



晶采光電科技股份有限公司
AMPIRE CO., LTD.

SPECIFICATIONS FOR LCD MODULE

CUSTOMER	
CUSTOMER PART NO.	
AMPIRE PART NO.	AM-320240LQTZQW-30H
APPROVED BY	
DATE	

☐ Approved For Specifications

☐ Approved For Specifications & Sample

AMPIRE CO., LTD.

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RECORD OF REVISION

Revision Date	Page	Contents	Editor
2019/02/25	--	New Release.	Raymond

1 General Description and Features

3.5 inch Amorphous-TFT-LCD (Thin Film Transistor Liquid Crystal Display) module. This module is composed of a 3.5" TFT-LCD panel, a driver circuit and backlight unit.

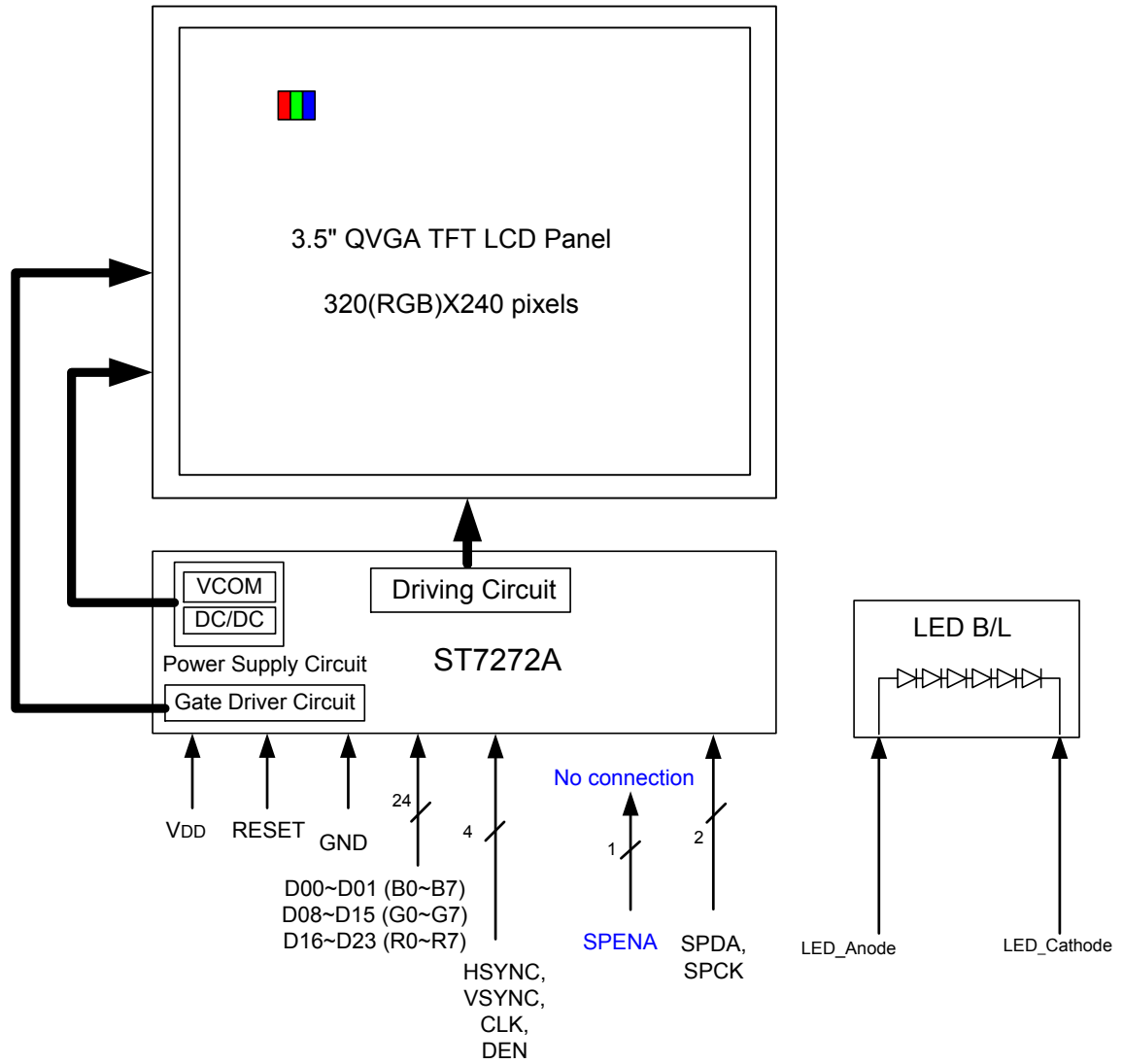
- 1.1 Construction: 3.5" IPS TFT-LCD, White LED Backlight.
- 1.2 Resolution (pixel): 320(R.G.B) X240.
- 1.3 Number of the Colors: 16.7M Dithering (R, G, B 8 bit digital each).
- 1.4 LCD type: Transmissive Color TFT LCD
- 1.5 24Bit RGB Interface
- 1.6 Interface: 54 pin.
- 1.7 Power Supply Voltage: 3.3V single power input. Built-in power supply circuit.

