TENTATIVE

| No. | rev.01 |
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SHARP

# TECHNICAL LITERATURE

# FOR

# TFT-LCD module

MODEL No. LQ695D1VG01

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So, please contact SHARP or its representative before designing your product based on this literature.

DEVELOPMENT DEPARTMENT 4
DISPLAY DEVICE UNIT 3
DISPLAY DEVICE BUSINESS DIVISION 1
SHARP CORPORATION

## 1. Application

This technical literature applies to the color 69.5 inch TFT-LCD module.



* In case of using the device for applications such as control and safety equipment for transportation (aircraft, trains, automobiles, etc.), rescue and security equipment and various safety related equipment which require higher reliability and safety, take into consideration that appropriate measures such as fail-safe functions and redundant system design should be taken.

* Do not use the device for equipment that requires an extreme level of reliability, such as aerospace applications, telecommunication equipment (trunk lines), nuclear power control equipment and medical or other equipment for life support.

* SHARP assumes no responsibility for any damage resulting from the use of the device that does not comply with the instructions and the precautions specified in this technical literature.

* Contact and consult with a SHARP sales representative for any questions about this device.

## 2. Overview

This module is color active matrix LCD Open Cell incorporating amorphous silicon TFT (Thin Film Transistor). It is composed of a color TFT-LCD panel, driver ICs, control circuit, LED driver circuit, and edge-light LED system etc.

Graphics and texts can be displayed on a 3840×RGB×2160 dots panel with one billion colors by using 10bit V-By-One to interface, +12V of DC supply voltages.

And in order to improve the response time of LCD, this module applies the Over Shoot driving (O/S driving) technology for the control circuit. In the O/S driving technology, signals are being applied to the Liquid Crystal according to a pre-fixed process as an image signal of the present frame when a difference is found between image signal of the previous frame and that of the current frame after comparing them.

With combination of these technologies, motion blur can be reduced and clearer display performance can be realized.

## 3. Mechanical Specifications

| Parameter | Specifications | Unit |
|---|---|---|
| Display size<br>(Active area) | 1538.88 (H) x865.62 (V) | mm |
| | 176.563 (Diagonal) [69.513] | cm |
| Pixel Format | 3840(H) x 2160(V)<br>(1pixel = R + G + B dot) | pixel |
| Pixel pitch | 0.401 (H) x 0.401 (V) | mm |
| Pixel configuration | R, G, B vertical stripe | |
| Display mode | Normally black | |
| Outline Dimensions<br>[Note1] | (1559.4 (H) x 893.0 (V) x 27.5(D)) | mm |
| Mass | T.B.D. | kg |
| Surface treatment<br>[Note2] | Low Haze Anti Glare<br>Hard coating: 2H and more | |

[Note1] Outline dimensions are shown in figure “MODULE OUTLINE DIMENSION”

# 4. Input Terminals

## 4.1. Driving interface of C-PWB

CN1 (Interface signals and +12V DC power supply)

Using connector : FI-RNE51SZ-HF (Japan Aviation Electronics Ind., Ltd.)

Matching connector : FI-RE51HL , FI-RE51CL (Japan Aviation Electronics Ind., Ltd.)

Mating V-by-One® HS Transmitter : THCV215 (THine)

| Pin No. | Symbol | Function | Remark |
|---|---|---|---|
| 1 | VCC | +12V Power Supply | |
| 2 | VCC | +12V Power Supply | |
| 3 | VCC | +12V Power Supply | |
| 4 | VCC | +12V Power Supply | |
| 5 | VCC | +12V Power Supply | |
| 6 | VCC | +12V Power Supply | |
| 7 | VCC | +12V Power Supply | |
| 8 | VCC | +12V Power Supply | |
| 9 | NC | | |
| 10 | NC | | |
| 11 | GND | | |
| 12 | GND | | |
| 13 | GND | | |
| 14 | GND | | |
| 15 | NC | | |
| 16 | NC | | |
| 17 | NC | | |
| 18 | NC | | |
| 19 | NC | | |
| 20 | NC | | |
| 21 | NC | | |
| 22 | NC | | |
| 23 | NC | | |
| 24 | GND | | |
| 25 | VB1_HTPDN | Hot plug detect | Output(Open Drain)<br>[Note1] |
| 26 | VB1_LOCKN | Lock Detect<br>L:Lock / H:Unlock | Output(Open Drain)<br>[Note1] |
| 27 | GND | | |
| 28 | VB1_0_TX- | V-by-One HS Data Lane0 | |
| 29 | VB1_0_TX+ | V-by-One HS Data Lane0 | |
| 30 | GND | | |
| 31 | VB1_1_TX- | V-by-One HS Data Lane1 | |
| 32 | VB1_1_TX+ | V-by-One HS Data Lane1 | |
| 33 | GND | | |
| 34 | VB1_2_TX- | V-by-One HS Data Lane2 | |
| 35 | VB1_2_TX+ | V-by-One HS Data Lane2 | |
| 36 | GND | | |
| 37 | VB1_3_TX- | V-by-One HS Data Lane3 | |
| 38 | VB1_3_TX+ | V-by-One HS Data Lane3 | |
| 39 | GND | | |
| 40 | VB1_4_TX- | V-by-One HS Data Lane4 | |
| 41 | VB1_4_TX+ | V-by-One HS Data Lane4 | |
| 42 | GND | | |
| 43 | VB1_5_TX- | V-by-One HS Data Lane5 | |
| 44 | VB1_5_TX+ | V-by-One HS Data Lane5 | |
| 45 | GND | | |
| 46 | VB1_6_TX- | V-by-One HS Data Lane6 | |
| 47 | VB1_6_TX+ | V-by-One HS Data Lane6 | |
| 48 | GND | | |
| 49 | VB1_7_TX- | V-by-One HS Data Lane7 | |
| 50 | VB1_7_TX+ | V-by-One HS Data Lane7 | |
| 51 | GND | | |

[note] GND of a liquid crystal panel drive part has connected with a module chassis.

CN2 (Interface signals )

Using connector : FI-RNE41SZ-HF (Japan Aviation Electronics Ind., Ltd.)

Matching connector : FI-RE41HL , FI-RE41CL (Japan Aviation Electronics Ind., Ltd.)

Matching V-by-One® HS transmitter: THCV215 (THine)

| Pin No. | Symbol | Function | Remark |
|---|---|---|---|
| 1 | GND | | |
| 2 | VB1_8_TX- | V-by-One HS Data Lane8 | |
| 3 | VB1_8_TX+ | V-by-One HS Data Lane8 | |
| 4 | GND | | |
| 5 | VB1_9_TX- | V-by-One HS Data Lane9 | |
| 6 | VB1_9_TX+ | V-by-One HS Data Lane9 | |
| 7 | GND | | |
| 8 | VB1_10_TX- | V-by-One HS Data Lane10 | |
| 9 | VB1_10_TX+ | V-by-One HS Data Lane10 | |
| 10 | GND | | |
| 11 | VB1_11_TX- | V-by-One HS Data Lane11 | |
| 12 | VB1_11_TX+ | V-by-One HS Data Lane11 | |
| 13 | GND | | |
| 14 | VB1_12_TX- | V-by-One HS Data Lane12 | |
| 15 | VB1_12_TX+ | V-by-One HS Data Lane12 | |
| 16 | GND | | |
| 17 | VB1_13_TX- | V-by-One HS Data Lane13 | |
| 18 | VB1_13_TX+ | V-by-One HS Data Lane13 | |
| 19 | GND | | |
| 20 | VB1_14_TX- | V-by-One HS Data Lane14 | |
| 21 | VB1_14_TX+ | V-by-One HS Data Lane14 | |
| 22 | GND | | |
| 23 | VB1_15_TX- | V-by-One HS Data Lane15 | |
| 24 | VB1_15_TX+ | V-by-One HS Data Lane15 | |
| 25 | GND | | |
| 26 | NC | | |
| 27 | NC | | |
| 28 | NC | | |
| 29 | NC | | |
| 30 | NC | | |
| 31 | NC | | |
| 32 | NC | | |
| 33 | NC | | |
| 34 | NC | | |
| 35 | NC | | |
| 36 | NC | | |
| 37 | NC | | |
| 38 | NC | | |
| 39 | NC | | |
| 40 | NC | | |
| 41 | NC | | |

[note] GND of a liquid crystal panel drive part has connected with a module chassis.

