

# AZ DISPLAYS, INC.

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*COMPLETE LCD SOLUTIONS*

## SPECIFICATIONS FOR LIQUID CRYSTAL DISPLAY

PART NUMBER:

AGM6448E

REVISED:

October 4, 2006

# AZ DISPLAYS, INC.

## 1. MECHANICAL DATA

| NO | ITEM              | CONTENTS                              | UNIT    |
|----|-------------------|---------------------------------------|---------|
| 1  | Product No.       | <b>AGM6448E</b>                       | —       |
| 2  | Module Size       | 205.5 (W) x 141.0 (H) x 7.0 max (D)   | mm      |
| 3  | Dot Size          | 0.21 (W) x 0.21 (H)                   | mm      |
| 4  | Dot Pitch         | 0.23 (W) x 0.23 (H)                   | mm      |
| 5  | Number of Dots    | 640 (W) x 480 (H)                     | Dot     |
| 6  | Duty              | 1/240                                 | —       |
| 7  | LCD Display Mode  | FSTN, Normally White / Positive Image | —       |
| 8  | Rear Polarizer    | Transflective Type(High Transparency) | —       |
| 9  | Viewing Direction | 6                                     | O'clock |
| 10 | Backlight         | CCFL                                  | —       |
| 11 | Controller        | Excluded                              | —       |
| 12 | DC/DC Converter   | Excluded                              | —       |
| 13 | Touch Panel       | Excluded                              | —       |
| 14 | Weight            | 310 (Approx.)                         | g       |

## 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          | VEE-VSS | 0    | 27  | V    |         |
| Static Electricity     | -       | -    | -   | -    | Note 1  |

Note 1 LCM should be grounded during handling LCM.

### (2) ENVIRONMENTAL ABSOLUTE MAXIMUM RATINGS

| ITEM                            | WIDE TEMP. |      |                         |      |
|---------------------------------|------------|------|-------------------------|------|
|                                 | OPERATION  |      | STORAGE                 |      |
|                                 | MIN.       | MAX. | MIN.                    | MAX. |
| Ambient Temperature             | -20        | 70   | -30                     | 80   |
| Humidity (Without Condensation) | Note 2,4   |      | Note 3,4                |      |
| Vibration(Note 5)               | -          |      | 49m/s <sup>2</sup> (5G) |      |

Note 2  $T_a \leq 70^\circ\text{C}$  : 75%RH max

Note 3 Please refer to item of reliability test

Note 4 Background color will change slightly depending on ambient temperature.

That phenomenon is reversible.

Note 5

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

Note 6 Operation temp not include CCFL Lamp

## 3. ELECTRICAL CHARACTERISTICS

### 3-1. ELECTRICAL CHARACTERISTICS OF LCD

| ITEM                                     | SYMBOL             | CONDITION  | MIN.    | TYP.                       | MAX. | UNIT |    |                   |
|--|--------------------|--|---------|----------------------------|------|------|----|-------------------|
| Power Supply for Logic                   | VDD-VSS            | -  | 3.0     | 3.3                        | 3.6  | V    |    |                   |
|  |                    |  | 4.75    | 5.0                        | 5.25 |      |    |                   |
| Input Voltage                            | VIL                | L level  | VSS     | 0.2VDD                     | -    | V    |    |                   |
|  | VIH                | H level  | 0.8VDD  | VDD                        | -    | V    |    |                   |
| LCM Recommend LCD Module Driving Voltage | VEE-VSS            | Duty=1/240   | -20°C   | 24.2                       | 24.6 | 25.0 | V  |                   |
|  |                    |  | 0°C     | 22.7                       | 23.1 | 23.5 |    |                   |
|  |                    |  | 25°C    | 21.9                       | 22.3 | 22.7 |    |                   |
|  |                    |  | 50°C    | 21.1                       | 21.5 | 21.9 |    |                   |
|  |                    |  | 70°C    | 20.6                       | 21.0 | 21.4 |    |                   |
| Power Supply Current for LCM             | IDD                | VDD=5.0V<br>VEE-VSS=22.3V<br>FLM=70Hz<br>PATTERN :<br>■ □ ■ □<br>□ ■ □ ■ | -       | 3                          | 6    | mA   |    |                   |
|  | IEE                |  | -       | 15                         | 30   |      |    |                   |
| LCM                                      | Surface Luminance  | Ls   | IL =5mA | PATTERN:<br>(Dots All On)  | -    | 30   | 50 | cd/m <sup>2</sup> |
|  |                    |  |         | PATTERN:<br>(Dots All Off) | 70   | 100  | -  |                   |
| LCM                                      | Surface Uniformity | U  | IL =5mA | PATTERN:<br>(Dots All On)  | 80   | 85   | -  | %                 |

## 3-2.ELECTRICAL CHARACTERISTICS OF BACKLIGHT

Used Lamp Rating

Temp.=25°C

| ITEM                   | SYMBOL | MIN. | TYP.  | MAX. | UNIT  | REMARK  |
|------------------------|--------|------|-------|------|-------|---|
| Lamp Voltage           | $V_L$  | —    | 350   | —    | Vrms  | —   |
| Lamp current           | $I_L$  | 4    | 5     | 6    | mArms | —   |
| Lamp power consumption | $P_L$  | —    | 1.75  | —    | W     | (*1)  |
| Lamp frequency         | $F_L$  | —    | 35    | —    | KHz   | —   |
| Lamp life time         | $L_L$  | —    | 20000 | —    | hrs   | at $I_L = 5 \text{ mArms}$<br>$T_a=25^\circ\text{C}$ (*2) |

(\*1) Power consumption excluded inverter loss .

