## GENERAL DESCRIPTION

EM58000 is a series of single chip dual channel IC with voice synthesizer/dual tone melody/dual tone sound effect. The dual channel can be (voice + voice), (voice + dual tone melody) or (voice + dual tone sound effect) simultaneously. That contains some input and I/O ports, and a tiny controller. By programming through the tiny controller, user's application including section combination, trigger modes, control outputs, IR communication, and other logical function can be easily implemented.

## FEATURES

| | EM58001 | EM58101 | EM58200 | EM58300 | EM58400 | EM58500 | EM58600 | EM58700 |
|---|---|---|---|---|---|---|---|---|
| TOTAL ROM(bits) | 10K x 10 | 16K x 10 | 32K x 10 | 64K x 10 | 128K x 10 | 256Kx10 | 512Kx10 | 1024Kx10 |
| PROGRAM ROM(bits) | 8K x 10 | | 32K x 10 | | | | | |
| RAM(nibbles) | 32 | 64 | 128 | | | | | |
| PORT1 [input](pins) | - | | 4 | | | | | |
| PORT2 [I/O](pins) | 2 | | 4 | | | | | |
| PORT3 [I/O](pins) | 4 | | | | | | | |
| VO(pins) | 1 | | 2 | | | | | |

- Single power supply 2.4 V~ 5.5 V.
- Port1 and Port2 with wake-up function, Port3.2 with programmable IR (38 KHz carry) communication function.
- Power down mode for saving power consumption.
- Single ROM for voice, melody, sound effect and program data.
- Readable ROM code data.
- One 6-bit timer overflow control.
- Two stacks for subroutine calling.
- Dual channel output simultaneously : (voice + voice), (voice + dual tone melody) or (voice + dual tone sound effect).
- 5-bit ASPCM synthesizer.
- Dual tone melody/sound effect generator with programmable envelope.
- Multiple playing speeds in 2 KHz ~ 32 KHz for voice playback.
- Multiple tempos and variable beats for dual tone melody/sound effect playback.
- Multiple levels of volume control.
- Fixed current D/A to drive external connected transistor for audio output.

## PIN DESCRIPTIONS

| Symbol | I/O | Function |
|---|---|---|
| P1.0 | I | Bit 0 of Port 1. (not for EM58001, EM58101) |
| P1.1 | I | Bit 1 of Port 1. (not for EM58001, EM58101) |
| P1.2 | I | Bit 2 of Port 1. (not for EM58001, EM58101) |
| P1.3 | I | Bit 3 of Port 1. (not for EM58001, EM58101) |
| P2.0 | I/O | Bit 0 of Port 2. (not for EM58001) |
| P2.1 | I/O | Bit 1 of Port 2. (not for EM58001) |
| P2.2 | I/O | Bit 2 of Port 2. |
| P2.3 | I/O | Bit 3 of Port 2. |
| P3.0 | I/O | Bit 0 of Port 3. |
| P3.1 | I/O | Bit 1 of Port 3. |
| P3.2 | I/O | Bit 2 of Port 3. The pin can generate 38KHz square wave. |
| P3.3 | I/O | Bit 3 of Port 3. The pin can be treated as an LED output flashing with volume. |
| VDD | I | Positive power supply. |
| OSC | I | Oscillation component connection pin. |
| VSS | I | Negative power supply. |
| VO1 | O | Audio1 output. |
| VO2 | O | Audio2 output. (not for EM58001, EM58101) |
| TEST | | For testing only |

## ABSOLUTE MAXIMUM RATINGS

| Items | Sym. | Min. | Max. | Unit |
|---|---|---|---|---|
| Supply Voltage | $V_{DD}$-$V_{SS}$ | -0.3 | 6.0 | V |
| Input Voltage | $V_{IN}$ | $V_{SS}$-0.3 | $V_{DD}$+0.3 | V |
| Operating Temperature | $T_{OP}$ | -20 | 70 | °C |
| Storage Temperature | $T_{STG}$ | -55 | +125 | °C |

## ELECTRICAL CHARACTERISTICS

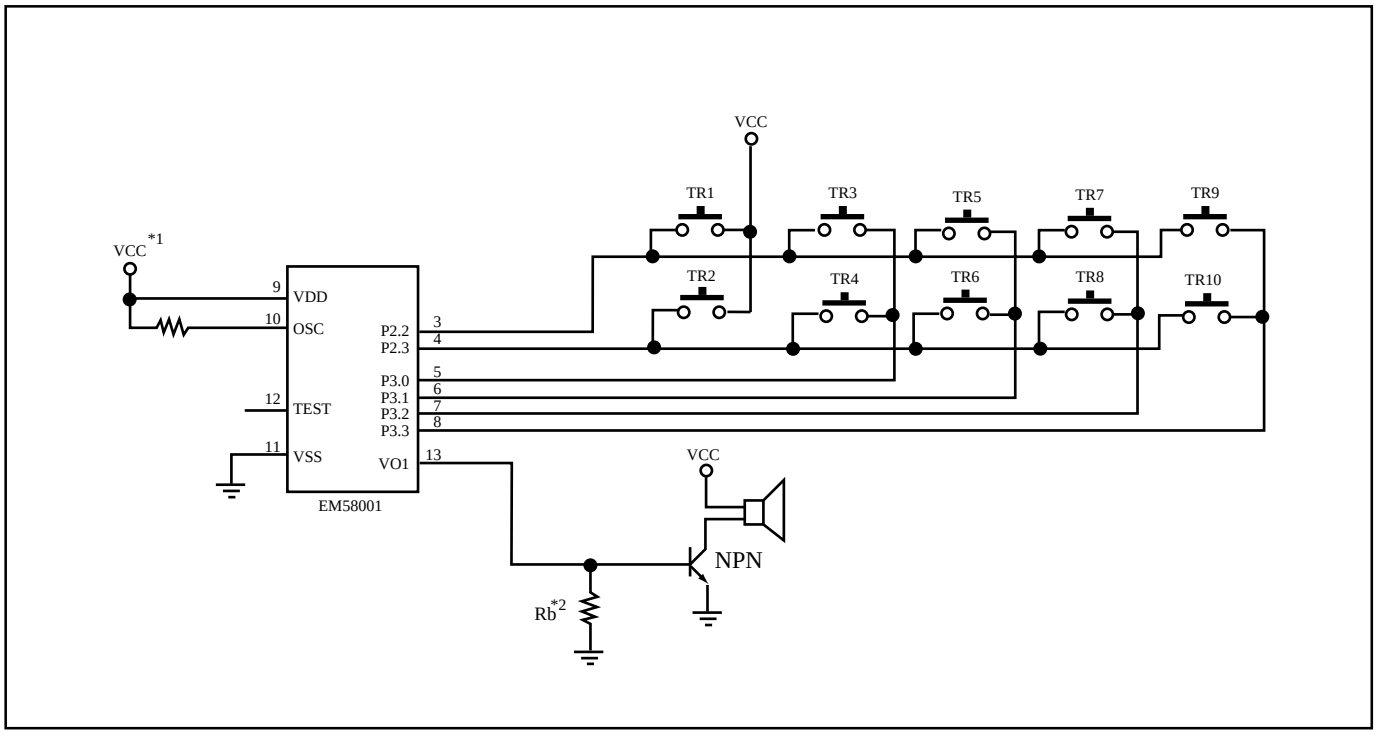
| Parameter | Sym. | Min. | Typ. | Max. | Unit | Condition |
|---|---|---|---|---|---|---|
| Operating voltage | $V_{DD}$ | 2.4 | 3.0 | 5.5 | V | |
| Standby current | $I_{DDS}$ | - | - | 1.0 | µA | $V_{DD}$=3V |
| Operating current | $I_{DDO}$ | - | - | 250 | µA | $V_{DD}$=3V, No load |
| Drive current of P2,P3 | $I_{OD}$ | 2.0 | 3.0 | - | mA | $V_{DD}$=3V, $V_O$=2.4V |
| Sink current of P3 | $I_{OS}$ | 2.3 | 3.5 | - | mA | $V_{DD}$=3V, $V_O$=0.4V |

| Parameter | Sym. | Min. | Typ. | Max. | Unit | Condition |
|---|---|---|---|---|---|---|
| Sink current of P2 (after KEYB) | $I_{OS1}$ | 2.3 | 3.5 | - | mA | $V_{DD}$=3V, $V_O$=0.4V |
| Sink current of P2 (before KEYB) | $I_{OS2}$ | - | 3.0 | 10 | µA | $V_{DD}$=3V, $V_O$=0.4V |
| Input current of P1 | $I_{IH}$ | - | 3.0 | 10 | µA | $V_{DD}$=3V |
| Output current of VO1, VO2 | $I_{VO}$ | 4.0 | 5.0 | 6.0 | mA | $V_{DD}$=3V, $V_O$=0.7V, two channel full scale output |
| Oscillation resistor | $R_{OSC}$ | - | 470 | - | KΩ | $V_{DD}$=2.4V~ 5.5V |
| Oscillation frequency | $F_{OSC}$ | 0.9 | 1.0 | 1.1 | MHz | $V_{DD}$=2.4V~ 5.5V |
| Oscillation frequency deviation | $\frac{\Delta F_{OSC}}{F_{OSC}}$ | -10 | 0 | 10 | % | $V_{DD}$=2.4V~ 5.5V |

