

**■ GENERAL DESCRIPTIONS**

SN6B000 is a 8-bit micro controller series with hi-density LCD driver. Combined with one or more SN6BS00 (64-segment drivers), SN6B000 can form one 1024/ 2048/ 4096/ 6144/ 8192 dots LCD system. A dual-tone melody and a voice synthesizer are included in SN6B000. Also, a 7-bit current-type DAC and the PWM circuit are built in SN6B000, so that makes users easily choose a speaker (DA), or a buzzer (PWM) for their applications. SN6B000 only contains 32 COM signals of LCD. All segment signals are provided by SN6BS00. Several different types of LCD applications can be implemented by suitably combining SN6B000 and SN6BS00. SN6B000 not only contains internal mask ROM itself (128K words, MC mode), but also possesses the interface to access external ROM (maximum 512K words, MP mode). A memory chip, SN6B400 consists of 256K-word mask ROM and is available to work with SN6B000 to accomplish the whole micro-processor system.

| Dots | Configuration         | COM | SEG |
|------|-----------------------|-----|-----|
| 1024 | 1 SN6B000 + 1 SN6BS00 | 16  | 64  |
| 2048 | 1 SN6B000 + 1 SN6BS00 | 32  | 64  |
| 4096 | 1 SN6B000 + 2 SN6BS00 | 32  | 128 |
| 6144 | 1 SN6B000 + 3 SN6BS00 | 32  | 192 |
| 8192 | 1 SN6B000 + 4 SN6BS00 | 32  | 256 |

**■ FEATURES**

- ◆ ROM space: 512K words ( $=2^{19} \times 16 = 2^{20} \times 8$ ); Program Space: 256K\*16
  - MC mode: 128K words in SN6B000
  - MP mode: along with SN6B400 to 256K words
- ◆ RAM Size:
  - 256 bytes in SN6B000
  - 4\*256 bytes in SN6BS00 (2\*256 bytes LCD RAM, 2\*256 bytes normal RAM)
- ◆ I/O Port : There are Port0 and Port1 (total 16 pins I/O)
  - All ports are I/O-type and P0.7 can be modulated with a carry signal
  - Each port can be set as "H", "L", *floating*, and *high-resistance "H"* (150K@5V)
  - Every port can wake up chip when chip is in power-down mode
- ◆ 60 instructions
- ◆ 8 levels stack buffer supports interrupt and call subroutine
- ◆ System Clock:
  - 2MHz RC oscillator
  - 2M/ 4M(3.58M) crystal
- ◆ Low speed clock: Register option, 32768 crystal or RC
- ◆ Three different operation modes can be selected:
  - Normal mode (both High/Low osc. On).
  - Slow mode (High osc. Off, Low osc. On).
  - Stop mode (both High and Low osc. Off).
- ◆ LCD: 1/16 duty (for 1024) or 1/32 duty, frame rate=64 or 128 Hz.
- ◆ A voltage regulator and double voltage circuit is included in SN6BS000
- ◆ 8 interrupt sources :
  - 5 internal interrupts: T0, TC0, TC1, TW, SPEECH (non-maskable).
  - 3 external interrupts: INTP0.0 ~ INTP0.2
  - ISR entry location: Reset: 0000, SPEECH: 0018h, and the others: 0008h
- ◆ Voice:
  - Built-in voice synthesizer
  - Sampling rate from 4K to 40Khz
  - Dual tone melody with 4 octaves
  - 7-bit DA converter (maximum 3mA)
  - PWM output for Buzzer

