

NAN YA PLASTICS CORP.
ELEC. MATERIALS DIV.
LCD DEPARTMENT

SPECIFICATION

SPEC. NO. : LM203-0
DATE : DEC.09, 1998
SHEET NO. : 1/18

U.S. MARKETING ARM:

MARK PRODUCTS CORPORATION
800 N. EDGEWOOD AVENUE
WOOD DALE, IL 60191
TEL: 630-787-9089
FAX: 630-787-9015

SPECIFICATION OF
320x240 LCD MODULE
PRODUCT NO.: LTBHB_203_K

SPEC. NO.: LM203-0

| |
|-------------|
| CUSTOMER |
| |
| APPROVED BY |
| |
| DATE: |

EDITED ON : DECEMBER.09.1998

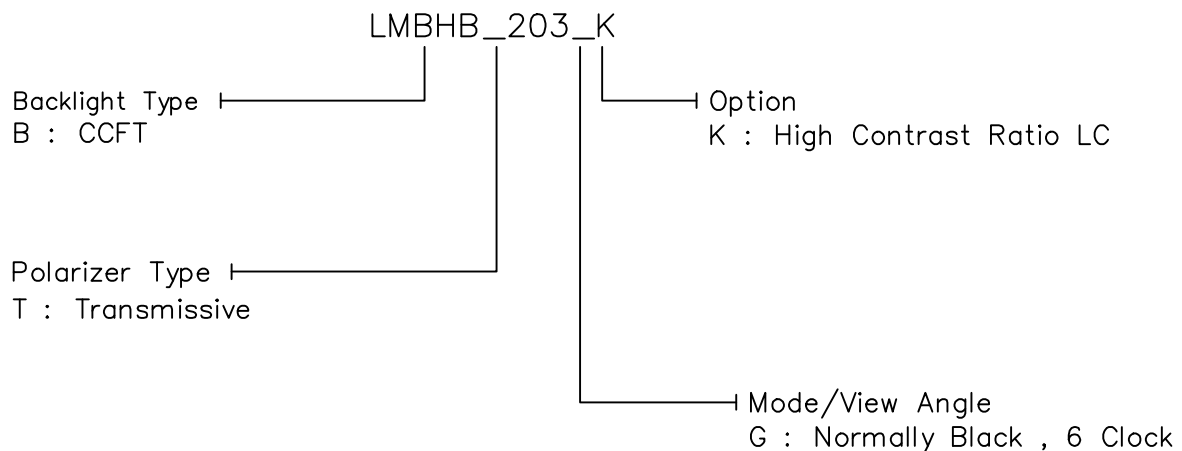
| SALE MANAGER | TECHNICAL APPROVE | DESIGN MANAGER | DESIGN CHECK | DESIGNER |
|-----------------|----------------------|-------------------|-----------------|----------|
| | | | | |

| | | | | | | | | |
|----------|------------------|------------------|--|--|--|-----|-----|----|
| REV/DATE | R0/ 09.29.98' | R1/ 12.09.98' | | | | APP | CHK | BY |
|----------|------------------|------------------|--|--|--|-----|-----|----|

1. MECHANICAL DATA

- (1) Product No. LTBHB_203_K
- (2) Module Size 168 (W)mm x 111.0 (H)mm x 7.4 (D)mm
(CCFT B.L.)
- (3) Dot Size 0.33 (W)mm x 0.33 (H)mm
- (4) Dot Pitch 0.36 (W)mm x 0.36 (H)mm
- (5) Number of Dots 320 (W) x 240 (H)Dots
- (6) Duty 1/240
- (7) LCD Display Mode FSTN: Black and White(Normal Black/Negative Image)
Rear Polarizer: Transmissive
- (8) Viewing Direction 6 O'clock
- (9) Backlight CCFT
- (10) Controller Excluded
- (11) DC/DC Converter Excluded
- (12) Weight 280 g(APPROX)

Note :



| | | | | | | | | |
|----------|------------------|------------------|--|--|--|-----|-----|----|
| REV/DATE | R0/ 09.29.98' | R1/ 12.09.98' | | | | APP | CHK | BY |
|----------|------------------|------------------|--|--|--|-----|-----|----|

2. ABSOLUTE MAXIMUM RATINGS

(1) ELECTRICAL ABSOLUTE RATINGS

VSS=0V STANDARD

| ITEM | SYMBOL | MIN | MAX | UNIT | COMMENT |
|------------------------|---------|------|------|-------|---------|
| Power Supply for Logic | VDD-VSS | -0.3 | 7.0 | V | |
| Power Supply for LCM | VDD-VEE | 0 | 30.0 | V | |
| Input Voltage | VI | -0.3 | VDD | V | |
| CCFL Driving Voltage | VFL | 0 | 500 | Vrms | |
| CCFL Input Current | IFL | - | 7.0 | mArms | |
| Static Electricity | - | - | - | - | Note 1 |

Note 1 LCM should be grounded during handling LCM.

(2) ENVIRONMENTAL ABSOLUTE MAXIMUM RATINGS

| ITEM | WIDE TEMP. | | | |
|--------------------------------|------------|------|----------|------|
| | OPERATING | | STORAGE | |
| | MIN. | MAX. | MIN. | MAX. |
| Ambient Temperature | -20 | 70 | -30 | 80 |
| Humidity(Without Condensation) | Note 2,3 | | Note 2,4 | |

Note 2 Background color changes slightly depending on ambient temperature.
This phenomenon is reversible.

