



# VK1623S Datasheet

48×8 LCD DRIVER

Rev.1.3

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## 1 General Description

The VK1623S is a RAM-mapped LCD segment driver capable of supporting up to 384 segments (48 SEG × 8 COM).

The device communication via a 3-wire or 4-wire serial interface, which is used for display parameter configuration, data transmission, and Power-down control.

## 2 Key Features

- Operating voltage:2.4-5.2V
- Integrated RC oscillator (default)
- External crystal input: 32.768 kHz (OSCO, OSC1)
- Selectable LCD bias:1/4
- Selectable LCD duty:1/8
- Built-in 48 × 8-bit display RAM
- Configurable buzzer output: 2 kHz or 4 kHz
- Power-down mode via software command(LCD OFF, SYS DIS)
- Eight selectable clock sources for time base / WDT
- WDT or time base overflow flag output via /IRQ pin
- 3 wire or 4 wire serial communication interface
- Software-configurable of LCD parameters
- Dual command formats for configuration and access
- Auto-increment addressing for sequential read/write
- Three RAM accessing modes
- VLCD adjustable via external pin ( $\leq VDD$ )
- Available Packages:
  - LQFP100(14.0mm × 14.0mm PP=0.5mm)
  - QFP100(20.0mm × 14.0mm PP=0.65mm)
  - DICE
  - COG

### 3 Product Selection

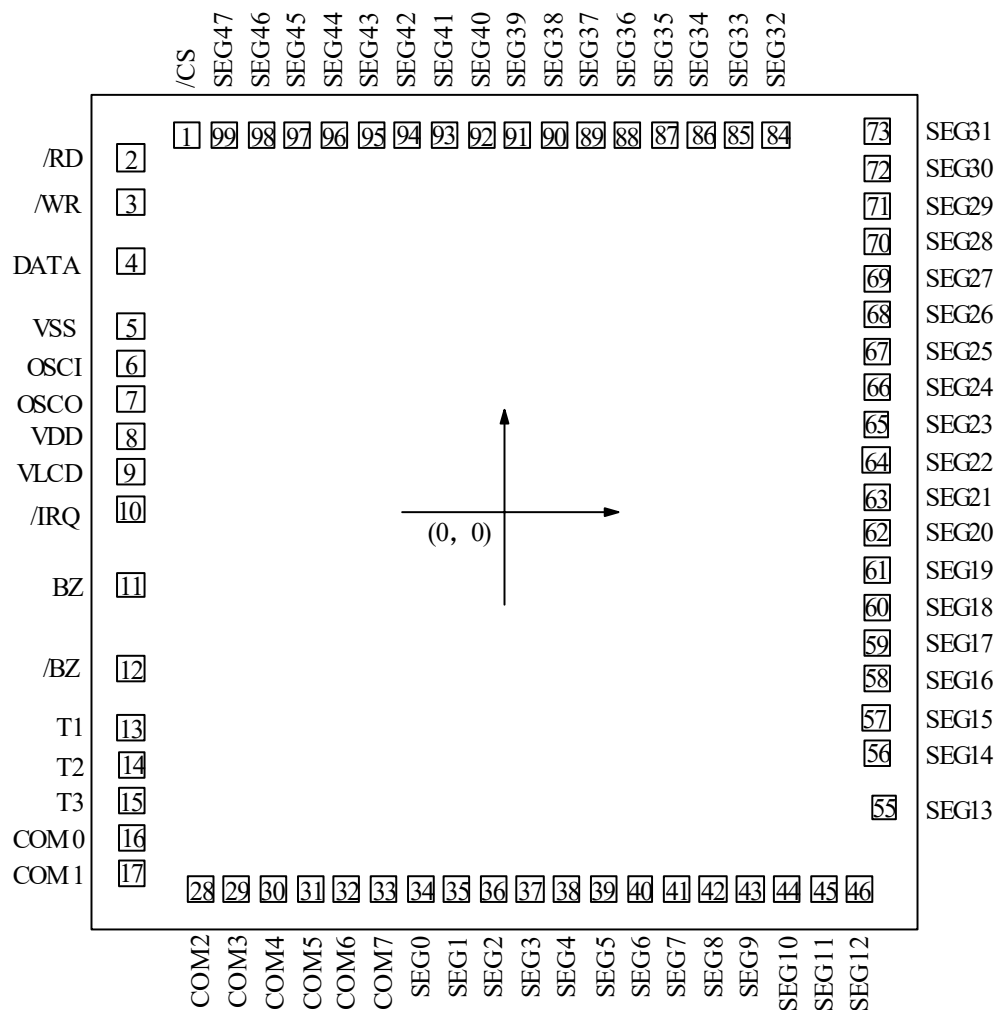
| Part No.           | VK1620 | VK1621S-1 | VK1622S | VK1623S | VK1625 | VK1626 |
|--------------------|--------|-----------|---------|---------|--------|--------|
| COM                | 4      | 4         | 8       | 8       | 8      | 16     |
| SEG                | 32     | 32        | 32      | 48      | 64     | 48     |
| On-chip Oscillator | -      | √         | √       | √       | √      | √      |
| Crystal Oscillator | √      | √         | -       | √       | √      | √      |
| External clock     | √      | √         | √       | √       | √      | √      |

### 4 Ordering Information

| Part No.  | Packaging | Tube Qty | Tray Qty | Box Qty  | Total Qty | Notes |
|-----------|-----------|----------|----------|----------|-----------|-------|
| VK1620    | LQFP64    |          | 250/tray | 2500/box | 15000 PCS |       |
|           | DICE      |          | 300/tray | 1500/box | 3000 PCS  | DICE  |
| VK1621S-1 | LQFP44    |          | 160/tray | 1600/box | 9600 PCS  |       |
|           | LQFP48    |          | 250/tray | 2500/box | 15000 PCS |       |
|           | SSPO48    | 30/tube  |          | 2400/box | 24000 PCS |       |
|           | DICE      |          | 300/tray | 1500/box | 3000 PCS  | DICE  |
| VK1622S   | LQFP44    |          | 160/tray | 1600/box | 5400 PCS  |       |
|           | LQFP52    |          | 90/tray  | 900/box  | 5400 PCS  |       |
|           | LQFP64    |          | 250/tray | 2500/box | 15000 PCS |       |
|           | QFP64     |          | 66/tray  | 660/box  | 3960 PCS  |       |
|           | DICE      |          | 250/tray | 1000/box | 2000 PCS  | DICE  |
| VK1623S   | LQFP100   |          | 90/tray  | 900/box  | 5400 PCS  |       |
|           | QFP100    |          | 66/tray  | 660/box  | 3960 PCS  |       |
|           | DICE      |          | 100/tray | 500/box  | 1000 PCS  | DICE  |
| VK1625    | LQFP100   |          | 90/tray  | 900/box  | 5400 PCS  |       |
|           | QFP100    |          | 66/tray  | 660/box  | 3960 PCS  |       |
|           | DICE      |          | 100/tray | 500/box  | 1000 PCS  | DICE  |
| VK1626    | LQFP100   |          | 90/tray  | 900/box  | 5400 PCS  |       |
|           | QFP100    |          | 66/tray  | 660/box  | 3960 PCS  |       |
|           | DICE      |          | 110/tray | 550/box  | 1500 PCS  | DICE  |

