# MikroElektronika
## DEVELOPMENT TOOLS | COMPILERS | BOOKS

For Customer: _____          □ : APPROVAL FOR SPECIFICATION

Customer Model No. _____     □ : APPROVAL FOR SAMPLE

Module No.:   AT043B35-15I-10          Date : 2012.5.30

Version :   1.5

## Table of Contents

## For Customer's Acceptance:

| Approved By | Comment |
|-------------|---------|
| | |

| PREPARED | CHECKED | VERIFIED BY QA DEPT | VERIFIED BY R&D DEPT |
|----------|---------|---------------------|----------------------|
| | | | |

## 2. Revision Record

| Date | Rev.No. | Page | Revision Items | Prepared |
|------|---------|------|----------------|----------|
| 2012.3.5 | V1.0 | | The first release | Qiu |
| 2012.5.22 | V1.2 | | Adding size remark | Qiu |
| 2012.5.23 | V1.3 | | Power supply changing to 3.0V | Qiu |
| 2012.5.29 | V1.4 | | Clarification on backlight details. | Qiu |
| 2012.5.30 | V1.5 | | Modify 5.1 and 6.1 parameters. | Qiu |

## 3.

AT043B35-15I-10 is a TFT-LCD module. It is composed of a TFT-LCD panel, driver IC , FPC,  a back light unit. The 4.3″ display area contains 480 x 272pixels and can display  up to 262K colors. This product accords with RoHS
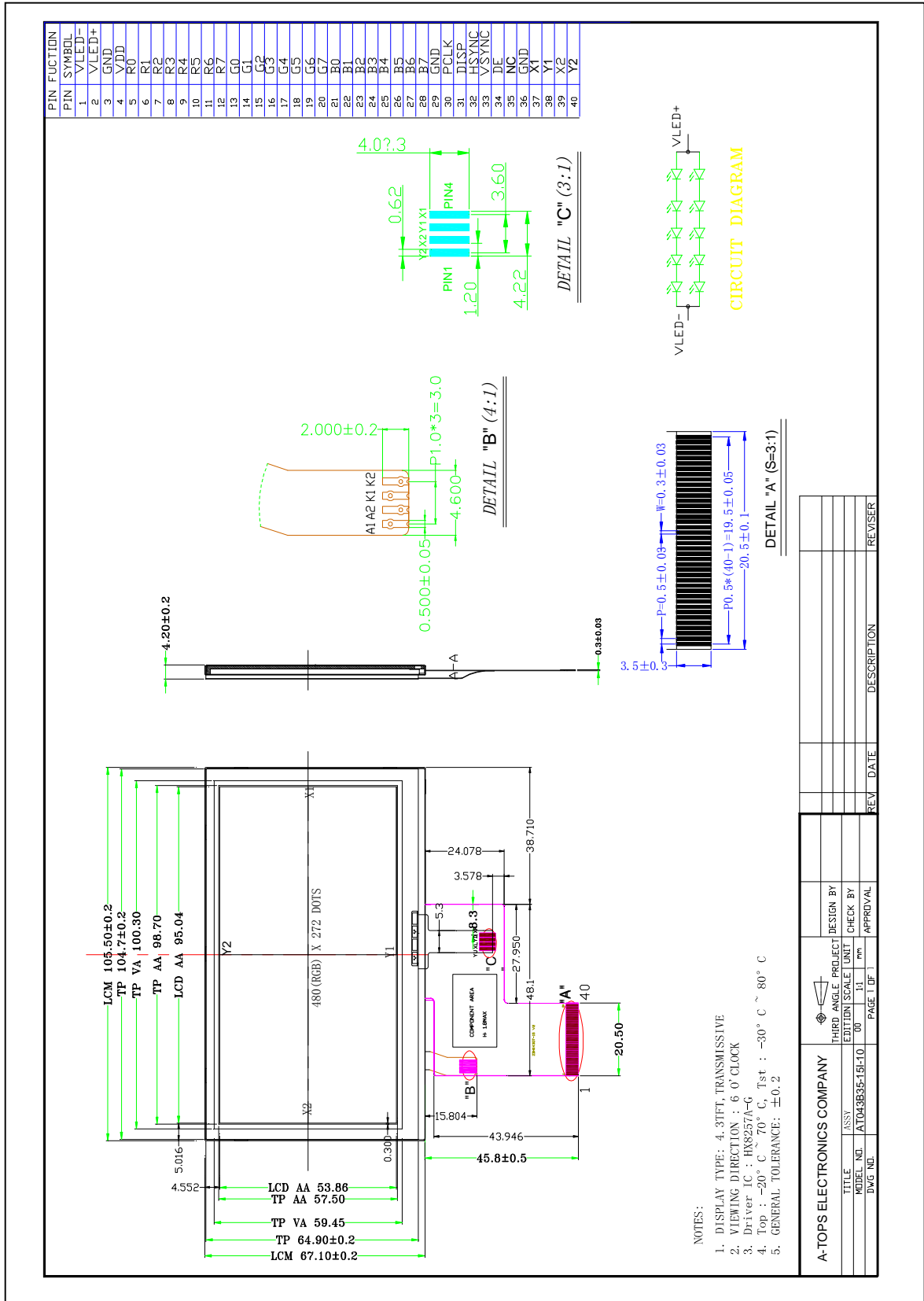
| Item | Contents | Unit | Note |
|---|---|---|---|
| LCD Type | TFT | - | |
| Display color | 262k | | 1 |
| Viewing Direction | 6 | O'Clock | |
| Operating temperature | -20~+70 | ℃ | |
| Storage temperature | -30~+80 | ℃ | |
| Module size | 105.4(W)×67.1(H)×4.2(D) | mm | 2 |
| Active Area(W×H) | 95.04X53.86 | mm | |
| Number of Dots | 480×272 | dots | |
| Controller | HX8257A | - | |
| Power Supply Voltage | 3.0 | V | |
| Outline Dimensions | Refer to outline drawing | - | |
| Backlight | 10-LEDs (white) | pcs | |
| Weight | 30 | g | |
| Interface | F.P.C 0.5mm | - | |
| Data Transfer | RGB888 | - | |
| Polarizer Mode | Transmissive/negative | - | |

