



# 深圳市宇华微科技有限公司

## PRODUCT SPECIFICATION

Doc. Number:

- Tentative Specification
- Preliminary Specification
- Approval Specification

### MODEL NO.: G156HAE-2.0

### SUFFIX: LK01

<b>Customer:</b>	
<b>APPROVED BY</b>	<b>SIGNATURE</b>
<b>Name / Title</b> _____	
Note : _____	
<p>Please return 1 copy for your confirmation with your signature and comments .</p>	

Approved By	Checked By	Prepared By



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# 1. GENERAL DESCRIPTION

## 1.1 OVERVIEW

G156HAE-LK01 is a 15.6" TFT Liquid Crystal Display AV module with LED Backlight units and 40 pins 2ch-LVDS interface. This module supports 1920 x 1080 FHD mode and can display 16.7M colors.

The PSWG is to establish a set of displays with standard mechanical dimensions and select electrical interface requirements for an industry standard 15.6" FHD LCD panel and the LED driving device for Backlight is built in PCBA.

## 1.2 FEATURE

- FHD (1920 x 1080 pixels) resolution
- DE (Data Enable) only mode
- 2ch-LVDS Interface
- PSWG (Panel Standardization Working Group)
- RoHS compliance

## 1.3 APPLICATION

- TFT LCD Monitor
- Factory Application
- Amusement

## 1.4 GENERAL SPECIFICATIONS

Item	Specification	Unit	Note
Active Area	344.16 (H) x 193.59(V) (15.6" diagonal)	mm	(1)
Driver Element	a-Si TFT active matrix	-	-
Pixel Number	1920 x R.G.B x 1080	pixel	-
Pixel Pitch	0.17925(H) x 0.17925 (W)	mm	-
Pixel Arrangement	RGB vertical Stripe	-	-
Display Colors	16.7M	color	-
Display Mode	Normally Black	-	-
Surface Treatment	Hard Coating (3H), Anti-Glare	-	-
Module Power Consumption	(Total 11W(Typ) @ Cell 3.2W(Typ),7.8W(Typ)	W	Typ.

## 1.5 MECHANICAL SPECIFICATIONS

Item		Min.	Typ.	Max.	Unit	Note
Module Size	Horizontal(H)	363.3	363.8	364.3	mm	(1)
	Vertical(V)	215.4	215.9	216.4	mm	
	Depth(D)	8.8	9.3	9.8	mm	
Bezel Area	Horizontal	346.76	347.06	347.36	mm	-
	Vertical	196.19	196.49	196.79	mm	
Active Area	Horizontal	-	344.16	-	mm	
	Vertical	-	193.59	-	mm	
Weight		-	1055	1097	g	

Note (1)Please refer to the attached drawings for more information of front and back outline dimensions.

## 2. ABSOLUTE MAXIMUM RATINGS

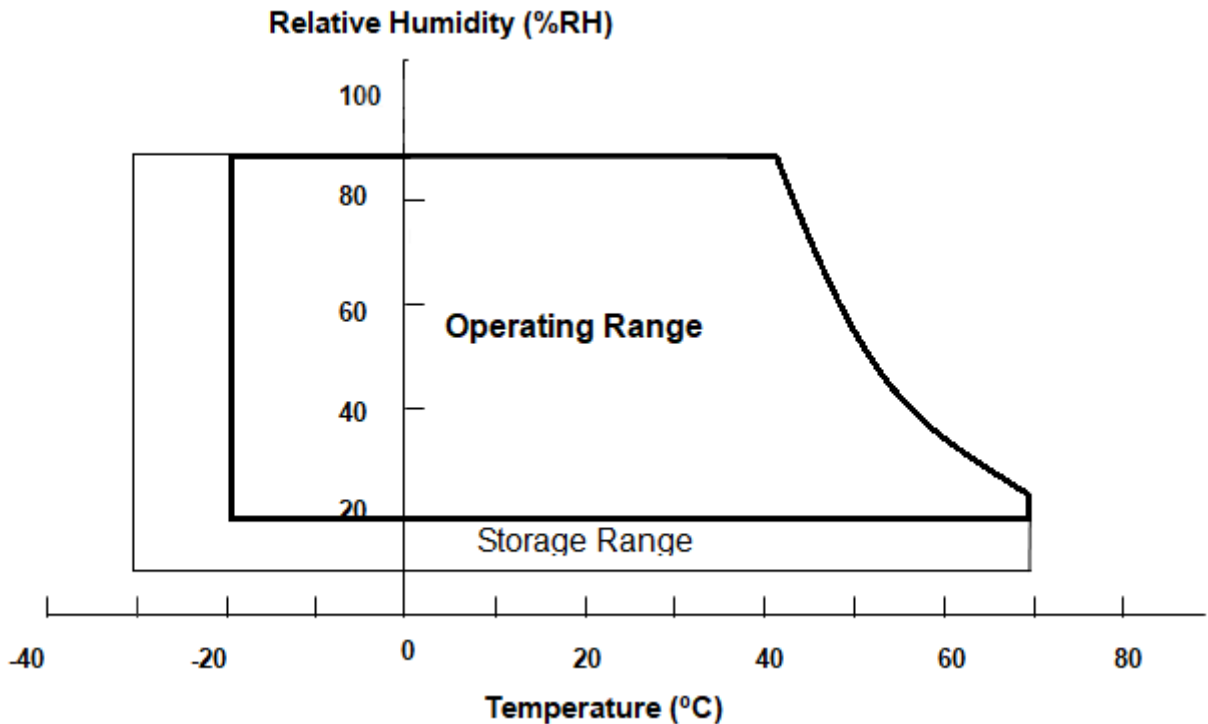
### 2.1 ABSOLUTE RATINGS OF ENVIRONMENT

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Operating Ambient Temperature	T <sub>OP</sub>	-30	+80	°C	(1)(2)
Storage Temperature	T <sub>ST</sub>	-30	+85	°C	

Note (1)

- (a) 90 %RH Max.
- (b) Wet-bulb temperature should be 39 °C Max.
- (c) No condensation.

