



- Preliminary Specification
- Final Specification

Module	6.5 Inch Color TFT-LCD
Model Name	FT065-EDC01 V.0 (AUO G065VN01V2)

Customer	Date
_____	_____
Checked & Approved by	
_____	_____
Note: This Specification is subject to change without notice.	

Approved by	Date
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## 1. Operating Precautions

- 1) Display area (Polarizer) of TFT-LCD Module is easily to be damaged, please be cautious and not to scratch it.
- 2) Be sure to power off your machine before connecting or disconnecting your signal cable to TFT-LCD Module.
- 3) Wipe off water drop on display area immediately. Long contact with water may cause discoloration or spots.
- 4) When the panel surface is soiled, wipe it with absorbent cotton or soft cloth.
- 5) Display area (Glass) of TFT-LCD Module may be broken or cracked if bump Module against hard object.
- 6) To avoid ESD (Electro Static Discharge) damage, be sure to ground yourself before handling TFT-LCD Module.
- 7) Do not open nor modify the TFT-LCD module assembly.
- 8) Do not press the reflector sheet at the back of the module to any direction.
- 9) In case if TFT-LCD module has to be put back into the packing container slot after it was taken out from the container, do not press the center of the LED Reflector edge. Instead, press at the far ends of the LED Reflector edge softly. Otherwise the TFT-LCD Module may be damaged.
- 10) When inserting or removing of your signal cable to TFT-LCD Module, be sure not to apply abnormal force (rotate, tilt...etc.) to the Connector of the TFT-LCD Module.
- 11) TFT-LCD Module is not allowed to be twisted & bent even force is added on module in a very short time. Please design your display product well to avoid external force applying to module by end-user directly.
- 12) Small amount of materials without flammability grade are used in the TFT-LCD module. The TFT-LCD module should be supplied by power complied with requirements of Limited Power Source (IEC60950 or UL1950), or be applied exemption.
- 13) Severe temperature condition may result in different luminance, response time.
- 14) Continuous operating TFT-LCD Module under high temperature environment may accelerate LED light bar exhaustion and reduce luminance dramatically.
- 15) The data on this specification sheet is applicable when TFT-LCD module is placed in landscape position.
- 16) Continuous displaying fixed pattern may induce image sticking. It's recommended to use screen saver or moving content periodically if fixed pattern is displayed on the screen.



## 2. General Description

**FT065-EDC01V0** is designed for industrial display applications with VGA (640 x RGB x 480) resolution and 16.2M (RGB 6-bits + FRC) or 262k colors (RGB 6-bits). It is composed of a TFT-LCD panel, driver ICs, control and power supply circuits board and a backlight unit including LED driving circuit, and offers LVDS interface for display signal input.

### 2.1 Display Characteristics

The following items are characteristics summary at 25 (Room Temperature).

Items	Unit	Specifications
Screen Diagonal	inch	6.5
Active Area	mm	132.48(H)x 99.36(V)
Pixels H x V		640x3(RGB) x 480
Pixel Pitch	mm	0.207 x 0.207
Pixel Arrangement		R.G.B. Vertical Stripe
Display Mode		TN, Normally White
Nominal Input Voltage VDD	Volt	3.3 typ.
Typical Power Consumption	Watt	3.213 W (LCD:0.86W/LED BLU: 2.353W) All black pattern
Weight	Grams	170g (typ.)
Physical Size	mm	153.0(H)x 118.0(V) x 10.9(D) (typ.)
Electrical Interface		1 channel LVDS
Surface Treatment		Glare, AR, Hardness: 3H
Support Color		16.2M / 262K colors
The most suitable view angle		6 o'clock
Temperature Range Operating Storage (Non-Operating)	°C °C	-30 to +80* -30 to +80* *Panel surface temperature
RoHS Compliance		RoHS Compliance



## 2.2 Optical Characteristics

The optical characteristics are measured under stable conditions at 25 (Room Temperature).

Item	Unit	Conditions	Min.	Typ.	Max.	Remark
White Luminance	cd/m <sup>2</sup>	F <sub>PWM</sub> = 100% (center point)	900	1000	-	Note 1
Uniformity	%	5 Points		-	1.25	Note 1, 2, 3
Contrast Ratio			400	600	-	Note 4
Response Time	msec	Rising	-	15	20	Note 5
	msec	Falling	-	10	15	
	msec	Rising + Falling	-	25	35	
Viewing Angle	degree degree	Horizontal (Right) CR = 10 (Left)	70 70	80 80	- -	Note 6
	degree degree	Vertical (Upper) CR = 10 (Lower)	60 60	70 70	- -	
Color / Chromaticity Coordinates (CIE 1931)		White x	0.263	0.313	0.363	
		White y	0.279	0.329	0.379	
		Red x	0.559	0.609	0.659	
		Red y	0.314	0.364	0.414	
		Green x	0.285	0.335	0.385	
		Green y	0.554	0.604	0.654	
		Blue x	0.099	0.149	0.159	
		Blue y	0.055	0.105	0.155	
Color Gamut	%		50	55	-	

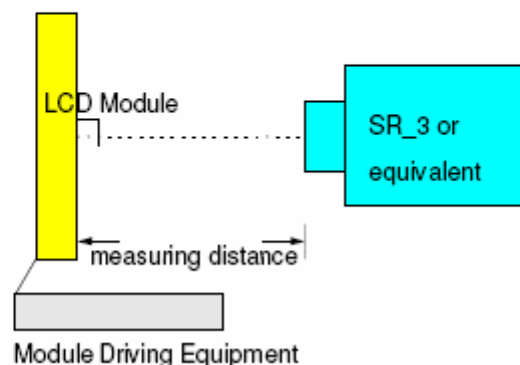
### Note 1: Measurement method

Equipment Pattern Generator, Power Supply, Digital Voltmeter, Luminance meter (SR\_3 or equivalent)

