

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

# SPECIFICATION

SPEC. NO. : LM157-0  
DATE : Feb. 20, 1998  
SHEET NO. : 1/17

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  
640x480 LCD MODULE  
PRODUCT NO.: LTBSHT157GC

SPEC. NO.: LM157-0

|             |
|-------------|
| APPROVED BY |
|             |

EDITED ON : Feb. 20, 1998

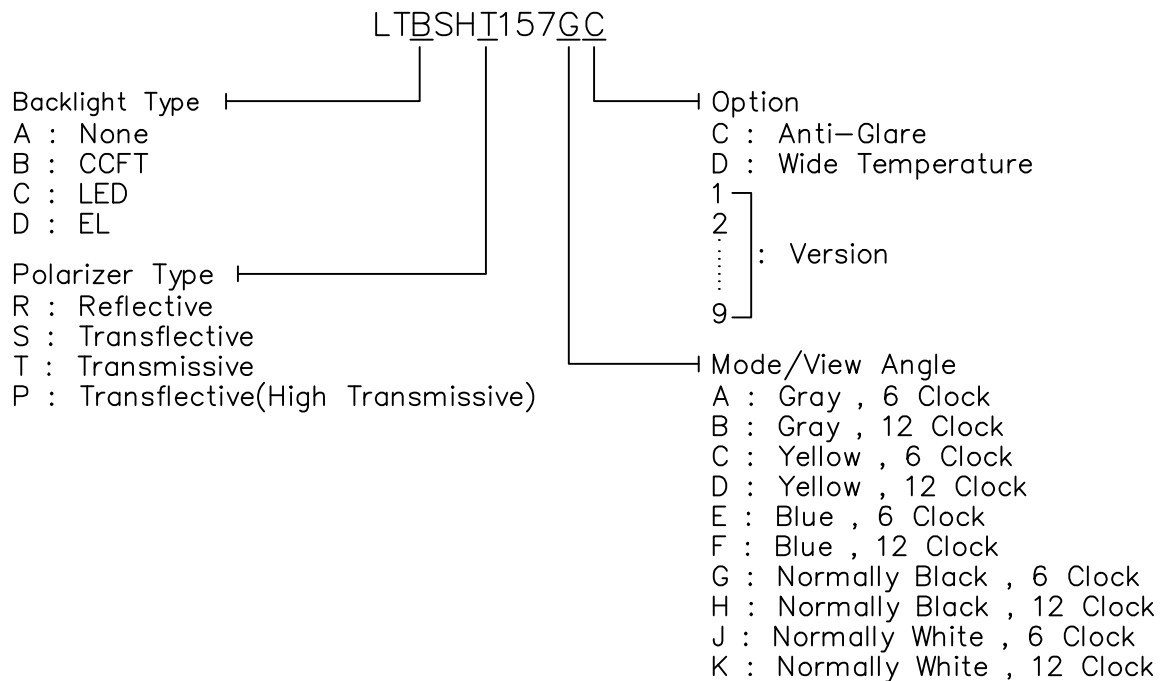
| SALES<br>MANAGER | DESIGN<br>MANAGER | PERSON IN<br>CHARGE |
|------------------|-------------------|---------------------|
|                  |                   |                     |

|          |                  |  |  |  |  |     |     |    |
|----------|------------------|--|--|--|--|-----|-----|----|
| REV/DATE | RO/<br>02.20.98' |  |  |  |  | APP | CHK | BY |
|----------|------------------|--|--|--|--|-----|-----|----|

# 1. MECHANICAL DATA

- (1) Product No. LTBSHT157GC
- (2) Module Size 260.0 (W)mm x 174.0 (H)mm x MAX8.0 (D)mm
- (3) Dot Size 0.27 (W)mm x 0.27 (H)mm
- (4) Dot Pitch 0.30 (W)mm x 0.30 (H)mm
- (5) Number of Dots 640 (W) x 480 (H)Dots
- (7) Duty 1/240
- (8) LCD Display Mode STN:  Blue Mode  
FSTN:  Black and White(Normally White/Positive Image)  
 Black and White(Normally Black/Negative Image)  
Rear Polarizer:  Reflective  Transflective  Transmissive  
 Transflective (High Transmissive)
- (9) Viewing Direction  6 O'clock  12 O'clock  \_\_\_O'clock
- (10) Backlight  W/O  CCFL
- (11) Weight W/O B/L:  
CCFL B/L: about 353.5 g

Note :



|          |                  |  |  |  |  |     |     |    |
|----------|------------------|--|--|--|--|-----|-----|----|
| REV/DATE | RO/<br>02.20.98' |  |  |  |  | APP | CHK | BY |
|----------|------------------|--|--|--|--|-----|-----|----|

## 2. ABSOLUTE MAXIMUM RATINGS

### (1) ELECTRICAL ABSOLUTE RATINGS

VSS=0 V Standard

| ITEM                   | SYMBOL  | MIN  | MAX | UNIT | COMMENT |
|------------------------|---------|------|-----|------|---------|
| Power Supply for Logic | VDD-VSS | -0.3 | 6.5 | V    |         |
| Input Voltage          | VDD-VEE | 0    | 27  | V    |         |
| Static Electricity     | -       | -    | -   | -    | Note 1  |

Note 1 LCM should be grounded during handling LCM.

