



LCD Module Technical Specification

First Edition
Aug 15, 2001

Final Revision

T-51381L064J-FW-P-AB

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Revision History

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| | | | |

1. Application

This technical specification applies to 6.4" color TFT-LCD module, T-51381L064J-FW-P-AB.

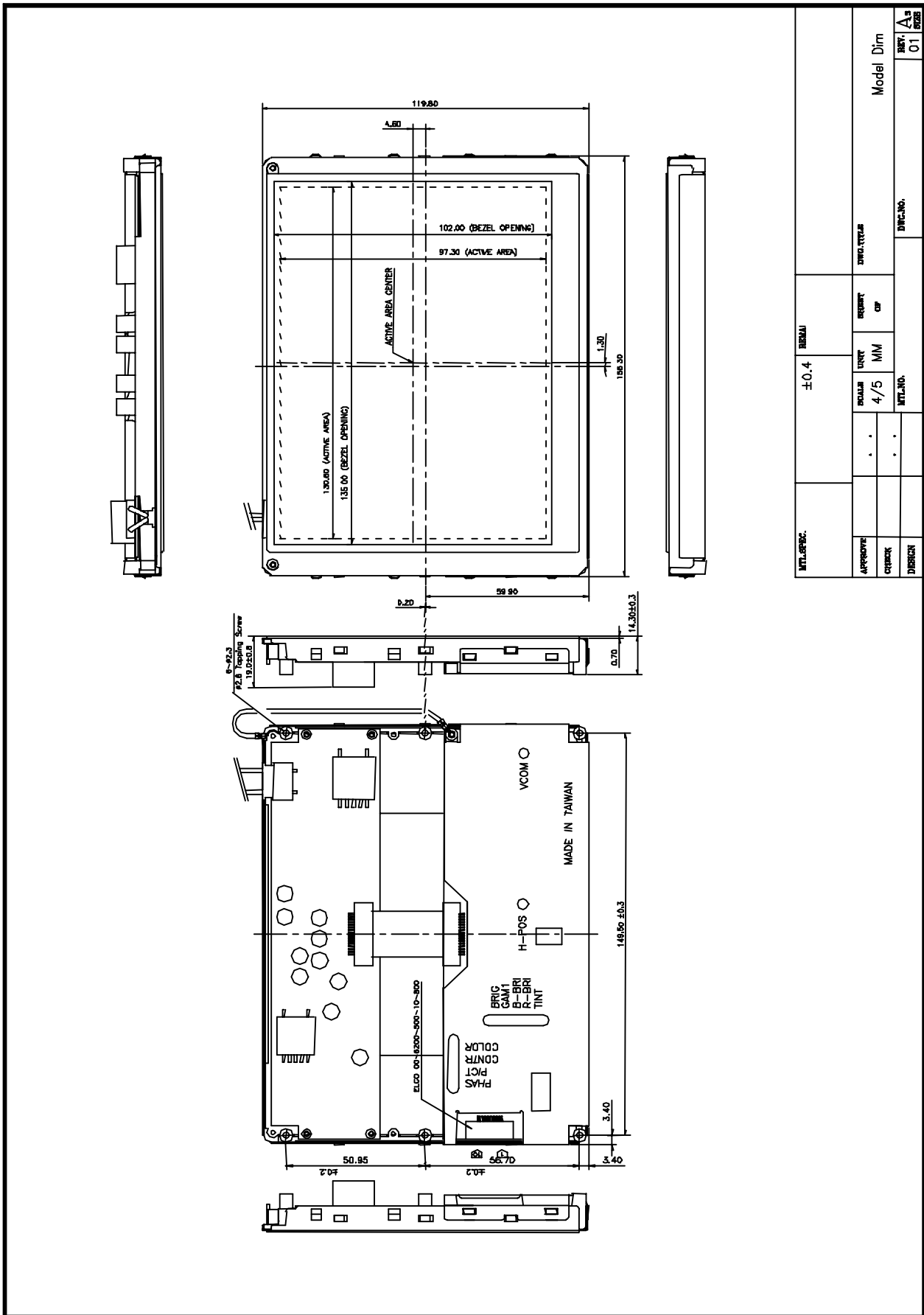
2. Features

- . Compatible with NTSC system
- . Pixel in stripe configuration
- . Slim and compact
- . Active area / Outline area = 67.9 %
- . Optimum Viewing Direction : 6 o'clock

3. Mechanical Specifications

| Parameter | Specifications | Unit |
|---------------------|------------------------------|------|
| Screen Size | 6.4 (diagonal) | inch |
| Display Format | 960×234 | dot |
| Active Area | 130.6 (H)×97.3 (V) | mm |
| Dot Pitch | 0.136 (H)×0.416 (V) | mm |
| Pixel Configuration | Stripe | |
| Outline Dimension | 156.3 (W)×119.8 (H)×14.3 (D) | mm |
| Weight | 285±5 | g |

4. Mechanical Drawing of TFT-LCD Module



| | | | | | |
|------------|------|----------|-------|------------|-----------|
| MTL. SPEC. | ±0.4 | BEZEL | BEZEL | DRIVE TYPE | Model Dim |
| APPROVE | | UNIT | MM | CP | |
| CHECK | | 4/5 | | | |
| DESIGN | | MTL. NO. | | DRWG. NO. | |
| | | | | | REV. A |
| | | | | | 01 |
| | | | | | 01 |

5. Input / Output Terminals

5-1) TFT-LCD Panel Driving

| 10 PIN | | | | |
|--------|--------|-----|------------------------|----------|
| Pin No | Symbol | I/O | Description | Remark |
| 1 | +5V | O | 5V output | |
| 2 | COL | I | COLOR | Note 5-1 |
| 3 | BRT | I | BRIGHTNESS | Note 5-1 |
| 4 | CNT | I | CONTRAST | Note 5-1 |
| 5 | VIDEO | I | COMPOSITE VIDEO SIGNAL | |
| 6 | GNDS | I | VIDEO GROUND | |
| 7 | GNDP | I | 12V POWER GROUND | Note 5-2 |
| 8 | GNDP | I | 12V POWER GROUND | Note 5-2 |
| 9 | +12V | I | +12V DC POWER INPUT | Note 5-2 |
| 10 | +12V | I | +12V DC POWER INPUT | Note 5-2 |

Note 5-1 : Customers can use pin1 (+5V) and variable resistor (VR) to adjust color, brightness and contrast.

Note 5-2 : Customers do not have to use 12VDC input if they design power supply on their own system.

5-2) Backlight driving

| Pin No | Symbol | Description | Remark |
|--------|--------|-----------------------------------|----------|
| 1 | VL1 | Input terminal (Hi voltage side) | |
| 2 | VL2 | Input terminal (Low voltage side) | Note 5-3 |

Note 5-3 : Low voltage side of backlight inverter connects with Ground of inverter circuits.