## 5 COB Pad Information

### 5.1 COB Pad Assignment



Chip Dimensions: 2730×2730  $\mu\text{m}^2$ , substrate potential: VDD

Pad size: 90×90  $\mu\text{m}$ , Pad spacing: 112  $\mu\text{m}$ ,

Al Pad size: 100×100 $\mu\text{m}$ , Al pad thickness: 1 $\mu\text{m}$ ,

## 5.2 COB PAD Coordinates

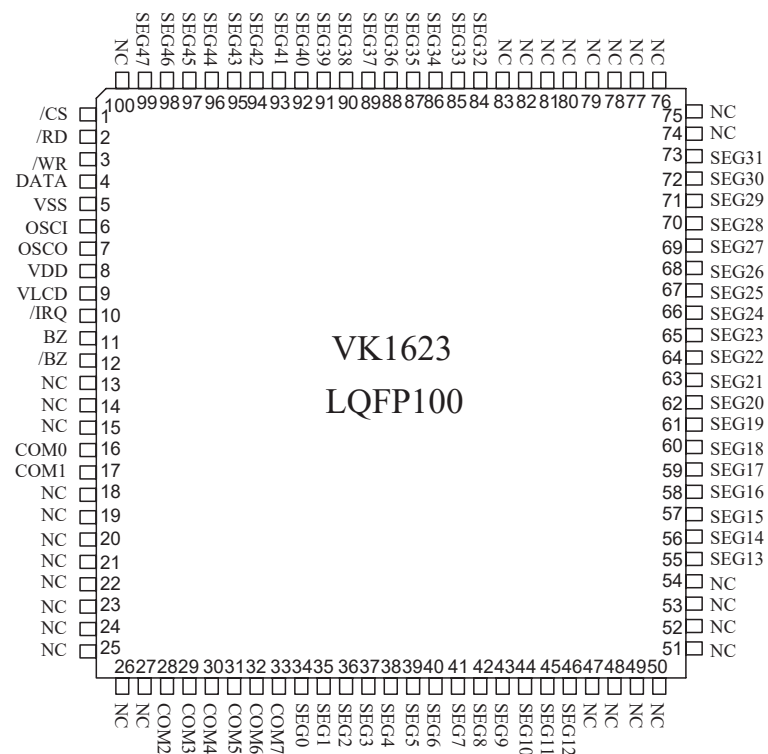
Unit: um

| Pad No | Name | X     | Y     | Pad No | Name  | X    | Y     |
|--------|------|-------|-------|--------|-------|------|-------|
| 1      | /CS  | -1076 | 1288  | 51     | NC    | —    | —     |
| 2      | /RD  | -1270 | 1212  | 52     | NC    | —    | —     |
| 3      | /WR  | -1270 | 1062  | 53     | NC    | —    | —     |
| 4      | DATA | -1270 | 860   | 54     | NC    | —    | —     |
| 5      | VSS  | -1270 | 638   | 55     | SEG13 | 1293 | -1008 |
| 6      | OSCI | -1270 | 513   | 56     | SEG14 | 1270 | -823  |
| 7      | OSCO | -1270 | 388   | 57     | SEG15 | 1270 | -698  |
| 8      | VDD  | -1270 | 263   | 58     | SEG16 | 1270 | -573  |
| 9      | VLCD | -1270 | 138   | 59     | SEG17 | 1270 | -448  |
| 10     | /IRQ | -1270 | 13    | 60     | SEG18 | 1270 | -323  |
| 11     | BZ   | -1270 | -249  | 61     | SEG19 | 1270 | -198  |
| 12     | /BZ  | -1270 | -534  | 62     | SEG20 | 1270 | -73   |
| 13     | T1   | -1270 | -738  | 63     | SEG21 | 1270 | 51    |
| 14     | T2   | -1270 | -863  | 64     | SEG22 | 1270 | 176   |
| 15     | T3   | -1270 | -988  | 65     | SEG23 | 1270 | 301   |
| 16     | COM0 | -1270 | -1113 | 66     | SEG24 | 1270 | 426   |
| 17     | COM1 | -1270 | -1238 | 67     | SEG25 | 1270 | 551   |
| 18     | NC   | —     | —     | 68     | SEG26 | 1270 | 676   |
| 19     | NC   | —     | —     | 69     | SEG27 | 1270 | 801   |
| 20     | NC   | —     | —     | 70     | SEG28 | 1270 | 926   |
| 21     | NC   | —     | —     | 71     | SEG29 | 1270 | 1051  |
| 22     | NC   | —     | —     | 72     | SEG30 | 1270 | 1176  |
| 23     | NC   | —     | —     | 73     | SEG31 | 1270 | 1301  |
| 24     | NC   | —     | —     | 74     | NC    | —    | —     |
| 25     | NC   | —     | —     | 75     | NC    | —    | —     |
| 26     | NC   | —     | —     | 76     | NC    | —    | —     |
| 27     | NC   | —     | —     | 77     | NC    | —    | —     |

Unit: um

| Pad No | Name  | X     | Y     | Pad No | Name  | X    | Y    |
|--------|-------|-------|-------|--------|-------|------|------|
| 28     | COM2  | -1035 | -1288 | 78     | NC    | —    | —    |
| 29     | COM3  | -910  | -1288 | 79     | NC    | —    | —    |
| 30     | COM4  | -785  | -1288 | 80     | NC    | —    | —    |
| 31     | COM5  | -660  | -1288 | 81     | NC    | —    | —    |
| 32     | COM6  | -535  | -1288 | 82     | NC    | —    | —    |
| 33     | COM7  | -410  | -1288 | 83     | NC    | —    | —    |
| 34     | SEG0  | -285  | -1288 | 84     | SEG32 | 923  | 1289 |
| 35     | SEG1  | -160  | -1288 | 85     | SEG33 | 798  | 1289 |
| 36     | SEG2  | -35   | -1288 | 86     | SEG34 | 673  | 1289 |
| 37     | SEG3  | 90    | -1288 | 87     | SEG35 | 548  | 1289 |
| 38     | SEG4  | 215   | -1288 | 88     | SEG36 | 423  | 1289 |
| 39     | SEG5  | 340   | -1288 | 89     | SEG37 | 298  | 1289 |
| 40     | SEG6  | 465   | -1288 | 90     | SEG38 | 173  | 1289 |
| 41     | SEG7  | 590   | -1288 | 91     | SEG39 | 48   | 1289 |
| 42     | SEG8  | 715   | -1288 | 92     | SEG40 | -76  | 1289 |
| 43     | SEG9  | 840   | -1288 | 93     | SEG41 | -201 | 1289 |
| 44     | SEG10 | 965   | -1288 | 94     | SEG42 | -326 | 1289 |
| 45     | SEG11 | 1090  | -1288 | 95     | SEG43 | -451 | 1289 |
| 46     | SEG12 | 1215  | -1288 | 96     | SEG44 | -576 | 1289 |
| 47     | NC    | —     | —     | 97     | SEG45 | -701 | 1289 |
| 48     | NC    | —     | —     | 93     | SEG46 | -826 | 1289 |
| 49     | NC    | —     | —     | 99     | SEG47 | -951 | 1289 |
| 50     | NC    | —     | —     | 100    | NC    | —    | —    |

## 6 Package Pinout Information (LQFP100)

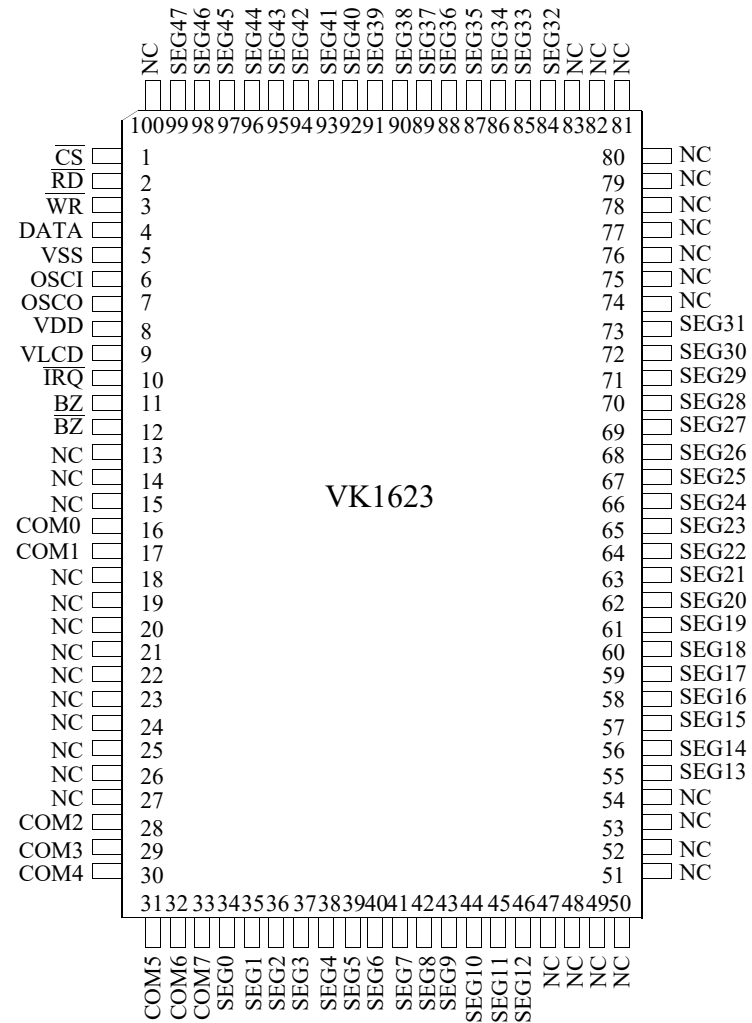


For more information: [Page 24](#)

## 6.1 VK1623/LQFP100 Pin Description

| No.                     | Name       | I/O | Function                                                                                                                                                                                                                   |
|-------------------------|------------|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1                       | /CS        | I   | Chip select signal with pull-up resistor ,active low.                                                                                                                                                                      |
| 2                       | /RD        | I   | Serial read signal with pull-up resistor, data out on the falling edge of the /RD signal.                                                                                                                                  |
| 3                       | /WR        | I   | Serial write signal with pull-up resistor, data latched on the rising edge of the /WR signal.                                                                                                                              |
| 4                       | DATA       | I/O | Serial data signal with pull-up resistor, input/output depending on access mode.                                                                                                                                           |
| 5                       | VSS        | VSS | Negative power supply                                                                                                                                                                                                      |
| 6                       | OSCI       | I   | Crystal oscillator: OSCI and OSCO pins are connected to a 32.768kHz crystal<br>External clock source: OSCI pin is connected to a, external clock source<br>On-chip RC oscillator: the OSCI and OSCO pins can be left open. |
| 7                       | OSCO       | I   |                                                                                                                                                                                                                            |
| 8                       | VDD        | VDD | Positive power supply                                                                                                                                                                                                      |
| 9                       | VLCD       | I   | LCD driving voltage input,must be $\leq VDD$                                                                                                                                                                               |
| 10                      | /IRQ       | O   | Time base or WDT overflow flag, NMOS open drain output.                                                                                                                                                                    |
| 11                      | BZ         | O   | 2kHz or 4kHz tone frequency output, when TONE OFF the /BZ pin output low level.                                                                                                                                            |
| 12                      | /BZ        | O   |                                                                                                                                                                                                                            |
| 13-15                   | NC         | —   | —                                                                                                                                                                                                                          |
| 16,17<br>28-33          | COM0-COM7  | O   | LCD COM drive outputs                                                                                                                                                                                                      |
| 34-46<br>55-73<br>84-99 | SEG0-SEG47 | O   | LCD SEG drive outputs                                                                                                                                                                                                      |