### (2) ENVIRONMENTAL ABSOLUTE MAXIMUM RATINGS

| ITEM                            | NORMAL TEMP. |      |                         |      |
|---------------------------------|--------------|------|-------------------------|------|
|                                 | OPERATING    |      | STORAGE                 |      |
|                                 | MIN.         | MAX. | MIN.                    | MAX. |
| Ambient Temperature             | 0            | 50   | -25                     | 60   |
| Humidity (Without Condensation) | Note 1,3     |      | Note 2,3                |      |
| Vibration(Note ※)               | -            |      | 49m/s <sup>2</sup> (5G) |      |

Note 1 Ta ≤ 50°C : 85%RH max

Ta > 50°C : Absolute humidity must be lower than the humidity of 85%RH at 50°C

Note 2 Ta at -25°C will be < 48 hrs, at 60°C will be < 120 hrs

Note 3 Background color changes slightly depending on ambient temperature. This phenomenon is reversible.

Note※

|                     |                              |
|---------------------|------------------------------|
| Frequency (HZ)      | 10~55~10/1 min               |
| Vibration Width     | 1.5 m/m                      |
| Vibration Direction | X/Y/Z                        |
| Vibration Time      | 15 min-1cycle X 3 directions |

### 3. ELECTRICAL CHARACTERISTICS

| ITEM                                     | SYMBOL  | CONDITION                 |      | MIN.   | TYP.   | MAX. | UNIT |
|--|---------|---------------------------|------|--------|--------|------|------|
| Power Supply for Logic                   | VDD-VSS | -                         |      | 4.75   | 5.0    | 5.25 | V    |
| Input Voltage                            | VIL     | L level                   |      | VSS    | 0.2VDD | -    | V    |
|  | VIH     | H level                   |      | 0.8VDD | VDD    | -    | V    |
| LCM Recommend LCD Module Driving Voltage | VDD-VEE | VDD=5V<br>Bias=1/13       | 0°C  | -      | 23.8   | 24.8 | V    |
|  |         |                           | 25°C | -      | 23.0   | -    |      |
|  |         |                           | 50°C | 18.6   | 19.6   | -    |      |
| Power Supply Current for LCM             | IDD     | VDD=5.0V<br>VDD-VEE=23.0V |      | -      | 30     | -    | mA   |
|  | IEE     | FLM=70Hz                  |      | -      | 20     | -    |      |
| Power Supply Current for CCFL B.L.       | ICCFL   | 450 Vrms<br>30KHz         |      | -      | 5      | -    | mA   |

## 4. OPTICAL CHARACTERISTICS

AT Vop

| ITEM<br>MODE |   | Cr(Contrast Ratio) |      | $\theta$ (Viewing Angle) |      | $\phi$ (Viewing Angle) |      |
|--------------|---|--------------------|------|--------------------------|------|------------------------|------|
|              |   | 25°C               |      | 25°C                     |      | 25°C                   |      |
|              |   | MIN.               | TYP. | MIN.                     | TYP. | MIN.                   | TYP. |
| R            | J | -                  | -    | -                        | -    | -                      | -    |
| S            | J | -                  | -    | -                        | -    | -                      | -    |
| P            | J | -                  | -    | -                        | -    | -                      | -    |
| T            | E | -                  | -    | -                        | -    | -                      | -    |
|              | G | 6                  | 20   | 45                       | 80   | 25                     | 40   |
| NOTE         |   | NOTE6              |      | NOTE5                    |      |                        |      |

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

| ITEM                 | SYMBOL | CONDITION | MIN. | TYP. | MAX. | UNIT | NOTE   |
|----------------------|--------|-----------|------|------|------|------|--------|
| Response Time (rise) | Tr     | 0°C       | -    | 730  | 1100 | ms   | NOTE 2 |
|                      |        | 25°C      | -    | 390  | 580  |      |        |
|                      |        | 50°C      | -    | 160  | 240  |      |        |
| Response Time (fall) | Tr     | 0°C       | -    | 980  | 1450 | ms   | NOTE 2 |
|                      |        | 25°C      | -    | 120  | 250  |      |        |
|                      |        | 50°C      | -    | 70   | 130  |      |        |

NOTE :

R: REFLECTIVE

S: TRANSFLECTIVE

P: TRANSFLECTIVE(HIGH TRANSMISSIVE)

