深圳市拓普微科技开发有限公司
SHENZHEN TOPWAY TECHNOLOGY CO., LTD.

LMT101ENMFWD-NAC

LCD Module User Manual

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Date: 2025-04-09	Date: 2025-04-14	Date:

Rev.	Descriptions	Edit	Release Date
0.1	Preliminary release	Yu	2019-08-20
0.2	Update General Specification	MaQiYang	2022-06-20
0.3	Update Instructions	Liyongzheng	2025-04-09

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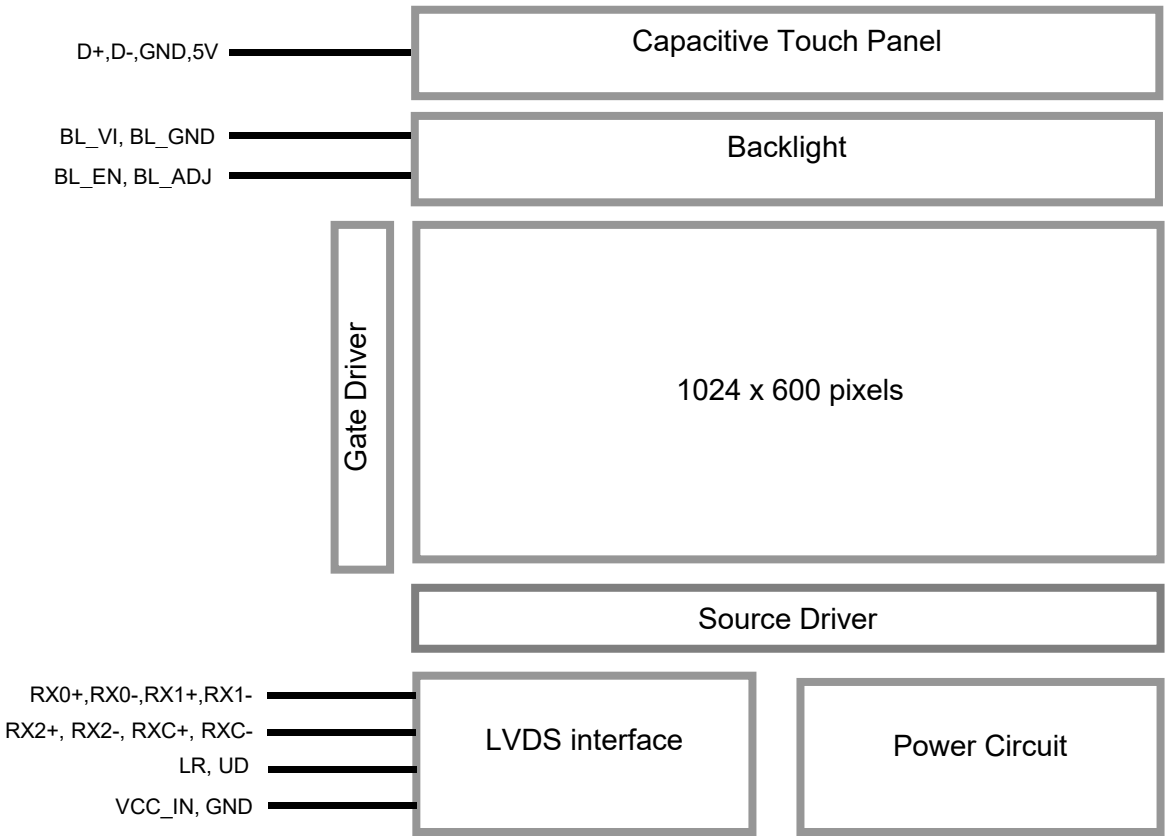
1. General Specification

Screen Size(Diagonal) :	10.1”
Active Area :	222.72 x 125.28 (mm)
Number of dots :	1024 (RGB) x 600
Pixel Pitch：	0.2175 x 0.2088 (mm)
Color Depth:	262k colors
Display Technology :	a-Si TFT active matrix
Display Mode :	Normal White, Transmissive
Display Interface :	LVDS 18bit
Viewing Direction :	6 o’clock(Gray scale Inversion) (*1) 12 o’clock (*2)
Touch Panel :	Capacitive
Surface Treatment :	Anti-Glare(Cover glass)
Touch Interface:	USB
Operating Temperature :	-20 ~ +70°C
Storage Temperature :	-30 ~ +80°C

Note:
*1. For saturated color display content (eg. pure-red, pure-green, pure-blue or pure-colors-combinations).
*2. For “color scales” display content.

