# AU OPTRONICS CORPORATION

## Product Specification

## 19.0” SXGA Color TFT-LCD Module

## Model Name: M190EN03 V.1

| Approved by | Prepared by |
|---|---|
| CC Chiu | Flossie Chuang |

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| Customer | Checked & Approved by |
|---|---|
| | |

# Product Specification

## 19.0” SXGA Color TFT-LCD Module
## Model Name: M190EN03
## V.1

## (◆) Preliminary Specifications
## ( ) Final Specifications

**Note: This Specification is subject to change without notice.**

# Contents

# Record of Revision

| Version and Date | Page | Old description | New Description | Remark |
|---|---|---|---|---|
| 0.1 2004/05/18 | All | First Edition for Customer | All | |
| 0.2 2004/07/08 | 7 | 2.1 Display Characteristics<br>Contrast Ratio=700:1 (Typ) | 2.1 Display Characteristics<br>Contrast Ratio=800:1 (Typ) | Modified |
| | 8 | 2.2 Optical Chaaracteristics<br>Contrast Ratio (Normal Direction)<br>Min=400<br>Typ=700 | 2.2 Optical Chaaracteristics<br>Contrast Ratio Normal Direction<br>Min=500<br>Typ=800 | Modified |
| | 12 | 4.1 TFT LCD Module<br>Logic/LCD Drive Voltage<br>Min=+4.5 | 4.1 TFT LCD Module<br>Logic/LCD Drive Voltage<br>Min=-0.3 | Modified |
| | 14 | 5.1.2 Signal Electrical Characteristics<br>VTH/VTL=±100MV | 5.1.2 Signal Electrical Characteristics<br>VTH/VTL = ±100mV | Modified |
| | 15 | 5.2 Backlight Unit<br>CCFL Power Consumption<br>Max=24 | 5.2 Backlight Unit<br>CCFL Power Consumption<br>Max=23.1 | Modified |
| 0.3 2004/07/30 | 7 | 2.1 Display Characteristics<br>Power consumption=30W (Typ) | 2.1 Display Characteristics<br>Power consumption=27.5W (Typ) | Modified |
| | 7 | 2.1 Display Characteristics | 2.1 Display Characteristics<br>Surface Treatment:<br>Anti-glare, hard coating (3H) | Added |
| | 13 | 5.1.1 Power Specification<br>IDD=TBD (Typ) ; TBD (Max)<br>Irush = 7 (Max)<br>PDD = - (Typ) ; 8 (Max) | 5.1.1 Power Specification<br>IDD =1300 (Typ) ; =1700 (Max)<br>Irush = 3.5 (Max)<br>PDD = 6.5 (Typ) ; 8.5 (Max) | Modified |
| | 13 | 5.1.1 Power Specification<br>Irush (LCD Inrush Current)<br>Max=7 (Max) | 5.1.1 Power Specification<br>Irush (LCD Inrush Current)<br>Max=3.5 (Max) | Modified |
| | 20 | 6.5 Power ON/OFF Sequence<br>T1 = 0 (min)<br>T3 = 300 (Min)<br>T4 = 300 (Min) | 6.5 Power ON/OFF Sequence<br>T1 = 0.5 (Min)<br>T3 = 200 (Min)<br>T4 = 200 (Min) | Modified |
| | 21 | 7.1 TFT LCD Module | 7.1 TFT LCD Module<br>**Connector Name / Designation**: Interface Connector / Interface card<br>**Manufacturer**: HIROSE or compatible<br>**Type Part Number**: MDF 76KBW-30S-1H(58)<br>**Mating Housing Part Number**: MDF 70G-30P-1SD | Added |
| | 28 | 13.0 Mechanical Characteristics | 13.0 Mechanical Characteristics<br>10. Total cable length must be 150± 10mm | Added |

# 1.0 Handling Precautions

1) Since front polarizer is easily damaged, pay attention not to scratch it.

2) Be sure to turn off power supply when inserting or disconnecting from input connector.

3) Wipe off water drop immediately. Long contact with water may cause discoloration or spots.

4) When the panel surface is soiled, wipe it with absorbent cotton or other soft cloth.

5) Since the panel is made of glass, it may break or crack if dropped or bumped on hard surface.

6) Since CMOS LSI is used in this module, take care of static electricity and insure human earth when handling.

7) Do not open nor modify the Module Assembly.

8) Do not press the reflector sheet at the back of the module to any directions.

9) In case if a module has to be put back into the packing container slot after once it was taken out from the container, do not press the center of the CCFL reflector edge. Instead, press at the far ends of the CCFL reflector edge softly. Otherwise the TFT module may be damaged.

10) At the insertion or removal of the Signal Interface Connector, be sure not to rotate nor tilt the Interface Connector of the TFT module.

11) After installation of the TFT module into an enclosure (Desktop monitor Bezel, for example), do not twist nor bend the TFT Module even momentary. At designing the enclosure, it should be taken into consideration that no bending/twisting forces are applied to the TFT module from outside. Otherwise the TFT module may be damaged.

# 2.0 General Description

This specification applies to the 19.0 inch Color TFT-LCD Module M190EN03 V1.

The display supports the SXGA (1280(H) x 1024(V)) screen format and 16.7M colors (RGB 8-bits data).

All input signals are 2 Channel LVDS interface compatible.

This module does not contain an inverter card for backlight.

## 2.1 Display Characteristics

The following items are characteristics summary on the table under 25 ℃ condition:

| ITEMS | Unit | SPECIFICATIONS |
|---|---|---|
| Screen Diagonal | [mm] | 480(19") |
| Active Area | [mm] | 376.32 (H) x 301.056 (V) |
| Pixels H x V | | 1280(x3) x 1024 |
| Pixel Pitch | [mm] | 0.294 (per one triad) x 0.294 |
| Pixel Arrangement | | R.G.B. Vertical Stripe |
| Display Mode | | Normally Black |
| White Luminance ( Center ) | [cd/m$^2$] | 250 cd/m2 @7mA (Typ) |
| Contrast Ratio | | 800 : 1 (Typ) |
| Optical Response Time | [msec] | 20ms (Typ, on/off) |
| Nominal Input Voltage VDD | [Volt] | +5.0 V |
| Power Consumption<br>(VDD line + CCFL line) | [Watt] | 27.5W(Typ) (w/o Inverter, All white pattern) |
| Weight | [Grams] | 2500 (Max) |
| Physical Size | [mm] | 396(W) x 324(H) x 17.5(D) (Typ) |
| Electrical Interface | | Even/Odd R/G/B data, 3 sync signal,<br>Clock |
| Support Color | | 16.7M colors (RGB 8-bit data ) |
| Surface treatment | | Anti-glare, hard coating (3H) |
| Temperature Range<br>Operating<br>Storage (Shipping) | <br>[$^o$C]<br>[$^o$C] | <br>0 to +50<br>-20 to +60 |

## 2.2 Optical Characteristics

The optical characteristics are measured under stable conditions at 25°C:

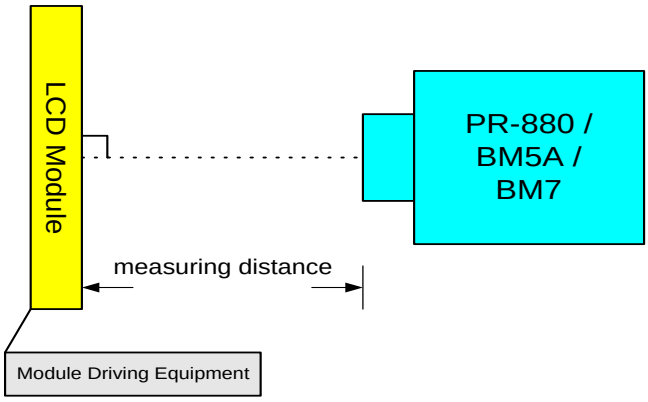
| Item | Unit | Conditions | Min. | Typ. | Max. | Note |
|---|---|---|---|---|---|---|
| Viewing Angle | [degree]<br>[degree] | Horizontal (Right)<br>CR = 10 (Left) | 75<br>75 | 85<br>85 | -<br>- | |
| | [degree]<br>[degree] | Vertical (Up)<br>CR = 10 (Down) | 75<br>75 | 85<br>85 | -<br>- | |
| Contrast Ratio | | Normal Direction | 500 | 800 | | |
| Response Time | [msec] | Rising Time | - | 15 | 25 | ***Note 1*** |
| | [msec] | Falling Time | - | 5 | 15 | ***Note 1*** |
| | [msec] | Rising + Falling | - | 20 | 40 | ***Note 1*** |
| Color / Chromaticity Coordinates (CIE) | | Red x | 0.611 | 0.641 | 0.671 | |
| | | Red y | 0.323 | 0.353 | 0.383 | |
| | | Green x | 0.259 | 0.289 | 0.319 | |
| | | Green y | 0.596 | 0.626 | 0.656 | |
| | | Blue x | 0.112 | 0.142 | 0.172 | |
| | | Blue y | 0.048 | 0.078 | 0.108 | |
| Color Coordinates (CIE) White | | White x | 0.283 | 0.313 | 0.343 | |
| | | White y | 0.299 | 0.329 | 0.359 | |
| White Luminance at CCFL 7.0mA (central point) | [cd/m$^2$] | | 200 | 250 | - | |
| Luminance Uniformity | [%] | | 70 | 75 | - | ***Note 2*** |
| Crosstalk (in75Hz) | [%] | | | | 1.5 | ***Note 3*** |
| Flicker | dB | | | | -20 | ***Note 4*** |

