**MULTI-INNO TECHNOLOGY CO., LTD.**

**www.multi-inno.com**

# LCD MODULE SPECIFICATION

## Model : MI0283QT-8

**For Customer's Acceptance:**

| | |
|---|---|
| Customer | |
| Approved | |
| Comment | |

| | |
|---|---|
| Revision | 1.2 |
| Engineering | |
| Date | 2012-11-26 |
| Our Reference | |

## REVISION RECORD

| REV NO. | REV DATE | CONTENTS | REMARKS |
|---|---|---|---|
| 1.0 | 2011-06-03 | First release | |
| 1.1 | 2012-02-22 | Update Viewing Direction | |
| 1.2 | 2012-11-26 | Update Power Consumption | |
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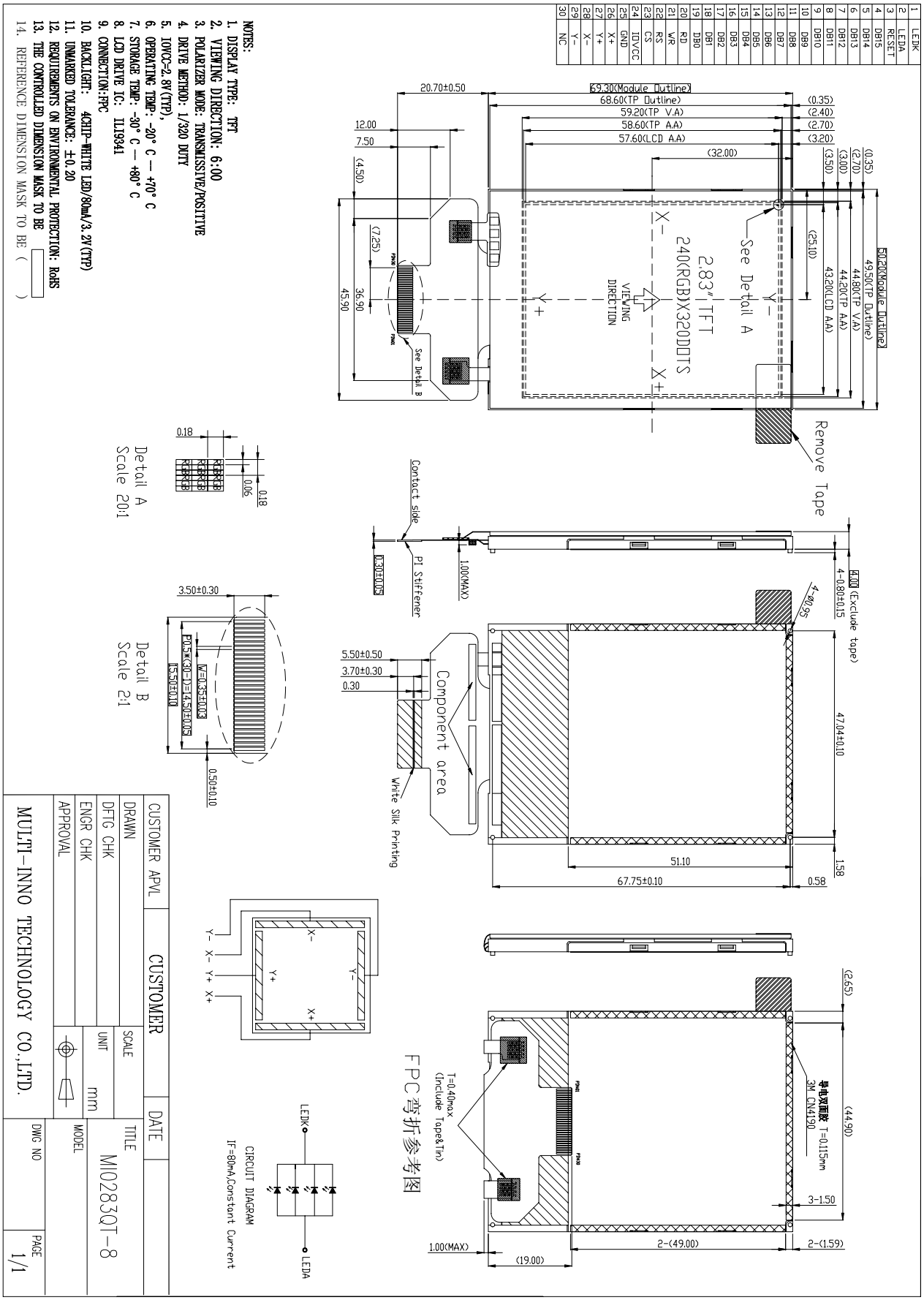
# CONTENTS

## ■ GENERAL INFORMATION

| Item | Contents | Unit/Note |
|---|---|---|
| LCD type | TFT/TRANSMISSIVE/POSITIVE | / |
| Viewing direction | 6:00 | O'Clock |
| Gray scale inversion direction | 12:00 | O'Clock |
| Module area (W × H) | 50.2×69.3×4.0 | $mm^2$ |
| Active area (W×H) | 43.2×57.6 | $mm^2$ |
| Number of Dots | 240(RGB)×320 | / |
| Pixel pitch(W × H) | 0.18 × 0.18 | $mm^2$ |
| DriverIC | ILI9341 | / |
| Colors | 65K/262K | / |
| Backlight Type | 4LED | / |
| Module Power consumption | 220 | mw |
| InterfaceType | 16bit CPU | / |
| Input voltage | 2.8 | V |
| Weight | 24.16 | g |

Note 1:Viewing direction for best image quality is different from TFT definition, there is a 180 degree shift.
Note 2 : RoHS compliant;
Note 3: LCM weight tolerance: ± 5% .

## ■ EXTERNAL DIMENSIONS



## ■ABSOLUTE MAXIMUM RATINGS

| Parameter | Symbol | Min | Max | Unit |
|---|---|---|---|---|
| Power supply voltage | VCI | -0.3 | 4.6 | V |
| Logic signal voltage | VDDI | -0.3 | 4.6 | V |
| Operatingtemperature | Top | -20 | 70 | °C |
| Storagetemperature | TST | -30 | 80 | °C |
| Humidity | RH | - | 90%(Max60 °C) | RH |

## ■ELECTRICAL CHARACTERISTICS

DC CHARACTERISTICS

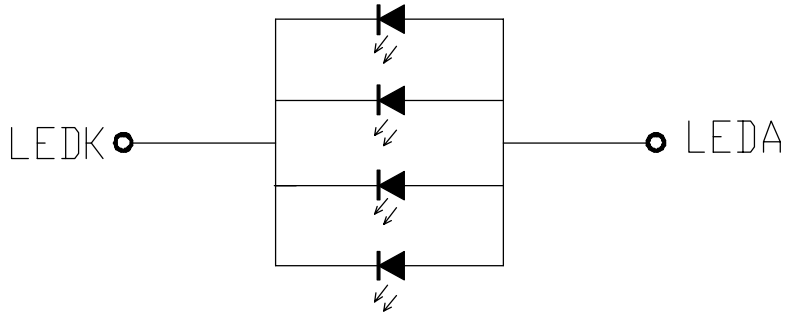
| Parameter | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| Power supply voltage | VCI | 2.5 | 2.8 | 3.3 | V |
| Logic signalI/O voltage | VDDI | 1.65 | 2.8 | 3.3 | V |
| Inputvoltage'H'level | VIH | 0.7VDDI | - | VDDI | V |
| Inputvoltage'L'level | VIL | VSS | - | 0.3VDDI | V |
| Outputvoltage'H'level | VOH | 0.8VDDI | - | VDDI | V |
| Outputvoltage'L'leve | VOL | VSS0 | - | 0.2VDDI | V |

Note:
1: Display full white. Backlight on state.
2: IC on standby mode.
3: the default voltage is 2.8V, for N lights in series, the power is that the current multiply N.

## ■ BACKLIGHT CHARACTERISTICS

| Item | | Symbol | Condition | Min | Typ | Max | Unit | Note |
|---|---|---|---|---|---|---|---|---|
| Supply voltage | | Vf | If=80mA | - | 3.2 | - | V | |
| Supply current | | - | - | - | - | - | mA | |
| Reverse voltage | | $V_r$ | - | - | - | - | V | |
| Forward current | Normal | $I_{pn}$ | 4-chip Parallel | | 80 | - | mA | 1 |
| | Dimming | $I_{pd}$ | | | | | | |
| Reverse Current | | $I_r$ | - | - | - | - | μA | |
| Uniformity | | △Bp | $I_f$=80mA | 80% | | | | |
| Color coordinate* | | X | | 0.270 | - | 0.315 | - | |
| | | Y | | 0.270 | - | 0.315 | - | |

White LED CIRCUIT DIAGRAM:




CIRCUIT DIAGRAM
If=80mA,Constant Current

NOTE:

1 The LED 's driver mode needs to be constant current mode.

2 Permanent damage to the device may occur if maximum values are exceeded or reverse voltage is loaded .Functional operation should be restricted to the conditions described under normal operating conditions.