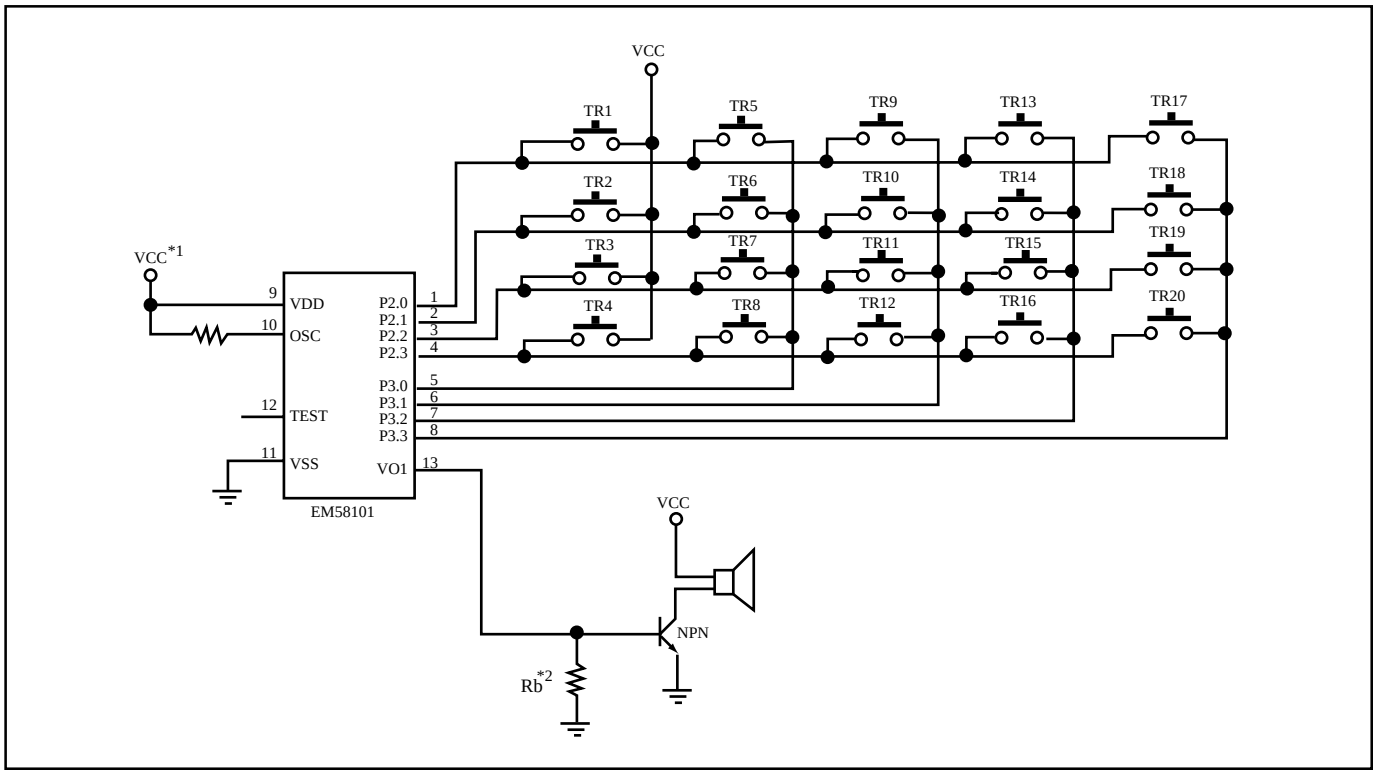
## APPLICATION CIRCUIT

In the following application circuits:
*1 : For heavy loading application, adding an electrolytic capacitor between Vcc and Ground is recommanded. The recommanded value for button cell application is 10µF.
*2 : The recommanded value for button cell application is 750Ω or less.

