**PRODUCT : LCD MODULE**
**MODEL NO : LCD550XLAI-01-100N**
**SUPPLIER : LCD Mikroelektronik GmbH**
**DATE : Jun.12.2020**

# SPECIFICATION

| Prepared by | Checked | Approved |
|---|---|---|
| | | |

CUSTOMER:
MODEL NO.: DATE:

| Approved | Checked | Department |
|---|---|---|
| | | |

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# Revision Record

| Rev No. | Rev Date | Contents | Remark |
|---|---|---|---|
| 1.0 | 2020.06.12 | New creation | |
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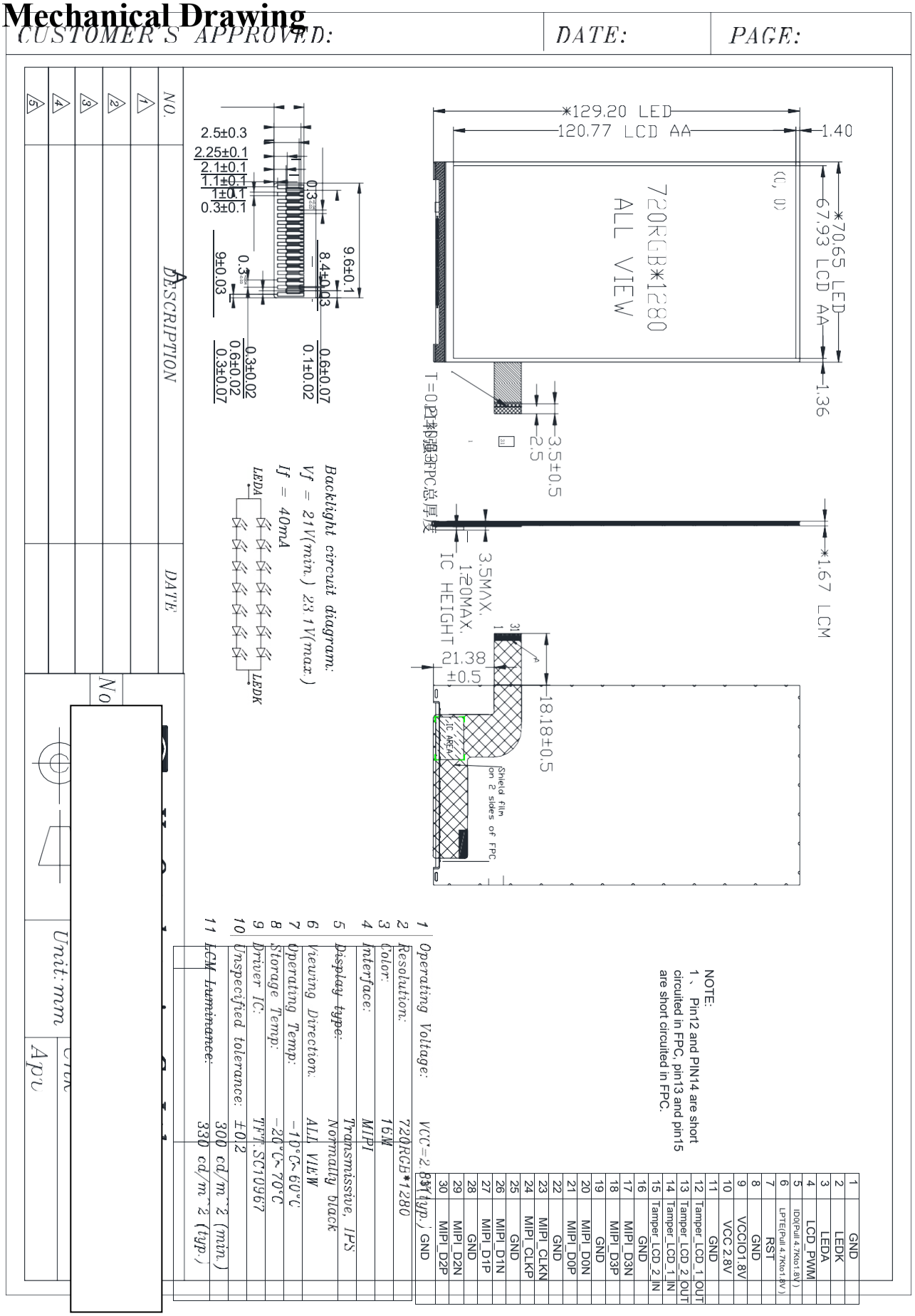
# 1. General Specifications

| No | Item | Contents | Unit |
|---|---|---|---|
| 1 | Size | 5.5 | inch |
| 2 | Resolution | 720( RGB)*1280 | |
| 3 | Interface | MIPI | |
| 4 | Color Depth | 16M | |
| 5 | Technology Type | a-Si TFT | |
| 6 | Pixel size | 0.0945*0.0945 | mm |
| 7 | Display Mode | Transmissive,IPS,NB | |
| 8 | Viewing Direction | ALL VIEW | |
| 9 | LCM (W x H x D) | 70.65*129.2*1.67 | mm |
| 10 | Active Area (W x H) | 67.93*120.77 | mm |
| 11 | With/Without TSP | Without TSP | |
| 12 | LED Numbers | 14 | |

# 2. Mechanical Drawing




| | |
|---|---|
| 1 | GND |
| 2 | LEDK |
| 3 | LEDA |
| 4 | LCD_PWM |
| 5 | IDD(Pull 4.7Kto1.8V) |
| 6 | LPTE(Pull 4.7Kto1.8V) |
| 7 | RST |
| 8 | GND |
| 9 | VCCIO1.8V |
| 10 | VCC 2.8V |
| 11 | GND |
| 12 | Tamper_LCD_1_OUT |
| 13 | Tamper_LCD_2_OUT |
| 14 | Tamper_LCD_1_IN |
| 15 | Tamper_LCD_2_IN |
| 16 | GND |
| 17 | MIPI_D3N |
| 18 | MIPI_D3P |
| 19 | GND |
| 20 | MIPI_D0N |
| 21 | MIPI_D0P |
| 22 | GND |
| 23 | MIPI_CLKN |
| 24 | MIPI_CLKP |
| 25 | GND |
| 26 | MIPI_D1N |
| 27 | MIPI_D1P |
| 28 | GND |
| 29 | MIPI_D2N |
| 30 | MIPI_D2P |

NOTE:
1、 Pin12 and PIN14 are short circuited in FPC, pin13 and pin15 are short circuited in FPC.

# 3. PIN Assignment

| Pin No | Symbol | I/O | Function | Remark |
|---|---|---|---|---|
| 1 | GND | P | Ground | |
| 2 | LEDK | P | LED cathode | |
| 3 | LEDA | P | LED anode | |
| 4 | LCD_PWM | O | Backlight on/off control pin. If CABC function is used, the pin can be connected to external LED driver IC. The output voltage | |
| 5 | ID0 | I | Tearing Effect，pull4.7Kto1.8V | |
| 6 | LPTE | I | Tearing Effect，pull4.7Kto1.8V | |
| 7 | RST | I | Reset pin. Setting either pin low initializes the LSI. It must be reset after power is supplied | |
| 8 | GND | p | Ground | |
| 9 | VCCIO1.8V | I | A power supply for the logic power and I/O circuit. | |
| 10 | VCC 2.8V | - | Power supply. | |
| 11 | GND | p | Ground | |
| 12 | SD7_1_IN | I | Connect to the host input pin | |
| 13 | SD6_1_IN | I | Connect to the host input pin | |
| 14 | SD7_1_OUT_2_IN | O | Connect to the host input pin | |
| 15 | SD6_1_OUT_2_IN | O | Connect to the host input pin | |
| 16 | GND | P | Ground | |
| 17 | MIPI_D3N | I/O | MIPI-DSI Data differential signal input pins. (Data lane 3)<br>if not used , Please connected to GND or open. | |
| 18 | MIPI_D3P | I/O | MIPI-DSI Data differential signal input pins. (Data lane 3)<br>if not used , Please connected to GND or open. | |

| Pin No | Symbol | I/O | Function | Remark |
|---|---|---|---|---|
| 19 | GND | P | Ground | |
| 20 | MIPI_D0N | I | MIPI-DSI Data differential signal input pins. (Data lane 0) if not used , Please connected to GND or open. | |
| 21 | MIPI_D0P | I | MIPI-DSI Data differential signal input pins. (Data lane 0) if not used , Please connected to GND or open. | |
| 22 | GND | P | Ground | |
| 23 | MIPI_CLKN | I | MIPI DSI : CLOCK differential signal input pins. if not used , Please connected to GND or open. | |
| 24 | MIPI_CLKP | I | MIPI DSI : CLOCK differential signal input pins. if not used , Please connected to GND or open. | |
| 25 | GND | P | Ground | |
| 26 | MIPI_D1N | I | MIPI-DSI Data differential signal input pins. (Data lane 1) if not used , Please connected to GND or | |
| 27 | MIPI_D1P | I | MIPI-DSI Data differential signal input pins. (Data lane 1) if not used , Please connected to GND or open. | |
| 28 | GND | P | Ground | |
| 29 | MIPI_D2N | I | MIPI-DSI Data differential signal input pins. (Data lane 2) if not used , Please connected to GND or open. | |
| 30 | MIPI_D2P | I | MIPI-DSI Data differential signal input pins. (Data lane 2) if not used , Please connected to GND or open. | |
| 31 | GND | P | Ground | |

**PS: For further details, please refer to SC10967-SY data sheet.**

# 4. Absolute Maximum Rating

AGND = GND = 0V , Ta = 25°C

| Item | Symbol | Min | Max | Unit | Remark |
|---|---|---|---|---|---|
| Power Voltage | VCC | -0.3 | 6.6 | V | |
| Operating Temperature | $T_{OPR}$ | -10 | 60 | °C | |
| Storage Temperature | $T_{STG}$ | -20 | 70 | °C | |

Note1: The absolute maximum rating values of this product are not allowed to be exceeded at any times. Should a module be used with any of the absolute maximum ratings exceeded, the characteristics of the module may not be recovered, or in an extreme case, the module may be permanently destroyed.

