Microtips Technology

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TFT Module Specification

MODEL: AWY-170320T19N01

This module uses ROHS material

CUSTOMER
APPROVED BY
DATE:

Approved by	Checked by		Made by
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Revision Record

| Rev No.	Rev Date	Contents	Note
A	2024/01/04	New issue.	

Table of Contents

1. Scope

This specification defines general provisions as well as inspection standards for TFT module supplied by Micotips Technology. If the event of unforeseen problem or unspecified items may occur, naturally shall negotiate and agree to solution

1. 2. General Information

Item	Standard Values	Units
LCD type	1.9"TFT	--
Dot arrangement	170×320	dots
Color filter array	RGB vertical stripe	--
Display mode	Normally Black	-
Viewing Direction	85/85/85/85 deg(U/D/L/R @ C/R>10)	--
Module size	49.72(W)×25.8(H)×1.43(T)	mm
Active area	42.72(W)×22.70(H)	mm
Dot pitch	0.1335(W)×0.1335(H)	mm
Interface	4-SPI/8bit MCU	--
Operating temperature	-10 ~ +60	°C
Storage temperature	-20 ~ +70	°C
Back Light	4 White LEDS	--

Issued Date. 2024/01/04

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Model: AWY-170320T19N01

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Product Specification

3. External Dimensions

REV	DESCRIPTION	DRAWER	CHECKER	DATE

25.80 BL
24.80 LCD
22.70 A.A
(12.90)
0.50
1.55
0.50
1.50

49.72 BL
48.52 LCD
42.72 A.A
(22.86)

1.9" TFT
170*RGB*320

18.39±0.5
3.11±0.5
32.69
3.50±0.5

Bending area

CN:FH34S-6S-0.5SHW(50)

1.43

FRONT BACK

DETAIL A

STEEL

ROHS 3.0

Interface:
IM1_IM2=0 MCU8BIT parallel
IM1_IM2=1 4LSPI serial
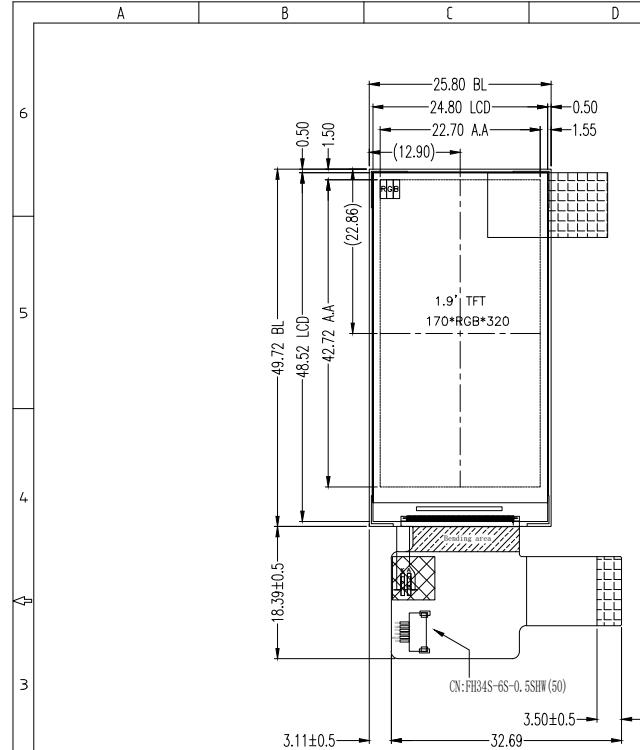
NOTES:
1. DISPLAY TYPE: 1.9"TFT,NORMALLY BLACK
2. VIEWING DIRECTION : U/L/D/R 80/80/80/80
3. TFT Driver IC : ST7789V3
4. Top : −10°C ~ 60°C, Tst : −20°C ~ 70°C
5. GENERAL TOLERANCE: ±0.2
6. LCM Luminance:LED/400cd/m² (Typical)

0.2±0.02
1   31
R0.2
W=0.3 +0.04 −0.03
0.6±0.07
0.3±0.07
8.4±0.05
9.0±0.05
9.6±0.08
0.3±0.15
1.0±0.15
1.1±0.15
2.1±0.15
2.25±0.15
2.5±0.3
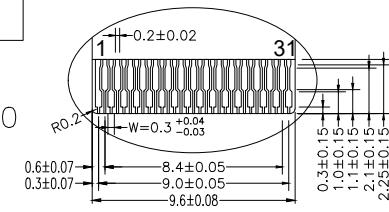
DETAIL A(3:1)
Connector:FH26-31S-0.3SHW(05)

LED CIRCUIT DIAGRAM:

LEDA — LEDK

4EA If=80mA

PIN ASSIGNMENT:

No.	PIN NAME
1	RESET
2	RS/SCL
3	WR/D_C
4	RD
5	CS
6	VDD
7	VDDIO
8	GND
9	IM1_IM2
10	SDA
11	GND
12	DB7
13	DB6
14	DB5
15	DB4
16	DB3
17	DB2
18	DB1
19	DB0
20	GND
21	LEDK
22	LEDK
23	LEDA
24	LEDA
25	TP_VCC_3V3
26	TP_SCL
27	TP_SDA
28	TP_RST
29	TP_INT
30	GND
31	GND
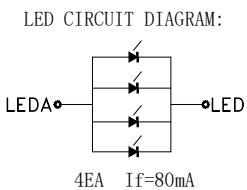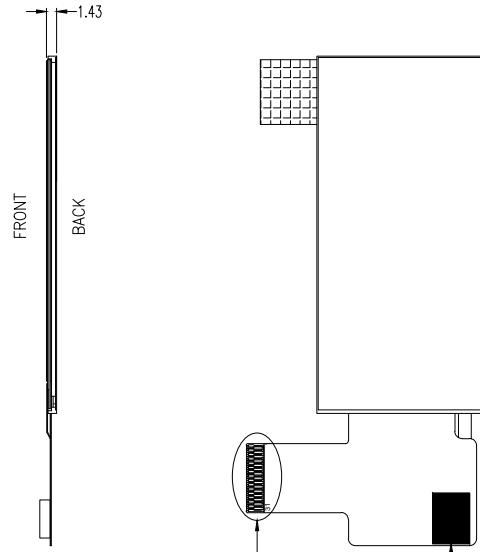
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TITLE	1.9" TFT	UNIT: mm	Product : AWY-170320T19N01
DATE		SCALE: 1/1	DRW NO : Y170320T19N01
2023 01 04		SHEET: 1/1	REV : A

UNLESS OTHERWISE SPECIFIED TOLERANCE IS ±0.2: FRACTIONS DECIMALS ANGLES IS±1.0°

4. Interface Description

Pin No.	Pin Name	Description	
1	RESET	Reset signal,Signal is active low	
2	RS/SCL	Display data/command selection pin.	
3	WR/D_C	Write enable in MCU parallel interface	
4	RD	Read enable in MCU parallel interface.	
5	CS	Chip select input pin.	
6	VDD	Power Supply for logic	
7	VDDIO	Power Supply for IO.	
8	GND	Power ground	
9	IM1_IM2	IM1_IM2=0	MCU8Bit parallel
		IM1_IM2=1	4LSPI serial
10	SDA	SPI interface input pin.Fix to VDDI or DGND level when not in use.	
11	GND	Power ground	
12~19	DB7-DB0	Data input.Fix to VDDI or DGND level when not in use	
20	GND	Power ground	
21~22	LEDK	LED backlight (Cathode).	
23~24	LEDA	LED backlight (Anode).	
25	TP_VCC	NC	
26	TP_SCL	NC	
27	TP_SDA	NC	
28	TP_RST	NC	
29	TP_INT	NC	
30~31	GND	Power ground	

5. Absolute Maximum Ratings

Item	Symbol	Min.	Max.	Unit
Logic Supply Voltage	VDDIO	-0.3	5.5	V
Analog Supply Voltage	VCC	-0.3	6.6	V
Operating Temperature	TOP	-10	60	°C
Storage Temperature	TST	-20	70	°C
Storage Humidity	HD	20	90	%RH

6. DC Characteristics

Item	Symbol	Min.	Typ.	Max.	Unit	Remark
Logic Supply Voltage	VDDIO	1.65	1.8	3.3	V	-
Analog Supply Voltage	VDD	2.6	2.8	3.3	V	-
Input High Voltage	V_{IH}	0.7VDDI0	-	VDDI0	V	-
Input Low Voltage	V_{IL}	GND	-	0.3 VDDI0	V	-
Output High Voltage	V_{OH}	0.8VDDI0	-	VDDI0	V	-
Output Low Voltage	V_{OL}	GND	-	0.2VDDI0	V	-
I/O Leak Current	ILI	-	-	1	uA	-