CN3 (Interface signals)

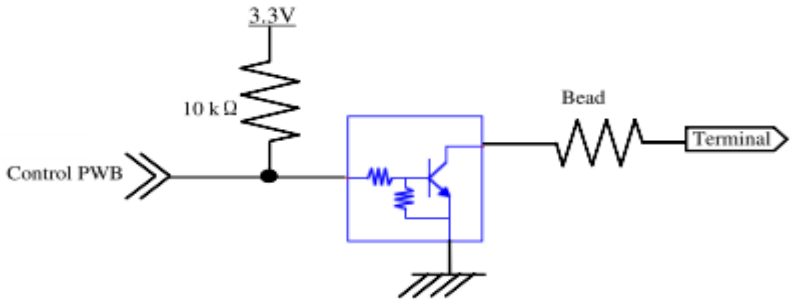
Using connector : A2008WR0-8PS (JWT)

| Pin No. | Symbol | Function | Remark |
|---|---|---|---|
| 1 | VCC | +12V Power Supply | |
| 2 | VCC | +12V Power Supply | |
| 3 | GND | | |
| 4 | - | | |
| 5 | - | | |
| 6 | - | | |
| 7 | - | | |
| 8 | GND | | |

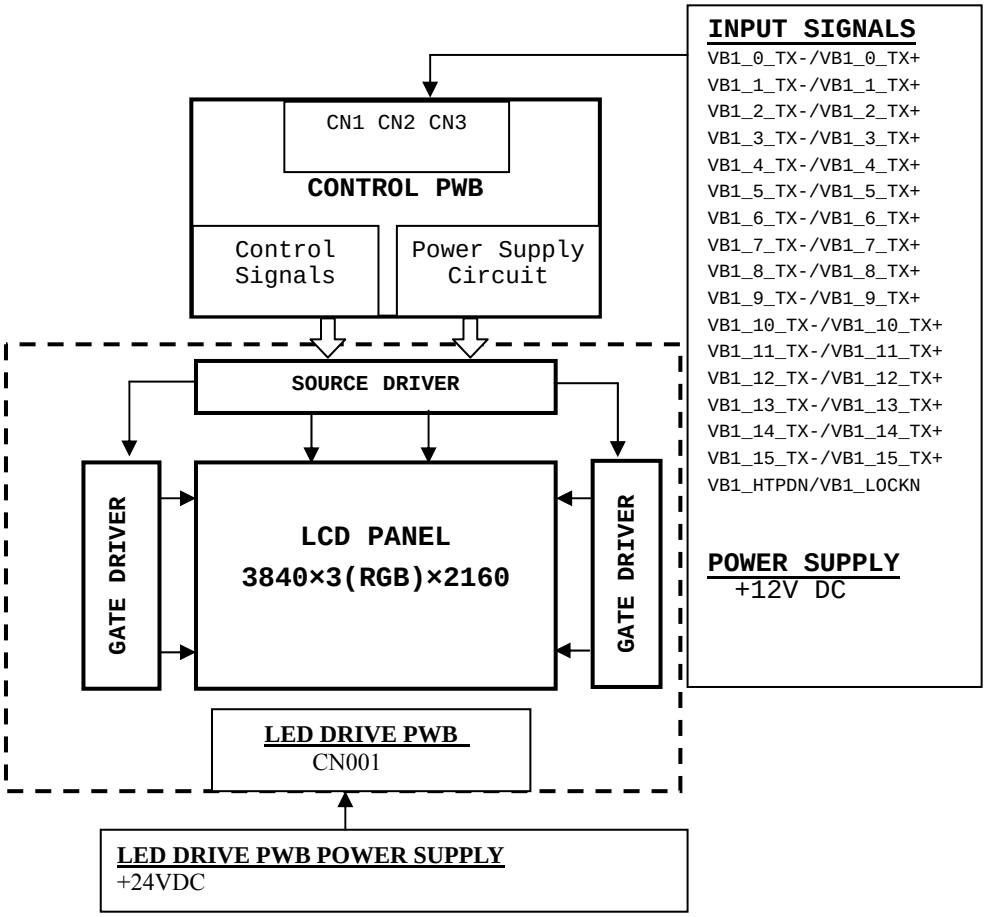
V-by-One® HS color data mapping

| | | | | | |
|---|---|---|---|---|---|
| Byte0 | D[0] | R2 | Byte2 | D[16] | B2 |
| | D[1] | R3 | | D[17] | B3 |
| | D[2] | R4 | | D[18] | B4 |
| | D[3] | R5 | | D[19] | B5 |
| | D[4] | R6 | | D[20] | B6 |
| | D[5] | R7 | | D[21] | B7 |
| | D[6] | R8 | | D[22] | B8 |
| | D[7] | R9(MSB) | | D[23] | B9(MSB) |
| Byte1 | D[8] | G2 | Byte3 | D[24] | - |
| | D[9] | G3 | | D[25] | - |
| | D[10] | G4 | | D[26] | B0(LSB) |
| | D[11] | G5 | | D[27] | B1 |
| | D[12] | G6 | | D[28] | G0(LSB) |
| | D[13] | G7 | | D[29] | G1 |
| | D[14] | G8 | | D[30] | R0(LSB) |
| | D[15] | G9(MSB) | | D[31] | R1 |

[Note 1]The equivalent circuit figure of the terminal forVB1_ HTPDN and VB1_LOCKN




4.2.Interface block diagram



4.3. Backlight driving

CN001 (+24VDC power supply and control signal)
Using connector : 2022WR-14B1(YEONHO) ⊿01
Mating connector : 2022HS-14B1(YEONHO) ⊿01 or equivalent connector.

| Pin No. ⊿ 01 | Symbol | I/O | Function | Remark |
|---|---|---|---|---|
| 1 | VLED | In | +24V | |
| 2 | VLED | In | +24V | |
| 3 | VLED | In | +24V | |
| 4 | VLED | In | +24V | |
| 5 | VLED | In | +24V | |
| 6 | GND | In | GND | |
| 7 | GND | In | GND | |
| 8 | GND | In | GND | |
| 9 | GND | In | GND | |
| 10 | GND | In | GND | |
| 11 | Error_out | Out | Error Detection | [Note 1] |
| 12 | Von/off | In | LED driver On/Off | [Note 2] |
| 13 | NC | - | -- | - |
| 14 | EX_DIM | In | Brightness Control(PWM 1 ~ 100%) | [Note 3] Pulse Dimming |

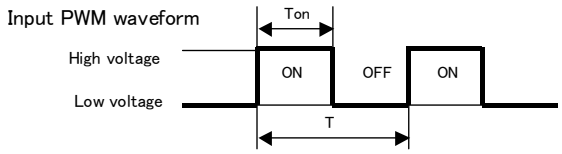
[Note 1] Error Detection

| | MIN | TYP | MAX |
|---|---|---|---|
| Normal | - | - | 0.8V |
| Abnormal | Open Collector | | |

[Note 2] LED driver ON/OFF

| Input voltage | Symbol | Voltage | Function |
|---|---|---|---|
| High voltage | $V_{ON}$ | 2.4 ~ 3.6 V | LED driver : On |
| Low voltage | $V_{OFF}$ | -0.3 ~ 0.8 V | LED driver : Off |

[Note 3] Pulse Dimming
Pin No.__ “EX_DIM” is used for the pulse dimming control by the PWM duty with input pulse.