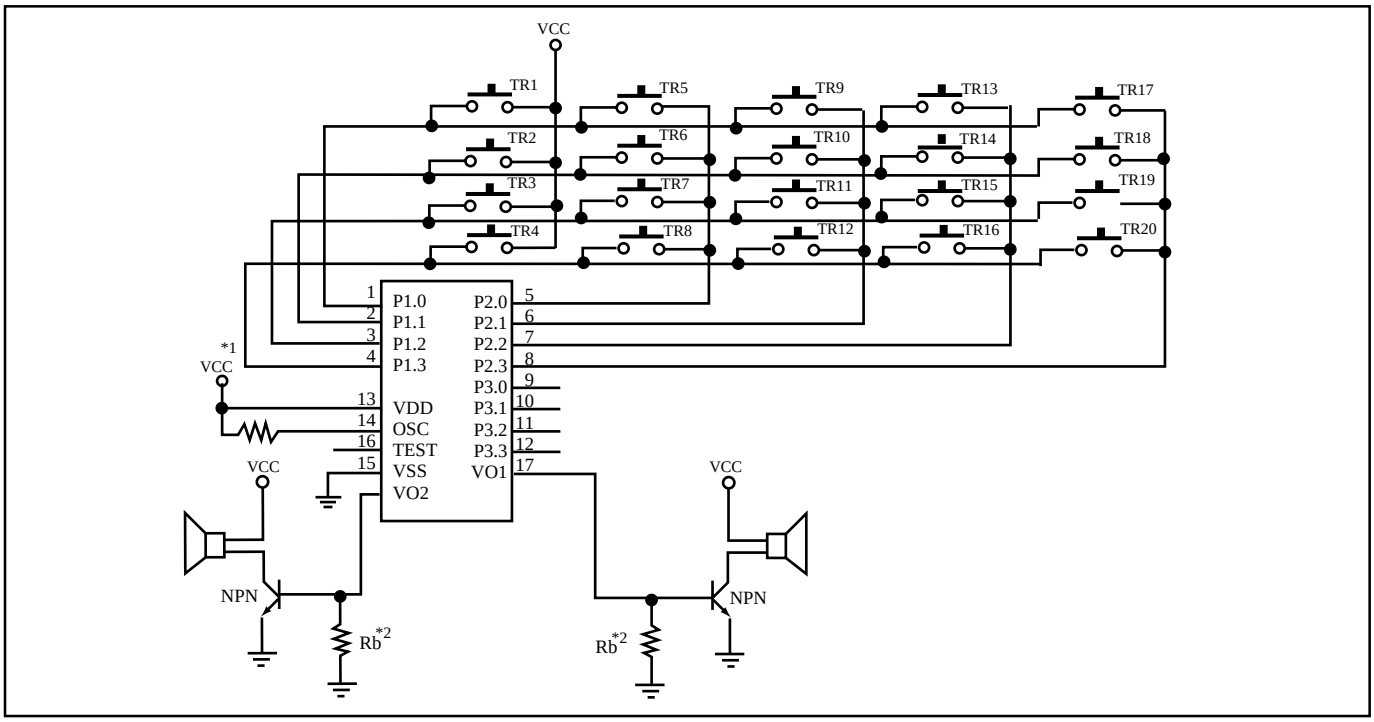
10-key Application Circuit For EM58001



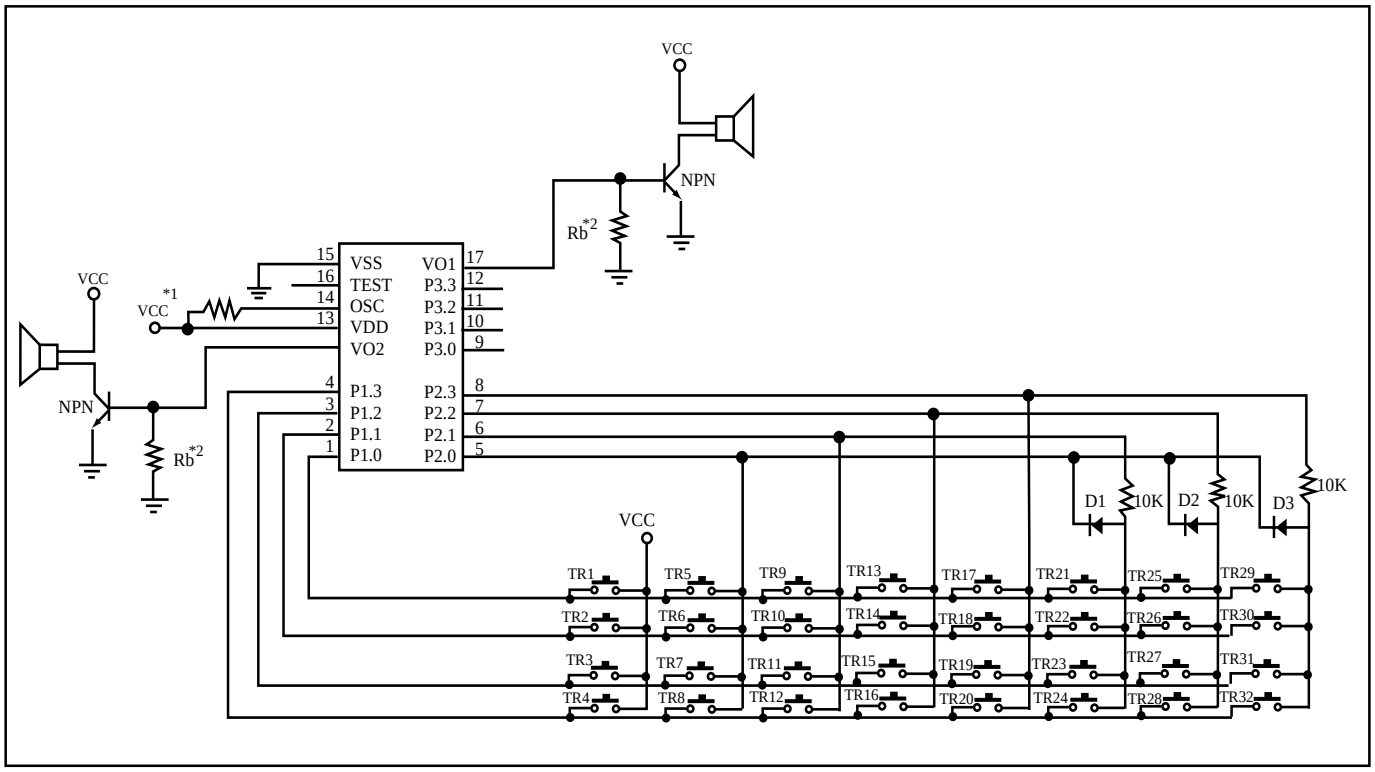
20-key Application Circuit For EM58101



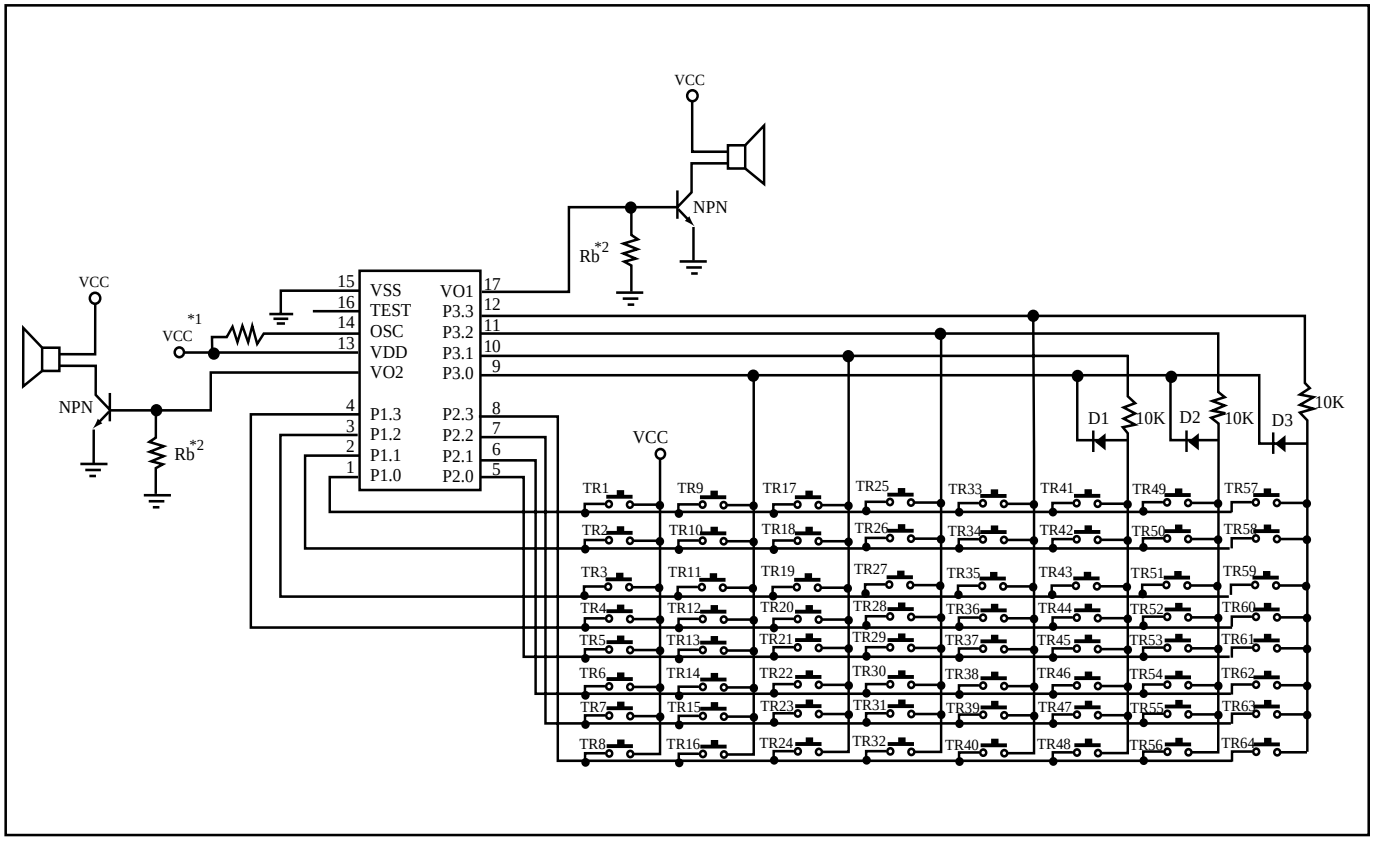

20-key Application Circuit For EM58200~EM58700



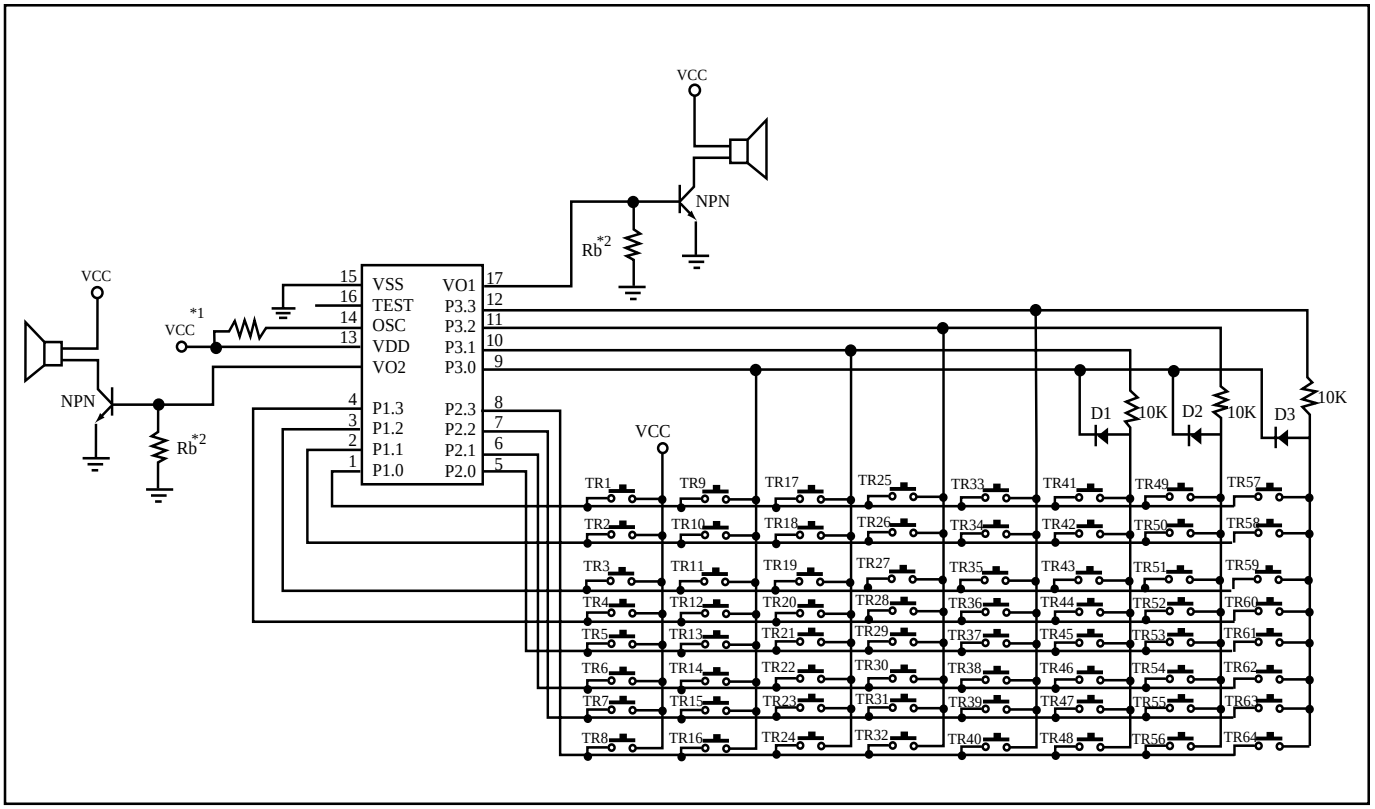
32-key Application Circuit For EM58200~EM58700