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7. Timing Characteristics

AC Characteristics

8080 Series MCU Parallel Interface Characteristics: 8-bit Bus
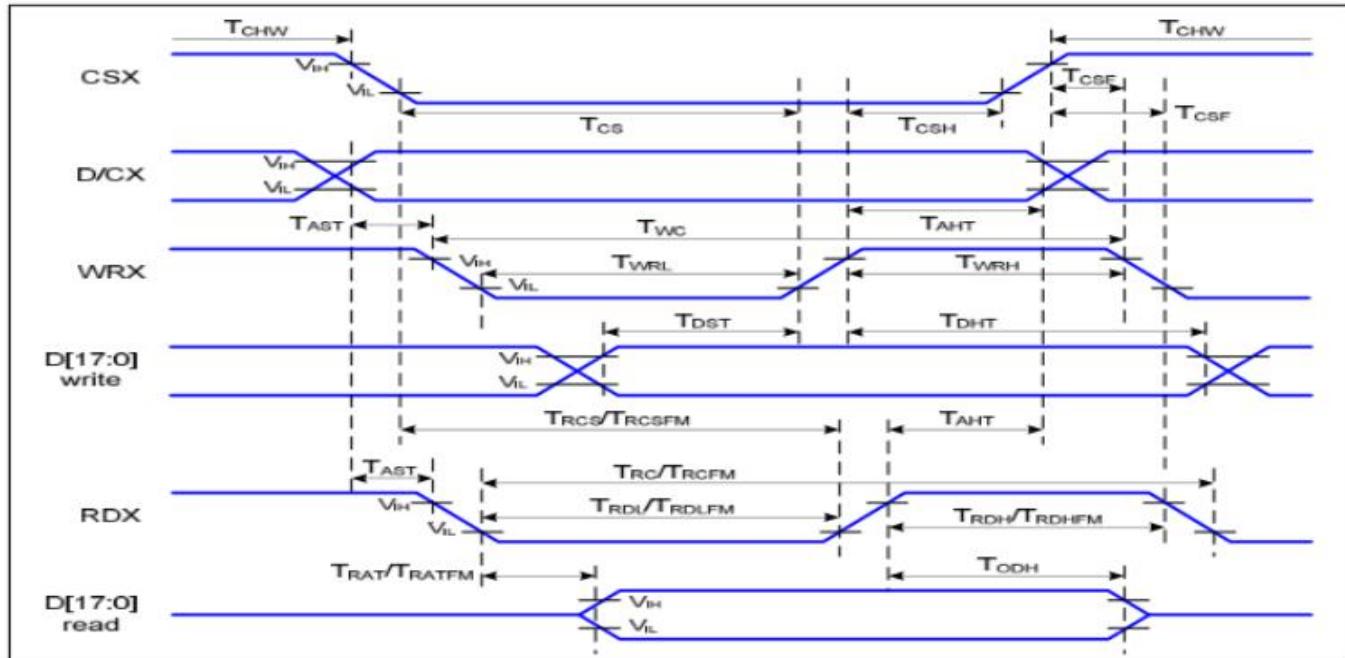
Signal	Symbol	Parameter	Min	Max	Unit	Description
D/CX	T_{AST}	Address setup time	0		ns	-
	T_{AHT}	Address hold time (Write/Read)	10		ns	
CSX	T_{CHW}	Chip select "H" pulse width	0		ns	-
	T_{CS}	Chip select setup time (Write)	15		ns	
	T_{RCS}	Chip select setup time (Read ID)	45		ns	
	T_{RCSFM}	Chip select setup time (Read FM)	355		ns	
	T_{CSF}	Chip select wait time (Write/Read)	10		ns	
	T_{CSH}	Chip select hold time	10		ns	
WRX	T_{WC}	Write cycle	66		ns	
	T_{WRH}	Control pulse "H" duration	15		ns	
	T_{WRL}	Control pulse "L" duration	15		ns	
RDX (ID)	T_{RC}	Read cycle (ID)	160		ns	When read ID data
	T_{RDH}	Control pulse "H" duration (ID)	90		ns	
	T_{RDL}	Control pulse "L" duration (ID)	45		ns	
RDX (FM)	T_{RCFM}	Read cycle (FM)	450		ns	When read from frame memory
	T_{RDHFM}	Control pulse "H" duration (FM)	90		ns	
	T_{RDLFM}	Control pulse "L" duration (FM)	355		ns	
D[17:0]	T_{DST}	Data setup time	10		ns	For CL=30pF

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Serial Interface Characteristics (4-line serial)
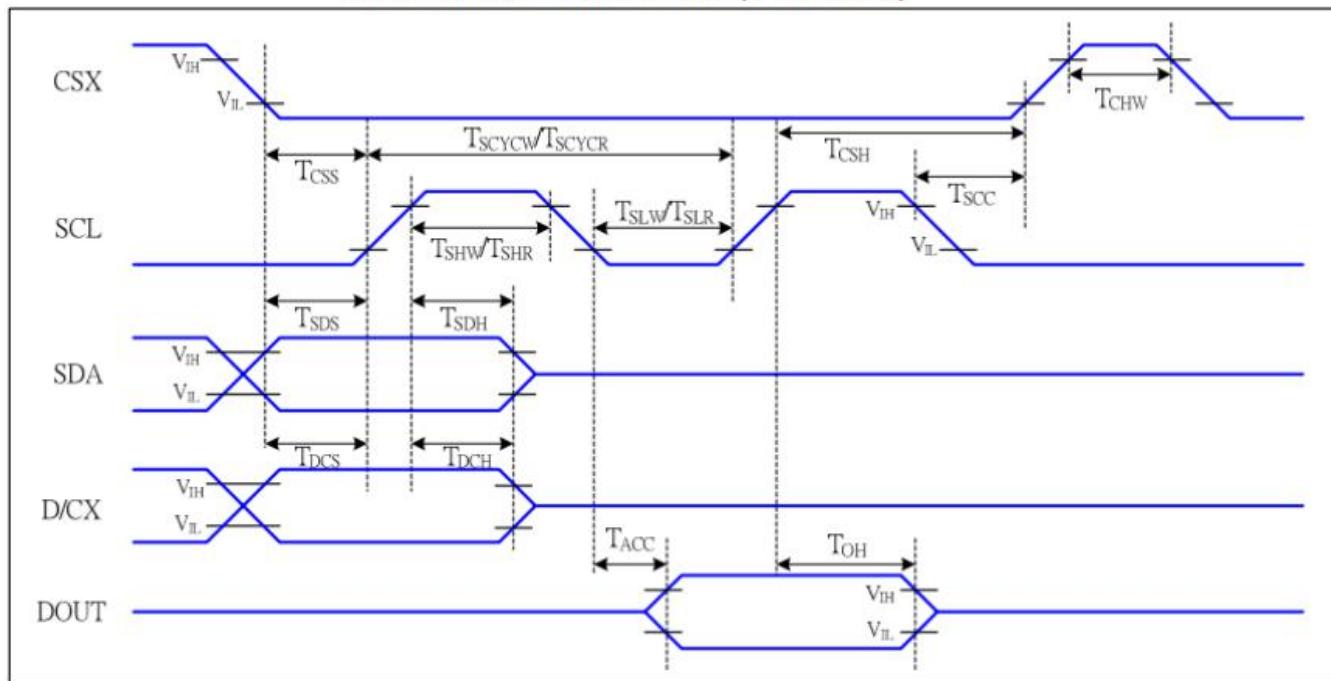
Signal	Symbol	Parameter	MIN	MAX	Unit	Description
CSX	T$_{CSS}$	Chip select setup time (write)	15		ns	
	T$_{CSH}$	Chip select hold time (write)	15		ns	
	T$_{CSS}$	Chip select setup time (read)	60		ns	
	T$_{SCC}$	Chip select hold time (read)	65		ns	
	T$_{CHW}$	Chip select "H" pulse width	40		ns	
SCL	T$_{SCYCW}$	Serial clock cycle (Write)	16		ns	-write command & data ram
	T$_{SHW}$	SCL "H" pulse width (Write)	7		ns	
	T$_{SLW}$	SCL "L" pulse width (Write)	7		ns	
	T$_{SCYCR}$	Serial clock cycle (Read)	150		ns	-read command & data ram
	T$_{SHR}$	SCL "H" pulse width (Read)	60		ns	
	T$_{SLR}$	SCL "L" pulse width (Read)	60		ns	
D/CX	T$_{DCS}$	D/CX setup time	10		ns	
	T$_{DCH}$	D/CX hold time	10		ns	
SDA (DIN)	T$_{SDS}$	Data setup time	7		ns	
	T$_{SDH}$	Data hold time	7		ns	
DOUT	T$_{ACC}$	Access time	10	50	ns	For maximum CL=30pF
	T$_{OH}$	Output disable time	15	50	ns	For minimum CL=8pF

