# HOLTEK

## HT85XXX
## *Green Voice*™

## Features

- Operating voltage: 2.4V~5.0V
- Driver speaker (32Ω) $V_{DD}$=4.5V, $I_{DD}$=90mA
- Programmable tone melody generator
- ADPCM, 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
- Eight programmable I/O pins
- Four programmable input pins
- Provides 36 sec to 96 sec of voice capacity
- Timer controller
- Voice fill-in function
- Powerful user-defined functions
- Power-on initial setting
- 28-pin SKDIP package

## General Description

The HT85XXX 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 HT85XXX series has a 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 Green Voice provides various operational functions similar to arithmetic operation, logic operation, branch decision, random counter, and a programmable timer. The Green Voice series are suitable for versatile voice and sound effect applications.

The HT85XXX Green Voice series is Easy Format™ supported.
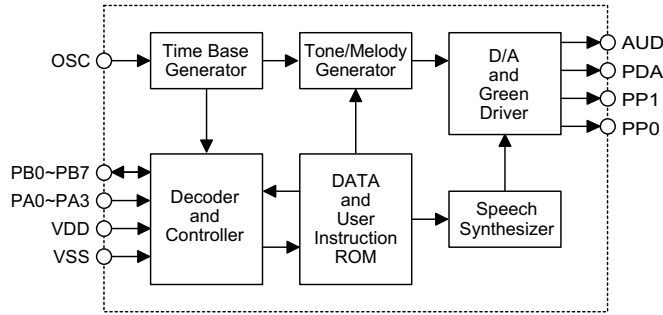
## Selection Table

The HT85XXX series provides various voice capacity as shown below:

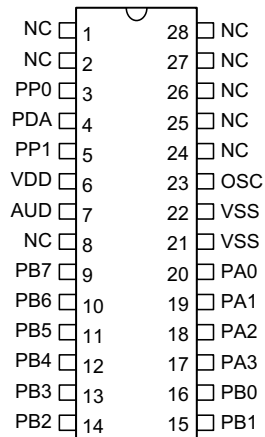| Part No. | HT85036 | HT85048 | HT85072 | HT85096 |
|----------|---------|---------|---------|---------|
| ROM | 768Kb | 1024Kb | 1536Kb | 2048Kb |
| Voice Length | 36 sec | 48 sec | 72 sec | 96 sec |

Note: The voice capacity is based on a sampling rate of 4-bit ADPCM 5.25kHz.
     *: under development.
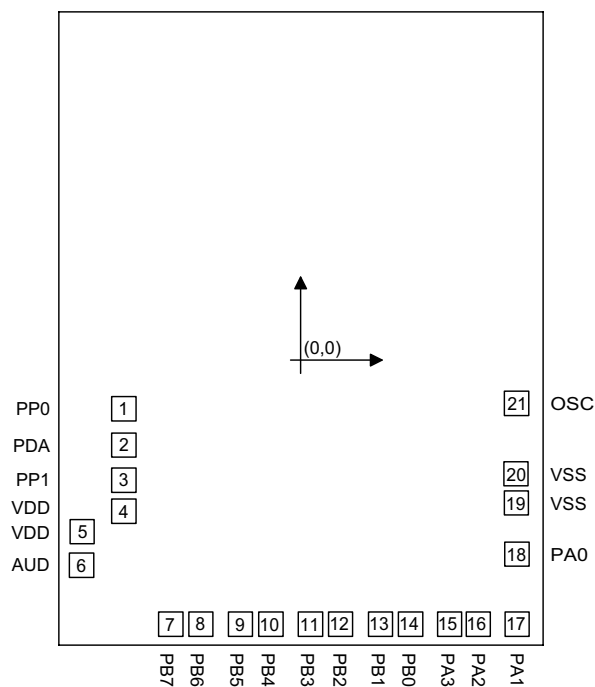
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## Block Diagram