Note (2) Panel surface temperature should be 0°C min. and 65°C max under V<sub>CC</sub>=5.0V, f<sub>r</sub> =60Hz, typical LED string current, 25°C ambient temperature, and no humidity control . Any condition of ambient operating temperature ,the surface of active area should be keeping not higher than 70°C.



## 2.2 ELECTRICAL ABSOLUTE RATINGS

### 2.2.1 TFT LCD MODULE

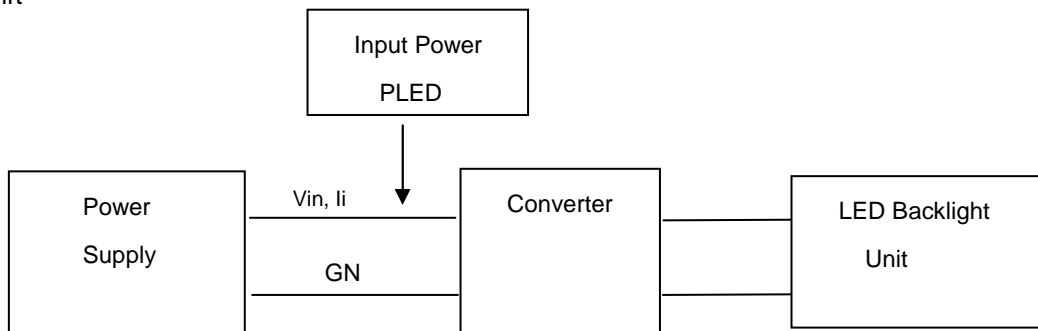
Item	Symbol	Value		Unit	Note
		Min.	Max.		
Power Supply Voltage	V <sub>CC</sub>	-0.3	5.5	V	(1)
Logic Input Voltage	V <sub>IN</sub>	-0.3	4.0	V	

## 2.2.2 BACKLIGHT UNIT

Parameter	Symbol	Value			Unit	Note	
		Min.	Typ.	Max.			
Converter Power Supply Voltage	LED_Vin	10.8	12.0	13.2	V		
Converter Power Supply Current	li	0.8	1.0	1.2	A	@LED_Vin= 12V Duty=100%	
Converter Input Rush Current	lirsh			3	A	@LED_Vin rising = 1mS	
Power Consumption	P <sub>LED</sub>		12		W	@ LED_Vin = 12V Duty=100%	
EN Control Level	Backlight on	LED_EN	2.0	5	5.5	V	
	Backlight off		0	0	0.15		
PWM Control Level	PWM High Level	LED_PWM	2.0	3.3	5.0	V	
	PWM Low Level		0	0	0.15		
PWM Control Duty Ratio			10	--	100	%	
PWM Control Frequency		f <sub>PWM</sub>	190	200	20k	Hz	
LED Life Time		L <sub>L</sub>	30,000			Hrs	(2)

Note (1) LED light bar input voltage and current are measured by utilizing a true RMS multimeter as shown below:

Note (2) The lifetime of LED is estimated data and defined as the time when it continues to operate under the conditions at  $T_a = 25 \pm 2^\circ\text{C}$  and Duty 100% until the brightness becomes  $\leq 50\%$  of its original value. Operating LED under high temperature environment will reduce life time and lead to color shift



## 2.2.3 Backlight Driving Conditions

Item	Symbol	Values			Unit	Remark
		Min.	Typ.	Max.		
Voltage for LED backlight	V <sub>L</sub>	25.2	30	33.6	V	Note 1
Current for LED backlight	I <sub>L</sub>	-	540	-	mA	
LED life time	-	30000		-	Hr	Note 2

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Color Chromaticity	Red	Rx	$\theta X=0^\circ, \theta Y=0^\circ$ Grayscale Maximum	Typ - 0.05	0.652	Typ + 0.05	-	(1), (5)
		Ry			0.338			
	Green	Gx			0.333			
		Gy			0.613			
	Blue	Bx			0.150			
		By			0.050			
	White	Wx			0.313			
		Wy			0.329			
Center Luminance of White		LC		280	350			(4), (5)
Contrast Ratio		CR		600	800			(2), (5)
Response Time		TR	$\theta X=0^\circ, \theta Y=0^\circ$	-	14	19	-	(3)
		TF		-	11	16	-	
White Variation		$\delta W$	$\theta X=0^\circ, \theta Y=0^\circ$	70		-	%	(5), (6)
Viewing Angle	Horizontal	$\theta X+$	$CR \geq 10$	85	89	-	Deg.	(1), (5)
		$\theta X-$		85	89	-		
	Vertical	$\theta Y+$		85	89	-		
		$\theta Y-$		85	89	-		

## D. Optical Specification

All optical specification is measured under typical condition (Note 1, 2)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Response Time	Tr+Tf	$\theta=0^\circ$	--	25	30	ms	Note 3
Contrast ratio	CR	$\theta=0^\circ$	700	800	--	--	Note 4
NTSC	%	$\theta=0^\circ$	67%	72%	--	%	C-light
Viewing Angle	Top	$CR \geq 10$	80	85	--	deg.	Note 5
	Bottom						
	Left						
	Right						
Luminance of White	LC	$\theta=0^\circ$	850	1000		cd/m2	
Chromaticity	White	X	$\theta=0^\circ$	0.282	0.312	0.342	@BLU_Silicate PS06W12 V3 Note 6
		Y	$\theta=0^\circ$	0.302	0.332	0.362	
	Red	X	$\theta=0^\circ$	0.617	0.647	0.677	
		Y	$\theta=0^\circ$	0.307	0.337	0.367	
	Green	X	$\theta=0^\circ$	0.292	0.322	0.352	
		Y	$\theta=0^\circ$	0.577	0.607	0.637	
	Blue	X	$\theta=0^\circ$	0.12	0.150	0.180	
		Y	$\theta=0^\circ$	0.017	0.047	0.077	

Remark: **Above table, all Values are simulated only. AUO will amend the data, when the actual Products output**

Note 1: Measurement should be performed in the dark room, optical ambient temperature =25°C

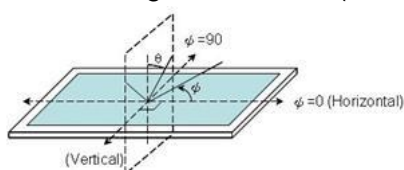
Note 2: To be measured on the center area of panel with a field angle of 1° by Topcon luminance meter BM-5, or SR3 or DMS-803 after 10 minutes operation.

