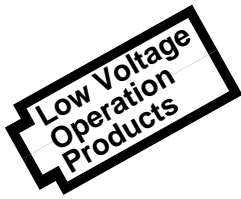# EPSON

# SVM7960C Series

## Multi-Melody IC

● **2 Sound Sources**
● **127 Words Melody ROM**
● **Dynamic Loudspeaker Driving Capability**
● **4 Melodies Max.(Binary Selection)**
  **or 3 Melodies(Direct Melody Selection)**
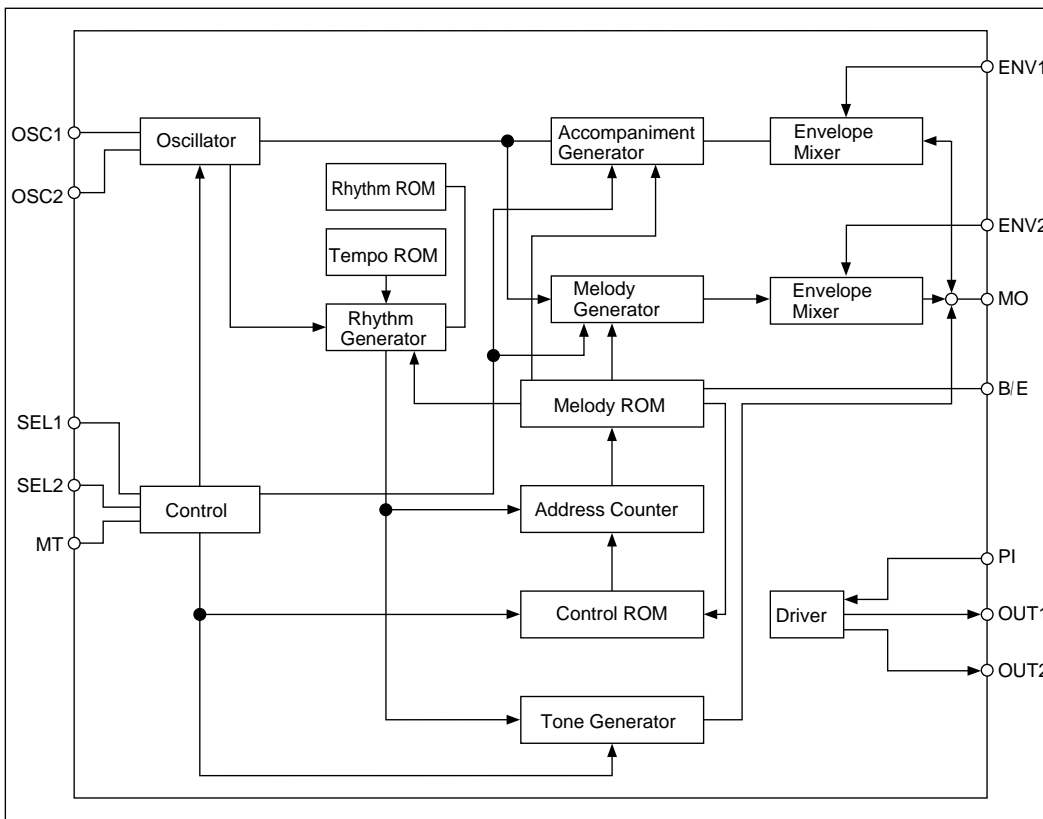
*Low Voltage Operation Products*

## ■ DESCRIPTION

The SVM7960C Series CMOS IC produce melodies or alarm tones from a preprogrammed ROM. The ROM has a capacity of 127 words and can store up to 4 melodies from two sound sources with envelope. The IC can be applied to watches, musical boxes and games. etc. Operation status provide easy installation of SVM7960C Series into microcomputer-applied equipment.
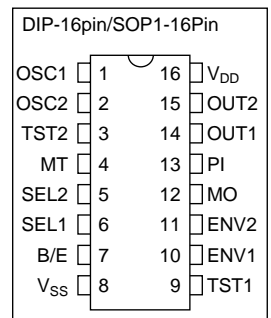
## ■ FEATURES

● Melody ROM capacity ............................ 127 words
● Up to 4 melodies (3 if it is direct melody selection method) can be performed.
● Two sound sources with envelope (CR envelope)
● DC or AC triggered performance start mode (mask selected)
● Level hold performance or one shot performance (mask selected)
● Equipped with operation status detection terminals (BUSY/END signal) (mask selected).
● Can drive an 8-ohm dynamic loudspeaker if provided externally with a transistor.
● Package ................................................. DIP-16pin (plastic) /SOP1-16pin(plastic)
● 1.5V/5V operating voltage (mask selected)

