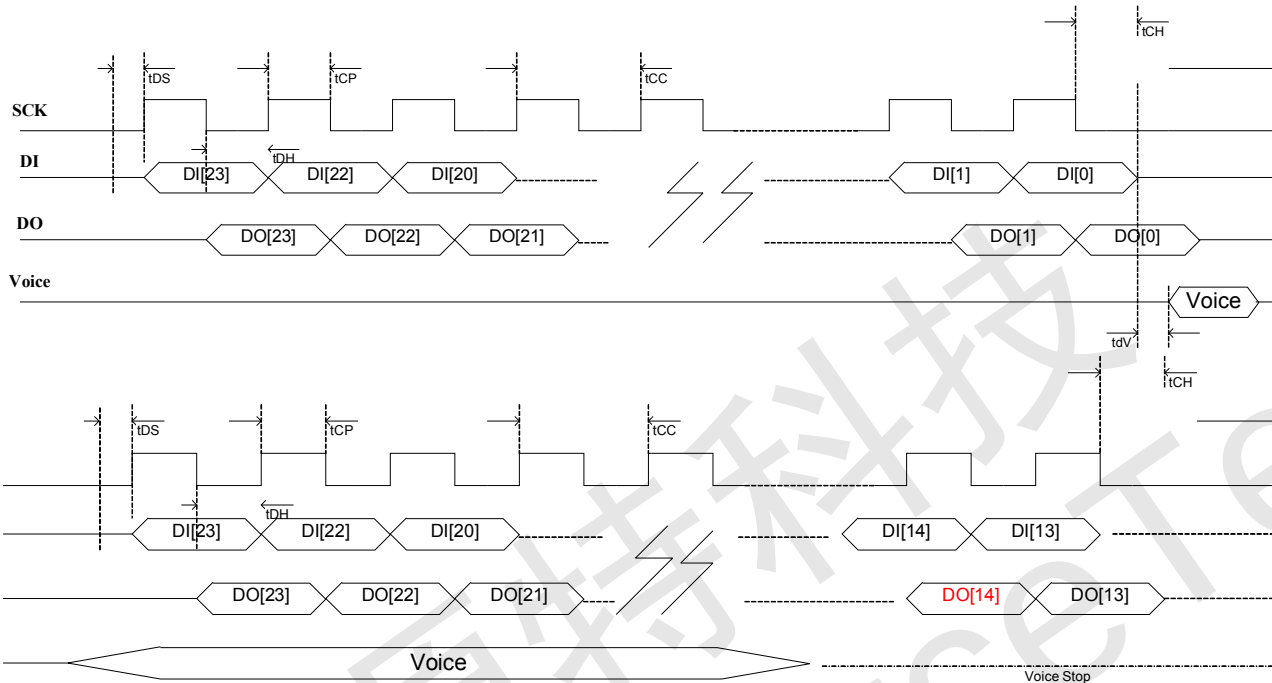
● DAC





◆ APT540 CPU Mode Timing

TH040 Play Voice Timing



* **DO[14]** =1 is Busy , =0 Voice Stop

TH040 Check Voice Stop Timing

Command	PIN	Command Data	Clock Count	Description
Initial	DI	0x1E525B	24 clk	Wake up the chip
	DO			
START	DI	0x0A0140	24 clk	Wake up the chip
	DO			
STOP	DI	0x0A0100	24 clk	Stop the chip
	DO			
PLAY	DI	0x18+ Group Address Ex:0x00C8	24 clk	Play Voice Step Address
	DO			
PAUSE	DI	0x0A0148	24 clk	Pause the Playback and hold at the Voice data
	DO			
RESUME	DI	0x0A0140	24 clk	Resume Playback from the previous Voice data
	DO			

