HT84XXX
Magic Voice™

Features

- Operating voltage: 2.4V~5.0V
- Programmable tone melody generator
- ADPCM or μ-law PCM, PCM synthesis
- Wide range of sampling rate for voice synthesis
- Minimum sampling rate step: 100Hz
- Voice melody mixed output
- Programmable 2 channels of melody mixed output
- Programmable 2 channels of voice mixed output
- 13 kinds of melody beats
- 5 octaves of tone level and 18 tempos
- 16 levels of digital volume control
- Two current type D/A outputs
- Eight programmable I/O pins
- Four programmable input pins
- Provides 36 sec to 384 sec of voice capacity
- Timer controller
- Voice fill-in function
- Powerful user-defined functions
- Power-on initial setting
- 28-pin SKDIP package

Applications

- High-end educational leisure products
- Alert and warning systems
- Speech synthesizers and sound effect generators

General Description

The HT84XXX family is a series of programmable speech synthesizers and tone generators designed for user-defined voice and melody applications. It provides various sampling rates and beats, tone levels, tempos for the speech synthesizer and melody generator. The HT84XXX series has two built-in high quality, current type D/A outputs with 16 levels of volume control. The user′s commands enable the user to program the powerful custom function such as to build-in a tiny controller. The Magic Voice™ provides various operational functions similar to arithmetic operation, logic operation, branch decision, random counter, and a programmable timer. The Magic Voice™ series are suitable for versatile voice and sound effect applications.

The HT84XXX Magic Voice™ is Easy Format™ supported.

ROM Selection Table

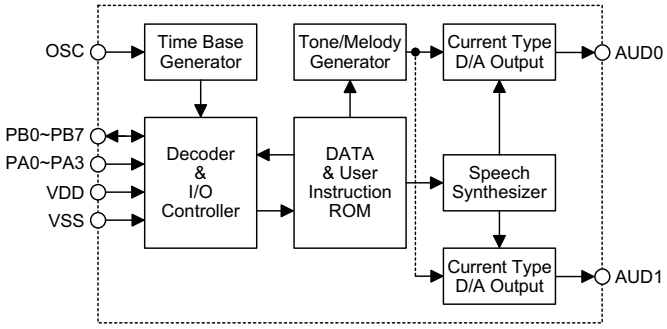
The HT84XXX series provides various voice capacity as shown below:

Part No.	HT84036	HT84072	HT84144	HT84192	HT84384
ROM	768Kb	1536Kb	3072Kb	4096Kb	8192Kb
Voice Length	36 sec	72 sec	144 sec	192 sec	384 sec

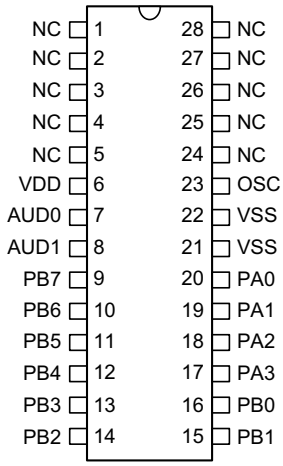
Note: The voice capacity is based on a sampling rate of 21Kb/s

Magic Voice™ is a trademark of Holtek Semiconductor Inc.
Easy Format™ is a trademark of Grow With Me, Inc.

Block Diagram



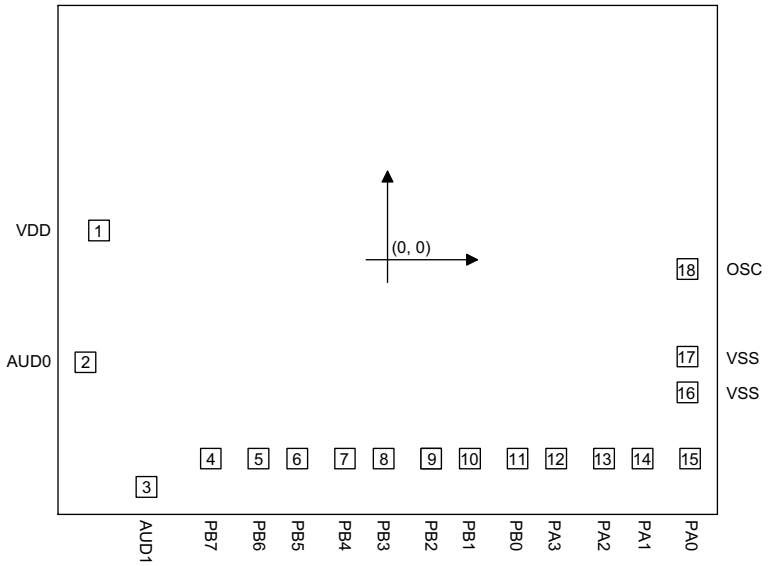
Pin Assignment



HT84XXX
– 28 SKDIP

Pad Assignment

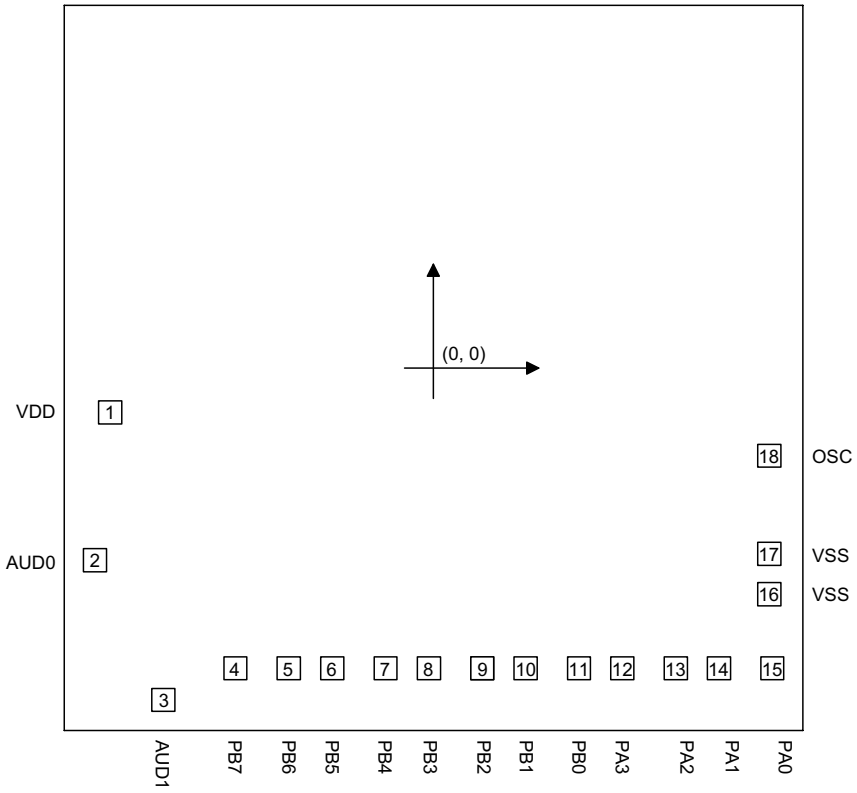
HT84036



Chip size: 2735 × 2105 $(\mu m)^2$

* The IC substrate should be connected to VSS in the PCB layout artwork.

