# LEADER TIME SRL

# PRODUCT SPECIFICATION

## 16*4 Characters COB LCD MODULE
## MODEL: LT-1604A-512 Ver:1.0

< ◇ > Finally Specification

| CUSTOMER'S APPROVAL | |
|---|---|
| **CUSTOMER :** | |
| **SIGNATURE:** | **DATE:** |
| | |

| APPROVED BY | PM REVIEWD | PD REVIEWD | PREPARED By |
|---|---|---|---|
| | | | |

**Prepared By:**

**LEADER TIME SRL**

**VIA MONS. PROSDOCIMI, 27**

**36042 BREGANZE (VI)**

- This specification is subject to change without notice. Please contact LT or its representative before designing your product based on this specification.

# Revision Status

| Version | Revise Date | Page | Content | Modified By |
|---------|-------------|------|---------|-------------|
| **VER 1.0** | **2018-05-28** | | **First Issued** | |
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**Model No.:** LT-1604A-512 **Ver:**1.0

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# 1. FEATURES

The features of LCD are showed as follows

* Display mode : STN/Gray/Transflective/Positive/Anti-UV

* Controller IC : AIP31066W3(English and Russian)

* Display format : 16X4Characters

* Interface : 4 Bit or 8 Bit MPU

* Driving Method : 1/16Duty, 1/5Bias

* Viewing Direction : 12 O'clock

* Backlight : 3 LED Side Blue

*Sample NO. : C1604A9SKB7B-B2_01/20180515

# 2. MECHANICAL SPECIFICATIONS

| Item | Specification | Unit |
|---|---|---|
| Module Size | 87(W) x60(H) x14.5MAX(D) | mm |
| Viewing Area | 61.8 (W) x 25.2(H) | mm |
| Activity Display Area | 56.21(W)x20.81(H) | mm |
| Character Font | 5x8 Dots | - |
| Character Size | 2.96(W)x4.76(H) | mm |
| Character Pitch | 3.55 (W) x5.35(H) | mm |
| Dot Size | 0.56(W)x0.56(H) | mm |

# 3. ELECTRICAL SPECIFICATIONS

### 3-1 ABSOLUTE MAXIMUM RATINGS (Ta = 25 °C)

| Item | Symbol | Min | Max | Unit |
|---|---|---|---|---|
| Supply Voltage For Logic | $V_{DD}$ | -0.3 | 7.0 | V |
| Supply Voltage For LCD Drive | $V_{LCD}$ | $V_{DD}$-10 | $V_{DD}$+0.3 | V |
| Input Voltage | Vin | -0.3 | $V_{DD}$+0.3 | V |
| Operating Temp. | Top | -20 | +70 | °C |
| Storage Temp. | Tst | -30 | +80 | °C |

*. NOTE: The response time will be extremely slow when the operating temperature is around -10℃, and the back ground will become darker at high temperature operating.

## 3-2 ELECTRICAL CHARACTERISTICS

| Item | | Symbol | Test Condition | Min. | Typ. | Max. | Unit |
|------|------|--------|----------------|------|------|------|------|
| Logic supply Voltage | | $V_{DD} - V_{ss}$ | | - | 5 | - | V |
| LCD Drive | | $V_{LCD}$ | | 4.1 | 4.2 | 4.4 | V |
| Input Voltage | "H" Level | $V_{IH}$ | Ta = 25 °C | 0.7 $V_{DD}$ | - | $V_{DD}$ | V |
| | "L" Level | $V_{IL}$ | $V_{DD}$=5V $\pm$ 10% | -0.3 | - | 0.6 | V |
| Frame Frequency | | $f_{FLM}$ | | - | 75 | - | Hz |
| Current Consumption | | $I_{DD}$ | | - | 1.4 | - | mA |

## 3-3 BACKLIGHT

### 3-3-1. Absolute Maximum Ratings

| Item | Symbol | Condition | Min. | Typ. | Max. | Unit |
|------|--------|-----------|------|------|------|------|
| Forward Current | IF | | - | - | 75 | mA |
| Power Dissipation | PD | Ta = 25 °C | - | - | 232.5 | mW |
| Reverse Current | IR | | - | - | 15 | uA |

### 3-3-2. Electrical-optical Characteristics

| Item | Symbol | Condition | Min. | Typ. | Max. | Unit |
|------|--------|-----------|------|------|------|------|
| Forward Voltage | VF | | 2.9 | 3.1 | 3.3 | V |
| Average Luminous Intensity | Iv | If=45mA Ta = 25 °C | 100 | - | - | cd/m$^2$ |
| Peak wave length | $\lambda$p | | 465 | 470 | 475 | nm |

**The brightness is measured without LCD panel**

For operation above 25 °C,The lfm & Pd must be derated , the current derating is -0.36mA/ °C for DC drive and -0.86mA/ °C for Pulse drive ,the Power dissipation is -0.75mW/ °C.The product working current must not more than the 60%of the lfm or Ifp according to the working temperature.

# 4. TERMINAL FUNCTIONS AND BLOCK DIAGRAM

## 4-1 INTERFACE PIN FUNCTION DESCRIPTION

| PIN NO. | SYMBOL | FUNCTIONS |
|---------|--------|-----------|
| 1 | VSS | Ground |
| 2 | VDD | Supply voltage for logical circuit |
| 3 | V0 | Supply voltage for LCD driving |
| 4 | RS | A signal for selecting registers. |
| 5 | R/W | A signal for selecting read or write actions.1: Read, 0: Write. |
| 6 | E | Read / Write enable signal |
| 7-14 | DB0~DB7 | Data Bus |
| 15 | BLU-A | Backlight (5.0V) |
| 16 | BLU-K | Backlight (-) |

