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HITACHI

Hitachi Displays, Ltd.

Date ; August 9, 2011

Rev.1

# For LG Electronics Inc.

CUSTOMER'S ACCEPTANCE SPECIFICATIONS

# TX11D101VM0EAA

Please return **1** copy with your signature on this page for approval.

**Accepted by :** _____ **Proposed by :** _____

**Date :** _____

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# RECORD OF REVISIONS

| Date | Sheet No. | Summary |
|---|---|---|
| Aug.5,2011<br>Rev. | | |

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## 3. GENERAL DATA

| | | |
|---|---|---|
| (1) | Part Name | TX11D101VM0EAA |
| (2) | Module Dimensions | 59.96 (W) mm × 101.70 (H) mm × 1.40 (t) mm<br>(Excluding I/F-FPC and electronic components) |
| (3) | Active Area Dimensions | 56.16 (W) mm × 93.60 (H) mm |
| (4) | Pixel Pitch | 0.117 (W) mm × 0.117 (H) mm |
| (5) | Resolution | 480 × 3 (R,G,B) (W) × 800 (H) dots |
| (6) | Color Pixel Arrangement | RGB Vertical Stripe |
| (7) | Display Mode | Transmissive Type, Normally Black Mode, In-Plane Switching Mode |
| (8) | Number of Colors | 16.7M Colors |
| (9) | Viewing Direction | - |
| (10) | Backlight | Light Emitting Diode (LED), 9 LEDs are series connection<br>Backlight current : 20mA / LED (typ) |
| (11) | Weight | 14.1 g (typ) |
| (12) | Power Supply Voltage | VCC = 2.8+/-0.1 V , VCI = 2.8+/-0.1 V |
| (13) | Interface I/O power supply<br>Note (1) | IOVCC = 1.8+/-0.1 V<br>The same voltage as "H" level of a customer's interface signal must be supplied to IOVCC. |
| (14) | LCD Driver IC | LG4574 (Source and Power IC : LGE ) |
| (15) | Interface | MIPI-DSI Video mode (2-Lane) |
| (16) | Methode of Inversion | 2 Line Dot Inversion |
| (17) | Surface Treatment | AR-Polarizer (Nitto ARC9) |

Note (1) IOVCC is the reference voltage for adjusting the I/O signal level of LG4574.
IOVCC voltage must be determined according to a customer's system.

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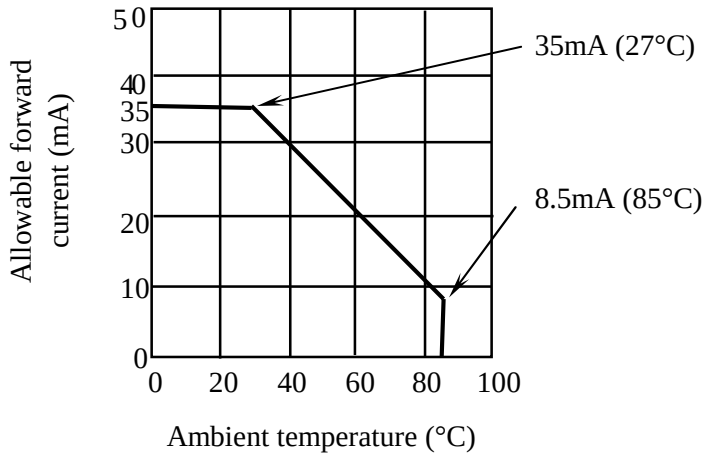
## 4. ABSOLUTE MAXIMUM RATINGS

4.1 ELECTRICAL ABSOLUTE MAXIMUM RATINGS OF LCD VSS=0 V, Ta=25°C

| Item | Symbol | Min | Max | Unit | Note |
|---|---|---|---|---|---|
| Power Supply for Interface | IOVCC | -0.3 | 4.5 | V | (1) |
| Power Supply for Analog and Logic | VCC | -0.3 | 4.5 | V | (1) |
| Power Supply for Analog and Logic | VCI | -0.3 | 4.5 | V | (1) |
| Input Voltage | Vt | -0.3 | IOVCC+0.3 | V | (2) |
| LED Reverse Voltage | $V_R$ | - | 5 | V | |
| LED Forward Current | $I_{LED}$ | - | Note (3) | mA | per LED |

Notes (1) Keep all Voltages no lower than GND.
(2) Applies to the RESET.
(3) Ambient Temperatures vs. Allow able Forward Current.




4.2 ENVIRONMENTAL ABSOLUTE MAXIMUM RATINGS

| Item | Operating | | Storage | | Remarks |
|---|---|---|---|---|---|
| | Min | Max | Min | Max | |
| Ambient Temperature | -20°C | 70°C | -30°C | 80°C | Note (2) |
| Humidity | Note (1) | | Note (1) | | No condensation |
| Corrosive Gas | Not Acceptable | | Not Acceptable | | |

Notes (1) Ta ≤ 40°C 85%RH max.
Ta > 40°C Absolute humidity must be lower than the humidity of 85%RH at 40°C.
(2) Background color slightly changes depending on ambient temperature and viewing angle.

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## 5. ELECTRICAL CHARACTERISTICS

LCD Module VSS=0V, Ta=25°C

| Item | Symbol | Condition | Min | Typ | Max | Unit | Note |
|---|---|---|---|---|---|---|---|
| Power Supply Voltage for Logic | VCC | - - | 2.7 | 2.8 | 2.9 | V | - |
| Power Supply Voltage for Analog | VCI | - - | 2.7 | 2.8 | 2.9 | V | - |
| Power Supply Voltage for I/O Interface | IOVCC | - | 1.7 | 1.8 | 1.9 | V | - |
| Input Voltage for Logic Circuits | VIH | "H" level | 0.80×IOVCC | - | IOVCC | V | (1),(2) |
| | VIL | "L" level | -0.3 | - | 0.20×IOVCC | | |
| Output Voltage for Logic Circuits | VOH1 | "H" level | 0.80×IOVCC | - | - | V | (1),(3) |
| | VOL1 | "L" level | - | - | 0.20×IOVCC | | |
| Power Supply Current | ICC | All White | - | ***TBD*** | | mA | (4),(6) |
| | | Deep standby | - | ***TBD*** | ***TBD*** | μA | (5),(6) |
| LED Forward Voltage | VLED | - | - | (3.1) | 3.4 | V | (7) |
| LED Forward Current | ILED | - | - | 20 | Note (8) | mA | (7) |
| Frame Frequency | fFLM | - | - | 60 | - | Hz | (9) |

Notes (1) IOVCC = 1.7V to 1.9V
(2) Input : RESET
(3) Output : PWM, TE, MAKERID
(4) IOVCC=1.8V, VCC=2.8V, VCI=2.8V, fFLM=60Hz, 2Line dot inversion mode.
(5) IOVCC=1.8V, VCC=2.8V, VCI=2.8V, Deep standby mode.
(6) ICC is total current of Interface, Logic and Analog.
(7) Each value is the characteristics of one LED.
(8) The operating current of LED should be determined within the maximum rating of the temperature environmental condition.
(9) The value is a frame frequency when the data of Item *(8.4.2)* is set to the register. When changing setting data, please contact us.

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## 6. OPTICAL CHARACTERISTICS

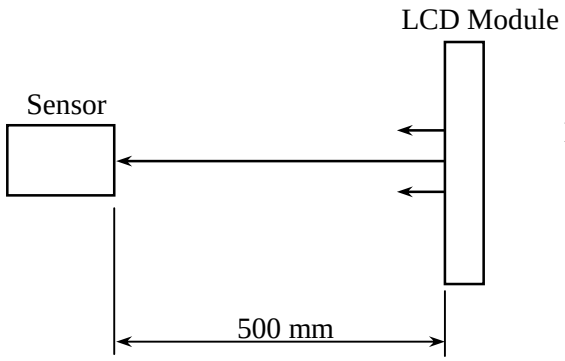
LCD (BACKLIGHT ON)

| Item | | Symbol | Condition | Min | Typ | Max | Unit | Note |
|---|---|---|---|---|---|---|---|---|
| Brightness | | B | φ=0°, θ=0° | 650 | 850 | - | $cd/m^2$ | (1),(2) |
| Brightness Uniformity | | - | φ=0°, θ=0° | 75 | - | - | % | (2),(3),(5) |
| Viewing Angle | | φ1+φ2 | θ=0°, CR≥10 | - | 170 | - | deg | (4),(6),(7) |
| | | | θ=90°, CR≥10 | - | 170 | - | | |
| Contrast Ratio | | CR | φ=0°, θ=0° | 600 | 1000 | - | - | (6) |
| Response Time | | tr+tf | φ=0°, θ=0° | - | 35 | 65 | ms | (8) |
| Color Tone (Primary Color) | Red | x | φ=0°, θ=0° | (TBD) | (TBD) | (TBD) | - | - |
| | | y | | (TBD) | (TBD) | (TBD) | | |
| | Green | x | | (TBD) | (TBD) | (TBD) | | |
| | | y | | (TBD) | (TBD) | (TBD) | | |
| | Blue | x | | (TBD) | (TBD) | (TBD) | | |
| | | y | | (TBD) | (TBD) | (TBD) | | |
| | White | x | | (TBD) | (TBD) | (TBD) | | |
| | | y | | (TBD) | (TBD) | (TBD) | | |
| Color temperature | | - | | 5000 | - | 9000 | K | |
| NTSC Ratio | | - | | 60 | 70 | - | % | - |
| Cross Talk | | - | | No visible problem on practical use | | | | (9) |
| Flecker | | - | | No visible problem on practical use | | | | (9) |

Measurement Conditions

Measurement environment : Dark room
Ambient temperature : Ta=25°C
Sequence : Refer to Item 8.7.2
Power supply voltage : VCC=VCI=2.8V, IOVCC=1.8V
Backlight current : $I_{LED}$=20mA

Notes (1) Definition of Brightness "B"




Sensor : KONICA MINOLTA CS-1000 or equivalent
Measurement point : Center of LCD's active area

(2) Display image for measurement : All White

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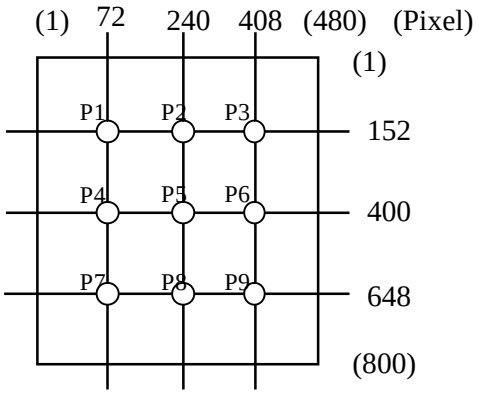
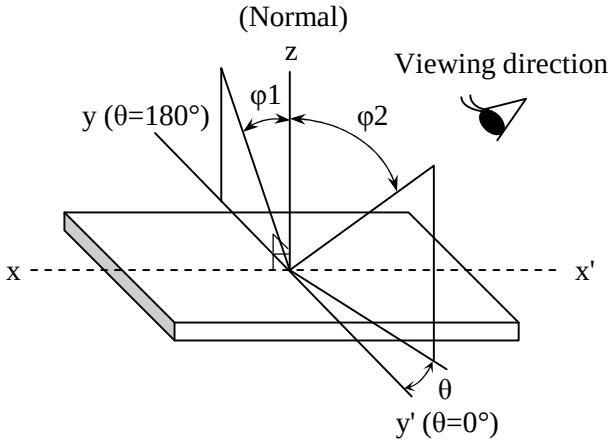
Notes (3) Measurement point




(4) Definition of θ and φ



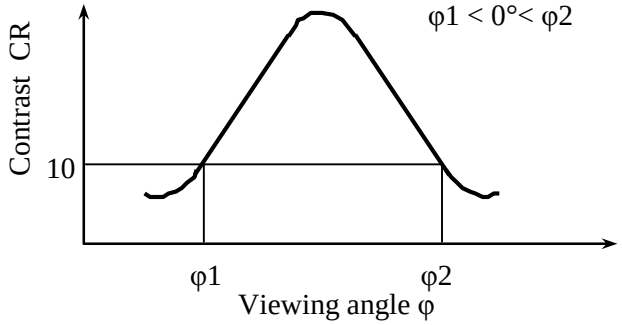

(5) Definition of brightness uniformity

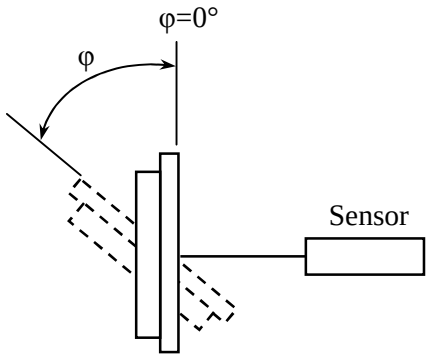
$$\text{Brightness uniformity} = \frac{\text{Brightness (min)}}{\text{Brightness (max)}} \times 100\ (\%)$$

(6) Definition of Contrast "CR"

$$\text{CR} = \frac{\text{Brightness when displaying White raster}}{\text{Brightness when displaying Black raster}}$$

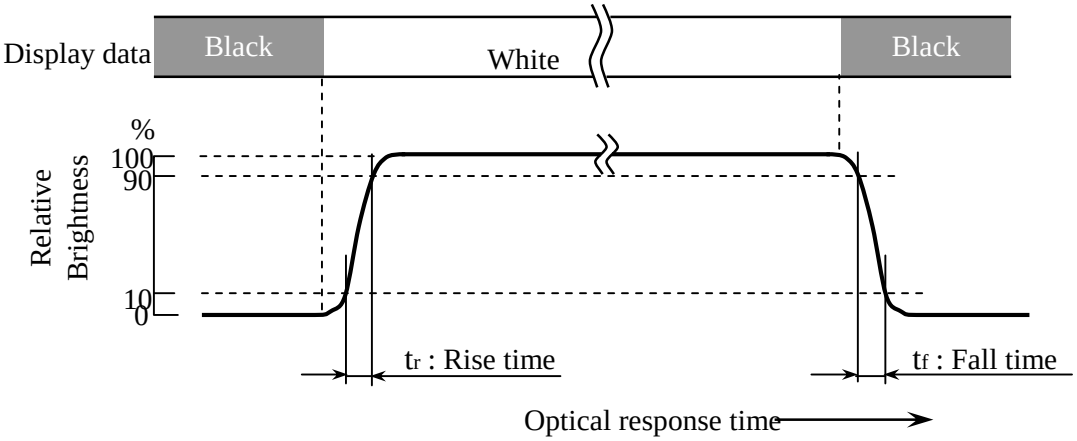
(7) Definition of Viewing Angle φ1and φ2




Sensor : TOPCON's BM-5A or equivalent

(8) Definition of Optical Response Time




(9) If a nonconformance is found, both parties will have a discussion to solve it.