(\*2) Lamp life time is defined as follows : The final brightness is at 50% of original brightness .

## 4. OPTICAL CHARACTERISTICS

WIDE TEMPERATURE MODE

 AT  $V_{OP}$ 

| ITEM |   | Cr(Contrast Ratio) |      |      |      |      |      |      |      |      |      | $\theta$ (Viewing Angle) |              | $\phi$ (Viewing Angle) |              |
|------|---|--------------------|------|------|------|------|------|------|------|------|------|--------------------------|--------------|------------------------|--------------|
|      |   | -20°C              |      | 0°C  |      | 25°C |      | 50°C |      | 70°C |      | 25°C                     |              | 25°C                   |              |
| MODE |   | MIN.               | TYP. | MIN. | TYP. | MIN. | TYP. | MIN. | TYP. | MIN. | TYP. | MIN.                     | TYP.         | MIN.                   | TYP.         |
| H    | J | 2.8                | 4    | 3.5  | 5    | 4.2  | 6    | 2.8  | 4    | 2.1  | 3    | -                        | F:40<br>R:30 | -                      | L:35<br>R:35 |
| NOTE |   | NOTE 6             |      |      |      |      |      |      |      |      |      | NOTE 5                   |              |                        |              |

NOTE :

H : Transflective(High Transparency)

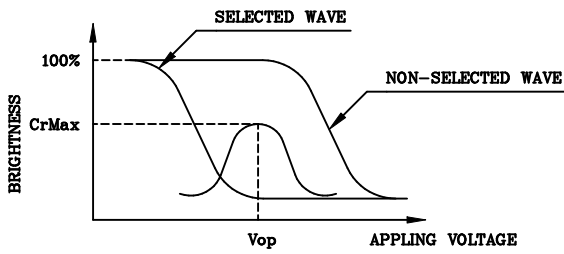
J : Normally White, 6 O'clock

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

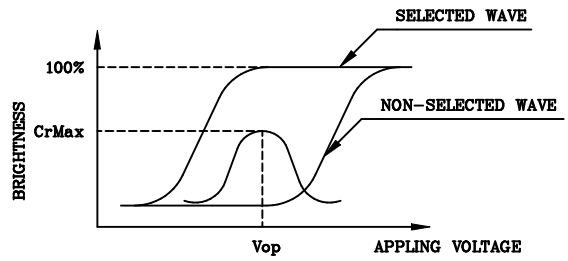
| ITEM                 | SYMBOL | CONDITION | MIN. | TYP. | MAX. | UNIT | NOTE   |
|----------------------|--------|-----------|------|------|------|------|--------|
| Response Time (rise) | Tr     | -20℃      | 2000 | 4000 | 6000 | ms   | NOTE 2 |
|                      |        | 0℃        | 400  | 750  | 1100 |      |        |
|                      |        | 25℃       | 125  | 250  | 375  |      |        |
|                      |        | 50℃       | 60   | 120  | 180  |      |        |
|                      |        | 70℃       | 35   | 70   | 105  |      |        |
| Response Time (fall) | Tf     | -20℃      | 1000 | 2000 | 3000 | ms   | NOTE 2 |
|                      |        | 0℃        | 210  | 420  | 630  |      |        |
|                      |        | 25℃       | 60   | 120  | 180  |      |        |
|                      |        | 50℃       | 30   | 60   | 90   |      |        |
|                      |        | 70℃       | 20   | 40   | 60   |      |        |

(NOTE 1)

Definition of Operation Voltage(Vop)



(positive type)



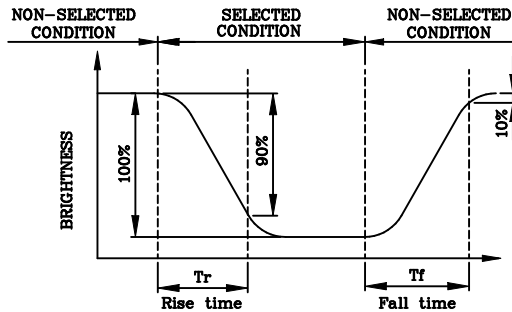
(negative type)

\*Conditions

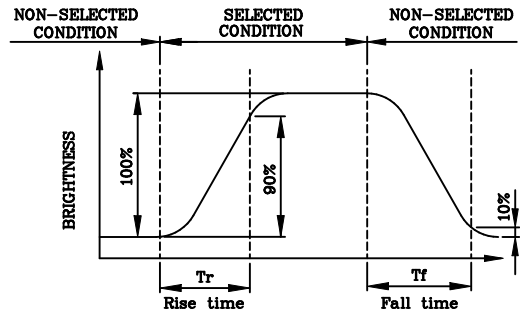
- Viewing Angle : 0
- Frame Frequency : 70Hz
- Applying Waveform : 1/N duty 1/a bias

(NOTE 2)

Definition of Response Time(Tr,Tf)



(positive type)