Note 3: The Optical features are based on emissive spectrum of the reference light source by CIE1931C-light. The LCD spectrum of transmission must be verified with the reference light-source to achieve the specified optical characteristics.

Note 4: Contrast ratio is calculated with the following formula.

$$\text{Contrast ratio} = \frac{\text{Photo detector output when LCD is at " White" state}}{\text{Photo detector output when LCD is at " Black" state}}$$

Note 5. Definition of viewing angle: refer to figure as below (FPC direction is at  $\psi =90$ ).



Note 6. The viewing angles are measured at the center area of the panel when all the input terminals of LCD panel are electrically opened.

## F. Electrical Specifications

### 1. Pin Assignment

Recommended connector: I-PEX 20455-040E-76B

Pin no	Symbol	Description	Remark
1	LED_VCC	LED Power Supply,12V(typical)	
2	LED_VCC	LED Power Supply,12V(typical)	
3	LED_VCC	LED Power Supply,12V(typical)	
4	LED_VCC	LED Power Supply,12V(typical)	
5	GND	Ground	
6	GND	Ground	
7	GND	Ground	
8	GND	Ground	
9	LED_EN	LED Enable	LED driver H: Enable L: Disable
10	LED_PWM	LED PWM Control	Note1
11	LCD_VCC	LCD Power Supply,3.3V(typical)	
12	LCD_VCC	LCD Power Supply,3.3V(typical)	
13	LCD_VCC	LCD Power Supply,3.3V(typical)	
14	NC	No Connection	
15	NC	No Connection	
16	NC	No Connection	
17	GND	Ground	
18	RX00-	-LVDS differential data input	
19	RX00+	+LVDS differential data input	
20	RX01-	-LVDS differential data input	
21	RX01+	+LVDS differential data input	
22	RX02-	-LVDS differential data input	
23	RX02+	+LVDS differential data input	
24	GND	Ground	
25	RX0C-	-LVDS differential clock input	
26	RX0C+	+LVDS differential clock input	
27	GND	Ground	
28	RX03-	-LVDS differential data input	
29	RX03+	+LVDS differential data input	
30	RXE0-	-LVDS differential data input	
31	RXE0+	+LVDS differential data input	
32	RXE1-	-LVDS differential data input	
33	RXE1+	+LVDS differential data input	
34	GND	Ground	
35	RXE2-	-LVDS differential data input	
36	RXE2+	+LVDS differential data input	
37	RXEC-	-LVDS differential clock input	
38	RXEC+	+LVDS differential clock input	
39	RXE3-	-LVDS differential data input	
40	RXE3+	+LVDS differential data input	

Note1: Refer to TI LP8866SQDCPRQ1 PWM control signal setting for Hybrid dimming mode with 19531Hz PWM frequency.

### 3. Electrical Characteristics

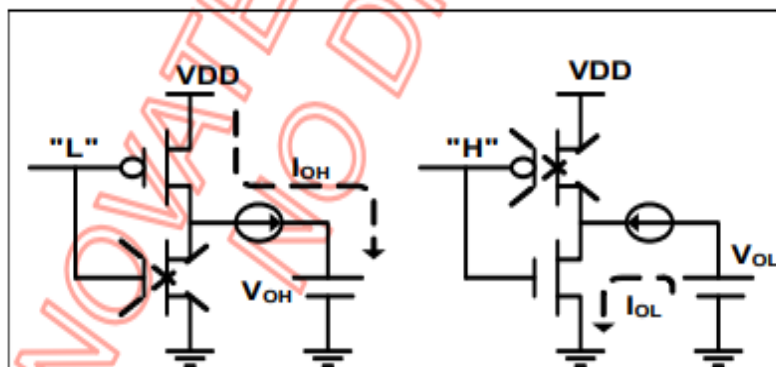
The following items are measured under stable condition and suggested application circuits.

#### 3.1 DC Electrical Characteristics

(VCC = 2.5V, VMM = 1.1V, TA = 25°C, unless otherwise noted)

Recommended Operating Conditions						
Symbol	Parameter	Min.	Typ.	Max.	Unit	Condition
LVDD_25 VCCIO_25 VCCTX_25	Supply Voltage	2.25	2.5	2.75	V	For 2.5V application case
VCC_11 VMM_11 VCCTX_11	Supply voltage	1.0	1.1	1.2	V	
$\Delta$ VMM	Supply power noise			100	mV	