2 Physical specifications

Item	Specifications	unit
Display Resolution	320(RGB)(W) x 240(H)	dot
Active area	70.08 x 52.56	mm
Screen size	3.5(Diagonal)	inch
Pixel pitch	0.219 (W) x 0.219 (H)	mm
Color configuration	R.G.B – Vertical stripe	
Overall Dimension	76.4(W) x 63.4(H) x 3.066(T)	mm
Input interface	digital 24-bits RGB	
Backlight unit	White LED	
Display Mode	Normally Black	
Driver IC	ST7272A	

Note 1: Requirements on Environmental Protection: RoHS

3 Functional Block Diagram



4 Electrical Specifications

TFT LCD Panel FPC Descriptions

No.	Symbol	I/O	Function	Remark
1	LED_Cathod	P	LED_Cathode	
2	LED_Cathod	P	LED_Cathode	
3	LED_Anode	P	LED_Anode	
4	LED_Anode	P	LED_Anode	
5	GND	-	Ground	
6	RESET	-	Reset Signal input. Active Low	
7	NC	-	No Connect	
8	NC	-	No Connect	
9	NC	-	No Connect	
10	NC	-	No Connect	
11	NC	-	No Connect	
12	D00	I	Blue Data Bit 0	
13	D01	I	Blue Data Bit 1	
14	D02	I	Blue Data Bit 2	
15	D03	I	Blue Data Bit 3	
16	D04	I	Blue Data Bit 4	
17	D05	I	Blue Data Bit 5	
18	D06	I	Blue Data Bit 6	
19	D07	I	Blue Data Bit 7	
20	D08	I	Green Data Bit 0	
21	D09	I	Green Data Bit 1	
22	D10	I	Green Data Bit 2	
23	D11	I	Green Data Bit 3	
24	D12	I	Green Data Bit 4	
25	D13	I	Green Data Bit 5	
26	D14	I	Green Data Bit 6	
27	D15	I	Green Data Bit 7	
28	D16	I	Red Data Bit 0	
29	D17	I	Red Data Bit 1	
30	D18	I	Red Data Bit 2	
31	D19	I	Red Data Bit 3	
32	D20	I	Red Data Bit 4	

No.	Symbol	I/O	Function	Remark
33	D21	I	Red Data Bit 5	
34	D22	I	Red Data Bit 6	
35	D23	I	Red Data Bit 7	
36	HSYNC	I	Horizontal Synchronous Signal	
37	VSYNC	I	Vertical Synchronous Signal	
38	CLK	I	Data Clock	
39	NC	-	No Connect	
40	NC	-	No Connect	
41	VDD	P	power supply (3.3V)	
42	VDD	P	power supply (3.3V)	
43	SPENA	I	No Connect	
44	GND	P	Ground	
45	NC	-	No Connect	
46	GND	P	Ground	
47	NC	-	No Connect	
48	NC	-	No Connect	
49	SPCK	I	SPI Serial Clock	
50	SPDA	I	SPI Serial Data Input/output	
51	NC	-	No Connect	
52	DEN	I	Data enabling signal	
53	GND	P	Ground	
54	GND	P	Ground	

Note1: I/O definition:

I----Input O----Output P----Power/Ground

5 Basic Display Color and Gray Scale

	Display	MSB				LSB				MSB				LSB				MSB				LSB				Gray scale Level
		R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	B5	B4	B3	B2	B1	B0	
Basic color	Black	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	-
	Blue	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	H	H	H	H	H	H	H	H	-
	Green	L	L	L	L	L	L	L	L	H	H	H	H	H	H	H	H	L	L	L	L	L	L	L	L	-
	Light Blue	L	L	L	L	L	L	L	L	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	-
	Red	H	H	H	H	H	H	H	H	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	-
	Purple	H	H	H	H	H	H	H	H	L	L	L	L	L	L	L	L	H	H	H	H	H	H	H	H	-
	Yellow	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	L	L	L	L	L	L	L	L	-
	White	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	-
Gray scale of Red	Black	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L0
	Dark ↑ ↓ Light	L	L	L	L	L	L	L	H	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L1
		L	L	L	L	L	L	H	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L2
		:				:				:				:				:				:				L3...L251
		H	H	H	H	H	H	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L252
		H	H	H	H	H	H	L	H	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L253
		H	H	H	H	H	H	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L254
	Red	H	H	H	H	H	H	H	H	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	Red L255
Gray scale of Green	Black	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L0
	Dark ↑ ↓ Light	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	H	L	L	L	L	L	L	L	L	L1
		L	L	L	L	L	L	L	L	L	L	L	L	L	L	H	L	L	L	L	L	L	L	L	L	L2
		:				:				:				:				:				:				L3...L251
		L	L	L	L	L	L	L	L	H	H	H	H	H	H	L	L	L	L	L	L	L	L	L	L	L252
		L	L	L	L	L	L	L	L	H	H	H	H	H	H	L	H	L	L	L	L	L	L	L	L	L253
		L	L	L	L	L	L	L	L	H	H	H	H	H	H	L	L	L	L	L	L	L	L	L	L	L254
		L	L	L	L	L	L	L	L	H	H	H	H	H	H	H	L	L	L	L	L	L	L	L	L	Green L255
	Green	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L0
Gray scale of Blue	Black	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	H	L1
	Dark ↑ ↓ Light	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	H	L	L2
		:				:				:				:				:				:				L3...L251
		L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	H	H	H	H	H	H	L	L	L	L252
		L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	H	H	H	H	H	H	L	H	L	L253
		L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	H	H	H	H	H	H	L	L	L	L254
	Blue	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	H	H	H	H	H	H	H	H	Blue L255

6 Absolute Maximum Ratings

(The following are maximum values which, if exceeded, may cause operation or damage to the unit.)

Item	Symbol	Min	Max	Unit	Note
Power Supply Voltage	VDD	-0.3	4.0	V	
Operating Temperature	T _{OP}	-20	70	°C	
Storage Temperature	T _{ST}	-30	80	°C	

Note:

*1. Non-condensation.

*2. Temp. ≤ 60°C, 90%RH Max.

Temp. > 60°C, Absolute humidity shall be less than 90%RH.