Aperture

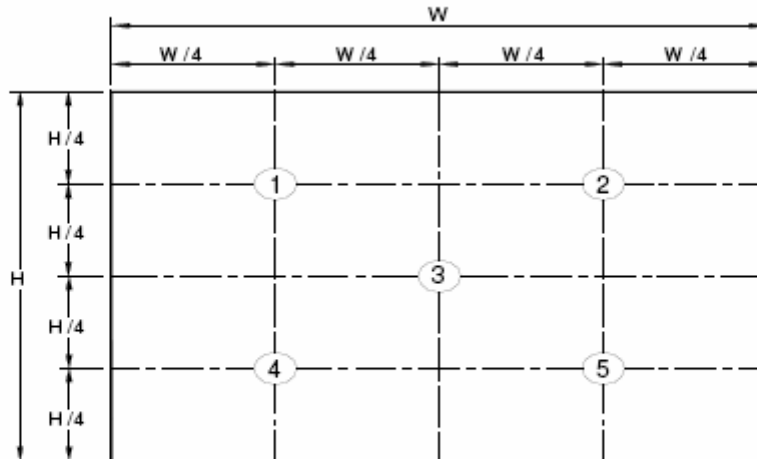
Test Point Center

Environment < 1 lux





Note 2: Definition of 5 points position (Display active area: 132.48mm(W) x 99.36mm(H))



Note 3:

The luminance uniformity of 5 points is defined by dividing the maximum luminance value by the minimum luminance value at full white condition.

$$\varepsilon_{w5} = \frac{\text{Maximum Brightness of five points}}{\text{Minimum Brightness of five points}}$$

Note 4: Definition of contrast ratio (CR):

$$\text{Contrast ratio (CR)} = \frac{\text{Brightness @ "White" state}}{\text{Brightness @ "Black" state}}$$

Note 5: Definition of response time:

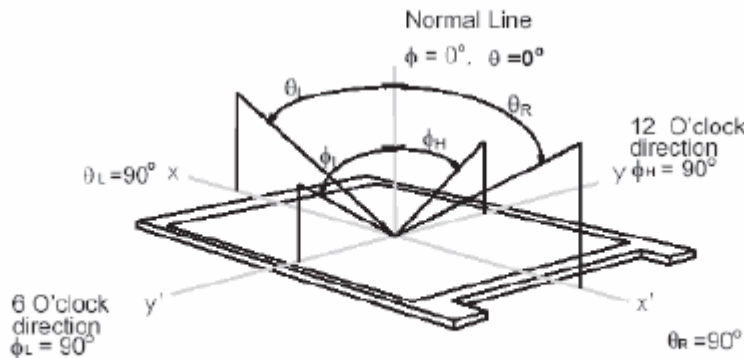
The output signals of photo detector are measured when the input signals are changed from "White" to "Black" (falling time) and from "Black" to "White" (rising time), respectively. The response time interval definition is between 10% and 90% of amplitude. Please refer to the figure as below.





