# 1.63 inch AMOLED

# SPECIFICATION

# MODEL NAME: LETBA320320N1

**Date: 2017 / 03 / 31**

| **Customer Signature** | | |
|---|---|---|
| **Customer** | | |
| **Approved Date** | **Approved By** | **Reviewed By** |
| | | |

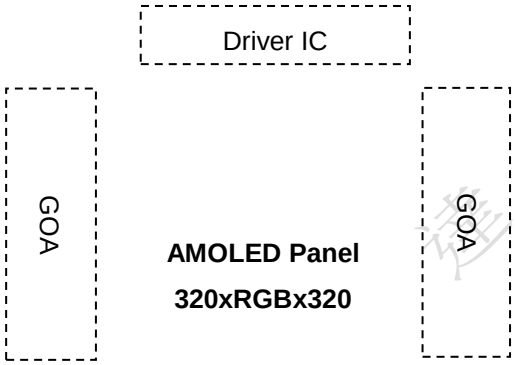
# Contents

# A. General Specification

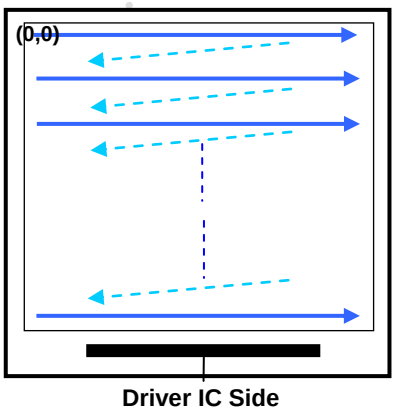
## 1. Physical Specifications

| | Item | Description | Remark |
|---|---|---|---|
| 1 | Screen Size (inch) | 1.63” | |
| 2 | Display Mode | AMOLED | |
| 3 | Display Resolution (dot) | 320xRGBx320 | |
| 4 | Active Area (mm*mm) | 29.28 (H)×29.28(V) | |
| 5 | Pixel Configuration | Hyper R.G.B | |
| 6 | Display Color (M) | 16.7 | |
| 7 | Brightness (nits) | 300 | |
| 8 | Interface | MIPI DSI | |
| 9 | Outline Dimension (mm*mm*mm) | 32.08 (H) × 36.48(V) × 0.7(T) | cell+foam |

## 2. Module Block Diagram




## 3. Panel Scan direction



## B. Electrical Specifications

1. Main FPC Pin assignment — AMOLED Panel Input/Output Signal Interface

Recommended connector: AXE520127 (Panasonic)

| FPC | Pin_name | I/O | Description |
|---|---|---|---|
| 1 | **ELVSS** | P | AMOLED power Negative |
| 2 | **ELVSS** | P | AMOLED power Negative |
| 3 | **ELVSS** | P | AMOLED power Negative |
| 4 | **VDD** | P | Power supply for analog |
| 5 | **IOVDD** | P | Power supply for Interface system excep MIPI interface |
| 6 | **GND** | P | GND |
| 7 | **TE** | O | Vsync(vertical sync)signal output from panel to avoid tearing effect |
| 8 | **MTP** | I | MTP(need to indicate to connect GND or NC) |
| 9 | **RESX** | I | Device reset signal (0 : Enable ; 1: Disable ) |
| 10 | **SWIRE** | O | SWIRE signal for PWR IC control |
| 11 | **ELVDD** | P | AMOLED power positive |
| 12 | **ELVDD** | P | AMOLED power positive |
| 13 | **ELVDD** | P | AMOLED power positive |
| 14 | **GND** | P | GND |
| 15 | **DSI_D0N** | I/O | MIPI data negative signal |
| 16 | **DSI_D0P** | I/O | MIPI data positive signal |
| 17 | **GND** | P | GND |
| 18 | **DSI_CLKN** | I | MIPI strobe negative signal |
| 19 | **DSI_CLKP** | I | MIPI strobe postive signal |
| 20 | **GND** | P | GND |

Note: I = input ; O = output ; P = Power ; I/O = input / Output

## 2. Absolute maximum ratings

| Item | Symbol | Min. | Max. | Unit | Remark |
|---|---|---|---|---|---|
| Digital Power supply | IOVDD | -0.3 | 5.5 | V | |
| Analog Power supply | VDD | -0.3 | 5.5 | V | |
| ELVDD power supply | ELVDD | - | 5.0 | V | |
| ELVSS power supply | ELVSS | -5.0 | - | V | |

Note : If the module exceeds the absolute maximum ratings, it may be damaged permanently. Also, if the module operates with the absolute maximum ratings for a long time, the reliability may drop.

# C. Electrical Characteristics

## 1. DC Operating Conditions

| Item | | Symbol | Min. | Typ. | Max. | Unit | Remark |
|---|---|---|---|---|---|---|---|
| Digital Power supply | | IOVDD | 1.65 | 1.8 | 1.95 | V | Note1 |
| Analog Power supply | | VDD | 2.8 | 3.0 | 3.1 | V | Note1 |
| ELVDD power supply | | ELVDD | 4.57 | 4.60 | 4.63 | V | Note1,2 |
| ELVSS power supply | | ELVSS | -3.35 | -3.40 | -3.45 | V | Note1 |
| Input Signal Voltage | H Level | $V_{IH}$ | 0.8*IOVDD | - | IOVDD | V | Note1 |
| | L Level | $V_{IL}$ | 0 | - | 0.2*IOVDD | V | |
| Output Signal Voltage | H Level | $V_{OH}$ | 0.8*IOVDD | - | IOVDD | V | Note1 |
| | L Level | $V_{OL}$ | 0 | - | 0.2*IOVDD | V | Note1 |

Note 1: The operation is guaranteed under the recommended operating conditions only. The operation is not guaranteed if a quick voltage change occurs during the operation. To prevent the noise, a bypass capacitor must be inserted into the line closed to the power pin.

Note 2 : TPS65631W Positive output voltage = 4.6V ± 0.8% at -40°C ≦ Ta ≦ +85 °C

## 2. Display Current Consumption

| Item | | Symbol | Condition | Min. | Typ. | Max. | Unit | Remark |
|---|---|---|---|---|---|---|---|---|
| **Panel Power** | | $P_{NL}$ | ELVDD:4.6V ELVSS:-3.4V | -- | -- | 138.4 | mW | Note1,2, |
| | | $I_{NL}$ | | -- | -- | 17.3 | mA | Note1,2, |
| **IC** | **Normal** | $P_{VDD}$ | VDD : 3.0V | -- | 25.2 | 39.3 | mW | Note2, |
| | | $I_{VDD}$ | | -- | 8.4 | 13.1 | mA | Note2, |
| | | $P_{IOVDD}$ | IOVDD :1.8V | -- | 18.0 | 19.8 | uW | Note2, |
| | | $I_{IOVDD}$ | | -- | 10.0 | 11.0 | uA | Note2, |
| | **Idle** | $P_{VDD}$ | VDD : 3.0V | -- | 12.0 | 15.3 | mW | Note3,4 |
| | | $I_{VDD}$ | | -- | 4.0 | 5.1 | mA | Note3,4 |
| | | $P_{IOVDD}$ | IOVDD :1.8V | -- | 18.0 | 19.8 | uW | Note3, |
| | | $I_{IOVDD}$ | | -- | 10.0 | 11.0 | uA | Note3, |

Note 1: Based on L255 (300nits) full white pattern

Note 2: Testing in MIPI-DSI frame rate 60Hz CMD mode.

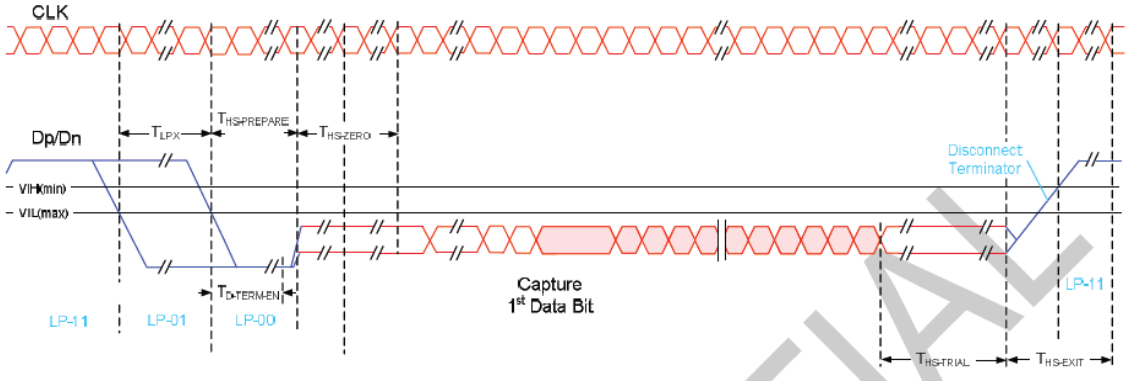
Note 3: Testing in MIPI-DSI frame rate 30Hz CMD mode.