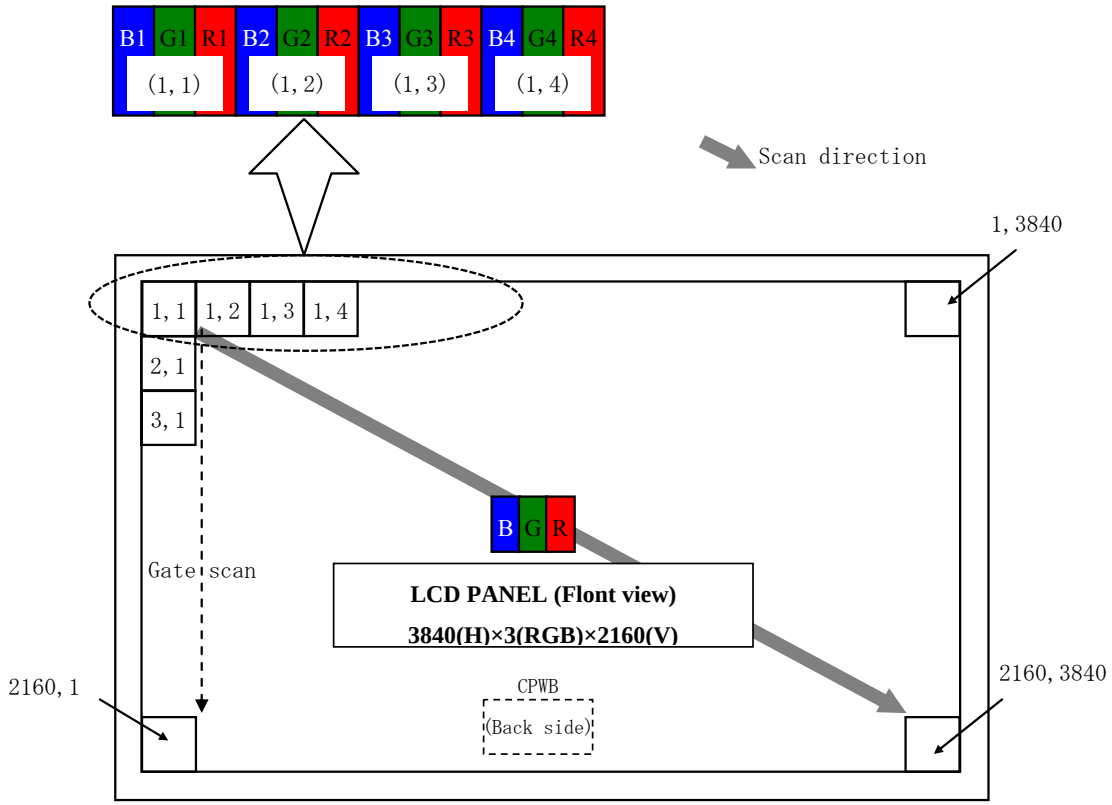



High voltage: 2.4 ~ 3.6 V
Low voltage: 0 ~ 0.8 V

| | | MIN | TYP | MAX | Remark |
|---|---|---|---|---|---|
| Pulse signal | [Hz] | 240 | - | T.B.D. | |
| DUTY(Ton/T) | [%] | 1 | - | 100 | Ta=25°C |
| Dimming level (luminance ratio) | [%] | - | - | 100 | Ta=25°C |

4.4. Display direction & PWB layout

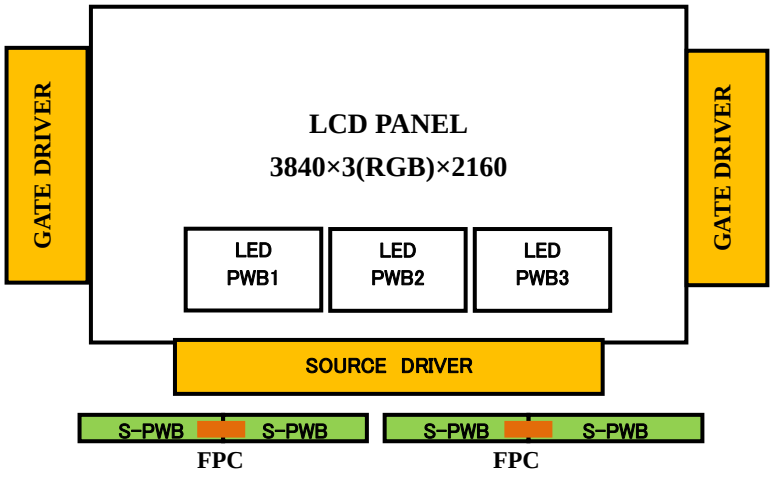
In this module each subpixel R, G, B is aligned as follows. Four S-PWBs and three LED-PWBs are layout at the bottom side of the screen.




**LCD subpixel alignment**

[Note] PWB layout

Four S-PWBs and three LED-PWBs are layout at the bottom side of the screen.




**Layout of LED-PWB, S-PWB (Front View)**

## 5. Absolute maximum ratings

| Parameter | Symbol | Condition | Ratings | Unit | Remark |
|---|---|---|---|---|---|
| 12V supply voltage (for Control PWB) | Vcc | Ta=25 °C | 0 ~ + 14 | V | |
| 24V supply voltage (for LED Driver) | $V_{LED}$ | Ta=25 °C | 0 ~ +29.0 | V | |
| Input voltage (for LED Driver) | $V_{on}$ /$V_{off}$ | Ta=25 °C | -0.3 ~ +5.25 | V | [Note 1] |
| | EX_DIM | Ta=25 °C | -0.3 ~ +5.25 | V | [Note 1] |
| Storage temperature | Tstg | - | -25 ~ +60 | °C | [Note 2] |
| Operation temperature (Ambient) | Topa | - | 0 ~ +50 | °C | |

[Note 1] Von/off, EX_DIM in CN001.

[Note 2] Humidity 95%RH Max.(Ta≦40°C)

Maximum wet-bulb temperature at 39 °C or less.(Ta>40°C)

No condensation.

## 6. Electrical characteristics of input signals

### 6.1. Control circuit driving

◿01 Ta=25°C

| Parameter | | Symbol | Min. | Typ. | Max. | Unit | Remark |
|---|---|---|---|---|---|---|---|
| +12V supply voltage | Supply voltage | Vcc | 11.4 | 12.0 | 12.6 | V | [Note1] |
| | Current dissipation | Icc | - | (1.7) | TBD | A | [Note2] |
| | Inrush current | $I_{RUSH}1$ | - | TBD | - | A | t1=500us [Note5] |
| | | $I_{RUSH}2$ | - | TBD | - | A | t1>5ms |
| Permissible input ripple voltage | | $V_{RP}$ | - | - | 100 | $mV_{P-P}$ | Vcc = +12V |
| Differential Input High threshold | | VRTH | | | 50 | mV | |
| Differential Input Low threshold | | VRTL | -50 | | | mV | |
| Unit Interval | | UI | 266 | | 1667 | ps | [Note4] |
| Differential Input Allowable Intra-pair Skew | | tRISK_Intra | 0.3 | | | UI | [Note3] |
| Differential Input Allowable Intra-pair Skew | | tRISK_Inter | 5 | | | UI | [Note3] |