environmental criterion.

Note 1:   Color tune is slightly changed by temperature and driving voltage.
Note 2:   Without FPC and Solder.

# 4. Outline Drawing

**Pin Function Table**

| PIN | SYMBOL |
|-----|--------|
| 1 | VLED- |
| 2 | VLED+ |
| 3 | GND |
| 4 | VDD |
| 5 | R0 |
| 6 | R1 |
| 7 | R2 |
| 8 | R3 |
| 9 | R4 |
| 10 | R5 |
| 11 | R6 |
| 12 | R7 |
| 13 | G0 |
| 14 | G1 |
| 15 | G2 |
| 16 | G3 |
| 17 | G4 |
| 18 | G5 |
| 19 | G6 |
| 20 | G7 |
| 21 | B0 |
| 22 | B1 |
| 23 | B2 |
| 24 | B3 |
| 25 | B4 |
| 26 | B5 |
| 27 | B6 |
| 28 | B7 |
| 29 | GND |
| 30 | PCLK |
| 31 | DISP |
| 32 | HSYNC |
| 33 | VSYNC |
| 34 | DE |
| 35 | NC |
| 36 | GND |
| 37 | X1 |
| 38 | Y1 |
| 39 | X2 |
| 40 | Y2 |

DETAIL "C" (3:1)

4.0±0.3
0.62
3.60
1.20
4.22
PIN4
PIN1
Y2X2Y1X1

CIRCUIT DIAGRAM
VLED+
VLED-

DETAIL "B" (4:1)
2.000±0.2
P1.0*3=3.0
4.600
0.500±0.05
A1 A2 K1 K2

DETAIL "A" (S=3:1)
W=0.3±0.03
P=0.5±0.03
P0.5*(40-1)=19.5±0.05
20.5±0.1
3.5±0.3

4.20±0.2
0.3±0.03
A-A

LCM 105.50±0.2
TP 104.7±0.2
TP VA 100.30
TP AA 98.70
LCD AA 95.04
480 (RGB) X 272 DOTS
Y2
Y1
X1
X2

24.078
3.578
5.3
8.3
27.950
48.1
38.710
40
20.50
1
15.804
43.946
45.8±0.5
COMPONENT AREA
Hi-LINK
"C"
"A"
"B"

5.016
0.300
4.552
LCD AA 53.86
TP AA 57.50
TP VA 59.45
TP 64.90±0.2
LCM 67.10±0.2

NOTES:
1. DISPLAY TYPE: 4.3TFT, TRANSMISSIVE
2. VIEWING DIRECTION : 6 O'CLOCK
3. Driver IC : HX8257A-G
4. Top : -20° C ~ 70° C, Tst : -30° C ~ 80° C
5. GENERAL TOLERANCE: ±0.2

A-TOPS ELECTRONICS COMPANY
THIRD ANGLE PROJECT
TITLE
ASSY
MODEL NO. AT043B35-15I-10
DWG NO.
EDITION SCALE UNIT
00  1:1  mm
PAGE 1 OF
DESIGN BY
CHECK BY
APPROVAL
REV | DATE | DESCRIPTION | REVISER

## 5. Absolute Maximum Ratings(Ta=25℃)

### 5.1 Electrical Absolute Maximum Ratings.(Vss=0V ,Ta=25℃)

| Item | Symbol | Min. | Max. | Unit | Note |
|---|---|---|---|---|---|
| Power Supply Voltage | $V_{CC}$ | -0.3 | 3.5 | V | |
| Logic Signal Input /Output Voltage | $V_{IOVCC}$ | -0.3 | $V_{CC}$+0.5 | V | 1，2 |
| Power Supply Voltage for LCD Module | Vop | 0 | 18 | V | |
| Current of LED Backlight | ILED | 0 | 60 | mA | |

Notes:

1. If the module exceeds above absolute maximum ratings, it may become permanently damaged.

   Using the module out of the following electrical characteristic,the module will be malfunction

   and/or cause poor reliability.