Equipment: Pattern Generator, Power Supply, Digital Voltmeter, Luminance meter (PR 880, BM-5A , BM 7 ,CS-1000, & EZContrast* )

Aperture: 1 ° with 100cm VD or 2 ° with 50cm viewing distance

Test Point: Center (VESA point 9)

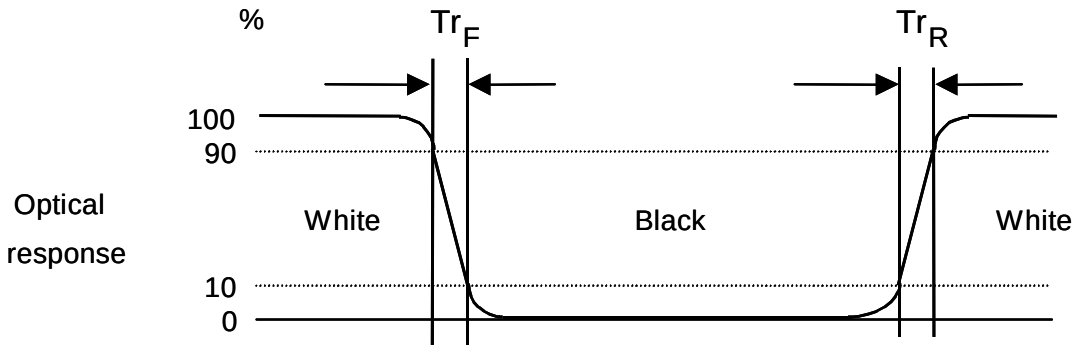
Environment: < 1 lux



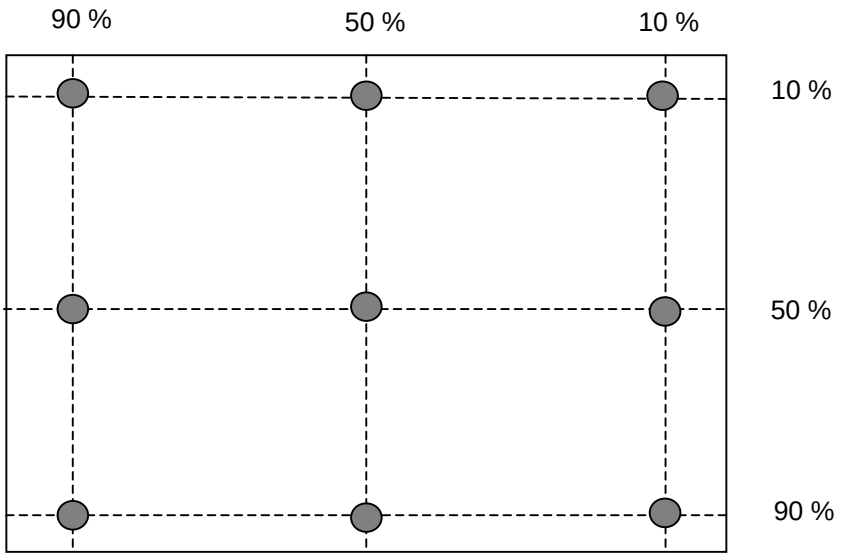

*' EZ Contrast is different measurement tool with very close viewing distance.

***Note 1:*** **Definition of Response time**

The output signals of photodetector are measured when the input signals are changed from “Black” to “White” (rising time), and from “White” to “Black ”(falling time), respectively. The response time is interval between the 10% and 90% of amplitudes.

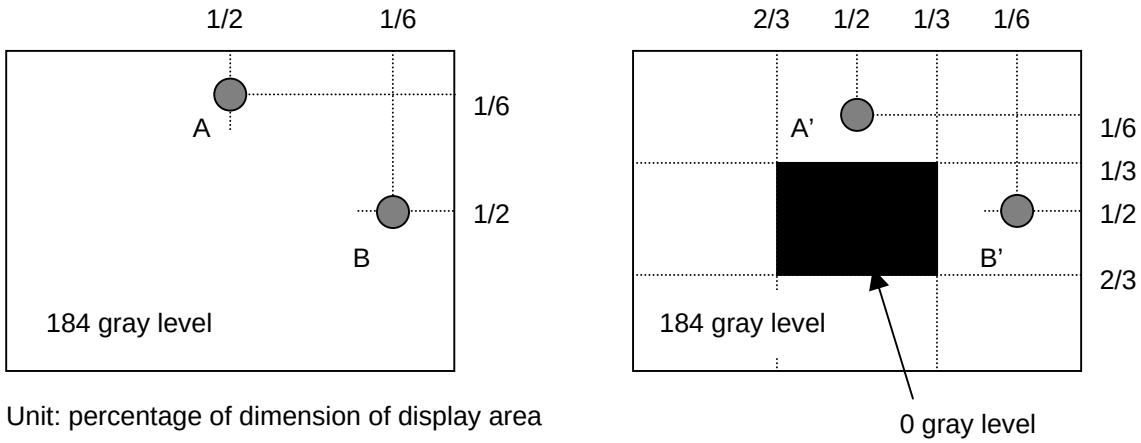



***Note 2:*** **Brightness uniformity of these 9 points is defined as below**




$$\text{Uniformity} = \frac{\text{Minimum Luminance in 9 points (1-9)}}{\text{Maximum Luminance in 9 Points (1-9)}}$$

***Note 3:*** Crosstalk is defined as below :

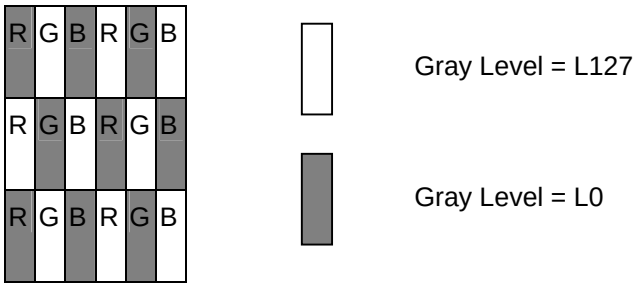



Unit: percentage of dimension of display area

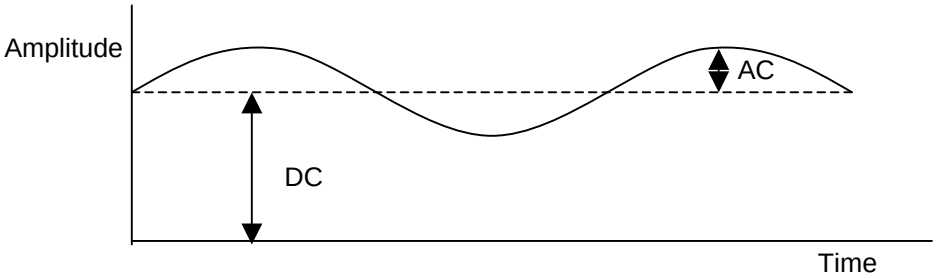
l $L_A$-$L_{A'}$ l / $L_A$ x 100%= 1.5% max., $L_A$ and $L_B$ are brightness at location A and B

l $L_B$-$L_{B'}$ l / $L_B$ x 100%= 1.5% max., $L_{A'}$ and $L_{B'}$ are brightness at location A' and B'