## Pin Assignment



**HT85XXX
− 28 SKDIP**

## Pad Assignment

**HT85036, HT85048, HT85072, HT85096**



Chip size: $2315 \times 2875 \ (\mu m)^2$

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

## Pad Coordinates

**HT85036, HT85048, HT85072, HT85096**                                     Unit: μm

| Pad No. | X | Y | Pad No. | X | Y |
|---------|---------|----------|---------|--------|----------|
| 1 | −785.05 | −216.50 | 12 | 178.65 | −1172.50 |
| 2 | −785.05 | −377.10 | 13 | 355.15 | −1172.50 |
| 3 | −785.05 | −533.85 | 14 | 489.95 | −1172.50 |
| 4 | −785.05 | −671.55 | 15 | 662.95 | −1172.50 |
| 5 | −970.35 | −761.05 | 16 | 789.70 | −1172.50 |
| 6 | −973.35 | −910.10 | 17 | 962.20 | −1172.50 |
| 7 | −577.70 | −1172.50 | 18 | 961.30 | −861.10 |
| 8 | −443.35 | −1172.50 | 19 | 958.10 | −634.65 |
| 9 | −226.85 | −1172.50 | 20 | 956.30 | −505.15 |
| 10 | −132.35 | −1172.50 | 21 | 960.96 | −192.93 |
| 11 | 44.15 | −1172.50 | | | |

## Pin Description

| Pin No. | Pin Name | I/O | Internal Connection | Description |
|---|---|---|---|---|
| 1, 2, 8, 24~28 | NC | — | — | No connection |
| 3, 4, 5 | PP0, PDA, PP1 | O | — | Green Voice Speaker control pin |
| 6 | VDD | — | — | Positive power supply |
| 7 | AUD | 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<br>Can be optioned as trigger inputs or LED outputs |
| 16 | PB0 | I/O | Pull-high or CMOS | Bidirectional I/O pins<br>Can be optioned as CDS interface with internal Schmitt trigger input |
| 20~17 | PA0~PA3 | I | Wake-up Pull-high | Trigger inputs<br>Can also be configured as wake-up inputs |
| 21, 22 | VSS | — | — | Negative power supply, ground |
| 23 | OSC | I | — | Built-in RC oscillator<br>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. AUD 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 |

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## Functional Description

The Green 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 Green Voice provides 8-bit PCM, 6-bit µ-law PCM and 4-bit ADPCM synthesis. In HT85XXX series, a mixed output of two channels PCM synthesis is allowed but only one channel ADPCM synthesis is allowed. For melody generator, the Green Voice supports a tone melody and PCM melody generator and two channels mixed output for the whole series.

The Green 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 Green 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 Green 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 HT85XXX series supply 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 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 HT85XXX 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

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## PCM/ADPCM synthesizer

The HT85XXX 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 | $\mu$-law PCM | AD4 |
|---|---|---|---|
| 4M | 12kHz | 11kHz | 8kHz |
| 5M | 15kHz | 14kHz | 10kHz |
| 6M | 18kHz | 16kHz | 12kHz |
| 8M | 24kHz | 22kHz | 16kHz |

## Oscillator configuration

The HT85XXX 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 240k$\Omega$. 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.

| $R_{OSC}$ / $f_{OSC}$ | HT84EVA | HT84P00 | IC |
|---|---|---|---|
| 4M | 180k$\Omega$ | 240k$\Omega$ | 240k$\Omega$ |
| 5M | 150k$\Omega$ | 210k$\Omega$ | 210k$\Omega$ |
| 6M | 120k$\Omega$ | 180k$\Omega$ | 180k$\Omega$ |
| 8M | 91k$\Omega$ | 150k$\Omega$ | 150k$\Omega$ |

