

|               |            |                  |            |
|---------------|------------|------------------|------------|
| MDT020000     | 240x320    | SPI Interface    | TFT Module |
| Specification |            |                  |            |
| Version: 1    |            | Date: 29/07/2023 |            |
| Revision      |            |                  |            |
| 1             | 27/07/2023 | First issue      |            |

| Display Features      |                         |  |                  |
|-----------------------|-------------------------|-------------------------------------------------------------------------------------|------------------|
| Display Size          | 2.00"                   |                                                                                     |                  |
| Resolution            | 240x320                 |                                                                                     |                  |
| Orientation           | Portrait                |                                                                                     |                  |
| Appearance            | RGB                     |                                                                                     |                  |
| Logic Voltage         | 1.8V                    |                                                                                     |                  |
| Interface             | SPI                     |                                                                                     |                  |
| Brightness            | 450 cd/m <sup>2</sup>   |                                                                                     |                  |
| Touchscreen           | ---                     |                                                                                     |                  |
| Module Size           | 35.40 x 48.40 x 2.20 mm |                                                                                     |                  |
| Operating Temperature | -20°C ~ +70°C           | Created By                                                                          | Checked By       |
| Pinout                | 15 way FFC              | CL                                                                                  | TSB              |
| Pitch                 | 0.50 mm                 | Box Quantity                                                                        | Weight / Display |
|                       |                         | ---                                                                                 | ---              |

\* - For full design functionality, please use this specification in conjunction with the ST7789V2 display driver specification.(Provided Separately)

| Display Accessories |                                                                                                                                                                  |
|---------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Part Number         | Description                                                                                                                                                      |
| MDIB-CC1            | Interconnect board for standard pitch pinouts to fine pitch wires. Providing pinouts for 2.54 pinout. 1.27, 1, 0.845, 0.8, 0.7, 0.65, 0.62, 0.6, 0.5 & 0.3 pads. |
|                     |                                                                                                                                                                  |
|                     |                                                                                                                                                                  |

| Optional Variants |         |
|-------------------|---------|
| Appearances       | Voltage |
|                   |         |
|                   |         |