**■ PIN ASSIGNMENT**
**SN6B000**

| Pin Name         | I/O | Descriptions  | Internal Pull-low |
|------------------|-----|---|-------------------|
| C0~C31           | O   | Common 0 ~ 31   |                   |
| VLC1, VLC4, VLC5 | I   | LCD Bias  |                   |
| VLCDR            | I   | LCD Bias  |                   |
| P/C              | I   | Micro-processor/Micro-controller                                      | √                 |
| A0~A19           | O   | Address Bus for ROM   |                   |
| D0~D7            | I/O | Data Bus for ROM  |                   |
| CE1B             | O   | Chip Enable of External ROM.  |                   |
| VO/ BUZ1         | O   | Voice out, 7-bit DA / PWM output                                      |                   |
| BUZ2             | O   | PWM output  |                   |
| OSC/XIN          |     | High speed Clock input:<br>CKSEL=L, RC oscillator<br>CKSEL=H, Crystal |                   |
| XOUT             | O   | High Speed clock output   |                   |
| CKSEL            | I   | High speed clock selection<br>( 0:2M RC oscillator, 1: Crystal)       | √                 |
| LXIN             | I   | Low speed clock input   |                   |
| LXOUT            | O   | Low speed clock output  |                   |
| P0, P1           | I/O | I/O Ports   |                   |
| XCE_0            | O   | Chip Enable of SN6BS00 0  |                   |
| XCE_1            | O   | Chip Enable of SN6BS00 1  |                   |
| XCE_2            | O   | Chip Enable of SN6BS00 2  |                   |
| XCE_3            | O   | Chip Enable of SN6BS00 3  |                   |
| XD7~XD0          | I/O | Data Bus to Slave Driver  |                   |
| XA9~XA0          | O   | Address Bus to Slave Driver   |                   |
| WR               | O   | Read Write signal   |                   |
| FRAME            | O   | Frame Synchronous Signal  |                   |
| CL               | O   | Display Synchronous Signal  |                   |
| M                | O   | Alternating signal for LCD  |                   |
| SYNC             | O   | Phase 1 synchronous pin.  |                   |
| TEST             | I   | Test Pin  | √                 |
| RESETB           | I   | Reset Pin   |                   |
| VDD              | I   | Positive power supply   |                   |
| GND              | I   | Negative power supply   |                   |

**SN6BS00:**

| Pin Name                | I/O | Descriptions               |
|-------------------------|-----|----------------------------|
| S0~S63                  | O   | Segment 0 ~ 63             |
| VLCDR, VLC2, VLC3, VLC5 | I   | LCD Bias                   |
| VREG                    | O   | Voltage Pumper             |
| VPS                     | I   | Voltage Pumper             |
| VO1, VO2                | I   | Voltage Pumper             |
| XA0~XA9                 | I   | Address Bus                |
| XD0~XD7                 | I/O | Data Bus                   |
| XCE                     | I   | Chip Enable                |
| WR                      | I   | Read Write signal          |
| FRAME                   | I   | Frame Synchronous Signal   |
| CL                      | I   | Display Synchronous Signal |
| M                       | I   | Alternating signal for LCD |
| VDD                     | I   | Positive power supply      |
| GND                     | I   | Negative power supply      |

**SN6B400:**

| Pin Name | I/O | Function Description      |
|----------|-----|---------------------------|
| VDD      | I   | Positive power supply     |
| CEB      | I   | Chip Enable. (Active Low) |
| SYNC     | I   | Clock Pin                 |
| D7~D0    | O   | Data Output               |
| A18~A0   | I   | Address Input             |
| VSS      | I   | Negative power supply.    |

## ■ ABSOLUTE MAXIMUM RATINGS

(All of the voltages referenced to Vss)

|                                      |       |                     |
|--------------------------------------|-------|---------------------|
| Supply voltage (Vdd)                 | ----- | - 0.3V ~ 6.0V       |
| Input in voltage (Vin) Vss           | ----- | - 0.2V ~ Vdd + 0.2V |
| Operating ambient temperature (Topr) | ----- | 0°C ~ + 70°C        |
| Storage ambient temperature (Tstor)  | ----- | -30°C ~ + 125°C     |
| Power consumption (Pc)               | ----- | 500 mW              |