8. Backlight Characteristic

LED CIRCUIT DIAGRAM:

LEDA —[▷▶ ▷▶ ▷▶ ▷▶]— LEDK

4EA   If=80mA
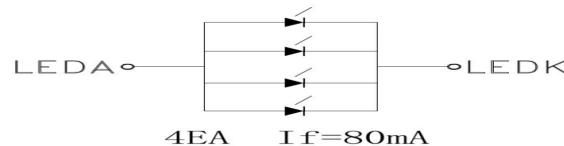
Item	Symbol	MIN	TYP	MAX	UNIT	Remark
Supply Voltage	Vf	2.6	3.0	3.5	V	Note 1
Supply Current	If	-	80	-	mA	-
Life Time	-	30000	-	-	Hr	Note 2
Backlight Color	White					

Note 1: The LED Supply Voltage is defined by the number of LED at Ta=25°C and If =80mA.

Note 2: LED current is measured by utilizing a high frequency current meter as shown below:
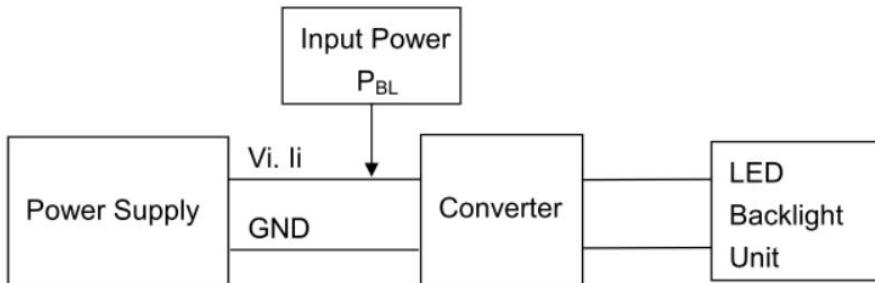
Note 3: The "LED life time" is defined as the module brightness decrease to 50% original brightness at Ta=25 ℃ and If =80mA. The LED lifetime could be decreased if operating If is larger than 80mA.

Note 4: LED light bar circuit:
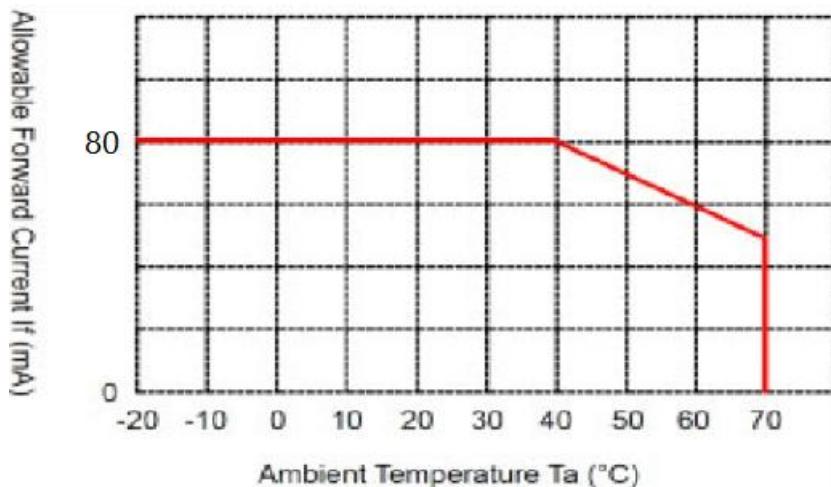
9. Optical Characteristics