## 1. GENERAL SPECIFICATIONS

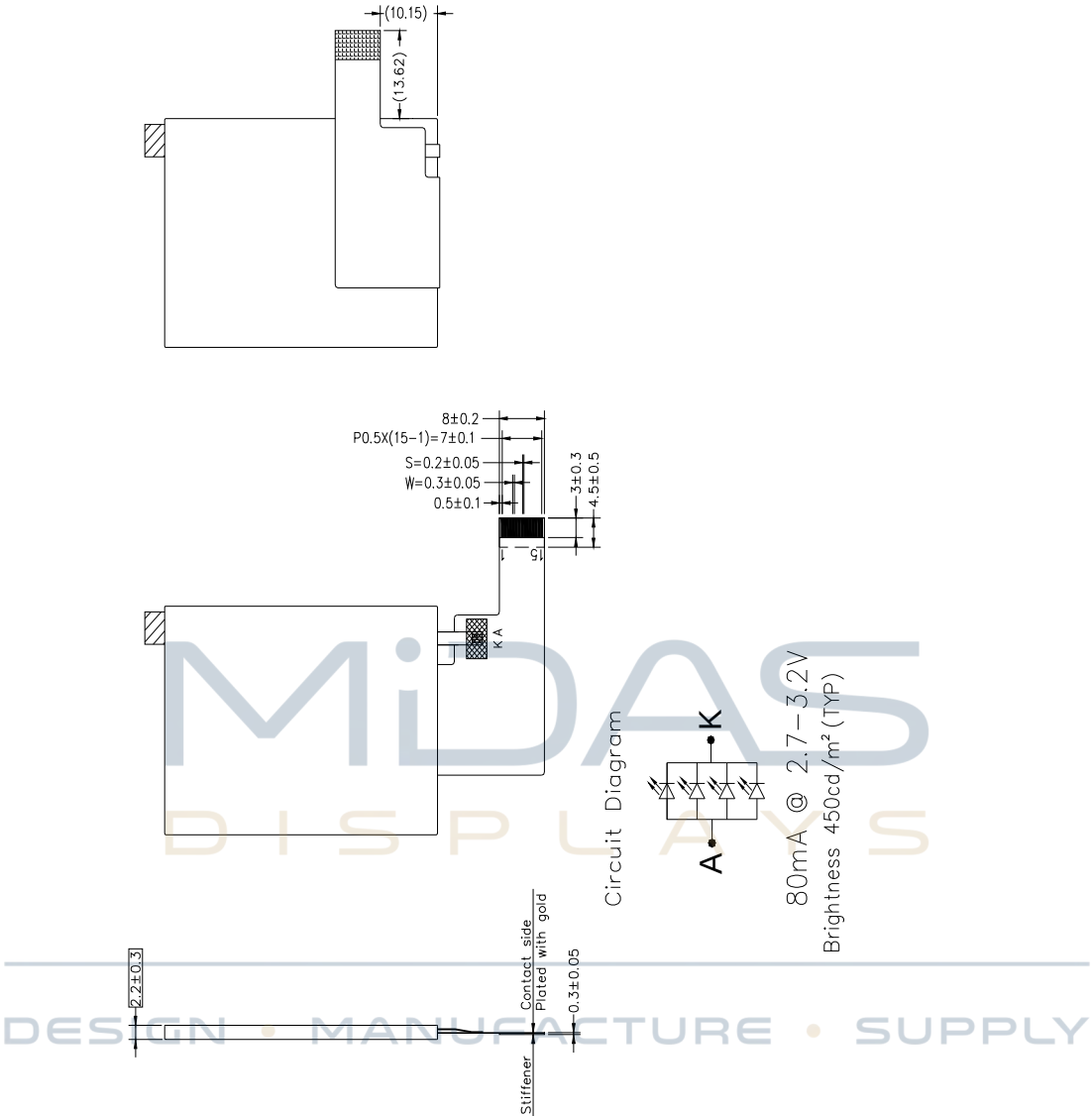
| Item                           | Contents                            | Unit    |
|--------------------------------|-------------------------------------|---------|
| LCD SIZE                       | 2                                   | inch    |
| LCD TYPE                       | TFT/IPS/NORMALLY BLACK/TRANSMISSIVE |         |
| MODULE SIZE(W*H*T)             | 35.40*48.40*2.20                    | mm      |
| ACTIVE SIZE(W*H)               | 30.6 (H) x 40.8 (V)                 | mm      |
| Pixel Size                     | 0.0425 (H) x 0.1275 (V)             | mm      |
| NUMBER OF DOTS                 | 240 x RGB x 320                     |         |
| DRIVER IC                      | ST7789V2                            |         |
| INTERFACE TYPE                 | SPI                                 |         |
| RECOMMEND VIEWING DIRECTION    | ALL                                 | O'CLOCK |
| GRAY SCALE INVERSION DIRECTION | -                                   | O'CLOCK |
| COLORS                         | 262K                                |         |
| BACKLIGHT TYPE                 | 4-DIES WHITE LED                    |         |
| TOUCH PANEL TYPE               | WITHOUT                             |         |

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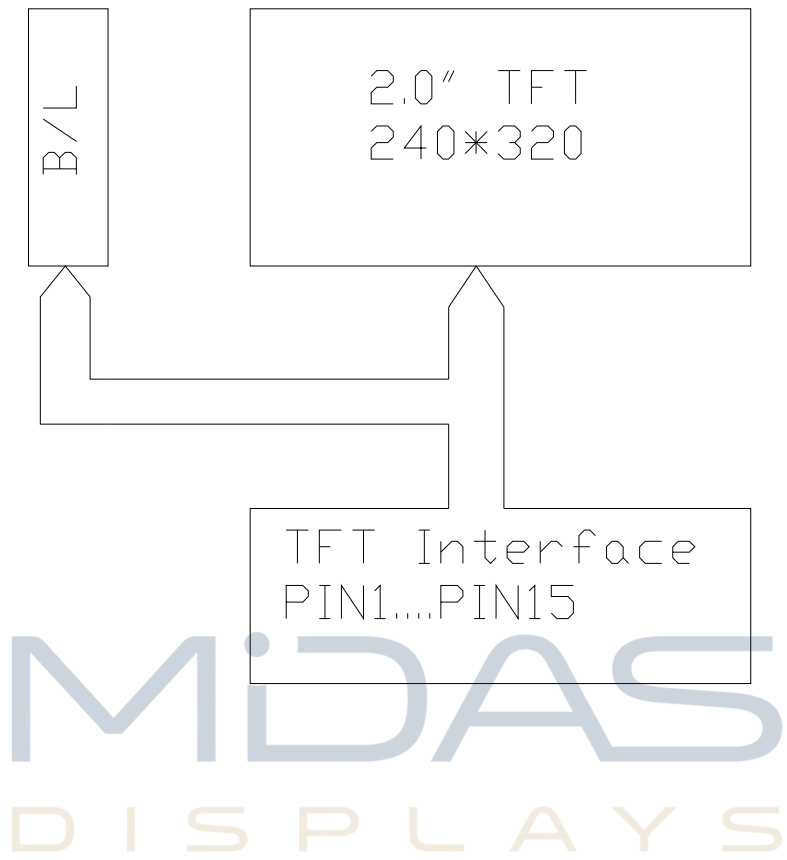


