



深圳市拓普微科技开发有限公司

SHENZHEN TOPWAY TECHNOLOGY CO., LTD.

LMT056DIDFWD

LCD Module User Manual

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Rev.	Descriptions	Edit	Release Date
0.1	Preliminary	Pengzhen	2025-04-10

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1. General Specification

Screen Size(Diagonal) :	5.6"
Outline Dimension :	126.5 x 100.0 x 5.7 (mm)
	(see attached drawing for details)
Active Area :	112.896 x 84.672 (mm)
Color Depth:	65k
Number of dots :	640 x (RGB) x 480
Pixel Pitch :	0.0588 x 0.1764 (mm)
Pixel Configuration :	RGB Stripe
Backlight :	LED
Surface Treatment :	Anti-Glare Treatment
Viewing Direction :	6H (gray scale inverse)(*2)
	12H(*3)
Operating Temperature :	-20 ~ +70°C
Storage Temperature :	-30 ~ +80°C

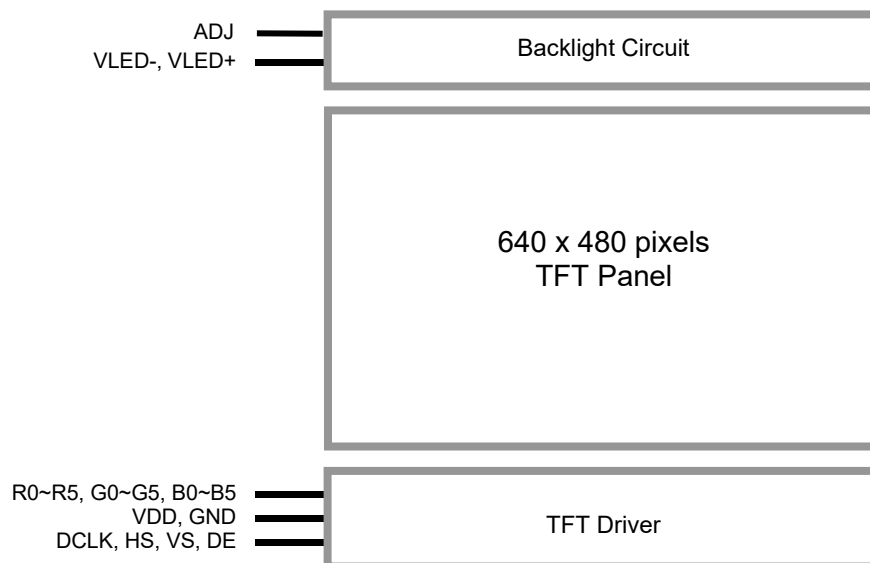
Note:

*1 Color tune may slightly changed by temperature and driving voltage.

*2. For saturated color display content (eg. pure-red, pure-green, pure-blue, or pure-colors-combinations)

*3. For "color scales" display content

2. Block Diagram



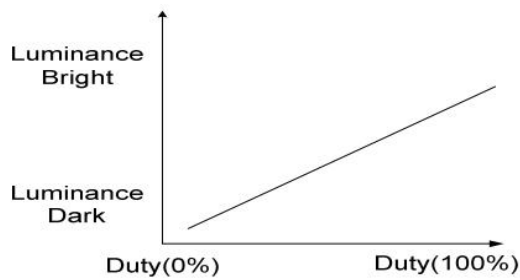
3. Terminal Functions

3.1 Interface

Pin No.	Pin Name	I/O	Descriptions	Remark
1	VLED+(5V)	P	Power Voltage for LED circuit	
2	VLED+(5V)			
3	ADJ	I	Adjust the LED brightness with PWM Pulse	Note 2,3
4	VLED-	P	Ground for LED circuit	
5	VLED-			
6	VDD(3.3V)	P	Power Voltage for digital circuit	
7	VDD(3.3V)			
8	MODE	I	DE or HV mode control	Note 4
9	DE	I	Data enable	
10	VS	I	Vsync signal input	
11	HS	I	Hsync signal input	
12	GND	P	Power ground	
13	B5	I	Blue data input (MSB)	
14	B4	I	Blue data input	
15	B3	I	Blue data input	
16	GND	P	Power ground	
17	B2	I	Blue data input	
18	B1	I	Blue data input	
19	B0	I	Blue data input (LSB)	
20	GND	P	Power ground	
21	G5	I	Green data input (MSB)	
22	G4	I	Green data input	
23	G3	I	Green data input	
24	GND	P	Power ground	
25	G2	I	Green data input	
26	G1	I	Green data input	
27	G0	I	Green data input (LSB)	
28	GND	P	Power ground	
29	R5	I	Red data input (MSB)	
30	R4	I	Red data input	
31	R3	I	Red data input	
32	GND	P	Power ground	
33	R2	I	Red data input	
34	R1	I	Red data input	
35	R0	I	Red data input (LSB)	
36	GND	P	Power ground	
37	DCLK	I	Sample clock	
38	GND	P	Power ground	
39	L/R	I	Select left or right scanning direction	Note 5,6
40	U/D	I	Select up or down scanning direction	Note 5,6

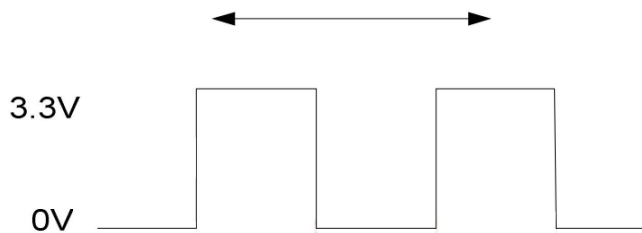
Note 1: I: input,O: output,P: Power

Note 2: Pin.3 is used to adjust brightness



Note 3: ADJ signal=0~3.3V,operation frequency: 100~300Hz

$F=100\sim300\text{Hz}$



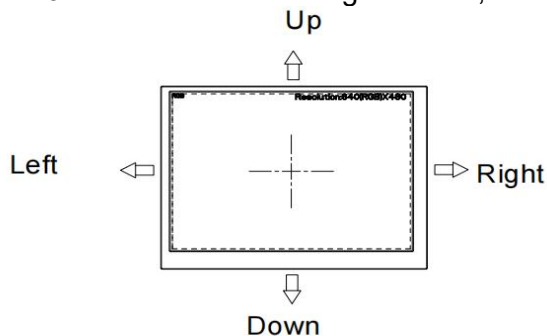
Note 4: DE Mode, Mode="H",HS floating and VS floating

HV Mode,Mode="L",and DE floating

Note 5: Selection of scanning mode

Setting of scan control input		Scanning direction
U/D	L/R	
GND	VDD	Up to down, left to right
VDD	GND	Down to up, right to left
GND	GND	Up to down, right to left
VDD	VDD	Down to up, left to right

Note 6: Definition of scanning direction,Refer to the figure as below:



4. Absolute Maximum Ratings

Items	Symbol	Min.	Max.	Unit	Condition
Power voltage	VDD	-0.3	+6.5	V	
	VLED	-0.3	+6.5	V	
Operating Temperature	T _{OP}	-20	+70	°C	No Condensation
Storage Temperature	T _{ST}	-30	+80	°C	No Condensation

Cautions:

Any Stresses exceeding the Absolute Maximum Ratings may cause substantial damage to the device. Functional operation of this device at other conditions beyond those listed in the specification is not implied and prolonged exposure to extreme conditions may affect device reliability.

