

# SPECIFICATION FOR CTP+LCD MODULE

**Part No.: TF156TM014-V1**

**Customer No.:**

**Date: 2026-4-21**

Supplier			Customer
Prepared	Checked	Approved	Approved



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## 1 General Specifications

### 1.1 Definition

The specification is used for capacitive touch module with TFT LCD & Backlight Unit.

### 1.2 Features and General Description

General	Specification	Unit	Note
Module Size	15.6	inch	diagonal
Structure	G+G+LCD, OCR Bonding		
Resolution	1920(RGB) × 1080		
Display Mode	Normally Black. Transmissive		
Pixel Pitch	0.17925(W) × 0.17925(H)	mm	
Pixel Arrangement	RGB Vertical stripe		
Viewing Direction	ALL	O'clock	
Outline Dimensions	385.16(W) × 234.59(H) × 14.77(D)	mm	
Viewing Area	345.16(W) × 194.59(H)		
Active Area	344.16(W) × 193.59(H)	mm	
LCD Interface	LVDS(2ch)		
CTP Interface	USB / I2C / RS232		
CTP IC	EXC81H84		
Touch Point	10		
Surface Hardness	6	H	
Surface Treatment	Etched AG(Gloss: 80±15)		



### 3 Pin assignment

#### 3.1 LCD Pin assignment

LVDS connector: MSBKT2407P30HB (STM)

Pin	Symbol	Description	Note
1	RXO0-	Negative Transmission data of Pixel 0 (ODD)	
2	RXO0+	Positive Transmission data of Pixel 0 (ODD)	
3	RXO1-	Negative Transmission data of Pixel 1 (ODD)	
4	RXO1+	Positive Transmission data of Pixel 1 (ODD)	
5	RXO2-	Negative Transmission data of Pixel 2 (ODD)	
6	RXO2+	Positive Transmission data of Pixel 2 (ODD)	
7	GND	Ground	
8	RXOCLK-	Negative Transmission Clock (ODD)	
9	RXOCLK+	Positive Transmission Clock (ODD)	
10	RXO3-	Negative Transmission data of Pixel 3 (ODD)	
11	RXO3+	Positive Transmission data of Pixel 3 (ODD)	
12	RXE0-	Negative Transmission data of Pixel 0 (EVEN)	
13	RXE0+	Positive Transmission data of Pixel 0 (EVEN)	
14	GND	Ground	
15	RXE1-	Negative Transmission data of Pixel 1 (EVEN)	
16	RXE1+	Positive Transmission data of Pixel 1 (EVEN)	
17	GND	Ground	
18	RXE2-	Negative Transmission data of Pixel 2 (EVEN)	
19	RXE2+	Positive Transmission data of Pixel 2 (EVEN)	
20	RXECLK-	Negative Transmission Clock (EVEN)	
21	RXECLK+	Positive Transmission Clock (EVEN)	
22	RXE3-	Negative Transmission data of Pixel 3 (EVEN)	
23	RXE3+	Positive Transmission data of Pixel 3 (EVEN)	
24	GND	Ground	
25	BIST	LCD Panel Self Test Enable(3.3V Typ) For test use When it is not used, Connecting to GND or Floating is recommended	
26	NC(SDA)	No connection	
27	NC(SCL)	No connection	
28	LCD_VDD	LCD Power Supply: 3.3V	
29	LCD_VDD	LCD Power Supply: 3.3V	
30	LCD_VDD	LCD Power Supply: 3.3V	

LED connector: MSB24038P8A (STM)

Pin	Symbol	Description
1	VLED	LED power supply(12V Typ)
2	VLED	LED power supply(12V Typ)
3	VLED	LED power supply(12V Typ)
4	GND	Ground
5	GND	Ground
6	GND	Ground
7	VLED_EN	Backlight On/Off (3.3V Typ)
8	VPWM_EN	System PWM signal input for dimming (3.3V Typ)



### 3.2 CTP Pin assignment

USB connector: JP1

Pin	Symbol	Description
1	GND_E	Ground
2	VDD	CTP Power Supply : 5V
3	GND	Ground
4	D+	CTP USB data port plus
5	D-	CTP USB data port minus

I2C connector: JP5

Pin	Symbol	Description
1	GND	Ground
2	I2C_SDA	CTP I2C SDA signal
3	I2C_SCL	CTP I2C SCL signal
4	VDD	CTP Power Supply : 5V
5	I2C_INT	CTP I2C INT signal

RS232 connector: JP5

Pin	Symbol	Description
1	UR_CTS	CTP RS232 CTS signal
2	UR_TX	CTP RS232 TX signal
3	UR_RX	CTP RS232 RX signal
4	UR_RTS	CTP RS232 RTS signal
5	GND_E	Ground
6	VDD	CTP Power Supply : 5V
7	GND	Ground

#### 4 Absolute Maximum Rating

The followings are maximum values which, if exceed, may cause faulty operation or damage to the unit. The operational and non-operational maximum voltage and current values are listed in Table