## ■ ELECTRICAL CHARACTERISTICS

### SN6B000

| PARAMETER                      | SYM.   | DESCRIPTION  | MIN.   | TYP.   | MAX.   | UNIT |
|--------------------------------|--------|--|--------|--------|--------|------|
| Operating voltage              | Vdd    |  | 3.9    | -      | 5.1    | V    |
| Operating current              | IddH   | Vdd = 5.0V, I/O pin unload, normal mode                    | -      | 1      | -      | mA   |
|                                | Idds   | Vdd = 5.0V, I/O pin unload, slow mode                      | -      | 15     | -      | uA   |
|                                | Istby  | Vdd = 5.0V, I/O pin unload, stop mode                      | -      | -      | 1      | uA   |
| Reset, TEST pin input voltage  | ViH    |  | 0.7Vdd | -      | -      | V    |
|                                | ViL    |  | -      | -      | 0.3Vss |      |
| Reset, TEST leakage current    | ILekg  | Vin = Vdd  | -      | -      | 1      | uA   |
| I/P port input voltage         | ViH    |  | 0.8Vdd | -      | -      | V    |
|                                | ViL    |  | -      | -      | 0.2Vss |      |
| I/P port pull-up resistor      | Rup    | Vin = Vss  | -      | 150    | -      | KΩ   |
| I/P port input leakage current | Ilekg  | Pull-up resistor disable, Vin = Vdd                        | -      | -      | 1      | uA   |
| Port0,1 output source Current  | IoH    | Vop = Vdd - 0.5V   | 1      | 2      | -      | mA   |
| Port0,1 output sink Current    | IoL    | Vop = Vss + 0.5V   | 2      | 4      | -      | mA   |
| LCD supply voltage             | Vlcd   |  | -      | -      | 6.5    | V    |
| LCD frame frequency            | Flcd   |  | -      | 64/128 | -      | Hz   |
| Vo output Current              | Ivo    | DA output current  | -      | 3      | 4      | mA   |
| BU1,BU2 Driving Current        | IdBU   | PWM driving current ability.<br>V <sub>BU1/BU2</sub> =2.5V | -      | 60     | -      | mA   |
| BU1,BU2 Sinking Current        | IsBU   | PWM sinking current ability.<br>V <sub>BU1/BU2</sub> =2.5V | -      | 60     | -      | mA   |
| INTP0 trigger pulse width      | Tint01 | P0.0 ~ P0.2 Interrupt request pulse width                  | 1/fcpu | -      | -      | S    |
| Oscillator frequency           | fHxosc | Rosc=300KΩ   | -      | 2      | -      | MHz  |

**SN6BS00**

(All of voltages referenced to Vss, Vdd = 5.0V, SN6B000@3.58MHz, ambient temperature is 25°C unless otherwise note.)

| <b>PARAMETER</b>       | <b>SYM.</b>       | <b>DESCRIPTION</b>   | <b>MIN.</b> | <b>TYP.</b> | <b>MAX.</b> | <b>UNIT</b> |
|------------------------|-------------------|--|-------------|-------------|-------------|-------------|
| Operating voltage      | Vdd               |  | 3.9         | -           | 5.1         | V           |
| Operating current      | IddH              | LCD pin unload, Voltage-doubler ON                                   | -           | 3           | -           | mA          |
| Standby Current        | Istby             | LCD pin unload, Voltage-doubler OFF,<br>No Data Access from SN6B000. | -           | -           | 1           | uA          |
| Output Voltage of VREG | V <sub>OREG</sub> | VDD=3.9V   | -           | 5.4         | -           | V           |
|                        |                   | VDD=4.5V   | -           | 5.9         | -           | V           |
|                        |                   | VDD=5.1V   | -           | 6.2         | -           | V           |

