产品规格书

Product Type: 6.2″TFT LCD Module

LCD Nunmber: AP062NA-01B

MODULE NO.:

CUSTOMER APPROVED	PREPARE BY	CHECK BY	APPROVED BY
SUPPLIER APPROVED	PREPARE BY	CHECK BY	APPROVED BY

■ Preliminary Specification

☐ Final Specific

1.0 GENERAL DESCRIPTION

1.1 Introduction

HannStar Display model AP062NA-01B is a color active matrix thin film transistor (TFT) liquid crystal display (LCD) that uses amorphous silicon TFT as a switching device. This model is composed of a TFT LCD panel, a driving circuit and a back- light system. This TFT LCD has a 6.2 (16:9) inch diagonally measured active display area with 800 horizontal by 480 vertical pixel resolutions.

1.2 Features

- 6.2 (16:9 diagonal) inch configuration
- 6 bits + FRC driver with 1channel TTL interface
- LED Backlight
- Up/Down, Left/Right reversion selection
- RoHS/ Halogen Free Compliance

1.3 Applications

- Automotive

1.4 General information

Item		Specification	Unit
Outline Dimension		162.2 x 95.9 x 7.9(T)	mm
Display area		137.52(H) x 77.232(V)	mm
Number of Pixel		800 RGB (H) x 480(V)	pixels
Pixel pitch		0.1719(H) x 0.1609(V)	mm
Pixel arrangement		RGB Vertical stripe	
Display mode		Normally white	
Surface treatment		Antiglare, Hard-Coating(3H) with EWV film	
Weight		160 (Typ.)	g
Back-light		Side-Light type	
Power Consumption	B/L System	1.54 (Max.)	W

1.5 Mechanical Information

Item		Min.	Typ.	Max.	Unit
Module Size	Horizontal(H)	161.9	162.2	162.5	mm
	Vertical(V)	95.6	95.9	96.2	mm
	Depth(D)	7.6	7.9	8.2	mm
Weight (Without inverter)		—	160	—	g

2.0 ABSOLUTE MAXIMUM RATINGS

2.1 Electrical Absolute Rating

2.1.1 TFT LCD Module

Item	Symbol	Min.	Max.	Unit	Note
Power supply voltage	Vcc	-0.3	6.0	V	GND=0
	V_{GH}	-0.3	40	V	GND=0
	V_{GL}	-20	0.3	V	GND=0
	AV_{DD}	-0.5	15	V	AGND=0
	V_{COM}	0	6	V	
Logic Signal Input Level	V_I	-0.3	Vcc +0.3	V	

2.1.2 Back-Light Unit

Item	Symbol	Typ.	Max.	Unit	Note
LED current	I_L	140	—	mA	(1) (2)(3)
LED voltage	V_L	9.5	—	V	(1) (2)(3)

Note

(1) Permanent damage may occur to the LCD module if beyond this specification. Functional operation should be restricted to the conditions described under normal operating conditions.

(2) Ta =25±2℃

(3) Test Condition: LED current 140 mA. The LED lifetime could be decreased if operating IL is larger than 140mA.

2.2 Environment Absolute Rating

Item	Symbol	Min.	Max.	Unit	Note
Operating Temperature	T_{opa}	-30	80	℃	
Storage Temperature	T_{stg}	-40	95	℃	

3.0 OPTICAL CHARACTERISTICS

3.1 Optical specification

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Contrast		CR	Θ=0 Normal viewing angle	480	600	—		(1)(2)
Response time	Rising	T_R		—	2	4	msec	(1)(3)
	Falling	T_F		—	6	12		
White luminance (Center)		Y_L		500	600	—	cd/m^2	(1)(4) (I_L=140mA)
Color chromaticity (CIE1931)	White	W_x		0.260	0.310	0.360		(1)(4)
		W_y		0.280	0.330	0.380		
Viewing angle	Hor.	Θ_L	CR>10	65	75	—		
		Θ_R		65	75	—		
	Ver.	Θ_U		60	70	—		
		Θ_D		60	70	—		
Brightness uniformity		B_{UNI}	Θ=0	70	-	—	%	(5)(7)
Optima View Direction		6 O' clock						(6)

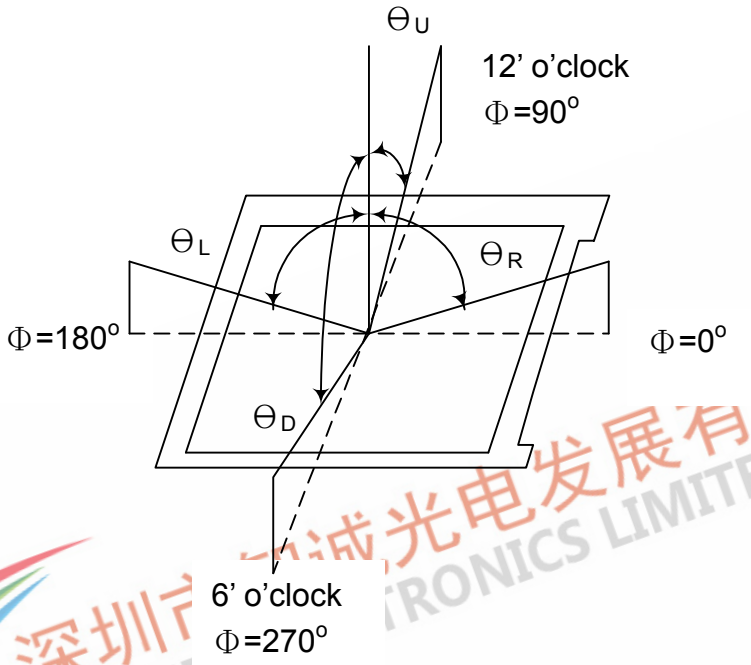
3.2 Measuring Condition

- Measuring surrounding: dark room
- LED current I_L : 140mA
- Ambient temperature: 25±2°C
- 15min. warm-up time.

3.3 Measuring Equipment

- FPM520 of Westar Display technologies, INC., which utilized SR-3 for Chromaticity and BM-5A for other optical characteristics.
- Measuring spot size: 20 ~ 21 mm

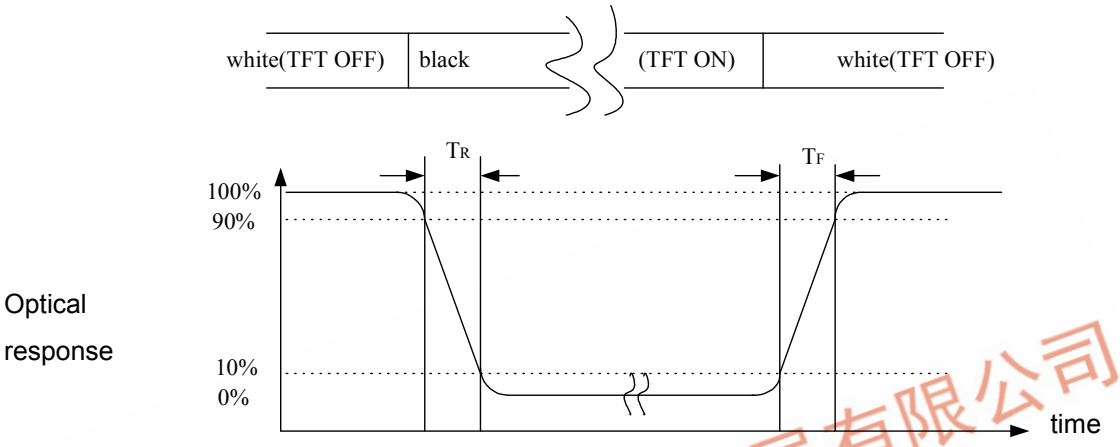
Note (1) Definition of Viewing Angle:



