

■ OVERVIEW

The SM1140 series is the CMOS IC that can play enveloped melodies with two sound sources. Adopting digital envelope realizes low-cost, high-quality sound system with less number of external component.

■ FEATURES

- Maximum play ROM amount: 127 words
- Maximum number of jump: 31 times
- Number of play: max. 4 tunes
- Play starts by D C trigger at power-on
- Built-in digital envelope
- Main melody accompaniment are independently output with 30 musical scales.
- Play mode is level-hold playing mode
- Wide range of supply voltage: 1.2 to 5.5V

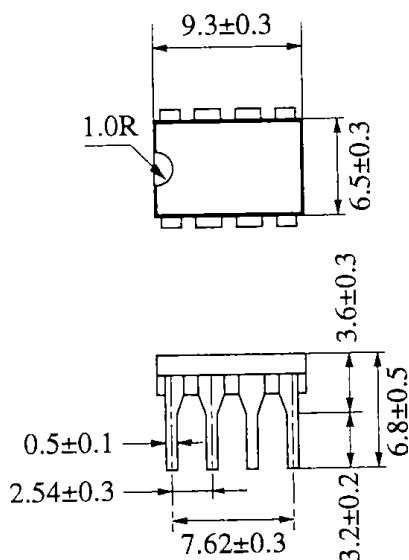
■ MARKING and PACKAGE

| 1140 | Package | Marking |
|--------------|-----------|------------|
| SM1140 x x P | 8-pin DIP | SM1140 x x |
| SM1140 x x S | 8-pin SOP | 140 x x |

x x : version name

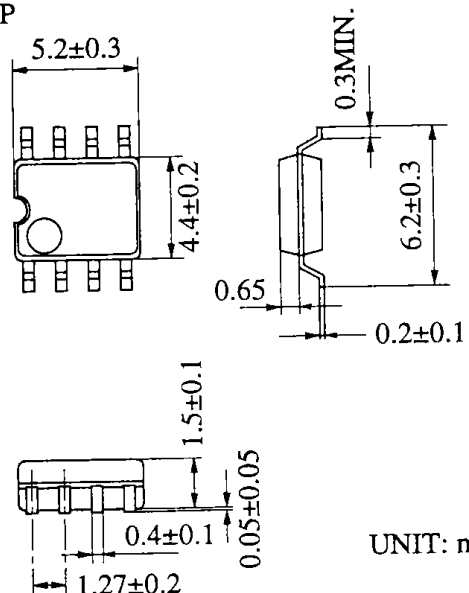
■ EXTERNAL DIMENSIONS

•8-PIN DIP



UNIT: mm

•8-PIN SOP

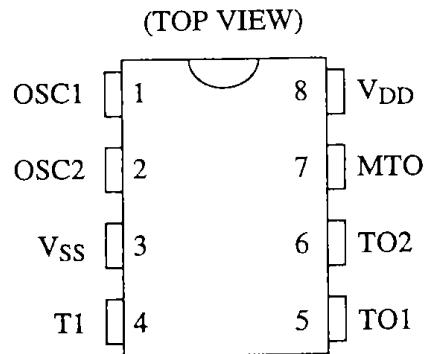


UNIT: mm

■ PIN DESCRIPTIONS

| No. | Symbol | Function |
|-----|-----------------|---|
| 1 | OSC1 | Resistor connecting pins for oscillation normally connecting 470kΩ resistor starts oscillation. |
| 2 | OSC2 | |
| 3 | V _{SS} | Ground |
| 4 | T1 | Test pin input. Internal pull-down resistor. |
| 5 | T01 | Test output. Oscillation frequency (Typ 32.768KHz) can be monitored at this pin. |
| 6 | T02 | Test output |
| 7 | MTO | Play signal output |
| 8 | V _{DD} | Supply pin +1.2 to +5.5V |