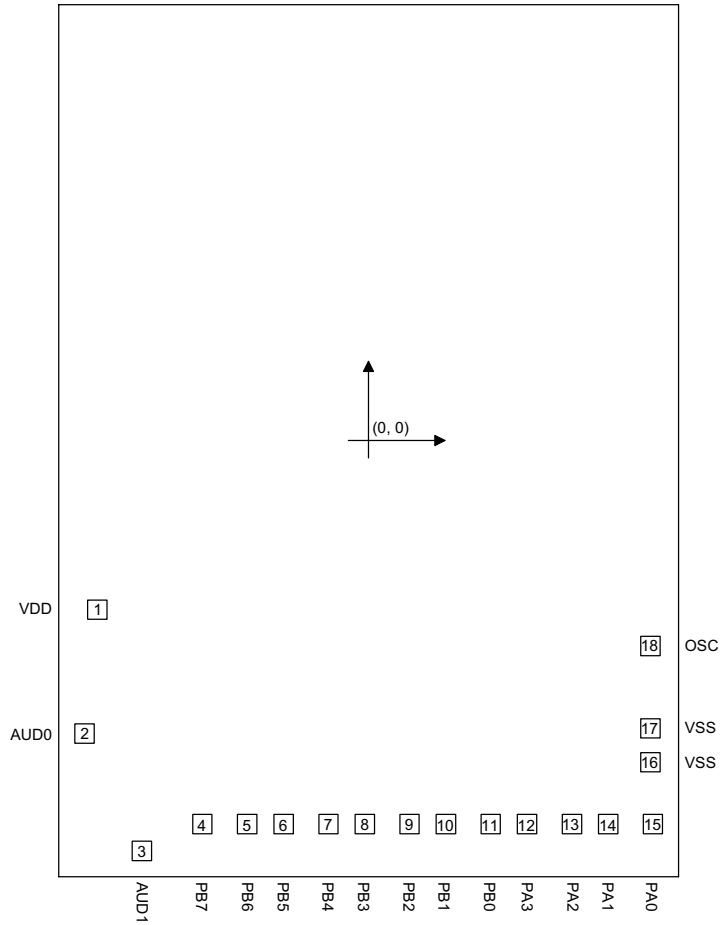
HT84072



Chip size: 2735 × 2645 (μm)^2

* The IC substrate should be connected to VSS in the PCB layout artwork.

HT84144



Chip size: 2735 × 3735 $(\mu m)^2$

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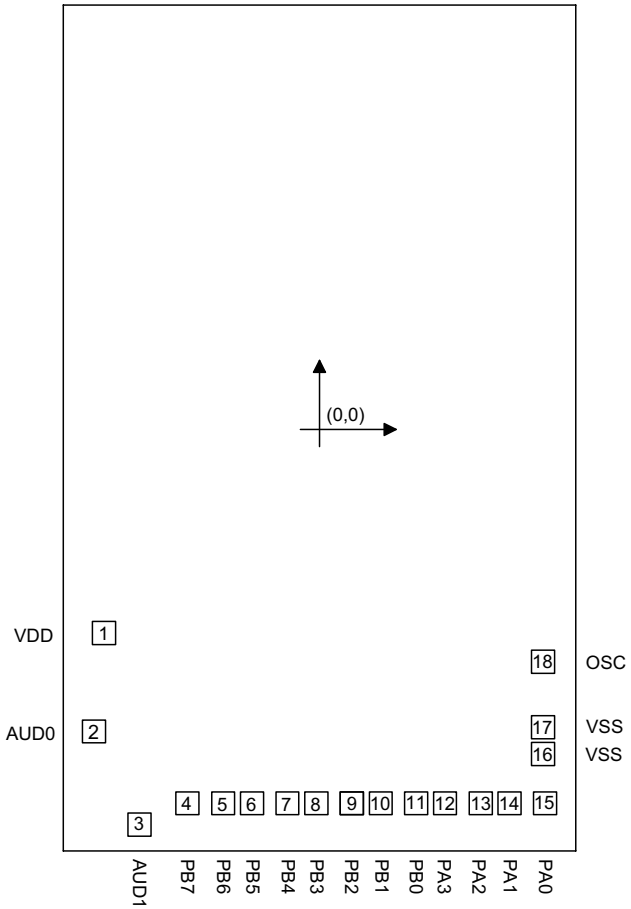
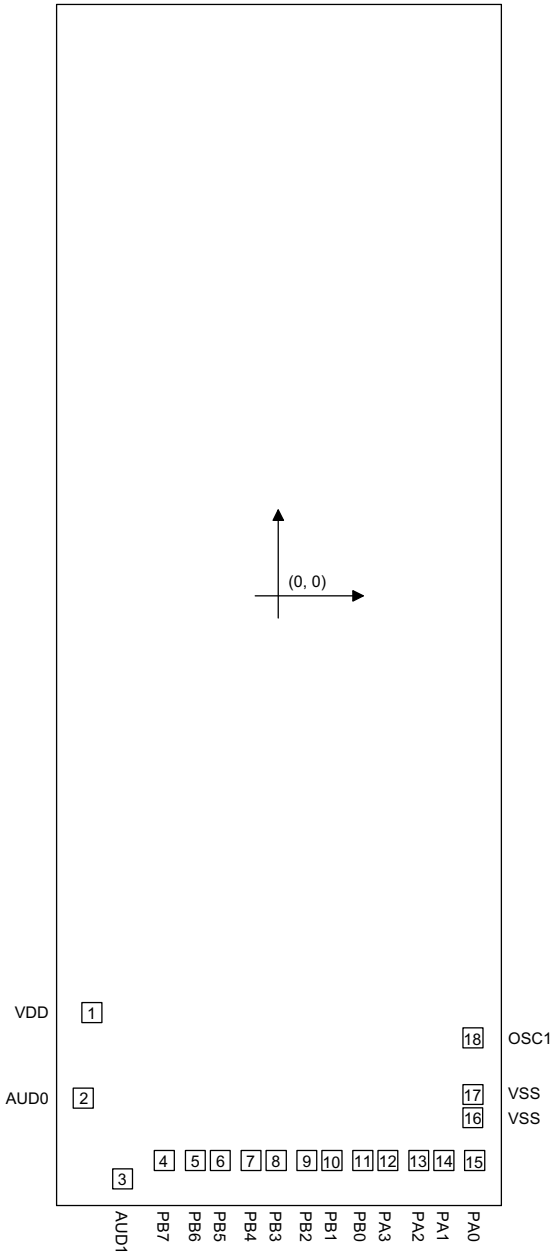
HT84192



Chip size: 2735 × 4460 $(\mu m)^2$

* The IC substrate should be connected to VSS in the PCB layout artwork.

HT84384



Chip size: 2740 × 7350 $(\mu m)^2$

* The IC substrate should be connected to VSS in the PCB layout artwork.

