

Product Specification

Model Name	S035TQ03NS-DR12
Description	TFT LCD Module 3.5" QVGA 320(RGB)x240 Dots
Date	2017/6/16
Version	1.0

Approved by/Date	Check by/Date	Prepared by/Date
Sam 2017/6/16	Borger 2017/6/16	Jack Guo 2017/6/16

Customer Approval	
Date	



CDTech(H.K.)Electronics Limited

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1 Record of Revision

Rev	Issued Date	Description	Editor
1.0	2017/6/16	First Release	Jack Guo

2 General Specifications

Feature		Spec
Characteristics	Size	3.5 inch
	Resolution	320(horizontal)*240(Vertical)
	Interface	24bit-RGB
	Connect type	Connector
	Color Depth	16.7M
	Technology type	a-Si
	Pixel pitch (mm)	0.219*0.219
	Pixel Configuration	R.G.B.Stripe
	Display Mode	Normally White
	Driver IC	NV3035
	Viewing Direction	12 O'clock
Mechanical	LCM (W x H x D) (mm)	76.90*64.0*4.25
	Active Area(mm)	70.08*52.56
	With/Without TSP	With RTP
	Weight (g)	28 g
	LED Numbers	6 LEDs

Note 1: Requirements on Environmental Protection: RoHs

Note 2: LCM weight tolerance: +/- 5%

3 Input/Output Terminals

No.	Symbol	Description
1	VBL-	Backlight LED Cathode
2	VBL-	Backlight LED Cathode
3	VBL+	Backlight LED Anode.
4	VBL+	Backlight LED Anode.
5	NC	No connect
6	RESET	Reset Signal pin
7	NC	No connect
8	YU	Touch panel coordinate in the up side of envisage drawing
9	XR	Touch panel coordinate in the left side of envisage drawing
10	YD	Touch panel coordinate in the down side of envisage drawing
11	XL	Touch panel coordinate in the right side of envisage drawing
12~19	B0~B7	Data bus
20~27	G0~G7	Data bus
28~35	R0~R7	Data bus
36	HSYNC	Line Synchronous Signal
37	VSNC	Frame Synchronous Signal
38	DOTCLK	Dot-clock signal and oscillator source
39,40	NC	No connect
41	VCC	Power supply for logic operation
42	VCC	Power supply for logic operation
43	CS	Chip select
44	GND	System Ground
45	NC	No connect
46	GND	System Ground
47	NC	No connect
48	NC	No connect
49	SCL	Serial Clock.
50	SDL	Serial Data
51	NC	No connect
52	DEN	Display enable signal
53	GND	System Ground
54	GND	System Ground

4 Absolute Maximum Rating

Item	Symbol	MIN	Typ	MAX	Unit	Remark
Supply Voltage	V_{DD}	-0.5	-	5.0	V	-
Operating Temperature	T_{OPR}	-20	-	60	°C	-
Storage Temperature	T_{STG}	-30	-	70	°C	

5 Electrical Characteristics

5.1 Driving TFT LCD Panel

Item		Symbol	MIN	TYP	MAX	Unit	Remark
Digital Supply Voltage		V_{DD}	3.0	3.3	3.6	V	
Input Signal Voltage	Low Level	V_{IL}	GND	-	0.1x VDD	V	
	High Level	V_{IH}	0.8x VDD	-	VDD	V	
TFT Common Electrode		V_{COMH}	2.5	-	4.5	V	
TFT Gate ON Voltage		V_{GH}	-	15	-	V	
TFT Gate Off Voltage		V_{GL}	-	-10	-	V	

5.2 LED Driving Conditions

Item	Symbol	MIN	TYP	MAX	Unit	Remark
Forward Current	I_F	-	20	-	mA	
Forward Voltage	V_F	18.0	19.2	20.4	V	
Backlight Power consumption	W_{BL}	-	0.384	-	W	
LED Lifetime			25000	-	Hrs	

Note 1: Each LED: $I_F = 20 \text{ mA}$, $V_F = 3.2 \pm 0.2 \text{ V}$.

Note 2: Optical performance should be evaluated at $T_a = 25^\circ\text{C}$ only.

