

### Features

- Operating voltage: 2.4V~5.0V
- 7 tempo options: 469, 234, 156, 117, 94, 78, 67
- 2 Envelope sustain durations: 1 beat, 2 beat s
- 2 "CHA" sustain duration options: 1/8 beat or 1/4 beat
- One octave lower transposition output by bonding option
- Extremely few external components
- Drive an 8Ω speaker through an NPN transistor
- Drive piezo directly
- Flashing follows one or both of the 2 tone generators
- Enclosed in a TO-92 package

### Applications

- Telephones
- Toys

### General Description

The HT3810 series are single-chip 128-note melody generators implemented in CMOS technology. A melody of 128-notes can be automatically played when power is switched on.

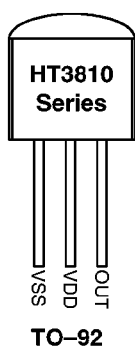
A customer merely needs to supply a melody sample which can be programmed into the ROM by changing a mask layer during device fabrication.

The IC contains two independent tone generators, "CHA" sound accompaniment circuit, envelope generator, time base generator and an output driver. With such powerful functions various special musical effects can be created,

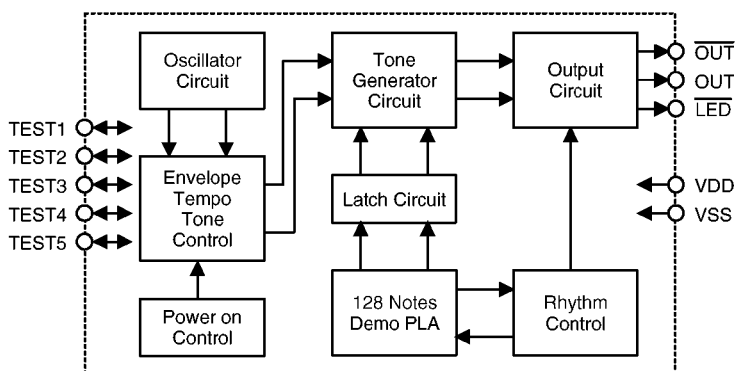
such as Chords, Broken Chords, "CHA" sound accompaniments, etc. The mask option can be made to accommodate various melodies, tempos, envelopes and "CHA" sound duration.

The LED driver may be set to flash following one or both of the two tone generators. The output driver can drive a piezo buzzer directly or an 8 ohm speaker through an external NPN transistor. The HT3810 series are ultra-miniature and require almost no external components for normal applications. They are offered in chip form or in a TO-92 package. Refer to the selection table for standard melodies.