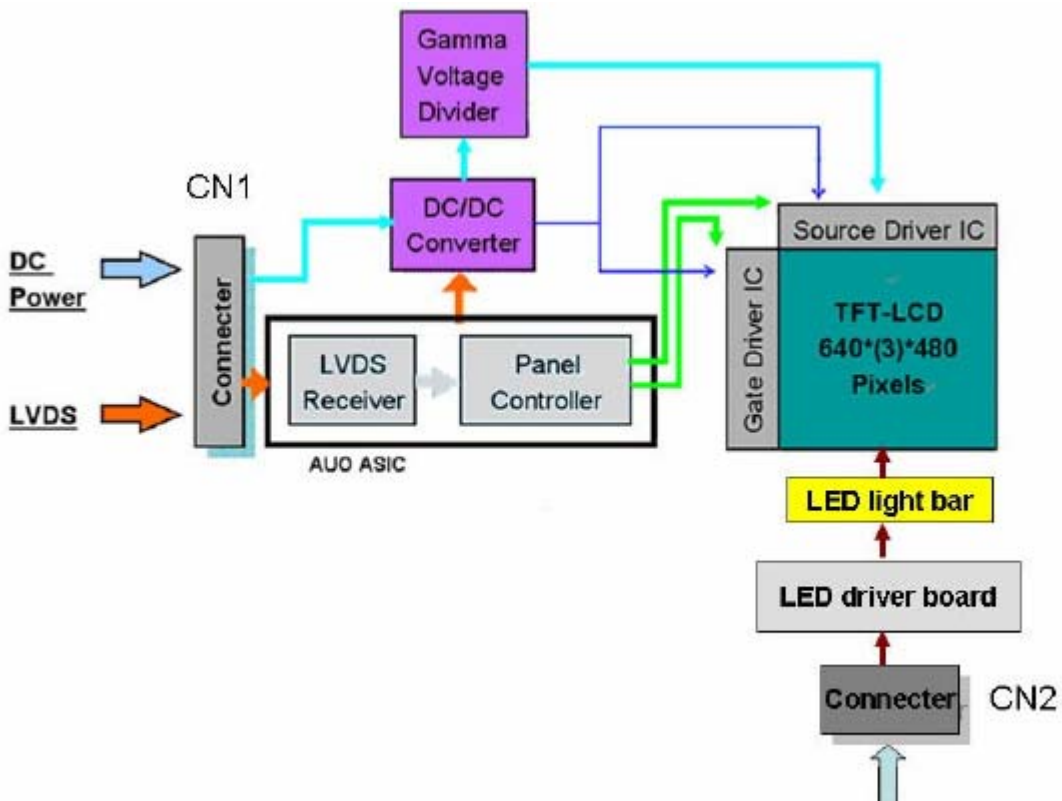
**Note 6: Definition of viewing angle**

Viewing angle is the measurement of contrast ratio  $\geq 10$ , at the screen center, over a 180° horizontal and 180° vertical range (off-normal viewing angles). The 180° viewing angle range is broken down as below: 90° ( $\theta$ ) horizontal left and right, and 90° ( $\phi$ ) vertical high (up) and low (down). The measurement direction is typically perpendicular to the display surface with the screen rotated to its center to develop the desired measurement viewing angle.



**3. Functional Block Diagram**

The following diagram shows the functional block of the V0color TFT/LCD module.







## 4. Absolute Maximum Ratings

### 4.1 Absolute Ratings

Item	Symbo	Min	Max	Unit	Remark
Logic/LCD Drive Voltage	VDD	-0.3	+4.0	Volt	Ta= 25°C
LCD Input Signal Voltage	VIN	-0.3	+4.0	Volt	Ta= 25°C
LED BLU Drive Voltage	V <sub>LED</sub>	0	16	Volt	Ta= 25°C
LED Dimming Input Voltage	V <sub>PWM</sub>	0	6	Volt	Ta= 25°C

### 4.2 Absolute Ratings of Environment

Item	Symbol	Min	Max	Unit	Remark
Operating Temperature	TOP	-30	+80*	°C	Note 1, 2
Operation Humidity	HOP	5	95	%RH	Note 1, 2
Storage Temperature	TST	-30	+80*	°C	Note 1
Storage Humidity	HST	5	95	%RH	Note 1

Note 1: Maximum Wet-tion.

Note 2: Only operation is guaranteed. Optical and display performance should be evaluated at 25 only.

\*: Panel surface temperature



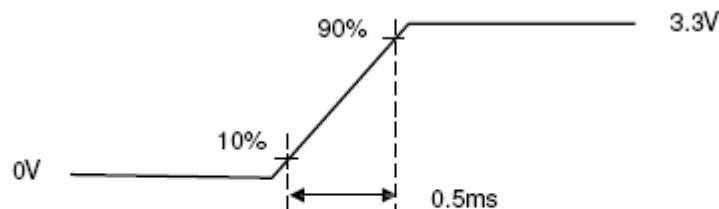
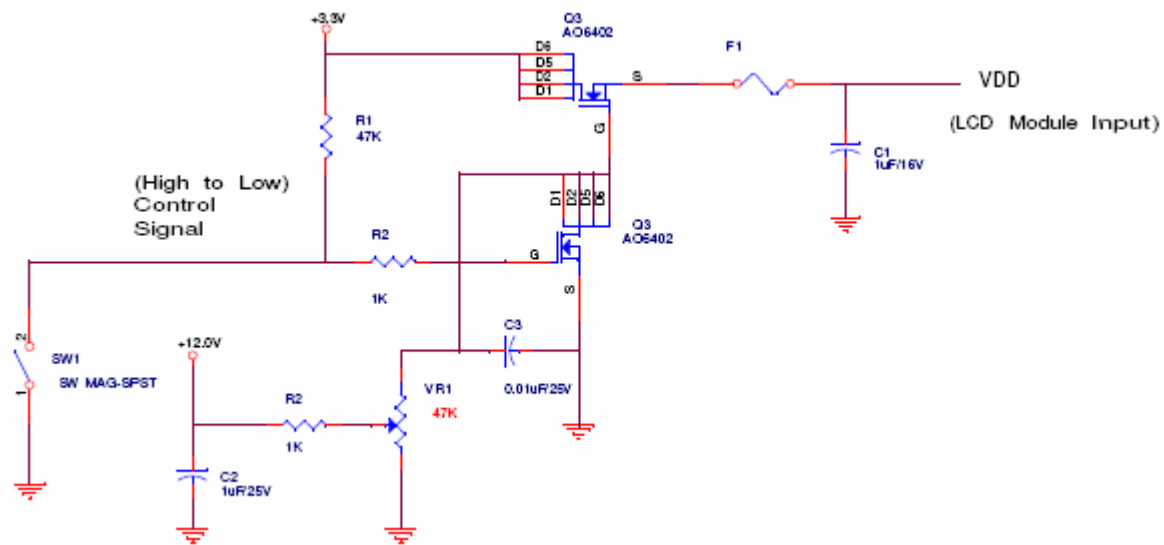
## 5. Electrical Characteristics

### 5.1 TFT-LCD Driving

#### 5.1.1 Power Specification

Symbol	Parameter	Min	Typ	Max	Units	Remark
VDD	Logic/LCD Drive Voltage	3.0	3.3	3.6	Volt	
IDD	VDD Current	-	260	300	mA	All Black Pattern (VDD=3.3V, at 60Hz)
Irush	LCD Inrush Current	-	-	1.5	A	Note 1
PDD	VDD Power	-	0.86		Watt	All Black Pattern (VDD=3.3V, at 60Hz)
VDDrp	Allowable Logic/LCD Drive Ripple Voltage	-	-	100	mVp-p	All Black Pattern (VDD=3.3V, at 60Hz)

Note 1: Measurement condition:



VDD rising time



### 5.1.2 Signal Electrical Characteristics

Input signals shall be low or Hi-Z state when VDD is off.