Note 3: If LED is driven by high current, high ambient temperature & humidity condition. The life Time of LED will be reduced. Operating life means brightness goes down to 50% initial brightness. Typical operating life time is estimated data.

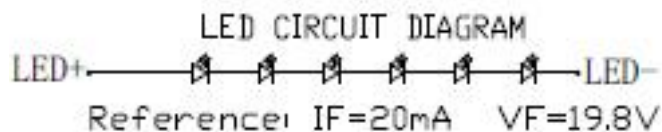
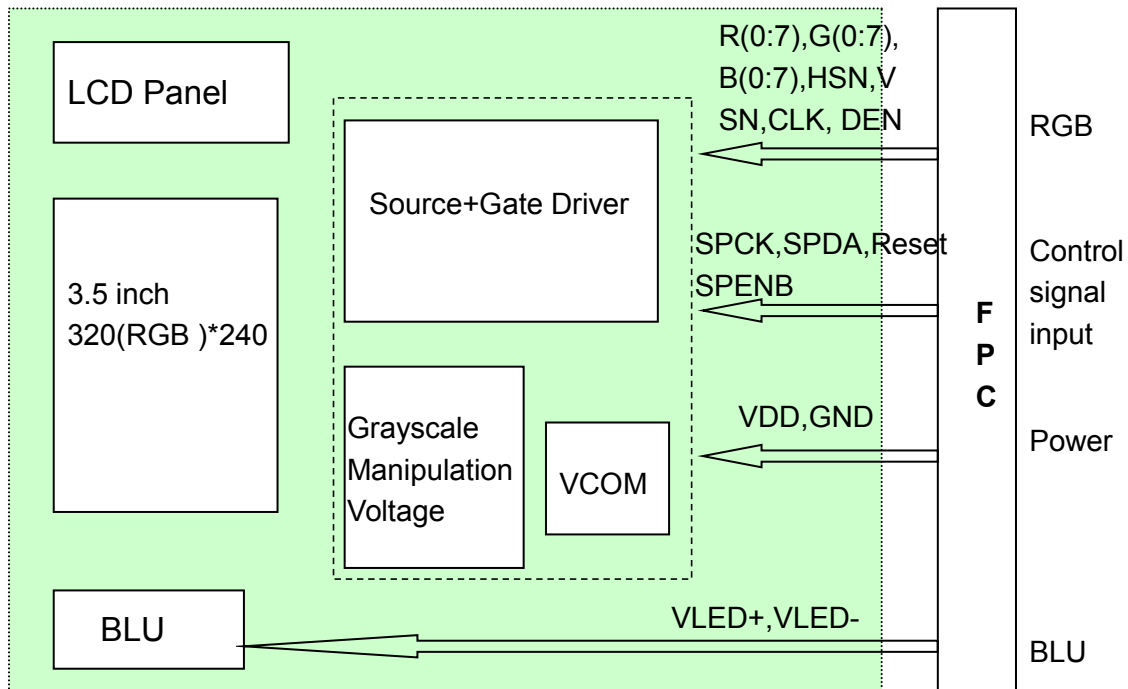


Figure: LED connection of backlight(Constant Current)