Pad Coordinates

HT84036 Unit: μm

Pad No.	X	Y	Pad No.	X	Y
1	–1125.31	114.74	10	320.15	–774.24
2	–1177.49	–398.79	11	505.75	–774.24
3	–939.68	–884.61	12	656.55	–774.24
4	–689.05	–774.24	13	842.15	–774.24
5	–503.45	–774.24	14	992.95	–774.24
6	–352.65	–774.24	15	1178.55	–774.24
7	–167.05	–774.24	16	1167.43	–517.18
8	–16.25	–774.24	17	1167.53	–377.08
9	169.35	–774.24	18	1167.53	–35.96

HT84072 Unit: μm

Pad No.	X	Y	Pad No.	X	Y
1	–1125.31	–155.26	10	320.15	–1044.24
2	–1177.49	–668.79	11	505.75	–1044.24
3	–939.68	–1154.61	12	656.55	–1044.24
4	–689.05	–1044.24	13	842.15	–1044.24
5	–503.45	–1044.24	14	992.95	–1044.24
6	–352.65	–1044.24	15	1178.55	–1044.24
7	–167.05	–1044.24	16	1167.43	–787.18
8	–16.25	–1044.24	17	1167.53	–647.08
9	169.35	–1044.24	18	1167.53	–305.96

HT84144 Unit: μm

Pad No.	X	Y	Pad No.	X	Y
1	–1125.31	–700.26	10	320.15	–1589.24
2	–1177.49	–1213.79	11	505.75	–1589.24
3	–939.68	–1699.61	12	656.55	–1589.24
4	–689.05	–1589.24	13	842.15	–1589.24
5	–503.45	–1589.24	14	992.95	–1589.24
6	–352.65	–1589.24	15	1178.55	–1589.24
7	–167.05	–1589.24	16	1167.43	–1332.18
8	–16.25	–1589.24	17	1167.53	–1192.08
9	169.35	–1589.24	18	1167.53	–850.96

HT84192 Unit: μm

Pad No.	X	Y	Pad No.	X	Y
1	–1125.31	–1062.76	10	320.15	–1951.74
2	–1177.49	–1576.29	11	505.75	–1951.74
3	–939.68	–2062.11	12	656.55	–1951.74
4	–689.05	–1951.74	13	842.15	–1951.74
5	–503.45	–1951.74	14	992.95	–1951.74
6	–352.65	–1951.74	15	1178.55	–1951.74
7	–167.05	–1951.74	16	1167.43	–1694.68
8	–16.25	–1951.74	17	1167.53	–1554.58
9	169.35	–1951.74	18	1167.53	–1213.46

HT84384 Unit: μm

Pad No.	X	Y	Pad No.	X	Y
1	–1121.81	–2507.96	10	323.65	–3396.94
2	–1173.99	–3021.49	11	509.25	–3396.94
3	–936.18	–3507.31	12	660.05	–3396.94
4	–685.55	–3396.94	13	845.65	–3396.94
5	–499.95	–3396.94	14	996.45	–3396.94
6	–349.15	–3396.94	15	1182.05	–3396.94
7	–163.55	–3396.94	16	1170.93	–3139.88
8	–12.75	–3396.94	17	1171.03	–2999.78
9	172.85	–3396.94	18	1171.03	–2658.66

Pin Description

Pin No.	Pin Name	I/O	Internal Connection	Description
1~5, 24~28	NC	—	—	No connection
6	VDD	—	—	Positive power supply
7	AUD0	O	PMOS Open Drain	Audio output for driving an external transistor
8	AUD1	O	PMOS Open Drain	Audio output for driving an external transistor
15~9	PB1~PB7	I/O	Pull-high or CMOS	Bidirectional I/O pins Can be optioned as trigger inputs or LED outputs
16	PB0	I/O	Pull-high or CMOS	Bidirectional I/O pins Can be optioned as CDS interface with internal Schmitt trigger input

Pin No.	Pin Name	I/O	Internal Connection	Description
20~17	PA0~PA3	I	Wake-up Pull-high	Trigger inputs Can also be configured as wake-up inputs
21, 22	VSS	—	—	Negative power supply, ground
23	OSC	I	—	Built-in RC oscillator An oscillator resistor is connected between OSC and VSS

Absolute Maximum Ratings

Supply Voltage.....–0.3V to 6V
Input Voltage.....V_{SS}–0.3V to V_{DD}+0.3V
Storage Temperature.....–50°C to 125°C
Operating Temperature .....–20°C to 70°C

Note: These are stress ratings only. Stresses exceeding the range specified under "Absolute Maximum Ratings" may cause substantial damage to the device. Functional operation of this device at other conditions beyond those listed in the specification is not implied and prolonged exposure to extreme conditions may affect device reliability.

Electrical Characteristics

Ta=25°C

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Unit
		V_{DD}	Conditions				
V_{DD}	Operating Voltage	—	—	2.4	—	5.2	V
I_{STB}	Standby Current	3V	No load, system HALT	—	1	3	μA
I_{DD}	Operating Current	3V	No load, f_{SYS}=4MHz	—	5	8	mA
I_{OL}	PB0~PB7 Sink Current	3V	V_{OL}=0.3V	4	6	—	mA
I_O	Max. AUD1 and AUD2 Output Current	3V	V_{OH}=0.6V	–1.5	–2	—	mA
f_{SYS}	System Frequency	3V	R_{OSC}=240kΩ	3.6	4.0	4.4	MHz

Functional Description

The Magic Voice™ series is a series of programmable speech synthesizers and melody generators. It provides various sampling rates and beats, tone levels, tempos for speech synthesizer and melody generator. For voice synthesizer, the Magic Voice™ provides 8-bit PCM, 6-bit μ-law PCM and 4-bit ADPCM synthesis. In HT84XXX series, a mixed output of two channels PCM synthesis is allowed but only one channel ADPCM synthesis is allowed. For melody generator, the Magic Voice™ supports a tone melody and PCM melody generator and two channels mixed output for the whole series.

The Magic Voice™ series build-in 8 programmable I/O pins and 4 programmable input pins along with powerful user′s command. The user′s instructions are employed to develop new and customized functions for a wide variety of innovative applications.

Speech and melody analysis

The speech and melody sources of the Magic Voice™ can be recorded and edited from the PC sound card and media tools. Holtek′s CAD tools first load a speech source file as .WAV or .PCM format, then transfer the speech file as PCM, LOG-PCM or ADPCM format, and finally save it to the internal mask ROM by changing a layer of the mask. The PCM format generates a higher sound quality whereas the ADPCM format brings about a longer recording capacity. The melody source can either be in the .MID or in the .MLD format.

The .MID file is the standard format of the windows media tools. The .MLD file is a text format. After the .MID file is compiled, the .MLD file is automatically generated.

The Magic Voice™ can support the following compression format of the voice .WAV and .PCM file: AD4, PCM8, μ-law PCM.

Current type D/A output

The HT84XXX series supply two high accuracy current type D/A output pins for audio output. The output volume is changeable from 0 to 15 digital levels by writing a value to the VOLUME_n (n=1 or 2) registers. The D/A pins are PMOS open drain structure and ouput synthesized signals for driving a speaker through an external NPN transistor when the chip is active. However, it becomes floating when the chip is in the standby state. An 8050 type transistor with h_{FE}=150 is recommended for the output driver of the D/A output pin.

Melody/Tone generator

The HT84XXX family has a built-in melody/tone generator. The generator can generate 13 different kinds of melody beats, 5 octaves of tone level, 18 tempos, and 2 channels mixed output. Of these components, the melody tempo is changeable and generates sound effects by writing a control value to the TEMPO register. The chip provides the following 18 tempos, 13 beats, and 5 octaves for user′s programming.

- 18 tempos (Beats/Min.)