## ■ BLOCK DIAGRAM

## ■ PIN CONFIGU-RATION



DIP-16pin/SOP1-16Pin

| | | |
|---|---|---|
| OSC1 | 1 | 16 | $V_{DD}$ |
| OSC2 | 2 | 15 | OUT2 |
| TST2 | 3 | 14 | OUT1 |
| MT | 4 | 13 | PI |
| SEL2 | 5 | 12 | MO |
| SEL1 | 6 | 11 | ENV2 |
| B/E | 7 | 10 | ENV1 |
| $V_{SS}$ | 8 | 9 | TST1 |

1

**SEIKO EPSON CORPORATION**

## ■ PIN DESCRIPTION

| Pin No. | Pin name | Pull-down resistor | Function |
|---|---|---|---|
| 1<br>2 | OSC1<br>OSC2 | - | A resistor is connected between both terminals to form a ring oscillator, or external reference signals are applied to OSC1. |
| 3 | TST2 | Provided | LSI test input |
| 4 | MT | Provided | For binary selection:Controls start and stop of performance.<br>For direct selection:Selects melody 1 and controls start and stop of its performance. |
| 5 | SEL2 | Provided | For binary selection:This terminal, in conjunction with SEL1, selects a melody.<br>For direct selection:Selects melody 3 and controls start and stop of its performance. |
| 6 | SEL1 | Provided | For binary selection:This terminal, in conjunction with SEL2, selects a melody.<br>For direct selection:Selects melody 2 and controls start and stop of its performance. |
| 7 | B/E | - | BUSY or END signal output terminal |
| 8 | $V_{SS}$ | - | Power supply terminal (0V) |
| 9 | TST1 | Provided | LSI test input |
| 10 | ENV1 | - | Connects resistor and capacitor to add envelope to main melody. |
| 11 | ENV2 | - | Connects resistor and capacitor to add envelope to accompaniment |
| 12 | MO | - | Output terminal for acoustic signals that have not been amplified. |
| 13<br>14<br>15 | PI<br>OUT1<br>OUT2 | Provided | Connects PNP/NPN transistors, resistors and capacitors to form a low-frequency linear amplifier circuit. |
| 16 | $V_{DD}$ | - | Power supply terminal (+) |

## ■ ABSOLUTE MAXIMUM RATINGS

$(V_{SS} =0V)$

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Supply voltage | $V_{DD}$ | -0.3 to 7.0 | V |
| Input terminal voltage | $V_{IO}$ | -0.2 to $V_{DD}$+0.2 | V |
| Operating temperature | $T_{opr}$ | -20 to +85 ($V_{DD}$1.5V) | °C |
| Storage temperature | $T_{stg}$ | -65 to +150 | °C |
| Soldering temperature and time | $T_{sol}$ | 260°C, 10s (at lead) | - |