5.3 Block Diagram



6 Interface Timing

6.1 AC Electrical Characteristics

Test Condition: (VDD=VDDP=3.3V, VDDA=5.0V, GND=GND A=GNDP=0V, TA= 25°C)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
System Operation Timing						
VDD power source slew time	T _{POr}			1000	us	From 0V to 90% VDD
RSTB active pulse width	T _{RSTB}	40			us	VDD = 3.3V
Input Output Timing						
CLKIN clock time	T _{clk}	33.3/125	-	-	ns	Please refer to timing table(p.32)
HSD to CLKIN	T _{hc}	-	-	1	CLKIN	
HSD width	T _{hwh}	1	-	-	CLKIN	
VSD width	T _{vwh}	1	-	-	Th	
HSD period time	T _h	60	63.56	67	us	
VSD setup time	T _{vst}	8	-	-	ns	
VSD hold time	T _{vhd}	10	-	-	ns	
HSD setup time	T _{hst}	8	-	-	ns	
HSD hold time	T _{hhd}	10	-	-	ns	
Data set-up time	T _{dsu}	8	-	-	ns	DIN[23:0] to CLKIN
Data hold time	T _{dhd}	10	-	-	ns	DIN[23:0] to CLKIN
DEN setup time	T _{esd}	12	-	-	ns	DEN to CLKIN
Time that VSD to 1 st line data input	T _{vs}	2	13	127	Th	@CCIR601 / 8bit RGB HV mode Control by HDLY[6:0] setting T _{vs} = HDLY[6:0]
Time that CCIR_V to 1 st line data input	T _{vs}	12	20	28	Th	@CCIR656 NTSC mode Control by HDLY[6:0] setting T _{vs} = HDLY[6:0]
Time that CCIR_V to 1 st line data input	T _{vs} 17 25 33 Th					@CCIR656 PAL mode Control by HDLY[6:0] setting T _{vs} = HDLY[6:0]
Time that VSD to 1 st line data input	T _{vs}	2	13	127	Th	@24bit RGB HV mode Control by HDLY[6:0] setting T _{vs} = HDLY[6:0]
Source output stable time 1	T _{st}	-	25	30	us	96% final, CL=30pF, RL=2K
Gate output stable time	T _{gst}	-	500	1000	ns	96% final, CL=40pF
VCOMOUT output stable time	T _{cst}	-	4	8	us	96% final, CL=33nF, RL=100ohm
3-wire serial communication AC timing						
Serial clock	T _{spck}	320	-	-	ns	
SPCK pulse duty		40	50	60	%	T _{ckh} / T _{spck}
Serial data setup time	T _{isu}	120	-	-	ns	
Serial data hold time	T _{ihd}	120	-	-	ns	
Serial clock high/low	T _{ckh/l}	120	-	-	ns	
Chip select distinguish	T _{cd}	1	-	-	us	
SPENB to VSD	T _{cv}	1	-	-	us	
SPENB input setup time	T _{eck}	150	-	-	ns	
SPENB input hold time	T _{cke}	150	-	-	ns	