2. $V_{CC}$ >$V_{SS}$ must be maintained.

3. Please be sure users are grounded when handing LCD Module.

### 5.2 Environmental Absolute Maximum Ratings.

| Item | Storage | | Operating | | Note |
|---|---|---|---|---|---|
| | MIN. | MAX. | MIN. | MAX. | |
| Ambient Temperature | -30℃ | 80℃ | -20℃ | 70℃ | 1,2 |
| Humidity | 0% RH | 90% RH | 0% RH | 90% RH | -- |

1. The response time will become lower when operated at low temperature.

2. Background color changes slightly depending on ambient temperature.

   The phenomenon is reversible.

# 6. Driver IC Electrical Specifications and Instruction Code

## 6.1 Driver IC Electrical characteristics(Vss=0V,Ta=25°C )

| Parameter | | Symbol | Condition | Min | Typ | Max | Unit | Note |
|---|---|---|---|---|---|---|---|---|
| Power supply | | VCC | Ta=25 | 2.6 | 3.0 | 3.5 | V | |
| Input voltage | 'H' | $V_{IH}$ | $V_{CC}$=3.0V | $0.8V_{CC}$ | - | $V_{CC}$ | V | |
| | 'L' | $V_{IL}$ | $V_{CC}$=3.0V | 0 | - | $0.2V_{CC}$ | V | |
| Current Consumption | | $I_{CC1}$ | Normal mode | - | 15 | 30 | mA | 2 |
| | | $I_{CC2}$ | Sleep mode | - | 0.03 | 0.09 | mA | 2 |

Note:

1:When an optimum contrast is obtained in transmissive mode.

2: Tested in 1×1 chessboard pattern.

## 6.2 LED backlight specification(VSS=0V ,Ta=25℃)

| Item | | Symbol | Condition | Min | Typ | Max | Unit | Note |
|---|---|---|---|---|---|---|---|---|
| Supply voltage | | - | - | - | 16.2 | - | V | 1 |
| Forward current | Normal | $I_{pn}$ | 10-chip | - | 40 | - | mA | 2 |
| | Dimming | $I_{pd}$ | | - | - | - | | |

Note:

1. Supply voltage is voltage dropout on backlight module.

2. The backlight driver in constant current is recommeded.

3. Normal backlight power consumption is 0.65W.
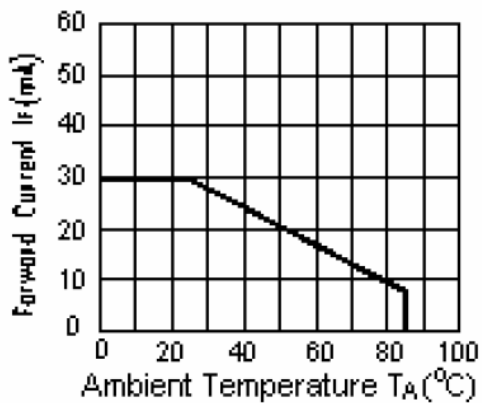


CIRCUIT DIAGRAM                    $I_{LED}$ VS TEMP

**6.3 Interface signals**

| Pin No. | Symbol | I/O | Function |
|---------|--------|-----|----------|
| 1 | VLED- | I | LED back light(Cathode) |
| 2 | VLED+ | I | LED back light(Anode) |
| 3 | GND | | GND |
| 4 | VDD | I | Power supply |
| 5-12 | R0~R7 | I | Red data bus |
| 13-20 | G0~G7 | I | Green data bus |
| 21-28 | B0~B7 | I | Blue data bus |
| 29 | GND | | GND |
| 30 | PCLK | I | Data clock |
| 31 | DISP | I | Standby mode select pin |
| 32 | HSYNC | I | Line SYNC signal |
| 33 | VSYNC | I | Frame SYNC signal |
| 34 | DE | I | Data enable pin |
| 35 | NC | | |
| 36 | GND | | GND |
| 37 | X1 | O | Touch Panel Control pin |
| 38 | Y1 | O | |
| 39 | X2 | O | |
| 40 | Y2 | O | |