Item	Conditions		Min.	Typ.	Max.	Unit	Note
Viewing Angle (CR>10)	Horizontal	θL	-	85	-	degree	(1),(2),(6)
		θR	-	85	-		
	Vertical	θT	-	85	-		
		θB	-	85	-		
Luminous Intensity for LCM	-		350	400	-	cd/m2	If=80mA
Uniformity for LCM	-		75	80	-	%	If=80mA
Contrast Ratio	Center		700	900	-	-	(1),(3),(6)
Response Time	Rising+Falling		-	25	35	ms	(1),(4),(6)
CF Color Chromaticity (CIE1931)	White x		0.270	0.320	0.370	-	(1), (6)
	White y		0.290	0.340	0.390	-	
	Red x		0.597	0.647	0.697	-	
	Red y		0.276	0.326	0.376	-	
	Green x		0.241	0.291	0.341	-	
	Green y		0.536	0.586	0.636	-	
	Blue x		0.089	0.139	0.189	-	
	Blue y		0.065	0.115	0.165	-	

Note (1) Measurement Setup: The LCD module should be stabilized at given temp. 25°C for 15 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting backlight for 15 minutes in a windless room.
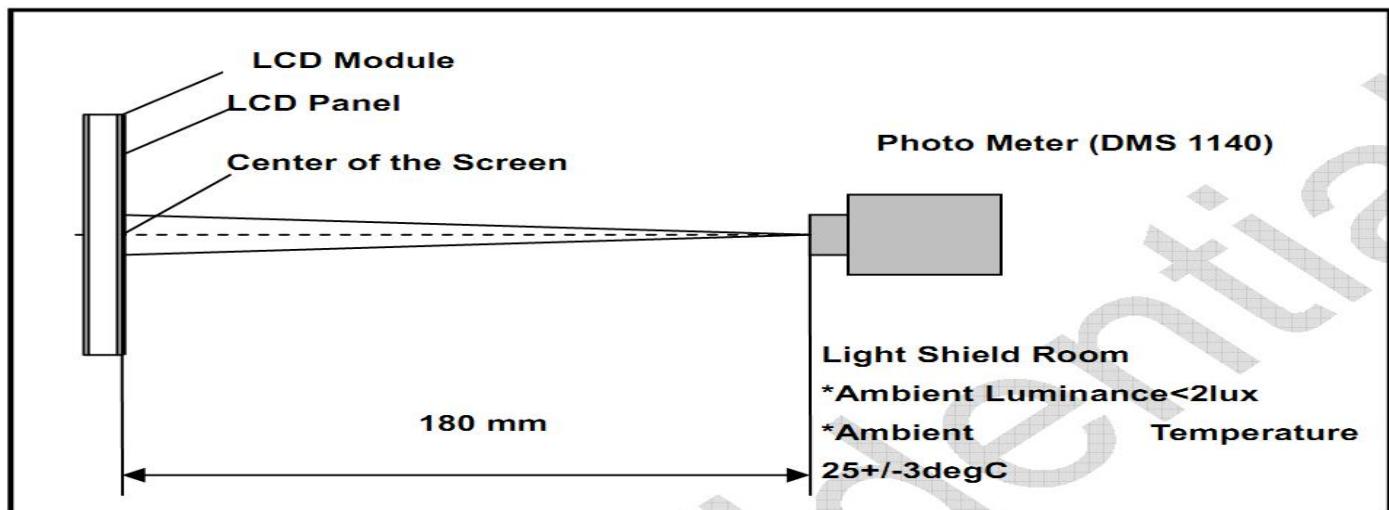
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Note (2) Definition of Viewing Angle
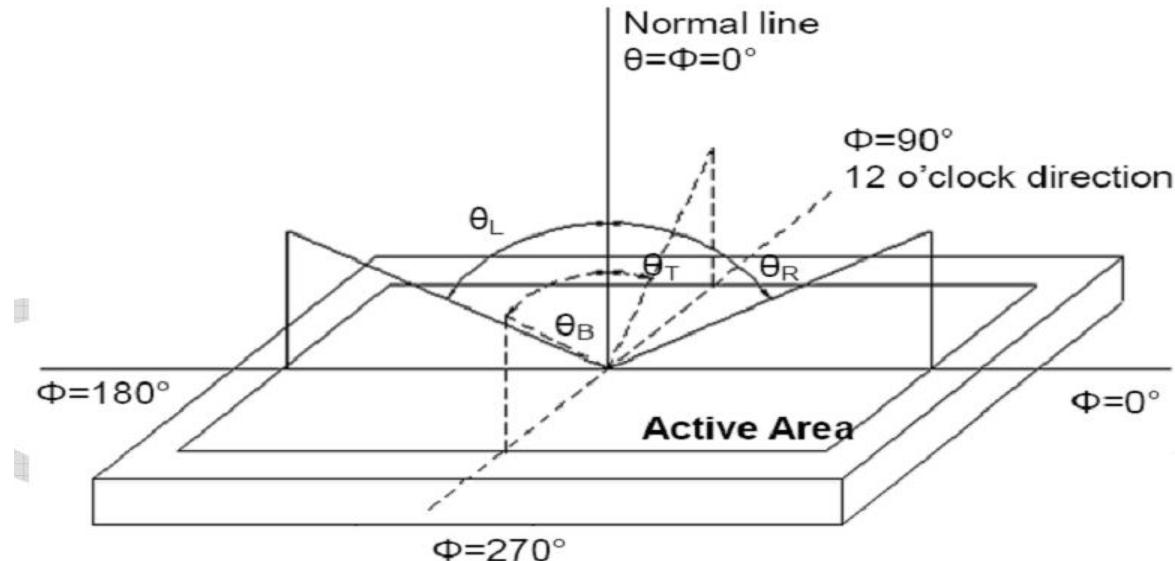
Note (3) Definition of Contrast Ratio (CR)