Note 4: VCI Current must < 9mA at Idle mode.

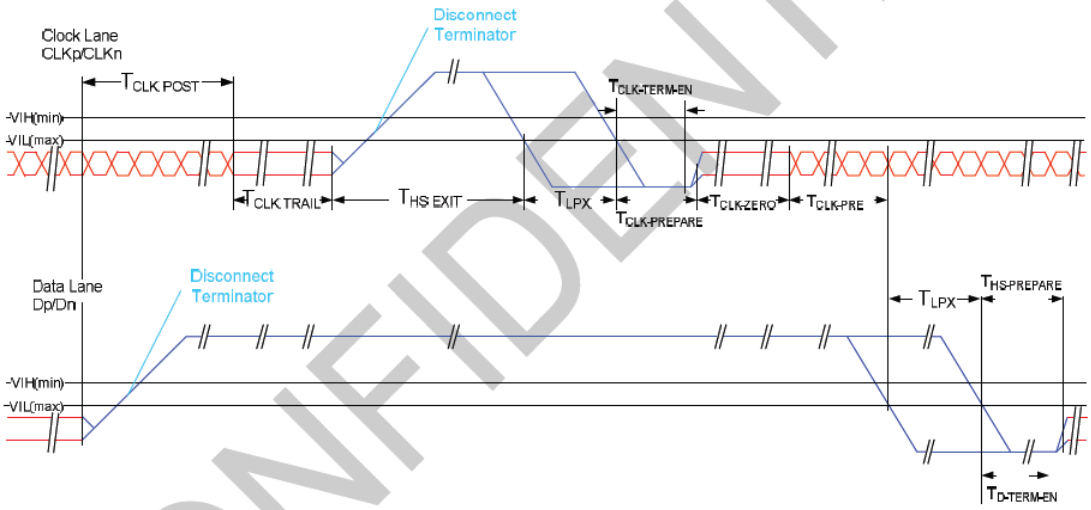
# D. AC Characteristics

## 1. MIPI Interface Characteristics

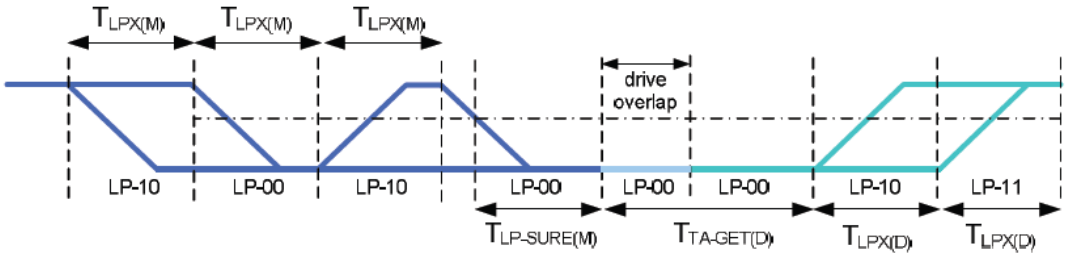
### HS Data Transmission Burst




### HS clock transmission




### Turnaround Procedure



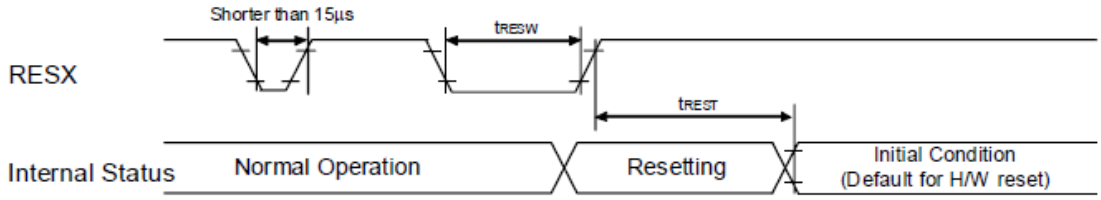
**Timing Parameters**

| Symbol | Description | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| $T_{CLK-POST}$ | Time that the transmitter continues to send HS clock after the last associated Data Lane has transitioned to LP Mode. Interval is defined as the period from the end of $T_{HS-TRAIL}$ to the beginning of $T_{CLK-TRAIL}$. | 60ns + 52*UI | | | ns |
| $T_{CLK-TRAIL}$ | Time that the transmitter drives the HS-0 state after the last payload clock bit of a HS transmission burst. | 60 | | | ns |
| $T_{HS-EXIT}$ | Time that the transmitter drives LP-11 following a HS burst. | 300 | | | ns |
| $T_{CLK-TERM-EN}$ | Time for the Clock Lane receiver to enable the HS line termination, starting from the time point when Dn crosses $V_{IL,MAX}$. | Time for Dn to reach $V_{TERM-EN}$ | | 38 | ns |
| $T_{CLK-PREPARE}$ | Time that the transmitter drives the Clock Lane LP-00 Line state immediately before the HS-0 Line state starting the HS transmission. | 38 | | 95 | ns |
| $T_{CLK-PRE}$ | Time that the HS clock shall be driven by the transmitter prior to any associated Data Lane beginning the transition from LP to HS mode. | 8 | | | UI |
| $T_{CLK-PREPARE}$ + $T_{CLK-ZERO}$ | $T_{CLK-PREPARE}$ + time that the transmitter drives the HS-0 state prior to starting the Clock. | 300 | | | ns |
| $T_{D-TERM-EN}$ | Time for the Data Lane receiver to enable the HS line termination, starting from the time point when Dn crosses $V_{IL,MAX}$. | Time for Dn to Reach $V_{TERM-EN}$ | | 35 ns +4*UI | |
| $T_{HS-PREPARE}$ | Time that the transmitter drives the Data Lane LP-00 Line state immediately before the HS-0 Line state starting the HS transmission | 40ns + 4*UI | | 60 ns + 6*UI | ns |
| $T_{HS-PREPARE}$ + $T_{HS-ZERO}$ | $T_{HS-PREPARE}$ + time that the transmitter drives the HS-0 state prior to transmitting the Sync sequence. | 145ns + 10*UI | | | ns |
| $T_{HS-TRAIL}$ | Time that the transmitter drives the flipped differential state after last payload data bit of a HS transmission burst | 96*UI | | | ns |
| $T_{LPX(M)}$ | Transmitted length of any Low-Power state | 100 | | 150 | ns |

| | | | | | |
|---|---|---|---|---|---|
| | period of MCU to display module | | | | |
| $T_{TA-SURE(M)}$ | Time that the display module waits after the LP-10 state before transmitting the Bridge state (LP-00) during a Link Turnaround. | $T_{LPX(M)}$ | | $2*T_{LPX(M)}$ | ns |
| $T_{LPX(D)}$ | Transmitted length of any Low-Power state period of display module to MCU | 50 | | 150 | ns |
| $T_{TA-GET(D)}$ | Time that the display module drives the Bridge state (LP-00) after accepting control during a Link Turnaround. | $5*T_{LPX(D)}$ | | | ns |
| $T_{TA-GO(D)}$ | Time that the display module drives the Bridge state (LP-00) before releasing control during a Link Turnaround. | $4*T_{LPX(D)}$ | | | ns |
| $T_{TA-SURE(D)}$ | Time that the MPU waits after the LP-10 state before transmitting the Bridge state (LP-00) during a Link Turnaround. | $T_{LPX(D)}$ | | $2*T_{LPX(D)}$ | ns |

## 2. Display RESET Timing Characteristics

**Reset input timing**




IOVDD=1.65 to 1.95V, VDD=2.8 to 3.1V, AGND=DGND=0V, Ta=-40 to 85℃

**Timing Parameters**

| Symbol | Parameter | Related Pins | MIN | TYP | MAX | Note | Unit |
|---|---|---|---|---|---|---|---|
| $t_{RESW}$ | *1) Reset low pulse width | RESX | 15 | - | - | - | µs |
| $t_{REST}$ | *2) Reset complete time | - | - | - | 5 | When reset applied during Sleep in mode | ms |
| | | - | | - | 120 | When reset applied during Sleep out mode | ms |

Note 1. Spike due to an electrostatic discharge on RESX line does not cause irregular system reset according to the table below.