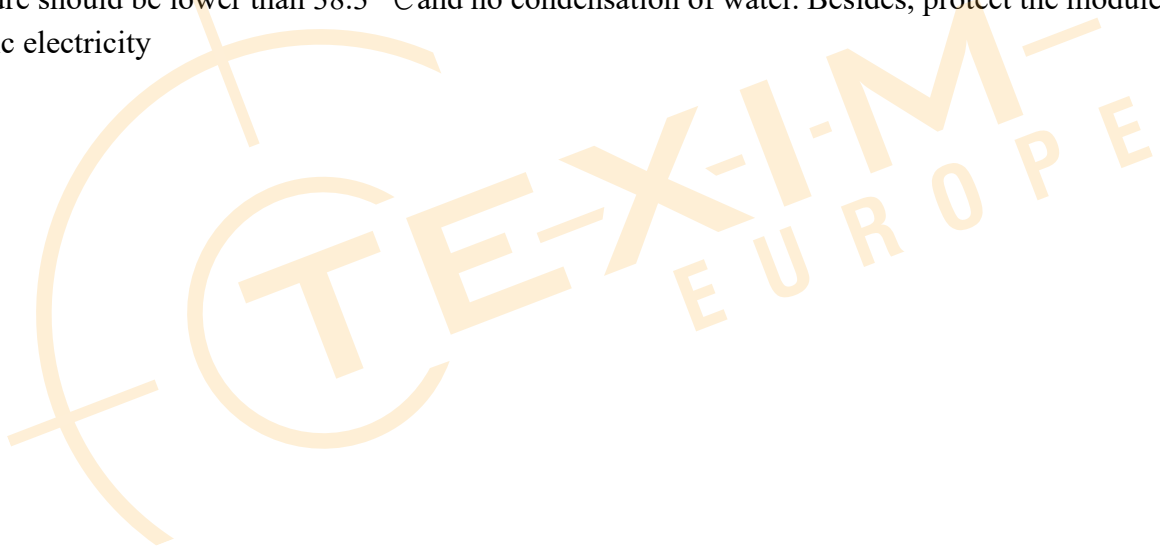
Parameter	Symbol	Min.	Max.	Unit
Power Supply Voltage	LCD_VDD	-0.3	4.0	V
Operating Temperature	T <sub>OP</sub>	-30	+85	°C
Storage Temperature	T <sub>ST</sub>	-30	+85	°C

Note (1) All the parameters specified in the table are absolute maximum rating values that may cause faulty operation or unrecoverable damage, if exceeded. It is recommended to follow the typical value.

Note (2) All the contents of electro-optical specifications and display fineness are guaranteed under Normal Conditions. All the display fineness should be inspected under normal conditions. Normal conditions are defined as follow: Temperature: 25°C, Humidity: 55 ± 10%RH.

Note (3) Unpredictable results may occur when it was used in extreme conditions. Ta= Ambient Temperature, Tgs= Glass Surface Temperature. All the display fineness should be inspected under normal conditions.

Note (4) Temperature and relative humidity range are shown in the figure below. Wet bulb temperature should be lower than 38.3 °C and no condensation of water. Besides, protect the module from static electricity



## 5 LCD Electrical Characteristic

### 5.1 LCD Input Power Specifications

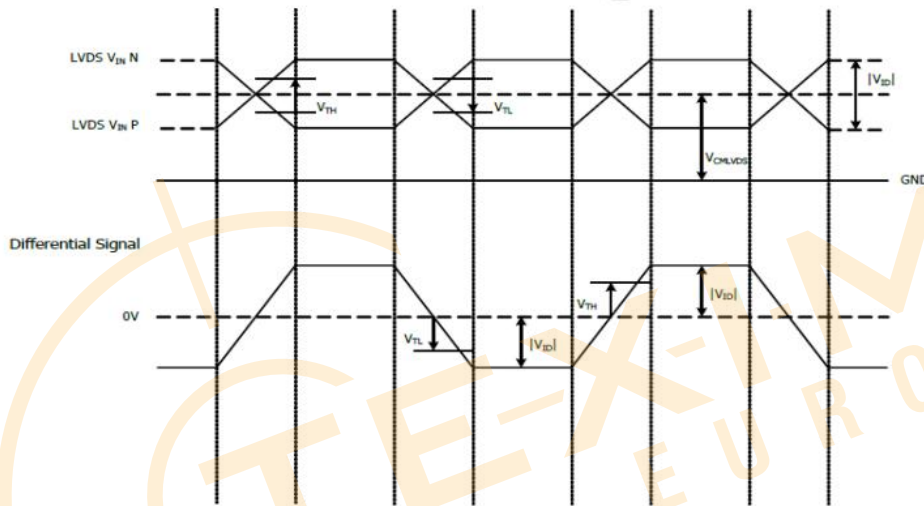
The built-in LVDS receiver is compatible with (ANSI/TIA/TIA-644 ) standard.

**Table 7 LVDS Receiver Electrical Characteristics**

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Differential Input High Threshold	V <sub>th</sub>	-	-	(+100)	mV	V <sub>CM</sub> =1.2V
Differential Input Low Threshold	V <sub>tl</sub>	(-100)	-	-	mV	V <sub>CM</sub> =1.2V
Magnitude Differential Input Voltage	V <sub>ID</sub>	(150)	-	(600)	mV	-
Common Mode Voltage	V <sub>CM</sub>	(0.7)	-	(1.6)	V	-

Note (1) Input signals shall be low or Hi- resistance state when VDD is off.

Note (2) All electrical characteristics for LVDS signal are defined and shall be measured at the interface connector of LCD.