## 2. EXTERNAL DIMENSIONS



- Remark:
1. Unmarked tolerance is  $\pm 0.3$
  2. All materials comply with RoHS
  3.   ...:critical dimension.
  4. LED life time: 30000h.

3.BLOCK DIAGRAM



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#### 4. PIN ASSIGNMENT

| PIN NO. | Symbol     | Function                                                                                                            |
|---------|------------|---------------------------------------------------------------------------------------------------------------------|
| 1       | LED+       | Backlight LED Power                                                                                                 |
| 2       | LED-       | Backlight LED Ground                                                                                                |
| 3       | TE         | Tearing effect signal is used to synchronize MCU to frame memory writing.If not used, please let this pin open      |
| 4       | SDA        | The data is latched on the rising edge of the SCL signal.                                                           |
| 5       | WRX        | Display data/command selection pin in 4-line serial interface.                                                      |
| 6       | SCL        | This pin is used to be serial interface clock.                                                                      |
| 7       | CSX        | Chip selection pin.                                                                                                 |
| 8       | RESX       | This signal will reset the device and it must be applied to properly initialize the chip.<br>-Signal is active low. |
| 9       | VDDI(1.8V) | Power supply for logic circuit                                                                                      |
| 10      | VDD(2.75V) | Power supply for analog circuit.                                                                                    |
| 11      | GND        | Ground                                                                                                              |
| 12      | NC         | Not connection                                                                                                      |
| 13      | NC         | Not connection                                                                                                      |
| 14      | NC         | Not connection                                                                                                      |
| 15      | NC         | Not connection                                                                                                      |