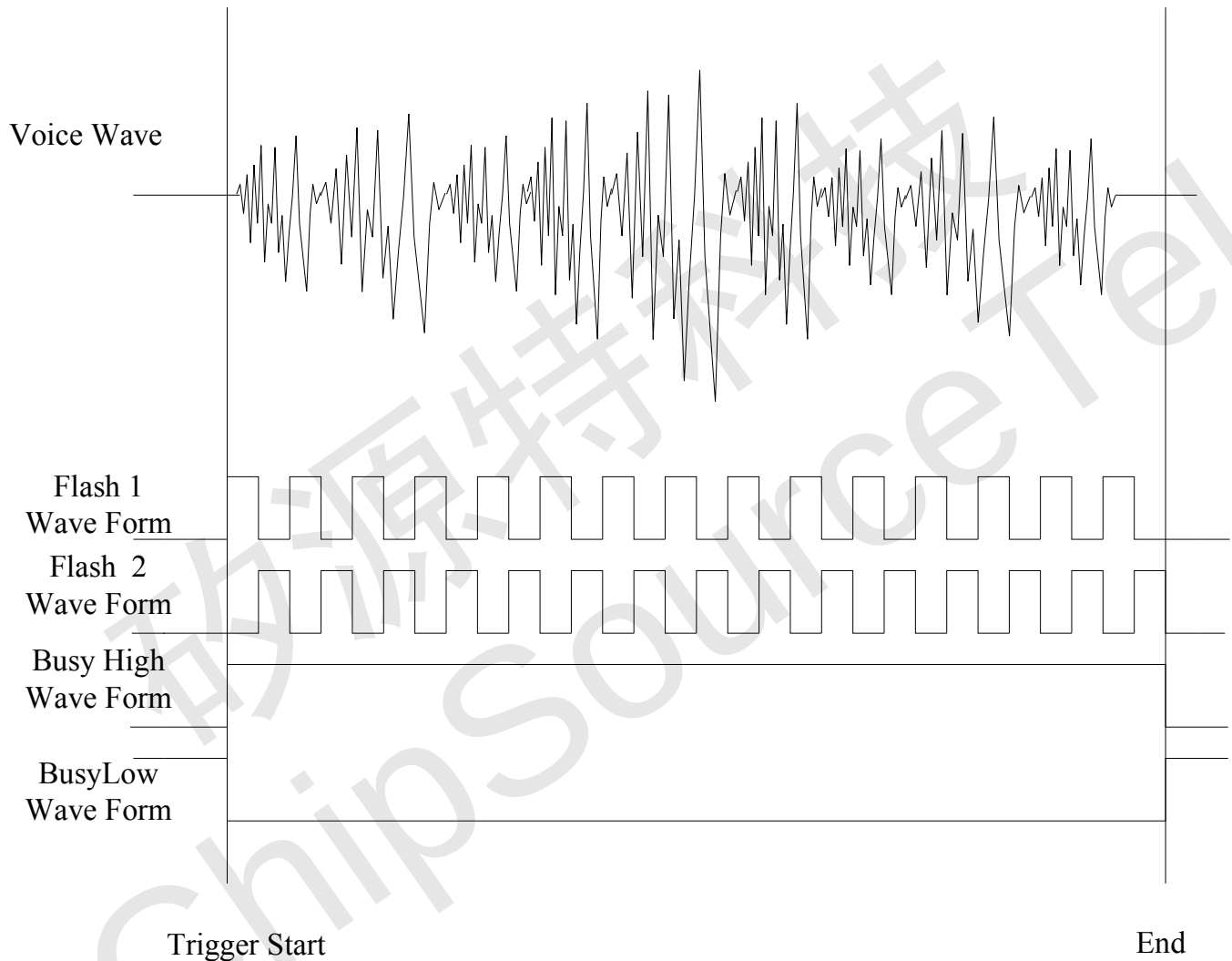


APT540

Read Busy	DI	0x2200	16 clk	Check Voice is Stop or Not
	DO	Check DO[14]		

Play Address Command is generated by the Tool.

◆ APT540 Voice Wave & Output Status





◆ DC Electrical Characteristics

Item	Symbol	Min	Typ	Max	Unit	Condition
Operating voltage	VDD	2.4	3.0	4.5	V	
Standby current (LDO ON)	Isb	3	4	5	uA	VDD=3V,no load
Standby current (LDO OFF)	Isb	1	1.5	3	uA	VDD=3V,no load
Operating current	Iop		600		uA	VDD=3V,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 PWM	Iod		200		mA	VDD=3V,VOUT=1.5V
Sink current of PWM	Ios		200		mA	VDD=3V,VOUT=1.5V



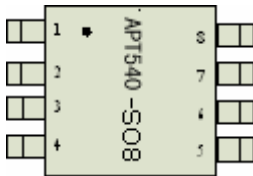
◆ AC Electrical Characteristics

Symbol	Characteristic	Rating			Unit
		Min.	Typ.	Max.	
tdb	Key Trigger debounce time (long)	14			ms
tdb	Key Trigger debounce time (short)	50			us
tBH	Busy signal output hold time	200			us
tBD	Busy signal output delay time	200			us
tdV	Voice output delay time	200			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



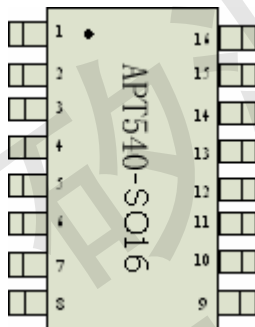
◆ APT540 Package Information

APT540-S08B



PIN	NAME
1	TG2/RSTB
2	TG1
3	TG3
4	VDDL
5	VSS
6	PWM1
7	VDD
8	PWM2/DAC

APT540-S016



PIN	NAME
1	TG6
2	TG5
3	TG2/RSTB
4	TG1
5	TG3
6	TG4
7	VDDL
8	X
9	X
10	VSS
11	VSS
12	PWM1
13	VDD
14	PWM2/DAC
15	TG8
16	TG7



◆ Writer Mapping Description

Writer Pin : TG1,TG2,TG3,PWM1,VDD,VDDL,VSS

OTP Writer Power Board Pin Mapping Table			
DIP 20	PAD Name	TH040-SO8	TH040-SO16
1 – VPP	1-TG2/RSTB	1-TG2/RSTB	3-TG2/RSTB
2 – DO	3-TG3	3-TG3	5-TG3
3 – DI	2-TG1	2-TG1	4-TG1
4 – GND	10,11-VSS	5-VSS	10,11-VSS
5 - TEST	X	X	X
17 – RSTN	X	X	X
NC	X	X	X
19 – CLK	12-PWM1	6-PWM1	12-PWM1
20 – VCC	13-VDD,9-VDDL	7-VDD,4-VDDL	7-VDDL,13-VDD

◆ Writer Board Slot Location (DIP20)