Note 3 $T_a \leq 70^\circ\text{C}$: 75%RH max
 $T_a > 70^\circ\text{C}$: Absolute humidity must be lower
than the humidity of 75%RH at 70°C

Note 4 T_a at -30°C will be < 48hrs, at 80°C will be < 120hrs

3. ELECTRICAL CHARACTERISTICS

(VDD = 5V±5%)

| ITEM | SYMBOL | CONDITION | MIN. | TYP. | MAX. | UNIT | | |
|---|-------------------|--|--|--|--------|-------------------|---|-------------------|
| Power Supply for Logic | VDD-VSS | - | 4.75 | 5.0 | 5.25 | V | | |
| Recommended LC Driving Voltage (Wide Temp. LCM) | VDD-V0 | Duty=1/240 Bias=1/13 | -20°C | 24.6 | 25.0 | 25.4 | V | |
| | | | 0°C | 23.6 | 24.0 | 24.4 | | |
| | | | 25°C | 22.8 | 23.2 | 23.6 | | |
| | | | 50°C | 21.7 | 22.1 | 22.5 | | |
| | | | 70°C | 20.8 | 21.2 | 21.6 | | |
| Input Voltage | VIH | H level | 0.7VDD | - | VDD | V | | |
| | VIL | L level | 0 | - | 0.3VDD | V | | |
| Power Supply Current | IDD | FLM = 70 Hz VDD = 5.0 V VEE = -24.0 V VDD-V0 = 23.2 V | - | 9.5 | - | mA | | |
| | IEE | PATTERN : □ ■ □ ■ □ ■ ■ □ ■ □ ■ □ | - | 7.6 | - | mA | | |
| CCFL LAMP | Open Voltage | V _{Open} | - | 420 | - | V _{rms} | | |
| | Lamp Voltage | V _L | - | 260 | - | V _{rms} | | |
| | Brightness | B | 27000 | - | - | cd/m ² | | |
| | Color Degree | X | Lamp Current = 5 mArms Frequency = 35 KHz | - | 0.336 | - | - | |
| Y | | - | | 0.334 | - | | | |
| LCM | Surface Luminance | CCFL | VDD=5.0V VDD-V0=23.2V | PATTERN: (Dots All Off) □ □ □ □ □ □ □ □ | - | 196.5 | - | cd/m ² |
| | | | | PATTERN: (Dots All ON) ■ ■ ■ ■ ■ ■ ■ ■ | - | 12.14 | - | cd/m ² |

4.OPTICAL CHARACTERISTICS

(For Wide Temperature Mode LCM)

AT Vop

| ITEM MODE | | Cr(Contrast Ratio) | | | | | | θ (Viewing Angle) | | θ (Viewing Angle) | |
|--------------|---|--------------------|------|------|------|------|------|--------------------------|------|--------------------------|------|
| | | 0°C | | 25°C | | 50°C | | 25°C | | 25°C | |
| | | MIN. | TYP. | MIN. | TYP. | MIN. | TYP. | MIN. | TYP. | MIN. | TYP. |
| T | G | - | 10 | - | 10 | - | 8.0 | - | 86 | - | 55 |
| note | | NOTE6 | | | | | | NOTE5 | | | |

note: T: TRANSMISSIVE

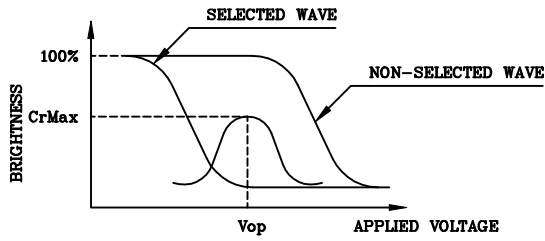
G: NORMALLY BLACK

AT $\phi=0^\circ \theta=0^\circ$

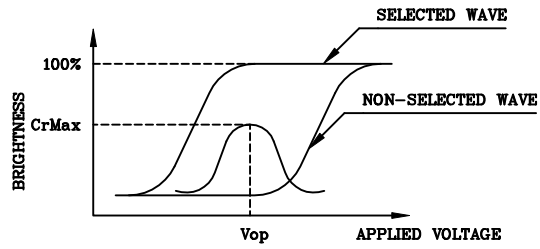
| ITEM | SYMBOL | CONDITION | MIN. | TYP. | MAX. | UNIT | NOTE |
|----------------------|--------|-----------|------|------|------|------|--------|
| Response Time (rise) | Tr | -20°C | - | 2700 | 4100 | ms | NOTE 2 |
| | | 0°C | - | 500 | 800 | | |
| | | 25°C | - | 150 | 250 | | |
| | | 50°C | - | 80 | 120 | | |
| | | 70°C | - | 60 | 90 | | |
| Response Time (fall) | Tf | -20°C | - | 3500 | 5300 | ms | NOTE 2 |
| | | 0°C | - | 800 | 1000 | | |
| | | 25°C | - | 250 | 400 | | |
| | | 50°C | - | 120 | 180 | | |
| | | 70°C | - | 80 | 120 | | |

(NOTE 1)

Definition of Operation Voltage(Vop)