***Note 4:*** Test Paterm: Subchecker Pattern



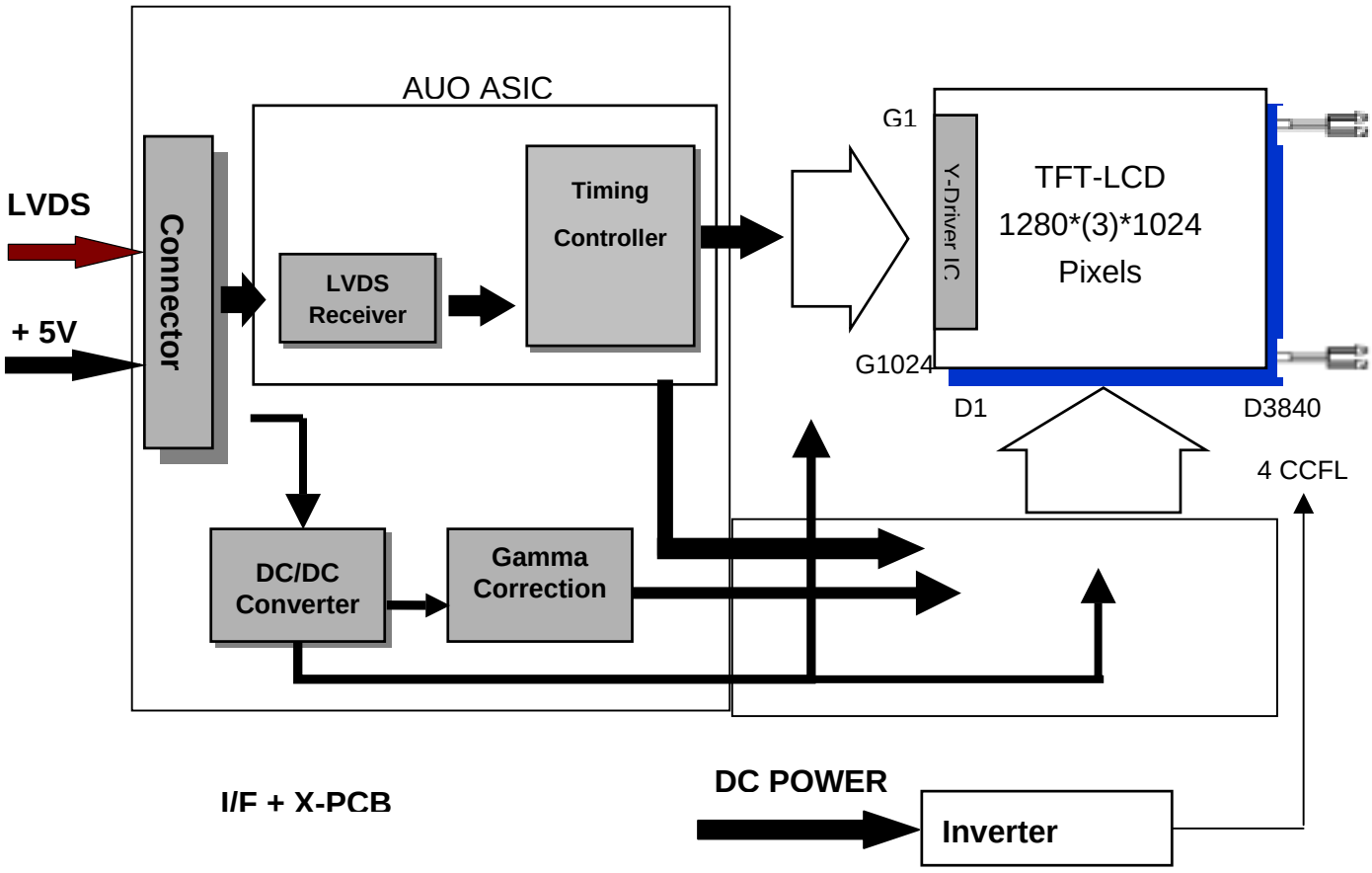

Method: Record dBV & DC value with (WESTAR)TRD-100




$$\text{Flicker (dB)} = 20\log\frac{\text{AC Level(at 30 Hz)}}{\text{DC Level}}$$

## 3.0 Functional Block Diagram

The following diagram shows the functional block of the 19.0 inches Color TFT/LCD Module:




**HIROSE MDF76KBW-30S-1H(58)**

**Mating Type:**
**HIROSE MDF 76G-30P-1SD**

**JST BHSR-02VS-1**

**Mating Type:**
**SM02B-BHSS-1-TB**

# 4.0 Absolute Maximum Ratings

Absolute maximum ratings of the module is as following:

## 4.1 TFT LCD Module

| Item | Symbol | Min | Max | Unit | Conditions |
|---|---|---|---|---|---|
| Logic/LCD Drive Voltage | VIN | -0.3 | +5.5 | [Volt] | ***Note 1,2*** |

## 4.2 Backlight Unit

| Item | Symbol | Min | Max | Unit | Conditions |
|---|---|---|---|---|---|
| CCFL Current | ICFL | - | 7.5 | [mA] rms | ***Note 1,2*** |

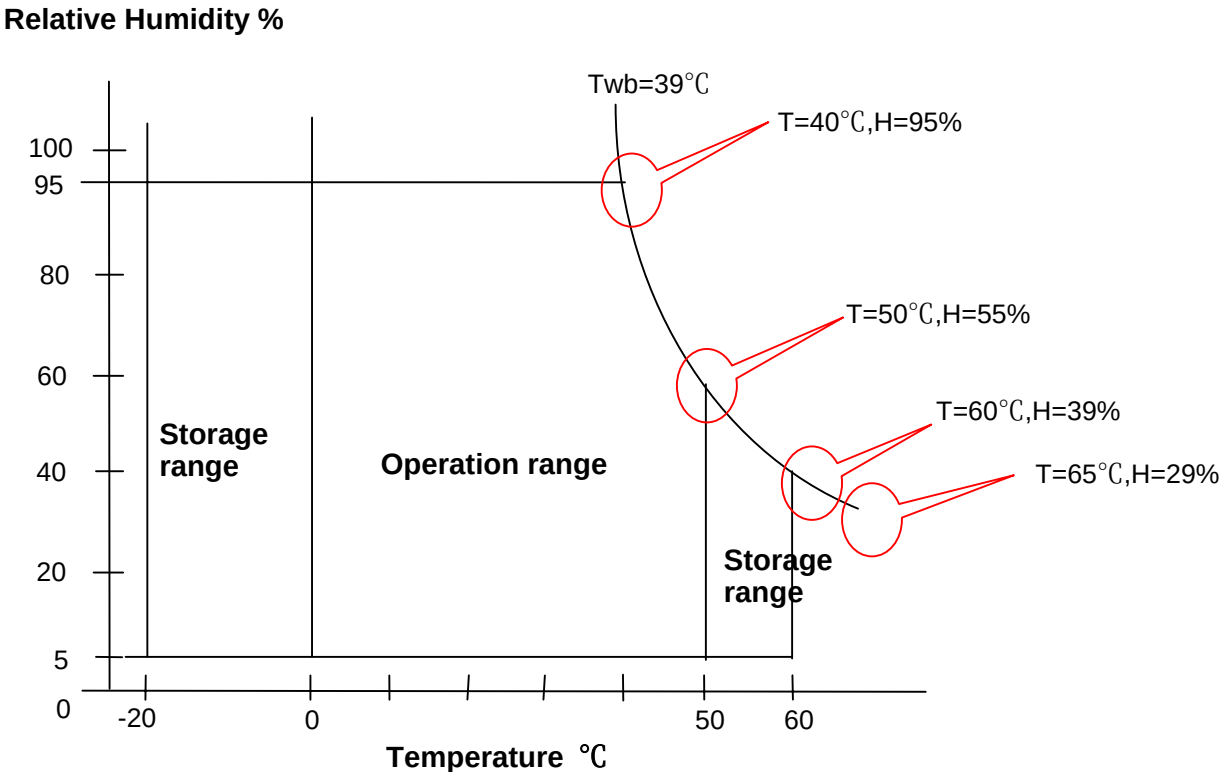
## 4.3 Absolute Ratings of Environment

| Item | Symbol | Min | Max | Unit | Conditions |
|---|---|---|---|---|---|
| Operating Humidity | HOP | 8 | 95 | [%RH] | ***Note 3*** |
| Storage Temperature | TST | -20 | +60 | [°C] | ***Note 3*** |
| Storage Humidity | HST | 8 | 95 | [%RH] | ***Note 3*** |