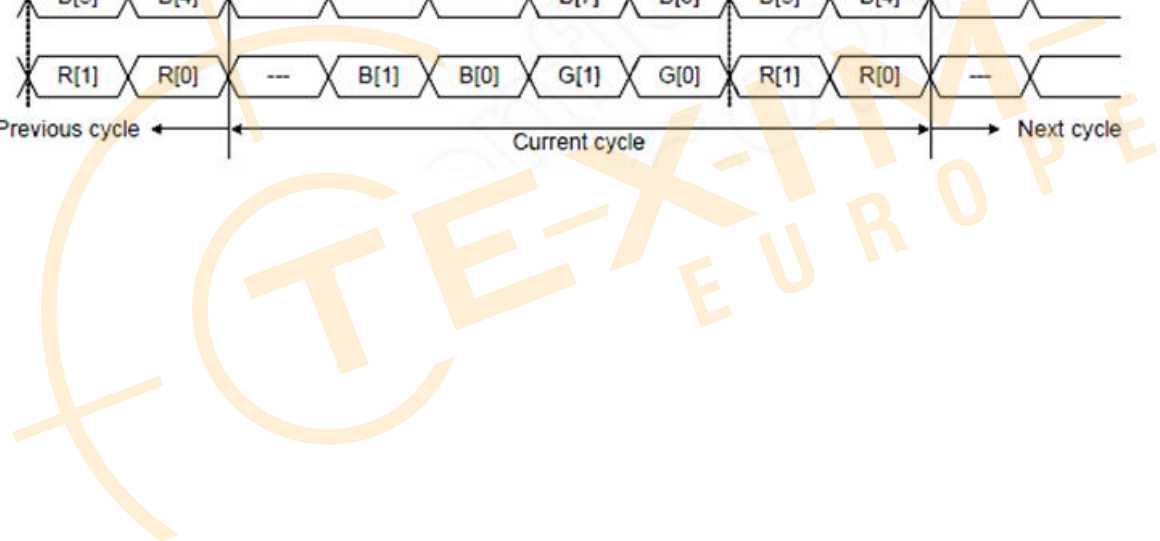
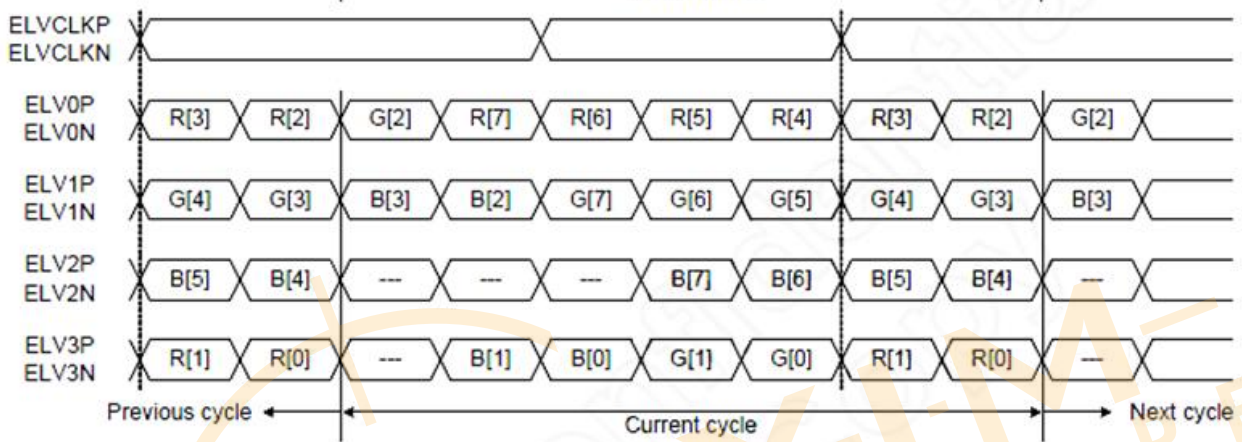
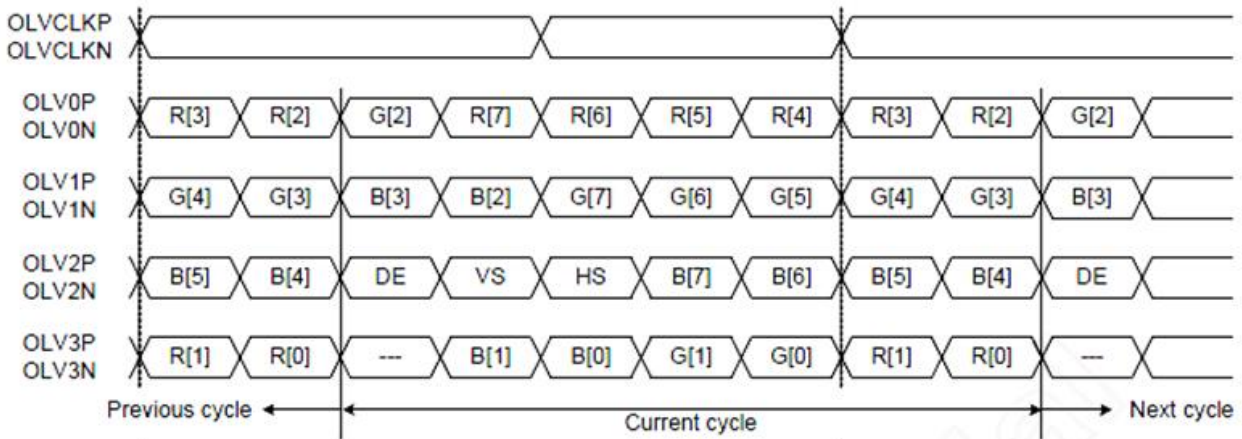


**Figure 7 Voltage Definitions**

**Table 8 LVDS AC Electrical Characteristics**

Parameter	Symbol	Min.	Typ.	Max.	Unit
Clock Period	TLVCP	-	(T)	-	ns
Clock High Time	TLVCH	-	(4T/7)	-	ns
Clock Low Time	TLVCL	-	(3T/7)	-	ns

Note: T=1/Fclk



## 5.2 LCD Input Power Specifications

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note	
<i>System Power Supply</i>							
LCD Drive Voltage (Logic)	$V_{DD}$	(3.0)	(3.3)	(3.6)	V	(1),(2)	
VDD Current	White Pattern $I_{DD}$	-	-	(0.454)	A	(1),(3)	
VDD Power Consumption	White Pattern $P_{DD}$	-	-	(1.5)	W		
LCD Self Test (BIST)	High level voltage	$V_{BIST}$	(0.7*VDD)	-	(VDD)	V	(1)
	Low level voltage		(0)	-	(0.3*VDD)		
Rush Current	$I_{Rush}$	-	-	(1.5)	A	(1),(4)	
Allowable Logic/LCD Drive Ripple Voltage	$V_{VDD-RP}$	-	-	(200)	mV	(1),(3)	
<i>LED Power Supply</i>							
LED Input Voltage	$V_{LED}$	(10.8)	(12)	(13.2)	V	(1),(2),(8)	
LED Power Consumption	$P_{LED}$	-	-	(26.3)	W	(1),(5),(8)	
LED Forward Voltage	$V_F$	-	-	(3.2)	V	(1),(2)	
LED Forward Current	$I_F$	-	(70)	-	mA		
PWM Signal Voltage	High level voltage	$V_{PWM}$	(2.5)	-	(5.5)	V	(1),(2)
	Low level voltage		(0)	-	(0.5)		
LED Enable Voltage	High level voltage	$V_{LED\_EN}$	(2.5)	-	(5.5)	V	(1),(2)
	Low level voltage		(0)	-	(0.5)		
Input PWM Frequency	$F_{PWM}$	(200)	-	(1,000)	Hz	(1),(2),(5)	
Duty Ratio	PWM	(10)	-	(100)	%	(1),(6)	
LED Life Time	LT	(50,000)	-	-	Hours	(1),(7)	

Note (1) All of the specifications are guaranteed under normal conditions. Normal conditions are defined as follow: Temperature: 25°C, Humidity: 55± 10%RH.