## 7. Optical Characteristics

| Item | Symbol | | Condition | Min. | Typ. | Max. | Unit | Note |
|------|--------|--|-----------|------|------|------|------|------|
| Brightness | Bp | | $\theta=0°$ $\Phi=0°$ | 450 | 500 | - | Cd/m$^2$ | 1 |
| Uniformity | $\triangle$Bp | | | 70 | 80 | - | % | 1,2 |
| Viewing Angle | 3:00 | | Cr≥10 | - | 65 | - | Deg | 3 |
| | 6:00 | | | - | 55 | - | | |
| | 9:00 | | | - | 65 | - | | |
| | 12:00 | | | - | 45 | - | | |
| Contrast Ratio | Cr | | $\theta=0°$ $\Phi=0°$ | 200 | 250 | | - | 4 |
| Response Time | $T_r$ | | | - | 16 | - | ms | 5 |
| | $T_f$ | | | - | 12 | - | ms | |
| Color of CIE Coordinate | W | x | $\theta=0°$ $\Phi=0°$ | 0.23 | 0.28 | 0.33 | - | 1,6 |
| | | y | | 0.28 | 0.33 | 0.38 | - | |
| | R | x | | 0.46- | 0.51 | 0.56 | - | |
| | | y | | 0.29 | 0.34 | 0.39 | - | |
| | G | x | | 0.26 | 0.31 | 0.36 | - | |
| | | y | | 0.51 | 0.56 | 0.61 | - | |
| | B | x | | 0.10 | 0.15 | 0.20 | - | |
| | | y | | 0.09 | 0.14 | 0.19 | - | |
| NTSC Ratio | S | | | 45 | 60 | - | % | |

Note：The parameter is slightly changed by temperature, driving voltage and materiel

Note 1: The data are measured after LEDs are turned on for 5 minutes. LCM displays full white. The brightness is the average value of 9 measured spots. Measurement equipment PR-705 (Φ8mm)

Measuring condition:
- Measuring surroundings: Dark room.
- Measuring temperature: Ta=25℃.
- Adjust operating voltage to get optimum contrast at the center of the display.

Measured value at the center point of LCD panel after more than 5 minutes while backlight turning on.
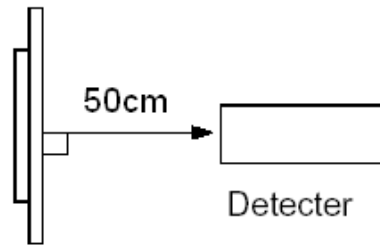
Note 2: The luminance uniformity is calculated by using following formula.

$\triangle$Bp = Bp (Min.) / Bp (Max.)×100 (%)
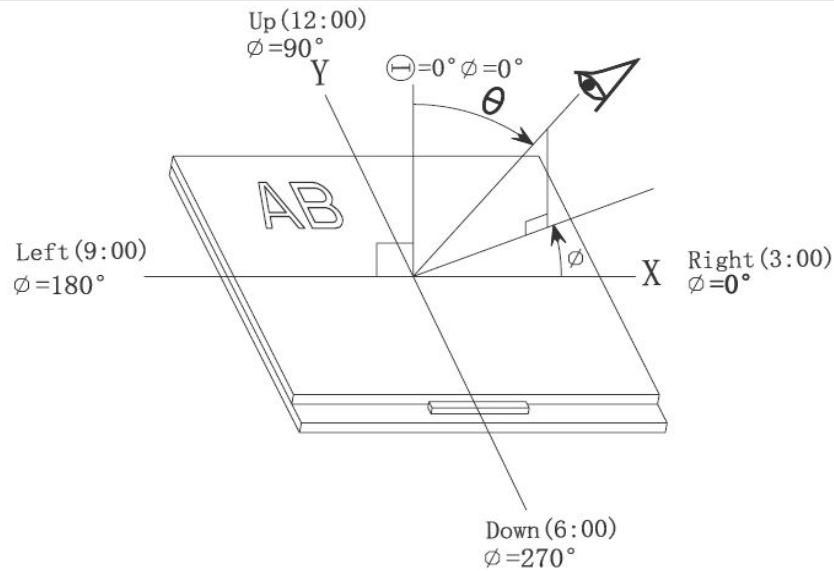
Bp (Max.) = Maximum brightness in 9 measured spots
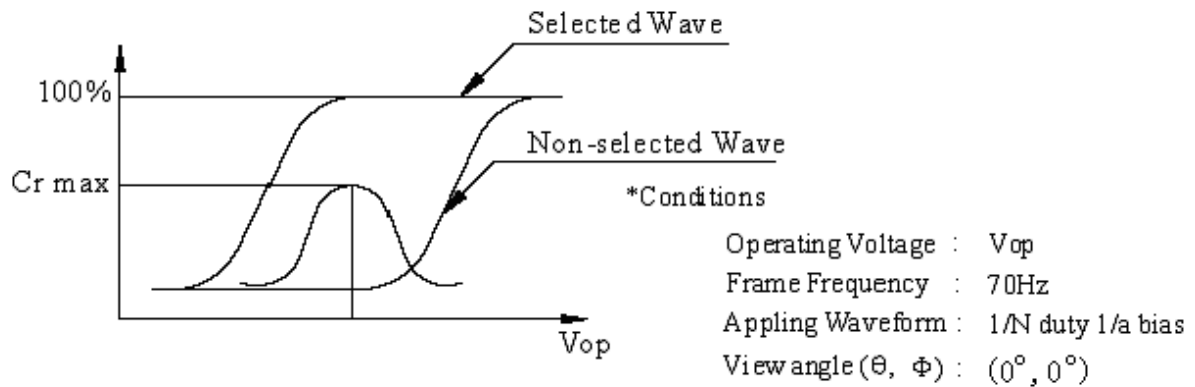
Bp (Min.) = Minimum brightness in 9 measured spots.
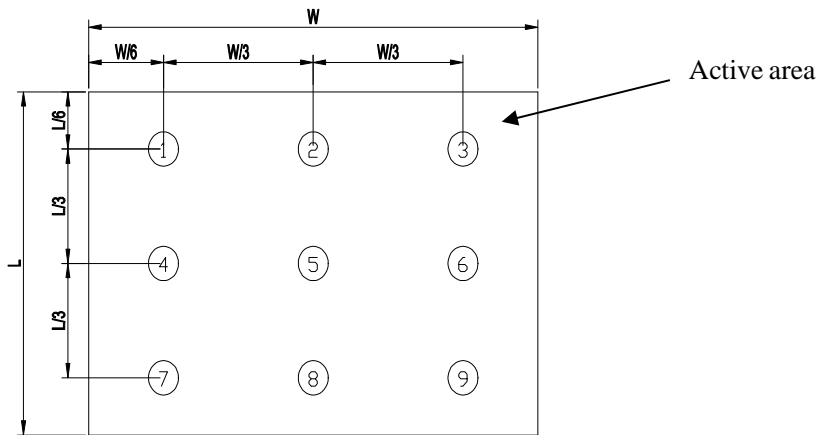