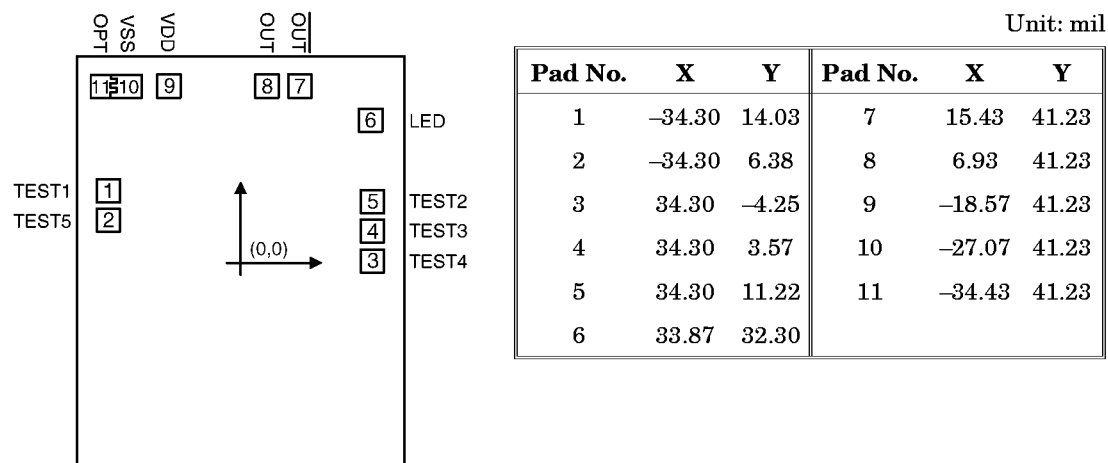
### Pin Assignment



### Block Diagram



## Pad Assignment



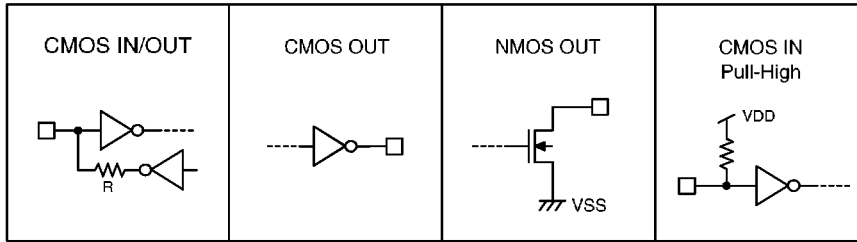
Chip size:  $81 \times 95 \text{ (mil)}^2$

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

## Pad Description

| Pad Name                | I/O | Internal Connection | Description                                                                                          |
|-------------------------|-----|---------------------|------------------------------------------------------------------------------------------------------|
| TEST1                   | I/O | CMOS                | 250 kHz output for IC test                                                                           |
| TEST5                   | I/O | CMOS                | For IC test only                                                                                     |
| TEST3                   | I/O | CMOS                | For IC test only                                                                                     |
| TEST4                   | I/O | CMOS                | For IC test only                                                                                     |
| TEST2                   | I/O | CMOS                | For IC test only                                                                                     |
| $\overline{\text{LED}}$ | O   | NMOS                | LED flash output, active low                                                                         |
| $\overline{\text{OUT}}$ | O   | CMOS                | Melody signal output pin, complement to OUT                                                          |
| OUT                     | O   | CMOS                | Melody signal output pin, complement to $\overline{\text{OUT}}$                                      |
| OPT                     | I   | CMOS Pull-High      | Option for an octave lower transposition output (Open=normal output, VSS=lower transposition output) |
| VDD                     | —   | —                   | Power supply (positive)                                                                              |
| VSS                     | —   | —                   | Power supply (negative)                                                                              |

Approximate internal connection circuits



**Absolute Maximum Ratings\***

|                      |                                                |                             |                |
|----------------------|------------------------------------------------|-----------------------------|----------------|
| Supply Voltage ..... | -0.3V to 5.5V                                  | Storage Temperature .....   | -50°C to 125°C |
| Input Voltage .....  | V <sub>SS</sub> -0.3V to V <sub>DD</sub> +0.3V | Operating Temperature ..... | -20°C to 75°C  |

\*Note: Stresses above those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. These are stress ratings only. Functional operation of this device at these or any other conditions above those indicated in the operational sections of this specification is not implied and exposure to absolute maximum rating conditions for extended periods may affect device reliability.

**Electrical Characteristics**

(T<sub>a</sub>=25°C)

| Symbol           | Parameter                                                | Test Conditions |                                     | Min. | Typ. | Max. | Unit |
|------------------|----------------------------------------------------------|-----------------|-------------------------------------|------|------|------|------|
|                  |                                                          | V <sub>DD</sub> | Conditions                          |      |      |      |      |
| V <sub>DD</sub>  | Operating Voltage                                        | —               | —                                   | 2.4  | —    | 5    | V    |
| I <sub>DD</sub>  | Operating Current                                        | 3V              | No load                             | —    | 0.4  | 1.0  | mA   |
|                  |                                                          | 5V              |                                     | —    | 0.8  | 2.0  |      |
| I <sub>OH</sub>  | Output Source Current<br>(OUT, $\overline{\text{OUT}}$ ) | 3V              | V <sub>OH</sub> =0.9V <sub>DD</sub> | -0.3 | -0.6 | —    | mA   |
|                  |                                                          | 5V              |                                     | -0.5 | -0.9 | —    |      |
| I <sub>OL1</sub> | Output Sink Current<br>(OUT, $\overline{\text{OUT}}$ )   | 3V              | V <sub>OL</sub> =0.1V <sub>DD</sub> | 0.4  | 0.7  | —    | mA   |
|                  |                                                          | 5V              |                                     | 0.6  | 1    | —    |      |
| I <sub>OL2</sub> | $\overline{\text{LED}}$ Output Sink Current              | 3V              | V <sub>OL</sub> =0.1V <sub>DD</sub> | 4    | 7    | —    | mA   |
|                  |                                                          | 5V              |                                     | 8    | 14   | —    |      |
| F <sub>SYS</sub> | System Frequency                                         | 3V              | TEST1 pad                           | —    | 250  | —    | kHz  |