## ■ELECTRO-OPTICAL CHARACTERISTICS

| Item | Symbol | Condition | Min | Typ | Max | Unit | Remark | Note |
|---|---|---|---|---|---|---|---|---|
| Response time | Tr +Tf | θ=0° ∅=0° Ta=25℃ | - | 50 | 80 | ms | Fig.1 | 4 |
| Contrastratio | Cr | | - | 500 | - | — | FIG 2. | 1 |
| Luminance uniformity | δ WHITE | | 80 | 90.8 | - | % | FIG 2. | 3 |
| Surface Luminance | Lv | | 150 | 240 | - | cd/m$^2$ | FIG 2. | 2 |
| Viewing angle range | θ | ∅ = 90° | - | 70 | - | deg | FIG 3. | 6 |
| | | ∅ = 270° | - | 57 | - | deg | FIG 3. | |
| | | ∅ = 0° | - | 70 | - | deg | FIG 3. | |
| | | ∅ = 180° | - | 70 | - | deg | FIG 3. | |
| CIE (x, y) chromaticity | Red x | θ=0° ∅=0° Ta=25℃ | - | 0.6368 | - | | FIG 2. | 5 |
| | Red y | | - | 0.3329 | - | | | |
| | Green x | | - | 0.3397 | - | | | |
| | Green y | | - | 0.6138 | - | | | |
| | Blue x | | - | 0.1433 | - | | | |
| | Blue y | | - | 0.0807 | - | | | |
| | White x | | - | 0.2886 | - | | | |
| | White y | | - | 0.3194 | - | | | |
| NTSC Ratio | S | | 55 | 67 | - | % | | |

Note 1. Contrast Ratio(CR) is defined mathematically as For more information see FIG 2.:

$$\textbf{Contrast Ratio} = \frac{\text{Average Surface Luminance with all white pixels } (P_1, P_2, P_3, P_4, P_5)}{\text{Average Surface Luminance with all black pixels } (P_1, P_2, P_3, P_4, P_5)}$$

Note 2. Surface luminance is the LCD surface from the surface with all pixels displaying white. For more information see FIG 2.

**Lv = Average** Surface Luminance with all white pixels $(P_1, P_2, P_3, P_4, P_5)$

Note 3. The uniformity in surface luminance , δ WHITE is determined by measuring luminance at each test position 1 through 5, and then dividing the maximum luminance of 5 points luminance by minimum luminance of 5 points luminance. For more information see FIG 2.

$$\delta\ \textbf{WHITE} = \frac{\textbf{Minimum Surface Luminance with all white pixels } (P_1, P_2, P_3, P_4, P_5)}{\textbf{Maximum Surface Luminance with all white pixels } (P_1, P_2, P_3, P_4, P_5)}$$

Note 4. Response time is the time required for the display to transition from White to black(Rise Time, Tr) and from black to white(Decay Time, Tf). For additional information see FIG 1. The test equipment is Autronic-Melchers's ConoScope. Series

Note 5. CIE (x, y) chromaticity,The x,y value is determined by measuring luminance at each test position 1 through 5,and then make average value

Note 6. Viewing angle is the angle at which the contrast ratio is greater than 2. For TFT module the conrast ratio is greater than 10. The angles are determined for the horizontal or x axis and the vertical or y axis with respect to the z axis which is normal to the LCD surface. For more information see FIG 3.

Note 7. For Viewing angle and response time testing, the testing data is base on Autronic-Melchers's ConoScope. Series Instruments. For contrast ratio, Surface Luminance, Luminance uniformity,CIE The test data is base on TOPCON's BM-5 photo detector.

Note 8. For TFT module, Gray scale reverse occurs in the direction of panel viewing angle.

**FIG.1. The definition of Response Time**

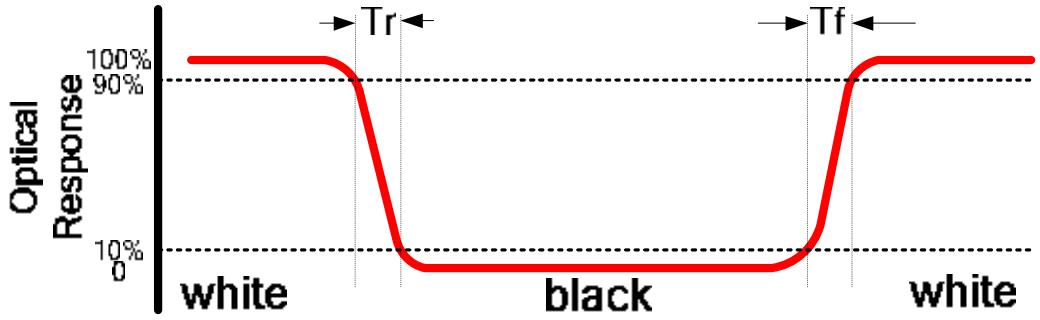



**FIG.2. Measuring method for Contrast ratio,surface luminance, Luminance uniformity ， CIE (x, y) chromaticity**

A : 5 mm
B : 5 mm
H,V : Active Area
Light spot size ∅=5mm, 500mm distance from the LCD surface to detector lens
measurement instrument is TOPCON's luminance meter BM-5

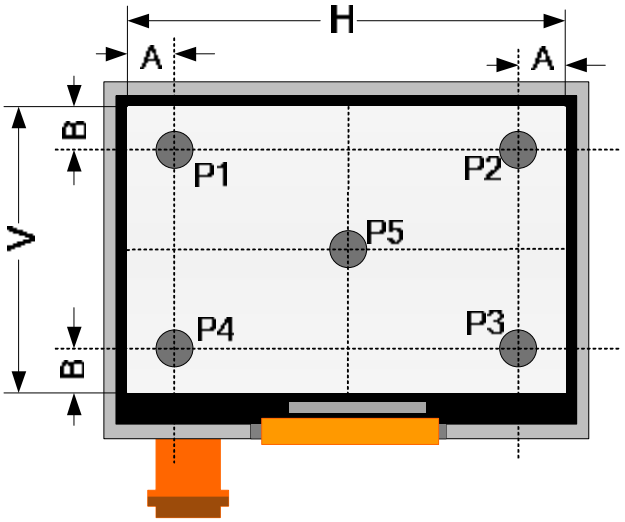
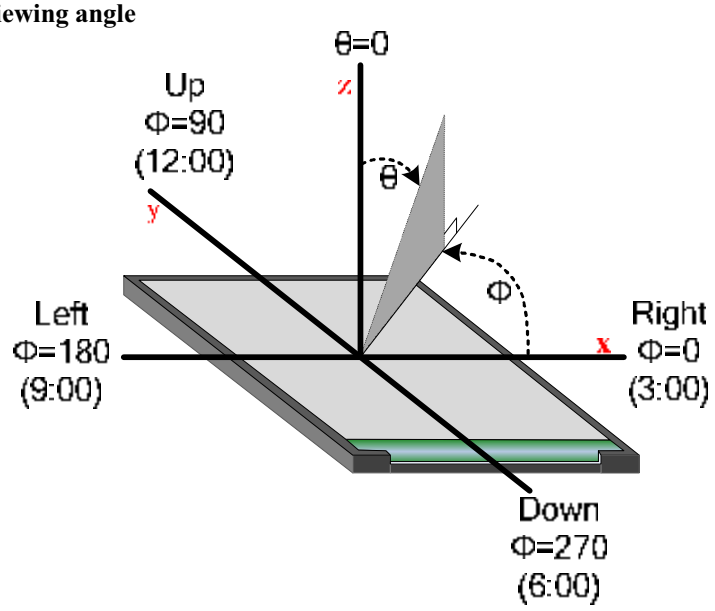



**FIG.3. The definition of viewing angle**



## ■ INTERFACE DESCRIPTION

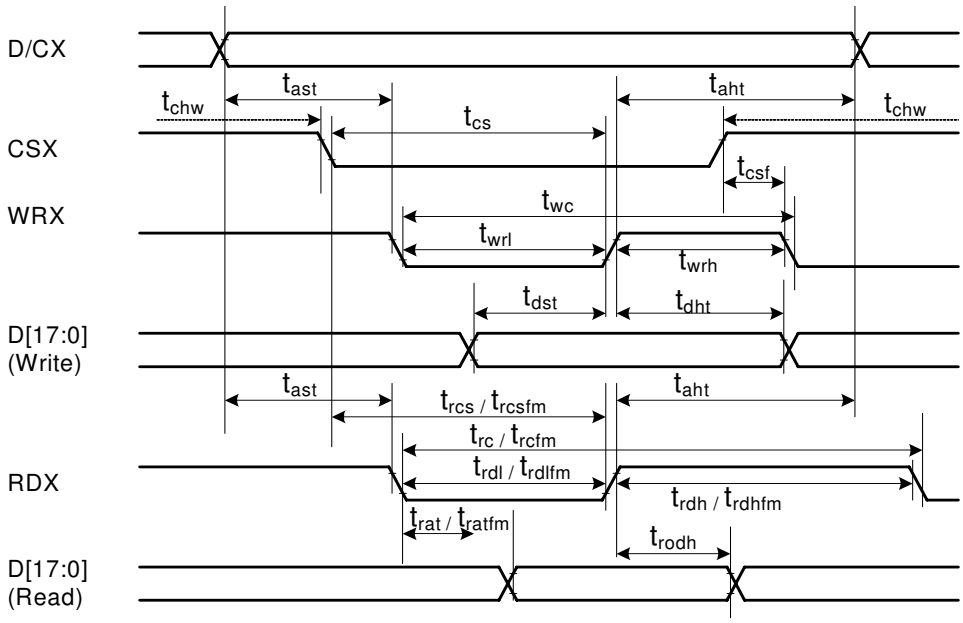
| Pin No. | Symbol | I/O | Function |
|---|---|---|---|
| 1 | LEDA | P | Anode for LED backlighting |
| 2 | LEDK | P | Cathode for LED backlighting |
| 3 | /RESET | I | Reset pin |
| 4 | DB15 | IO | 16bit- Parallel data |
| 5 | DB14 | IO | |
| 6 | DB13 | IO | |
| 7 | DB12 | IO | |
| 8 | DB11 | IO | |
| 9 | DB10 | IO | |
| 10 | DB9 | IO | |
| 11 | DB8 | IO | |
| 12 | DB7 | IO | |
| 13 | DB6 | IO | |
| 14 | DB5 | IO | |
| 15 | DB4 | IO | |
| 16 | DB3 | IO | |
| 17 | DB2 | IO | |
| 18 | DB1 | IO | |
| 19 | DB0 | IO | |
| 20 | RD | I | Read execution control pin |
| 21 | WR | I | Write execution control pin |
| 22 | RS | I | Register select signal |
| 23 | CS | I | Chip Select Signal |
| 24 | IOVCC | P | Logic power ,provide with 2.8V |
| 25 | GND | G | Ground |
| 26 | X+ | O | Touch panel output |
| 27 | Y+ | O | Touch panel output |
| 28 | X- | O | Touch panel output |
| 29 | Y- | O | Touch panel output |
| 30 | NC | - | No Connect |