## 7 Package Pinout Information (QFP100)



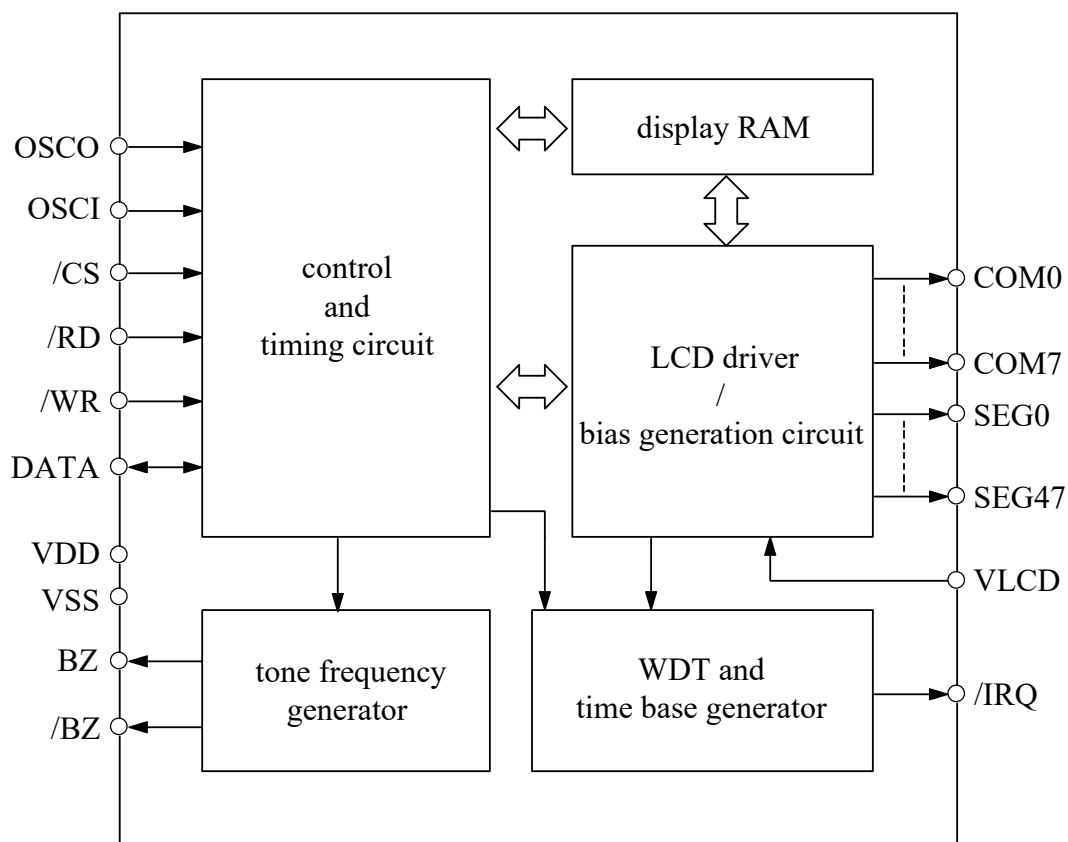
For more information: [Page 25](#)

## 7.1 VK1623/QFP100 Pin Description

| No.                     | Name       | I/O | Function                                                                                                                                                                                                                   |
|-------------------------|------------|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1                       | /CS        | I   | Chip select signal with pull-up resistor ,active low.                                                                                                                                                                      |
| 2                       | /RD        | I   | Serial read signal with pull-up resistor, data out on the falling edge of the /RD signal.                                                                                                                                  |
| 3                       | /WR        | I   | Serial write signal with pull-up resistor, data latched on the rising edge of the /WR signal.                                                                                                                              |
| 4                       | DATA       | I/O | Serial data signal with pull-up resistor, input/output depending on access mode.                                                                                                                                           |
| 5                       | VSS        | VSS | Negative power supply                                                                                                                                                                                                      |
| 6                       | OSCI       | I   | Crystal oscillator: OSCI and OSCO pins are connected to a 32.768kHz crystal<br>External clock source: OSCI pin is connected to a, external clock source<br>On-chip RC oscillator: the OSCI and OSCO pins can be left open. |
| 7                       | OSCO       | I   |                                                                                                                                                                                                                            |
| 8                       | VDD        | VDD | Positive power supply                                                                                                                                                                                                      |
| 9                       | VLCD       | I   | LCD driving voltage input,must be $\leq VDD$                                                                                                                                                                               |
| 10                      | /IRQ       | O   | Time base or WDT overflow flag, NMOS open drain output.                                                                                                                                                                    |
| 11                      | BZ         | O   | 2kHz or 4kHz tone frequency output ,<br>when TONE OFF the /BZ pin output low level.                                                                                                                                        |
| 12                      | /BZ        | O   |                                                                                                                                                                                                                            |
| 13-15                   | NC         | —   | —                                                                                                                                                                                                                          |
| 16,17<br>28-33          | COM0-COM7  | O   | LCD COM drive outputs                                                                                                                                                                                                      |
| 34-46<br>55-73<br>84-99 | SEG0-SEG47 | O   | LCD SEG drive outputs                                                                                                                                                                                                      |

## 8 Functional Description

### 8.1 Block Diagram



## 8.2 Display RAM

The VK1623S integrates  $48 \times 8$ -bit RAM for LCD display, directly mapped to SEGx/COMx segments. Data is latched and updated on the LCD according to scan timing set by the system configuration. The display RAM can be accessed using three commands: READ, WRITE, and READ-MODIFY-WRITE. Each RAM address corresponds to a specific combination of SEG and COM lines.

The following is a mapping from the RAM to the LCD pattern:

| COM7 COM6 COM5 COM4 |    |    |    |    | COM3 COM2 COM1 COM0 |    |    |    |    | address 7 bit<br>(A6---A0) |
|---------------------|----|----|----|----|---------------------|----|----|----|----|----------------------------|
| SEG0                |    |    |    |    | 1                   |    |    |    |    | 0                          |
| SEG1                |    |    |    |    | 3                   |    |    |    |    | 2                          |
| SEG2                |    |    |    |    | 5                   |    |    |    |    | 4                          |
| SEG3                |    |    |    |    | 7                   |    |    |    |    | 6                          |
| ⋮                   |    |    |    |    | ⋮                   |    |    |    |    | ⋮                          |
| SEG47               |    |    |    |    | 95                  |    |    |    |    | 94                         |
|                     | D3 | D2 | D1 | D0 | Data\Addr           | D3 | D2 | D1 | D0 | Data\Addr                  |

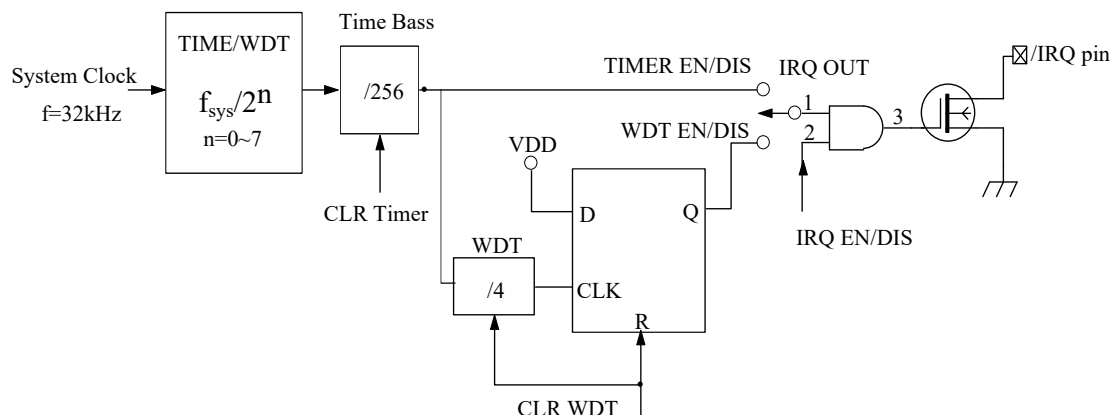
## 8.3 Time Base and WDT

The time base generator consists of an 8-stage ripple counter and provides accurate timing functionality. The Watchdog Timer (WDT) comprises the 8-stage time base plus an additional 2-stage counter. It helps reset or interrupt the host system in case of abnormal operation, such as unexpected jumps or execution errors. A WDT timeout sets an internal status flag. Both the time base overflow and WDT timeout flags can be routed to the /IRQ pin through software configuration. Eight frequency division options are available for the time base and WDT clock, derived using the formula:

$$f_{WDT} = f_{sys} / 2^n \quad (n=0 \sim 7) \quad f_{sys} = 32\text{kHz}$$

The time base generator and the Watchdog Timer (WDT) share the same 8-stage counter. The WDT is cleared by executing the CLR WDT command, while the time base generator can be cleared using either the CLR WDT or the CLR TIMER command. Executing the WDT EN command enables both the time base generator and the WDT timeout flag output, which can be routed to the /IRQ pin. Conversely, executing the WDT DIS command disables the time base generator. After the TIMER EN command is issued, the WDT is disconnected from the /IRQ pin, and the time base overflow signal is instead connected to it. The /IRQ output can be globally enabled or disabled using the IRQ EN and IRQ DIS commands, respectively. By default, the /IRQ output is disabled upon system power-up.

#### Timer and WDT Configurations:



## 8.4 Tone Output

The VK1623S integrates a basic tone generator capable of producing 2 kHz or 4 kHz output signals. The output consists of a differential pair: BZ and /BZ, designed to drive a passive piezoelectric buzzer. Use the TONE 2K or TONE 4K commands to select the desired tone frequency. Tone output can be enabled or disabled via the TONE ON or TONE OFF commands. When the tone function is disabled or the system is powered down, both BZ and /BZ will remain at low level.

## 8.5 LCD Driver

The VK1622S is a 384-segment LCD driver (48 SEG × 8 COM). It supports software configurable bias settings of 1/4, and COM configurations of 8.