5. Electrical Characteristics

5.1 DC Characteristics

VDD=5.0V, VSS=0V, T_{OP} =25°C

Items	Symbol	MIN.	TYP.	MAX.	Unit	Applicable Pin
Power Voltage	VDD	3.1	3.3	3.5	V	Note 1
	VLED	4.8	5.0	5.2	V	Note 2
Current Consumption	I _{DD}	-	200	250	mA	
	I _{LED}	-	380	450	mA	Note 3
Input logic high voltage	V _{IH}	0.7VDD	-	VDD	V	Note 4
Input logic low voltage	V _{IL}	0	-	0.3VDD	V	
LED life time	-	20,000	-	-	Hr	Note 5

Note 1: VCC setting should match the signals output voltage (refer to Note 4) of customer' s system board.

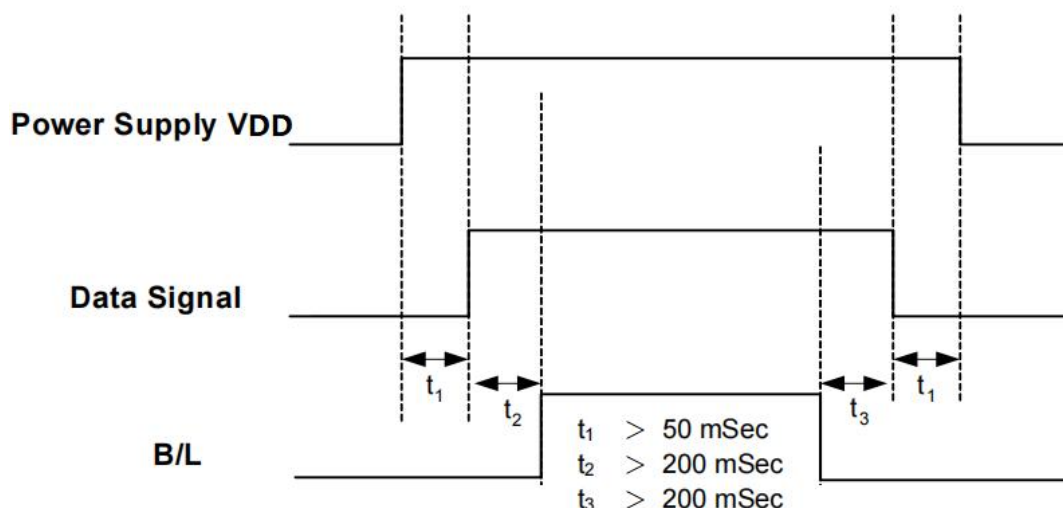
Note 2: LED driving voltage.

Note 3: LED driving current.

Note 4: DCLK,DE,HS,VS,R0~R5,G0~G5,B0~B5.

Note 5: The "LED life time" is defined as the module brightness decrease to 50% original brightness at Ta=25°C and VLED=5.0V. The LED lifetime could be decreased if operating VLED is larger than 5.0V.

5.2 Power Sequence



Note: Data includes DE, VS, HS, B0~B5, G0~G5, R0~R5, DCLK.

6. AC Characteristics

6.1 Timing Conditions

Input/Output Timing

Item	Symbol	Values			Unit	Remark
		Min.	Typ.	Max.		
PXLCLK clock time	Tclk	33.3	39.7	-	ns	
PXLCLK pulse duty	Tcwh	40	50	60	%	Tclk
DATA set-up time	Tdsu	12	-	-	ns	DATA to PXLCLK
DATA hold time	Tdhd	12	-	-	ns	DATA to PXLCLK
DE setup time	Tesu	12	-	-	ns	DE to PXLCLK
VSYNC setup time	Tvst	12	-	-	ns	
VSYNC hold time	Tvhd	12	-	-	ns	
HSYNC setup time	Thst	12	-	-	ns	
HSYNC hold time	Thhd	12	-	-	ns	
HSYNC period time	Th	22.91	31.76	-	ns	
HSYNC width	Thwh	1	-	-	Tclk	
VSYNC width	Tvwh	1	-	-	Th	
HSYNC to CLKIN	Thc	-	-	1	Tclk	

DE Mode input Timing Limitation

DE Mode	Values			Unit	Remark
	Min.	Typ.	Max.		
THC	48	160	765	tclk	
THD	640	640	640	tclk	
TH	688	800	1405	tclk	1TH=1line
TVC	6	45	255	line	
TVD	480	480	480	line	
TV	486	525	735	line	1TV=1field

HV Mode input Timing Limitation

HV Mode	Values			Unit	Remark
	Min.	Typ.	Max.		
Thwh	-	10	-	tclk	
Thbp	-	134	-	tclk	
Thfp	-	16	-	tclk	
THD	-	640	-	tclk	
TH	-	800	-	tclk	1TH=1line
Tvwh	-	2	-	line	
Tvbp	-	11	-	line	
Tvfp	-	32	-	line	
TVD	-	480	-	line	
TV	-	525	-	line	1TV=1field

