



晶采光電科技股份有限公司
AMPIRE CO., LTD.

SPECIFICATIONS FOR LCD MODULE

| | |
|--------------------------|------------------------------------|
| CUSTOMER | |
| CUSTOMER PART NO. | |
| AMPIRE PART NO. | AG-240128G (Controller) |
| APPROVED BY | |
| DATE | |

AMPIRE CO., LTD.

**TOWER A, 4F, No.114, Sec. 1, HSIN-TAI 5th RD., HIS-CHIH,
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|--------------------|-------------------|---------------------|
| | | |

RECORD OF REVISION

| Revision Date | Page | Contents |
|---------------|------|---|
| 1999/11/22 | - | New Release |
| 2000/10/6 | 12 | Add power on / off sequence |
| | 13 | Modify sampling plan |
| 2001/7/20 | | Add white LED Back-light characteristic (Page 6) |
| | | Add white LED Back-light drawing (Page 18) |
| 2001/12/12 | | Modify LED characteristic |

1 FEATURES

- (1) Display format : 240 × 128 dot-matrix ; 1/ 128 duty.
- (2) Construction : STN/FSTN LCD, Bezel, Zebra ,Heat Seal and PCB.
- (3) Optional LED / EL / CCFL back-light.
- (4) Built in controller T6963C.
- (5) 5V single power input. Built-in DC/DC converter for LCD driving.
- (6) Normal / Extended temperature type.

2 NUMBERING SYSTEM

AG-240128G -
1 2 3 4 5

| No | Code Value | Description | Remark |
|----|------------|---------------------------------|---------------------------|
| 1 | G | STN gray type LCD | LCD Type |
| | Y | STN yellow green type LCD | |
| | S | STN negative type LCD | |
| | F | FSTN type LCD | |
| 2 | A | Reflective type / 6:00 view | Polarizer / Viewing Angel |
| | B | Reflective type / 12:00 view | |
| | I | Transflective type / 6:00 view | |
| | J | Transflective type / 12:00 view | |
| | T | Negative type / 6:00 view | |
| | U | Negative type / 12:00 view | |
| 3 | None | Without backlight | Backlight type |
| | L | 5V LED | |
| | E | EL | |
| | C | CCFL | |
| 4 | None | Without backlight | Backlight color |
| | Y | Yellow-green | |
| | B | Blue | |
| | W | White | |
| 5 | None | Normal temperature type | LCM temperature type |
| | H | Extended temperature type | |

3 MECHANICAL DATA

| Parameter | Standard Value | Unit |
|--------------------------------------|------------------------------------|------|
| Dot size | 0.40 (W) × 0.40(H) | mm |
| Dot pitch | 0.45(W) × 0.45(H) | mm |
| Viewing area | 114.0(W) × 64.0(H) | mm |
| Module size (None/EL) | 144.0(W) × 104.0(H) × 12.0 max (T) | mm |
| Module size (LED/CCFL back-light) | 144.0(W) × 104.0(H) × 15.0 max (T) | mm |

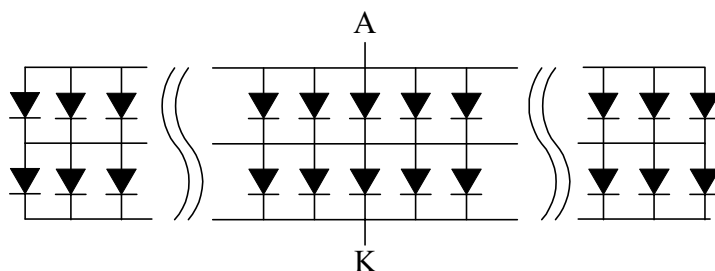
4 ABSOLUTE MAXIMUM RATINGS

| Parameter | | Symbol | Min | Max | Unit |
|------------------------------|-----------------|----------------|-----|-----|------|
| Logic Circuit Supply Voltage | | VDD-VSS | 0 | 7.0 | V |
| LCD Driving Voltage | | VDD-VO | 0 | 26 | V |
| Input Voltage | | V _I | VSS | VDD | V |
| Normal temp. type | Operating Temp. | TOP | 0 | 50 | °C |
| | Storage Temp. | TSTG | -20 | 70 | °C |
| Extended temp. type | Operating Temp. | TOP | -20 | 70 | °C |
| | Storage Temp. | TSTG | -30 | 80 | °C |