# 5. Electrical Characteristics

## 5.1. Recommended Operating Condition

AGND = GND = 0V , Ta = 25° C

| Item | Symbol | Min | Typ. | Max | Unit | Remark |
|---|---|---|---|---|---|---|
| Power Voltage | VCC | 2.5 | 2.8 | 6.2 | V | |
| | VCCIO | 1.65 | 1.8 | 2.0 | V | |
| Input logic high voltage | VIH | 0.7 VCCIO | - | VCCIO | V | |
| Input logic low voltage | VIL | 0 | - | 0.3VCCIO | V | |

## 5.2. Recommended Driving Condition for Backlight

Ta = 25° C

| Item | Symbol | Min | Typ. | Max | Unit | Remark |
|---|---|---|---|---|---|---|
| Forward Voltage | Vf | | 21 | 23.1 | V | |
| Forward Current | If | | 40 | | mA | |
| Operating Life Time | - | 30000 | | | Hours | |

Note 1: Ta means ambient temperature of TFT-LCD module.
Note 2: IF, VF are defined for one channel LED. There are two LED channel in back light unit.
Note 3: If the module is driven by high current or at high ambient temperature & humidity condition. The operating life will be reduced.
Note 4: Operating life means brightness goes down to 50% initial brightness. Minimum operating life time is estimated data.

# 6. Timing Characteristics

## 6.1. DC Electrical Characteristics

VCC=VCI,VCCIO=IOVCC

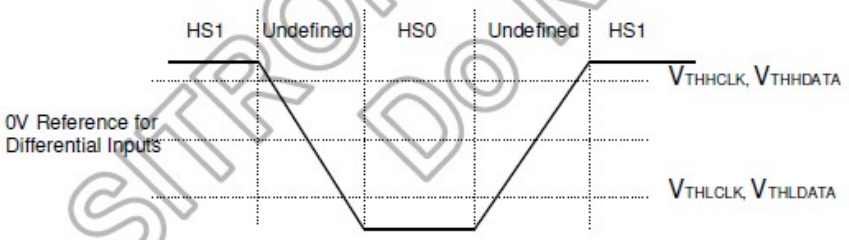
| Parameter | Symbol | Conditions | Spec. | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | |
| **Power & Operating Voltages** | | | | | | |
| Logic Operating voltage | IOVCC | I/O supply voltage | 1.65 | 1.8 | 2.0 | V |
| Analog Operating voltage | VCI | Operation voltage | 2.5 | - | 6.2 | |
| **Input / Output** | | | | | | |
| Logic High level input voltage | VIH | - | 0.7IOVCC | - | IOVCC | V |
| Logic Low level input voltage | VIL | - | VSSD | - | 0.3IOVCC | |
| Logic High level output voltage | VOH | IOH = -1.0mA | 0.8IOVCC | - | IOVCC | |
| Logic Low level output voltage | VOL | IOL = +1.0mA | VSSD | - | 0.2IOVCC | |
| Input leakage current | IIL | - | -1 | - | 1 | μA |
| **DC/DC Converter Operation** | | | | | | |
| VSP booster voltage | VSP | IVSP=1mA | 4.5 | | 6.2 | V |
| VSN booster voltage | VSN | IVSN=-1mA | -6.2 | | -4.5 | |
| VGH booster voltage | VGH | Ivgh=1mA | 10 | | 20 | |
| VGL booster voltage | VGL | Ivgl=-1mA | -15 | | -7.5 | |
| VGH and VGL difference | \|VGH-VGL\| | - | - | - | 32 | |
| Oscillator tolerance | OSC | 25℃ | -3 | | 3 | % |
| **Source Driver** | | | | | | |
| Gamma reference voltage | VSPR | - | 3.3 | | 5.6 | V |
| | VSNR | - | -5.6 | | -3.3 | |
| Output voltage deviation | DVOS | VSSD+1.0 ~ VSPROUT-1.0 | - | - | +/- 20 | mV |
| | | VSSD+0.1V ~ VSSD+1.0<br>VSPR-1.0 ~ VSPR-0.1V | - | - | +/- 50 | mV |
| Output offset voltage | Voff | - | | - | +/-50 | mV |

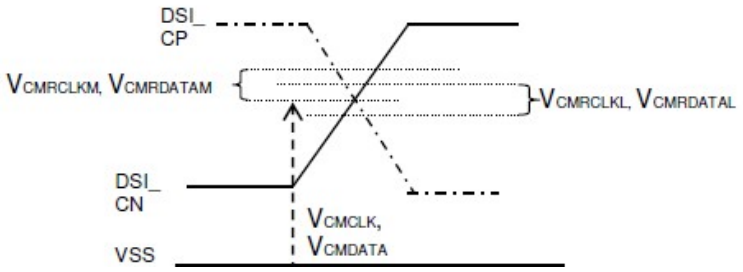
LP Mode

| Parameter | Symbol | Conditions | Spec. | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | |
| Logic high level input voltage | $V_{IHLPCD}$ | LP-CD | 450 | - | 1350 | mV |
| Logic low level input voltage | $V_{ILLPCD}$ | LP-CD | 0 | - | 200 | mV |
| Logic high level input voltage | $V_{IHLPRX}$ | LP-RX(CLK, D0) | 880 | - | 1350 | mV |
| Logic low level input voltage | $V_{ILLPRX}$ | LP-RX(CLK, D0) | 0 | - | 550 | mV |
| Logic low level input voltage | $V_{ILLPRXULP}$ | LP-RX(CLK ULP mode) | 0 | - | 300 | mV |
| Logic high level output voltage | $V_{OHLPTX}$ | LP-TX(D0) | 1.1 | - | 1.3 | V |
| Logic low level output voltage | $V_{OLLPTX}$ | LP-TX(D0) | -50 | - | 50 | mV |
| Logic high level input current | $V_{IH}$ | LP-CD, LP-RX | - | - | 10 | uA |
| Logic low level input current | $V_{IL}$ | LP-CD, LP-RX | -10 | - | - | uA |
| Input pulse rejection | SGD | DSI-CLK+/-, DSI-D0+/1 | - | - | 300 | Vps |

High Speed Mode

| Parameter | Symbol | Conditions | Spec. | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | |
| Input common mode | $V_{CMCLK}$ $V_{CMDATA}$ | DSI_CP/DSI_CN DSI_D0P/DSI_D0P | 70 | - | 330 | mV |
| Input common mode variation <450 MHZ | $V_{CMRCLKL}$ $V_{CMRDATAL}$ | DSI_CP/DSI_CN DSI_D0P/DSI_D0P | -50 | - | 50 | mV |
| Input common mode variation >450 MHZ | $V_{CMRCLKM}$ $V_{CMRDATAM}$ | DSI_CP/DSI_CN DSI_D0P/DSI_D0P | - | - | 100 | mV |
| Low-level differential Input threshold | $V_{THLCLK}$ $V_{THLDATA}$ | DSI_CP/DSI_CN DSI_D0P/DSI_D0P | -70 | - | - | mV |
| High-level differential Input threshold | $V_{THHCLK}$ $V_{THHDATA}$ | DSI_CP/DSI_CN DSI_D0P/DSI_D0P | - | - | 70 | mV |
| Single ended input low voltage | $V_{ILHS}$ | DSI_CP/DSI_CN DSI_D0P/DSI_D0P | -40 | - | - | mV |
| Single ended input high voltage | $V_{IHHS}$ | DSI_CP/DSI_CN DSI_D0P/DSI_D0P | - | - | 460 | mV |
| Differential input termination resistor | $R_{TERM}$ | DSI_CP/DSI_CN DSI_D0P/DSI_D0P | 80 | 100 | 125 | Ω |
| Single-ended threshold voltage for termination enable | $V_{TERMEN}$ | DSI_CP/DSI_CN DSI_D0P/DSI_D0P | - | - | 450 | mV |
| Termination capacitor | $C_{TERM}$ | DSI_CP/DSI_CN DSI_D0P/DSI_D0P | - | - | - | pF |