5-3) Input / Output Connector

A) Video & Power Input Connector

ELCO 00-6200-500-10-800

Pin No. : 10

Pitch : 1.0 mm

6. Absolute Maximum Ratings:

GND = 0 V , Ta = 25 C

| Parameter | Symbol | MIN. | MAX. | Unit | Remark |
|----------------------------------|-----------------|-----------------|------|-------|--------|
| Supply Voltage for Source Driver | V _{SH} | -0.5 | +16 | V | |
| Supply Voltage for Gate Driver | H Level | V _{GH} | -0.3 | +26.5 | V |
| | L Level | V _{GL} | -7 | 20 | V |
| Supply voltage for controller | V _{DD} | -0.3 | +6.5 | V | |
| Digital input signals | | -0.5 | 5.5 | V | |
| Digital output signals | | -0.5 | 5.5 | V | |
| Storage Temperature | | -30 | +80 | C | |
| Operation Temperature | | -10 | +60 | C | |

7. Electrical Characteristics

7-1) Recommended Operating Conditions:

A) Driving for TFT-LCD Panel

GND = 0V , Ta = 25 C

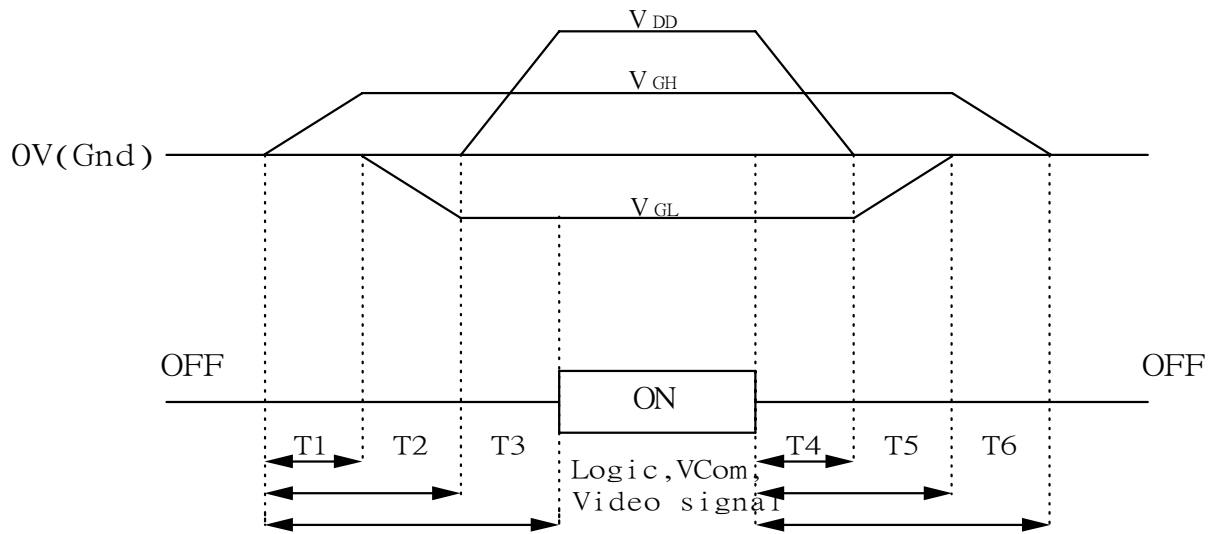
| Parameter | Symbol | MIN. | TYP | MAX. | Unit | Remark | |
|----------------------------------|-------------------|-----------------|------|-------|-------|----------|----------|
| Supply voltage for source driver | V _{SH} | +13.5 | +14 | +14.5 | V | | |
| Supply voltage for gate driver | H Level | V _{GH} | +19 | +20 | +24 | V | |
| | L level | V _{GL} | -5.5 | -5 | -4 | V | |
| Supply voltage for controller | V _{DD} | +4.7 | +5 | +5.3 | V | | |
| Digital input Voltage | H level | | +2.4 | - | +5 | V | Note 7-1 |
| | L level | | -0.3 | - | +0.8 | V | |
| Digital output voltage | H level | | +5 | +5.5 | V | Note 7-2 | |
| | L level | | 0 | - | +0.45 | | V |
| Supply voltage for Module | +12V | +10 | +12 | +16 | V | | |
| Dissipation Current for Module | I _{+12V} | | +0.6 | | A | | |

Note 7-1 : $\overline{\text{HSY}}$, $\overline{\text{CSY}}$, $\overline{\text{VSY}}$, $\overline{\text{CKC}}$

Note 7-2 : $\overline{\text{HSY}}$, $\overline{\text{VSY}}$, $\overline{\text{PSI}}$, $\overline{\text{PSC}}$, $\overline{\text{FRP}}$

B) Power on sequence (Voltage source)

The power on sequence only effect by V_{DD} , V_{GL} and V_{GH} , the others do not care.



- 1) 10ms T1 T2 T3
- 2) 10ms T4 T5 T6

C) Driving for backlight

$T_a = 25\text{ }^\circ\text{C}$

| Parameter | Symbol | Min. | Typ. | Max. | Unit | Remark |
|------------------|--------|------|------|------|------|--------------------|
| Lamp voltage | V_L | 470 | 520 | 630 | Vrms | $I_L = 6\text{mA}$ |
| Lamp current | I_L | 4 | 6 | 8 | mA | |
| Lamp frequency | P_L | 20 | 35 | 60 | KHz | Note 7-3 |
| Kick-off voltage | V_s | | | 1500 | Vrms | |

Note 7-3 : The wave form of lamp driving voltage should be as closed to a perfect SIN wave as possible.

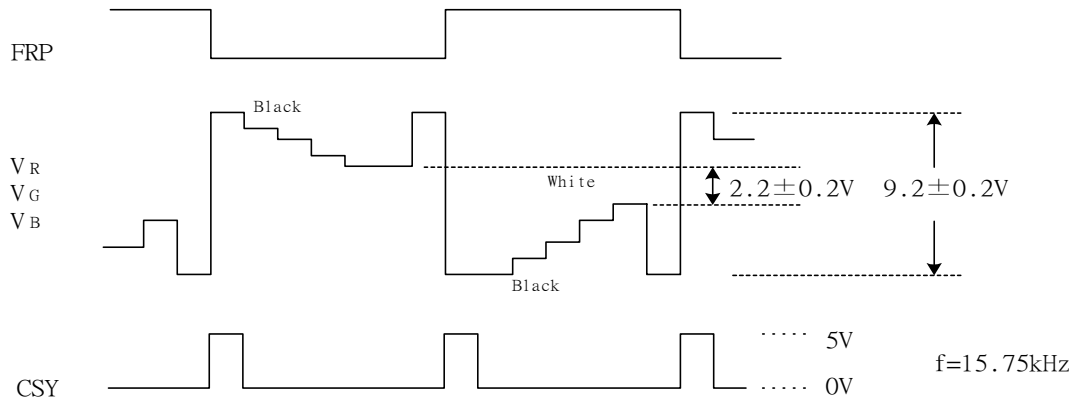
7-2) Power Consumption

$T_a = 25\text{ }^\circ\text{C}$

| Parameter | Symbol | Conditions | TYP. | Unit | Remark |
|-------------------------------|--------|-------------------|------|------|----------|
| Supply current for LCD Module | +12V | $V = +12\text{V}$ | 600 | mA | |
| LCD Module Power Consumption | | | 7.2 | W | Note 7-4 |

Note 7-4 : It includes the loading of the system.