2. Block Diagram



3. Terminal Function

3.1 K1 LVDS Terminal (STARCONN 076B20-0048RA-G4 or Equivalent)

Pin No.	Pin Name	IO	Descriptions
1	NC	-	No connection
2	NC	-	No connection
3	NC	-	No connection
4	NC	-	No connection
5	GND	Power	Ground
6	RXC+	Input	LVDS receiver negative signal clock
7	RXC-	Input	LVDS receiver positive signal clock
8	GND	Power	Ground
9	RX2+	Input	LVDS receiver negative signal channel 2
10	RX2-	Input	LVDS receiver positive signal channel 2
11	GND	Power	Ground
12	RX1+	Input	LVDS receiver negative signal channel 1
13	RX1-	Input	LVDS receiver positive signal channel 1
14	GND	Power	Ground
15	RX0+	Input	LVDS receiver negative signal channel 0
16	RX0-	Input	LVDS receiver positive signal channel 0
17	LR	Input	Display X-Flip Setting (*1)
18	UD	Input	Display Y-Flip Setting (*1)
19	VCC_IN	Power	Positive Power Supply
20	VCC_IN		

Note:

*1: Selection of scanning mode

Setting of scan control input		Scanning direction
UD	LR	
Low	High	Up to down, left to right(normal)
High	Low	Down to up, right to left
Low	Low	Up to down, right to left
High	High	Down to up, left to right

3.2 K2 Backlight Connector (LM123S004HTF13 or Equivalent)

Pin No.	Pin Name	IO	Descriptions
1	BL_VI	Power	Positive Power Supply
2	BL_ADJ	Input	Backlight dimming control(High actives) PWM may be used to adjust the output brightness
3	BL_EN	Input	Backlight Driver Control BLON=Hi, Backlight Driving Booster enable BLON=Lo, Backlight Driving Booster disable
4	BL_GND	Power	Power Supply GND (0V)

3.3 K3 Capacitive Touch Panel Terminal (Micro USB)

Pin No	Pin Name	I/O	Descriptions
1	5V	Power	USB Power Supply(5V)
2	D-	I/O	USB D- signal
3	D+	I/O	USB D+ signal
4	GND	Power	Ground(0V)
5	GND	Power	Ground(0V)

4. Absolute Maximum Ratings

Items	Symbol	Min.	Max.	Unit	Condition
Power Supply voltage	VCC_IN	2.8	+3.6	V	
Backlight Supply voltage	BL_Vi	-0.3	+15.0	V	
Operating Temperature	T_{OP}	-20	70	℃	No Condensation
Storage Temperature	T_{ST}	-30	80	℃	No Condensation
Operating and Storage Humidity	HSTG	10%	90%	%(RH)	

Note:
*1. This rating applies to all parts of the module. And should not be exceeded.
*2. The operating temperature only guarantees operation of the circuit. The contrast, response speed, and the other specification related to electro-optical display quality is determined at the room temperature, T_{OP}=25℃
*3. Ambient temperature when the backlight is lit (reference value)
*4. 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 Driving TFT LCD Panel

Top=25℃, GND=0V

Items		Symbol	MIN.	TYP.	MAX.	Unit	Note
Supply Voltage		VCC_IN	3.0	3.3	3.6	V	
Input Signal Voltage	Low Level	V_{IL}	GND	--	0.3VCC	V	LR,UD
	High Level	V_{IH}	0.7VCC	--	VCC	V	LR,UD
VCC Power Consumption		I_{VCC-IN}	-	200	300	mA	*1

Note.
*1. Normal display condition

5.2 LED Backlight Circuit Characteristics

BL_GND=0V, T_{OP}=25℃

Parameter	Symbol	MIN.	TYP.	MAX.	Unit	Note
Operating Voltage	BL_VI	11.5	12.0	12.5	V	
Input High Voltage	V_{IH}	3.0	-	BL_VI	V	BL_EN, BL_ADJ
Input Low Voltage	V_{IL}	BL_GND	-	0.3	V	BL_EN, BL_ADJ
Operating Current(*1)	I_{BL_VI}	-	200	300	mA	BL_VI