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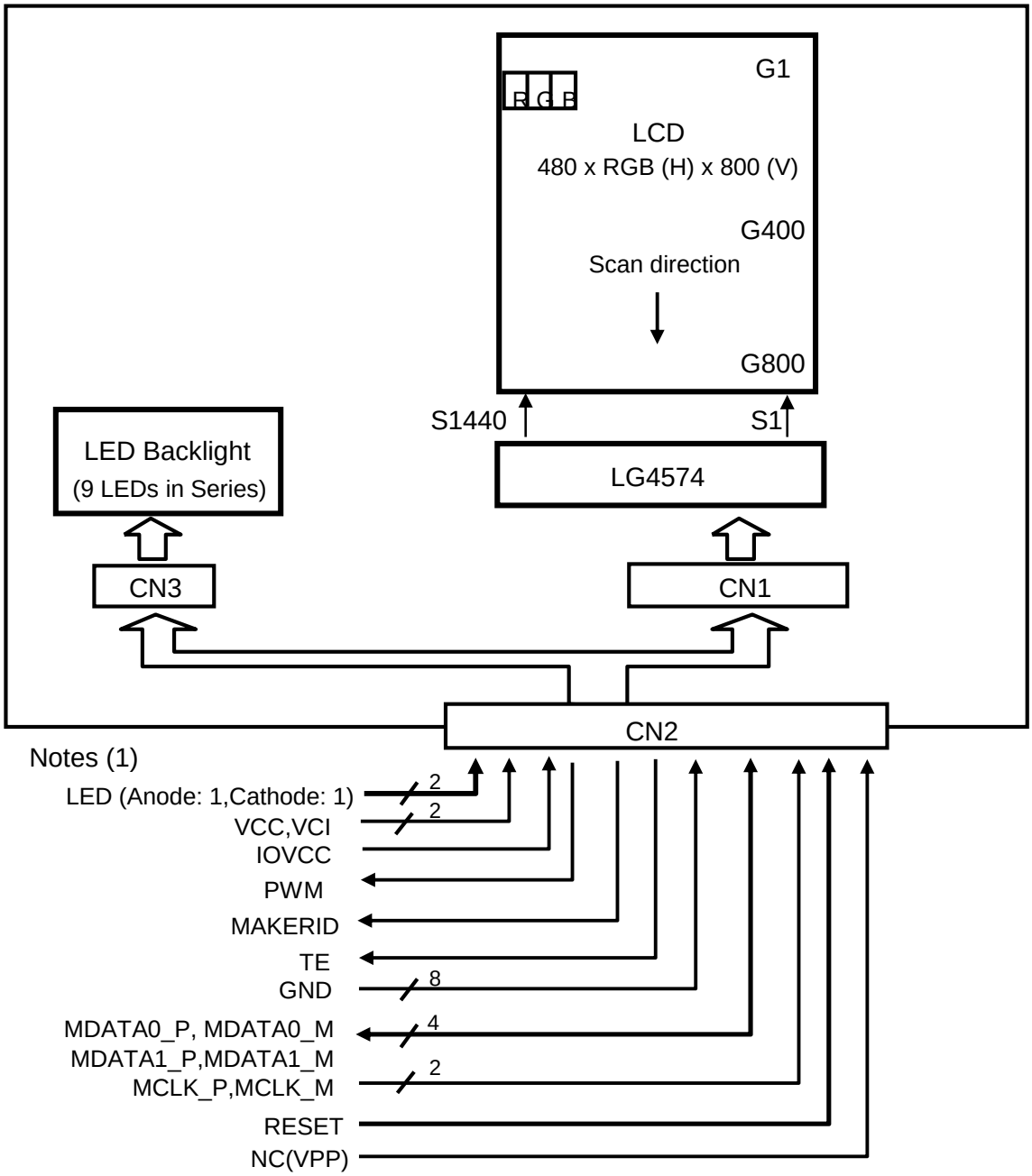
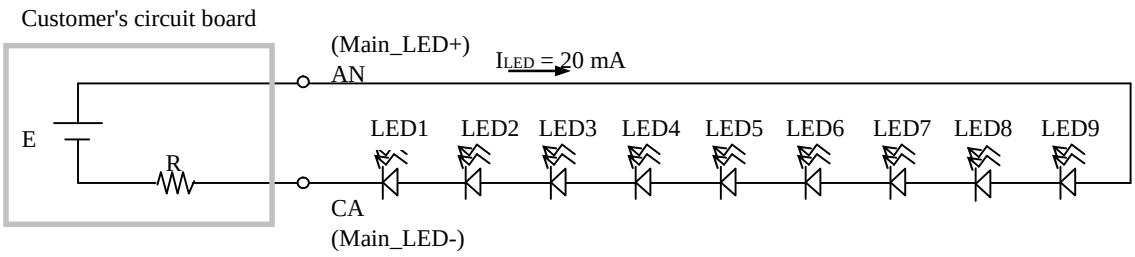
## 7. BLOCK DIAGRAM




Note (1) R : Resistance for limiting current (R > 100 ohm)

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# 8. INTERFACE

## 8.1 INTERNAL PIN CONNECTION

| Pin No. | Signal | I/O | Function | Driver's Signal name |
|---|---|---|---|---|
| 1 | GND | - | GND | - |
| 2 | DATA0_N | I/O | Negative MIPI Data1 Input/Output | DATA0_N |
| 3 | DATA0_P | I/O | Positive MIPI Data1 Input/Output | DATA0_P |
| 4 | GND | - | GND | |
| 5 | DATA1_N | I/O | Negative MIPI Data2 Input/Output | DATA1_N |
| 6 | DATA1_P | I/O | Positive MIPI Data2 Input/Output | DATA1_P |
| 7 | GND | - | GND | |
| 8 | DATA1_N | I/O | Negative MIPI Data2 Input/Output | DATA1_N |
| 9 | DATA1_P | I/O | Positive MIPI Data2 Input/Output | DATA1_P |
| 10 | GND | - | GND | - |
| 11 | LEDCA | - | Ground for LED | - |
| 12 | LEDAN | - | Power Supply for LED | - |
| 13 | GND | - | GND | - |
| 14 | PWM | O | PWM output pin of Active Back Light control processir | PWM |
| 15 | TE | O | Tearing Effect output pin | TE |
| 16 | MAKER ID(Low) | O | Maker ID(Low: GND level) | - |
| 17 | RESET | I | Reset Input pin | RESET |
| 18 | NC(VPP) | - | | |
| 19 | GND | - | GND | |
| 20 | IOVCC | - | IO Power (1.8V) | IOVCI |
| 21 | VCC | - | Analog power supply for Analog Circuit (2.8V) | VCC |
| 22 | GND | - | GND | |
| 23 | VCI | - | Analog power supply for reference (2.8V) | VCI |
| 24 | GND | - | GND | - |

Note(1) When you does not use this pin, please fix this pin to "H" (IOVCC).

Note(2) Pin No.2 is used for Vcom write at Hitachi.

LCM Connector :GB042-30S-H10(Receptacle) (LS-Mtron) , Suitable Connector : GB042-30P-H10(Plug) (LS-Mtron)

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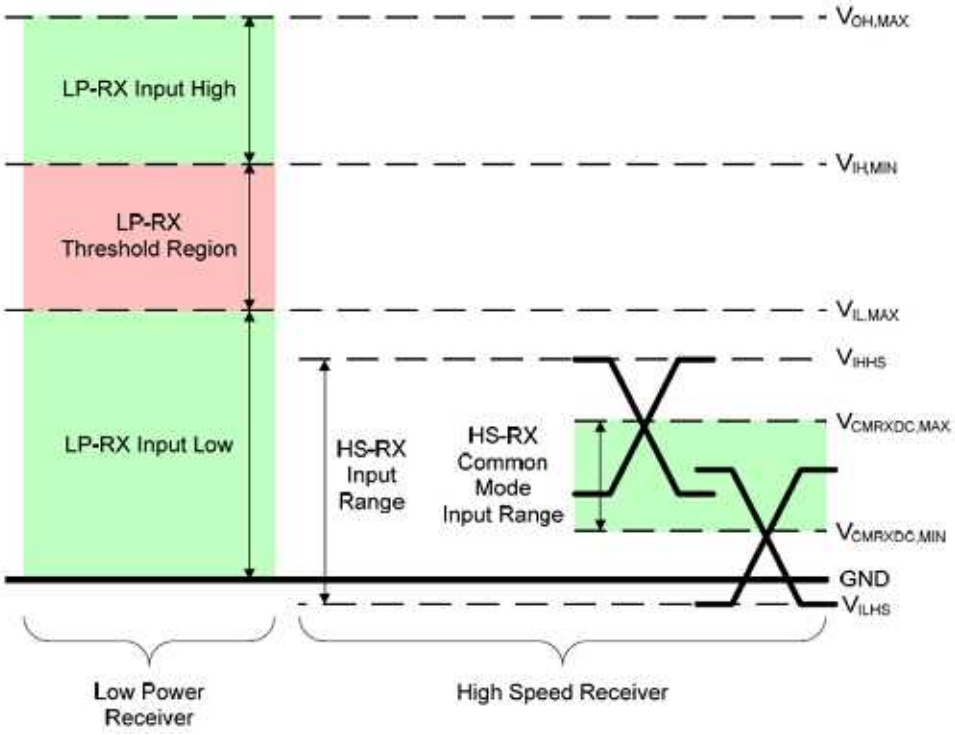
8.2 MIPI HS Receiver Characteristics

8.2.1 DC Characteristics of MIPI HS Receiver

| Parameter | Description | Min | Nom | Max | Units |
|---|---|---|---|---|---|
| V CMRX(DC) | Common-mode voltage HS receive mode | 70 | | 330 | mV |
| V IDTH | Differential input high threshold | | | 70 | mV |
| V IDTL | Differential input low threshold | -70 | | | mV |
| V IHHS | Single-ended input high voltage | | | 460 | mV |
| V ILHS | Single-ended input low voltage | -40 | | | mV |
| V TERM-EN | Single-ended threshold for HS termination enable | | | 450 | mV |
| Z ID | Differential input impedance | 80 | 100 | 125 | ohm |

The differential input high and low threshold voltages of the HS receiver are denoted by V IDTH and V IDTL , respectively. V ILHS and V IHHS are the single-ended, input low and input high voltages, respectively. V CMRX(DC) is the differential input common-mode voltage.




Signaling voltage levels.

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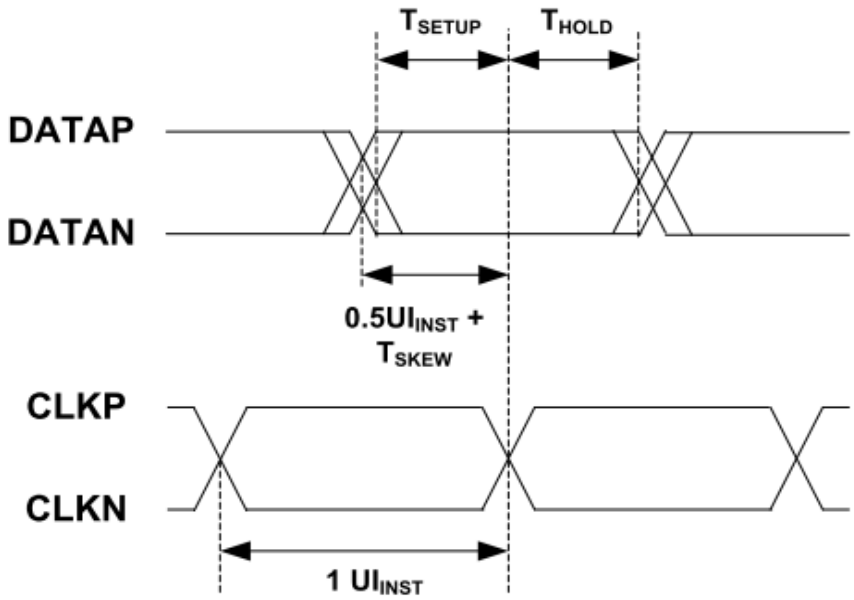
8.2.2 AC Characteristics of MIPI HS Receiver

| Parameter | Description | Min | Nom | Max | Units | Notes |
|---|---|---|---|---|---|---|
| UI INST | Data Rate (UI instantaneous) | 2.0 | | 12.5 | ns | |
| T SETUP | Data to Clock Setup Time | 0.15 | | | UI INST | (1) |
| T SHOLD | Clock to Data Hold Time | 0.15 | | | UI INST | (1) |
| T SKEW | Data to Clock Skew | -0.15 | | 0.15 | UI INST | |

Notes (1) Total setup and hold window for receiver of 0.3*UI INST




AC Timing Waveform for HS Mode MIPI Operation

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8.3 MIPI LP Receiver Characteristics

8.3.1 DC Characteristics of MIPI LP Receiver

| Parameter | Description | Min | Nom | Max | Units | Notes |
|---|---|---|---|---|---|---|
| V IH | Logic 1 input voltage | 880 | | | mV | |
| V IL | Logic 0 input voltage | | | 550 | mV | |
| V IL-ULPS | Logic 0 input voltage, ULP State | | | 300 | mV | |
| V HYST | Input Hysteresis | 25 | | | m | |

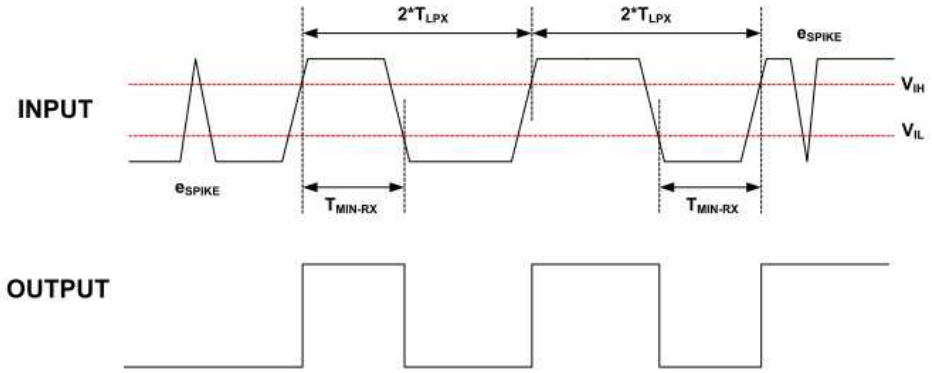
8.3.2 AC Characteristics of MIPI LP Receiver

| Parameter | Description | Min | Nom | Max | Units | Notes |
|---|---|---|---|---|---|---|
| e SPIKE | Input pulse rejection | | | 300 | Vp-s | (1) (2) |
| T MIN-RX | Minimum pulse width response | 20 | | | ns | (3) |
| V INT | Peak interference amplitude | | | 200 | mV | |
| f INT | Interference frequency | 450 | | | MHz | |

Notes (1) Time-voltage integration of a spike above V IL when being in LP-0 state or below V IH when being in LP-1 state.

(2) An impulse less than this will not change the receiver state.

(3) An input pulse greater than this shall toggle the output.




AC Timing Waveform for LP Mode MIPI Operation

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8.4 MIPI LP Transmitter Characteristics

8.4.1 DC Characteristics of MIPI LP Transmitter.

| Parameter | Description | Min | Nom | Max | Units | Notes |
|---|---|---|---|---|---|---|
| V OH | Thevenin output high level | 1.1 | 1.2 | 1.3 | V | |
| V OL | Thevenin output low level | -50 | | 50 | mV | |
| Z OLP | Output impedance of LP transmitter | 110 | | | ohm | (1) |

Notes (1) Though no maximum value for Z OLP is specified, the LP transmitter output impedance shall ensure the T RLP /T FLP specification is met.

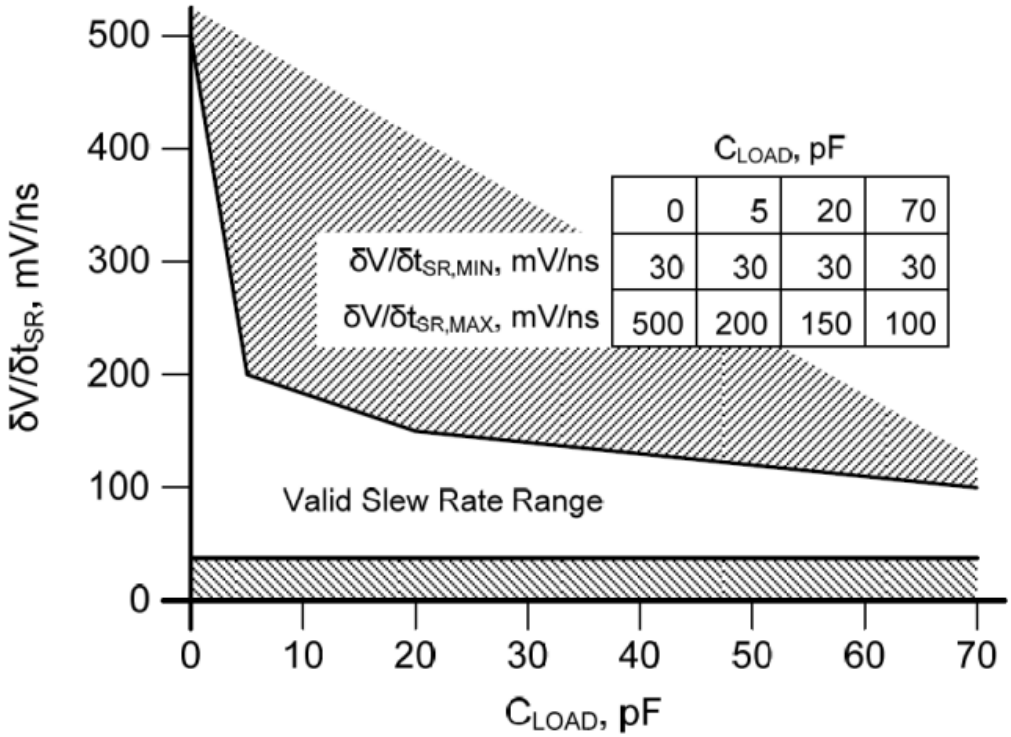
V OL is the Thevenin output, low-level voltage in the LP transmit mode. This is the voltage at an unloaded pad pin in the low-level state. V OH is the Thevenin output, high-level voltage in the high-level state, when the pad pin is not loaded.

8.4.2 AC Characteristics of MIPI LP Transmitter

| Parameter | Description | | Min | Nom | Max | Units | Notes |
|---|---|---|---|---|---|---|---|
| T RLP /T FLP | 15%-85% rise time and fall time | | | | 25 | ns | (1) |
| T REOT | Thevenin output low level | | | | 35 | ns | (1)(5)(6) |
| T LP-PULSE-TX | Pulse width of the LP exclusive-OR clock | First LP exclusive-OR clock pulse after Stop state or last pulse before Stop | 40 | | | | (4) |
| | | All other pulses | 20 | | | | (4) |
| T LP-PER-TX | Period of the LP exclusive -OR clock | | 90 | | | ns | |
| □V/□t SR | Slew rate @ C LOAD = 0pF | | 30 | | 500 | mV/ns | (1)(2)(3) |
| | Slew rate @ C LOAD = 5pF | | 30 | | 200 | mV/ns | (1)(2)(3) |
| | Slew rate @ C LOAD = 20pF | | 30 | | 150 | mV/ns | (1)(2)(3) |
| | Slew rate @ C LOAD = 70pF | | 30 | | 100 | mV/ns | (1)(2)(3) |
| C LOAD | Load capacitance | | 0 | | 70 | pF | (1) |

1. C LOAD includes the low-frequency equivalent transmission line capacitance. The capacitance of TX and RX are assumed to always be <10pF. The distributed line capacitance can be up to 50pF for a transmission line with 2ns delay.
2. When the output voltage is between 15% and below 85% of the fully settled LP signal levels.
3. Measured as average across any 50 mV segment of the output signal transition.
4. This parameter value can be lower then T LPX due to differences in rise vs. fall signal slopes and trip levels and mismatches between Dp and Dn LP transmitters.
5. The rise-time of T REOT starts from the HS common-level at the moment the differential amplitude drops below 70mV, due to stopping the differential drive.
6. With an additional load capacitance C CM between 0-60pF on the termination center tap at RX side of the Lane

The times T RLP and T FLP are the 15%-85% rise and fall times, respectively, of the output signal voltage, when the LP transmitter is driving a capacitive load C LOAD . The 15%-85% levels are relative to the fully settled V OH and V OL voltages. The slew rate δV/δt SR is the derivative of the LP transmitter output signal voltage over time. The slew rate specification shall be met for the 15%-85% range while driving a capacitive load, C LOAD .