# ■ APPLICATION NOTES

## 1.1 Interface Timing Chart

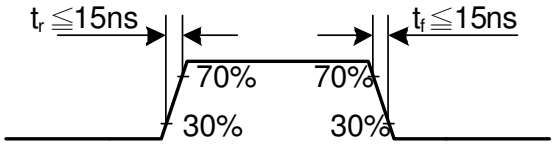
Note: Please refer to ILITEK's ILI9341 data sheet for more details.

ILITEK's ILI9341 INTERFACE PROTOCOL Inter 80 system CPU interface




| Signal | Symbol | Parameter | min | max | Unit | Description |
|---|---|---|---|---|---|---|
| DCX | tast | Address setup time | 0 | - | ns | |
| | taht | Address hold time (Write/Read) | 0 | - | ns | |
| CSX | tchw | CSX "H" pulse width | 0 | - | ns | |
| | tcs | Chip Select setup time (Write) | 15 | - | ns | |
| | trcs | Chip Select setup time (Read ID) | 45 | - | ns | |
| | trcsfm | Chip Select setup time (Read FM) | 355 | - | ns | |
| | tcsf | Chip Select Wait time (Write/Read) | 10 | - | ns | |
| WRX | twc | Write cycle | 66 | - | ns | |
| | twrh | Write Control pulse H duration | 15 | - | ns | |
| | twrl | Write Control pulse L duration | 15 | - | ns | |
| RDX (FM) | trcfm | Read Cycle (FM) | 450 | - | ns | |
| | trdhfm | Read Control H duration (FM) | 90 | - | ns | |
| | trdlfm | Read Control L duration (FM) | 355 | - | ns | |
| RDX (ID) | trc | Read cycle (ID) | 160 | - | ns | |
| | trdh | Read Control pulse H duration | 90 | - | ns | |
| | trdl | Read Control pulse L duration | 45 | - | ns | |
| D[17:0], D[17:10]&D[8:1], D[17:10], D[17:9] | tdst | Write data setup time | 10 | - | ns | For maximum CL=30pF For minimum CL=8pF |
| | tdht | Write data hold time | 10 | - | ns | |
| | trat | Read access time | - | 40 | ns | |
| | tratfm | Read access time | - | 340 | ns | |
| | trod | Read output disable time | 20 | 80 | ns | |