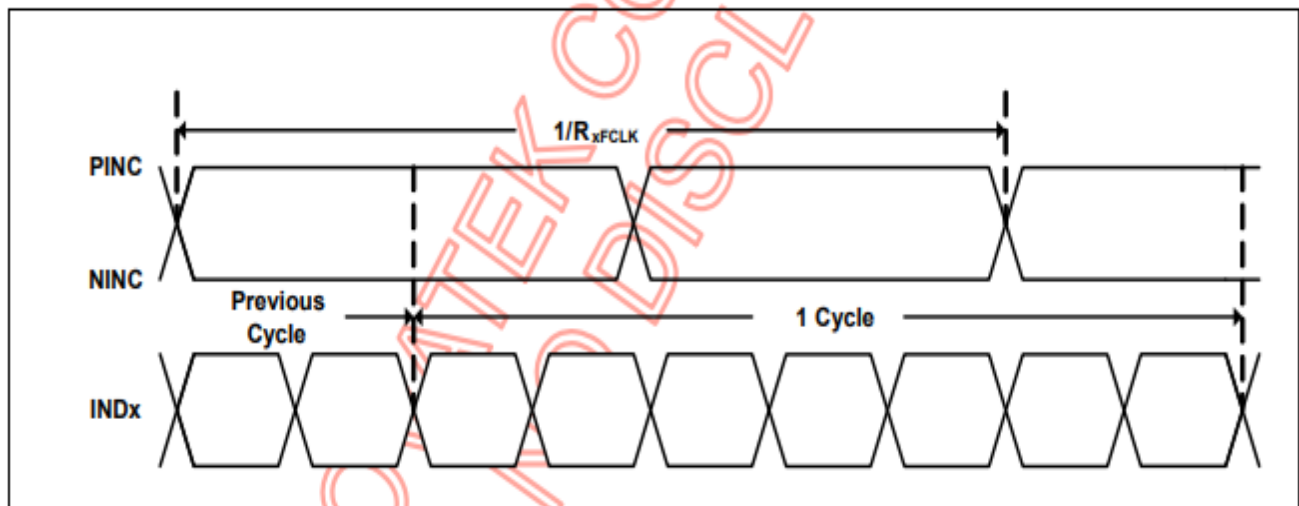
Output Control Signals						
Symbol	Parameter	Min.	Typ.	Max.	Unit	Condition
$V_{OH}$	High-level output voltage	1.9			V	VCCIO_25=2.5V @ $I_{OH} = -3mA(E4E2=01)$
$V_{OL}$	Low-level output voltage			0.4	V	VCCIO_25=2.5V @ $I_{OL} = 3mA(E4E2=00)$

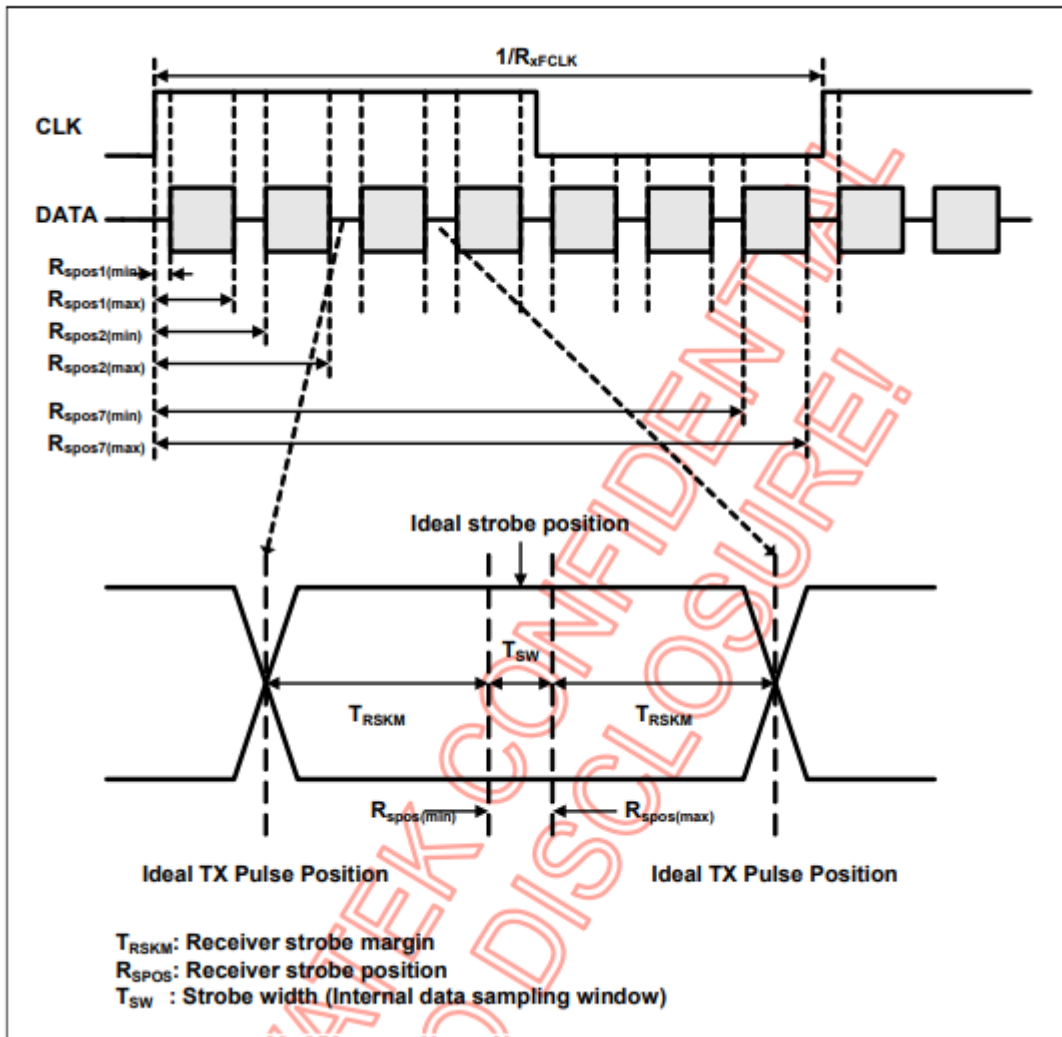


### 3.2 AC Electrical Characteristics

(VDD = 2.5V, TA = 25 degrees, unless otherwise noted)