5 ELECTRICAL CHARACTERISTICS

| Parameter | Symbol | Condition | Min | Typ | Max | Unit | Note |
|---|---------|----------------|---------|------|---------|-------------------|--|
| ----- Electronic Characteristics ----- | | | | | | | |
| Logic Circuit Supply Voltage | VDD-VSS | -- | 4.75 | 5.0 | 5.25 | V | |
| LCD Driving Voltage | VDD-VO | -20 °C | 20.0 | 21.0 | 22.0 | V | 0 ~ 50 °C for Normal Temp. type -20 ~ 70 °C for Extended Temp. type |
| | | 0 °C | 19.0 | 20.0 | 21.0 | | |
| | | 25 °C | 18.0 | 18.9 | 19.8 | | |
| | | 50 °C | 17.1 | 18.0 | 18.9 | | |
| | | 70 °C | 16.0 | 17.0 | 18.0 | | |
| Input Voltage | VIH | -- | 0.7 VDD | -- | VDD | V | |
| | VIL | -- | VSS | -- | 0.3 VDD | V | |
| Logic Supply Current | IDD | VDD = 5V | -- | 25 | -- | mA | |
| ----- Optical Characteristics ----- | | | | | | | |
| Contrast | CR | STN type | -- | 5 | -- | | Note 1 |
| | | FSTN type | -- | 8 | -- | | |
| Rise Time | tr | 25°C | -- | 170 | 255 | ms | Note 2 |
| Fall Time | tf | 25°C | -- | 400 | 600 | ms | |
| Viewing Angle Range | θ f | 25°C & CR≥2 | -- | 40 | -- | Deg. | Note 3 |
| | θ b | | -- | 35 | -- | | |
| | θ l | | -- | 40 | -- | | |
| | θ r | | -- | 40 | -- | | |
| Frame Frequency | fF | 25°C | -- | 64 | -- | Hz | |
| ----- YG LED Back-light Characteristics ----- | | | | | | | |
| Forward Voltage | VF | -- | -- | 4.05 | 4.3 | V | Supply Voltage between A&K |
| Forward Current | IF | VF=4.05V | -- | 1000 | -- | mA | |
| LCM Luminous intensity | | VF=4.05V | -- | 30 | -- | cd/m ² | |

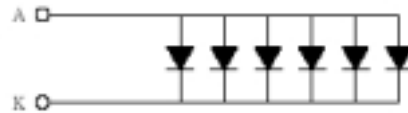
* LED Dice number = 2x110=132



| Parameter | Min | Typ | Max | Unit | Note |
|---|-----|-----|-----|-------------------|------|
| ----- EL Back-light Characteristics ----- | | | | | |
| Driving Voltage | -- | 110 | -- | Vrms | |
| Frequency | -- | 400 | -- | Hz | |
| LCM Luminous intensity | -- | 15 | -- | cd/m ² | |

| ----- White edge-type LED Back-light Characteristics ----- | | | | | | | |
|--|--------|-----------|-----|-----|-----|-------------------|----------------------------|
| Parameter | Symbol | Condition | Min | Typ | Max | Unit | Note |
| Forward Voltage | VF | -- | -- | 3.3 | 3.6 | V | Supply Voltage between A&K |
| Forward Current | IF | VF=3.3V | -- | 120 | -- | mA | |
| Bare LED Luminous intensity | | VF=3.3V | -- | 120 | -- | cd/m ² | |
| LCM Luminous intensity | | VF=3.3V | -- | 30 | -- | cd/m ² | |