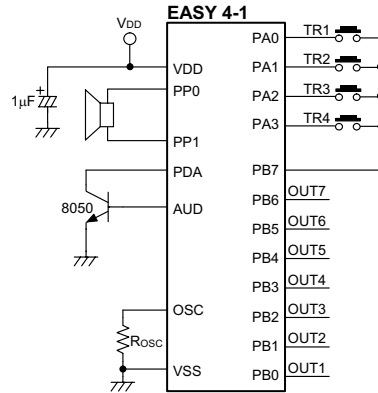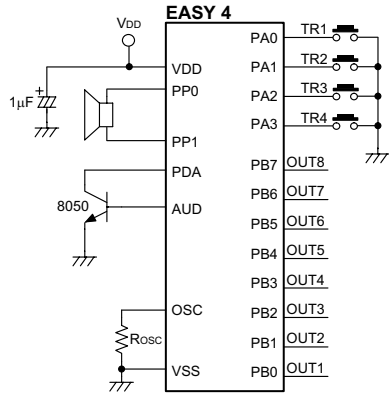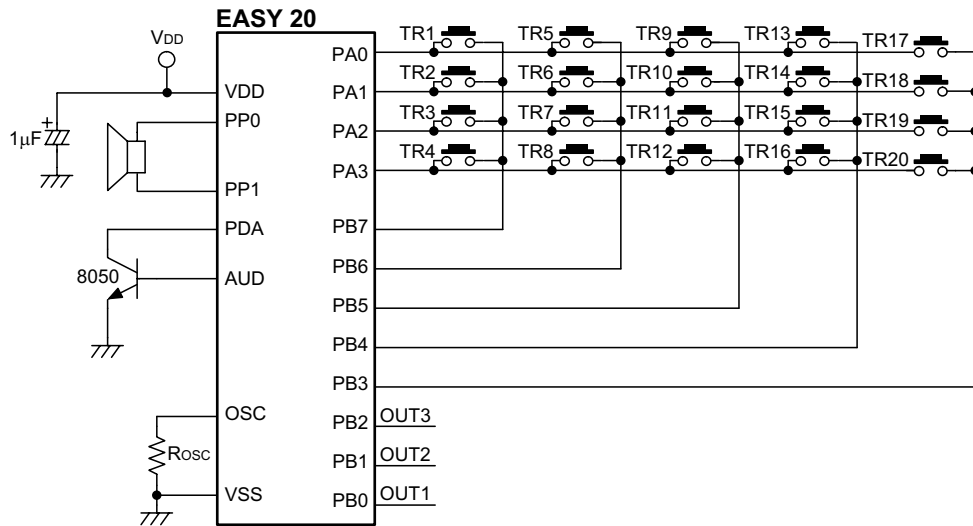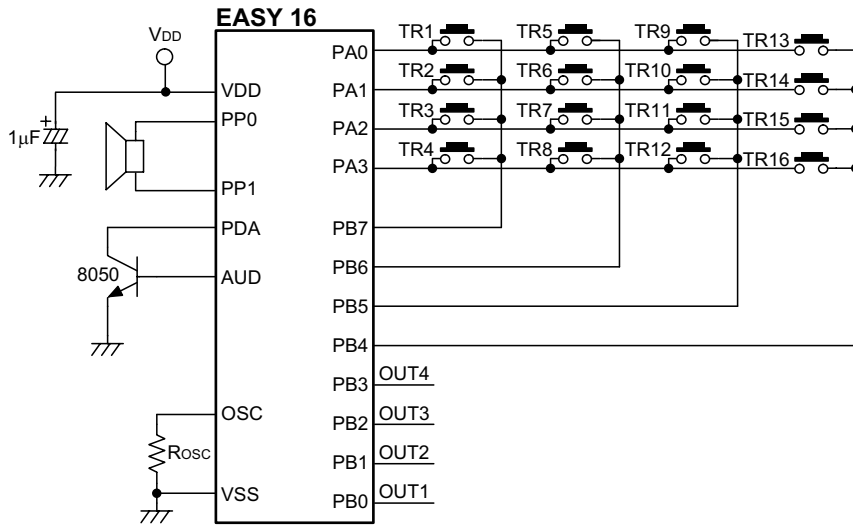## Mask options

