

AZ DISPLAYS

SPECIFICATIONS FOR LIQUID CRYSTAL DISPLAY

| CUSTOMER APPROVAL | | | |
|---|--|-----------------|--|
| ※ PART NO. : <u>ATM0177B3A-T (AZ DISPLAYS) VER3.2</u> | | | |
| APPROVAL | | COMPANY CHOP | |
| CUSTOMER COMMENTS | | | |

| AZ DISPLAYS ENGINEERING APPROVAL | | |
|----------------------------------|------------|-------------|
| DESIGNED BY | CHECKED BY | APPROVED BY |
| Herbert | LH | GZH |

REVISION RECORD

| REVISION | REVISION DATE | PAGE | CONTENTS |
|---------------|-------------------|-----------|---------------------------------|
| VER1.0 | 2014-05-14 | | FIRST ISSUED |
| VER2.0 | 2014-07-10 | | CHANGE TP DIMENSION |
| VER3.0 | 2015-04-22 | | CORRECT DRIVING CURRENT |
| VER3.1 | 2015-05-29 | 14 | CHANGE BACKLIGHT CIRCUIT |
| VER3.2 | 2015-06-02 | 14 | ADD SOME DIMENSIONS |
| | | | MODIFY SOME DIMENSIONS |

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1. GENERAL SPECIFICATIONS

| Item | Specification | Remark |
|-----------------------|--|--------|
| 1. LCD size | 1.77 inch(Diagonal) | |
| 2. Driver element | a-Si TFT active matrix | |
| 3. Resolution | 128x(RGB)x160 | |
| 4. Display mode | Normally white , Transmissive | |
| 5. Dot Pitch (W*H) | 0.073mm(W) x 0.219mm(H) | |
| 6. Pixel pitch(W*H) | 0.219mm(W) x 0.219mm(H) | |
| 7. Active Area(W*H) | 28.032mm(W) x 35.04mm(H) | |
| 8. Module size (W*H) | 34.70mm(W) x 46.7mm(H) x 3.75mm Max(D) | Note 1 |
| 9. Surface treatment | Clear | |
| 10. Color arrangement | RGB-stripe | |
| 11. Color | 65K | |
| 12. Contrller | ILI9163V | |
| 13. Interface | 4-wire SPI | |
| 14. Weight | T.B.D. | |
| 15. RoHS | RoHS compliant | |

Note 1: Please refer to mechanical drawing.

2. PIN ASSIGNMENT

| Pin No. | Symbol | Function | Level | Note |
|---------|--------|----------------------------------|-------|------|
| 1 | XR | Right electrode of TP | I/O | |
| 2 | YD | Bottom electrode of TP | I/O | |
| 3 | XL | Left electrode of TP | I/O | |
| 4 | YU | Top electrode of TP | I/O | |
| 5 | A | Power for LED backlight(Cathode) | P | |
| 6 | NC | No connection | -- | |
| 7 | NC | No connection | -- | |
| 8 | GND | Power ground | P | |
| 9 | VCC | Power supply | P | |
| 10 | SDA | Serial data | I/O | |
| 11 | SCK | Serial clock | I | |
| 12 | A0 | Data/clock selection | I | |
| 13 | REST | Reset | I | |
| 14 | K | Power for LED backlight(Anode) | P | |
| 15 | CS | Chip selection | I | |

I: input, O: output, P: Power

3. Operating Specification

3.1 ABSOLUTE MAXIMUM RATINGS

| Item | Symbol | Values | | Unit | Remark |
|-----------------------|----------|--------|------|------|--------------------|
| | | Min. | Max. | | |
| Power Voltage | V_{CC} | -0.3 | 4.6 | V | |
| Operation Temperature | T_{OP} | -20 | 70 | °C | |
| Storage Temperature | T_{ST} | -30 | 80 | °C | |
| LED Reverse Voltage | V_R | - | 1.2 | V | Each LED Note 2 |
| LED Forward Current | I_F | | 25 | mA | Each LED |

Note 1: 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.

