## Product Specification

AU OPTRONICS CORPORATION
B154EW04 V7 (QD15TL04 Rev.03)
( ) Preliminary Specifications
(V) Final Specifications

| Module | 15.4" WXGA Color TFT-LCD |
| :--- | :--- |
| Model Name | B154EW04 V7 (QD15TL04 REV.03) |


| Customer | Date |
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|  <br> Approved by |  |
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Note: This Specification is subject to change without notice.

| Approved by | Date |  |
| :---: | :---: | :---: |
| Beyond Yang | $\underline{5 / 29 / 2007}$ |  |
| Prepared by |  |  |
| Amy Tu | $\underline{5 / 29 / 2007}$ |  |
|  |  |  |
| AU Optronics corporation |  |  |

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The device listed in these technical literature sheets was designed and manufactured for use in OA equipment.

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

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

AUO assumes no responsibility for any damage resulting from the use of the device, which does not comply with the instructions, and the precautions specified in these technical literature sheets.

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

|  |  | Revision History |  |
| :---: | :---: | :---: | :---: |
| REV. | Date | ECN NO. | Change Content |
| 0 | 5/23/2005 | N/A | Preliminary Specification Initiation |
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## 1. Application

This specification applies to a color TFT-LCD module, QD15TL04.

## 2. Overview

This module is a color active matrix LCD module incorporating amorphous silicon TFT (Thin Film Transistor). It is composed of a color TFT-LCD panel; driver ICs, control circuit and power supply circuit and a backlight unit. Graphics and texts can be displayed on a $1280 \times 3$
 interface and supplying +3.3V DC supply voltage for TFT-LCD panel driving and supply voltage for backlight.
The TFT-LCD panel used for this module has very high aperture ratio. A low-reflection and higher-color-saturation type color filter is also used for this panel. Therefore, high-brightness and high-contrast image, which is suitable for the multimedia use, can be obtained by using this module.

Optimum viewing direction is 6 o'clock.

## [Features]

1) High aperture panel; high-brightness or low power consumption.
2) Brilliant and high contrast image.
3) Small footprint and thin shape.
4) Light weight.
5) Wide Screen 15.4" WXGA
3. General Specifications

| Parameter | Specifications | Unit |
| :--- | :--- | :---: |
| Display size | $390.1(15.4 ")$ Diagonal | mm |
| Active area | $331.2 \times 207.0$ | mm |
| Pixel format | $1280(\mathrm{H}) \times 800(\mathrm{~V})$ | Pixel |
|  | $(1$ pixel $=$ R+G+B dots) |  |
| Pixel pitch | $0.2588(\mathrm{H}) \times 0.2588(\mathrm{~V})$ | mm |
| Pixel configuration | R, G, B vertical stripe |  |
| Display mode | Normally white | mm |
| Unit outline dimensions (typ.) $* 1$ | $344.5(W) \times 222.5(H) \times 6.35(T)$ max. | g |
| Mass | 585 max. |  |
| Surface treatment | Haze $0 ;$ Hardness $3 H ;$ Low reflection |  |

*1.Note: excluding backlight cables. Outline dimensions are shown in this specification.

## 4. Input Terminals

4-1. TFT-LCD panel driving
CN1 (1 channel, LVDS signals - NSC/Ti standard and +3.3V DC power supply)
Using connector: FI-XB30Sx-HFxx/FI-X30Sx-HFxx/equivalent (JAE)
Interface Cable Pin Assignments

| PIN NO | . SYMBOL | FUNCTION |
| :---: | :---: | :---: |
| 1 | VSS | Ground |
| 2 | VDD | Power Supply, 3.3 V (typical) |
| 3 | VDD | Power Supply, 3.3 V (typical) |
| 4 | V EEDID | DDC 3.3V power |
| 5 | TEST | EDID Enable |
| 6 | Clk EEDID | DDC Clock |
| 7 | DATA EEDID | DDC Data |
| 8 | Rin0- | - LVDS differential data input (R0-R5, G0) (odd pixels) |
| 9 | Rin0+ | + LVDS differential data input (R0-R5, G0) (odd pixels) |
| 10 | VSS | Ground |
| 11 | Rin1- | - LVDS differential data input (G1-G5, B0-B1) (odd pixels) |
| 12 | Rin1+ | + LVDS differential data input (G1-G5, B0-B1) (odd pixels) |
| 13 | VSS | Ground |
| 14 | Rin2- | - LVDS differential data input (B2-B5, HS, VS, DE) (odd pixels) |
| 15 | Rin2+ | + LVDS differential data input (B2-B5, HS, VS, DE) (odd pixels) |
| 16 | VSS | Ground |
| 17 | ClkIN- | - LVDS differential clock input (odd pixels) |
| 18 | ClkIN+ | + LVDS differential clock input (odd pixels) |
| 19 | VSS | Ground |
| 20 | NC | No connect |
| 21 | NC | No connect |
| 22 | NC | No connect |
| 23 | NC | No connect |
| 24 | NC | No connect |
| 25 | NC | No connect |
| 26 | NC | No connect |
| 27 | NC | No connect |
| 28 | NC | No connect |
| 29 | NC | No connect |
| 30 | NC | No connect |

[Note 1] Relation between LVDS signals and actual data shows below section (4-2).
[Note 2] The shielding case is connected with signal GND.