6.2 DC Electrical Characteristics

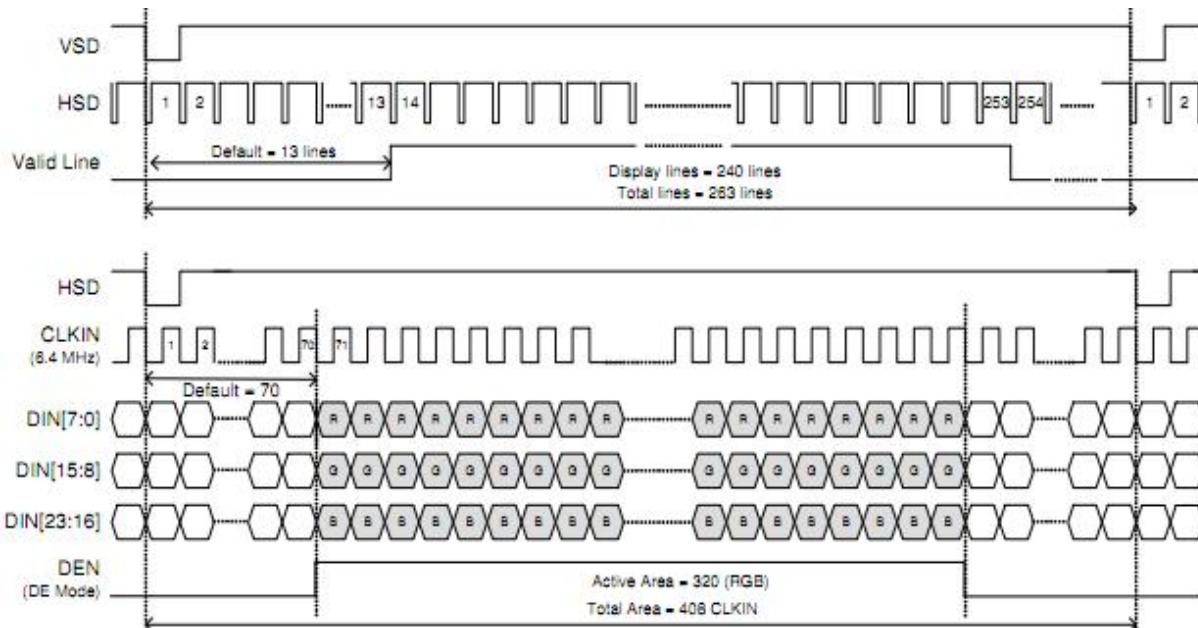
(For the digital circuit: Test Condition: VDD=VDDP=3.3V, VDDA=5.0V, GND=GND A=GNDP= 0V, TA=25℃)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Digital Block Circuit						
Digital Supply Voltage	VDD	3.0	3.3	3.6	V	Digital power
Low Level Input Voltage	Vil	GND	-	0.2xVDD	V	Digital input pins TA=85℃
High Level Input Voltage	Vih	0.8xVDD	-	VDD	V	Digital input pins TA=85℃
Low Level Input Voltage	Vil	GND	-	0.2xVDD	V	Digital input pins TA=25℃
High Level Input Voltage	Vih	0.8xVDD	-	VDD	V	Digital input pins TA=25℃
Low Level Input Voltage	Vil	GND	-	0.1xVDD	V	Digital input pins TA= -20℃
High Level Input Voltage	Vih	0.9xVDD	-	VDD	V	Digital input pins TA= -20℃
Input Leakage Current	Ii	-	-	±1	μA	Digital input pins
Pull-high/low Impedance	Rin	-	200K	-	ohm	Digital control input pins
High Level Output Voltage	Voh	VDD-0.4	-	VDD	V	Digital output pins; Ioh = 400 uA
Low Level Output Voltage	Vol	GND	-	GND+0.4	V	Digital output pins; Iol = -400 uA
Digital Stand-by Current	Iddst	-	(50)	(100)	uA	No load, CLKIN/VSD/HSD stopped
Digital Operating Current	Idd1	-	2	-	mA	CLKIN = 27 MHz (CCIR601mode)
Power Circuit						
Charge Pump Supply Voltage	VDDP	3.0	3.3	3.6	V	For VGH/VGL power and Source Driver power, must in this range
VCOMAC output level	VCOMAC	4.6	-	6.1	V	By VCSL[2:0] setting VCOMAC = V(VCSL[2:0]) ± 100mV
VCOMDC output level	VCOMDC	1.0	-	2.26	V	By VCDCSL[5:0] setting VCOMDC = V(VCDCSL[5:0]) ± 50mV
Positive power supply	VGH	14.5	15	15.5	V	Gate driver load + procard load
Negative power supply	VGL	-9	-10	-11	V	Gate driver load + procard load
Base drive current	IDRV	-	-	10	mA	VDDP=3.3V, DRV=0.7 V
DRV output voltage	VDRV	GND +0.1	-	VDD -0.1	V	
Feed back voltage	VFB	0.55	0.6	0.65	V	DC/DC operating, VBL current=20 mA