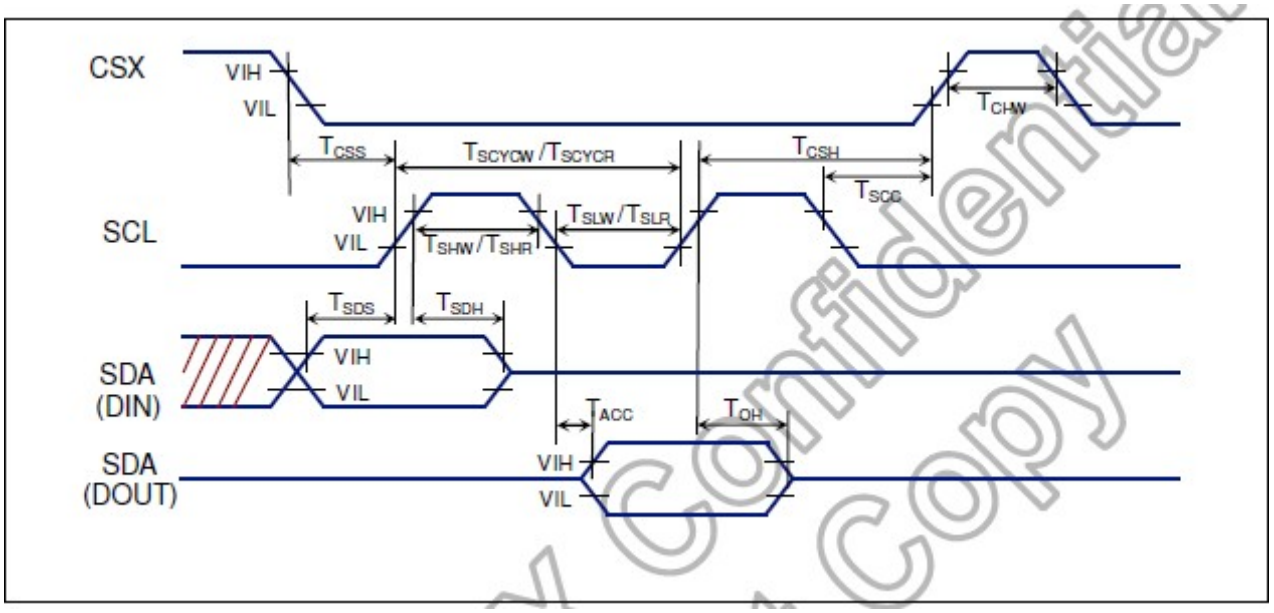



**Differential voltage range and Command mode voltage**

## 6.2 Timing

### Serial Interface Characteristics




Serial Interface Characteristics

**(VSSA=0V, IOVCC=1.8V, VCI=2.8V, $T_A$ = 25°C)**

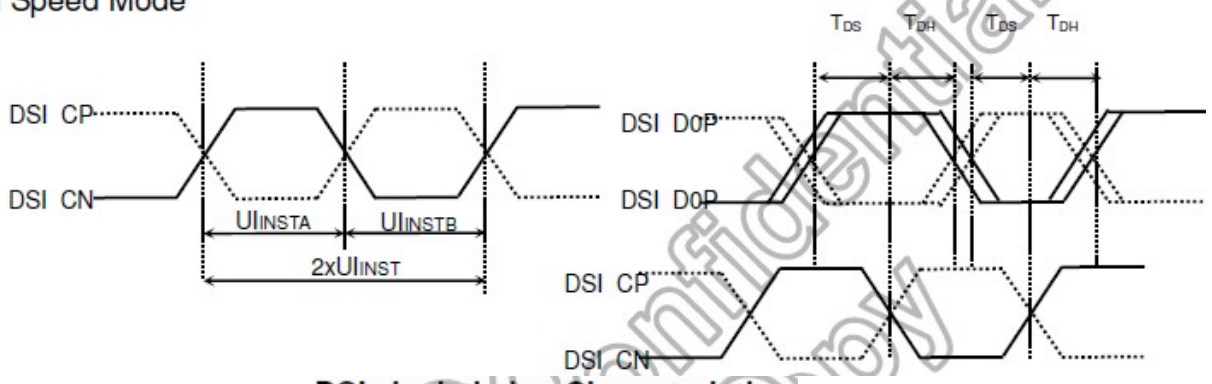
| Signal | Symbol | Parameter | Min. | Max. | Unit | Description |
|---|---|---|---|---|---|---|
| CSX | $t_{CSS}$ | Chip select setup time (Write) | 15 | - | ns | - |
| | $t_{CSS}$ | Chip select setup time (Read) | 60 | - | | |
| | $t_{CSH}$ | Chip select hold time (Write) | 15 | - | | |
| | $t_{CSH}$ | Chip select hold time (Read) | 65 | - | | |
| DCX | $t_{AST}$ | Address setup time | 0 | - | ns | - |
| | $t_{AHT}$ | Address hold time (Write/Read) | 10 | - | | |
| SCL (Write) | $t_{WC}$ | Write cycle | 66 | - | ns | - |
| | $t_{WRH}$ | Control pulse "H" duration | 15 | - | | |
| | $t_{WRL}$ | Control pulse "L" duration | 15 | - | | |
| SCL (Read) | $t_{RC}$ | Read cycle | 150 | - | ns | - |
| | $t_{RDH}$ | Control pulse "H" duration | 60 | - | | |
| | $t_{RDL}$ | Control pulse "L" duration | 60 | - | | |
| SDA (Input) | $t_{DS}$ | Data setup time | 10 | - | ns | For maximum $C_L$=30pF<br>For minimum $C_L$=8pF |
| | $t_{DH}$ | Data hold time | 10 | - | | |
| SDA (Output) | $t_{ACC}$ | Read access time | - | 100 | ns | |
| | $t_{OH}$ | Output disable time | 10 | - | | |

**Note:** The input signal rise time and fall time (tr, tf) is specified at 15 ns or less.
Logic high and low levels are specified as 30% and 70% of IOVCC for Input signals.

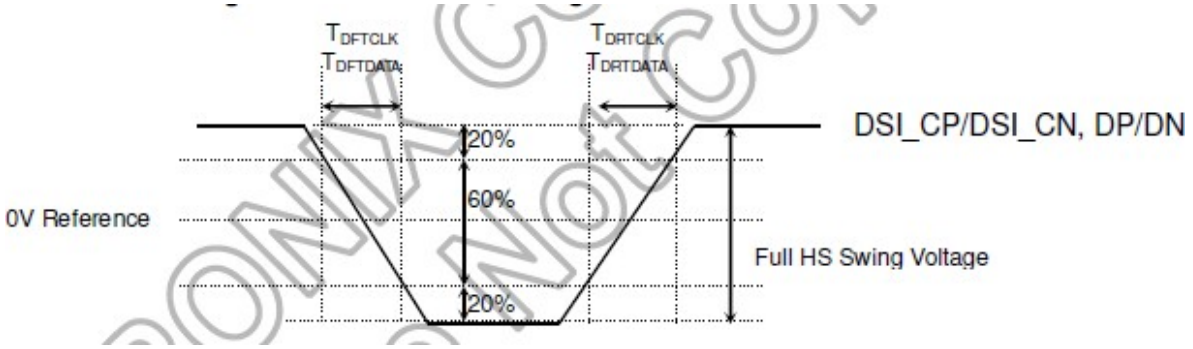
Serial Interface Characteristics

## DSI Interface Timing Characteristics

High Speed Mode




DSI clock timing Characteristics



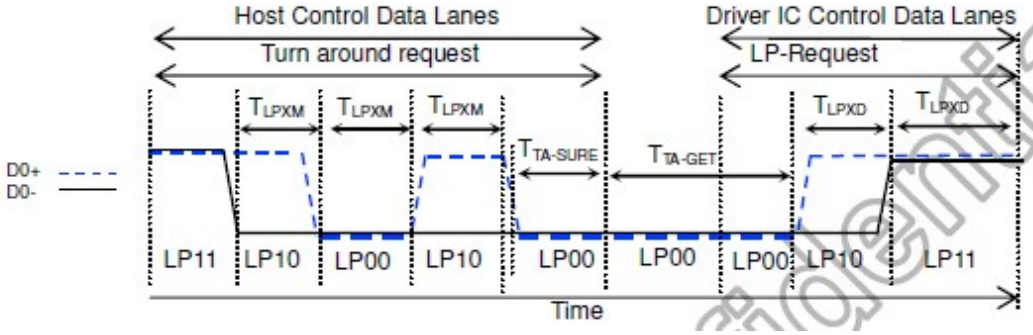

Rising and falling time on clock and data channel

(VSSA=0V, IOVCC=1.65V to 3.3V, VCI=2.5V to 3.3V, $T_A$ = -30 to 70°C)

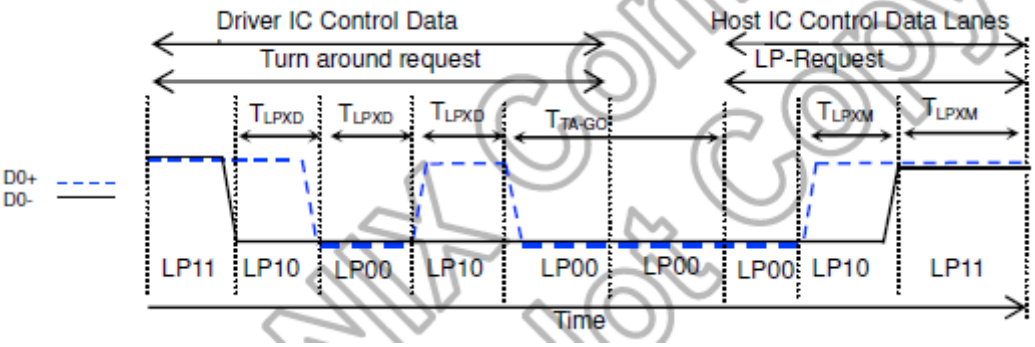
| Signal | Item | Symbol | Spec. | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | |
| DSI_CP/ DSI_CN | Double UI instantaneous | $2xU_{INST}$ | TBD | - | 25 | ns |
| | UI instantaneous | $U_{INSTA}$ $U_{INSTB}$ | TBD | - | 12.5 | ns |
| DP/DN | Data to clock setup time | $T_{DS}$ | 0.15xUI | - | - | ps |
| | Data to clock hold time | $T_{DH}$ | 0.15xUI | - | - | ps |
| DSI_CP/ DSI_CN | Differential rise time for clock | $T_{DRTCLK}$ | 150 | - | 0.3UI | ps |
| | Differential fall time for clock | $T_{DFTCLK}$ | 150 | - | 0.3UI | ps |
| DP/DN | Differential rise time for data | $T_{DRTDATA}$ | 150 | - | 0.3UI | ps |
| | Differential fall time for data | $T_{DFTDATA}$ | 150 | - | 0.3UI | ps |