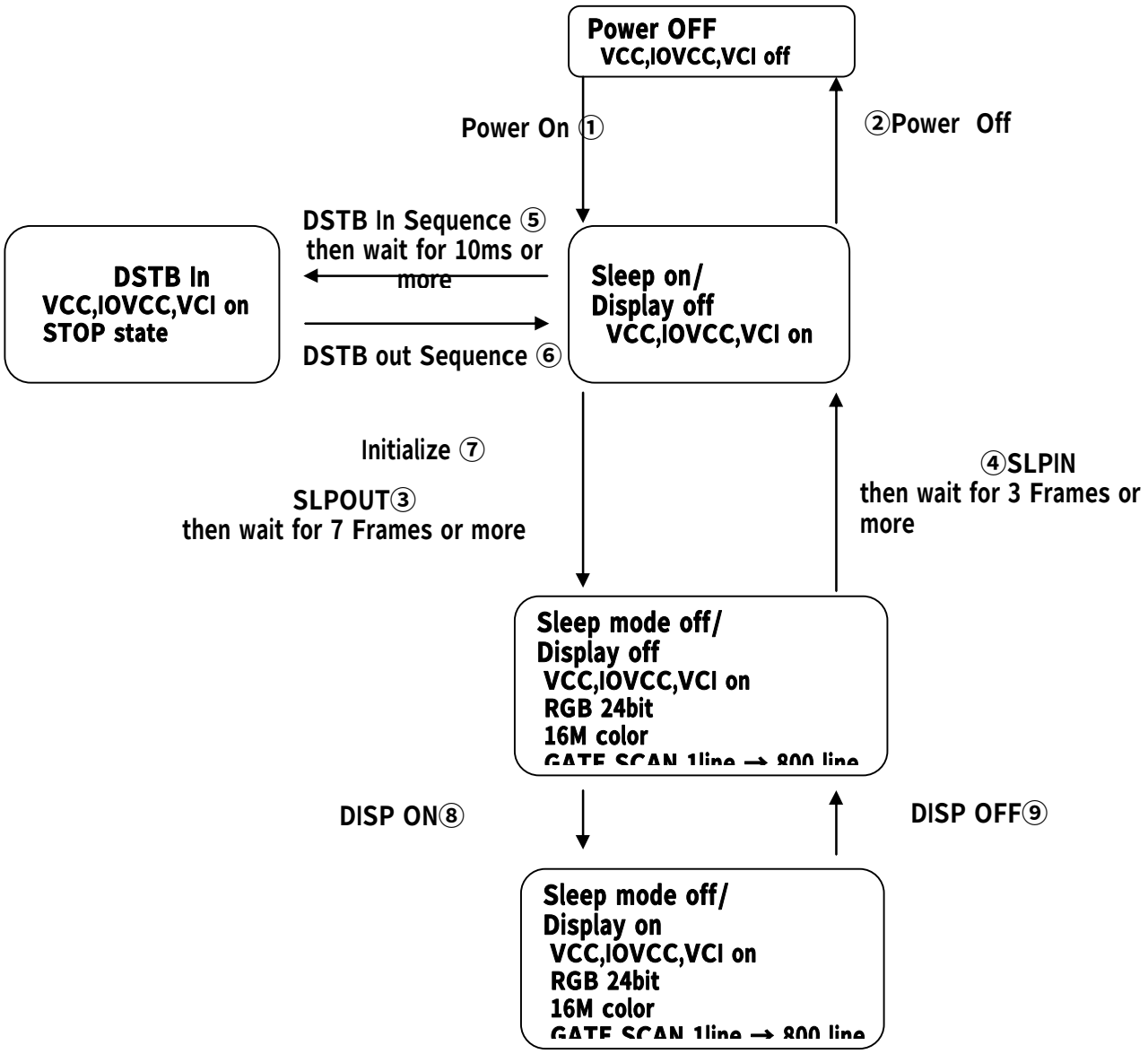



| $C_{LOAD}$, pF | 0 | 5 | 20 | 70 |
|---|---|---|---|---|
| $\delta V/\delta t_{SR,MIN}$, mV/ns | 30 | 30 | 30 | 30 |
| $\delta V/\delta t_{SR,MAX}$, mV/ns | 500 | 200 | 150 | 100 |

Slew rate of LP TX vs. C Load

## 8.5 REGISTER SETTING

### 8.5.1 STATE TRANSITION DIAGRAM OF OPERATION MODE



Tentative

## 8.5.2 SEQUENCE

| ① Power On 注1) | | State (h) → (z) | | | |
|---|---|---|---|---|---|
| Order | Instruction | Register | Data | previous | Remarks |
| 1 | | RESX = "L" | | | |
| 2 | Power On | VCC,IOVCC,VCI On | | | |
| 3 | | wait | 1ms(min.) | | |
| 4 | Power On Reset | RESX = "H" | | | |
| 5 | | wait | 10ms(min.) | | |

| ② Power off | | State (z) → (h) | | | |
|---|---|---|---|---|---|
| Order | Instruction | Register | Data | previous | Remarks |
| 1 | Power Off | VCI,IOVCC,VCC Off | | | |

| ③ SLPOUT | | State (a) → (z) | | | |
|---|---|---|---|---|---|
| Order | Instruction | Register | Data | previous | Remarks |
| 1 | SLPOUT | D1 | 0x05 | | |
| 2 | | Command | 0x11 | | |
| 3 | | Dummy | 0x00 | | |
| 4 | | wait | (min.) | | 7 Frames or more |

| ⑧ DISP ON | | State (a) → (z) | | | |
|---|---|---|---|---|---|
| Order | Instruction | Register | Data | previous | Remarks |
| 1 | Memory Write | D1 | 0x39 | | |
| 2 | | WC | 0x** | | |
| 3 | | WC | 0x** | | |
| 4 | | ECC | | | |
| 5 | | Command | 0x2C | | |
| 6 | | 1st Pixel data | 0x****** | | |
| 7 | | - | - | | |
| 8 | | Nth Pixrl data | ****** | | |
| 9 | | CRC | | | |
| 10 | | CRC | | | |
| 11 | DISPLAY ON | D1 | 0x05 | | |
| 12 | | Command | 0x29 | | |
| 13 | | Dummy | 0x00 | | |

| ⑨ DISP OFF | | State (a) → (z) | | | |
|---|---|---|---|---|---|
| Order | Instruction | Register | Data | previous | Remarks |
| 1 | DISPLAY OFF | D1 | 0x05 | | |
| 2 | | Command | 0x28 | | |
| 3 | | Dummy | 0x00 | | |

| ④ SLPIN | | State (a) → (z) | | | |
|---|---|---|---|---|---|
| Order | Instruction | Register | Data | previous | Remarks |
| 1 | SLPIN | D1 | 0x05 | | |
| 2 | | Command | 0x10 | | |
| 3 | | Dummy | 0x00 | | |
| 4 | | wait | (min.) | | 3 Frames or more |

| ⑤ DSTB In Sequence | | State (a) → (b) | | | |
|---|---|---|---|---|---|
| Order | Instruction | Register | Data | previous | Remarks |
| 1 | Power Control 1 | D1 | 0x23 | | |
| 2 | | Command | 0xC1 | | |
| 3 | | P1 | 0x01 | | |
| 4 | | ECC | | | |
| 5 | | wait | 10ms(min.) | | |

| ⑥ DSTB Out Sequence | | State (b),(c) → (a) | | | |
|---|---|---|---|---|---|
| Order | Instruction | Register | Data | previous | Remarks |
| 1 | DSTB Out Sequence | - | CS=Low | | |
| 2 | | - | CS=Low | | |
| 3 | | wait | 10ms(min.) | | |
| 4 | | - | CS=Low | | |
| 5 | | - | CS=Low | | |
| 6 | | - | CS=Low | | |
| 7 | | - | CS=Low | | |

Tentative

⑦ Initialize

Initialize

| Order | Instruction | Register | Data | previous | Remarks |
|---|---|---|---|---|---|
| 1 | Column Address Set | D1 | 0x39 | | |
| 2 | | WC | 0x05 | | |
| 3 | | WC | 0x00 | | |
| 4 | | ECC | | | |
| 5 | | Command | 0x2A | | |
| 6 | | P1 | 0x00 | | SC=16'h00 |
| 7 | | P2 | 0x00 | | |
| 8 | | P3 | 0x01 | | EC=16'h1DF |
| 9 | | P4 | 0xDF | | |
| 10 | Page Address Set | D1 | 0x39 | | |
| 11 | | WC | 0x05 | | |
| 12 | | WC | 0x00 | | |
| 13 | | ECC | | | |
| 14 | | Command | 0x2B | | |
| 15 | | P1 | 0x00 | | SP=16'h00 |
| 16 | | P2 | 0x00 | | |
| 17 | | P3 | 0x03 | | EP=16'h31F |
| 18 | | P4 | 0x1F | | |
| 19 | Memory Access Control | D1 | 0x15 | | |
| 20 | | Command | 0x36h | | |
| 21 | | P1 | 0x00 | | MY=0,MX=0,MV=0,BGR=0,FH=0,FV=0 |
| 22 | | ECC | | | |
| 23 | Interface Pixel Format | D1 | 0x15 | | |
| 24 | | Command | 0x3Ah | | |
| 25 | | P1 | 0x77 | | MY=0,MX=0,MV=0,BGR=0,FH=0,FV=0 |
| 26 | | ECC | | | |
| 27 | Panel Characteristics Setting | D1 | 0x29 | | |
| 28 | | WC | 0x03 | | |
| 29 | | WC | 0x00 | | |
| 30 | | ECC | | | |
| 31 | | Command | 0xB2 | | |
| 32 | | P1 | 0x00 | | LR:NoSwap,REV:NB |
| 33 | | P2 | 0xC7 | | VRS:199,(199+1)×4=800 |
| 34 | | CRC | | | |
| 35 | | CRC | | | |
| 36 | Panel Drive Setting | D1 | 0x23 | | |
| 37 | | Command | 0xB3 | | |
| 38 | | P1 | 0x02 | | DINV:2dotinv. |
| 39 | | ECC | | | |
| 40 | Display Control 1 | D1 | 0x29 | | |
| 41 | | WC | 0x08 | | |
| 42 | | WC | 0x00 | | |
| 43 | | ECC | | | |
| 44 | | Command | 0xB5 | | |
| 45 | | P1 | 0x01 | | SDT=8'h1 : 1xDISPLAY CLK |
| 46 | | P2 | 0x00 | | SHPN=8'h0 : 0 |
| 47 | | P3 | 0x05 | | ENGND=8'h5 : 5xDISPLAY CLK |
| 48 | | P4 | 0x00 | | SHIZ=8'h0 : 0 |
| 49 | | P5 | 0x20 | | PTS=2'h2 : GND,SND,SLT |
| 50 | | P6 | 0x05 | | SPM1=8'h5 : 5xDISPLAY CLK |
| 51 | | P7 | 0x00 | | SPM2=8'h0 : 0 |
| 52 | | CRC | | | |
| 53 | | CRC | | | |
| 54 | Display Control 2 | D1 | 0x29 | | |
| 55 | | WC | 0x09 | | |
| 56 | | WC | 0x00 | | |
| 57 | | ECC | | | |
| 58 | | Command | 0xB6 | | |
| 59 | | P1 | 0x10 | | GSWAP:Non-Swap,CM=3'h1:H-Type1,Al |
| 60 | | P2 | 0x01 | | CLW=8'h1 : 1xDISPLAY CLK |
| 61 | | P3 | 0x82 | | GPWRSEL=1 : mode2,GSWAPH2:Non,( |
| 62 | | P4 | 0x01 | | GNO=8'h1 : 2xDISPLAY CLK |
| 63 | | P5 | 0x01 | | FTI=8'h1 : 1xDISPLAY CLK |
| 64 | | P6 | 0x00 | | FTIB(T-Type) |
| 65 | | P7 | 0x00 | | GPM1(L-Type) |
| 66 | | P8 | 0x00 | | GPM2(L-Type) |
| 67 | | CRC | | | |
| 68 | | CRC | | | |
| 69 | Display Control 3 | D1 | 0x29 | | |
| 70 | | WC | 0x08 | | |
| 71 | | WC | 0x00 | | |
| 72 | | ECC | | | |
| 73 | | Command | 0xB7 | | |
| 74 | | P1 | 0x46 | | RTN=8'h46 : 70xDISPLAY CLK |
| 75 | | P2 | 0x00 | | FP[9:0]=10'h16 :22Horizontal Line |
| 76 | | P3 | 0x16 | | |
| 77 | | P4 | 0x00 | | BP[9:0]=10'h14 :20Horizontal Line |
| 78 | | P5 | 0x14 | | |
| 79 | | P6 | 0x02 | | DIV=2'h2 :1/4*(Internal RC OSC CLK) D |
| 80 | | P7 | 0x00 | | TEI=3'h0 :1Frames |
| 81 | | CRC | | | |
| 82 | | CRC | | | |

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|---|---|---|---|---|
| 83 | Display Control 4 | D1 | 0x29 | |
| 84 | | WC | 0x06 | |
| 85 | | WC | 0x00 | |
| 86 | | ECC | | |
| 87 | | Command | 0xB8 | |
| 88 | | P1 | 0x05 | VFST=0,GSPF=5'h05: 64xDISPLAY CLK |
| 89 | | P2 | 0xC5 | FL=1,VBPEX=1 :6H,GSPS=5'h05: 64xDISPLAY CLK |
| 90 | | P3 | 0x2C | STVG=2'h0,GLOL=2'h2 :4H,VGSET=1 :VGH,VGSET2=1 :VGH,ACFIX=2'h0 :Normal |
| 91 | | P4 | 0x66 | ACR=1H,ACF=2H,ACBR=1H,ACBF=2H |
| 92 | | P5 | 0xCC | AC2R=3H,AC2F=0H,ACB2R=3H,ACB2F=0H |
| 93 | | CRC | | |
| 94 | | CRC | | |
| 95 | Internal Oscillator Setting | D1 | 0x29 | |
| 96 | | WC | 0x04 | |
| 97 | | WC | 0x00 | |
| 98 | | ECC | | |
| 99 | | Command | 0xC0 | |
| 100 | | P1 | 0x01 | EN_OSCREG=0,OSC=1 |
| 101 | | P2 | 0x05 | FSEL=0,FRS=4'h5 : 14.16MHz |
| 102 | | P3 | 0x10 | FTRIM=5'h10 : 0% |
| 103 | | CRC | | |
| 104 | | CRC | | |
| 105 | Power Control 2 | D1 | 0x29 | |
| 106 | | WC | 0x03 | |
| 107 | | WC | 0x00 | |
| 108 | | ECC | | |
| 109 | | Command | 0xC2 | |
| 110 | | P1 | 0x80 | ST4_HIZ=1,ST2_HIZ=0,ST1_HIZ=0,STMOPT=0,STMODE=3'h0 |
| 111 | | P2 | 0x4E | PFM_EN=1,ST4_EN_LGVL=0,ST3_EN_DDVDL=0,ST2_EN_VCL/VGL/VGH=1,ST1_EN_DDVDH=0 |
| 112 | | CRC | | |
| 113 | | CRC | | |
| 114 | Power Control 3 | D1 | 0x29 | |
| 115 | | WC | 0x06 | |
| 116 | | WC | 0x00 | |
| 117 | | ECC | | |
| 118 | | Command | 0xC3 | |
| 119 | | P1 | 0x20 | ST1_NOTC=2'h2 : 150ns,ST1_BT=2'h0 : 2X DualStrong |
| 120 | | P2 | 0x02 | ST1_SFT=0,ST3_SOFT_EN=0,ST2_SOFT_EN=1,ST1_SOFT_EN=0 |
| 121 | | P3 | 0x00 | ST1_FB_COMP=0,ST1_SOFT_TVAR=3'h0 : 0 |
| 122 | | P4 | 0x08 | ST1_FB_FAP=2'h0 : 0,ST1_FB_VREF=3'h8 : 6V |
| 123 | | P5 | 0x0A | ST1_4PHASE=0,PFM_VREF=3'hA : DDVDH=5.8V |
| 124 | | CRC | | |
| 125 | | CRC | | |
| 126 | Power Control 4 | D1 | 0x29 | |
| 127 | | WC | 0x07 | |
| 128 | | WC | 0x00 | |
| 129 | | ECC | | |
| 130 | | Command | 0xC4 | |
| 131 | | P1 | 0x11 | ST2_PROT=1,ST2_FB_EN=1 |
| 132 | | P2 | 0x02 | ST2_FB_COMP=1,ST2_FB_FAP=2h : 20uA |
| 133 | | P3 | 0x00 | ST2_BT_RTVAR |
| 134 | | P4 | 0x00 | ST2_BT_FTVAR |
| 135 | | P5 | 0x11 | ST2_BT_HSVAR=3'h1 ,ST2_BT_LSVAR=3'h1 :VGH=VGL=DDVDH×3 |
| 136 | | P6 | 0x8A | ST2_VGL_REG=-14.1V,ST2_VGH_REG=15V |
| 137 | | CRC | | |
| 138 | | CRC | | |
| 139 | Power Control 5 | D1 | 0x29 | |
| 140 | | WC | 0x06 | |
| 141 | | WC | 0x00 | |
| 142 | | ECC | | |
| 143 | | Command | 0xC5 | |
| 144 | | P1 | 0x12 | DC1_LINE=1,DC1=101.14kHz |
| 145 | | P2 | 0x34 | PHASE_INIT=1,DC2_LINE=1,DC2=VGH=VGL=VCL=25.285kHz |
| 146 | | P3 | 0x11 | DC3_LINE=1,DC3=DDVDL=101.14kHz |
| 147 | | P4 | 0x14 | DC4_LINE=1,DC4=LVGL=25.285kHz |
| 148 | | P5 | 0x13 | DC5_LINE=1,DC5=PFM_DDVDH=809.12kHz |
| 149 | | CRC | | |
| 150 | | CRC | | |
| 151 | Power Control 6 | D1 | 0x29 | |
| 152 | | WC | 0x03 | |
| 153 | | WC | 0x00 | |
| 154 | | ECC | | |
| 155 | | Command | 0xC6 | |
| 156 | | P1 | 0x22 | GDC,BDC |
| 157 | | P2 | 0x00 | OPB,BMB |
| 158 | | CRC | | |
| 159 | | CRC | | |
| 160 | Power Control 7 | D1 | 0x29 | |
| 161 | | WC | 0x06 | |
| 162 | | WC | 0x00 | |
| 163 | | ECC | | |
| 164 | | Command | 0xC7 | |
| 165 | | P1 | **0x04** | VMUL=0,VBS=0,REGPD=0,AP=3'h4 : BaseBiase*1 |
| 166 | | P2 | 0x9C | EN_SOFT_REG=1,VRH1=5'h1C : 5.189V |
| 167 | | P3 | 0x1C | VCMSW=0,VRH2=5'h1C : -5.189V |
| 168 | | P4 | 0x- | VCM1 |
| 169 | | P5 | 0x- | VCM2 |
| 170 | | CRC | | |
| 171 | | CRC | | |
| 172 | Power Control 8 | D1 | 0x29 | |
| 173 | | WC | 0x03 | |
| 174 | | WC | 0x00 | |
| 175 | | ECC | | |
| 176 | | Command | 0xC8 | |
| 177 | | P1 | 0x43 | RI=4h : BaseBias*1,RV=3h : 1.6V |
| 178 | | P2 | 0x60 | RSET=6h : BaseBias*1,RCONT=0h : BaseBias*1 |
| 179 | | CRC | | |
| 180 | | CRC | | |