***Note 1:*** With in Ta (25℃ )

***Note 2:*** Permanent damage to the device may occur if exceed maximum values

***Note 3:*** For quality perfermance, please refer to AUO IIS(Incoming Inspection Standard).



# 5.0 Electrical characteristics

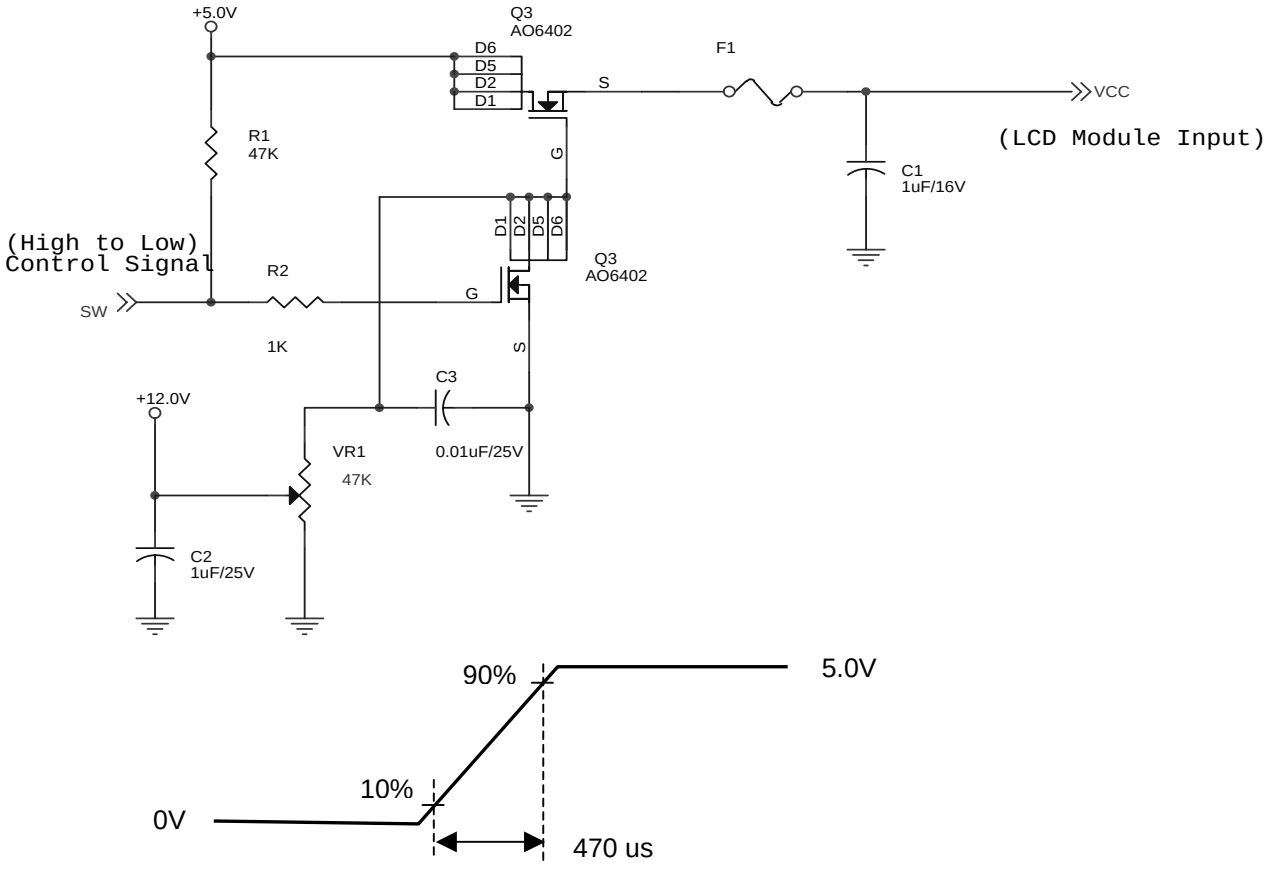
## 5.1 TFT LCD Module

### 5.1.1 Power Specification

Input power specifications are as follows;

| Symbol | Parameter | Min | Typ | Max | Units | Condition |
|---|---|---|---|---|---|---|
| VDD | Logic/LCD Drive Voltage | 4.5 | 5 | 5.5 | [Volt] | ±10% |
| IDD | VDD current | - | 1300 | 1700 | [mA] | Vin=5V , All White Pattern, +30%, at 75Hz |
| Irush | LCD Inrush Current | - | - | 3.5 | [A] | ***Note*** |
| PDD | VDD Power | - | 6.5 | 8.5 | [Watt] | Vin=5V , All White Pattern, +30%, at 75Hz |
| VDDrp | Allowable Logic/LCD Drive Ripple Voltage | | | 100 | [mV] p-p | |
| VDDns | Allowable Logic/LCD Drive Ripple Voltage | | | 100 | [mV] p-p | |

***Note:*** Measurement conditions:




**Vin rising time**

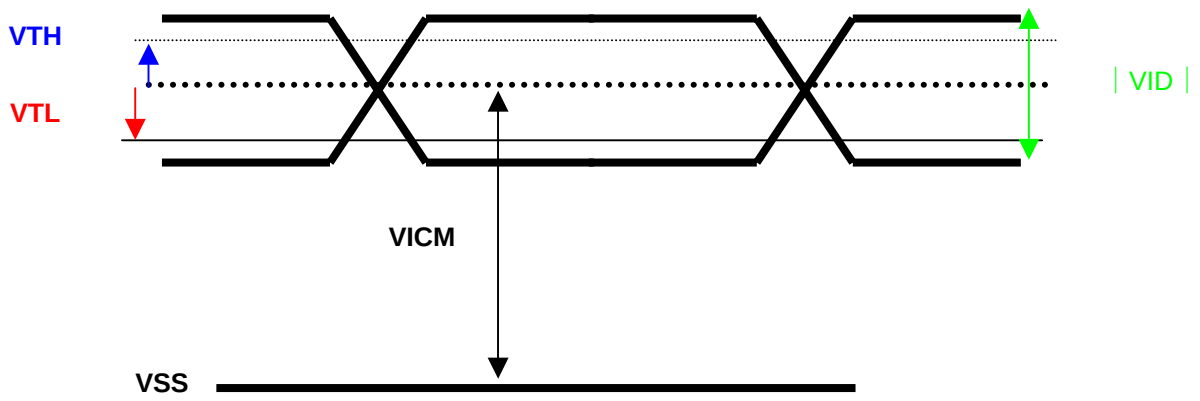
### 5.1.2 Signal Electrical Characteristics

Input signals shall be low or Hi-Z state when Vin is off
It is recommended to refer the specifications of SN75LVDS82DGG (Texas Instruments) in detail.

Each signal characteristics are as follows;

| Symbol | Parameter | Min | Typ | Max | Units | Condition |
|---|---|---|---|---|---|---|
| VTH | Differential Input High Threshold | - | - | +100 | [mV] | VICM = 1.2V<br>***Note*** |
| VTL | Differential Input Low Threshold | -100 | - | - | [mV] | VICM = 1.2V<br>***Note*** |
| \|VID\| | Input Differential Voltage | 100 | 400 | 600 | [mV] | ***Note*** |
| VICM | Differential Input Common Mode Voltage | +1.0 | +1.2 | +1.35 | [V] | VTH/VTL = ±100mV<br>***Note*** |

***Note:*** LVDS Signal Waveform



## 5.2 Backlight Unit

Parameter guideline for CCFL Inverter

| Symbol | Parameter | Min. | Typ. | Max. | Unit | Condition |
|---|---|---|---|---|---|---|
| ISCFL | CCFL standard current | 6.5 | 7.0 | 7.5 | [mA] rms | (Ta=25°C) ***Note 1*** |
| IRCFL | CCFL operation range | 3.0 | 7.0 | 7.5 | [mA] rms | (Ta=25°C) |
| FCFL | CCFL Frequency | 40 | 50 | 60 | [KHz] | (Ta=25°C) ***Note 2*** |
| ViCFL (0°C) | CCFL Ignition Voltage (End of the lamp wire connector) | 1810 | - | - | [Volt] rms | (Ta=0°C) ***Note 3*** |
| ViCF (25°C) | CCFL Ignition Voltage (End of the lamp wire connector) | 1540 | - | - | [Volt] rms | (Ta=25°C) ***Note 3*** |
| VCFL | CCFL Operation Voltage | - | 750 @7mA | 800 | [Volt] rms | (Ta=25°C) ***Note 4*** |
| PCFL | CCFL Power consumption (for reference) | - | 21 | 23.1 | [Watt] | (Ta=25°C) ***Note 5*** |
| LTCFL | CCFL life Time | 40,000 | 50,000 | - | [Hour] | (Ta=25°C) ***Note 6*** |

***Note 1:*** CCFL standard current is measured at 25±2℃..

***Note 2:*** CCFL Frequency should be carefully determined to avoid interference between inverter and TFT LCD

***Note 3:*** ViCFL means Ignition Voltage for both ends of the lamp, and CCFL inverter should be able to give out a power that has a generating capacity of over 1810 voltage. Lamp units need 1810 voltage minimum for ignition

***Note 4:*** CCFL operation voltage is measured at 25±2℃.

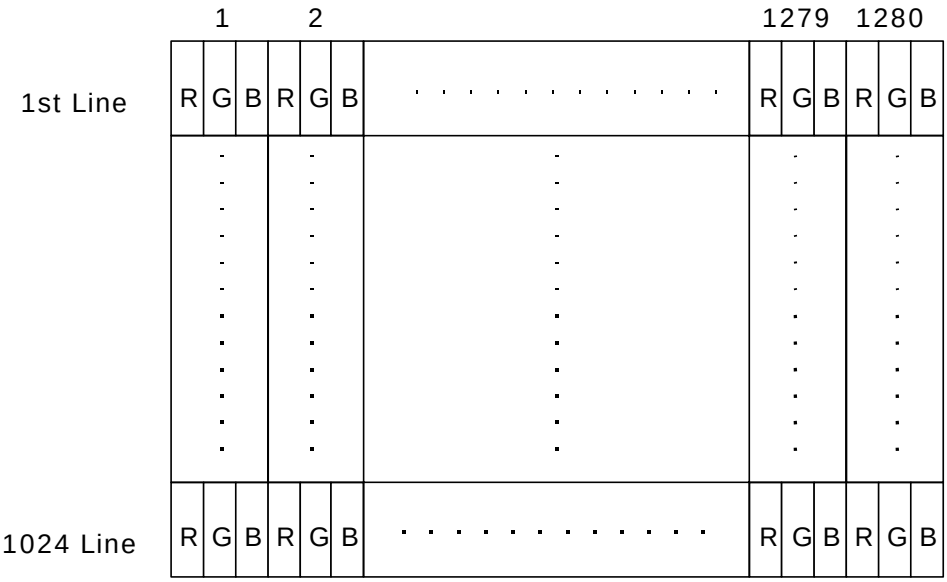
***Note 5:*** The variance of CCFL power consumption is ±10%. Calculator value for reference (ICFL×VCFL×4=PCFL).