## 4-2 BLOCK DIAGRAM

**Model No.:** LT-1604A-512 **Ver:**1.0
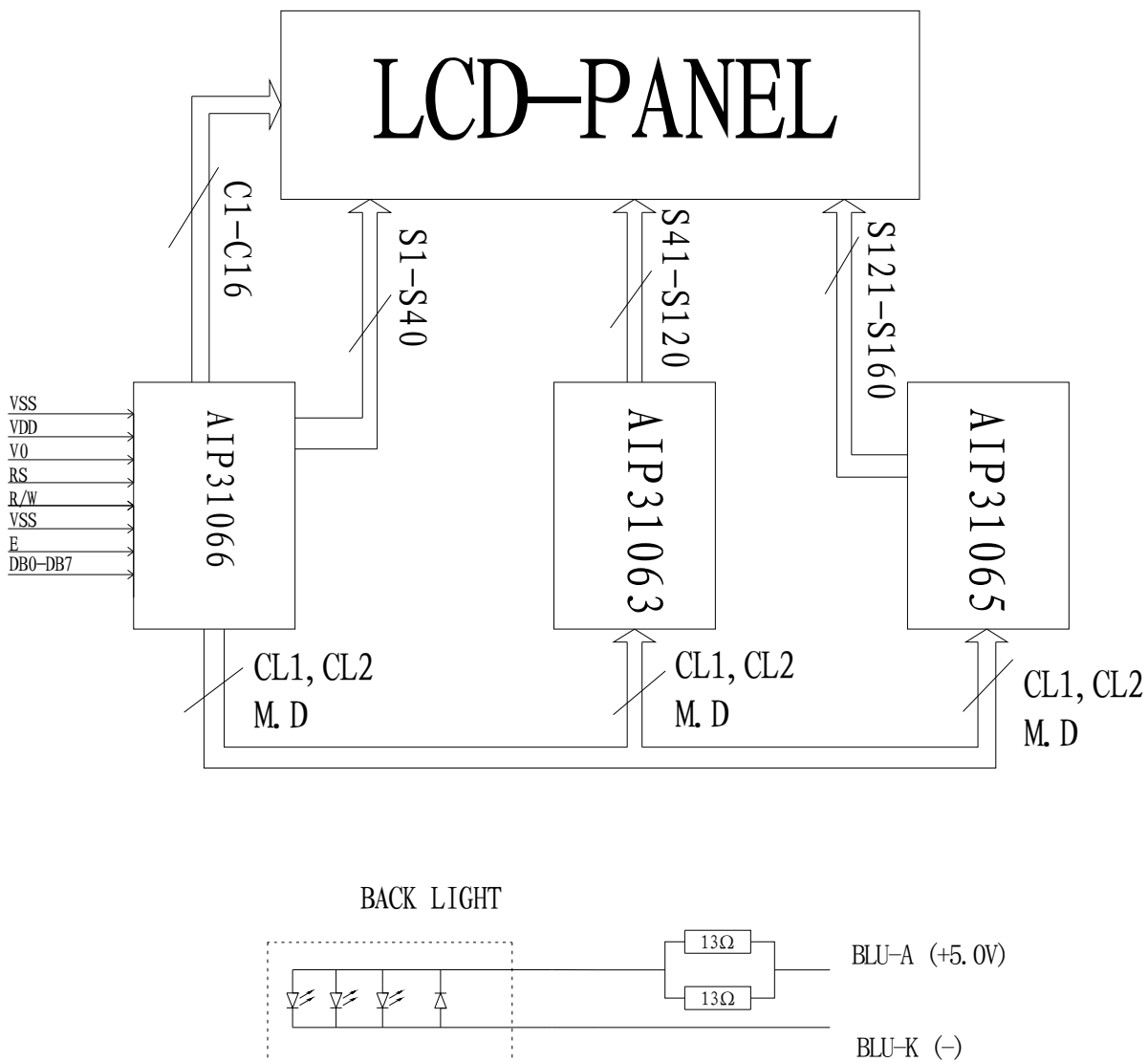
# 5. TIMING CHARACTERISTICS

## 5-1 Write mode
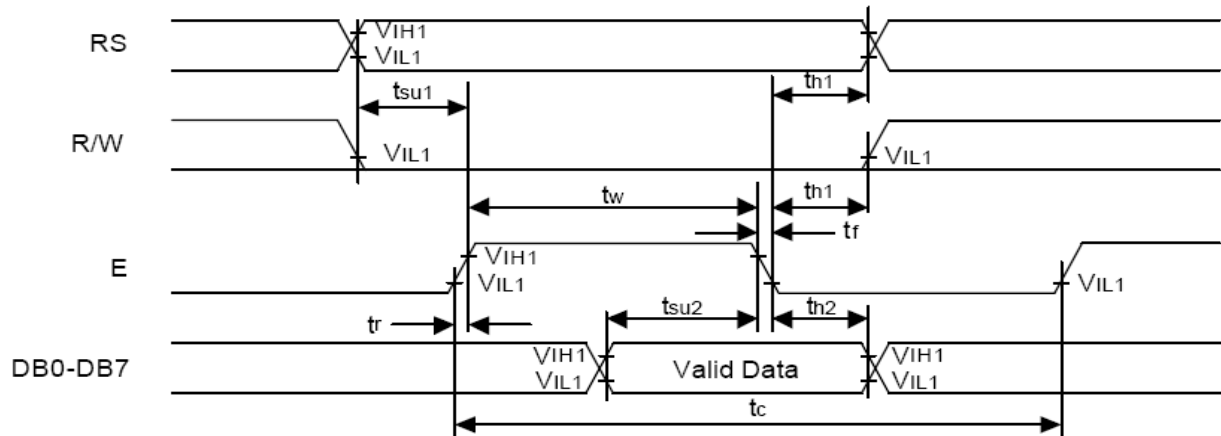


(VDD = 5V, Ta = 25°C)

| Mode | Characteristics | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| Write Mode (refer to Figure-6) | E Cycle Time | $t_c$ | 500 | – | – | ns |
| | E Rise/Fall Time | $t_R$, $t_F$ | – | – | 20 | |
| | E Pulse Width (High, Low) | $t_w$ | 230 | – | – | |
| | R/W and RS Setup Time | $t_{su1}$ | 40 | – | – | |
| | R/W and RS Hold Time | $t_{H1}$ | 10 | – | – | |
| | Data Setup Time | $t_{su2}$ | 80 | – | – | |
| | Data Hold Time | $t_{H2}$ | 10 | – | – | |