T: TRANSMISSIVE

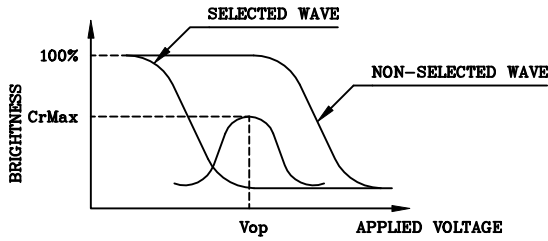
E: BLUE

G: NORMALLY BLACK

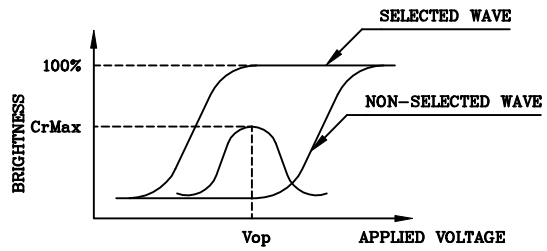
J: NORMALLY WHITE

(NOTE 1)

Definition of Operation Voltage(Vop)



(positive type)



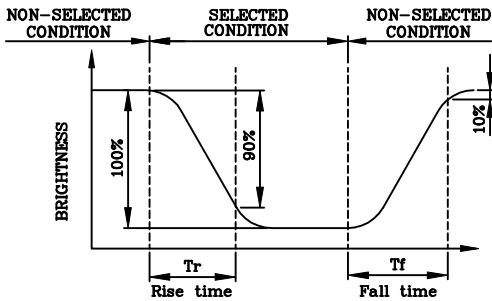
(negative type)

\*Conditions

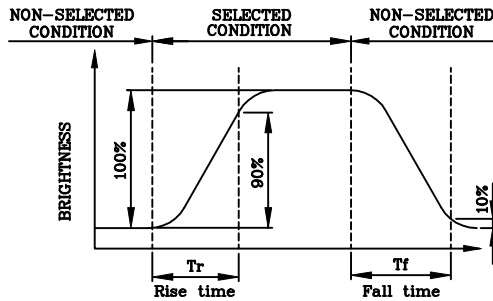
Viewing Angle : 0  
 Frame Frequency : 70Hz  
 Applied Waveform : 1/N duty, 1/a bias

(NOTE 2)

Definition of Response Time(Tr,Tf)



(positive type)



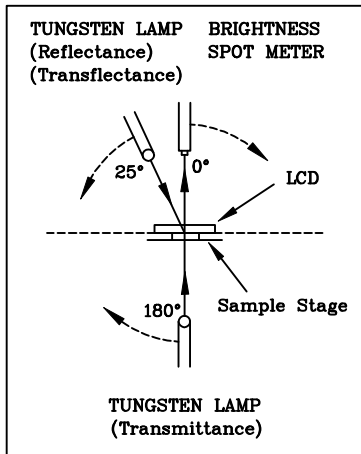
(negative type)

\*Conditions

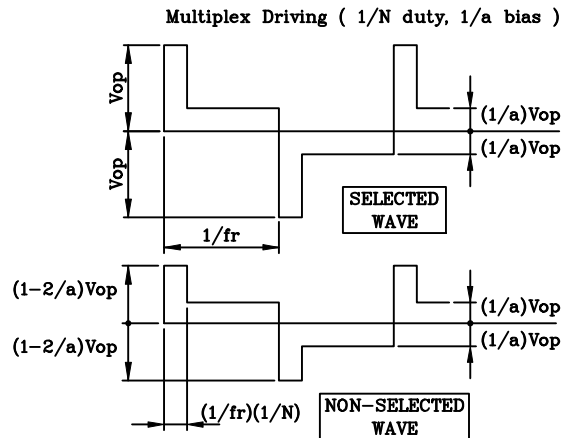
Operating Voltage : Vop  
 Viewing Angle (θ,φ) : (0,0)  
 Frame Frequency : 70Hz  
 Applied Waveform : 1/N duty, 1/a bias

(NOTE 3)

Description of Measuring Equipment and Driving Waveforms

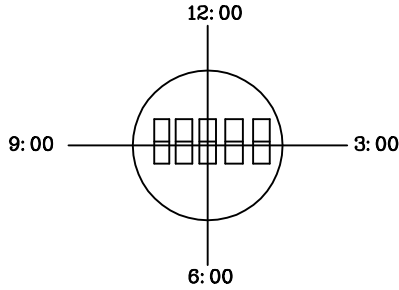


CONST.  
 TEMP.  
 CHAMBER



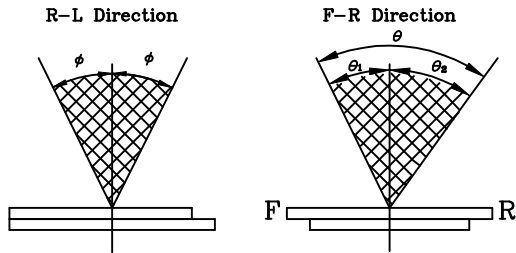
(NOTE 4)