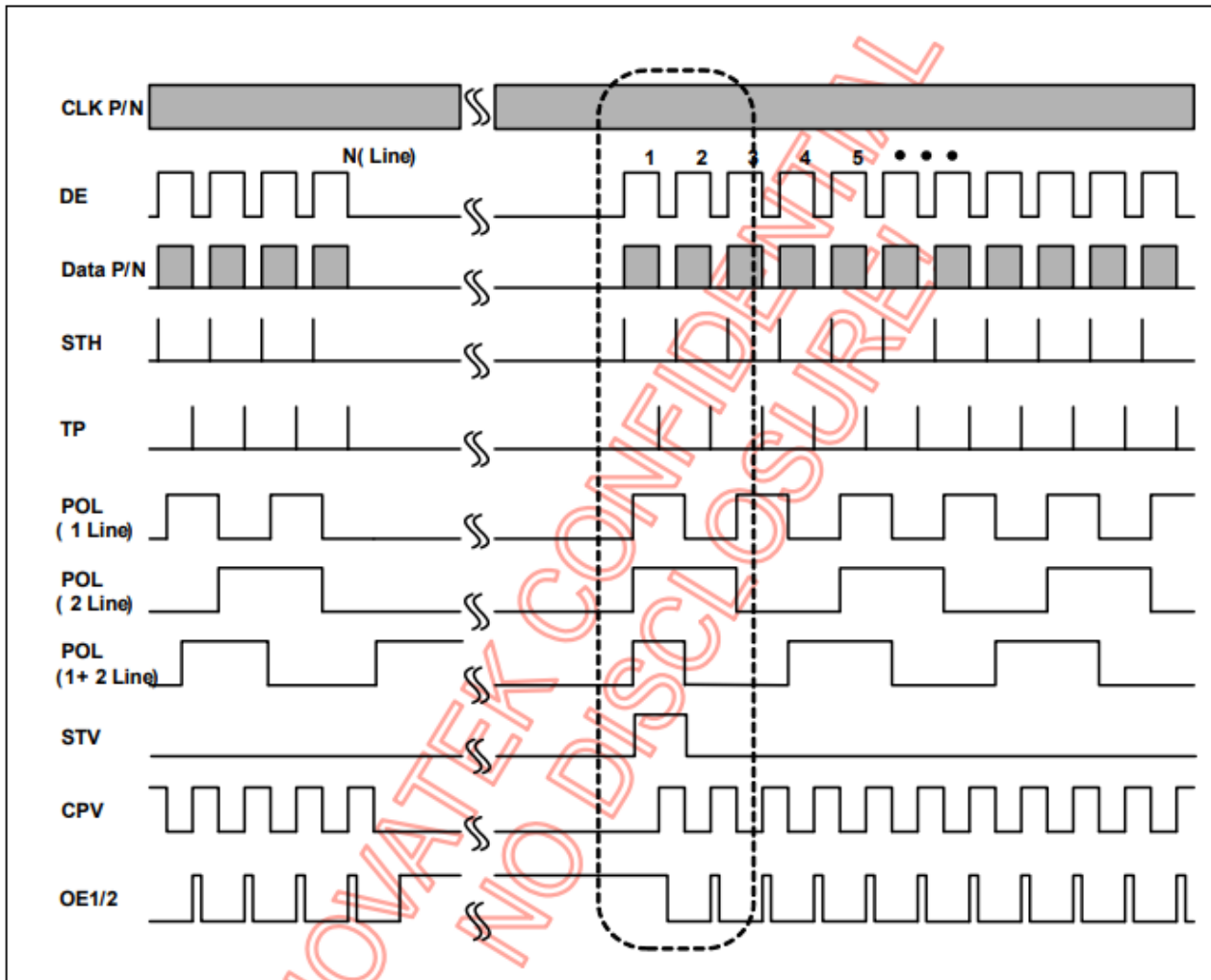
LVDS Receiver Differential Input						
Symbol	Parameter	Min.	Typ.	Max.	Unit	Condition
$R_{xFCLK}$	Clock frequency	20		120	MHz	
$T_{RSKM}$	Input data skew margin	-350		+350	ps	120Mhz for 2Port only LVDD_25=2.5V Rxclk=120M VID=400mV RXVCM=1.2V
		-380		+380	ps	LVDD_25=2.5V Rxclk=100M VID=400mV RXVCM=1.2V
$F_{MODU}$	Input LVDS Signal Modulation Frequency	30		300	KHz	
$R_{MODU}$	Input LVDS Signal Modulation Range			+/-3	%	





## 4. Timing

### 4.1 Data Input Format for LVDS



### 4.2 Input Timing Characteristics

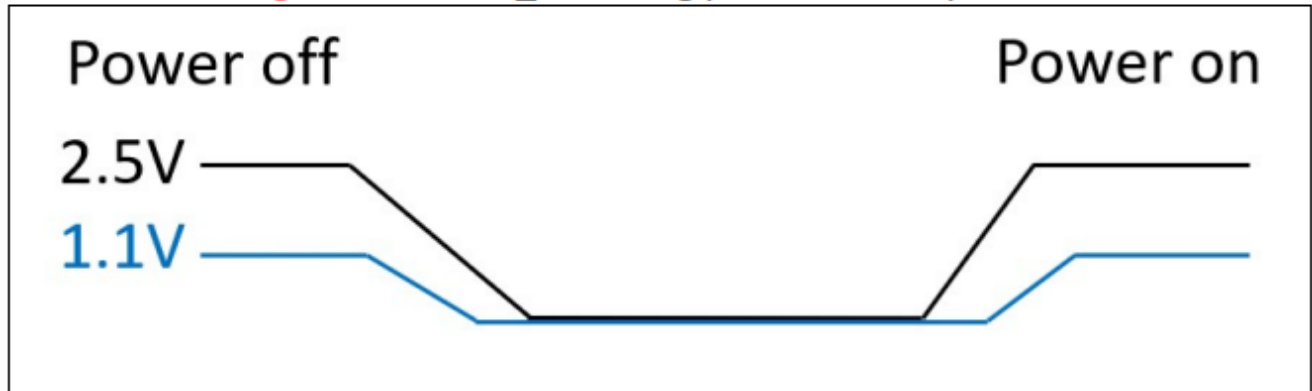
Parameter	Description	MIN.	TYP.	MAX.	Unit
MCLK	Input Pixel Clock	20		120	MHz
HTOTAL	Horizontal Total Pixels				
HACTIVE	Horizontal Active Pixels		960		Pixels
HBLANKING	Horizontal Blanking Pixels	50			
VTOTAL	Vertical Total Lines			8192	
VACTIVE	Vertical Active Lines		1080		Lines
VBLANKING,MLV	Vertical Blanking Lines	8			