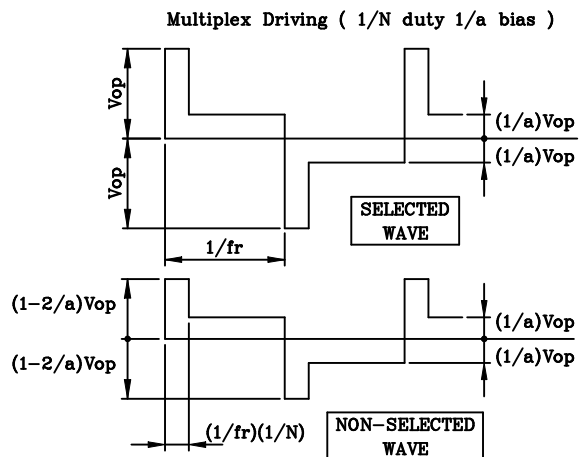
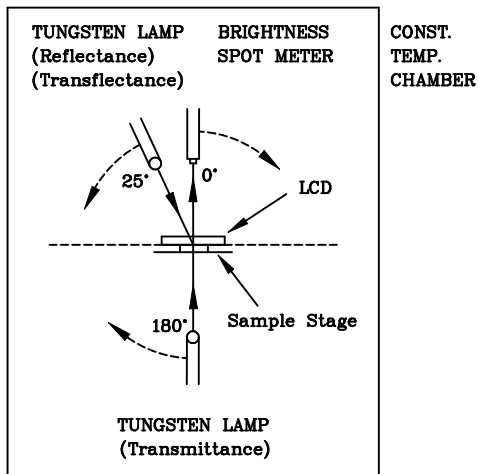
(negative type)

\*Conditions

- Operating Voltage : Vop
- Viewing Angle ( $\theta, \phi$ ) : (0,0)
- Frame Frequency : 70Hz
- Applying Waveform : 1/N duty 1/a bias

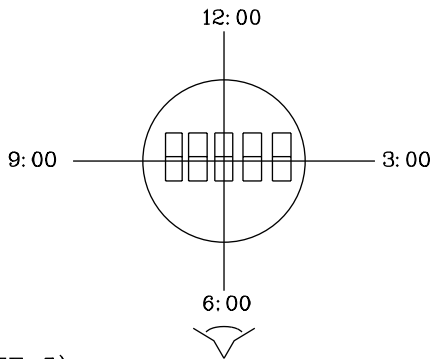
(NOTE 3)

Description of Measuring Equipment and Driving Waveforms



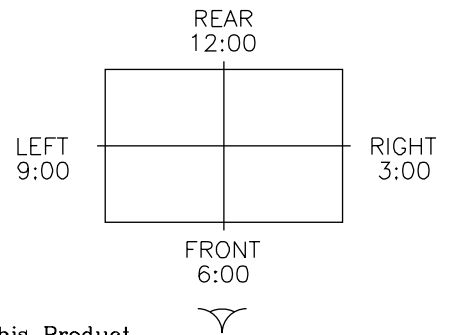
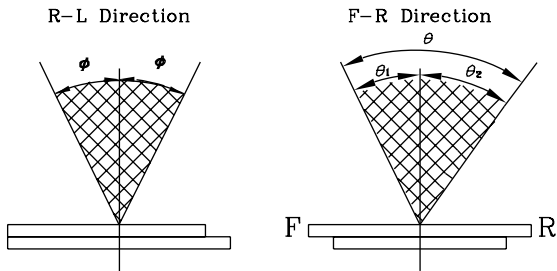
(NOTE 4)

Definition of Viewing Direction



(NOTE 5)

Definition of Viewing Angle



\*For This Product  
The Viewing Direction Is 6 O'clock  
So  $\theta_1 > \theta_2$

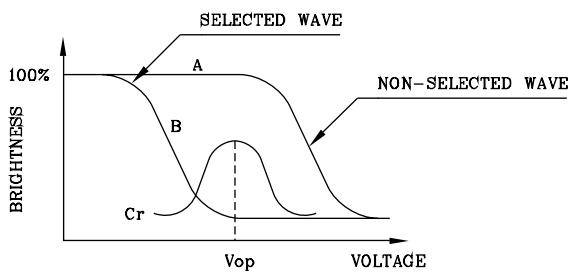
$$\theta = \theta_1 + \theta_2$$

\*Conditions

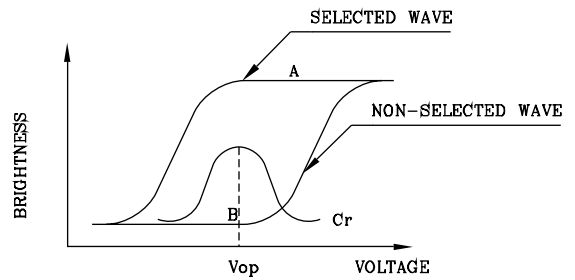
Operating Voltage :  $V_{op}$   
Frame Frequency : 70Hz  
Applying Waveform : 1/N duty 1/a bias  
Contrast Ratio : larger than 2

(NOTE 6)

Definition of Contrast Ratio (Cr)



(positive type)



(negative type)