Cautions:
Exceeding the recommended driving current could cause substantial damage to the backlight and shorten its lifetime.
Note:
*1: BL_EN=Hi, BL_ADJ=Hi;
*2: Recommended BL_ADJ PWM Freq. is 3kHz
*3: Terminal circuit（Fig.1） :

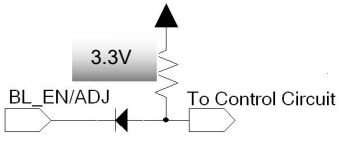
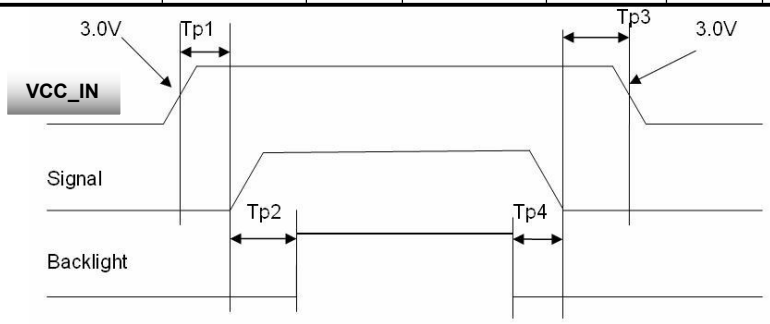


Fig.1 Terminal circuit

5.3 Power On/Off Sequence

Items	Symbol	MIN.	TYP.	Max.	Unit	Note
VCC_IN 3.0V to signal starting	Tp1	0	-	50	ms	
Signal starting to backlight on	Tp2	150	-	-	ms	
Signal off to VCC_IN 3.0V	Tp3	0	-	50	ms	
Backlight off to signal off	Tp4	150	-	-	ms	