Note 3: The definition of viewing angle:
Refer to the graph below marked by $\theta$ and $\Phi$

Up (12:00)
$\varnothing$ =90°

$\ominus$=0° $\varnothing$ =0°

$\theta$

Y

AB

Left (9:00)
$\varnothing$ =180°

$\varnothing$

X

Right (3:00)
$\varnothing$ =0°

Down (6:00)
$\varnothing$ =270°

Note 4: Definition of contrast ratio.( Test LCD using DMS501)

Selected Wave

100%

Cr max

Non-selected Wave

*Conditions

Operating Voltage : Vop

Frame Frequency : 70Hz

Appling Waveform : 1/N duty 1/a bias

View angle (θ, Φ) : (0°, 0°)

Vop

$$Contrast\ ratio(Cr) = \frac{Brightness\ of\ selected\ dots}{Brightness\ of\ non-selected\ dots}$$

Note 5: Definition of Response time. (Test LCD using DMS501):

The output signals of photo detector are measured when the input signals are changed from "black" to "white"(falling time) and from "white" to "black"(rising time), respectively. The response time is defined as the time interval between the 10% and 90% of amplitudes.Refer to figure as below.
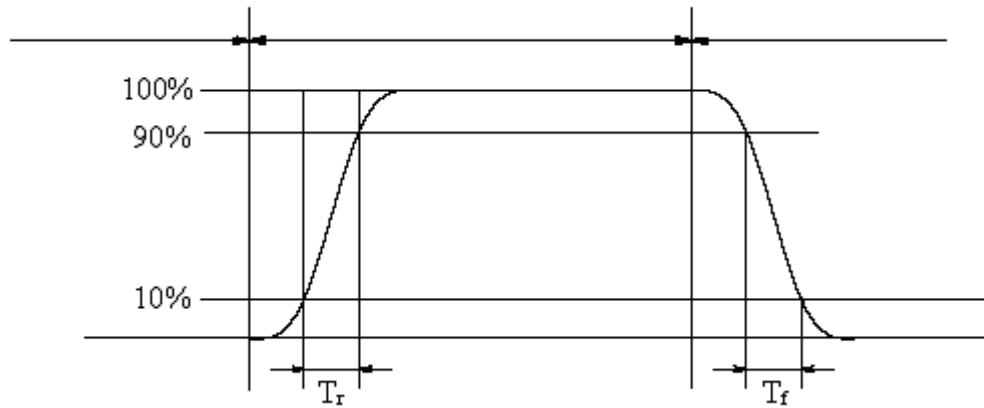
The definition of response time

Note 6: Definition of Color of CIE Coordinate and NTSC Ratio.