## 4-2 Interface block diagram

Using receiver : DS90CF364(National semiconductor)


4-3. Inverter connector pin assign
CN3:(Inverter signals and Inverter Power Supply)
Using connector: LVC-D20SYFG (HONDA)
Corresponding connector: LVC-D20LVM-SG (HONDA)

| Pin no. | Symbol | Function |
| :---: | :---: | :--- |
| $1,2,3$ | INV SRC | Input voltage |
| 4 | N.C | No connect |
| $5,8,11,13$ | GND | Ground |
| 6 | 5VSUS | System +5V voltage (Inverter no use) |
| 7 | 5VALW | Dallas IC VCC Voltage |
| 9 | SDA | Brightness control data signal (SMBUS DATA) |
| 10 | SCL | Brightness control clock signal (SMBUS CLOCK) |
| 12 | FPBACK | Control signal input into the inverter turning BLU |
| 14 | LAMP_STAT | Lamp Status |
| 15 | N.C. | No connect |
| 16 | N.C. | No connect |
| 17 | N.C. | No connect |
| 18 | N.C. | No connect |
| 19 | N.C. | No connect |
| 20 | N.C. | No connect |

## 5. Absolute Maximum Ratings

## 5-1 LCD module

| Parameter | Symbol | Condition | Ratings | Unit | Remark |
| :--- | :---: | :---: | :---: | :---: | :---: |
| Input voltage | $\mathrm{V}_{\mathrm{I}}$ | $\mathrm{Ta}=\mathbf{2 5}{ }^{\circ} \mathrm{C}$ | $-\mathbf{0 . 3 \sim \text { VDD } + 0 . 3}$ | V | [Note1] |
| +3.3 V supply voltage | VDD | $\mathrm{Ta}=\mathbf{2 5}{ }^{\circ} \mathrm{C}$ | $0 \sim+4$ | V |  |
| Storage temperature | Tstg | - | $-\mathbf{2 5 \sim + 6 0}$ | ${ }^{\circ} \mathrm{C}$ | [Note2] |
| Operating temperature (Ambient) | Topa | - | $0 \sim+50$ | ${ }^{\circ} \mathrm{C}$ |  |

[Note1] LVDS signals
[Note2] Humidity : 95\%RH Max. at $\mathrm{Ta} \leqq 40^{\circ} \mathrm{C}$.
Maximum wet-bulb temperature at $39^{\circ} \mathrm{C}$ or less at $\mathrm{Ta}>40^{\circ} \mathrm{C}$.
No condensation.

## 5-2 Inverter driving

## 5-2.1 Backlight lifetime

The backlight system is an edge-lighting type with single CCFT (Cold Cathode Fluorescent Tube).

The lifetime of the lamp are shown in the following table.

| Parameter | Symbol | Min. | Typ. | Max. | Unit | Remark |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Lamp life time | LL | 20000 | - | - | Hour | [Note] |

[Note] Lamp life time is defined as the time when $\square$ occurs in the continuous operation under the condition of $\mathrm{Ta}=25^{\circ} \mathrm{C}$ and SDA data $=00 \mathrm{HEX}$ $\approx$ Brightness becomes $50 \%$ of the original value under standard condition.

5-2.2 Recommended Operation Condition

| Parameter | Symbol | Min. | Typ | Max | Unit |
| :--- | :---: | :---: | :---: | :---: | :---: |
| Inverter power supply <br> voltage | Vin | 7.5 | - | 21 | V |
| Base of Brightness <br> control voltage | VBB | 4.85 | 5.0 | 5.2 | V |
| Brightness control IC <br> supply voltage | VBC | 4.5 | 5.0 | 5.5 | V |
| Logic signals | SDA, SCL <br> FPVEE | 0 |  | 5 | V |

5-2.3 DC Electrical Conditions
$\mathrm{Ta}=25^{\circ} \mathrm{C}$

| Parameter |  | Symbol | Condition | Min. | Typ | Max | Unit | Remark |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| VIN supply current |  | IVin | $\mathrm{VIN}=7.5 \mathrm{~V}, \mathrm{VBB}=5 \mathrm{~V}$ | - | 450 | 585 | mA | Note |
|  |  |  | VIN=21V,VBB=5V | 200 | - | 300 |  |  |
| Brightness control IC supply current |  | IVbc | $\mathrm{VBC}=4.5 \sim 5.5 \mathrm{~V}$ | - | - | 200 | uA |  |
| $\begin{aligned} & \text { SDA } \\ & \text { SCL } \end{aligned}$ | Input voltage low | Vil | $\mathrm{VBC}=4.5 \sim 5.5 \mathrm{~V}$ | - | - | $\begin{aligned} & 0.3 \times \\ & \text { VBC } \end{aligned}$ | V |  |
|  | Input voltage high | Vih | $\mathrm{VBC}=4.5 \sim 5.5 \mathrm{~V}$ | $\begin{aligned} & 0.7 \times \\ & \text { VBC } \end{aligned}$ | - | - | V |  |
| FPVEE | Input voltage Iow | Vil | VIN=7.5~21V | 0 | - | 0.6 | V |  |
|  | Input voltage high | Vih | VIN=7.5~21V | 3.0 | - | 5.0 | V |  |