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|---|---|---|---|---|
| 181 | Power Control 9 | D1 | 0x29 | |
| 182 | | WC | 0x04 | |
| 183 | | WC | 0x00 | |
| 184 | | ECC | | |
| 185 | | Command | 0xC9 | |
| 186 | | P1 | 0x00 | OFCEN |
| 187 | | P2 | 0x30 | OFCTSW |
| 188 | | P3 | 0x10 | OFCTD2,OFCTD1 |
| 189 | | CRC | | |
| 190 | | CRC | | |
| 191 | Backlight Control | D1 | 0x29 | |
| 192 | | WC | 0x05 | |
| 193 | | WC | 0x00 | |
| 194 | | ECC | | |
| 195 | | Command | 0xCA | |
| 196 | | P1 | 0x82 | CDSP=8,CDMP=2 |
| 197 | | P2 | 0xA1 | WSD,MODE=1,PWMP=0,FPWM=1h : Frame frequency*4 |
| 198 | | P3 | 0x21 | DD_MODE=1,THR1=1h : 98.438% |
| 199 | | P4 | 0x11 | THR2=1h : 96.875%,THR3=1h : 96.875% |
| 200 | | CRC | | |
| 201 | | CRC | | |
| 202 | VREF_GEN | D1 | 0x29 | |
| 203 | | WC | 0x04 | |
| 204 | | WC | 0x00 | |
| 205 | | ECC | | |
| 206 | | Command | 0xCB | |
| 207 | | P1 | 0x0B | RSTRS=Bh : VCIREF*(134/200) |
| 208 | | P2 | 0x15 | REFTR |
| 209 | | P3 | 0x34 | VREF_SEL=0,REFRS |
| 210 | | CRC | | |
| 211 | | CRC | | |
| 212 | Positive Gamma Curve for Red | D1 | 0x29 | |
| 213 | | WC | 0x0A | |
| 214 | | WC | 0x00 | |
| 215 | | ECC | | |
| 216 | | Command | 0xD0 | |
| 217 | | P1 | 0x03 | PKP1,PKP0 |
| 218 | | P2 | 0x16 | PKP3,PKP2 |
| 219 | | P3 | 0x77 | PKP5,PKP4 |
| 220 | | P4 | 0x06 | PRP1,PRP0 |
| 221 | | P5 | 0x02 | VRP0 |
| 222 | | P6 | 0x00 | VRP1 |
| 223 | | P7 | 0x31 | PFP1,PFP0 |
| 224 | | P8 | 0x11 | PFP3,PFP2 |
| 225 | | P9 | 0x03 | PMP |
| 226 | | CRC | | |
| 227 | | CRC | | |
| 228 | Negative Gamma Curve for Red | D1 | 0x29 | |
| 229 | | WC | 0x0A | |
| 230 | | WC | 0x00 | |
| 231 | | ECC | | |
| 232 | | Command | 0xD1 | |
| 233 | | P1 | 0x03 | PKN1,PKN0 |
| 234 | | P2 | 0x16 | PKN3,PKN2 |
| 235 | | P3 | 0x77 | PKN5,PKN4 |
| 236 | | P4 | 0x06 | PRN1,PRN0 |
| 237 | | P5 | 0x02 | VRN0 |
| 238 | | P6 | 0x00 | VRN1 |
| 239 | | P7 | 0x31 | PFN1,PFN0 |
| 240 | | P8 | 0x11 | PFN3,PFN2 |
| 241 | | P9 | 0x03 | PMN |
| 242 | | CRC | | |
| 243 | | CRC | | |
| 244 | Positive Gamma Curve for Green | D1 | 0x29 | |
| 245 | | WC | 0x0A | |
| 246 | | WC | 0x00 | |
| 247 | | ECC | | |
| 248 | | Command | 0xD2 | |
| 249 | | P1 | 0x03 | PKP1,PKP0 |
| 250 | | P2 | 0x16 | PKP3,PKP2 |
| 251 | | P3 | 0x77 | PKP5,PKP4 |
| 252 | | P4 | 0x06 | PRP1,PRP0 |
| 253 | | P5 | 0x02 | VRP0 |
| 254 | | P6 | 0x00 | VRP1 |
| 255 | | P7 | 0x31 | PFP1,PFP0 |
| 256 | | P8 | 0x11 | PFP3,PFP2 |
| 257 | | P9 | 0x03 | PMP |
| 258 | | CRC | | |
| 259 | | CRC | | |
| 260 | Negative Gamma Curve for Green | D1 | 0x29 | |
| 261 | | WC | 0x0A | |
| 262 | | WC | 0x00 | |
| 263 | | ECC | | |
| 264 | | Command | 0xD3 | |
| 265 | | P1 | 0x03 | PKN1,PKN0 |
| 266 | | P2 | 0x16 | PKN3,PKN2 |
| 267 | | P3 | 0x77 | PKN5,PKN4 |
| 268 | | P4 | 0x06 | PRN1,PRN0 |
| 269 | | P5 | 0x02 | VRN0 |
| 270 | | P6 | 0x00 | VRN1 |
| 271 | | P7 | 0x31 | PFN1,PFN0 |
| 272 | | P8 | 0x11 | PFN3,PFN2 |
| 273 | | P9 | 0x03 | PMN |
| 274 | | CRC | | |
| 275 | | CRC | | |

Tentative

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|---|---|---|---|---|
| 276 | Positive Gamma Curve for Blue | D1 | 0x29 | |
| 277 | | WC | 0x0A | |
| 278 | | WC | 0x00 | |
| 279 | | ECC | | |
| 280 | | Command | 0xD4 | |
| 281 | | P1 | 0x03 | PKP1,PKP0 |
| 282 | | P2 | 0x16 | PKP3,PKP2 |
| 283 | | P3 | 0x77 | PKP5,PKP4 |
| 284 | | P4 | 0x06 | PRP1,PRP0 |
| 285 | | P5 | 0x02 | VRP0 |
| 286 | | P6 | 0x00 | VRP1 |
| 287 | | P7 | 0x31 | PFP1,PFP0 |
| 288 | | P8 | 0x11 | PFP3,PFP2 |
| 289 | | P9 | 0x03 | PMP |
| 290 | | CRC | | |
| 291 | | CRC | | |
| 292 | Negative Gamma Curve for Blue | D1 | 0x29 | |
| 293 | | WC | 0x0A | |
| 294 | | WC | 0x00 | |
| 295 | | ECC | | |
| 296 | | Command | 0xD5 | |
| 297 | | P1 | 0x03 | PKN1,PKN0 |
| 298 | | P2 | 0x16 | PKN3,PKN2 |
| 299 | | P3 | 0x77 | PKN5,PKN4 |
| 300 | | P4 | 0x06 | PRN1,PRN0 |
| 301 | | P5 | 0x02 | VRN0 |
| 302 | | P6 | 0x00 | VRN1 |
| 303 | | P7 | 0x31 | PFN1,PFN0 |
| 304 | | P8 | 0x11 | PFN3,PFN2 |
| 305 | | P9 | 0x03 | PMN |
| 306 | | CRC | | |
| 307 | | CRC | | |
| 308 | MIPI DSI Configuration | D1 | 0x29 | |
| 309 | | WC | 0x06 | |
| 310 | | WC | 0x00 | |
| 311 | | ECC | | |
| 312 | | Command | 0xE0 | |
| 313 | | P1 | 0x43 | NO_BTA,MODE=1 : VideoMode,HRX_FREQ=0,NO_CD,LTX_CLK=0,LTX_FREQ=3h |
| 314 | | P2 | 0x40 | HRX_TO |
| 315 | | P3 | 0x80 | LTX_TO |
| 316 | | P4 | 0x00 | ER_MASK |
| 317 | | P5 | 0x00 | ER_MASK |
| 318 | | CRC | | |
| 319 | | CRC | | |
| 320 | MIPI D-PHY Configuration | D1 | 0x29 | |
| 321 | | WC | 0x04 | |
| 322 | | WC | 0x00 | |
| 323 | | ECC | | |
| 324 | | Command | 0xE1 | |
| 325 | | P1 | 0x77 | RTERM_HS=7h : 50Ω,CCM_HS=7h |
| 326 | | P2 | 0x38 | LTX_CTL=1,SCE=1,SKEW_HS |
| 327 | | P3 | 0x22 | CBIAS_LP,CBIAS_HS |
| 328 | | CRC | | |
| 329 | | CRC | | |
| 330 | Frame Memory Control | D1 | 0x29 | |
| 331 | | WC | 0x05 | |
| 332 | | WC | 0x00 | |
| 333 | | ECC | | |
| 334 | | Command | 0xE3 | |
| 335 | | P1 | 0x01 | DCMR |
| 336 | | P2 | 0x00 | ROSC,ECCBYP |
| 337 | | P3 | 0x02 | SS |
| 338 | | P4 | 0x00 | OPT |
| 339 | | CRC | | |
| 340 | | CRC | | |
| 341 | Discharge Mode Control | D1 | 0x23 | |
| 342 | | Command | 0xE7 | |
| 343 | | P1 | 0x00 | EN_APOD=0 |
| 344 | | ECC | | |
| 345 | OTP 1 | D1 | 0x29 | |
| 346 | | WC | 0x04 | |
| 347 | | WC | 0x00 | |
| 348 | | ECC | | |
| 349 | | Command | 0xF8 | |
| 350 | | P1 | 0x00 | PTM,SELT,PRD,PWE,VPP,PPROG |
| 351 | | P2 | 0x00 | PA |
| 352 | | P3 | 0x00 | PDIN |
| 353 | | CRC | | |
| 354 | | CRC | | |
| 355 | OTP 2 | D1 | 0x29 | |
| 356 | | WC | 0x03 | |
| 357 | | WC | 0x00 | |
| 358 | | ECC | | |
| 359 | | Command | 0xF9 | |
| 360 | | P1 | 0xF1 | SEL_OTP_FTRIM/REFTR/REFRS/SKEW,RWEN,OTP_CLK |
| 361 | | P2 | 0xFF | SEL_OTP_RP/RN/GP/GN/BP/BN/ID/VCM |
| 362 | | CRC | | |
| 363 | | CRC | | |
| 364 | OTP 3 | D1 | 0x23 | |
| 365 | | Command | 0xFA | |
| 366 | | P1 | 0x- | EN_APOD |
| 367 | | ECC | | |
| 368 | OTP 4 | D1 | 0x29 | |
| 369 | | WC | 0x03 | |
| 370 | | WC | 0x00 | |
| 371 | | ECC | | |
| 372 | | Command | 0xFB | |
| 373 | | P1 | 0x- | ID1 |
| 374 | | P2 | 0x- | ID2 |
| 375 | | P3 | 0x- | ID3 |
| 376 | | CRC | | |
| 377 | | CRC | | |

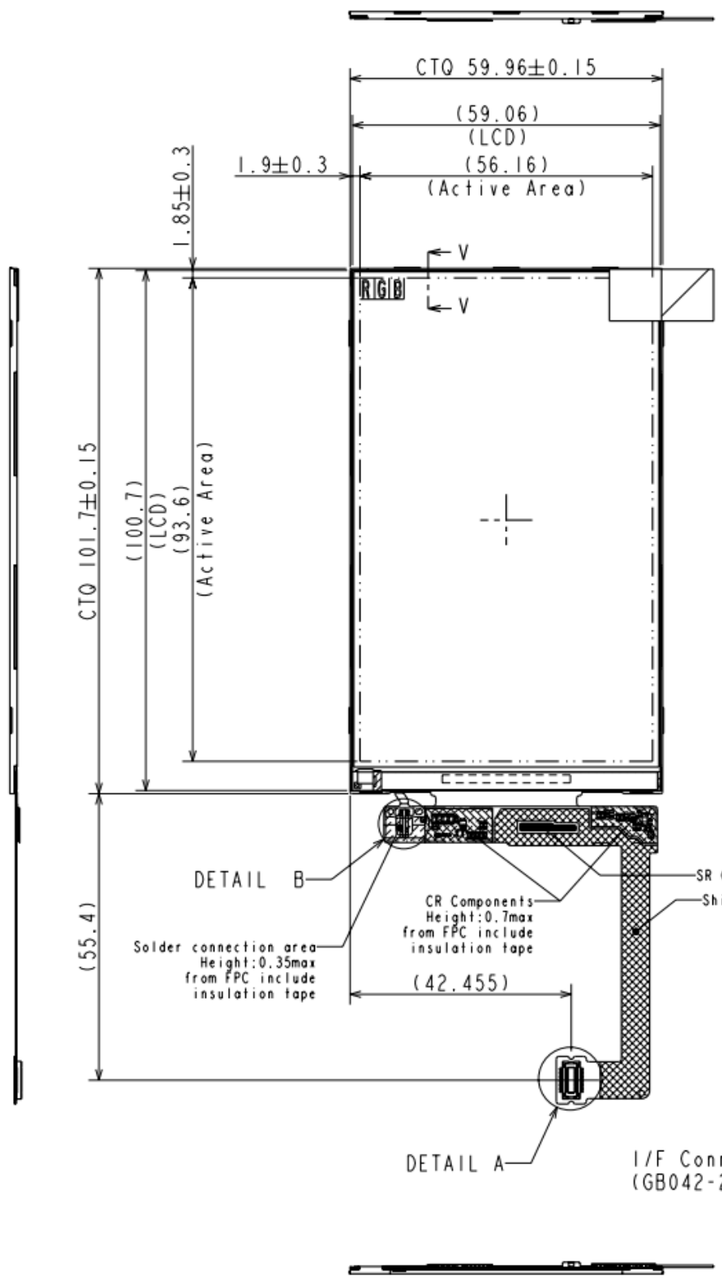
9. DIMENSIONAL OUTLINE

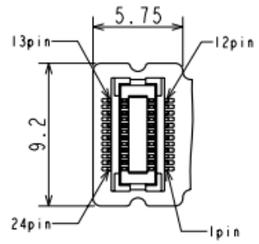
Tentative

Hitachi Confidential
4.3" WVGA (480 x 800)
Dimensional outline

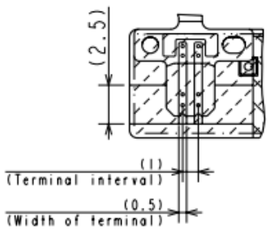
TENTATIVE

Date: Aug.5,2011
Hitachi Displays,Ltd.