## 8.6 Communication Interfacing

The VK1623S communicates with the host via a 3-wire or 4-wire serial interface.

When used solely for display output, only 3 lines are required (/CS, /WR, and DATA); /RD is optional for reading.

- /CS: Chip select input. It enables the serial interface when low and terminates communication when high.
- /RD: Read clock input. On the falling edge, data is output from the device onto the DATA line.
- /WR: Write clock input. On the rising edge, data and commands from DATA are latched into the device.
- DATA: Bidirectional serial data line used to transfer both command and display data.
- /IRQ: Open-drain output pin for either WDT timeout or time base overflow flag, selectable via software.

## 8.7 Command Format

The VK1623S is configured via software commands that support two primary modes: command mode and data mode.

- Command mode is used to configure system-level parameters. It is identified by a command mode ID of 100.
- Data mode supports three types of memory operations: READ, WRITE, and READ-MODIFY-WRITE.

These commands allow the host controller to configure LCD behavior and access display RAM contents.

The following are the data mode IDs and the command mode ID:

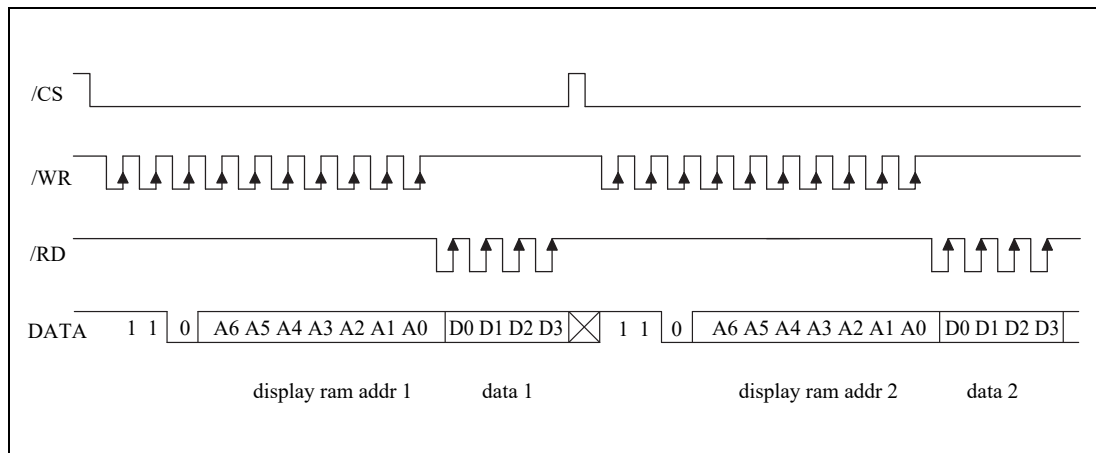
| Command           | MODE    | ID  |
|-------------------|---------|-----|
| READ              | DATA    | 110 |
| WRITE             | DATA    | 101 |
| Read-Modify-Write | DATA    | 101 |
| COMMAND           | COMMAND | 100 |

## 9 Cmd/Data Timing Diagram

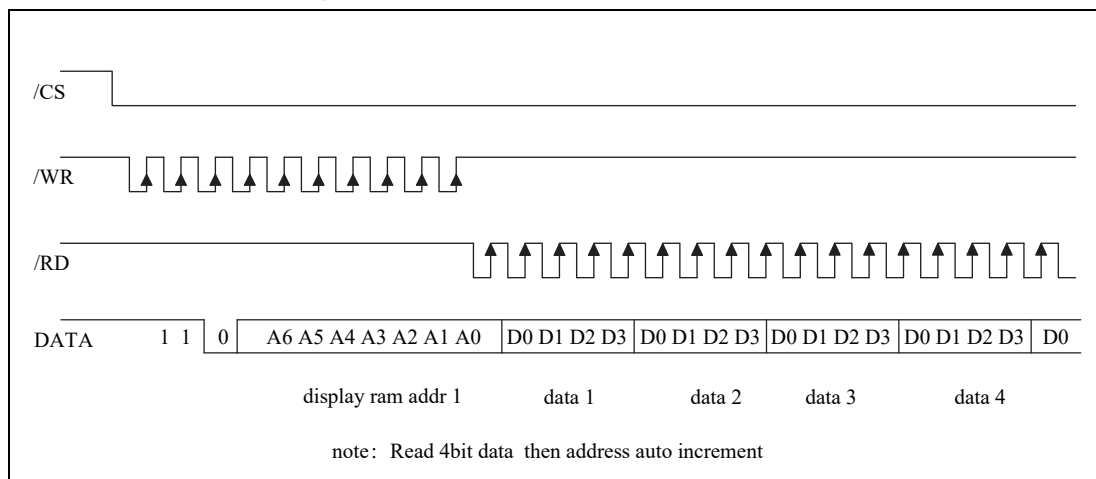
The following are the data mode IDs and the command mode ID Timing Diagrams.