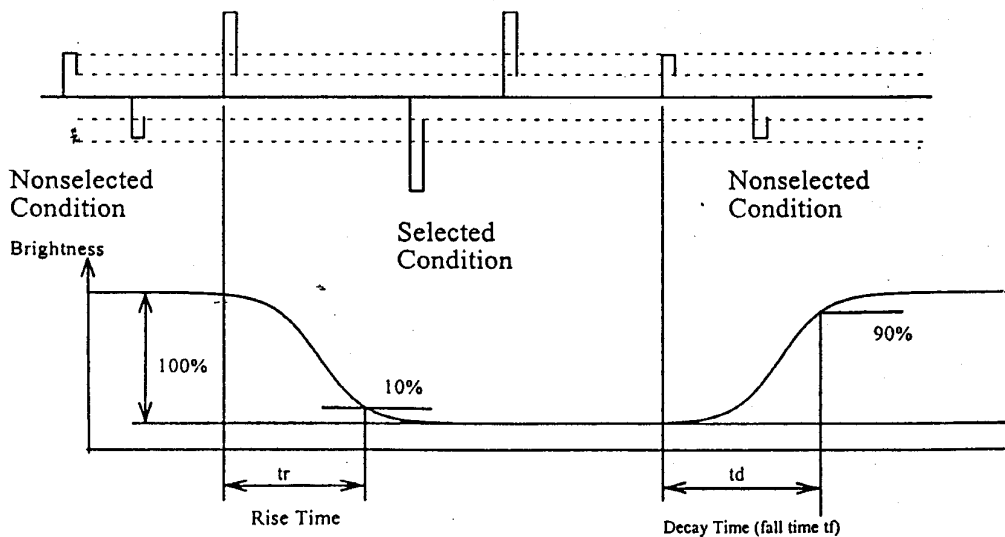
* LED Dice number = 6



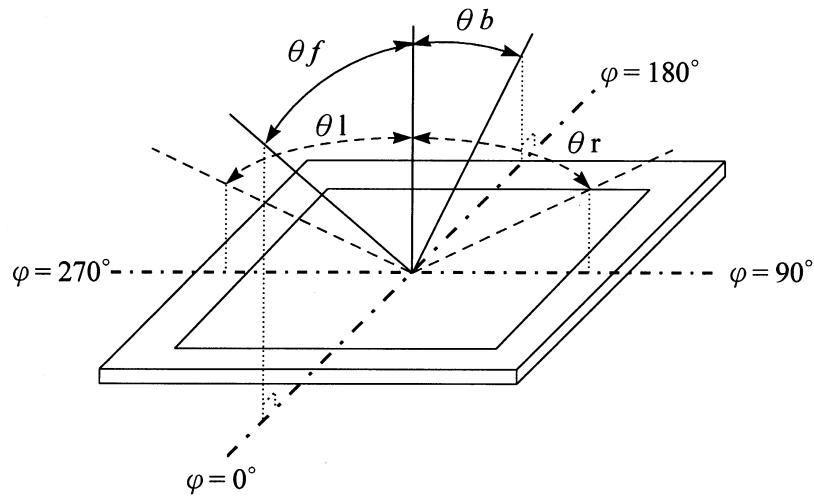
(NOTE 1) Contrast ratio :

$$CR = (\text{Brightness in OFF state}) / (\text{Brightness in ON state})$$

(NOTE 2) Response time :



(NOTE 3) Viewing angle



5.1 C.C.F.L. BACK-LIGHT SPECIFICATION

(1) The brightness life of the back light shall be kept as specified under the following absolute maximum conditions:

| | |
|-----------------------------|-------------------------|
| Power Consumption | 2.88 W |
| TA = 25 °C, fL = 37 ± 5 KHz | (with DIYN 43 Inverter) |
| Tube Current | 6.0 ± 0.5 mA |
| TA = 25 °C, fL = 37 ± 5 KHz | |

(2) Electrical Characteristics

The following operating conditions are recommended for the back light unit.

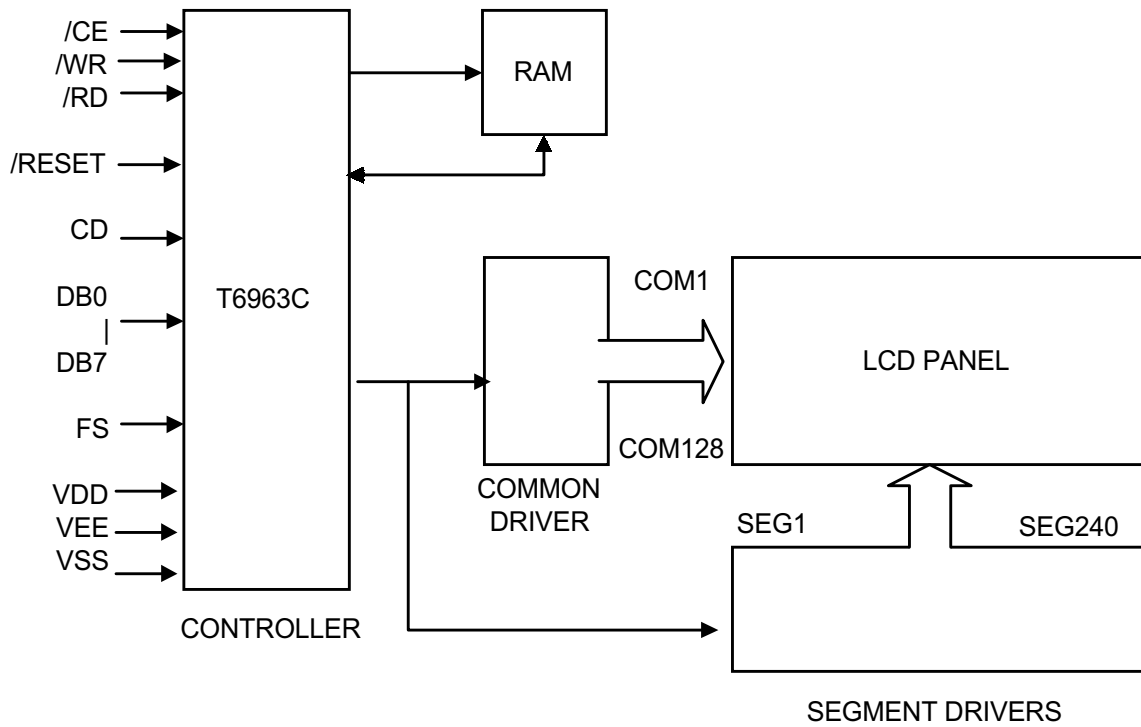
| | |
|-----------------|--------------------------------|
| Start Voltage | 975 Vrms min, at Ta=0 °C |
| Tube Voltage | 390 ± 40 Vrms typ, at Ta=25 °C |
| Tube Current | 5.0 ± 0.5 mA typ, at Ta=25 °C |
| Drive Frequency | 55 ± 5 KHz typ, at Ta=25 °C |