## 5.2 Read mode



(VDD = 5V, Ta = 25°C)
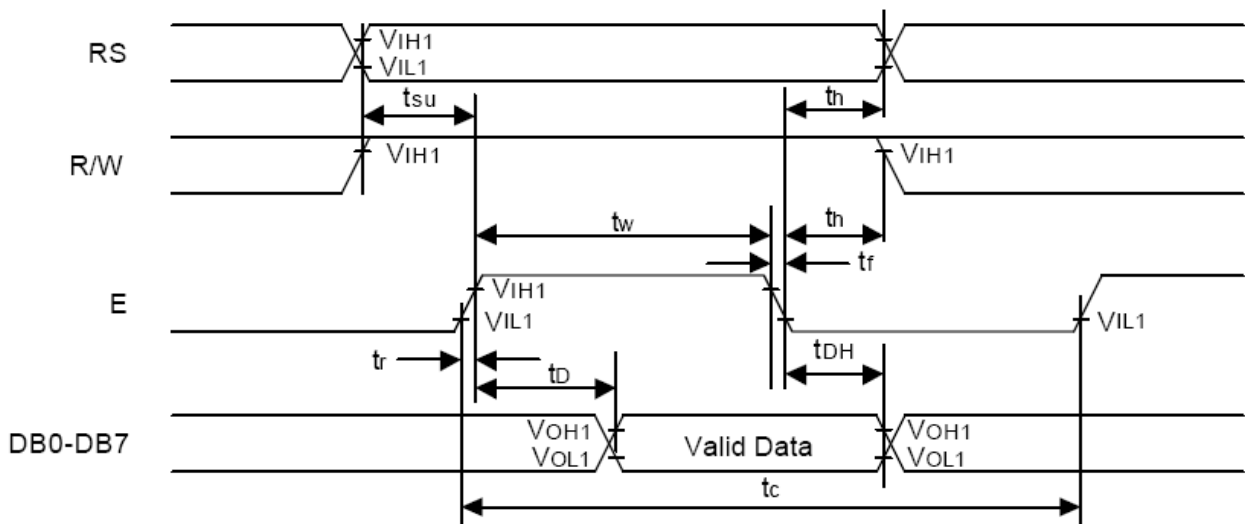
| Read Mode | Characteristics | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| Read Mode (refer to Figure-7) | E Cycle Time | $t_c$ | 500 | – | – | ns |
| | E Rise/Fall Time | $t_R$, $t_F$ | – | – | 20 | |
| | E Pulse Width (High, Low) | $t_w$ | 230 | – | – | |
| | R/W and RS Setup Time | $t_{su}$ | 40 | – | – | |
| | R/W and RS Hold Time | $t_H$ | 10 | – | – | |
| | Data Output Delay Time | $t_D$ | – | – | 120 | |
| | Data Hold Time | $t_{DH}$ | 5 | – | – | |

# 6. COMMAND LIST

## 6-1 Instruction Table

| Instruction | Instruction Code | | | | | | | | | | Description Instruction Code | Execution time(fsoc=270) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | RS | R/W | DB7 | DB6 | DB5 | DB4 | DB3 | DB2 | DB1 | DB0 | | |
| Clear Display | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | Write "20H" to DDRAM. and set DDRAM address to "00H" from AC. | 1.53ms |
| Return Home | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | X | Set DDRAM address to "00H" from AC and return cursor to its original position if shifted. The contents of DDRAM are not changed. | 1.53ms |
| Entry Mode Set | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | I/D | SH | Assign cursor moving direction and make shift of entire display enable. | 39μs |
| Display ON/OFF Control | 0 | 0 | 0 | 0 | 0 | 0 | 1 | D | C | B | Set display(D), cursor(C), and blinking of cursor(B) on/off control bit. | 39μs |
| Cursor or Display Shift | 0 | 0 | 0 | 0 | 0 | 1 | S/C | R/L | X | X | Set cursor moving and display shift control bit, and the direction, without changing DDRAM data. | 39μs |
| Function Set | 0 | 0 | 0 | 0 | 1 | DL | N | F | X | X | Set interface data length (DL : 4-bit/8-bit), numbers of display line (N : 1-line/2-line), display font type (F : 5 X 8 dots/ 5 X 11 dots) | 39μs |
| Set CGRAM Address | 0 | 0 | 0 | 1 | AC5 | AC4 | AC3 | AC2 | AC1 | AC0 | Set CGRAM address in address counter. | 39μs |
| Set DDRAM Address | 0 | 0 | 1 | AC6 | AC5 | AC4 | AC3 | AC2 | AC1 | AC0 | Set DDRAM address in address counter. | 39μs |
| Read Busy Flag and Address | 0 | 1 | BF | AC6 | AC5 | AC4 | AC3 | AC2 | AC1 | AC0 | Whether during internal operation or not can be known by reading BF. The contents of address counter can also be read. | 0μs |
| Write Data to RAM | 1 | 0 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | Write data into internal RAM (DDRAM/CGRAM). | 43μs |
| Read Data from RAM | 1 | 1 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | Read data from internal RAM (DDRAM/CGRAM). | 43μs |