### 9.1 READ Mode

Command Code : 110

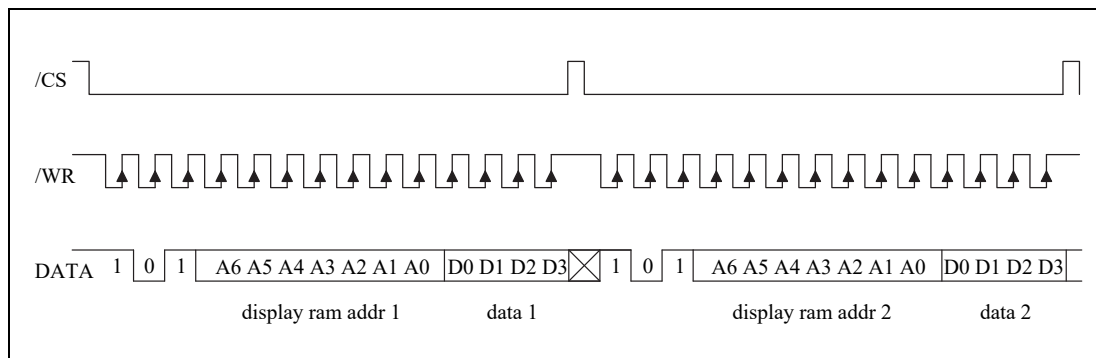


### Successive Address Reading

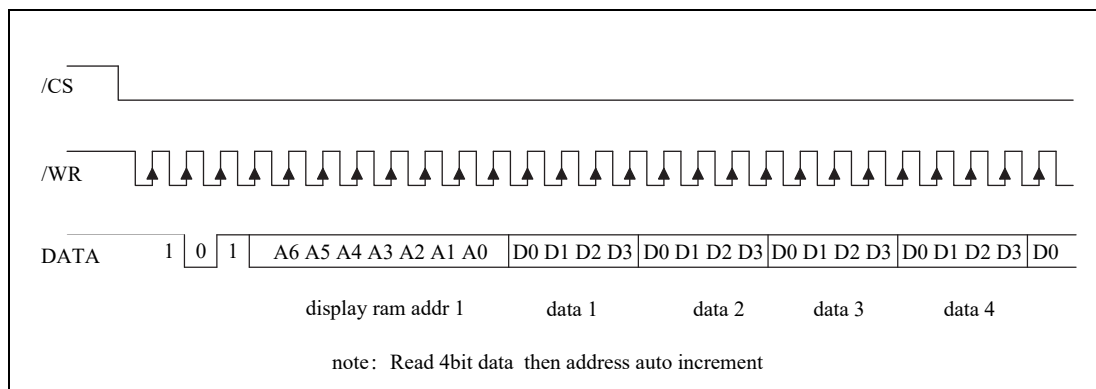


## 9.2 WRITE Mode

Command Code : 101

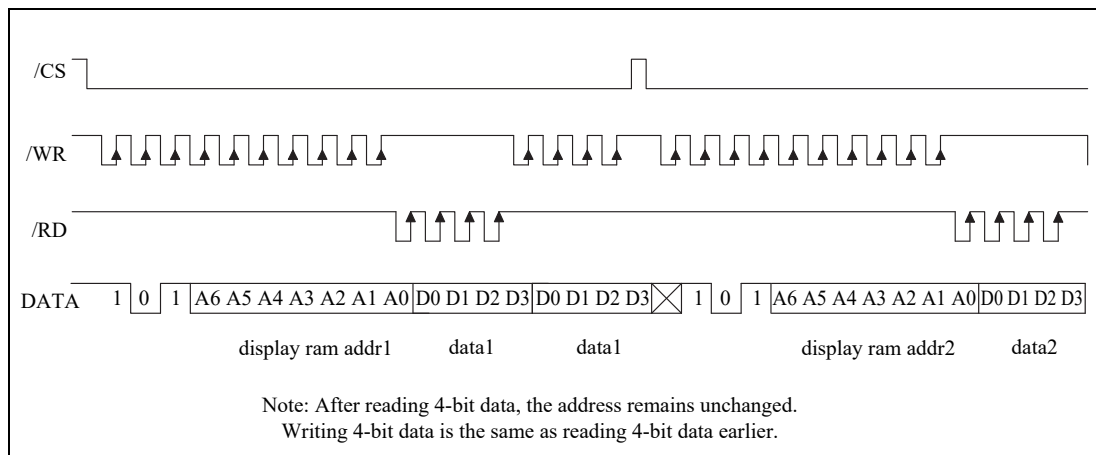


Successive Address Writing

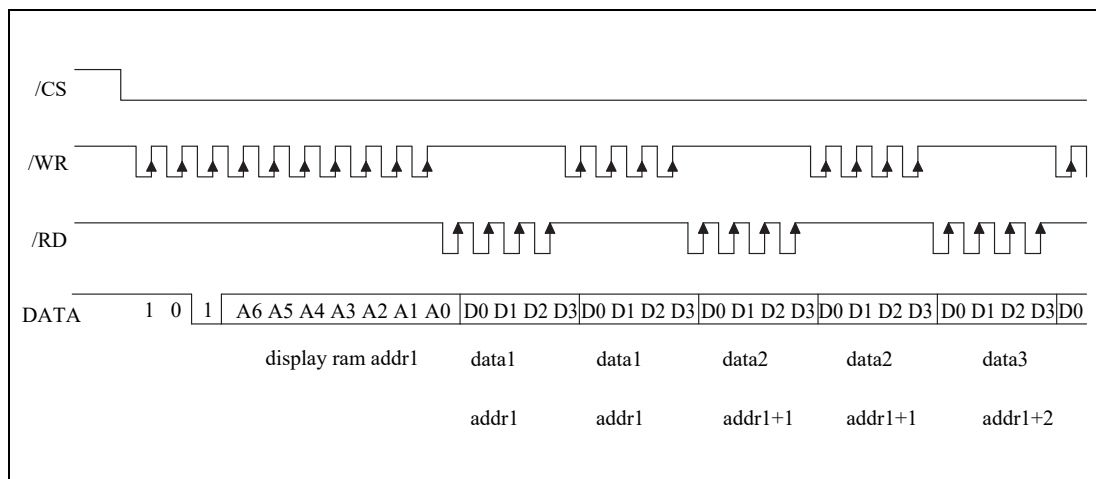


## 9.3 Read-Modify-Write Mode

Command Code : 101

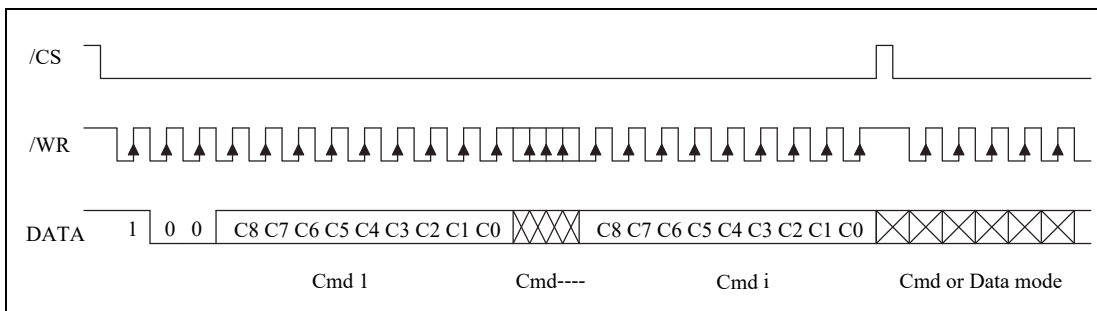


Successive Address Accessing



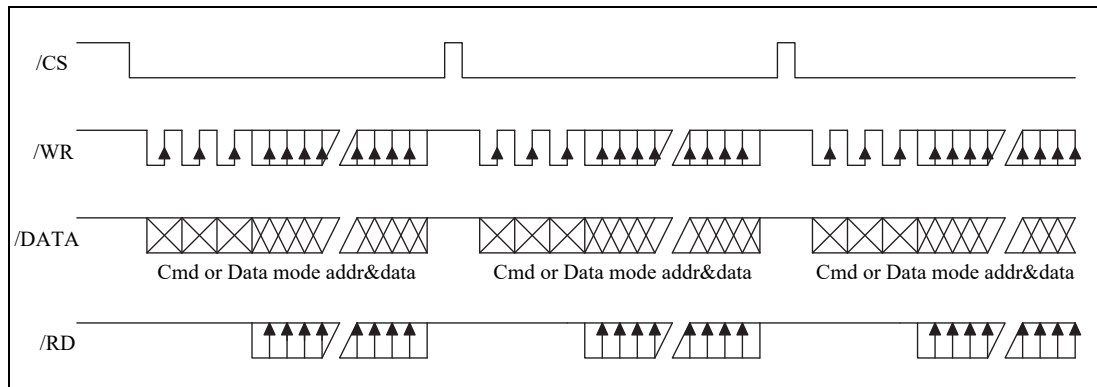
## 9.4 Command Mode

Command Code : 100



## 9.5 Data and Command Mode

Data and Command Mode



## 10 Command Summary

| Name              | ID  | Command Code           | D/C | Function                                                               | Def. |
|-------------------|-----|------------------------|-----|------------------------------------------------------------------------|------|
| READ              | 110 | A6A5A4A3A2A1A0D0D1D2D3 | D   | Read data from the RAM                                                 |      |
| WRITE             | 101 | A6A5A4A3A2A1A0D0D1D2D3 | D   | Write data to the RAM                                                  |      |
| READ-MODIFY-WRITE | 101 | A6A5A4A3A2A1A0D0D1D2D3 | D   | READ and WRITE to the RAM                                              |      |
| SYS DIS           | 100 | 0000-0000-X            | C   | Turn off both system oscillator                                        | YES  |
| SYS EN            | 100 | 0000-0001-X            | C   | Turn on system oscillator                                              |      |
| LCD OFF           | 100 | 0000-0010-X            | C   | Turn off LCD bias generator                                            | YES  |
| LCD ON            | 100 | 0000-0011-X            | C   | Turn on LCD bias generator                                             |      |
| TIMERS DIS        | 100 | 0000-0100-X            | C   | Disable time base output                                               |      |
| WDT DIS           | 100 | 0000-0101-X            | C   | Disable WDT time-out flag output                                       |      |
| TIMER EN          | 100 | 0000-0110-X            | C   | Enable time base output                                                |      |
| WDT EN            | 100 | 0000-0111-X            | C   | Enable WDT time-out flag output                                        |      |
| TONE OFF          | 100 | 0000-1000-X            | C   | Turn off tone outputs                                                  | YES  |
| CLR TIMER         | 100 | 0000-11XX-X            | C   | Clear the contents of time base generator                              |      |
| CLR WDT           | 100 | 0000-111X-X            | C   | Clear the contents of WDT stage                                        |      |
| RC32K             | 100 | 0001-10XX-X            | C   | on-chip RC oscillator                                                  | YES  |
| EXT_XTAL 32k      | 100 | 0001-11XX-X            | C   | external clock source                                                  |      |
| TONE 4k           | 100 | 010X-XXXX-X            | C   | Tone frequency, 4kHz                                                   |      |
| TONE 2k           | 100 | 011X-XXXX-X            | C   | Tone frequency, 2kHz                                                   |      |
| IRQ DIS           | 100 | 100X-0XXX-X            | C   | Disable IRQ output                                                     | YES  |
| IRQ EN            | 100 | 100X-1XXX-X            | C   | Enable IRQ output                                                      |      |
| F1                | 100 | 101X-X000-X            | C   | Time base/WDT clock output:1Hz<br>The WDT time-out flag after: 4s      |      |
| F2                | 100 | 101X-X001-X            | C   | Time base/WDT clock output:2Hz<br>The WDT time-out flag after: 2s      |      |
| F4                | 100 | 101X-X010-X            | C   | Time base/WDT clock output:4Hz<br>The WDT time-out flag after: 1s      |      |
| F8                | 100 | 101X-X011-X            | C   | Time base/WDT clock output:8Hz<br>The WDT time-out flag after: 1/2s    |      |
| F16               | 100 | 101X-X100-X            | C   | Time base/WDT clock output:16Hz<br>The WDT time-out flag after: 1/4s   |      |
| F32               | 100 | 101X-X101-X            | C   | Time base/WDT clock output:32Hz<br>The WDT time-out flag after: 1/8s   |      |
| F64               | 100 | 101X-X110-X            | C   | Time base/WDT clock output:64Hz<br>The WDT time-out flag after: 1/16s  |      |
| F128              | 100 | 101X-X111-X            | C   | Time base/WDT clock output:128Hz<br>The WDT time-out flag after: 1/32s | YES  |
| TEST              | 100 | 1110-0000- X           | C   | Test mode                                                              |      |
| NORMAL            | 100 | 1110-0011- X           | C   | Normal mode                                                            | YES  |