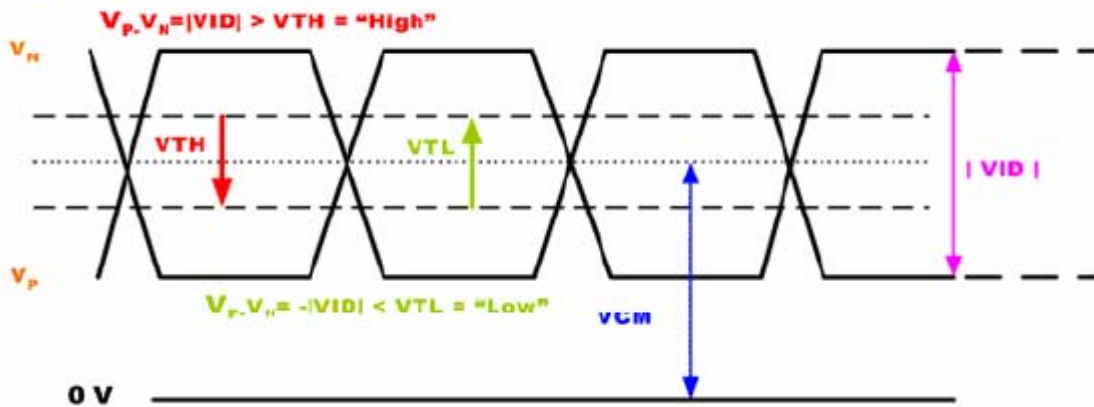
LVDS signal (Note 1)

LVDS Transmitter: THC63LVDM83A (THINE) or equivalent

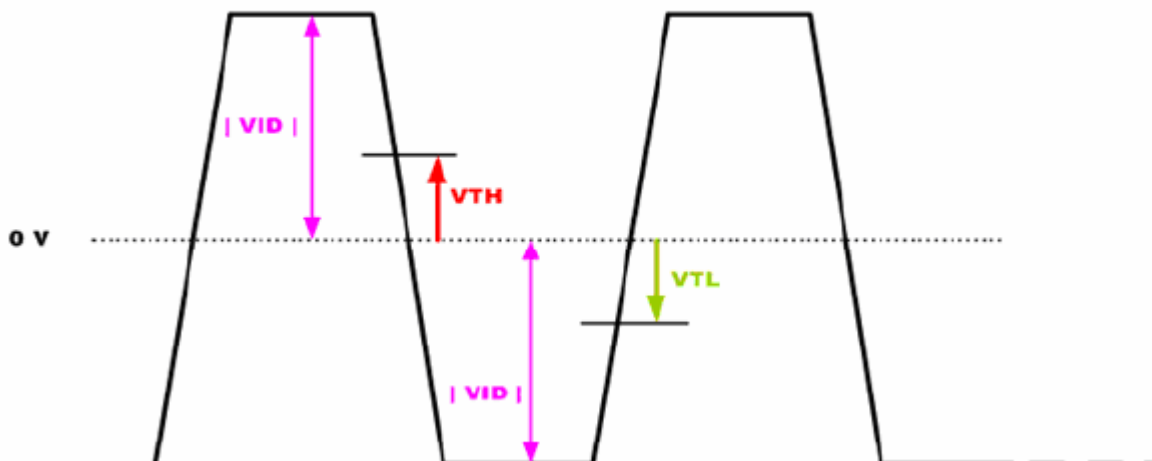
Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark
Differential Input High Threshold	VTH	-	-	100	mV	VCM=1.20V
Differential Input Low Threshold	VTL	-100	-	-	mV	VCM=1.20V
Input Differential Voltage	VID	100	400	600	mV	
Differential Input Common Mode Voltage	VCM	1.1	-	1.45	V	VTH, VTL= ±100mV

Note 1: LVDS Signal Waveform.

#### Single-end Signal



#### Differential Signal





## 5.2 Backlight Unit Driving

### 5.2.1 Parameter guideline for LED driver

Following characteristics are measured under stable condition at 25°C Temperature).

Symbol	Parameter	Min	Typ	Max	Units	Remark
$V_{LED}$	LED Input Voltage	9	18.1	13	Volt	
$I_{LED}$	LED Input Current	-	0.13		A	100% PWM duty
$P_{LED}$	LED Power Consumption	-	2.353		W	100% PWM duty
$I_{rush_{LED}}$	Inrush Current	-	0.37	0.41	A	100% PWM duty
$V_{LED\ On/Off}$	On Control Voltage	3.0	3.3	5.0	Volt	
	Off Control Voltage	0		0.15	Volt	
$V_{PWM}$	Dimming control Voltage High	3.0	3.3	5.0	Volt	
	Dimming control Voltage Low	0		0.1	Volt	
$F_{PWM}$	Dimming Frequency	200		30K	Hz	
$D_{PWM}$	Dimming duty cycle	1		100	%	
Operating Life		50000			Hrs	Note 2, 3

Note 1: See Section 6.6 for LED Backlight Unit Interface Signal Description.

Note 2: If ED065C01 V0 module is driven at high ambient temperature & humidity condition. The operating life will be reduced.