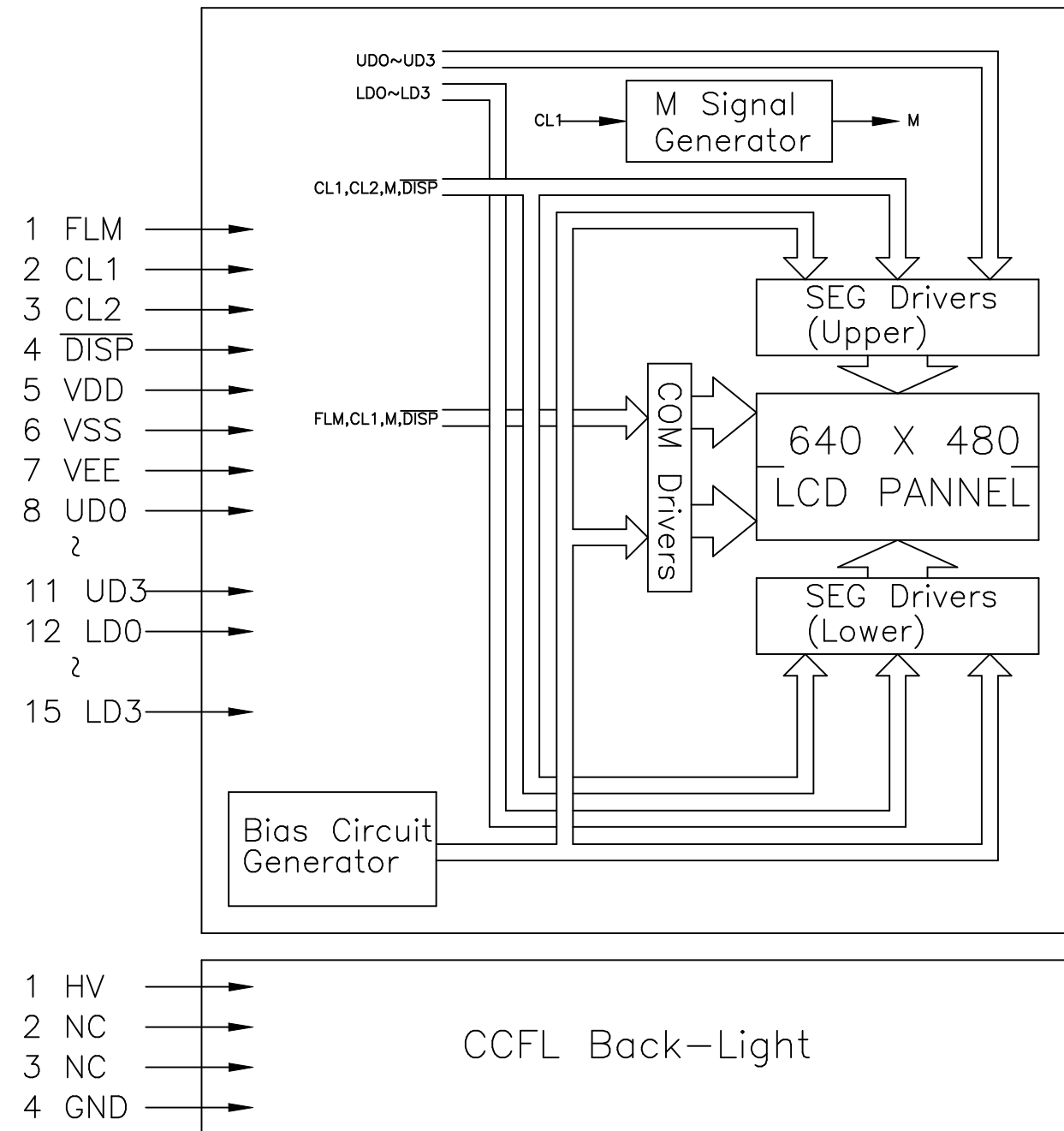
$$\text{Contrast Ratio} : Cr = A/B$$

\*Conditions

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



## 5. BLOCK DIAGRAM



## 6. INTERNAL PIN CONNECTION

### LCD

| Pin No. | Symbol                   | Level | Function                           |
|---------|--------------------------|-------|------------------------------------|
| 1       | FLM                      | H/L   | SCAN START-UP SIGNAL               |
| 2       | CL1                      | H→L   | DATA LATCH PULSE                   |
| 3       | CL2                      | H→L   | DATA SHIFT PULSE                   |
| 4       | $\overline{\text{DISP}}$ | H/L   | DISPLAY OFF ("H"=ON,"L"=OFF)       |
| 5       | VDD                      | —     | POWER SUPPLY FOR LOGIC (+3.3V/+5V) |
| 6       | VSS                      | —     | SIGNAL GROUND (GND)                |
| 7       | VEE                      | —     | POWER SUPPLY FOR LCD (+V)          |
| 8       | UD0                      | H/L   | DISPLAY DATA (UPPER HALF)          |
| 9       | UD1                      |       |                                    |
| 10      | UD2                      |       |                                    |
| 11      | UD3                      |       |                                    |
| 12      | LD0                      | H/L   | DISPLAY DATA (LOWER HALF)          |
| 13      | LD1                      |       |                                    |
| 14      | LD2                      |       |                                    |
| 15      | LD3                      |       |                                    |

