

Features

- Operating voltage: 3.5V~5.0V
- Directly interface with external parallel ROMs
- External ROM options:
 - 1Mb×4
 - 2Mb×3
 - 4Mb×2
 - 8Mb×1
- 12-bit analysis and 3-bit/4-bit ADPCM coding algorithm
- Eight keys available
- Auto power control for an external power amplifier
- 3.58MHz crystal oscillator/ resonator for a system clock (VDD=5V)
- Programmable sound sampling rate
- KEY0 as a stop key
- KEY1 as a sequential key
- KEY2~KEY7 options:
 - Retriggerable
 - Non-retriggerable
 - Level hold
 - Play once and auto stop
 - Repeat and non-stop
- Voice capacity options:
 - 456 seconds for 8Mb×1, 6kHz sampling rate, 3-bit format
 - 342 seconds for 8Mb×1, 6kHz sampling rate, 4-bit format

Applications

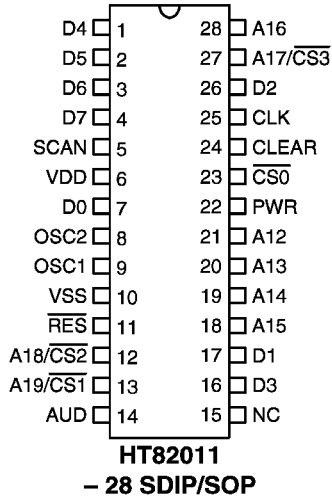
- Toys
- Alarm clocks
- Public address system
- Alert & warning system
- Sound effect generators
- Products with a voice interface

General Description

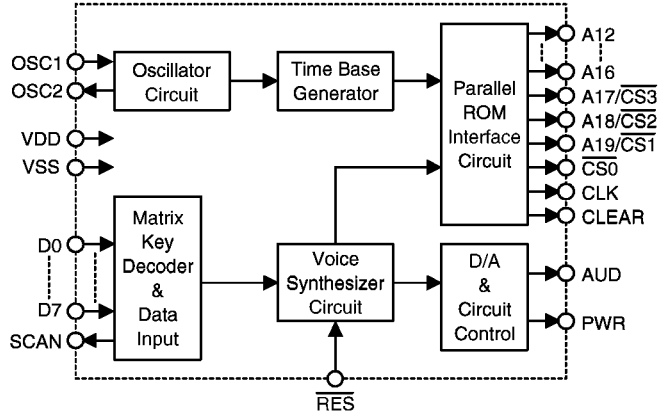
The HT82011 is a 3-bit/4-bit ADPCM sound synthesizer LSI implemented in a CMOS technology. It provides an 8-matrix key operation and an external parallel ROM interface circuit. The size of the voice capacity is determined by the type (1M, 2M, 4M or 8M) and the number of external ROMs. Customer's sound sources are

encoded into a 3-bit/4-bit format by HOLTEK's tools. Sectional playback arrangement instructions of each key are stored in the table ROM. The key features are also programmable. With such a flexible structure, the HT82011 is excellent for versatile sound applications.