■ PIN OUT



■ ABSOLUTE MAXIMUM RATINGS

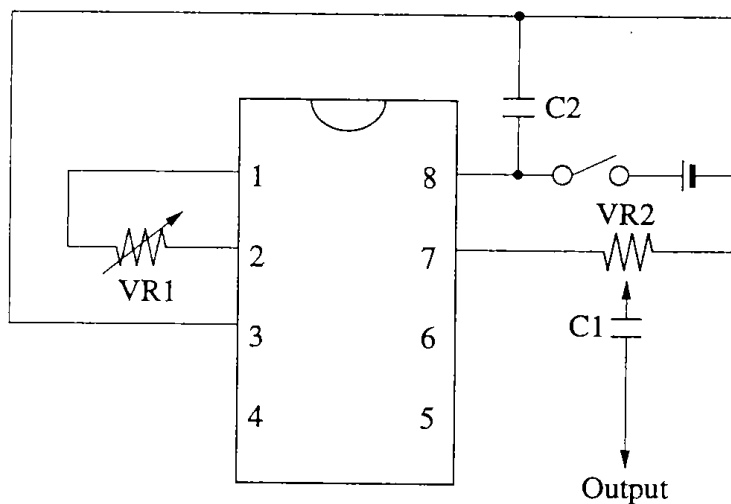
| Item | Symbol | Ratings | Unit |
|-----------------|----------------------------------|---|------|
| Supply voltage | V _{DD} -V _{SS} | -0.3 to 7.0 | V |
| Input voltage | V _{IN} | V _{SS} -0.2 < V _{IN} < V _{DD} +0.2 | V |
| Operating temp. | T _{OPR} | -20 to +80 | °C |
| Storage temp. | T _{STG} | -55 to +125 | °C |
| Soldering temp. | T _{SLD} | 260 ± 5 | °C |
| Soldering time | t _{SLD} | 10 | Sec. |

■ ELECTRICAL CHARACTERISTICS

$T_a=250^{\circ}\text{C}$, $V_{SS}=0\text{V}$, $V_{DD}=1.5\text{V}$

| Item | Symbol | Condition | Rating | | | Unit | Note |
|---------------------------------|--------------|--|-------------------------|------|------|---------------|-------------|
| | | | Min. | Typ. | Max. | | |
| Supply voltage | V_{DD} | | 1.2 | 1.5 | 5.5 | V | |
| Current consumption | I_{DD} | MTO=OPEN | | 200 | 400 | μA | |
| Input current | I_{IH} | $V_{IH}=11.5\text{V}$ | | | 0.1 | μA | OSC1 pin |
| | I_{IL} | $V_{IL}=0\text{V}$ | | | 0.1 | μA | |
| Input oscillation width | V_{osc} | When external clock input $V_{DD} \geq 1.5\text{V}$ | $V_{DD}/2$ ± 0.4 | | | V | OSC1 pin |
| Oscillation frequency variation | f_{osc} | External $R=470\text{k}\Omega$ | -20 | | +20 | % | |
| Frequency stability | $\Delta f/f$ | $f_{osc}=32.768\text{KHz}$ | | | 1 | %/0.1V | |