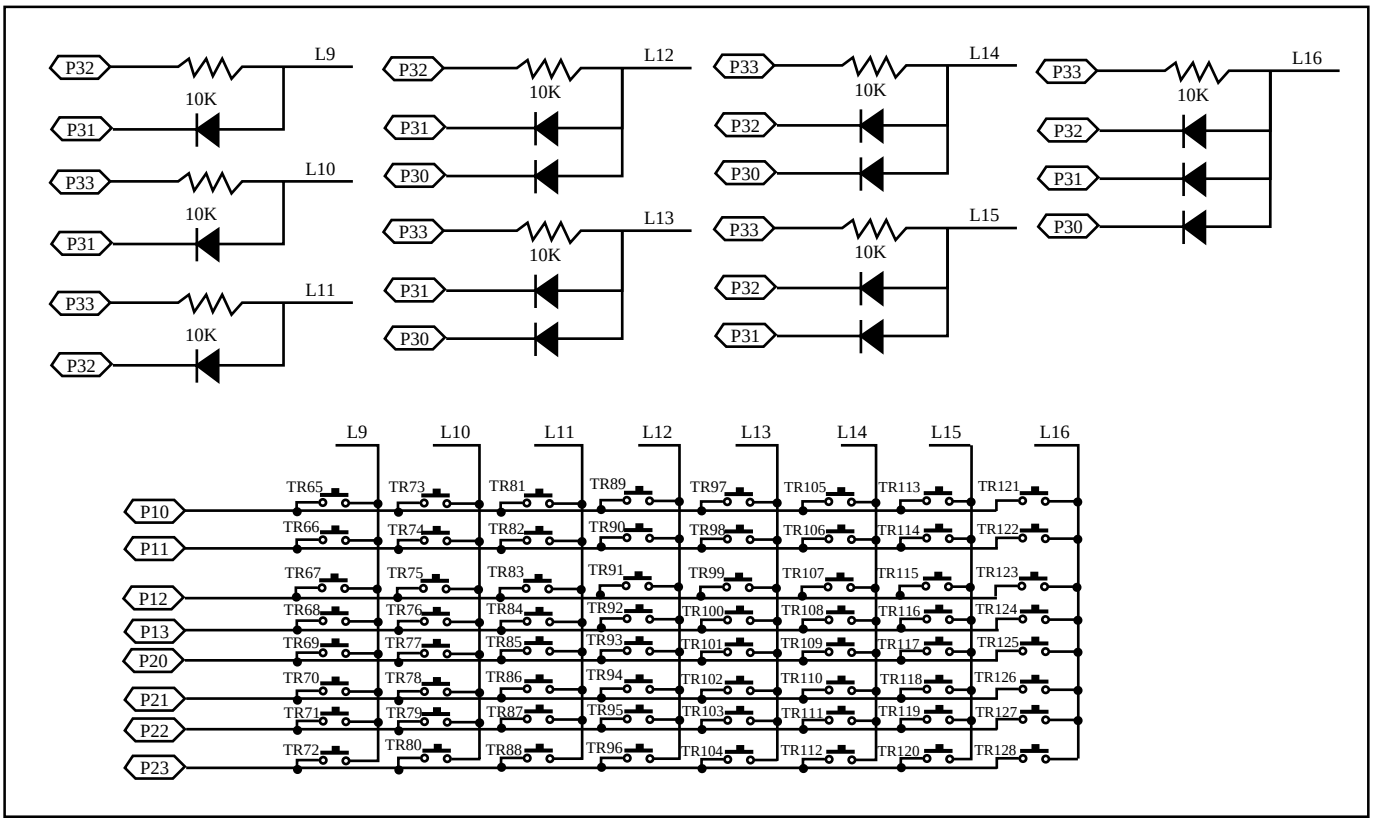

64-key Application Circuit For EM58200~EM58700



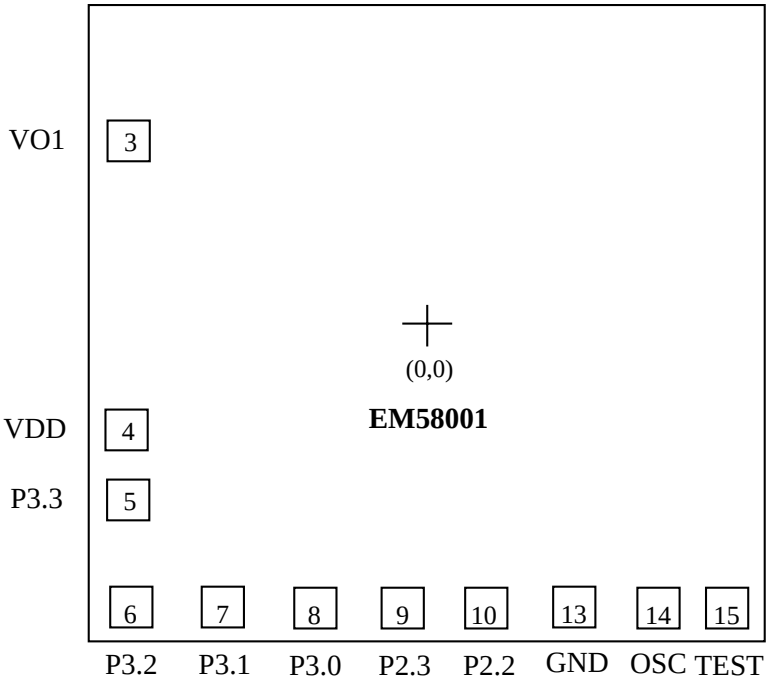
128-key Application Circuit (A) For EM58200~EM58700




128-key Application Circuit (B) For EM58200~EM58700



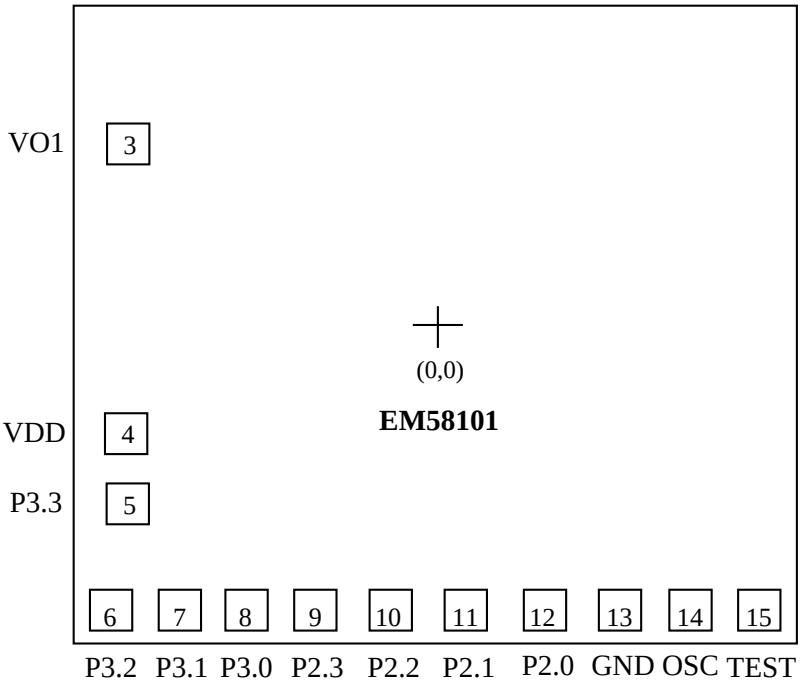
## PAD DIAGRAM




Chip Size : 1300 x 1500 um
For PCB layout, IC substrate must be connected to Vss.