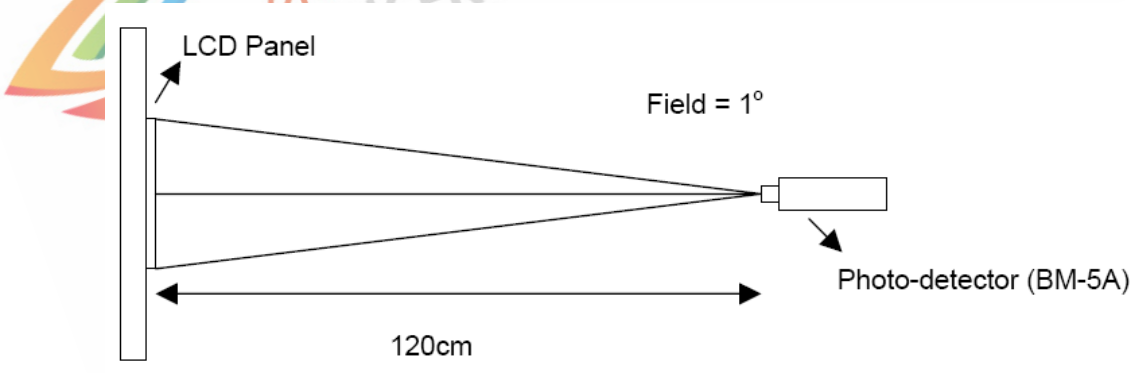
Note (2) Definition of Contrast Ratio (CR):

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

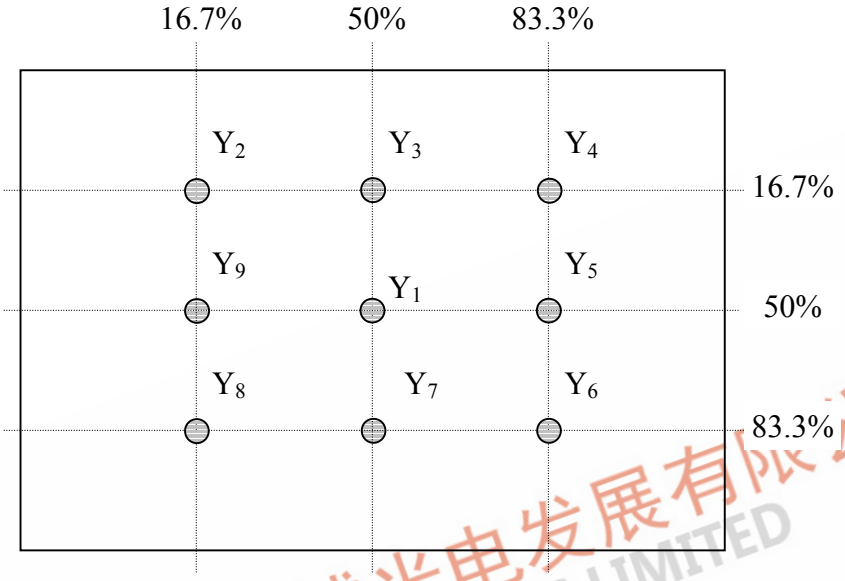
Note (3) Definition of Response Time : Sum of T_R and T_F



Note (4) Definition of optical measurement setup



Note (5) Definition of brightness uniformity



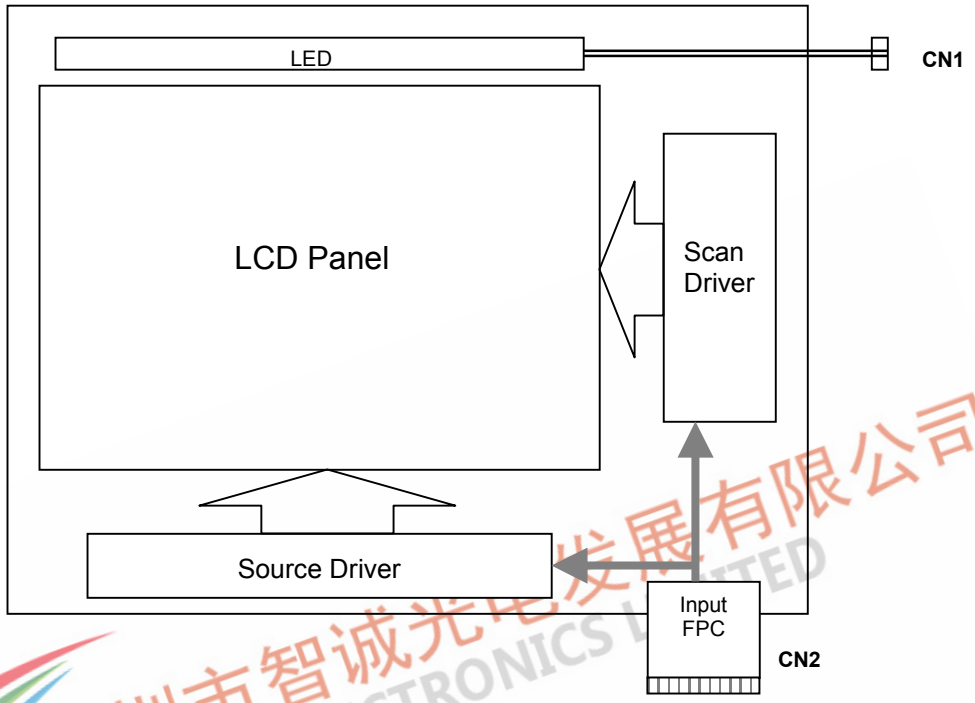
$$\frac{\text{(Min Luminance of 9 points)}}{\text{(Max Luminance of 9 points)}} \times 100\%$$

Note (6) Rubbing Direction (The different Rubbing Direction will cause the different optimal view direction.

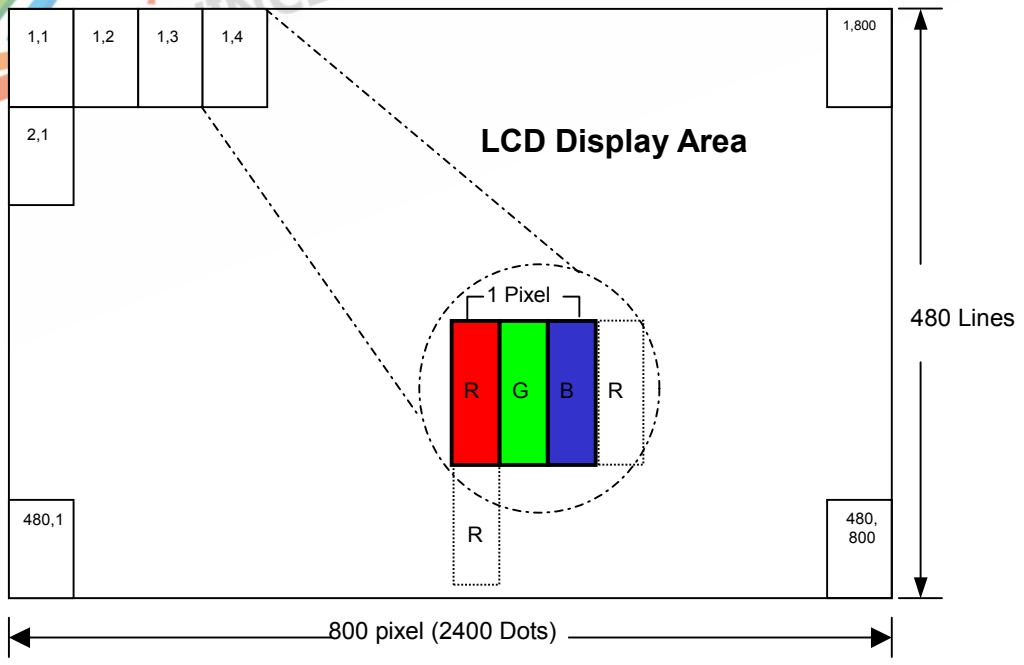
Note (7) Measured at the brightness of the panel when all terminals of LCD panel are electrically open.