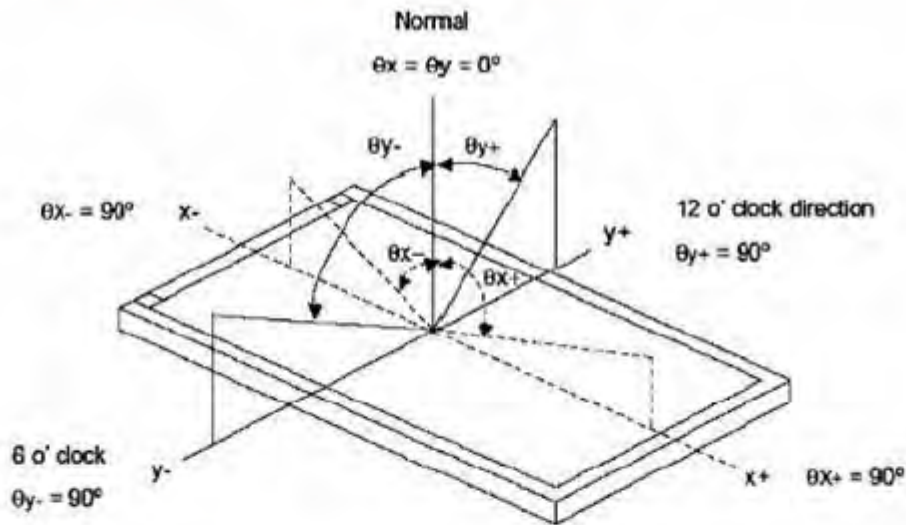


## 5. OPTICAL CHARACTERISTICS

| ITEM                        |       | SYMBOL           | CONDITIONS              | SPECIFICATIONS |       |        | UNIT              | NOTE |
|-----------------------------|-------|------------------|-------------------------|----------------|-------|--------|-------------------|------|
|                             |       |                  |                         | MIN            | TYP.  | MAX    |                   |      |
| Luminance                   |       | L                |                         |                | 450   |        | Cd/m <sup>2</sup> |      |
| Contrast ratio              |       | CR               | $\theta = 0^\circ$      | 640            | 800   |        |                   |      |
| Response time               |       | T <sub>ON</sub>  |                         |                | 30    | 40     | ms                |      |
|                             |       | T <sub>OFF</sub> |                         |                |       |        |                   |      |
| CIE<br>COLOUR<br>COORDINATE | RED   | RX               | VIEWING<br>NORMAL ANGLE |                |       |        |                   |      |
|                             |       | RY               |                         |                |       |        |                   |      |
|                             | GREEN | GX               |                         |                |       |        |                   |      |
|                             |       | GY               |                         |                |       |        |                   |      |
|                             | BLUE  | BX               |                         |                |       |        |                   |      |
|                             |       | BY               |                         |                |       |        |                   |      |
|                             | WHITE | WX               |                         | -0.015         | 0.307 | +0.015 |                   |      |
|                             |       | WY               |                         | -0.015         | 0.344 | +0.015 |                   |      |
| VIEWING<br>ANGLE            | Hor.  | $\theta_{x+}$    | CR $\geq 10$            | 75             | 85    |        | Degree            |      |
|                             |       | $\theta_{x-}$    |                         | 75             | 85    |        |                   |      |
|                             | Ver.  | $\theta_{y+}$    |                         | 75             | 85    |        |                   |      |
|                             |       | $\theta_{y-}$    |                         | 75             | 85    |        |                   |      |



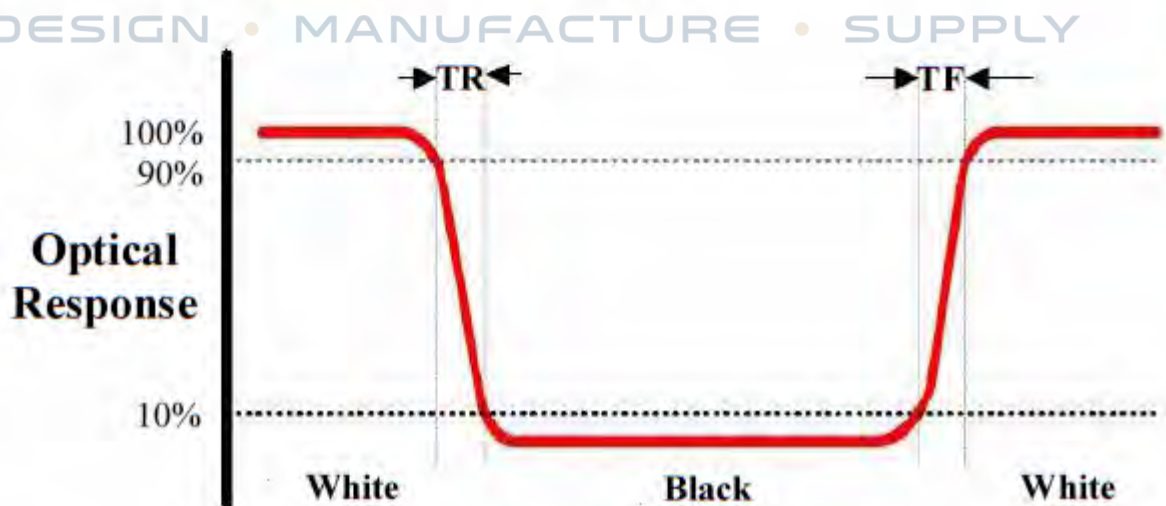
**Note 1: Definition of Viewing Angle  $\theta_x$  and  $\theta_y$ :**