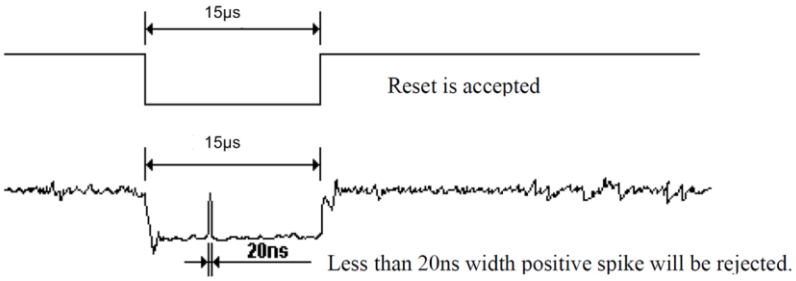
| RESX Pulse | Action |
|---|---|
| Shorter than 5µs | Reset Rejected |
| Longer than 15µs | Reset |
| Between 5µs and 15µs | Reset starts (It depends on voltage and temperature condition.) |

Note 2. During the resetting period, the display will be blanked (The display is entering blanking sequence, which maximum time is 120 ms, when Reset Starts in Sleep Out –mode. The display

remains the blank state in Sleep In –mode) and then return to Default condition for H/W reset.

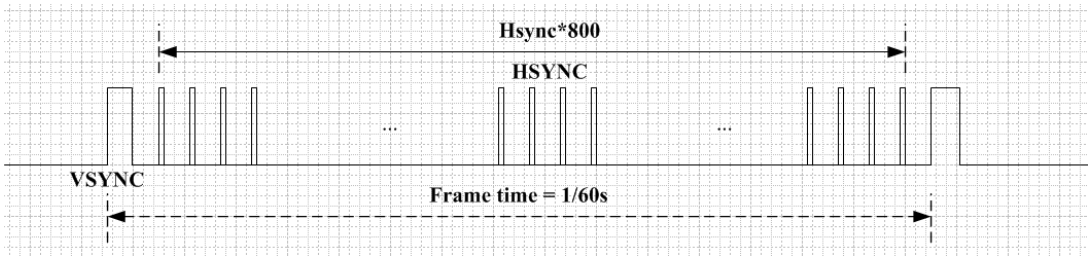
Note 3. During Reset Complete Time, data in OTP will be latched to internal register during this period. This loading is done every time when there is H/W reset complete time (tREST) within 5ms after a rising edge of RESX.

Note 4. Spike Rejection also applies during a valid reset pulse as shown below:




Note 5. It is necessary to wait 5msec after releasing RESX before sending commands. Also Sleep Out command cannot be sent for 120msec.