### CCFL

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

### LCD

Used connector : MOLEX 53261-1590

Mating connector : MOLEX 51021-1500(HOUSING) X 1 +

MOLEX 50058-8000(TERMINAL) X 15 or Compatible

### CCFL

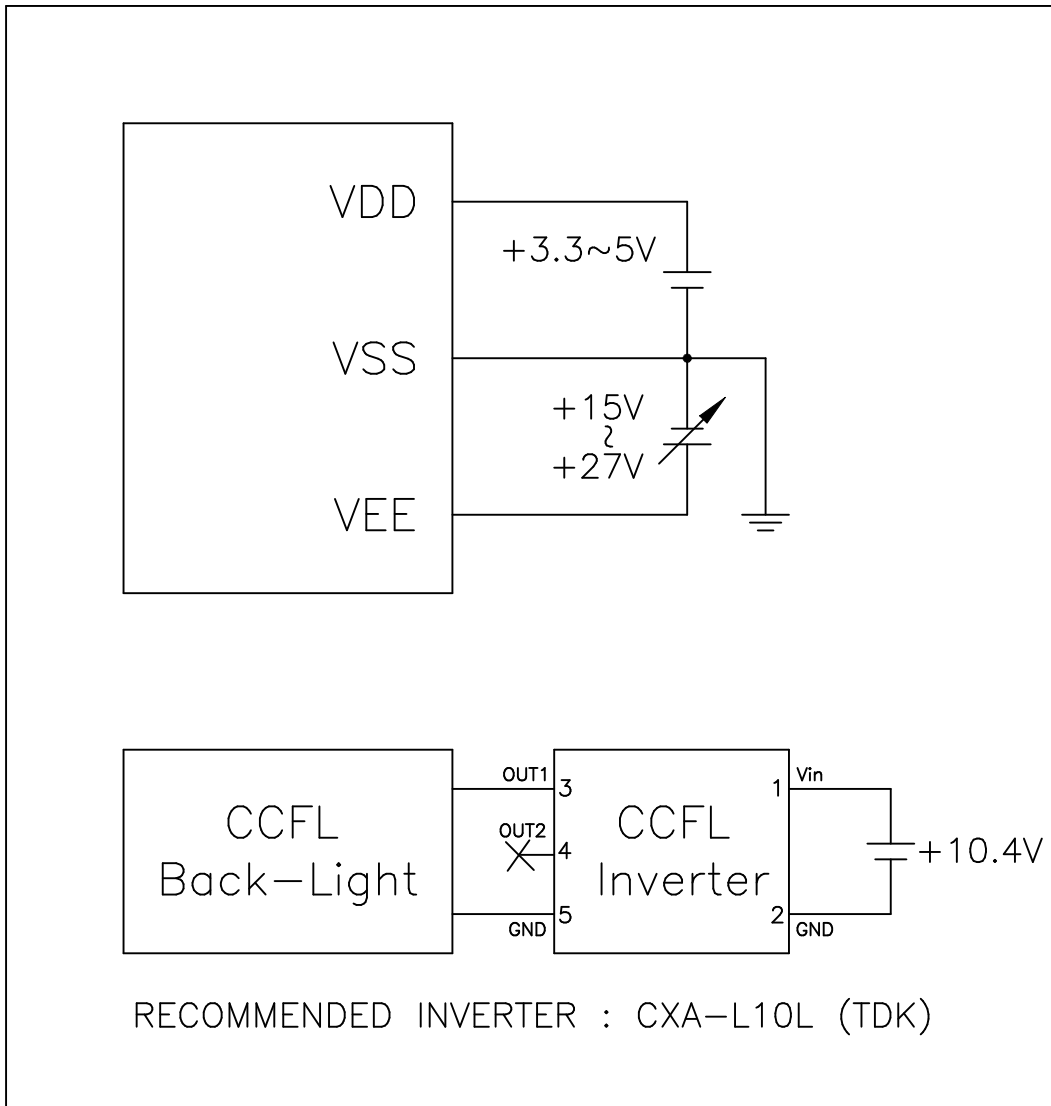
Used connector : M63M83-04 (MITSUMI)

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

M60-04-30-134P (MITSUMI)

M61M73-04 (MITSUMI)