7 Electrical Characteristics

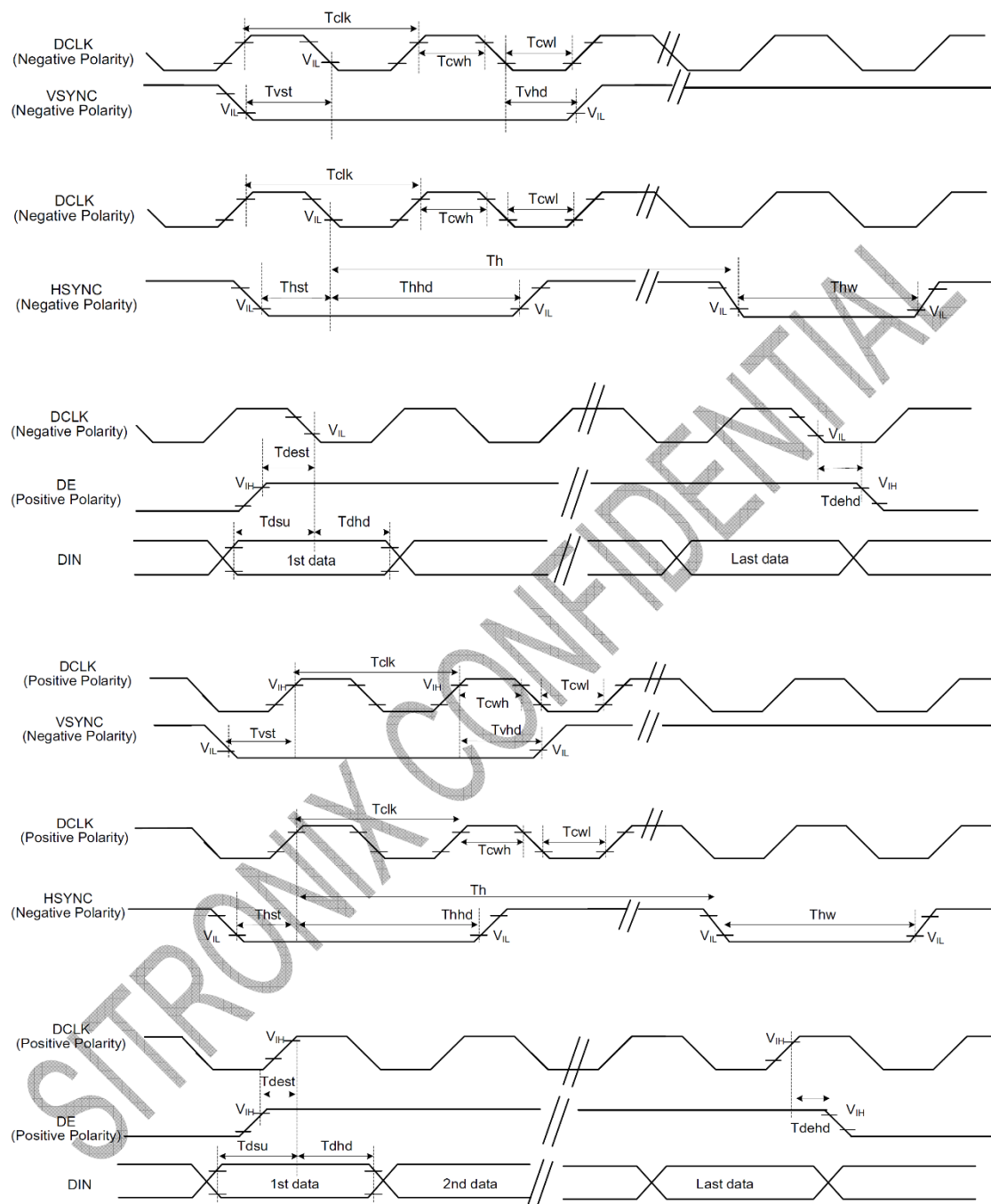
7.1 DC Electrical characteristic of the LCD

Typical operating conditions (GND=0V, Ta=25°C)

Item		Symbol	Min.	Typ.	Max.	Unit	Remark
Power supply		VDD	3.0	3.3	3.6	V	
Input Voltage for logic	H Level	V _{IH}	0.7*VDD	-	VDD	V	
	L Level	V _{IL}	0	-	0.3*VDD	V	
Supply Current		RUN Mode	--	20	--	mA	FR=60Hz
		Standby mode	--	.	50	uA	

7.2 AC Electrical characteristic of the LCD

7.2.1 System Bus Timing for RGB Interface



Item	Symbol	Min.	Typ.	Max.	Unit	Conditions
CLK Pulse Duty	Tclk	40	50	60	%	
HSYNC Width	Thw	2	-	-	DCLK	
HSYNC Period	Th	55	60	65	us	
VSYNC Setup Time	Tvst	12	-	-	ns	
VSYNC Hold Time	Tvhd	12	-	-	ns	
HSYNC Setup Time	Thst	12	-	-	ns	
HSYNC Hold Time	Thhd	12	-	-	ns	
Data Setup Time	Tdsu	12	-	-	ns	
Data Hold Time	Tdhd	12	-	-	ns	
DE Setup Time	Tdest	12	-	-	ns	
DE Hold Time	Tdehd	12	-	-	ns	

7.3 Electrical characteristic of LED Back-light

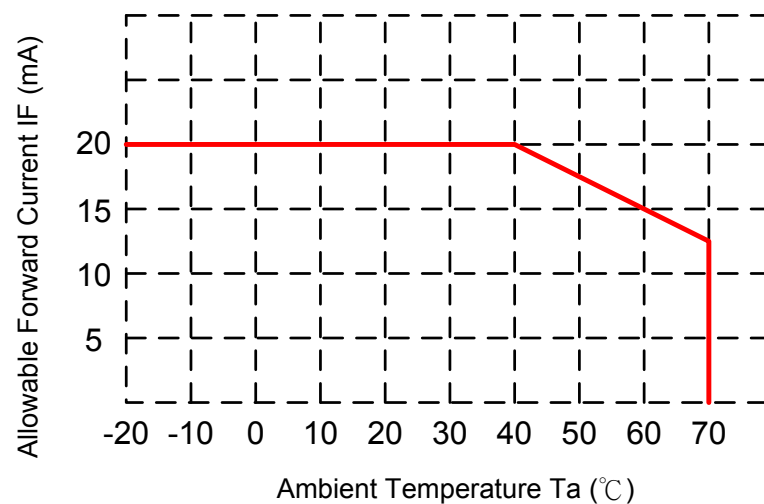
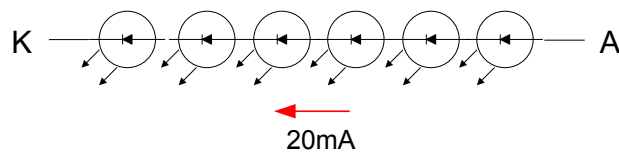
Item	Symbol	Min.	Typ.	Max.	Unit	Remark
Forward current	IF	-	20	--	mA	
Forward voltage	VF	16.2	18.0	19.2	V	
Power consumption	WBL	-	360	-	mW	
Operating Life time			36		kHrs	Ta=25°C

Note1: The figure below shows the connection of backlight LED.