(positive type)



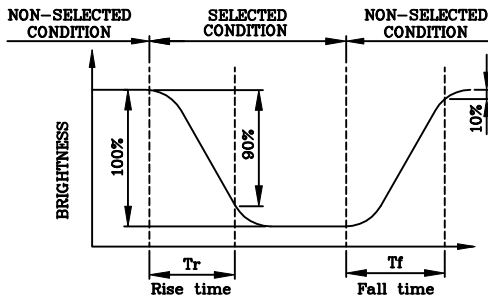
(negative type)

*Conditions

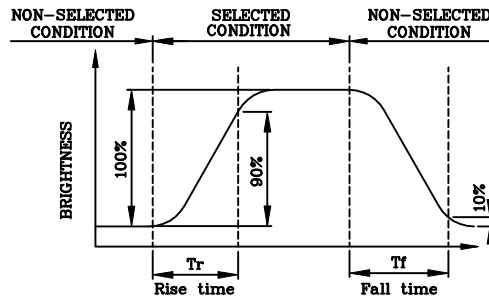
Viewing Angle : 0
Frame Frequency : 70Hz
Applied Waveform : 1/N duty, 1/a bias

(NOTE 2)

Definition of Response Time(Tr,Tf)



(positive type)



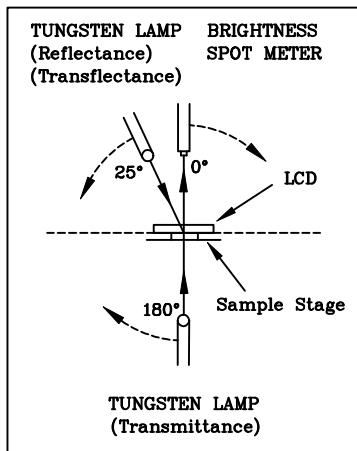
(negative type)

*Conditions

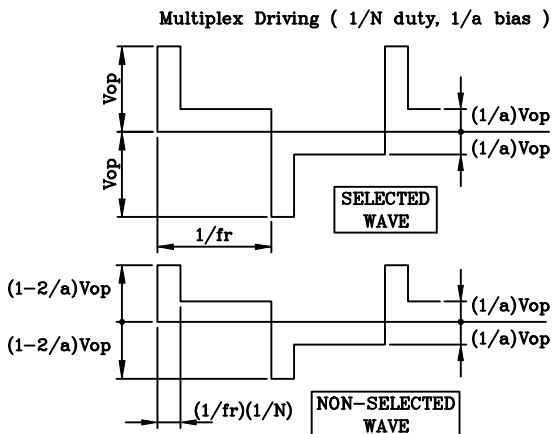
Operating Voltage : Vop
Viewing Angle (θ, ϕ) : (0,0)
Frame Frequency : 70Hz
Applied Waveform : 1/N duty, 1/a bias

(NOTE 3)

Description of Measuring Equipment and Driving Waveforms

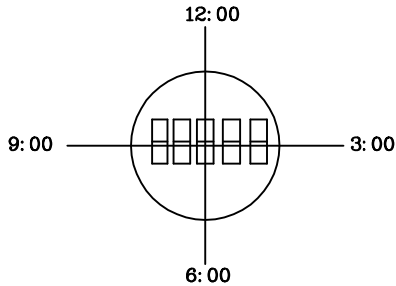


CONST.
TEMP.
CHAMBER



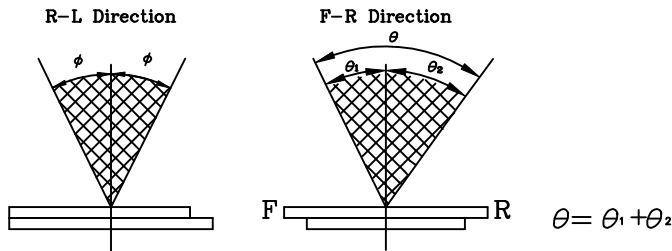
(NOTE 4)

Definition of Viewing Direction



(NOTE 5)

Definition of Viewing Angle

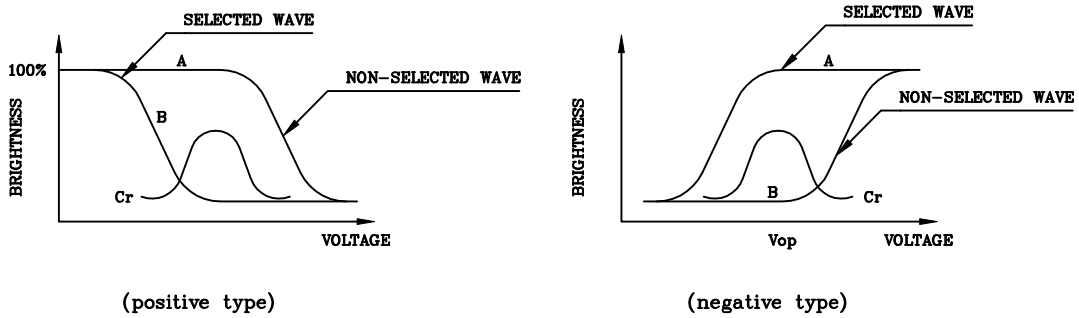


***Conditions**

Operating Voltage : V_{op}
 Frame Frequency : 70Hz
 Applied Waveform : 1/N duty, 1/a bias
 Contrast Ratio : larger than 2