4.0 BLOCK DIAGRAM

4.1 TFT LCD Module



4.2 Pixel Format



5.0 INTERFACE PIN CONNECTION

5.1 TFT LCD Module

CN2 (Input signal): FPC Down Connector, (FH28-60S-0.5SH (HIROSE), 60pin,pitch = 0.5mm)

Terminal no.	Symbol	I/O	Function
1	AGND	P	Analog Ground
2	AVDD	P	Analog Power
3	VCC	P	Digital Power
4	R0	I	Data Input(LSB)
5	R1	I	Data Input
6	R2	I	Data Input
7	R3	I	Data Input
8	R4	I	Data Input
9	R5	I	Data Input
10	R6	I	Data Input
11	R7	I	Data Input(MSB)
12	G0	I	Data Input(LSB)
13	G1	I	Data Input
14	G2	I	Data Input
15	G3	I	Data Input
16	G4	I	Data Input
17	G5	I	Data Input
18	G6	I	Data Input
19	G7	I	Data Input(MSB)
20	B0	I	Data Input(LSB)
21	B1	I	Data Input
22	B2	I	Data Input
23	B3	I	Data Input
24	B4	I	Data Input
25	B5	I	Data Input
26	B6	I	Data Input
27	B7	I	Data Input(MSB)
28	DCLK	I	Clock input
29	DE	I	Data Enable signal
30	HSD	I	Horizontal sync input.Negative polarity
31	VSD	I	Vertical sync input.Negative polarity
32	MODE3	I	DE/SYNC mode select .normally pull high H:DE mode.L:HSD/VSD mode
33	RSTB	I	global reset pin.Active low to enter reset state.suggest to connecting with an RC reset circuit for stability .normally pull high.
34	STBYB	I	standby mode,normally pull high STBYB="1",normal operation STBYB="0",timming control ,soruce driver will turn off,all output are high-Z
35	SHLR	I	Source right or left sequence control.SHLR="L",shift left:last data=S1<-S2…S1200=first data SHLR="H",shift right:first data=S1->SS2…S1200=last data

Terminal no.	Symbol	I/O	Function
36	VCC	P	Digital Power
37	UPDN	I	gate up or down scan control. UPDN="L" , DOWN shift : G1->G2…->G480 ; UPDN="H", up shift: G1<-G2…<-G480
38	GND	P	Digital Ground
39	AGND	P	Analog Ground
40	AVDD	P	Analog Power
41	VCOMin	I	For external VCOM DC input (Adjustable)
42	DITH	I	Dithering setting: DITH="H" 6bit resolution (last 2 bits of input data truncated) (default setting) DITH="L" 8bit resolution
43	NC	-	Not connect For Test
44	NC	-	Not connect
45	V10	P	Gamma correction voltage reference
46	V9	P	Gamma correction voltage reference
47	V8	P	Gamma correction voltage reference
48	V7	P	Gamma correction voltage reference
49	V6	P	Gamma correction voltage reference
50	V5	P	Gamma correction voltage reference
51	V4	P	Gamma correction voltage reference
52	V3	P	Gamma correction voltage reference
53	V2	P	Gamma correction voltage reference
54	V1	P	Gamma correction voltage reference
55	NC	-	Not connect
56	VGH	P	Positive Power for TFT
57	VCC	P	Digital Power
58	VGL	P	Negative Power for TFT
59	GND	P	Digital Ground
60	NC	-	Not connect

5.2 Back-Light Unit

CN1 LED Power Source (**BHSR-02VS-1**) or equivalent

Mating Connector: (**SBHT-002T-P0.5**) or equivalent

Terminal no.	Symbol	Function	Color
1	VL	LED power supply (high voltage)	Red
2	GL	LED power supply (low voltage)	White

6.0 ELECTRICAL CHARACTERISTICS

6.1 TFT LCD Module

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Supply Voltage	Vcc	3.0	3.3	3.6	V	
	V_{GH}	12	15	23	V	
	V_{GL}	-12	-7	-5	V	
	AV_{DD}	9.9	10	10.1	V	
VCOM	VCOMin	-	3.4	-	V	
Input signal voltage	V_{iH}	0.7 Vcc	-	Vcc	V	Note (1)
	V_{iL}	0	-	0.3 Vcc	V	
Current of power supply	I_{DD}	-	12.37	-	mA	Vcc =3.3V
	I_{ADD}	-	13.599	-	mA	AV_{DD}=10 V (Black)
	I_{GH}	-	0.099	-	mA	V_{GH}=15V
	I_{GL}	-	0.371	-	mA	V_{GL}= -7V
Input level of V1~V5	Vx	AVDD/2-		AVDD-0.1-	V	
Input level of V6~V10	Vx	0.1-		AVDD/2-	V	

Note (1): HSYNC, VSYNC, DE, Digital Data

Note (2): Be sure to apply the power voltage as the power sequence spec.

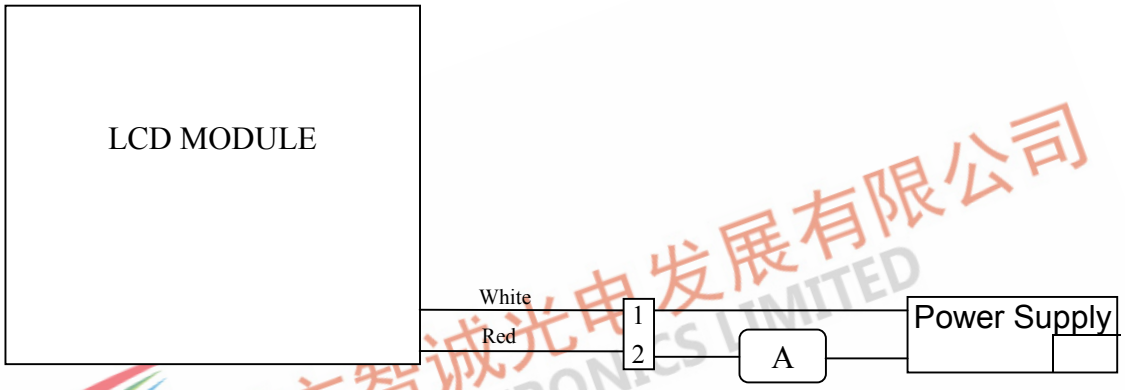
Note (3): DGND=AGND=0V,)

6.2 Back-Light Unit

The backlight system is an edge-lighting type with 21 LED.

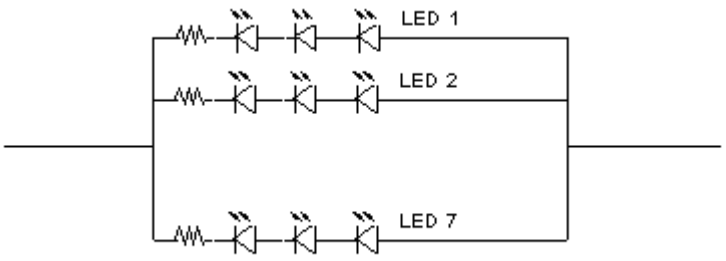
The characteristic of the LED is shown in the following tables.

Item	Symbol	Min.	Typ.	Max.	Unit	Note
LED current	IL	—	140	—	mA	(2)
LED voltage	VL	—	9.5	—	V	
Operating LED life time	Hr	20,000	—	—	Hour	(1)(2)



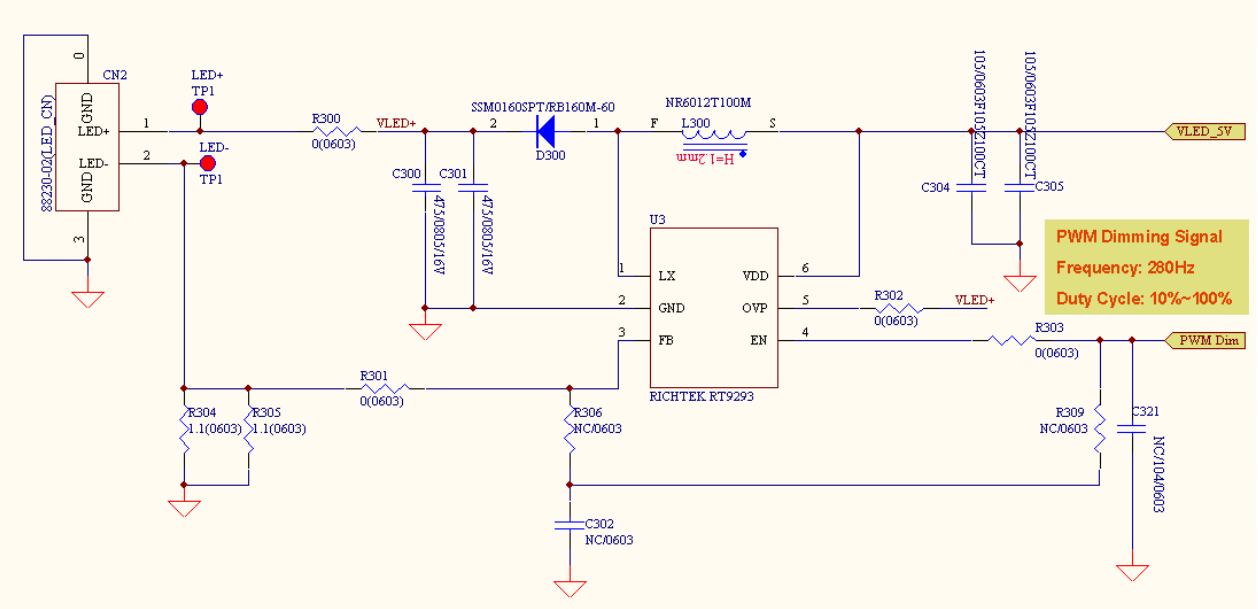
Note (1) LED life time (Hr) can be defined as the time in which it continues to operate under the condition: Ta=25±3°C, typical IL value indicated in the above table until the brightness becomes less than 50%.