| Pad No. | Symbol | X | Y |
|---|---|---|---|
| 1 | NC | | |
| 2 | NC | | |
| 3 | VO1 | -402.0 | 421.4 |
| 4 | VDD | -418.4 | -125.4 |
| 5 | P3.3 | -418.4 | -269.3 |
| 6 | P3.2 | -440.4 | -523.4 |
| 7 | P3.1 | -318.8 | -523.4 |
| 8 | P3.0 | -198.2 | -523.4 |
| 9 | P2.3 | -76.1 | -523.4 |
| 10 | P2.2 | 46.3 | -523.4 |
| 11 | NC | | |
| 12 | NC | | |
| 13 | GND | 190.5 | -523.4 |
| 14 | OSC | 321.5 | -523.4 |
| 15 | TEST | 442.7 | -523.4 |
| 16 | NC | | |
| 17 | NC | | |
| 18 | NC | | |
| 19 | NC | | |
| 20 | NC | | |

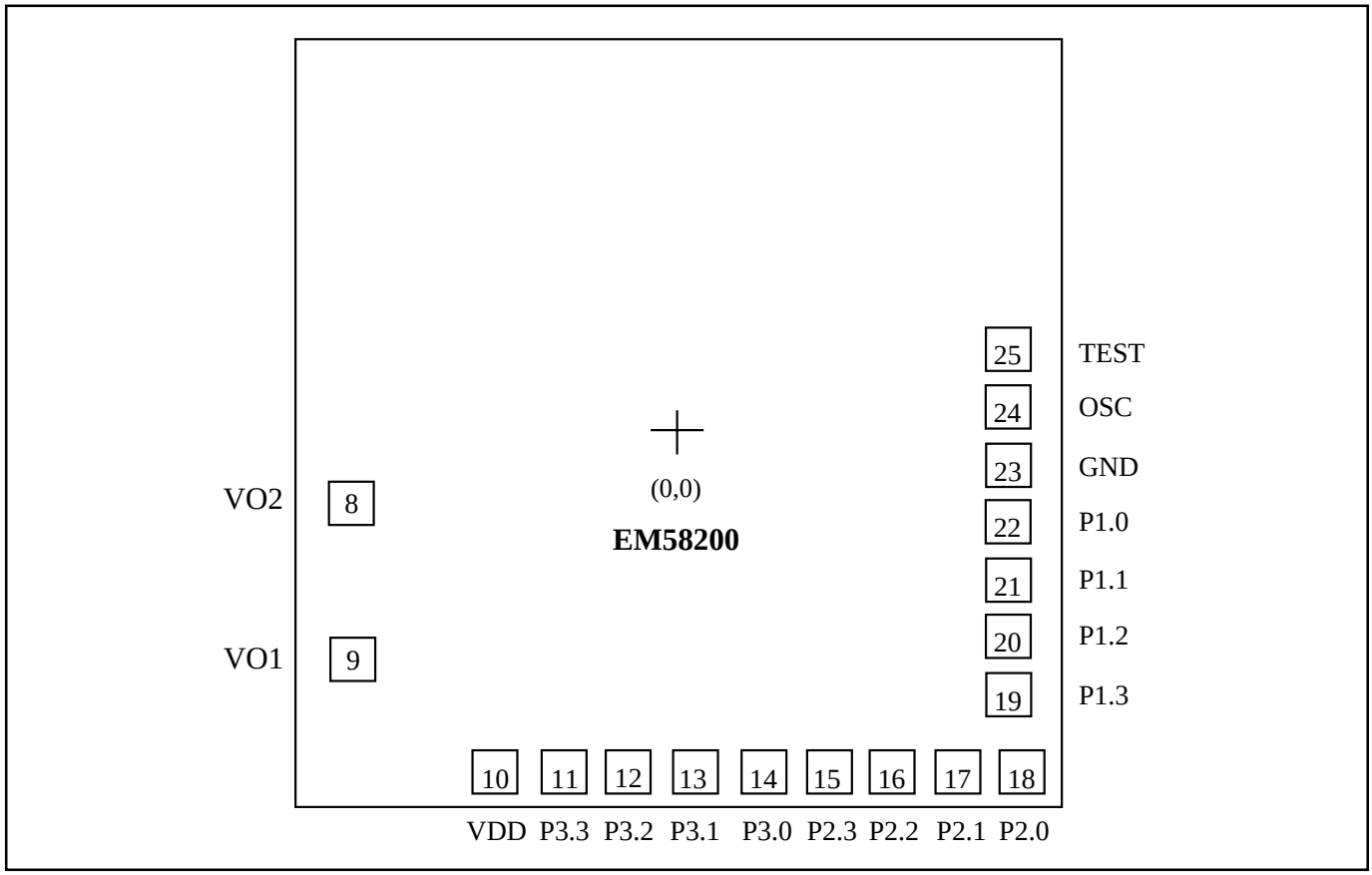
## PAD DIAGRAM




Chip Size : 1500 x 1400 um
For PCB layout, IC substrate must be connected to Vss.

| Pad No. | Symbol | X | Y |
|---|---|---|---|
| 1 | NC | | |
| 2 | NC | | |
| 3 | VO1 | -512.0 | 391.0 |
| 4 | VDD | -528.4 | -153.7 |
| 5 | P3.3 | -528.4 | -284.7 |
| 6 | P3.2 | -564.8 | -498.4 |
| 7 | P3.1 | -443.9 | -498.4 |
| 8 | P3.0 | -323.0 | -498.4 |
| 9 | P2.3 | -200.9 | -498.4 |
| 10 | P2.2 | -78.5 | -498.4 |
| 11 | P2.1 | 43.9 | -498.4 |
| 12 | P2.0 | 166.3 | -498.4 |
| 13 | GND | 310.5 | -498.4 |
| 14 | OSC | 441.5 | -498.4 |
| 15 | TEST | 562.7 | -498.4 |
| 16 | NC | | |
| 17 | NC | | |
| 18 | NC | | |
| 19 | NC | | |
| 20 | NC | | |

## PAD DIAGRAM

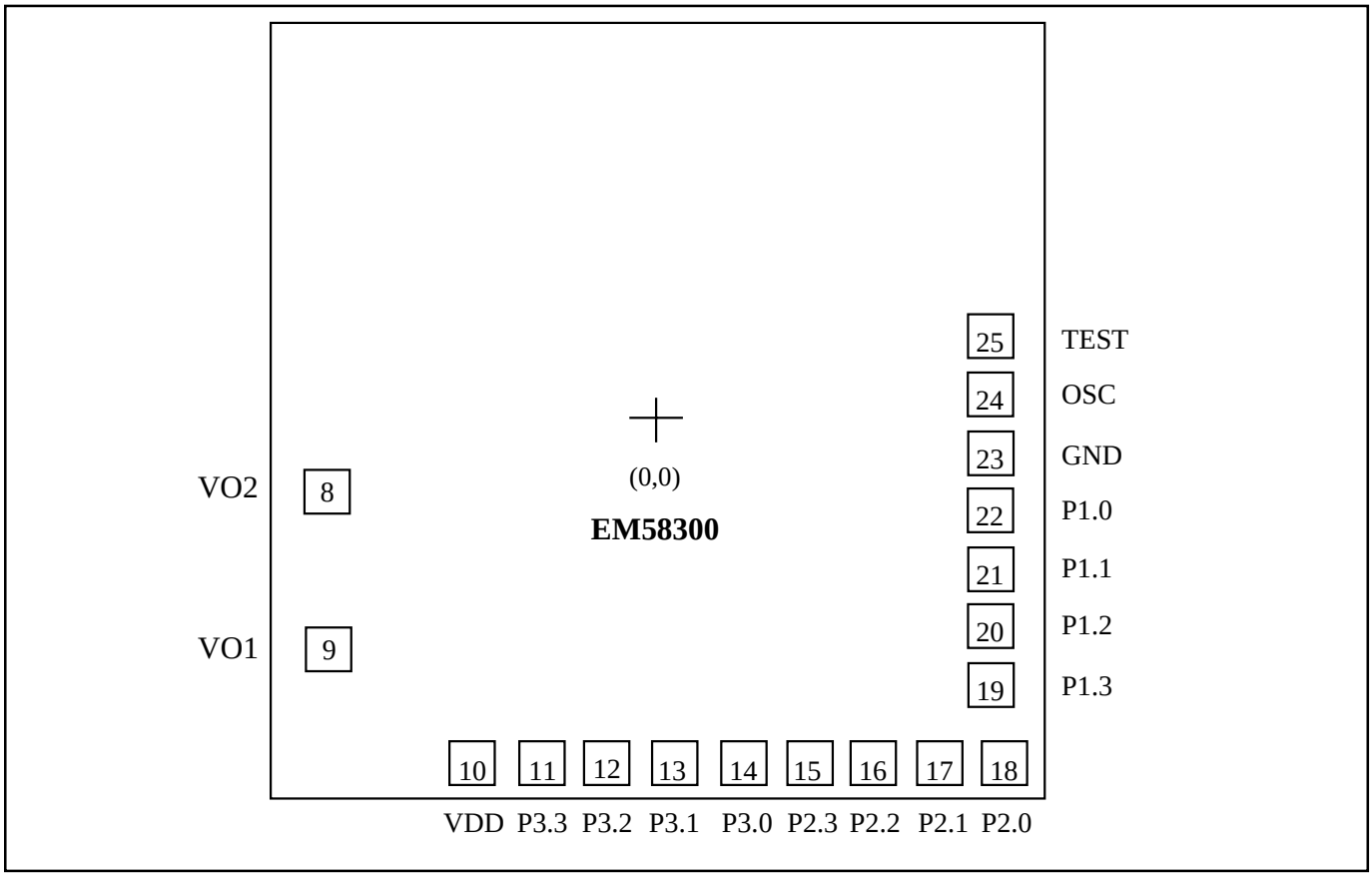



Chip Size : 1700 x 1750 um
For PCB layout, IC substrate must be connected to Vss.