(NOTE 6)

Definition of Contrast Ratio (Cr)

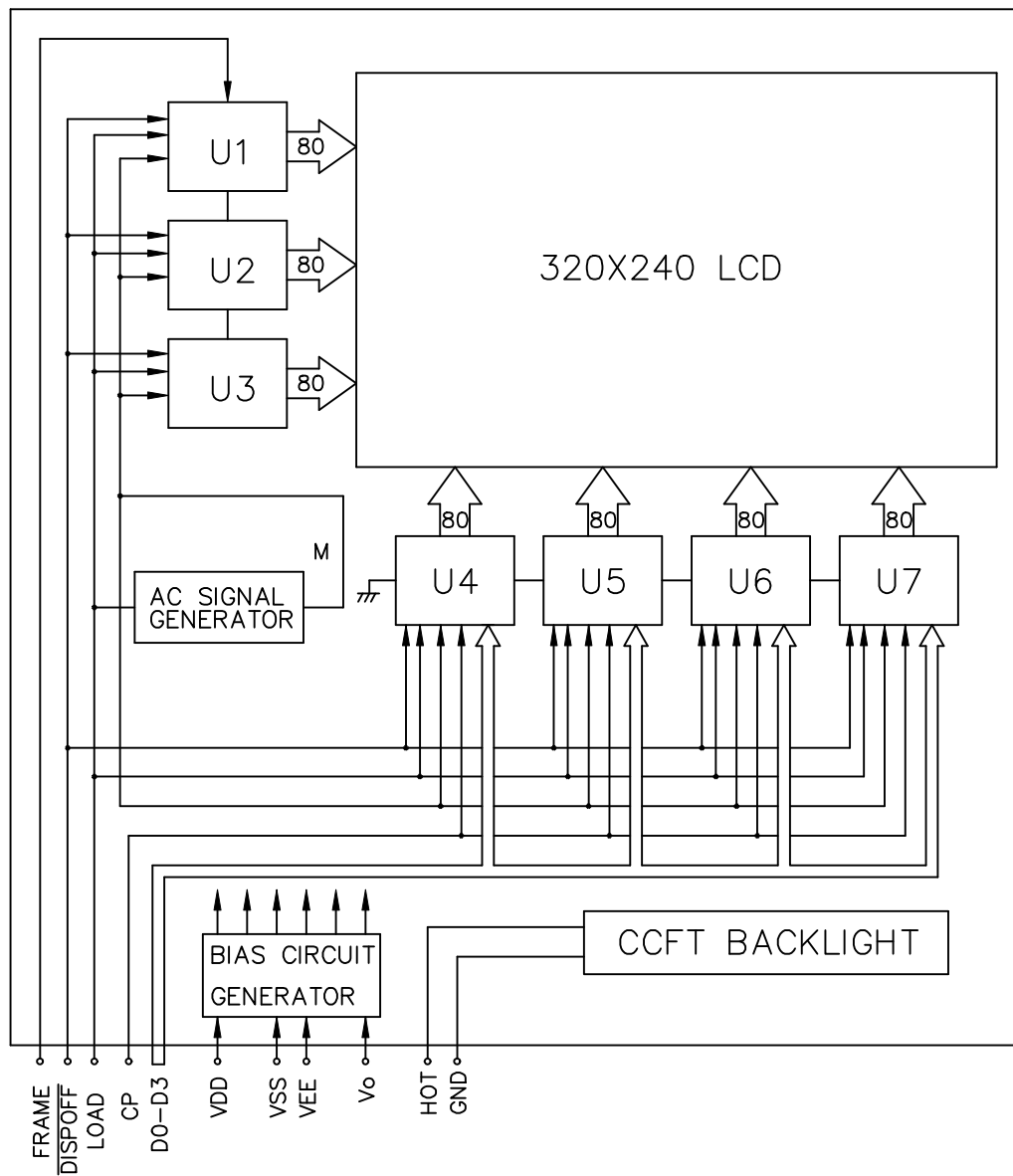


***Conditions**

Viewing Angle : 0
 Frame Frequency : 70Hz
 Applied Waveform : 1/N duty, 1/a bias

| | | | | | | | | |
|----------|------------------|------------------|--|--|--|-----|-----|----|
| REV/DATE | R0/ 09.29.98' | R1/ 12.09.98' | | | | APP | CHK | BY |
|----------|------------------|------------------|--|--|--|-----|-----|----|