68	78	82	93	100	105
109	114	119	125	132	139
147	156	179	192	227	310

- 13 beats

$$\frac{1}{24}, \frac{1}{12}, \frac{1}{8}, \frac{1}{6}, \frac{1}{4}, \frac{1}{3}, \frac{1}{2}, \frac{2}{3}, \frac{3}{4}, 1, \frac{4}{3}, \frac{3}{2}, 2$$

- 5 octaves

  C1~B1, C2~B2, C3~B3, C4~B4, C5~B5

PCM/ADPCM synthesizer

The HT84XXX family contains a PCM and ADPCM synthesizer. The synthesizer offers a wide range of sampling rates from 4kHz to 24kHz for PCM synthesis and 4kHz to 16kHz for ADPCM synthesis. The sampling rate of the synthesizer can be changed by writing a control value to the sampling rate register. It also supports a small variety of 100Hz. For a higher performance sound quality, the PCM coding is required. But for a longer recording capacity, the ADPCM coding is recommended.

The capability of the voice sampling rate for various voice compression format.

f_{OSC}	PCM8	μ-law PCM	AD4
4M	12kHz	11kHz	8kHz
5M	15kHz	14kHz	10kHz
6M	18kHz	16kHz	12kHz
8M	24kHz	22kHz	16kHz

Oscillator configuration

The HT84XXX series provides an RC oscillator for the system clock. The system oscillator stops in the standby state so as to reduce power consumption.

For the oscillator circuit, an external resistor is required between OSC and VSS. The oscillator frequency is typically 4MHz for an external resistor of 240kΩ. The RC type of oscillator offers the most cost-effective solution, although the frequency of the oscillation may vary with temperature and the chip itself due to process variation.

f_{OSC} \ R_{OSC}	HT84EVA	HT84P00	IC
4M	180kΩ	240kΩ	240kΩ
5M	150kΩ	210kΩ	210kΩ
6M	120kΩ	180kΩ	180kΩ
8M	91kΩ	150kΩ	150kΩ

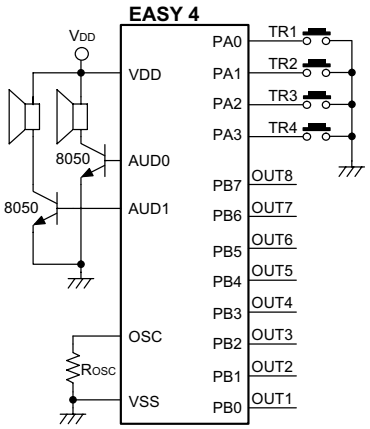
Mask options

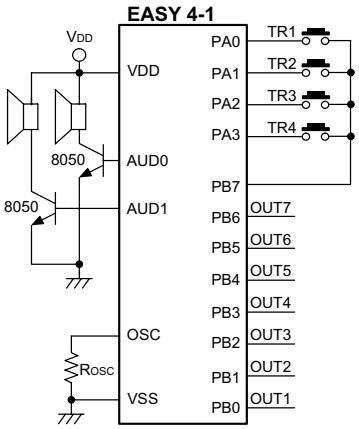
The following options have to be defined to ensure a proper system functioning:

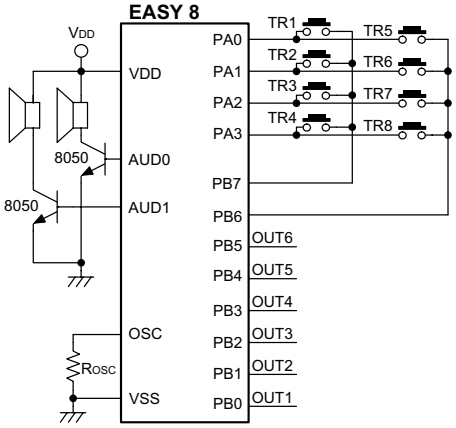
- Pull-high resistor: 33kΩ/98kΩ (3V)
- Key debounce time: 0ms~255ms (f_{OSC}=4MHz)

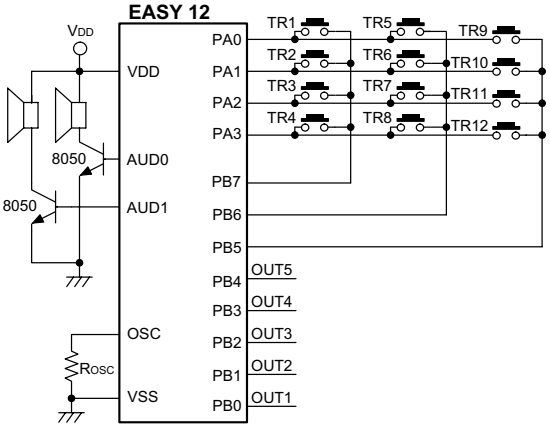
Application Circuits

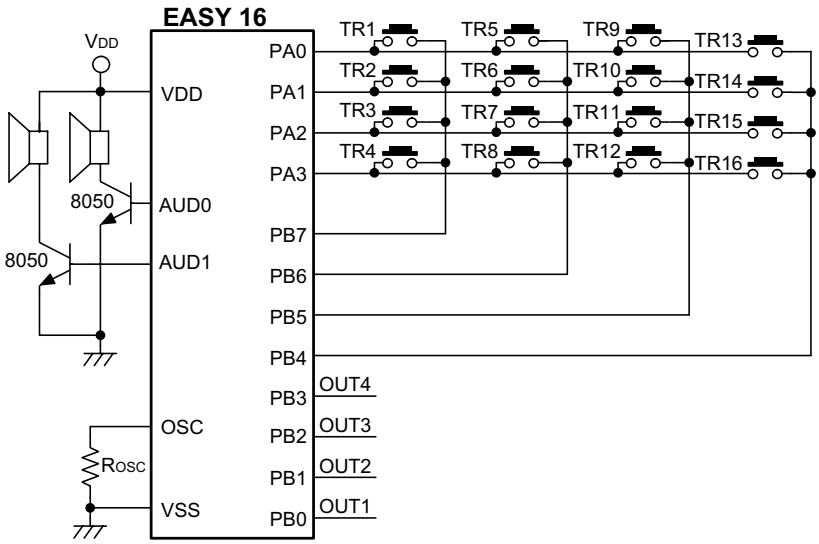
Basic application










EASY 16
VDD
VDD
8050
AUD0
8050
AUD1
OSC
ROSC
VSS
PA0
PA1
PA2
PA3
PB7
PB6
PB5
PB4
PB3
PB2
PB1
PB0
OUT4
OUT3
OUT2
OUT1
TR1
TR2
TR3
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TR9
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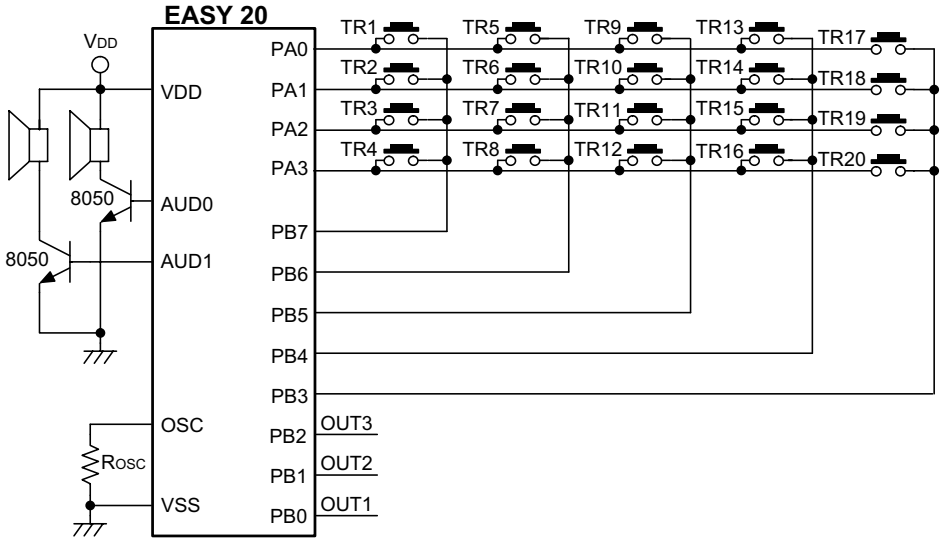
TR12
TR13
TR14
TR15
TR16