    The contrast ratio can be calculated by the following expression

    Contrast Ratio (CR) = L255 / L0

    L255: Luminance of gray level 255, L0: Luminance of gray level 0

Note (4) Definition of response time
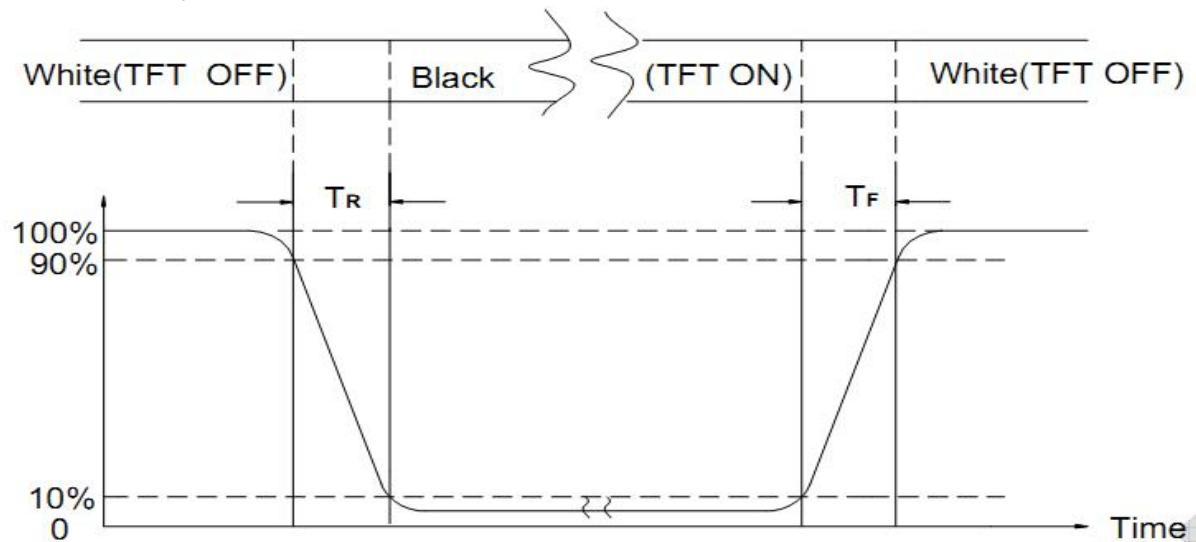
Note (5) Definition of Transmittance (Module is without signal input)

        Transmittance = Center Luminance of LCD / Center Luminance of Back Light x 100%

Note (6) Definition of color chromaticity (CIE1931)

    Color coordinates measured at the center point of LCD

10. Reliability Test Conditions and Methods

No.	Test Items	Test Condition	Inspection After Test
1	High Temperature Storage	70°C±2°C×96Hours	Inspection after 2~4hours storage at room temperature, the samples should be free from defects: 1, Air bubble in the LCD. 2, Seal leak. 3, Non-display. 4, Missing segments. 5, Glass crack. 6, Current IDD is twice higher than initial value. 7, The surface shall be free from damage. 8, The electric characteristic requirements shall be satisfied.
2	Low Temperature Storage	-20°C±2°C×96Hours	
3	High Temperature Operating	60°C±2°C×96Hours	
4	Low Temperature Operating	-10°C±2°C×96Hours	
5	Temperature Cycle(Storage)	-10°C ⟷ 25°C ⟷ 60°C (30min) (5min) (30min) 1cycle Total 10cycle	
6	Damp Proof Test (Storage)	50°C±5°C×90%RH×96Hours	
7	Vibration Test	Frequency:10Hz~55Hz~10Hz Amplitude:1.5mm X,Y,Z direction for total 3hours (packing condition test will be tested by a carton)	
8	Drooping Test	Drop to the ground from 1M height one time every side of carton. (packing condition test will be tested by a carton)	
9	ESD Test	Voltage:±6KV,R:330Ω,C:150PF,Air Mode,10times	
10	Image Sticking Test	25 ± 2°C Operation with test pattern sustained for 2 hrs, then change to gray pattern immediately. After 5 mins, the mura must be disappeared completely Image Sticking –pattern　　　Mid-Gray pattern	

REMARK:
1, The Test samples should be applied to only one test item.
2, Sample side for each test item is 5~10pcs.
3,For Damp Proof Test, Pure water(Resistance＞10MΩ)should be used.
4,In case of malfunction defect caused by ESD damage, if it would be recovered to normal state after resetting, it would be judge as a good part.
5, EL evaluation should be accepted from reliability test with humidity and temperature: Some defects such as black spot/blemish can happen by natural chemical reaction with humidity and Fluorescence EL has.
6, Failure Judgment Criterion: Basic Specification Electrical Characteristic, Mechanical Characteristic, Optical Characteristic.

11. Inspection Standard

11.1 Scope

Specifications contain

11.1.1 Display Quality Evaluation

11.1.2 Mechanics Specification

11.2 Sampling Plan

Unless there is other agreement, the sampling plan for incoming inspection shall follow MIL-STD-105E.

11.2.1 Lot size: Quantity per shipment as one lot (different model as different lot).

11.2.2 Sampling type: Normal inspection, single sampling.

11.2.3 Sampling level: Level II.

11.2.4 AQL: Acceptable Quality Level

      Major defect: AQL=0.65

      Minor defect: AQL=1.5

11.3 Panel Inspection Condition

11.3.1 Environment:

Room Temperature: 25±5°C.