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

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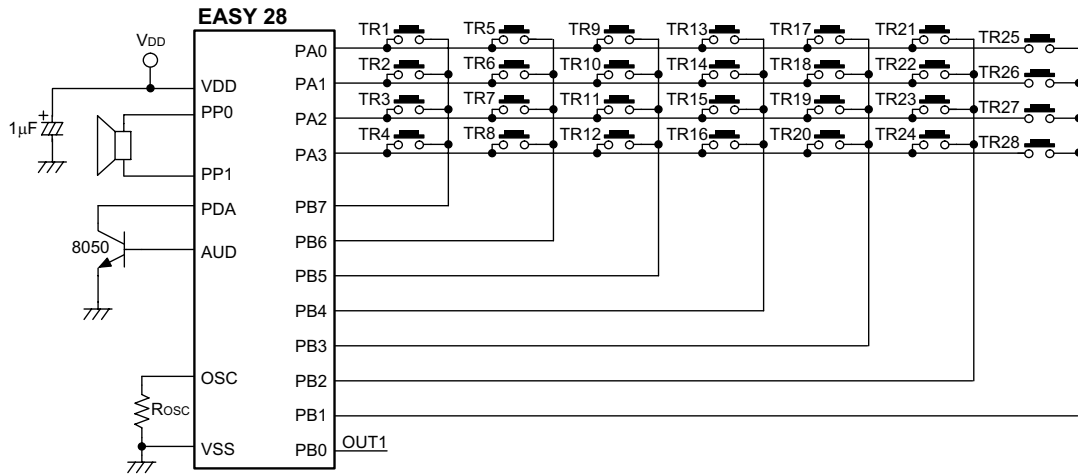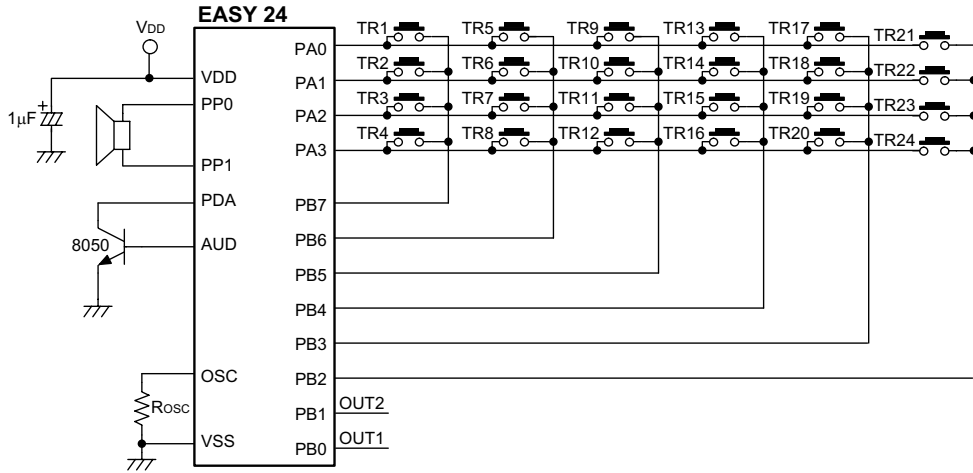- Key debounce time: 0ms~255ms ($f_{OSC}$=4MHz)