**NOTE:** When an MPU program with checking the Busy Flag (DB7) is made, it must be necessary 1/2 fosc is necessary for executing the next instruction by the falling edge of the 'E' signal after the Busy Flag (DB7) goes to "LOW".
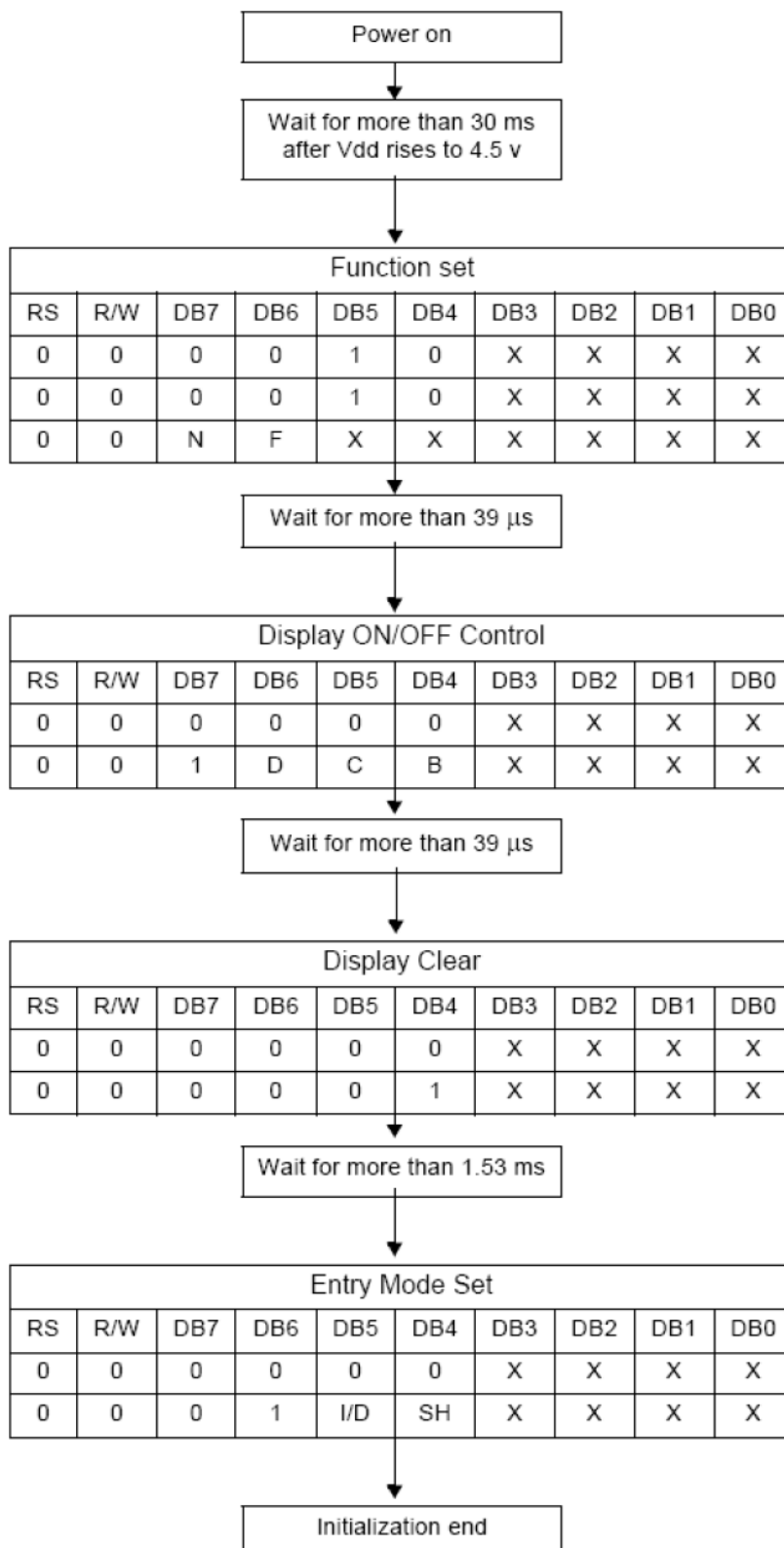
# 7. INSTRUCTION SET

## INITIALIZING BY INSTRUCTION

1) 8-bit interface mode (Condition: fosc = 270KHZ)

| Power on |
| --- |

↓

| Wait for more than 30 ms after Vᴅᴅ rises to 4.5 v |
| --- |

↓

**Function set**

| RS | R/W | DB7 | DB6 | DB5 | DB4 | DB3 | DB2 | DB1 | DB0 |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 0 | 0 | 0 | 0 | 1 | 1 | N | F | X | X |

| N | 0 | 1-line mode |
| --- | --- | --- |
| | 1 | 2-line mode |

| F | 0 | display off |
| --- | --- | --- |
| | 1 | display on |

↓

| Wait for more than 39 µs |
| --- |

↓

**Display ON/OFF Control**

| RS | R/W | DB7 | DB6 | DB5 | DB4 | DB3 | DB2 | DB1 | DB0 |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 0 | 0 | 0 | 0 | 0 | 0 | 1 | D | C | B |

| D | 0 | display off |
| --- | --- | --- |
| | 1 | display on |

| C | 0 | cursor off |
| --- | --- | --- |
| | 1 | cursor on |

| B | 0 | blink off |
| --- | --- | --- |
| | 1 | blink on |

↓

| Wait for more than 39 µs |
| --- |

↓

**Display Clear**

| RS | R/W | DB7 | DB6 | DB5 | DB4 | DB3 | DB2 | DB1 | DB0 |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |

↓

| Wait for more than 1.53 ms |
| --- |

↓

**Entry Mode Set**

| RS | R/W | DB7 | DB6 | DB5 | DB4 | DB3 | DB2 | DB1 | DB0 |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | I/D | SH |

| I/D | 0 | decrement mode |
| --- | --- | --- |
| | 1 | increment mode |

| SH | 0 | entire shift off |
| --- | --- | --- |
| | 1 | entire shift on |

↓

| Initialization end |
| --- |

2) 4-bit interface mode (Condition: fosc = 270KHZ)