**HT3810 Series Melody Selection Table**
**Children's song series**

| ITEM    | MELODY                                                       | TEMPO | CHA |
|---------|--------------------------------------------------------------|-------|-----|
| HT3810A | Karinka                                                      | 234   | 1/4 |
| HT3810B | Happy Birthday To You                                        | 117   | 1/4 |
| HT3810C | Are You Sleeping?                                            | 156   | 1/4 |
| HT3810D | The Peddler                                                  | 234   | 1/4 |
| HT3810E | It is a Small World                                          | 117   | 1/4 |
| HT3810F | Home Sweet Home                                              | 94    | 1/4 |
| HT3810G | The More We Get Together                                     | 156   | 1/4 |
| HT3810H | Landler Tanz                                                 | 156   | 1/4 |
| HT3810I | When The Saints Go Marching In                               | 234   | 1/4 |
| HT3810J | Cuckoo Waltz                                                 | 156   | 1/4 |
| HT3810K | Yankee Doodle                                                | 234   | 1/4 |
| HT3810L | Oh! Susannah                                                 | 234   | 1/4 |
| HT3810M | Cradle Song                                                  | 117   | 1/4 |
| HT3810N | London Bridge Is Falling Down<br>+ The Train Is Running Fast | 234   | 1/4 |
| HT3810P | Tom Dooley                                                   | 156   | 1/4 |
| HT3810Q | Little Brown Jug                                             | 156   | 1/4 |
| HT3810R | Rock a Bye Baby                                              | 117   | 1/4 |
| HT3810S | Old Folks At Home                                            | 117   | 1/4 |
| HT3810T | Little Bees                                                  | 156   | 1/4 |
| HT3810U | Donkey Donkey                                                | 234   | 1/4 |
| HT3810V | Song Of Joy                                                  | 156   | 1/4 |
| HT3810W | Old Macdonald Had a Farm                                     | 156   | 1/4 |
| HT3810X | If You Are Happy                                             | 156   | 1/4 |
| HT3810Y | I Am So Happy                                                | 156   | 1/4 |
| HT3810Z | My Little Tricycle                                           | 156   | 1/4 |
| HT3811A | Popeye The Sailor Man                                        | 156   | 1/4 |
| HT3811B | Row! Row! Row Your Boat                                      | 156   | 1/4 |
| HT3811C | Fly Birdie Fly                                               | 156   | 1/4 |

| ITEM    | MELODY                           | TEMPO | CHA |
|---------|----------------------------------|-------|-----|
| HT3811D | Good-Bye Little Fish             | 156   | 1/4 |
| HT3811E | Who's Afraid Of The Big Bad Wolf | 156   | 1/4 |
| HT3811F | Picnic                           | 117   | 1/4 |
| HT3811G | Mary Had a Little Lamb           | 156   | 1/4 |

**Lyrical song series**

| ITEM    | MELODY                        | TEMPO | CHA |
|---------|-------------------------------|-------|-----|
| HT3812A | Green Sleeves                 | 117   | 1/4 |
| HT3812B | Music Box Dancer              | 234   | 1/4 |
| HT3812C | Love Story                    | 78    | 1/4 |
| HT3812D | For Elise                     | 94    | 1/4 |
| HT3812E | Moonlight On The Colorado     | 117   | 1/4 |
| HT3812F | Home On The Range             | 156   | 1/4 |
| HT3812G | Love Me Tenderly              | 117   | 1/4 |
| HT3812H | Yesterday                     | 94    | 1/4 |
| HT3812I | Romance De Amor               | 156   | 1/4 |
| HT3812J | Love Is Blue                  | 94    | 1/4 |
| HT3812K | Unchained Melody              | 156   | 1/4 |
| HT3812L | Somewhere In Time             | 78    | 1/4 |
| HT3812M | Dona Dona                     | 156   | 1/4 |
| HT3812N | If You Love Me                | 94    | 14  |
| HT3812P | Fly Me To The Moon            | 117   | 1/4 |
| HT3812Q | Let Me Call You My Sweetheart | 156   | 1/4 |