5. BLOCK DIAGRAM



* AC SIGNAL SETTING

| J1 | J2 | J3 | J4 | J5 | J6 | J7 | J8 |
|----|----|----|----|----|----|----|----|
| L | H | L | L | H | L | L | L |

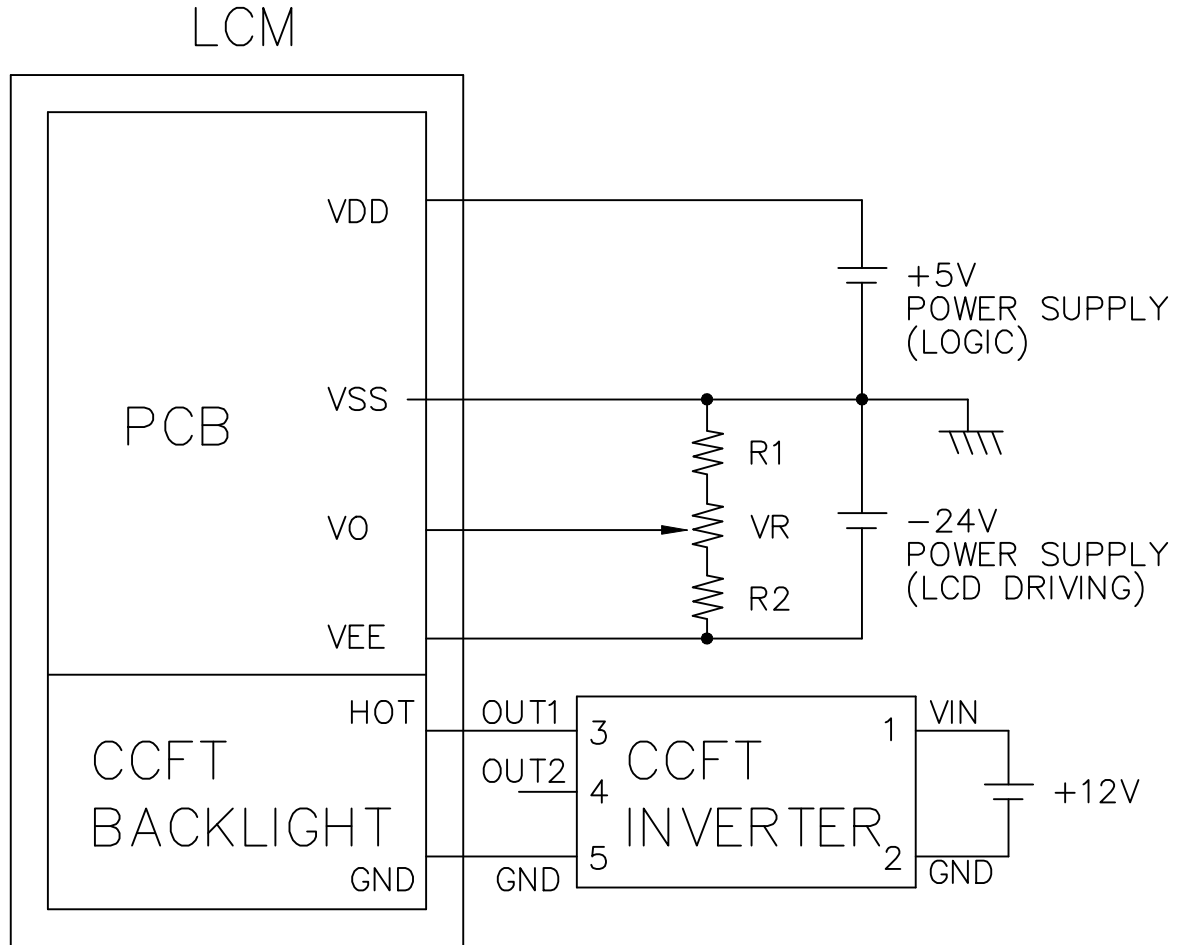
6. INTERNAL PIN CONNECTION

| PIN NO. | SYMBOL | LEVEL | FUNCTION |
|---------|-----------------------------|-------|-----------------------------|
| 1 | D0 | H/L | DISPLAY DATA SIGNAL |
| 2 | D1 | | |
| 3 | D2 | | |
| 4 | D3 | | |
| 5 | $\overline{\text{DISPOFF}}$ | H/L | H: ON/L: OFF |
| 6 | FRAME | H | SCAN START-UP SIGNAL |
| 7 | NC | - | NO CONNECTION |
| 8 | LOAD | H→L | INPUT DATA LATCH SIGNAL |
| 9 | CP | H→L | DATA INPUT CLOCK SIGNAL |
| 10 | VDD | - | POWER SUPPLY FOR LOGIC(+5V) |
| 11 | VSS | - | SIGNAL GROUND(0V) |
| 12 | VEE | - | POWER SUPPLY FOR LCD |
| 13 | VO | - | LCD CONTRAST ADJUST VOLTAGE |
| 14 | FGND | - | FRONT PANEL GROUND |

CCFL CONNECTOR : M63M83-04(MITSUMI)

| PIN NO. | SYMBOL | LEVEL | FUNCTION |
|---------|--------|-------|-----------------------------|
| 1 | HOT | - | POWER SUPPLY FOR CCFT (HOT) |
| 2 | NC | - | NO CONNECTION |
| 3 | NC | - | NO CONNECTION |
| 4 | GND | - | POWER SUPPLY FOR CCFT (GND) |