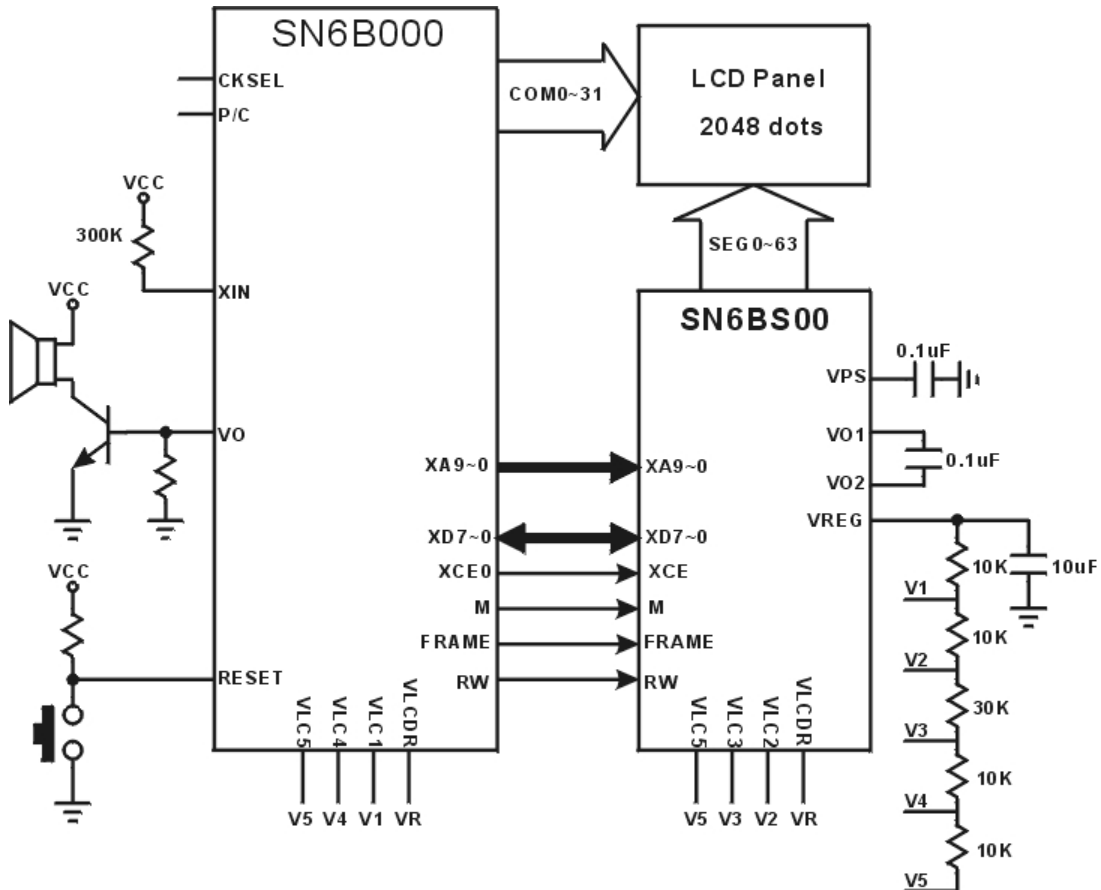
**SN6B400**

(All of voltages referenced to Vss, Vdd = 5.0V, SN6B000@3.58MHz, ambient temperature is 25°C unless otherwise note.)

| <b>PARAMETER</b>  | <b>SYM.</b> | <b>DESCRIPTION</b>          | <b>MIN.</b> | <b>TYP.</b> | <b>MAX.</b> | <b>UNIT</b> |
|-------------------|-------------|-----------------------------|-------------|-------------|-------------|-------------|
| Operating voltage | Vdd         |                             | 3.6         | -           | 5.1         | V           |
| Operating current | IddH        |                             | -           | 400         | -           | uA          |
| Standby Current   | Istby       | CEB=5V                      | -           | -           | 1           | uA          |
| Access time       | Tac         | Loading=10pf, VDD = 3.6V~5V | -           | -           | 300         | nS          |