**Note 2: Definition of contrast ratio CR:**

$$CR = \frac{\text{Luminance of white state}}{\text{Luminance of black state}}$$

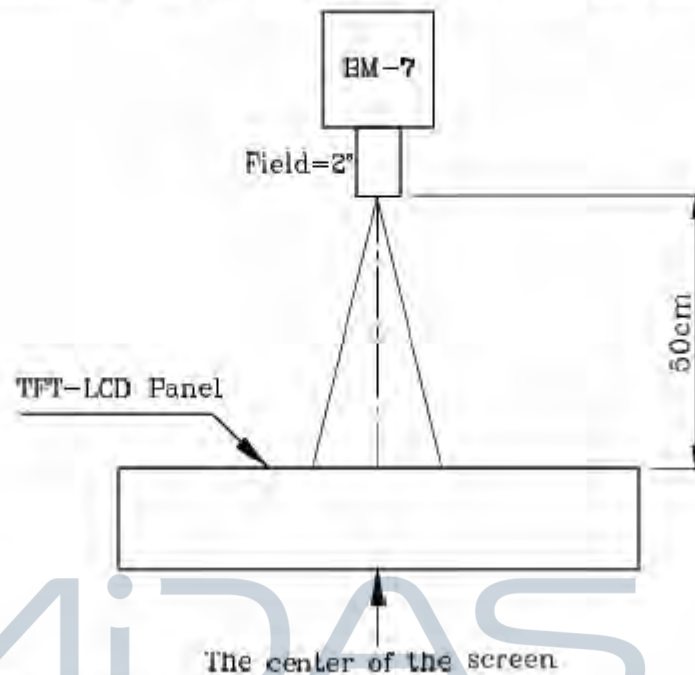
**Note 3: Definition of Response Time ( $T_r$ ,  $T_f$ )**



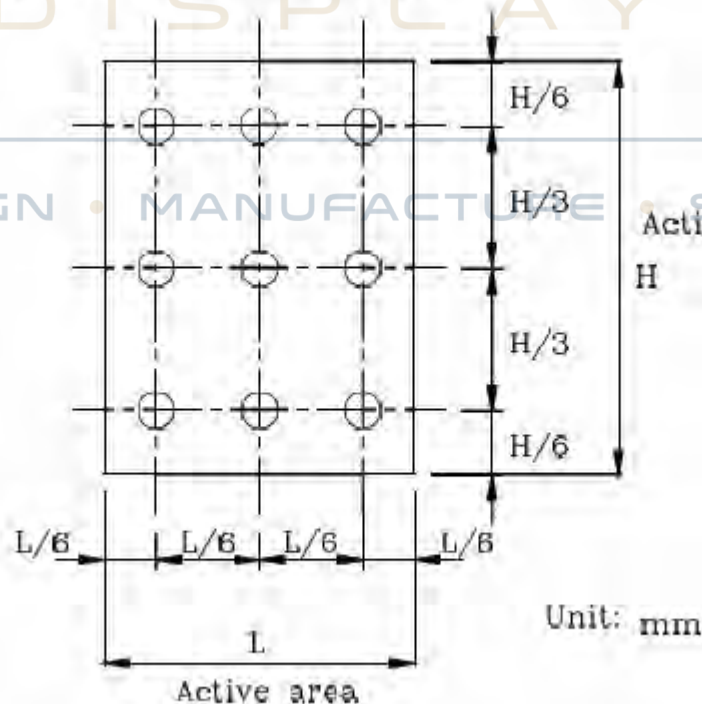
#### Note 4: Definition of Luminance

##### ① The Brightness Test Equipment Setup

Field=2° (As measuring “black” image, field=2° is the best testing condition)



##### ② The Brightness Test Point Setup



## 6. ABSOLUTE MAXIMUM RATINGS

| PARAMETER                | SYMBOL           | MIN  | MAX | UNIT |
|--------------------------|------------------|------|-----|------|
| Power Supply Voltage     | VDD              | -0.3 | 4.6 | V    |
| Supply voltage for logic | VDDI             | -0.3 | 4.6 | V    |
| Supply current (One LED) | I <sub>LED</sub> |      | 30  | mA   |
| Operating temperature    | T <sub>op</sub>  | -20  | +70 | °C   |
| Storage temperature      | T <sub>st</sub>  | -30  | +80 | °C   |