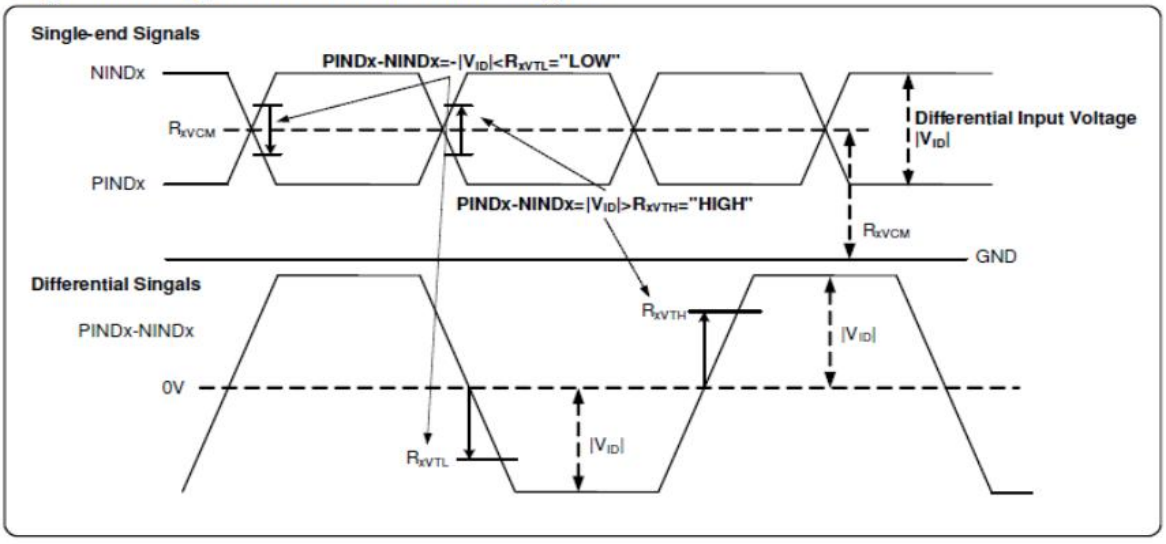
Interface Power On/Off Sequence

6. LVDS Signal timing characteristic

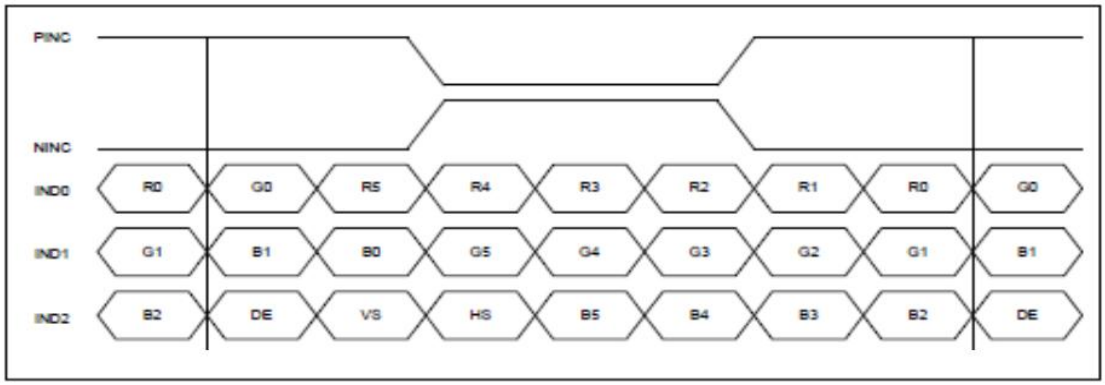
6.1 Electrical characteristics

Item	Symbol	MIN.	TYP.	MAX.	Unit	Condition
Differential input high Threshold voltage	R_{XVTH}	-	-	+0.1	V	R_{XVCOM}=1.2V
Differential input low Threshold voltage	R_{XVTL}	-0.1	-	-	V	
Input voltage range (Singled-end)	R_{XVIN}	0	-	VDD-1.2+ $\|V_{ID}\|/2$	V	
Differential input Common Mode voltage	R_{XVCOM}	$\|V_{ID}\|/2$	-	VDD-1.2	V	
Differential input voltage	$\|V_{ID}\|$	0.2	-	0.6	V	
Differential input leakage Current	R_{VXLIZ}	-10	-	+10	uA	
LVDS digital operating Current	Iddlvds	-	15	30	mA	Fclk=65MHz VDD=3.3v
LVDS digital stand-by Current	Istlvds	-	10	50	uA	Clock & all functions are stopped

Single-end signals & Differential singals



6.2 LVDS input timing



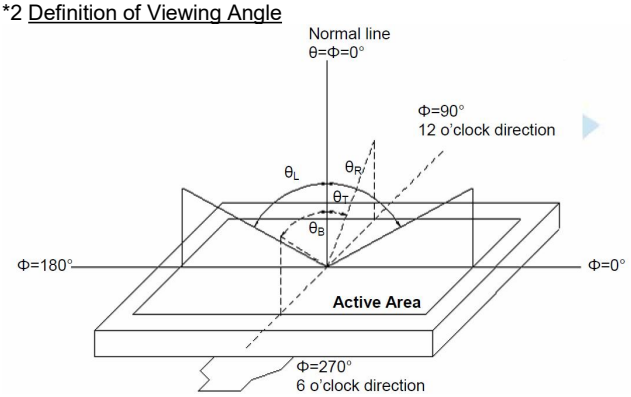
DE mode：

Item	Symbol	MIN.	TYP.	MAX.	Unit	Remark
DCLK Frequency	fclk	40.8	51.2	67.2	MHz	
Horizontal display area	thd		1024		DCLK	
HSD period	th	1114	1344	1400	DCLK	
HSD blanking	thb+thfp	90	320	376	DCLK	
Vertical display area	tvd		600		TH	
VSD period	Tv	610	635	800	TH	
VSD blanking	tvbp+tvfp	10	35	200	TH	