| Pad No. | Symbol | X | Y |
|---|---|---|---|
| 1 | NC | | |
| 2 | NC | | |
| 3 | NC | | |
| 4 | NC | | |
| 5 | NC | | |
| 6 | NC | | |
| 7 | NC | | |
| 8 | VO2 | -572.0 | -17.2 |
| 9 | VO1 | -572.0 | -401.5 |
| 10 | VDD | -383.4 | -628.4 |
| 11 | P3.3 | -252.4 | -628.4 |
| 12 | P3.2 | -131.5 | -628.4 |
| 13 | P3.1 | -10.6 | -628.4 |
| 14 | P3.0 | 110.3 | -628.4 |

| Pad No. | Symbol | X | Y |
|---|---|---|---|
| 15 | P2.3 | 232.4 | -628.4 |
| 16 | P2.2 | 354.8 | -628.4 |
| 17 | P2.1 | 477.2 | -628.4 |
| 18 | P2.0 | 599.6 | -628.4 |
| 19 | P1.3 | 588.4 | -453.7 |
| 20 | P1.2 | 588.4 | -331.3 |
| 21 | P1.1 | 588.4 | -208.9 |
| 22 | P1.0 | 588.4 | -86.5 |
| 23 | GND | 588.4 | 57.7 |
| 24 | OSC | 588.4 | 188.7 |
| 25 | TEST | 588.4 | 309.9 |
| 26 | NC | | |
| 27 | NC | | |
| 28 | NC | | |

## PAD DIAGRAM

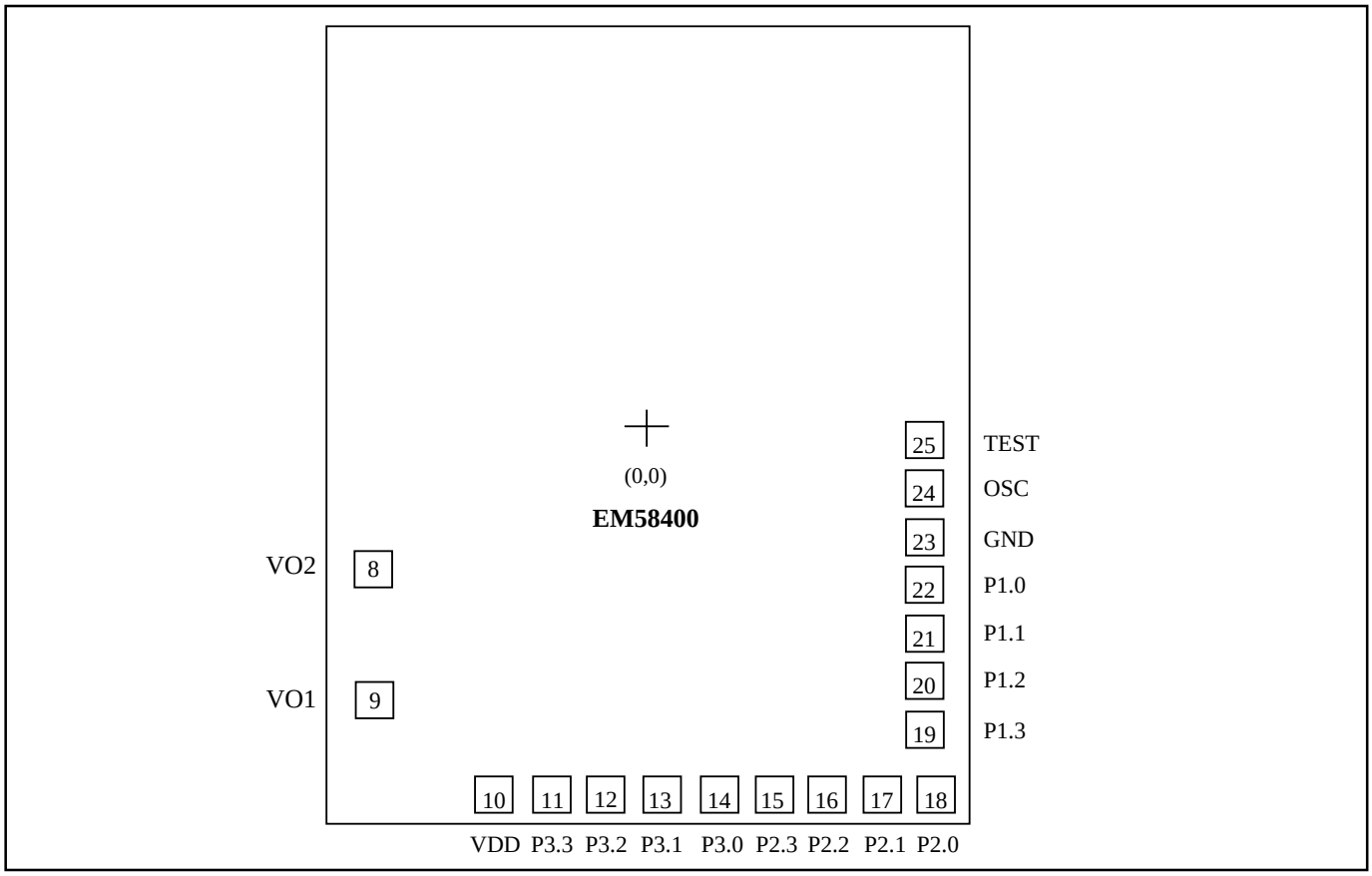



Chip Size : 1700 x 2000 um
For PCB layout, IC substrate must be connected to Vss.

| Pad No. | Symbol | X | Y |
|---|---|---|---|
| 1 | NC | | |
| 2 | NC | | |
| 3 | NC | | |
| 4 | NC | | |
| 5 | NC | | |
| 6 | NC | | |
| 7 | NC | | |
| 8 | VO2 | -572.0 | -147.2 |
| 9 | VO1 | -572.0 | -531.6 |
| 10 | VDD | -383.4 | -758.4 |
| 11 | P3.3 | -252.4 | -758.4 |
| 12 | P3.2 | -131.5 | -758.4 |
| 13 | P3.1 | -10.6 | -758.4 |
| 14 | P3.0 | 110.3 | -758.4 |

| Pad No. | Symbol | X | Y |
|---|---|---|---|
| 15 | P2.3 | 232.4 | -758.4 |
| 16 | P2.2 | 354.8 | -758.4 |
| 17 | P2.1 | 477.2 | -758.4 |
| 18 | P2.0 | 599.6 | -758.4 |
| 19 | P1.3 | 588.4 | -583.7 |
| 20 | P1.2 | 588.4 | -461.3 |
| 21 | P1.1 | 588.4 | -338.9 |
| 22 | P1.0 | 588.4 | -216.5 |
| 23 | GND | 588.4 | -72.3 |
| 24 | OSC | 588.4 | 58.7 |
| 25 | TEST | 588.4 | 179.9 |
| 26 | NC | | |
| 27 | NC | | |
| 28 | NC | | |