7. POWER SUPPLY

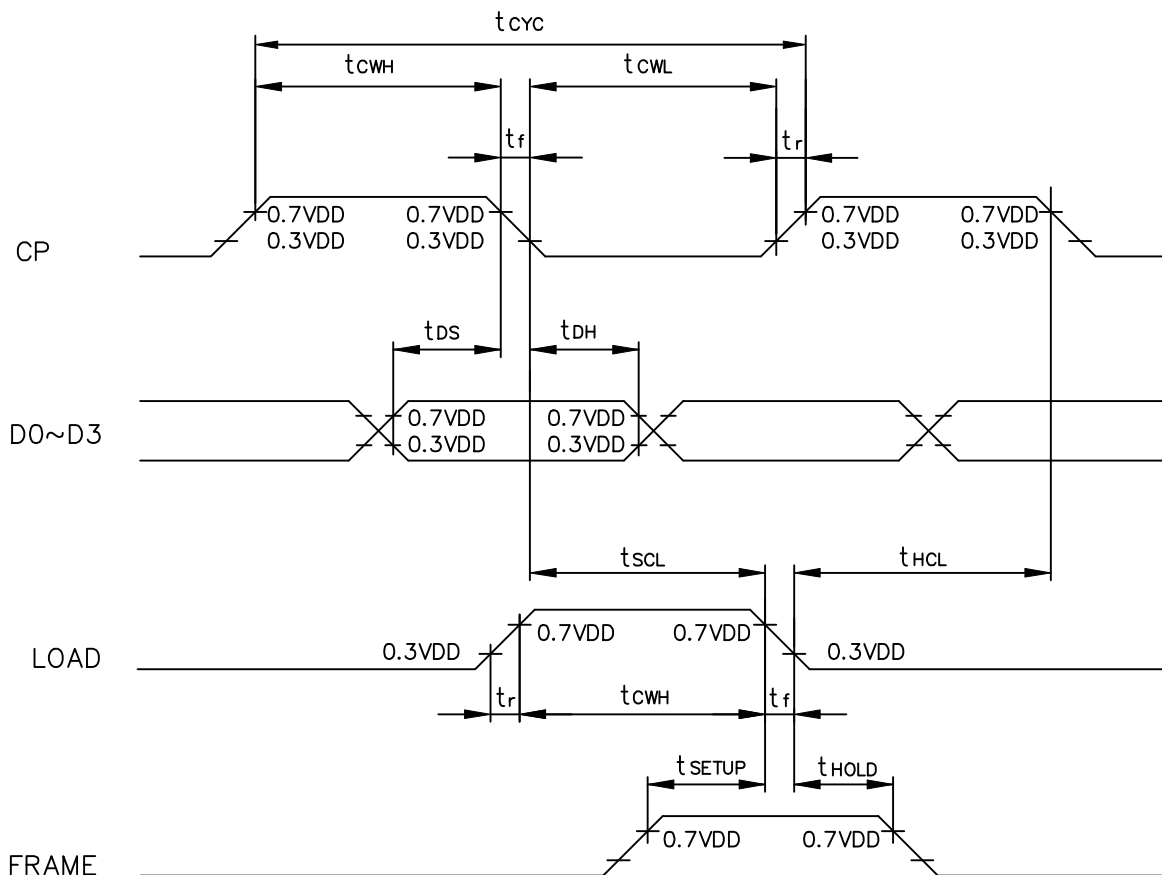


1. $R1 + VR + R2 = 10K \sim 20K \Omega$

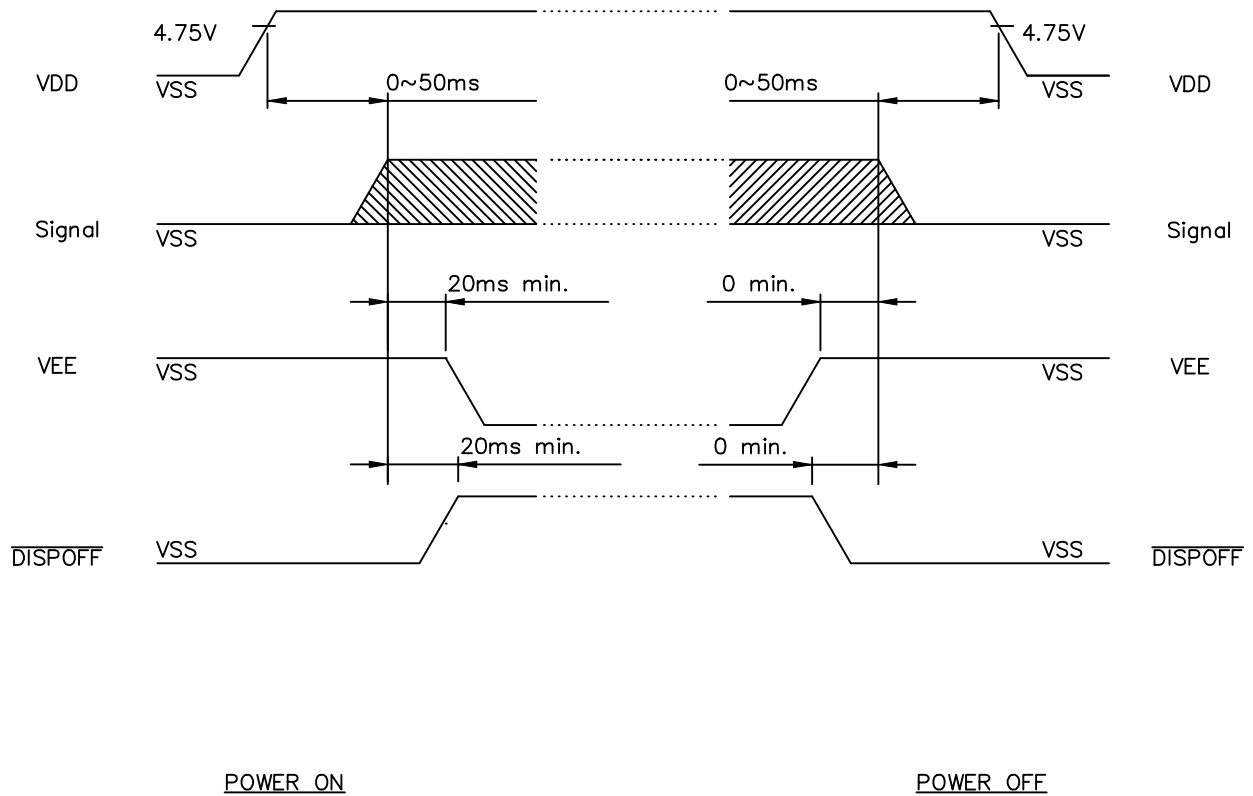
2. RECOMMENDED CCFT INVERTER : CXA-M10L-L(TDK)