7-3) Input / Output signal timing chart



| Parameter | | Symbol | MIN. | TYP. | MAX. | Unit | Remarks |
|-------------------------------|------------------|-----------|------|------|------|---------|--------------|
| Horizontal Sync. Output Pulse | Width | T_{HO} | 4.2 | 4.7 | 5.2 | μs | |
| | Phase Difference | T_{HP} | 0 | 2 | | μs | |
| | Rising Time | T_{HR} | - | - | 0.5 | μs | |
| | Falling Time | T_{HF} | - | - | 0.5 | μs | |
| Vertical Sync. Output Pulse | Width | T_{VO} | - | 4H | - | μs | H=1/15.75KHZ |
| | Phase Difference | T_{VPO} | - | 1H | - | μs | odd field |
| | Phase Difference | T_{VPE} | - | 1.5H | - | μs | even field |
| | Rising Time | T_{VR} | - | - | 2 | μs | |
| | Frequency | f_{FRP} | 7.67 | 7.87 | 8.07 | KHZ | |
| Polarity Alternating Signal | Delay time | T_{FD} | - | - | 4 | μs | |
| | Falling Time | T_{VF} | - | - | 2 | μs | |

7-4) Display Time Range

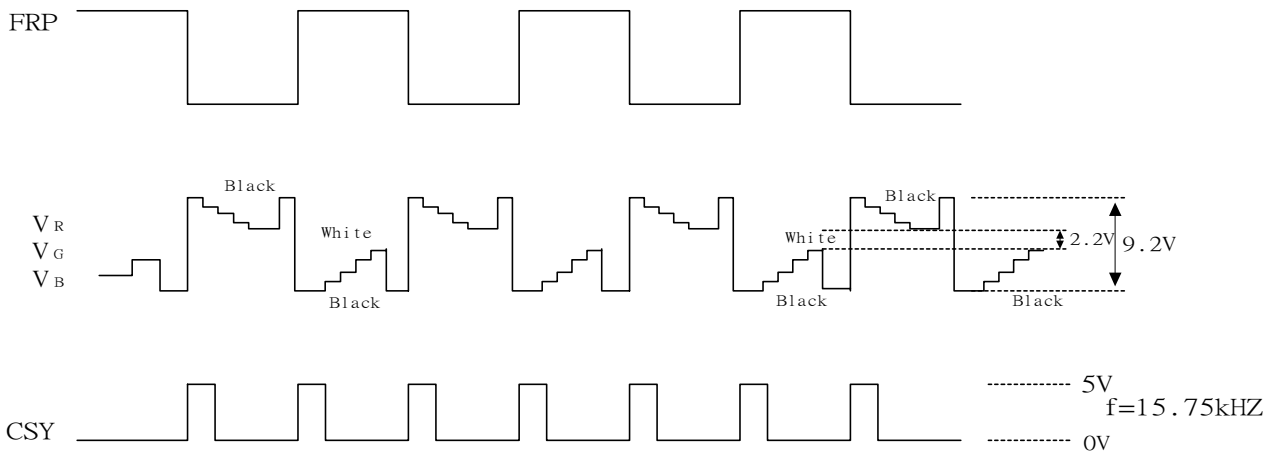
A) When sync. signal of NTSC system is applied.

a) Horizontally

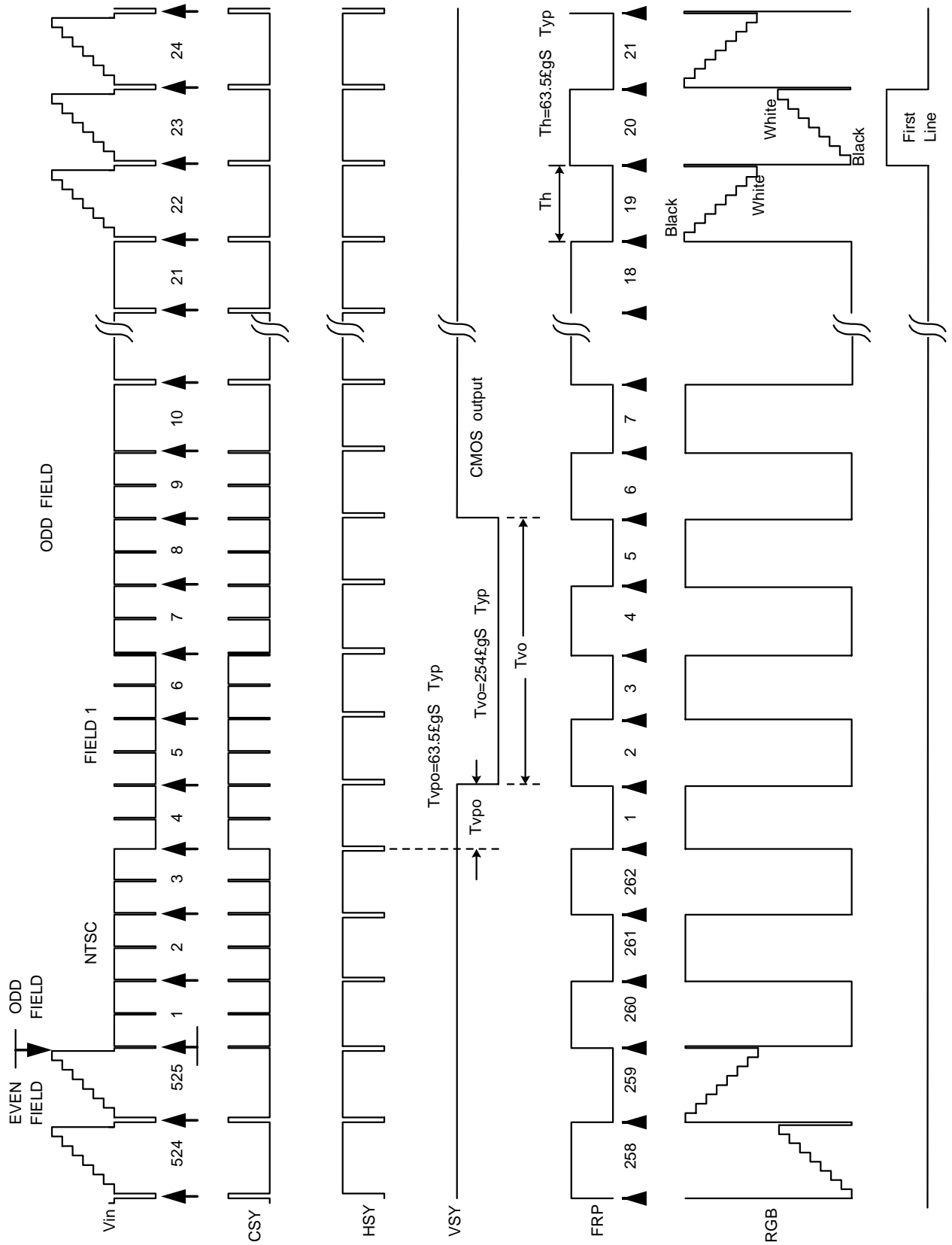
12.6 ~ 63.39 μs .