Note (2) All of the absolute maximum ratings specified in the table, if exceeded, may cause faulty operation or unrecoverable damage. It is recommended to follow the typical value.

Note (3) The specified  $V_{DD}$  current and power consumption are measured under the  $V_{DD} = 3.3$  V,  $F_V = 60$  Hz condition and White Pattern.

Note (4) The figures below is the measuring condition of  $V_{DD}$ . Rush current can be measured when  $T_{RUSH}$  is 0.5 ms.

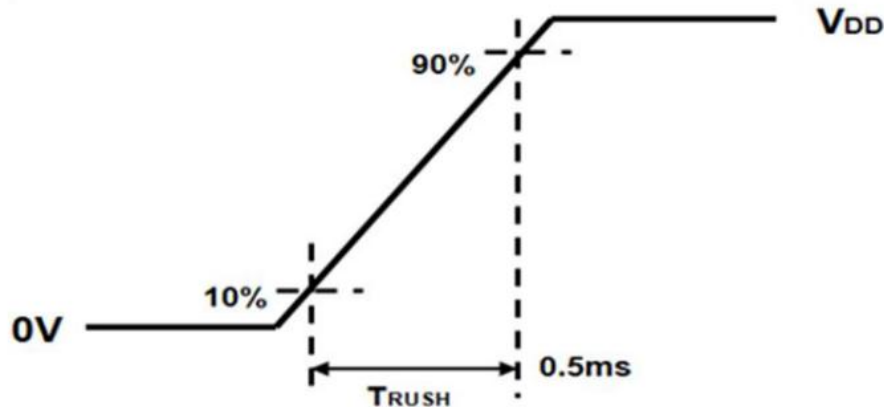


Figure 10  $V_{DD}$  Rising Time

Note (5) The power consumption of LED Driver are under the  $V_{LED} = 12.0V$ , Dimming of Max luminance.

Note (6) Although acceptable range as defined, the dimming ratio is not effective at all conditions. The PWM frequency should be fixed and stable for more consistent luminance control at any specific level desired.

Note (7) The operation of LED Driver below minimum dimming ratio may cause flickering or reliability issue.

Note (8) The life time is determined as the sum of the lighting time till the luminance of LCD at the typical LED current reducing to 50% of the minimum value under normal operating condition.

### 5.3 Power ON/OFF Sequence

Interface signals are also shown in the chart. Signals from any system shall be Hi- resistance state or low level when  $V_{DD}$  voltage is off.

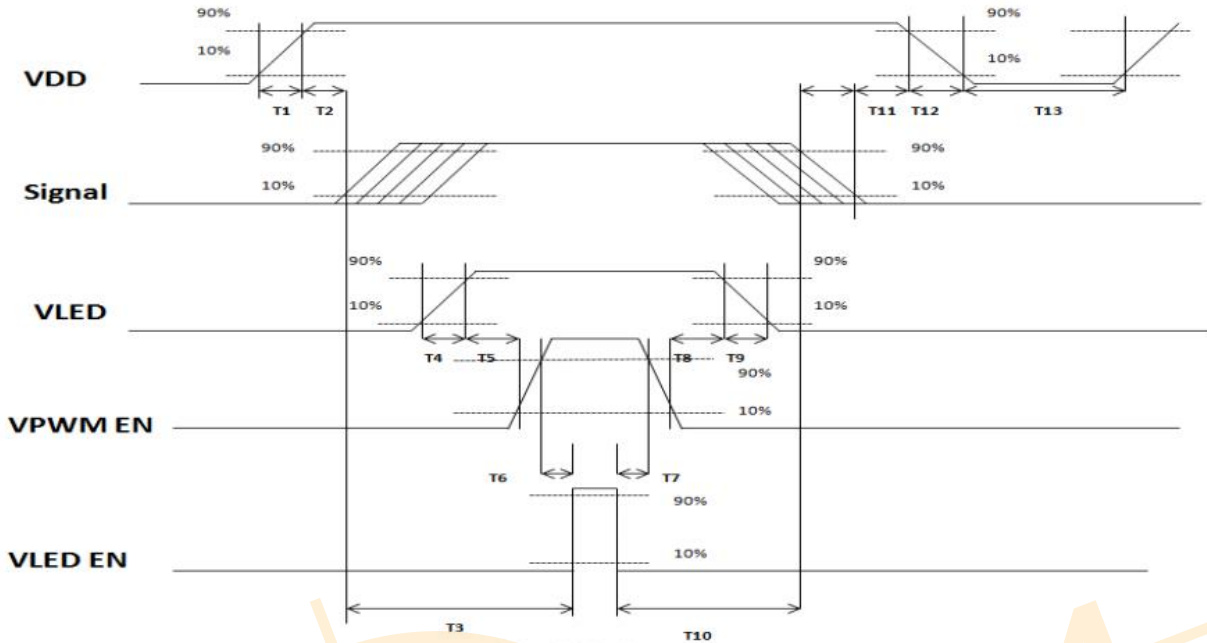


Figure 11 Power Sequence

Table 11 Power Sequencing Requirements

Parameter	Min.	Typ.	Max.	Unit
T1	(0.5)	-	(10)	ms
T2	(30)	(40)	(50)	ms
T3	(200)	-	-	ms
T4	(0.5)	-	(10)	ms
T5	(10)	-	-	ms
T6	(10)	-	-	ms
T7	(0)	-	-	ms
T8	(10)	-	-	ms
T9	-	-	(10)	ms
T10	(110)	-	-	ms
T11	(0)	(16)	(50)	ms
T12	-	-	(10)	ms
T13	(1,000)	-	-	ms

#### 5.4 Interface Timings

Parameter	Symbol	Min.	Typ.	Max.	Unit
LVDS Clock Frequency	Fclk	(69.5)	(70.5)	(73)	MHz
H Total Time	HT	(1050)	(1052)	(960+B)	Clocks
H Active Time	HA	960			-
V Total Time	VT	(1104)	(1116)	(1080+A)	Lines
V Active Time	VA	1080			-
Frame Rate	FV	-	(60)	-	Hz