### 4.3 Internal VCO OSC timing Specification

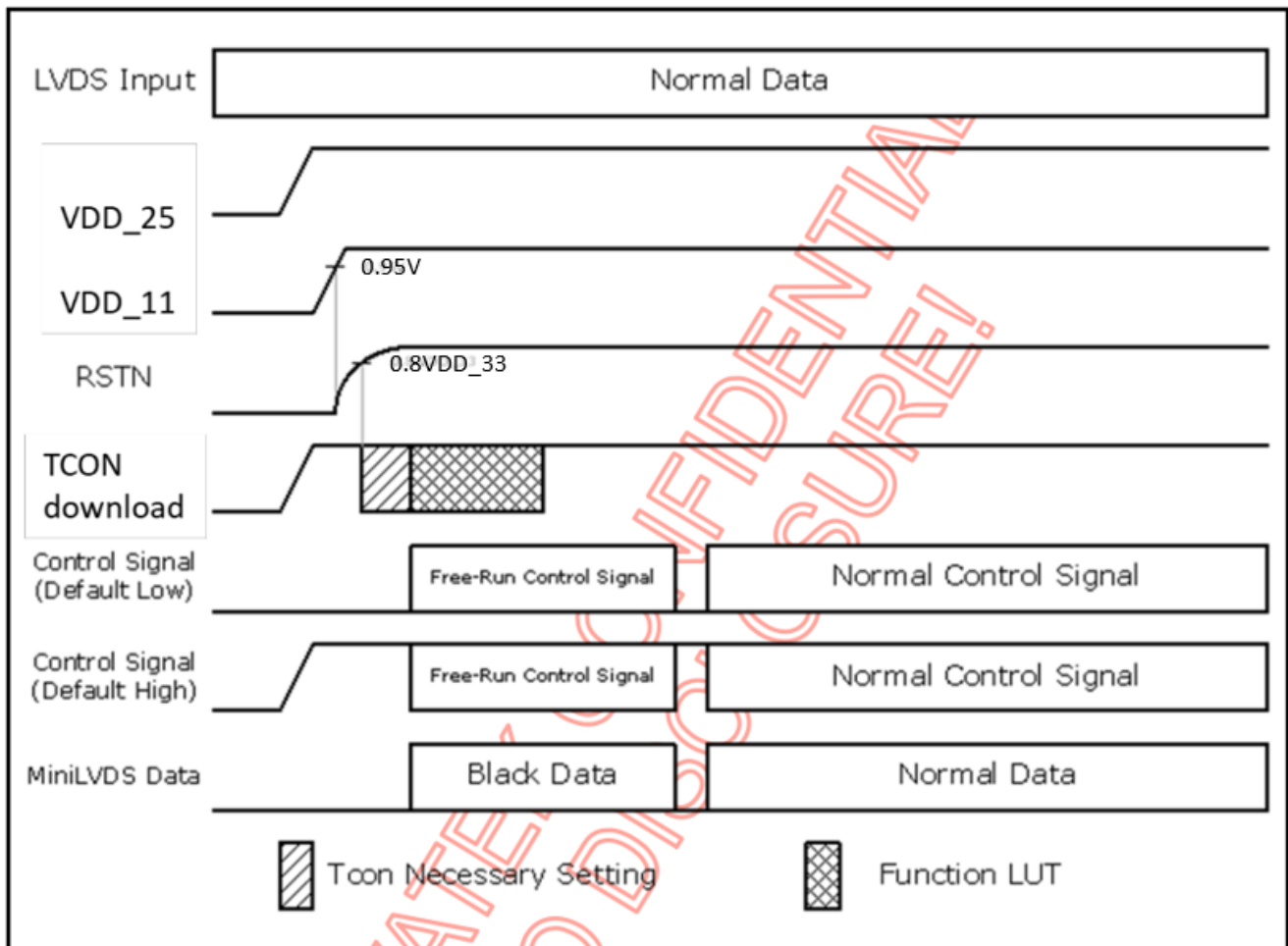
Internal Built-in Oscillator						
Symbol	Parameter	Min.	Typ.	Max.	Unit	Condition
fosc	Internal oscillator frequency	91.2	96	100.8	MHz	+/-5% 0~85 degrees With thermal compensation