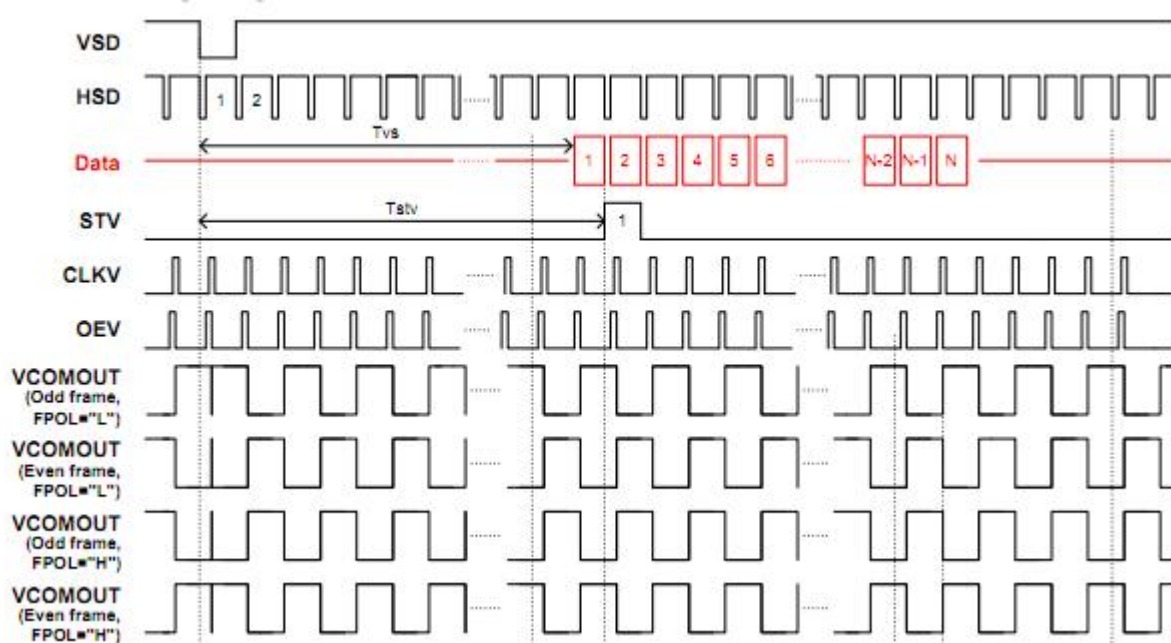
6.3 24 Bit RGB Mode

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
CLKIN frequency	Fclk	6.1	6.4	8.0	MHz	VDD = 3.0 ~3.6V
CLKIN cycle time	Tclk	125	156	164	ns	
CLKIN pulse duty	Tcwh	40	50	60	%	Tclk
Time that HSD to 1'st data input(NTSC)	Ths	40	70	255	CLKIN	DDLY =70, Offset = 0 (fixed)