b) Vertical

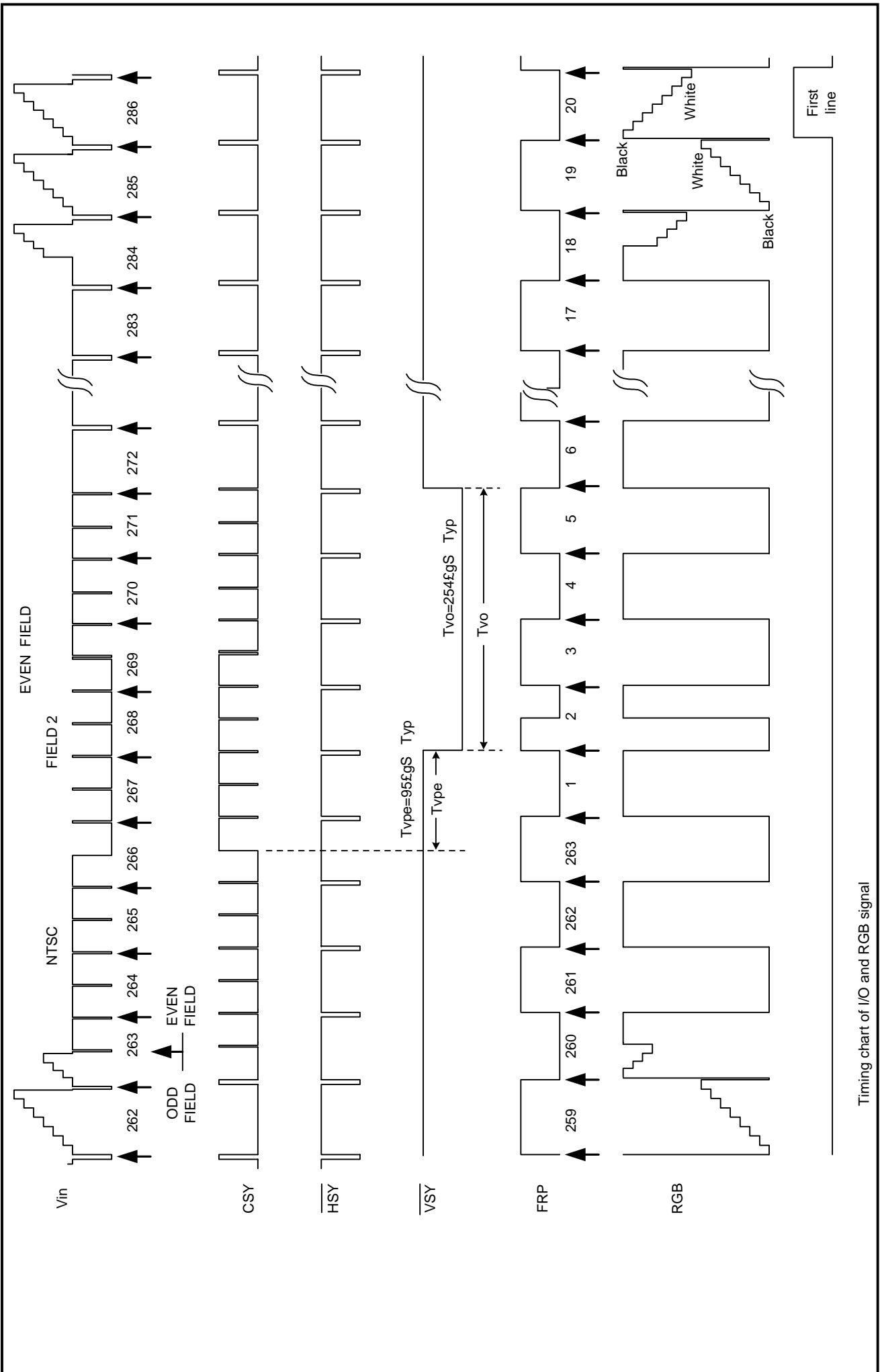
19 ~ 253 H



B) NTSC System

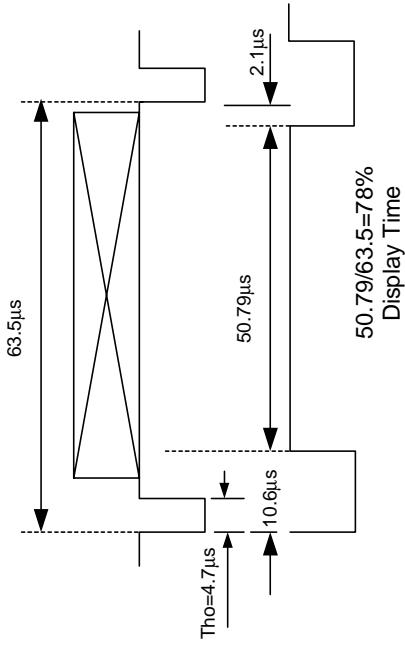


Timing chart of I/O and RGB signal



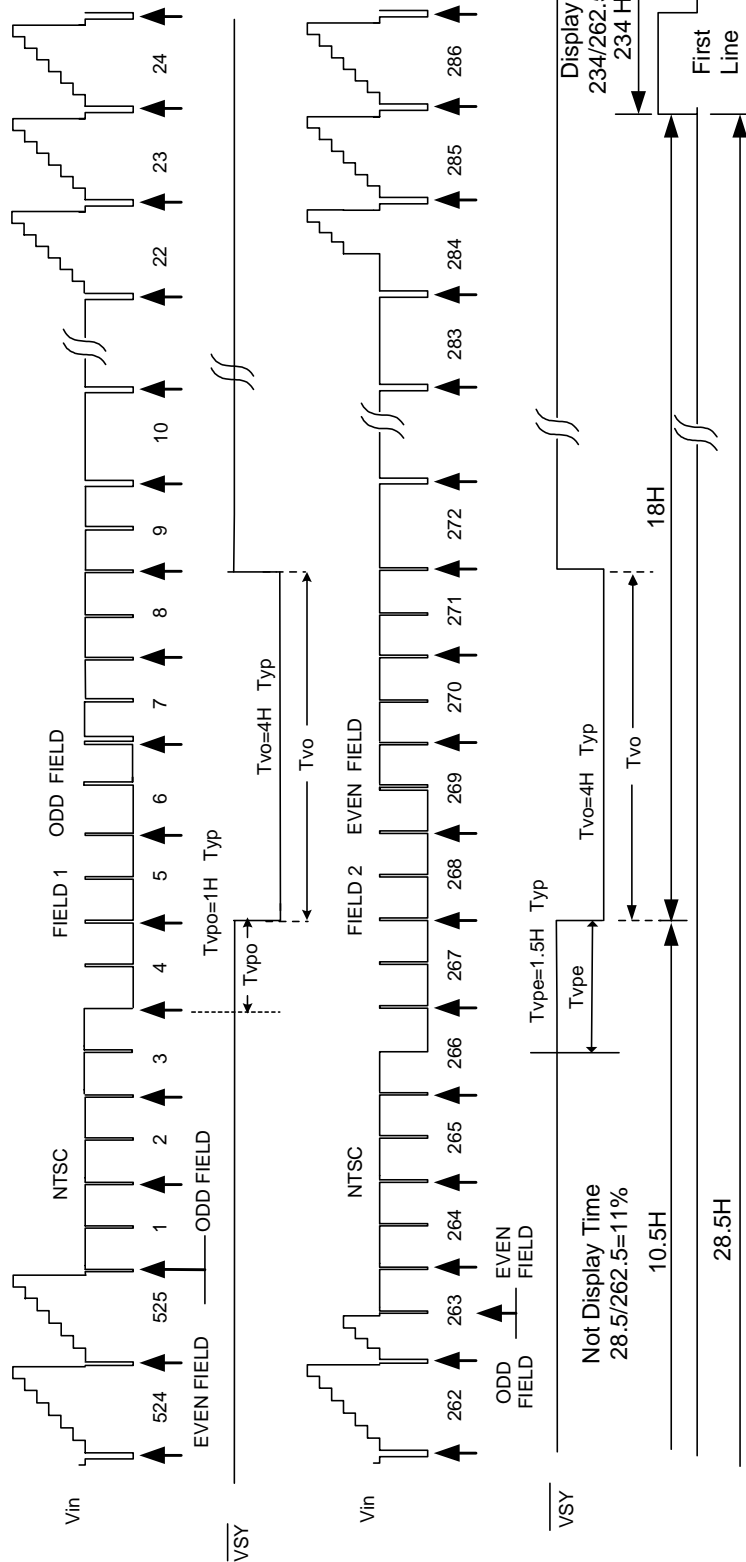
Timing chart of I/O and RGB signal

Sampling Clock: 18.9MHz



(1) Horizontal Timing

(2) Vertical Timing



NTSC Display Timing

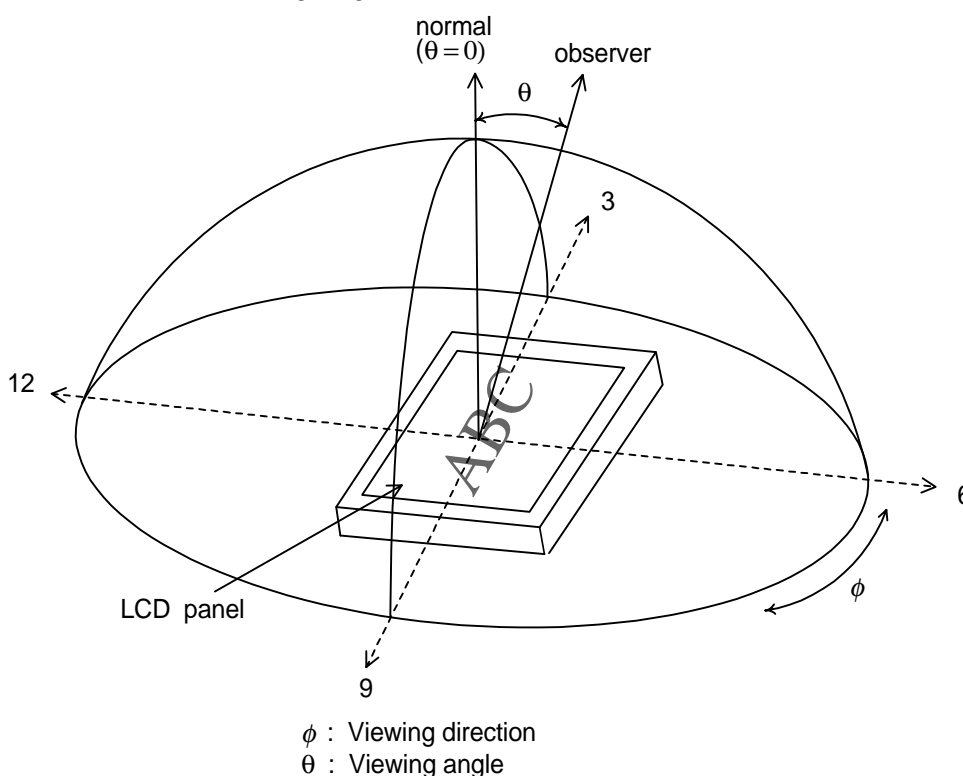
8. Optical Characteristics

8-1) Specification:

Ta = 25°C

| Parameter | Symbol | Condition | MIN. | TYP. | MAX. | Unit | Remarks |
|--------------------|------------|--------------------------|----------|----------|-------|-------------------|----------|
| Viewing Angle | Horizontal | θ | ± 45 | ± 55 | | deg | Note 8-1 |
| | Vertical | θ (to 12 o'clock) | 10 | 15 | | deg | |
| | | θ (to 6 o'clock) | 30 | 35 | | deg | |