6.2 Timing Diagram

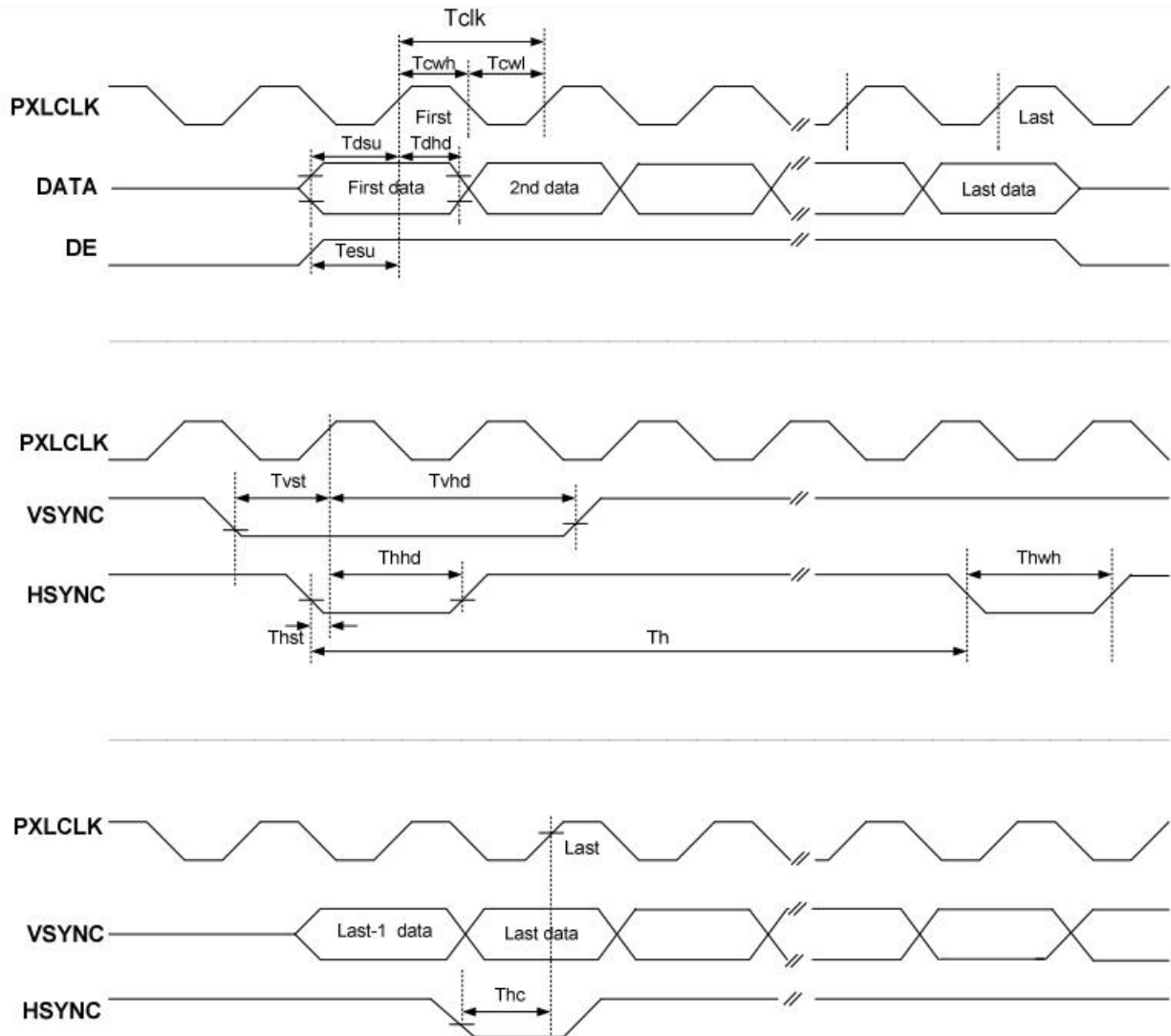


Fig.6.2-1 Clock and Data Input Timing Diagram

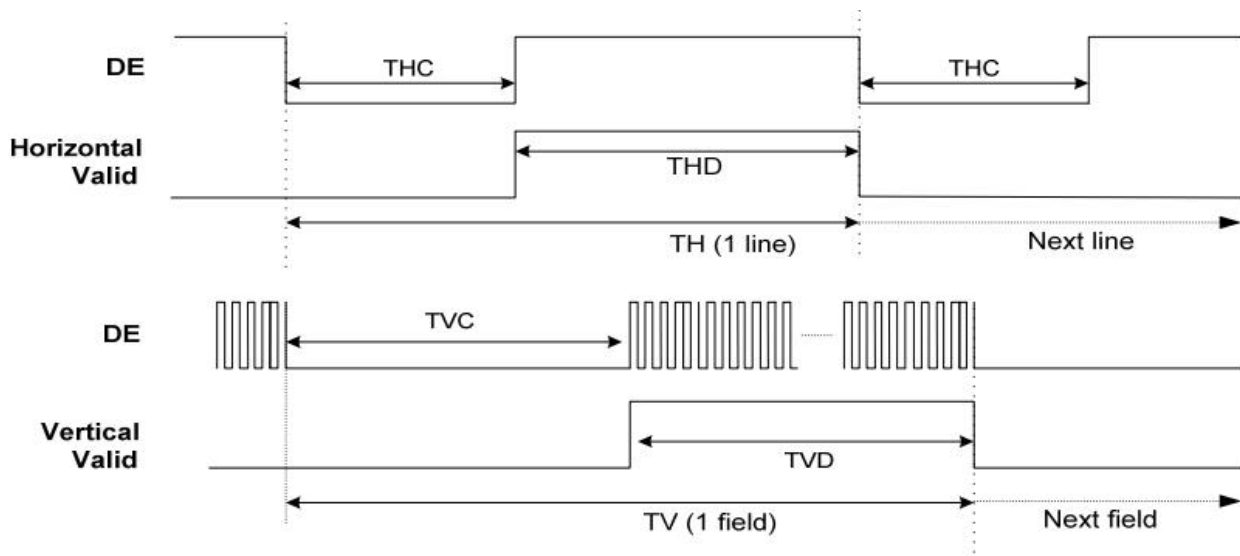


Fig.6.2-2 DE Mode Input Timing

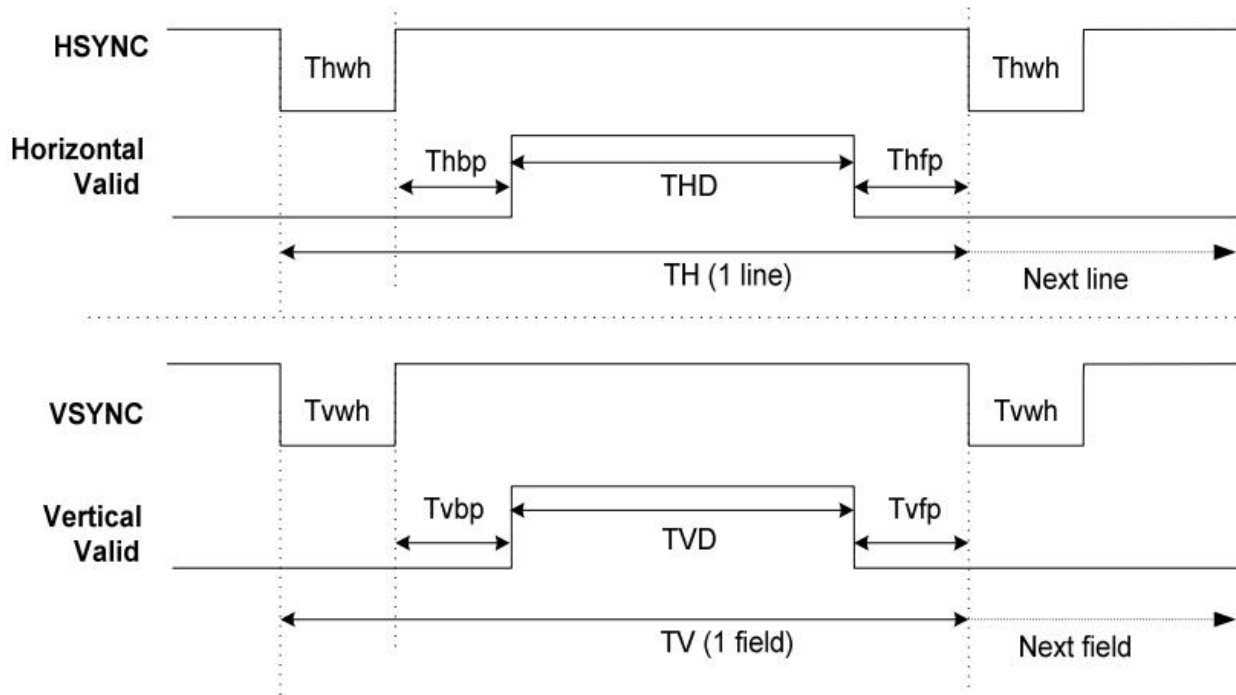


Fig.6.2-3 HV Mode Input Timing

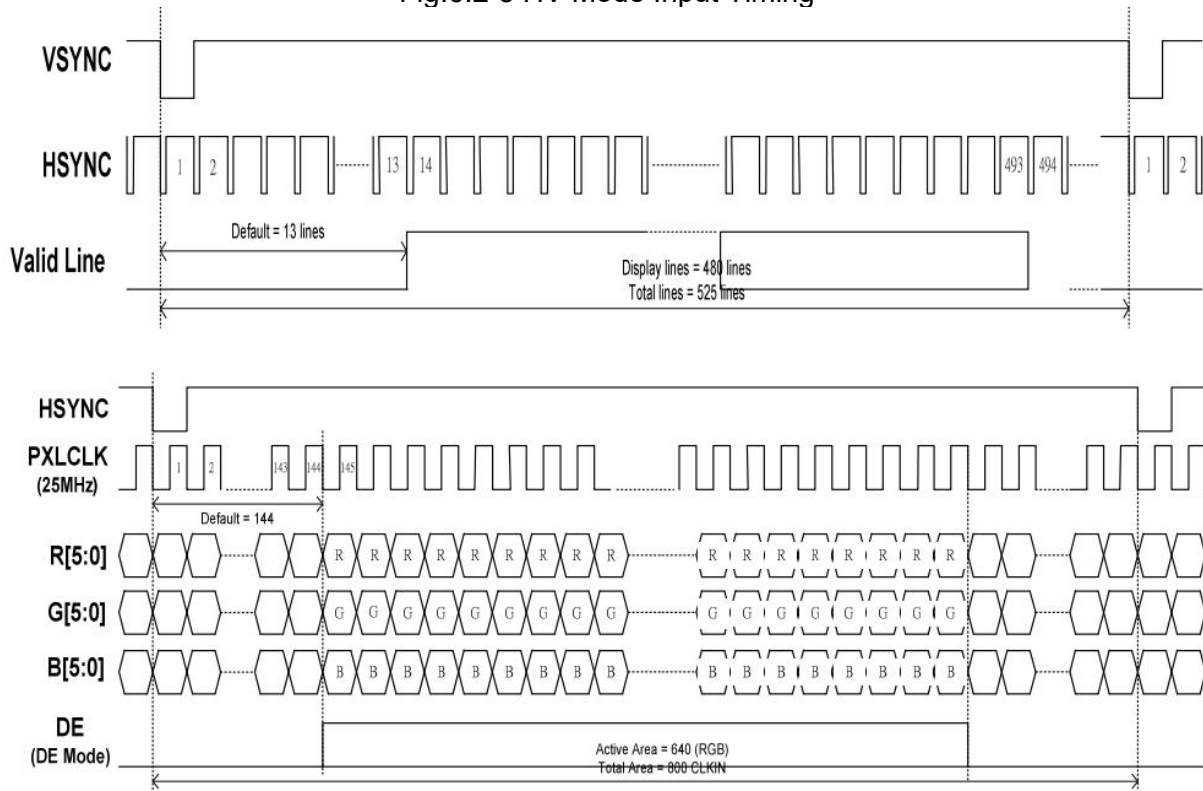


Fig.6.2-4 18 bit RGB mode for 640 x (RGB) x 480

7. Optical Characteristics

Item	Symbol	Condition	MIN.	TYP.	MAX.	UNIT	Note.
Viewing angle ($CR \geq 10$)	θ_L	9 o'clock	60	70	-	degree	*2
	θ_R	3 o'clock	60	70	-		
	θ_T	12 o'clock	40	50	-		
	θ_B	6 o'clock	60	70	-		
Response Time	T_f	Normal $\theta = 0^\circ$	-	10	20	msec	*3
	T_r		-	15	30	msec	
Contrast ratio	CR		400	500	-	-	*1
Color chromaticity	W_x		0.26	0.31	0.36	-	
	W_y		0.28	0.33	0.38	-	
Luminance	L		300	350	-	cd/m ²	*4
Luminance uniformity	Y_U		70	75	-	%	*4