note: X: 0 or 1

D/C:Data/Command mode

A6-A0: Display RAM addresses

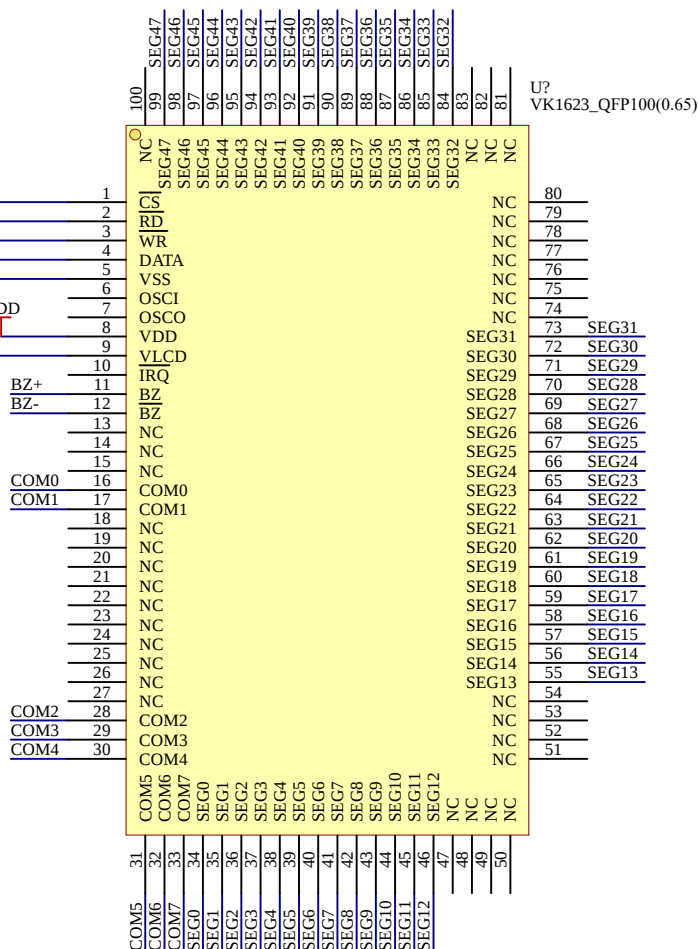
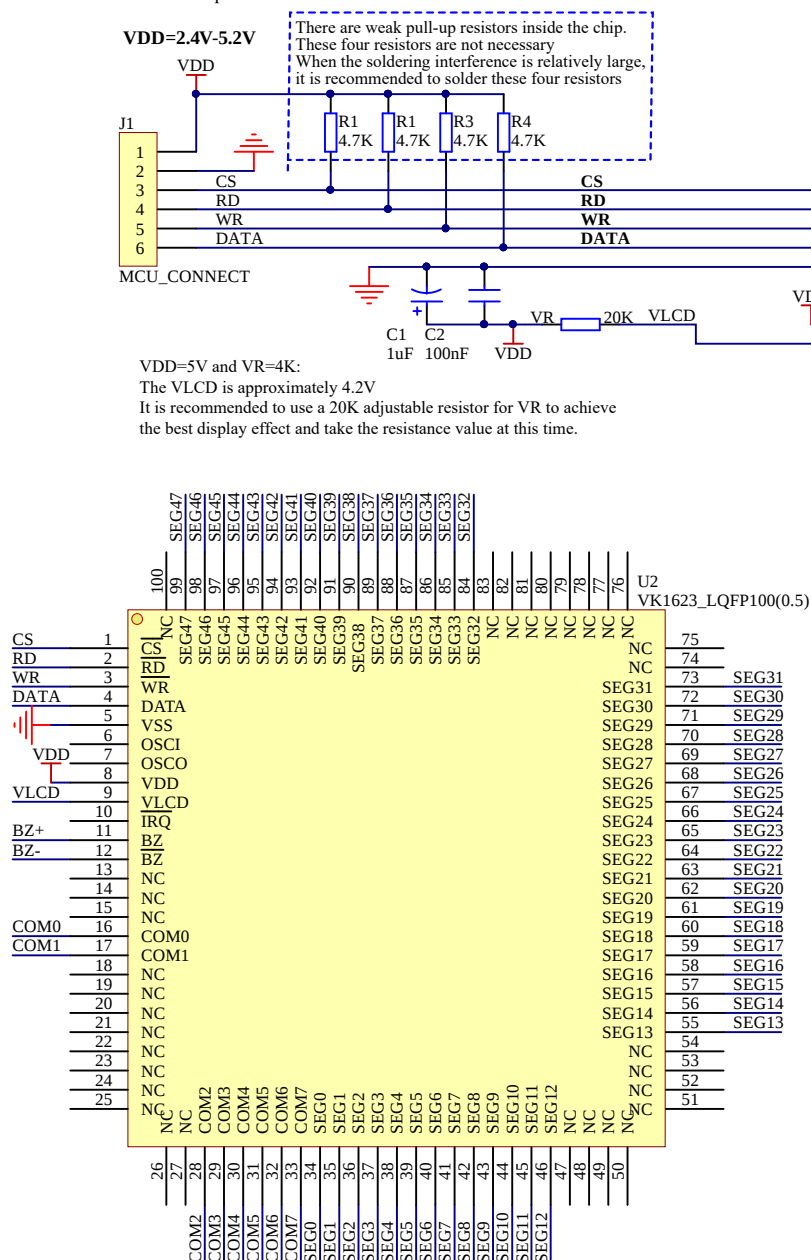
Def.:Power on reset default

D3-D0:4bit Display RAM data

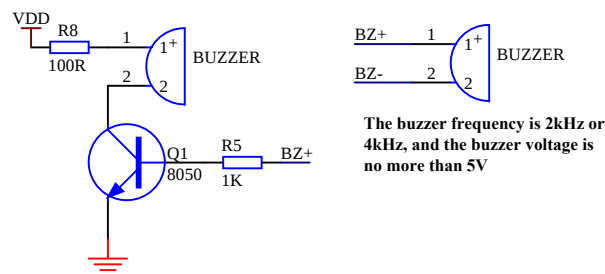
110,101and 100 is Command ID

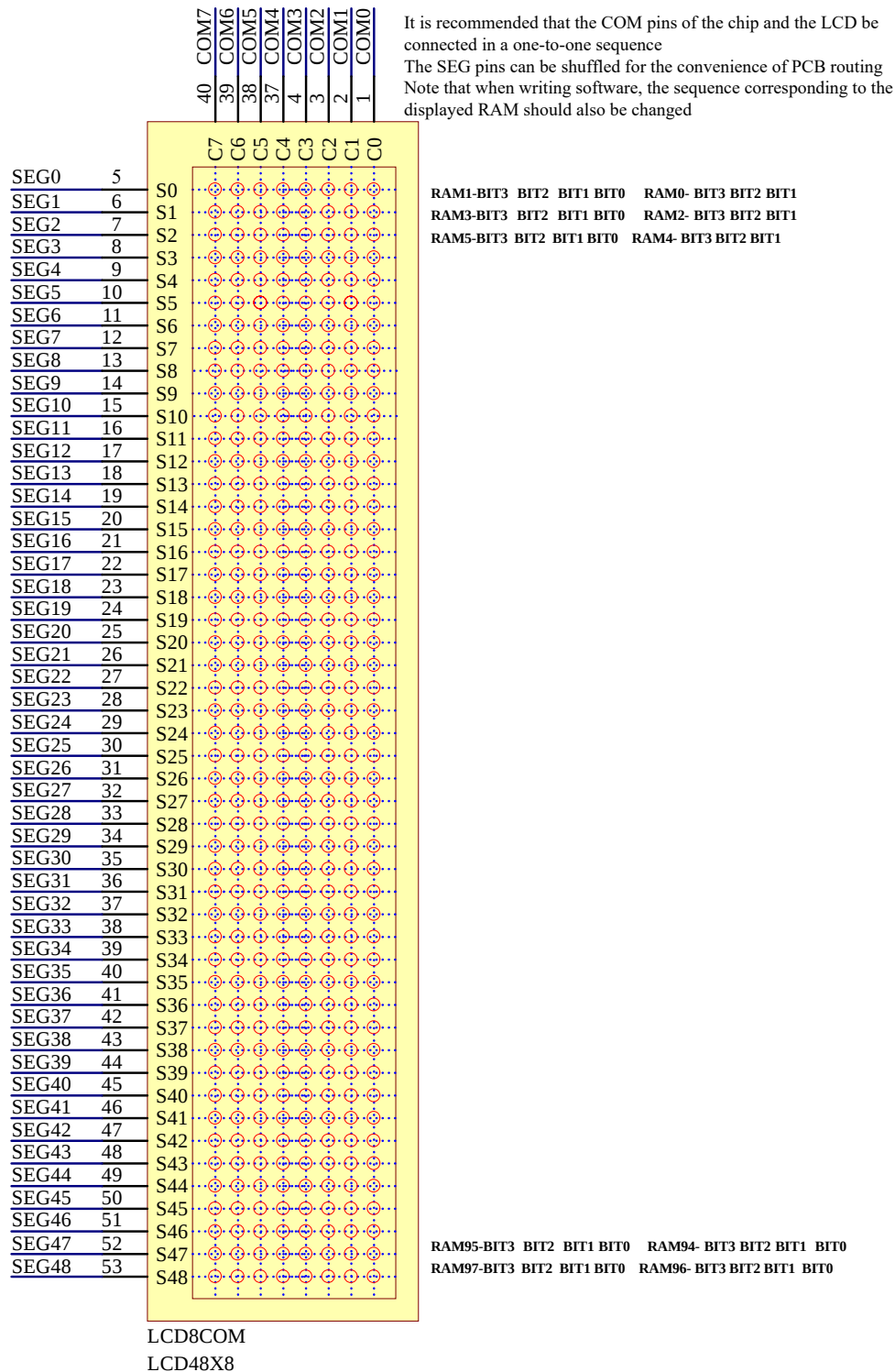
## 11 Application Circuits

When the LCD only displays, the RD pin can be left floating and not connected  
When the surrounding interference is relatively large, a 10R to 1k resistor and a small PF-level capacitor to ground can be connected in series on the communication pin  
When the power supply of the chip machine (3.3V) and the driver chip (5V) is inconsistent, it is recommended to add a level conversion circuit to the communication pin



Passive buzzer driving current >1mA circuit    Passive buzzer driving current <1mA circuit