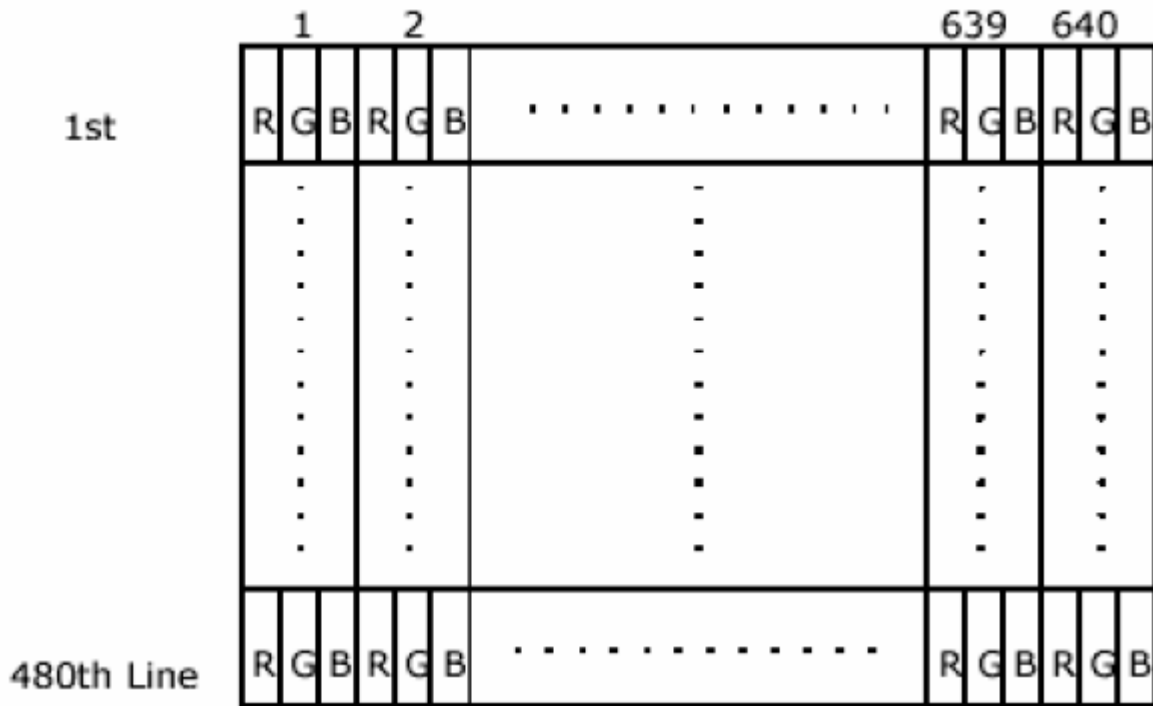
Note 3: Operating life means brightness goes down to 50% initial brightness. Typical operating life time is estimated data.



### 6. Signal Characteristic

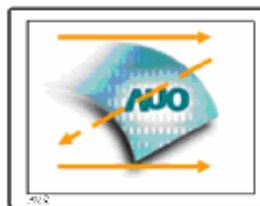
#### 6.1 Pixel Format Image

Following figure shows the relationship between input signal and LCD pixel format.



#### 6.2 Scanning Direction

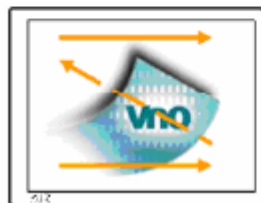
The following figures show the image seen from the front view. The arrow indicates the direction of scan.



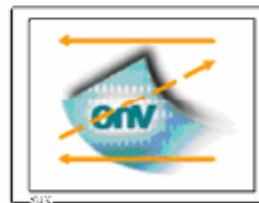
R/L=Low or NC; U/D= Low or NC



R/L=High; U/D= Low or NC



R/L=Low or NC; U/D= High

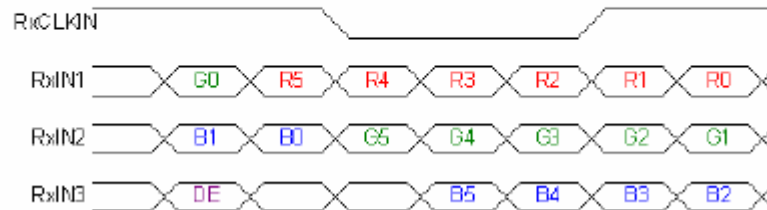


R/L=High; U/D= High

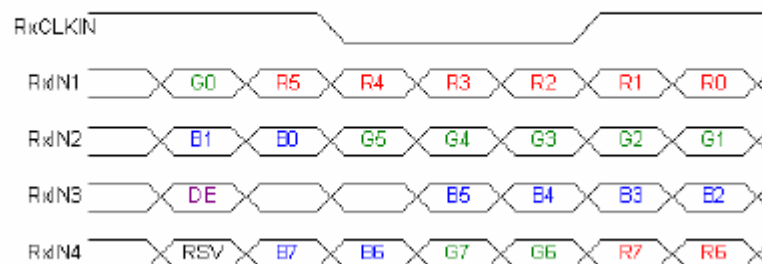


6.3 The Input Data Format

SEL68 = "Low" or "NC" for 6 bits LVDS Input



SEL68 = "High" for 8 bits LVDS Input



Signal Name	Description	Remark
R7	Red Data 7	Red-pixel Data  For 8Bits LVDS input MSB: R7 ; LSB: R0
R6	Red Data 6	
R5	Red Data 5	
R4	Red Data 4	
R3	Red Data 3	
R2	Red Data 2	
R1	Red Data 1	
R0	Red Data 0	For 6Bits LVDS input MSB: R5 ; LSB: R0
G7	Green Data 7	Green-pixel Data  For 8Bits LVDS input MSB: G7 ; LSB: G0
G6	Green Data 6	
G5	Green Data 5	
G4	Green Data 4	
G3	Green Data 3	
G2	Green Data 2	
G1	Green Data 1	
G0	Green Data 0	
B7	Blue Data 7	Blue-pixel Data  For 8Bits LVDS input MSB: B7 ; LSB: B0
B6	Blue Data 6	
B5	Blue Data 5	
B4	Blue Data 4	
B3	Blue Data 3	
B2	Blue Data 2	
B1	Blue Data 1	
B0	Blue Data 0	
RxCLKIN	LVDS Data Clock	
DE	Data Enable Signal	When the signal is high, the pixel data shall be valid to be displayed.
RSV	Reserved Signal	"High" or "Low" is acceptable

Note 1: Output signals from any system shall be low or Hi-Z state when VDD is off.