Note: Brightness control from minmum to maximum

## 5-2.4. Power ON/OFF sequence

$7.5 \mathrm{~V} \leqq$ Vin<21V
$10 \mathrm{~ms} \leqq t d$


## 5-2.5 FPVEE ON sequence

Backlight power on/off is possible with FPVEE.
Make sure to have more than 50-millisecond interval between each power-on.

$$
50 \mathrm{~ms} \leqq \mathrm{t} 1
$$

$$
\mathrm{t} 2 \leqq 20 \mathrm{~ms}
$$



## 5-2.6 The Condition of Shut Down

Please refer to the figure below for the conditions that will cause the inverter shut down. If the Vin voltage is higher than 8.0 V but there is no enable signal, then the inverter will shut down.

If the Vin voltage is down less than 8.0 V , it will cause the inverter shut down.
The enable signal has to be reset to get the inverter started again.

## 5-2.7 Brightness Control



| SDA data | Brightness | Notes |
| :--- | :--- | :--- |
| 00HEX | Maximum Brightness | Set on power-up |
| 01~FEHEX | $\downarrow$ |  |
| FFHEX | Minimum Brightness |  |

6. Electrical Characteristics

6-1.TFT-LCD panel driving
$\mathrm{Ta}=25^{\circ} \mathrm{C}$

| Parameter |  |  | Symbol | Min. | Typ. | Max. | Unit | Remark |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| VDD | Supply voltage |  | VDD | +3.0 | +3.3 | +3.6 | V | [Note2] |
|  | Current dissipation |  | IDD | - | 400 | 600 | m A | [Note3] |
| Permissive input ripple voltage |  |  | $\mathrm{V}_{\text {RP }}$ | - | - | 100 | mV p-p | $\mathrm{Vcc}=+3.3 \mathrm{~V}$ |
| Differential input Threshold voltage |  | High | $\mathrm{V}_{\text {TH }}$ | - | - | +100 | mV | $\mathrm{V}_{\mathrm{CM}}=+1.2 \mathrm{~V}$ |
|  |  | Low | $\mathrm{V}_{\mathrm{TL}}$ | -100 | - | - | mV | [Note1] |
| Terminal resistor |  |  | $\mathrm{R}_{\mathrm{T}}$ | - | 100 | - | $\Omega$ | Differential input |
| Rush current |  |  | $\mathrm{I}_{\text {RUSH }}$ |  |  | 1.5 | A | Rise time 470uS |

[Note1] $\mathrm{V}_{\mathrm{CM}}$ : Common mode voltage of LVDS driver.
[Note2]
On-off conditions for supply voltage


Vcc-dip conditions should also follow the On-off conditions for supply voltage
[Note3] Typical current situation : 16-gray-bar pattern.


## 6-2. Backlight driving

The backlight system is an edge-lighting type with single CCFT (Cold Cathode Fluorescent Tube).

The characteristics of the lamp are shown in the following table.

| Parameter | Symbol | Min. | Typ. | Max. | Unit | Remark |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Lamp current range | IL | 3.0 | 6.0 | 7.0 | mArms | [Note1] |
| Lamp voltage | VL | 657 | 730 | 803 | Vrms |  |
| Lamp power consumption | $\mathrm{P}_{\mathrm{L}}$ | - | 4.38 | - | W | $\mathrm{I}=6.0 \mathrm{~mA}$ [Note2] |
| Lamp frequency | FL | 54 | 60 | 66 | kHz | [Note3] |
| Kick-off voltage | Vs | - | - | 1650 | Vrms | Ta=25 ${ }^{\circ} \mathrm{C}$ |
|  |  | - | - | 1920 | Vrms | Ta=0 ${ }^{\circ} \mathrm{C}$ [Note4] |
| Lamp life time | LL | 15000 | - | - | hour | [Note5] |

[Note1] Lamp current is measured with current meter for high frequency as shown below.