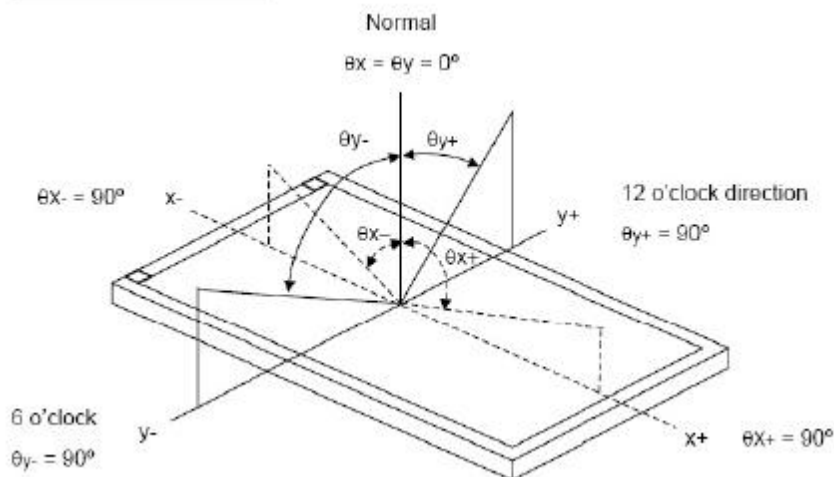
Note:

*1. Definition of Contrast Ratio

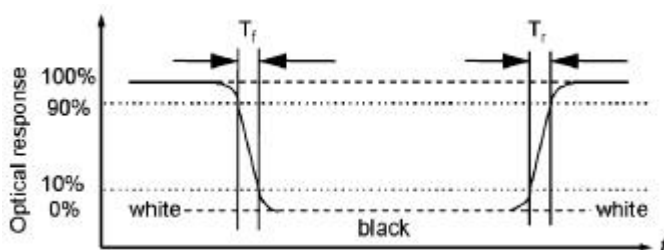
The contrast ratio could be calculate by the following expression:

Contrast Ratio (CR) = Luminanc with all pixels white / Luminance with all pixels black

*2 Definition of Viewing Angle



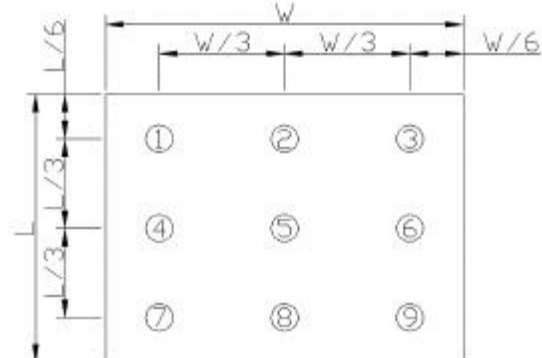
*3 Definition of response time



*4 Definition of Luminance Uniformity

Luminance uniformity (Lu)=

Min. Luminance form pt1~pt9 / Max Luminance form Pt1~pt9



8. LCD Module Design and Handling Precautions

- Please ensure V0, VCOM is adjustable, to enable LCD module get the best contrast ratio under different temperatures, view angles and positions.
- Normally display quality should be judged under the best contrast ratio within viewable area. Unexpected display pattern may come out under abnormal contrast ratio.
- Never operate the LCD module exceed the absolute maximum ratings.
- Never apply signal to the LCD module without power supply.(No Hot-plugging)
- Keep signal line as short as possible to reduce external noise interference.
- IC chip (e.g. TAB or COG) is sensitive to light. Strong light might cause malfunction. Light sealing structure casing is recommended.
- Make sure there is enough space (with cushion) between case and LCD panel, to prevent external force passed on to the panel; otherwise that may cause damage to the LCD and degrade its display result.
- Avoid showing a display pattern on screen for a long time (continuous ON segment).
- LCD module reliability may be reduced by temperature shock.
- When storing and operating LCD module, avoids exposure to direct sunlight, high humidity, high or low temperature. They may damage or degrade the LCD module.
- Never leave LCD module in extreme condition (max./min storage/operate temperature) for more than 48hr.
- Recommend LCD module storage conditions is 0 C~40 C <80%RH.
- LCD module should be stored in the room without acid, alkali and harmful gas.
- Avoid dropping & violent shocking during transportation, and no excessive pressure press, moisture and sunlight.
- LCD module can be easily damaged by static electricity. Please maintain an optimum anti-static working environment to protect the LCD module. (eg. ground the soldering irons properly)
- Be sure to ground the body when handling LCD module.
- Only hold LCD module by its sides. Never hold LCD module by applying force on the heat seal or TAB.
- When soldering, control the temperature and duration avoid damaging the backlight guide or diffuser which might degrade the display result such as uneven display.
- Never let LCD module contact with corrosive liquids, which might cause damage to the backlight guide or the electric circuit of LCD module.
- Only clean LCD with a soft dry cloth, Isopropyl Alcohol or Ethyl Alcohol. Other solvents (e.g. water) may damage the LCD.
- Never add force to components of LCD module. It may cause invisible damage or degrade the module's reliability.
- When mounting LCD module, please make sure it is free from twisting, warping and bending.
- Do not add excessive force on surface of LCD, which may cause the display color change abnormally.

8. 液晶显示模块设计和使用须知

- 请注意 V0, VCOM 的设定, 以确保液晶显示模块在不同的使用温度下以及在不同的视角和位置观察模块显示, 均能达到最佳对比度, 请务必将应用电路上设置为对比度可调。
- 请注意液晶显示模块的显示品质判定是指在正常对比度下以及视窗 (V. A) 范围内进行的, 非正常对比度下液晶可能会出现非预期的显示不良, 应注意区分。
- 请勿在最大额定值以外使用液晶显示模块。
- 请勿在没有接通电源的条件下, 给液晶显示模块输送信号。(禁止热插拔)
- 请尽可能缩短信号线的连接, 以避免对液晶显示模块的信号干扰。
- 集成电路 IC 芯片 (如 TAB 或 COG) 对紫外线极为敏感, 强光环境下可能会引起液晶显示模块功能失效, 故应采用不透光的外壳。
- 请在液晶显示模块与外壳之间保留足够的空间 (可使用衬垫), 以缓冲外力对液晶显示模块的损坏或因受力不均而产生的显示不均等异常现象。
- 避免液晶显示屏在某一画面下长时间点亮, 否则有出现残影的风险; 请通过软件每隔一段时间改变一次画面。
- 液晶显示模块的可靠性可能因温度冲击而降低。
- 请勿在阳光直射、高湿、高温或低温下储存和使用液晶显示模块, 这将造成液晶显示模块的损坏或失效。
- 请勿在极限环境 (最大/最小存储/工作温度) 下使用或放置液晶显示模块超过 48 小时以上。
- 液晶显示模块建议存储条件为: 0 C~40 C <80%RH。
- 请勿让液晶显示模块存储于带有 酸性, 碱性, 有害气体环境之中。
- 在运输过程中, 请勿让液晶显示模块跌落与猛烈震动, 同时避免 异常挤压, 高湿度, 与阳光照射。
- 液晶显示模块极易受静电损坏, 请务必保证液晶显示模块在防静电的工作环境中使用或保存。(如: 烙铁正确接地, 等)
- 拿取液晶显示模块时需注意操作人员的接地情况。
- 请手持液晶显示模块的边沿取放模块, 防止热压纸或 TAB 部位受力。
- 焊接液晶模块时, 请注意控制烙铁的温度、焊接时间, 以免烫坏导光板或偏光片, 导致显示不均等不良现象发生。
- 请勿使用洗板水等腐蚀性液体接触液晶模块, 以免腐蚀导光板或模块电路。
- 仅可使用柔软的干布, 异丙醇或乙醇清洁液晶屏表面, 其他任何溶剂 (如: 水) 都有可能损坏液晶模块。
- 请勿挤压液晶显示模块上的元器件, 以避免产生潜在的损坏或失效而影响产品可靠性。
- 装配液晶显示模块时, 请务必注意避免液晶显示模块的扭曲或变形。
- 请勿挤压液晶显示屏表面, 这将导致显示颜色的异常。