**6.4 TFT- LCD Interface Signal Description**

G065VN01 V2 TFT-LCD module includes LVDS receiver. LVDS is a differential signal technology for high-speed data transfer LCD interface. LVDS Transmitter shall be THC63LVDM83A (THINE) or equivalent.

<b>Pin No.</b>	<b>Signal</b>	<b>Description</b>
1	VDD	Power supply 3.3V(Typical)
2	VDD	Power supply 3.3V(Typical)
3	GND	Ground
4	SEL68	LVDS 6/8bit select function control Low or NC → 6 bit input mode High → 8 bit input mode
5	RxIN1-	LVDS differential data input Pair 1
6	RxIN1+	
7	GND	Ground
8	RxIN2-	LVDS differential data input Pair 2
9	RxIN2+	
10	GND	Ground
11	RxIN3-	LVDS differential data input Pair 3
12	RxIN3+	
13	GND	Ground
14	RXCLKIN-	LVDS differential Clock input Pair
15	RXCLKIN+	
16	NC	No connection
17	UD	Vertical reverse scan control Low or NC → Normal mode High → Vertical reverse scan
18	RL	Horizontal reverse scan control Low or NC → Normal mode High → Horizontal reverse scan
19	RxIN4-	LVDS differential data input Pair 4
20	RxIN4+	

Note : "Low" stands for 0V. "High" stands for 3.3V. "NC" stands for "No Connected."





### 6.5 TFT- LCD Interface Timing

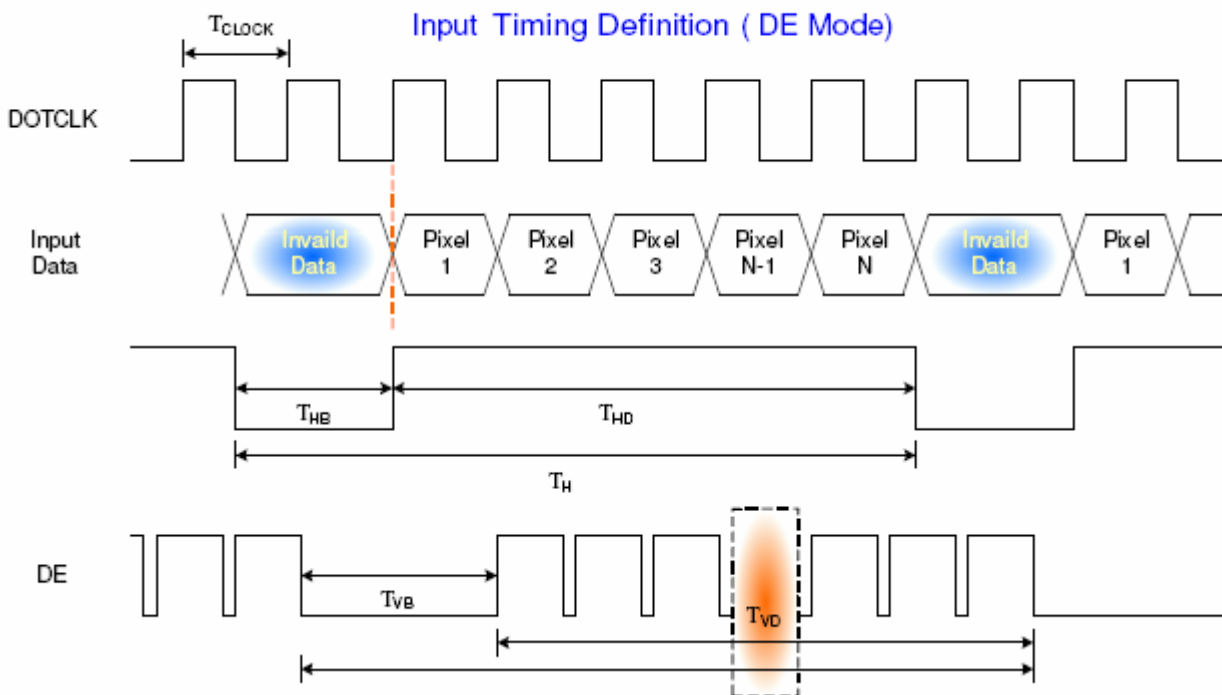
#### 6.5.1 Timing Characteristics

DE mode only

Signal	Symbol	Min.	Typ.	Max.	Unit	Remark	
Clock frequency (DOTCLK)	1/ $T_{CLOCK}$	20	25.2	50	MHz	Note1	
Horizontal Section	Period	$T_H$	770	800	1070	$T_{CLOCK}$	Note1
	Active	$T_{HD}$	640				
	Blanking	$T_{HE}$	130	160	430		
Vertical Section	Period	$T_V$	520	525	622	$T_{LINE}$	Note1
	Active	$T_{VD}$	480				
	Blanking	$T_{VE}$	40	45	142		

Note 1: Recommended frame rate is 60 Hz.