## 7. POWER SUPPLY

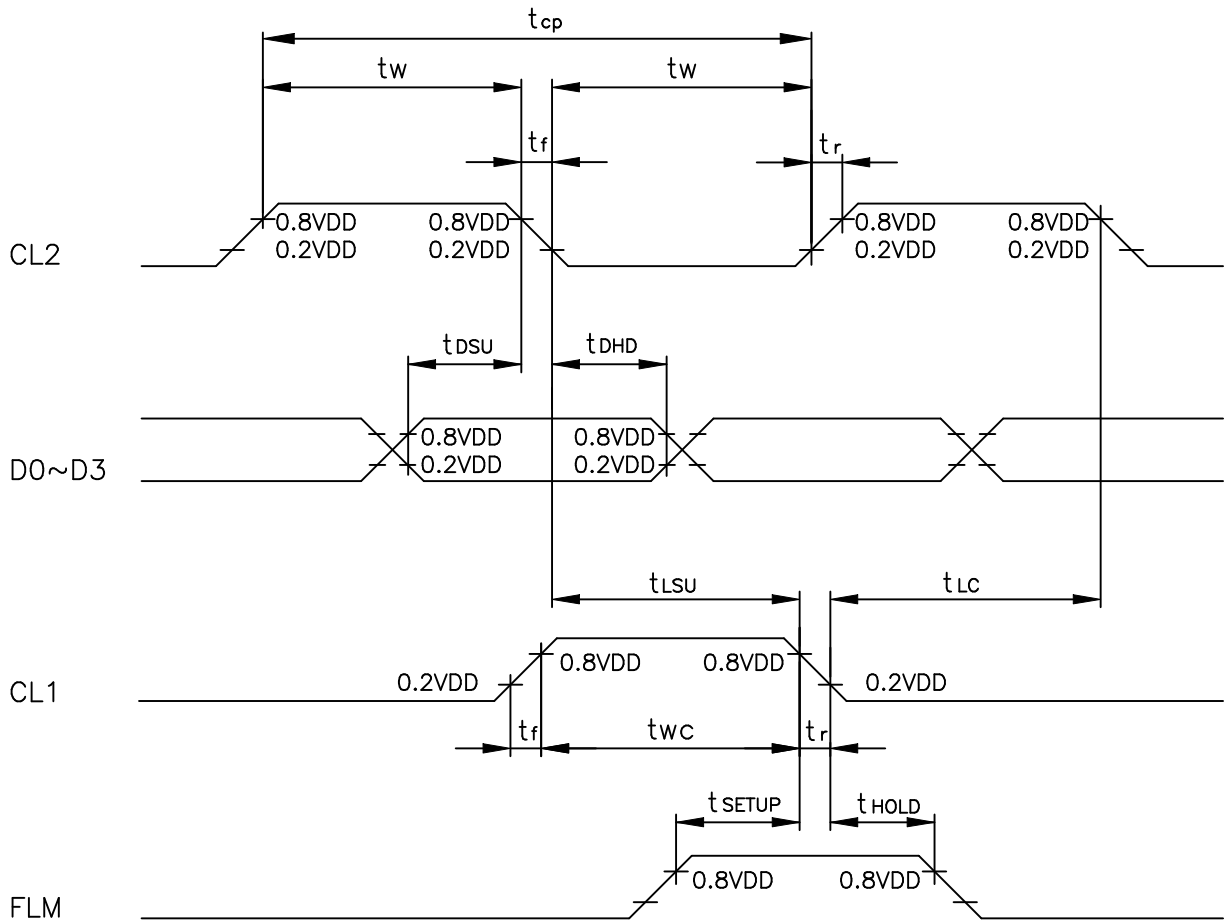


## 8. TIMING CHARACTERISTICS

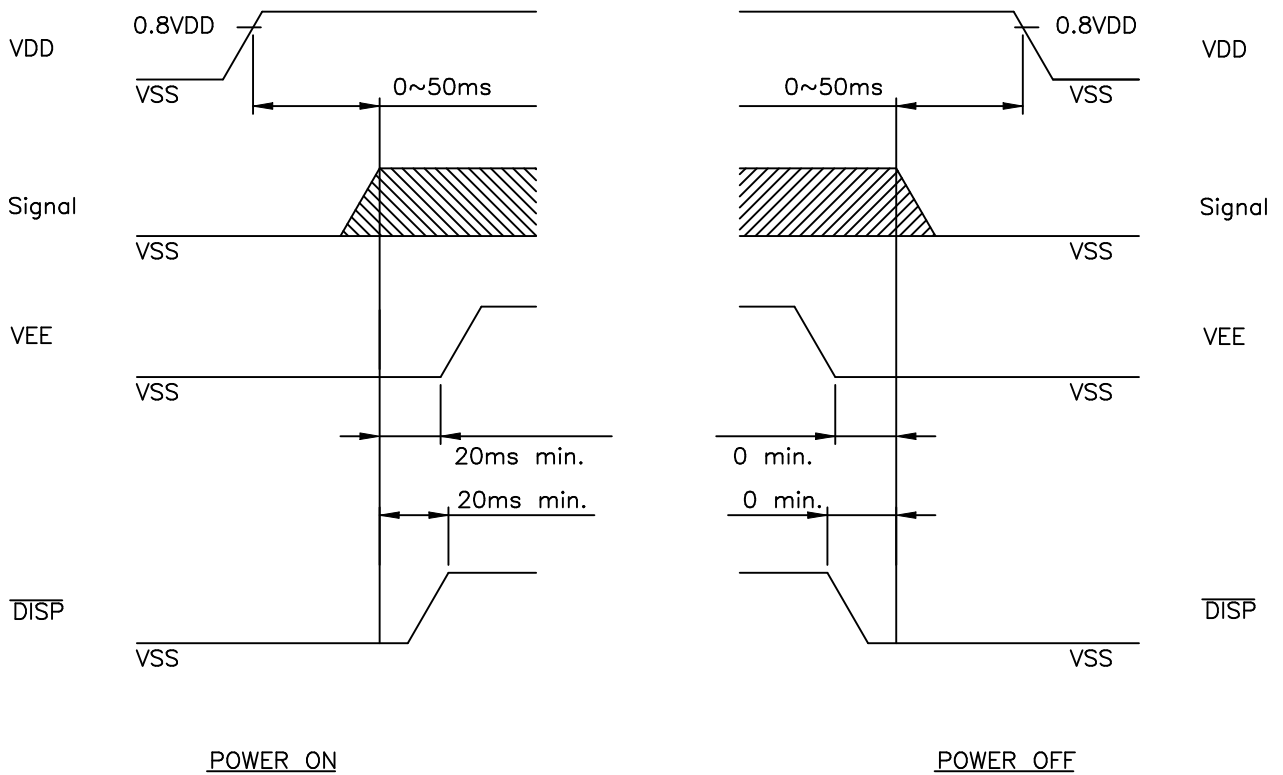
### 8-1. INTERFACE TIMING

@VDD=2.5~5.5V

| ITEM                    | SYMBOL      | MIN. | TYP. | MAX. | UNIT |
|-------------------------|-------------|------|------|------|------|
| Shift Clock Period      | $t_{cp}$    | 152  | -    | -    | ns   |
| "CL2" 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   |
| "CL2" → "CL1" FALL TIME | $t_{lsu}$   | 65   | -    | -    | ns   |
| "CL1" → "CL2" FALL TIME | $t_{lc}$    | 65   | -    | -    | ns   |
| "FLM" SETUP TIME        | $t_{setup}$ | 100  | -    | -    | ns   |
| "FLM" HOLD TIME         | $t_{hold}$  | 100  | -    | -    | ns   |
| "CL1" PULSE WIDTH       | $t_{wc}$    | 65   | -    | -    | ns   |