8.1 TIMING CHARACTERISTICS

| ITEM | SYMBOL | MIN. | TYP. | MAX. | UNIT |
|------------------------|-------------|------|------|------|------|
| CLOCK CYCLE TIME | t_{cyc} | 152 | - | - | ns |
| CLOCK HIGH LEVEL WIDTH | t_{cWH} | 65 | - | - | ns |
| CLOCK LOW LEVEL WIDTH | t_{cWL} | 65 | - | - | ns |
| CLOCK RISE TIME | t_r | - | - | 50 | ns |
| CLOCK FALL TIME | t_f | - | - | 50 | ns |
| DATA SETUP TIME | t_{ds} | 50 | - | - | ns |
| DATA HOLD TIME | t_{dH} | 40 | - | - | ns |
| CLOCK SETUP TIME | t_{sCL} | 65 | - | - | ns |
| CLOCK HOLD TIME | t_{HCL} | 65 | - | - | ns |
| FRAME SETUP TIME | t_{SETUP} | 100 | - | - | ns |
| FRAME HOLD TIME | t_{HOLD} | 100 | - | - | ns |



8.4 POWER ON/OFF TIMING



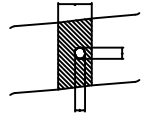
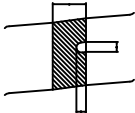
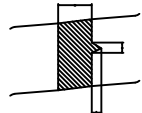
The missing pixels may occur when the LCM is driven beyond above power interface timing sequence.

9. RELIABILITY TEST

| NO | ITEM | CONDITION | | | STANDARD | NOTE |
|----|------------------------------------|--|-------|--|---------------------------|----------|
| 1 | High Temp. Storage | 70°C | 120HR | | Appearance without defect | |
| 2 | Low Temp. Storage | -20°C | 120HR | | Appearance without defect | |
| 3 | High Temp. & High Humidity Storage | 40°C 90%RH | 120HR | | Appearance without defect | |
| 4 | Thermal Shock | -20°C,30min → 25°C,5min → 60°C,30min → 25°C,5min (= 1 cycle) | | | Appearance without defect | 5 cycles |