Note (2) The "LED life time" is defined as the module brightness decrease to 50% original brightness at Ta=25℃ and IL=140mA. The LED lifetime could be decreased if operating IL is larger than 140mA. The constant current driving method is suggested.



LED Light Bar Circuit

Note (3)　Suggested Schematic of LED Back-Light Driver



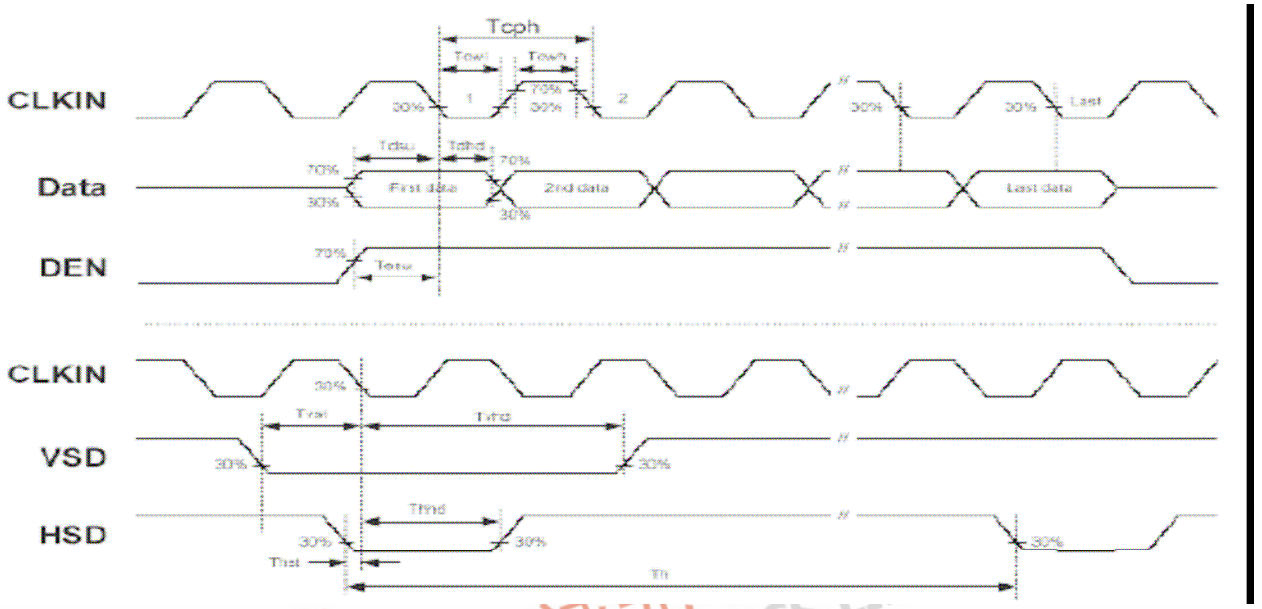
I =0.3/(R304//R305)

Suggested Schematic of LED Back-Light Driver

6.3 AC Characteristics

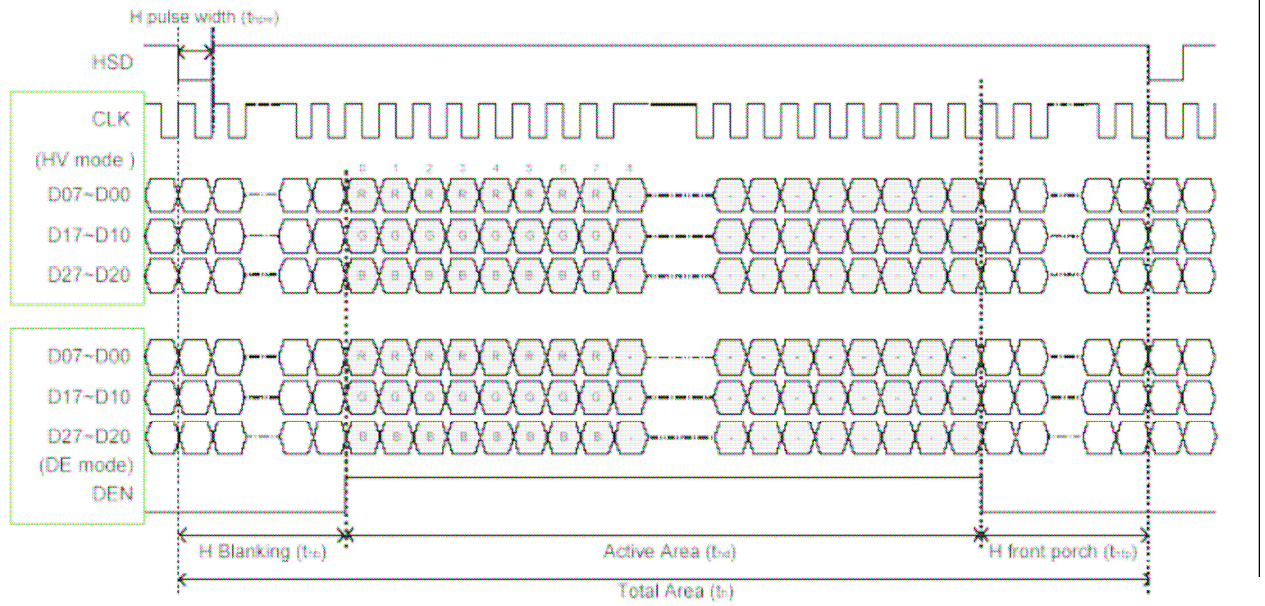
Item	Symbol	Min.	Typ.	Max.	Unit	Note
DCLK cycle time	Tcph	25			ns	
DCLK frequency	fclk		30	40	MHz	
DCLK pulse duty	Tcwh	40	50	60	%	
VSD setup time	Tvst	8			ns	
VSD hold time	Tvhd	8			ns	
HSD setup time	Thst	8			ns	
HSD hold time	Thhd	8			ns	
Data setup time	Tdsu	8			ns	
Data hold time	Tdhd	8			ns	
DE setup time	Tesu	8			ns	
DE hold time	Tehd	8			ns	
Horizontal display area	thd		**800**		Tcph	
HSD period time	th		928		Tcph	
HSD pulse width	thpw	1	48		Tcph	
HSD back porch	thb		**88**		Tcph	
HSD front porch	thfp		**40**		Tcph	
Vertical display area	tvd		480		th	
VSD period time	tv		525		th	
VSD pulse width	tvpw		3		th	
VSD back porch	tvb		**32**		th	
VSD front porch	tvfp		13		th	