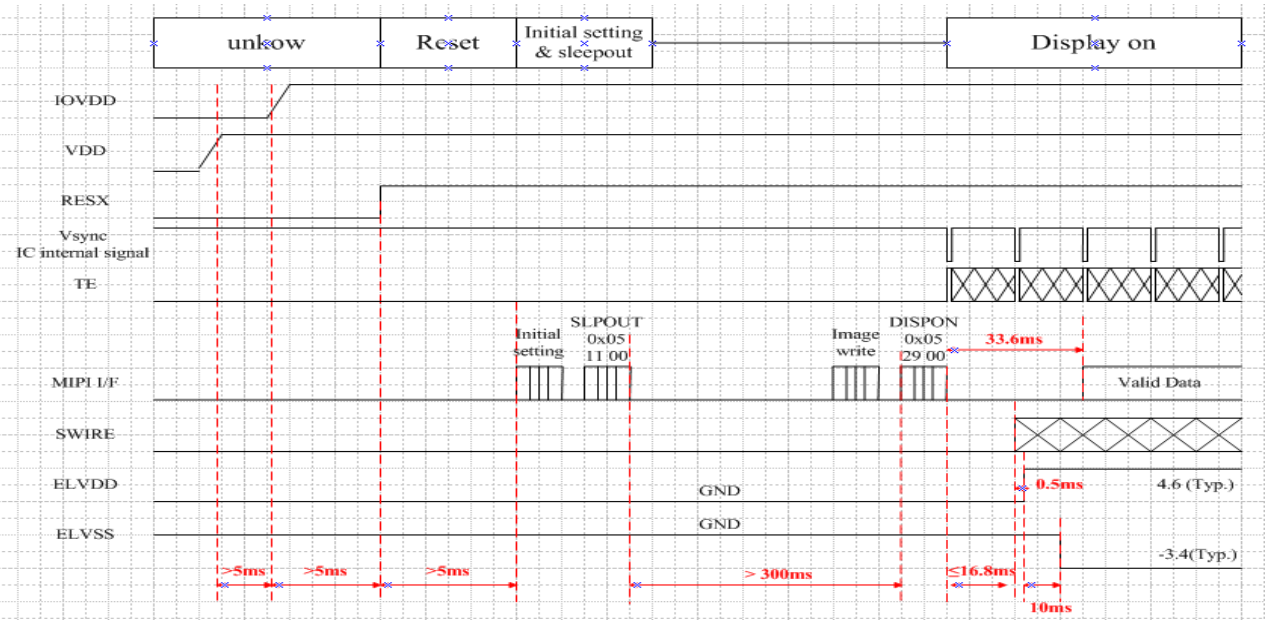
## 3. TE Timing Characteristics



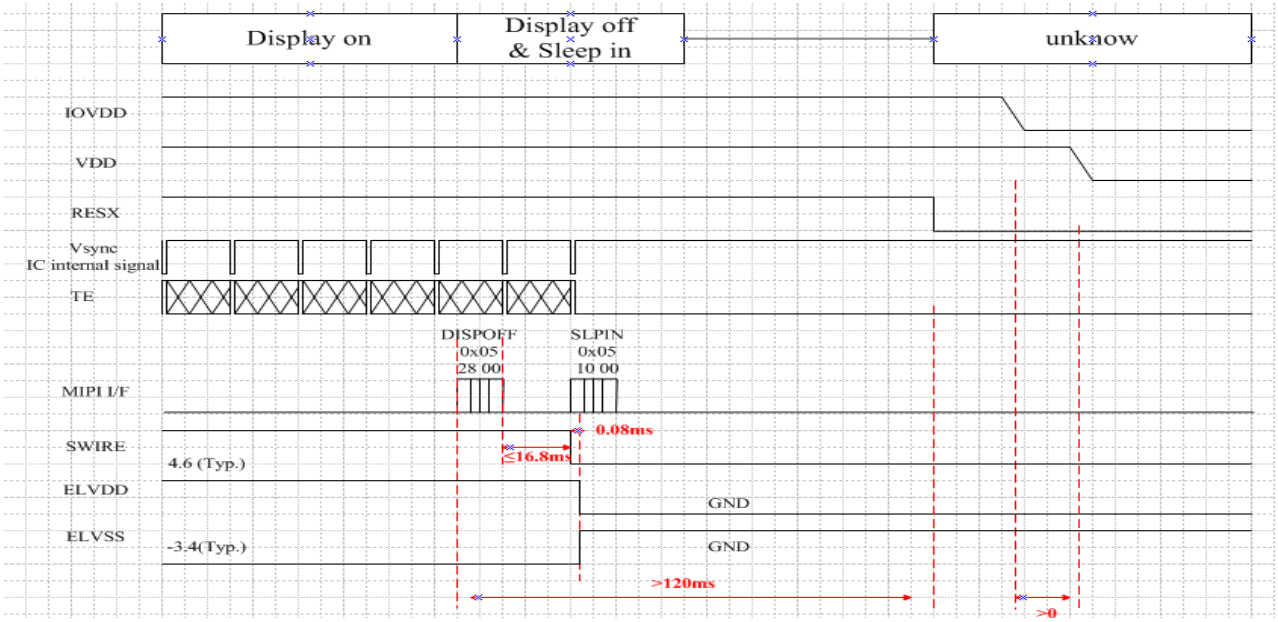
# E. Recommended Operating Sequence

## 1. Display Power on / off Sequence

**Power on sequence**




**Power off sequence**



## 2. Display Initial code

| Recommended Power on Initial Sequence | | | | | | | |
|---|---|---|---|---|---|---|---|
| Step | Instruction/Parameters | Delay time | R/W | MIPI Data Type | Address MIPI | Data hex. | Description |
| 1 | Turn on $V_{vDD}$ | | | | | | VDD=2.8V~3.1V |
| 2 | Turn on $V_{IOVDD}$ | | | | | | IOVDD=1.8V |
| 3 | Delay | no limit | | | | | |
| 4 | REST pin low | 20us | | | | | |
| 5<br>6 | REST pin high<br>Delay | 5 ms | | | | | |
| 7 | | | W | 0x39 | F0 | 55 | |
| 8 | | | W | | | AA | |
| 9 | | | W | | | 52 | |
| 10 | | | W | | | 08 | |
| 11 | | | W | | | 00 | |
| 12 | | | W | 0x39 | BD | 03 | |
| 13 | | | W | | | 20 | |
| 14 | | | W | | | 14 | |
| 15 | | | W | | | 4B | |
| 16 | | | W | | | 00 | |
| 17 | | | W | 0x39 | BE | 03 | |
| 18 | | | W | | | 20 | |
| 19 | | | W | | | 14 | |
| 20 | | | W | | | 4B | |
| 21 | | | W | | | 01 | |
| 22 | | | W | 0x39 | BF | 03 | |
| 23 | | | W | | | 20 | |
| 24 | | | W | | | 14 | |
| 25 | | | W | | | 4B | |
| 26 | | | W | | | 00 | |
| 27 | | | W | 0x39 | BB | 07 | |
| 28 | | | W | | | 07 | |
| 29 | | | W | | | 07 | |
| 30 | | | W | 0x39 | C7 | 40 | |
| 31 | | | W | 0x39 | F0 | 55 | |
| 32 | | | W | | | AA | |
| 33 | | | W | | | 52 | |
| 34 | | | W | | | 08 | |
| 35 | | | W | | | 02 | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 36 | | | W | 0x15 | EB | 02 | |
| 37 | | | W | 0x39 | FE | 08 | |
| 38 | | | W | | | 50 | |
| 39 | | | W | 0x39 | C3 | F2 | |
| 40 | | | W | | | 95 | |
| 41 | | | W | | | 04 | |
| 42 | | | W | 0x39 | E9 | 00 | |
| 43 | | | W | | | 36 | |
| 44 | | | W | | | 38 | |
| 45 | | | W | 0x15 | CA | 04 | |
| 46 | | | W | 0x39 | F0 | 55 | |
| 47 | | | W | | | AA | |
| 48 | | | W | | | 52 | |
| 49 | | | W | | | 08 | |
| 50 | | | W | | | 01 | |
| 51 | | | W | 0x39 | B0 | 03 | |
| 52 | | | W | | | 03 | |
| 53 | | | W | | | 03 | |
| 54 | | | W | 0x39 | B1 | 05 | |
| 55 | | | W | | | 05 | |
| 56 | | | W | | | 05 | |
| 57 | | | W | 0x39 | B2 | 01 | |
| 58 | | | W | | | 01 | |
| 59 | | | W | | | 01 | |
| 60 | | | W | 0x39 | B4 | 07 | |
| 61 | | | W | | | 07 | |
| 62 | | | W | | | 07 | |
| 63 | | | W | 0x39 | B5 | 03 | |
| 64 | | | W | | | 03 | |
| 65 | | | W | | | 03 | |
| 66 | | | W | 0x39 | B6 | 55 | |
| 67 | | | W | | | 55 | |
| 68 | | | W | | | 55 | |
| 69 | | | W | 0x39 | B7 | 36 | |
| 70 | | | W | | | 36 | |
| 71 | | | W | | | 36 | |
| 72 | | | W | 0x39 | B8 | 23 | |
| 73 | | | W | | | 23 | |
| 74 | | | W | | | 23 | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 75 | | | W | 0x39 | B9 | 03 | |
| 76 | | | W | | | 03 | |
| 77 | | | W | | | 03 | |
| 78 | | | W | 0x39 | BA | 03 | |
| 79 | | | W | | | 03 | |
| 80 | | | W | | | 03 | |
| 81 | | | W | 0x39 | BE | 32 | |
| 82 | | | W | | | 30 | |
| 83 | | | W | | | 70 | |
| 84 | | | W | 0x39 | CF | FF | |
| 85 | | | W | | | D4 | |
| 86 | | | W | | | 95 | |
| 87 | | | W | | | E8 | |
| 88 | | | W | | | 4F | |
| 89 | | | W | | | 00 | |
| 90 | | | W | | | 04 | |
| 91 | | | W | 0x15 | 35 | 01 | |
| 92 | | | W | 0x15 | 36 | 00 | |
| 93 | | | W | 0x15 | C0 | 20 | |
| 94 | | | W | 0x39 | C2 | 17 | |
| 95 | | | W | | | 17 | |
| 96 | | | W | | | 17 | |
| 97 | | | W | | | 17 | |
| 98 | | | W | | | 17 | |
| 99 | | | W | | | 0B | |
| 100 | Turn on peripheral packet | | | 0x32 | | | Video Turn On |
| 101 | | | W | 0x39 | F0 | 55 | |
| 102 | | | W | | | AA | |
| 103 | | | W | | | 52 | |
| 104 | | | W | | | 08 | |
| 105 | | | W | | | 02 | |
| 106 | | | W | 0x39 | ED | 48 | |
| 107 | | | W | | | 00 | |
| 108 | | | W | | | FF | |
| 109 | | | W | | | 13 | |
| 110 | | | W | | | 08 | |
| 111 | | | W | | | 30 | |
| 112 | | | W | | | 0C | |
| 113 | | | W | | | 00 | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 114 | Delay | 20 ms | | | | | |
| 115 | Sleep out (SLPOUT) | | W | 0x05 | 11 | 00 | |
| 116 | Delay | 300 ms | | | | | |
| 117 | | | W | 0x39 | F0 | 55 | |
| 118 | | | W | | | AA | |
| 119 | | | W | | | 52 | |
| 120 | | | W | | | 08 | |
| 121 | | | W | | | 02 | |
| 122 | | | W | 0x39 | ED | 48 | |
| 123 | | | W | | | 00 | |
| 124 | | | W | | | FE | |
| 125 | | | W | | | 13 | |
| 126 | | | W | | | 08 | |
| 127 | | | W | | | 30 | |
| 128 | | | W | | | 0C | |
| 129 | | | W | | | 00 | |
| 130 | Delay | 20 ms | | | | | |
| 131 | | | W | 0x39 | ED | 48 | |
| 132 | | | W | | | 00 | |
| 133 | | | W | | | E6 | |
| 134 | | | W | | | 13 | |
| 135 | | | W | | | 08 | |
| 136 | | | W | | | 30 | |
| 137 | | | W | | | 0C | |
| 138 | | | W | | | 00 | |
| 139 | Delay | 20 ms | | | | | |
| 140 | | | W | 0x39 | ED | 48 | |
| 141 | | | W | | | 00 | |
| 142 | | | W | | | E2 | |
| 143 | | | W | | | 13 | |
| 144 | | | W | | | 08 | |
| 145 | | | W | | | 30 | |
| 146 | | | W | | | 0C | |
| 147 | | | W | | | 00 | |
| 148 | Delay | 20 ms | | | | | |
| 149 | | | W | 0x39 | ED | 48 | |
| 150 | | | W | | | 00 | |
| 151 | | | W | | | E0 | |
| 152 | | | W | | | 13 | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 153 | | | W | | | 08 | |
| 154 | | | W | | | 30 | |
| 155 | | | W | | | 0C | |
| 156 | | | W | | | 00 | |
| 157 | Delay | 20 ms | | | | | |
| 158 | | | W | 0x39 | ED | 48 | |
| 159 | | | W | | | 00 | |
| 160 | | | W | | | E0 | |
| 161 | | | W | | | 13 | |
| 162 | | | W | | | 08 | |
| 163 | | | W | | | 00 | |
| 164 | | | W | | | 0C | |
| 165 | | | W | | | 00 | |
| 166 | Delay | 20 ms | | | | | |
| 167 | Display on (DISPON) | | W | 0x05 | 29 | 00 | |
| 168 | | | W | 0x39 | F0 | 55 | |
| 169 | | | W | | | AA | |
| 170 | | | W | | | 52 | |
| 171 | | | W | | | 08 | |
| 172 | | | W | | | 00 | |
| Recommended Power off Mode Sequence | | | | | | | |
| Step | Instruction/Parameters | Delay time | R/W | MIPI Data Type | Address MIPI | Data hex. | Description |
| 1 | Black pattern(黑畫面) | | | | | | |
| 2 | delay | 20ms | | | | | |
| 3 | Display off (DISPOFF) | | W | 0x05 | 28 | 00 | |
| 4 | delay | 20ms | | | | | |
| 5 | | | W | 0x39 | F0 | 55 | |
| 6 | | | W | | | AA | |
| 7 | | | W | | | 52 | |
| 8 | | | W | | | 08 | |
| 9 | | | W | | | 00 | |
| 10 | | | W | 0x39 | C8 | 84 | |
| 11 | | | W | | | 12 | |
| 12 | | | W | | | 00 | |
| 13 | | | W | | | 00 | |
| 14 | | | W | | | A0 | |
| 15 | | | W | | | 00 | |
| 16 | | | W | | | 0D | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 17 | | | W | 0x39 | F0 | 55 | |
| 18 | | | W | | | AA | |
| 19 | | | W | | | 52 | |
| 20 | | | W | | | 08 | |
| 21 | | | W | | | 01 | |
| 22 | delay | 20ms | | | | | |
| 23 | | | W | 0x39 | C2 | 1F | |
| 24 | | | W | | | 1F | |
| 25 | | | W | | | 1F | |
| 26 | | | W | | | 1F | |
| 27 | | | W | | | 1F | |
| 28 | | | W | | | 1F | |
| 29 | | | W | | | 1F | |
| 30 | | | W | | | 1F | |
| 31 | | | W | | | 1F | |
| 32 | | | W | | | 1F | |
| 33 | | | W | | | 1F | |
| 34 | | | W | | | 1F | |
| 35 | delay | 20ms | | | | | |
| 36 | Display on (DISPON) | | W | 0x05 | 29 | 00 | |
| 37 | delay | 20ms | | | | | |
| 38 | Display off (DISPOFF) | | W | 0x05 | 28 | 00 | |
| 39 | Sleep in (SLPIN) | | W | 0x05 | 10 | 00 | |
| 40 | delay | 120ms | | | | | |
| 41 | REST pin low | | | | | | |
| 42 | Power off | | | | | | |