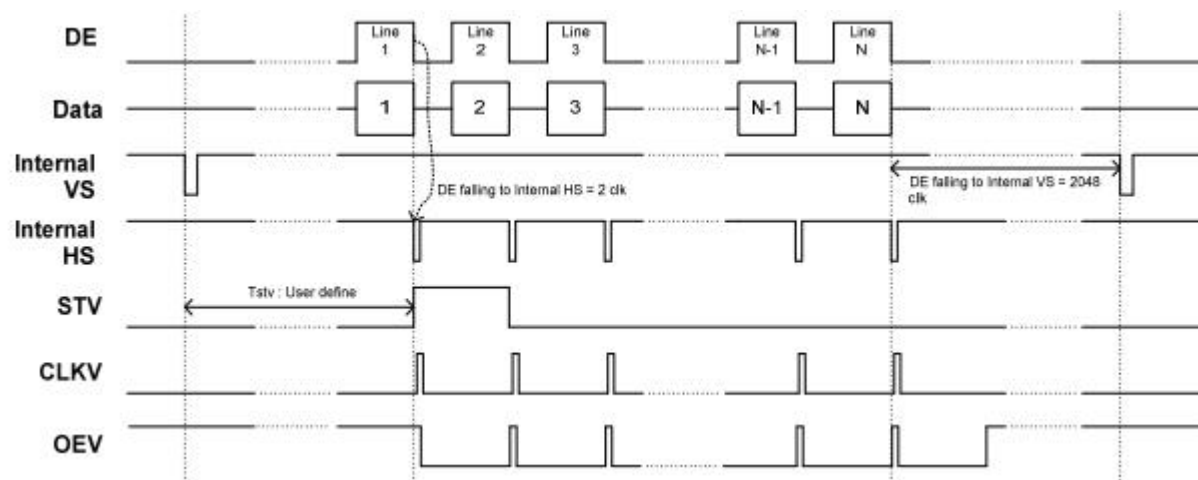
6.4 Input Data Timing



6.5 Vertical Timing Diagram (HV Mode)



6.6 Vertical Timing Diagram (DE Mode)



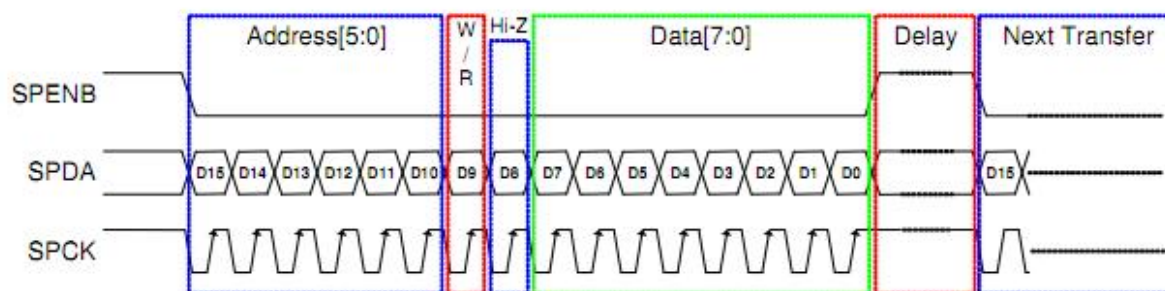
6.7 3-Wire Serial Port Interface

3-Wire Command Format

NT39016 uses the 3-wire serial port as communication interface for all the function and parameter setting. 3-Wire communication can be bi-directional controlled by the "R/W" bit in address field. NT39016 3-Wire engine act as a "slave mode" for all the time, and will not issue any command to the 3-Wire bus itself.

Under read mode, 3-Wire engine will return the data during "Data phase". The returned data should be latched at the rising edge of SPCK by external controller. Data in the "Hi-Z phase" will be ignored by 3-Wire engine during write operation, and should be ignored during read operation also. During read operation, external controller should float SPDA pin under "Hi-Z phase" and "Data phase".

Refer to the section of "3-Wire Timing Diagram" for the detail timing, please.



3-Wire Command Format:

Bit	Description
D15-D10	Register Address [5:0].
D9	W/R control bit. "1" for Write; "0" for Read
D8	Hi-Z bit during read mode. Any data within this bits will be ignored during write mode
D7-D0	Data for the W/R operation to the address indicated by Address phase

3-Wire Writer Format:

MSB															LSB	
D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0	
Register Address [5:0]						1	X	DATA (Issue by external controller)								

3-Wire Read Format:

MSB															LSB	
D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0	
Register Address [5:0]						0	Hi-Z	DATA (Issue by NT39016)								

7 Optical Characteristics

Items		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark	Note
Response time		Tr+Tf	-	-	50	80	ms	FIG.1	Note4
Contrast Ratio		CR		-	350	-	-	FIG.2	Note1
Surface luminance		LV	$\theta = 0^\circ$	200	250	-	cd/m ²	FIG.2	Note2
Luminance uniformity		Yu	$\theta = 0^\circ$	75	80	-	%	FIG.2	Note3
NTSC		-	$\theta = 0^\circ$	-	50	-	%	FIG.2	Note5
Viewing angle		θ Cr>10	$\phi = 90^\circ$	-	40	-	deg	FIG.3	Note6
			$\phi = 270^\circ$	-	60	-	deg	FIG.3	
			$\phi = 0^\circ$	-	60	-	deg	FIG.3	
			$\phi = 180^\circ$	-	60	-	deg	FIG.3	
Chromaticity	Red	R _x	$\theta = 0^\circ$ $\phi = 0^\circ$ Ta=25°	0.261	0.311	0.361	-	FIG.2 CIE1931	Note5
		R _y		0.300	0.353	0.400	-		
	Green	G _x		0.586	0.636	0.686	-		
		G _y		0.300	0.350	0.400	-		
	Blue	B _x		0.261	0.311	0.361	-		
		B _y		0.501	0.551	0.601	-		
	White	W _x		0.084	0.134	0.184	-		
		W _y		0.101	0.151	0.201	-		

Note1. Definition of contrast ratio

Contrast ratio(Cr) is defined mathematically by the following formula. For more information see FIG.2.

$$\text{Contrast ratio} = \frac{\text{Luminance measured when LCD on the "White" state}}{\text{Luminance measured when LCD on the "Black" state}}$$

For contrast ratio, Surface Luminance, Luminance uniformity and CIE, the testing data is based on TOPCON's BM-5 or BM-7 photo detector or compatible.

Note2. Definition of surface luminance.

Surface luminance is the luminance with all pixels displaying white. For more information see FIG.2.