Note2: Optical performance should be evaluated at Ta=25°C only.

Note3: IF LED is driven by high current, high ambient temperature & humidity condition, the life time of LED will be reduced.

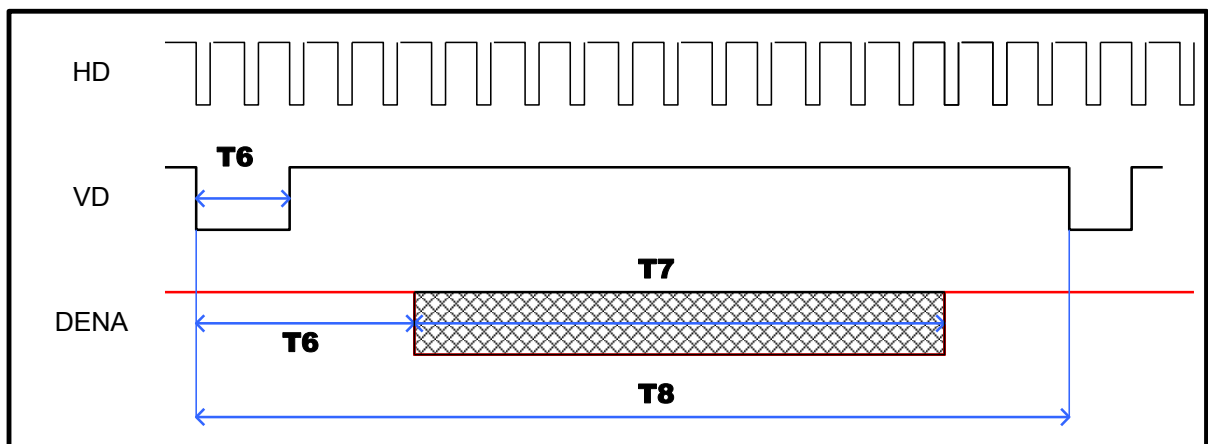
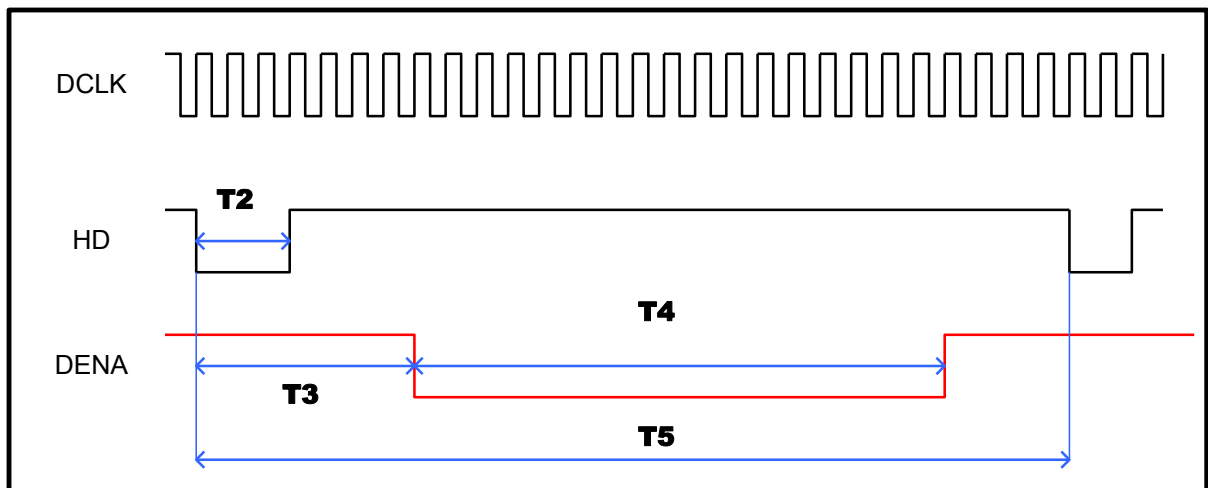
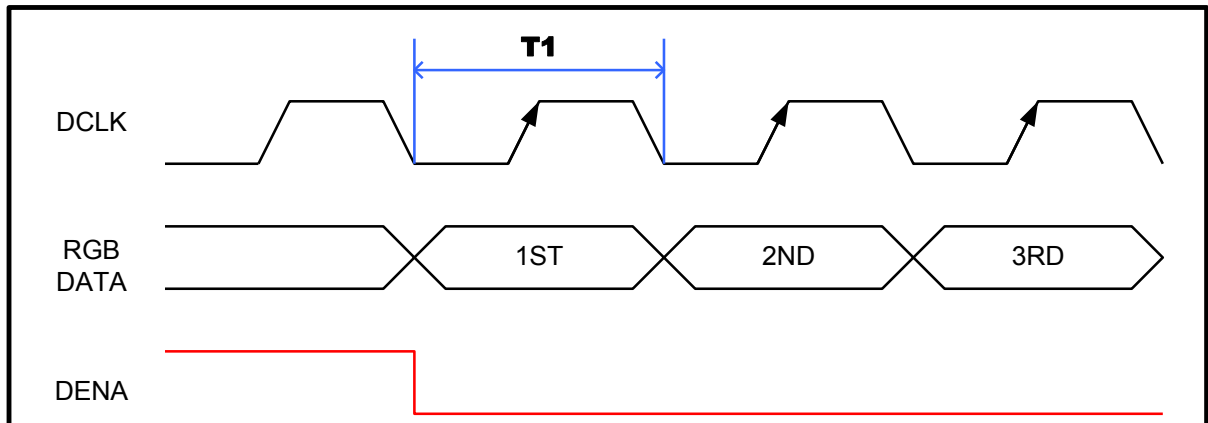
Note4: Operating life means brightness goes down to 50% initial brightness. Typical operating life time is estimated data.