[Note1]

Input voltage sequences

50us < t1 < 20ms

20ms < t2

0 < t3<1s

1s < t4

0 < t5

1s < t6

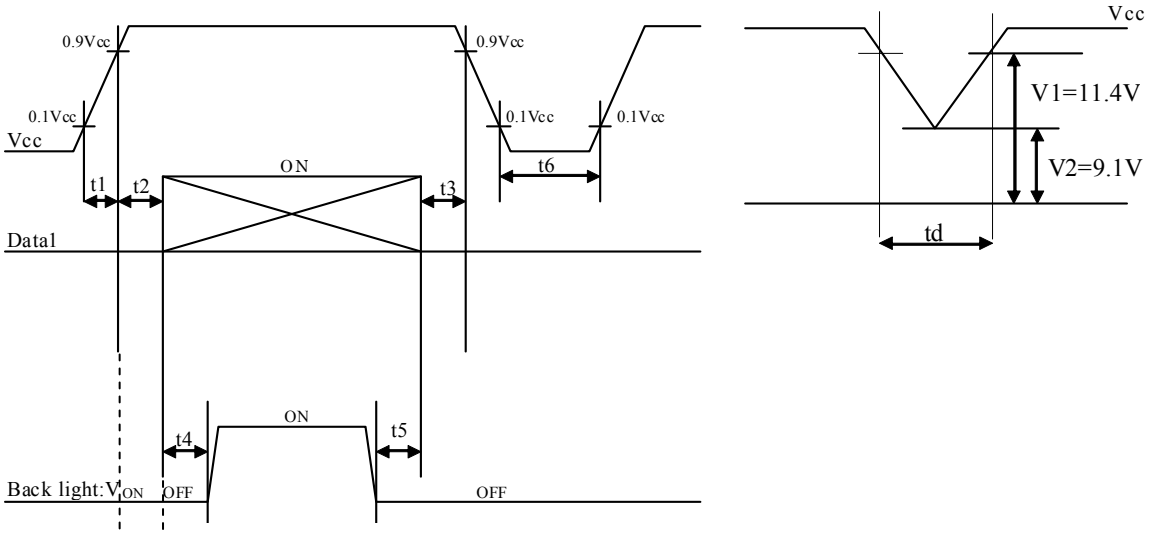
Dip conditions for supply voltage

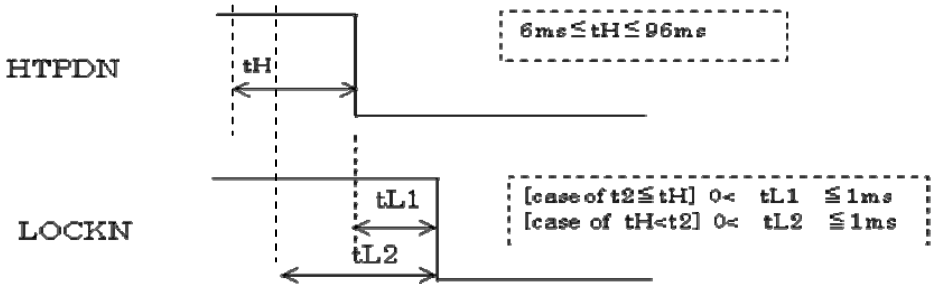
a) V2 ≦ Vcc < V1

td < 10ms

b) Vcc < V2

This case is based on input voltage sequences.



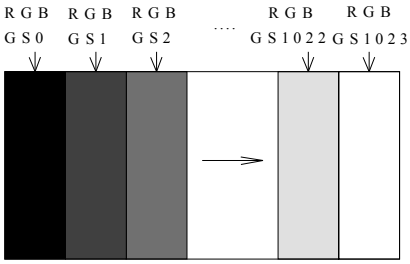




*Data1: V-by-One differential Data

[Note] About the relation between data input and back light lighting, please base on the above-mentioned input sequence. When back light is switched on before panel operation or after a panel operation stop, it may not display normally. But this phenomenon is not based on change of an incoming signal, and does not give damage to a liquid crystal display.

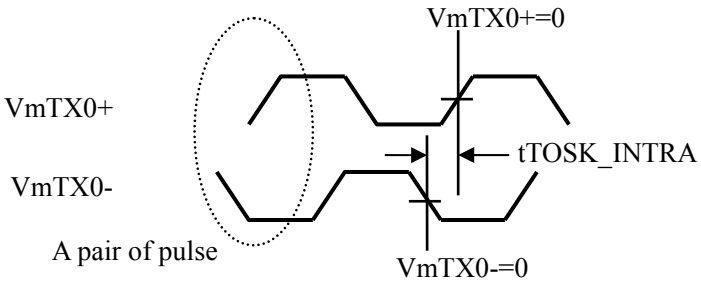
[Note2] Typical current situation: 1024 gray-bar patterns. (Vcc = +12V)

The explanation of RGB gray scale is seen in section 8. ⊿01

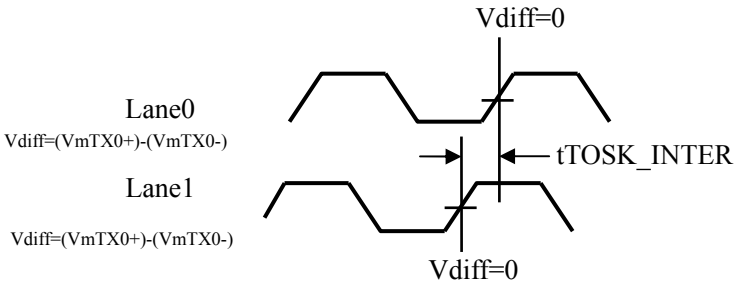



Vcc = +12V
1/Tc = 74.25MHz
TH = 3.705μs
TV = 120Hz

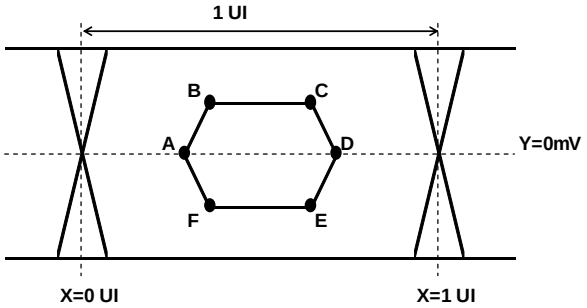
[Note 3] Differential input Allowable Intra-pair Skew




Differential input Allowable Inter-pair Skew




[Note 4] Eye diagram (Eye mask)




| | X[UI] | Y[mV] |
|---|---|---|
| A | 0.25 | 0 |
| B | 0.3 | 50 |
| C | 0.7 | 50 |
| D | 0.75 | 0 |
| E | 0.7 | −50 |
| F | 0.3 | −50 |