## PAD DIAGRAM

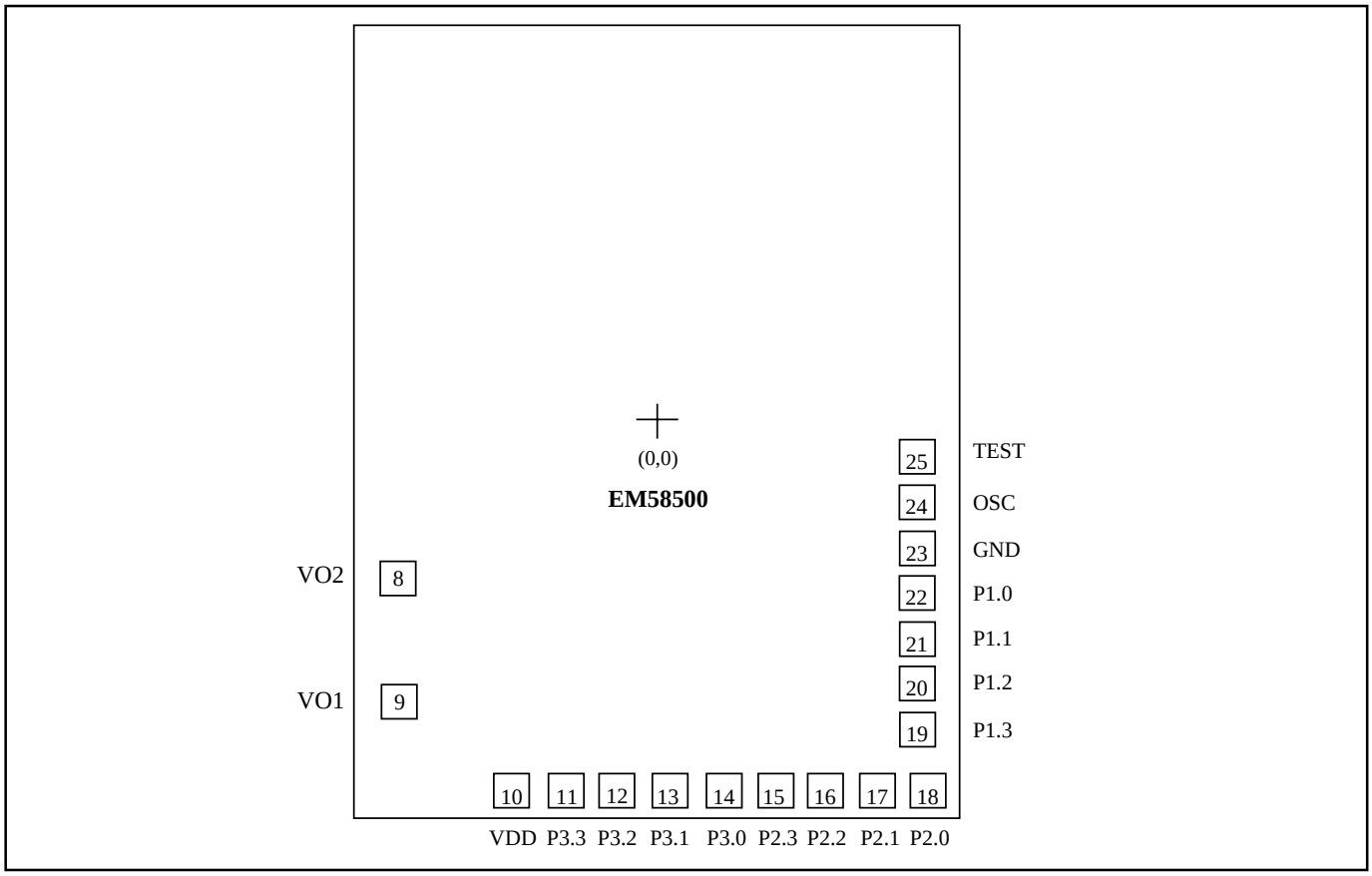



Chip Size : 1700 x 2500 um
For PCB layout, IC substrate must be connected to Vss.

| Pad No. | Symbol | X | Y |
|---|---|---|---|
| 1 | NC | | |
| 2 | NC | | |
| 3 | NC | | |
| 4 | NC | | |
| 5 | NC | | |
| 6 | NC | | |
| 7 | NC | | |
| 8 | VO2 | -572.0 | -412.2 |
| 9 | VO1 | -572.0 | -796.5 |
| 10 | VDD | -383.4 | -1023.4 |
| 11 | P3.3 | -252.4 | -1023.4 |
| 12 | P3.2 | -131.5 | -1023.4 |
| 13 | P3.1 | -10.6 | -1023.4 |
| 14 | P3.0 | 110.3 | -1023.4 |

| Pad No. | Symbol | X | Y |
|---|---|---|---|
| 15 | P2.3 | 232.4 | -1023.4 |
| 16 | P2.2 | 354.8 | -1023.4 |
| 17 | P2.1 | 477.2 | -1023.4 |
| 18 | P2.0 | 599.6 | -1023.4 |
| 19 | P1.3 | 588.4 | -848.7 |
| 20 | P1.2 | 588.4 | -726.3 |
| 21 | P1.1 | 588.4 | -603.9 |
| 22 | P1.0 | 588.4 | -481.5 |
| 23 | GND | 588.4 | -337.3 |
| 24 | OSC | 588.4 | -206.3 |
| 25 | TEST | 588.4 | -85.1 |
| 26 | NC | | |
| 27 | NC | | |
| 28 | NC | | |

## PAD DIAGRAM

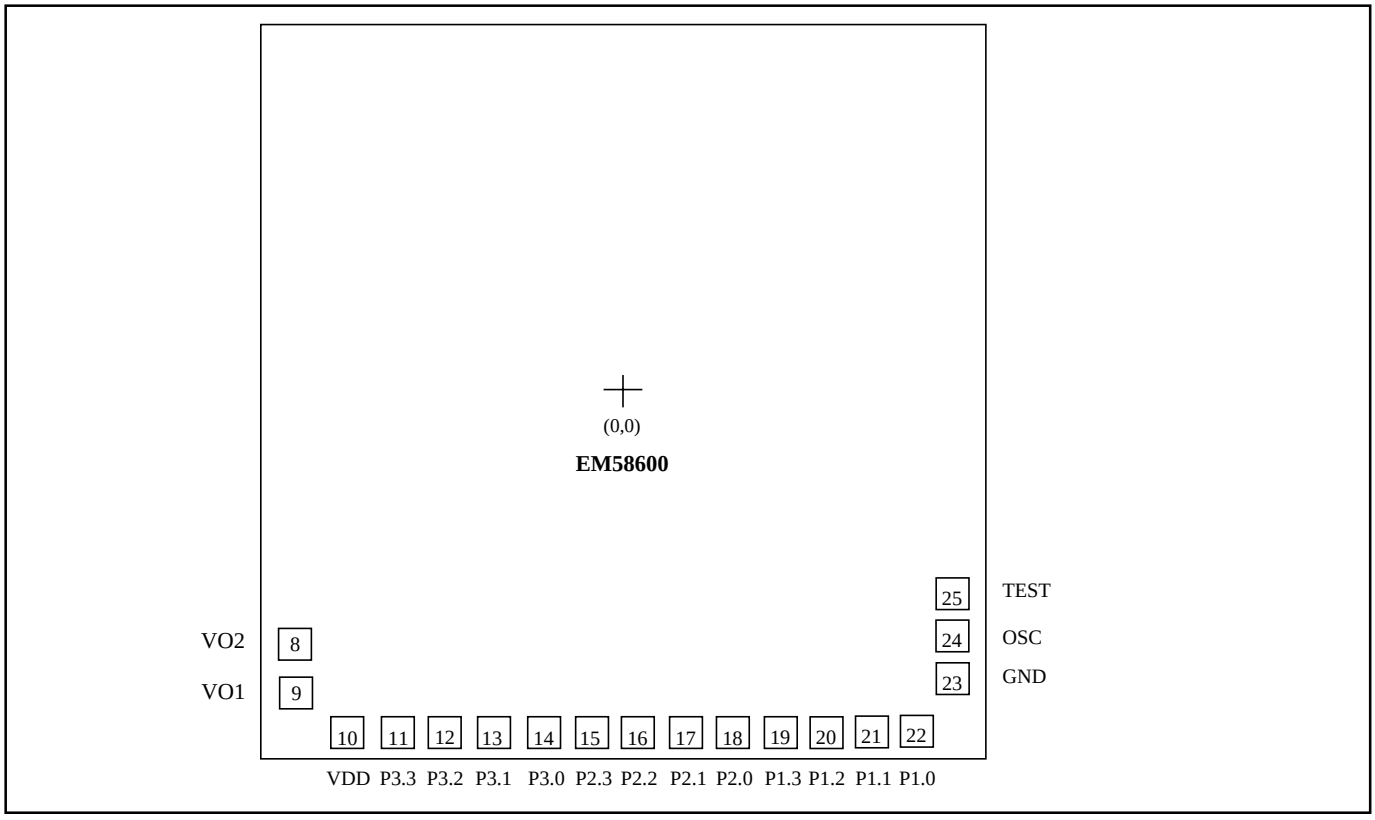



Chip Size : 1700 x 3600 um
For PCB layout, IC substrate must be connected to Vss.