[Note2] Calculated Value for reference ( $\mathrm{IL} \times \mathrm{V}_{\mathrm{L}}$ )
[Note3] Lamp frequency may produce interference with horizontal synchronous frequency, and this may cause beat on the display. Therefore lamp frequency shall be detached as much as possible from the horizontal synchronous frequency and from the harmonics of horizontal synchronous to avoid interference.
[Note4] The voltage above this value should be applied to the lamp for more than 1 second to start-up. Otherwise the lamp may not be turned on.
[Note5] Lamp life time is defined as the time when either (1) or (2) occurs in the continuous operation under the condition of $\mathrm{Ta}=25^{\circ} \mathrm{C}$ and $\mathrm{IL}=6.0 \mathrm{mArms}$.
(1) Brightness becomes $50 \%$ of the original value under standard condition.
(2) Kick-off voltage at $\mathrm{Ta}=0^{\circ} \mathrm{C}$ exceeds maximum value.

Note) The performance of the backlight, for example life time or brightness, is much influenced by the characteristics of the DC-AC inverter for the lamp. When you design or order the inverter, please make sure that a poor lighting caused by the mismatch of the backlight and the inverter (miss-lighting, flicker, etc.) never occur. When you confirm it, the module should be operated in the same condition as it is installed in your instrument.
7. Timing characteristics of LCD module input signals

## 7-1. Timing characteristics

(This is specified at digital outputs of LVDS driver.)

(Vertical)

| Item (symbol) | Min. | Typ. | Max. | Unit | Remark |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Vsync cycle (TVA) | - | 16.667 | - | ms | Negative |
|  | 808 | 816 | 850 | line |  |
| Blanking period(TTVB) | 8 | 16 | - | line |  |
| Sync pulse width (T $\mathrm{VC}_{\mathrm{VC}}$ ) | 2 | 4 | - | line |  |
| Back porch (TVD) | 5 | 8 | - | line |  |
| Sync pulse width + Back <br> porch (T VC $\mathrm{T}_{\mathrm{VD}}$ ) | 7 | 12 | - | line |  |
| Active display area (TVE) | 800 | 800 | 800 | line |  |
| Front porch (TVF) | 1 | 4 | - | line |  |

( Horizontal)

| Item (symbol) | Min. | Typ. | Max. | Unit | Remark |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Hsync cycle ( $\mathrm{T}_{\mathrm{HA}}$ ) | - | 20.44 | - | $\mu \mathrm{s}$ | Negative |
|  | 1380 | 1408 | 1428 | clock |  |
| Blanking period ( $\mathrm{T}_{\mathrm{HB}}$ ) | 100 | 128 | - | clock |  |
| Sync pulse width ( $\mathrm{T}_{\mathrm{HC}}$ ) | 16 | 32 | - | clock |  |
| Back porch (THD | 68 | 75 | - | clock |  |
| Sync pulse width + Back <br> porch ( $\mathrm{T}_{\mathrm{HC}}+\mathrm{T}_{\mathrm{HD}}$ ) | 84 | 107 | - | clock |  |
| Active display area (THE) | 1280 | 1280 | 1280 | clock |  |
| Front porch (THF $)$ | 16 | 21 | - | clock |  |

## (Clock)

| Item | Min. | Typ. | Max. | Unit | Remark |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Frequency | 67.0 | 68.9 | 72.0 | MHz | [Note1] |

Note) In case of lower frequency, the deterioration of display quality, flicker etc., may be occurred.

## 7-2. Input Data Signals and Display Position on the screen


8. Input Signals, Basic Display Colors and Gray Scale of Each Color

|  |  <br> Gray scale | Data signal |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | Gray <br> Scale | R0 | R1 | R2 | R3 | R4 | R5 | G0 | G1 | G2 | G3 | G4 | G5 | B0 | B1 | B2 | B3 | B4 | B5 |
|  | Black | - | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | Blue | - | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 |
|  | Green | - | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | Cyan | - | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
|  | Red | - | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | Magenta | - | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 |
|  | Yellow | - | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | White | - | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
|  | Black | GS0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  |  | GS1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  |  | GS2 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  |  | $\downarrow$ | $\begin{aligned} & \downarrow \\ & \downarrow \end{aligned}$ |  |  |  |  |  | $\begin{aligned} & \downarrow \\ & \downarrow \end{aligned}$ |  |  |  |  |  | $\downarrow$$\downarrow$ |  |  |  |  |  |
|  |  | $\downarrow$ |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | GS61 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  |  | GS62 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | Red | GS63 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | Black | GS0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | 乞 <br> Darker <br> 介 <br> $\Downarrow$ <br> Brighter <br> $\Downarrow$ | GS1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  |  | GS2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  |  | $\downarrow$ | $\begin{aligned} & \downarrow \\ & \downarrow \end{aligned}$ |  |  |  |  |  | $\begin{aligned} & \downarrow \\ & \downarrow \end{aligned}$ |  |  |  |  |  | $\downarrow$ |  |  |  |  |  |
|  |  | $\downarrow$ |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | GS61 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
|  |  | GS62 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | Green | GS63 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | Black | GS0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  |  | GS1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
|  |  | GS2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
|  |  | $\downarrow$ | $\begin{aligned} & \downarrow \\ & \downarrow \end{aligned}$ |  |  |  |  |  |  |  |  |  |  |  | $\downarrow$ |  |  |  |  |  |
|  |  | $\downarrow$ |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | GS61 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 1 |
|  |  | GS62 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 |
|  | Blue | GS63 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 |

0 : Low level voltage, 1 : High level voltage
Each basic color can be displayed in 64 gray scales from 6 bit data signals. According to the combination of total 18 bit data signals, the 262,144 -color display can be achieved on the screen.