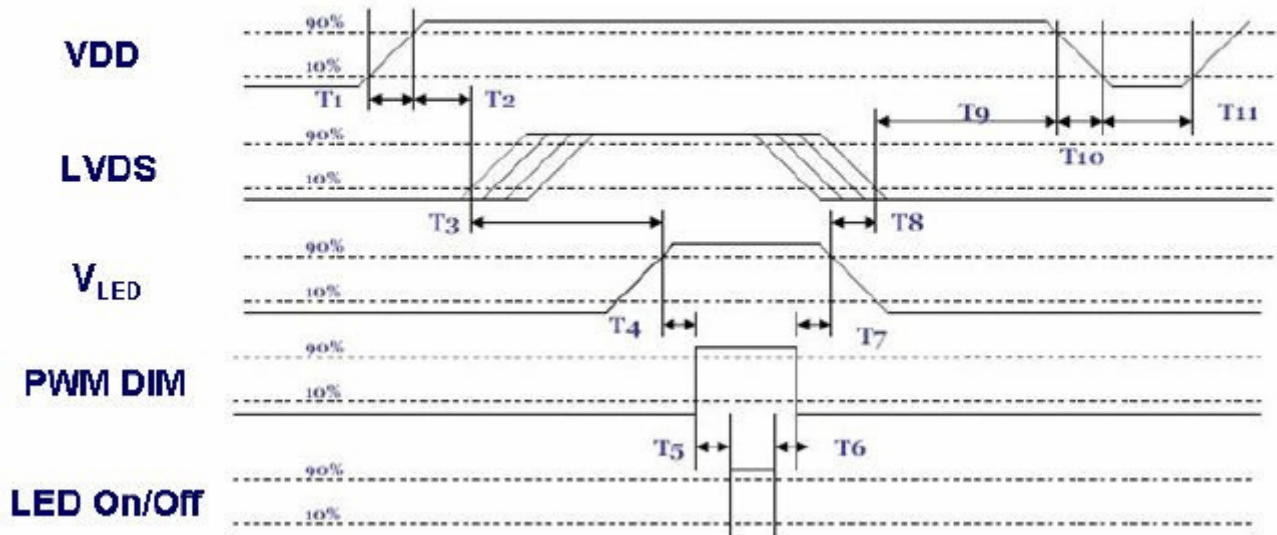
#### 6.5.2 Input Timing Diagram

**Note1:** Please follow PSWG.**Note2:** R/G/B data 7:MSB, R/G/B data 0:LSB



### 6.6 Power ON/OFF Sequence

VDD power, LCD interface signals and backlight on/off sequence are shown in the following chart. Signals from any system shall be Hi-Z state or low level when VDD is off.



Power ON/OFF sequence timing

Parameter	Value			Units
	Min.	Typ.	Max.	
T1	0.5	-	10	ms
T2	30	40	50	ms
T3	200	-	-	ms
T4	10	-	-	ms
T5	10	-	-	ms
T6	0	-	-	ms
T7	10	-	-	ms
T8	100	-	-	ms
T9	0	16	50	ms
T10	-	-	10	ms
T11	1000	-	-	ms

ON/OFF sequence should be applied to avoid abnormal function in the display. Please make sure to turn off the power when you plug the cable into the input connector or pull the cable out of the connector.



## 7. Connector & Pin Assignment

### 7.1 TFT- LCD Signal (CN1): LCD Connector

Manufacturer	STM
Connector Model Number	MSB24013P20, compatible with I-PEX 20268-020E
Mating Connector Model Number	Hirose DF19 -20S-1C or compatible

Pin#	Symbol	Pin#	Symbol
1	VDD	11	RxIN3-
2	VDD	12	RxIN3+
3	GND	13	GND
4	SEL68	14	RxCLKIN-
5	RxIN1-	15	RxCLKIN+
6	RxIN1+	16	NC
7	GND	17	U/D
8	RxIN2-	18	R/L
9	RxIN2+	19	RxIN4-
10	GND	20	RxIN4+

### 7.2 LED Backlight Unit (CN2): Backlight Connector

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

Connector Name / Designation	LED Connector / Backlight
Manufacturer	
Type Part Number	A20D/HD2-2P
Mating Type Part Number	S2B-PH-SM4-TB

Pin #	Symbol	Cable Color	Pin Description
1	+12V	Red	Power +12V
2	GND	Black	GND



## 7.3 LED Driver Board

### 7.3.1 Input connector : J1

Model Name : S7B-PH-SM4-TB(JST)

#### (J1)

Connector Type: 2.0mm 7pin Wafer (SMD)

Pin No.	Description
1	+12V
2	+12V
3	+12V
4	Ground
5	PWM Control
6	Ground
7	ON/OFF Control



(pin1)

### 7.3.2 Output connector : J2 , J3

Model Name : S2B-PH-SM4-TB(JST)

#### (J2)

Connector Type: 2.0mm 2pin Wafer (SMD)

Pin No.	Description
1	VLED+
2	VLED-

#### (J3)

Connector Type: 2.0mm 2pin Wafer (SMD)