Humidity: 65±5% RH.

Illumination: 300 ~ 700 Lux.

11.3.2 Inspection Distance:

    35±5 cm

11.3.3 Inspection Angle:

The vision of inspector should be perpendicular to the surface of the Module.

11.3.4 Inspection time：

Perceptibility Test Time: 20 seconds max.

11.4 Inspection Plan

Class	Item	Judgment	Class
Packing & Indicate	1. Outside and inside package.	"MODEL NO.", "LOT NO." and "QUANTITY" should indicate on the package.	Minor
	2. Model mixed and quantity.	Other model mixed Quantity short or over	Major
	3. Product indication.	"MODEL NO." should indicate on the product.	Major
Assembly	4. Dimension, LCD glass scratch and scribe defect.	According to specification or drawing.	Major
Appearance	5. Viewing area.	Polarizer edge or LCD's sealing line is visible in the viewing area…….Rejected.	Minor
	6. Blemish, black spot, white spot in the LCD and LCD glass cracks.	According to standard of visual inspection.(inside viewing area)	Minor
	7. Blemish, black spot, white spot and scratch on the polarizer.	According to standard of visual inspection.(inside viewing area)	Minor
	8. Bubble in polarizer.	According to standard of visual inspection.(inside viewing area)	Minor
	9. LCD's rainbow color.	Strong deviation color (or newton ring) of LCD…………………………......Rejected. Or according to limited sample.(if needed, and inside viewing area)	Minor
Electrical	10. Electrical and optical characteristics.(contrast Vop chromaticity….etc)	According to specification or drawing.(inside viewing area)	Major
	11. Missing line.	Missing dot line character	Major
	12.Short circuit. Wrong pattern display.	No display, wrong pattern display, current consumption. Out of specification	Major
	13. Dot defect.(for color and TFT)	According to standard of visual Inspection.	Minor

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11.5 Standard Of Visual Inspection

No.	Class	Item	Judgment
11.5.1	Minor	Black and white spot. Foreign materiel. Dust. Blemish. Scratch.	(A) Round type: Unit: mm **Diameter (mm.) / Acceptable Q'ty** $\Phi \leqq 0.2$ — Disregard $0.2 < \Phi \leqq 0.3$ — 3(Distance>5mm) $0.3 < \Phi$ — 0 Note: $\Phi = $ (length+width)/2 (B) Linear type: Unit: mm **Length / Width (mm.) / Acceptable Q'ty** -- / $W \leqq 0.03$ / Disregard $L \leqq 5.0$ / $0.03 < W \leqq 0.07$ / 2(Distance>5mm) -- / $0.07 < W$ / FOLLOW ROUND TYPE
11.5.2	Minor	Dent on polarizer.	Unit: mm. **Diameter / Acceptable Q'ty** $\Phi \leqq 0.2$ — Disregard $0.2 < \Phi \leqq 0.5$ — 2(Distance>5mm) $0.5 < \Phi$ — 0
11.5.3	Minor	Bubble in polarizer.	Unit: mm. **Diameter / Acceptable Q'ty** $\Phi \leqq 0.2$ — Disregard $0.2 < \Phi \leqq 0.5$ — 2(Distance>5mm) $0.5 < \Phi$ — 0
11.5.4	Minor	Dot defect	**Items / Acceptable Q'ty** Bright dot — $N \leqq 1$ Dark dot — $N \leqq 2$ Total dot — $N \leqq 3$ Pixel define : Note1: The definition of dot: The size of a defective dot over 1/2 of whole dot is regarded as one defective dot. Note 2: Bright dot: Dots appear bright and unchanged in size in which LCD panel is displaying under black pattern. Note 3: The bright dot defect must be visible through 2% ND filter Note 4: Dark dot: Dots appear dark and unchanged in size in which LCD panel is displaying under pure red, green, blue pattern.
11.5.5	Minor	Mura	ND 5% (In 50% gray screen)
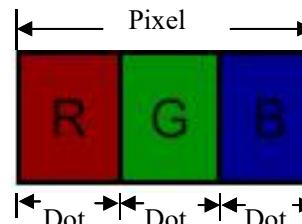
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No.	Class	Item	Judgment
11.5.6	Minor	LCD glass chipping.	$Y>S$ Reject
11.5.7	Minor	LCD glass chipping.	X or $Y>S$ Reject
11.5.8	Major	LCD glass crack.	$Y>(1/2)T$ Reject
11.5.9	Major	LCD glass scribe defect.	1. $a>L/3$, $A>1.5mm$ Reject 2. B : According to dimension
11.5.10	Minor	LCD glass chipping. (on the terminal area)	$\Phi = (x+y)/2>2.5mm$ Reject
11.5.11	Minor	LCD glass chipping. (on the terminal surface)	$Y>(1/3)T$ Reject
11.5.12	Minor	LCD glass chipping.	$Y>T$ Reject
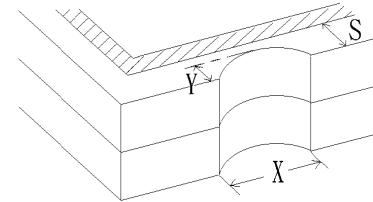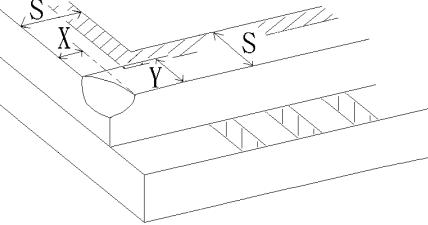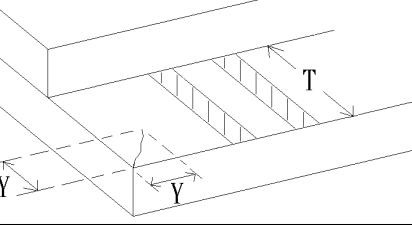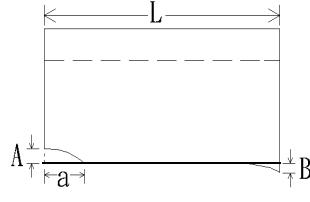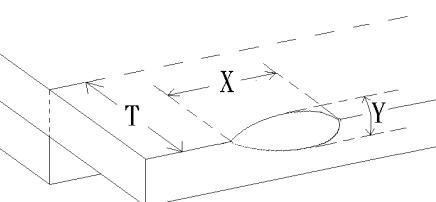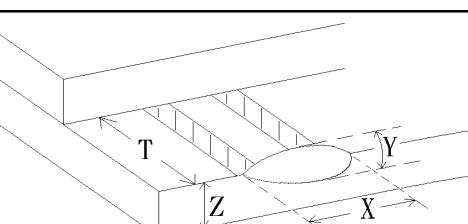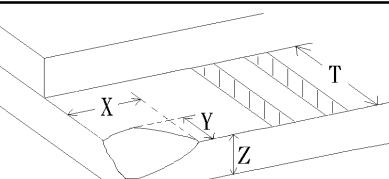
12. Handling Precautions