| Contrast Ratio | CR | | 80 | 120 | | | Note 8-2 |
| Response time | Rise | Tr | | | 30 | ms | Note 8-4 |
| | Fall | Tf | | | 50 | ms | |
| Brightness | | | 250 | 300 | | cd/m ² | Note 8-3 |
| White Chromaticity | x | | 0.253 | 0.303 | 0.353 | | |
| | y | | 0.315 | 0.365 | 0.415 | | |
| Lamp Life Time | +25°C | | 10,000 | | | hr | |

Note 8-1: The definitions of viewing angles



Note 8-2 : CR = $\frac{\text{Luminance when Testing point is White}}{\text{Luminance when Testing point is Black}}$

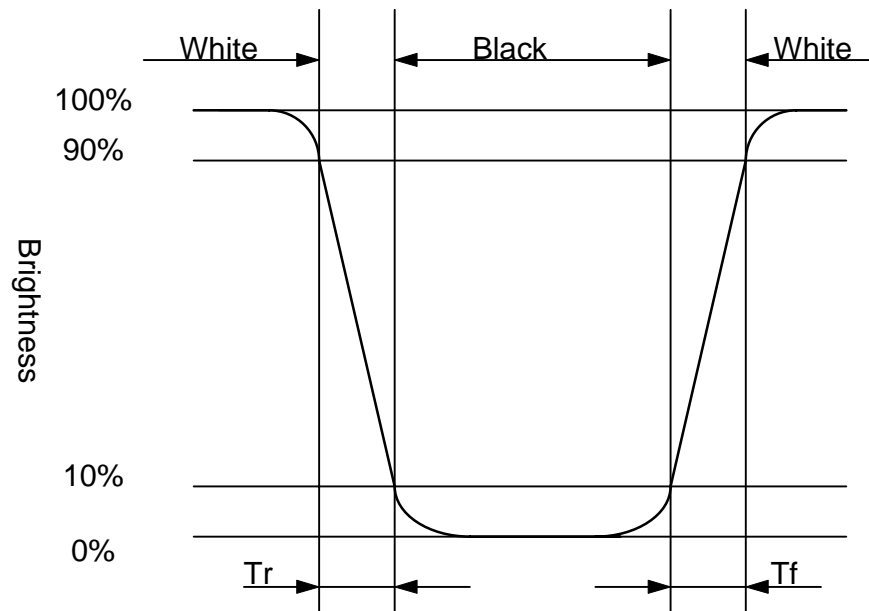
(Testing configuration see 8-2)

Contrast Ratio is measured in optimum common electrode voltage.

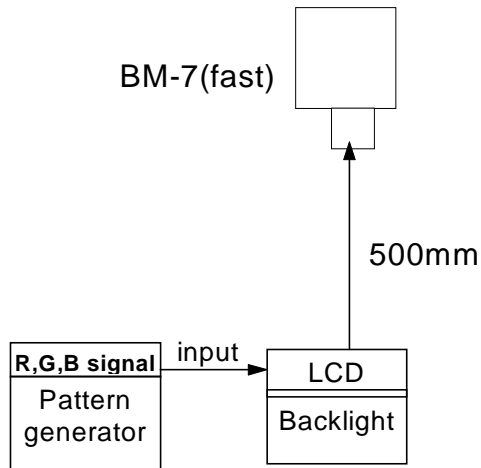
Note 8-3 : Topcon BM-7(fast) luminance meter 2° field of view is used in the testing (after 20~30 minutes operation).

Lamp Current is 6mA.