## F. Brightness Control

**Recommended Power on Initial Sequence**

| Step | Delay time | R/W | MIPI Data Type | Address | | Data hex. | Description |
|---|---|---|---|---|---|---|---|
| | | | | MIPI | Others | | |
| 1 | | W | 0x39 | F0 | F000 | 55 | |
| 2 | | W | | | F001 | AA | |
| 3 | | W | | | F002 | 52 | |
| 4 | | W | | | F003 | 08 | |
| 5 | | W | | | F004 | 01 | |
| 6 | | W | 0x39 | CF | CF00 | FF | CF00 control Max Brightness |
| 7 | | W | | | CF01 | D4 | |
| 8 | | W | | | CF02 | 95 | |
| 9 | | W | | | CF03 | E8 | |
| 10 | | W | | | CF04 | 4F | |
| 11 | | W | | | CF05 | 00 | |
| 12 | | W | | | CF06 | 04 | |

| Address | | Data hex. | Gray Level |
|---|---|---|---|
| MIPI | Others | | |
| CF | CF00 | 00 | L0 |
| ⋮ | ⋮ | ⋮ | ⋮ |
| CF | CF00 | 80 | L128 |
| ⋮ | ⋮ | ⋮ | ⋮ |
| CF | CF00 | FF | L255 |

## G. Idle mode Flow

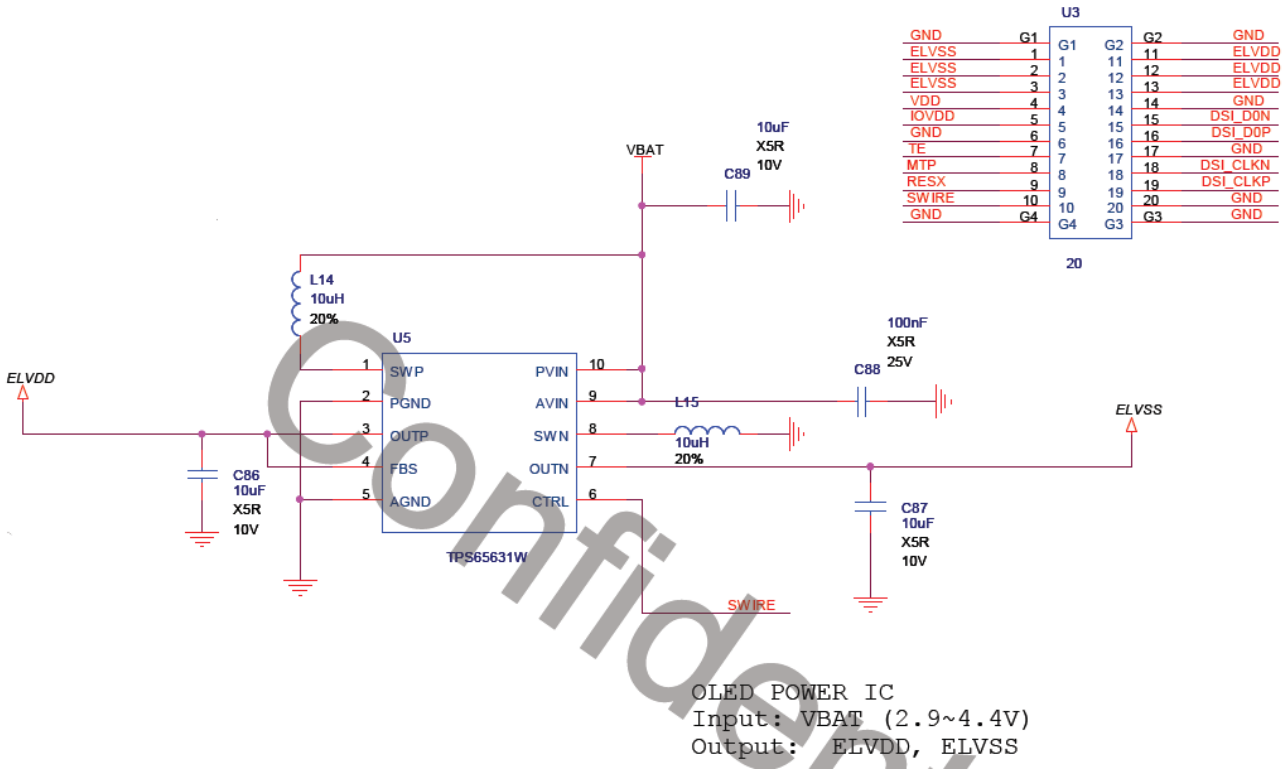
**(1) Normal to Idle**

| Recommended Idle Initial Sequence | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Step | Instruction/Parameters | Delay time | R/W | MIPI Data Type | Address | | Data hex. | Description |
| | | | | | MIPI | Others | | |
| 1 | Enter Idle mode | | W | 0x05 | 39 | 3900 | 00 | Idle mode 30HZ |

**(2) Idle to Normal**

| Recommended Power on Initial Sequence | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Step | Instruction/Parameters | Delay time | R/W | MIPI Data Type | Address | | Data hex. | Description |
| | | | | | MIPI | Others | | |
| 1 | Idle mode Off | | W | 0x05 | 38 | 3800 | 00 | Normal mode 60HZ |

## H. Application Circuit






1. 1.63” panel has to be used with power IC TPS65631W, **TI.**
   Inteltronic don’t suggest use other power IC instead of TPS65631W, since they don’t be qualified by Inteltronic.