- LCD panel is made with glass. Any mechanical shock (e.g. dropping from high place) will damage the LCD module.
 - Protective film is attached on LCD screen. Be careful when peeling off this protective film, since static electricity may be generated.
 - Polarizer on LCD gets scratched easily. If possible, do not remove LCD protective film until the last step of installation.
 - When peeling off protective film from LCD, static charge may cause abnormal display pattern. The symptom is normal, and it will turn back to normal in a short while.
 - LCD panel has sharp edges, please handle with care.
 - Never attempt to disassemble or rework LCD module.
 - If display panel is damaged and liquid crystal substance leaks out, be sure not to get any in your mouth, if the substance comes into contact with your skin or clothes promptly wash it off using soap and water.
- 液晶屏由玻璃制作而成，任何机械碰撞(如从高处跌落)均有可能损坏液晶显示模块。
 - 液晶屏表面带有保护膜，揭除保护膜时需要注意可能产生的静电。
 - 因液晶显示屏表面的偏光片极易划伤，安装完成之前请尽量不要揭下保护膜。
 - 请缓慢揭除保护膜，在此过程中液晶显示屏上可能会产生静电，此为正常情况，可在短时间内消失。
 - 请注意避免被液晶显示屏的边缘割伤。
 - 请不要试图拆卸或改造液晶显示模块。
 - 当液晶显示屏出现破裂，内部液晶液体可能流出；相关液体不可吞吃，绝对不可接触嘴巴，如接触到皮肤或衣服，请使用肥皂与清水彻底清洗。

9. TFT QA Standard

9.1 INSPECTION CONDITION 检验条件

Unless otherwise stated, all the inspections are carryout under the following condition
除非有特别的规定，检验条件按以下执行。

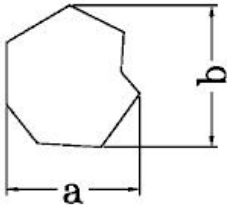
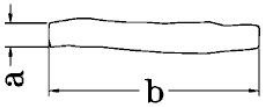
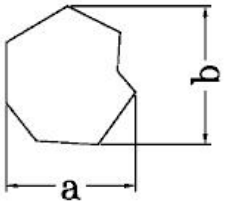
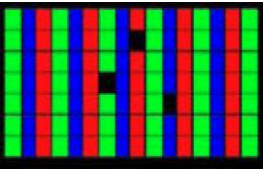
The following standards only apply to the visible area. As long as function good non-visual area appearance can be ignored. Available deerskin with petroleum ether, a clean stains do not apply to the exterior standard. If debris in a certain direction is perpendicular to the direction of three times the length of that line debris; the insulation as granular debris; the silver carbon glue as a rejection of defects.

以下标准只适用于可视区。只要功能良好非可视区的外观可忽略。可用鹿皮沾石油醚，擦干净的污渍不适用于该外观标准。如果杂物某方向的长度是垂直方向的 3 倍则认为是线状杂物；多出的绝缘点看作粒状杂物；多出的银碳胶视为拒收缺陷。

No.	Items 项目	Conditions 条件
1	Lighting 照明	Illumination: Appearance 300-700Lux 环境亮度在 300~700LUX
2	Inspection Distance 检验距离	30-40cm form the test sample, within normal viewing angle 眼睛距显示器表面 30~40cm
3	Temperature 环境温度	Room Temperature (25 °C), no condensation 室温 (25 度±5%)，无凝水
4	Viewing Angle 视角	U/D: 45°/45°, L/R: 45°/45° 前后 45 度角范围内，左右 45 度角范围内
5	Inspection Time 检验时间	15 seconds 15 秒内
6	Defect Allowance 缺陷总数	5 max 允许 5 个

9.2 Display Pattern 显示缺陷

No.	Items /Contents 检查项目	Type 类别		Standard 标准	Judgment 判定
		MA	MI		
1	No Display 无显示	√		--	Not Allowed 不允许
2	Line defect 缺少行或列	√		--	Not Allowed 不允许
3	Display abnormally 错误的显示	√		--	Not Allowed 不允许
4	Function Defective 缺少功能	√		--	Not Allowed 不允许

5	Glass Crack 玻璃破碎		√	--	Not Allowed 不允许
6	Spot Defect Including: Black spot, White spot Foreign particle, Polarizer dirt, Cell particle 黑点/白点		√	$(a+b)/2 \leq 0.25$	Allowed 允许
				$0.25 < (a+b)/2 \leq 0.5$	3 max. 允许 3 个
				$(a+b)/2 > 0.5$	Not Allowed 不允许
7	Line Defect Including: Black line, White line, Scratch 线		√	$a \leq 0.05$	Allowed 允许
				$0.05 < a \leq 0.08$ and $b \leq 3$	3 max. 允许 3 个
				$a > 0.08$ or $b > 3$	Not Allowed 不允许
8	Polarizer Dent/Bubble 偏光片气泡		√	$(a+b)/2 \leq 0.25$	Allowed 允许
				$0.25 < (a+b)/2 \leq 0.5$	3 max. 允许 3 个
				$(a+b)/2 > 0.5$	Not Allowed 不允许
9	Bright dot defect 亮点 (在全黑屏下多像素点)		√	Random	2 max. 允许 2 个
				3 consecutive dots 3 个或以上连续的点	Not Allowed 不允许
10	Dark dot defect 暗点 (在全红或全绿或全蓝屏下缺像素点)		√	Random	3 max. 允许 3 个
				4 consecutive dots 4 个或以上连续的点	Not Allowed 不允许
13	Bright dot defect + Dark dot defect 亮点 + 暗点		√	--	4 max. 允许 4 个
14	FPC or FFC FPC/FFC	√		Broken 损坏	Not Allowed 不允许
		√		naked wire、hole 裸线、孔洞	Not Allowed 不允许
		√		FPC kink、indentation Top wound、scratch FPC 折痕、顶伤	Lgnore 忽略
15	PCBA defect PCBA 缺陷	--	--	Refer to IPC-A-610 按照 IPC-A-610	--
16	Bezel scratches,pits,bumps,Don't try dirt 外框划痕,凹点,凸点,脏物		√	Do not affect display,assembly,ignore 不影响显示, 组装则忽略	