Definition of Viewing Direction



(NOTE 5)

Definition of Viewing Angle



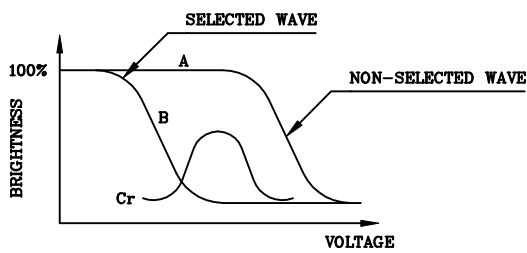
$$\theta = \theta_1 + \theta_2$$

\*Conditions

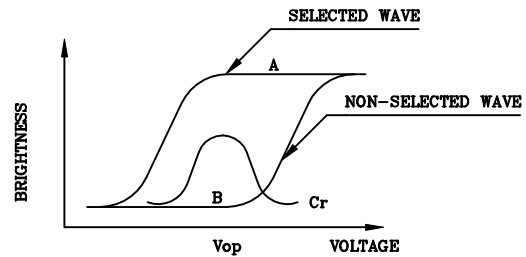
- Operating Voltage :  $V_{op}$
- Frame Frequency : 70Hz
- Applied Waveform : 1/N duty, 1/a bias
- Contrast Ratio : larger than 2

(NOTE 6)

Definition of Contrast Ratio (Cr)



(positive type)



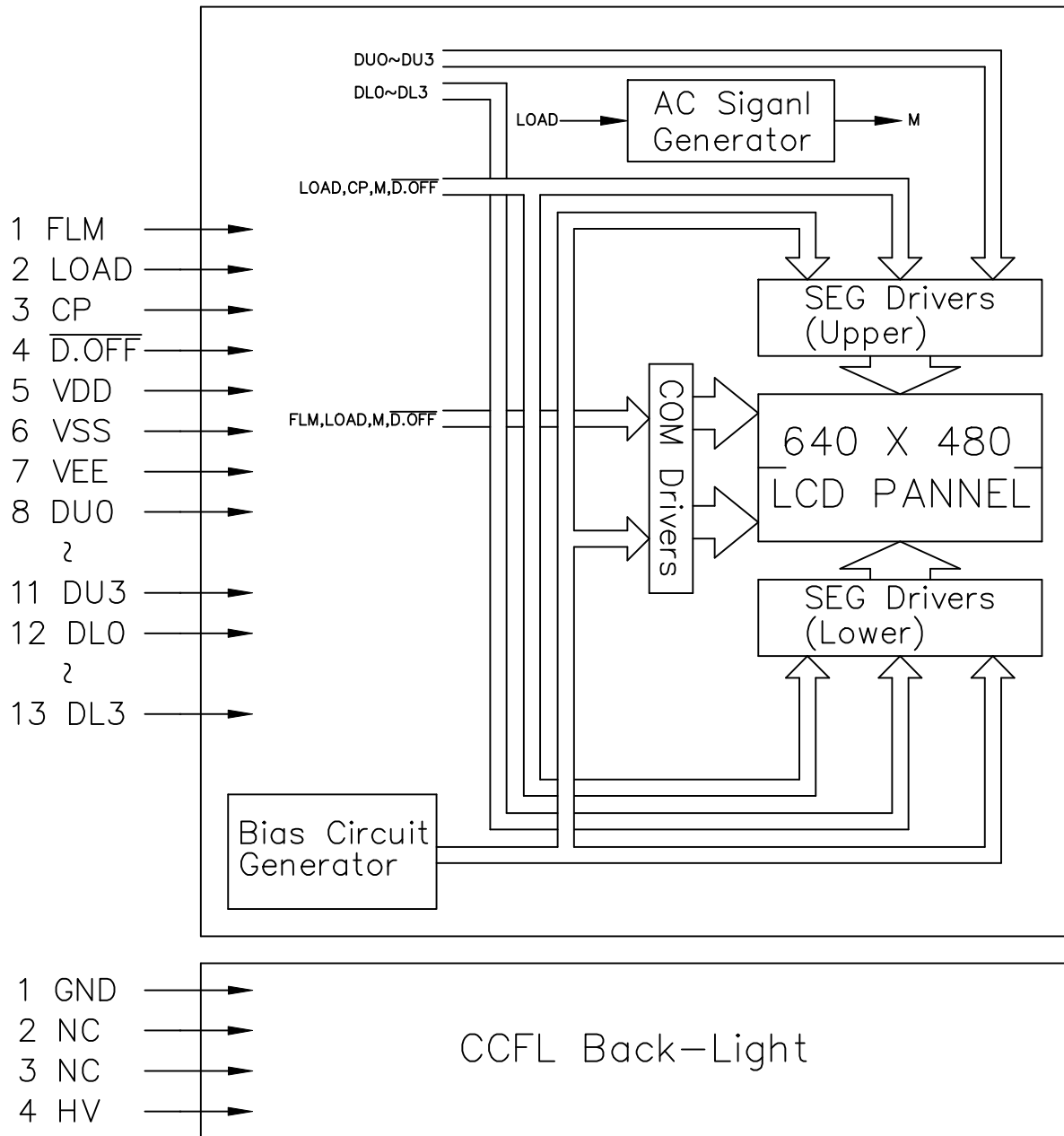
(negative type)