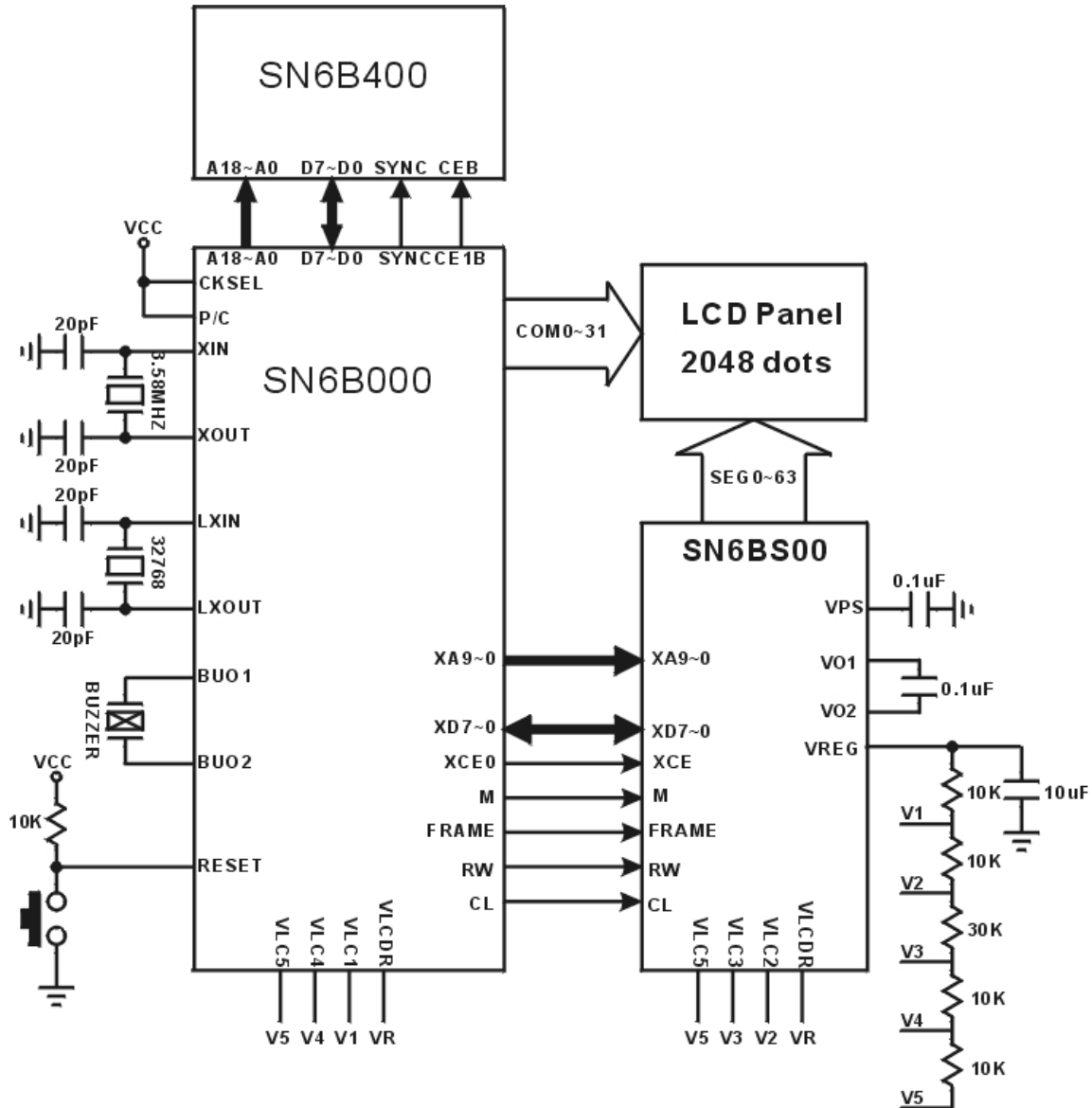
**■ APPLICATION CIRCUIT**

- ◆ **MC mode with 2048-dot (64 seg X 32 com, 1/7 bias) LCD**
  - Clock: RC type (CPU frequency: 2MHZ)