Note 2: V_R Conditions: Zener Diode 20mA

3.1.1 Typical Operation Conditions

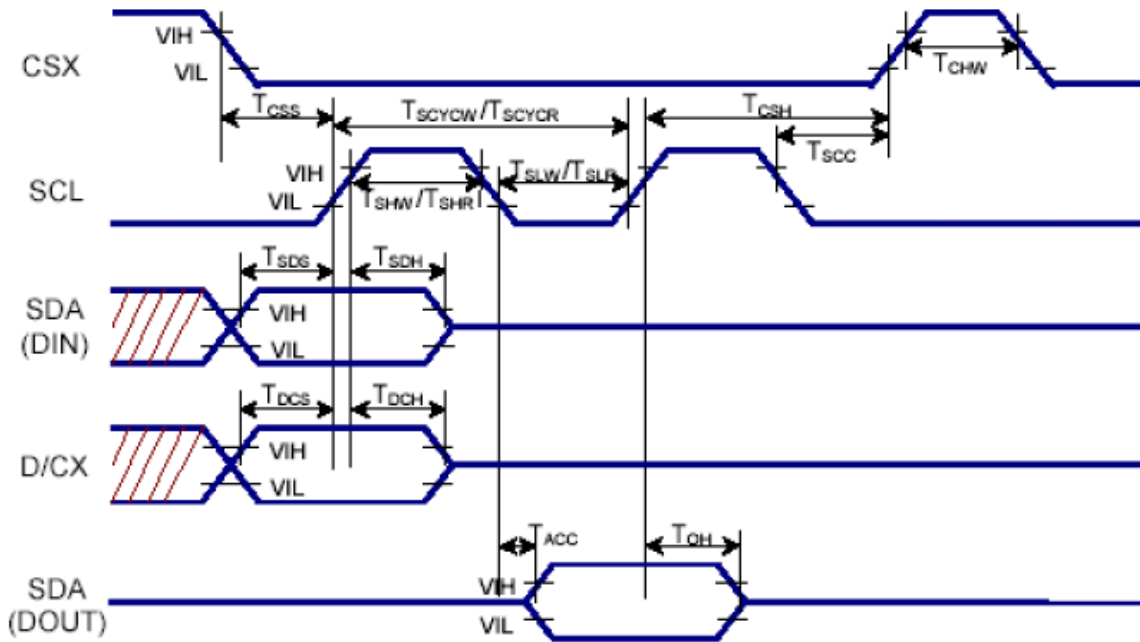
| Item | Symbol | Values | | | Unit | Remark |
|--------------------------|----------|-------------|------|-------------|------|--------|
| | | Min. | Typ. | Max. | | |
| Power Voltage | V_{CC} | 2.6 | 2.8 | 3.3 | V | |
| Input Logic High Voltage | V_{IH} | $0.8V_{CC}$ | -- | V_{CC} | V | |
| Input Logic Low Voltage | V_{IL} | 0 | -- | $0.2V_{CC}$ | V | |

3.1.2 Backlight driving conditions

| Item | Symbol | Values | | | Unit | Remark |
|---------------------------|--------|--------|------|------|------|--------|
| | | Min. | Typ. | Max. | | |
| Voltage for LED Backlight | V_L | 2.9 | 3.2 | 3.3 | V | |
| Current for LED Backlight | I_L | -- | 40 | -- | mA | |
| LED life time | -- | 30000 | -- | -- | Hr | Note 1 |

Note 1: The "LED life time" is defined as the module brightness decrease to 50% original brightness at $T_a=25^\circ\text{C}$ and $I_L=40\text{mA}$.