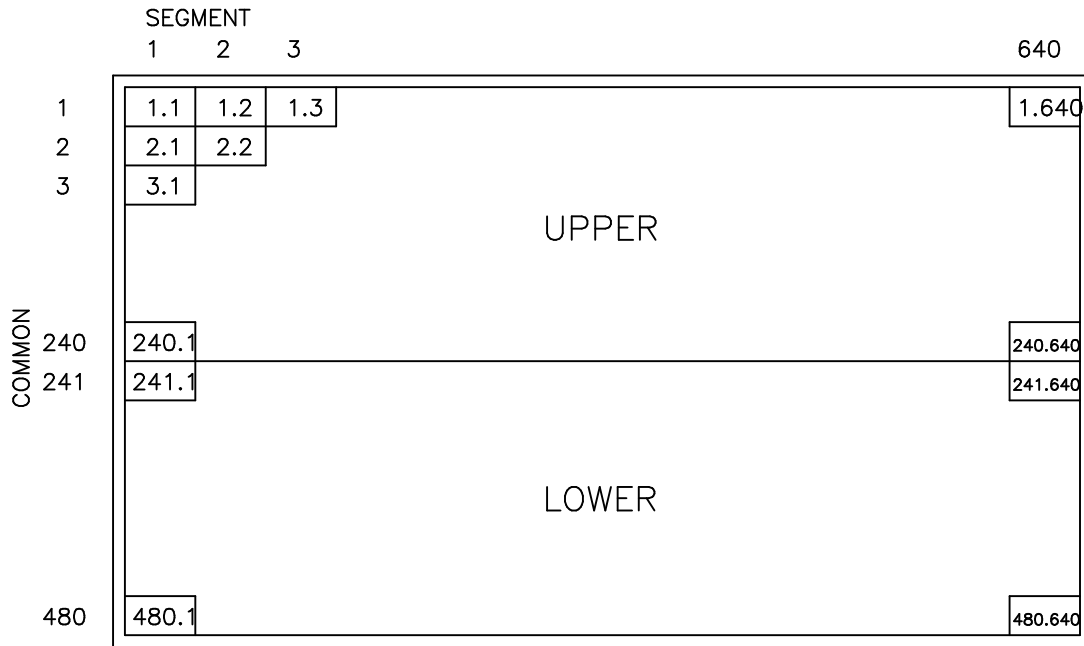


## 8-2. POWER ON/OFF TIMING

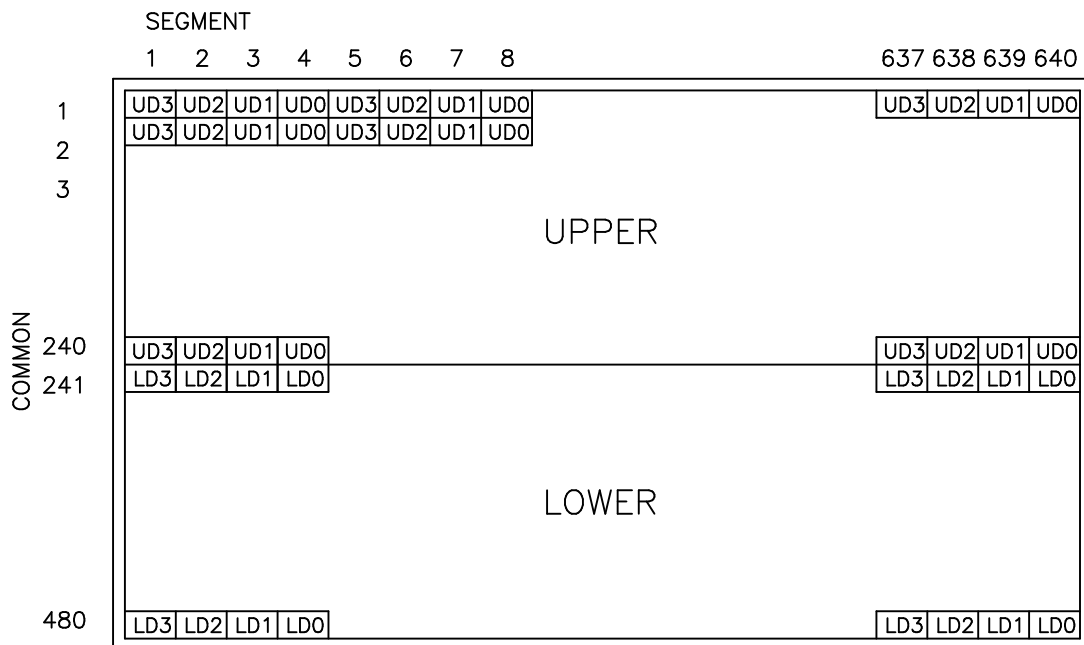


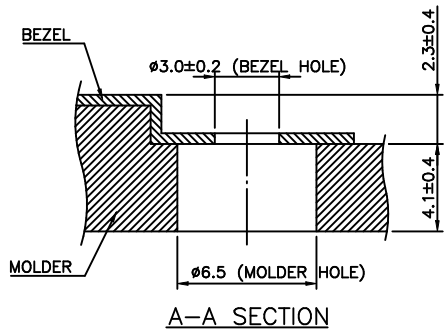
The missing pixels may occur when the LCM is driven beyond above power interface timing sequence.