*Note: Ta = -30 to 70 ℃, VDDI=1.65V to 3.3V, VCI=2.5V to 3.3V, VSS=0V.*



## INSTRUCTION DESCRIPTION(ILITEK's ILI9341

| Regulative Command Set | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Command Function | D/CX | RDX | WRX | D17-8 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | Hex |
| No Operation | 0 | 1 | ↑ | XX | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 00h |
| Software Reset | 0 | 1 | ↑ | XX | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 01h |
| Read Display Identification Information | 0 | 1 | ↑ | XX | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 04h |
| | 1 | ↑ | 1 | XX | X | X | X | X | X | X | X | X | XX |
| | 1 | ↑ | 1 | XX | ID1 [7:0] | | | | | | | | XX |
| | 1 | ↑ | 1 | XX | ID2 [7:0] | | | | | | | | XX |
| | 1 | ↑ | 1 | XX | ID3 [7:0] | | | | | | | | XX |
| Read Display Status | 0 | 1 | ↑ | XX | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 09h |
| | 1 | ↑ | 1 | XX | X | X | X | X | X | X | X | X | XX |
| | 1 | ↑ | 1 | XX | D [31:25] | | | | | | | X | 00 |
| | 1 | ↑ | 1 | XX | X | D [22:20] | | | D [19:16] | | | | 61 |
| | 1 | ↑ | 1 | XX | X | X | X | X | X | D [10:8] | | | 00 |
| | 1 | ↑ | 1 | XX | D [7:5] | | | X | X | X | X | X | 00 |
| Read Display Power Mode | 0 | 1 | ↑ | XX | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0Ah |
| | 1 | ↑ | 1 | XX | X | X | X | X | X | X | X | X | XX |
| | 1 | ↑ | 1 | XX | D [7:2] | | | | | | 0 | 0 | 08 |
| Read Display MADCTL | 0 | 1 | ↑ | XX | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 0Bh |
| | 1 | ↑ | 1 | XX | X | X | X | X | X | X | X | X | XX |
| | 1 | ↑ | 1 | XX | D [7:2] | | | | | | 0 | 0 | 00 |
| Read Display Pixel Format | 0 | 1 | ↑ | XX | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0Ch |
| | 1 | ↑ | 1 | XX | X | X | X | X | X | X | X | X | XX |
| | 1 | ↑ | 1 | XX | RIM | DPI [2:0] | | | X | DBI [2:0] | | | 06 |
| Read Display Image Format | 0 | 1 | ↑ | XX | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 0Dh |
| | 1 | ↑ | 1 | XX | X | X | X | X | X | X | X | X | XX |
| | 1 | ↑ | 1 | XX | X | X | X | X | X | D [2:0] | | | 00 |
| Read Display Signal Mode | 0 | 1 | ↑ | XX | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0Eh |
| | 1 | ↑ | 1 | XX | X | X | X | X | X | X | X | X | XX |
| | 1 | ↑ | 1 | XX | D [7:2] | | | | | | 0 | 0 | 00 |
| Read Display Self-Diagnostic Result | 0 | 1 | ↑ | XX | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0Fh |
| | 1 | ↑ | 1 | XX | X | X | X | X | X | X | X | X | XX |
| | 1 | ↑ | 1 | XX | D [7:6] | | X | X | X | X | X | X | 00 |
| Enter Sleep Mode | 0 | 1 | ↑ | XX | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 10h |
| Sleep OUT | 0 | 1 | ↑ | XX | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 11h |
| Partial Mode ON | 0 | 1 | ↑ | XX | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 12h |
| Normal Display Mode ON | 0 | 1 | ↑ | XX | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 13h |
| Display Inversion OFF | 0 | 1 | ↑ | XX | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 20h |
| Display Inversion ON | 0 | 1 | ↑ | XX | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 21h |
| Gamma Set | 0 | 1 | ↑ | XX | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 26h |
| | 1 | 1 | ↑ | XX | GC [7:0] | | | | | | | | 01 |
| Display OFF | 0 | 1 | ↑ | XX | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 28h |
| Display ON | 0 | 1 | ↑ | XX | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 29h |
| Column Address Set | 0 | 1 | ↑ | XX | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 2Ah |
| | 1 | 1 | ↑ | XX | SC [15:8] | | | | | | | | XX |
| | 1 | 1 | ↑ | XX | SC [7:0] | | | | | | | | XX |
| | 1 | 1 | ↑ | XX | EC [15:8] | | | | | | | | XX |
| | 1 | 1 | ↑ | XX | EC [7:0] | | | | | | | | XX |
| Page Address Set | 0 | 1 | ↑ | XX | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 2Bh |
| | 1 | 1 | ↑ | XX | SP [15:8] | | | | | | | | XX |
| | 1 | 1 | ↑ | XX | SP [7:0] | | | | | | | | XX |
| | 1 | 1 | ↑ | XX | EP [15:8] | | | | | | | | XX |
| | 1 | 1 | ↑ | XX | EP [7:0] | | | | | | | | XX |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Memory Write | 0 | 1 | ↑ | XX | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 2Ch |
| | 1 | 1 | ↑ | D [17:0] | | | | | | | | | XX |
| Color SET | 0 | 1 | ↑ | XX | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 2Dh |
| | 1 | ↑ | 1 | XX | | | R00 [5:0] | | | | | | XX |
| | 1 | ↑ | 1 | XX | | | Rnn [5:0] | | | | | | XX |
| | 1 | ↑ | 1 | XX | | | R31 [5:0] | | | | | | XX |
| | 1 | ↑ | 1 | XX | | | G00 [5:0] | | | | | | XX |
| | 1 | ↑ | 1 | XX | | | Gnn [5:0] | | | | | | XX |
| | 1 | ↑ | 1 | XX | | | G64 [5:0] | | | | | | XX |
| | 1 | ↑ | 1 | XX | | | B00 [5:0] | | | | | | XX |
| | 1 | ↑ | 1 | XX | | | Bnn [5:0] | | | | | | XX |
| | 1 | ↑ | 1 | XX | | | B31 [5:0] | | | | | | XX |
| Memory Read | 0 | 1 | ↑ | XX | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | 2Eh |
| | 1 | ↑ | 1 | XX | X | X | X | X | X | X | X | X | XX |
| | 1 | ↑ | 1 | D [17:0] | | | | | | | | | XX |
| Partial Area | 0 | 1 | ↑ | XX | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 30h |
| | 1 | 1 | ↑ | XX | SR [15:8] | | | | | | | | 00 |
| | 1 | 1 | ↑ | XX | SR [7:0] | | | | | | | | 00 |
| | 1 | 1 | ↑ | XX | ER [15:8] | | | | | | | | 01 |
| | 1 | 1 | ↑ | XX | ER [7:0] | | | | | | | | 3F |
| Vertical Scrolling Definition | 0 | 1 | ↑ | XX | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 33h |
| | 1 | 1 | ↑ | XX | TFA [15:8] | | | | | | | | 00 |
| | 1 | 1 | ↑ | XX | TFA [7:0] | | | | | | | | 00 |
| | 1 | 1 | ↑ | XX | VSA [15:8] | | | | | | | | 01 |
| | 1 | 1 | ↑ | XX | VSA [7:0] | | | | | | | | 40 |
| | 1 | 1 | ↑ | XX | BFA [15:8] | | | | | | | | 00 |
| | 1 | 1 | ↑ | XX | BFA [7:0] | | | | | | | | 00 |
| Tearing Effect Line OFF | 0 | 1 | ↑ | XX | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 34h |
| Tearing Effect Line ON | 0 | 1 | ↑ | XX | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 1 | 35h |
| | 1 | 1 | ↑ | XX | X | X | X | X | X | X | X | M | 00 |
| Memory Access Control | 0 | 1 | ↑ | XX | 0 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 36h |
| | 1 | 1 | ↑ | XX | MY | MX | MV | ML | BGR | MH | X | X | 00 |
| Vertical Scrolling Start Address | 0 | 1 | ↑ | XX | 0 | 0 | 1 | 1 | 0 | 1 | 1 | 1 | 37h |
| | 1 | 1 | ↑ | XX | VSP [15:8] | | | | | | | | 00 |
| | 1 | 1 | ↑ | XX | VSP [7:0] | | | | | | | | 00 |
| Idle Mode OFF | 0 | 1 | ↑ | XX | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 38h |
| Idle Mode ON | 0 | 1 | ↑ | XX | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 1 | 39h |
| Pixel Format Set | 0 | 1 | ↑ | XX | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 0 | 3Ah |
| | 1 | 1 | ↑ | XX | X | DPI [2:0] | | | X | DBI [2:0] | | | 66 |
| Write Memory Continue | 0 | 1 | ↑ | XX | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 3Ch |
| | 1 | 1 | ↑ | D [17:0] | | | | | | | | | XX |
| Read Memory Continue | 0 | 1 | ↑ | XX | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 3Eh |
| | 1 | ↑ | 1 | XX | X | X | X | X | X | X | X | X | XX |
| | 1 | ↑ | 1 | D [17:0] | | | | | | | | | XX |
| Set Tear Scanline | 0 | 1 | ↑ | XX | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 44h |
| | 1 | 1 | ↑ | XX | X | X | X | X | X | X | X | STS [8] | 00 |
| | 1 | 1 | ↑ | XX | STS [7:0] | | | | | | | | 00 |
| Get Scanline | 0 | 1 | ↑ | XX | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 45h |
| | 1 | ↑ | 1 | XX | X | X | X | X | X | X | X | X | XX |
| | 1 | ↑ | 1 | XX | X | X | X | X | X | X | GTS [9:8] | | 00 |
| | 1 | ↑ | 1 | XX | GTS [7:0] | | | | | | | | 00 |
| Write Display Brightness | 0 | 1 | ↑ | XX | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 51h |
| | 1 | 1 | ↑ | XX | DBV [7:0] | | | | | | | | 00 |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Read Display Brightness | 0 | 1 | ↑ | XX | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 52h |
| | 1 | ↑ | 1 | XX | X | X | X | X | X | X | X | X | XX |
| | 1 | ↑ | 1 | XX | DBV [7:0] | | | | | | | | 00 |
| Write CTRL Display | 0 | 1 | ↑ | XX | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 1 | 53h |
| | 1 | 1 | ↑ | XX | X | X | BCTRL | X | DD | BL | X | X | 00 |
| Read CTRL Display | 0 | 1 | ↑ | XX | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 54h |
| | 1 | ↑ | 1 | XX | X | X | X | X | X | X | X | X | XX |
| | 1 | ↑ | 1 | XX | X | X | BCTRL | X | DD | BL | X | X | 00 |
| Write Content Adaptive Brightness Control | 0 | 1 | ↑ | XX | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 55h |
| | 1 | 1 | ↑ | XX | X | X | X | X | X | X | C [1:0] | | 00 |
| Read Content Adaptive Brightness Control | 0 | 1 | ↑ | XX | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 56h |
| | 1 | ↑ | 1 | XX | X | X | X | X | X | X | X | X | XX |
| | 1 | ↑ | 1 | XX | X | X | X | X | X | X | C [1:0] | | 00 |
| Write CABC Minimum Brightness | 0 | 1 | ↑ | XX | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 5Eh |
| | 1 | 1 | ↑ | XX | CMB [7:0] | | | | | | | | 00 |
| Read CABC Minimum Brightness | 0 | 1 | ↑ | XX | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 1 | 5Fh |
| | 1 | ↑ | 1 | XX | X | X | X | X | X | X | X | X | XX |
| | 1 | ↑ | 1 | XX | CMB [7:0] | | | | | | | | 00 |
| Read ID1 | 0 | 1 | ↑ | XX | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | DAh |
| | 1 | ↑ | 1 | XX | X | X | X | X | X | X | X | X | XX |
| | 1 | ↑ | 1 | XX | Module's Manufacture [7:0] | | | | | | | | XX |
| Read ID2 | 0 | 1 | ↑ | XX | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | DBh |
| | 1 | ↑ | 1 | XX | X | X | X | X | X | X | X | X | XX |
| | 1 | ↑ | 1 | XX | LCD Module / Driver Version [7:0] | | | | | | | | XX |
| Read ID3 | 0 | 1 | ↑ | XX | 1 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | DCh |
| | 1 | ↑ | 1 | XX | X | X | X | X | X | X | X | X | XX |
| | 1 | ↑ | 1 | XX | LCD Module / Driver ID [7:0] | | | | | | | | XX |