3.3 Timing Characteristics



| Signal | Symbol | Parameter | MIN | MAX | Unit | Description |
|--------|--------|----------------------------|-----|-----|------|-------------|
| CSX | TCSS | Chip select setup time | 15 | | ns | |
| | TCSH | Chip select hold time | 60 | | ns | |
| | TCHW | Chip select setup time | 40 | | ns | |
| SCL | TSCYCW | Serial clock cycle(Write) | 66 | | ns | |
| | TSHW | SCL "H" pulse width(Write) | 1 | | ns | |
| | TSLW | SCL "L" pulse width(Write) | 15 | | ns | |
| | TSCYCR | Serial clock cycle(Read) | 150 | | ns | |
| | TSHR | SCL "H" pulse width(Read) | 60 | | ns | |

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| | | | | | | |
|--------------------|------|---------------------------|----|----|----|-----------------------|
| | TSLR | SCL "L" pulse width(Read) | 60 | | ns | |
| D/CX | TDCS | D/CX setup time | 7 | | ns | |
| | TDCH | D/CX hold time | 7 | | ns | |
| SDA(DIN) (DOUT) | TSDS | Data setup time | 10 | | ns | |
| | TSDH | Data hold time | 10 | | ns | |
| | TACC | Access time | 10 | 50 | ns | For maximum CL = 30pF |
| | TOH | Output disable time | 15 | | ns | For minimum CL = 8pF |

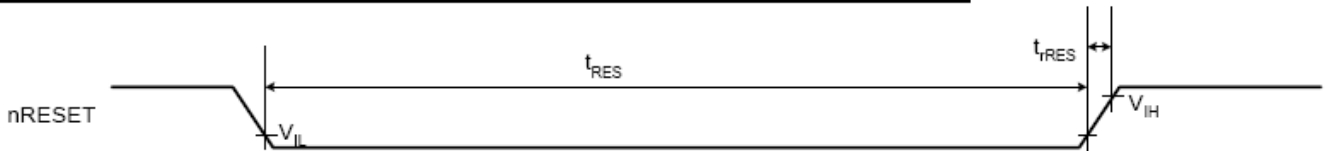
Note 1: VDDI=1.65 to 3.3V, VDD=2.6 to 3.3V, AGND=GND=0V. Ta=-30 to 70°C (to +85°C no damage)

Note 2 : 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 10% and 90% of VDDI for Input signals.

Reset Timing Characteristics (VCC = 1.8 ~ 3.3 V, IOVCC = 1.65 ~ 3.3 V)

| Item | Symbol | Unit | Min. | Typ. | Max. |
|-----------------------|-----------|---------|------|------|------|
| Reset low-level width | t_{RES} | ms | 1 | - | - |
| Reset rise time | t_{RES} | μ S | - | - | 10 |



4.0 OPTICAL SPECIFICATIONS

| Item | Symbol | Condition | Values | | | Unit | Remark |
|----------------------------|------------|---------------------------------|--------|------|------|-------------------|------------------|
| | | | Min. | Typ. | Max. | | |
| Viewing Angle (CR ≥ 10) | θ_L | $\Phi=180^\circ$ (9 O'CLOCK) | 60 | 70 | -- | degree | Note 1 |
| | θ_R | $\Phi=0^\circ$ (3 O'CLOCK) | 60 | 70 | -- | | |
| | θ_T | $\Phi=90^\circ$ (12 O'CLOCK) | 20 | 30 | -- | | |
| | θ_B | $\Phi=270^\circ$ (6 O'CLOCK) | 35 | 45 | -- | | |
| Response Time | T_{ON} | Normal $\Theta=\Phi=0^\circ$ | -- | 10 | 20 | msec | Note 3 |
| | T_{OFF} | | -- | 15 | 30 | msec | Note 3 |
| Contrast Ratio | CR | | 400 | 500 | -- | -- | Note 4 |
| Color Chromaticity | W_X | | 0.26 | 0.31 | 0.36 | -- | Note 2 |
| | W_Y | | 0.28 | 0.33 | 0.38 | -- | Note 5 Note 6 |
| Luminance | L | | 360 | -- | -- | cd/m ² | Note 6 |
| Luminance Uniformity | YU | | 75 | 80 | -- | % | Note 7 |

Test Conditions:

1. If=40mA, the ambient temperature is 25°C.
2. The test systems refer to Note 2.

Note 1: Definition of viewing angle range

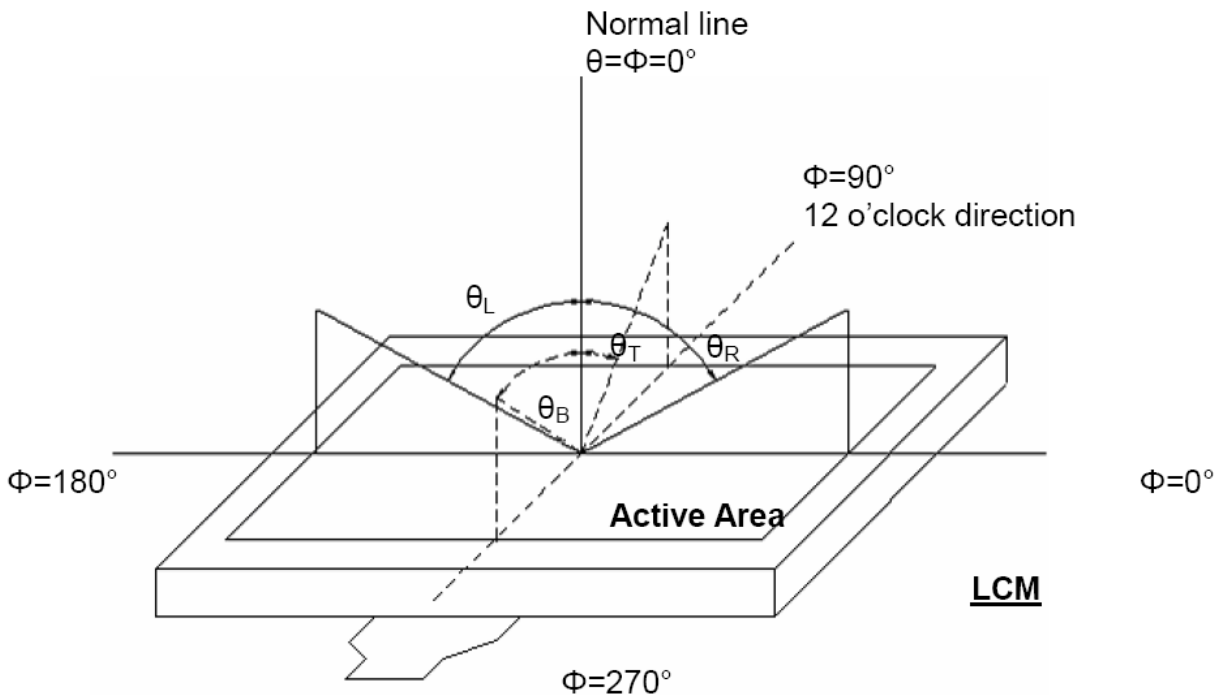


Figure 4.1 Definition of viewing angle.

Note 2: Definition of optical measurement system.

The optical characteristics should be measured in dark room. After 30 minutes operation, the optical properties are measured at the center point of the LCD screen. (Response time is measured by Photo detector TOPCON)



Figure 4.2 Optical measurement system setup

Note 3: Definition of Response time

The response time is defined as the LCD optical switching time interval between “White” state and “Black” state. Rise time (TON) is the time between photo detector output intensity changed from 90% to 10%. And fall time (TOFF) is the time between photo detector output intensity changed from 10% to 90%.



Figure 4.3 Definition of response.

Note 4: Definition of contrast ratio

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

Note 5: Definition of color chromaticity (CIE1931)

Color coordinates measured at center point of LCD.

Note 6: All input terminals LCD panel must be ground while measuring the center area of the panel.