## 12 Electrical Characteristics

### 12.1 Absolute Maximum Ratings

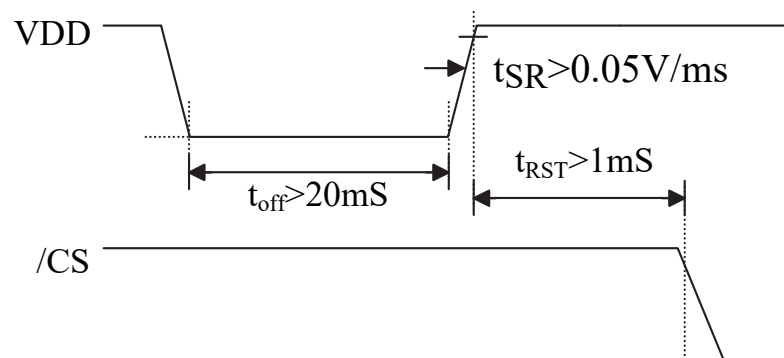
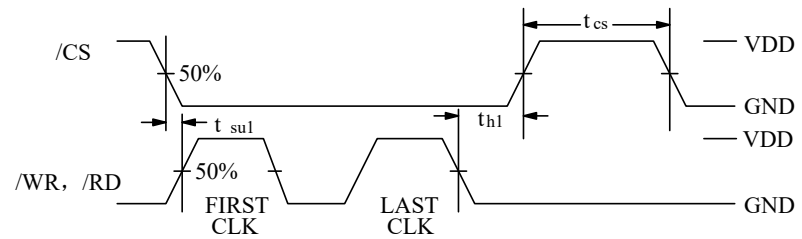
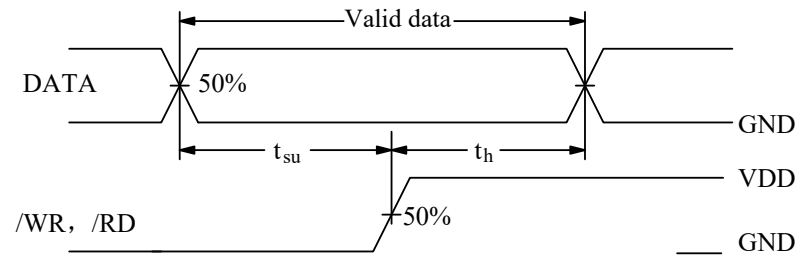
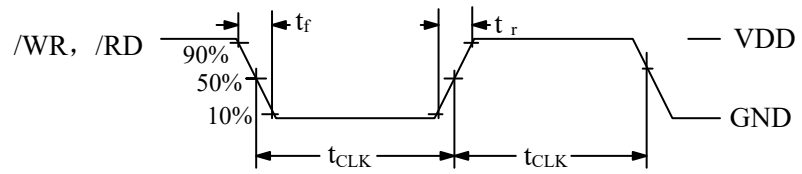
| Parameter             | Symbol           | Ratings                      | Unit |
|-----------------------|------------------|------------------------------|------|
| Supply voltage        | VDD              | -0.3~5.5                     | V    |
| Input Voltage         | VIN              | $V_{SS}-0.3 \sim V_{DD}+0.3$ | V    |
| Storage Temperature   | T <sub>STG</sub> | -50~+125                     | °C   |
| Operating Temperature | T <sub>OTG</sub> | -40~+85                      | °C   |

### 12.2 DC Electrical Characteristics

| Parameter              | Symbol | Min. | Typ. | Max. | Unit | Test Conditions |                                          |
|------------------------|--------|------|------|------|------|-----------------|------------------------------------------|
|                        |        |      |      |      |      | VDD             | Conditions                               |
| Operating voltage      | VDD    | 2.4  | —    | 5.2  | V    | —               | —                                        |
| Operating current      | IDD1   | —    | 155  | 310  | μA   | 3V              | No load/LCD ON<br>On-chip RC oscillator  |
|                        |        | —    | 260  | 420  |      | 5V              |                                          |
| Operating current      | IDD2   | —    | 150  | 310  | μA   | 3V              | No load/LCD ON<br>External crystal       |
|                        |        | —    | 250  | 420  |      | 5V              |                                          |
| Operating current      | IDD11  | —    | 8    | 30   | μA   | 3V              | No load/LCD OFF<br>On-chip RC oscillator |
|                        |        | —    | 20   | 60   |      | 5V              |                                          |
| Operating current      | IDD22  | —    | —    | 20   | μA   | 3V              | No load/LCD OFF<br>External crystal      |
|                        |        | —    | —    | 35   |      | 5V              |                                          |
| Standby Current        | ISTB   | —    | 1    | 10   | μA   | 3V              | No load,<br>Power down mode              |
|                        |        | —    | 2    | 20   |      | 5V              |                                          |
| Low-level Input        | VIL    | 0    | —    | 0.6  | V    | 3V              | DATA, /WR, /CS,/RD                       |
|                        |        | 0    | —    | 1.0  |      | 5V              |                                          |
| High-level Input       | VIH    | 2.4  | —    | 3.0  | V    | 3V              | DATA, /WR, /CS,/RD                       |
|                        |        | 4.0  | —    | 5.0  |      | 5V              |                                          |
| BZ, /BZ, /IRQ          | IOL1   | 0.9  | 1.8  | —    | mA   | 3V              | VOL=0.3V                                 |
|                        |        | 1.7  | 3.0  | —    |      | 5V              | VOL=0.5V                                 |
| BZ, /BZ                | IOH1   | -0.9 | -1.8 | —    | mA   | 3V              | VOH=2.7V                                 |
|                        |        | -1.7 | -3.0 | —    |      | 5V              | VOH=4.5V                                 |
| DATA                   | IOH1   | 0.9  | 1.8  | —    | mA   | 3V              | VOL=0.3V                                 |
|                        |        | 1.7  | 3.0  | —    |      | 5V              | VOL=0.5V                                 |
| DATA                   | IOH1   | -0.9 | -1.8 | —    | mA   | 3V              | VOH=2.7V                                 |
|                        |        | -1.7 | -3.0 | —    |      | 5V              | VOH=4.5V                                 |
| LCD COM Sink Current   | IOL2   | 80   | 160  | —    | μA   | 3V              | VOL=0.3V                                 |
|                        |        | 180  | 360  | —    |      | 5V              | VOL=0.5V                                 |
| LCD COM Source Current | IOH2   | -40  | -80  | —    | μA   | 3V              | VOH=2.7V                                 |
|                        |        | -90  | -180 | —    |      | 5V              | VOH=4.5V                                 |
| LCD SEG Sink Current   | IOL3   | 50   | 100  | —    | μA   | 3V              | VOL=0.3V                                 |
|                        |        | 120  | 240  | —    |      | 5V              | VOL=0.5V                                 |
| LCD SEG Source Current | IOH3   | -30  | -60  | —    | μA   | 3V              | VOH=2.7V                                 |
|                        |        | -70  | -140 | —    |      | 5V              | VOH=4.5V                                 |
| Pull-UP Resistor       | RUP    | 100  | 200  | 300  | kΩ   | 3V              | DATA, /WR, /CS,/RD                       |
|                        |        | 50   | 100  | 150  |      | 5V              |                                          |