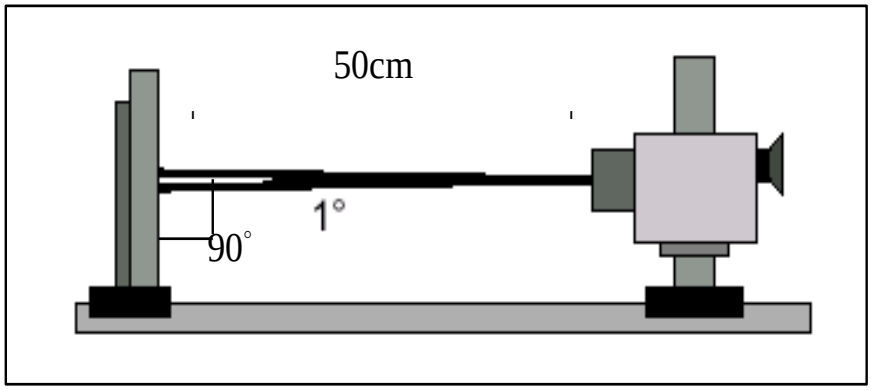
# I. Specifications

| Item | | Abbr. | Min. | Typ. | Max. | Unit | Remark |
|---|---|---|---|---|---|---|---|
| Optical Characteristic ( w/o Cover Lens ) | | Brightness | 270 | 300 | 330 | nits | Note 3 |
| | | Wx | 0.275 | 0.305 | 0.335 | | |
| | | Wy | 0.290 | 0.320 | 0.350 | | |
| Contrast ratio | | @25deg | 10000 | -- | -- | | Note 4 |
| Brightness Uniformity | | 300nits | 75% | -- | -- | | Note 5 |
| Viewing angle CR>1600 | | Top | 80° | -- | -- | deg | Note 6 |
| | | Bottom | 80° | -- | -- | deg | |
| | | Left | 80° | -- | -- | deg | |
| | | Right | 80° | -- | -- | deg | |
| Color | Red | CIE1931 x | 0.645 | 0.675 | 0.705 | Red | Note 7 |
| | Red | CIE1931 y | 0.295 | 0.325 | 0.355 | Red | |
| | Green | CIE1931 x | 0.186 | 0.236 | 0.286 | Green | |
| | Green | CIE1931 y | 0.661 | 0.711 | 0.761 | Green | |
| | Blue | CIE1931 x | 0.090 | 0.130 | 0.170 | Blue | |
| | Blue | CIE1931 y | 0.025 | 0.065 | 0.105 | Blue | |
| NTSC | | CIE x , y | 90 | 100 | -- | % | |
| Life time | T95 | 25°C | 100 | -- | -- | hrs | Note 8 |
| Crosstalk | 300nits | Vertical | -- | -- | 5.0 | % | Note 9 |
| Flicker | | | -- | -- | -30 | db | Note 10 |
| Optical Switching Time | | +25°B/W(Tr+Tf)/2 | -- | -- | 1 | ms | Note 11 |
| Gamma | | γ | 2.0 | 2.2 | 2.4 | | |

Note 1: Ambient temperature =25 ℃±2 ℃

Note 2: To be measured in the dark room.

Note 3: The brightness measurement shall be done at the center of the display with a full white image. The brightness shall meet the following spec, at 100% check.

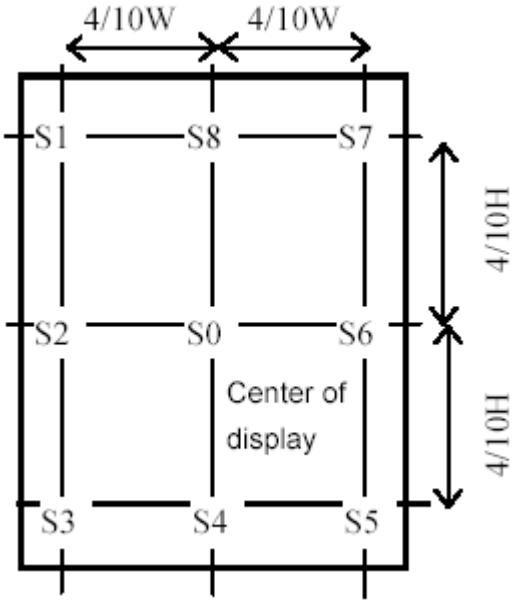


Note 4: Definition of contrast ratio:

Contrast ratio is calculated with the following formula:

$$\text{Contrast ratio (CR)} = \frac{\text{Photo detector output when OLED is at “White” state}}{\text{Photo detector output when OLED is at “Black}}$$

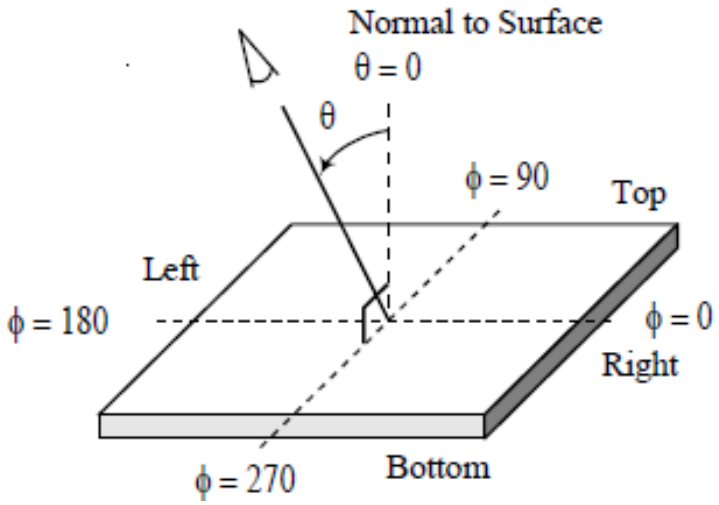
Note 5: Uniformity. Refer to figure as below




$$\text{Luminance uniformity} = \frac{\text{Minimum value from S0 to S8}}{\text{Maximum value from S0 to S8}} \times 100(\%)$$

Note 6: Definition of viewing angle :

The optical performance is specified as the driver IC located at =270°

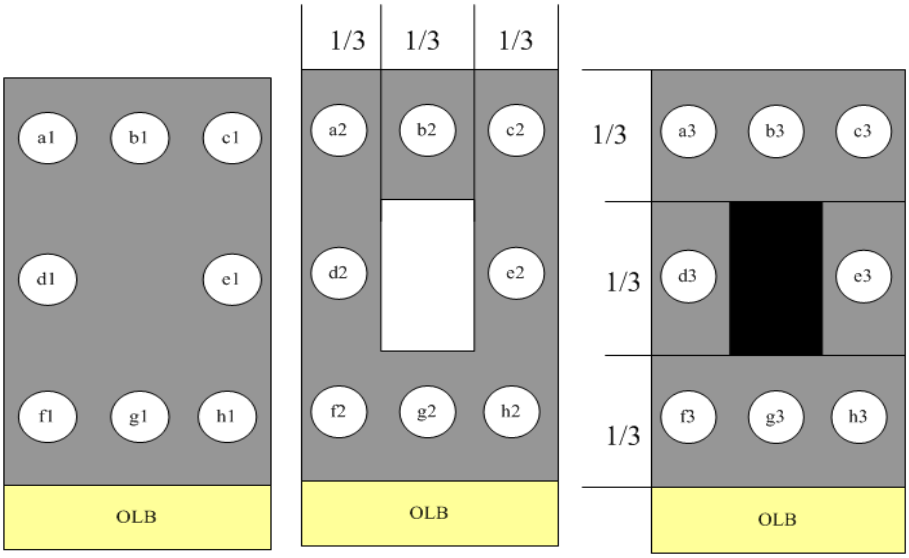



Note 7: The color chromaticity should be based on sample performance because new OLED material should be verified later.