**Christmas song series**

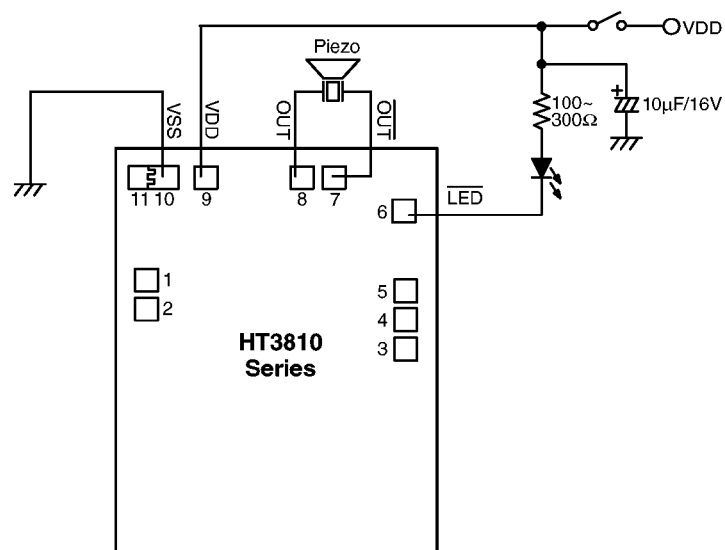
| ITEM    | MELODY                                                        | TEMPO | CHA |
|---------|---------------------------------------------------------------|-------|-----|
| HT3813A | Jingle Bells                                                  | 156   | 1/4 |
| HT3813B | Santa Claus Is Coming To Town                                 | 156   | 1/4 |
| HT3813C | Rudolph The Red-Nosed Reindeer                                | 156   | 1/4 |
| HT3813D | Silent Night                                                  | 156   | 1/4 |
| HT3813E | We Wish You a Merry Christmas                                 | 156   | 1/4 |
| HT3813F | Parade Of The Wooden Soldiers                                 | 156   | 1/4 |
| HT3813G | The Twelve Days Of Christmas                                  | 156   | 1/4 |
| HT3813H | Frosty The Snow Man                                           | 156   | 1/4 |
| HT3813I | Away In a Manger                                              | 156   | 1/4 |
| HT3813J | It Came Upon The Midnight Clear                               | 156   | 1/4 |
| HT3813K | Sleigh Ride                                                   | 156   | 1/4 |
| HT3813L | Jesus Loves Me + The First Noel                               | 156   | 1/4 |
| HT3813M | Hark The Herald Angels Sing<br>+ The Twelve Days Of Christmas | 156   | 1/4 |

**Popular song series**

| ITEM    | MELODY                              | TEMPO | CHA |
|---------|-------------------------------------|-------|-----|
| HT3814A | You Are My Sunshine                 | 234   | 1/4 |
| HT3814B | Wooden Heart                        | 234   | 1/4 |
| HT3814C | The Yellow Rose Of Texas            | 156   | 1/4 |
| HT3814D | Butterfly (short CHA accompaniment) | 94    | 1/8 |
| HT3814E | Bengawan Solo                       | 117   | 1/4 |
| HT3814F | You Light Up My Life                | 117   | 1/4 |
| HT3814G | Lambada I                           | 234   | 1/4 |
| HT3814H | Lambada II                          | 234   | 1/8 |
| HT3814I | Hey Jude                            | 156   | 1/4 |
| HT3814J | Changing Partner                    | 117   | 1/4 |
| HT3814K | I Just Called To Say I Love You     | 117   | 1/4 |
| HT3814L | My Way                              | 94    | 1/4 |
| HT3814M | Wedding March                       | 156   | 1/4 |