## ■ ELECTRICAL CHARACTERISTICS

### ● $V_{DD}$=1.5V, Ta=25 C

$(V_{SS} =0V, Ta =25°C)$

| Characteristic | Symbol | Condition | | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|---|
| Operating voltage | $V_{DD}$ | | | | 1.2 | 1.5 | 3.5 | V |
| "1" input voltage | $V_{IH}$ | | | | $V_{DD}$-0.3 | - | $V_{DD}$ | V |
| "0" input voltage | $V_{IL}$ | | | | $V_{SS}$ | - | $V_{SS}$+0.3 | V |
| "1" input current (1) | $I_{IH1}$ | $V_{IHI}$-$V_{DD}$, during performance, either by binary or terminal selection, at SEL1/SEL2 | | $V_{DD}$=1.5V | 0.6 | 2.0 | 6.0 | μA |
| "1" input current (2) | $I_{IH2}$ | MT | $V_{IH2}$=$V_{DD}$ | $V_{DD}$=1.5V | 0.6 | 2.0 | 6.0 | μA |
| "1" input current (3) | $I_{IH3}$ | PI $V_{IH3}$=$V_{DD}$ | During standby | $V_{DD}$=1.5V | 2.0 | 6.0 | 20 | μA |
| | | | During performance | $V_{DD}$=1.5V | - | - | 0.05 | μA |
| "1" input current (4) | $I_{IH4}$ | $V_{IH4}$-$V_{DD}$, during standby, by binary selection, at OSC1/SEL1/SEL2 | | $V_{DD}$=1.5V | - | - | 0.05 | μA |
| "0" input current | $I_{IL}$ | SEL1, SEL2, MT, PI, OSC1 $V_{IL}$=$V_{SS}$ | | $V_{DD}$=1.5V | - | - | 0.05 | μA |
| "1" output current (2) | $I_{OH2}$ | B/E, bipolar transistor $V_{BE}$=0.7V | | $V_{DD}$=1.2V | 6.0 | 20 | 60 | μA |
| "0" output current (3) | $I_{OL3}$ | OUT2, bipolar transistor | During standby | $V_{DD}$=1.5V | - | - | 1.5 | μA |
| | | $V_{BE}$=0.7V | During performance | $V_{DD}$=1.5V | 100 | 300 | 750 | μA |
| "1" output current (4) | $I_{OH4}$ | OUT2, bipolar transistor $V_{BE}$=0.7 | | $V_{DD}$=1.2V | 100 | 300 | 750 | μA |
| Input amplitude | $A_I$ | $V_{DD}$1.5V, when external reference signal is applied to OSC1 | | | $\frac{V_{DD}}{2} \pm 0.4$ | - | - | V |
| Average Current Consumption in standby mode | $I_S$ | All terminals open | | $V_{DD}$=1.5V | - | | 0.3 | mA |
| | | Standard circuit connected, SEL1, SEL2, MT teminals open | | $V_{DD}$=1.5V | - | 3.0 | - | μA |
| Average Current Consumption in performance mode | $I_O$ | $f_{OSC}$=32kHz<br>All terminals,except MT, open | | $V_{DD}$=1.5V | - | 50 | 100 | μA |

●$V_{DD}$=5.0V

($V_{SS}$ =0V, Ta =25°C)

| Characteristic | Symbol | Condition | | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|---|
| Operating voltage | $V_{DD}$ | | | | 3.0 | 5.0 | 5.5 | V |
| "1" input voltage | $V_{IH}$ | | | | $V_{DD}$-0.3 | - | $V_{DD}$ | V |
| "0" input voltage | $V_{IL}$ | | | | $V_{SS}$ | - | $V_{SS}$+0.3 | V |
| "1" input current (1) | $I_{IH1}$ | $V_{IH1}$-$V_{DD}$, during performance, either by binary or terminal selection, at SEL1/SEL2 | | $V_{DD}$=5.0V | 10 | 30 | 100 | μA |
| "1" input current (2) | $I_{IH2}$ | MT | $V_{IH2}$=$V_{DD}$ | $V_{DD}$=5.0V | 5 | 15 | 50 | μA |
| "1" input current (3) | $I_{IH3}$ | P  $V_{IH3}$=$V_{DD}$ | During standby | $V_{DD}$=5.0V | 60 | 200 | 600 | μA |
| | | | During performance | $V_{DD}$=5.0V | - | - | 0.1 | μA |
| "1" input current (4) | $I_{IH4}$ | $V_{IH4}$-$V_{DD}$, during standby, by binary selection, at OSC1/SEL1/SEL2 | | $V_{DD}$=5.0V | - | - | 0.1 | μA |
| "0" input current | $I_{IL}$ | SEL1, SEL2, MT, PI, OSC1  $V_{IL}$=$V_{SS}$ | | $V_{DD}$=5.0V | - | - | 0.1 | μA |
| "1" output current (2) | $I_{OH2}$ | B/E, bipolar transistor $V_{BE}$=0.7V | | $V_{DD}$=4.5V | 0.3 | 0.9 | 1.8 | mA |
| "0" output current (3) | $I_{OL3}$ | OUT1 | During standby | $V_{DD}$=5.0V | - | - | 8.0 | μA |
| | | Bipolar transistor $V_{BE}$=0.7V | During performance | $V_{DD}$=4.5V | 0.8 | 2.0 | 4.0 | mA |
| "1" output current (4) | $I_{OH4}$ | OUT2, bipolar transistor $V_{BE}$=0.7 | | $V_{DD}$=4.5V | 0.8 | 2.0 | 4.0 | mA |
| Input amplitude | $A_I$ | $V_{DD}$1.5V, when external reference signal is applied to OSC1 | | | $\frac{V_{DD}}{2}\pm0.4$ | - | - | V |
| Average Current Consumption in standby mode | $I_S$ | All ternimals open | | $V_{DD}$=5.0V | - | - | 0.5 | μA |
| | | Standard circuit connected, SEL1, SEL2, MT terminals open | | $V_{DD}$=5.0V | - | 10.0 | - | μA |
| Average Current Consumption in perfomance mode | $I_O$ | $f_{OSC}$=32kHz All terminals, except MT, open | | $V_{DD}$=5.0V | - | 1 | 2 | mA |