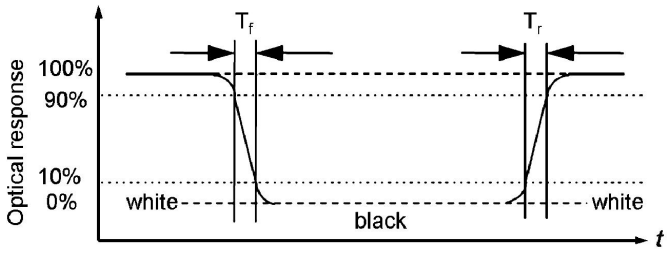
7. Optical Characteristics

Item	Symbol	Condition	MIN.	TYP.	MAX.	UNIT	Note.
Viewing angle (CR≥10)	θ_L	9 o'clock	-	75	-	degree	*2
	θ_R	3 o'clock	-	75	-		
	θ_T	12 o'clock	-	60	-		
	θ_B	6 o'clock	-	60	-		
Response Time	T_{ON}	Normal θ=0°	-	7	10	msec	*3
	T_{OFF}		-	9	18	msec	
Contrast ratio	CR		400	500	-	-	*1
Color chromaticlty	W_X		0.263	0.313	0.363	-	
	W_Y		0.279	0.329	0.379	-	
Luminance	L		-	300	-	cd/m²	*4
Luminance uniformity	Y_U		70	80	-	%	*4

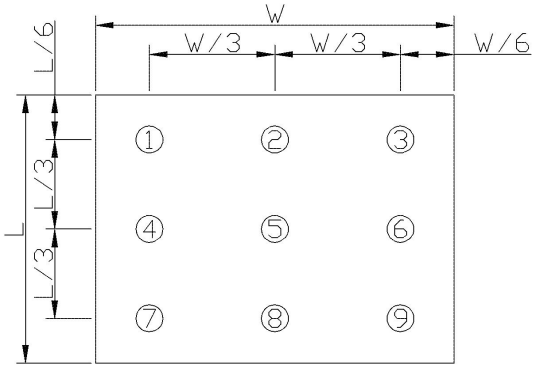
Note:
*1. Definition of Contrast Ratio
The contrast ratio could be calculate by the following expression:
Contrast Ratio (CR) = Luminanc with all pixels white / Luminance with all pixels black
*2 Definition of Viewing Angle



*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）
- WARNING! Be aware of (if any) frame grounding of the LCD Module connection with the system which may cause safety issue(e.g. electric shock,etc).
- 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.

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）
- 警告！使用前需评估液晶显示模块的金属框架/壳体地(如有)与整机关系和安全性(如：漏电安全性，等)。
- 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。
- 集成电路因 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匀等异常现象。
- 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，导致显示不匀等不良现象发生。
- 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。

- Do not add excessive force on surface of LCD, which may cause the display color change abnormally.
- 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.

- 请勿挤压液晶显示屏表面，这将导致显示颜色的异常。
- 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线，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. CTP Mounting Instructions

9.1 Surface Mounting (Figure 1)

- As the CTP assembling on the countersink area with double side adhesive.The countersink area should be flat and clean to ensure the double side adhesive installation result.
- The Bezel is recommend to keep a gap (≥ 0.3mm each side) around the cover lens for tolerance.
- It is recommended to provide an additional support bracket with gasket for backside support when necessary (e.g. TFT module without mounding structure). They should only provide appropriate support and keep the module in place.
- The mounting structure should be strong enough to prevent external uneven force or twist act onto the module

9. 电容触摸屏安装指导

9.1 嵌入安装（附图 1）

- 客户面框应具有使用双面胶粘贴 CTP 的结构沉台面，其粘贴面要求平整且洁净无污以保证粘贴牢靠.
- 考虑到制作误差，建议面框与 CTP 盖板之间四周留有≥0.3mm 间隙.
- 建议必要时在背面提供垫有胶垫附加支架(例如无安装结构的 TFT 模块)，应仅利用适当支撑以保持模块位置.
- 安装结构应具有足够的强度，以防止外部不均匀力或扭曲力作用到模块上。