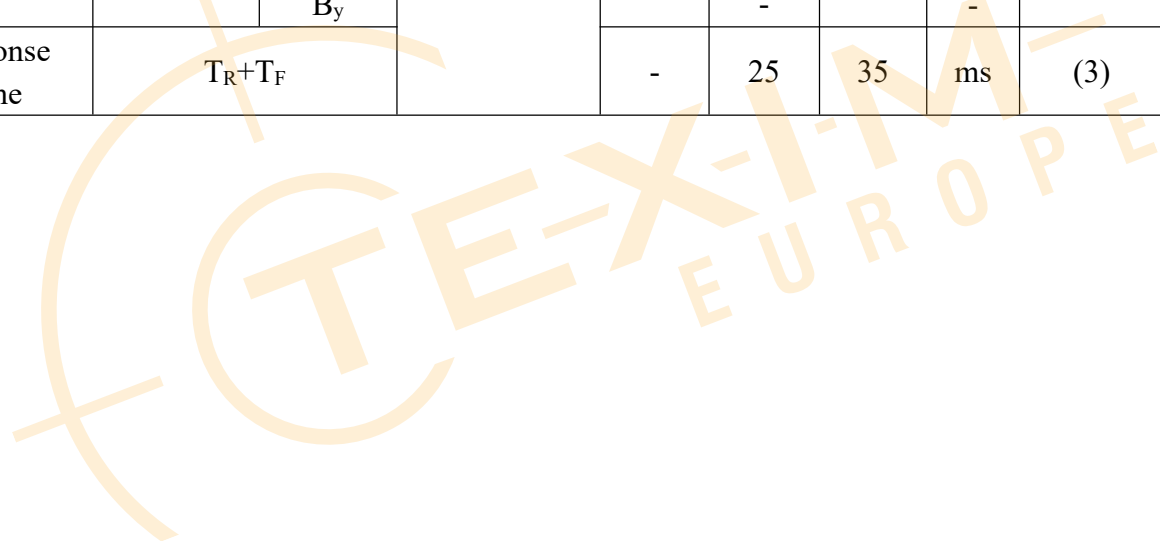
Note (1) SCC can only be driven to 2%

Note (2) The maximum clock frequency= $[(960+B) \cdot (1080+A) \cdot 60] < 73\text{MHz}$

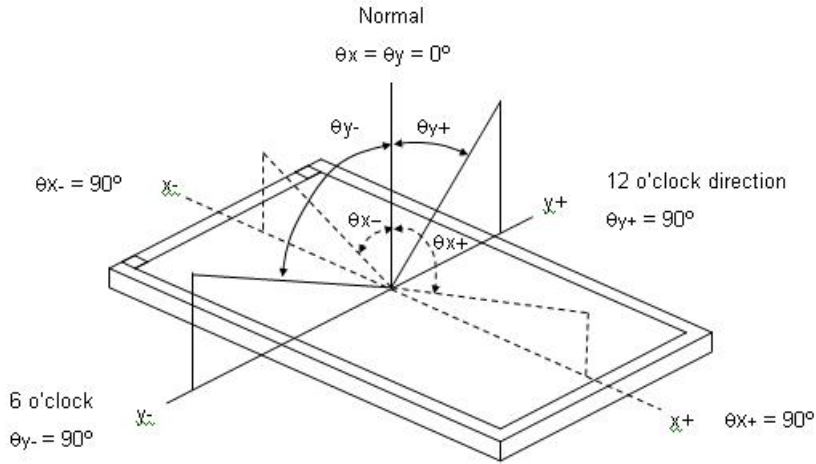


## 6 Optical Characteristics

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Viewing Angle	Horizontal	$\theta_{X+}$	$CR \geq 10$	80	85	-	Deg.	(1), (5)
		$\theta_{X-}$		80	85	-	Deg.	
	Vertical	$\theta_{Y+}$		80	85	-	Deg.	
		$\theta_{Y-}$		80	85	-	Deg.	
Luminance (W/ CTP)		Lv	$\theta_X=0^\circ, \theta_Y=0^\circ$	680	850	-	nit	(4), (5)
Uniformity	9 points	$\Delta Y9$		75	80	-	%	(5), (6)
Contrast ratio		CR		700	1000	-		(2), (5)
Color Chromaticity (CIE 1931)	White	$W_x$	$\theta_X=0^\circ, \theta_Y=0^\circ$ R=G=B=255 Gray scale	Typ- 0.05	0.313	Typ+ 0.05	-	(1), (5)
		$W_y$			0.329		-	
	Red	$R_x$			-		-	
		$R_y$			-		-	
	Green	$G_x$			-		-	
		$G_y$			-		-	
	Blue	$B_x$			-		-	
		$B_y$			-		-	
Response Time	$T_R+T_F$		-	25	35	ms	(3)	



Note (1) Definition of Viewing Angle ( $\theta_x, \theta_y$ ):



Note (2) Definition of Contrast Ratio (CR):

The contrast ratio can be calculated by the following expression.