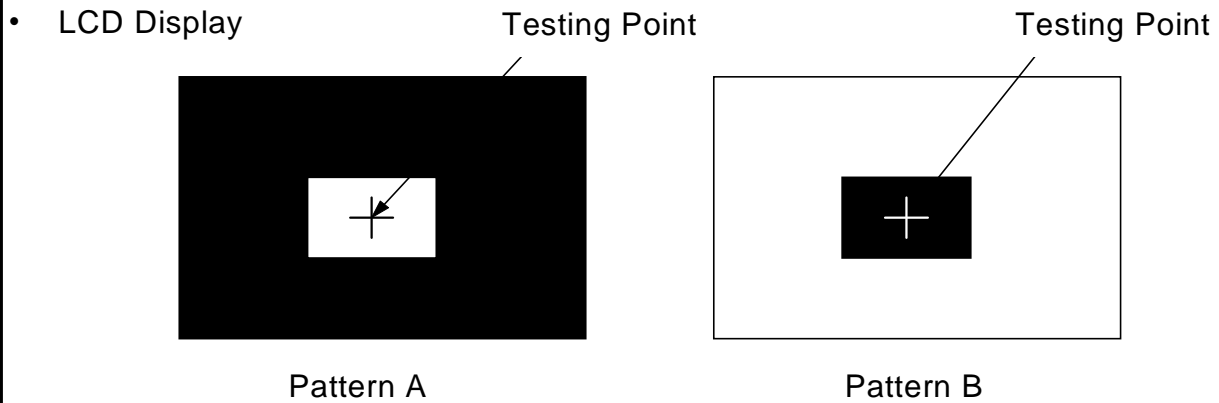
Note 8-4 : The definition of response time:



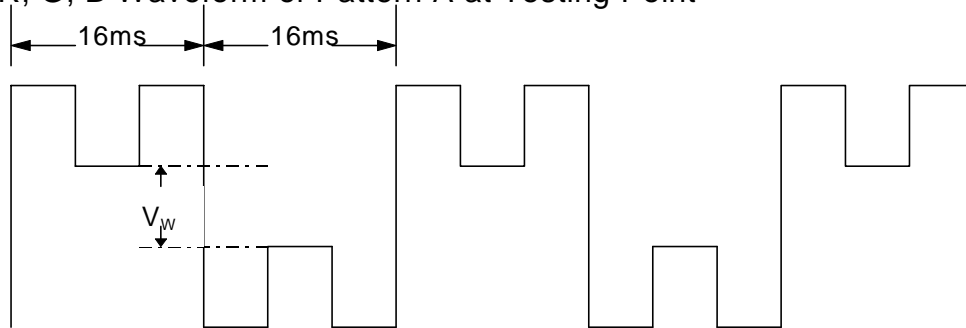
8-2) Testing configuration



Caution: 1. Environmental illumination 1 lux
 2. Before test CR, Vcom voltage must be adjusted carefully to get the best CR.

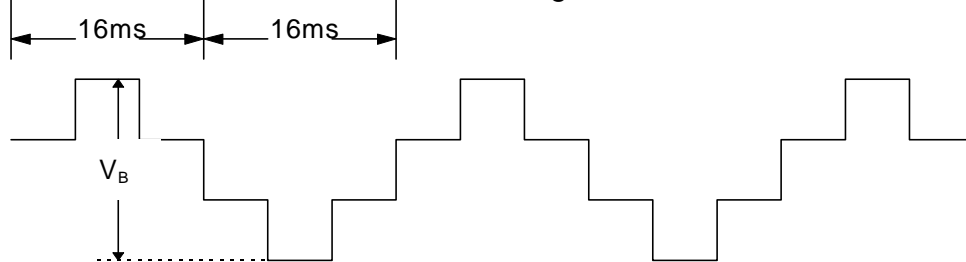


- R, G, B Waveform of Pattern A at Testing Point



$$V_w = 2.2V \pm 0.2V$$

- G, B Waveform of Pattern B at Testing Point



$$V_b = 9.2V \pm 0.2V$$

9. Handling Cautions

9-1) Mounting of module

- a) Please power off the module when you connect the input/output connector.
- b) Please connect the ground pattern of the inverter circuit surely. If the connection is not perfect, some following problems may happen possibly.
 - 1. The noise from the backlight unit will increase.
 - 2. The output from inverter circuit will be unstable.
 - 3. In some cases a part of module will heat.
- c) Polarizer which is made of soft material and susceptible to flaw must be handled carefully.
- d) Protective film (Laminator) is applied on surface to protect it against scratches and dirt. It is recommended to peel off the laminator before use and taking care of static electricity.

9-2) Precautions in mounting

- a) When metal part of the TFT-LCD module (shielding lid and rear case) is soiled, wipe it with soft dry cloth.
- b) Wipe off water drops or finger grease immediately. Long contact with water may cause discoloration or spots.
- c) TFT-LCD module uses glass which breaks or cracks easily if dropped or bumped on hard surface. Please handle with care.
- d) Since CMOS LSI is used in the module. So take care of static electricity and earth yourself when handling.

9-3) Adjusting module

- a) Adjusting volumes on the rear face of the module have been set optimally before shipment.
- b) Therefore, do not change any adjusted values. If adjusted values are changed, the specifications described may not be satisfied.

9-4) Others

- a) Do not expose the module to direct sunlight or intensive ultraviolet rays for many hours.
- b) Store the module at a room temperature place.
- c) The voltage of beginning electric discharge may over the normal voltage because of leakage current from approach conductor by to draw lump read lead line around.
- d) If LCD panel breaks, it is possibly that the liquid crystal escapes from the panel. Avoid putting it into eyes or mouth. When liquid crystal sticks on hands, clothes or feet. Wash it out immediately with soap.
- e) Observe all other precautionary requirements in handling general electronic components.
- f) Please adjust the voltage of common electrode as material of attachment by 1 module.

10. Reliability Test

| No | Test Item | Test Condition |
|----|---|---|
| 1 | High Temperature Storage Test | Ta = +80 C, 240 hrs |
| 2 | Low Temperature Storage Test | Ta = -30C, 240 hrs |
| 3 | High Temperature Operation Test | Ta = +60 C, 240 hrs |
| 4 | Low Temperature Operation Test | Ta = -10 C, 240 hrs |
| 5 | High Temperature & High Humidity Operation Test | Ta = +60C, 95%RH, 240 hrs |
| 6 | Thermal Cycling Test (non-operating) | -25C +25C +70C, 200 Cycles 30 min 5min 30 min |
| 7 | Vibration Test (non-operating) | Frequency : 10 ~ 55 Hz Amplitude : 1.5 mm Sweep time : 11 mins Test period : 2 hrs for each direction of X, Y, Z |
| 8 | Shock Test (non-operating) | 100G, 6ms Direction : ± X, ± Y, ± Z Cycle : 3 times |
| 9 | Electrostatic Discharge Test | 150pF, 330 Air : ± 15KV; Contact : ± 8KV 10 times/point, 9 points/panel face |

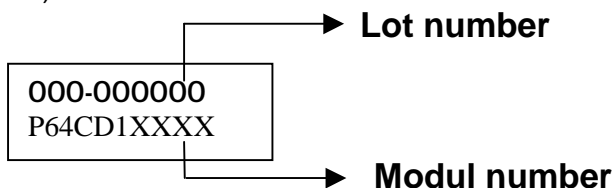
Ta: ambient temperature

[Criteria]

Under the display quality test conditions with normal operation state, there should be no change which may affect practical display function.