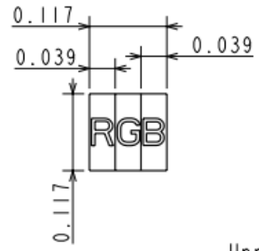


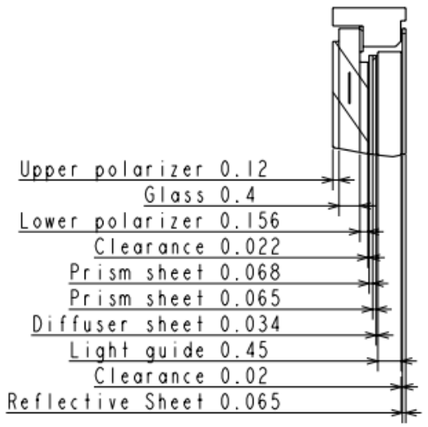

DETAIL A
スケール 3:1



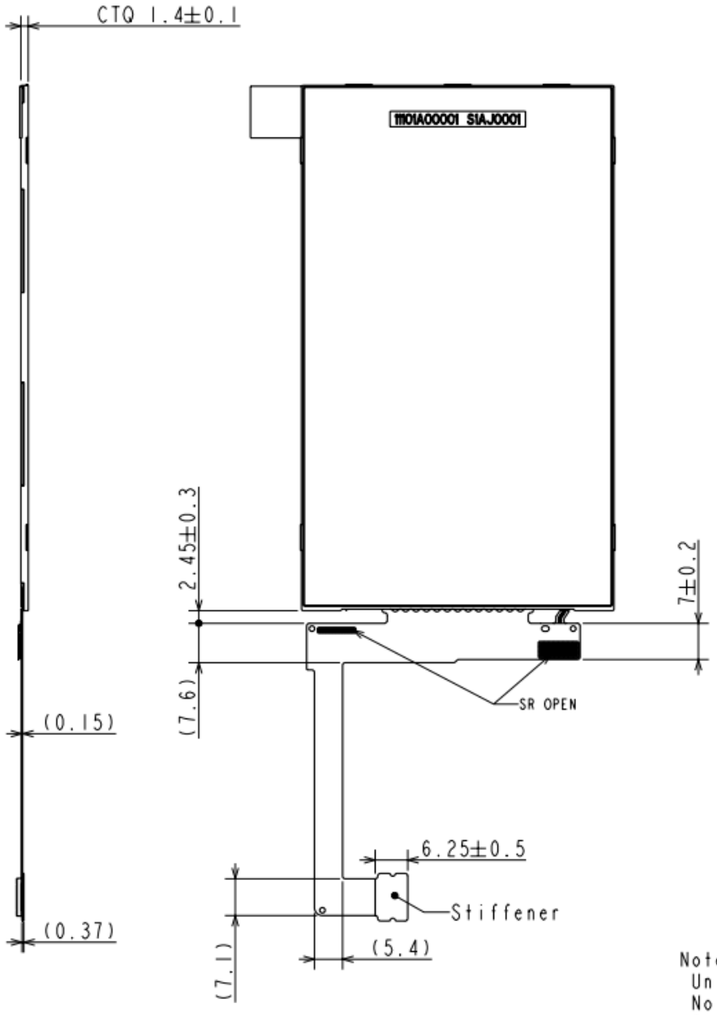

DETAIL B
スケール 3:1




LCD DOTS Detail




Section V-V




| No. | Signal | No. | Signal |
|---|---|---|---|
| 13 | GND | 12 | LED-AN |
| 14 | BLU-PWM | 11 | LED-CA |
| 15 | TE | 10 | GND |
| 16 | MAKER-ID (Low) | 9 | CLKP |
| 17 | RESET | 8 | CLKN |
| 18 | NC(VPP) | 7 | GND |
| 19 | GND | 6 | DATA1_P |
| 20 | IOVCC | 5 | DATA1_N |
| 21 | VCC | 4 | GND |
| 22 | GND | 3 | DATA0_P |
| 23 | VCI(SWREG) | 2 | DATA0_N |
| 24 | GND | 1 | GND |

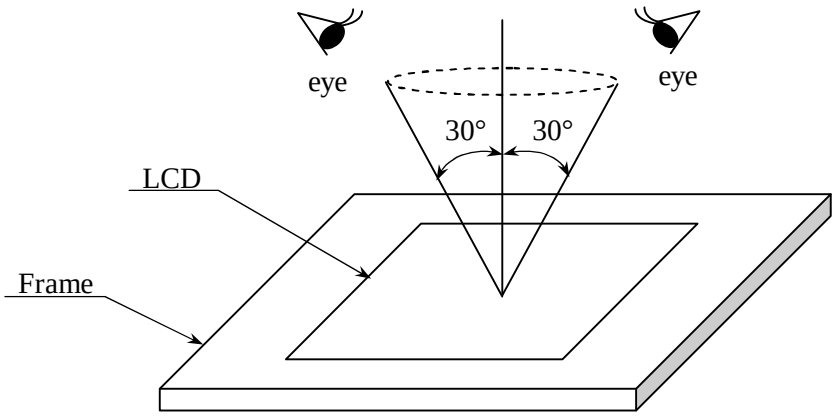
Notes
Unit : mm
No specified size tolerance : ±0.2
SUS : Non SUS Frame
Upper Polarizer : AR-Polarizer (Nitto ARC-9)
Driver IC : LG4574 (Chip size:24.58×1.55×t0.17)
Connector : LS Mtron (GB042-24S-H10)

Tentative

## 10. VISUAL INSPECTION

### 10.1 INSPECTION CONDITION

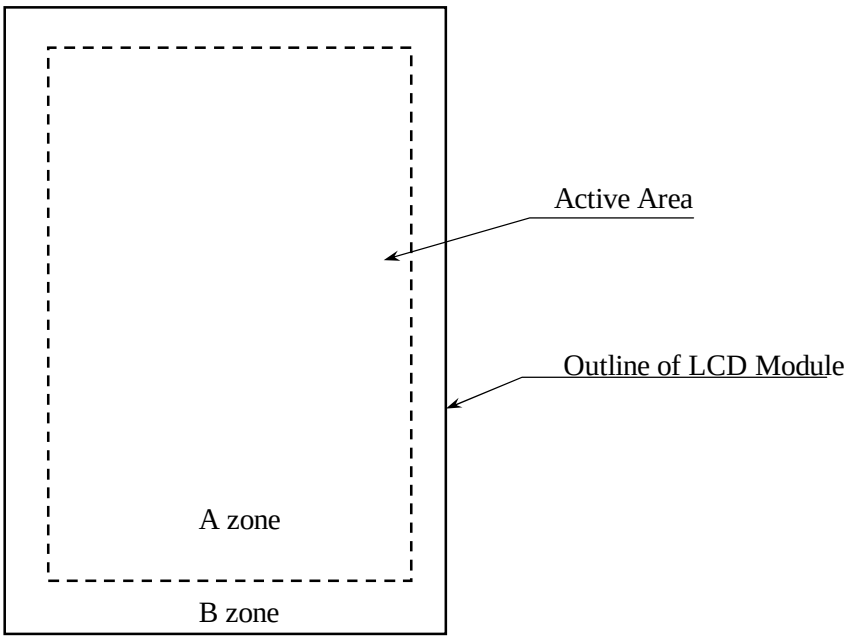
(1) Ambient illumination : 1000 - 1500 [lx]
(2) Distance between inspector's eyes and LCD Module : Approximately 30 [cm]
(3) Viewing angle : ≤ 30°
(4) Ambient Temperature : 25°C
(5) Refer to the Measurement Conditions described in Item 6 for the conditions other than specified here.




### 10.2 DEFINITION OF ZONE

The visual inspection zones of LCD Module is divided into three as follows.

A zone : Active Area (For dimensions, see Item 9, DIMENSIONAL OUTLINE)
B zone : Whole LCD module except the Active Area (Including FPC and frame)



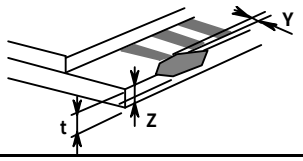
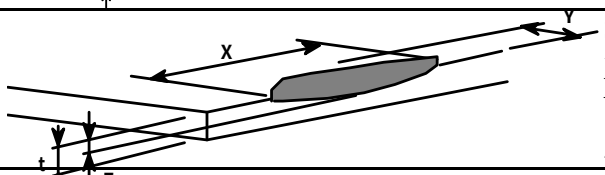
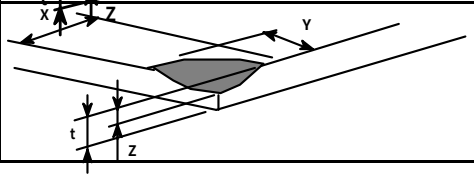
Tentative

## 10.3 COSMETIC SPECIFICATION

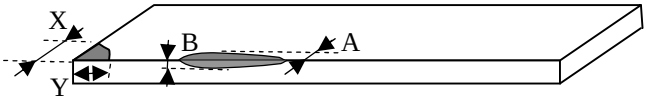
### 10.3.1 Screen Diffects Specification

| No. | Item | | | Maximum Acceptable Number | Unit | Applied zone | LCD module | Back light | Note |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Dot Defect | Bright dot | | 0 | PC | A | On | | (1),(2),(3),(4) |
| | | Dark dot | | 2 | | | | | |
| | | Total Number | | 2 | | | | | |
| 2 | Line Defect | | | 0 | PC | A | On | | - |
| 3 | Uneven Brightness (Linear) | | | Serious one is not allowed | - | A | On | | (6) |
| 4 | Uneven Brightness (Circular) | | | | | | | | |
| 5 | Foreign Particles, Stain (Liner)[mm] W:Width, L:Length | W≦0.02 | L<1.0 | Ignored | PC | A | On | | (5),(6),(7) |
| | | 0.02<W≦0.03 | L≦1.0 | 1 | | | | | |
| | | 0.03<W | - | 0 | | | | | |
| 6 | Foreign Particles, Stain (Circular)[mm] D:Average diameter | D≦0.1 | | Ignored | PC | A | On | | (5),(6),(7) |
| | | 0.1<D≦0.2 | | 1 | | | | | |
| | | 0.2<D | | 0 | | | | | |
| 7 | Scratch of Polarizer (Liner)[mm] W:Width, L:Length | W≦0.02 | L<1.0 | Ignored | PC | A | Off | | (5),(6),(7) |
| | | 0.02<W≦0.03 | L≦1.0 | 1 | | | | | |
| | | 0.03<W | - | 0 | | | | | |
| 8 | Scratch of Polarizer (Circular)[mm] D:Average diameter | D≦0.1 | | Ignored | PC | A | Off | | (5),(6),(7) |
| | | 0.1<D≦0.2 | | 1 | | | | | |
| | | 0.2<D | | 0 | | | | | |
| 9 | Polarizer Bubble [mm] D:Average diameter | D≦0.1 | | Ignored | PC | A | Off | | (5),(6),(7) |
| | | 0.1<D≦0.2 | | 1 | | | | | |
| | | 0.2<D | | 0 | | | | | |
| 10 | Scratch, Dent in Frame | | | Serious one is not allowed | - | B | Off | | (6) |
| 11 | Scratch of FPC | | | | - | B | Off | | (6) |

10.3.1 anel chipping Specification: It is internal standard, and this is not guarantee SPEC.

| Item | Criterion for Defects | |
|---|---|---|
| Glass Chipping [Pad Area] |  | Size (mm)<br>Y≦1.0<br>Z≦t |
| Glass Chipping [Except Pad Area] |  | Size (mm)<br>X≦5.0<br>Y≦1.5<br>Z≦t |
| Glass Chipping [Corner] |  | Size (mm)<br>X(or Y)≦5.0<br>Y(or X)≦1.5<br>Z≦t |

10.3.3 Driver IC chipping Specification: Delivery specifications for Driver IC Chipping are as follows.




X,Y≦0.05mm
A,B≦0.04mm

Tentative

Notes (1) A defect whose area is more than 50% of the dot is regarded as a Dot Defect.

(2) A dot whose brightness at all black screen is more than 30% of a normal white dot is defined as a Bright Dot Defect.

(3) A defect whose brightness in all white screen is less than 60% of a normal white dot is defined as a Dark Dot Defect.

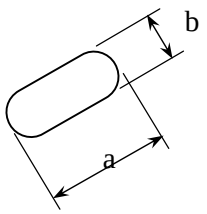
(4) Defective dots which are not adjacent are taken as a single Dot Defect each.

(5) Something which can be easily wiped off is disregarded as a defect.

(6) In case a problem arises, both parties should discuss needed items such as limit samples.

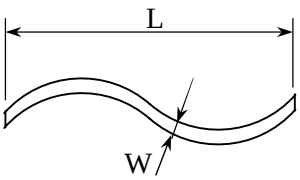
(7) Definitions for D, W and L are as follows.

Definition of D



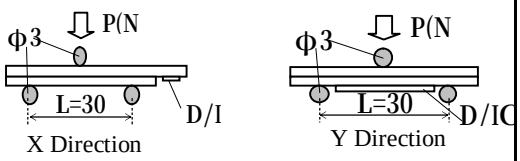
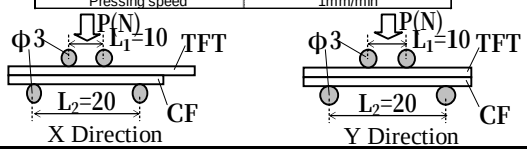

$$D = \frac{a + b}{2} \text{ (mm)}$$

Definition of W and L



Tentative

## 10.4 RELIABILITY TEST

| No. | Test Items | Test Conditions | Quantity | Note |
|---|---|---|---|---|
| 1 | High temperature, operating | 70℃, 96 h | 10 | (1), (2) (5) |
| 2 | Low temperature, operating | -20℃, 96 h | 10 | |
| 3 | High temperature & high humidity, operating | 60℃, 90%RH, 96 h | 10 | |
| 4 | High temperature, storage | 80℃, 96 h | 10 | (2), (5) |
| 5 | Low temperature, storage | -30℃, 96 h | 10 | |
| 6 | High temperature & high humidity, storage | 60℃, 90%RH, 96 h | 10 | |
| 7 | Thermal shock, storage | -30℃ (0.5h) / +80℃ (0.5h), 24 cycles | 10 | |
| 8 | Vibration | 10-55 Hz, Vibration amplitude : 1.5 mm, Direction : X, Y, Z, 2 h/axis | 5 | |
| 9 | Packaging drop test | Drop height : 30 cm, 1 angle, 3 edges | 1 | (2), (4) |
| 10 | 3 Point Bending | Support jigs: 3.0mm diam.<br>Support Jigs Distance: 30mm<br>Pressing jig: 3.0mm diam.<br>Jig Material: Steel (or Al)<br>Pressing speed: 3mm/min<br>  | | (3) |
| 11 | 4 Point Bending | Support jigs: 3.0mm diam.<br>Support Jigs Distance: 20mm<br>Pressing Jigs: 3.0mm diam.<br>Pressing Jigs Distance: 10mm<br>Jig Material: Steel (or Al)<br>Pressing speed: 1mm/min<br>  | | (3) |
| 12 | Static Electricity | 100 pF - 1.5 kohm, 25°C-70%RH<br>±2 kV | 5 | (6) |

Notes (1) Operation conditions : VDD=VCI=2.8V, IOVCC=1.8V, fFLM=60Hz.

(2) To be no defective functions related to electrical and/or optical characteristics when the tested module operates.

(3) It is not the guaranteed value for lot acceptance.
If a nonconformance is found, both parties will have a discussion to solve it.

(4) One set includes 10 trays which contain 3 pieces of LCD modules each and an empty tray as the cover.

(5)A slippage and a wrinkle of the Refrector sheet after reliability test, will be discussed separately.

(6) 100 pF - 1.5 kohm, 25°C-70%RH
Static electricity discharge is to be aimed at the center of the active area.

Tentative

## 11. PRECAUTIONS IN DESIGN

### 11.1 GENERAL ATTENTION

(1) The LCD module covered by this specification has been designed specifically for a mobile phone application. When used for other applications, we do not warrant any of the content of these specifications including quality and safety sections. Furthermore, this module has not been explicitly developed for medical equipment critically related to human life such as life support apparatus.

(2) Never attempt to disassemble this LCD module. There is a danger of burns, electric shock, and injury. If the module is disassembled, we do not warrant any of these specifications including quality and safety sections.

### 11.2 PRECAUTIONS AGAINST ELECTROSTATIC DISCHARGE

This module includes C-MOS LSI(s), which are sensitive and vulnerable to electrostatic discharge. Any operator should be grounded with suitable anti-ESD equipment such as a wrist band when handling the module. Avoid touching terminal pins directly.

### 11.3 HANDLING PRECAUTIONS

(1) Do not subject the LCD module to a humid environment for any extended period. If the ambient storage temperature is over 35°C, steps should be taken to avoid high humidity. The polarizer can deteriorate under high temperatures and high humidity. Additionally, this can also cause the polarizer to bubble and peel. Please store/operate the LCD module within the specified temperatures and humidity ranges.

(2) As polarizer material tends to be easily scratched, the LCD module must be handled with due care to avoid touching, pressure or rubbing by any material which is harder than 3H pencil lead (e.g. metal fixings, tweezers, glass, etc.)

(3) No pressure more than 19.6 kPa must be applied to the LCD module surface. If pressure is exerted over an area of less than 1 $cm^2$, the maximum pressure must not exceed 1.96 N.

(4) As adhesives containing organic materials are used for securing upper and lower polarizers, these can be deteriorated by chemical reaction with chemicals such as acetone, toluene, ethanol and isopropyl alcohol (IPA). The following solvent is recommended for use : Normal hexane. Please contact us if it is necessary to use chemicals other than these mentioned above.