## 7. ELECTRICAL CHARACTERISTICS

### 7.1 ELECTRICAL CHARACTERISTICS

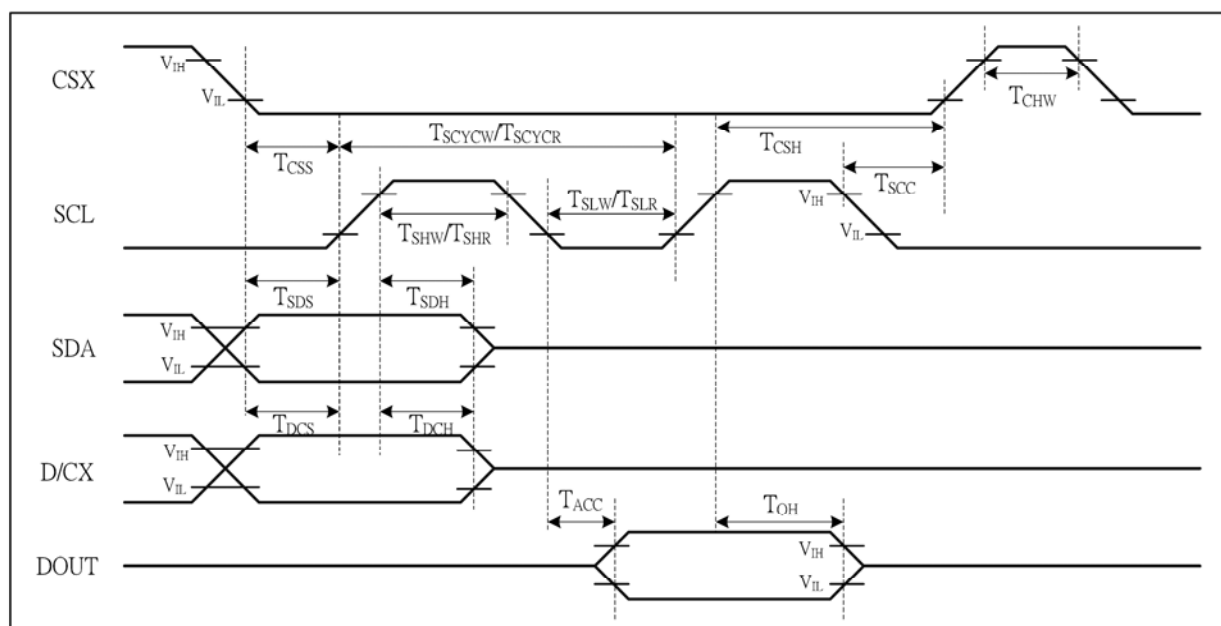
| Parameter     | Symbol | Condition | Min     | Typ  | Max     | Unit | Note |
|---------------|--------|-----------|---------|------|---------|------|------|
| Power supply  | VDD    | Ta=25°C   | 2.4     | 2.75 | 3.3     | V    |      |
| Power supply  | VDDI   | Ta=25°C   | 1.65    | 1.8  | 3.3     | V    |      |
| Input voltage | VIH    | Ta=25°C   | 0.7VDDI | -    | VDDI    | V    |      |
|               | VIL    | Ta=25°C   | GND     | -    | 0.3VDDI | V    |      |

### 7.2 BACKLIGHT CHARACTERISTICS

| Item              | Symbol | Condition | Min    | Typ | Max   | Unit | Note |
|-------------------|--------|-----------|--------|-----|-------|------|------|
| Supply voltage    | Vr     | -         | 2.7    |     | 3.2   | V    |      |
| Supply current    | If     | -         |        | 80  |       | mA   |      |
| Power consumption | P      |           | 0.216  |     | 0.256 | W    |      |
| LED life time     | -      | -         | 30,000 | -   | -     | Hr   |      |