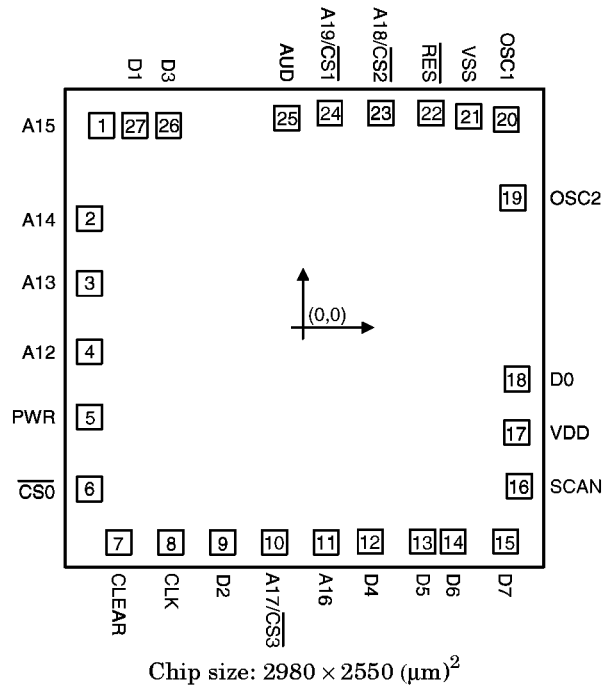
Pin Assignment



Block Diagram



Pad Assignment



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

Pad Coordinates

 Unit: μm

Pad No.	X	Y	Pad No.	X	Y
1	-1224.25	988.5	15	1227.25	-1045.0
2	-1296.25	535.5	16	1312.25	-774.0
3	-1296.25	217.5	17	1295.75	-513.0
4	-1296.25	-119.0	18	1296.25	-252.0
5	-1296.25	-437.0	19	1273.25	635.0
6	-1296.25	-789.5	20	1234.75	1018.0
7	-1120.25	-1050.0	21	1007.75	1034.5
8	-804.75	-1050.0	22	777.75	1050.0
9	-490.75	-1050.0	23	470.75	1050.0
10	-175.25	-1050.0	24	162.75	1050.0
11	139.25	-1050.0	25	-101.25	1024.5
12	407.25	-1045.0	26	-819.25	988.5
13	725.25	-1045.0	27	-1023.25	988.5
14	910.25	-1045.0			

Pad Description

Pad No	Pad Name	I/O	Internal Connection	Descriptions
1~4	A15~A12	O	CMOS	Connect to external ROM address pins of A15~A12
5	PWR	O	CMOS	For an external amplifier power control PWR becomes low during AUD signal output, making an external amplifier active
6	$\overline{\text{CS0}}$	O	CMOS	Connects to an external ROM, functions as a chip selection pin
7	CLEAR	O	CMOS	Connects to an IC of 4040 to reset the outputs of A0~A11
8	CLK	O	CMOS	Connects to an IC of 4040 for binary counter timing
9	D2	I	Pull-High	D2 receives sound data from an external ROM and a matrix key scan input, where D2 has a wake-up function.
10	A17/ $\overline{\text{CS3}}$	O	CMOS	Connects to an external ROM address of A17 for ROMs of 2Mb, 4Mb and 8Mb types, or functions as a chip selection pin for ROM of 1Mb type
11	A16	O	CMOS	Connects to an external ROM address of A16
12~15	D4~D7	I	Pull-High	D4~D7 receive sound data from an external ROM and a matrix key scan input
16	SCAN	O	CMOS	Matrix key scan output, active low
17	VDD	—	—	Positive power supply

Pad No	Pad Name	I/O	Internal Connection	Descriptions
18	D0	I	Pull-High	D0 receives sound data from an external ROM and a matrix key input pin, where D0 has a wake-up function
19	OSC2	O	—	Oscillator output
20	OSC1	I	—	Oscillator input
21	VSS	—	—	Negative power supply (GND)
22	$\overline{\text{RES}}$	I	Pull-High	Input for resetting the chip inside Reset is active at a low-going edge or low level
23	A18/ $\overline{\text{CS2}}$	O	CMOS	Connects to an external ROM address of A18 for ROMs of 4Mb and 8Mb types, or functions as a chip selection pin for ROMs of 1Mb and 2Mb types
24	A19/ $\overline{\text{CS1}}$	O	CMOS	Connects to an external ROM address for ROM of 8Mb type, or functions as a chip selection pin for ROMs of 1Mb, 2Mb and 4Mb types
25	AUD	O	PMOS Open Drain	Audio output for driving an external transistor or amplifier
26	D3	I	Pull-High	D3 receives sound data from an external ROM and a matrix key scan input, where D3 has a wake-up function
27	D1	I	Pull-High	D1 receives sound data from an external ROM and a matrix key scan input, where D1 has a wake-up function

Absolute Maximum Ratings*

Supply Voltage -0.3V to 5.5V Storage Temperature -50°C to 125°C
 Input Voltage $V_{SS}-0.3V$ to $V_{DD}+0.3V$ 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.