1931 CIE Chromaticity Diagram
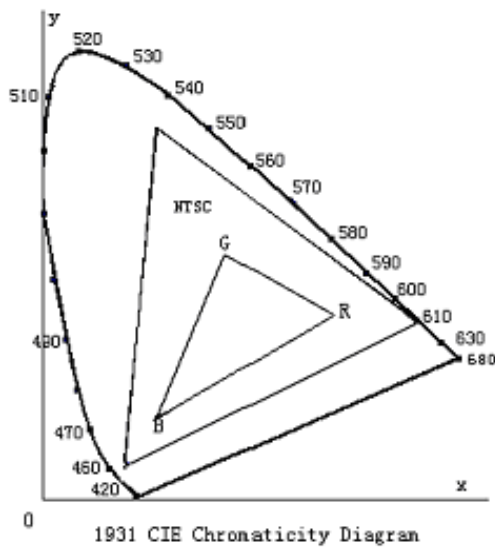
**Color gamut:**

$$S = \frac{\text{area of RGB triangle}}{\text{area of NTSC triangle}} \times 100\%$$

Note 7: Definition of cross talk.

Cross talk ratio(%)=|pattern A Brightness-pattern B Brightness|/pattern A Brightness*100



Pattern A          Pattern B

Measurement point(center)
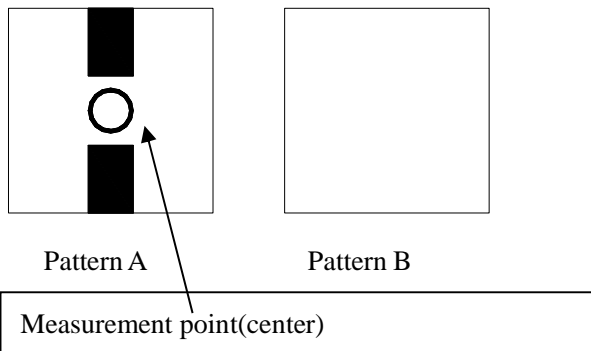
Electric volume value=3F+/-3Hex

## 8. Reliability Test Items and Criteria

| No | Test Item | Test condition | Criterion |
|---|---|---|---|
| 1 | High Temperature Storage | 80℃±2℃ 96H<br>Restore 2H at 25℃<br>Power off | 1. After testing, cosmetic and electrical defects should not happen.<br>2. Total current consumption should not be more than twice of initial value. |
| 2 | Low Temperature Storage | -30℃±2℃ 96H<br>Restore 2H at 25℃<br>Power off | |
| 3 | High Temperature Operation | 70℃±2℃ 96H<br>Restore 2H at 25℃<br>Power on | |
| 4 | Low Temperature Operation | -20℃±2℃ 96H<br>Restore 4H at 25℃<br>Power on | |
| 5 | High Temperature/Humidity Operation | 60℃±2℃ 90%RH 96H<br>Power on | |
| 6 | Temperature Cycle | −30℃ ←—————→ 80℃<br><br>30min    5min    30min<br><br>after 5 cycle, Restore 2H at 25℃<br>Power off | |
| 7 | Vibration Test | 10Hz~150Hz, 100m/s², 120min | Not allowed cosmetic and electrical defects. |
| 8 | Shock Test | Half- sine wave,300m/s²,11ms | |

Note: Operation: Supply 3.0V for logic system.

The inspection terms after reliability test, as below

| ITEM | Inspection |
|---|---|
| Contrast | CR>50% |
| IDD | IDD<200% |
| Brightness | Brightness>60% |
| Color Tone | Color Tone+/-0,05 |

## 9 Quality level

### 9.1 Classification of defects

Major defects (MA): A major defect refers to a defect that may substantially degrade usability for product applications, including all functional defects(such as no display, abnormal display, open or missing segment, short circuit, missing component), outline dimension beyond the drawing, progressive defects and those affecting reliability.

Minor defects (MI): A minor defect refers to a defect which is not considered to be able to substantially degrade the product application or a defect that deviates from existing standards almost unrelated to the effective use of the product or its operation, such as black spot, white spot, bright spot, pinhole, black line, white line, contrast variation, glass defect, polarizer defect, etc.

## 9.2 Definition of inspection range

This dot defect of TFT LCD which is for AT043B35-15I-10 V1.4 dividing three areas to make a judgment (according to figure 1).

A area : center of viewing area

B area : periphery of viewing area

C area : Outside viewing area

For other defects, dividing two areas to make a judgment (according figure 2).