$$\text{Contrast Ratio (CR)} = L_{255} / L_0$$

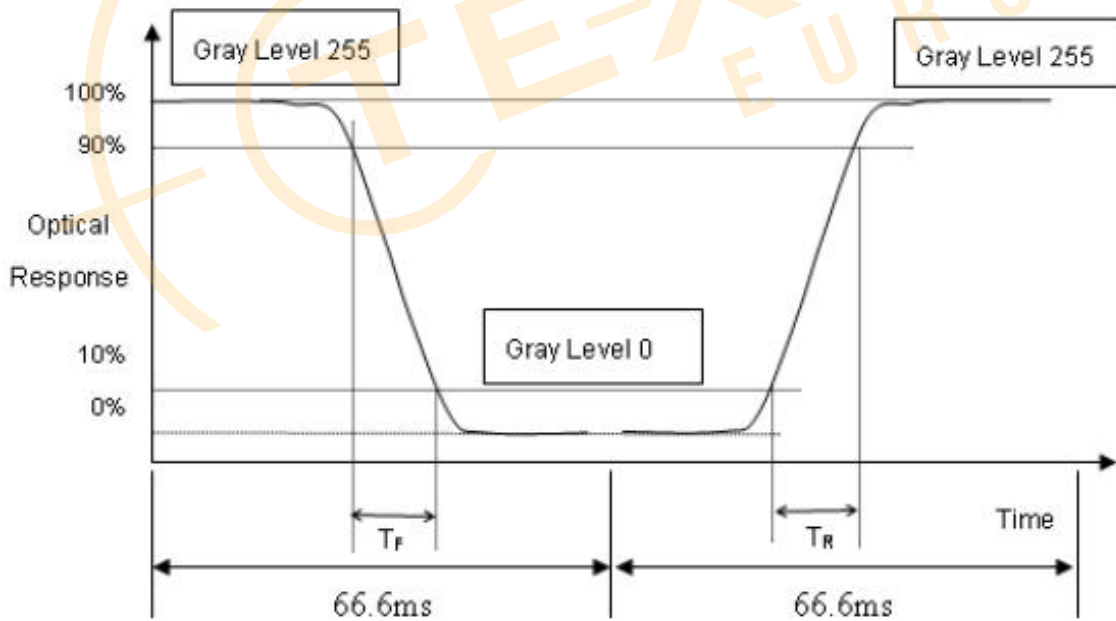
L255: Luminance of gray level 255

L 0: Luminance of gray level 0

$$\text{CR} = \text{CR} (5)$$

CR (X) is corresponding to the Contrast Ratio of the point X at Figure in Note (6).

Note (3) Definition of Response Time ( $T_R, T_F$ ):



Note (4) Definition of Luminance of White (LC):

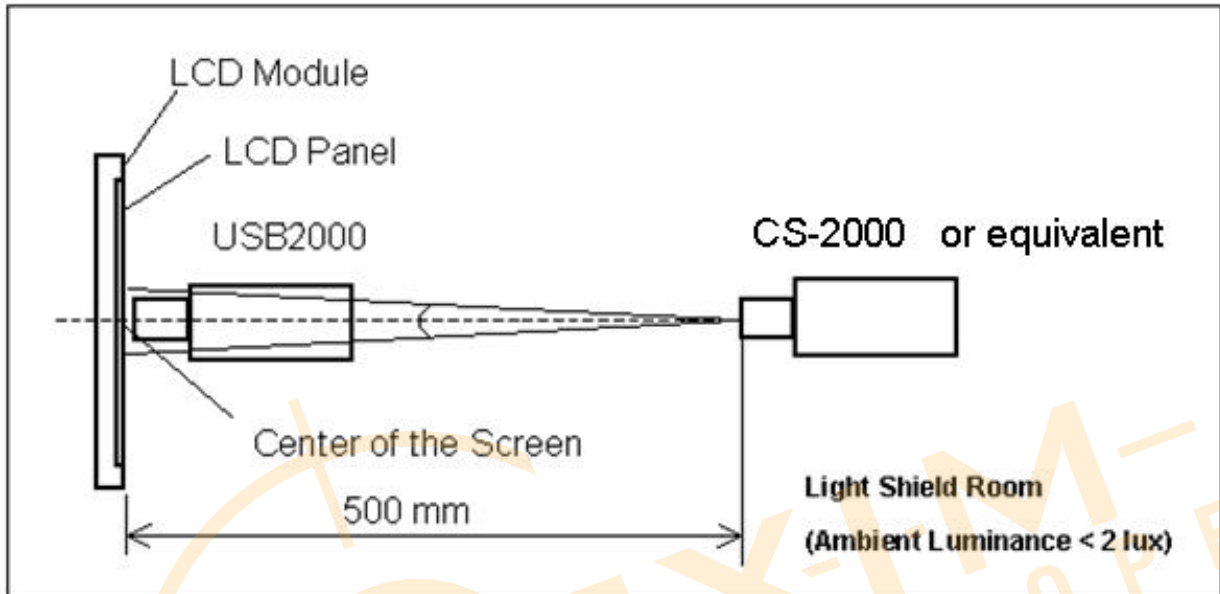
Measure the luminance of gray level 255 at center point

$$LC = L (5)$$

L (x) is corresponding to the luminance of the point X at Figure in Note (6).

Note (5) Measurement Setup:

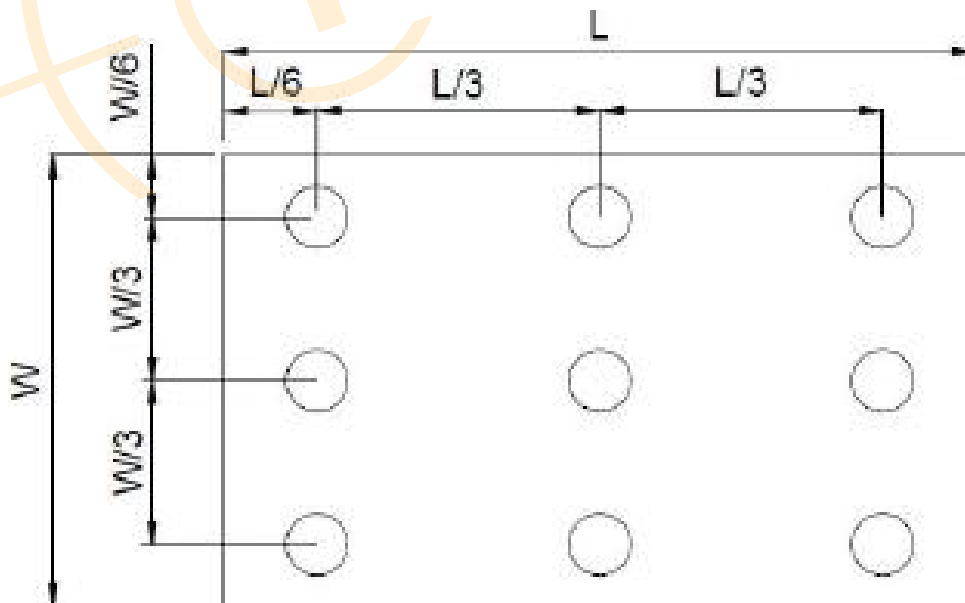
The LCD module should be stabilized at given temperature for 30 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 30 minutes in a windless room.