10.LCD PRODUCT QUALITY STANDARD

(1) DISPLAY APPEARANCE

| NO | ITEM | C R I T E R I A | | | | | | | | | | | | | |
|------------------|--|--|--|----------------|---------------|---------|-----------------|---------|----------|-----------------|---|-------|----------|------|--|
| 1. | INCLUSIONS (BLACK SPOT , WHITE SPOT , DUST) | (1) ROUND TYPE | | | | | | | | | | | | | |
| | | <table border="1"> <thead> <tr> <th>DIAMETER mm (a*)</th> <th>NO. OF DEFECT*</th> </tr> </thead> <tbody> <tr> <td>a ≦ 0.20</td> <td>NEGLECT</td> </tr> <tr> <td>0.20 < a ≦ 0.35</td> <td>5 MAX</td> </tr> <tr> <td>0.35 < a</td> <td>NONE</td> </tr> </tbody> </table> | DIAMETER mm (a*) | NO. OF DEFECT* | a ≦ 0.20 | NEGLECT | 0.20 < a ≦ 0.35 | 5 MAX | 0.35 < a | NONE | | | | | |
| DIAMETER mm (a*) | NO. OF DEFECT* | | | | | | | | | | | | | | |
| a ≦ 0.20 | NEGLECT | | | | | | | | | | | | | | |
| 0.20 < a ≦ 0.35 | 5 MAX | | | | | | | | | | | | | | |
| 0.35 < a | NONE | | | | | | | | | | | | | | |
| | | (2) LINEAR TYPE | | | | | | | | | | | | | |
| | | <table border="1"> <thead> <tr> <th>LENGTH mm(L)</th> <th>WIDTH mm(W)</th> <th>NO. OF DEFECT</th> </tr> </thead> <tbody> <tr> <td>N A</td> <td>W ≦ 0.03</td> <td>NEGLECT</td> </tr> <tr> <td>L ≦ 3</td> <td>0.03 < W ≦ 0.08</td> <td>6</td> </tr> <tr> <td>3 < L</td> <td>0.08 < W</td> <td>NONE</td> </tr> </tbody> </table> | LENGTH mm(L) | WIDTH mm(W) | NO. OF DEFECT | N A | W ≦ 0.03 | NEGLECT | L ≦ 3 | 0.03 < W ≦ 0.08 | 6 | 3 < L | 0.08 < W | NONE | |
| LENGTH mm(L) | WIDTH mm(W) | NO. OF DEFECT | | | | | | | | | | | | | |
| N A | W ≦ 0.03 | NEGLECT | | | | | | | | | | | | | |
| L ≦ 3 | 0.03 < W ≦ 0.08 | 6 | | | | | | | | | | | | | |
| 3 < L | 0.08 < W | NONE | | | | | | | | | | | | | |
| 2. | SCRATCH | 1.SCRATCH ON PROTECTIVE FILM IS PERMITTED . 2.SCRATCH ON POLARIZER SHALL BE AS FOLLOW: (1) ROUND TYPE | | | | | | | | | | | | | |
| | | <table border="1"> <thead> <tr> <th>DIAMETER mm (a*)</th> <th>NO. OF DEFECT*</th> </tr> </thead> <tbody> <tr> <td>a ≦ 0.15</td> <td>NEGLECT</td> </tr> <tr> <td>0.15 < a ≦ 0.20</td> <td>2 MAX</td> </tr> <tr> <td>0.20 < a</td> <td>NONE</td> </tr> </tbody> </table> | DIAMETER mm (a*) | NO. OF DEFECT* | a ≦ 0.15 | NEGLECT | 0.15 < a ≦ 0.20 | 2 MAX | 0.20 < a | NONE | | | | | |
| DIAMETER mm (a*) | NO. OF DEFECT* | | | | | | | | | | | | | | |
| a ≦ 0.15 | NEGLECT | | | | | | | | | | | | | | |
| 0.15 < a ≦ 0.20 | 2 MAX | | | | | | | | | | | | | | |
| 0.20 < a | NONE | | | | | | | | | | | | | | |
| | | (2) LINEAR TYPE BE JUDGED BY 1.-(2) LINEAR TYPE | | | | | | | | | | | | | |
| 3. | DENT | DIAMETER < 1.5mm | | | | | | | | | | | | | |
| 4. | BUBBLE | NOT EXCEEDING 0.5mm AVERAGE DIAMETER IS ACCEPTABLE BETWEEN GLASS AND POLARIZING FILM. | | | | | | | | | | | | | |
| 5. | PIN HOLE | (a+b)/2 ≦ 0.15 mm MAXIMUM NUMBER:IGNORED 0.15 < (a+b)/2 ≦ 0.20 MAXIMUM NUMBER:10 |  | | | | | | | | | | | | |
| 6. | DOT DEFECT | (a+b)/2 ≦ 0.20 mm MAXIMUM NUMBER:IGNORED 0.20 < (a+b)/2 ≦ 0.30 MAXIMUM NUMBER:5 x = WIDTH |   | | | | | | | | | | | | |
| 7. | CONTRAST IRREGULARITY (SPOT) | DIAMETER SPEC. a ≦ 0.50 mm 0.50 < a ≦ 0.75 0.75 < a ≦ 1.00 1.00 < a | NO. OF DEFECT* NEGLECT 5 3 NONE | | | | | | | | | | | | |
| 8. | DOT WIDTH | DESIGN WIDTH±15% | | | | | | | | | | | | | |
| 9. | COLOR TONE AND UNIFORMITY | OBVIOUS UNEVEN COLOR IS NOT PERMITTED | | | | | | | | | | | | | |

(2) NOTE:

• SAFETY

- 1.If the LCD panel breaks, be careful not to allow the liquid crystal to touch your skin.
- 2.If the liquid crystal touches your skin or clothes, please wash it off immediately by using soap and water.

• HANDLING

- 1.Prevent all contact with static electricity, which can damage the CMOS ICs. The module is packaged in a static-shielding bag to prevent damage during shipment, warehousing and removal from the shipping carton.
- 2.Do not remove the panel or frame from the module.
- 3.The polarizing plate on the front surface of the display is very fragile and easily scratched. The module is shipped with a protective liner which must be removed from the polarizing plate prior to assembly.
- 4.Do not wipe the polarizing plate with a dry cloth, as it may easily scratch the surface of polarizing plate.
- 5.Do not use ketonics solvent or aromatic solvent on the polarizing plate. Use a soft cloth soaked with plastic-lens cleaning solution.

• STORAGE

- 1.Store the panel or module in a dark place where the temperature is $25^{\circ}\text{C}\pm 5^{\circ}\text{C}$ and the humidity is below 65% RH.
- 2.Do not place the module near organics solvents or corrosive gases.
- 3.Do not crush, shake, or jolt the module.

• TERMS OF WARRANTY

- 1.Acceptance inspection period
The inspection period is within one month after the arrival of the contracted goods at the buyer's factory site.
- 2.Applicable warranty period
The warranty period is within twelve months from the date of invoice under normal usage and storage conditions.

• TYPICAL OPERATING LIFETIME OF BACKLIGHT

- LED : 50,000HR
EL : 5,000HR
CCFT : 10,000HR

| | | | | | | | | |
|----------|------------------|------------------|--|--|--|-----|-----|----|
| REV/DATE | R0/ 09.29.98' | R1/ 12.09.98' | | | | APP | CHK | BY |
|----------|------------------|------------------|--|--|--|-----|-----|----|