Contrast Ratio :  $Cr = A/B$

\*Conditions

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

## 5. BLOCK DIAGRAM



\* AC Signal Setting

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



## 6. INTERNAL PIN CONNECTION

### LCD

| Pin No. | Symbol             | Level | Function                     |
|---------|--------------------|-------|------------------------------|
| 1       | FLM                | H/L   | SCAN START-UP SIGNAL         |
| 2       | LOAD               | H.÷L  | DATA LATCH PULSE             |
| 3       | CP                 | H.÷L  | DATA SHIFT PULSE             |
| 4       | $\overline{D.OFF}$ | H/L   | DISPLAY OFF ("H"=ON,"L"=OFF) |
| 5       | VDD                | -     | POWER SUPPLY FOR LOGIC (+5V) |
| 6       | VSS                | -     | SIGNAL GROUND (GND)          |
| 7       | VEE                | -     | POWER SUPPLY FOR LCD (-V)    |
| 8       | DU0                | H/L   | DISPLAY DATA (UPPER HALF)    |
| 9       | DU1                |       |                              |
| 10      | DU2                |       |                              |
| 11      | DU3                |       |                              |
| 12      | DL0                | H/L   | DISPLAY DATA (LOWER HALF)    |
| 13      | DL1                |       |                              |
| 14      | DL2                |       |                              |
| 15      | DL3                |       |                              |

### CCFT

| Pin No. | Symbol | Level | Function                     |
|---------|--------|-------|------------------------------|
| 1       | GND    | -     | GROUND LINE (INVERTER)       |
| 2       | NC     | -     | NON CONNECTION               |
| 3       | NC     | -     | NON CONNECTION               |
| 4       | HV     | -     | HIGH VOLTAGE LINE (INVERTER) |

### LCD

Used connector : 53261-1590 (MOLEX)

Mating connector : 51021-1500 (MOLEX)

### CCFT

Used connector : M63M83-04 (MITSUMI)

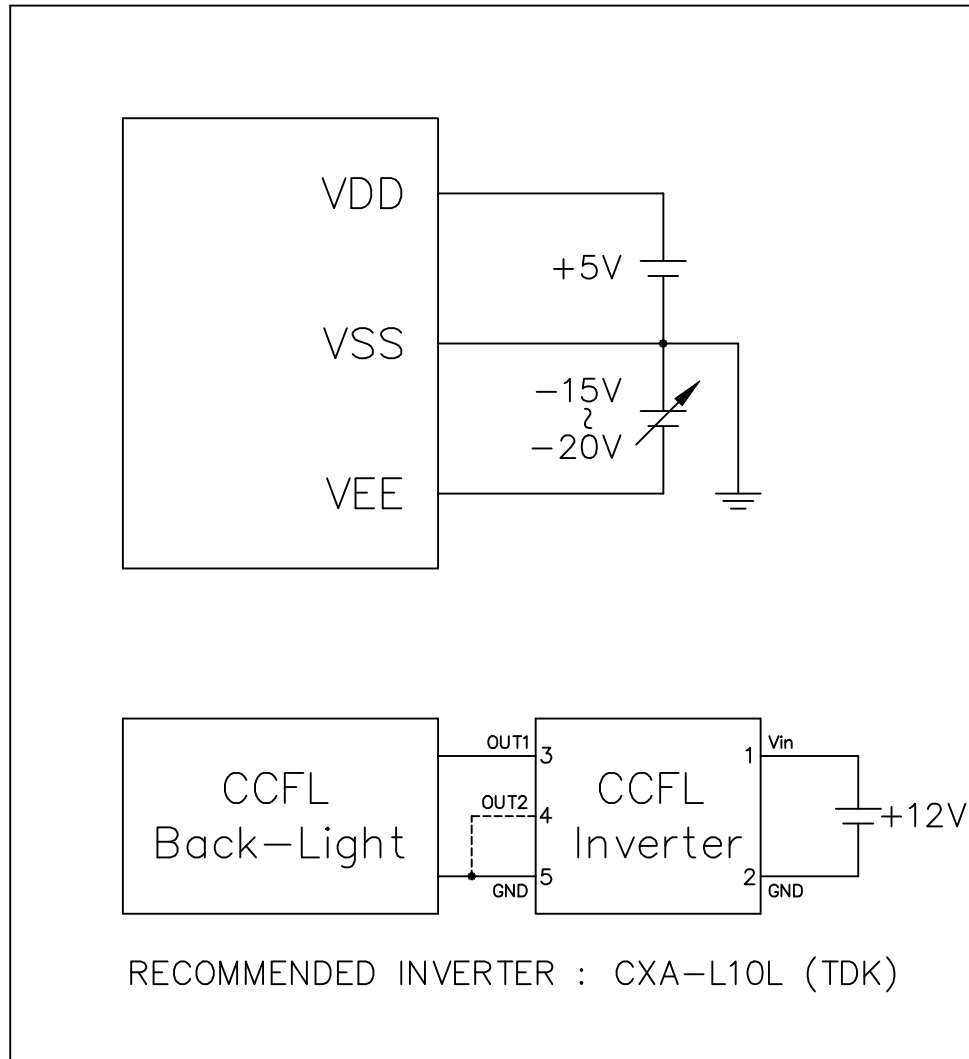
Mating connector : M60-04-30-114P (MITSUMI)