■ APPLICATION CIRCUIT



VR1 : 500 k Ω

VR2 : 50 k Ω

C1 : Determine due to next stage input
Impedance

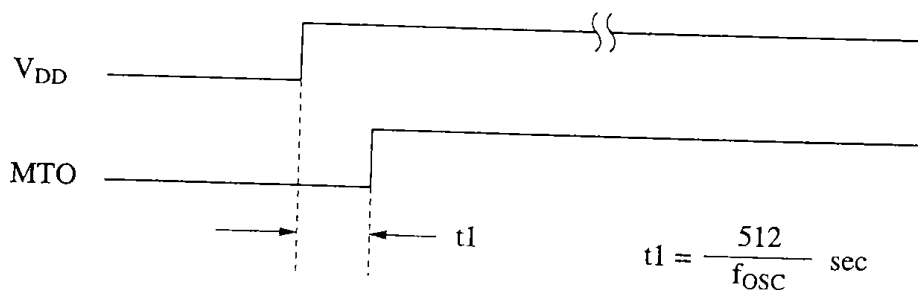
C2 : by-pass capacitor 0.1 μF or more

FUNCTION SPECIFICATIONS

1. Play type

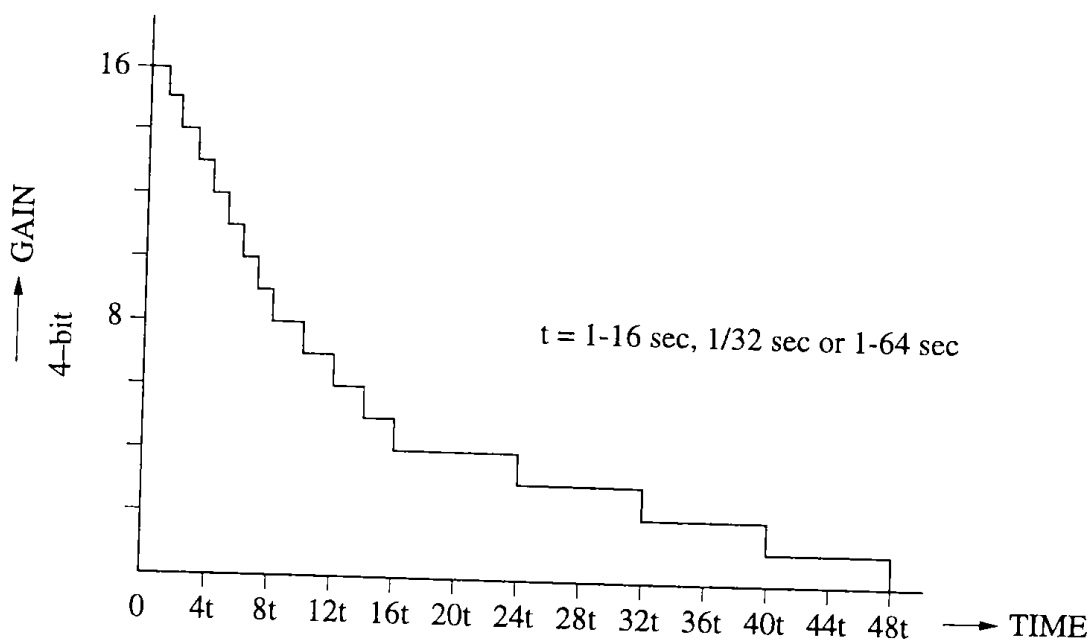
Play type is the level-hold playing mode in which play continues while power is on.

2. Play start timing



3. Digital envelope

In line with the previously programmed quasi-exponent curve, main melody and accompaniment are enveloped independently. Envelope waveform is shown as follows.



Envelope waveform

■ MUSICAL SPECIFICATIONS

1. Maximum number of program steps

Maximum 127 steps can be mask-programmed into the internal ROM. Within 1 step interval length, tie and rest of tone 1 and 2 can be specified.

2. Length (including rest)

8 kinds among 16th note (rest) to half note (rest) can be used.

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|------|---|---|---|---|---|---|---|---|
| NOTE | | | | | | | | |
| REST | | | | | | | | |

A note or rest longer than a half note (rest) can be made by combining 2 pieces of sound using tie. In this case 2 steps of ROM are needed.

3. Tempo

One kind among the following 32 can be selected.

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|--------|-------|-------|-------|-------|-------|-------|-------|
| = | 1280.0 | 640.0 | 426.7 | 320.0 | 256.0 | 213.3 | 182.9 | 160.0 |
| | 8 | 9 | A | B | C | D | E | F |
| | 142.2 | 128.0 | 116.4 | 106.7 | 98.5 | 91.4 | 85.3 | 80.0 |
| | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |
| | 75.3 | 71.1 | 67.4 | 64.0 | 61.0 | 58.2 | 55.7 | 53.3 |
| | 18 | 19 | 1A | 1B | 1C | 1D | 1E | 1F |
| | 51.2 | 49.2 | 47.4 | 45.7 | 44.1 | 42.7 | 41.3 | 40.0 |

4. Compass and scale

As for tune 1 and 2, 30 kinds of sound can be selected as scale from among 3 octaves of either C4 ~ C7 or C3 ~ C6 by mask-selection. The scale ranges of tune 1 and 2 do not have to be identical.