11. Indication of Lot Number Label

a) Indicated contents of the label



Contents of lot number : 1st—Process area : class 1000 ⇒ H
class 100K ⇒ M

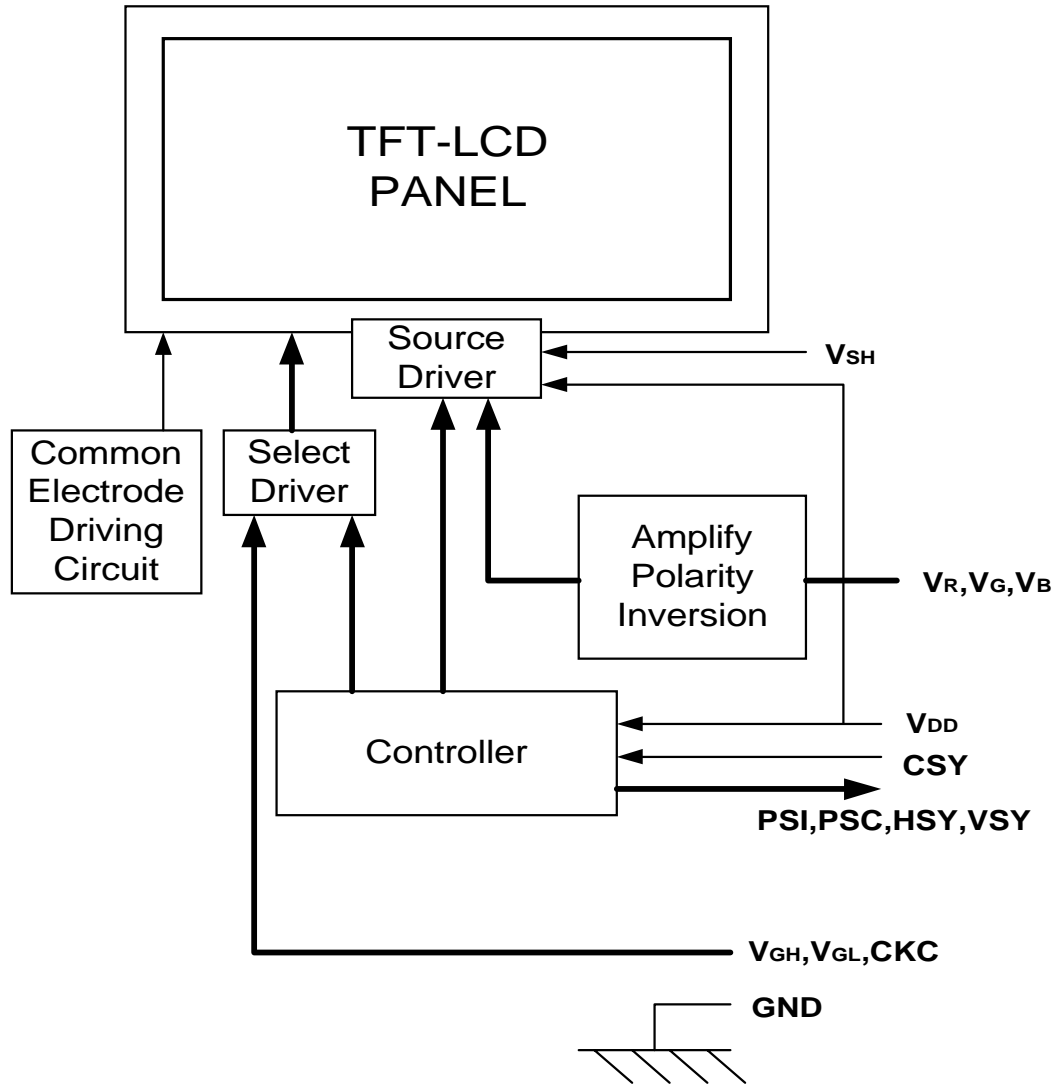
2nd~3rd—Module screen size(in inch) : 1.8"⇒18, 2.5"⇒25.....

5th—Production year : 1999⇒9, 2000⇒A, 2001⇒1.....

6th—Production month : 1, 2, 3,....9, A, B, C

7th~10th—Serial numbers : 0001~9999

12. Block Diagram



DC-DC CONVERTER / DC-AC INVERTER
6.4" SWITCHING POWER SUPPLY BOARD
MODEL NO. : 71-9010021

1. Application

This technical specification applies to DC – DC Converter / DC – AC Backlight Inverter Board, 71-9010021.

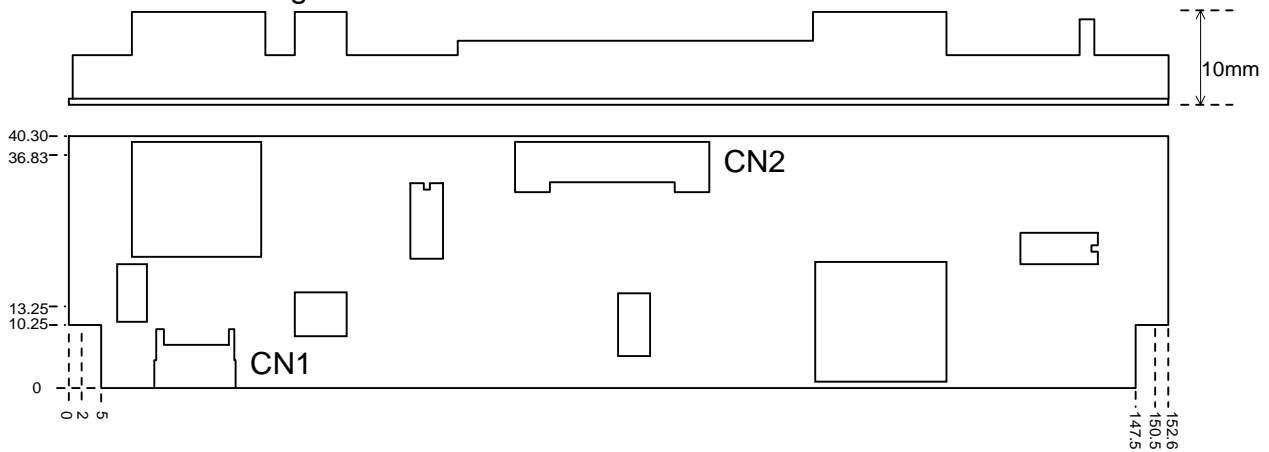
2. Features

- . Brightness Adjustable
- . Apply to 6.4" TFT-LCD MODULE

3. Mechanical Specifications

| Parameter | Specifications | Unit |
|-------------------|---------------------------------|------|
| Outline Dimension | 152.6 (H) × 40.3 (V) × 10.0 (D) | mm |
| Weight | 38 | g |

4. Mechanical Drawing



CN1 : TYPE : JST SM02(8.0)B-BHS-1-TB

CN2 : TYPE : ELCO 6200-500-16-800 BOTTOM CONTACT

PIN ASSIGNMENT : (1) 20V O/P

(2) GND

(3) -5V O/P

(4) PSI I/P(INVERTER SYNC.) NC

(5) PSC I/P(CONVERTER SYNC.)

(6) 5V O/P

(7) GND

(8) 14V O/P

(9) GND

(10) 13V O/P

(11) ENABLE

(12) ADJ

(13) GND I/P

(14) GND I/P

(15) +12V I/P

(16) +12V I/P

5. Input / Output Terminals

5-1) Connect To Backlight (CN1)

| Pin No. | Symbol | I/O | Description | Remark |
|---------|--------|-----|-------------------------------|--------|
| 1 | VL1 | O | High Voltage for Lamp | |
| 2 | VL2 | O | Low Voltage for Lamp (Ground) | |

5-2) Connect to Chroma Decoder (CN2)

| Pin No | Symbol | I/O | Description | Remark |
|--------|-----------------|-----|--|--------|
| 1 | V _{GH} | O | Supply Voltage for LCD Gate Driver (Hi level) | Note 1 |
| 2 | GND | | Ground | |
| 3 | V _{GL} | O | Supply Voltage for LCD Gate Driver (Low level) | Note 2 |
| 4 | PSI | I | Synchronize Pulse for Backlight Inverter | Note 8 |
| 5 | PSC | I | Synchronize Pulse for DC-DC Converter | Note 8 |
| 6 | V _{DD} | O | Supply voltage for Controller / Decoder | Note 3 |
| 7 | GND | | Ground | |
| 8 | V _{SH} | O | Supply voltage for LCD source driver | Note 4 |
| 9 | GND | | Ground | |
| 10 | V _{EE} | O | Supply Voltage for Video Decoder | Note 5 |
| 11 | ENA | I | Power save option | Note 7 |
| 12 | DIM | I | Adjust the brightness of backlight | Note 6 |
| 13 | GND | I | Ground | |
| 14 | GND | I | Ground | |
| 15 | V _P | I | Input Voltage for DC-DC converter / Backlight Inverter | Note 9 |
| 16 | V _P | I | Input Voltage for DC-DC converter / Backlight Inverter | |

Note 1 : V_{GH} : +20V (Typ.).