***Note 6:*** Definition of life: brightness becomes 50% or less than the minimum luminance value of CCFL..The typical life time of CCFL is on the condition at 7.0mA lamp current.

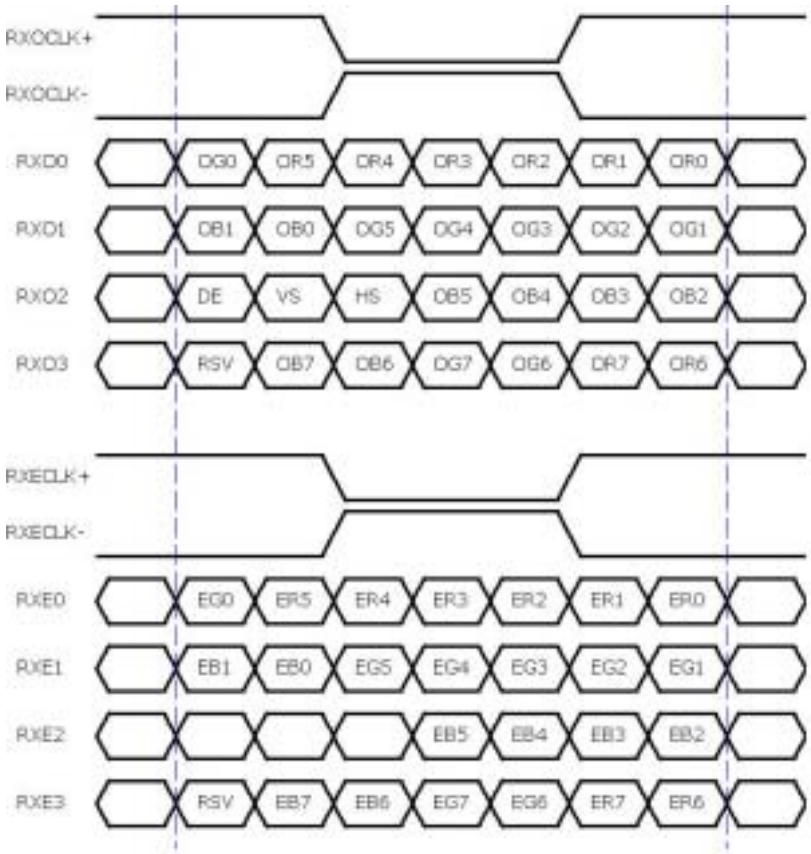
# 6.0 Signal Characteristic

## 6.1 Pixel Format Image

Following figure shows the relationship of the input signals and LCD pixel format.




## 6.2 The input data format




**Note 1:** R/G/B data 7:MSB, R/G/B data 0:LSB

O = “First Pixel Data”

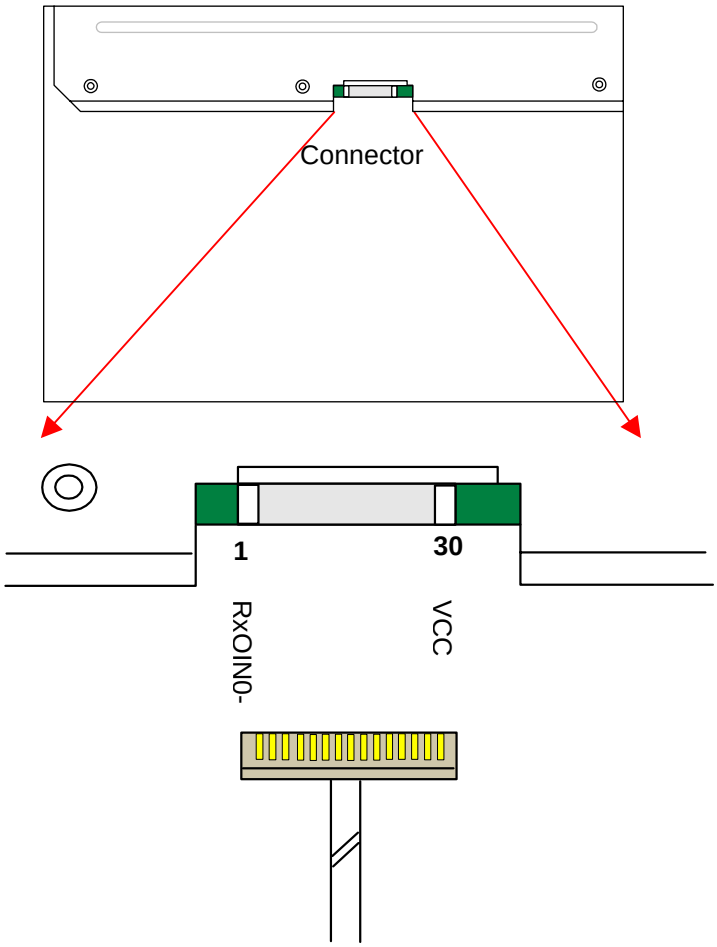
E = “Second Pixel Data”

## 6.3 Signal Description

The module using one LVDS receiver SN75LVDS82(Texas Instruments) or compatible. LVDS is a differential signal technology for LCD interface and high speed data transfer device. Transmitter shall be SN75LVDS83(negative edge sampling) or compatible**.** The first LVDS port(RxOxxx) transmits odd pixels while the second LVDS port(RxExxx) transmits even pixels.

| PIN # | SIGNAL NAME | DESCRIPTION |
|---|---|---|
| 1 | RxOIN0- | Negative LVDS differential data input (Odd data) |
| 2 | RxOIN0+ | Positive LVDS differential data input (Odd data) |
| 3 | RxOIN1- | Negative LVDS differential data input (Odd data) |
| 4 | RxOIN1+ | Positive LVDS differential data input (Odd data) |
| 5 | RxOIN2- | Negative LVDS differential data input (Odd data, H-Sync,V-Sync,DSPTMG) |
| 6 | RxOIN2+ | Positive LVDS differential data input (Odd data, H-Sync,V-Sync,DSPTMG) |
| 7 | VSS | Power Ground |
| 8 | RxOCLKIN- | Negative LVDS differential clock input (Odd clock) |
| 9 | RxOCLKIN+ | Positive LVDS differential clock input (Odd clock) |
| 10 | RxOIN3- | Negative LVDS differential data input (Odd data) |
| 11 | RxOIN3+ | Positive LVDS differential data input (Odd data) |
| 12 | RxEIN0- | Negative LVDS differential data input (Even clock) |
| 13 | RxEIN0+ | Positive LVDS differential data input (Even data) |
| 14 | VSS | Power Ground |
| 15 | RxEIN1- | Positive LVDS differential data input (Even data) |
| 16 | RxEIN1+ | Negative LVDS differential data input (Even data) |
| 17 | VSS | Power Ground |
| 18 | RxEIN2- | Negative LVDS differential data input (Even data) |
| 19 | RxEIN2+ | Positive LVDS differential data input (Even data) |
| 20 | RxECLKIN- | Negative LVDS differential clock input (Even clock) |
| 21 | RxECLKIN+ | Positive LVDS differential clock input (Even clock) |
| 22 | RxEIN3- | Negative LVDS differential data input (Even data) |
| 23 | RxEIN3+ | Positive LVDS differential data input (Even data) |
| 24 | VSS | Power Ground |
| 25 | NC | - |
| 26 | NC | - |
| 27 | NC | - |
| 28 | VCC | +5.0V Power Supply |
| 29 | VCC | +5.0V Power Supply |
| 30 | VCC | +5.0V Power Supply |