  - No low speed clock
  - Speaker voice output



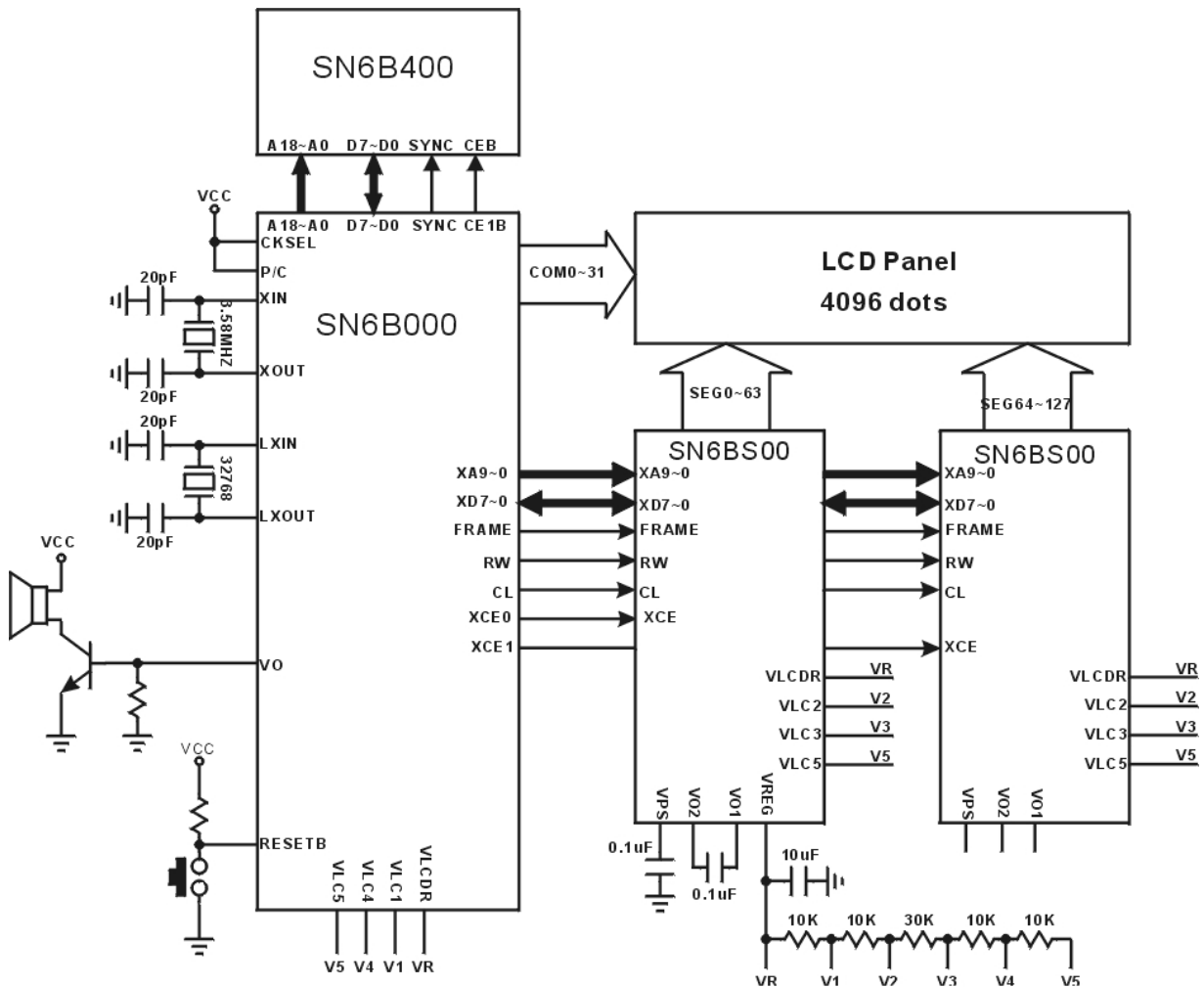
◆ **MP mode with SN6B400 and 2048-dot (64seg X 32com, 1/7 bias) LCD**