Power on

Wait for more than 30 ms after Vdd rises to 4.5 v

**Function set**

| RS | R/W | DB7 | DB6 | DB5 | DB4 | DB3 | DB2 | DB1 | DB0 |
|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 0  | 0   | 0   | 0   | 1   | 0   | X   | X   | X   | X   |
| 0  | 0   | 0   | 0   | 1   | 0   | X   | X   | X   | X   |
| 0  | 0   | N   | F   | X   | X   | X   | X   | X   | X   |

| N | 0 | 1-line mode |
|---|---|-------------|
|   | 1 | 2-line mode |

| F | 0 | display off |
|---|---|-------------|
|   | 1 | display on  |

Wait for more than 39 µs

**Display ON/OFF Control**

| RS | R/W | DB7 | DB6 | DB5 | DB4 | DB3 | DB2 | DB1 | DB0 |
|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 0  | 0   | 0   | 0   | 0   | 0   | X   | X   | X   | X   |
| 0  | 0   | 1   | D   | C   | B   | X   | X   | X   | X   |

| D | 0 | display off |
|---|---|-------------|
|   | 1 | display on  |

| C | 0 | cursor off |
|---|---|------------|
|   | 1 | cursor on  |

| B | 0 | blink off |
|---|---|-----------|
|   | 1 | blink on  |

Wait for more than 39 µs

**Display Clear**

| RS | R/W | DB7 | DB6 | DB5 | DB4 | DB3 | DB2 | DB1 | DB0 |
|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 0  | 0   | 0   | 0   | 0   | 0   | X   | X   | X   | X   |
| 0  | 0   | 0   | 0   | 0   | 1   | X   | X   | X   | X   |

Wait for more than 1.53 ms

**Entry Mode Set**

| RS | R/W | DB7 | DB6 | DB5 | DB4 | DB3 | DB2 | DB1 | DB0 |
|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 0  | 0   | 0   | 0   | 0   | 0   | X   | X   | X   | X   |
| 0  | 0   | 0   | 1   | I/D | SH  | X   | X   | X   | X   |

| I/D | 0 | decrement mode |
|-----|---|----------------|
|     | 1 | increment mode |

| SH | 0 | entire shift off |
|----|---|------------------|
|    | 1 | entire shift on  |

Initialization end

# 8. CHARACTER GENERATOR ROM

| Upper 4bit / Lower 4bit | LLLL | LLLH | LLHL | LLHH | LHLL | LHLH | LHHL | LHHH | HLLL | HLLH | HLHL | HLHH | HHLL | HHLH | HHHL | HHHH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LLLL | CG RAM (1) | | | | | | | | | | | | | | | |
| LLLH | (2) | | | | | | | | | | | | | | | |
| LLHL | (3) | | | | | | | | | | | | | | | |
| LLHH | (4) | | | | | | | | | | | | | | | |
| LHLL | (5) | | | | | | | | | | | | | | | |
| LHLH | (6) | | | | | | | | | | | | | | | |
| LHHL | (7) | | | | | | | | | | | | | | | |
| LHHH | (8) | | | | | | | | | | | | | | | |
| HLLL | (1) | | | | | | | | | | | | | | | |
| HLLH | (2) | | | | | | | | | | | | | | | |
| HLHL | (3) | | | | | | | | | | | | | | | |
| HLHH | (4) | | | | | | | | | | | | | | | |
| HHLL | (5) | | | | | | | | | | | | | | | |
| HHLH | (6) | | | | | | | | | | | | | | | |
| HHHL | (7) | | | | | | | | | | | | | | | |
| HHHH | (8) | | | | | | | | | | | | | | | |

**Model No.:** LT-1604A-512  **Ver:**1.0

# 9. QUALITY SPECIFICATIONS

### 9 - 1. LCM Appearance and Electric inspection Condition
**1. Inspection will be done by placing LCM 30cm away from inspector's eyeballs under normal illumination.**

Upper Polarizer · Conductive Rubber · PCB · Foot (Frame) · 45° · Metal (Platic) Frame · LCD Glass · Bottom Polarizer · Backlight · Coating Epoxy
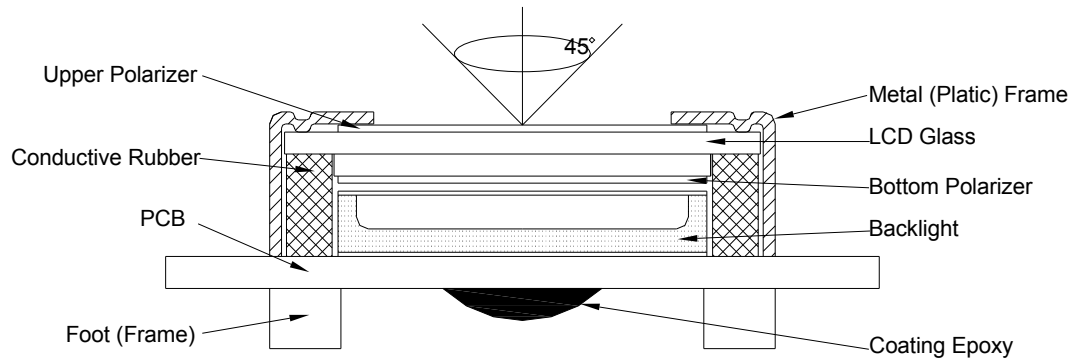
**2. View Angle: with in 45°around perpendicular line.**