DSI High Speed Mode Characteristics

## Low Power Mode




**BTA from HOST to Display Module Timing**



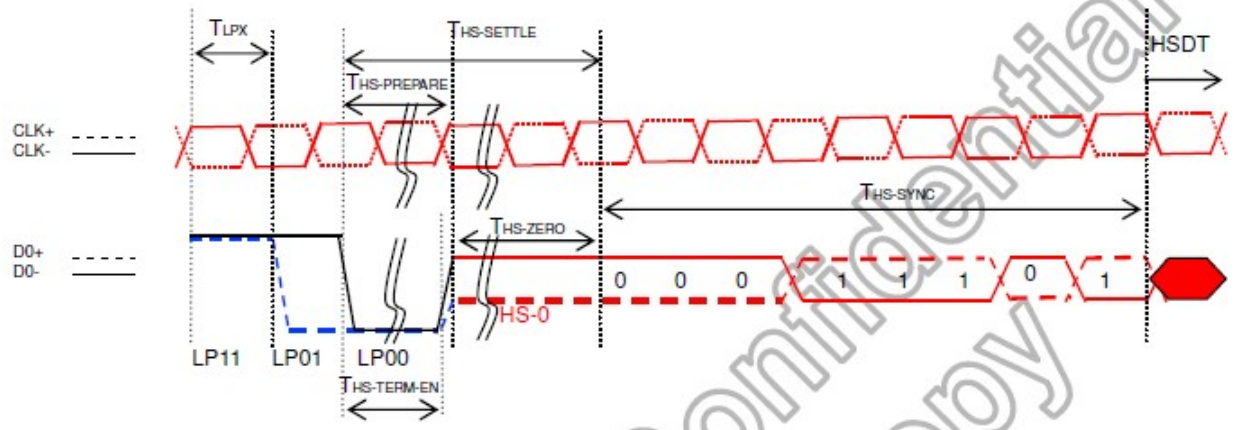

**BTA from Display Module Timing to HOST**

(VSSA=0V, IOVCC=1.65V to 3.3V, VCI=2.3V to 3.3V, $T_A$ = -30 to 70°C)

| Signal | Item | Symbol | Spec. | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | |
| DSI_D0P/ DSI_D0P | Length of LP-00/LP01/LP10/LP11 Host→ Display module | $T_{LPXM}$ | 50 | - | - | ns |
| | Length of LP-00/LP01/LP10/LP11 Display module →Host | $T_{LPXD}$ | 50 | - | - | ns |
| | Time-out before the MPU start driver | $T_{TA-SURE}$ | $T_{LPXD}$ | - | 2x$T_{LPXD}$ | ns |
| | Time to drive LP-00 by display module | $T_{TA-GET}$ | 5x$T_{LPXD}$ | - | - | ns |
| | Time to drive LP-00 after turnaround request Host | $T_{TAGO}$ | 4x$T_{LPXD}$ | - | - | ns |

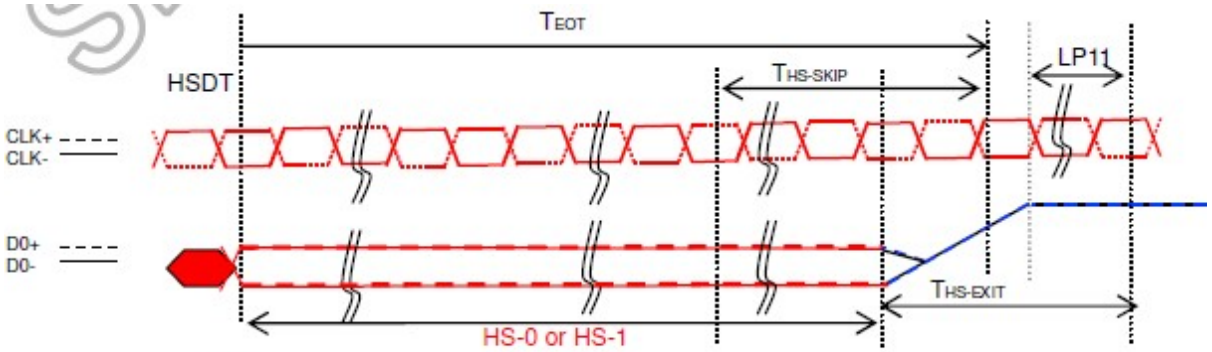
**DSI Low Power Mode Characteristics**

## DSI BURSTS




| Signal | Item | Symbol | Spec. | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | |
| DSI_D0P/ DSI_D0P | Length of LP-00/LP01/LP10/LP11 | $T_{LPX}$ | 50 | - | - | ns |
| | Time to Driver LP-00 to prepare for HS transmission | $T_{HS-PREPARE}$ | 40+4UI | - | 85+6UI | ns |
| | Time to enable data receiver line termination | $T_{HS-TERM-EN}$ | - | - | 35+4xUI | ns |
| | Time to drive LP-00 by display module | $T_{TA-GET}$ | 5x$T_{LPXD}$ | - | - | ns |
| | Time to drive LP-00 after turnaround request Host | $T_{TAGO}$ | 4x$T_{LPXD}$ | - | - | ns |

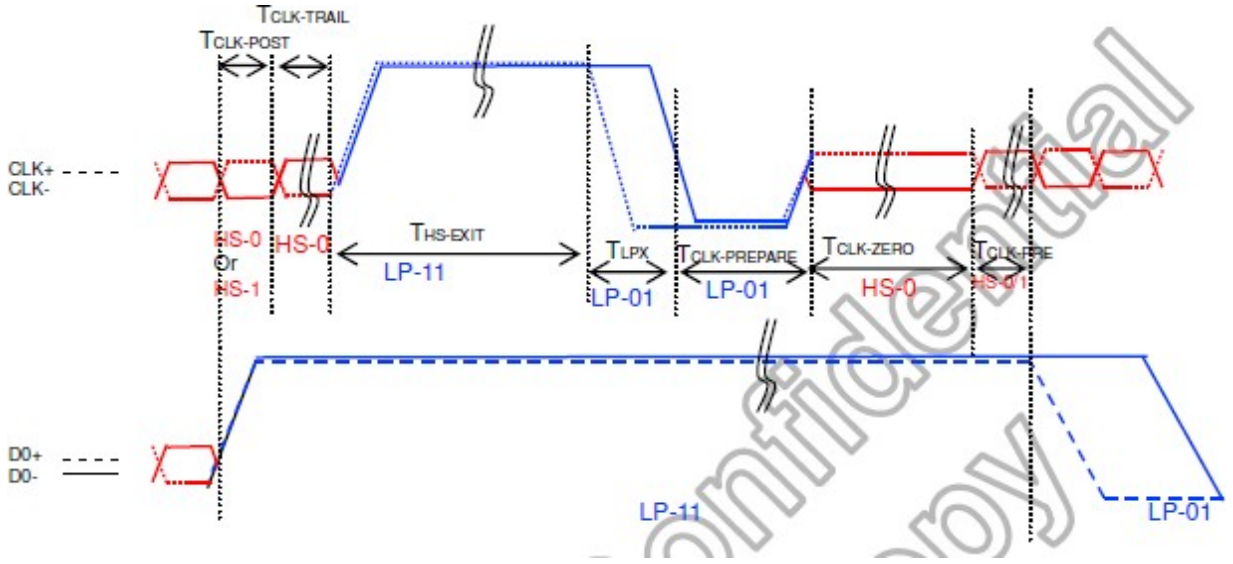
**DSI Low Power Mode to High Speed Mode Timing**




NOTE:
If the last bit is HS-0, the transmitter changes from HS-0 to HS-1
If the last bit is HS-0, the transmitter changes from HS-1 to HS-0

| Signal | Item | Symbol | Spec. | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | |
| DSI_D0P/ DSI_D0P | Time-Out at Display Module to Ignore Transition Period of EoT | $T_{HS-SKIP}$ | 40 | - | 55+4xUI | ns |
| | Time to Driver LP-11 after HS Burst | $T_{HS-EXIT}$ | 100 | - | - | ns |

**DSI Low Power Mode to High Speed Mode Timing**




| Signal | Item | Symbol | Spec. | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | |
| DSI_CP/ DSI_CN | Time that the MCU shall continue sending HS clock after the last associated Data Lane has transitioned to LP mode | $T_{CLK-POST}$ | 60+52xUI | - | - | ns |
| | Time to drive HS differential state after last payload clock bit of a HS transmission burst | $T_{CLK-TRAIL}$ | 60 | - | - | ns |
| | Time to drive LP-11 after HS burst | $T_{HS-EXIT}$ | 100 | - | - | ns |
| | Time to drive LP-00 to prepare for HS transmission | $T_{CLK-PREPARE}$ | 38 | - | 95 | ns |
| | Time-out at Clock Lane Display Module to enable HS Termination | $T_{CLK-TERM-EN}$ | - | - | 38 | ns |
| | Minimum lead HS-0 drive period before starting Clock | $T_{CLK-PREPARE}$ + $T_{CLK-ZERO}$ | 300 | - | - | ns |
| | Time that the HS clock shall be driven prior to any associated data Lane beginning the transition from LP to HS mode | $T_{CLK-PRE}$ | 8xUI | | | |