| **Extended Command Set** | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Command Function | D/CX | RDX | WRX | D17-8 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | Hex |
| RGB Interface Signal Control | 0 | 1 | ↑ | XX | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | B0h |
| | 1 | 1 | ↑ | XX | ByPass_MODE | RCM [1:0] | | X | VSPL | HSPL | DPL | EPL | 40 |
| Frame Control (In Normal Mode) | 0 | 1 | ↑ | XX | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | B1h |
| | 1 | 1 | ↑ | XX | X | X | X | X | X | X | DIVA [1:0] | | 00 |
| | 1 | 1 | ↑ | XX | X | X | X | RTNA [4:0] | | | | | 1B |
| Frame Control (In Idle Mode) | 0 | 1 | ↑ | XX | 1 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | B2h |
| | 1 | 1 | ↑ | XX | X | X | X | X | X | X | DIVB [1:0] | | 00 |
| | 1 | 1 | ↑ | XX | X | X | X | RTNB [4:0] | | | | | 1B |
| Frame Control (In Partial Mode) | 0 | 1 | ↑ | XX | 1 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | B3h |
| | 1 | 1 | ↑ | XX | X | X | X | X | X | X | DIVC [1:0] | | 00 |
| | 1 | 1 | ↑ | XX | X | X | X | RTNC [4:0] | | | | | 1B |
| Display Inversion Control | 0 | 1 | ↑ | XX | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | B4h |
| | 1 | 1 | ↑ | XX | X | X | X | X | X | NLA | NLB | NLC | 02 |
| Blanking Porch Control | 0 | 1 | ↑ | XX | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 1 | B5h |
| | 1 | 1 | ↑ | XX | 0 | VFP [6:0] | | | | | | | 02 |
| | 1 | 1 | ↑ | XX | 0 | VBP [6:0] | | | | | | | 02 |
| | 1 | 1 | ↑ | XX | 0 | 0 | 0 | HFP [4:0] | | | | | 0A |
| | 1 | 1 | ↑ | XX | 0 | 0 | 0 | HBP [4:0] | | | | | 14 |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Display Function Control | 0 | 1 | ↑ | XX | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | B6h |
| | 1 | 1 | ↑ | XX | X | X | X | X | PTG [1:0] | | PT [1:0] | | 0A |
| | 1 | 1 | ↑ | XX | REV | GS | SS | SM | ISC [3:0] | | | | 82 |
| | 1 | 1 | ↑ | XX | X | X | NL [5:0] | | | | | | 27 |
| | 1 | 1 | ↑ | XX | X | X | PCDIV [5:0] | | | | | | XX |
| Entry Mode Set | 0 | 1 | ↑ | XX | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 1 | B7h |
| | 1 | 1 | ↑ | XX | X | X | X | X | DSTB | GON | DTE | GAS | 07 |
| Backlight Control 1 | 0 | 1 | ↑ | XX | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | B8h |
| | 1 | 1 | ↑ | XX | X | X | X | X | X | X | X | X | XX |
| | 1 | 1 | ↑ | XX | X | X | X | X | TH_UI [3:0] | | | | 04 |
| Backlight Control 2 | 0 | 1 | ↑ | XX | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 1 | B9h |
| | 1 | 1 | ↑ | XX | X | X | X | X | X | X | X | X | XX |
| | 1 | 1 | ↑ | XX | TH_MV [3:0] | | | | TH_ST [3:0] | | | | B8 |
| Backlight Control 3 | 0 | 1 | ↑ | XX | 1 | 0 | 1 | 1 | 1 | 0 | 1 | 0 | BAh |
| | 1 | 1 | ↑ | XX | X | X | X | X | X | X | X | X | XX |
| | 1 | 1 | ↑ | XX | X | X | X | X | DTH_UI [3:0] | | | | 04 |
| Backlight Control 4 | 0 | 1 | ↑ | XX | 1 | 0 | 1 | 1 | 1 | 0 | 1 | 1 | BBh |
| | 1 | 1 | ↑ | XX | X | X | X | X | X | X | X | X | XX |
| | 1 | 1 | ↑ | XX | DTH_MV [3:0] | | | | DTH_ST [3:0] | | | | C9 |
| Backlight Control 5 | 0 | 1 | ↑ | XX | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | BCh |
| | 1 | 1 | ↑ | XX | X | X | X | X | X | X | X | X | XX |
| | 1 | 1 | ↑ | XX | DIM2 [3:0] | | | | X | DIM1 [2:0] | | | 44 |
| Backlight Control 7 | 0 | 1 | ↑ | XX | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | BEh |
| | 1 | 1 | ↑ | XX | PWM_DIV [7:0] | | | | | | | | 0F |
| Backlight Control 8 | 0 | 1 | ↑ | XX | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | BFh |
| | 1 | 1 | ↑ | XX | X | X | X | X | X | LEDONR | LEDONPOL | LEDPWMOPL | 00 |
| Power Control 1 | 0 | 1 | ↑ | XX | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | C0h |
| | 1 | 1 | ↑ | XX | X | X | VRH [5:0] | | | | | | 26 |
| Power Control 2 | 0 | 1 | ↑ | XX | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | C1h |
| | 1 | 1 | ↑ | XX | X | X | X | X | X | BT [2:0] | | | 00 |
| VCOM Control 1 | 0 | 1 | ↑ | XX | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | C5h |
| | 1 | 1 | ↑ | XX | X | VMH [6:0] | | | | | | | 31 |
| | 1 | 1 | ↑ | XX | X | VML [6:0] | | | | | | | 3C |
| VCOM Control 2 | 0 | 1 | ↑ | XX | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | C7h |
| | 1 | 1 | ↑ | XX | nVM | VMF [6:0] | | | | | | | C0 |
| NV Memory Write | 0 | 1 | ↑ | XX | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | D0h |
| | 1 | 1 | ↑ | XX | X | X | X | X | X | PGM_ADR [2:0] | | | 00 |
| | 1 | 1 | ↑ | XX | PGM_DATA [7:0] | | | | | | | | XX |
| NV Memory Protection Key | 0 | 1 | ↑ | XX | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | D1h |
| | 1 | 1 | ↑ | XX | KEY [23:16] | | | | | | | | 55 |
| | 1 | 1 | ↑ | XX | KEY [15:8] | | | | | | | | AA |
| | 1 | 1 | ↑ | XX | KEY [7:0] | | | | | | | | 66 |
| NV Memory Status Read | 0 | 1 | ↑ | XX | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | D2h |
| | 1 | ↑ | 1 | XX | X | X | X | X | X | X | X | X | XX |
| | 1 | ↑ | 1 | XX | X | ID2_CNT [2:0] | | | X | ID1_CNT [2:0] | | | XX |
| | 1 | ↑ | 1 | XX | BUSY | VMF_CNT [2:0] | | | X | ID3_CNT [2:0] | | | XX |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Read ID4 | 0 | ↑ | 1 | XX | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 1 | D3h |
| | 1 | ↑ | 1 | XX | X | X | X | X | X | X | X | X | XX |
| | 1 | ↑ | 1 | XX | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 00 |
| | 1 | ↑ | 1 | XX | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 93 |
| | 1 | ↑ | 1 | XX | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 41 |
| Positive Gamma Correction | 0 | 1 | ↑ | XX | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | E0h |
| | 1 | 1 | ↑ | XX | X | X | X | X | VP0 [3:0] | | | | 08 |
| | 1 | 1 | ↑ | XX | X | X | VP1 [5:0] | | | | | | 0E |
| | 1 | 1 | ↑ | XX | X | X | VP2 [5:0] | | | | | | 12 |
| | 1 | 1 | ↑ | XX | X | X | X | X | VP4 [3:0] | | | | 05 |
| | 1 | 1 | ↑ | XX | X | X | X | VP6 [4:0] | | | | | 03 |
| | 1 | 1 | ↑ | XX | X | X | X | X | VP13 [3:0] | | | | 09 |
| | 1 | 1 | ↑ | XX | X | VP20 [6:0] | | | | | | | 47 |
| | 1 | 1 | ↑ | XX | VP36 [3:0] | | | | VP27 [3:0] | | | | 86 |
| | 1 | 1 | ↑ | XX | X | VP43 [6:0] | | | | | | | 2B |
| | 1 | 1 | ↑ | XX | X | X | X | X | VP50 [3:0] | | | | 0B |
| | 1 | 1 | ↑ | XX | X | X | X | VP57 [4:0] | | | | | 04 |
| | 1 | 1 | ↑ | XX | X | X | X | X | VP59 [3:0] | | | | 00 |
| | 1 | 1 | ↑ | XX | X | X | VP61 [5:0] | | | | | | 00 |
| | 1 | 1 | ↑ | XX | X | X | VP62 [5:0] | | | | | | 00 |
| | 1 | 1 | ↑ | XX | X | X | X | X | VP63 [3:0] | | | | 00 |
| Negative Gamma Correction | 0 | 1 | ↑ | XX | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | E1h |
| | 1 | 1 | ↑ | XX | X | X | X | X | VN0 [3:0] | | | | 08 |
| | 1 | 1 | ↑ | XX | X | X | VN1 [5:0] | | | | | | 1A |
| | 1 | 1 | ↑ | XX | X | X | VN2 [5:0] | | | | | | 20 |
| | 1 | 1 | ↑ | XX | X | X | X | X | VN4 [3:0] | | | | 07 |
| | 1 | 1 | ↑ | XX | X | X | X | VN6 [4:0] | | | | | 0E |
| | 1 | 1 | ↑ | XX | X | X | X | X | VN13 [3:0] | | | | 05 |
| | 1 | 1 | ↑ | XX | X | VN20 [6:0] | | | | | | | 3A |
| | 1 | 1 | ↑ | XX | VN36 [3:0] | | | | VN27 [3:0] | | | | 8A |
| | 1 | 1 | ↑ | XX | X | VN43 [6:0] | | | | | | | 40 |
| | 1 | 1 | ↑ | XX | X | X | X | X | VN50 [3:0] | | | | 04 |
| | 1 | 1 | ↑ | XX | X | X | X | VN57 [4:0] | | | | | 18 |
| | 1 | 1 | ↑ | XX | X | X | X | X | VN59 [3:0] | | | | 0F |
| | 1 | 1 | ↑ | XX | X | X | VN61 [5:0] | | | | | | 3F |
| | 1 | 1 | ↑ | XX | X | X | VN62 [5:0] | | | | | | 3F |
| | 1 | 1 | ↑ | XX | X | X | X | X | VN63 [3:0] | | | | 0F |
| Digital Gamma Control 1 | 0 | 1 | ↑ | XX | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | E2h |
| 1st Parameter | 1 | 1 | ↑ | XX | RCA0 [3:0] | | | | BCA0 [3:0] | | | | XX |
| : | 1 | 1 | ↑ | XX | RCAx [3:0] | | | | BCAx [3:0] | | | | XX |
| 16th Parameter | 1 | 1 | ↑ | XX | RCA15 [3:0] | | | | BCA15 [3:0] | | | | XX |
| Digital Gamma Control 2 | 0 | 1 | ↑ | XX | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | E3h |
| 1st Parameter | 1 | 1 | ↑ | XX | RFA0 [3:0] | | | | BFA0 [3:0] | | | | XX |
| : | 1 | 1 | ↑ | XX | RFAx [3:0] | | | | BFAx [3:0] | | | | XX |
| 64th Parameter | 1 | 1 | ↑ | XX | RFA63 [3:0] | | | | BFA63 [3:0] | | | | XX |
| Interface Control | 0 | 1 | ↑ | XX | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 0 | F6h |
| | 1 | 1 | ↑ | XX | MY_EOR | MX_EOR | MV_EOR | X | BGR_EOR | X | X | WEMODE | 01 |
| | 1 | 1 | ↑ | XX | X | X | EPF [1:0] | | X | X | MDT [1:0] | | 00 |
| | 1 | 1 | ↑ | XX | X | X | ENDIAN | X | DM [1:0] | | RM | RIM | 00 |