12.1 Mounting Method

The LCD panel of MTUSATFT module consists of two thin glass plates with polarizes which easily be damaged. And since the module in so constructed as to be fixed by utilizing fitting holes in the printed circuit board.

Extreme care should be needed when handling the LCD modules.

12.2 Caution of LCD Handling And Cleaning

When cleaning the display surface, Use soft cloth with solvent

[Recommended below] and wipe lightly

- Isopropyl alcohol
- Ethyl alcohol

Do not wipe the display surface with dry or hard materials that will damage the polarizer surface.

Do not use the following solvent:

- Water
- Aromatics

Do not wipe ITO pad area with the dry or hard materials that will damage the ITO patterns

Do not use the following solvent on the pad or prevent it from being contaminated:

- Soldering flux
- Chlorine (Cl) , Sulfur (S)

If goods were sent without being silicon coated on the pad, ITO patterns could be damaged due to the corrosion as time goes on.

If ITO corrosion happen by miss-handling or using some materials such as Chlorine (CI), Sulfur (S) from customer, Responsibility is on customer.

12.3 Caution Against Static Charge

The LCD module use C-MOS LSI drivers, so we recommended that you:

Connect any unused input terminal to power or ground, do not input any signals before power is turned on, and ground your body, work/assembly areas, and assembly equipment to protect against static electricity.

12.4 Packing

- Module employs LCD elements and must be treated as such.
- Avoid intense shock and falls from a height.
- To prevent modules from degradation, do not operate or store them exposed direct to sunshine or high temperature/humidity

12.5 Caution for operation

It is an indispensable condition to drive LCD's within the specified voltage limit since the higher

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- voltage then the limit cause the shorter LCD life.
- An electrochemical reaction due to direct current causes LCD's undesirable deterioration, so that the use of direct current drive should be avoided.
- Response time will be extremely delayed at lower temperature then the operating temperature range and on the other hand at higher temperature LCD's how dark color in them. However those phenomena do not mean malfunction or out of order with LCD's, which will come back in the specified operation temperature.
- If the display area is pushed hard during operation, some font will be abnormally displayed but it resumes normal condition after turning off once.
- Slight dew depositing on terminals is a cause for electro-chemical reaction resulting in terminal open circuit.
  Usage under the maximum operating temperature, 50%Rh or less is required.

12.6 Storing

In the case of storing for a long period of time for instance, for years for the purpose or replacement use, the following ways are recommended.

- Storage in a polyethylene bag with the opening sealed so as not to enter fresh air outside in it. And with no desiccant.
- Placing in a dark place where neither exposure to direct sunlight nor light's keeping the storage temperature range.
- Storing with no touch on polarizer surface by the anything else.
  [It is recommended to store them as they have been contained in the inner container at the time of delivery from us

12.7 Safety

- It is recommendable to crash damaged or unnecessary LCD's into pieces and wash off liquid crystal by either of solvents such as acetone and ethanol, which should be burned up later.
- When any liquid leaked out of a damaged glass cell comes in contact with your hands, please wash it off well with soap and water

13. Precaution for Use

13.1

A limit sample should be provided by the both parties on an occasion when the both parties agreed its necessity. Judgment by a limit sample shall take effect after the limit sample has been established and confirmed by the both parties.

13.2

On the following occasions, the handing of problem should be decided through discussion and agreement between responsible of the both parties.

- When a question is arisen in this specification
- When a new problem is arisen which is not specified in this specifications
- When an inspection specifications change or operating condition change in customer is reported to ACROWISE TFT , and some problem is arisen in this specification due to the change
- When a new problem is arisen at the customer's operating set for sample evaluation in the customer site.