## ■ OSCILLATION CHARACTERISTICS

●$V_{DD}$=1.5V

($V_{SS}$ =0V, Ta =25°C)

| Characteristic | Symbol | Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Oscillation frequency | $f_{OSC}$ | $V_{DD}$=1.5V, $VR_1$=750k | - | 32.768 | - | kHz |
| Oscillation self-excided voltage | $V_{STA}$ | $VR_1$=750k | 1.2 | - | - | V |
| Oscillation stop voltage | $V_{STP}$ | $VR_1$=750k | - | - | 1.2 | V |

●$V_{DD}$=5.0V

($V_{SS}$ =0V, Ta =25°C)

| Characteristic | Symbol | Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Oscillation frequency | $f_{OSC}$ | $V_{DD}$=5.0V, $VR_1$=820k | - | 32.768 | - | kHz |
| Oscillation self-excided voltage | $V_{STA}$ | $VR_1$=820k | 1.2 | - | - | V |
| Oscillation stop voltage | $V_{STP}$ | $VR_1$=820k | - | - | 1.2 | V |

## ■ MONITOR OUTPUT (BUSY/END TERMINALS)

The SVM7960 has an operation status monitoring output terminal. Either BUSY or END signals can be selected by mask selection.

| BUSY | END |
|---|---|
| Perfomance output — During performance — Stop; 1 cycle / Performance; BUSY signal | Performance output — During performance — Stop; 1 cycle / Performance; END signal → ← 1/128(sec) |
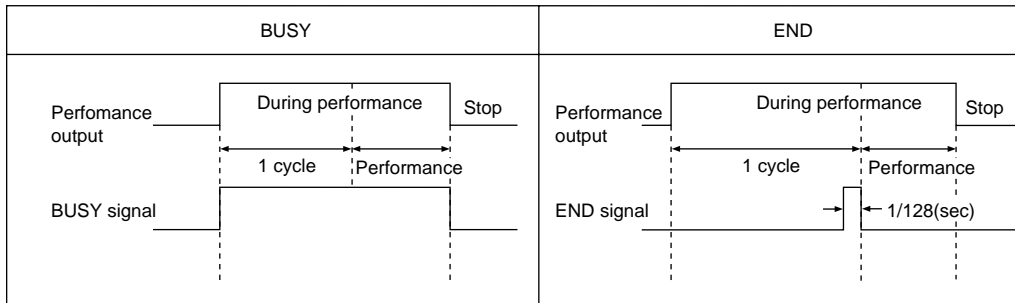
The pulse width of the END signal is for $f_{OSC}$=32.768KHz.
Both BUSY and END can be output with inverted phases.

## ■ TIMING CHART

### DC Level-hold

Binary DC level ($f_{OSC}$=32.768kHz)

MT
SEL$_{1\sim2}$
Amplifier
Performance Output — tune M1 | tune M1 mid-tune | tune M2
1 complete tune    mid-tune
7.8ms →  ←    t<62.5ms
t< ♪ +7.8ms
END signal or BUSY signal
→ ← $t_{sta}$=257.8ms
$t_{stp}$< ♪ 1 beat

### DC One-shot

Binary DC one-shot ($f_{OSC}$=32.768kHz)