8 Communication Interface

8.1 SYNC-DE Mode

TTL RGB



RGB Mode Selection Table	DCLK
SYNC - DE Mode	Input
SYNC Mode	Input
DE Mode	Input

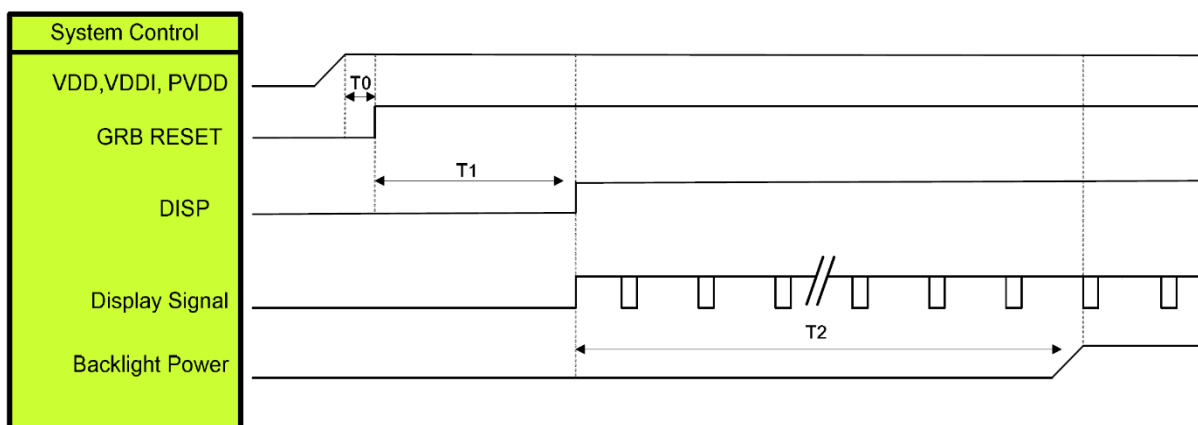
Note: "Input" means these signals are driven by host side.

8.2. Parallel 24-bit RGB Input Timing Table

Parallel 24-bit RGB Input Timing (PVDD=VDD=VDDI= 3.3V, AGND= 0V, TA=25°C)

ITEM	SYMBOL	MIN	TYP	MAX	UNIT
Clock Frequency	1/T1	5	6	8	MHz
HSYNC Plus Wide	T2	2	4	43	clocks
HSYNC to DE	T3	3	43	43	Clocks
Horizontal Display Period	T4	--	320	--	Clocks
Horizontal total Period	T5	325	371	438	Clocks
VSYNC Plus Wide	T2	2	4	12	Lines
VSYNC to DE	T6	2	12	12	Lines
Vertical Display Period	T7	--	240	--	Lines
Vertical total Period	T8	244	260	289	Lines

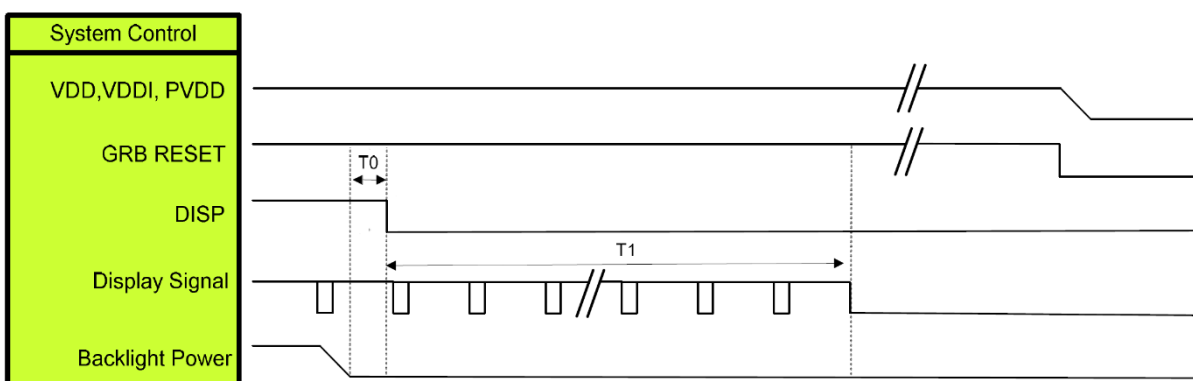
8.3 Power on sequence



Symbol	Description	Min. Time	Unit
T0	System power stability to GRB RESET signal	0	ms
T1	GRB RESET= "High" to DISP="High"	10	ms
T2	Display Signal output to Backlight Power on	250	ms

Note: Display signal: DCLK; VSYNC; HSYNC; DE; DR[7:0]; DG[7:0]; DB[7:0]

8.4 Power off sequence



Symbol	Description	Min. Time	Unit
T0	Backlight Power off to DISP="Low"	5	ms
T1	DISP="Low" to IC internal voltage discharge complete	80	ms

Note: Display signal: DCLK; VSYNC; HSYNC; DE; DR[7:0]; DG[7:0]; DB[7:0]

9 Optical specification

9.1 Optical characteristic of the LCD

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Contrast		CR	$\Theta=0$ Normal viewing angle	640	800	—		(1)(2)
Response time		T_R+T_F		—	30	40	msec	(1)(3)
White luminance (Center)		Y_L		350	400	—	cd/m ²	(1)(4)
Color chromaticity (CIE1931)	White	W_x		-0.06	0.317	+0.06		(1)(4)
		W_y			0.339			
	Red	R_x			0.646			
		R_y			0.332			
	Green	G_x			0.323			
		G_y			0.567			
	Blue	B_x			0.134			
		B_y			0.121			
Viewing angle	Hor.	Θ_L	CR>10	75	85	—		
		Θ_R		75	85	—		
	Ver.	Θ_U		75	85	—		
		Θ_D		75	85	—		