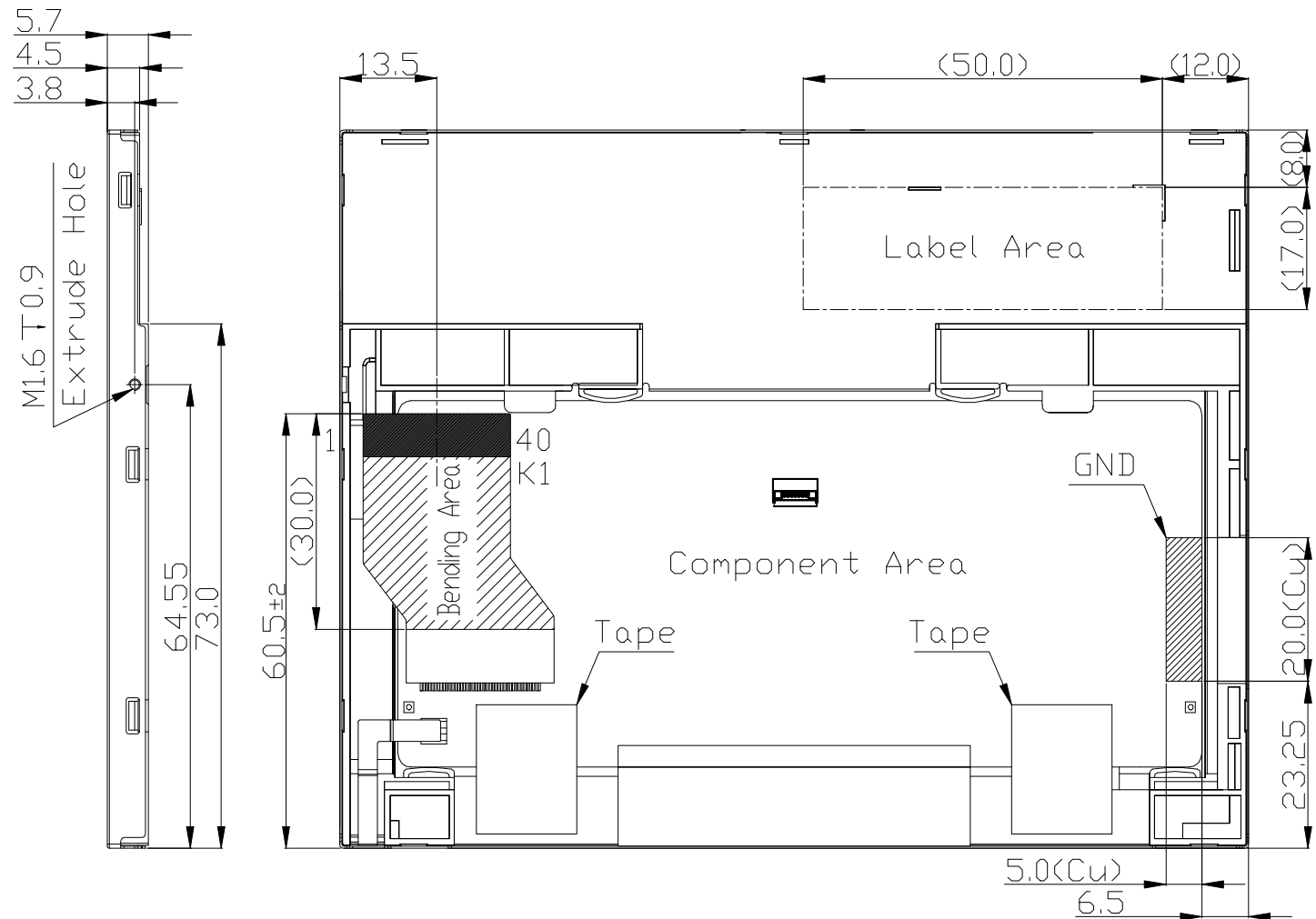
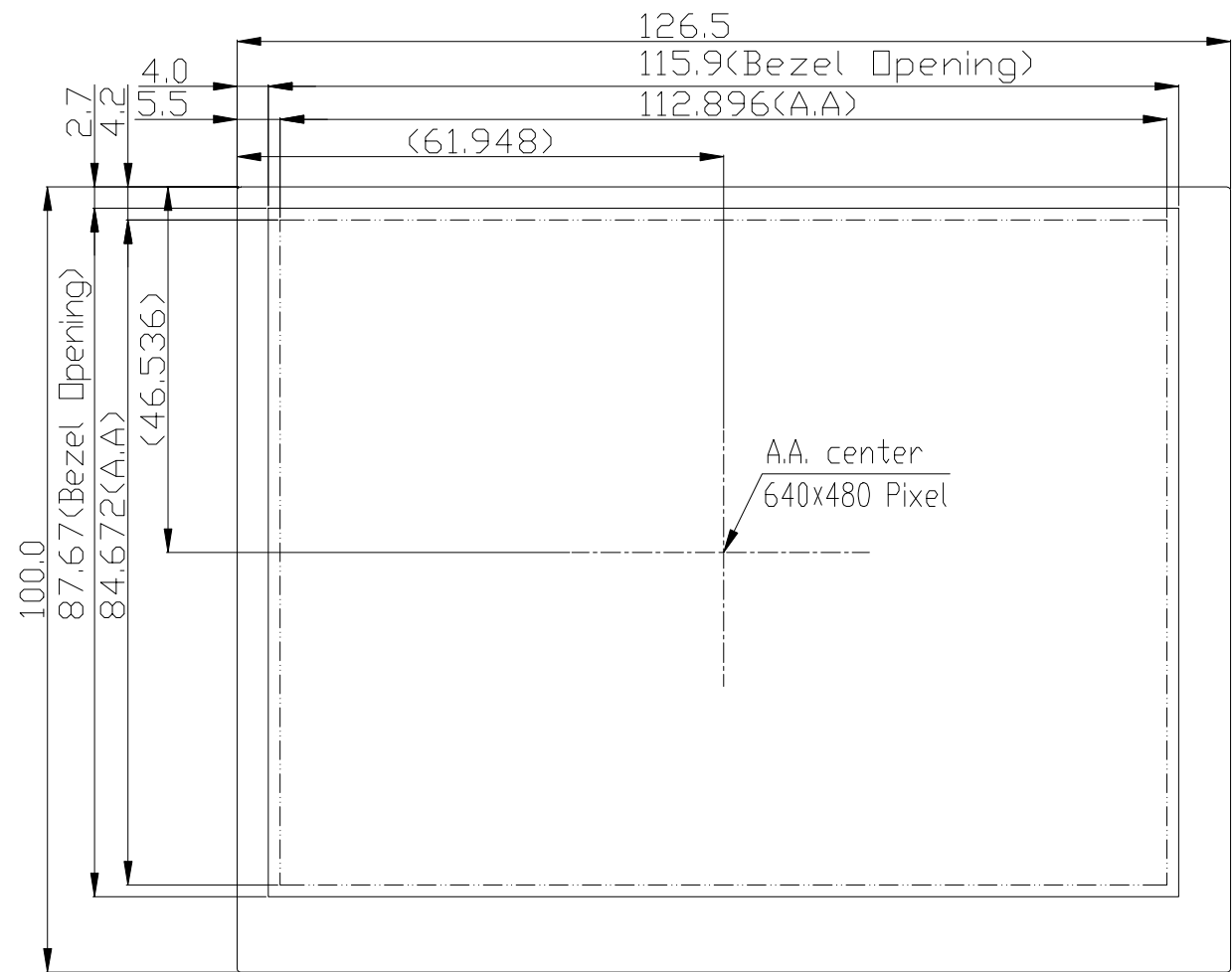
9.3 Quality Level and Sampling 抽样方法