Note (6) Definition of White Variation ( $\delta W$ ):

Measure the luminance of gray level 255 at 9 points

$$\delta W = ( \text{Minimum} [L (1) \sim L (9)] / \text{Maximum} [L (1) \sim L (9)] ) * 100\%$$

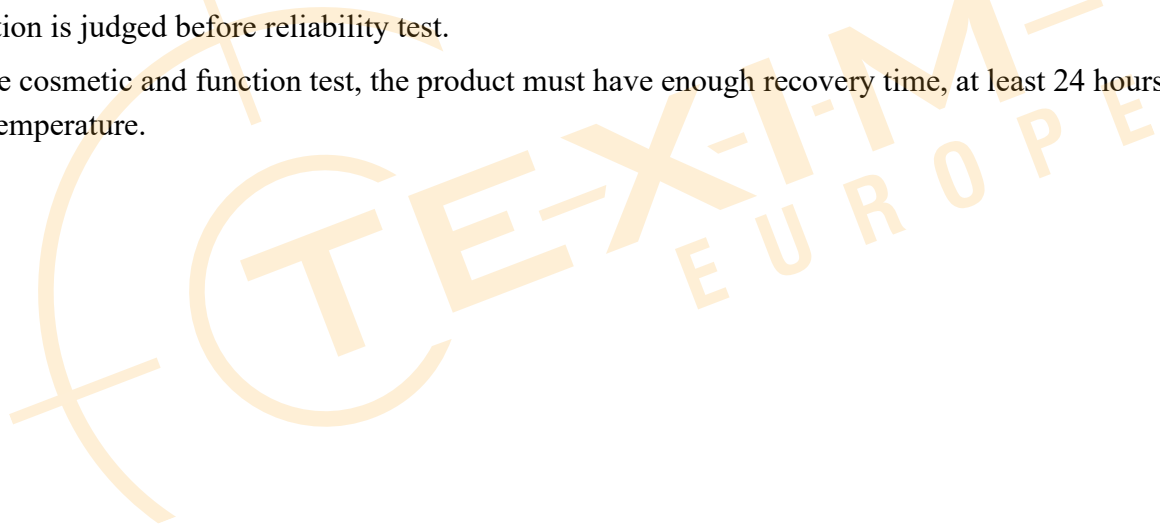


## 7 Reliability Test

Test Item	Condition
High Temperature Storage Test	85°C, 240 hrs
Low Temperature Storage Test	-30°C, 240 hrs
High Temperature Operation Test	85°C, 240 hrs
Low Temperature Operation Test	-30°C, 240 hrs
High temperature & high humidity operation Test	40°C, 90%RH, 240 hrs
Thermal Shock Test (TST)	-20°C/30min, 60°C/30min, 100 cycles
Electro-static discharge test (non-operating)	Air : 150 pF, 330Ω, 15 KV Contact : 150 pF, 330Ω, 8 KV

Note :

- (1) There should be no condensation on the surface of panel during test.
- (2) At testing Vibration and Shock, the fixture in holding the module has to be hard and rigid enough so that the module would not be twisted or bent by the fixture.
- (3) In the standard conditions, there is no function failure issue occurred. All the cosmetic specification is judged before reliability test.
- (4) Before cosmetic and function test, the product must have enough recovery time, at least 24 hours at room temperature.



## 8 Appearance Inspection

### 8.1 Inspection Sampling Method:

Unless there is other agreement, the sampling plan for incoming inspection shall follow GB2828.1-2012.

- (1) Lot size: Quantity per shipment as one lot (different model as different lot).
- (2) Sampling type: Normal inspection, single sampling.
- (3) Sampling level: Level II.

### 8.2 Inspection Conditions

The environmental condition and visual inspection shall be conducted as below:

- (1) Light: 800~1400Lux;
- (2) Vision requirement: Naked or corrected vision of at least 1.0 and no color blindness;
- (3) Inspection background: black and white board is used as the background below the product;
- (4) Inspection distance: 30~40cm from human eyes to the measured surface;
- (5) Inspection Angle: the detected surface is 90 degree from to line of sight, and the measured Object should be rotated 45 degree from side to side;
- (6) Inspection time: 5~10s;

### 8.3 Inspection equipment

Secondary elements, calipers, feelers, filinka, petroleum ether, ND filter

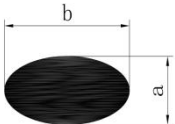
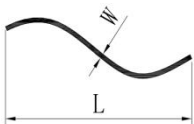
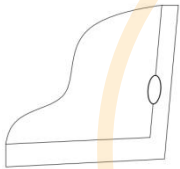
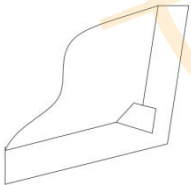
### 8.4 Defect code comparison table

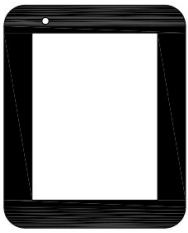
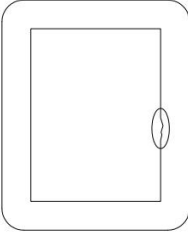

Code	Name (Unit)	Code	Name (Unit)
N	Number	D	Diameter (mm)
L	Length (mm)	H	Depth (mm)
W	Width (mm)	S	Distance (mm)
S	Area (mm <sup>2</sup> )		

### 8.5 Inspection precautions

- (1) Inspectors must wear finger gloves and electrostatic bracelets.
- (2) Place the inspected product in front of the inspector, and hold the edge of the product with both hands carefully. Do not bend the product.