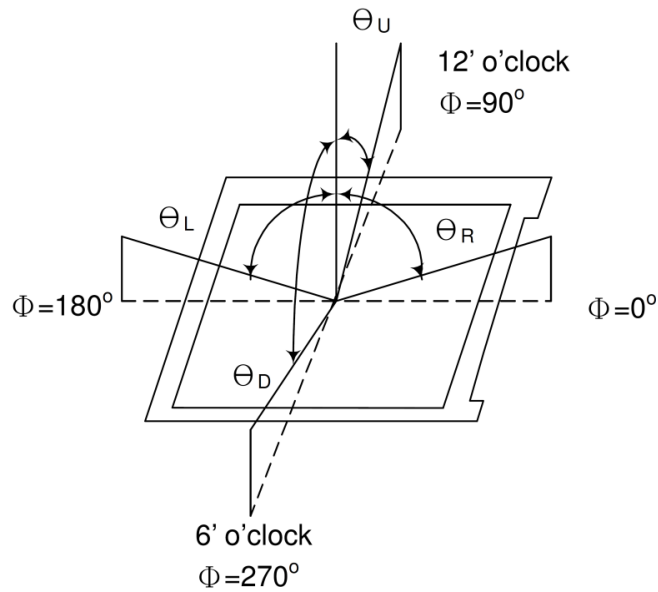
Measuring Condition

- Measuring surrounding : dark room
- Ambient temperature : 25±2°C
- 15min. warm-up time.

Measuring Equipment

Measuring Equipment is BM-7

Note 1 Definition of viewing angle

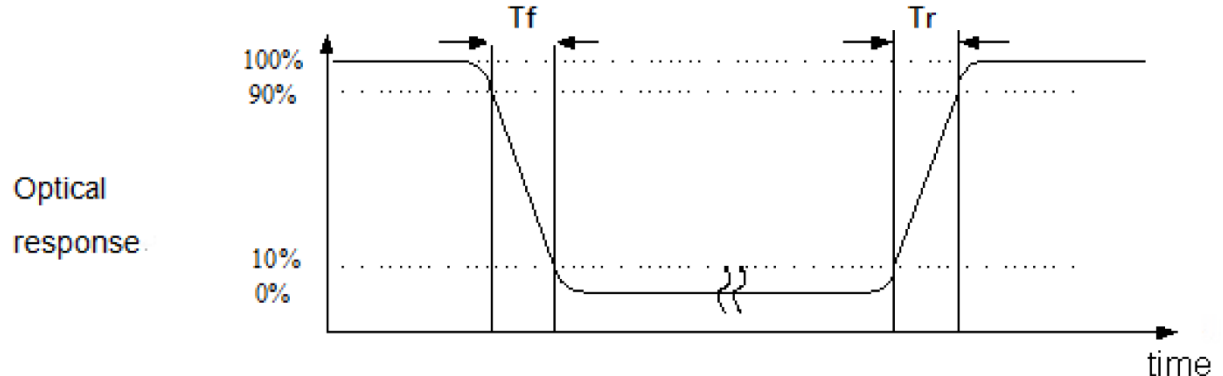


Note 2: Definition of contrast ratio (CR)

Measured at the center point of panel

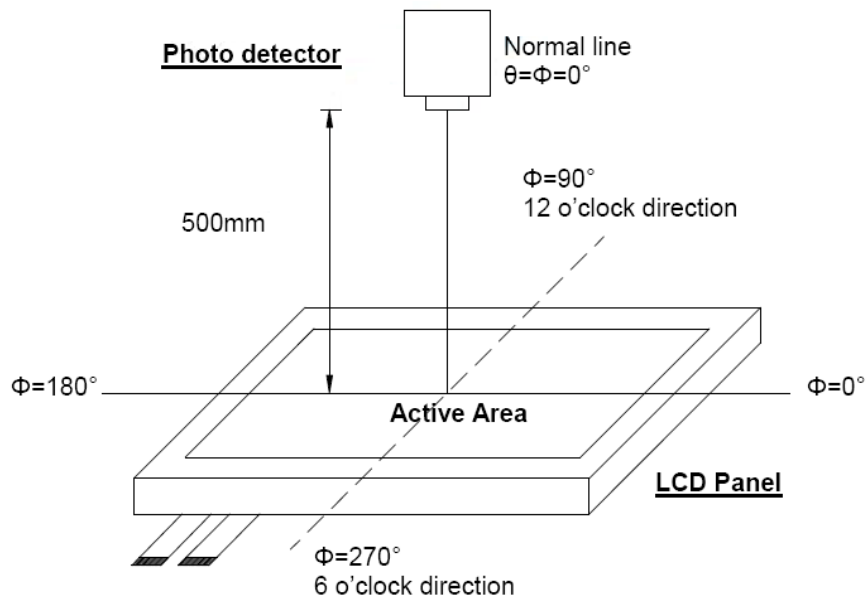
$$CR = \frac{\text{Luminance with all pixels white}}{\text{Luminance with all pixels black}}$$

Note 3: Definition of response time: Sum of T_R and T_F



Note 4: Definition of optical measurement setup

The optical characteristics should be measured in dark room. After 30 minutes operation, the optical properties are measured at the center point of the LCD screen. (Response time is measured by Photo detector TOPCON BM-7, other items are measured by BM-5A/Field of view: 1° / Height: 500mm.)



10 Reliability Test

The reliability test items and its conditions are shown below.

Test Item	Test Conditions	Note
High Temperature Operation	70±3°C , t=240 hrs	
Low Temperature Operation	-20±3°C , t=240 hrs	
High Temperature Storage	80±3°C , t=240 hrs	1,2
Low Temperature Storage	-30±3°C , t=240 hrs	1,2
Storage at High Temperature and Humidity	60°C, 90% RH , 240 hrs	1,2
Vibration Test (Packing)	Sweep frequency : 10~55~10 Hz/1min Amplitude : 0.75mm Test direction : X.Y.Z/3 axes Duration : 30 min/each axis	2

Note 1: Condensation of water is not permitted on the module.