## 9.EDID data structure

This is the EDID (Extended Display Identification Data) data format to support displays as defined in the VESA Plug \& Display.

| Byte (decimal) | $\begin{aligned} & \text { Byte } \\ & \text { (hex) } \end{aligned}$ | Field Name and Comments | Value <br> (hex) | Value <br> (binary) |
| :---: | :---: | :---: | :---: | :---: |
| 0 | 00 | Header | 00 | 00000000 |
| 1 | 01 | Header | FF | 11111111 |
| 2 | 02 | Header | FF | 11111111 |
| 3 | 03 | Header | FF | 11111111 |
| 4 | 04 | Header | FF | 11111111 |
| 5 | 05 | Header | FF | 11111111 |
| 6 | 06 | Header | FF | 11111111 |
| 7 | 07 | Header | 00 | 00000000 |
| 8 | 08 | EISA manufacture code = QDS | 44 | 01000100 |
| 9 | 09 | EISA manufacture code (Compressed ASCII) | 93 | 10010011 |
| 10 | 0A | Product code: 0070 (N15W6A) | 46 | 01000110 |
| 11 | OB | Product code | 00 | 00000000 |
| 12 | 0C | LCD module Serial No (fixed "0") | 00 | 00000000 |
| 13 | OD | LCD module Serial No (fixed "0") | 00 | 00000000 |
| 14 | OE | LCD module Serial No (fixed "0") | 00 | 00000000 |
| 15 | OF | LCD module Serial No (fixed "0") | 00 | 00000000 |
| 16 | 10 | Week of manufacture | 00 | 00000000 |
| 17 | 11 | Year of manufacture - 1990 (ex2000-1990=10), 20051990=15=F (hex) | 0F | 00001111 |
| 18 | 12 | EDID structure version \# = 1 | 01 | 00000001 |
| 19 | 13 | EDID revision \# = 3 | 03 | 00000011 |
| 20 | 14 | Video I/P definition = Digital I/P | 80 | 10000000 |
| 21 | 15 | Max H image size (cm) $=33 \mathrm{~cm}$ | 21 | 00100001 |
| 22 | 16 | Max V image size (cm) $=21 \mathrm{~cm}$ | 15 | 00010101 |
| 23 | 17 | Display gamma ( $2.2 \times 100$ ) -100=120 | 78 | 01111000 |
| 24 | 18 | Feature support (no DMPS, Active off, RGB, timing BLK1) | 0A | 00001010 |
| 25 | 19 | Red/Green Low bit | 47 | 01000111 |
| 26 | 1A | Blue/White Low bit | 99 | 10011001 |
| 27 | 1B | Red X (Rx)(written value "0.580") | 94 | 10010100 |
| 28 | 1C | Red Y (Ry)(written value "0.340") | 57 | 01010111 |
| 29 | 1D | Green X (Gx)(written value " 0.310 ") | 4F | 01001111 |
| 30 | 1E | Green Y (Gy)(written value "0.550") | 8C | 10001100 |
| 31 | 1F | Blue X (Bx)(written value " 0.156 ") | 27 | 00100111 |
| 32 | 20 | Blue Y (By)(written value " 0.129 ") | 21 | 00100001 |
| 33 | 21 | White X ( Wx )(written value " 0.313 ") | 50 | 01010000 |
| 34 | 22 | White Y (Wy)(written value "0.329") | 54 | 01010100 |
| 35 | 23 | Established timings 1 | 00 | 00000000 |
| 36 | 24 | Established timings 2 | 00 | 00000000 |
| 37 | 25 | Established timings 3 (Manufacture's reserved timing) | 00 | 00000000 |