### 9- 2. Definition
**1. COB**

PCB · Metal (Plastic) Frame · LCD

**2. Heat Seal**

LCD

Heat Seal

**3. TAB and COG**

LCD Glass · ITO Terminal Pad · IC

TAB

LCD Glass · IC · Pin
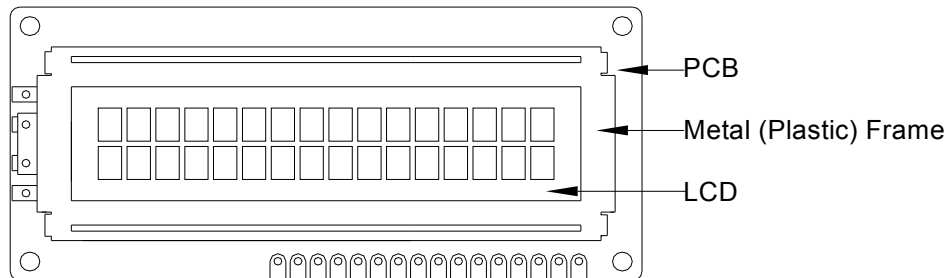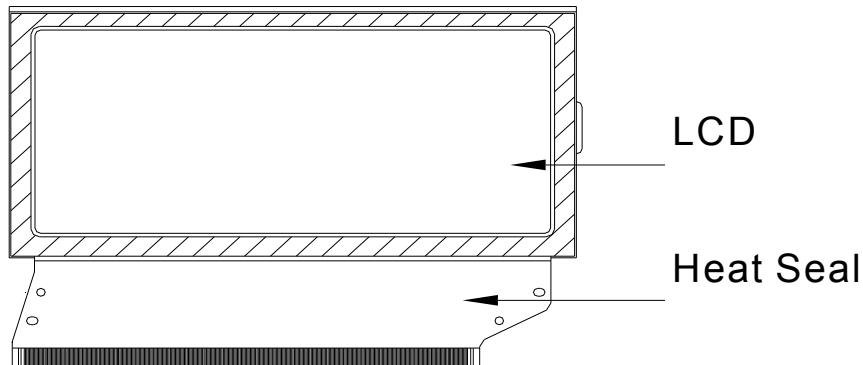
COG
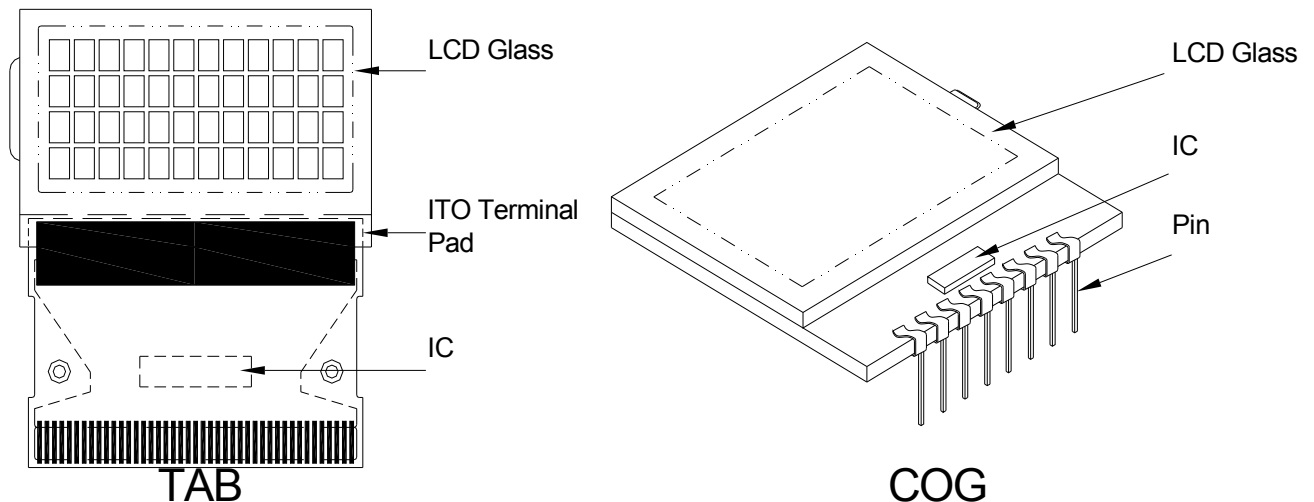
## 9-3. Sampling Plan and Acceptance

1. Sampling Plan
   MIL - STD - 105E (Ⅱ) ordinary single inspection is used.
2. Acceptance
   Major defect:　　　　AQL = 0.65%
   Minor defect:　　　　AQL = 1.5%
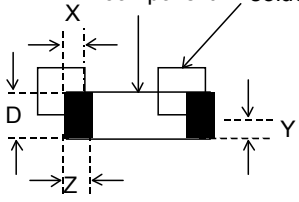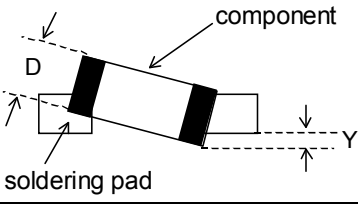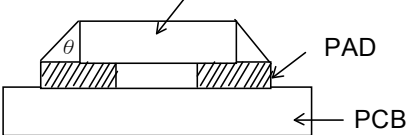
## 9-4. Criteria

### 1. COB

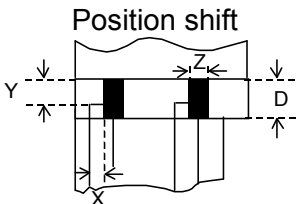| Defect | Inspection Item | Inspection Standards | |
|--------|-----------------|----------------------|---|
| Major | PCB copper flakes peeling off | Any copper flake in viewing Area should be greater than 1.0mm$^2$ | Reject |
| Major | Height of coating epoxy | Exceed the dimension of drawing | Reject |
| Major | Void or hole of coating epoxy | Expose bonding wire or IC | Reject |
| Major | PCB cutting defect | Exceed the dimension of drawing | Reject |

### 2. SMT

| Defect | Inspection Item | Inspection Standards | |
|--------|-----------------|----------------------|---|
| Minor | Component marking not readable | | Reject |
| Minor | Component height | Exceed the dimension Of drawing | Reject |
| Major | Component solder defect (missing , extra, wrong component or wrong orientation | | Reject |
| Minor | Component position shift  | $X < 3/4Z$ <br> $Y > 1/3D$ | Reject |
| Minor | Component tilt  | $Y > 1/3D$ | Reject |
| Minor | Insufficient solder  | $\theta \leq 20°$ | Reject |