Note 2: The module should be inspected after 1 hour storage in normal conditions (15-35°C, 45-65%RH).

Note 3: The module shouldn't be tested more than one condition, and all the test conditions are independent.

Note 4: All the reliability tests should be done without protective film on the module.

11 USE PRECAUTIONS

11.1 Handling Precautions

- 11.1.1. The display panel is made of glass. Do not subject it to a mechanical shock by dropping it from a high place, etc.
- 11.1.2. If the display panel is damaged and the liquid crystal substance inside it 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.
- 11.1.3. Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary.
- 11.1.4. The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully.
- 11.1.5. If the display surface is contaminated, breathe on the surface and gently wipe it with a soft dry cloth. If still not completely clear, moisten cloth with one of the following solvents:
 - Isopropyl alcohol
 - Ethyl alcoholSolvents other than those mentioned above may damage the polarizer. Especially, do not use the following:
 - Water
 - Ketone
 - Aromatic solvents
- 11.1.6. Do not attempt to disassemble the LCD Module.
- 11.1.7. If the logic circuit power is off, do not apply the input signals.
- 11.1.8. To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.
 - 11.1.8.1. Be sure to ground the body when handling the LCD Modules.
 - 11.1.8.2. Tools required for assembly, such as soldering irons, must be properly ground.
 - 11.1.8.3. To reduce the amount of static electricity generated, do not conduct assembly and other work under dry conditions.
 - 11.1.8.4. The LCD Module is coated with a film to protect the display surface. Be care when peeling off this protective film since static electricity may be generated.

11.2 Storage Precautions

- 11.2.1. When storing the LCD modules, avoid exposure to direct sunlight or to the light of fluorescent lamps.
- 12.2.2. The LCD modules should be stored under the storage temperature range. If the LCD modules will be stored for a long time, the recommend condition is:
Temperature : 0°C ~ 40°C Relatively humidity: ≤80%
- 11.2.3. The LCD modules should be stored in the room without acid, alkali and harmful gas.

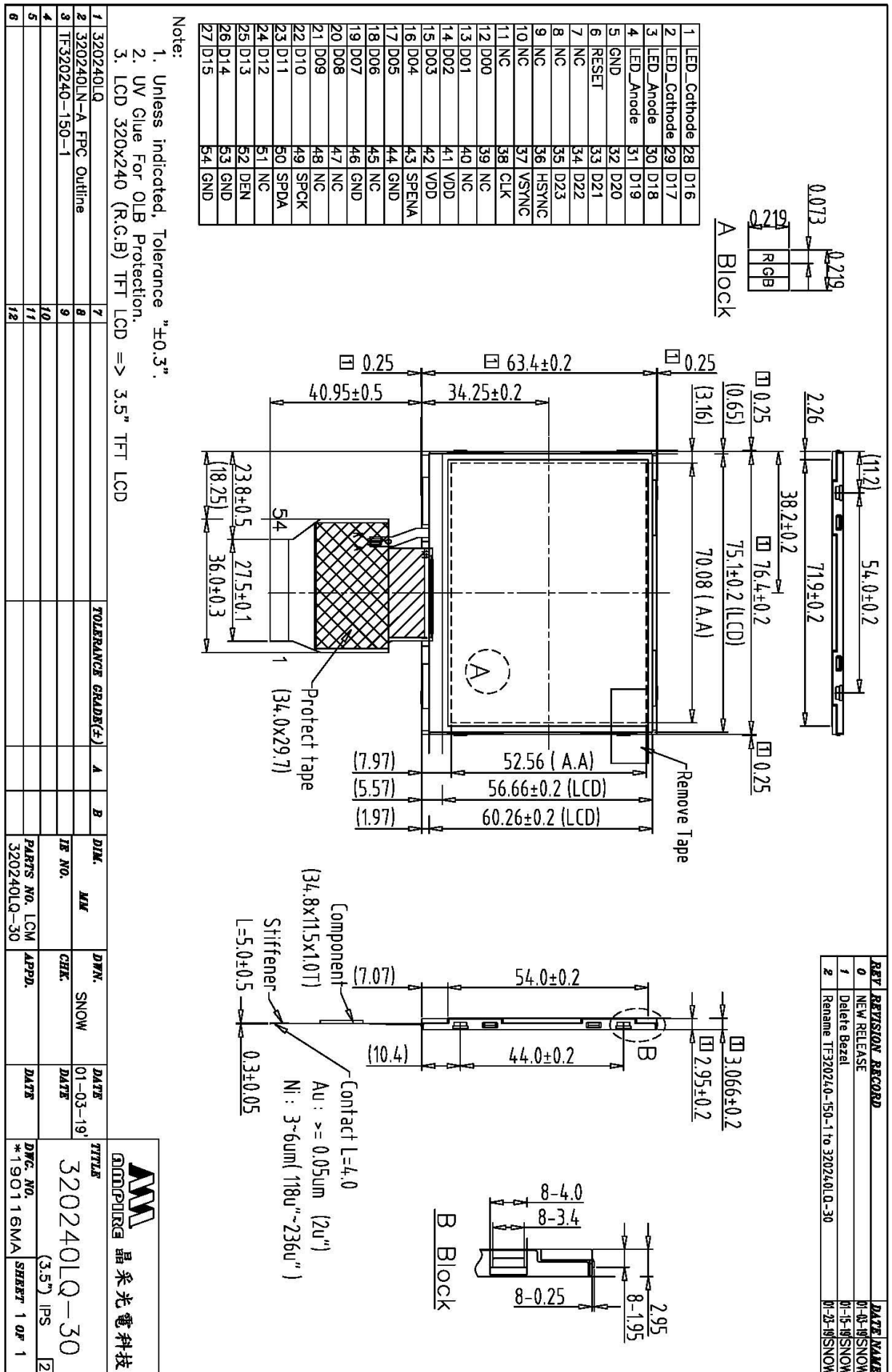
11.3 Transportation Precautions

The LCD modules should be no falling and violent shocking during transportation, and also should avoid excessive press, water, damp and sunshine.