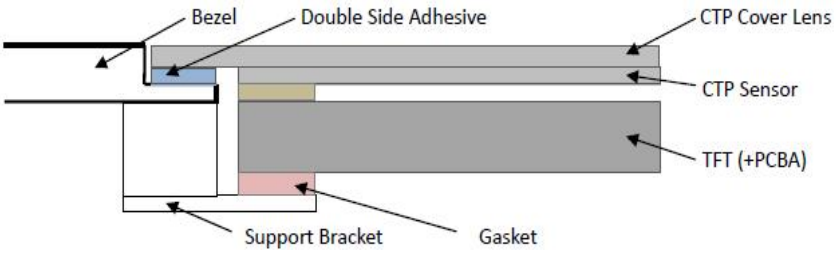


Figure 1

9.2 Pressure sensitive adhesive tape operation

- For maximum bond strength, the surfaces should be flat and thoroughly cleaned.
- 50:50 mixture of isopropyl alcohol and water is suggested.
- Let dry before taping.
- Ideal tape application is accomplished when temperature is between 21° C and 38°C.Initial tape application to surfaces at temperatures below 10°C is not recommended.
- Alignment jig should be applied for objects alignment
- Pressing jig surface should be fine enough to prevent uneven pressure onto the display module.
- General initial tape application pressure is 15PSI (0.1N/mm²) for 5~10sec(operating pressure can be calculated with the tape surface area)
- The bond is allowed to dwell 72 hr (100% bond typical build). (note: 20min about 50%; 1hr about 70%; 24hr about 90%)
- Consult manufacturer’s directions for use and precautions when using cleaning solvents.