### 3. Metal (Plastic) Frame

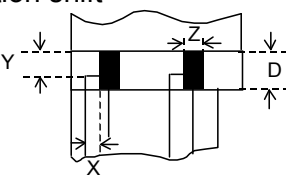| Defect | Inspection Item | Inspection Standards | | |
|--------|-----------------|---------------------|---|---|
| Major | Crack / breakage | Anywhere | | Reject |
| Minor | Frame Scratch | W | L | Acceptable of Scratch |
| | | w<0.1mm | Any | Ignore |
| | | 0.1≤w<0.2mm | L≤5.0mm | 2 |
| | | 0.2≤w<0.3mm | L≤3.0mm | 1 |
| | | w≥0.3mm | Any | 0 |
| | | Note: 1. Above criteria applicable to scratch lines with distance greater than 5mm.<br>    2. Scratch on the back side of frame (not visible) can be ignored. | | |
| Minor | Frame Dent , Prick<br><br>$\Phi = \dfrac{L + W}{2}$ | | | Acceptable of Dents / Pricks |
| | | Φ≤1.0mm | | 2 |
| | | 1.0<Φ≤1.5mm | | 1 |
| | | 1.5mm<Φ | | 0 |
| | | Note : 1. Above criteria applicable to any two dents / pricks with distance greater than 5mm<br>    2. Dent / prick on the back side of frame (not visible) can be ignored | | |
| Minor | Frame Deformation | Exceed the dimension of drawing | | |
| Minor | Metal Frame Oxidation | Any rust | | |

### 4. Flexible Film Connector (FFC)

| Defect | Inspection Item | | Inspection Standards | |
|--------|-----------------|---|---------------------|---|
| Minor | Tilted soldering | | Within the angle +5° | Acceptable |
| Minor | Uneven solder joint /bump | | | Reject |
| Minor | Hole | $\Phi = \dfrac{L + W}{2}$ | Expose the conductive line | Reject |
| | | | Φ > 1.0mm | Reject |
| Minor | Position shift<br> | | Y > 1/3D | Reject |
| | | | X > 1/2Z | Reject |

## 5. Screw

| Defect | Inspection Item | Inspection Standards | |
|---|---|---|---|
| Major | Screw missing/loosen | | Reject |
| Minor | Screw oxidation | Any rust | Reject |
| Minor | Screw deformation | Difficult to accept screw driver | Reject |

## 6. Heatseal 、TCP 、FPC

| Defect | Inspection Item | | Inspection Standards | |
|---|---|---|---|---|
| Major | Scratch expose conductive layer | | | Reject |
| Minor | HS Hole | $\Phi = \dfrac{L + W}{2}$ | Φ> 0.5mm | Reject |
| Major | Adhesion strength | | Less than the specification | Reject |
| Minor | Position shift  | | Y > 1/3D | Reject |
| | | | X > 1/2Z | Reject |
| Major | Conductive line break | | | Reject |

## 7. LED Backing Protective Film and Others

| Defect | Inspection Item | Inspection Standards | |
|---|---|---|---|
| Minor | LED dirty, prick | Acceptable number of units | |
| | | Φ≤0.10mm | ignore |
| | | 0.10<Φ≤0.15mm | 2 |
| | | 0.15<Φ≤0.2mm | 1 |
| | | Φ>0.2mm | 0 |
| | | The distance between any two spots should be ≥5mm<br>Any spot/dot/void outside of viewing area is acceptable | |
| Minor | Protective film tilt | Not fully cover LCD | Reject |
| Major | COG coating | Not fully cover ITO circuit | Reject |

## 8. Electric Inspection

| Defect | Inspection Item | Inspection Standards | |
|---|---|---|---|
| Major | Short | | Reject |
| Major | Open | | Reject |

## 9. Inspection Specification of LCD

| Defect | Inspect Item | | Inspection Standards | | | |
|---|---|---|---|---|---|---|
| Minor | Linear Defect | * Glass Scratch<br>* Polarizer Scratch<br>* Fiber and Linear material | W | W≤0.03 | 0.03<W≤0.05 | W>0.05 |
| | | | L | L<5 | L<3 | Any |
| | | | ACC. NO. | 1 | 1 | Reject |
| | | | Note | L is the length and W is the width of the defect | | |
| Minor | Black Spot and Polarizer Pricked | * Foreign material between glass and polarizer or glass and glass<br>* Polarizer hole or protuberance by external force | Φ | Φ≤0.1 | 0.1<Φ≤0.15 | 0.15<Φ≤0.2 | Φ>0.2 |
| | | | ACC. NO. | 3EA / 100mm$^2$ | 2 | 1 | 0 |
| | | | Note | Φ is the average diameter of the defect.<br>Distance between two defects > 10mm. | | |

| Minor | White Spot and Bubble in polarizer | * Unobvious transparent foreign material between glass and glass or glass and polarizer<br>* Air protuberance between polarizer and glass | Φ | Φ≤0.3 | 0.3<Φ≤0.5 | 0.5<Φ |
|---|---|---|---|---|---|---|
| | | | ACC. NO. | 3EA / 100mm$^2$ | 1 | 0 |
| | | | Note | Φ is the average diameter of the defect.<br>Distance between two defects > 10mm. | | |

| Minor | Segment Defect |  | Φ | Φ≤0.10 | 0.10<Φ≤0.20 | 0.20<Φ≤0.25 | Φ>0.25 |
|---|---|---|---|---|---|---|---|
| | | | ACC. NO. | 3EA / 100mm$^2$ | 2 | 1 | 0 |
| | | | Note | W is more than 1/2 segment width | | | Reject |
| | | | | $\Phi = \dfrac{L + W}{2}$<br>Distance between two defect is 10mm | | | |

| Minor | Protuberant Segment | <br>$\Phi = ( L + W ) / 2$ | Φ | Φ≤0.10 | 0.10<Φ≤0.20 | 0.20<Φ≤0.25 | Φ>0.25 |
|---|---|---|---|---|---|---|---|
| | | | W | Glue | W≤1/2 Seg<br>W≤0.2 | W≤1/2 Seg<br>W≤0.2 | Ignore |
| | | | ACC. NO. | 3EA / 100mm$^2$ | 2 | 1 | 0 |

| Minor | Assembly Mis-alignment |  | 1. Segment | | | |
|---|---|---|---|---|---|---|
| | | | B | B≤0.4mm | 0.4<B≤1.0mm | B>1.0mm |
| | | | B-A | B-A<1/2B | B-A<0.2 | B-A<0.25 |
| | | | Judge | Acceptable | Acceptable | Acceptable |
| | | | 2. Dot Matrix | | | |
| | | | Deformation>2° | | | Reject |

| Minor | Stain on LCD Panel Surface | | Accept when stains can be wiped lightly with a soft cloth or a similar one. Otherwise, judged according to the above items: "Black spot" and "White Spot" |
|---|---|---|---|