**Note1:** Start from left side



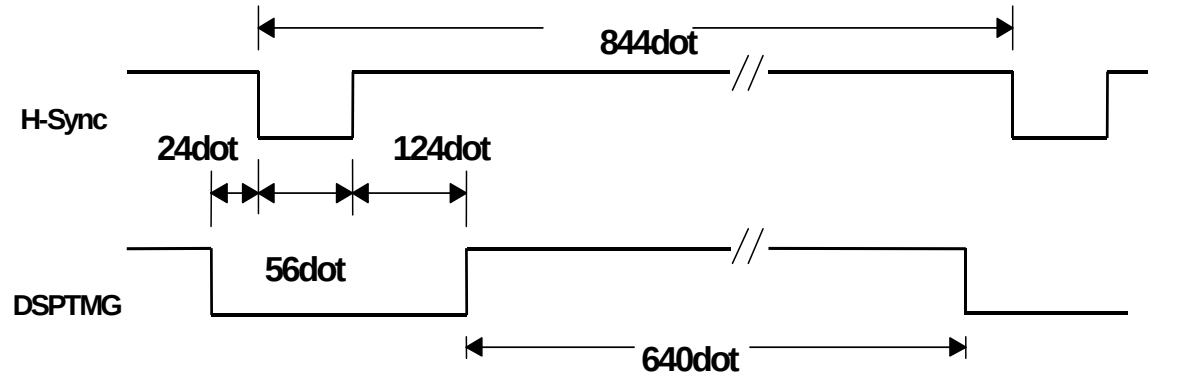

**Note2:** Input signals of odd and even clock shall be the same timing.

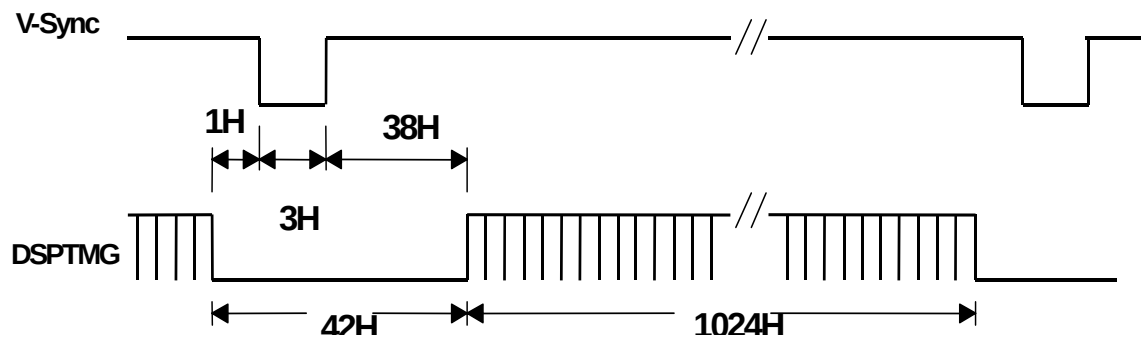
### 6.4.1 Timing Characteristics

Basically, interface timings described here is not actual input timing of LCD module but output timing of SN75LVDS82DGG (Texas Instruments) or equivalent. **Note:** Typical value refer to VESA STANDARD

| Signal | Item | Symbol | MIN | TYP | MAX | Unit |
|---|---|---|---|---|---|---|
| DTCLK | Freq. | Fdck | 50 | 67.5 | 70 | MHz |
| DTCLK | Cycle | Tck | 14.2 | 14.8 | 20 | ns |
| +V-Sync | Frame Rate | 1/Tv | 56.25 | 75 | 77 | Hz |
| +V-Sync | Cycle | Tv | 13 | 13.33 | 17.78 | ms |
| +V-Sync | Cycle | Tv | 1035 | 1066 | 2047 | lines |
| +V-Sync | Active level | Tva | 3 | 3 | | lines |
| +V-Sync | V-back porch | Tvb | 7 | 38 | 63 | lines |
| +V-Sync | V-front porch | Tvf | 1 | 1 | | lines |
| +DSPTMG | V-Line | m | - | 1024 | - | lines |
| +H-Sync | Scan rate | 1/Th | - | 80.06 | - | KHz |
| +H-Sync | Cycle | Th | 800 | 844 | 1023 | Tck |
| +H-Sync | Active level | Tha (*1) | 4 | 56 | | Tck |
| +H-Sync | Back porch | Thb (*1) | 4 | 124 | | Tck |
| +H-Sync | Front porch | Thf | 4 | 24 | | Tck |
| +DSPTMG | Display Pixels | n | - | 640 | - | Tck |

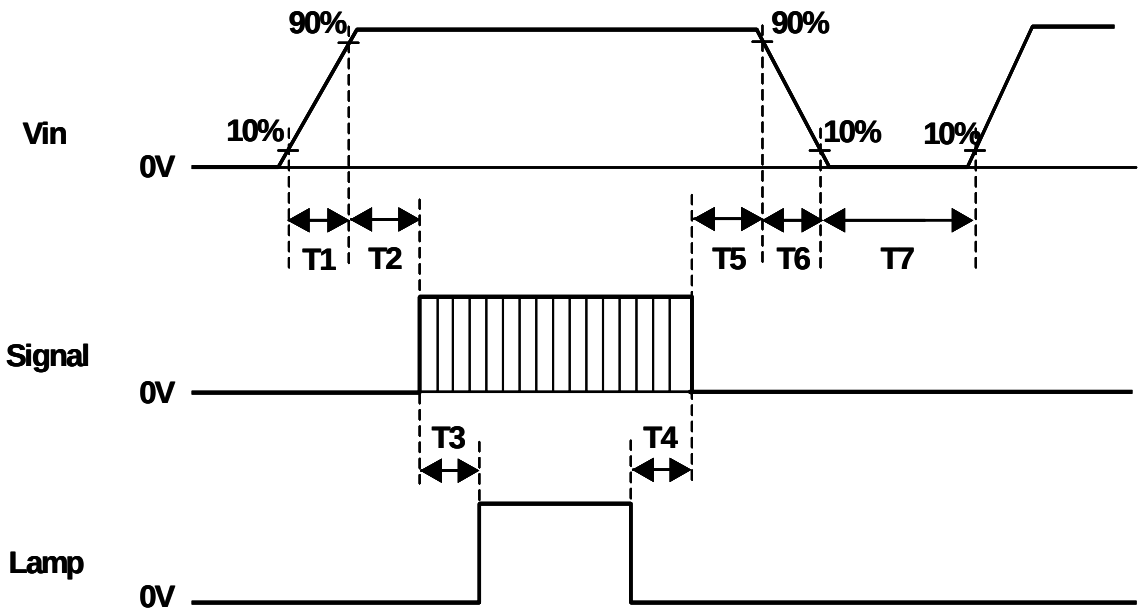
### 6.4.2 Timing diagram



## 6.5 Power ON/OFF Sequence

Vin power and lamp on/off sequence is as follows. Interface signals are also shown in the chart. Signals from any system shall be Hi-Z state or low level when Vin is off.




| Symbol | Values | | | Unit |
|---|---|---|---|---|
| | Min | Typ | Max | |
| T1 | 0.5 | - | 10 | [ms] |
| T2 | 0.5 | 40 | 50 | [ms] |
| T3 | 200 | - | - | [ms] |
| T4 | 200 | - | - | [ms] |
| T5 | 0.5 | 16 | 50 | [ms] |
| T6 | 0.5 | - | 10 | [ms] |
| T7 | 1000 | - | - | [ms] |

## 7.0 Connector & Pin Assignment

Physical interface is described as for the connector on module.
These connectors are capable of accommodating the following signals and will be following components.

## 7.1 TFT LCD Module

| | |
|---|---|
| **Connector Name / Designation** | Interface Connector / Interface card |
| **Manufacturer** | HIROSE or compatible |
| **Type Part Number** | MDF 76KBW-30S-1H(58) |
| **Mating Housing Part Number** | MDF 70G-30P-1SD |

| | |
|---|---|
| **Connector Name / Designation** | Interface Connector / Interface card |
| **Manufacturer** | JAE or compatible |
| **Type Part Number** | FI-XB30SL-HF10 |
| **Mating Housing Part Number** | FI-X30HL-T ( Locked Type )<br>FI-X30S-H ( Unlocked Type ) |

| Pin# | Signal Name | Pin# | Signal Name |
|---|---|---|---|
| 1 | RxOIN0- | 2 | RxOIN0+ |
| 3 | RxOIN1- | 4 | RxOIN1+ |
| 5 | RxOIN2- | 6 | RxOIN2+ |
| 7 | VSS | 8 | RxOCLKIN- |
| 9 | RxOCLKIN+ | 10 | RxOIN3- |
| 11 | RxOIN3+ | 12 | RxEIN0- |
| 13 | RxEIN0+ | 14 | VSS |
| 15 | RxEIN1- | 16 | RxEIN1+ |
| 17 | VSS | 18 | RxEIN2- |
| 19 | RxEIN2+ | 20 | RxECLKIN- |
| 21 | RxECLKIN+ | 22 | RxEIN3- |
| 23 | RxEIN3+ | 24 | VSS |
| 25 | NC | 26 | NC |
| 27 | NC | 28 | VCC |
| 29 | VCC | 30 | VCC |

## 7.2 Backlight Unit

| | |
|---|---|
| **Connector Name / Designation** | Lamp Connector / Backlight lamp |
| **Manufacturer** | JST |
| **Type Part Number** | BHSR-02VS-1 |
| **Mating Type Part Number** | SM02B-BHSS-1-TB |

## 7.3 Signal for Lamp connector

| | Connector No. | Pin No. | Input | Color | Function |
|---|---|---|---|---|---|
| Upper | CN1 | 1 | Hot1 | Pink | High Voltage |
| | | 2 | Cold1 | White | Low Voltage |
| | CN2 | 1 | Hot2 | Pink | High Voltage |
| | | 2 | Cold2 | White | Low Voltage |
| Lower | CN3 | 1 | Hot1 | Pink | High Voltage |
| | | 2 | Cold1 | White | Low Voltage |
| | CN4 | 1 | Hot2 | Pink | High Voltage |
| | | 2 | Cold2 | White | Low Voltage |

# 8.0 Vibration, Shock, and Drop

## 8.1 Vibration & Shock

**Vibration Test Spec:**

- Frequency: 10 - 200Hz
- Sweep: 30 Minutes each Axis (X, Y, Z)
- Acceleration: 1.5G(10~200Hz P- P)
- Test method:

| | |
|---|---|
| **Acceleration (G)** | 1.5 |
| **Frequency (Hz)** | 10~200~10 |
| **Active time (min)** | 30 |

**Shock Test Spec:**

| | |
|---|---|
| **Acceleration (G) –a** | 50 |
| **Active time -b** | 20 ms |
| **Wave form** | Half-sin |
| **Times** | 1 |

- Direction: ±X , ±Y, ±Z

## 8.2 Drop test

Package test: The drop height is 60cm.