*Note 1: Undefined commands are treated as NOP (00h) command.*

*Note 2: B0 to D9 and DE to FF are for factory use of display supplier. USER can decide if these commands are available or they are treated as NOP (00h) commands before shipping to USER. Default value is NOP (00h).*

*Note 3: Commands 10h, 12h, 13h, 26h, 28h, 29h, 30h, 36h (Bit B4 only), 38h and 39h are updated during V-SYNC when ILI9341 is in Sleep OUT mode to avoid abnormal visual effects. During Sleep IN mode, these commands are updated immediately. Read status (09h), Read display power mode (0Ah), Read display MADCTL (0Bh), Read display pixel format (0Ch), Read display image mode (0Dh), Read display signal mode (0Eh) and Read display self diagnostic result (0Fh) of these commands are updated immediately both in Sleep IN mode and Sleep OUT mode.*

## ■ INITIAL CODE

```
code void INIT()
{
        write_cmd(0x01);    //software reset
          delay(5);
          write_cmd(0x28);      // display off
//------------------------------------------------------
          write_cmd(0xcf);
           write_data16(0x00,0x00);
          write_data16(0x00,0x83);
          write_data16(0x00,0x30);

            write_cmd(0xed);
           write_data16(0x00,0x64);
          write_data16(0x00,0x03);
          write_data16(0x00,0x12);
          write_data16(0x00,0x81);

          write_cmd(0xe8);
           write_data16(0x00,0x85);
          write_data16(0x00,0x01);
          write_data16(0x00,0x79);

          write_cmd(0xcb);
           write_data16(0x00,0x39);
          write_data16(0x00,0x2c);
          write_data16(0x00,0x00);
          write_data16(0x00,0x34);
          write_data16(0x00,0x02);

          write_cmd(0xf7);
           write_data16(0x00,0x20);

          write_cmd(0xea);
           write_data16(0x00,0x00);
          write_data16(0x00,0x00);


//------------power control-------------------------------
          write_cmd(0xc0);    //power control
          write_data16(0x00,0x26);

          write_cmd(0xc1);    //power control
          write_data16(0x00,0x11);
//--------------VCOM设定不符合开机会闪烁  ---------
          write_cmd(0xc5);    //vcom control
         write_data16(0x00,0x35);//35
          write_data16(0x00,0x3e);//3E

          write_cmd(0xc7);    //vcom control
          write_data16(0x00,0xbe); //     0x94
//------------memory access control------------------------
          write_cmd(0x36);      // memory access control
          write_data16(0x00,0x48); //0048        my,mx,mv,ml,BGR,mh,0.0

          write_cmd(0x3a);      // pixel format set
          write_data16(0x00,0x55);//16bit /pixel
//----------------- frame rate----------------------------
          write_cmd(0xb1);      //    frame rate
          write_data16(0x00,0x00);
          write_data16(0x00,0x1B);    //70

//----------------Gamma---------------------------------
          write_cmd(0xf2);    // 3Gamma Function Disable
          write_data16(0x00,0x08);

          write_cmd(0x26);
          write_data16(0x00,0x01); //    gamma set 4 gamma curve 01/02/04/08
```

```
                write_cmd(0xE0);    //positive gamma correction
                write_data16(0x00,0x1f);
                write_data16(0x00,0x1a);
                write_data16(0x00,0x18);
                write_data16(0x00,0x0a);
                write_data16(0x00,0x0f);
                write_data16(0x00,0x06);
                write_data16(0x00,0x45);
                write_data16(0x00,0x87);
                write_data16(0x00,0x32);
                write_data16(0x00,0x0a);
                write_data16(0x00,0x07);
                write_data16(0x00,0x02);
                write_data16(0x00,0x07);
                write_data16(0x00,0x05);
                write_data16(0x00,0x00);

                write_cmd(0xE1);    //negamma correction
                write_data16(0x00,0x00);
                write_data16(0x00,0x25);
                write_data16(0x00,0x27);
                write_data16(0x00,0x05);
                write_data16(0x00,0x10);
                write_data16(0x00,0x09);
                write_data16(0x00,0x3a);
                write_data16(0x00,0x78);
                write_data16(0x00,0x4d);
                write_data16(0x00,0x05);
                write_data16(0x00,0x18);
                write_data16(0x00,0x0d);
                write_data16(0x00,0x38);
                write_data16(0x00,0x3a);
                write_data16(0x00,0x1f);
//--------------ddram ---------------------
          write_cmd(0x2a);       // column set
             write_data16(0x00,0x00);
            write_data16(0x00,0x00);
            write_data16(0x00,0x00);
            write_data16(0x00,0xEF);

               write_cmd(0x2b);      // page address set
        write_data16(0x00,0x00);
             write_data16(0x00,0x00);
             write_data16(0x00,0x01);
             write_data16(0x00,0x3F);

           // write_cmd(0x34);      // tearing effect off
             //write_cmd(0x35);      // tearing effect on

              //write_cmd(0xb4);      // display inversion
              //write_data16(0x00,0x00);

              write_cmd(0xb7);    //entry mode set
              write_data16(0x00,0x07);
//-----------------display---------------------
              write_cmd(0xb6);      //    display function control
              write_data16(0x00,0x0a);
              write_data16(0x00,0x82);
             write_data16(0x00,0x27);
              write_data16(0x00,0x00);

                    write_cmd(0x11);    //sleep out
             delay(100);
                write_cmd(0x29);      // display on
              delay(T00);
            write_cmd(0x2c);      //memory write
}
```

## ■ RELIABILITY TEST

| No. | Test Item | Test Condition | Remark |
|---|---|---|---|
| 1 | High Temperature Storage | 80±2℃/96 hours | The test result shall be evaluated after the sample has been left at room temperature and humidity for 2 hours without load. No condensation shall be accepted. 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; |
| 2 | Low Temperature Storage | -30±2℃/96 hours | |
| 3 | High Temperature Operating | 70±2℃/96 hours | |
| 4 | Low Temperature Operating | -20±2℃/96 hours | |
| 5 | Temperature Cycle storage | -30±2℃~25~80±2℃×10cycles<br>(30min.) (5min.) (30min.) | |
| 6 | Damp proof Test operating | 60℃±5℃×90%RH/96hours | |
| 7 | Vibration Test | 10Hz~150Hz,100m/s$^2$,120min | |
| 8 | Drop test(package state) | 800mm, concrete floor,1corner, | |
| 9 | ESD test | C=150pF,R=330Ω<br>Air: ±8KV,30times<br>Contact: ±4KV,20times | |
| 10 | Shock test | Half-sine,wave,300m/s | |

## ■ INSPECTION CRITERION

| | |
|---|---|
| OUTGOING QUALITY STANDARD | PAGE 1 OF 7 |
| TITLE:FUNCTIONAL TEST & INSPECTION CRITERIA | |

This specification is made to be used as the standard acceptance/rejection criteria for Color mobile phone LCM with touch panel.

1 Sample plan

Sampling plan according to GB/T2828.1-2003/ISO 2859-1：1999 and ANSI/ASQC Z1.4-1993, normal level 2 and based on:

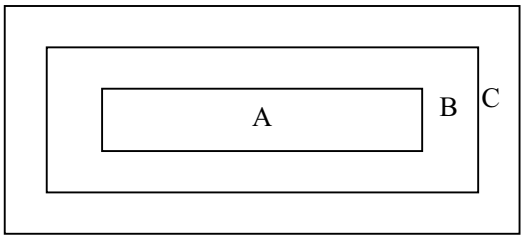
Major defect: AQL 0.65

Minor defect: AQL 1.5

2. Inspection condition

Viewing distance for cosmetic inspection is about 30cm with bare eyes, and under an environment of 20~40W light intensity, all directions for inspecting the sample should be within 45° against perpendicular line.

3. Definition of inspection zone in LCD.




Zone A: character/Digit area

Zone B: viewing area except Zone A (ZoneA+ZoneB=minimum Viewing area)

Zone C: Outside viewing area (invisible area after assembly in customer's product)

Fig.1 Inspection zones in an LCD.

Note: As a general rule, visual defects in Zone C are permissible, when it is no trouble for quality and assembly of customer's product.