EASY 20
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VDD
8050
AUD0
8050
AUD1
OSC
ROSC
VSS
PA0
PA1
PA2
PA3
PB7
PB6
PB5
PB4
PB3
PB2
PB1
PB0
OUT3
OUT2
OUT1
TR1
TR2
TR3
TR4
TR5
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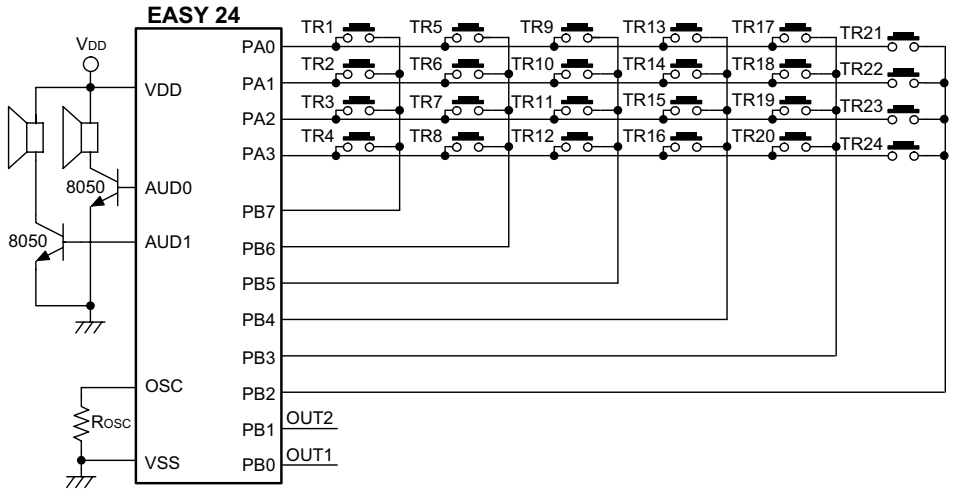
TR19
TR20


EASY 24
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VDD
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VSS
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PA2
PA3
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PB5
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PB2
PB1
PB0
OUT2
OUT1
TR1
TR2
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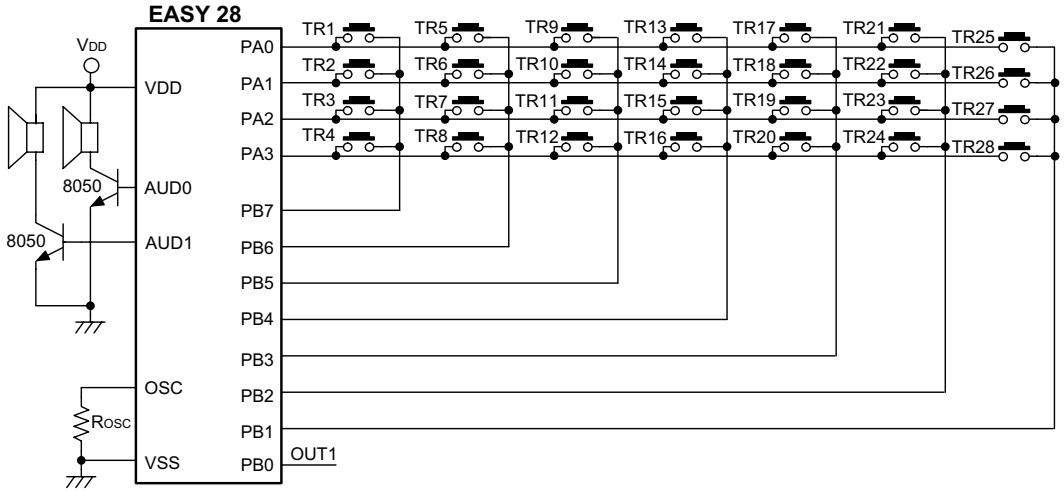
EASY 28
VDD
VDD
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AUD0
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AUD1
OSC
ROSC
VSS
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PA1
PA2
PA3
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PB5
PB4
PB3
PB2
PB1
PB0
OUT1
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TR2
TR3
TR4
TR5
TR6
TR7
TR8
TR9
TR10
TR11
TR12
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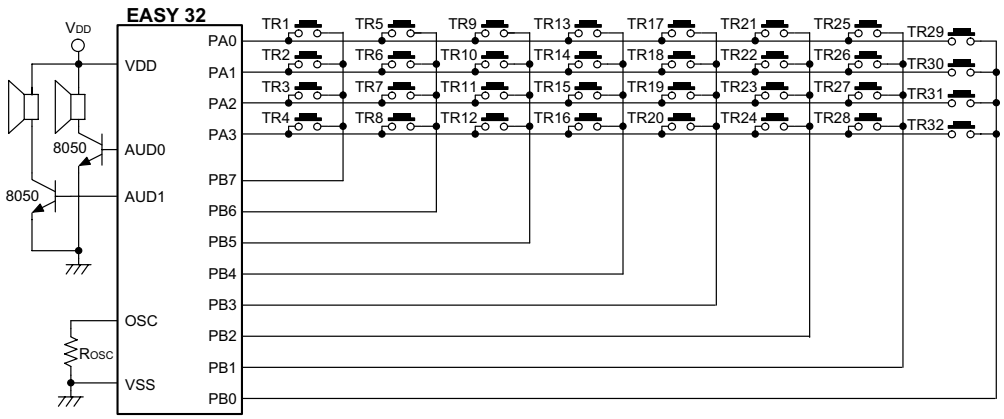
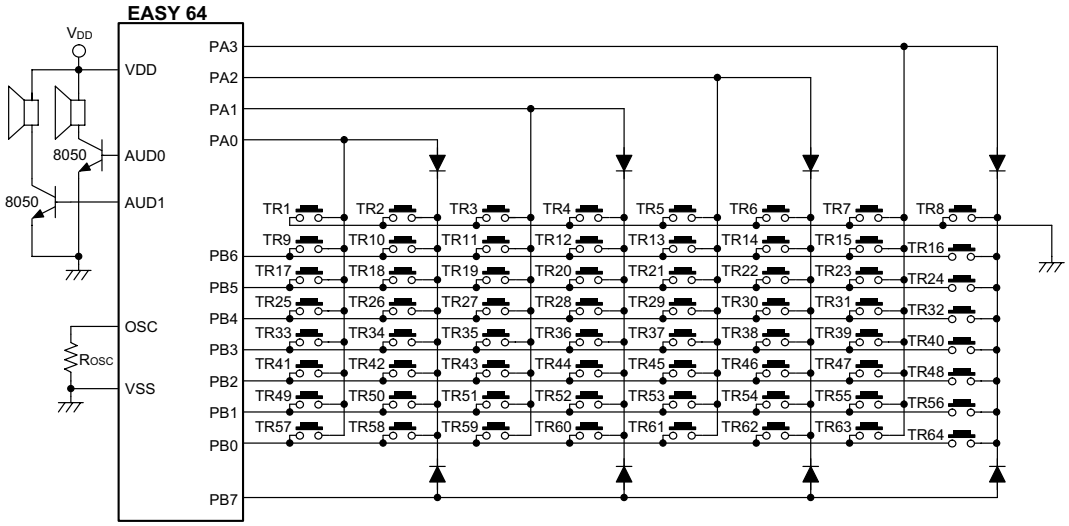
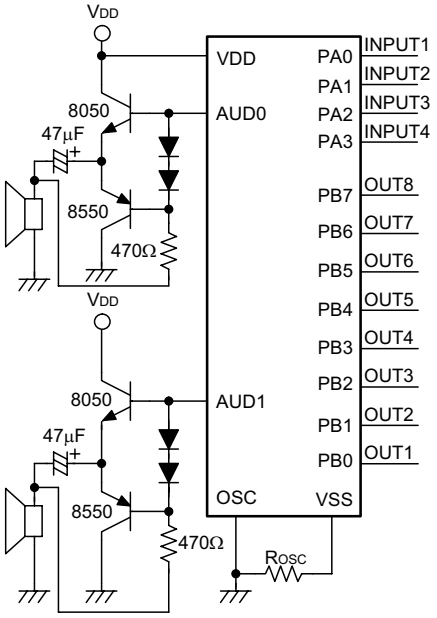