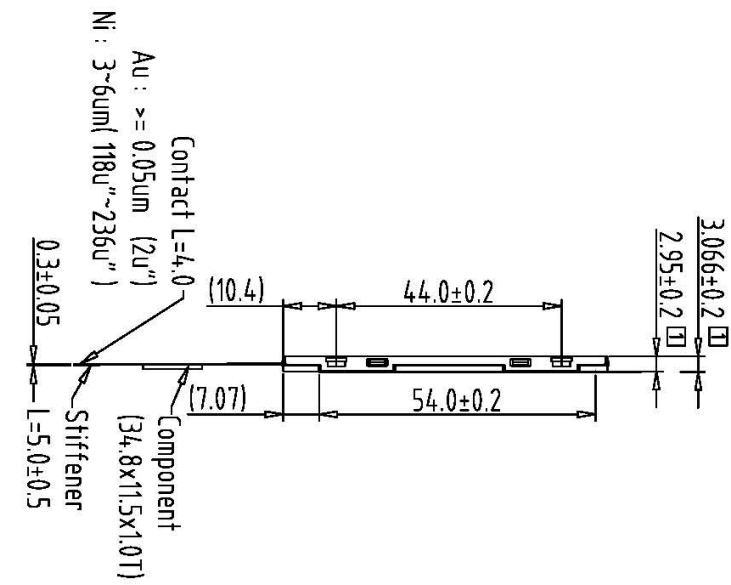
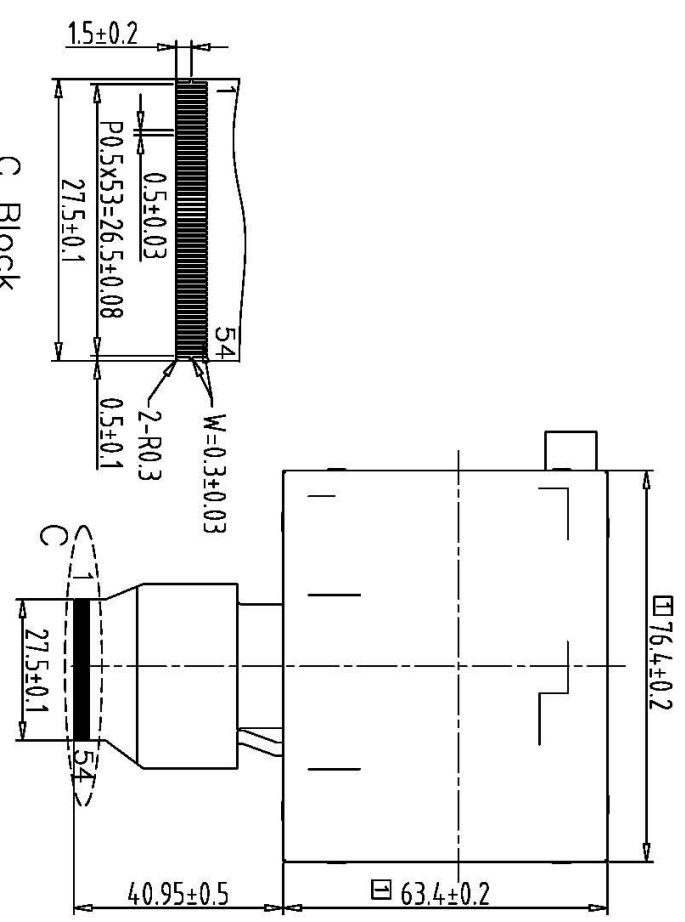
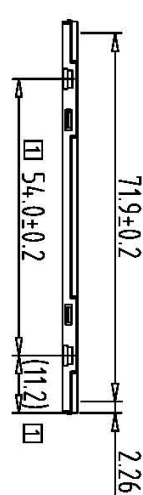
11.4 Other

- 11.4.1. AMIPRE will provide one year warrantee for all products and three months warrantee for all repairing products.
- 11.4.2. Do not keep the LCD at the same display pattern continually. The residual image will happen and it will damage the LCD. Please use screen saver.

12 Mechanical Dimensions



REV. REVISION RECORD		DATE NAME
0	NEW RELEASE	01-03-19 SNOW
1	Delete Bezel	01-03-19 SNOW
2	Rename TF320240-150-1 to 320240LQ-30	01-03-19 SNOW



Contact L=4.0
 Au : $\geq 0.05\mu\text{m}$ (2u")
 Ni : 3~6um(118u"~236u")
 Stiffener
 L=5.0±0.5

1	LED_Cathode	28	D16
2	LED_Cathode	29	D17
3	LED_Anode	30	D18
4	LED_Anode	31	D19
5	GND	32	D20
6	RESET	33	D21
7	NC	34	D22
8	NC	35	D23
9	NC	36	H SYNC
10	NC	37	V SYNC
11	NC	38	CLK
12	D00	39	NC
13	D01	40	NC
14	D02	41	VDD
15	D03	42	VDD
16	D04	43	SPENA
17	D05	44	GND
18	D06	45	NC
19	D07	46	GND
20	D08	47	NC
21	D09	48	NC
22	D10	49	SPCK
23	D11	50	SPDA
24	D12	51	NC
25	D13	52	DEN
26	D14	53	GND
27	D15	54	GND

Note:

1. Unless indicated, Tolerance "±0.3".
2. UV Glue For OLB Protection.
3. LCD 320x240 (R.G.B) TFT LCD => 3.5" TFT LCD

C Block

Back view

1	320240LQ	7		TOLERANCE GRADE(±)	A	B	DIAM.	MM	DWN.	SNOW	DATE	01-03-19	TITLE	320240LQ-30	DWG. NO.	*190117MA	SHEET	1 OF 1
2	320240LN-A FPC Outline	8																
3	TF320240-150-1	9																
4		10																
5		11																
6		12																

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