A zone : Inside Viewing area

B zone : Outside Viewing area

X1(A.A~V.A): 2mm      X2(A.A~V.A): 2mm

Y1(A.A~V.A): 2mm      Y2(A.A~V.A): 2mm



Figure 1

Figure 2

A zone: Viewing Area(VA)

## 9.3 Inspection items and general notes

| General notes | ①Should any defects which are not specified in this standard happen, additional standard shall be determined by mutual agreement between customer and A-TOPS. ②Viewing area should be the area which A-TOPS guarantees. ③Limit sample should be prior to this Inspection standard. ④Viewing judgment should be under static pattern. ⑤Inspection conditions<br>　Inspection distance: 250 mm (from the sample)　　Temperature　　: 25±5 ºC<br>　Inspection angle　: 45 degrees in 12 o'clock direction (all defects in viewing area should be inspected from this direction) | |
|---|---|---|
| Inspection items | Pinhole, Bright spot, Black spot, White spot, Black line, White Line, Foreign particle, Bubble | The color of a small area is different from the remainder. The phenomenon doesn't change with voltage |
| | Contrast variation | The color of a small area is different from the remainder. The phenomenon changes with voltage |
| | Polarizer defect | Scratch, Dirt, Particle, Bubble on polarizer or between polarizer and glass |
| | Dot defect (TFT LCD) | The pixel appears bright or dark abnormally when display |
| | Functional defect | No display, Abnormal display, Open or missing segment, Short circuit, False viewing direction |
| | Glass defect | Glass crack, Shaved corner of glass, Surplus glass |
| | PCB defect | Components assembly defect |

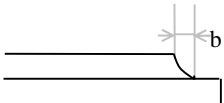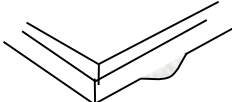## 9.4 Outgoing Inspection level

| Outgoing Inspection standard | Inspection conditions | Inspection | | | | |
|---|---|---|---|---|---|---|
| | | Min. | Max. | Unit | IL | AQL |
| Major Defects | See 8.3 general notes | See 8.5 | | | II | 0.065 |
| Minor Defects | See 8.3 general notes | See 8.5 | | | II | 0.065 |
| Note：Sampling standard conforms to GB2828 | | | | | | |
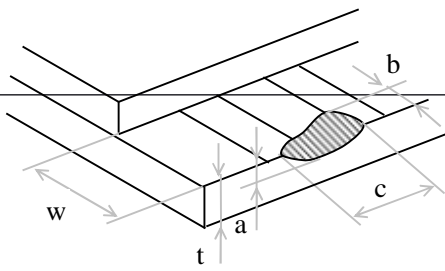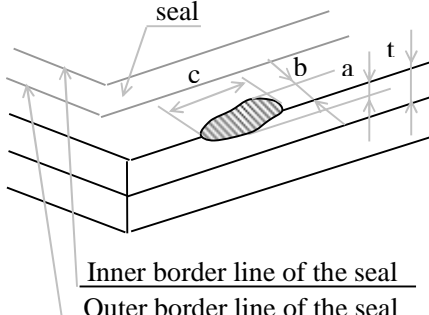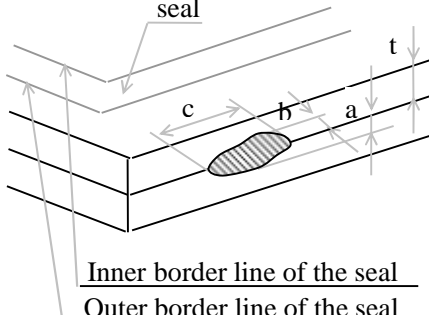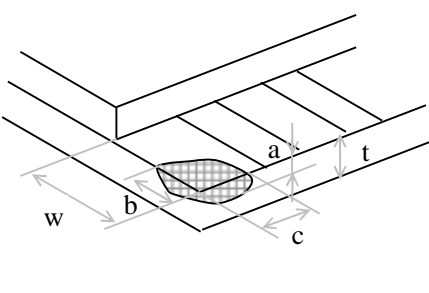
## 9.5 Inspection Items and Criteria

| Inspection items | | | Judgment standard | | | |
|---|---|---|---|---|---|---|
| | | | Category | | Acceptable number | |
| | | | | | A zone | B zone |
| 1 | Black spot, White spot, Pinhole, Foreign Particle, Particle in or on glass, Scratch on glass |  $\Phi=(a+b)/2(m$ | A | $\Phi<=0.15$ | Neglected | Neglected |
| | | | B | $0.15< \ <= \ 0.35$ | 3 | |
| | | | C | $0.35< \ \Phi$ | 0 | |
| | | | D | - | - | |
| | | | Total defective point(B,C) | | 3 | |
| 2 | Black line, White line, and Particle Between Polarizer and glass, Scratch on glass |  W: Width  L:Length(mm) | A | $W<=0.05$ | Neglected | Neglected |
| | | | B | $0.05<W<=0.1$ $L<=5.0$ | 2 | |
| | | | C | $0.1<W$ , $5.0<L$ | 0 | |
| | | | Total defective point(B,C) | | 2 | |
| 3 | Bright spot | | any size | | none | none |
| 4 | Contrast variation |  $\Phi=(a+b)/2(mm)$ | A | $\Phi<0.3$ | Neglected | Neglected |
| | | | B | $0.3<\Phi<=0.4$ | 3 | |
| | | | C | $0.4<\Phi$ | 0 | |
| | | | Total defective point(B,C) | | 3 | |
| 5 | Bubble inside cell | | any size | | none | none |