**Clock Lanes High Speed Mode to/from Low Power Mode Timing**

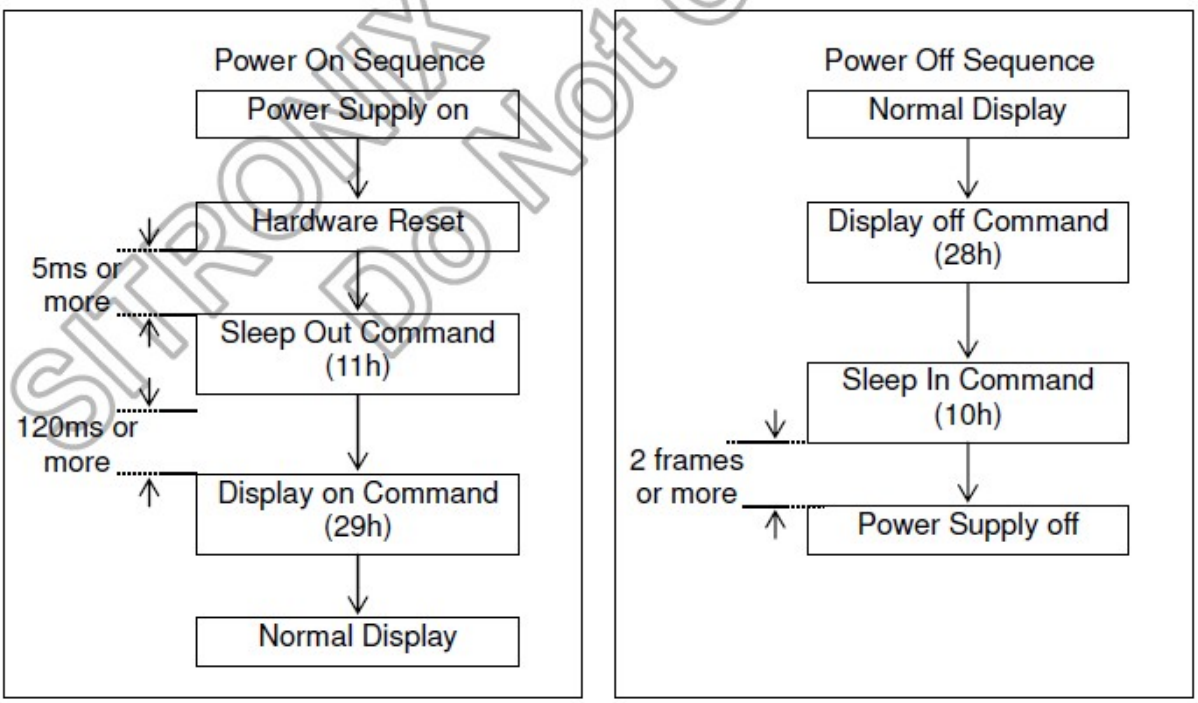
## 6.3.Power ON/OFF Sequence

Power source IOVCC, VCI can be applied and powered down in any order. IOVCC, VCI can be powered down in any order.

During power off, if LCD is in the Sleep Out mode, IOVCC, VCI must be powered down minimum 120msec after NRESET has been released.

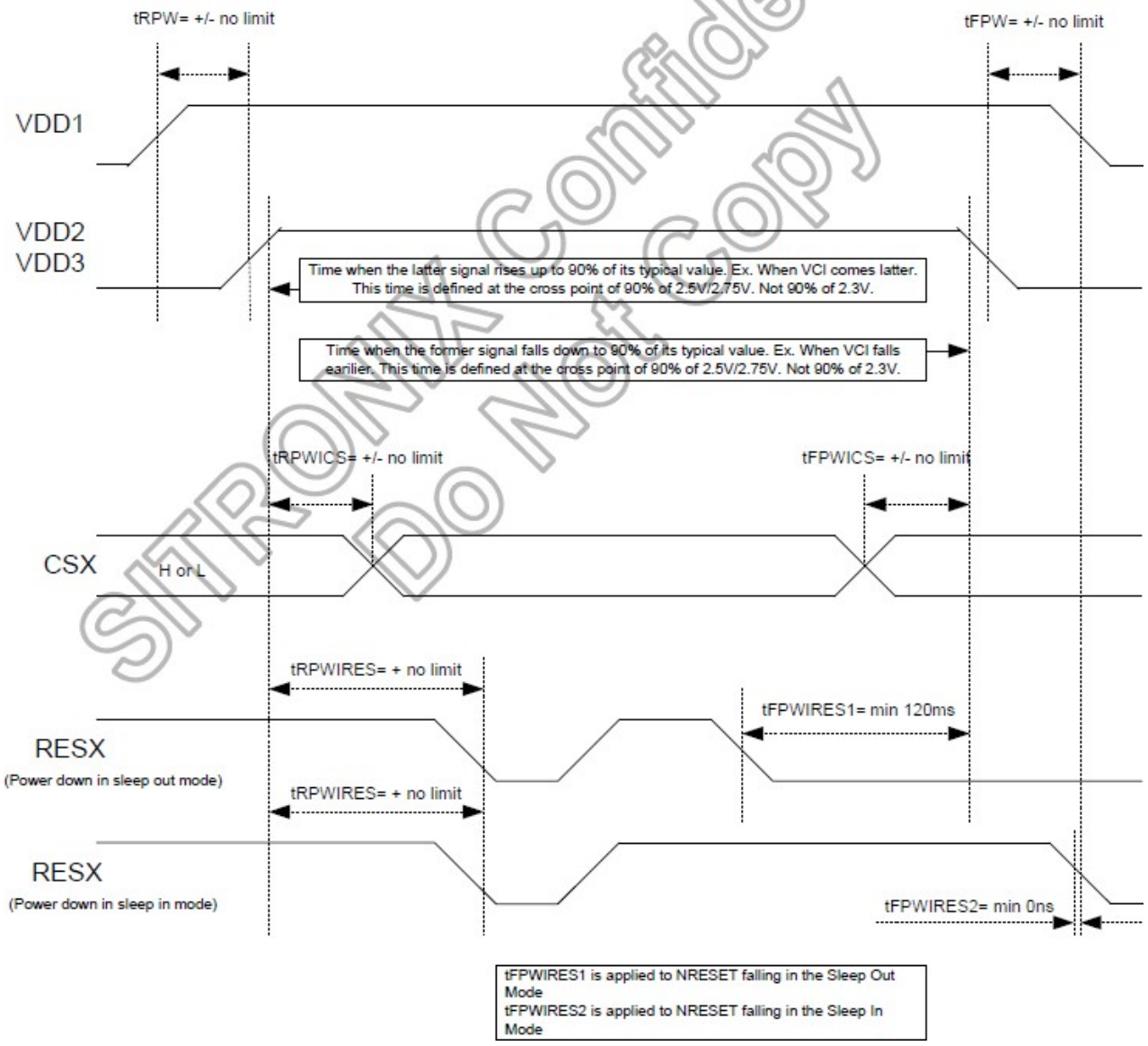
During power off, if LCD is in the Sleep In mode, IOVCC, VCI can be powered down minimum 0msec after NRESET has been released.

NCS can be applied at any timing or can be permanently grounded. NRESET has priority over NCS.



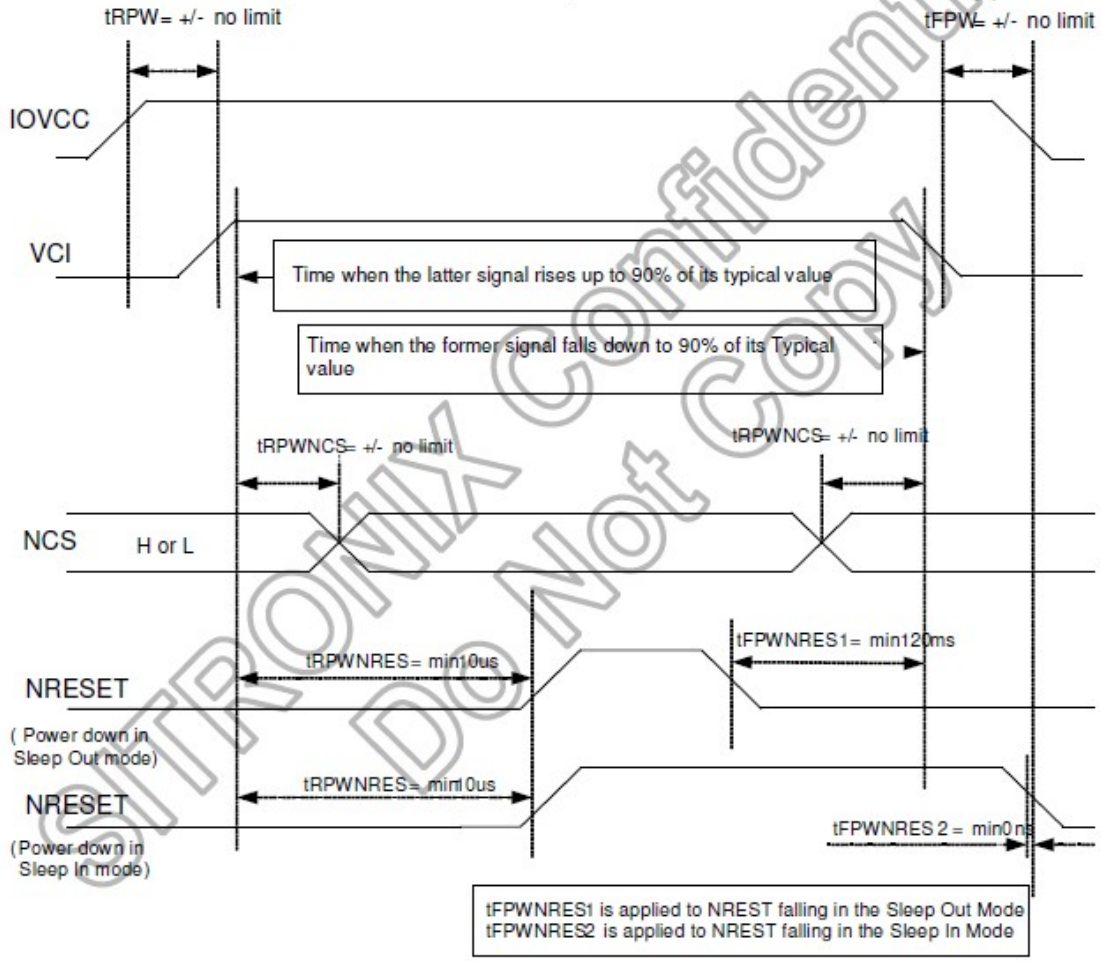
## Case 1: RESX line is held high or unstable by host at power on

If RESX line is held high or unstable by the host during power on, then a Hardware Reset must be applied after both VDD1, VDD2 and VDD3 have been applied- otherwise correct functionality is not guaranteed. There is no timing restriction upon this hardware reset.