- Clock: 3.58MHZ crystal (CPU frequency: 3.58MHZ)
- 32768 low speed clock
- Buzzer voice output



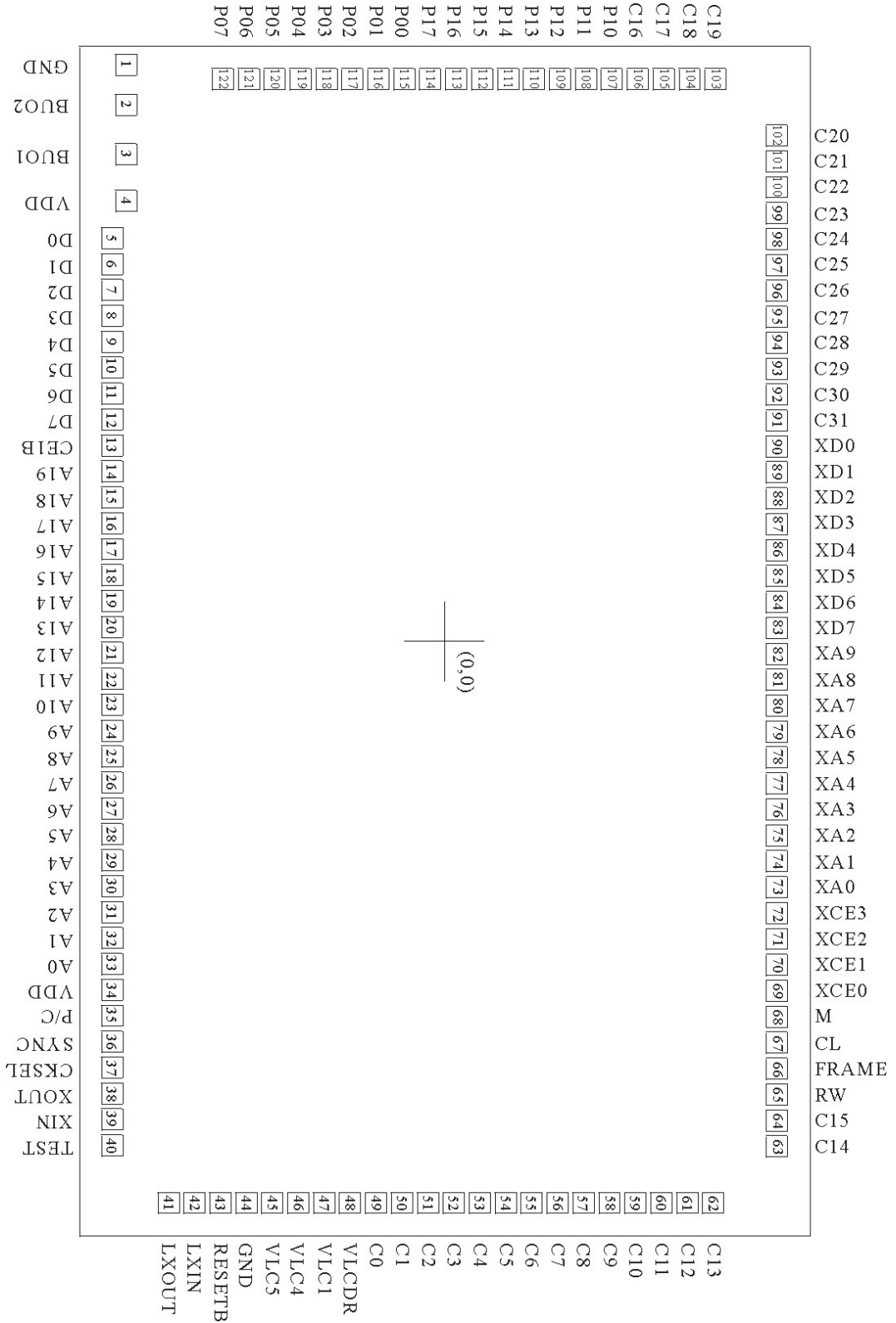


- ◆ MP mode with SN6B400 and 4096-dot (128seg X 32com, 1/7 bias) LCD
  - Clock: 3.58MHZ (CPU frequency: 3.58MHZ)
  - 32768 low speed clock
  - Speaker voice output