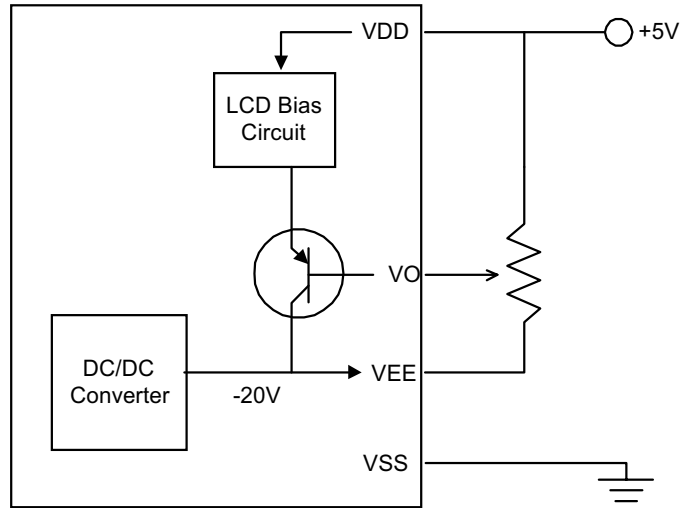
(3) Initial Optical Characteristics

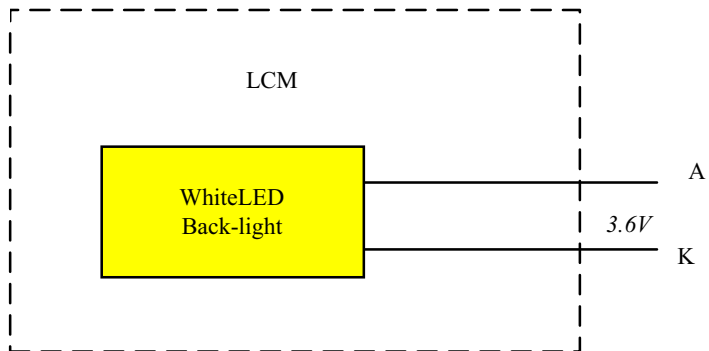
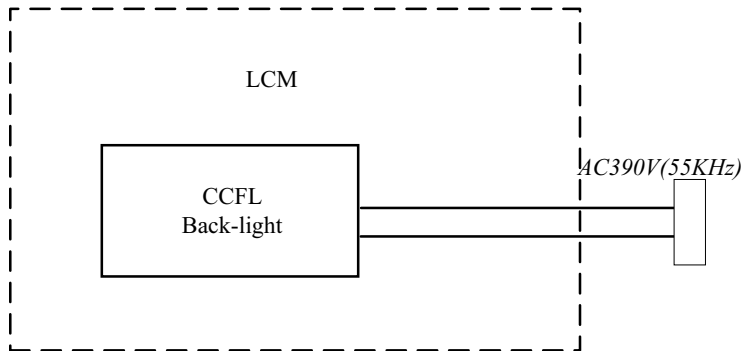
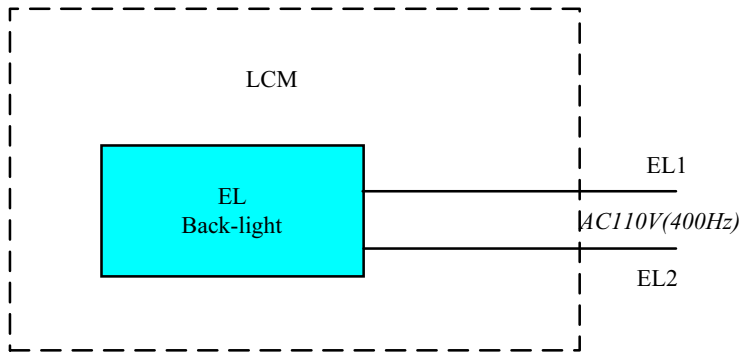
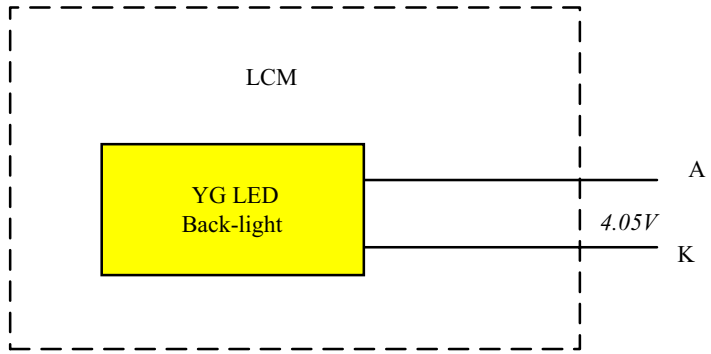
The unit shall satisfy the following criteria at $25 \pm 2^\circ\text{C}$ ambient temperature, 30% - 85% relative humidity, no air flow and with applying rating input voltage and input current by using DIYN 43 inverter, input voltage 12V, be measured 3 min. after initial power on.