## Case 2: RESX line is held low by host at power on

If RESX line is held low (and stable) by the host during power on, then the RESX must be held low for minimum 10µsec after both VDD1, VDD2 and VDD3 have been applied.




Note: Unless otherwise specified timings herein show cross point at 50% of signal/power level

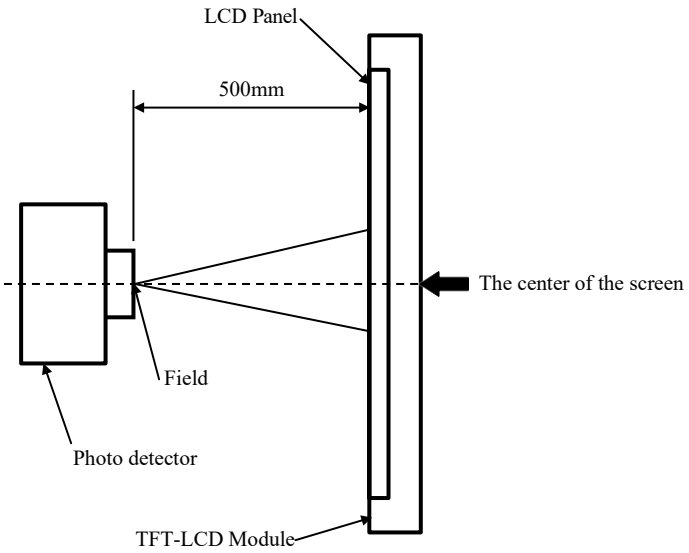
# 7. Optical Characteristics

| Item | | Symbol | Condition | Min | Typ. | Max | Unit | Remark |
|---|---|---|---|---|---|---|---|---|
| View Angles | | θT | CR≥10 | 70 | 80 | - | Degree | Note 2 |
| | | θB | | 70 | 80 | - | | |
| | | θL | | 70 | 80 | - | | |
| | | θR | | 70 | 80 | - | | |
| Contrast Ratio | | CR | θ = 0° | 1000 | 1200 | - | | Note 1<br>Note 3 |
| Response Time | | $T_{ON}$ +$T_{OFF}$ | 25°C | - | 35 | - | ms | Note 1<br>Note 4 |
| Chromaticity | Red | x | θ = 0° | 0.631 | 0.661 | 0.691 | | Note 1<br>Note 5 |
| | | y | | 0.293 | 0.323 | 0.353 | | |
| | Green | x | | 0.242 | 0.272 | 0.302 | | |
| | | y | | 0.555 | 0.585 | 0.615 | | |
| | Blue | x | | 0.104 | 0.134 | 0.164 | | |
| | | y | | 0.093 | 0.123 | 0.153 | | |
| | White | x | | 0.262 | 0.292 | 0.322 | | |
| | | y | | 0.302 | 0.332 | 0.362 | | |
| Luminance | | L | | 300 | 330 | - | $cd/m^2$ | Note 1<br>Note 5 |

Test Conditions:

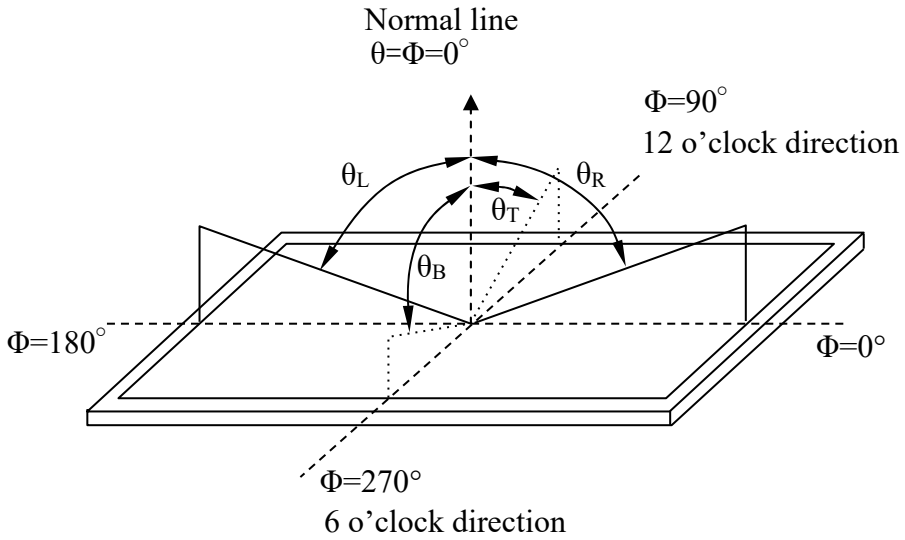
1. If= 40 mA(Backlight current), VCC = 3.3V, the ambient temperature is 25°C.
2. The test systems refer to Note 2.

Note1: Definition of optical measurement system.
The optical characteristics should be measured in dark room. After 5Minutes operation, the optical properties are measured at the center point of the LCD screen. ALL input terminals LCD panel must be ground when measuring the center area of the panel.




| Item | Photo detector | Field |
|---|---|---|
| Contrast Ratio | CS1000 | 1º |
| Luminance | | |
| Lum Uniformity | | |
| Chromaticity | CS1000 | |
| Response Time | DMS703 | - |

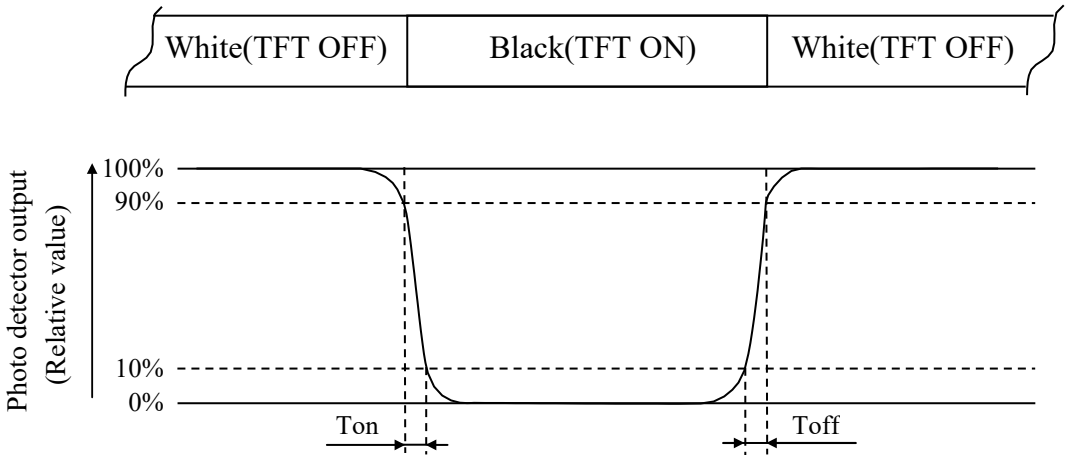
Note2: Definition of viewing angle range and measurement system.
Viewing angle is measured at the center point of the LCD by CONOSCOPE (DMS703)



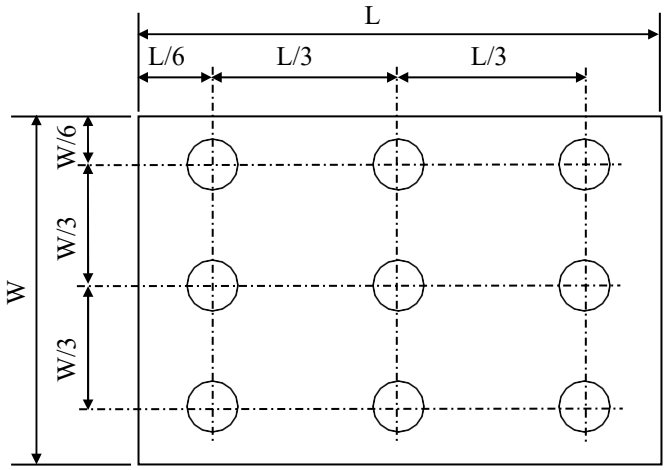

Note3: Definition of contrast ratio

$$\text{Contrast ratio(CR)} = \frac{\text{Luminance measured when LCD is on the "White" state}}{\text{Luminance measured when LCD is on the "Black" state}}$$

"White state ":The state is that the LCD should drive by Vwhite.
"Black state ":The state is that the LCD should drive by Vblack.
Vwhite: To be determined Vblack: To be determined
Note4:Definition of Response time
The response time is defined as the LCD optical switching time interval between "White"state and "Black" state. Rise time ($T_{ON}$)is the time between photo detector output intensity changed from 90% to 10%.And fall time ($T_{OFF}$)is the time between photo detector output intensity changed from 10% to90%.




Note5:Definition of color chromaticity（CIE1931）
Color coordinates measured at center point of LCD.
Note6: Definition of Luminance Uniformity
Active area is divided into 9 measuring areas(Refer Fig.2).Every measuring point is placed at the center of each measuring area.
Luminance Uniformity (U)=Lmin/Lmax
L--------Active area length W -------Active area width




L max: The measured Maximum luminance of all measurement position.
L min: The measured Minimum luminance of all measurement position.
Note7: Definition of luminance: Measure the luminance of white state at center point.