Items 项目	Standard 标准
Sampling Standard 引用标准	MIL-STD-105E
Sampling Level 抽样等级	II
AQL level 合格判定水平	MA: AQL=0.65 MI: AQL=1.0

Warranty

This product has been manufactured to our company's specifications as a part for use in your company's general electronic products. It is guaranteed to perform according to delivery specifications. For any other use apart from general electronic equipment, we cannot take responsibility if the product is used in medical devices, nuclear power control equipment, aerospace equipment, fire and security systems, or any other applications in which there is a direct risk to human life and where extremely high levels of reliability are required. If the product is to be used in any of the above applications, we will need to enter into a separate product liability agreement.

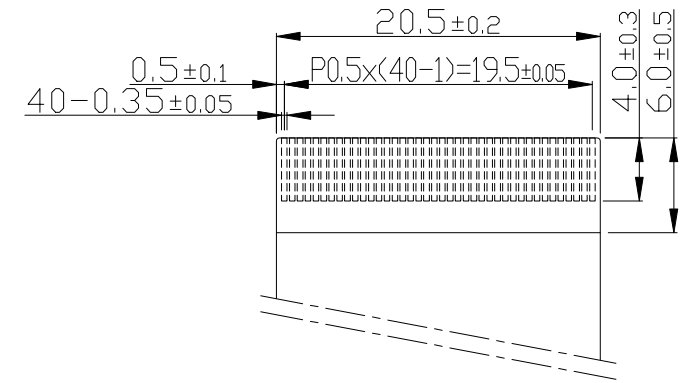
- We cannot accept responsibility for any defect, which may arise from additional manufacturing of the product (including disassembly and reassembly), after product delivery.
- We cannot accept responsibility for any defect, which may arise after the application of strong external force to the product.
- We cannot accept responsibility for any defect, which may arise due to the application of static electricity after the product has passed our company's acceptance inspection procedures.
- When the product is in CCFL models, CCFL service life and brightness will vary according to the performance of the inverter used, leaks, etc. We cannot accept responsibility for product performance, reliability, or defect, which may arise.
- We cannot accept responsibility for intellectual property of a third part, which may arise through the application of our product to our assembly with exception to those issues relating directly to the structure or method of manufacturing of our product.



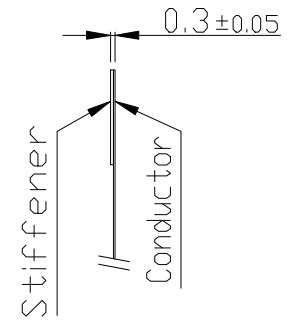
K1 Terminal		
No.	Pin	Name
1	VLED+	(5V)
2	VLED+	(5V)
3	ADJ	
4	VLED-	
5	VLED-	
6	VDD	(3.3V)
7	VDD	(3.3V)
8	MODE	
9	DE	
10	VS	
11	HS	
12	GND	
13	B5	
14	B4	
15	B3	
16	GND	
17	B2	
18	B1	
19	B0	
20	GND	
21	G5	
22	G4	
23	G3	
24	GND	
25	G2	
26	G1	
27	G0	
28	GND	
29	R5	
30	R4	
31	R3	
32	GND	
33	R2	
34	R1	
35	R0	
36	GND	
37	DCLK	
38	GND	
39	L/R	
40	U/D	

Note:

- *1. LCD Display Type : TFT,Transmissive
- *2. Pixel Arrangment : RGB-STRIPE
- *3. Color Depth : 65K Colors
- *4. Operating Voltage : 3.3V
- *5. Backlight : White LED
- *6. Backlight Supply : 5V
- *7. Interface : RGB 18bits
- *8. Matched connection :
K1 : P0.5x40pin FFC Socket
- *9. Operating Temperature : -20°C~70°C
- *10. Storage Temperature : -30°C~80°C
- *11. Unmarked Tolerance : ≤150,±0.3; >150,±0.5



K1 Details
Scale=2/1



C		
B		
A		
Rev	Note	Date
Dwg	Title	
	LMT056DIDFWD Outline Dwg	
Dwg No.	MK-008852-1-1	Date
		2025-04-10
Scale	Tol.	Unit
1/1		mm
Approved	Checked	Paper Size
		A3
		Drawn
		BiChangLiu
TOPWAY		