## 8.6 Inspection items and standards

Items	Standard	Conclusion	Inspection tools
Dot (white, black, heterochromatic )  $D=(a+b)/2$	$D \leq 0.3$	Ignore, dense density is not allowed	Visual inspection
	$0.3 < D \leq 0.8$	The distance with another dot is more than 10 mm, Transparent areas : $N \leq 5$ , Ink areas : $N \leq 6$	
	$D > 0.8$	Not allow	
Linear defects (fibers/foreign bodies/ scratches, etc.) 	$W \leq 0.08$	Ignore, dense density is not allowed	Visual inspection
	$0.08 < W \leq 0.2$	$L \leq 15$ , the distance with another scratch or impurity is more than 5mm Transparent areas : $N \leq 5$ , Ink areas : $N \leq 5$	
	$W > 0.2, L > 15$	Not allow	
Bubble	According to the point standard		Visual inspection
Edge broken loss 	<ol style="list-style-type: none"> <li>The sensor edge creaks, without damaging the line. The function test is OK for reception, and the front side is not visible after fitting.</li> <li>Edge creak on front of cover plate: NG.</li> <li>Back <math>X &lt; 0.5\text{mm}</math>; <math>Y &lt; 0.5\text{mm}</math>; <math>Z &lt; 1/3\text{GT}</math> (GT= glass thickness), without affecting the functionality of the product, each side is allowed three</li> </ol>		Visual inspection
Corner broken loss 			

Items	Standard	Conclusion	Inspection tools
Creak	Creaks found at any location are not allowed		Visual inspection
Size	Meet the requirements of finished product inspection drawings		
Ink pinhole 	$D \leq 0.2$	Ignore, dense density is not allowed	
	$0.2 < D \leq 0.3$	$N \leq 6$ $DS \geq 10\text{mm}$ , Repair with a paint pen of the same color as the cover plate	
Ink sawtooth 	$W \leq 0.2\text{mm}$	Ignore, dense density is not allowed	
Newton's rings	No more than 1/6 of the display area, light up invisible. If there are special requirements, the limited sample shall prevail.		
FPC 	1. Oxidation, breakage, residual glue, coating peeling, cracking and other phenomena of FPC gold fingers are not allowed. 2. Less components, false welding, deformation are not allowed.		
Color	Consistent with the sample, no serious color difference		
Mura/Waving/ Hot spot	Not visible through 5% ND filter		

## 9 Notices

### 9.1 Cautions for storage

Store the module in a dark room where must keep at  $25\pm 10^{\circ}\text{C}$  and 65%RH or less. Don't expose the products to the direct sunlight or stresses.

### 9.2 Cautions for operation

- (1) Do not put a heavy, hard or sharp object on the product.
- (2) Do not bend the product in order to assure the reliability.
- (3) Do not put one product on the other. Otherwise, the product to may be scratched or be changed.
- (4) Do not oile the touch panel, Do not put heavy goods on the touch panel.
- (5) Do not use any organic solvent acid or alkali solution to clean the surface of the product. Please use dry clothes or soft clothes with ethanol to clean the surface.

### 9.3 Cautions for operation

Light transmission is an important factor for the product. So, please wear clean finger sacks, gloves and mask to protect the products from fingerprint or stain attach, and also must ensure the area where your finger touches is outside the view area when handing the panel.

### 9.4 Others

- (1) Please note that dew gathering in the panel due to abrupt temperature or humidity change, etc. Which may cause deterioration of performance.
- (2) When this product was built into the package, if there is vulcanization material such as vulcanized rubber which has a possibility of generating the salutation gas near the package since abnormalities will be caused to wring of the product and it will become the cause if functional degradation, please give a constitutional cations.
- (3) Cation for product safety set

Although full care is taken to ensure product quality, failure modes such as degradation, short circuits, or open circuits might be caused, Therefore, to design a product set, please study the effects of any single failure of the panel in advance and consider the safety of product configuration.

Quality function livers for on year, outward appearance haves non-color variation in six months.

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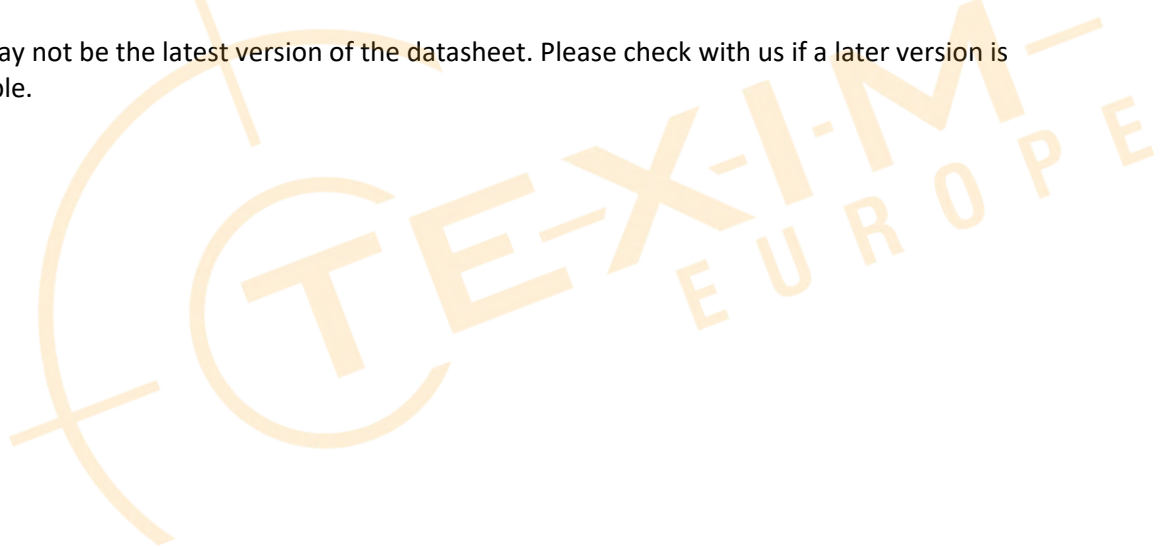
It is the customer's responsibility to validate that a particular product with the properties described in the product specification is suitable for use in a particular application.

Parameters provided in datasheets and / or specifications may vary in different applications and performance may vary over time.

All operating parameters, including typical parameters, must be validated for each customer application by the customer's technical experts.

Please contact us if you have any questions about the contents of the datasheet.

This may not be the latest version of the datasheet. Please check with us if a later version is available.





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