# 10. RELIABILITY

| No | Item | Condition | Quantity | Criteria |
|---|---|---|---|---|
| 1 | High Temperature Operating | 70℃, 96Hrs | 2 | GB/T2423.2 -2008 |
| 2 | Low Temperature Operating | -20℃, 96Hrs | 2 | GB/T2423.1 -2008 |
| 3 | High Humidity | 60℃, 90%RH, 96Hrs | 2 | GB/T2423.3 -2006 |
| 4 | High Temperature Storage | 80℃, 96Hrs | 2 | GB/T2423.2 -2008 |
| 5 | Low Temperature Storage | -30℃, 96Hrs | 2 | GB/T2423.1 -2008 |
| 6 | Thermal Cycling Test | -20℃, 60min~70℃, 60min, 20 cycles. | 2 | GB/T2423.2 2 -2012 |
| 7 | Packing vibration | Frequency range:10Hz~50Hz Acceleration of gravity:5G X,Y,Z  30 min for each direction. | 2 | GB/T5170.1 4 -2009 |
| 8 | Electrical Static Discharge | Air:±8KV 150pF/330Ω 5 times<br>Contact:±4KV 150pF/330Ω 5 times | 2 | GB/T17626. 2 -2006 |
| 9 | Drop Test (Packaged) | Height:80 cm,1 corner, 3 edges, 6 surfaces. | 2 | GB/T2423.8 -1995 |

Note:  1) Above conditions are suitable for our company standard products.
2) For restrict products, the test conditions listed as above must be revised.

# 11. HANDLING PRECAUTION

(1) Mounting Method

The panel of the LCD Module consists of two thin glass plates with polarizers, which easily get damaged since the Module is fixed by utilizing fitting holes in the printed circuit board. Extreme care should be taken when handling the LCD Modules.

(2) Caution of LCD handling & cleaning

When cleaning the display surface, use soft cloth with solvent (recommended below) and wipe lightly.
- Isopropyl alcohol
- Ethyl alcohol
- Tricolor trifler thane

Do not wipe the display surface with dry or hard materials that will damage the polarizer surface.
Do not use the following solvent:
- Water
- Kenton
- Aromatics

(3) Caution against static charge

The LCD Module use C-MOS LSI drivers, so we recommend that you connect any unused input terminal to VDD or VSS, do not input any signals before power is turned on. And ground your body, Work/assembly table. And assembly equipment to protect against static electricity.

(4) Packaging
- Modules use LCD elements, and must be treated as such. Avoid intense shock and falls from a height.
- To prevent modules from degradation. Do not operate or store them exposed directly to sunshine or high temperature/humidity.

(5) Caution for operation
- It is indispensable to drive LCD's within the specified voltage limit since the higher voltage than the limit shorten LCD life. An electrochemical reaction due to direct current causes LCD deterioration, Avoid the use of direct current drive.
- 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 range.
- If the display area is pushed hard during operation, some font will be abnormally displayed but it resumes normal condition after turning off once.
-A slight dew depositing on terminals is a cause for electro-chemical reaction resulting in terminal open circuit.
Usage under the relative condition of 40°C, 50%RH or less is required.

(6) Storage

In the case of storing for a long period of time, (For years) for the purpose or replacement use, the following ways are recommended.
- Storage in a polyethylene bag with sealed so as not to enter fresh air outside in it, And with no desiccant.
- Placing in a dark place where neither exposure to direct sunlight nor light is. Keeping temperature in the specified storage temperature range.
- Storing with no touch on polarizer surface by the anything else. (It is recommended to store them as they have been contained in the inner container at the time of delivery)

(7) Safety
- It is recommendable to crash damaged or unnecessary LCD into pieces and wash off liquid crystal by using solvents such as acetone and ethanol. Which should be burned up later.
When any liquid crystal leaked out of a damaged glass cell comes in contact with your hands, please wash it off well with soap and water.

(8) Other
- After the product shipped, any product quality issues must be feedback within three months, otherwise, we will not be responsible for the subsequent or consequential events.

# 12. OUTLINE DIMENSION

NOTE:The dimension with"( )" is reference

| PIN Assignment | |
|---|---|
| NO. | Name |
| 1 | VSS |
| 2 | VDD |
| 3 | V0 |
| 4 | RS |
| 5 | R/W |
| 6 | E |
| 7 | DB0 |
| 8 | DB1 |
| 9 | DB2 |
| 10 | DB3 |
| 11 | DB4 |
| 12 | DB5 |
| 13 | DB6 |
| 14 | DB7 |
| 15 | BLU-A |
| 16 | BLU-K |

DOTS DETAIL
SCALE 4:1

3.55
2.96
0.60
0.56
0.56
0.60
4.76
5.35

14.5MAX
1.6
10±0.3

4-PTHØ2.5

1.8
16
P2.54X15=38.1
16-PTHØ1
1
10±0.3

(56.21A.A)
61.8±0.2(V.A)
69.3±0.3
83±0.2
87±0.5

(20.81A.A)
25.2±0.2(V.A)
37.5±0.3
56±0.2
60±0.5

REVISION RECORD
REV | First Issue
APPROVED

| MODEL NAME: | | | |
|---|---|---|---|
| DATE 2018.04.20 | | TITLE: Outline | |
| VERSION A | UNIT mm | | |
| NO. | | | |
| SCALE 1/1 | DRAWN | | |
| APPROVED | CHECKED | FILE NAME: | |

| General Tolerance ± | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| 0~1 | 0.05 | 0.1 | 0.1 | 0.2 |
| 1~10 | 0.05 | 0.1 | 0.1 | 0.2 |
| 10~30 | 0.1 | 0.2 | 0.2 | 0.3 |
| 30~60 | 0.1 | 0.2 | 0.3 | 0.5 |
| 60~120 | 0.1 | 0.2 | 0.5 | 0.8 |

**Model No.:** LT-1604A-512 **Ver:**1.0