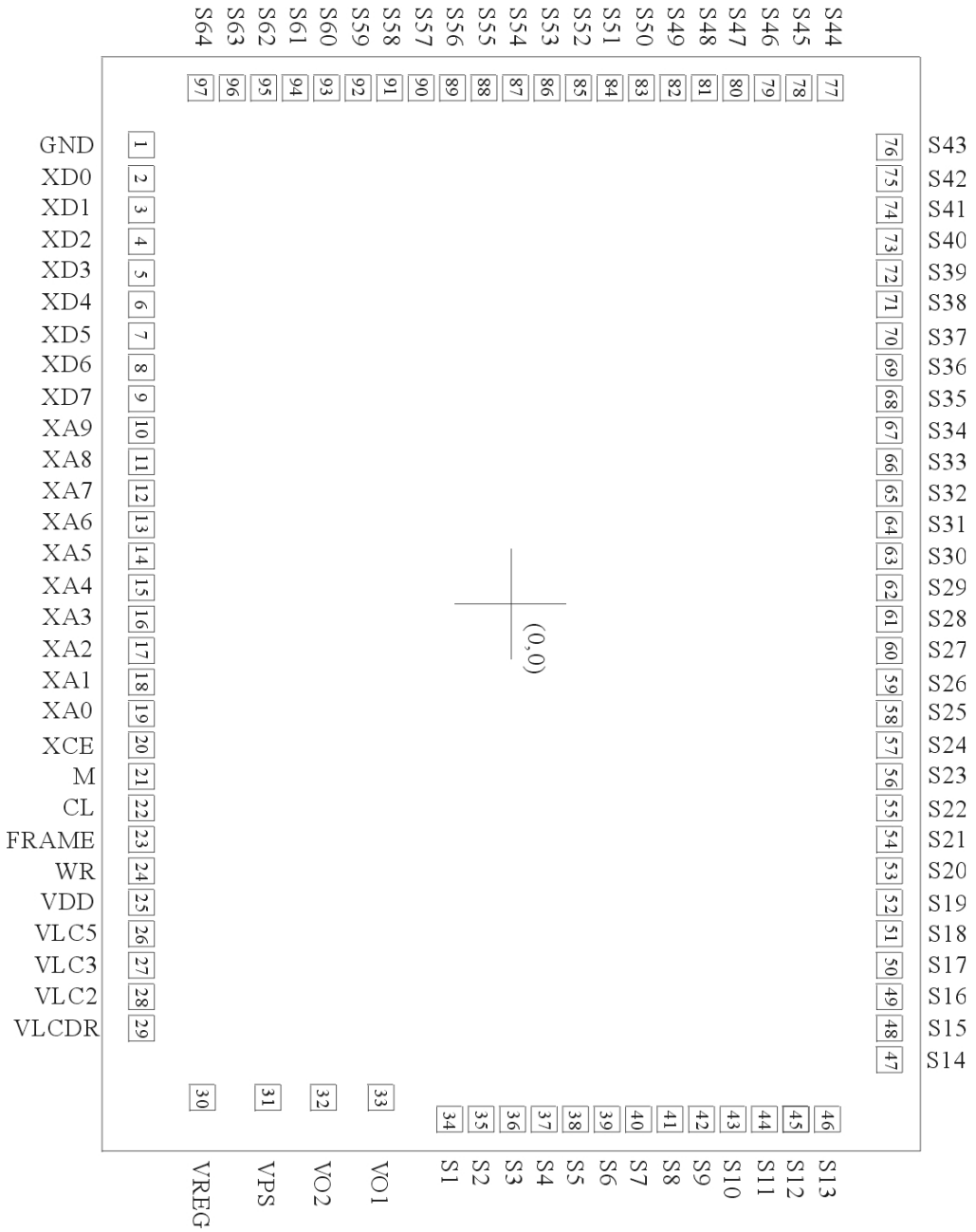


■ BONDING PAD



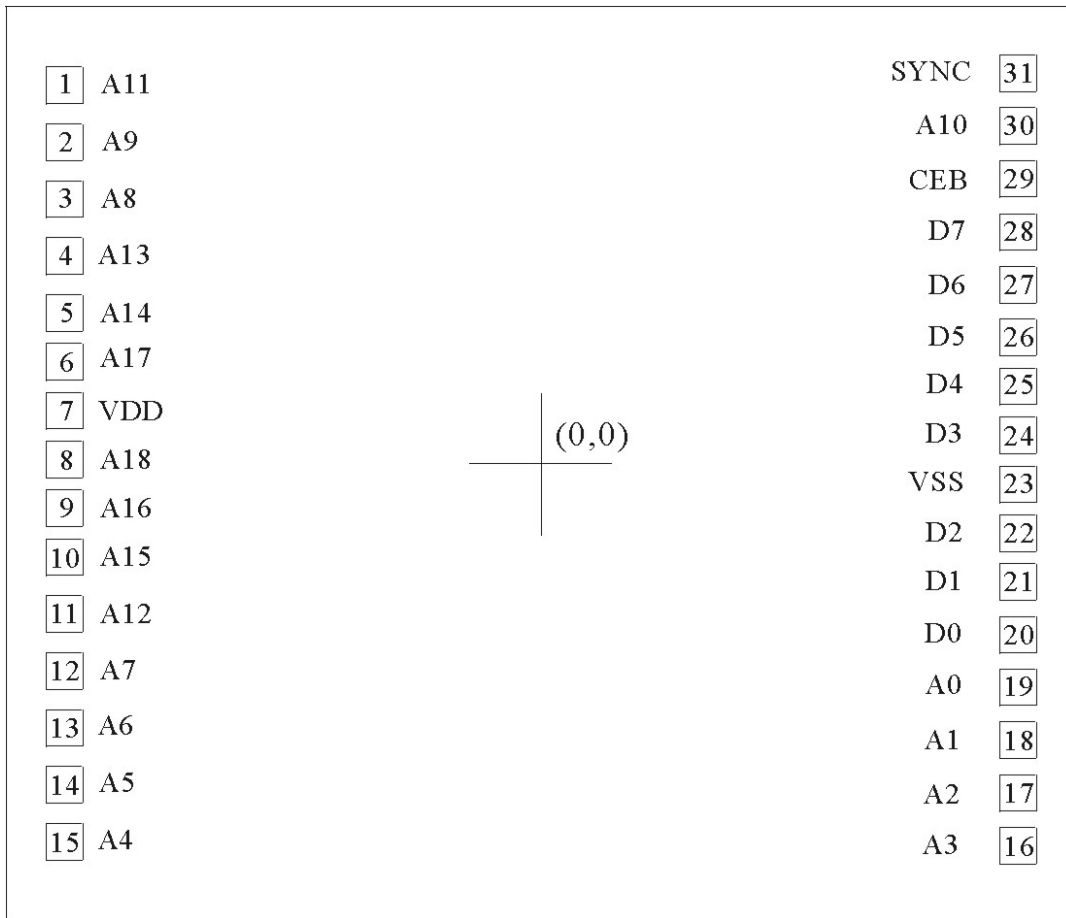
**SN6B000**

Note : The substrate MUST be connected to Vss in PCB layout.



Note : The substrate MUST be connected to Vss in PCB layout.

**SN6BS00**



### SN6B400

Note : The substrate **MUST** be connected to Vss in PCB layout.

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