Pin No.	Description
1	VLED+
2	VLED-

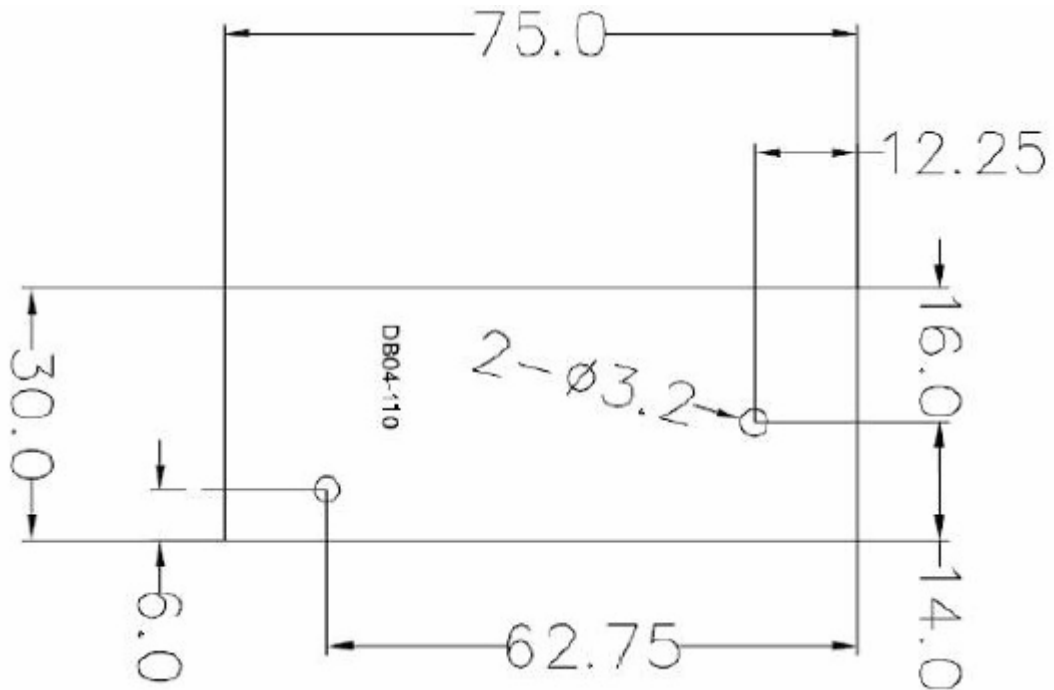


(pin1)



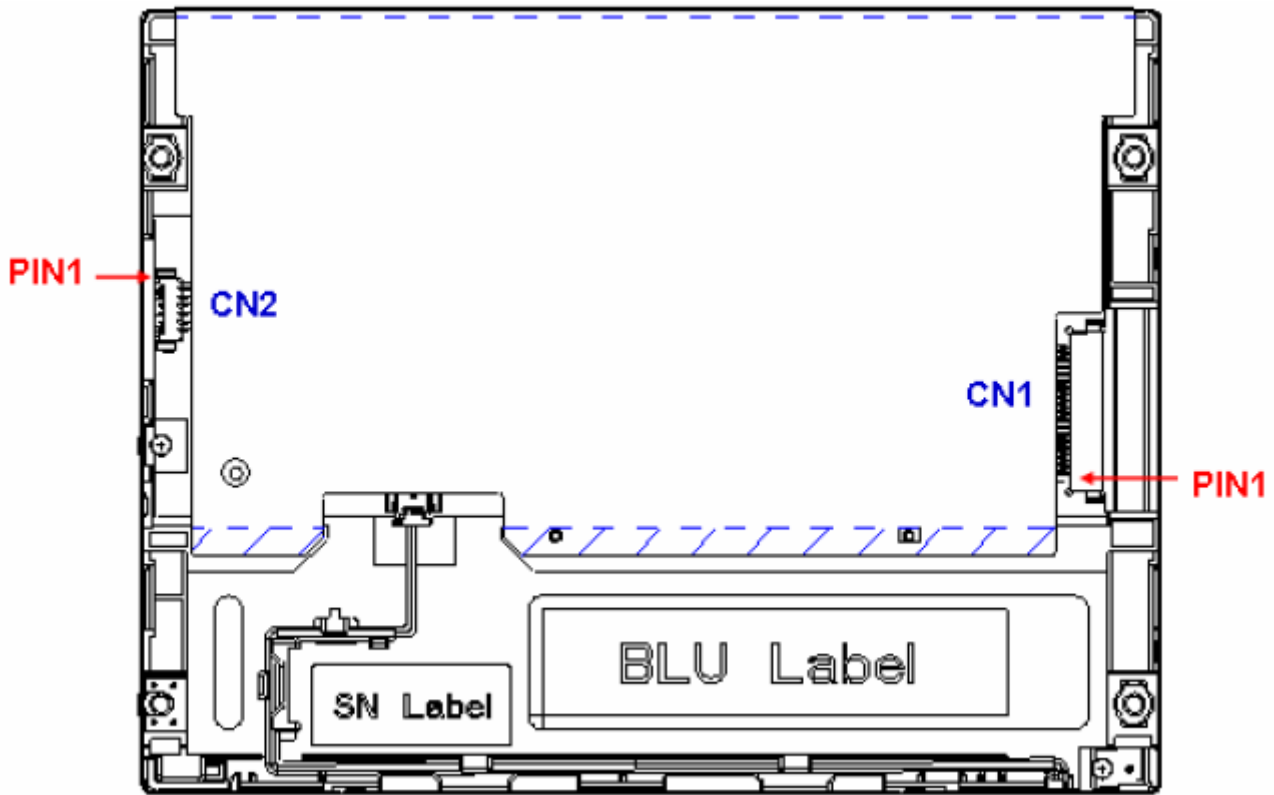
**LED Driving Board Outline Dimension (Rear View)**

**Dimension : 75(L)\*30(W)\*8.65(H)mm**





7.4 PIN 1 definition of CN1 and CN2



(Rear side of TFT-LCD)



### 8. Mechanical Characteristics