→ ← $t_{ON}$=15.6ms (min.)
MT
SEL$_{1\sim2}$
Amplifier — 15.6ms
Performance Output — tune M1 | tune M2
mid-tune    1 complete tune
t<62.5ms → ←    →← t< ♪ +7.8ms
END signal or BUSY signal
7.8ms→ ←
→← $t_{sta}$=257.8ms
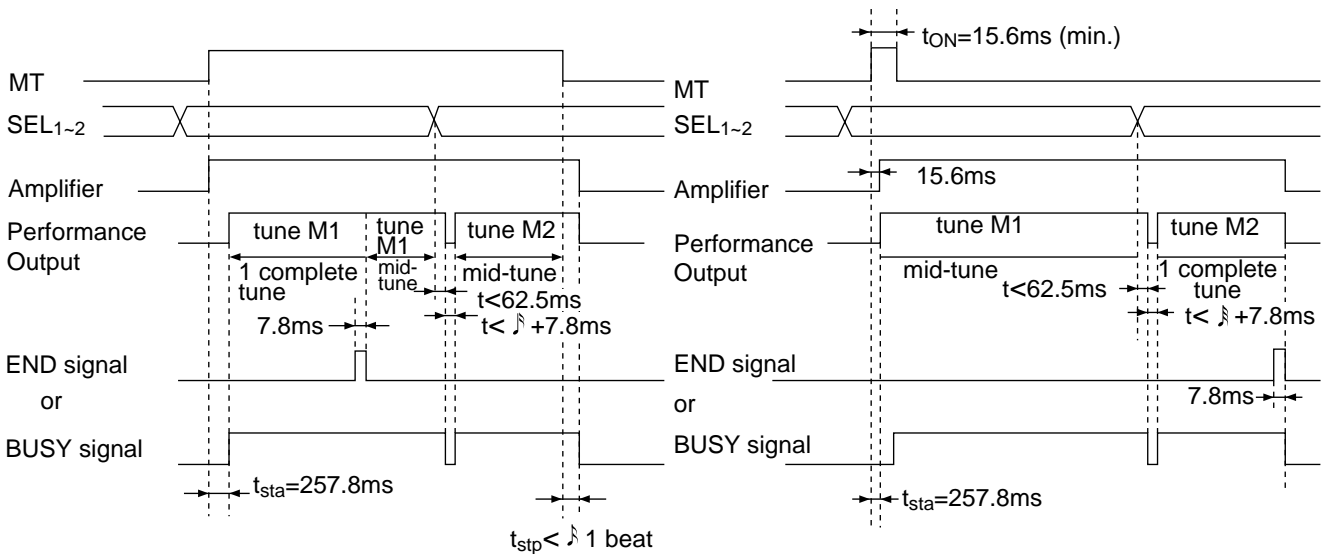
## ■ LINE UP

| Model | Oscillation frequency | Performance mode | Melody selection |
|---|---|---|---|
| SVM7960 | External reference signal | Level hold | Binary code selection |
| SVM7961 | | One shot | |
| SVM7962 | CR oscillation | Level hold | |
| SVM7963 | | One shot | |
| SVM7964 | External reference signal | Level hold | Direct selection |
| SVM7965 | | One shot | |
| SVM7966 | CR oscillation | Level hold | |
| SVM7967 | | One shot | |

The models are further classified into the following types according to their functions:

| Peformance start input signal / Melody switching during performance / B/E output terminal | AC input | | DC input | |
|---|---|---|---|---|
| | Possible | Impossible | Possible | Impossible |
| BUSY output | A | B | C | D |
| END output | E | F | G | H |

## ■ PACKAGE DIMENSIONS

Plastic DIP-16pin

Unit: mm
(inch)

Plastic SOP1-16pin

Unit: mm
(inch)
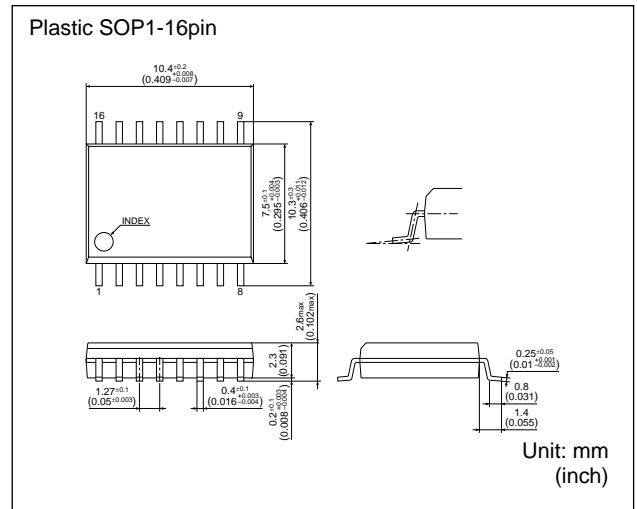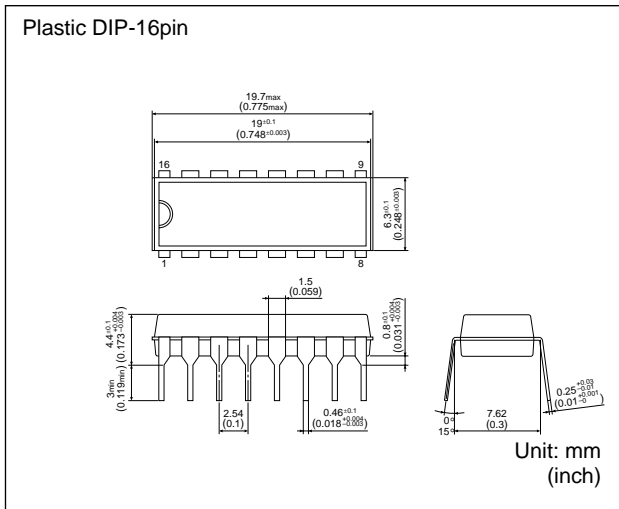
## ■ BASIC EXTERNAL CONNECTION