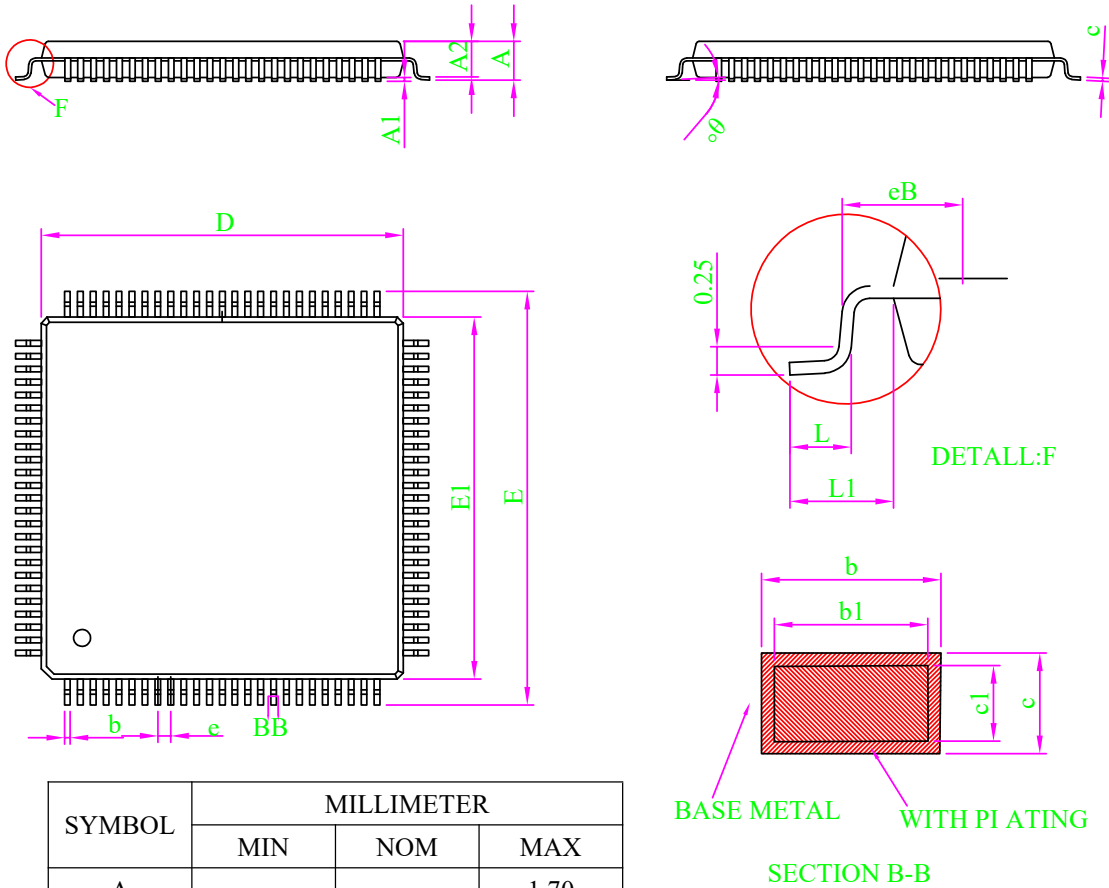
## 12.3 AC Electrical Characteristics

| Parameter                                   | Symbol                          | Min. | Typ.                | Max. | Unit | Test Conditions |                        |
|---------------------------------------------|---------------------------------|------|---------------------|------|------|-----------------|------------------------|
|                                             |                                 |      |                     |      |      | VDD             | Conditions             |
| System Clock                                | f <sub>SYS1</sub>               | 22   | 32                  | 40   | kHz  | 3V              | On-chip RC oscillator  |
|                                             |                                 | 24   | 32                  | 40   |      | 5V              |                        |
| System Clock                                | f <sub>SYS2</sub>               | —    | 32                  | —    | kHz  | 3V              | External clock source  |
|                                             |                                 | —    | 32                  | —    |      | 5V              |                        |
| LCD Clock                                   | f <sub>LCD1</sub>               | 44   | 64                  | 80   | Hz   | 3V              | On-chip RC oscillator  |
|                                             |                                 | 48   | 64                  | 80   | Hz   | 5V              |                        |
|                                             | f <sub>LCD2</sub>               | —    | 64                  | —    | Hz   | 3V              | External clock (32kHz) |
|                                             |                                 | —    | 64                  | —    | Hz   | 5V              |                        |
| LCD Common Period                           | t <sub>COM</sub>                | —    | n/ f <sub>LCD</sub> | —    | sec  | —               | N: Number of COM       |
| Serial Data Clock(/WR)                      | FCLK1                           | —    | —                   | 150  | kHz  | 3V              | Duty cycle 50%         |
|                                             |                                 | —    | —                   | 300  |      | 5V              |                        |
| Serial Data Clock(/RD)                      | FCLK2                           | —    | —                   | 75   | kHz  | 3V              | Duty cycle 50%         |
|                                             |                                 | —    | —                   | 150  |      | 5V              |                        |
| Serial Interface Reset PW                   | t <sub>CS</sub>                 | —    | 250                 | —    | ns   | —               | /CS                    |
| /WR, /RD Input Pulse Width                  | t <sub>CLK</sub>                | 3.34 | —                   | —    | μS   | 3V              | Write mode             |
|                                             |                                 | 6.67 | —                   | —    |      |                 | Read mode              |
|                                             |                                 | 1.67 | —                   | —    | μS   | 5V              | Write mode             |
|                                             |                                 | 3.34 | —                   | —    |      |                 | Read mode              |
| Rise/Fall Time Serial Data Clock Width      | t <sub>r</sub> , t <sub>f</sub> | —    | 120                 | —    | ns   | 3V              | —                      |
|                                             |                                 |      |                     |      |      | 5V              |                        |
| Setup Time for DATA to /WR, /RD Clock Width | t <sub>su</sub>                 | —    | 120                 | —    | ns   | 3V              | —                      |
|                                             |                                 |      |                     |      |      | 5V              |                        |
| Hold Time for DATA to /WR, /RD Clock Width  | t <sub>h</sub>                  | —    | 120                 | —    | ns   | 3V              | —                      |
|                                             |                                 |      |                     |      |      | 5V              |                        |
| Setup Time for /CS to /WR, /RD Clock Width  | t <sub>su1</sub>                | —    | 100                 | —    | ns   | 3V              | —                      |
|                                             |                                 |      |                     |      |      | 5V              |                        |
| Hold Time for /CS to /WR, /RD Clock Width   | t <sub>h1</sub>                 | —    | 100                 | —    | ns   | 3V              | —                      |
|                                             |                                 |      |                     |      |      | 5V              |                        |



## 13 Package Information

### 13.1 LQFP100(14.0mm × 14.0mm PP=0.5mm)

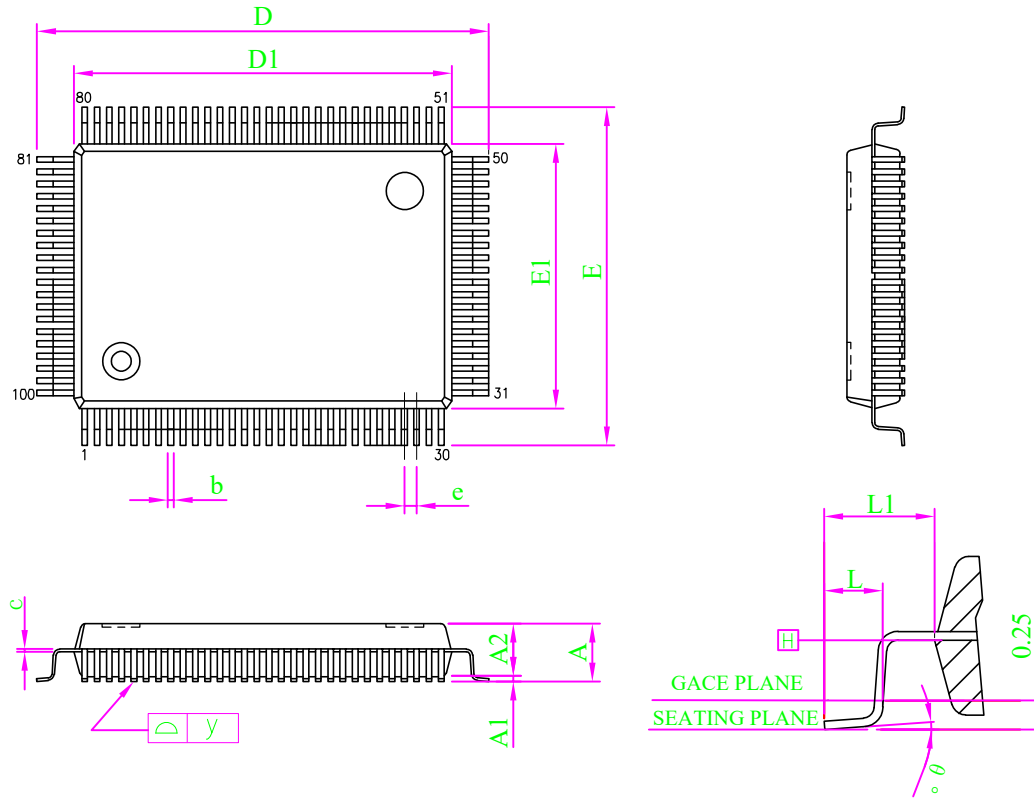


| SYMBOL | MILLIMETER |       |       |
|--------|------------|-------|-------|
|        | MIN        | NOM   | MAX   |
| A      | -          | -     | 1.70  |
| A1     | 0.10       | 0.15  | 0.20  |
| A2     | 1.30       | 1.40  | 1.50  |
| b      | 0.17       | -     | 0.27  |
| b1     | 0.16       | 0.20  | 0.24  |
| c      | 0.13       | -     | 0.17  |
| c1     | 0.12       | 0.13  | 0.14  |
| D      | 13.90      | 14.00 | 14.10 |
| E      | 15.80      | 16.00 | 16.20 |
| E1     | 13.90      | 14.00 | 14.10 |
| eB     | 15.05      | -     | 15.40 |
| e      | 0.50BSC    |       |       |
| L      | 0.42       | 0.57  | 0.72  |
| L1     | 0.95       | 1.00  | 1.15  |
| θ      | 0          | -     | 10°   |

Note:

1. All dimension are in mm.
2. Dim D&E1 does not include plastic flash; Flash: Plastic residual around body edge after de junk/singulation.
3. Dim b does not include dambar protrusion/intrusion.
4. Plating thickness 0.007mm-0.015mm

### 13.2 QFP100(20.0mm × 14.0mm PP=0.65mm)



| SYMBOL         | MIN   | NOMINAL | MAX   |
|----------------|-------|---------|-------|
| A              | —     | —       | 3.40  |
| A1             | 0.25  | —       | 0.50  |
| A2             | 2.57  | 2.72    | 2.87  |
| b              | —     | 0.30    | —     |
| c              | 0.10  | 0.15    | 0.20  |
| D              | 23.65 | 23.90   | 24.15 |
| D1             | 19.90 | 20.00   | 20.10 |
| e              | —     | 0.65    | —     |
| E              | 17.65 | 17.90   | 18.15 |
| E1             | 13.90 | 14.00   | 14.10 |
| L              | 0.65  | 0.80    | 0.95  |
| L1             | —     | 1.95    | —     |
| y              | —     | —       | 0.10  |
| $\theta^\circ$ | 0     | —       | 7     |

UNIT:mm

#### NOTES:

- 1.JEDEC OUTLINE:MO-112 CC-1
- 2.DATUM PLANE  $\square H$  IS LOCATED AT THE BOTTOM OF THE MOLD PARTING LINE COINCIDENT WITH WHERE THE LEAD EXITS THW BODY.
- 3.DIMENSIONS D1 AND E1 DO NOT INCLUDE MOLD PROTRUSION, ALLOWABLE PROTRUSION IS 0.25mm PER SIDE. DIMENSIONS D1 AND E1 DO NOT INCLUDE MOLD MISMATCH AND ARE DETERMINED AT DATUM PLANE  $\square H$ .
- 4.DIMENSION b DOES NOT INCLUDE DAMBAR PROTRUSION.

## 14 Disclaimer

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## 15 Revision History

| No. | Version | Date       | Modify the content    | Check |
|-----|---------|------------|-----------------------|-------|
| 1   | 1.0     | 2018-08-10 | initial release       | YES   |
| 2   | 1.1     | 2018-10-11 | Add reference circuit | YES   |
| 3   | 1.2     | 2019-03-21 | Alignment correction  | YES   |
| 4   | 1.3     | 2025-06-11 | Change Description    | YES   |

[1] Please refer to the latest version of this document before starting or finalizing any design.

[2] Since the release of this document, the status or availability of this product may have changed. For the most up-to-date information, please visit:

<https://www.szvinka.com/>