D.C. Characteristics

(Ta=25°C)

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Unit
		V _{DD}	Conditions				
V _{DD}	Operating Voltage	—	—	3.5	—	5	V
I _{DD}	Operating Current	5V	No load, f _{SYS} =3.58MHz	—	1.5	3	mA
I _{STB}	Standby Current	5V	No load, Halt mode	—	—	5	μA
V _{IL}	Input Low Voltage	5V	—	0	—	0.2V _{DD}	V
V _{IH}	Input High Voltage	5V	—	0.8V _{DD}	—	5V	V
I _{OL}	A12~A18, CLK, CLEAR, SCAN, CS0, PWR, D0~D7 Output Sink Current	5V	V _{OL2} =0.5V	2.5	—	—	mA
I _{OH}	A12~A18, CLK, CLEAR, SCAN, CS0, PWR, D0~D7 Output Source Current	5V	V _{OH2} =4.5V	-1	—	—	mA
I _O	Max. AUD Output Current	5V	V _{OH} =0.6V	-3	-5	—	mA
R _{PH}	Pull-High resistor	5V	V _{IL} =0V	30	—	300	kΩ

A.C. Characteristics

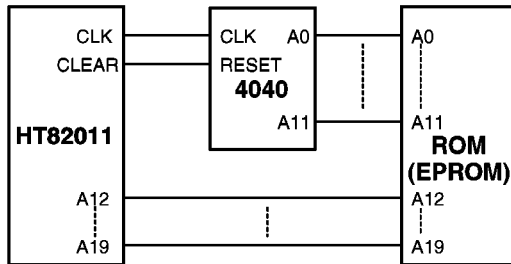
(Ta=25°C)

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Unit
		V _{DD}	Conditions				
f _{SYS}	System Frequency	5V	Crystal or Resonator Oscillator	—	3.58	4	MHz
t _{RES}	Reset Pulse Width	—	V _{DD} =5V	5	—	—	ms

Functional Description

The HT82011 is a 3-bit/4-bit ADPCM sound synthesizer LSI. It provides 8 matrix keys (KEY0~KEY7) and an external parallel ROM interface. Of the 8 keys, KEY0 is a stop key. KEY1 is a sequential key. The remaining 6 keys (KEY2~KEY7) can be selected as a retriggerable, non-retriggerable, level hold, play once & auto stop or repeat & non-stop trigger key. The external ROMs store the customer's sound data as well as key definitions.

The HT82011 provides addresses of A0~A11 through an external serial binary counter (4040). Addresses of A12~A19 are directly offered to external ROMs. Of A12~A19, A17~A19 can be set as chip selection pins for ROMs of 1Mb, 2Mb and 4Mb, thus yielding 4 options of voice ROM, namely, 1Mb×4, 2Mb×3, 4Mb×2 and 8Mb×1.



The customer's sound source is analyzed and coded through HOLTEK's tools. The encoded data are then stored in an external ROM of 1Mb, 2Mb, 4Mb or 8Mb type.

Sound length

Memory Type	Sampling Rate	ADPCM Format	Time
1Mb×4	6K	3-bit	228 secs
		4-bit	171 secs
2Mb×3	6K	3-bit	342 secs
		4-bit	256 secs
4Mb×2	6K	3-bit	456 secs
		4-bit	342 secs

Memory Type	Sampling Rate	ADPCM Format	Time
8Mb×1	6K	3-bit	456 secs
		4-bit	342 secs

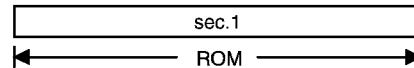
Sections and groups

- Sections

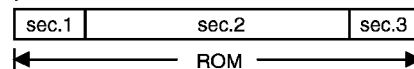
Section is the basic element constituting the contents of the voice ROM. During programming, the customer's sound sources can be divided into as many sections as required. A section can be composed of a sound or an interval of silence. However, the silence length is not counted in the voice ROM. The length of each section, is limited by the requirements of the sound contents.

A section when triggered by a key input can be played once, repeatedly or cascaded with other sections depending on the instructions of the key function table. The following are examples of section division:

Example 1: One section only



Example 2: 3 section division



Example 3: N section division



- Groups

The HT82011 plays groups according to the key input. Each group can be made up of one or more sections. When a key is triggered, the corresponding group is played immediately. For example, triggering KEY2 plays group 2, and so on. A section is allowed to appear in different groups.