# 8. Environmental/Reliability Test

| No. | Test Item | Test Condition | Inspection after test |
|---|---|---|---|
| 1 | High Temperature Storage | 70±2℃/240 hours | Inspection after 2~4hours storage at room temperature, the sample shall be free from defects:<br>1.Air bubble in the LCD;<br>2.Sealleak;<br>3.Non-display;<br>4.missing segments;<br>5.Glass crack;<br>6.Current Idd is twice higher than initial value. |
| 2 | Low Temperature Storage | -20±2℃/240 hours | |
| 3 | High Temperature Operating | 60±2℃/240 hours | |
| 4 | Low Temperature Operating | -10±2℃/240 hours | |
| 5 | Temperature Cycle | -30℃~ 25℃~ 80℃ × 10cycles<br>(30min.) (5min.) (30min.) | |
| 6 | Damp Proof Test | 40℃±5℃×90%RH/240hours | |
| 7 | Vibration Test | Frequency：10Hz~55Hz~10Hz<br>Amplitude：1.5mm,<br>X，Y，Z direction for total 3hours<br>(Packing condition) | |
| 8 | Drooping test | Drop to the ground from 1m height, one time, every side of carton.<br>(Packing condition) | |
| 9 | ESD test | Voltage:±8KV R: 330Ω<br>C: 150pF<br>Air discharge, 10time | |
| | | Voltage:±6KV R: 330Ω<br>C: 150pF<br>Contact discharge, 10time | |

Remark:
1.The test samples should be applied to only one test item.
2.Sample size for each test item is 5~10pcs.
3.For Damp Proof Test, Pure water(Resistance＞10MΩ) should be used.
4.In case of malfunction defect caused by ESD damage, if it would be recovered to normal state after resetting, it would be judge as a good part.
5.Failure Judgment Criterion: Basic Specification, Electrical Characteristic, Mechanical Characteristic, Optical Characteristic.
6.Please use automatic switch menu(or roll menu) testing mode when test operating mode.

# 9. Packing Drawing (TBD)

# 10. Standard Specifications For Product Quality

## 10.1. Manner of test:

**10.1.1** The test must be under 40W fluorescent light, and the distance of view must be at 30±10cm.

**10.1.2** Room temperature 25±5℃ Humidity: (60±10)%RH.

## 10.2. Quality specification

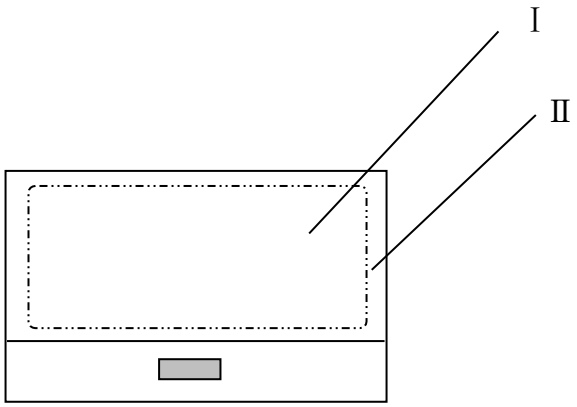
It shall be based on GB2828-87, inspection level II .

| | IETM | CHECK LEVEL | AQL |
|---|---|---|---|
| MAJOR (MA) | 1.Liquid crystal leakage<br>2.Wrong polarizer<br>3.Outside dimension<br>4. Bright dot、Dark dot<br>5. Display abnormal<br>6. Class crack | II | 0.25 |
| MINOR (MI) | 1. Spot Defect (Including black spot、white spot、 pinhole、foreign particle、bubbles、hurt）<br>2. fragment<br>3. Line Defect (Including black line、white ine、scratch)<br>4. Incision defect<br>5. Newton's ring<br>6. Other visual defects | II | 1.0 |

## 10.3. Definition of area:

**10.3.1** Ⅰ area: viewing area

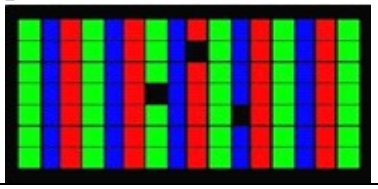
〃 area: outside viewing area



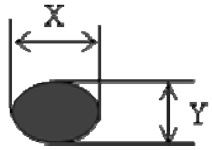
## 10.4. Standard of appearance test for Ⅰ area: (unit: mm)

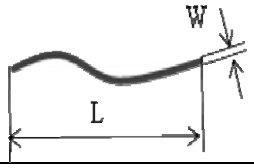
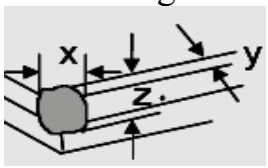
NOTE：Defect ignore for Ⅱ area.

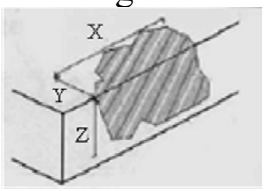
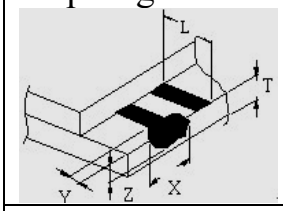
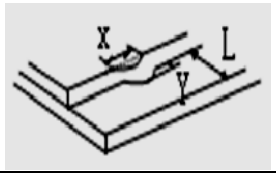
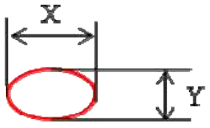
### 10.4.1 Bright/Dark Dots explain

| Name | Explain | Definition |
|---|---|---|
| Bright dot | Dots appear bright and unchanged in size in which LCD panel is displaying under black pattern   | The definition of dot: The size of a defective dot over 1/2 of single pixel dot is regarded as one defective dot .<br>NOTE: One pixel consists of 3 sub-pixels, including R,G, and B dot.(Sub-pixel = Dot) |
| Dark dot | Dots appear dark and unchanged in size in which LCD panel isdisplaying under pure red, green, blue pattern.  | |
| ADJACENT DOT | Adjacent two sub-pixel are defect（define two dot defect） | |

### 10.4.2 Inspection standard

| № | Items | Criterion | | Checking Manner | Defect Classes |
|---|---|---|---|---|---|
| 1 | Bright/dark dot | Under 6” (contain 6”) | Bright dot：2<br>Dark dot：N≤4<br>**Note:** be more than 5mm apart | Checking with eyes | MAJ |
| | | 6”-12” | Bright dot：N≤4<br>Dark dot：N≤5<br>Total Bright and Dark Dots：N≤8<br>**Note ：**<br>1.Two bright dot defects (red, green, blue, and white) should be larger than 15mm；<br>2.The distance between black dot defects or black and bright dot defects should be more than 5mm apart. | | |
| 2 | Spot Defect (Including black spot.white spot. Pinhole.foreign particle.bubbles.hurt）<br>  <br><br>D=(X+Y)/2 | Under 6” （contain 6”） | D≤0.1 Ignore 0.1<br>＜D≤0.35 N≤3<br>0.35＜D N=0 | Checking with eyes | MIN |
| | | 6”-12” | D≤0.3 Ignore 0.3<br>＜D≤0.6 N≤4<br>0.6＜D N=0 | | |

| № | Items | Criterion | | Checking manner | Defect classes |
|---|---|---|---|---|---|
| 3 | Line Defect (Including black Line.white line. scratch)   | Under 6” （contain 6”） | W≤0.02 Ignore 0.02＜W≤0.04 L≤5 N≤2<br>0.04＜W≤0.06 L≤5 N≤1<br>W＞0.06 N=0 | Checking with eyes | MIN |
| | | 6”-12” | W≤0.07 Ignore 0.07＜W≤0.1 L≤10 N≤4 W＞0.1 N=0 | | |
| 4 | Display abnormal | Not allowed | | Checking with eyes | MAJ |
| 5 | Outside dimension | Accord with drawing | | Callipers | MAJ |
| 6 | Class crack | Not allowed | | Checking with eyes | MAJ |
| 7 | Leak | Not allowed | | Checking with eyes | MAJ |
| 8 | Comer fragment   | X≤3 Y≤3 Z≤T Ignore<br>Note ：<br>1.No hurt identifying .wire.seal<br>2.T：Glass thickness X: Length Y: Width Z: thickness | | Checking with eyes | MIN |

| № | Items | Criterion | | Checking manner | Defect classes |
|---|---|---|---|---|---|
| 9 | Side fragment   | Y≤1 Z≤T Ignore<br>Note ：<br>1.No hurt identifying .wire.seal<br>2.T： Glass thickness X: Length Y: Width Z: thickness | | Checking with eyes | MIN |
| | Step fragment   | Y≤1 and Y≤1/4 L | | Checking with eyes | MIN |
| | Incision defect   | Y≤1 and accord with outside dimension | | Checking with eyes | MIN |
| 10 | Newton’s ring （CTP or Cover board）   D=(X+Y)/2 | Under 6 (contain 6”) | D≤25 N≤3<br>D＞25 N=0 | Checking with eyes | MIN |
| | | 6”-12” | D≤70 N≤5<br>D＞70 N=0 | | |

# 11. Precautions for Use of LCD Modules

## 11.1 Handing Precautions

(1) The display panel is made of glass and polarizer. As glass is fragile. It tends to become or chipped during handling especially on the edges. Please avoid dropping or jarring. Do not subject it to a mechanical shock by dropping it or impact.

(2) If the display panel is damaged and the liquid crystal substance leaks out, be sure not to get any in your mouth. If the substance contacts your skin or clothes, wash it off using soap and water.

(3) Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary. Do not touch the display with bare hands. This will stain the display area and degraded insulation between terminals (some cosmetics are determined to the polarizer).

(4) The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully. Do not touch, push or rub the exposed polarizers with anything harder than an HB pencil lead (glass,tweezers, etc.). Do not put or attach anything on the display area to avoid leaving marks on. Condensation on the surface and contact with terminals due to cold will damage, stain or dirty the polarizer. After products are tested at low temperature they must be warmed up in a container before coming is contacting with room temperature air.

(5) If the display surface becomes contaminated, breathe on the surface and gently wipe it with a soft dry cloth. If it is heavily contaminated, moisten cloth with one of the following solvents

- Isopropyl alcohol
- Ethyl alcohol

Do not scrub hard to avoid damaging the display surface.

(6) Solvents other than those above-mentioned may damage the polarizer. Especially, do not use the following.

- Water
- Ketone
- Aromatic solvents

Wipe off saliva or water drops immediately, contact with water over a long period of time may cause deformation or color fading. Avoid contacting oil and fats.