6.4 Timing Diagram of Interface Signal



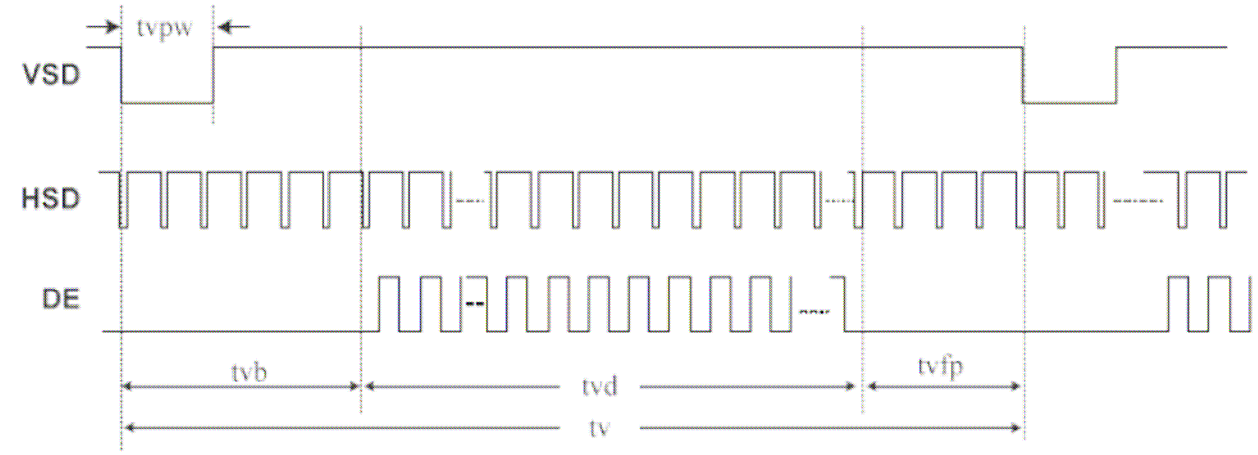
Sampling clock timing

Horizontal input timing



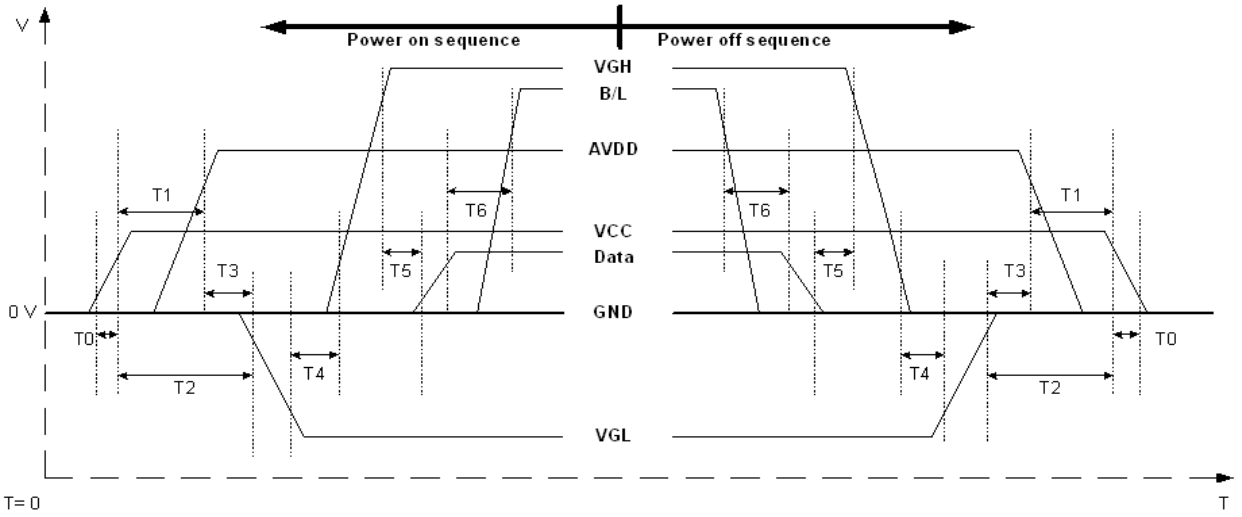
Horizontal display timing range

Vertical input timing

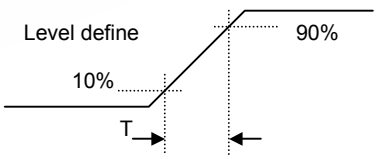


Vertical timing

6.5 Power Sequence



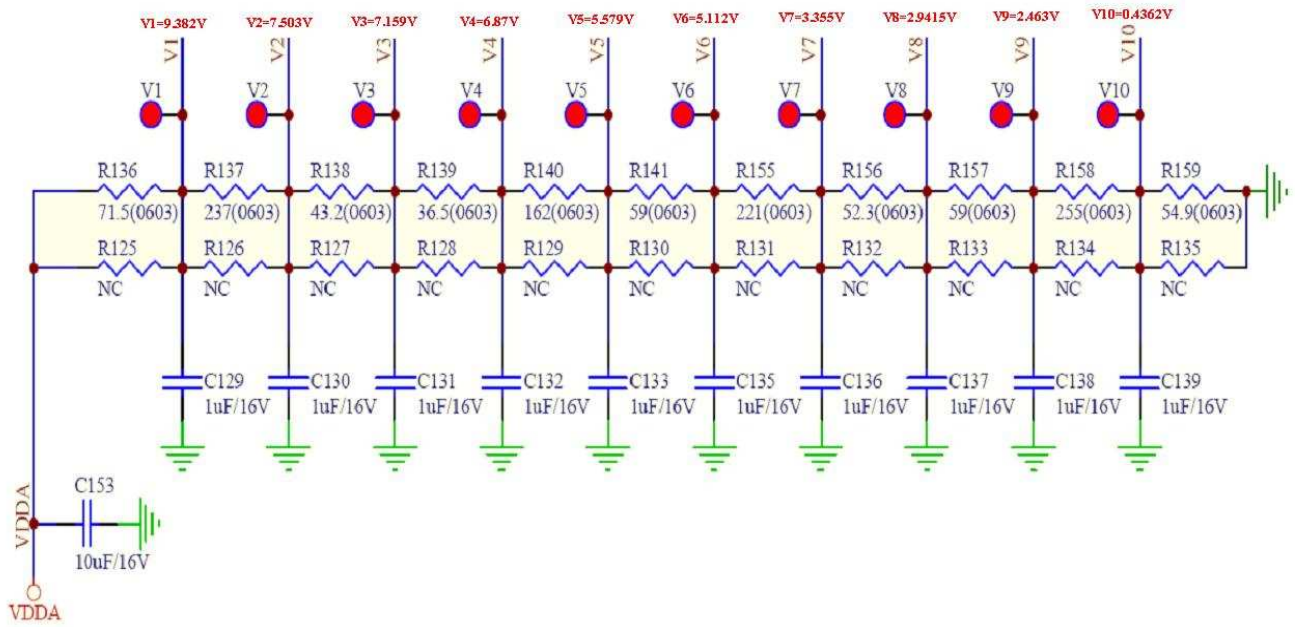
Item	Min.	Typ.	Max.	Unit
T0	0.5	--	20	msec
T1	16			msec
T2	20			msec
T3	**0**			msec
T4	**20**		--	msec
T5	**20**			msec
T6	**50**			msec



Power On Sequence: VCC-> AVDD -> VGL -> VGH -> Data -> B/L
Power Off Sequence: B/L-> Data -> VGH -> VGL -> AVDD -> VCC

Notes: Data include R0~R7, G0~G7, B0~B7, HSD, VSD, DCLK, SHLR, UPDN, DE MODE, RSTB, STBYB, SHLR, UPDN, DITH