# 9.0 Environment

The display module will meet the provision of this specification during operating condition or after storage or shipment condition specified below. Operation at 10% beyond the specified range will not cause physical damage to the unit.

## 9.1 Temperature and Humidity

### 9.1.1 Operating Conditions

The display module operates error free, when operated under the following conditions;

| | |
|---|---|
| Temperature | 0 $^0$C to 50 $^0$C |
| Relative Humidity | 8% to 95% |
| Wet Bulb Temperature | 39.0 $^0$C |

### 9.1.2 Shipping Conditions

The display module operates error free, after the following conditions;

| | |
|---|---|
| Temperature | -20 $^0$C to 60 $^0$C |
| Relative Humidity | 8% to 95% |
| Wet Bulb Temperature | 39.0 $^0$C |

## 9.2 Atmospheric Pressure

The display assembly is capable of being operated without affecting its operations over the pressure range as following specified;

| | Pressure | Note |
|---|---|---|
| Maximum Pressure | 1040hPa | 0m = sea level |
| Minimum Pressure | 674hPa | 3048m = 10.000 feet |

Note : Non-operation attitude limit of this display module = 30,000 feet. = 9145 m.

## 9.3 Thermal Shock

The display module will not sustain damage after being subjected to 100 cycles of rapid temperature change. A cycle of rapid temperature change consists of varying the temperature from -20$^0$C to 60$^0$C, and back again.

**Thermal shock cycle** -20 $^0$C for 30min
60 $^0$C for 30min

Power is not applied during the test. After temperature cycling, the unit is placed in normal room ambient for at least 4 hours before powering on.

# 10.0 Reliability

This display module and the packaging of that will comply following standards.

## 10.1 Failure Criteria

The display assembly will be considered as failing unit when it no longer meets any of the requirements stated in this specification. Only as for maximum white luminance, following criteria is applicable.

- **Maximum white Luminance shall be 125cd/m$^2$ or more.**

## 10.2 Failure Rate

The average failure rate of the display module (from first power-on cycle till 1,000 hours later) will not exceed 1.0%. The average failure rate of the display module from 1,000 hours until 16,000 hours will not exceed 0.7% per 1000 hours.

### 10.2.1 Usage

The assumed usage for the above criteria is:

- 220 power-on hours per month
- 500 power on/off cycles per month
- Maximum brightness setting
- Operation to be within office environment (25$^0$C typical)

### 10.2.1 Component De-rating

All the components used in this device will be checked the load condition to meet the failure rate criteria.

## 10.3 On/OFF Cycle

The display module will be capable of being operated over the following ON/OFF Cycles.

| ON/OFF | Value | Cycles |
|---|---|---|
| +Vin and CCFL power | 30,000 | 10 seconds on / 10 seconds off |

# 11.0 Safety

## 11.1 Sharp Edge Requirements

There will be no sharp edges or comers on the display assembly that could cause injury.

## 11.2 Materials

### 11.2.1 Toxicity

There will be no carcinogenic materials used anywhere in the display module. If toxic materials are used, they will be reviewed and approved by the responsible ADT Toxicologist.

### 11.2.2 Flammability

All components including electrical components that do not meet the flammability grade UL94-V1 in the module will complete the flammability rating exception approval process.

The printed circuit board will be made from material rated 94-V1 or better. The actual UL flammability rating will be printed on the printed circuit board.

## 11.3 Capacitors

If any polarized capacitors are used in the display assembly, provisions will be made to keep them from being inserted backwards.

# 12.0 Other requirement

## 12.1 National Test Lab Requirement

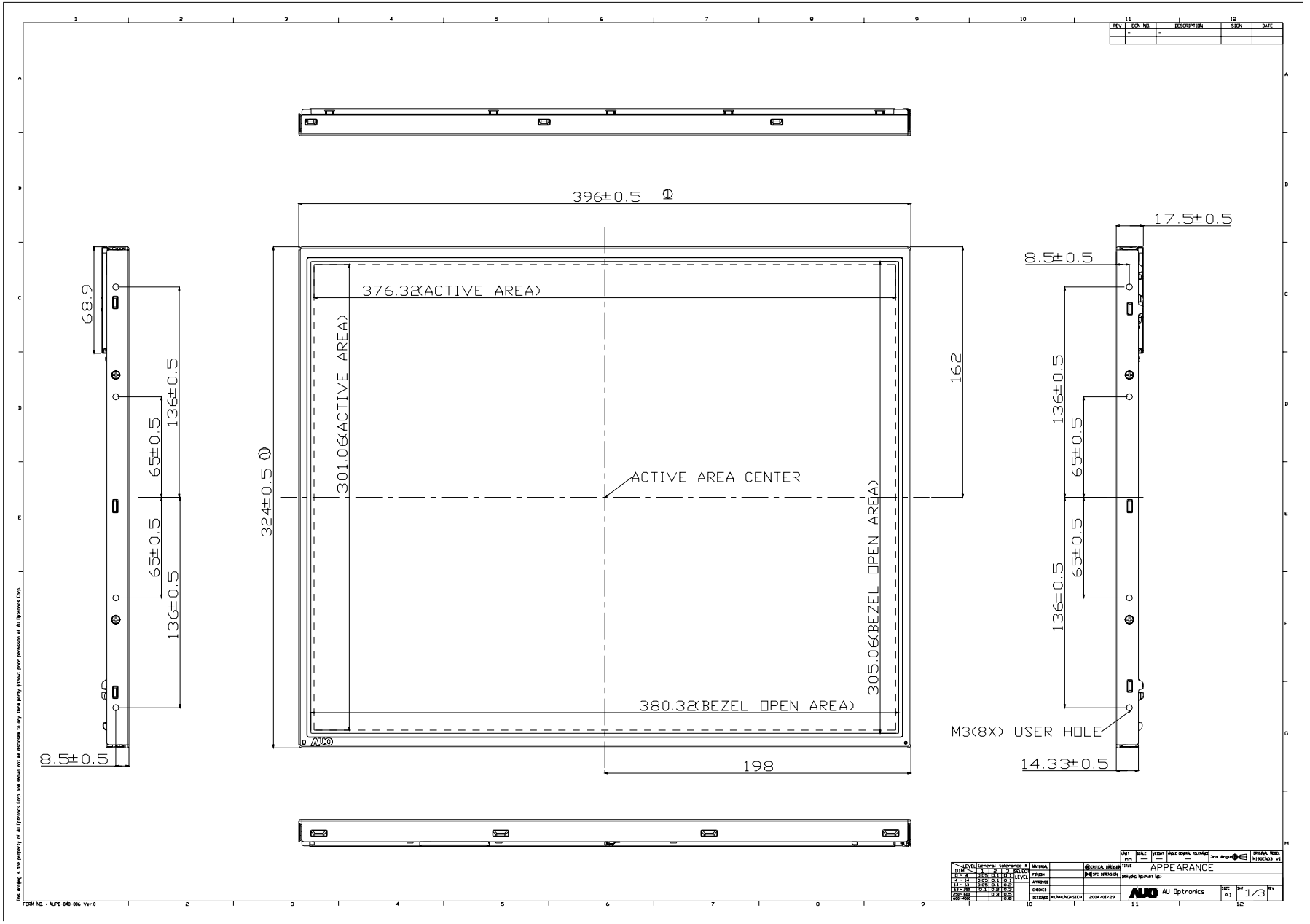
The display module will satisfy all requirements for compliance to