| 38 | 26 | Standard timing ID1 | 01 | 00000001 |
| :---: | :---: | :---: | :---: | :---: |
| 39 | 27 | Standard timing ID1 | 01 | 00000001 |
| 40 | 28 | Standard timing ID2 | 01 | 00000001 |
| 41 | 29 | Standard timing ID2 | 01 | 00000001 |
| 42 | 2A | Standard timing ID3 | 01 | 00000001 |
| 43 | 2B | Standard timing ID3 | 01 | 00000001 |
| 44 | 2C | Standard timing ID4 | 01 | 00000001 |
| 45 | 2D | Standard timing ID4 | 01 | 00000001 |
| 46 | 2E | Standard timing ID5 | 01 | 00000001 |
| 47 | 2F | Standard timing ID5 | 01 | 00000001 |
| 48 | 30 | Standard timing ID6 | 01 | 00000001 |
| 49 | 31 | Standard timing ID6 | 01 | 00000001 |
| 50 | 32 | Standard timing ID7 | 01 | 00000001 |
| 51 | 33 | Standard timing ID7 | 01 | 00000001 |
| 52 | 34 | Standard timing ID8 | 01 | 00000001 |
| 53 | 35 | Standard timing ID8 | 01 | 00000001 |
| 54 | 36 | Pixel Clock/10,000 (LSB) | BC | 10111100 |
| 55 | 37 | Pixel Clock/10,000 (MSB) | 1B | 00011011 |
| 56 | 38 | Horizontal Active | 00 | 00000000 |
| 57 | 39 | Horizontal Blanking (Thbp) | A0 | 10100000 |
| 58 | 3A | Horizontal Active/Horizontal Blanking (Thbp) | 50 | 01010000 |
| 59 | 3B | Vertical Active | 20 | 00100000 |
| 60 | 3C | Vertical Blanking (Tvbp) | 17 | 00010111 |
| 61 | 3D | Vertical active/Vertical blanking (Tvbp) | 30 | 00110000 |
| 62 | 3E | Horizontal Sync, Offset (Thfp) | 30 | 00110000 |
| 63 | 3F | Horizontal Sync, Pulse Width | 20 | 00100000 |
| 64 | 40 | Vertical Sync, Offset (Tvfp)/Sync Width | 26 | 00100110 |
| 65 | 41 | Horizontal Vertical Sync Offset/Width upper 2 bits | 00 | 00000000 |
| 66 | 42 | Horizontal Image Size | 4B | 01001011 |
| 67 | 43 | Vertical Image Size | CF | 11001111 |
| 68 | 44 | Horizontal Image Size / Vertical Image Size | 10 | 00010000 |
| 69 | 45 | Horizontal Border | 00 | 00000000 |
| 70 | 46 | Vertical Border | 00 | 00000000 |
| 71 | 47 | Non-interlaced, Normal, no stereo, Separate sync, H/V pol Negatives, DE only note: LSB is set to " 1 " if panel is DE-timing only. H/V can be ignored. | 18 | 00011000 |
| 72 | 48 | Flag | 00 | 00000000 |
| 73 | 49 | Flag | 00 | 00000000 |
| 74 | 4A | Flag | 00 | 00000000 |
| 75 | 4B | Data Type Tag: Descriptor Defined by Manufacturer | OF | 00001111 |
| 76 | 4C | Flag | 00 | 00000000 |
| 77 | 4D | Value $=\mathrm{HSPW}_{\text {min }} / 2$ (pixel clks) | 08 | 00001000 |
| 78 | 4E | Value $=\mathrm{HSPW}_{\text {max }} / 2$ (pixel clks) | 00 | 00000000 |
| 79 | 4F | Value $=$ Thbp $_{\text {min }} / 2 \quad$ (pixel clks) | 2A | 00101010 |
| 80 | 50 | Value $=$ Thbp $_{\text {max }} / 2 \quad$ (pixel clks) | 00 | 00000000 |