The following is an example illustrating the composition of the function table:

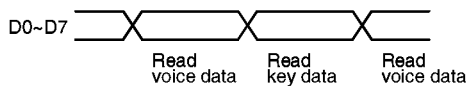
Group 1	sec.1 + sec.2 + sec.2
Group 2	sec.2 + sec.3
Group 3	sec.4
⋮	⋮
⋮	⋮
Group 7	sec.1 + sec.3+ + sec.N

Power-on state

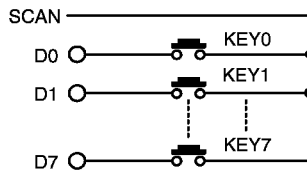
The HT82011 provides two kinds of power-on operations, namely, auto playing and standby operations. It will play the sounds of KEY1 after power is turn on or system resets in the auto playing operation. The chip, on the other hand, will directly enter the standby state after power is on or system resets in the standby operation.

Key input

The HT82011 provides eight trigger key inputs, namely, KEY0~KEY7. Their scan input and sound data input pins share the same D0~D7 for the purpose of saving pinout number. D0~D7 will read in sound data so as to determine which key of KEY0~KEY7 is triggered. The timing is shown below:

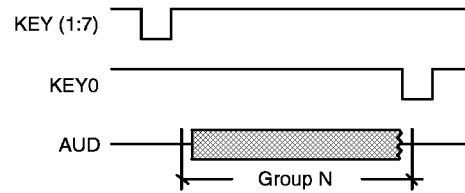


A low clock pulse is sent out from SCAN when D0~D7 are data for reading KEY0~ KEY7. It functions as a trigger signal of KEY0~KEY7. On the other hand, a value "Low" will be read in from its corresponding D0~D7 when one of KEY0~KEY7 is pressed. Only one key can be active at a time.



Key features

- KEY0 as a stop key
KEY0 is defined as a stop key. Any sound output stops by pressing this key.

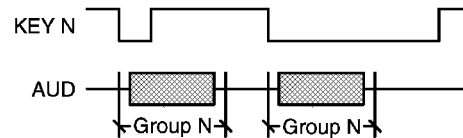


- KEY1 as a sequential key
KEY1 functions as a sequential key. Its sequential cycle is from KEY1 to the last active key. The playing sequence is reset whenever a key other than KEY1 is triggered.

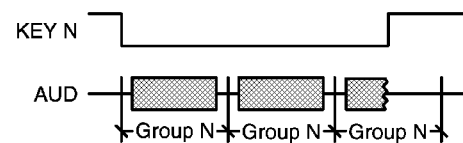
The playing sequence of sequential KEY1 is:
KEY1 → KEY2 → ... → KEYn (the last active key) → KEY1 → KEY2 → ...

- Trigger modes
All of KEY2~KEY7 can be set as a one shot or level-hold trigger key. KEY1 can be set as a one-shot trigger key only.

- ♦ One shot key
After one of KEY2~KEY7 is pressed, the corresponding sound will play once, whether or not it is pressed momentarily or kept held.



- ♦ Level-hold key
When one of KEY2~KEY7 is pressed and held down, the corresponding sound will repeat playing till that key is released.

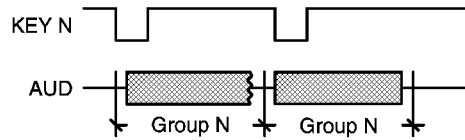


• Trigger functions

KEY1~KEY7 can all be set as retriggerable or non-retriggerable.

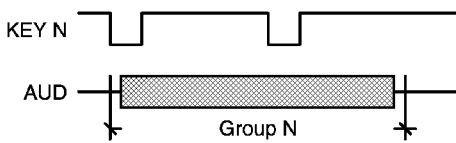
• Retriggerable

When a sound is playing, any further trigger input can replace it, whether or not the playing sound is completed.



• Non-retriggerable

When a sound is playing, any further trigger input is inhibited till the playing sound is finished.



• Key debounce time

The debounce time of KEY0~KEY7 are all set as 22ms (based on a 6kHz sampling rate).

Programming

The recorded sound data can be transformed to ADPCM codes of 3-bit or 4-bit format by HOLTEK's CAD tools. The coded data, code format and user-defined functions including key trigger functions, sampling rates, power on status, active key number, external ROM type and number are all saved in the external ROMs. Of the 3-bit format, the same memory can be used to save longer sounds. Of the 4-bit format, the synthesized sounds are more approaching the original sounds.