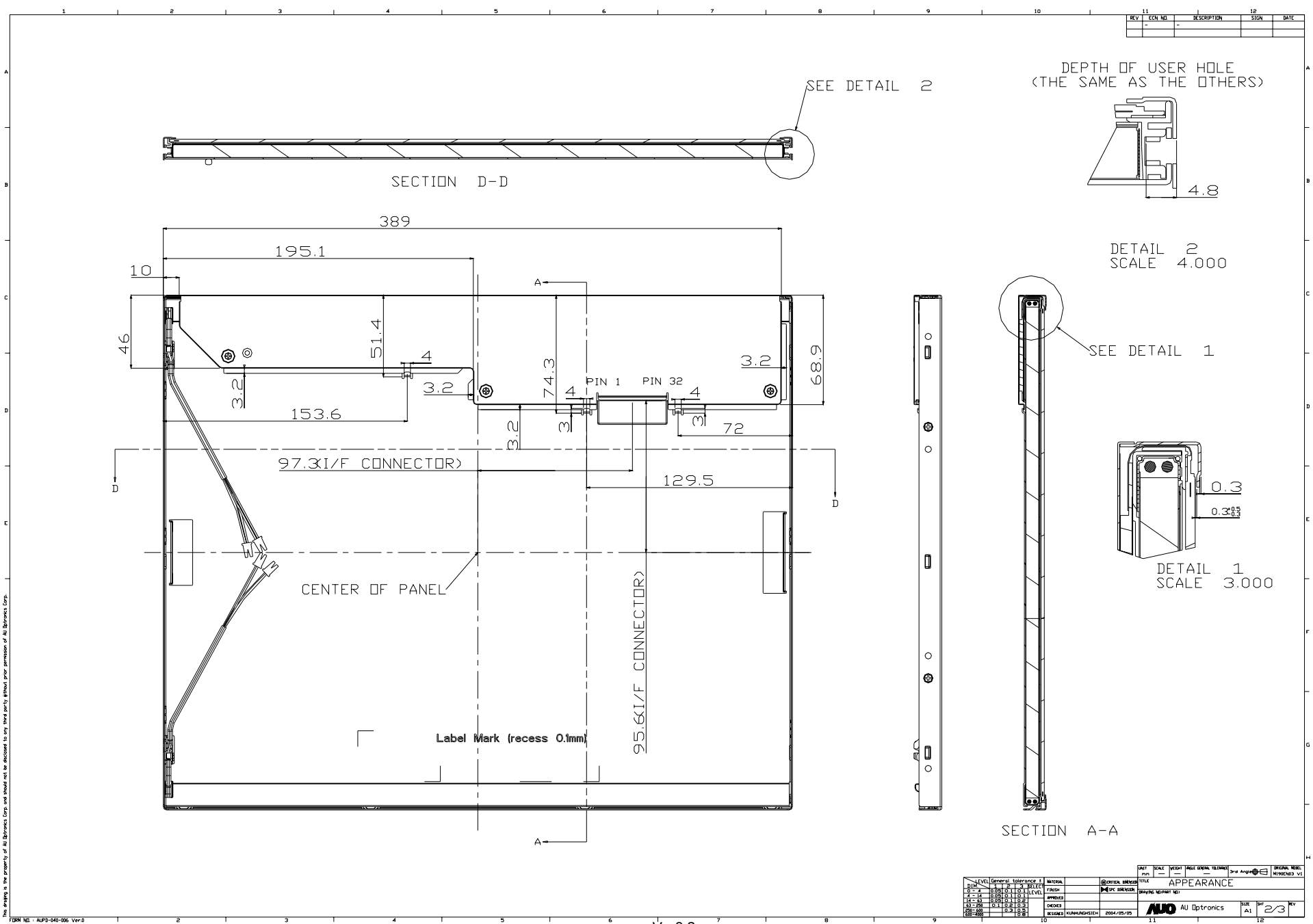
| | |
|---|---|
| **UL 1950, First Edition** | U.S.A. Information Technology Equipment |
| **CSA C22.2 No.950-M89** | Canada, Information Technology Equipment |
| **EEC 950** | International, Information Technology Equipment |
| **EN 60 950** | International, Information Processing Equipment (European Norm for IEC950) |

## 12.2 Label

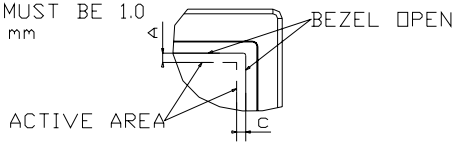
## The label is on the panel as shown below:

## 13.0 Mechanical Characteristics



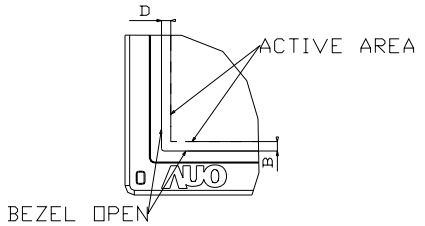


NOTE:
1.PRELIMINARY DRAWING FOR REFERENCE ONLY.
2.THE DIMENSION EXCULDES DEFORMATION.
3.MODULE THICKNESS SHOULD BE 18mm MAX.
4.TOLERENCE WITHOUT NOTICED TO BE±0.5mm.
5.LAMP CABLE CONNECTOR TO BE JST BHSR-02VS-1
6.I/F CONNECTOR TO BE JAE FI-XB30SL-HF10.
7.M3 USER HOLE SCREW TORQUE 4.0kg-cm MAX.
8.USER HOLE SCREW PENETRATION 4.5mm MAX.
9.DIMENSION TOLERENCE,ABSOLUTE VALUES OF A-B AND C-D MAX MUST BE 1.0
10.CABLE LENGTH FROM CONSTRAIN TO FREE END MUST BE 130±10 mm
TOTAL CABLE LENGTH MUST BE 150±10 mm

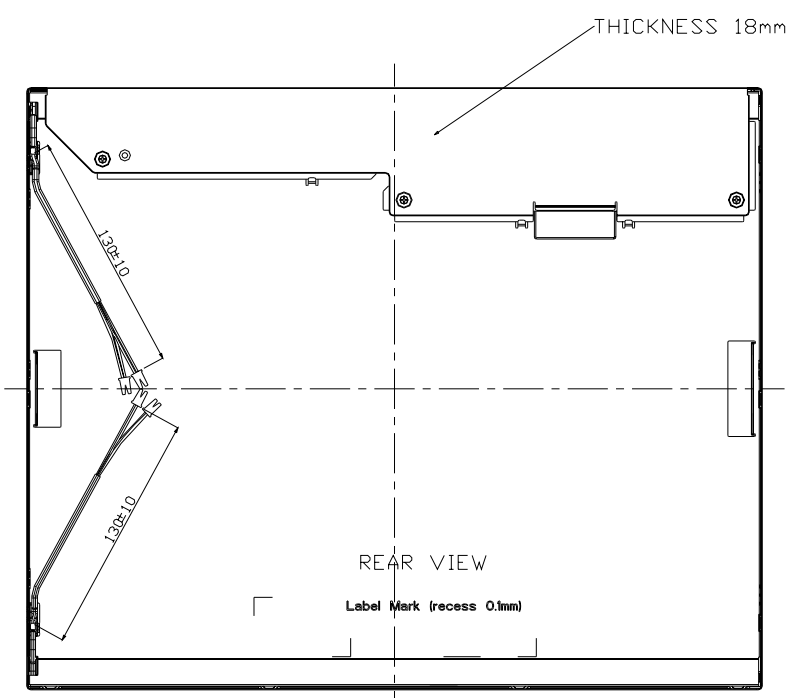



DETAIL A
SCALE 2.000

CHECK NOTE 9

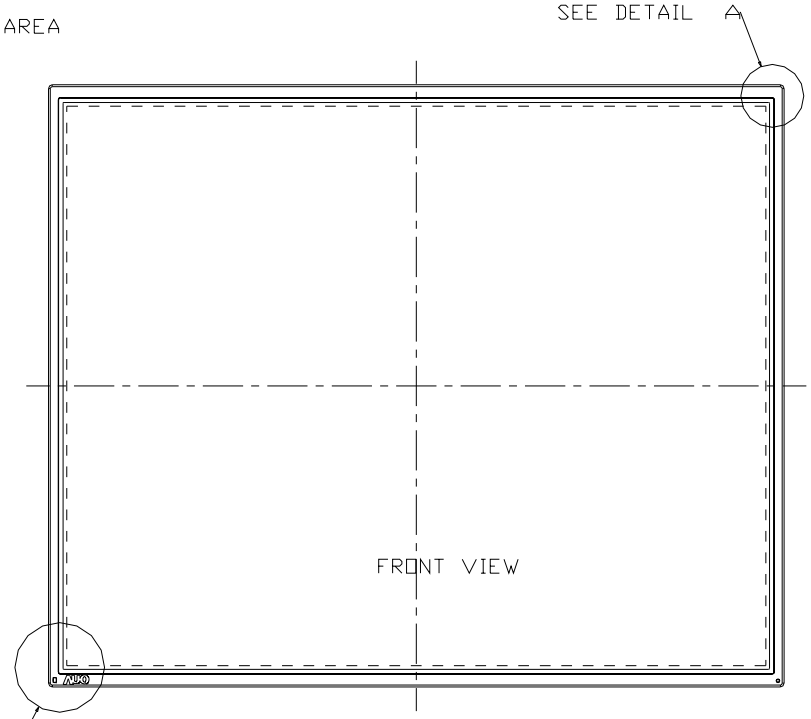



DETAIL B
SCALE 2.000




REAR VIEW

SCALE 0.800




FRONT VIEW

SCALE 0.800

| REV | ECN NO. | DESCRIPTION | SIGN | DATE |
|---|---|---|---|---|
| | - | - | | |

| UNIT | SCALE | WEIGHT | ANGLE GENERAL TOLERANCE | ORIGINAL MODEL |
|---|---|---|---|---|
| mm | - | - | - | M190EN03 V1 |

| MATERIAL | CRITICAL DIMENSION |
|---|---|
| FINISH | SPC DIMENSION |
| APPROVED | |
| CHECKED | |
| DESIGNED | KUNHUANGHSIEH 2004/05/05 |

TITLE: APPEARENCE
DRAWING NO(PART NO.)
AU Optronics
SIZE A1 SHT 3/3 REV

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