| Item | Min | Typ | Max | Unit | Note |
|------------------------|-------|-------|-------|-------------------|------|
| LCM Average Brightness | 120 | 140 | -- | cd/m ² | |
| Brightness Uniformity | 85% | -- | -- | % | |
| Chromaticity X | 0.337 | 0.341 | 0.361 | | |
| Y | 0.382 | 0.402 | 0.422 | | |

6 BLOCK DIAGRAM & POWER SUPPLY



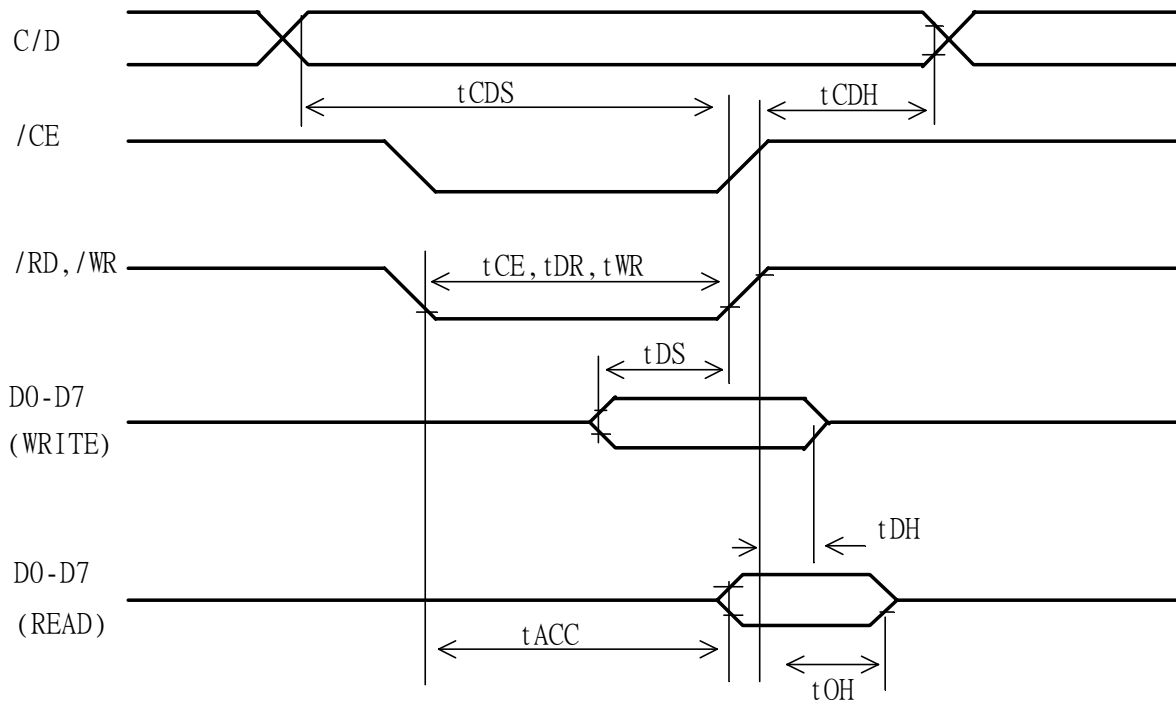




7 PIN CONNECTIONS

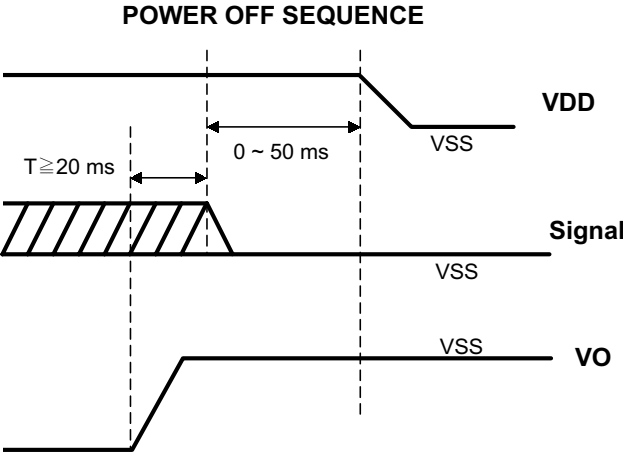
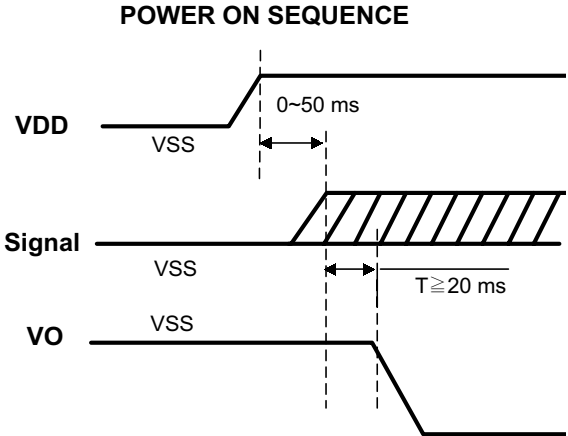
| Pin No. | Symbol | Function |
|---------|-----------|---|
| 1 | VSS | Ground (0V) |
| 2 | VDD | Logic Supply Voltage(+5V) |
| 3 | VO | LCD Power Supply |
| 4 | C/D | WR = L --- C/D = H : Command Write C/D = L : Data Write RD = L --- C/D = H : Status Read C/D = L : Data Read |
| 5 | /RD | Read data when RD = L |
| 6 | /WR | Write data when WR = L |
| 7-14 | DB0 - DB7 | Data Bus Line |
| 15 | /CE | Chip Enable |
| 16 | /RES | H --- Normal L --- Initialize T6963C |
| 17 | VEE | Negative Power Supply (-20V) |
| 18 | MD2 | Pin for selection of number of columns H – 32 columns L – 40 columns |
| 19 | FS | FS : Pin for selection of font H -- Font 6x8 (default) L -- Font 8x8 |
| 20 | NC | No Connection |