Note 8: Time to 95% Luminance

To measure the burn-in effect, a test pattern with white background applied to the AMOLED display at 30% loading

Note 9: Cross-talk




$$CrossTalk\_White = \left\{ \begin{array}{l} 1-\left(\frac{b2}{a2}\div\frac{b1}{a1}\right)\times 100\%, 1-\left(\frac{b2}{c2}\div\frac{b1}{c1}\right)\times 100\%, \\ 1-\left(\frac{d2}{a2}\div\frac{d1}{a1}\right)\times 100\%, 1-\left(\frac{d2}{f2}\div\frac{d1}{f1}\right)\times 100\%, \\ 1-\left(\frac{e2}{c2}\div\frac{e1}{c1}\right)\times 100\%, 1-\left(\frac{e2}{h2}\div\frac{e1}{h1}\right)\times 100\%, \\ 1-\left(\frac{g2}{f2}\div\frac{g1}{f1}\right)\times 100\%, 1-\left(\frac{g2}{h2}\div\frac{g1}{h1}\right)\times 100\% \end{array} \right\}$$

$$CrossTalk\_Black = \left\{ \begin{array}{l} 1-\left(\frac{b3}{a3}\div\frac{b1}{a1}\right)\times 100\%, 1-\left(\frac{b3}{c3}\div\frac{b1}{c1}\right)\times 100\%, \\ 1-\left(\frac{d3}{a3}\div\frac{d1}{a1}\right)\times 100\%, 1-\left(\frac{d3}{f3}\div\frac{d1}{f1}\right)\times 100\%, \\ 1-\left(\frac{e3}{c3}\div\frac{e1}{c1}\right)\times 100\%, 1-\left(\frac{e3}{h3}\div\frac{e1}{h1}\right)\times 100\%, \\ 1-\left(\frac{g3}{f3}\div\frac{g1}{f1}\right)\times 100\%, 1-\left(\frac{g3}{h3}\div\frac{g1}{h1}\right)\times 100\% \end{array} \right\}$$

$$CrossTalk = MAX\{CrossTalk\_White, CrossTalk\_Black\}$$

Note 10: Flicker

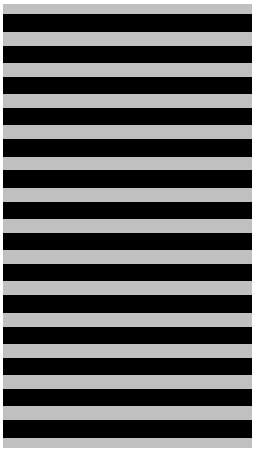
The flicker level is defined using Fast Fourier Transformation (FTT) as follows:

$$Flic\,\mathrm{ker} = 20\log_{10}\left(2\frac{f_{FFTC}(n)}{f_{FFTC}(0)}\right) + FS(Hz) \quad \text{(dB)}$$

where fFFTC(n) is the nth FFT coefficient, and fFFTC(0) is the 0th FFT coefficient which is DC component. FS(Hz) is the flicker sensitivity as a function of frequency.

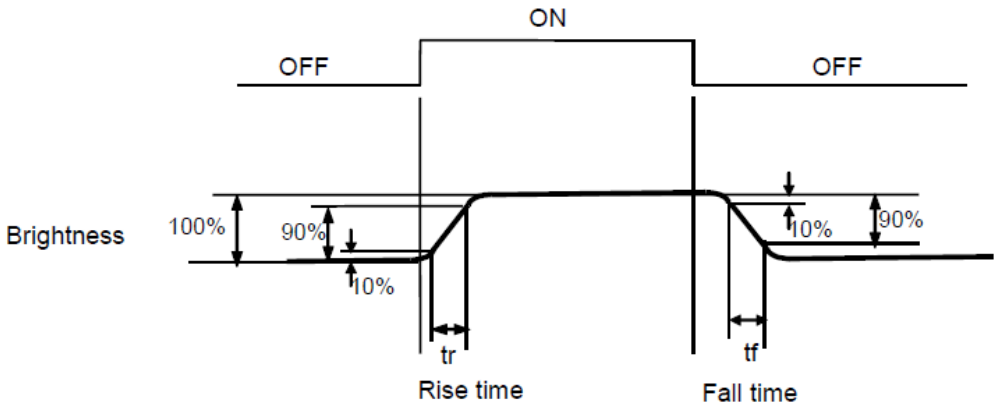
The flicker level shall be measured with the test pattern in below.

The gray leves of test pattern is 128.



Note 11: Optical Switching Time:

The optical switching time measurements should be performed at driven BLACK and driven WHITE at typ. brightness setting by the driving techniques specified. The luminance should be measured with the emitting display and the detector at θ=0°and ψ=90°. The rise time tr is the time between a 10% optically response of the display and a 90% optically response of the display. The fall time tf is the time between a 10% optically response of the display and a 90% optically response to the display. The response time is defined as the average of the rise time and the fall time.