[Note5] Vcc12V inrush current waveform

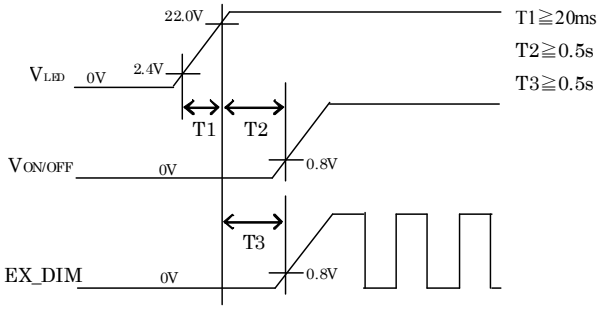
TBD

6.2 . LED driving for Back Light

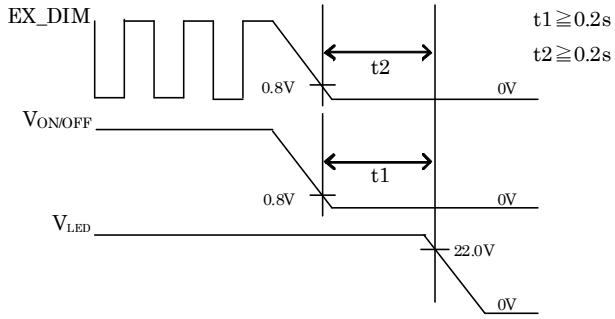
◢ 01 Ta=25°C

| Parameter | | Symbol | Min. | Typ. | Max. | Unit | Remark |
|---|---|---|---|---|---|---|---|
| +24V supply voltage | Current dissipation | $I_{LED}$ | - | (7.0) | T.B.D. | A | $V_{LED}$ = 24V, Ta=25°C DUTY =100% [Note 1] |
| | Irush current | $I_{RUSH}$ | - | T.B.D. | T.B.D. | A | |
| | Supply voltage | $V_{LED}$ | 21.6 | 24.0 | 26.4 | V | 24V±10% |
| Permissible input ripple voltage | | $V_{RP}$ | - | - | 1 | $V_{P-P}$ | $V_{LED}$= + 24.0V |
| Input voltage (On) | | $V_{ON}$ | 2.4 | 3.3 | 3.6 | V | $V_{ON/OFF}$ |
| Input voltage (Off) | | $V_{OFF}$ | -0.3 | - | 0.8 | V | |
| Input voltage (EX_DIM high) | | EX_DIM H | 2.4 | 3.3 | 3.6 | V | EX_DIM |
| Input voltage (EX_DIM Low) | | EX_DIM L | -0.3 | 0 | 0.8 | V | |

[Note 1] 1) $V_{LED}$-turn-on condition




2) $V_{LED}$-turn-off condition




6.3 LED lifetime

LED light system is bottom-side-edge type. The characteristics of the LED are shown in the following table. The value mentioned below is at the case of one LED.

| Item | Symbol | Min. | Typ. | Max. | Unit | Remarks |
|---|---|---|---|---|---|---|
| Life time | $T_{LED}$ | - | 50,000 | - | Hour | [Note] |

[Note]

LED life time is defined as the time when brightness becomes 50% of the original value in the continuous operation under the condition of Ta = 25°C

[Operation condition]

- ambient temperature Ta=25°C

## 7. Timing characteristics of input signals

Timing diagrams of input signal are shown in below figure.

| Parameter | | Symbol | Min. | Typ. | Max. | Unit | Remark |
|---|---|---|---|---|---|---|---|
| Clock | Frequency | 1/Tc | 69.0 | 74.25 | 75.0 | MHz | |
| Data enable signal | Horizontal period | TH | 265 | 275 | 351 | clock | |
| | | | 3.53 | 3.7 | - | µs | |
| | Horizontal period (High) | THd | 240 | 240 | 240 | clock | |
| | Vertical period | TV | 2240 | 2250 | 2872 | line | |
| | | | 94 | 120 | 120.6 | Hz | |
| | Vertical period (High) | TVd | 2160 | 2160 | 2160 | line | |

[Note]

- When vertical period is very long, flicker and etc. may occur.
- Please turn off the module after it shows the black screen.
- Please make sure that length of vertical period should become of an integral multiple of horizontal length of period. Otherwise, the screen may not display properly.
- As for your final setting of driving timing, we will conduct operation check test at our side, please inform your final setting.

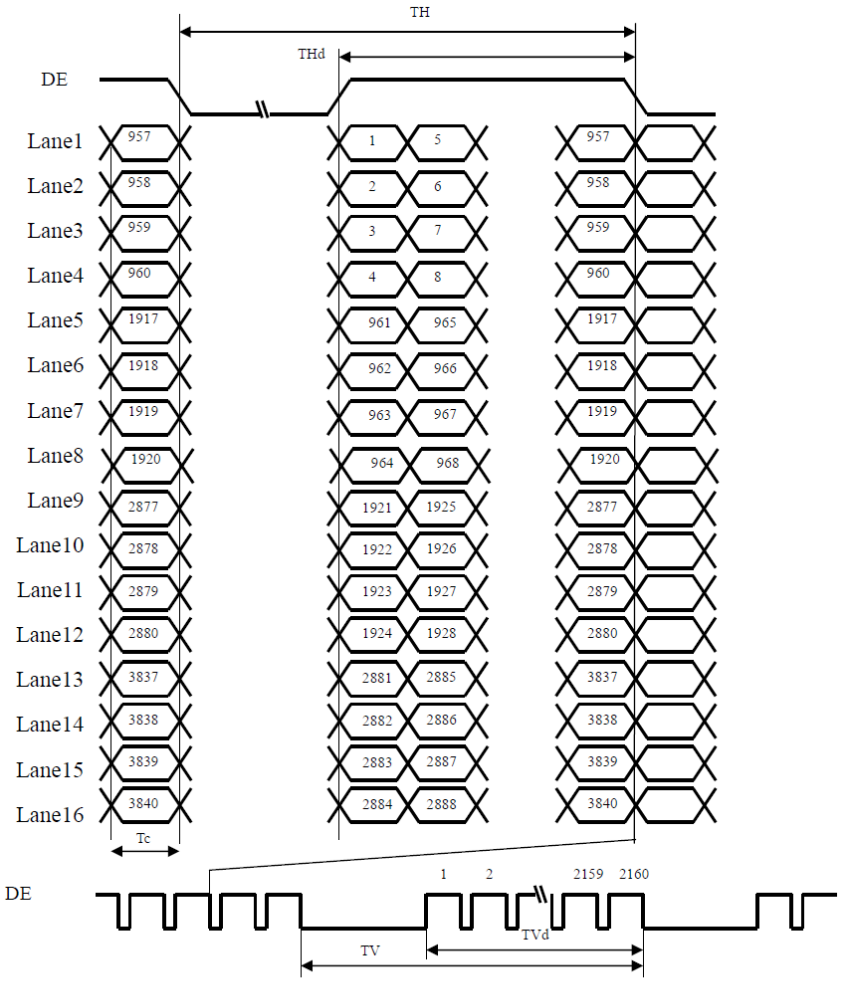



Figure: Timing characteristics of input signal

## 8. Input signal, basic display colors and gray scale of each color

| | Colors & Gray scale | Gray Scale | Data signal | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | R0 | R1 | R2 | R3 | R4 | R5 | R6 | R7 | R8 | R9 | G0 | G1 | G2 | G3 | G4 | G5 | G6 | G7 | G8 | G9 | B0 | B1 | B2 | B3 | B4 | B5 | B6 | B7 | B8 | B9 |
| Basic Color | Black | – | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Blue | – | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Green | – | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Cyan | – | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Red | – | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Magenta | – | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Yellow | – | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | White | – | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Gray Scale of Red | Black | GS0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | ⇧ | GS1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Darker | GS2 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | ⇧ | ↓ | | | | | ↓ | | | | | | | | | | ↓ | | | | | | | | | | ↓ | | | | | |
| | ⇩ | ↓ | | | | | ↓ | | | | | | | | | | ↓ | | | | | | | | | | ↓ | | | | | |
| | Brighter | GS1021 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | ⇩ | GS1022 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Red | GS1023 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Gray Scale of Green | Black | GS0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | ⇧ | GS1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Darker | GS2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | ⇧ | ↓ | | | | | ↓ | | | | | | | | | | ↓ | | | | | | | | | | ↓ | | | | | |
| | ⇩ | ↓ | | | | | ↓ | | | | | | | | | | ↓ | | | | | | | | | | ↓ | | | | | |
| | Brighter | GS1021 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | ⇩ | GS1022 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Green | GS1023 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Gray Scale of Blue | Black | GS0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | ⇧ | GS1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Darker | GS2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | ⇩ | ↓ | | | | | ↓ | | | | | | | | | | ↓ | | | | | | | | | | ↓ | | | | | |
| | ⇩ | ↓ | | | | | ↓ | | | | | | | | | | ↓ | | | | | | | | | | ↓ | | | | | |
| | Brighter | GS1021 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | ⇩ | GS1022 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Blue | GS1023 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

- 0: Low level voltage / 1: High level voltage
- Each basic color can be displayed in 1024 gray scales from 10 bits data signals. According to the combination of total 30 bits data signals, one billion-color display can be achieved on the screen.