## 8.TIMING CHARACTERISTICS



4-line serial Interface Timing Characteristics

VDDI=1.65 to 3.3V, VDD=2.4 to 3.3V, AGND=DGND=0V, Ta=25°C

| Signal       | Symbol      | Parameter                      | MIN | MAX | Unit | Description                  |
|--------------|-------------|--------------------------------|-----|-----|------|------------------------------|
| CSX          | $T_{CSS}$   | Chip select setup time (write) | 15  |     | ns   |                              |
|              | $T_{CSH}$   | Chip select hold time (write)  | 15  |     | ns   |                              |
|              | $T_{CSS}$   | Chip select setup time (read)  | 60  |     | ns   |                              |
|              | $T_{SCC}$   | Chip select hold time (read)   | 65  |     | ns   |                              |
|              | $T_{CHW}$   | Chip select "H" pulse width    | 40  |     | ns   |                              |
| SCL          | $T_{SCYCW}$ | Serial clock cycle (Write)     | 16  |     | ns   | -write command & data<br>ram |
|              | $T_{SHW}$   | SCL "H" pulse width (Write)    | 7   |     | ns   |                              |
|              | $T_{SLW}$   | SCL "L" pulse width (Write)    | 7   |     | ns   |                              |
|              | $T_{SCYCR}$ | Serial clock cycle (Read)      | 150 |     | ns   | -read command & data<br>ram  |
|              | $T_{SHR}$   | SCL "H" pulse width (Read)     | 60  |     | ns   |                              |
|              | $T_{SLR}$   | SCL "L" pulse width (Read)     | 60  |     | ns   |                              |
| D/CX         | $T_{DCS}$   | D/CX setup time                | 10  |     | ns   |                              |
|              | $T_{DCH}$   | D/CX hold time                 | 10  |     | ns   |                              |
| SDA<br>(DIN) | $T_{SDS}$   | Data setup time                | 7   |     | ns   |                              |
|              | $T_{SDH}$   | Data hold time                 | 7   |     | ns   |                              |
| DOUT         | $T_{ACC}$   | Access time                    | 10  | 50  | ns   | For maximum CL=30pF          |
|              | $T_{OH}$    | Output disable time            | 15  | 50  | ns   | For minimum CL=8pF           |

4-line serial Interface Characteristics

9.RELIABILITY TEST ITEMS AND CRITERIA

| NO. | TEST ITEM                                    | CONDITIONS  |      |
|-----|----------------------------------------------|-------------|------|
| 1   | HIGH TEMPERATURE STORAGE                     | TA=+80℃     | 240H |
| 2   | LOW TEMPERATURE STORAGE                      | TA=-30℃     | 240H |
| 3   | HIGH TEMPERATURE OPERATION                   | TA=+70℃     | 240H |
| 4   | LOW TEMPERATURE OPERATION                    | TA=-20℃     | 240H |
| 5   | HIGH TEMPERATURE AND HIGH HUMIDITY OPERATION | +60℃, 90%RH | 240H |



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## 10. LCD MODULES HANDLING PRECAUTIONS

- The display panel is made of glass. Do not subject it to a mechanical shock by dropping it from a high place, etc.
- If the display panel is damaged and the liquid crystal substance inside it leaks out, do not get any in your mouth. If
- The substance come into contact with your skin or clothes promptly wash it off using soap and water.
- Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary.
- The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarize carefully.
- To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.
  - Be sure to ground the body when handling the LCD module.
  - Tools required for assembly, such as soldering irons, must be properly grounded.
  - To reduce the amount of static electricity generated, do not conduct assembly and other work under dry conditions.
  - The LCD module is coated with a film to protect the display surface. Exercise care when peeling off this protective film since static electricity may be generated.
- Storage precautions  
When storing the LCD modules, avoid exposure to direct sunlight or to the light of fluorescent lamps. Keep the modules in bags designed to prevent static electricity charging under low temperature / normal humidity conditions (avoid high temperature / high humidity and low temperatures below 0°C). Whenever possible, the LCD modules should be stored in the same conditions in which they were shipped from our company.

## 11. OTHERS

- Liquid crystals solidify at low temperature (below the storage temperature range) leading to defective orientation of liquid crystal or the generation of air bubbles (black or white). Air bubbles may also be generated if the module is subjected to a strong shock at a low temperature.
- If the LCD modules have been operating for a long time showing the same display patterns may remain on the screen as ghost images and a slight contrast irregularity may also appear. Abnormal operating status can be resumed to be normal condition by suspending use for some time. It should be noted that this phenomena does not adversely affect performance reliability.
- To minimize the performance degradation of the LCD modules resulting from caused by static electricity, etc. exercise care to avoid holding the following sections when handling the modules:
  - Exposed area of the printed circuit board
  - Terminal electrode sections.