Note 7: Definition of Luminance Uniformity

Active area is divided into 9 measuring areas (Refer to Fig. 4-4).Every measuring point is placed at the center of each measuring area.

$$\text{Luminance Uniformity (Yu)} = \frac{B_{min}}{B_{max}}$$

L-----Active area length W----- Active area width

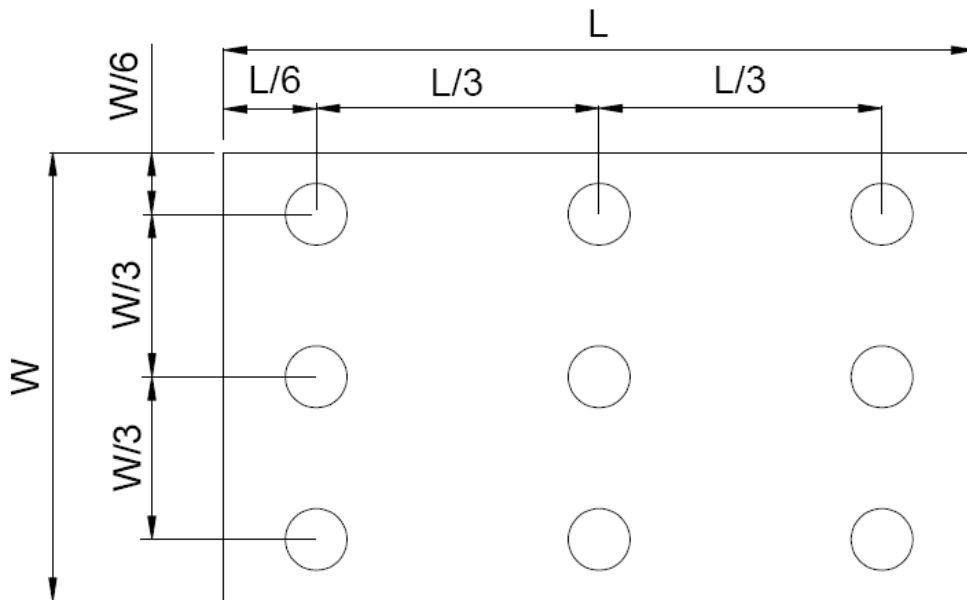


Figure 4.3 Definition of measuring points.

Bmax: The measured maximum luminance of all measurement position.

Bmin: The measured minimum luminance of all measurement position.

5. RELIABILITY TEST

| Item | Test Condition Item | Remark |
|--|---|------------------|
| High temperature storage | Ta= 70 °C 240hrs | Note 1 Note 4 |
| Low temperature storage | Ta=-20 °C 240hrs | Note 1 Note 4 |
| High temperature operation | Ts= 60 °C 240hrs | Note 2 Note 4 |
| Low temperature operation | Ts=-10 °C 240hrs | Note 1 Note 4 |
| High temperature/High humidity operation | 90% RH 40°C 120hrs | Note 4 |
| Thermal Shock | -1°C/30 min ~ +6°C/30 min for a total 10 cycles, Start with cold temperature and end with high temperature. | Note 4 |
| Package drop test | Height:100 cm 1 corner, 3 edges, 6 surfaces | |

Note 1: Ta is the ambient temperature of samples.

Note 2: Ts is the temperature of panel's surface.

Note 3: In the standard condition, there shall be no practical problem that may affect the display function. After the reliability test, the product only guarantees operation, but don't guarantee all of the cosmetic specification.

Note 4: Before cosmetic and function test, the product must have enough recovery time, at least 2 hours at room temperature.