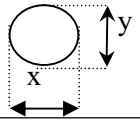
| OUTGOING QUALITY STANDARD | PAGE 2 OF 7 |
|---|---|
| TITLE:FUNCTIONAL TEST & INSPECTION CRITERIA | |

## 4. Inspection standards

### 4.1 Major Defect

| Item No | Items to be inspected | Inspection Standard | Classification of defects |
|---|---|---|---|
| 4.1.1 | All functional defects | 1) No display<br>2) Display abnormally<br>3) Missing vertical，horizontal segment<br>4) Short circuit<br>5) Back-light no lighting, flickering and abnormal lighting. | Major |
| 4.1.2 | Missing | Missing component | |
| 4.1.3 | Outline dimension | Overall outline dimension beyond the drawing is not allowed. | |
| 4.1.4 | linearity | No more than 1.5% | |

### 4.2 Cosmetic Defect

| Item No | Items to be inspected | Inspection Standard | Classification of defects |
|---|---|---|---|
| 4.2.1 | **Clear Spots**<br><br>Black and white Spot defect<br><br>Pinhole,<br><br>Foreign Particle,<br><br>polarizer Dirt | For dark/white spot, size Φ is defined as $\Phi = \frac{(x+y)}{2}$   | Minor |

1.

| Zone / Size(mm) | Acceptable Qty | | |
|---|---|---|---|
| | A | B | C |
| Φ≤0.1 | Ignore | | Ignore |
| 0.10<Φ≤0.15 | **2** | | |
| 0.15<Φ≤0.20 | **1** | | |
| 0.20<Φ | 0 | | |

| | | | Minor |
|---|---|---|---|
| | **Clear Spots**<br><br>TP Dirt | 2. | |

| Zone / Size(mm) | Acceptable Qty | | |
|---|---|---|---|
| | A | B | C |
| Φ≤0.1 | Ignore | | Ignore |
| 0.10<Φ≤0.15 | **3** | | |
| 0.15<Φ≤0.25 | **2** | | |
| 0.25<Φ | 0 | | |

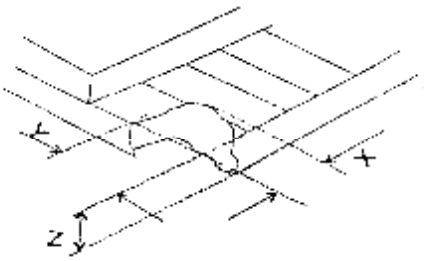
| | | | |
|---|---|---|---|
| | **Dim Spots**<br><br>Circle shaped and dim edged defects | 3.<br>2. Zone / Size(mm) \| Acceptable Qty: A \| B \| C<br>Φ≤0.2 \| Ignore \| Ignore<br>0.20<Φ≤0.40 \| 2 \| Ignore<br>0.40<Φ≤0.60 \| 1 \| Ignore<br>0.60<Φ \| 0 \| Ignore | Minor |

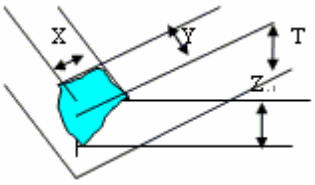
**4.2 Cosmetic Defect**

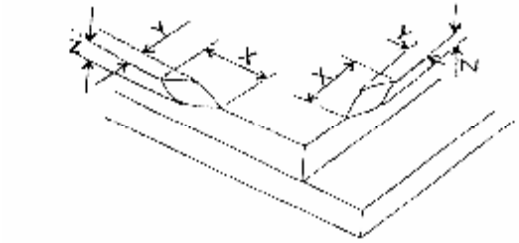
| Item No | Items to be inspected | Inspection Standard | Classification of defects |
|---|---|---|---|
| 4.2.2 | **Line defect**<br>Black line, White line, Foreign material on polarizer | size(mm): L(Length) \| W(Width); Acceptable Qty: zone A \| B \| C<br>Ignore \| W≤0.02 \| Ignore \| Ignore \| Ignore<br>L≤3.0 \| 0.02<W≤0.03 \| 2<br>L≤2.0 \| 0.03<W≤0.05 \| 1<br>\| 0.05<W \| Define as spot defect | Minor |
| | Foreign material on TP film | The line can be seen after mobile phone in the operating condition:<br>size(mm): L(Length) \| W(Width); Acceptable Qty: zone A \| B \| C<br>Ignore \| W≤0.03 \| Ignore \| Ignore \| Ignore<br>L≤5.0 \| 0.03<W≤0.05 \| 3<br>\| 0.05<W \| Define as spot defect | |
| | | If the scratch can be seen after mobile phone cover assembling or in the operating condition, judge by the line defect of 4.2.2.<br>If the scratch can be seen only in non-operating condition or some special angle, judge by the following. | |

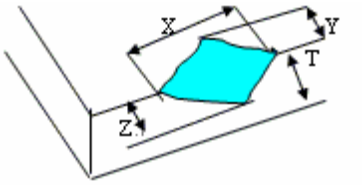
<table>
<tr><td>4.2.3</td><td>Dim line defect<br><br>Polarizer scratch<br>TP film scratch</td><td>
<table>
<tr><td colspan="2">Size(mm)</td><td colspan="3">Acceptable Qty</td></tr>
<tr><td rowspan="2">L(Length)</td><td rowspan="2">W(Width)</td><td colspan="3">Zone</td></tr>
<tr><td>A</td><td>B</td><td>C</td></tr>
<tr><td>Ignore</td><td>W≤0.03</td><td colspan="2">Ignore</td><td rowspan="4">Ignore</td></tr>
<tr><td>5.0＜L≤10.0</td><td>0.03＜W≤0.05</td><td colspan="2">2</td></tr>
<tr><td>L≤5.0</td><td>0.05＜W≤0.08</td><td colspan="2">1</td></tr>
<tr><td></td><td>0.08＜W</td><td colspan="2">0</td></tr>
</table>
</td><td>Minor</td></tr>
<tr><td>4.2.4</td><td>Polarize<br>Air bubble</td><td>Air bubbles between glass & polarizer
<table>
<tr><td>2. Zone<br>Size(mm)</td><td colspan="3">Acceptable Qty</td></tr>
<tr><td>A</td><td>B</td><td>C</td></tr>
<tr><td>Φ≤0.2</td><td colspan="2">Ignore</td><td rowspan="4">Ignore</td></tr>
<tr><td>0.20＜Φ≤0.30</td><td colspan="2">2</td></tr>
<tr><td>0.30＜Φ≤0.50</td><td colspan="2">1</td></tr>
<tr><td>0.50＜Φ</td><td colspan="2">0</td></tr>
</table>
</td><td>Minor</td></tr>
</table>

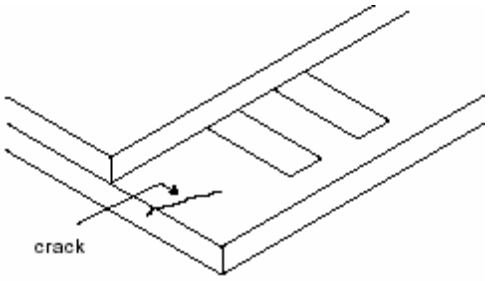
**4.3. Cosmetic Defect**

<table>
<tr><td>Item No</td><td>Items to be inspected</td><td>Inspection Standard</td><td>Classification of defects</td></tr>
<tr><td></td><td></td><td>(i) Chips on corner<br>A:LCD Glass defect<br> 
<table>
<tr><td>X</td><td>Y</td><td>Z</td></tr>
<tr><td>≤2.0</td><td>≤S</td><td>Disregard</td></tr>
</table>
Notes: S=contact pad length<br>Chips on the corner of terminal shall not be allowed to extend into the ITO pad or expose perimeter seal.</td><td>Minor</td></tr>
</table>

<table>
<tr><td>4.3.5</td><td>Glass defect</td><td>B:TP Glass defect<br> 

<table>
<tr><td>X(mm)</td><td>Y(mm)</td><td>Z(mm)</td></tr>
<tr><td>≤3.0</td><td>≤3.0</td><td>Disregard</td></tr>
</table></td><td></td></tr>
<tr><td></td><td></td><td>(ii)Usual surface cracks<br>A:LCD Glass defect<br> 

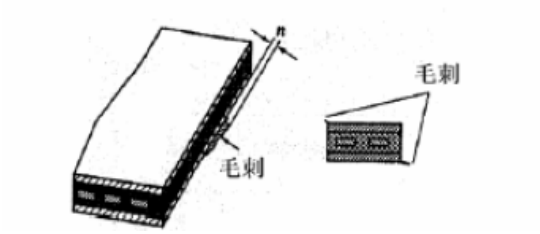
<table>
<tr><td>X</td><td>Y</td><td>Z</td></tr>
<tr><td>≤3.0</td><td><Inner border line of the seal</td><td>Disregard</td></tr>
</table>
B:TP Glass defect<br> 

<table>
<tr><td>X(mm)</td><td>Y(mm)</td><td>Z(mm)</td></tr>
<tr><td>≤6.0</td><td><2.0</td><td>Disregard</td></tr>
</table></td><td>Minor</td></tr>
<tr><td></td><td></td><td>(iii) Crack<br>Cracks tend to break are not allowed.<br> 
</td><td>Major</td></tr>
</table>