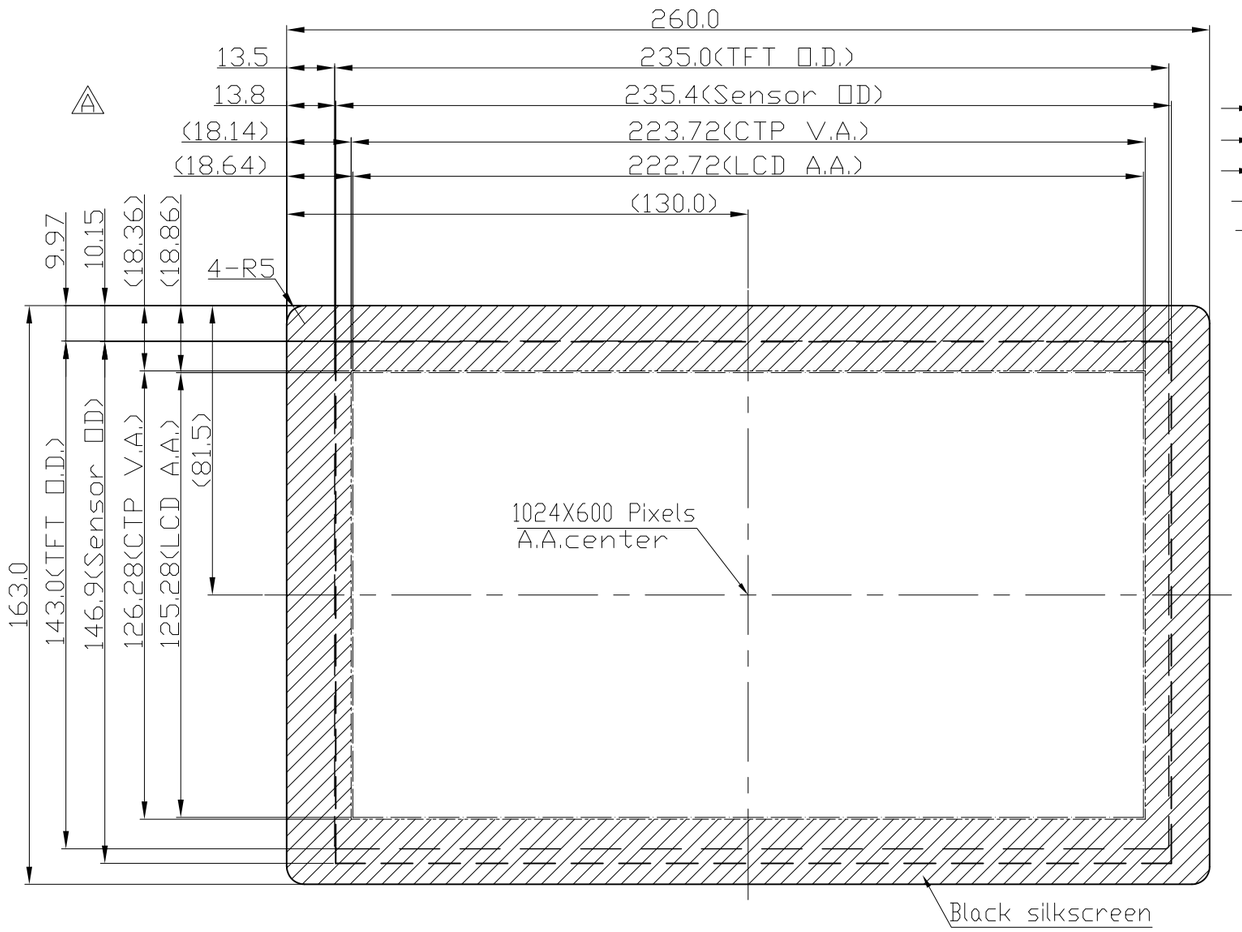
9.2 压敏胶带贴合

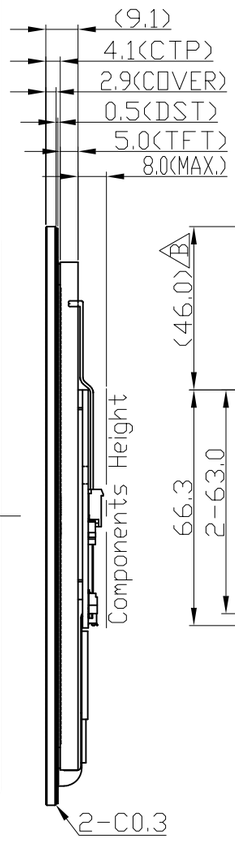
- 为达到最佳贴合效果,被贴合物应为平整,无翘曲，无凸点等;并需完全清洁干净,无灰尘,无油污,无残留物等。
- 建议用异丙醇和水的 50:50 混合液清洁，或先用脱脂剂，后用异丙醇和水的 50:50 混合液。
- 表面干透后才可进行贴合。
- 理想作业环境温度为 21℃~38℃。不建议在 10℃ 或以下的环境温度下作业。
- 撕去离型纸后应尽早贴合，避免污染胶带表面。
- 建议使用治具定位，一次贴正。(二次贴合可能会影响效果)初压治具需要注意平整，避免压破模块或产生变型。
- 一般初压时用不小于 15PSI (0.1N/mm²)的压力并保持 5~10 秒(请使用胶带面积运算实际组装所需压力)。
- 初压后一般需在常温下静置(避免受力)72hr 以达到最佳贴合效果(100%)。(注：20min 约 50%；1hr 约 70%；24hr 约 90%)
- 详细请参阅胶带供应商的使用说明与清洁建议。