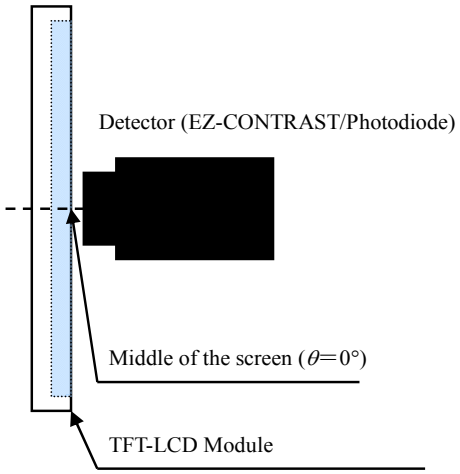
## 9. Optical characteristics

Ta=25°C, Vcc=12V, $V_{INV}$=24.0V, $V_{BRT}$=100%, Timing: 120Hz (typ. value)

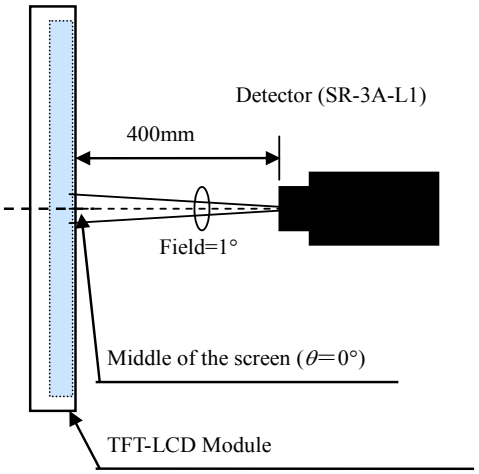
| Parameter | | Symbol | Condition | Min. | Typ. | Max. | Unit | Remark |
|---|---|---|---|---|---|---|---|---|
| Viewing angle range | Horizontal | $\theta$21<br>$\theta$22 | CR≧10 | 70 | 88 | - | deg. | [Note1,4] |
| | Vertical | $\theta$11<br>$\theta$12 | | 70 | 88 | - | deg. | |
| Contrast ratio | | CRn | $\theta$=0 deg. | | TBD | | - | [Note2,4] |
| Response time | | $\tau_{DRV}$ | | | TBD | | ms | [Note3,4,5] |
| Chromaticity | White | x | | Typ.-0.03 | TBD | Typ+0.03 | - | [Note4] |
| | | y | | | TBD | | - | |
| | Red | x | | | TBD | | - | |
| | | y | | | TBD | | - | |
| | Green | x | | | TBD | | - | |
| | | y | | | TBD | | - | |
| | Blue | x | | | TBD | | - | |
| | | y | | | TBD | | - | |
| Luminance | White | $Y_L$ | | (280) | (350) | - | cd/m$^2$ | |
| ~~Luminance~~ | ~~White~~ | ~~$Y_L$~~ | | ~~(400)~~ | ~~(500)~~ | - | ~~cd/m$^2$~~ | ⊿01 |
| Luminance uniformity | White | δw | | - | - | (1.43) | | [Note6] |

- The measurement shall be executed 60 minutes after lighting at rating.

[Note] The optical characteristics are measured using the following equipment.

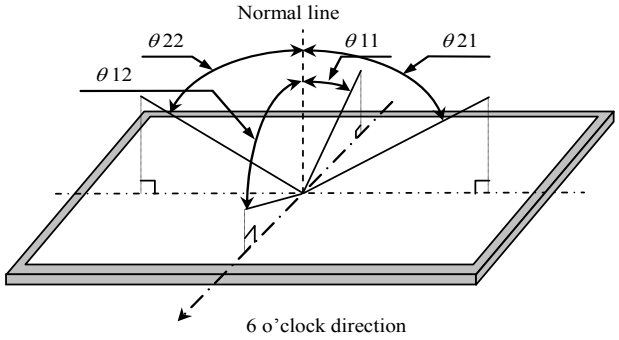



Measurement of viewing angle range and Response time.
-Viewing angle range: EZ-CONTRAST
- Response time: Photodiode




Measurement of Contrast, Luminance, Chromaticity.

[Note1] Definitions of viewing angle range:




[Note2] Definition of contrast ratio:

The contrast ratio is defined as the following.

$$\text{Contrast Ratio} = \frac{\text{Luminance (brightness) with all pixels white}}{\text{Luminance (brightness) with all pixels black}}$$

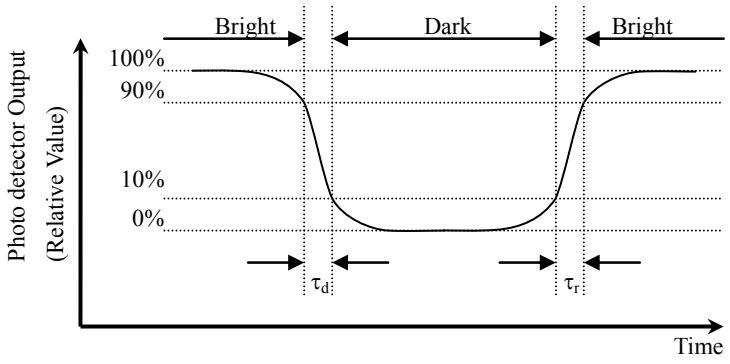
[Note3] Definition of response time

The response time (τ) is defined as the following figure and shall be measured by switching the input signal for "any level of gray (0%, 25%, 50%, 75% and 100%)" and "any level of gray (0%, 25%, 50%, 75% and 100%)".

| | 0% | 25% | 50% | 75% | 100% |
|---|---|---|---|---|---|
| 0% | | tr:0%-25% | tr:0%-50% | tr:0%-75% | tr:0%-100% |
| 25% | td: 25%-0% | | tr: 25%-50% | tr25%-75% | tr: 25%-100% |
| 50% | td: 50%-0% | td: 50%-25% | | tr: 50%-75% | tr: 50%-100% |
| 75% | td: 75%-0% | td: 75%-25% | td: 75%-50% | | tr: 75%-100% |
| 100% | td: 100%-0% | td: 100%-25% | td: 100%-50% | td:100%-75% | |

t*:x-y --- response time from level of gray(x) to level of gray(y)

$$\tau_{rd} = \{\sum(tr : x - y) + \sum(td : x - y)\}/20$$



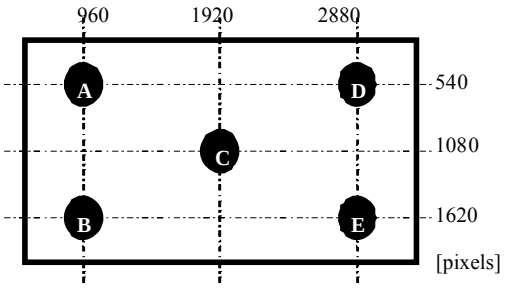

[Note4] This value shall be measured at center of the screen.