| Pad No. | Symbol | X | Y |
|---|---|---|---|
| 1 | NC | | |
| 2 | NC | | |
| 3 | NC | | |
| 4 | NC | | |
| 5 | NC | | |
| 6 | NC | | |
| 7 | NC | | |
| 8 | VO2 | -572.0 | -932.2 |
| 9 | VO1 | -572.0 | -1316.6 |
| 10 | VDD | -383.4 | -1543.4 |
| 11 | P3.3 | -252.4 | -1543.4 |
| 12 | P3.2 | -131.5 | -1543.4 |
| 13 | P3.1 | -10.6 | -1543.4 |
| 14 | P3.0 | 110.3 | -1543.4 |

| Pad No. | Symbol | X | Y |
|---|---|---|---|
| 15 | P2.3 | 232.4 | -1543.4 |
| 16 | P2.2 | 354.8 | -1543.4 |
| 17 | P2.1 | 477.2 | -1543.4 |
| 18 | P2.0 | 599.6 | -1543.4 |
| 19 | P1.3 | 588.4 | -1368.7 |
| 20 | P1.2 | 588.4 | -1246.3 |
| 21 | P1.1 | 588.4 | -1123.9 |
| 22 | P1.0 | 588.4 | -1001.5 |
| 23 | GND | 588.4 | -857.3 |
| 24 | OSC | 588.4 | -726.3 |
| 25 | TEST | 588.4 | -605.1 |
| 26 | NC | | |
| 27 | NC | | |
| 28 | NC | | |

## PAD DIAGRAM

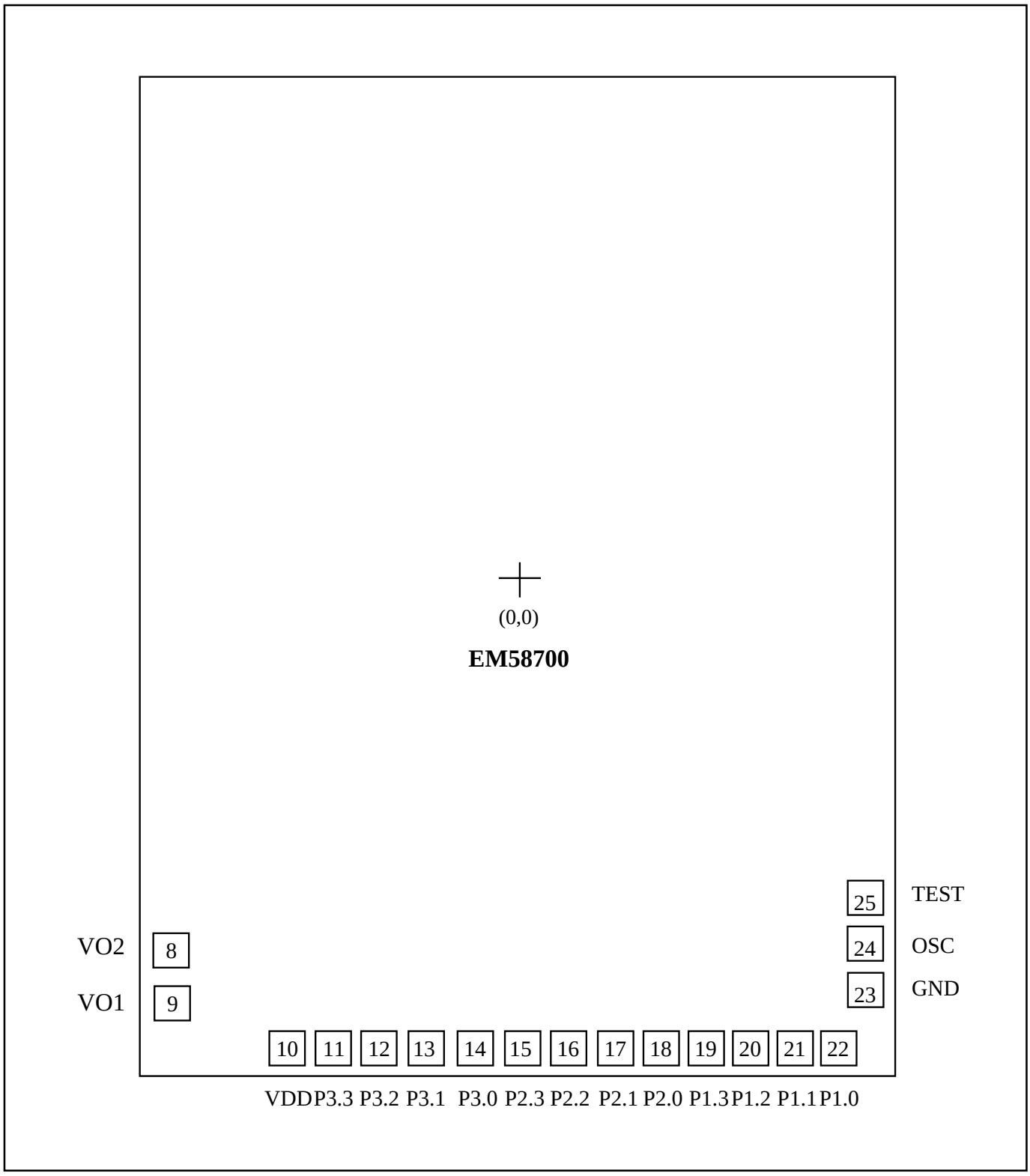



Chip Size : 3050 x 3100 um
For PCB layout, IC substrate must be connected to Vss.

| Pad No. | Symbol | X | Y |
|---|---|---|---|
| 1 | NC | | |
| 2 | NC | | |
| 3 | NC | | |
| 4 | NC | | |
| 5 | NC | | |
| 6 | NC | | |
| 7 | NC | | |
| 8 | VO2 | -1285.0 | -1111.6 |
| 9 | VO1 | -1285.0 | -1241.6 |
| 10 | VDD | -884.3 | -1340.0 |
| 11 | P3.3 | -695.7 | -1340.0 |
| 12 | P3.2 | -519.2 | -1340.0 |
| 13 | P3.1 | -342.7 | -1340.0 |
| 14 | P3.0 | -166.2 | -1340.0 |
| 15 | P2.3 | 15.0 | -1340.0 |
| 16 | P2.2 | 191.5 | -1340.0 |

| Pad No. | Symbol | X | Y |
|---|---|---|---|
| 17 | P2.1 | 377.4 | -1340.0 |
| 18 | P2.0 | 553.9 | -1340.0 |
| 19 | P1.3 | 739.8 | -1340.0 |
| 20 | P1.2 | 916.3 | -1340.0 |
| 21 | P1.1 | 1102.2 | -1340.0 |
| 22 | P1.0 | 1278.7 | -1340.0 |
| 23 | GND | 1293.4 | -1138.0 |
| 24 | OSC | 1293.4 | -1007.0 |
| 25 | TEST | 1293.4 | -885.8 |
| 26 | NC | | |
| 27 | NC | | |
| 28 | NC | | |
| 29 | NC | | |
| 30 | NC | | |
| 31 | NC | | |
| 32 | NC | | |

## PAD DIAGRAM




Chip Size : 2930 x 5080 um
For PCB layout, IC substrate must be connected to Vss.

| Pad No. | Symbol | X | Y |
|---|---|---|---|
| 1 | NC | | |
| 2 | NC | | |
| 3 | NC | | |
| 4 | NC | | |
| 5 | NC | | |
| 6 | NC | | |
| 7 | NC | | |
| 8 | VO2 | -1285.0 | -2161.6 |
| 9 | VO1 | -1285.0 | -2291.6 |
| 10 | VDD | -884.3 | -2390.0 |
| 11 | P3.3 | -695.7 | -2390.0 |
| 12 | P3.2 | -519.2 | -2390.0 |
| 13 | P3.1 | -342.7 | -2390.0 |
| 14 | P3.0 | -166.2 | -2390.0 |
| 15 | P2.3 | 15.0 | -2390.0 |
| 16 | P2.2 | 191.5 | -2390.0 |

| Pad No. | Symbol | X | Y |
|---|---|---|---|
| 17 | P2.1 | 377.4 | -2390.0 |
| 18 | P2.0 | 553.9 | -2390.0 |
| 19 | P1.3 | 739.8 | -2390.0 |
| 20 | P1.2 | 916.3 | -2390.0 |
| 21 | P1.1 | 1102.2 | -2390.0 |
| 22 | P1.0 | 1278.7 | -2390.0 |
| 23 | GND | 1293.4 | -2188.0 |
| 24 | OSC | 1293.4 | -2057.0 |
| 25 | TEST | 1293.4 | -1935.8 |
| 26 | NC | | |
| 27 | NC | | |
| 28 | NC | | |
| 29 | NC | | |
| 30 | NC | | |
| 31 | NC | | |
| 32 | NC | | |