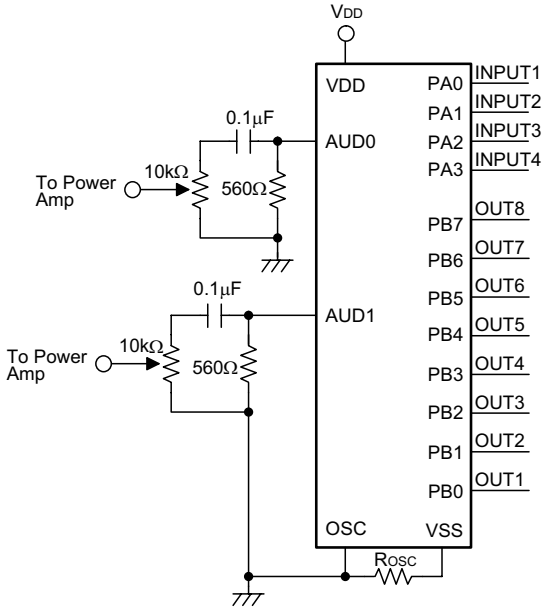
Note: In Easy 64 mode, only falling edge trigger can be used in input state

In Easy 64 mode, the path command "TRn?L:pathname" and "TRn?H:pathname" are invalid

Push-pull amplifilter application



OP amplifilter application



Application Notes

Easy Format™

The syntax of the Easy Format™ consists of four major parts. They are format and audio file declaration part, input states declaration part, output states declaration part and path command part. The architecture of the Easy Format™ program is shown as follows:

```
EASY n              ; Comment
                    ; Format and audio file declaration part
....
Stereo/Mono         ; Two AUD output or single AUD output
INPUT STATES        ; Input states declaration part
....
OUTPUT STATES       ; Output states declaration part
....
PATHS               ; Path command part
....
```

Note: Easy Format™ is a trademark of Grow With Me, Inc.

Format and voice/melody file declaration

In this area the format and audio file declaration are used to define the number of input and output as well as declare the audio format.

Syntax: EASY n

The EASY n command is used to define the maximum number of trigger input in the application circuit. The alphanumeric n represents the number of trigger input where n has the choice from 4 to 64 with a scale 4. However, the determination of trigger input reflects the number of output. The relation of the number of I/O is shown in the following table.

EASY n	TRn	OUTn
EASY 4	TR1, TR2, TR3, TR4	OUT1, OUT2, ..., OUT7
EASY 8	TR1, TR2, ..., TR8	OUT1, OUT2, ..., OUT6
EASY 12	TR1, TR2, ..., TR12	OUT1, OUT2, ..., OUT5
EASY 16	TR1, TR2, ..., TR16	OUT1, OUT2, ..., OUT4
EASY 20	TR1, TR2, ..., TR20	OUT1, OUT2, OUT3
EASY 24	TR1, TR2, ..., TR24	OUT1, OUT2
EASY 28	TR1, TR2, ..., TR28	OUT1
EASY 32	TR1, TR2, ..., TR32	
EASY 64	TR1, TR2, ..., TR64	
* refer to the application circuit		

Syntax:

voice_file/compression_method
melody_file
tone_file

The source audio files must be included in your Easy program. The audio files include the voice files with the extended name .PCM or .WAV, the melody files with .MID or .MLD format and the tone files with Holtek's .HT8 format. The compression methods of voice files have three options such as μ-law PCM, PCM8 and AD4.

Example:

```
voice1.wav/pcm8      ; #0 voice files declaration
voice2.pcm/ad4       ; #1
melody1.mid          ; #2 melody files declaration
melody2.mld          ; #3
tone1.ht8            ; #4 tone files declaration
```

Stereo/Mono:

The audio output selection. If the audio output is declared as "Stereo", the channel 1 voice will output via AUD1 and the channel 2 voice will output via AUD2. If the audio output is declared as "Mono", the channel 1 and channel 2 voices will mixedly output via AUD1 and AUD2 is invalid. The default declaration is "Mono". The audio file compressed by AD4 cannot output through channel 2. If the melody file outputs through channel 2, the melody file cannot include any channel 1 instructions.

Input states declaration

Syntax:

```
INPUT STATES
;           TRn                                  ....
statename:  [rising_edge_path][/falling_edge_path]  ....
```

The bracket [ ] is denoted as optional existence. If the path is assigned as "X", the input trigger signal is ignored. Unassigned trigger paths will automatically be assigned as "X". When TRn detects a rising edge or a falling edge signal, the path name of the rising edge path or falling edge path will be executed. The statename and path label can be any name defined by the user. The "/" denotes the falling edge path. The maximum number of statename are 256 and the maximum number of different pathname are 128.

Example:

```
INPUT STATES    ; input states declaration
;               TR1         TR2         TR3
Run:            P12Start    /P13Stop    P14Go/P15Pause
```

where "Run" denotes the input statename and "P12Start", "/P13Stop", "P14Go" and "/P15Pause" are all pathnames. When a rising edge signal triggers the TR1, then the path of P12Start will be executed. And if a falling edge signal triggers the TR1, then the signal is ignored, etc.

Output states declaration

Syntax:

```
OUTPUT STATES
;                OUTn        ....
statename:       OutputMode  ....
```

The possible output mode are listed and described on the following table. The maximum number of output state are 256.