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| 6 | Polarizer defect (if Polarizer is used) | Scratch ,damage on polarizer, Particle on polarizer or between polarizer and glass. | Refer to item 1 and item 2. | | | |
|---|---|---|---|---|---|---|
| | | Bubble, dent and convex | A | Φ<=0.2 | Neglected | Neglected |
| | | | B | 0.2 <Φ<=0.3 | 3 | |
| | | | C | 0.5 <Φ | 0 | |

| 7 | Surplus glass | Stage surplus glass  | B<=0.4mm |
|---|---|---|---|
| | | Surrounding surplus glass  | Should not influence outline dimension and assembling. |

| 8 | Open segment or open common | Not permitted |
|---|---|---|
| 9 | Short circuit | Not permitted |
| 10 | False viewing direction | Not permitted |
| 11 | Contrast ratio uneven | According to the limit specimen |
| 12 | Crosstalk | According to the limit specimen |
| 13 | Black /White spot(display) | Refer to item 1 |
| 14 | Black /White line(display) | Refer to item 2 |

| | Inspection items | | Judgment standard | | Acceptable number |
|---|---|---|---|---|---|
| | | | Category(application: B zone) | | |
| 15 | Glass defect crack | ⅰ）The front of lead terminals  | A | a≤ t,  b≤1/5W,  c≤4mm | Max.3 defects allowed |

| | | | B | Crack at two sides of lead terminals should not cover patterns and alignment mark |
|---|---|---|---|---|
| | | ⅱ）Surrounding crack－non-contact side  | | b < Inner borderline of the seal |
| | | ⅲ）Surrounding crack－ contact side  | | b < Outer borderline of the seal |
| | | ⅳ）Corner  | A | a <= t,   b <= 5.0,   c <= 5.0 |
| | | | B | Glass crack should not cover patterns u and alignment mark and patterns. |

| Inspection items | Judgment standard |
|---|---|
| | Category(application: B zone) |

| 16 | FPC defect | Component soldering:<br>No cold soldering、short、open circuit、burr、tin ball<br>The flat encapsulation component position deviation must be less than 1/3 width of the pin (Pic.1);<br>the sheet component deviation:<br>Pin deviates from the pad and contact with the near components is not permitted（Pic.2） | Component<br>$L \leq W/2$  W<br>Soldering pad  Lead  Component<br>$L1 > 0$<br>$L2 > 0$ |
|---|---|---|---|
| | | lead defect:<br>The lead lack must be less than 1/3 of its width;<br>The lead burr must be less than 1/3 of the seam;<br>Impurities connect with the near leads is not permitted | |
| | | Connector soldering:<br>Soldering tin is at contact position of the plug and socket is not permitted<br>No foundation is scald<br>Serious cave distortion on plug and socket contact pin is not permitted | head  Base Board<br>Soldering tin is not permit in this area<br><br>Soldering tin is not permit in this area<br>socket<br>Base Board |
| | | Glue on root of the speaker receiver and motor lead:<br>The insulative coat of the lead must join into the FPC; the protected glue must envelop to the insulative coat. | Glue  Lead<br>FPC  Insulative coat |

# 10. Precautions for Use of LCD Modules

## 10.1 Handling Precautions

10.1.1 The display panel is made of glass. Do not subject it to a mechanical shock

by dropping it from a high place, etc.

10.1.2 If the display panel is damaged and the liquid crystal substance inside it leaks out, be sure not to get any in your mouth, if the substance comes into contact with your skin or clothes, promptly wash it off using soap and

10.1.3 Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary.

10.1.4 The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully.

10.1.5 If the display surface is contaminated, breathe on the surface and gently wipe it with a soft dry cloth. If still not completely clear, moisten cloth with one of the following solvents:

&mdash; Isopropyl alcohol

&mdash; Ethyl alcohol

Solvents other than those mentioned above may damage the polarizer. Especially, do not use the following:

&mdash; Water

&mdash; Ketone

&mdash; Aromatic solvents

10.1.6 Do not attempt to disassemble the LCD Module.

10.1.7 If the logic circuit power is off, do not apply the input signals.

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

a. Be sure to ground the body when handling the LCD Modules.

b. Tools required for assembly, such as soldering irons, must be properly ground.

c. To reduce the amount of static electricity generated, do not conduct assembly and other work under dry conditions.

d. The LCD Module is coated with a film to protect the display surface. Be care when peeling off this protective film since static electricity may be generated.