(7) Exercise care to minimize corrosion of the electrode. Corrosion of the electrodes is accelerated by water droplets, moisture condensation or a current flow in a high-humidity environment.

(8) Install the LCD Module by using the mounting holes. When mounting the LCD module make sure it is free of twisting, warping and distortion. In particular, do not forcibly pull or bend the I O cable
or the backlight cable.

(9) Do not attempt to disassemble or process the LCD module.

(10) NC terminal should be open. Do not connect anything.

(11) If the logic circuit power is off, do not apply the input signals.

(12) Electro-Static Discharge Control,Since this module uses a CMOS LSI, the same careful attention should be paid to electrostatic discharge as for an ordinary CMOS IC. To

prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.

- Before remove LCM from its packing case or incorporating it into a set, be sure the module and your body have the same electric potential.Be sure to ground the body when handling the LCD modules.

- Tools required for assembling, such as soldering irons, must be properly grounded. make certain the AC power source for the soldering iron does not leak. When using an electric screwdriver to attach LCM, the screwdriver should be of ground potentiality to minimize as much as possible any transmission of electromagnetic waves produced sparks coming from the commutator of the motor.

- To reduce the amount of static electricity generated, do not conduct assembling and other work under dry conditions. To reduce the generation of static electricity be careful that the air in the work is not too dried. A relative humidity of 50%-60% is recommended.As far as possible make the electric potential of your work clothes and that of the work bench the ground potential.

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.

(13)Since LCM has been assembled and adjusted with a high degree of precision, avoid applying excessive shocks to the module or making any alterations or modifications to it.

- Do not alter, modify or change the shape of the tab on the metal frame.
- Do not make extra holes on the printed circuit board, modify its shape or change the positions of components to be attached.
- Do not damage or modify the pattern writing on the printed circuit board.
- Absolutely do not modify the zebra rubber strip (conductive rubber) or heat seal connector.
- Except for soldering the interface, do not make any alterations or modifications with a soldering iron.
- Do not drop, bend or twist LCM.

## 11.2 Storage Precautions

When storing the LCD modules, the following precaution is necessary.

(1) Store them in a sealed polyethylene bag. If properly sealed, there is no need for the dessicant.

(2) Store them in a dark place. Do not expose to sunlight or fluorescent light, keep the temperature between 0°C and 35°C.

(3) The polarizer surface should not come in contact with any other objects. (We advise you to store them in the container in which they were shipped).

## 11.3 Others

Liquid crystals solidify under low temperature (below the storage temperature range) leading to defective orientation or the generation of air bubbles (black or white). Air bubbles may also be generated if the module is subject to a low temperature.

If the LCD modules have been operating for a long time showing the same display patterns, the display patterns may remain on the screen as ghost images and a slight contrast irregularity may also appear.A normal operating status can be regained by suspending use for some time. It should be noted that this phenomenon does not

adversely affect performance reliability.

To minimize the performance degradation of the LCD modules resulting from destruction caused by static electricity etc., exercise care to avoid holding the following sections when handling the modules.

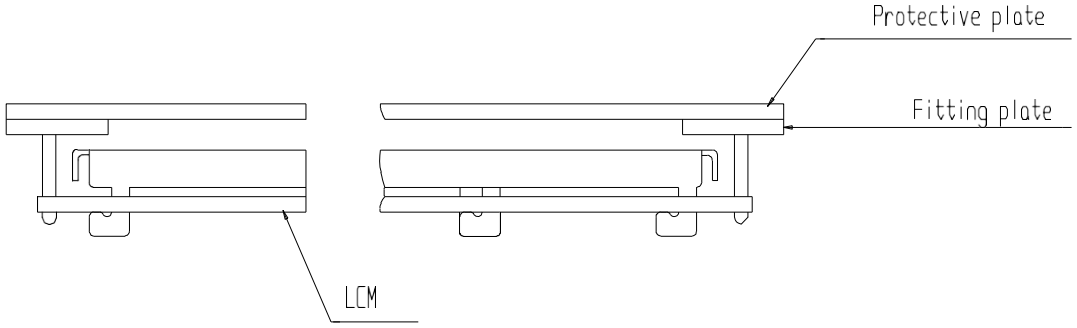
- Exposed area of the printed circuit board.
-Terminal electrode sections.

## 11.4 USING LCD MODULES

### Installing LCD Modules

The hole in the printed circuit board is used to fix LCM as shown in the picture below. Attend to the following items when installing the LCM.

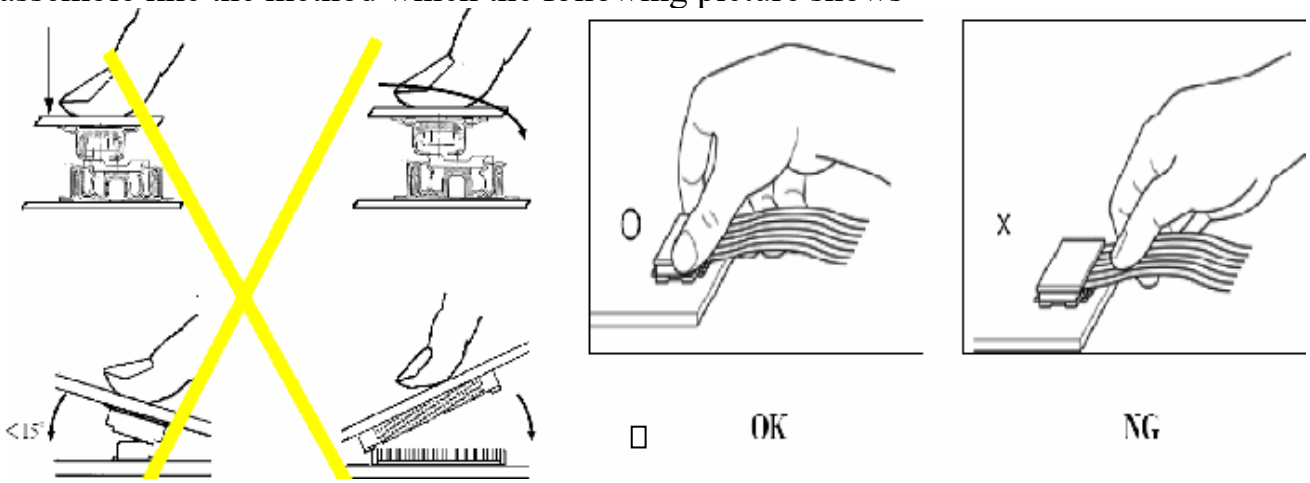
(1) Cover the surface with a transparent protective plate to protect the polarizer and LC cell.




(2) When assembling the LCM into other equipment, the spacer to the bit between the LCM and the fitting plate should have enough height to avoid causing stress to the module surface, refer to the individual specifications for measurements. The measurement tolerance should be ±0.1mm.

**Precaution for assemble the module with BTB connector:**

Please note the position of the male and female connector position,don't assemble or assemble like the method which the following picture shows




**Precaution for soldering to the LCM**

| | Hand soldering | Machine drag | Machine press soldering |
|---|---|---|---|
| No ROHS Product | 290°C~350°C.<br>Time : 3-5S. | 330°C ~350°C.<br>Speed : 4-8mm/s. | 300°C~330C.<br>Time : 3-6S.<br>Press: 0.8~1.2Mpa |

| | | | |
|---|---|---|---|
| ROHS Product | 340°C~370°C.<br>Time : 3-5S. | 350°C ~370°C.<br>Time : 4-8 mm/s. | 330°C~360C.<br>Time : 3-6S.<br>Press: 0.8~1.2Mpa |

(1) If soldering flux is used, be sure to remove any remaining flux after finishing to soldering operation. (This does not apply in the case of a non-halogen type of flux.) It is recommended that you protect the LCD surface with a cover during soldering to prevent any damage due to flux spatters.

(2) When soldering the electroluminescent panel and PC board, the panel and board should not be detached more than three times. This maximum number is determined by the temperature and time conditions mentioned above,though there may be some variance depending on the temperature of the soldering iron.

(3) When remove the electroluminescent panel from the PC board, be sure the solder has completely melted, the soldered pad on the PC board could be damaged.

**Precautions for Operation**

( 1) It is an indispensable condition to drive LCD's within the specified voltage limit since the higher voltage then the limit cause the shorter LCD life.An electrochemical reaction due to direct current causes LCD's undesirable deterioration, so that the use of direct current drive should be avoided.

(2) Response time will be extremely delayed at lower temperature than the operating temperature range and on the other hand at higher temperature LCD's show dark color in them.However those phenomena do not mean malfunction or out of order with LCD's, Which will come back in the specified operating temperature.

(3) If the display area is pushed hard during operation, the display will become abnormal. However, it will return to normal if it is turned off and then back on.

(4) A slight dew depositing on terminals is a cause for electro-chemical reaction resulting in terminal open circuit. Usage under the maximum operating temperature,50%RH or less is required.

(5) Input each signal after the positive/negative voltage becomes stable.

(6) Please keep the temperature within specified range for use and storage. Polarization degradation, bubble generation or polarizer peel-off may occur with high temperature and high humidity.

**Safety**

(1) It is recommended to crush damaged or unnecessary LCDs into pieces and wash them off with solvents such as acetone and ethanol, which should later be burned.

(2) If any liquid leaks out of a damaged glass cell and comes in contact with the hands, wash off thoroughly with soap and water.

(3) WEEE order must be executed in product scrap

# 12. Prior Consult Matter

1.①For standard products, we keep the right to change material, process ... for improving the product property without notice on our customer.

②For OEM products, if any change needed which may affect the product property, we will consult with our customer in advance.

2.If you have special requirement about reliability condition, please let us know before you start the test on our samples.

# 13. Factory

FACTORY NAME: LCD Mikroelektronik GmbH
FACTORY ADDRESS: Otto-Lilienthal-Str. 13, D-76275 Ettlingen