(5) Lightly wipe the surface with a clean, soft material such as a cotton swab or cleaning cloth for glasses, dampened with the recommended chemical. Always wipe the surface horizontally or vertically. Never wipe using a circular motion and avoid excess pressure or scrubbing. To prevent the display surface from damage and to maintain in a good state, it is generally sufficient, to wipe the surface with a cotton swab.

(6) If spittle or a water drop comes in contact with the display area, immediately wipe it off. Liquids can damage the LCD module resulting in deformation and faded color.

Tentative

(7) Condensation on the LCD module may cause staining, dirtying or damage to the pola necessary to move the LCD module from an area of lower ambient temperature to a higher one, it is required to let it normalize to the new ambient temperature before unpacking or use.

(8) Touching the display area or the terminal pins with bare hands or contaminating them should be avoided. In our experience, staining on the display area and poor insulation between terminals are often caused by being touched with bare hands. (Some cosmetics are detrimental to polarizers.)

(9) As the display is made of glass, it is possible to break under shock loads, especially the periphery can be easily cracked or chipped in handling. Please handle the module with care and prevent it from being dropped.

(10) Never bend nor scratch the interface part. These actions can cause poor electrical contact.

(11) Since the top and bottom areas of bent FPC tend to be easily damaged, be very careful not to push or hold in those areas.

(12) Be careful not to apply local stress to the back of the LCD module. This will potentially cause scratching to the backlight guide, or result in a non-uniformity issue. Pay extra attention to the interface connector portion at the time of connector insertion.

(13) Never hold the LCD module by the FPC when handling.

(14) Please insert the FPC into the connector first, keeping the FPC parallel to the connector's opening. Be sure to lock the connector before securing the module.

11.4 OPERATION PRECAUTION

(1) Noise spikes can cause a malfunction of the circuit. Recommended condition of spike noise level is: Vcc = ±200 mV (over and under shoot voltage).

(2) Response time depends on temperature (at a lower temperature, it becomes longer). Brightness and color are also temperature dependant.

(3) Be aware of the possibility of condensation under a sudden temperature change. Formation of dewdrops can cause damage to polarizer or electrical contacts and result inferior displaying or malfunction. And even after the condensation has dispersed, smears or spots may occur on the display surface.

(4) When a fixed pattern is displayed for a long period, afterimage is likely to occur.

(5) As the LCD module provides a high frequency circuit, sufficient countermeasures against electromagnetic noise, such as shielding, may be required.

(6) Do not connect nor disconnect the module to or from main system with power applied.

(7) Provide light shielding so that the driver is not exposed to light. Exposure to strong light may cause malfunction of the driver.

Tentative

## 11.5 STORAGE

When storing the LCD modules as spare parts, the following precautions are necessary.

(1) Store the LCD modules in a dark place; do not expose them to sunlight or fluorescent light. Keep the temperature between 10 and 30°C, and the humidity between 55% and 75%RH.

(2) The polarizer surface should not come in contact with any other object. It is recommended that the LCD modules are stored in the container in which they were shipped.

## 11.6 SAFETY

This LCD module is a glass product. In case of damage, ensure operators wear a pair of protective gloves whilst handling it. Additionally, if any liquid (liquid crystal) accidentally comes into contact with skin, immediately wash it off with soap and water.

## 11.7 MECHANICAL DESIGN

(1) The design of the mobile phone case and other components for this LCD module should be well studied so that any shock will not be transferred to the LCD module. When the mobile phone is dropped and the case provides insufficient shock absorption, the LCD module may become damaged.

(2) Providing a cushion material (e.g. PORON) in the case will help to reduce shock load transfer to the LCD driver.

(3) To prevent foreign substances from entering the display area, please apply a polyurethane foam cushion (e.g. PORON) around the LCD.

## 11.8 ENVIRONMENTAL PROTECTION

(1) Abide by national laws, legislation and local regulations when disposing of this LCD module.

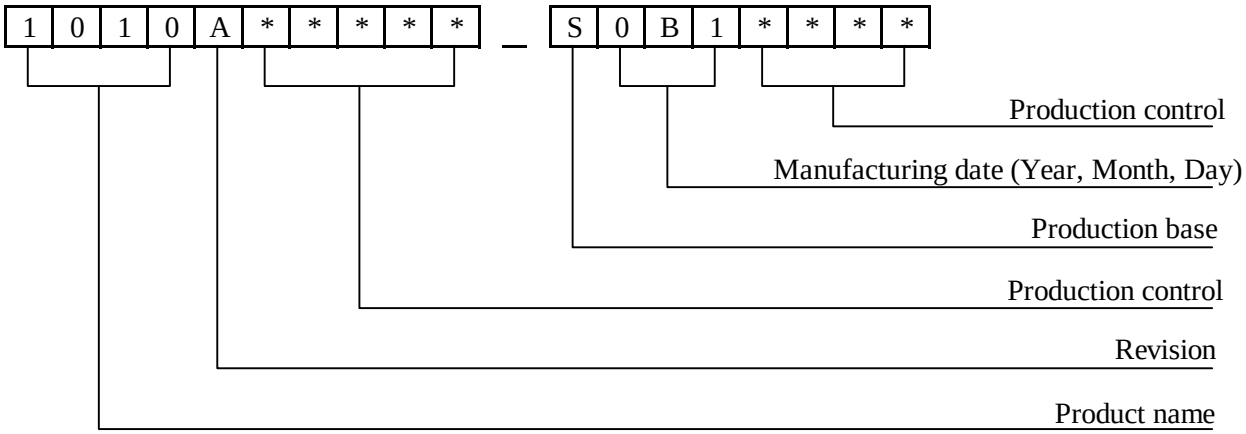
(2) This LCD module complies with RoHS Directive.

Tentative

## 12. DESIGNATION OF LOT MARK

LOT MARK

Lot mark is printed on the back of the LCD module.




| Revision | Description of change |
|---|---|
| A | |
| | |

| Year | Figure in lot mark |
|---|---|
| 2010 | 0 |
| 2011 | 1 |
| 2012 | 2 |
| 2013 | 3 |

| Month | Figure in lot mark | Month | Figure in lot mark |
|---|---|---|---|
| Jan. | 1 | July | 7 |
| Feb. | 2 | Aug. | 8 |
| Mar. | 3 | Sep. | 9 |
| Apr. | 4 | Oct. | A |
| May | 5 | Nov. | B |
| June | 6 | Dec. | C |

| Day | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|
| Figure in lot mark | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |

| Day | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 |
|---|---|---|---|---|---|---|---|---|---|---|
| Figure in lot mark | A | B | C | D | E | F | G | H | J | K |

| Day | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 |
|---|---|---|---|---|---|---|---|---|---|---|
| Figure in lot mark | L | M | N | P | Q | R | S | T | U | V |

| Day | 30 | 31 |
|---|---|---|
| Figure in lot mark | W | X |

| Production base | Figure in lot mark |
|---|---|
| Hitachi Displays | H |
| Hitachi Display Device (Suzhou) | S |

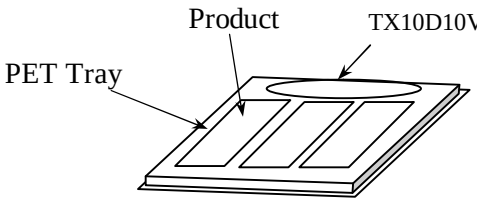
Print example

1010A00001_S0B10001

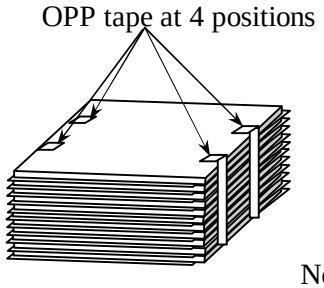
Tentative

## 13. PACKING SPECIFICATIONS

### 13.1 INNER BOX SPECIFICATIONS

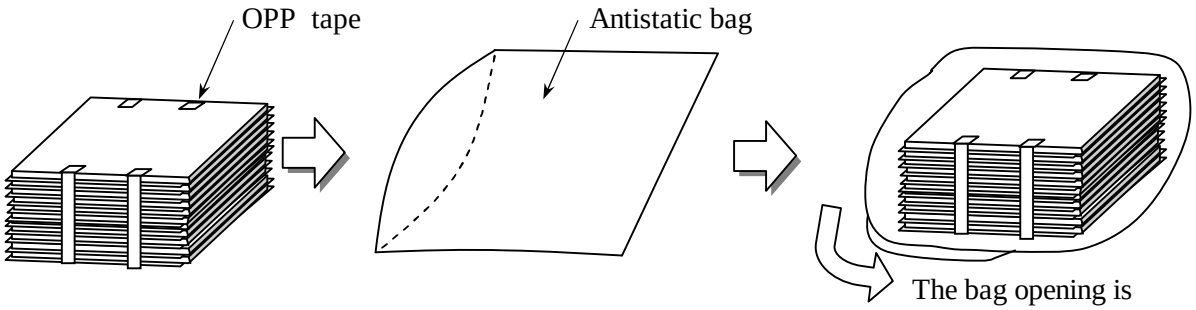


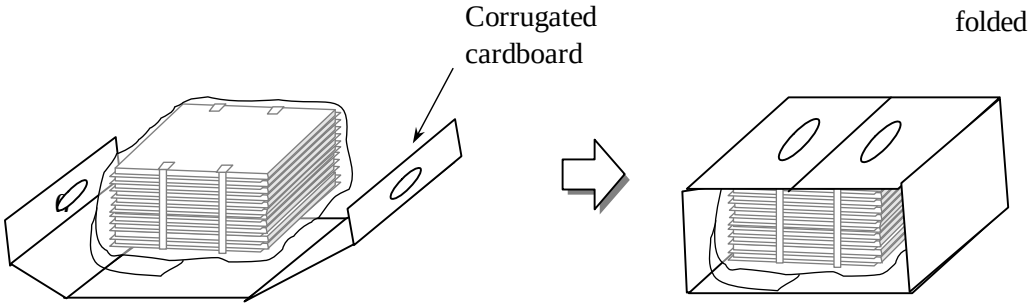

3 LCD modules per tray

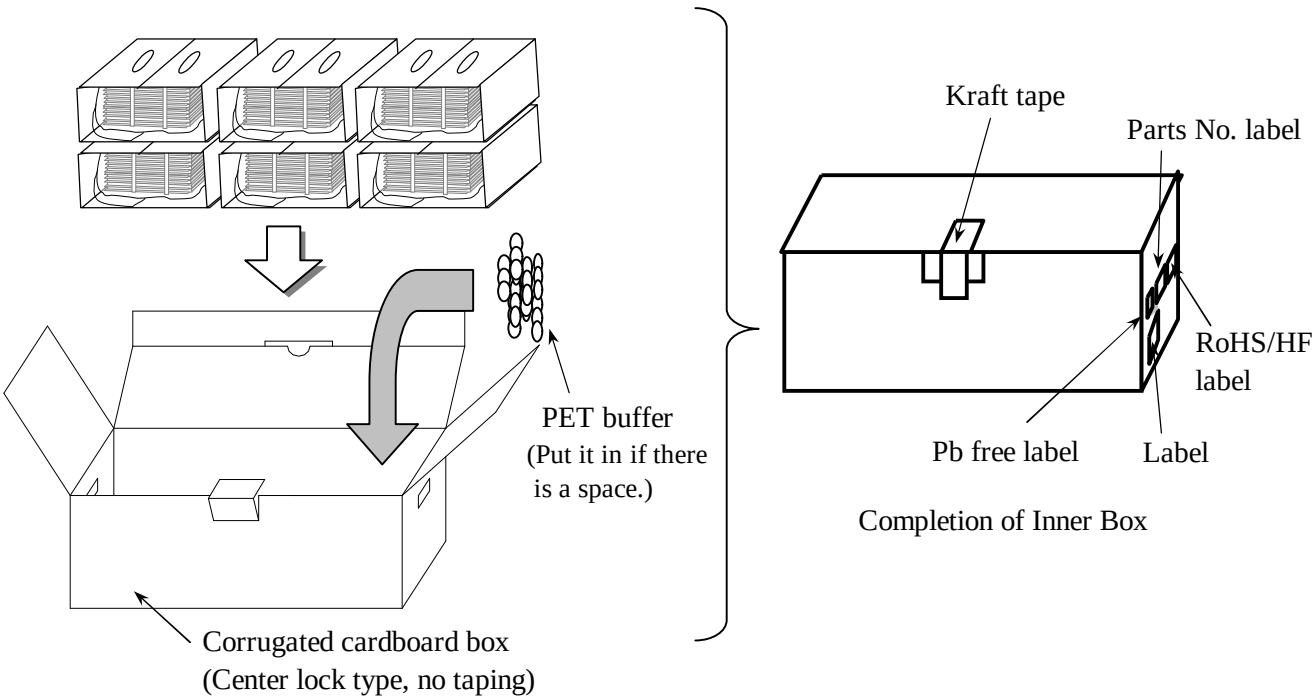



Note:
Alternately turn trays 180°

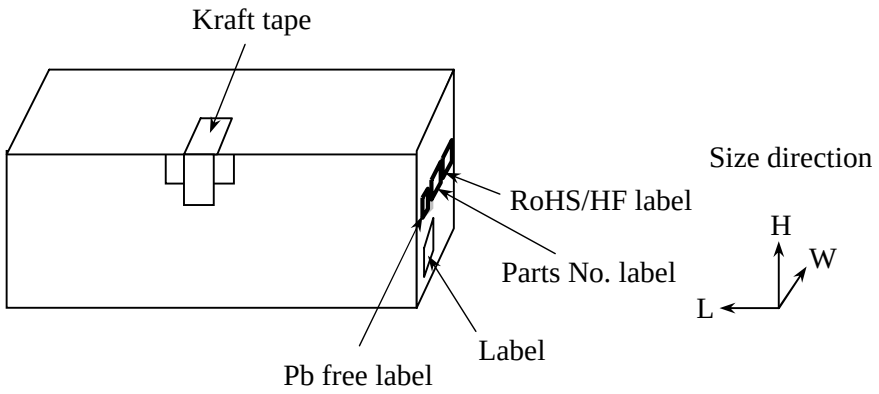
Ten (10) trays with products + empty tray as cover
= Eleven (11) trays (30 modules per batch)



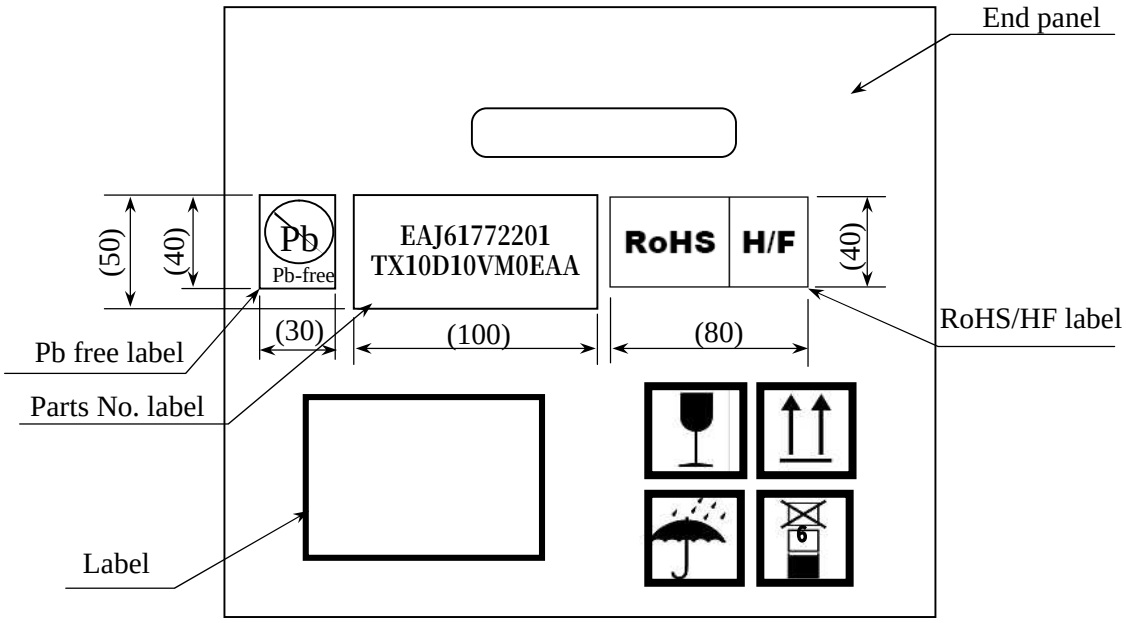



Tentative




| | |
|---|---|
| Size (L, W, H) | 765 × 315 × 270 mm |
| Quantity | 1 to 180 pcs |