Output Mode	Description
X	Set OUTn to input mode with pull-high resistor
H	Set the output pins to logic high
L	Set the output pins to logic low
P+	Send a (+) pulse train to output pins
P-	Send a (-) pulse train to output pins
SP+	Send a plus single pulse to output pins
SP-	Send a minus single pulse to output pins

Example:

```
OUTPUT STATES              ; output states declaration
;                OUT1      OUT2
SirenOn:         P+        L
```

where "SirenOn" denotes the output statename. Executing "SirenOn" in the path command will send a positive pulse train to PB0 and send a logic low to PB1.

Path command definition

Syntax:

```
PATHS
pathname:  path command  ....
```

The pathname is defined according to the user's desire. The elements of the path command are listed and described on the following table. Each path equation consists of many path commands and each command is separated by one or more space. In order to increase the program readability if the path commands exceed the screen display you can break the path command to the next line and put the symbol "&" in front of the new line.

Path_Command	Description
Input statename	To active input state
Output statename	To active output state
Pathname	To execute the specified path
VAR=pathname	Define the variable path
VAR	To execute the variable path
Volume_1=n	Define the volume 1 value (n=0~15)
Volume_2=n	Define the volume 2 value (n=0~15)
Samplerate_1=n	Define the sampling rate 1 value
Samplerate_2=n	Define the sampling rate 2 value
Delay(n)	To delay n (min=0.1s) (n=0.1~65), f_{OSC}=4MHz
TRn?H:pathname	If TRn is logic High, then the pathname is executed.
TRn?L:pathname	If TRn is logic Low, then the pathname is executed.
Flashrate=n	Set the output pulse rate to ″n″ pulses per second, where n can be assigned as 1, 2, 3, ..., 12
FlashrateT=n	Set the output pulse rate after the melody tempo, n=1, 2, 3, ..., 12
FlashrateV=n	Set the output pulse rate after the volume, n=1, 2, ..., 12
END	Enter power down mode
Mi=PB	Read Port B to Mi
STOP1	Stop the sound of channel 1 playback
STOP2	Stop the sound of channel 2 playback
Mi=data	Set the contents of Mi to be data
Mi=Mj	Set the contents Mi to be Mj
Mi(bn)=1 or 0	Set bit bn to be 1 or 0, bn=0~7
Mi=Mj+data	Add immediate data with Mj to Mi
Mi=Mi+Mj	Add Mi with Mj to Mi
Mi=Mj.AND.data	And immediate data with Mj to Mi, data=0~255
Mi=Mj.OR.data	OR immediate data with Mj to Mi, data=0~255
Mi=Mj.XOR.data	XOR immediate data with Mj to Mi, data=0~255
Mi?data:pathname	If Mi=data then pathname is executed
Mi?Mj:pathname	If Mi=Mj then pathname is executed.
Mi(bn)?1:pathname	If the bit bn of Mi is ″1″ then the pathname is executed.
Mi(bn)?0:pathname	If the bit bn of Mi is ″0″ then the pathname is executed.

Path_Command	Description
Mi:[Path1, Path2, Path3, ... Pathn]	Path1 is executed when Mi=1; Path2 is executed when Mi=2; .... Pathn is executed when Mi=n
Random(Mi)	Get a random code and put it to Mi
Timert: timer_path	Initial the timer. If time out then timer_path is executed, t=0.1~65 sec.
TimerON	Start the timer counter
TimerOFF	Stop timer counter
n*soundfile, n*#N or #N	Play the soundfile n times #N is the N′th soundfile which is defined in the audio file declaration part. The starting number is 0
[n*soundfile] or [repeat *soundfile]	Play the soundfile n times or repeatedly via channel 2 and simultaneously execute the next path command.
Wait	Stop executing the next path command until the channel 2 soundfile is terminated.

Note: The n of TRn ranges from 1 to 32

″Volume_1=15″ is equal to ″Volume=15″

″Samplerate_1=4000″ is equal to ″Samplerate=4000″, ″4000″ means that the sampling rate is 4kHz.

The Mi, Mj are working registers (i, j=0, 1, 2, ..., 10), the M0~M4 are dedicated for users, the others are shared with VAR and Timer command.

Register	Command	Comment
M0~M4	—	Normal register
M5, M6	VAR	If the VAR instruction is used, the M5, M6 will be invalid.
M7~M10	Timer	If the Timer instruction are used, the M7~M10 will be invalid.

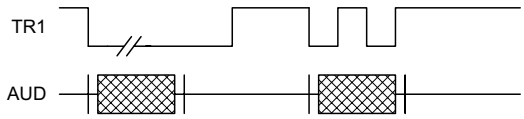
Example:

```
EASY 4
INPUT STATES
;                TR1     TR2     TR3     TR4
start:           /P1     X       X       X

PATHS
POWERON:         start           END
```

where ″POWERON″ is a reserved pathname and provides the initial setting. When the power is turned on, a falling edge trigger in TR1 is accepted and others are all ignored.

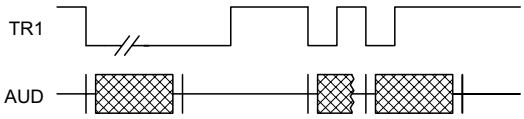
Application 1 — One shot, nonretriggerable

```
EASY 4
voice.wav/pcm8    ;#0 sound file declaration
INPUT STATES
;                 TR1       TR2       TR3       TR4
state1:           /path1    X         X         X
busy:             X         X         X         X

PATHS
POWERON:          state1    END
path1:            busy      1*voice   state1    END
```



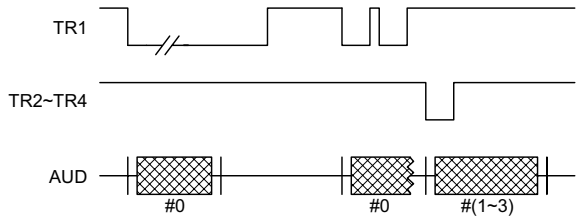
Application 2 — One shot, retriggerable by itself

```
EASY 4
voice.wav/pcm8    ;#0 sound file declaration
INPUT STATES
;                 TR1       TR2       TR3       TR4
state1:           /path1    X         X         X

PATHS
POWERON:          state1    END
path1:            1*voice    END
```



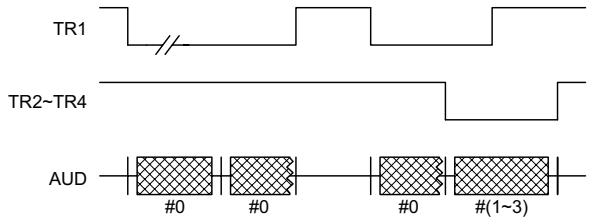
Application 3 — One shot, retriggerable by the other pin only

```
EASY 4
voice1.wav/pcm8   ;#0 sound file declaration
voice2.wav/pcm8   ;#1
voice3.wav/pcm8   ;#2
voice4.wav/pcm8   ;#3
INPUT STATES
;                 TR1       TR2       TR3       TR4
state0:           /path1    /path2    /path3    /path4
state1:           X         /path2    /path3    /path4
state2:           /path1    X         /path3    /path4
state3:           /path1    /path2    X         /path4
state4:           /path1    /path2    /path3    X

PATHS
POWERON:          state0    END
path1:            state1    #0        state0    END
path2:            state2    #1        state0    END
path3:            state3    #2        state0    END
path4:            state4    #3        state0    END
```