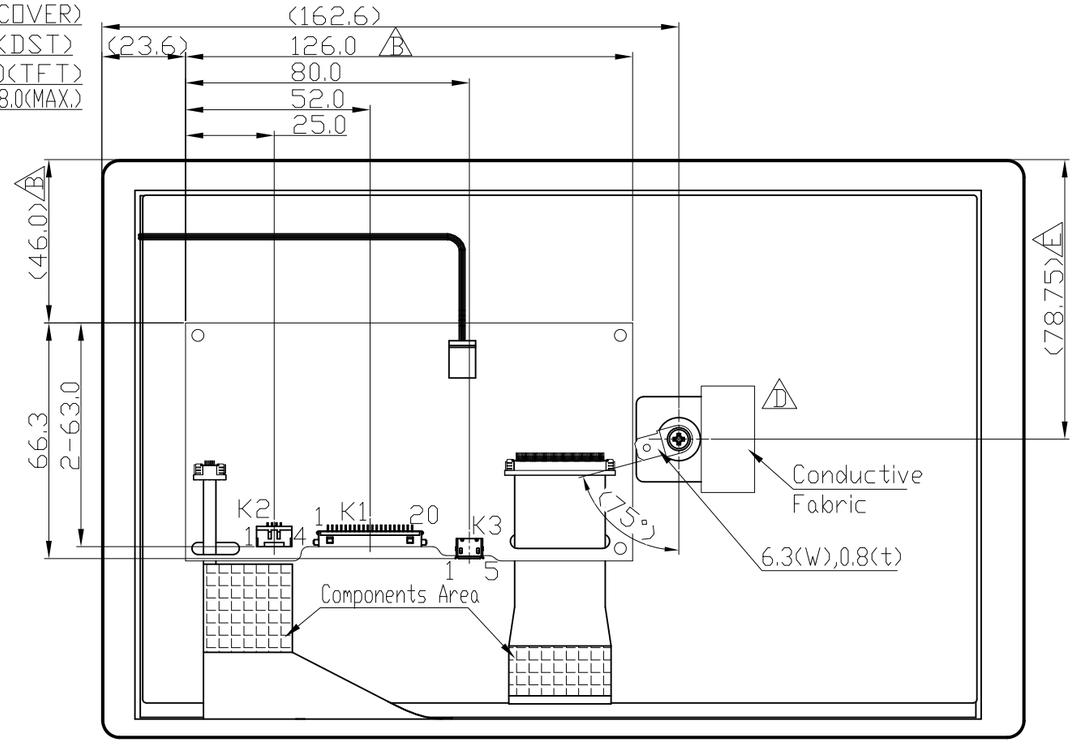
Warranty

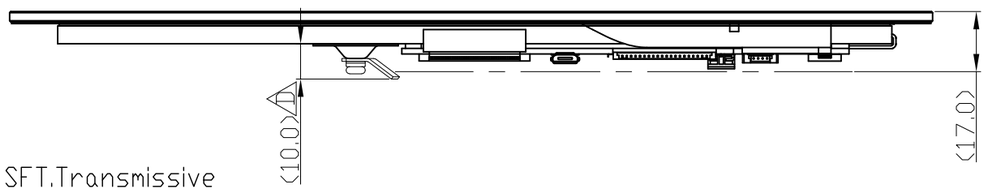
This product has been manufactured to our company's specifications as a part for use in your company's general electronic products. It is guaranteed to perform according to delivery specifications. For any other use apart from general electronic equipment, we cannot take responsibility if the product 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 form 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.









Note:

*1. LCD Display Type: SFT.Transmissive
*2. Pixel Arrangment: RGB-STRIPE
*3. Color Depth : 262k Colors
*4. Backlight: White LED
*5. □perating Voltage : 3.3V △
*6. Backlight Supply: 12.0V
*7. Interface: LVDS(18bit)
*8. Terminal:
K1: STARC□NN 076B20-0048RA-G4 or Equivalent
K2: LM123S004HTF13,4PIN,UNE or Equivalent
K3: MCSB5BSW-R1K5-H(724) or Equivalent
*9. Touch Panel Type : Capacitive touch panel
Light Transmission: 85%
Surface hardness: ≥ 6H
Surface treatment: anti-glare
*10. □perating Temperature : -20°C~70°C
*11. Storage Temperature : -30°C~80°C
*12. Unmarked Tolerace : ≤150,±0.3; >150,±0.5

K2 Terminal	
No	Pin Name
1	BL_VI
2	BL_ADJ
3	BL_EN
4	BL_GND

K3 Terminal	
No	Pin Name
1	5.0V
2	D-
3	D+
4	GND
5	GND

K1 Terminal	
No	Pin Name
1	NC
2	NC
3	NC
4	NC
5	GND
6	RXC+
7	RXC-
8	GND
9	RX2+
10	RX2-
11	GND
12	RX1+
13	RX1-
14	GND
15	RX0+
16	RX0-
17	LR
18	UD
19	VCC_IN
20	VCC_IN

Rev	Note	Date
E	Lift up Connection TAG 0.25 mm	2021-11-09 Luo Lin
D	Add Connection TAG	2021-11-05 Luo Lin
C	Add Note	2019-08-23 HeHongLiang
B	Refine □utline	2019-04-04 HeHongLiang
A	Revise □utline	2019-03-29 HeHongLiang

Dwg Title	LMT101ENMFWD-NAC □utline Dwg			
Dwg No.	MK-006593e-1-1			Date 2019-03-21
Scale 1/1	Tol.	Unit mm	Paper Size A3	
Approved	Checked	Drawn HeHongLiang		

TOPWAY