| 81 | 51 | Value $=\mathrm{VSPW}_{\text {min }} / 2$ (line pulses) | 01 | 00000001 |
| :---: | :---: | :---: | :---: | :---: |
| 82 | 52 | Value $=\mathrm{VSPW}_{\text {max }} / 2$ (line pulses) | 00 | 00000000 |
| 83 | 53 | Value $=\mathrm{Tvbp}_{\text {min }} / 2$ (line pulses) | 04 | 00000100 |
| 84 | 54 | Value $=\mathrm{Tvbp}_{\max } / 2 \quad$ (line pulses) | 00 | 00000000 |
| 85 | 55 | Thp ${ }_{\text {min }}=$ value*2 $^{+} \mathrm{HA}_{\text {pixel clks }}$ (pixel clks) | 32 | 00110010 |
| 86 | 56 | Thp ${ }_{\text {max }}=$ value ${ }^{*} 2+\mathrm{HA}_{\text {pixel clk }}$ (pixelclks) | 4A | 01001010 |
| 87 | 57 | $\mathrm{Tvp}_{\text {min }}=$ value $^{*} 2+\mathrm{VA}$ lines (line pulses) | 04 | 00000100 |
| 88 | 58 | $\mathrm{Tvp}_{\text {max }}=$ value $^{*} 2+\mathrm{VA}$ lines (line pulses) | 14 | 00010100 |
| 89 | 59 | Module "A" Revision =0 | 00 | 00000000 |
| 90 | 5A | Flag | 00 | 00000000 |
| 91 | 5B | Flag | 00 | 00000000 |
| 92 | 5C | Flag | 00 | 00000000 |
| 93 | 5D | Dummy Descriptor | FE | 11111110 |
| 94 | 5E | Flag | 00 | 00000000 |
| 95 | 5F | Dell PN Character G | 47 | 01000111 |
| 96 | 60 | Dell PN Character D | 44 | 01000100 |
| 97 | 61 | Dell PN Character 7 | 37 | 00110111 |
| 98 | 62 | Dell PN Character 3 | 33 | 00110011 |
| 99 | 63 | Dell PN Character 8 | 38 | 00111000 |
| 100 | 64 | LCD Supplier EEDID Reversion \# 00 | 00 | 00000000 |
| 101 | 65 | Manufacturer PN | 00 | 00000000 |
| 102 | 66 | Manufacturer PN | 00 | 00000000 |
| 103 | 67 | Manufacturer PN | 00 | 00000000 |
| 104 | 68 | Manufacturer PN | 00 | 00000000 |
| 105 | 69 | Manufacturer PN | 00 | 00000000 |
| 106 | 6A | Manufacturer PN | 00 | 00000000 |
| 107 | 6B | Manufacturer P/N (if <13 char, then terminate with ASCII code 0Ah, set remaining char $=20 \mathrm{~h}$ ) | 00 | 00000000 |
| 108 | 6C | Flag | 00 | 00000000 |
| 109 | 6D | Flag | 00 | 00000000 |
| 110 | 6E | Flag | 00 | 00000000 |
| 111 | 6F | Data Type Tag ASCII String | FE | 11111110 |
| 112 | 70 | Flag | 00 | 00000000 |
| 113 | 71 | SMBUS Value=10nits | E0 | 11100000 |
| 114 | 72 | SMBUS Value=17nits | D0 | 11010000 |
| 115 | 73 | SMBUS Value=24nits | C0 | 11000000 |
| 116 | 74 | SMBUS Value=30nits | B8 | 10111000 |
| 117 | 75 | SMBUS Value=60nits | 98 | 10011000 |
| 118 | 76 | SMBUS Value=110nits | 68 | 01101000 |
| 119 | 77 | SMBUS Value=150nits | 40 | 01000000 |
| 120 | 78 | SMBUS Value=max nits (Typical=00h) | 00 | 00000000 |
| 121 | 79 | Number of LVDS receiver chips | 01 | 00000001 |
| 122 | 7A | Panel type-EDID Enable | 01 | 00000001 |
| 123 | 7B | (If<13 char, then terminate with ASCII code OAh, set remaining char=20h) | 0A | 00001010 |


| 124 | 7C | (If<13 char, then terminate with ASCII code OAh, set remaining char=20h) | QD15TL04 Page |  |
| :---: | :---: | :---: | :---: | :---: |
|  |  |  | 20 | 00100000 |
| 125 | 7D | (If<13 char, then terminate with ASCII code OAh, set remaining char=20h) | 20 | 00100000 |
| 126 | 7E | Extension flag | 00 | 00000000 |
| 127 | 7F | Checksum | 5F | 01011111 |

## 10. Optical Characteristics

| Parameter |  | Symbol | Condition | Min. | Typ. | Max. | Unit | Remark |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Viewing <br> Angle <br> Range | Horizontal | $\theta$ 21, $\theta 22$ | CR>10 | 40 | - | - | Deg. | [Note1,4] |
|  | Vertical | $\theta 11$ |  | 10 | - | - | Deg. |  |
|  |  | $\theta 12$ |  | 30 | - | - | Deg. |  |
| Contrast ratio |  | CRn | $\theta=0^{\circ}$ | 300 | 350 | - |  | [Note2,4] |
| Response <br> Time | Rise | Tr | $\theta=0^{\circ}$ | - | 8 | - | ms | [Note3,4] |
|  | Decay | Td |  | - | 17 | - | ms |  |
| Chromaticity of White |  | $\begin{aligned} & W_{x} \\ & W_{y} \end{aligned}$ |  | $\begin{aligned} & 0.295 \\ & 0.310 \end{aligned}$ | $\begin{aligned} & 0.315 \\ & 0.330 \end{aligned}$ | $\begin{aligned} & 0.335 \\ & 0.350 \end{aligned}$ |  | [Note4] |
| Chromaticity of Red |  | $\begin{aligned} & \mathrm{Rx} \\ & \mathrm{Ry} \end{aligned}$ |  | $\begin{aligned} & 0.560 \\ & 0.320 \\ & \hline \end{aligned}$ | $\begin{aligned} & 0.580 \\ & 0.340 \\ & \hline \end{aligned}$ | $\begin{aligned} & 0.600 \\ & 0.360 \\ & \hline \end{aligned}$ |  |  |
| Chromaticity of Green |  | $\begin{aligned} & G x \\ & G y \end{aligned}$ |  | $\begin{aligned} & 0.290 \\ & 0.530 \end{aligned}$ | $\begin{aligned} & 0.310 \\ & 0.550 \end{aligned}$ | $\begin{aligned} & 0.330 \\ & 0.570 \end{aligned}$ |  |  |
| Chromaticity of Blue |  | $\begin{aligned} & \mathrm{Bx} \\ & \mathrm{By} \end{aligned}$ |  | $\begin{aligned} & 0.135 \\ & 0.110 \end{aligned}$ | $\begin{aligned} & 0.155 \\ & 0.130 \end{aligned}$ | $\begin{aligned} & 0.175 \\ & 0.150 \end{aligned}$ |  |  |
| Luminance of white <br> [Note4] |  | Y L 2 | 5 Points | 150 | 165 | - | $\mathrm{Cd} / \mathrm{m}^{2}$ | $\begin{gathered} \text { IL }=6.0 \\ \text { mArms } \\ \mathrm{F}_{\mathrm{L}}=55 \mathrm{kHz} \end{gathered}$ |
| White Uniformity |  | $\delta \mathrm{W}$ | 5 Points <br> 13 Points | - | - | $\begin{aligned} & 20 \% \\ & 35 \% \end{aligned}$ |  | [Note5] |