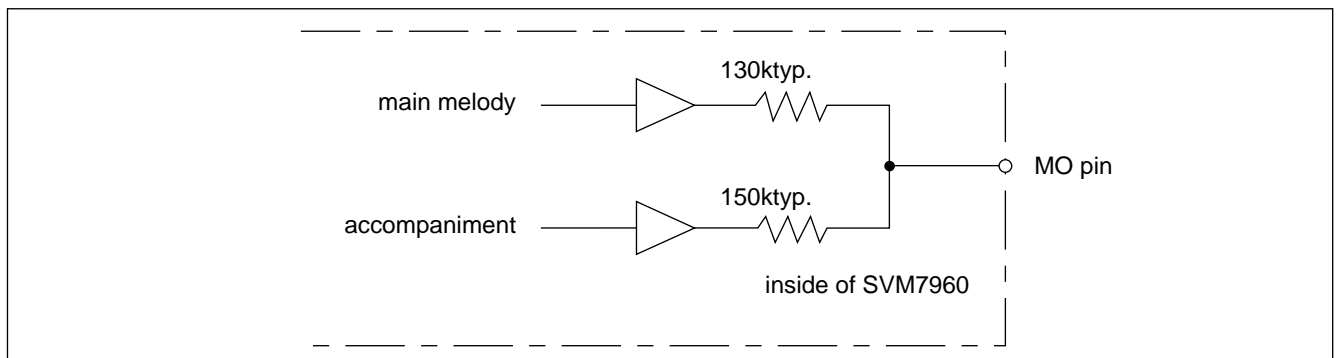CR oscillation, DC input

SVM7960
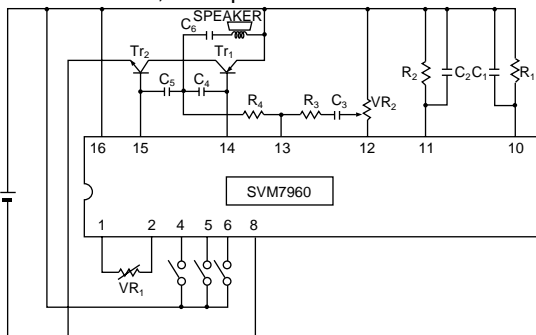
Note:  Don't touch the oscillation circuit with your hand while playing musical tunes or activating "MT" signal
The oscillation resistor(VR1) should be covered with resin or others.
Justly settle power supply (dry cells), not so as to chatter (over than 10 msec).
Disconnect "MT" to $V_{DD}$ in case of level hold type or switch the power supply off, when anything unusual should happen.
Don't make bonding to pads of "OSC1" and "OSC2" when you assemble SVM7900 (including CR for oscillation on chip).

## ■ RECOMMENDED CONDITIONS FOR EXTERNAL DEVICES

| Symbol | Ratings | Unit | Symbol | Ratings | Unit |
|---|---|---|---|---|---|
| $VR_1$ | 1          Note: | M | $C_3$ | 0.1 | μF |
| $VR_2$ | 50 | k | $C_4$ | 0.01 to 0.047 | μF |
| $R_1$ | 100 | k | $C_5$ | 0.01 (or nothing) | μF |
| $R_2$ | 100 | k | $C_6$ | 100 to 300 | μF |
| $R_3$ | 51 to 150 | k | SPK | 8 | |
| $R_4$ | 510 | k | $Tr_1$ | PNP DCh$_{FE}$≒160 | - |
| $C_1$ | 4.7 | μF | $Tr_2$ | NPN DCh$_{FE}$≒160 | - |
| $C_2$ | 4.7 | μF | | | |

Note:  Typically 750k-ohms when $V_{DD}$=1.5V
Typically 820k-ohms when $V_{DD}$=5.0V

## ■ MO OUTPUT PIN EQUIVALENT CIRCUIT

main melody — ▷ — 130ktyp. —

accompaniment — ▷ — 150ktyp. —

MO pin

inside of SVM7960