■ OUTPUT MUSICAL SCALE 1

Scale output standard clock-freq. =32.768KHz

| Name | Output Frequency | Standard Frequency | Error (cent) | Data |
|------|------------------|--------------------|--------------|------|
| C3 | 131.072 | 130.813 | 3.43 | FA |
| C#3 | 138.847 | 138.591 | 3.20 | EC |
| D3 | 146.942 | 146.832 | 1.29 | DF |
| D#3 | 155.299 | 155.563 | -2.95 | D3 |
| E3 | 164.663 | 164.814 | -1.58 | C7 |
| F3 | 174.298 | 174.614 | -3.14 | BC |
| F#3 | 185.130 | 184.997 | 1.24 | B1 |
| G3 | 196.216 | 195.998 | 1.92 | A7 |
| G#3 | 207.392 | 207.652 | -2.17 | 9E |
| A3 | 219.919 | 220.000 | -0.63 | 95 |
| A#3 | 232.397 | 233.082 | -5.09 | 8D |
| B3 | 246.376 | 246.942 | -3.97 | 85 |
| C4 | 262.144 | 261.625 | 3.43 | 7D |
| C#4 | 277.695 | 277.183 | 3.20 | 76 |
| D4 | 292.571 | 293.665 | -6.46 | 70 |
| D#4 | 312.076 | 311.127 | 5.27 | 69 |
| E4 | 330.990 | 329.627 | 7.14 | 63 |
| F4 | 348.596 | 349.228 | -3.14 | 5E |
| F#4 | 368.180 | 369.994 | -8.51 | 59 |
| G4 | 390.095 | 391.995 | -8.41 | 54 |
| G#4 | 414.785 | 415.305 | -2.17 | 4F |
| A4 | 442.811 | 440.000 | 11.02 | 4A |
| A#4 | 468.114 | 466.164 | 7.23 | 46 |
| B4 | 496.485 | 493.883 | 9.10 | 42 |
| C5 | 520.127 | 523.251 | -10.37 | 3F |
| C#5 | 555.390 | 554.365 | 3.20 | 3B |
| D5 | 585.143 | 587.330 | -6.46 | 38 |
| D#5 | 618.264 | 622.254 | -11.14 | 35 |
| E5 | 655.360 | 659.255 | -10.26 | 32 |
| F5 | 697.191 | 698.457 | -3.14 | 2F |
| F#5 | 744.727 | 739.989 | 11.05 | 2C |
| G5 | 780.190 | 783.991 | -8.41 | 2A |
| G#5 | 840.205 | 830.610 | 19.88 | 27 |
| A5 | 885.622 | 880.000 | 11.02 | 25 |
| A#5 | 936.229 | 932.328 | 7.23 | 23 |
| B5 | 992.970 | 987.767 | 9.09 | 21 |
| C6 | 1057.03 | 1046.50 | 17.33 | 1F |

Scale output standard clock-freq. 65.536KHz

| Name | Output Frequency | Standard Frequency | Error (cent) | Data |
|------|------------------|--------------------|--------------|------|
| C4 | 262.144 | 261.625 | 3.43 | FA |
| C#4 | 277.695 | 277.183 | 3.20 | EC |
| D4 | 293.883 | 293.665 | 1.29 | DF |
| D#4 | 310.597 | 311.127 | -2.95 | D3 |
| E4 | 329.327 | 329.627 | -1.58 | C7 |
| F4 | 348.596 | 349.228 | -3.14 | BC |
| F#4 | 370.260 | 369.994 | 1.24 | B1 |
| G4 | 392.431 | 391.995 | 1.92 | A7 |
| G#4 | 414.785 | 415.305 | -2.17 | 9E |
| A4 | 439.839 | 440.000 | -0.63 | 95 |
| A#4 | 464.794 | 466.164 | -5.09 | 8D |
| B4 | 492.752 | 493.883 | -3.97 | 84 |
| C5 | 524.288 | 523.251 | 3.43 | 7D |
| C#5 | 555.390 | 554.365 | 3.20 | 76 |
| D5 | 585.143 | 587.330 | -6.46 | 70 |
| D#5 | 624.152 | 622.254 | 5.27 | 69 |
| E5 | 661.980 | 659.255 | 7.14 | 63 |
| F5 | 697.191 | 698.457 | -3.14 | 5E |
| F#5 | 736.360 | 739.989 | -8.51 | 59 |
| G5 | 780.190 | 783.991 | -8.41 | 54 |
| G#5 | 829.570 | 830.610 | -2.17 | 4F |
| A5 | 885.622 | 880.000 | 11.02 | 4A |
| A#5 | 936.229 | 932.328 | 7.23 | 46 |
| B5 | 992.970 | 987.767 | 9.09 | 42 |
| C6 | 1040.25 | 1046.50 | -10.37 | 3F |
| C#6 | 1110.78 | 1108.73 | 3.20 | 3B |
| D6 | 1170.29 | 1174.66 | -6.46 | 38 |
| D#6 | 1236.53 | 1244.51 | -11.14 | 35 |
| E6 | 1310.72 | 1318.51 | -10.26 | 32 |
| F6 | 1394.38 | 1396.91 | -3.14 | 2F |
| F#6 | 1489.45 | 1479.98 | 11.05 | 2C |
| G6 | 1560.38 | 1567.98 | -8.41 | 2A |
| G#6 | 1680.41 | 1661.22 | 19.88 | 27 |
| A6 | 1771.24 | 1760.00 | 11.02 | 25 |
| A#6 | 1872.46 | 1864.66 | 7.23 | 23 |
| B6 | 1985.94 | 1975.54 | 9.09 | 21 |
| C7 | 2114.06 | 2093.01 | 17.33 | 1F |