### 4.4 Power on/off Timing

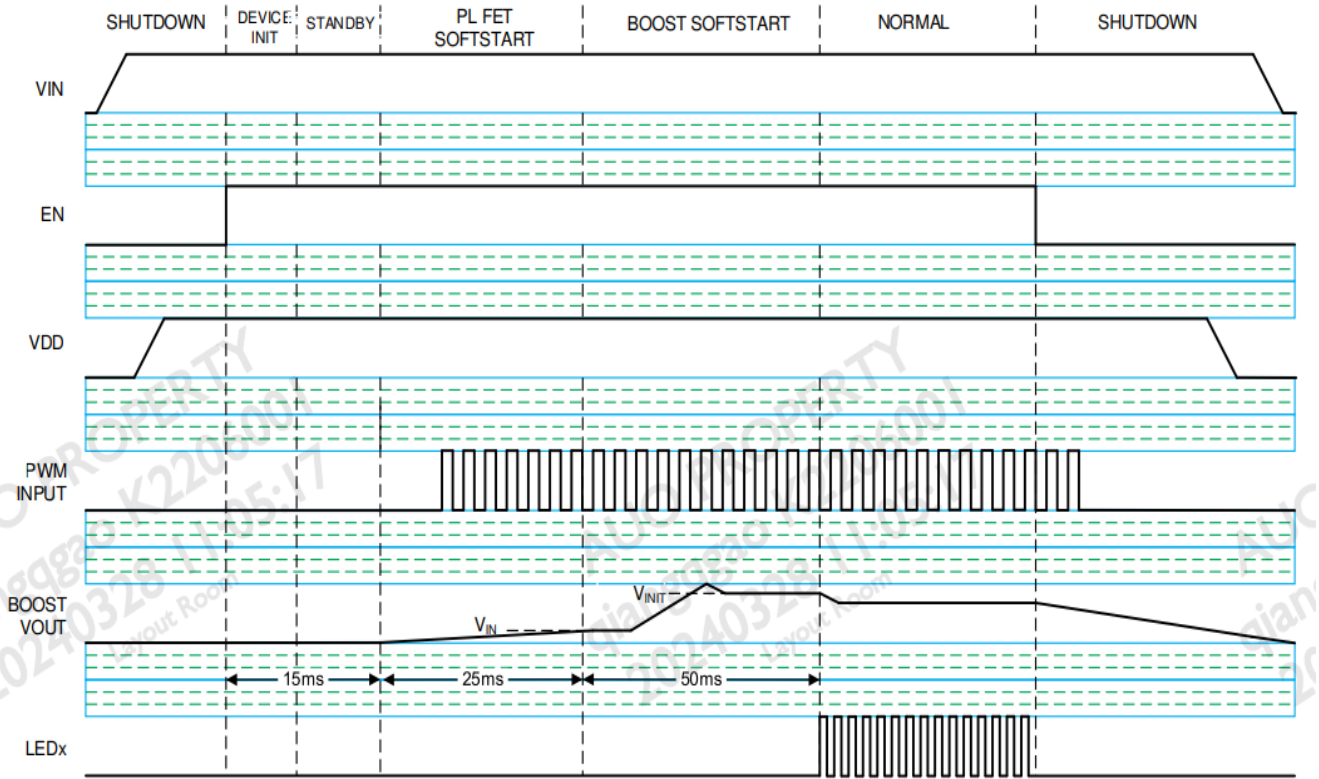
VDD25 must **higher** than VDD\_11 during power on and power off



### 4.5 Power on Sequence



### 4.6 LED Driver IC Power on Sequence



## G. Reliability Test Items

The panel performance shall meet the judgment criteria after the testing items have been performed. However, only a single item of these tests shall be executed on a single panel. No more one test item shall be executed on a single panel.

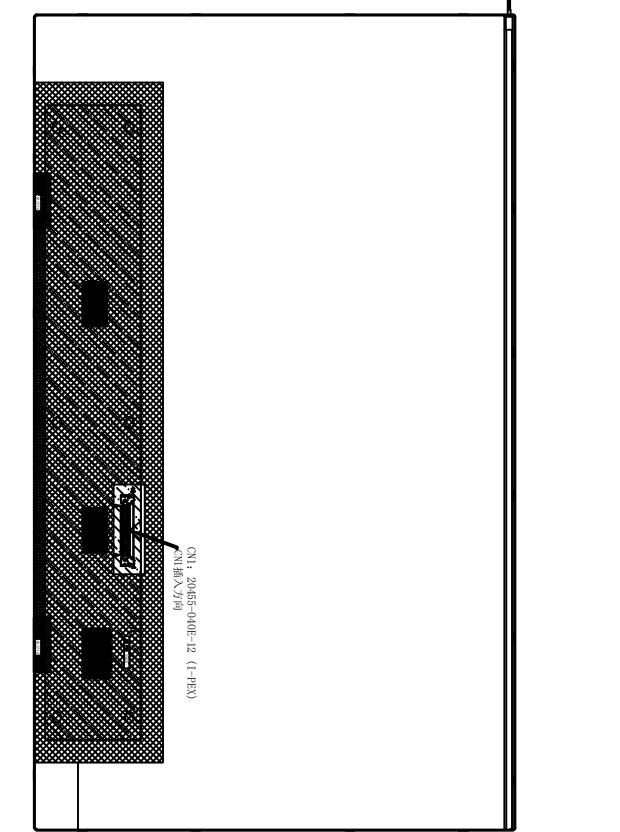
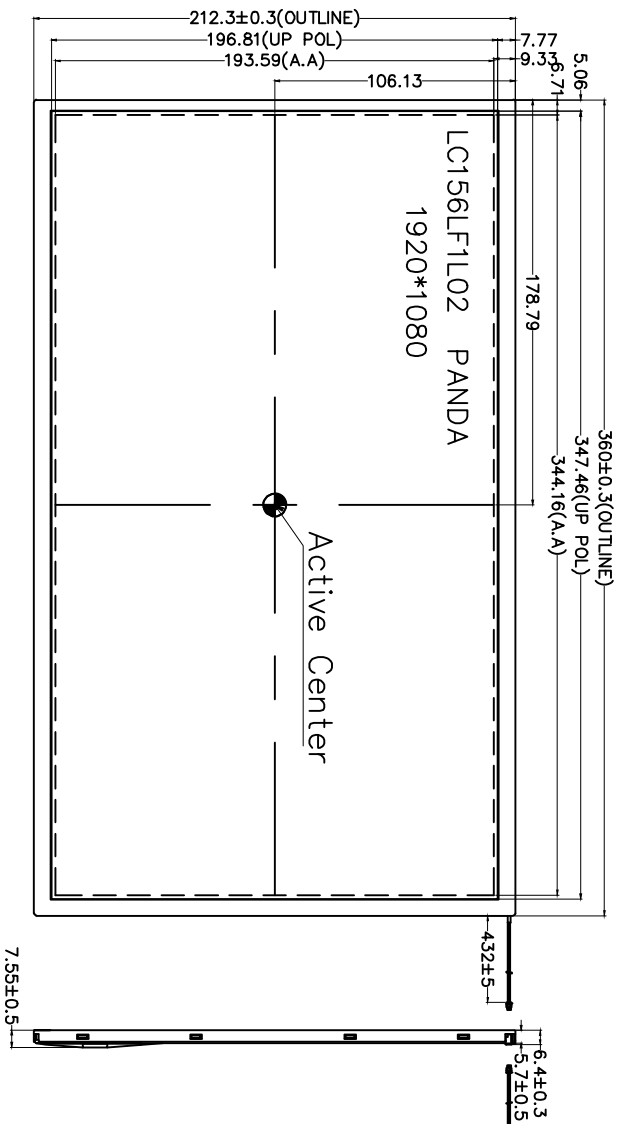
No.	Test items	Conditions		Remark
1	High temperature storage	Ta= 85°C	240H	
2	Low temperature storage	Ta= -30°C	240H	
3	High temperature operation	Ta= 80°C	240H	Operation
4	Low temperature operation	Ta= -30°C	240H	Operation
5	High temperature and high humidity	Ta= 60°C. 90% RH	240H	Operation
6	Thermal shock Test	-30°C 0.5hr ~ +80°C 0.5hr, 100 cycles		Non-operation