**4.4 Parts Defect**

| Item No | Items to be inspected | Inspection Standard | Classification of defects |
|---|---|---|---|
| | 4.4.1 Parts contraposition | 1、Not allow IC and FPC/heat-seal lead width is more than 50% beyond lead pattern.<br>2、Not allow chip or solder component is off center more than 50% of the pad outline. | Major |
| | 4.4.2 SMT | According to the <Acceptability of electronic assemblies> IPC-A-610C class 2 standard. Component missing or function defect are Major defect, the others are Minor defect. | |

| | OUTGOING QUALITY STANDARD | PAGE 7 OF 7 |
|---|---|---|
| TITLE: FUNCTIONAL TEST & INSPECTION CRITERIA | | |

| | | | |
|---|---|---|---|
| | 4.4.3<br>TP Defect | 1、 Pattern font：<br>Pattern fonts are clear and symmetrical， pattern fonts filter lightly are allowed; The fort line is not allow to thinner or thicker than 1/3of normal size, and swing is not more than 0.1mm. the line is smooth and not broken.<br>  <br>图案字体 Pattern font<br>2、The wing forward in the side of Visual Area：<br>The length of wing forward inside of the Visual Area: n≤0.2mm；<br>Not excess 3 point， and the distanceD≥20mm。<br>  <br><br>3、Film impression:With operation, must be invisibility.<br>4、Touch panel knob：if writing function normally,it could be allowed.<br>  <br>TP鼓 TP knob<br>5、 Newton ring<br>Without operation, the color circle of Regularity or Non-regularity from the normal or slope angle of view.<br>1、**Regularity：** The area of the newton ring is less than 1/3 area of the touch panel; and no character affected and line distorted after touch panel lightening. It’s ok.<br>2、 **Non-regularity** ： The area of the Newton ring is less than the 1/2 area of touch panel with lightening. And no character affected and line<br>  <br>规律形 非规律形 | Minor |

# ■ PRECAUTIONS FOR USING LCD MODULES

## 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

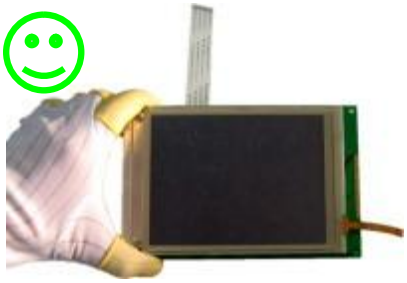
（13）Since LCM has been assembled and adjusted with a high degree of precision, avoid applying excessive shocks to the module or making any alterations or modifications to it.

- 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.

## Handling precaution for LCM

**LCM is easy to be damaged. Please note below and be careful for handling.**

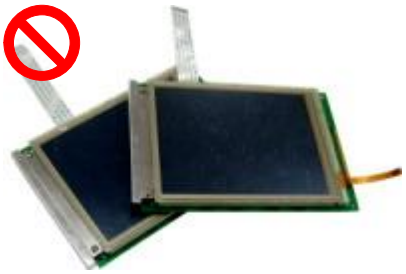
**Correct handling:**



As above picture, please handle with anti-static gloves around LCM edges.

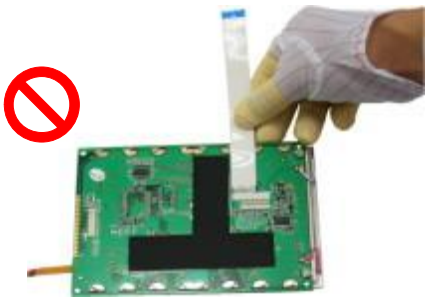
**Incorrect handling:**

Please don't touch IC directly.

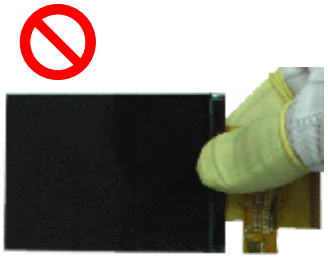


Please don't stack LCM.

Please don't hold the surface of panel.



Please don't stretch interface of output, such as FPC cable.



Please don't hold the surface of IC.

Please don't operate with sharp stick such as pens.

**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, and keep the relative humidity between 40%RH and 60%RH.

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

**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.

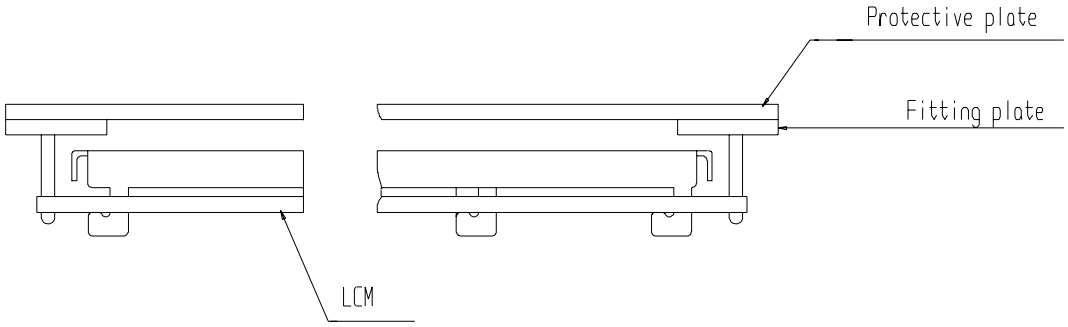
- Exposed area of the printed circuit board.
-Terminal electrode sections.

## ■ 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.

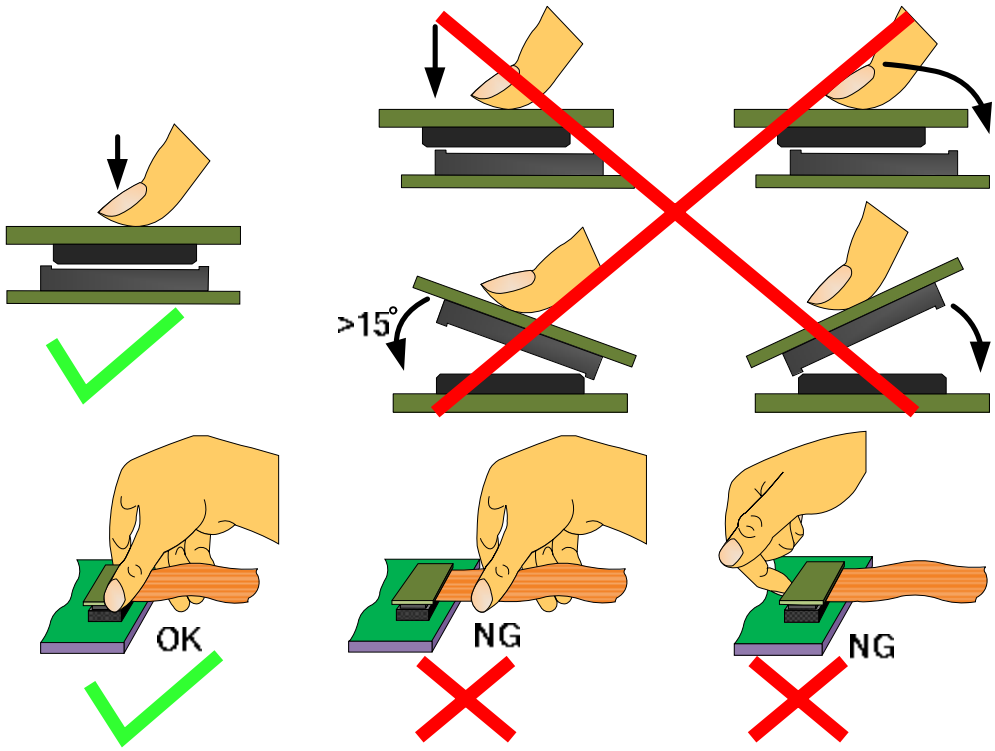
(1) Cover the surface with a transparent protective plate to protect the polarizer and LC cell.




(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 the LCM**

| | Manual soldering | Machine drag soldering | Machine press soldering |
|---|---|---|---|
| **No RoHS product** | 290°C ~350°C.<br>Time : 3-5S. | 330°C ~350°C.<br>Speed : 4-8 mm/s. | 300°C ~330°C.<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 ~360°C.<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) Viewing angle varies with the change of liquid crystal driving voltage (VLCD). Adjust VLCD to show the best contrast.

(2) 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.

(3) 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.

(4) 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.

(5) 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.

(6) Input logic voltage before apply analog high voltage such as LCD driving voltage when power on. Remove analog high voltage before logic voltage when power off the module. Input each signal after the positive/negative voltage becomes stable.

(7) 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.

**Limited Warranty**

Unless agreed betweenMulti-Inno and customer,Multi-Inno will replace or repair any of its LCD modules which are found to be functionally defective when inspected in accordance with Multi-Inno LCD acceptance standards (copies available upon request) for a period of one year from date of production. Cosmetic/visual defects must be returned to Multi-Inno within 90 days of shipment. Confirmation of such date shall be based on data code on product. The warranty liability of Multi-Inno limited to repair and/or replacement on the terms set forth above. Multi-Inno will not be responsible for any subsequent or consequential events.

**Return LCM under warranty**

No warranty can be granted if the precautions stated above have been disregarded. The typical examples of violations are :

- Broken LCD glass.
- PCB eyelet is damaged or modified.
- PCB conductors damaged.
- Circuit modified in any way, including addition of components.
- PCB tampered with by grinding, engraving or painting varnish.
- Soldering to or modifying the bezel in any manner.

Module repairs will be invoiced to the customer upon mutual agreement. Modules must be returned with sufficient description of the failures or defects. Any connectors or cable installed by the customer must be removed completely without damaging the PCB eyelet, conductors and terminals.

## ■ PRIOR CONSULT MATTER

1.①For Multi-Inno 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.