8 TIMING CHARACTERISTICS



| ITEM | SYMBOL | MIN | MAX | UNIT |
|-------------------------|-------------|-----|-----|------|
| C/D SET UP TIME | TCDS | 100 | -- | ns |
| C/D HOLD TIME | THCL | 10 | -- | ns |
| /CE,/RD,/WR PULSE WIDTH | TCE,TRD,TWR | 80 | -- | ns |
| DATA SET UP TIME | TDS | 80 | -- | ns |
| DATA HOLD TIME | TDH | 40 | -- | ns |
| ACCESS TIME | TACC | -- | 150 | ns |
| OUTPUT HOLD TIME | TOH | 10 | 50 | ns |

8.1 Power ON/OFF Sequence



9 QUALITY AND RELIABILITY

9.1 TEST CONDITIONS

Tests should be conducted under the following conditions :

Ambient temperature : $25 \pm 5^{\circ}\text{C}$

Humidity : $60 \pm 25\% \text{ RH}$.

9.2 SAMPLING PLAN

Sampling method shall be in accordance with MIL-STD-105E , level II, normal single sampling plan .

9.3 ACCEPTABLE QUALITY LEVEL

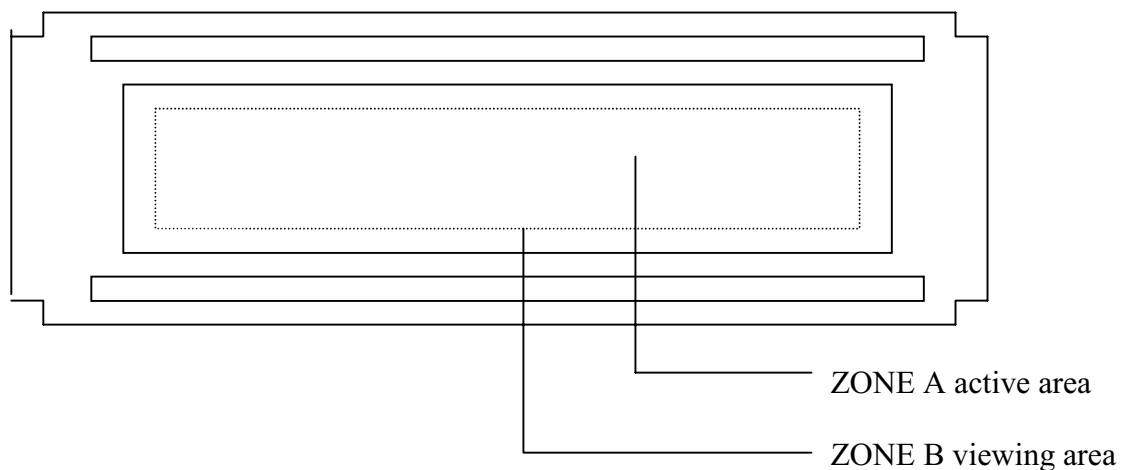
A major defect is defined as one that could cause failure to or materially reduce the usability of the unit for its intended purpose. A minor defect is one that does not materially reduce the usability of the unit for its intended purpose or is an infringement from established standards and has no significant bearing on its effective use or operation.