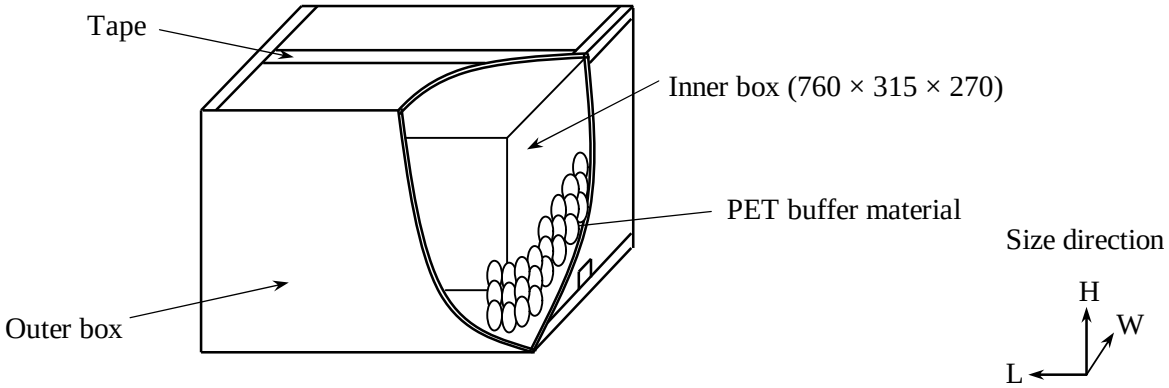
Marking of Inner Box



Tentative

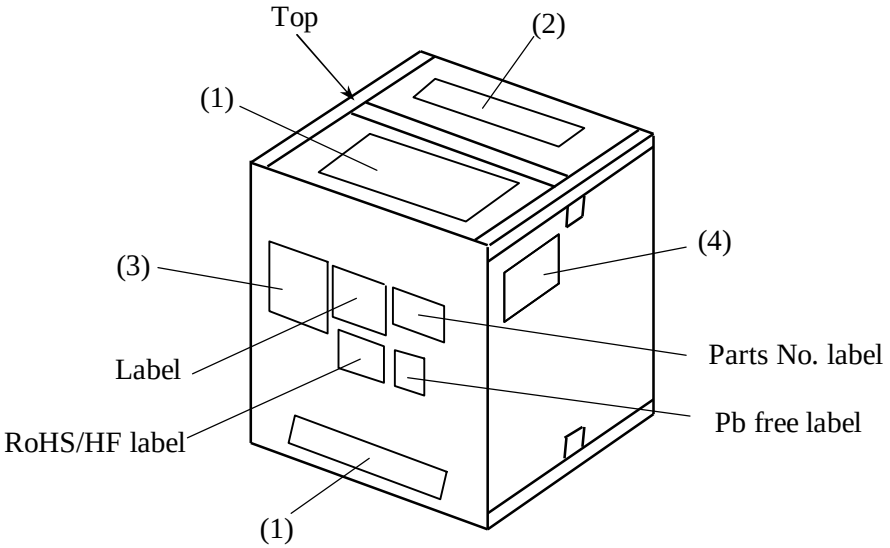
## 13.2 OUTER BOX SPECIFICATIONS

An outer box is used only when the number of products is less than the minimum quantity for pallet.




| | |
|---|---|
| Weight (gross) | 12.2 kg when the quantity is 180 pcs |
| Size (L, W, H) | 885 × 435 × 405 mm |
| Quantity | 1 to 180 pcs |

Marking of Outer Box



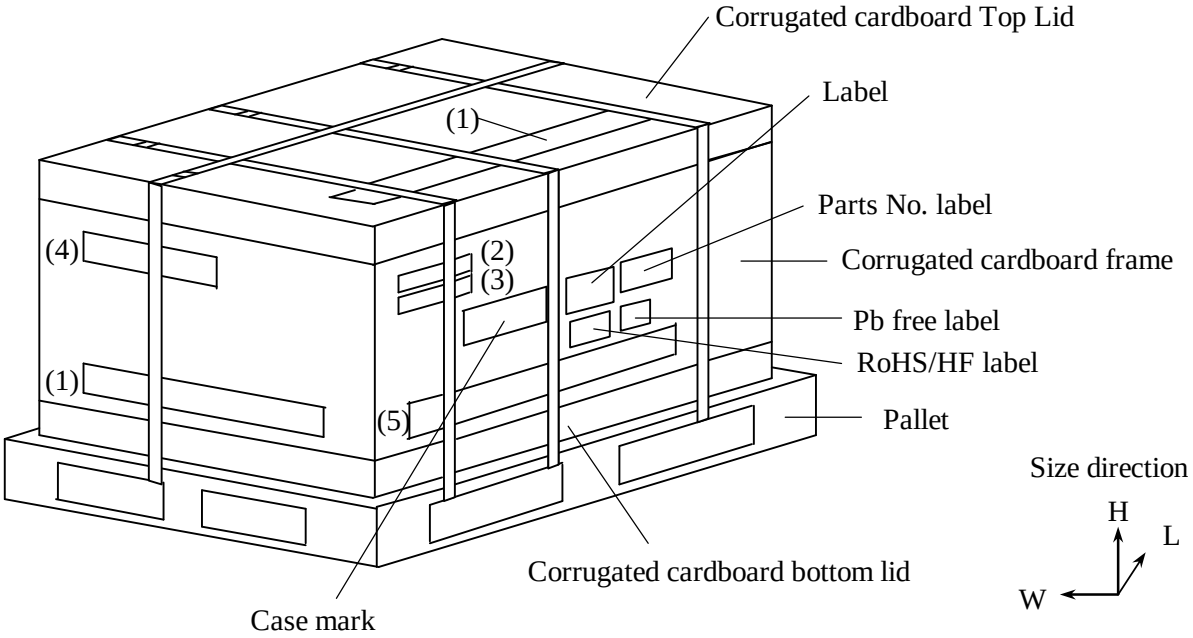

| | Mark | Position |
|---|---|---|
| (1) | "FRAGILE HANDLE WITH CARE" | Top panel and both side panels |
| (2) | "GLASS" | Top panel |
| (3) | Case mark | One side panel |
| (4) | | Both end panels |

Markings are in red, except for the case mark.

Tentative

## 13.3 PALLET SPECIFICATIONS

A pallet is used for shipment of three (3) to nine (9) inner boxes.




| | |
|---|---|
| Weight (gross) | Approx. 106.6 kg when the quantity is 1620 pcs |
| Size (L, W, H) | Approx. 1200 × 820 × 990 mm |
| Quantity | 181 to 1620 pcs |

Marking of Pallet load

| | Mark | Position |
|---|---|---|
| (1) | "FRAGILE HANDLE WITH CARE" | Top panel and both end panels |
| (2) | "精密機器" | Both side panels |
| (3) | "小心軽放" | Both side panels |
| (4) | | Both end panels |
| (5) | "HANDLE WITH FORKLIFT TRUCK ONLY" | Both side panels |

All markings in red

## 14. PRECAUTIONS FOR USE

Tentative

(1) A limit sample shall be provided by both parties when both parties agree to its necessity. Judgment by limit sample shall take effect after the limit sample has been established and confirmed by both parties.

(2) Under the following situations, handling of the problem should be decided through immediate discussion and agreement between responsible people of both parties.

a) When a question arises concerning the specifications.

b) When a new item which is not mentioned in the specification occurs.

c) When the customer changes any item of inspection specification or operating condition and reports it to Hitachi, and an issue with the specification arises because of this change.

d) When a new issue is found with the customer's operating set for sample evaluation.

(3) All the specifications in this document become effective immediately after approval signatures of both parties are in place.

Tentative

# 15. PARTS SPECIFICATION

## 15.1 PARTS LIST

LCM Parts List

| Part No. | Part Name | Supplier | Specification | Quantity | Remarks |
|---|---|---|---|---|---|
| 1 | UPPER POLARIZER | NITTO DENKO | Anti-Reflection type(ARC9) | 1 | |
| 2 | SHADING TAPE | DIC Corporation | LS-025H(N) | 1 | |
| 3 | COLOR FILTER GLAS | Asahi Glass | t0.20 mm | 1 | |
| 4 | TFT GLASS | Asahi Glass | t0.20 mm | 1 | |
| 5 | DRIVER IC | LGE | LG4574 | 1 | |
| 6 | UPPER POLARIZER | NITTO DENKO | APCF type | 1 | |
| 7 | Main-FPC | SUMITOMO DENKO | 2 layers | 1 | |
| 8 | INSLATION TAPE | NICHIEI KAKOH | PET25-S7GREEN | 2 | |
| 9 | BACK LIGHT UNIT | Hitachi Displays | 9 LEDs | 1 | |

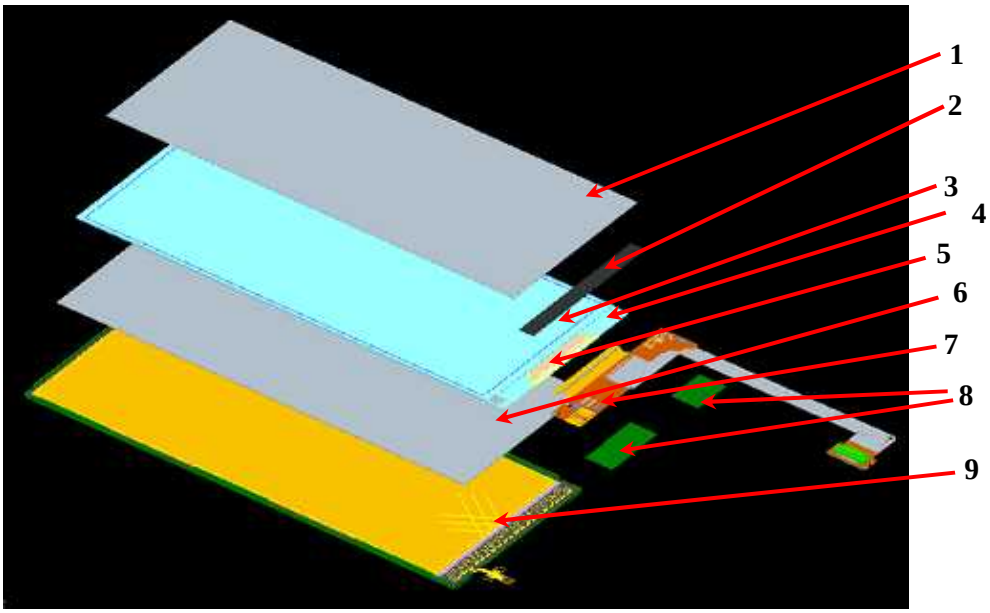
Main-FPC Parts List

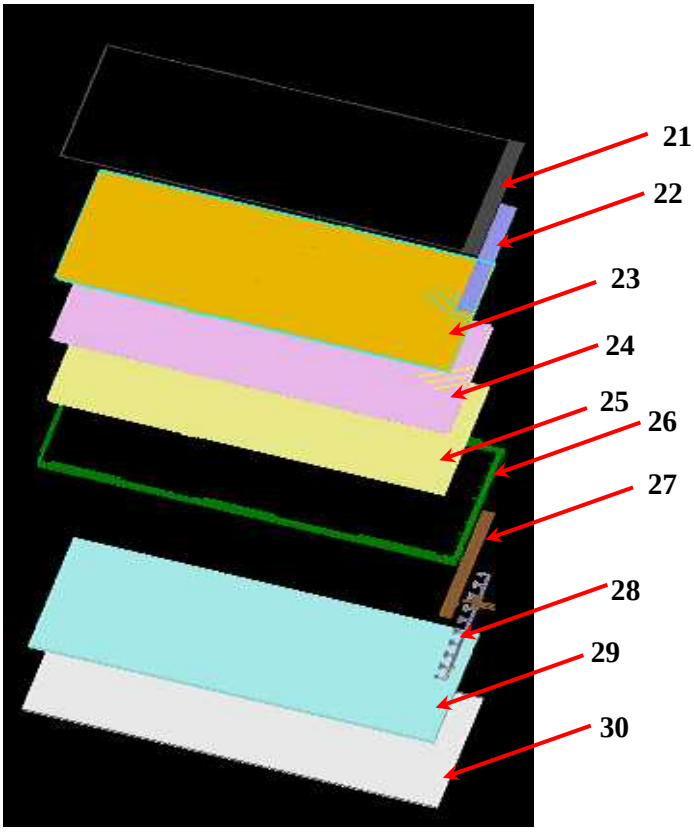
| Part No. | Part Name | Supplier | Specification | Quantity | Remarks |
|---|---|---|---|---|---|
| 040 | RESISTOR | Panasonic,etc | ERJ2GE0R00X, etc. | 1 | |
| 050 | CHIP CAPACITOR | Murata ,etc | GRM155B31A105KE15D, e | 13 | |
| 051 | CONNECTOR | LS-Mtron | GB042-24S-H10 | 1 | |
| 052 | CHIP CAPACITOR | TAIYO YUDEN, etc | LMK105BJ225MV-F | 1 | |
| 053 | CHIP CAPACITOR | Murata | GNM1M2B31A105ME19D | 2 | |
| 054 | CHIP CAPACITOR | TAIYO YUDEN, etc | LMK105BJ225MV-F, etc | 4 | |
| 055 | FUSE | KOA | TF10BN0_63TTB | 1 | |
| 058 | TRANSISTOR | ROHM | RUM003N02G | 1 | |
| 059 | TRANSISTOR | RENESAS | HRL0103C-N | 1 | |
| 060 | CHIP CAPACITOR | Murata | GRM155B31A474KE14D | 1 | |
| 061 | CHIP CAPACITOR | Murata, etc | GRM155B11H102KA01D | 1 | |
| 062 | INDUCTOR | TDK | CPL2006T4R7M, etc | 1 | |

Back Light Unit Parts List

| Part No. | Part Name | Supplier | Specification | Quantity | Remarks |
|---|---|---|---|---|---|
| 21 | **SHADING TAPE** | SEKISUI CHEMICAL | #550TL6BW | 1 | |
| 22 | SPACER TAPE | NITTO DENKO CORPORATION | No.5682ET + S28#16 | 1 | |
| 23 | **UPPER PRISM SHEE** | Sumitomo 3M Limited | TBEF2-GM(19)v2 | 1 | |
| 24 | **LOWER PRISM SHEE** | Sumitomo 3M Limited | TBEF2-GT(24) | 1 | |
| 25 | **DIFFUSION FILM** | TSUJIDEN | D148P2SIV | 1 | |
| 26 | MOLD | Idemitsu kosan | URC2500 | 1 | |
| 27 | LED-FPC | FPC: SUIWA | 2 layers | 1 | |
| | | LED: NICHIA | NSSW206A, Note(*3) | 9 | |
| 29 | **AD TAPE** | SEKISUI CHEMICAL | #550T5W + No.631S#12 | 1 | |
| 30 | **LIGHT GUIDE** | Sumitomo dau Limited | SD2201W ME050 | 1 | |
| 31 | **REFLECTION SHEET** | Sumitomo 3M Limited | ESR | 1 | |