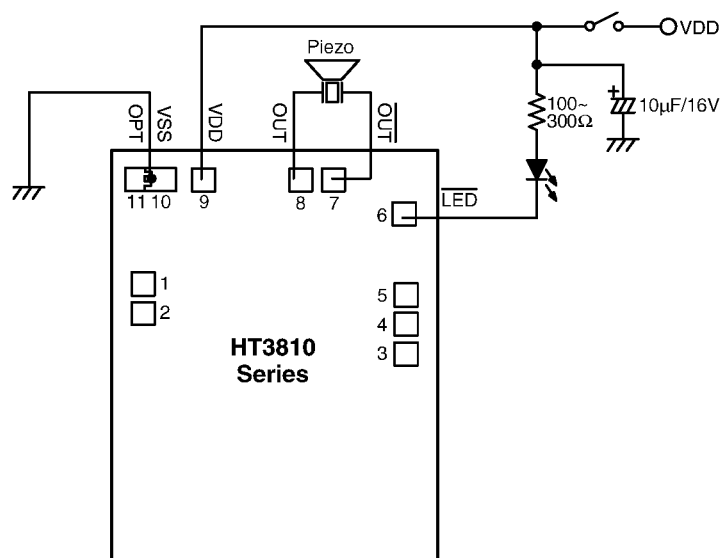
## Application Circuits

### Chip form piezo application (normal output)



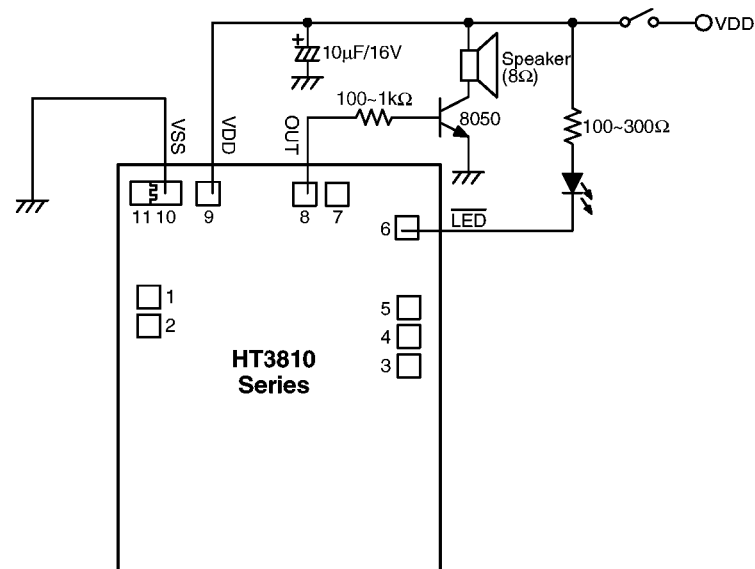
\* The substrate should be connected to VDD in the PCB layout artwork.

### Chip form piezo application (one octave lower transposition output)



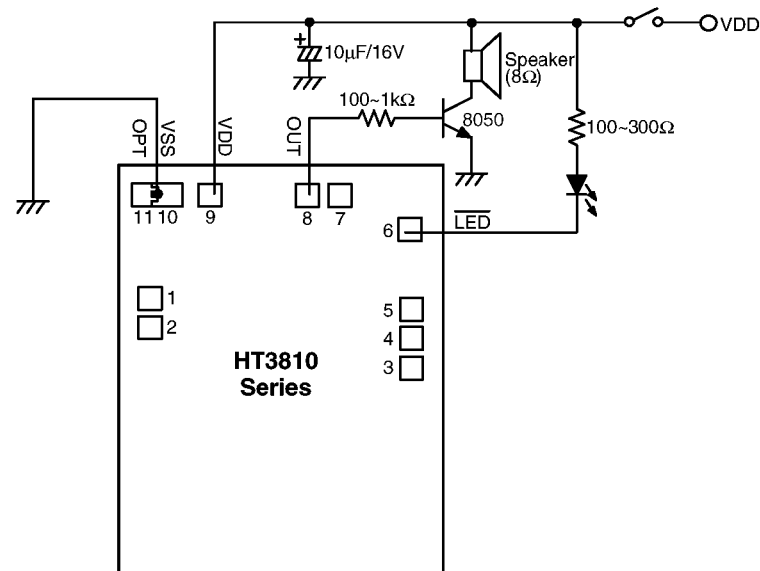
\* The substrate should be connected to VDD in the PCB layout artwork.

Chip form speaker application (normal output)



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

Chip form speaker application (one octave lower transposition output)



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



For 3-pin package