M60-04-30-134P (MITSUMI)

M61M73-04 (MITSUMI)

|          |                  |  |  |  |  |     |     |    |
|----------|------------------|--|--|--|--|-----|-----|----|
| REV/DATE | RO/<br>02.20.98' |  |  |  |  | APP | CHK | BY |
|----------|------------------|--|--|--|--|-----|-----|----|

## 7. POWER SUPPLY

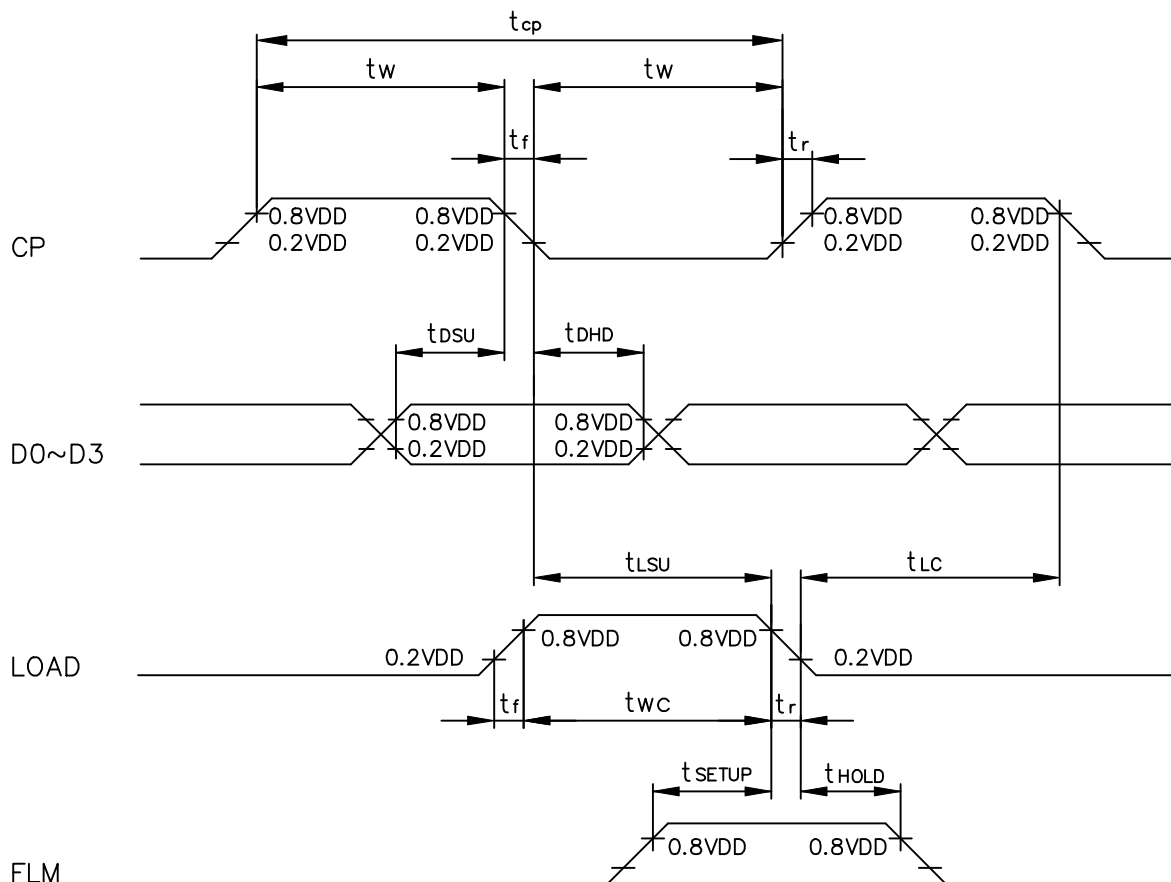


# 8. TIMING CHARACTERISTICS

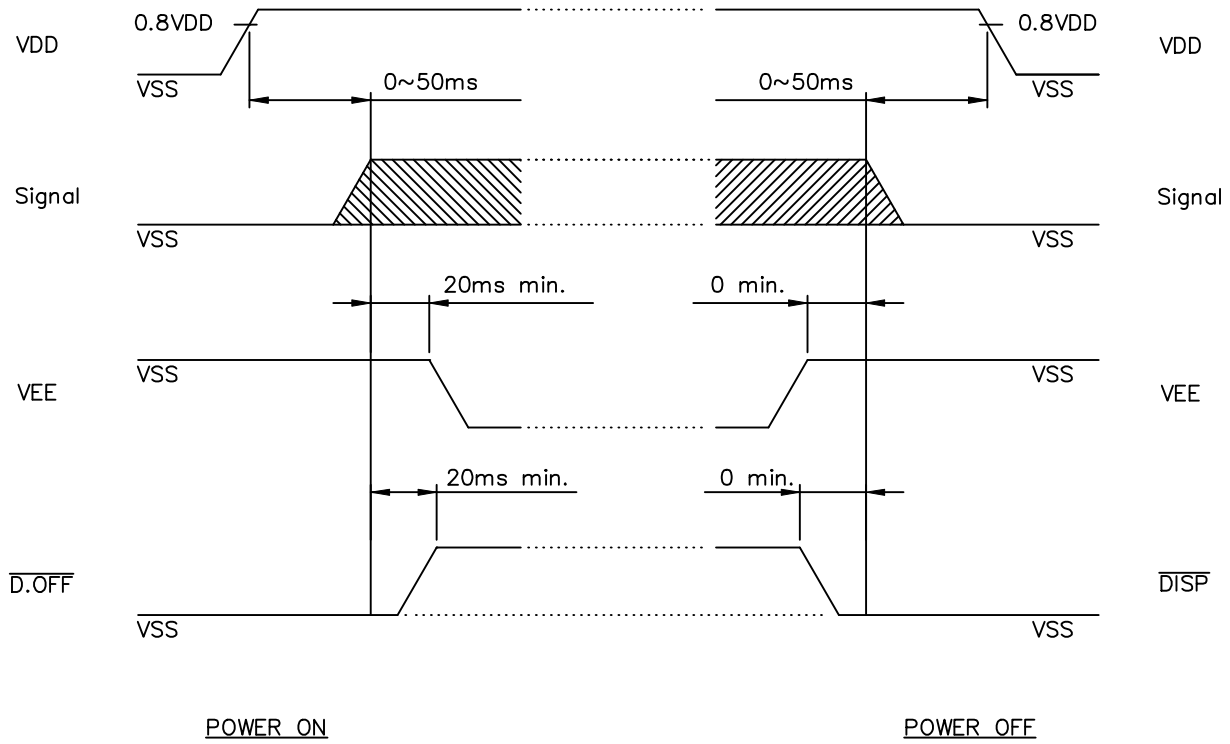
## 8-1. INTERFACE TIMING

@VDD=2.5~5.5V

| ITEM                    | SYMBOL      | MIN. | TYP. | MAX. | UNIT |
|-------------------------|-------------|------|------|------|------|
| Shift Clock Period      | $t_{cp}$    | 152  | -    | -    | ns   |
| "CP" PULSE WIDTH        | $t_w$       | 65   | -    | -    | ns   |
| CLOCK RISE, FALL TIME   | $t_r, t_f$  | -    | -    | 50   | ns   |
| DATA SETUP TIME         | $t_{dsu}$   | 50   | -    | -    | ns   |
| DATA HOLD TIME          | $t_{dhd}$   | 40   | -    | -    | ns   |
| "CP" → "LOAD" FALL TIME | $t_{lsu}$   | 65   | -    | -    | ns   |
| "LOAD" → "CP" FALL TIME | $t_{lc}$    | 65   | -    | -    | ns   |
| "FLM" SETUP TIME        | $t_{setup}$ | 100  | -    | -    | ns   |
| "FLM" HOLD TIME         | $t_{hold}$  | 100  | -    | -    | ns   |
| "LOAD" PULSE WIDTH      | $t_{wc}$    | 65   | -    | -    | ns   |