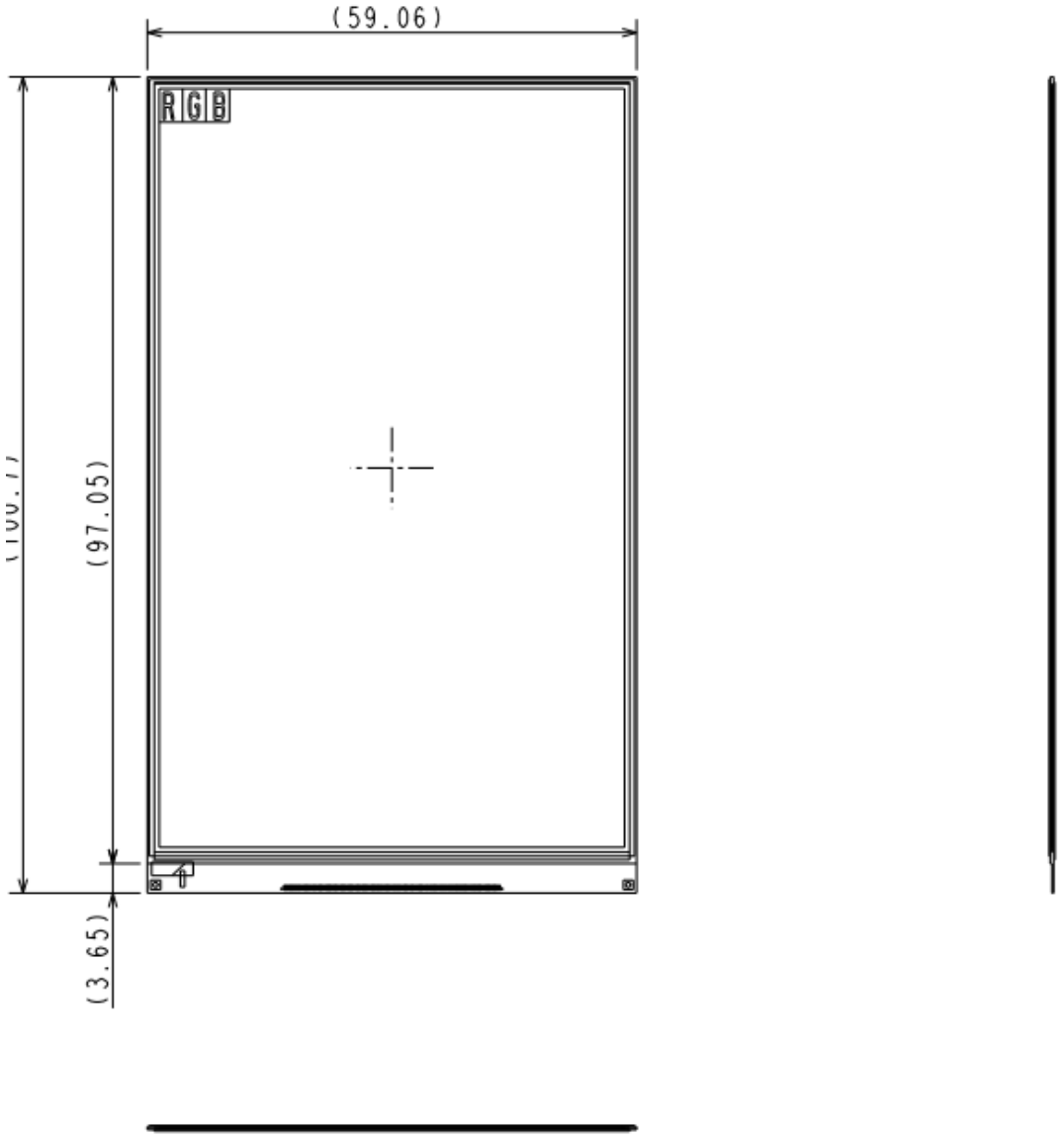
Tentative



Tentative

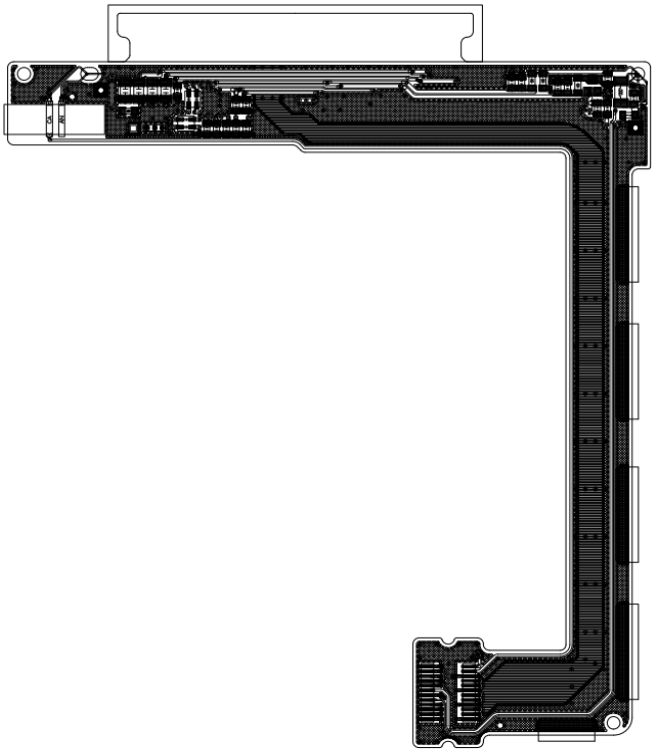
15.2 LCD LAYOUT



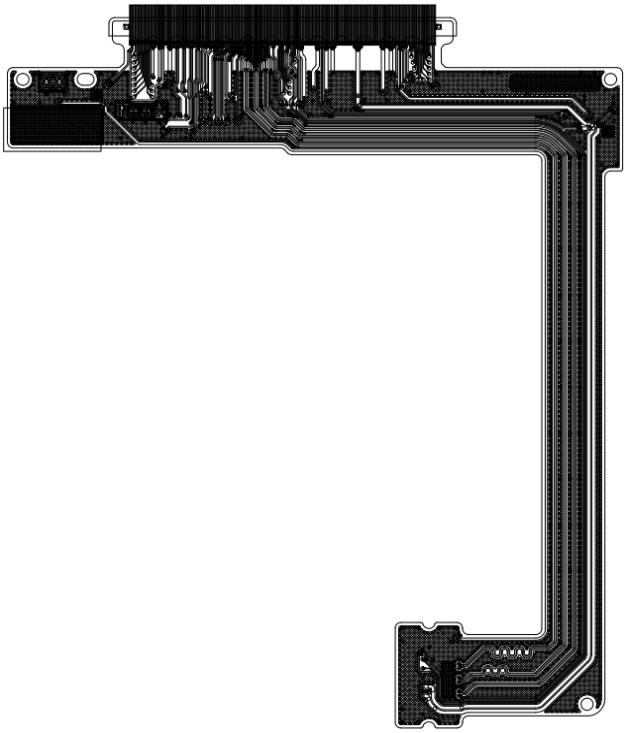
Tentative

## 15.3 FPC LAYOUT

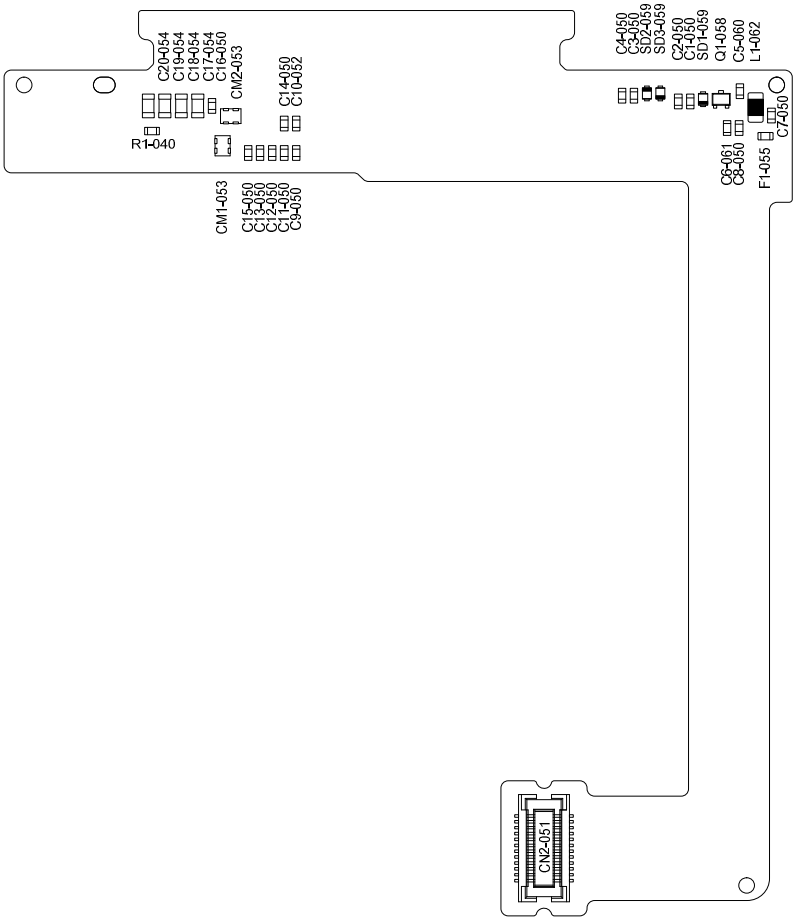
(1) )FPC Pattern Layout (Electronic components mounting side)



(2) FPC Pattern Layout (Transparent

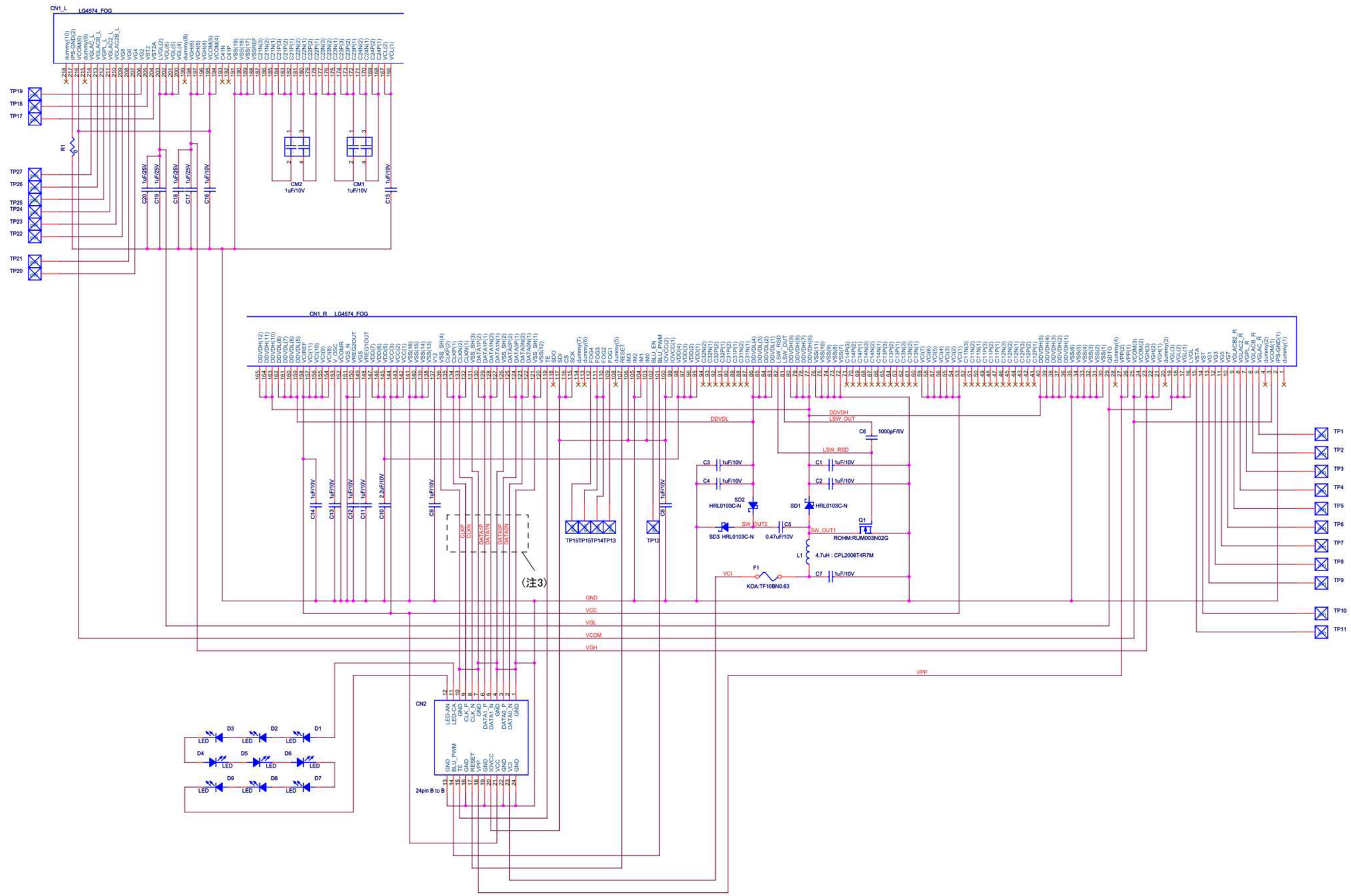


(3) COMPONENTS LAYOUT DRAWING



Tentative

(4) FPC CIRCUIT DIAGRAM

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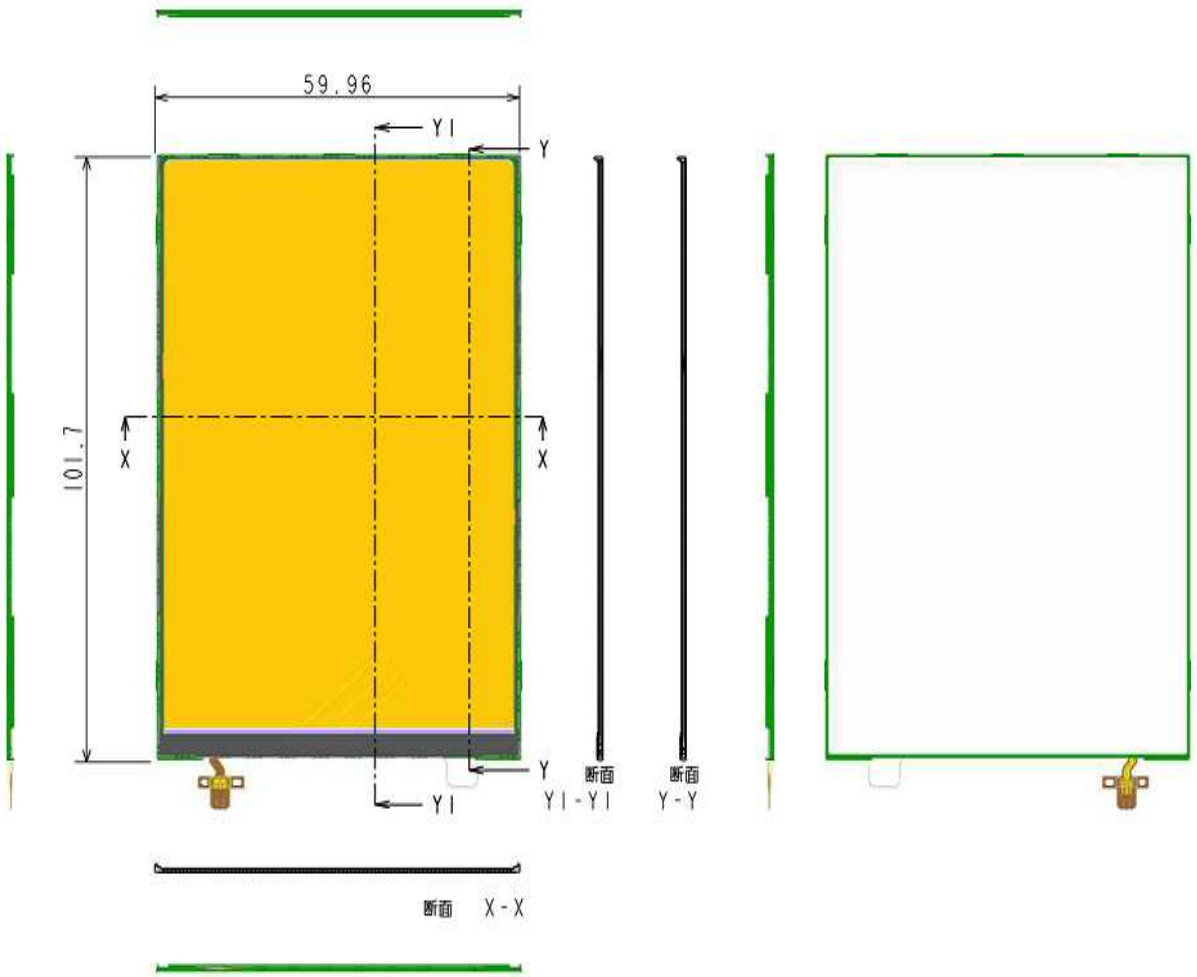
|---|---|---|---|---|---|---|

15.4 BLU LAYOUT

Tentative



Tentative

15.5 LED SPECIFICATION

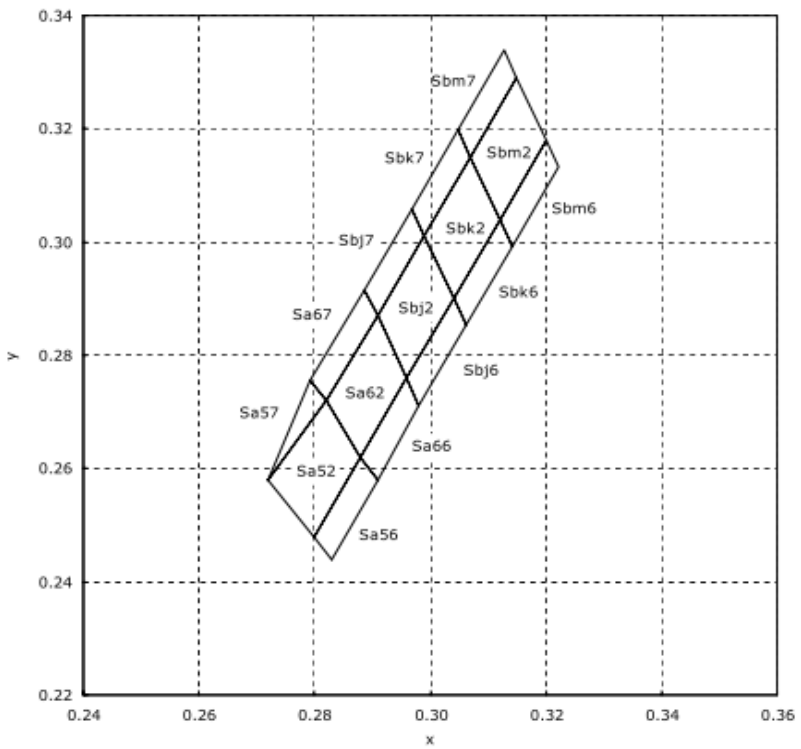
Note(*3) Delivery specifications for LED are as follows.

(Ta=25℃)

Luminous Ranks

| | Symbol | Condition | Min. | Max. | Unit |
|---|---|---|---|---|---|
| Rank NW800 | øV | IF=20[mA] | 8.00 | 8.25 | lm |
| Rank NW775 | øV | IF=20[mA] | 7.725 | 8.00 | lm |
| Rank NW750 | øV | IF=20[mA] | 7.50 | 7.75 | lm |

Color Ranks

| Sa67 | | | | | Sbj7 | | | | |
|---|---|---|---|---|---|---|---|---|---|
| x | 0.282 | 0.2793 | 0.2887 | 0.291 | x | 0.291 | 0.2887 | 0.2968 | 0.299 |
| y | 0.272 | 0.2755 | 0.2916 | 0.287 | y | 0.287 | 0.2916 | 0.3058 | 0.301 |

| Sa62 | | | | | Sbj2 | | | | |
|---|---|---|---|---|---|---|---|---|---|
| x | 0.288 | 0.282 | 0.291 | 0.296 | x | 0.296 | 0.291 | 0.299 | 0.304 |
| y | 0.262 | 0.272 | 0.287 | 0.276 | y | 0.276 | 0.287 | 0.301 | 0.290 |