[Note5] This value is valid when O/S driving is used at typical input time value.

[Note 6] Definition of white uniformity ;

White uniformity is defined as the following with five measurements. (A~E)

$$\delta w = \frac{\text{Maximum luminance of five points (brightness)}}{\text{Minimum luminance of five points (brightness)}}$$




## 10. Reliability test item

| No. | Test item | Condition |
|---|---|---|
| 1 | High temperature storage test | Ta=60°C 240h |
| 2 | Low temperature storage test | Ta=-10°C 240h |
| 3 | High temperature and high humidity operation test | Ta=40°C ; 95%RH 240h<br>(No condensation) |
| 4 | High temperature operation test | Ta=50°C 240h |
| 5 | Low temperature operation test | Ta=0°C 240h |
| 6 | Vibration test<br>(non-operation) | Frequency: 10~57Hz/Vibration width (one side): 0.075mm<br>: 58~500Hz/Acceleration: 9.8 m/s²<br>Sweep time: 11 minutes<br>Test period: 3 hours (1h for each direction of X, Y, Z) |
| 7 | ESD test | * At the following conditions, it is a thing without incorrect operation and destruction.<br>(1)Non-operation: Contact electric discharge ±10kV<br>Non-contact electric discharge ±20kV<br>(2)Operation: Contact electric discharge ±8kV<br>Non-contact electric discharge ±15kV<br>Conditions: 150pF, 330ohm |

[Result evaluation criteria]

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

## 11. Packing form

a) Piling number of cartons : 2 Maximum
b) Packing quantity in one carton : T.B.D.
c) Carton size : T.B.D.
d) Total mass of one carton filled with full modules : T.B.D.

## 12. Carton storage condition

| | |
|---|---|
| Temperature | 0°C to 40°C |
| Humidity | 95% RH or less |
| Reference condition | 20°C to 35°C, 85% RH or less (summer)<br>5°C to 15°C, 85% RH or less (winter)<br>the total storage time (40°C, 95% RH) : 240h or less |
| Sunlight | Be sure to shelter a production from the direct sunlight. |
| Atmosphere | Harmful gas, such as acid and alkali which bites electronic components and/or wires must not be detected. |
| Notes | Be sure to put cartons on palette or base, don't put it on floor, and store them with keeping off a wall.<br>Please take care of ventilation in storehouse and around cartons, and control temperature within the natural environment. |
| Storage life | 1 year. |

## 13. Label ⊿01

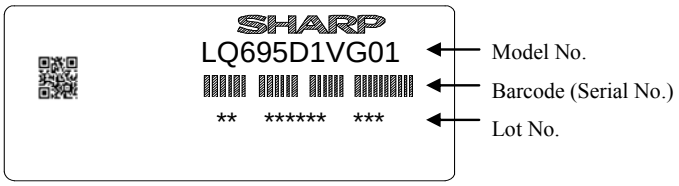
a) Lot No. Label

The label that displays SHARP, product model, a product number is stuck on the back of the module.

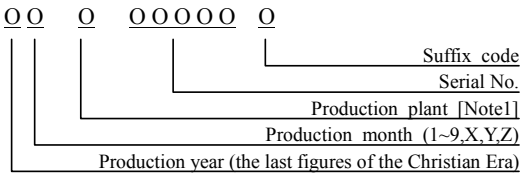
a) Overview

This label is stuck on the backlight chassis.

ex)LQ695D1VG01




How to express Lot No.




[Note1] Serial No.

- 1st ~ 99,999th/month :00001~99999
- 100,000th ~ 109,999th/month :A0000~A9999
- 110,000th ~ 119,999th/month :B0000~B9999

  --------- (without “I”,”O”)

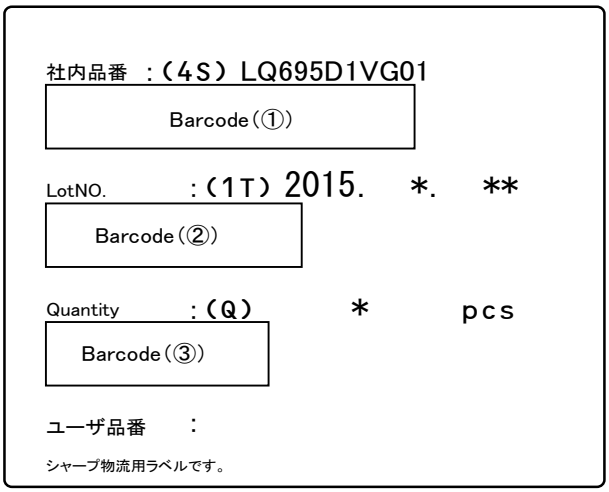
[Note2] Production place code

| Code | Place | Model No. & Suffix Code |
|---|---|---|
| N | NSEC | LQ695D1VG01 |

b) Packing label

This label is stuck on each packing box.

ex) LQ695D1VG01




① Model No.& Suffix Code

② Lot No.