9.4 APPEARANCE

An appearance test should be conducted by human sight at approximately 30 cm distance from the LCD module under fluorescent light. The inspection area of LCD panel shall be within the range of following limits.

9.5 INSPECTION QUALITY CRITERIA

| Item | Description of defects | | | Class of Defects | Acceptable level (%) |
|----------------------|---|-----------|--------|------------------|----------------------|
| Function | Short circuit or Pattern cut | | | Major | 0.65 |
| Dimension | Deviation from drawings | | | Major | 1.5 |
| Black spots | Ave . dia . D | area A | area B | Minor | 2.5 |
| | $D \leq 0.2$ | Disregard | | | |
| | $0.2 < D \leq 0.3$ | 3 | 4 | | |
| | $0.3 < D \leq 0.4$ | 2 | 3 | | |
| | $0.4 < D$ | 0 | 1 | | |
| Black lines | Width W, Length L | A | B | Minor | 2.5 |
| | $W \leq 0.03$ | disregard | | | |
| | $0.03 < W \leq 0.05$ | 3 | 4 | | |
| | $0.05 < W \leq 0.07, L \leq 3.0$ | 1 | 1 | | |
| | See line criteria | | | | |
| Bubbles in polarizer | Average diameter D $0.2 < D < 0.5$ mm for N = 4 , D > 0.5 for N = 1 | | | Minor | 2.5 |
| Color uniformity | Rainbow color or newton ring. | | | Minor | 2.5 |
| Glass Scratches | Obvious visible damage. | | | Minor | 2.5 |
| Contrast ratio | See note 1 | | | Minor | 2.5 |
| Response time | See note 2 | | | Minor | 2.5 |
| Viewing angle | See note 3 | | | Minor | 2.5 |



9.6 RELIABILITY

| Test Item | Test Conditions | | Note |
|----------------------------|---|---|------|
| | Normal Temp. type | Extended Temp. type | |
| High Temperature Operation | 50±3°C , t=96 hrs | 70±3°C , t=96 hrs | |
| Low Temperature Operation | 0±3°C , t=96 hrs | -20±3°C , t=96 hrs | |
| High Temperature Storage | 70±3°C , t=96 hrs | 80±3°C , t=96 hrs | 1,2 |
| Low Temperature Storage | -20±3°C , t=96 hrs | -30±3°C , t=96 hrs | 1,2 |
| Temperature Cycle | -20°C ~ 25°C ~ 70°C 30 m in. 5 min. 30 min. (1 cycle) Total 5 cycle | -30°C ~ 25°C ~ 80°C 30 min. 5 min. 30 min. (1 cycle) Total 5 cycle | 1,2 |
| Humidity Test | 40 °C, Humidity 90%, 96 hrs | | 1,2 |
| Vibration Test (Packing) | Sweep frequency : 10 ~ 55 ~ 10 Hz/1min Amplitude : 0.75mm Test direction : X.Y.Z/3 axis Duration : 30min/each axis | | 2 |

Note 1 : Condensation of water is not permitted on the module.

Note 2 : The module should be inspected after 1 hour storage in normal conditions
(15-35°C , 45-65%RH).