Note 2 : V_{GL} : -5V (Typ.).

Note 3 : V_{DD} : +5V (Typ.).

Note 4 : V_{SH} : +14V (Typ.).

Note 5 : V_{EE} : +13V (Typ.).

Note 6 : Pin 12 (DIM) can adjust the brightness of backlight by changing the input voltage between +0.6V to +2V. If the input voltage is +0.6V the brightness is the lowest. The brightness will increase when the input signal increase.

| Pin 12 (DIM) | Brightness |
|--------------|------------|
| Hi (+2.0V) | Highest |
| Low (+0.6V) | Lowest |
| Open | Highest |

Note 7 : When Pin 11 (ENA) is driven high, the system is enabled. when Pin 5 (ENA) is pulled low, the system is shut down.

| Pin 11 (ENA) | LCD System |
|--------------|------------------|
| Hi (+2V~+5V) | Enable |
| Low (<+0.3V) | System turn off |
| Open | Normal Operation |

Note 8 : Please refer to the specification of LCD module.

Note 9 : V_P : +12V (Typ.)

6. Connector

| Connector No. | CN 1 | CN 2 |
|---------------|---------------------|--------------------|
| Type | Shrouded Header | FFC Down Connector |
| Pins | 2 | 16 |
| Pitch | 8 mm | 1 mm |
| Maker | JST | ELCO |
| Model No. | SM02(8.0)B-BHS-1-TB | 6200-500-16-800 |

7. Electrical Characteristics

7-1) Recommended Operating Conditions:

GND = 0V , $T_a = 25\text{ C}$

| Parameter | Symbol | MIN. | TYP | MAX. | Unit | Remark |
|--|----------|----------|-------|-------|-------|--------|
| Supply Voltage for DC-DC Converter | V_P | +10.8 | +12 | +14 | V | |
| Supply voltage for source driver | V_{SH} | +13.5 | +14 | +14.5 | V | |
| Supply voltage for gate driver | H Level | V_{GH} | +18.8 | +20 | +21.2 | V |
| | L level | V_{GL} | -5.5 | -5 | -4.5 | V |
| Supply voltage for controller/ Decoder | V_{DD} | +4.75 | +5 | +5.25 | V | |
| Supply voltage for decoder | V_{EE} | +12 | +13 | +14 | V | |
| Lamp Voltage | VL1 | | 550 | 1400 | Vrms | |
| Lamp Current | IL1 | 7.2 | 8 | 8.8 | mA | |

7-2) Power Consumption

| Parameter | Symbol | Conditions | TYP. | MAX | Unit | Remark |
|------------------------------------|--------|--------------|------|-----|------|--------|
| Supply Current for DC-DC Converter | V_C | $V_C = +12V$ | 190 | | mA | 2.3W |

| | | | | | | |
|---------------------------------------|-------|--------------|-----|-----|----|--------|
| Supply Current for Backlight Inverter | V_i | $V_i = +12V$ | 366 | | mA | 4.4W |
| Total Power Consumption | | | | 9.6 | W | Note A |

Note A : DC input current : $0.8 A \pm 10\%$ typical at 12Vdc input.

8. Environment Operating Characteristics

- .Temperature : $-10C \sim +70C$.
- .Temperature coefficient : $\pm 0.03\% / C$ over the entire operating temperature.
- .Relative humidity : $5 \sim 95\% RH$. ,non-condensation.
- .Altitude : $0 \sim 7000$ feet.
- .Cooling : Free air convection cooling.

9. Storage Characteristics

- .Temperature : $-30 \sim +85C$
- . Relative humidity : $0 \sim 95\% RH$. ,non-condensation.
- . Vibration : $1.5mm$, $10 \sim 50 Hz$. Gravity= $1G$, Sweep Time= 15 minutes ,
Test period= 2 hours , for each axis (X,Y,Z).

10. Reliability : 10000 hours MIN. at MAX. load and 25Cambient.

11. ESD Test

The power supply is designed to correspondence with the IEC801-2 ESD rule criterion B.

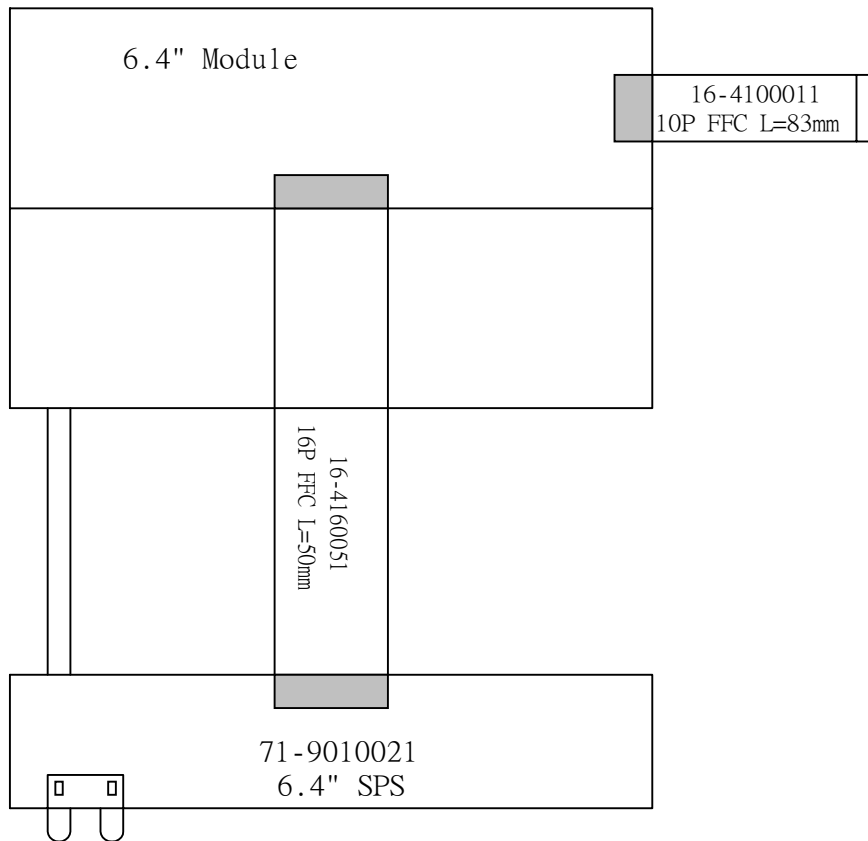
Test condition : (1). Contact discharge 8kV.

(2). Directly discharge accessible metal part at least 10 times.

(3). Impairment of function outside the device's error limits, but with automatic recovery after exposure.

Test result : Perfectly meet the test condition.

12.Assembly Drawing



WARNING !

Before power on , please make sure the 16-pin cable to be connected properly. Improper connection of the 16-pin cable to the socket may permanently damage the module.

Instruction:

1. Connect DC 12V to "Power Supply Board". DO NOT TURN ON.
2. Connect Video AV to "Decoder Board". DO NOT TURN ON.
3. Power on DC 12V.