6. PRECAUTION FOR USING LCM

1. When design the product with this LCD Module, make sure the viewing angle matches to its purpose of usage.
2. As LCD panel is made of glass substrate, Dropping the LCD module or banging it against hard objects may cause cracking or fragmentation. Especially at corners and edges.
3. Although the polarizer of this LCD Module has the anti-glare coating, always be careful not to scratch its surface. Use of a plastic cover is recommended to protect the surface of polarizer.
4. If the LCD module is stored at below specified temperature, the LC material may freeze and be deteriorated. If it is stored at above specified temperature, the molecular orientation of the LC material may change to Liquid state and it may not revert to its original state. Excessive temperature and humidity could cause polarizer peel off or bubble. Therefore, the LCD module should always be stored within specified temperature range.
5. Saliva or water droplets must be wiped off immediately as those may leave stains or cause color changes if remained for a long time. Water vapor will cause corrosion of ITO electrodes.
6. If the surface of LCD panel needs to be cleaned, wipe it swiftly with cotton or other soft cloth. If it is not still clean enough, blow a breath on the surface and wipe again.
7. The module should be driven according to the specified ratings to avoid malfunction and permanent damage. Applying DC voltage cause a rapid deterioration of LC material. Make sure to apply alternating waveform by continuous application of the M signal. Especially the power ON/OFF sequence should be kept to avoid latch-up of driver LSIs and DC charge up to LCD panel.
8. Mechanical Considerations
 - a) LCM are assembled and adjusted with a high degree of precision. Avoid excessive shocks and do not make any alterations or modifications. The following should be noted.
 - b) Do not tamper in any way with the tabs on the metal frame.
 - c) Do not modify the PCB by drilling extra holes, changing its outline, moving its components or modifying its pattern.

9. Static Electricity

a) Operator

Wear the electrostatics shielded clothes because human body may be statically charged if not ware shielded clothes. Never touch any of the conductive parts such as the LSI pads; the copper leads on the PCB and the interface terminals with any parts of the human body.

b) Equipment

There is a possibility that the static electricity is charged to the equipment, which has a function of peeling or friction action (ex: conveyer, soldering iron, working table). Earth the equipment through proper resistance (electrostatic earth: 1×10^8 ohm).

Only properly grounded soldering irons should be used.

If an electric screwdriver is used, it should be well grounded and shielded from commutator sparks.

The normal static prevention measures should be observed for work clothes and working benches; for the latter conductive (rubber) mat is recommended.

c) Floor

Floor is the important part to drain static electricity, which is generated by operators or equipment.

There is a possibility that charged static electricity is not properly drained in case of insulating floor. Set the electrostatic earth (electrostatic earth: 1×10^8 ohm).

d) Humidity

Proper humidity helps in reducing the chance of generating electrostatic charges. Humidity should be kept over 50%RH.

e) Transportation/storage

The storage materials also need to be anti-static treated because there is a possibility that the human body or storage materials such as containers may be statically charged by friction or peeling.

The modules should be kept in antistatic bags or other containers resistant to static for storage.

f) Soldering

Soldering anything to this TFT display would void the warranty.

g) Others

The laminator (protective film) is attached on the surface of LCD panel to prevent it from scratches or stains. It should be peeled off slowly using static eliminator.