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# Application Circuits

**Basic application**



EASY 4
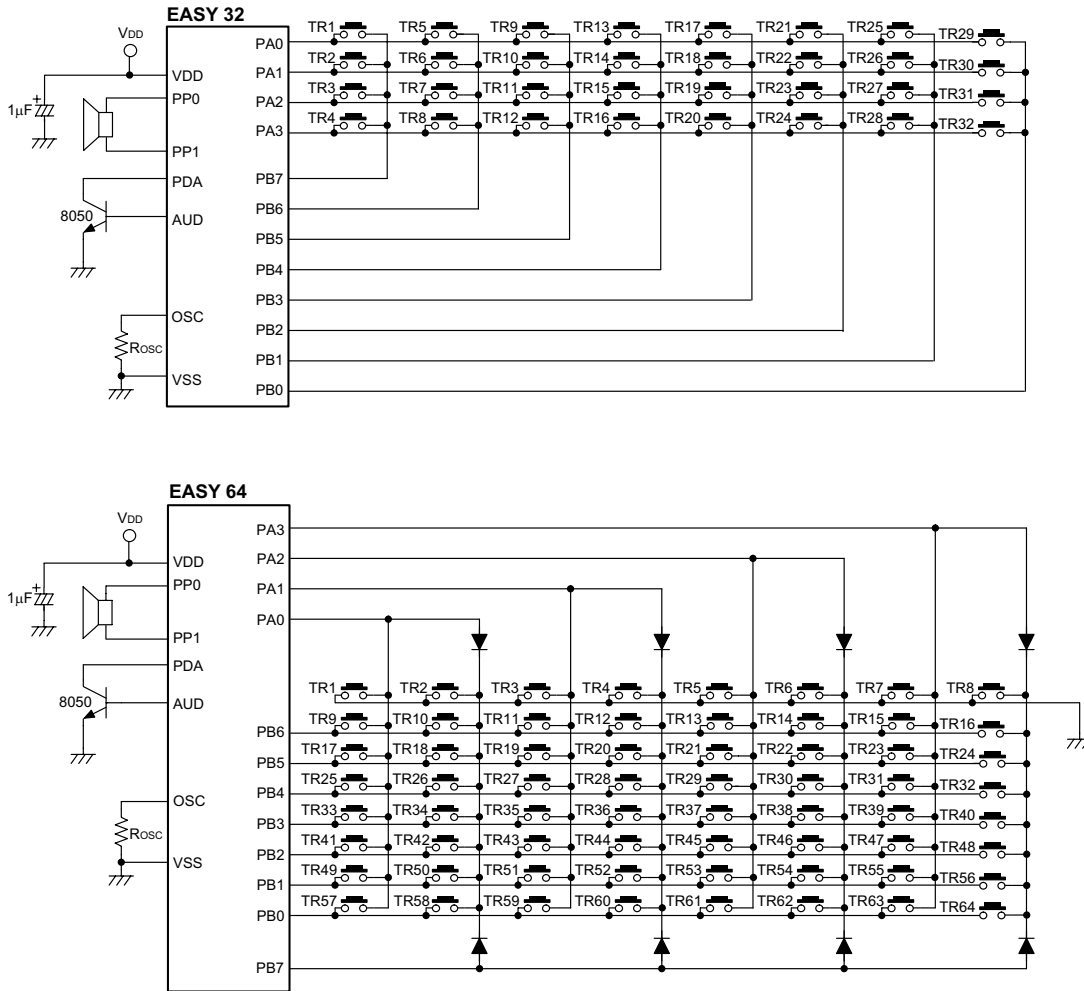


EASY 4-1



EASY 8



EASY 12

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**EASY 16**



**EASY 20**
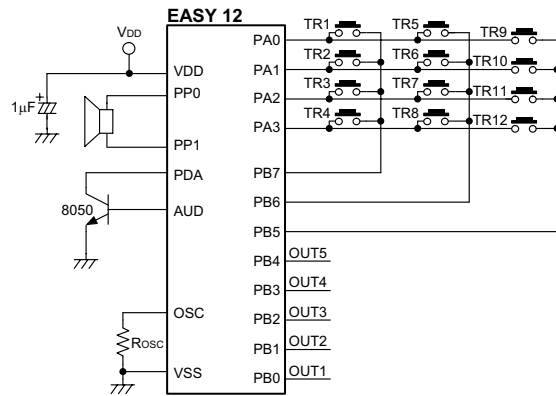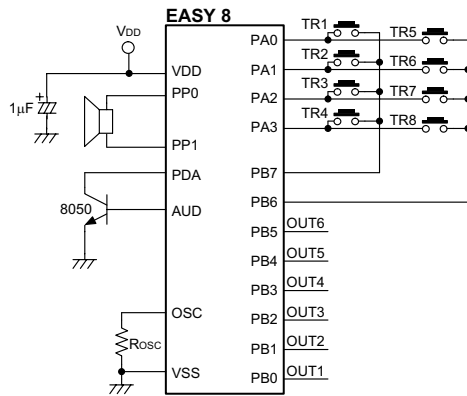
Note: In Easy 64 mode, only falling edge trigger can be used in input state

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

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