Sampling rate

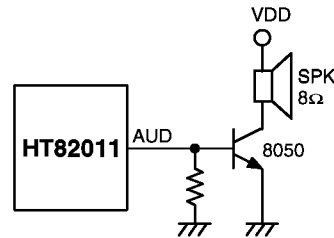
The HT82011 provides 16 kinds of sampling rate from 4kHz to 8kHz of code sounds. The sampling rate has to be raised if a better quality sound is required. It will shorten the total recording time. A lower sampling rate, on the other hand, will result in longer recording time but sacrifice sound quality.

AUD

The AUD pin is a PMOS open drain structure. It outputs sound signals to drive a speaker through an external NPN transistor when the chip is active. However, this pin becomes a floating output when the chip is in the standby state.

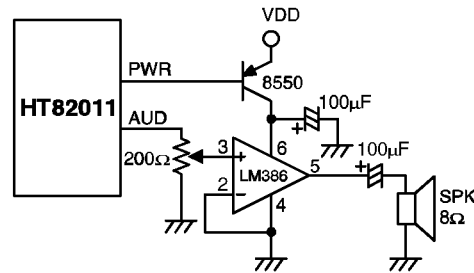
• For transistor

The 8050 type transistor with $h_{FE} \approx 150$ is recommended for an output driver.



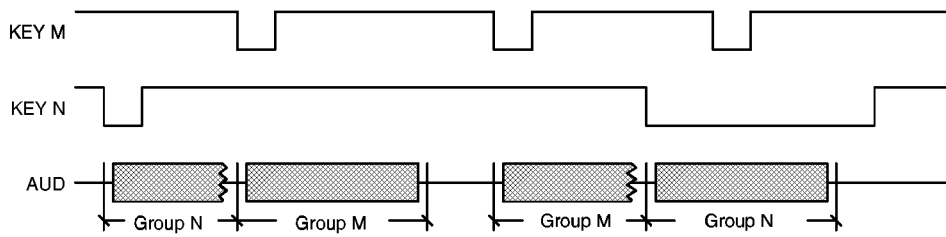
• For power amplifier

The HT82011 provides a PWR pin to control power consumption in the standby state. An external power amplifier is required for a speaker output if a better audio frequency response and more power are demanded.