## 8-3.DISPLAY PATTERN



NOTE : 1.1 MEANS 1ST COMMON 1ST SEGMENT DOT





NOTE:

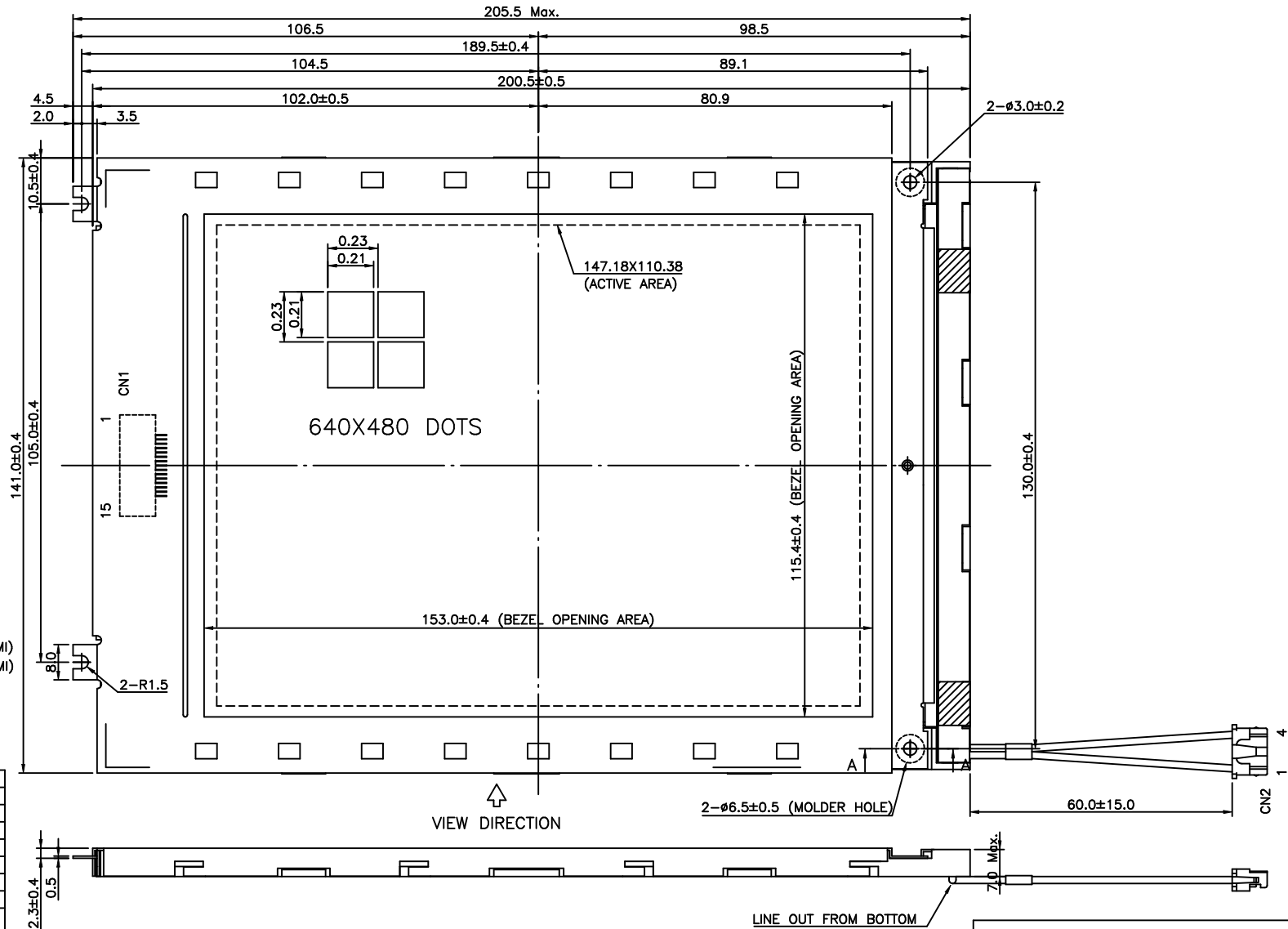
- Resolution: 640X480 DOTS
- Backlight: CCFT
- Frame Material: SECC (0.5mmt)
- LCD Connector: 53261-1590 (MOLEX)
- CCFT Connector: M63M83-04 (MITSUMI)  
correspondable CCFT connector : M60-04-30-114P (MITSUMI)  
M60-04-30-134P (MITSUMI)  
M61M73-04 (MITSUMI)
- Tolerance No Specified:  $\pm 0.5\text{mm}$

CN1. LCD Connector

| Pin No. | Symbol | Signal Level | Function                     |
|---------|--------|--------------|------------------------------|
| 1       | FLM    | H            | Scan Start-up Signal         |
| 2       | CL1    | H+L          | Data Latch Pulse             |
| 3       | CL2    | H+L          | Data Shift Pulse             |
| 4       | DISP   | 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       | UD0    | H/L          | Display Data (Upper Half)    |
| 9       | UD1    | H/L          |                              |
| 10      | UD2    | H/L          |                              |
| 11      | UD3    | H/L          |                              |
| 12      | LD0    | H/L          | Display Data (Lower Half)    |
| 13      | LD1    | H/L          |                              |
| 14      | LD2    | H/L          |                              |
| 15      | LD3    | H/L          |                              |

CN2. CCFT Connector

| Pin No. | Symbol | Signal Level | Function                     |
|---------|--------|--------------|------------------------------|
| 1       | HV     | -            | High Voltage Line (Inverter) |
| 2~3     | NC     | -            | Non Connection               |
| 4       | GND    | -            | Ground Line (Inverter)       |



AZ DISPLAYS, INC.

AGM6448E

|         | NAME        | DATE     | THIRD ANGLE P. |
|---------|-------------|----------|----------------|
| APPROVE |             |          |                |
| CHECK   |             |          |                |
| DESIGN  | C. B. LAN   | 93.08.17 | SCALE          |
| DRAWN   | C. B. LAN   | 93.08.17 | UNIT           |
| DWG NO. | M7011AD161A |          |                |

| REV. NO. | DESCRIPTION | DATE | DESIGN | CHECK | APPROVE |
|----------|-------------|------|--------|-------|---------|
|          |             |      |        |       |         |