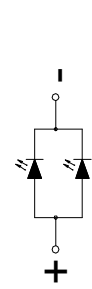
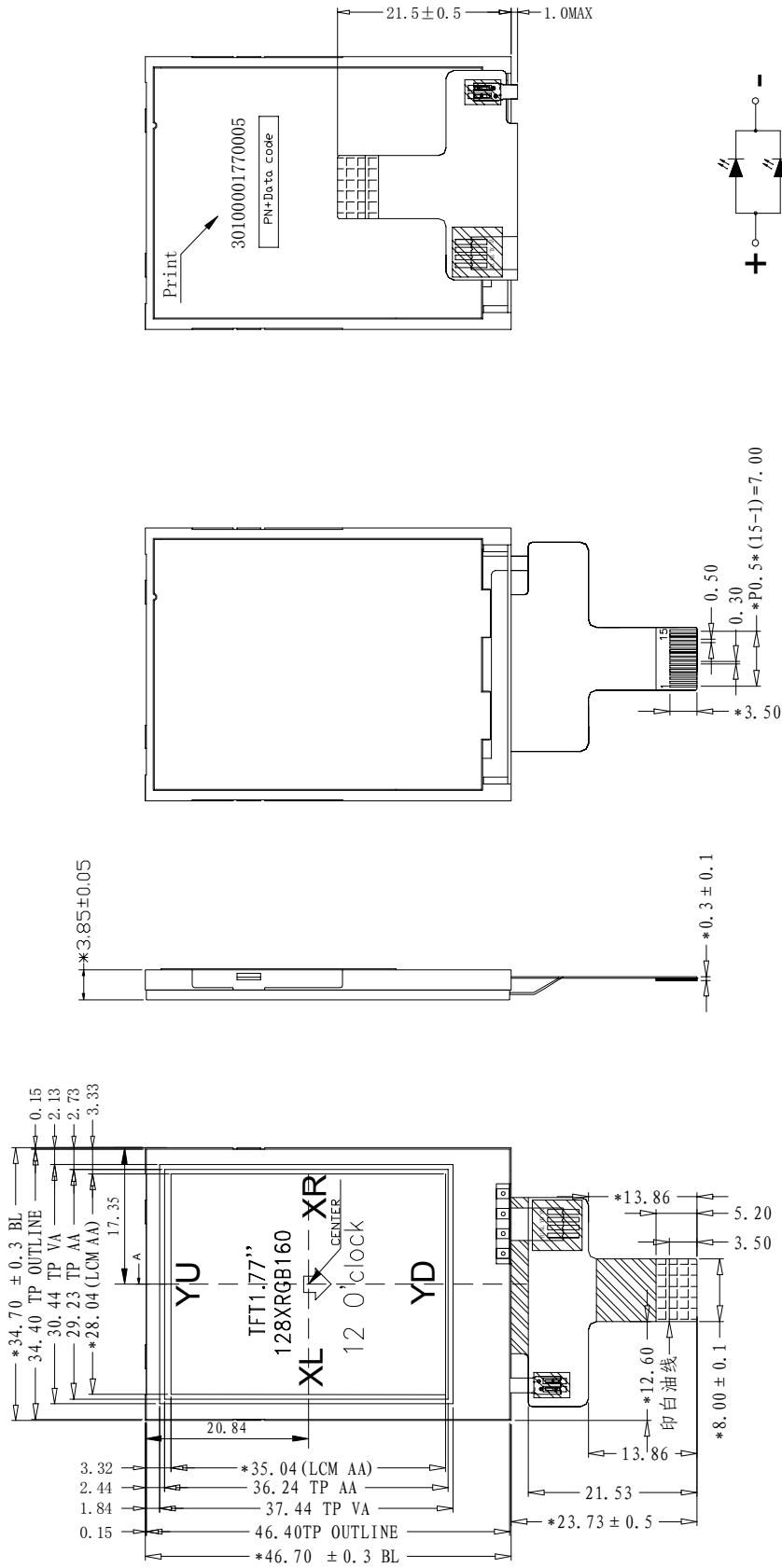
Static eliminator should also be installed to the workbench to prevent LCD module from static charge.

10. Operation

- a) Driving voltage should be kept within specified range; excess voltage shortens display life.
- b) Response time increases with decrease in temperature.
- c) Display may turn black or dark blue at temperatures above its operational range; this is (however not pressing on the viewing area) may cause the segments to appear "fractured".
- d) Mechanical disturbance during operation (such as pressing on the viewing area) may cause the segments to appear "fractured".

11. If any fluid leaks out of a damaged glass cell, wash off any human part that comes into contact with soap and water. The toxicity is extremely low but caution should be exercised at all the time.
12. Disassembling the LCD module can cause permanent damage and it should be strictly avoided.
13. LCD retains the display pattern when it is applied for long time (Image retention). To prevent image retention, do not apply the fixed pattern for a long time. Image retention is not a deterioration of LCD. It will be removed after display pattern is changed.
14. Do not use any materials, which emit gas from epoxy resin (hardener for amine) and silicone adhesive agent (dealcohol or deoxym) to prevent discoloration of polarizer due to gas.
15. Avoid the exposure of the module to the direct sunlight or strong ultraviolet light for a long time.

7. MECHANICAL DRAWING



LED CIRCUIT DIAGRAM

8. PACKAGE DRAWING

T.B.D.

9. INSPECTION SPECIFICATION

T.B.D.