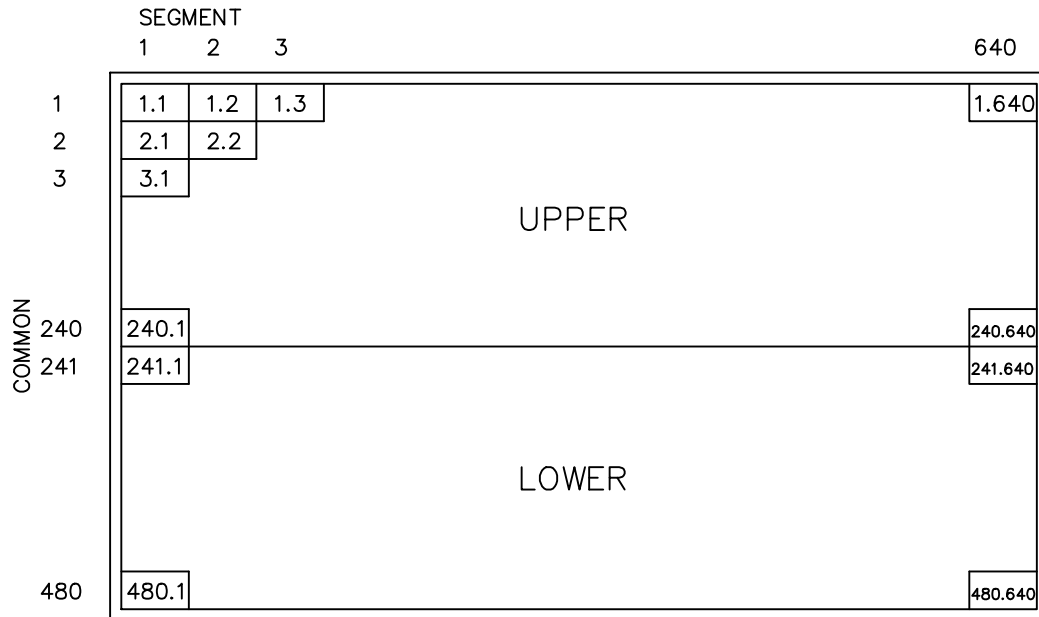


8-2. POWER ON/OFF TIMING

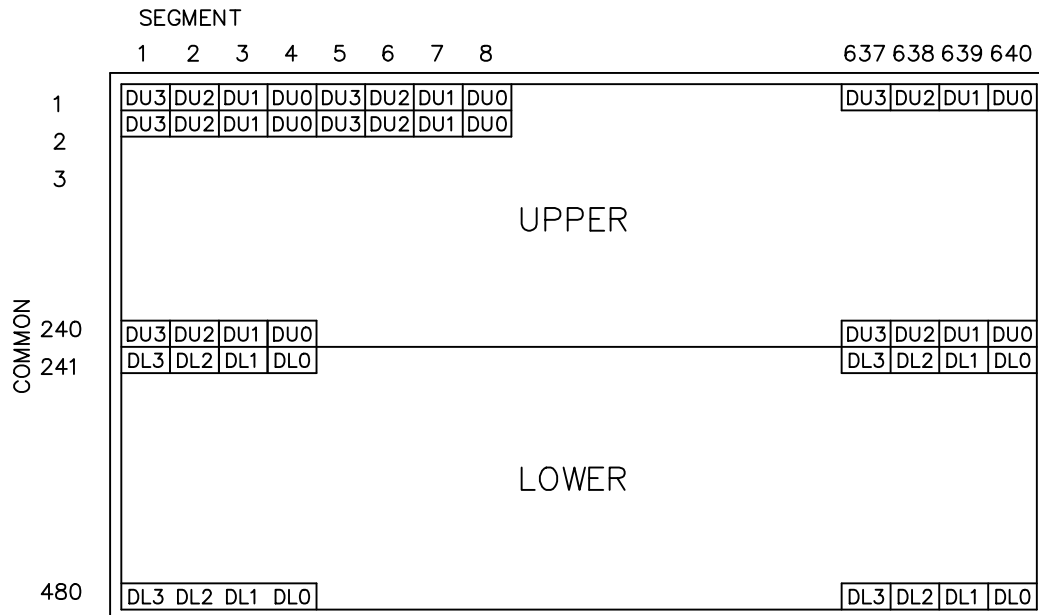


The missing pixels may occur when the LCM is driven beyond above power interface timing sequence.

# 9. DISPLAY PATTERN



NOTE : 1.1 MEANS 1ST COMMON 1ST SEGMENT DOT

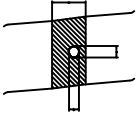
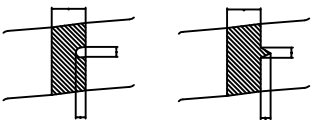


## 10. RELIABILITY TEST

| 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<br>90%RH  | 120HR |  | Appearance without defect |          |
| 4  | Thermal Shock                      | -20°C,30min → 25°C,5min<br>→ 60°C,30min → 25°C,5min<br>(= 1 cycle) |       |  | Appearance without defect | 5 cycles |

# 11.LCD PRODUCT QUALITY STANDARD

## (1) DISPLAY APPEARANCE

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

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| NAN YA PLASTICS CORP.<br>ELEC. MATERIALS DIV.<br>LCD DEPARTMENT | SPECIFICATION | SPEC. NO. : LM157-0<br>DATE : Feb. 20, 1998<br>SHEET NO. : 16/17 |
|---|---------------|--|

(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

|          |                  |  |  |  |  |     |     |    |
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| REV/DATE | R0/<br>02.20.98' |  |  |  |  | APP | CHK | BY |
|----------|------------------|--|--|--|--|-----|-----|----|