The optical characteristics shall be measured in a dark room or equivalent state with the method shown in Fig. 3.


Center of the screen
Fig 3. Optical characteristics measurement method

## [Note1] Definitions of viewing angle range:


[Note2] Definition of contrast ratio:
The contrast ratio is defined as the following.

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

[Note3] Definition of response time:
The response time is defined as the following figure and shall be measured by switching the input signal for "black" and "white" .

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

11. Display Quality

The display quality of the color TFT-LCD module shall be in compliance with the Incoming Inspection Standard.
12. Handling Precautions
a) Be sure to turn off the power supply when inserting or disconnecting the cable.
b) Be sure to design the cabinet so that the module can be installed without any extra stress such as warp or twist.
c) Since the front polarizer is easily damaged, pay attention not to scratch it.
d) Wipe off water drop immediately. Long contact with water may cause discoloration or spots.
e) When the panel surface is soiled, wipe it with absorbent cotton or other soft cloth.
f) Since the panel is made of glass, it may break or crack if dropped or bumped on hard surface. Handle with care.
g) Since CMOS LSI is used in this module, take care of static electricity and injure the human earth when handling.
h) Observe all other precautionary requirements in handling components.
i) This module has its circuitry PCBs on the rear side and should be handled carefully in order not to be stressed.
j) Laminated film is attached to the module surface to prevent it from being scratched. Peel the film off slowly just before the use with strict attention to electrostatic charges. lonized air shall be blown over during the action. Blow off the 'dust' on the polarizer by using an ionized nitrogen gun, etc..
K) Mounting screw hole can stand torque 1.3~1.5 Kgf-cm.
13. Reliability test items

| No. | Test item | Conditions |
| :---: | :---: | :---: |
|  |  |  |
| 1 | High temperature storage test | Ta $=60^{\circ} \mathrm{C}$ 240h |
| 2 | Low temperature storage test | Ta $=-25^{\circ} \mathrm{C} \quad 240 \mathrm{~h}$ |
| 3 | High temperature <br> \& High humidity operation test | $\mathrm{Ta}=40^{\circ} \mathrm{C} ; 90 \% \mathrm{RH} \quad 240 \mathrm{~h}$; (As remark \#3) (No condensation) |
| 4 | High temperature operation test | $\mathrm{Ta}=50^{\circ} \mathrm{C} \quad 240 \mathrm{~h}$ <br> (The panel temp. must be less than $60^{\circ} \mathrm{C}$ ) |
| 5 | Low temperature operation test | $\mathrm{Ta}=0^{\circ} \mathrm{C} \quad 240 \mathrm{~h}$ |
| 6 | Vibration test (non- operating) | Frequency: $10 \sim 500 \mathrm{~Hz}, 1.5 \mathrm{G}$, Test period : 3 hours <br> (1 hour for each direction of $X, Y, Z$ ) |
| 7 | Shock test <br> (Non- operating) | Max. Gravity: 220G <br> Pulse width: $\mathbf{2} \mathbf{~ m s}$, Half sine wave <br> Direction : $\pm \mathbf{X}, \pm \mathbf{Y}, \pm \mathbf{Z}$ <br> Once for each direction. |

## Remark:

(1) A failure is defined as the appearance of pixel failured on any color layer or the appearance of horizontal or vertical lines, bars etc.
(2) Low temperature storage " Panel must return to operating temperature range prior to activation."
(3) Hi temperature / Humidity test

Max. wet-bulb temperature is less than $39^{\circ} \mathrm{C}$; At glass temperature high than $40^{\circ} \mathrm{C}$.
Temperature and relative humidity range is shown in the figure below.

14. Others

1) Lot No. Label:

2) Adjusting volume has been set optimally before shipment, so do not change any adjusted value. If adjusted value is changed, the specification may not be satisfied.
3) Disassembling the module can cause permanent damage and should be strictly avoided.
4) Please be careful since image retention may occur when a fixed pattern is displayed for a long time.
5) If any problem occurs in relation to the description of this specification, it shall be resolved through discussion with spirit of cooperation.
15. Mechanical Outline Dimension