Application 4 — Level hold, retriggerable by the other pin only

```
EASY 4
voice1.wav/pcm8   ;#0 sound file declaration
voice2.wav/pcm8   ;#1
voice3.wav/pcm8   ;#2
voice4.wav/pcm8   ;#3
INPUT STATES
;                 TR1       TR2       TR3       TR4
state0:           /path1    /path2    /path3    /path4
state1:           path11    /path2    /path3    /path4
state2:           /path1    path11    /path3    /path4
state3:           /path1    /path2    path11    /path4
state4:           /path1    /path2    /path3    path11

PATHS
POWERON:          state0    END
path1:            state1    #0        path1
path2:            state2    #1        path2
path3:            state3    #2        path3
path4:            state4    #3        path4
path11:           state0    END
```



Application 5 — LED output, direct mode

```
EASY 4
voice1 .wav/pcm8  ;#0 sound file declaration
INPUT STATES
;                 TR1         TR2         TR3         TR4
state0:           /path1      X           X           X
OUTPUT STATES
;OUT              1           2
alarm:            P+          L
standby:          L           H
turnoff:          X           X

PATHS
POWERON:          state0      flashrate=6Hz           END
path1:            alarm       #0          standby     delay(2)    turnoff     END
```

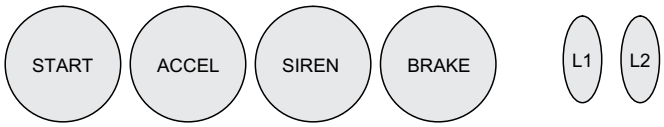
Application 6 — LED output matrix mode

```
EASY 4
INPUT STATES
;                 TR1
state0:           /path0
OUTPUT STATES
;                 OUT1  OUT2  OUT3  OUT4  OUT5  OUT6  OUT7
LED1:             P+    L     L     L     H     H     H
LED2:             L     P+    L     L     H     H     H
LED3:             L     L     P+    L     H     H     H
LED4:             P+    L     L     H     L     H     H
LED5:             L     P+    L     H     L     H     H
LED6:             L     L     P+    H     L     H     H
LED7:             P+    L     L     H     H     L     H
LED8:             L     P+    L     H     H     L     H
LED9:             L     L     P+    H     H     L     H
LED10:            P+    L     L     H     H     H     L
LED11:            L     P+    L     H     H     H     L
LED12:            L     L     P+    H     H     H     L
turnoff:          X     X     X     X     X     X     X
```

```
PATHS
POWERON:    state0  M0=0    flashrate=3Hz    END
path0:      M0=M0+1
            & M0:[P1,P2,P3,P4,P5,P6,P7,P8,P9,P10,P11,P12]
P1:         LED1    delay(2)  turnoff   END
P2:         LED2    delay(2)  turnoff   END
P3:         LED3    delay(2)  turnoff   END
P4:         LED4    delay(2)  turnoff   END
P5:         LED5    delay(2)  turnoff   END
P6:         LED6    delay(2)  turnoff   END
P7:         LED7    delay(2)  turnoff   END
P8:         LED8    delay(2)  turnoff   END
P9:         LED9    delay(2)  turnoff   END
P10:        LED10   delay(2)  turnoff   END
P11:        LED11   delay(2)  turnoff   END
P12:        M0=0  LED12   delay(2)  turnoff   END
```

Application 7 — Police car

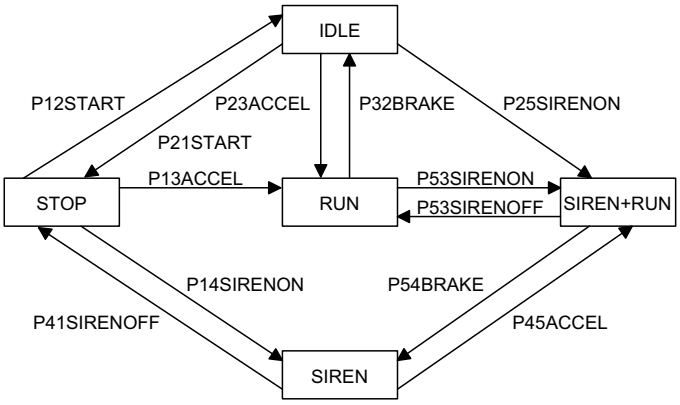
This is a full program application example to demonstrate how Easy Format handles a complicated design requirement. All the work is to be done on a single page.



There are four input trigger buttons and two output pins to drive two LEDs.

- BUTTON #1: Turn ON (START) or OFF the engine.
- BUTTON #2: Gas pedal to give ACCELERATION sound from idle and then keep on at a steady running sound.
- BUTTON #3: SIREN sound On/Off: toggle ON and toggle Off.
- BUTTON #4: BRAKE, triggers deceleration sound and then brings the car to idle.
- LEDs OUTPUTs: Blinks in opposite phase when the Siren sound is on. That is when one light is on, the other light is off in an alternating pattern.
- TIME OUT REQUIREMENTS: every sound needs to be automatically shut down after a specified period if no more trigger signal is received.

Easy Format™ application example: Police Car flow chart



EASY 4

```
*************************************************************************
;* voice file define
*************************************************************************
StartSnd.wav/ad4
IdleSnd.wav/ad4
AccelSnd.wav/ad4
RunSnd.wav/ad4
DecelSnd.wav/ad4
SirenSnd.wav/ad4
SiRunSnd.wav/ad4
*************************************************************************
;* I/O States
*************************************************************************
INPUT STATES
;               TR1         TR2         TR3             TR4
;               Start       Accel       Siren           Brake
StopCar:        /P12Start   /P13Accel   /P14SirenOn     X
Idle:           /P21Start   /P23Accel   /P25SirenOn     X
Run:            X           X           /P35SirenOn     /P32Brake
Siren           X           /P45Accel   /P41SirenOff    X
SirenRun        X           X           /P53SirenOff    /P54Brake

OUTPUT STATES
;               OUT1        OUT2
SirenOn:        P+          P-
SirenOff:       H           H
*************************************************************************
;* Paths
*************************************************************************
Paths
POWERON:        StopCar     SirenOff    FLASHRATE=6Hz   END
P12Start:       Idle        1*StartSnd  10*IdleSnd      PowerDown
P21Start:       StopCar     END
P13Accel:       Run     2*IdleSnd   1*AccelSnd      20*RunSnd
                 & PowerDown
```

P14SirenOn: Siren SirenOn 10*SirenSnd PowerDown
P41SirenOff: StopCar SirenOff END
P23Accel: Run 1*AccelSnd 20*RunSnd PowerDown
P32Brake: Idle 1*DecelSnd 10*idleSnd PowerDown
P25SirenOn: 1*AccelSnd SirenRun SirenOn 10*SiRunSnd PowerDown
P35SirenOn: SirenRun SirenOn 10*SiRunSond PowerDown
P53SirenOff: SirenOff Run 20*RunSnd PowerDown
P45Accel: P25SirenOn
P54Brake: 1*DecelSnd Siren SirenOn 10*SirenSnd
& PowerDown
PowerDown: SirenOff StopCar End

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