6.6 Gamma circuit



7.0 Reliability test items

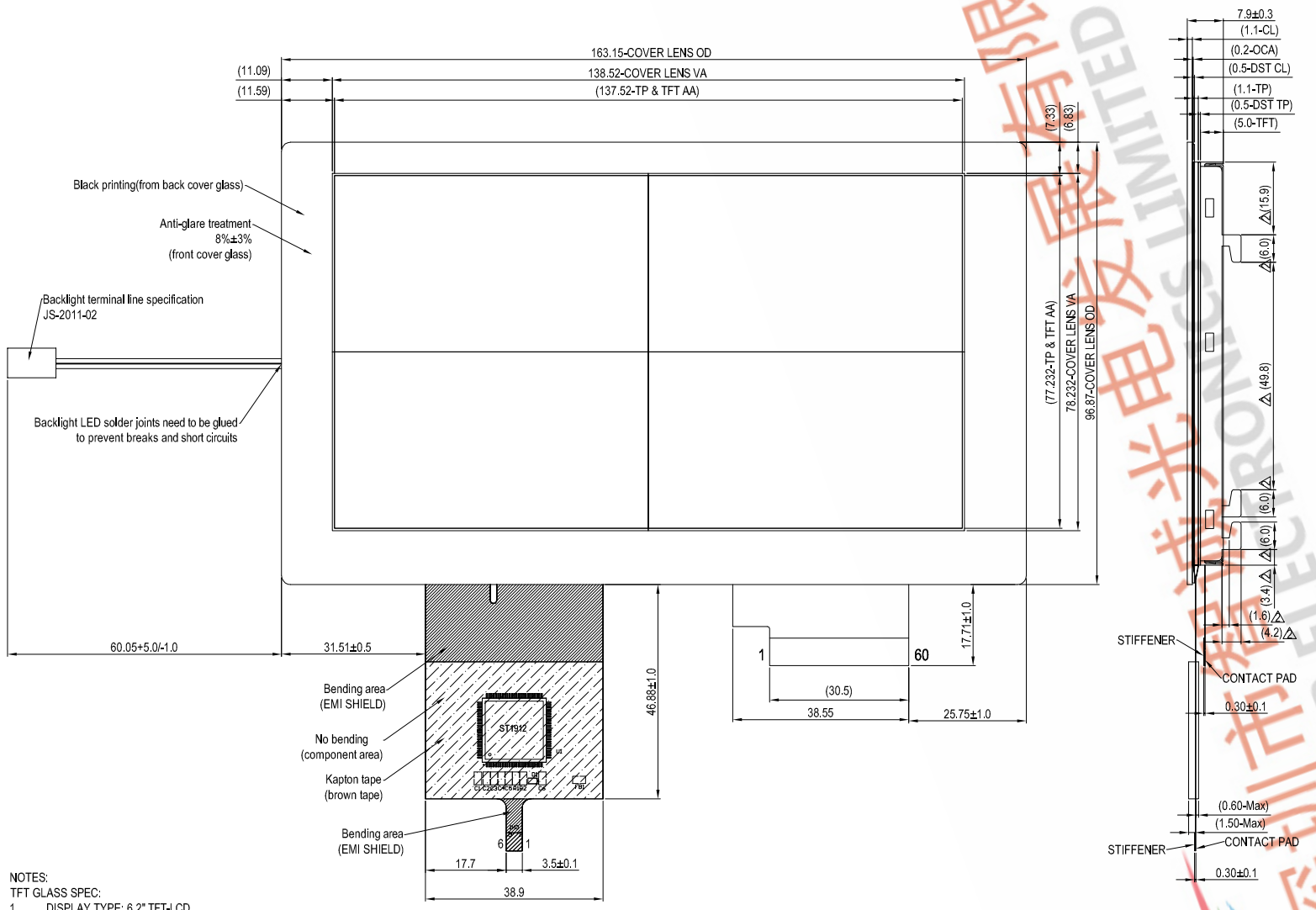
No.	Item	Conditions	Remark
1	High Temperature Storage	Ta=+95°C, 96hrs	
2	Low Temperature Storage	Ta=-40°C, 96hrs	
3	High Temperature Operation	Ta=+80°C, 96hrs	
4	Low Temperature Operation	Ta=-30°C, 96hrs	
5	High Temperature and High Humidity (operation)	Ta=+60°C, 90%RH, 96hrs	
6	Thermal Cycling Test (non operation)	-30°C(30min) → +80°C(30min), 200cycles	
7	Electrostatic Discharge	±200V,200pF(0Ω) 1 time/each terminal	
8	Vibration	1.Random: 1.04Grms, 5~500Hz, X/Y/Z, 30min/each direction 2. Sine: Freq. Range: 8~33.3Hz Stoke: 1.3mm Sweep: 2.9G, 33.3~400Hz X/Z: 2hr, Y: 4hr, cyc: 15min	
9	Shock	100G, 6ms, ±X, ±Y, ±Z 3 time for each direction	JIS C7021, A-10 (Condition A)
10	Vibration (with carton)	Random: 0.015G^2/Hz, 5~200Hz -6dB/Octave, 200~400Hz XYZ each direction: 2hr	
11	Drop (with carton)	Height: 60cm 1 corner, 3 edges, 6 surfaces	JIS Z0202

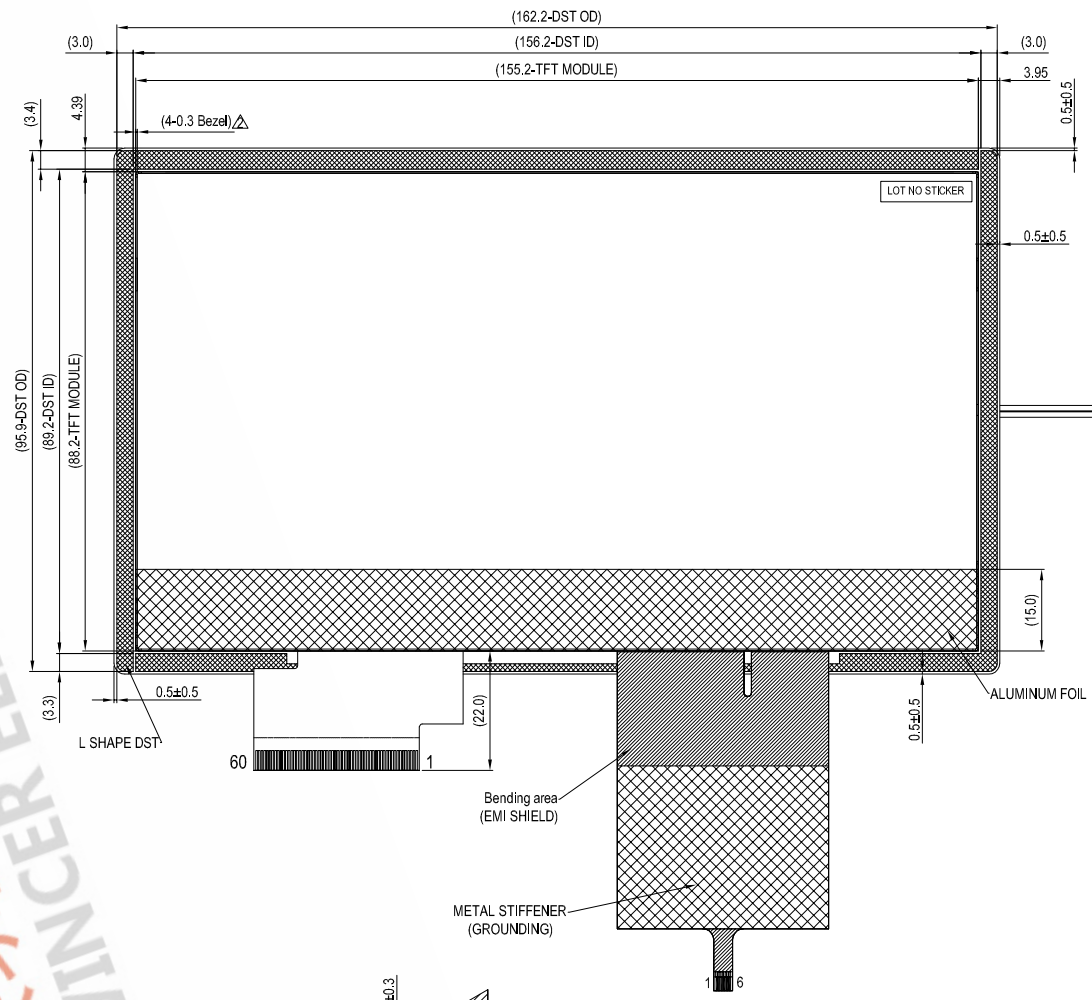
Note: There is no display function NG issue occurred, all the cosmetic specification is judged before the reliability stress.