Ta: Ambient temperature.

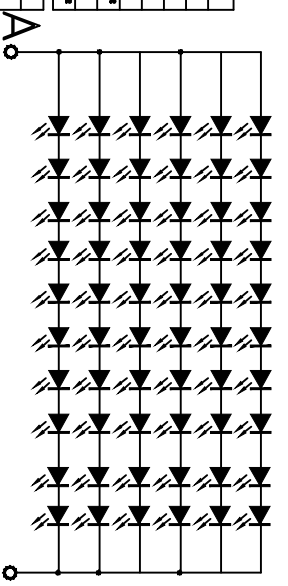
### Note

1. AUO RA tests will use Raydium IC RM97030 (Source IC). Other IC if needed to support the above RA Item, Please contact IC Vendors to provide special support in advance.
2. All the tests are performed by whole set of TFT-LCD module with completed driver IC, FPC, and backlight module.
3. Failure Judgment Criteria
  - a. After the tests, the panel should be left at room temperature and room humidity (15°C~35°C, 45%~65% RH) for 24 hours. Then the panel could be inspected for normal operation.
  - b. There should be no functions abnormalities on display quality. Don't need to judge Mura or Polarizer related problems.
4. The reliability test conditions of system do not exceed the verified conditions of TFT module.

**MECHANICAL OUTLINE, UNIT:mm**  
(Unspecified Tolerances is: ±0.3 mm)



电路原理图: 10串X6并=60 LED



**ELECTRICAL-OPTICAL CHARACTERISTICS**  
( $T_a=25^{\circ}\text{C}$ , The Ambient temperature  $T_a=25^{\circ}\text{C}$ )

Item	Symbol	Condition	min.	typ.	max.	Unit
Forward Current	$I_f$	$I_f=540\text{ mA}$		30		V
Reverse Current	$I_r$	$V_r=5\text{ V}$			10	$\mu\text{A}$
Power dissipation	$P_d$	$I_f=540\text{ mA}$			TBD	W
Colour Coordinates	$x, y$	$I_f=540\text{ mA}$			TBD	
Beam Diameter (Center Area)	$\Phi$	$I_f=540\text{ mA}$			75	mm
Beam Uniformity	$U_v$	$I_f=540\text{ mA}$			75	%
Beam Uniformity (reference)	$U_v$	$I_f=540\text{ mA}$			850	cd/m <sup>2</sup>
Operating Temperature Range	$T_{op}$	normal use	-30		+80	$^{\circ}\text{C}$
Storage Temperature Range	$T_{stg}$	normal use	-30		+85	$^{\circ}\text{C}$

REV	DESCRIPTION:	DATE
V0	新发行	2024.08.7

**深圳市宇华微科技有限公司**

PRODUCT NAME: G156HAED-LK01

CUST NUMBER: 型号

PROJECTION: 三 角

CHECK: 核对 APPROVE: 批准

SHEET: 1 of 1

APPROVALS: 签字

DESIGN: 设计

SCALE: 1:1

DATE: 日期

## 10. DEFINITION OF LABELS

### 10.1 YHW MODULE LABEL

The barcode nameplate is pasted on each module as illustration, and its definitions are as following explanation.

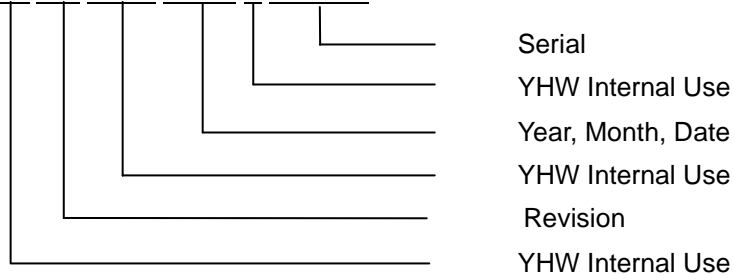


Note (1) Safety Compliance(UL logo) will open after C1 version.

(a) Model Name: G156HAE-LK01

(b) \* \* \* \* : Factory ID

(c) Serial ID: X X X X X X X Y M D X N N N N



Serial ID includes the information as below:

- (a) Manufactured Date: Year: 1~9, for 2021~2029  
 Month: 1~9, A~C, for Jan. ~ Dec.  
 Day: 1~9, A~Y, for 1<sup>st</sup> to 31<sup>st</sup>, exclude I , O and U
- (b) Revision Code: cover all the change
- (c) Serial No.: Manufacturing sequence of product

**H. Packing**

TBD