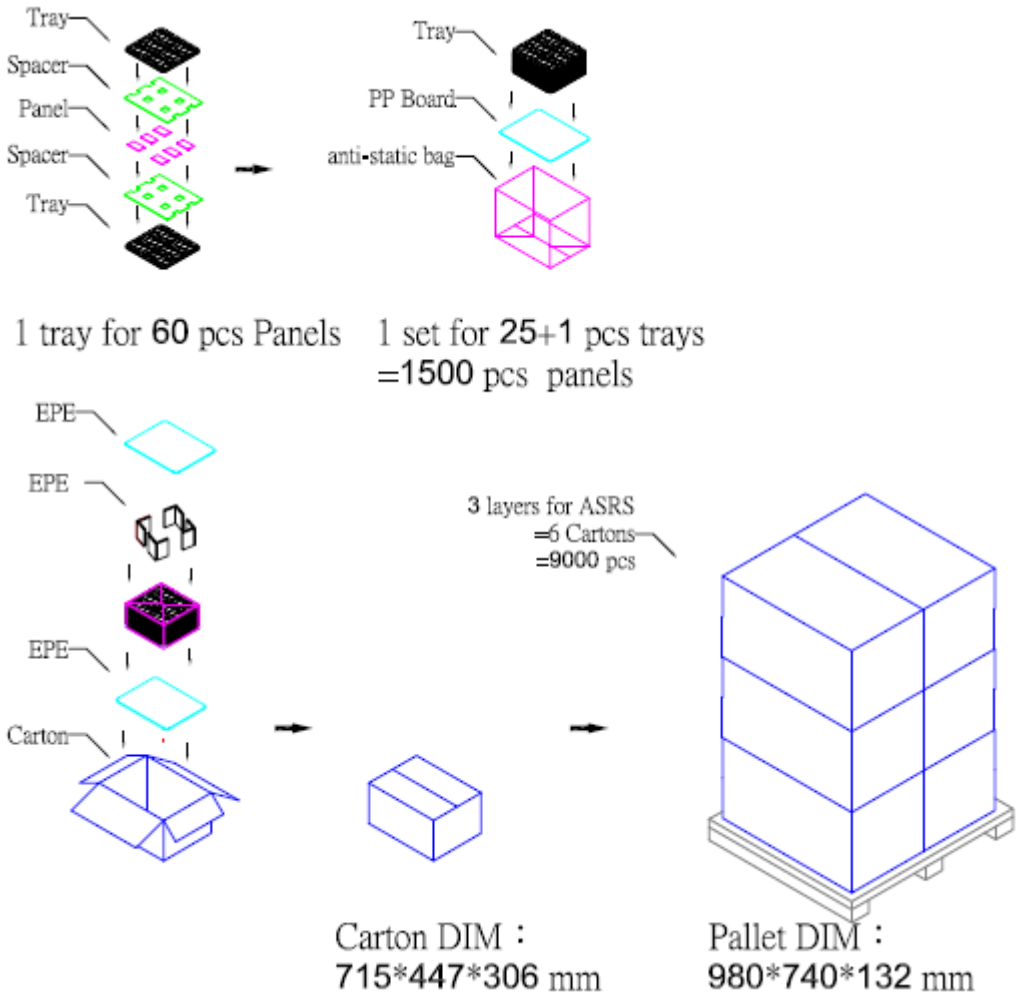


## J. Reliability Test Items

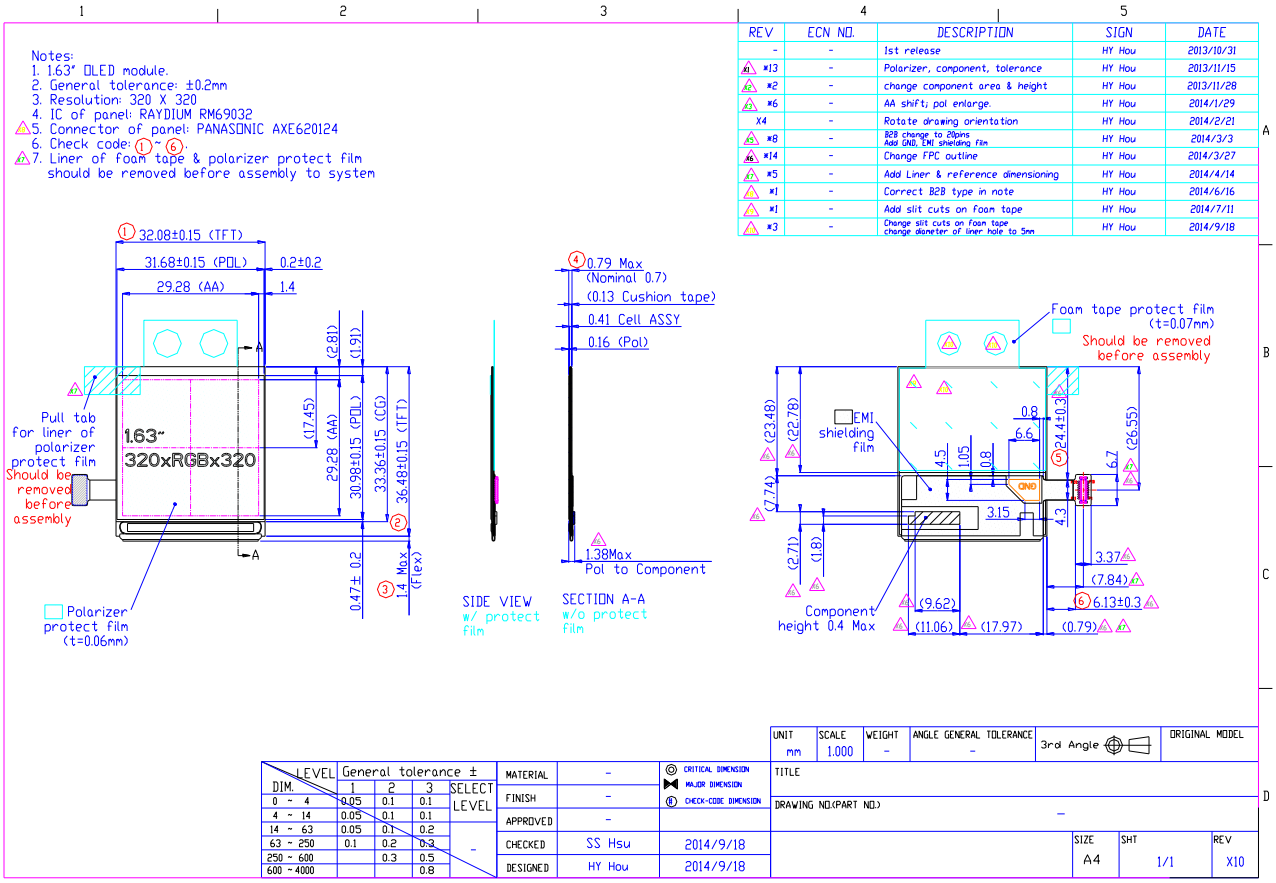
| Category | No. | Test items | Conditions | Remark |
|---|---|---|---|---|
| Reliability (Environment) | 1 | High Temp. Operation | Ta= 60℃ 168hrs | Ta: Ambient temperature. |
| | 2 | High Temp. Storage | Ta= 70 ℃ 168hrs | Non-operation |
| | 3 | Low Temp. Operation | Ta= -20 ℃ 168hrs | |
| | 4 | Low Temp. Storage | Ta= -30 ℃ 168hrs | Non-operation |
| | 5 | High Temp./Humi. Operation | Ta= 40 ℃. 95% RH 168hrs | |
| | 6 | Thermal Shock | -30 ℃ ~70 ℃, Dwell for 30 min. 30 cycles. | Non-operation |
| | 7 | Vibration test | Random 1.5G,10~200Hz,30min/axis | Non-operation |

Judge Criteria:No functional defect

## K. Packing


Tray
Spacer
Panel
Spacer
Tray
Tray
PP Board
anti-static bag
1 tray for 60 pcs Panels
1 set for 25+1 pcs trays
=1500 pcs panels
EPE
EPE
EPE
Carton
3 layers for ASRS
=6 Cartons
=9000 pcs
Carton DIM：
715*447*306 mm
Pallet DIM：
980*740*132 mm

# L. Outline Demension



## M. Precaution:

Please pay attention to the following items when you use the OLED Modules(Panel):

7-1 Do not twist or bend the module(panel) and prevent the unsuitable external force for display during assembly.
7-2 Adopt measures for good heat radiation. Be sure to use the module(panel) with in the specified temperature.
7-3 Avoid dust or oil mist during assembly.
7-4 Follow the correct power sequence while operating. Do not apply the invalid signal, otherwise, it will cause improper shut down and damage the module(panel).
7-5 Less EMI: it will be more safety and less noise.
7-6 Please operate module(panel) in suitable temperature. The response time & brightness will drift by different temperature.
7-7 Avoid to display the fixed pattern (exclude the white pattern) in a long period, otherwise, it will cause image sticking.
7-8 Please be sure to turn-off the power when connecting or disconnecting the circuit.
7-9 Polarizer scratches easily, please handle it carefully.
7-10 Display surface never likes dirt or stains.
7-11 A dew drop may lead to destruction. Please wipe off any moisture before using module(panel).
7-12 Sudden temperature changes cause condensation, and it will cause polarizer damaged.
7-13 High temperature and humidity may degrade performance. Please do not expose the module(panel) to the direct sunlight and so on.
7-14 Acetic acid or chlorine compounds are not friends with AMOLED display module(panel).
7-15 Static electricity will damage the module(panel), please do not touch the module(panel) without any grounded device.
7-16 Please avoid any static electricity damage (ESD) during producing and operating.
7-17 Do not disassemble and reassemble the module(panel) by self.
7-18 Be careful do not touch the rear side directly.
7-19 No strong vibration or shock. It will cause module(panel) broken.
7-20 Storage the modules(panel) in suitable environment with regular packing.
7-21 Be careful of injury from a broken display module(panel).
7-22 Please avoid the pressure adding to the surface (front or rear side) of modules(panel), because it will cause the display non-uniformity or other function issue.

# 8 .Inspection Specifications

The buyer (customer) shall inspect the modules within twenty calendar days since the delivery date (the "inspection period") at its own cost. The results of the inspection (acceptance or rejection) shall be recorded in writing, and a copy of this writing will be promptly sent to the seller.

The buyer may, under commercially reasonable reject procedures, reject an entire lot in the delivery involved if, within the inspection period, such samples of modules within such lot show an unacceptable number of defects in accordance with this incoming inspection standards, provided however that the buyer must notify the seller in writing of any such rejection promptly, and not later than within three business days of the end of the inspection period.

Should the buyer fail to notify the seller within the inspection period, the buyer's right to reject the modules shall be lapsed and the modules shall be deemed to have been accepted by the buyer.

# 9. Warranty

Inteltronic Inc. warrants to you, the original purchaser, that each of its products will be free from defects in materials and workmanship for one year from the date of purchase.

Inteltronic Inc. will be limited to replace or repair any of its module which is found and confirmed defective electrically or visually when inspected in accordance with Inteltronic Inc. general module inspection standard.

This warranty does not apply to any products which have been on customer's production line, repaired or altered by persons other than repair personnel authorized by Inteltronic Inc., or which have been subject to misuse, abuse, accident or improper installation. Inteltronic Inc. assumes no liability under the terms of this warranty as a consequence of such events.

If an Inteltronic Inc. product is defective, it will be repaired or replaced at no charge during the warranty period. For out-of-warranty repairs, you will be billed according to the cost of replacement materials, service time and freight. In returning the modules, they must be properly packaged with original package; there should be detailed description of the failures or defect.

# 10. RMA

Products purchased through Inteltronic Inc. and under warranty may be returned for replacement. Contact support@inteltronicinc.com for RMA number and procedures



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