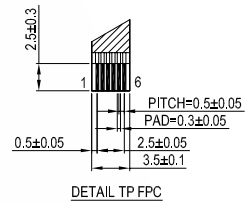
BILL OF MATERIAL TABLE				
NO	ITEM	QTY	THICKNESS	FUNCTION
1	COVER GLASS	1	1.1mm	FRONT GLASS OF THE TOUCH PANEL (CHEMICALLY STRENGTHENED)
2	DOUBLE SIDED TAPE COVER GLASS	1	0.5mm	TO LAMINATE THE COVER GLASS INTO CHASSIS
3	OPTICAL CLEAR ADHESIVE	1	0.2mm	TO LAMINATE COVER GLASS AND SENSOR GLASS TOGETHER
4	GLASS SENSOR	1	1.1mm	TOUCH SENSOR. TO RECEIVE THE TOUCH POSITION OF HUMAN FINGER
5	DOUBLE SIDED TAPE SENSOR	4	0.5mm	TO LAMINATE THE TOUCH PANEL INTO TFT MODULE
6	FLEXIBLE PRINTED CIRCUIT	1	0.3mm	TO CONNECT TO THE CUSTOMER BOARD
7	CAPACITIVE TOUCH SCREEN CONTROLLER = ST1912	1	1.2mm (MAX)	TOUCH CONTROLLER
8	TFT MODULE	1	5.0mm	FOR DISPLAY
	TOTAL	11	7.9mm	

⚠	REVISE BEZEL DESIGN
	ADD NITTO 5000NS OR EQUIVALENT
	ADD ALUMINUM FOIL
	ADAM-09.04.2019
⚠	REMOVE NITTO 5000NS DST
	ADAM-10.04.2019

Dim	Tol
X.X	±0.3
X.XX	±0.10
ANGULAR	±0.5°

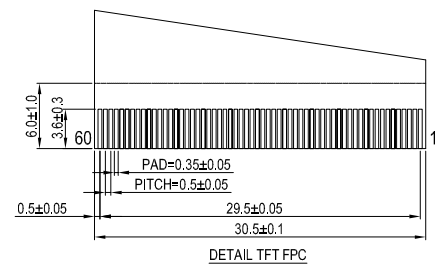






DETAIL TP FPC

CTP FPC pinout	
NO	Description
1	RST
2	VDD
3	GND
4	INT
5	SDA
6	SCL



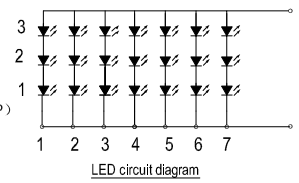
DETAIL TFT FPC

NOTES:
TFT GLASS SPEC:
1. DISPLAY TYPE: 6.2" TFT-LCD
2. DISPLAY TYPE = TRANSMISSIVE
3. DISPLAY MODE = TN MODE, NORMALLY WHITE
4. VIEW DIRECTION = 12 O'CLOCK
5. TEMPERATURE RANGE = STORAGE -40°c ~ 95°c, OPERATING -30°c ~ 80°c
6. RESPONSE TIME = 40ms (TYP.)
7. CONTRAST RATIO = 600 (TYP.)
8. TFT RESOLUTION 800(RGB) x 480

BACKLIGHT SPEC:
1. BACKLIGHT CIRCUIT: 21 LEDS I=30mA/CHIP
2. Module color coordinates： X=0.31+/-0.05,Y=0.33+/-0.05
3. LCM LUMINANCE :500cd/m2 (MIN) ; 600 cd/m2 (TYP) （with TP）
4. Fix current (if=210mA)

TOUCH PANEL SPEC:
1. CAPACITIVE TOUCH SCREEN CONTROLLER = ST1912
2. GLASS THICKNESS 1.1MM

COVER LENS SPEC:
1. BLACK COLOR PRINTING FROM BACKSIDE
2. ANTI-GLARE TREATMENT AT FRONT PANEL



LED circuit diagram

TFT FPC Pin out		9	R5	19	G7	29	DE	39	AGND	49	V6	59	GND
No.	Pad Name	10	R6	20	B0	30	HSD	40	AVDD	50	V5	60	NC
1	AGND	11	R7	21	B1	31	VSD	41	VCOMIN	51	V4		
2	AVDD	12	G0	22	B2	32	MODE3	42	DITH	52	V3		
3	VCC	13	G1	23	B3	33	RSTB	43	NC	53	V2		
4	R0	14	G2	24	B4	34	STBYB	44	BIST	54	V1		
5	R1	15	G3	25	B5	35	SHLR	45	V10	55	NC		
6	R2	16	G4	26	B6	36	VCC	46	V9	56	VGH		
7	R3	17	G5	27	B7	37	UPDN	47	V8	57	VCC		
8	R4	18	G6	28	DCLK	38	GND	48	V7	58	VGL		

( ) : REPEATED OR REFERENCE DIMENSION ONLY

SPECIAL CHARACTERISTIC : Ⓟ= SPC IS REQUIRED , Ⓢ= MSA IS REQUIRED, Ⓒ= NO SPC/MSA REQUIRED

REFERENCE (FOR PD USE ONLY)

			PART NAME	TFT MODULE WITH CTP ASSY
APPROVED	CHECKED	DRAWN	DRAWING NUMBER	SHEET 1/1 · REV. 3
		UNIT : MM NTS		

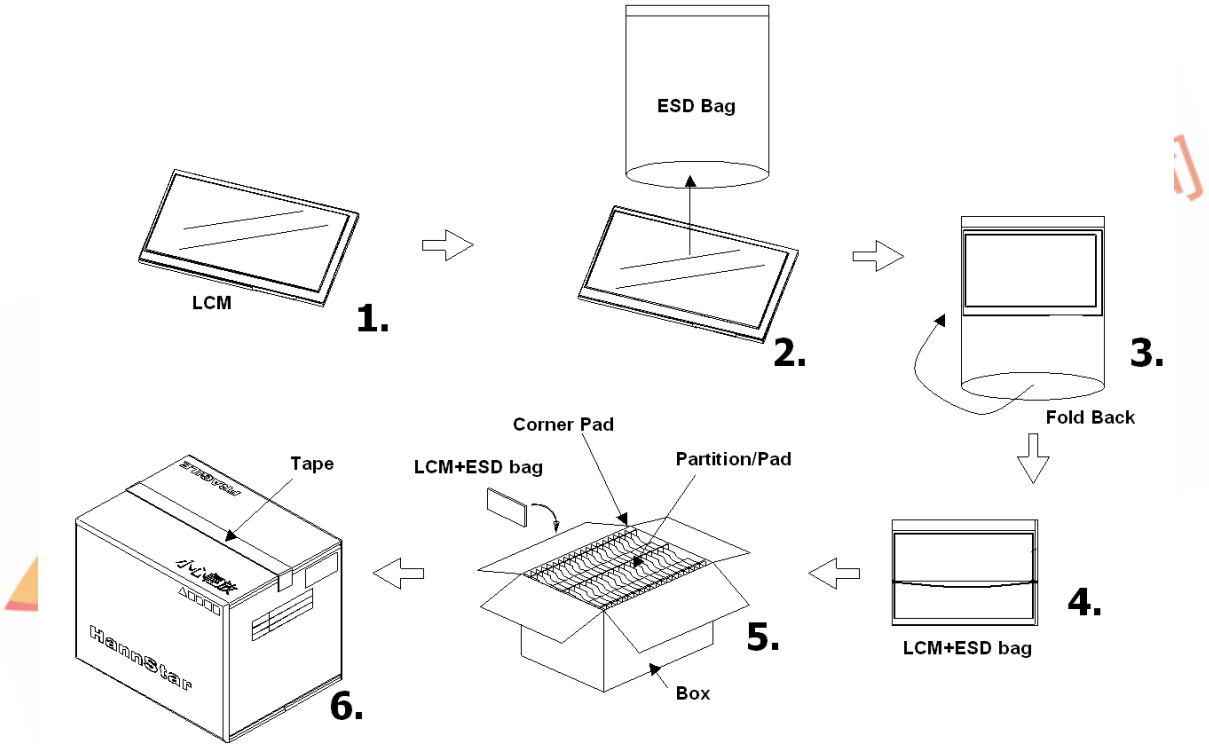
10.0 PACKAGE SPECIFICATION

10.1 Packing form

(1) Package quantity in one carton: 60 pieces.

(2) Carton size: 418mm × 364mm × 266mm.

10.2 Packing assembly drawings



	Material	Notice
Box	Corrugated Paper Board	(AB Flute)
Partition/Pad	Corrugated Paper Board	(B Flute)
Corner Pad	Corrugated Paper Board	(AB Flute)
ESD bag	PE	

IIS标准

TO ：

Date :

Model ： 所有车载系列产品

标准：按原厂大板玻璃IIS执行除带点率控制在10%&A区无大于0.3的亮点）。

Customer Approved:	
Signature	Date
Supplier Approved:	
Signature	Date

1.0 Purpose:

Define the inspection criteria for Sheet total yield counting.