Definitions of life end point :

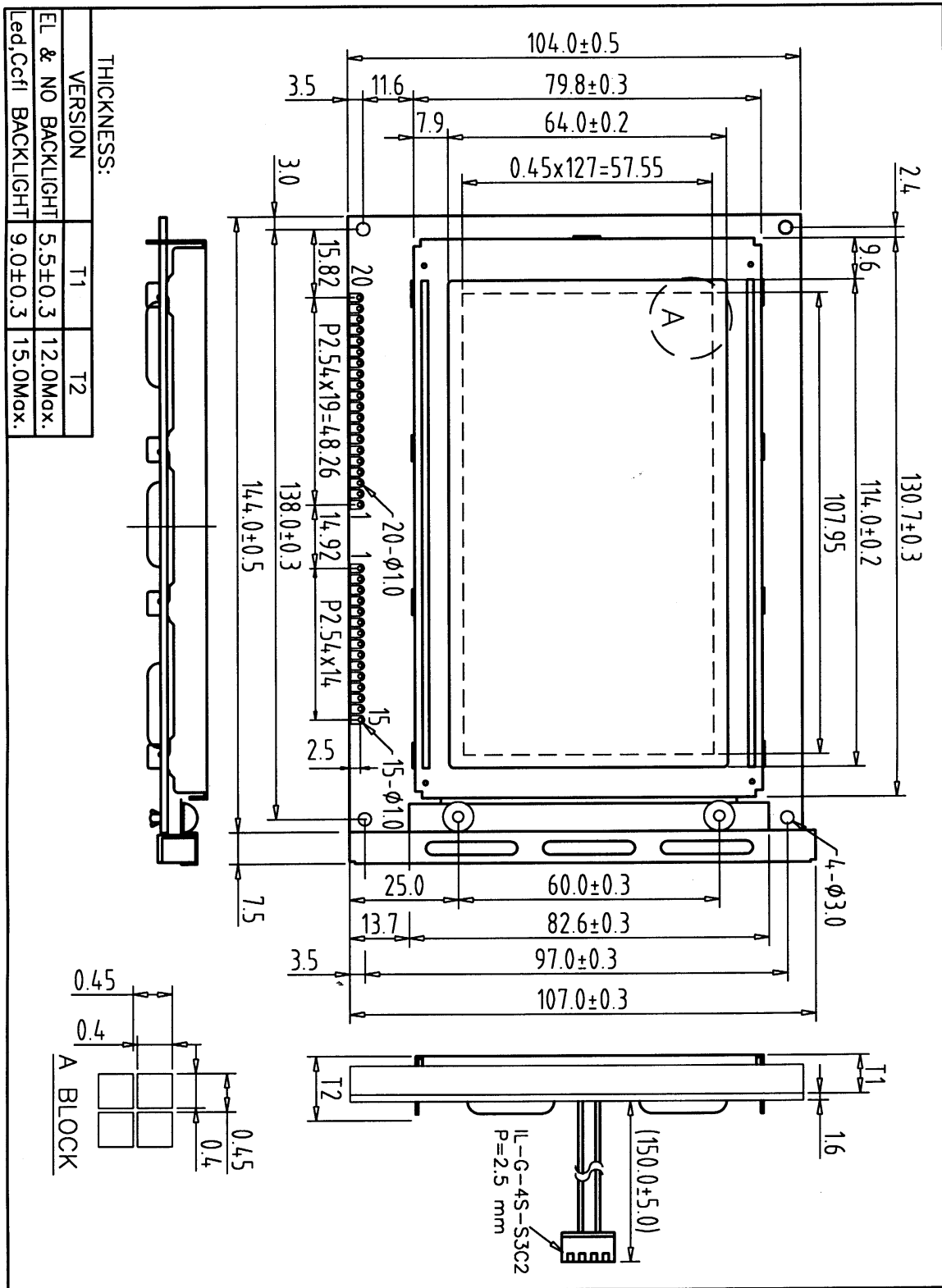
- Current drain should be smaller than the specific value.
- Function of the module should be maintained.
- Appearance and display quality should not have degraded noticeably.
- Contrast ratio should be greater than 50% of the initial value.

10 HANDLING PRECAUTIONS

- (1) An LCD module is a fragile item and should not be subjected to strong mechanical shocks.
- (2) Avoid applying pressure to the module surface. This will distort the glass and cause a change in colour.
- (3) Under no circumstances should the position of the bezel tabs or their shape be modified.
- (4) Do not modify the display PCB in either shape or positioning of components.
- (5) Do not modify or move location of the zebra or heat seal connectors.
- (6) The device should only be soldered to during interfacing. Modification to other areas of the board should not be carried out.
- (7) In the event of LCD breakage and resultant leakage of fluid do not inhale, ingest or make contact with the skin. If contact is made rinse immediately.
- (8) When cleaning the module use a soft damp cloth with a mild solvent, such as Isopropyl or Ethyl alcohol. The use of water, ketone or aromatic is not permitted.
- (9) Prior to initial power up input signals should not be applied.
- (10) Protect the module against static electricity and observe appropriate anti-static precautions.

11 OUTLINE DIMENSION

(1) EL,YG-LED,CCFL Back-light Drawing



(2) White LED Back-light drawing