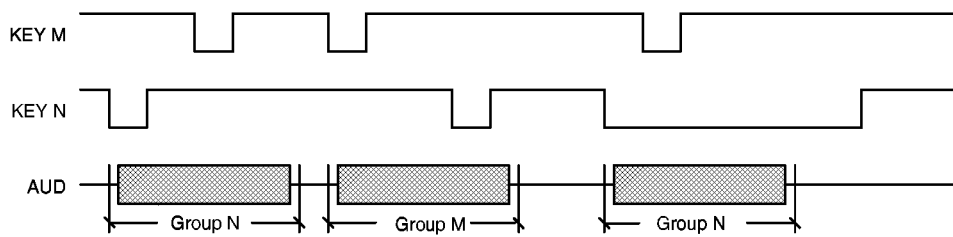


Timing Diagram

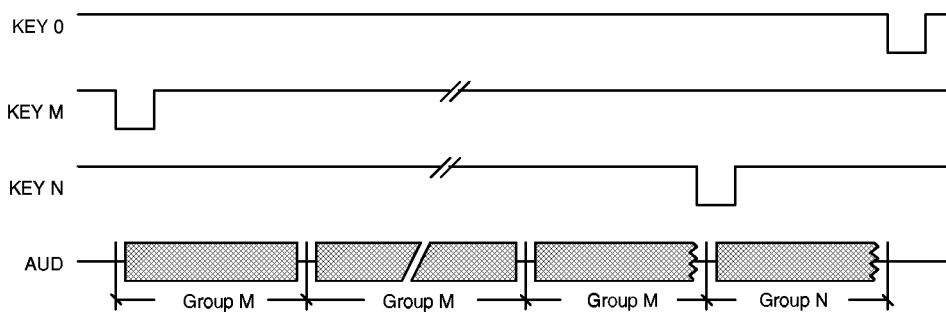
One shot and retriggerable



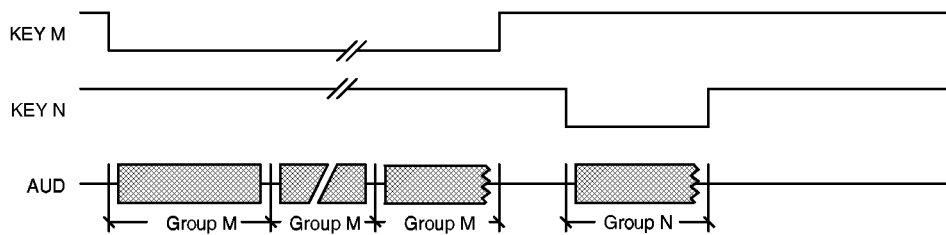
One shot and non-retriggerable



Repeat and retriggerable

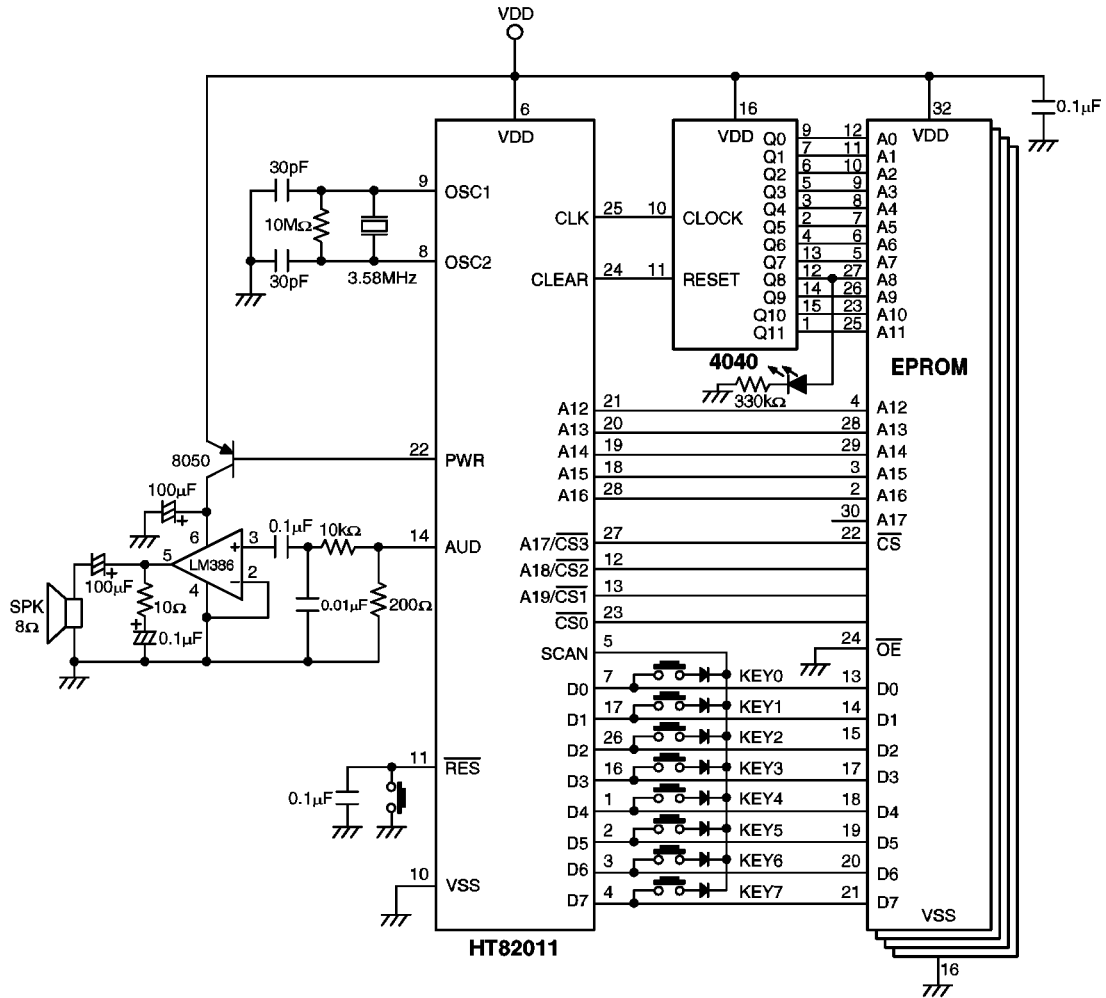


Level hold



Application Circuits

Application with an LM386 AMP



Application with a transistor