The total yield counting is 90% / Monthly base

2.0 Inspection condition is as following [Visual Inspection]

- Viewing distance is approximately 30 cm
- Viewing angle is normal to the LCD panel
- Ambient temperature: 25℃ ± 5℃
- Ambient illumination: 1000±200 Lux for Sheet appearance inspection
- Ambient illumination: 100±50 Lux for shorting bar test.
- B/L brightness is 2000±200cd/m^2

3.0 Inspection criteria (Inspection criteria for sheet)

（HannStar will make a mark on the defect chip especially）

Item	Symptom	Judgment criteria
1/4 sheet appearance inspection D: Diameter (Note 1)	Crack	Not allowed
	Chipping	No damage any pad and circuit
	Surface Stains / Dirt	1. The defect can be wiped by alcohol is acceptable. 2. Others are followed as: (Per chip) D≦0.1mm, Ignore 0.1mm＜D≦0.2mm, N≦1 D＞0.2mm：Not Allowed
	Panel scratch of active area	1. Dummy area: don't care. 2.As L: don't care, W≦0.05mm ➔Ignore As L≦3.0mm, 0.05mm＜W≦0.08mm ➔ n≦4 As W＞0.08mm Not allowable
	Pad open or short circuit	Not allowed

D: diameter , N: number , W: horizontal width , L: vertical height

4.0 Inspection criteria for light on test

4.1 Test pattern:

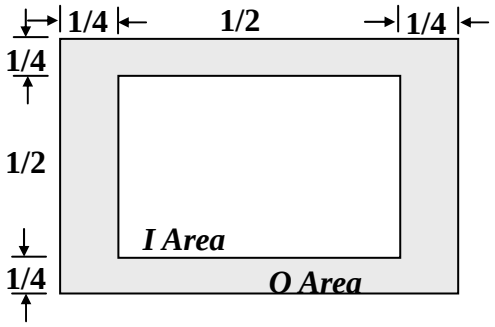
Test pattern	Description
Black	The driving waveform is defined in product spec. All visible defects are judged as the following inspection criteria, 4-2
Gray	
Red	
Green	
Blue	

4.2 Inspection criteria:

Item	Symptom	Judgment criteria		Note
Electrical defect	Area	I	O	Note 1.
	Bright dot	0	1	Note 2
	Dark dot	4	4	Note 2
	Distance between Bright - Bright	–		Note 3
	Distance between Dark- dark	≧5mm		Note 3.
	Distance between Bright - Dark	–		Note 3.
	Total Bright and Dark Dots	4		
	Line defect	Not Allowed		
	No Function	Not Allowed		
Visual defect	Black or white spot / particle	1.D≦0.15mm：No count 2.0.15mm＜D≦0.4mm, N≦3 3. D＞0.4mm：Not allowable		Note 4
	Black or white line / particle (line)	0.05mm<W≦0.1mm, 0.3mm＜L≦0.7mm,N≦3 W>0.1mm,L>0.7mm:Not allowable		
	Mura	ND 5%		

D: diameter , N: number , W: horizontal width , L: vertical height

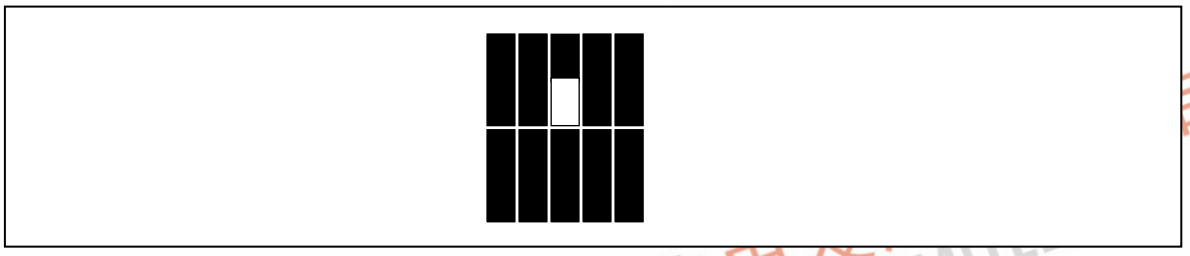
Note 1 Definition of Area



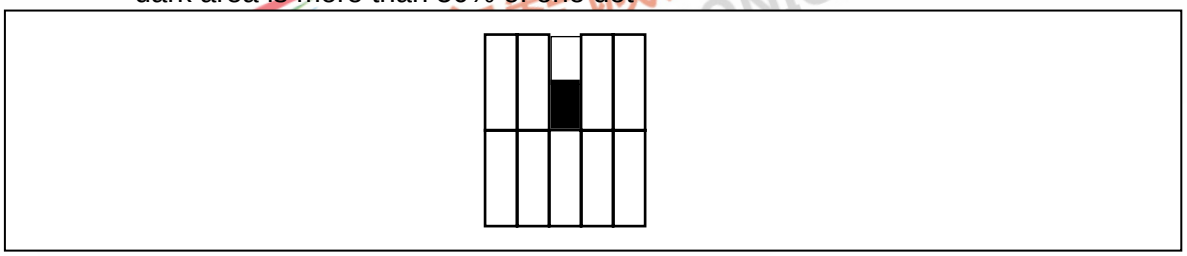
Note 2. Bright, Dark dot defect description

-bright area is more than 50% of one dot

-Visible under：ND5%

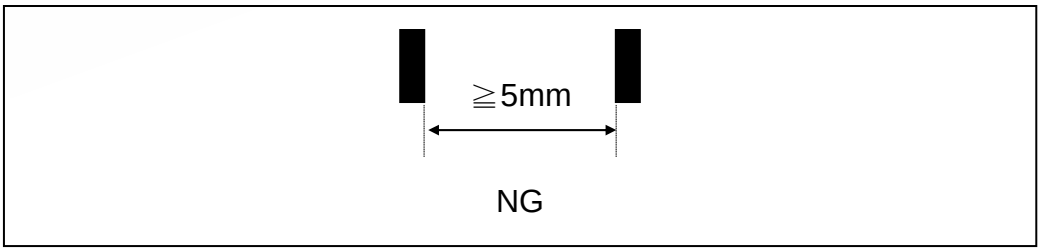


- dark area is more than 50% of one dot

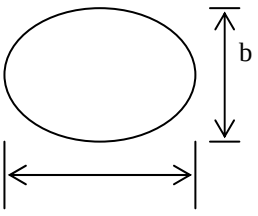


Note 3. Minimum distance between dot defects

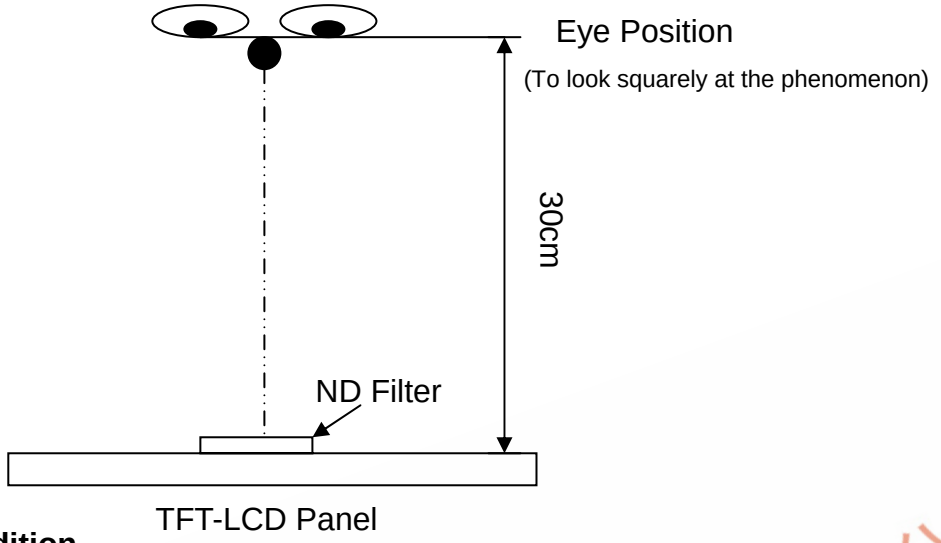
-Dark dot to Dark dot



Note4. D：Diameter D=(a+b)/2



Note 5. Bright dot, mura and leak are defined through transmission ND Filter as following.



5.0 Storage Condition

Storage temperature range : $25\pm5^{0}C$

Storage humidity range : 50±20%RH

6.0 Life Time

Due to the product is Sheet shipping, to prevent quality problem caused by external environment, this product should be stored under storage condition as item 5.0 and finish LCD process within one month from receiving products.