③ Quantity

## 14.Precautions

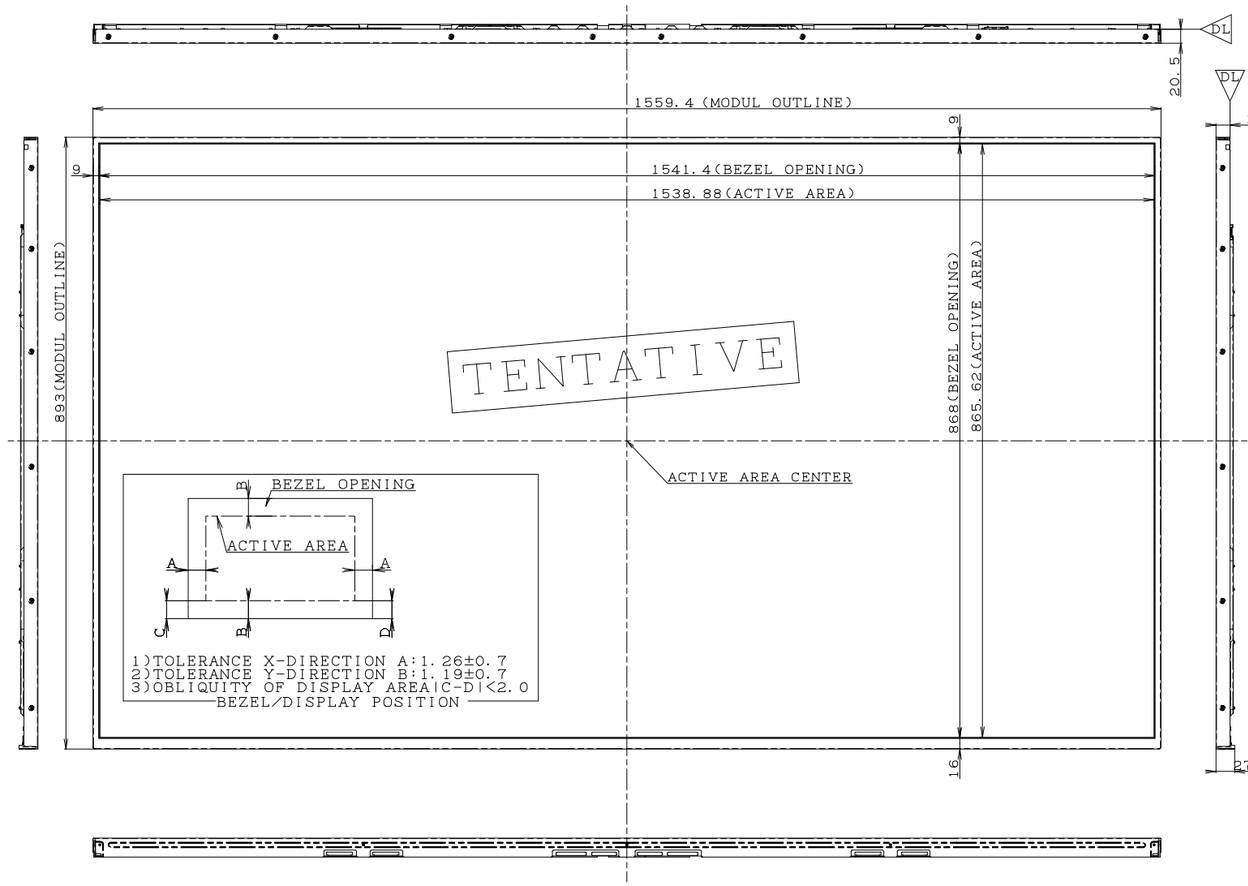
14-1 Fail safe design

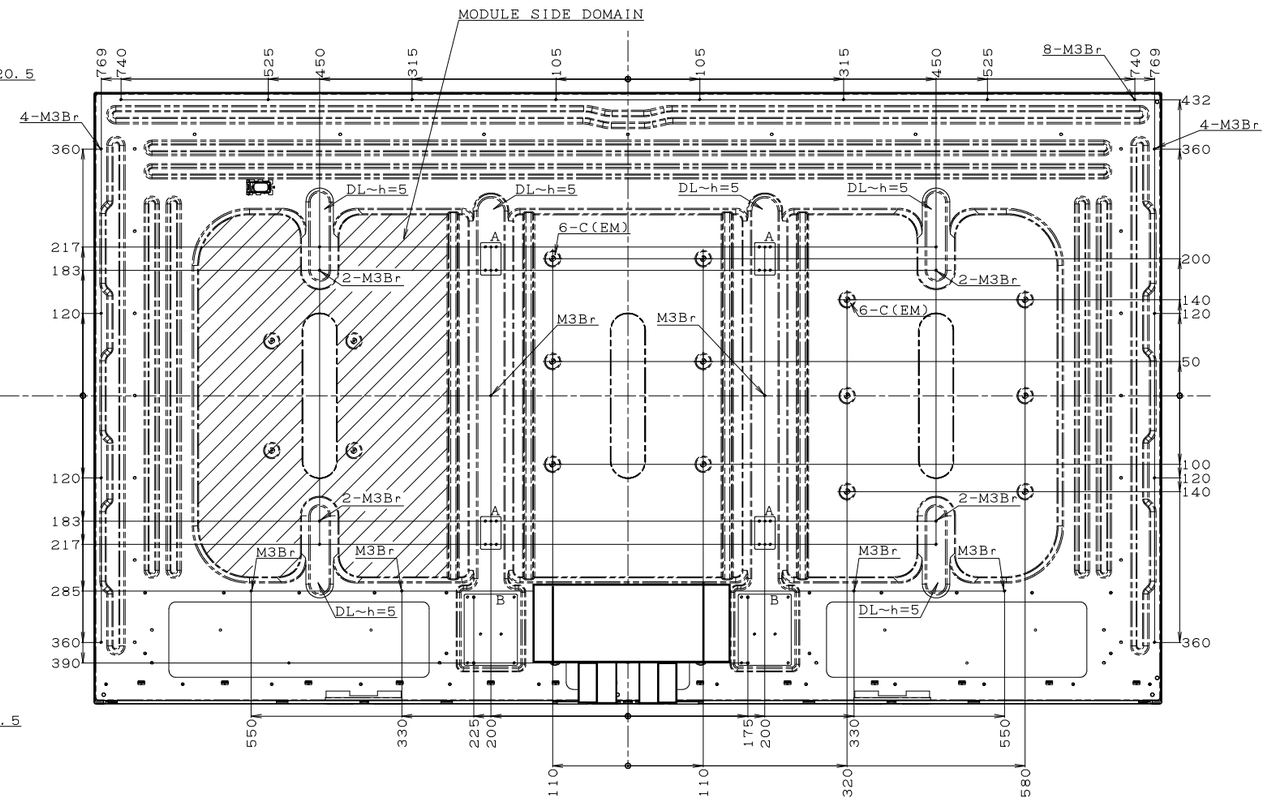
LCD module has an inherent chance of failure. Customers must protect against injury, damage or loss from such as failures by incorporating safety design measures into your facility equipment such as redundancy, fire protection, and prevention of over-current levels and other abnormal operating conditions.

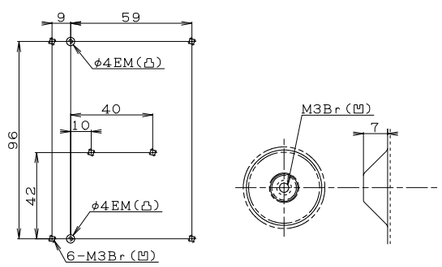
14-2 Handling Precautions of the module

a) Be sure to turn off the power supply when inserting or disconnecting the cable.
b) Be sure to design the cabinet so that the module can be installed without any extra stress such as warp or twist.
c) Since the front polarizer is easily damaged, pay attention not to scratch it.
d) Since long contact with water may cause discoloration or spots, wipe off water drop immediately.
e) When the panel surface is soiled, wipe it with absorbent cotton or other soft cloth.
f) Since the panel is made of glass, it may break or crack if dropped or bumped on hard surface. Handle with care.
g) Since CMOS LSI is used in this module, take care of static electricity and take the human earth into consideration when handling.
h) The module has some printed circuit boards (PCBs) on the back side, take care to keep them form any stress or pressure when handling or installing the module; otherwise some of electronic parts on the PCBs may be damaged.
i) Observe all other precautionary requirements in handling components.
j) When some pressure is added onto the module from rear side constantly, it causes display non-uniformity issue, functional defect, etc. So, please avoid such design.
k) When giving a touch to the panel at power on supply, it may cause some kinds of degradation. In that case, once turn off the power supply, and turn on after several seconds again, and that is disappear.
l) When handling LCD modules and assembling them into cabinets, please be noted that long-term storage in the environment of oxidization or deoxidization gas and the use of such materials as reagent, solvent, adhesive, resin, etc. which generate these gasses, may cause corrosion and discoloration of the LCD modules.
m) This LCD module is designed to prevent dust from entering into it. However, there would be a possibility to have a bad effect on display performance in case of having dust inside of LCD module. Therefore, please ensure to design your TV set to keep dust away around LCD module.
o) Adjusting Vcom has been set optimally before shipment, so do not change any adjusted value. If adjusted value is changed, the specification may not be satisfied.
p) Disassembling the module can cause permanent damage and should be strictly avoided.
q) Please be careful since image retention may occur when a fixed pattern is displayed for a long time.
r) The chemical compound, which causes the destruction of ozone layer, is not being used.
s) In any case, please do not resolve this LCD module.
t) This module is corresponded to RoHS.
u) When any question or issue occurs, it shall be solved by mutual discussion.

2014/08/29

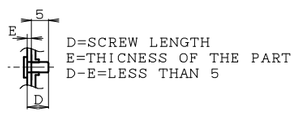


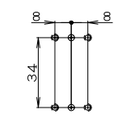




NOTE)
1. UNSPECIFIED TOLERANCE TO BE ±2.0

| Abbreviation/ 略語説明 | | |
|---|---|---|
| DL | Datum Line | 基準線 |
| Br | Burring | バーリング |
| EM | Emboss | 突出し |




DETAIL M3Br




DETAIL A
(4 POSITION)

DETAIL B
(2 POSITION)

DETAIL C
(12 POSITION)

# 70INCH MODULE OUTLINE DIMENSIONS