L_v = Average Surface Luminance with all white pixels ($P_1, P_2, P_3, \dots, P_n$)

Note3. Definition of luminance uniformity

The luminance uniformity in surface luminance is determined by measuring luminance at each test position 1 through n , and then dividing the maximum luminance of n points luminance by minimum luminance of n points luminance. For more information see FIG.2.

$$YU = \frac{\text{Minimum surface luminance with all white pixels } (P_1, P_2, P_3, \dots, P_n)}{\text{Maximum surface luminance with all white pixels } (P_1, P_2, P_3, \dots, P_n)}$$

Note4. Definition of response time

The response time is defined as the LCD optical switching time interval between "White" state and "Black" state. Rise time (T_r) is the time between photo detector output intensity changed from 90% to 10%. And fall time (T_f) is the time between photo detector output intensity changed from 10% to 90%.

For additional information see FIG1.

Note5. Definition of color chromaticity (CIE1931)

CIE (x,y) chromaticity, The x,y value is determined by screen active area center position P5. For more information see FIG.2.

Note6. Definition of viewing angle

Viewing angle is the angle at which the contrast ratio is greater than 10. Angles are determined for the horizontal or x axis and the vertical or y axis with respect to the z axis which is normal to the LCD surface. For more information see FIG.3.

For viewing angle and response time testing, the testing data is based on Autronic-Melchers' s ConoScope or DMS series Instruments or compatible.

FIG.1.The definition of response Time

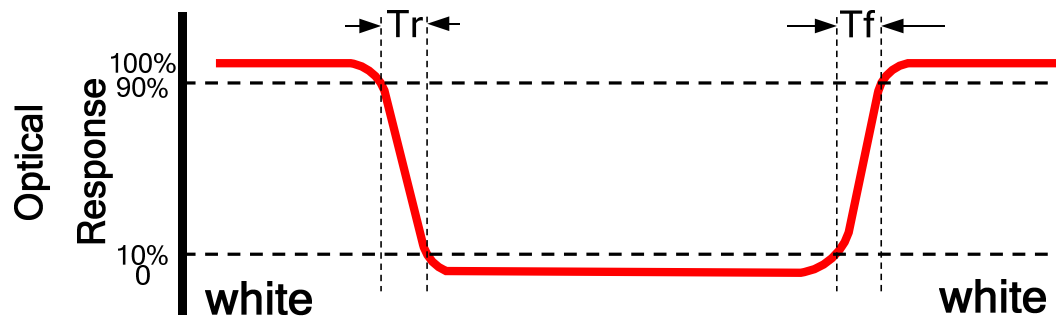


FIG.2. Measuring method for contrast ratio, surface luminance,

luminance uniformity, CIE (x,y) chromaticity

Size : $S \leq 5"$ (see Figure a) A : 5 mm B : 5 mm

H,V : Active area

Light spot size $\varnothing=5\text{mm}$ (BM-5) or $\varnothing=7.7\text{mm}$ (BM-7) 50cm distance or compatible distance from the LCD surface to detector lens.

test spot position : see Figure a.

measurement instrument : TOPCON's luminance meter BM-5 or BM-7 or compatible (see Figure c).

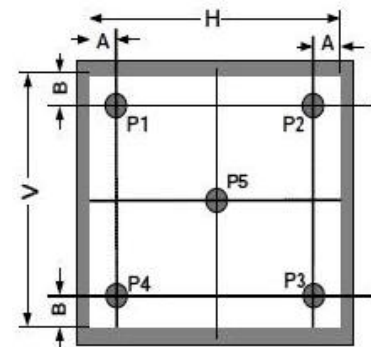


Figure a

Size : $5" < S \leq 12.3"$ (see Figure b) H,V : Active area

Light spot size $\varnothing=5\text{mm}$ (BM-5) or $\varnothing=7.7\text{mm}$ (BM-7) 50cm distance or compatible distance from the LCD surface to detector lens.

test spot position : see Figure b.

measurement instrument : TOPCON's luminance meter BM-5 or BM-7 or compatible (see Figure c).

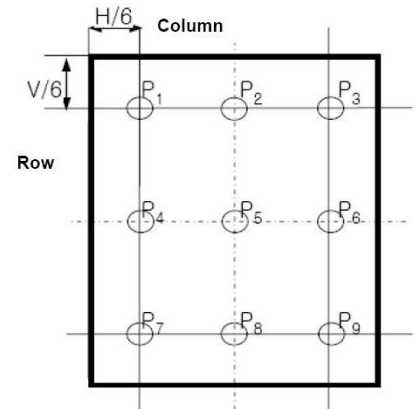


Figure b

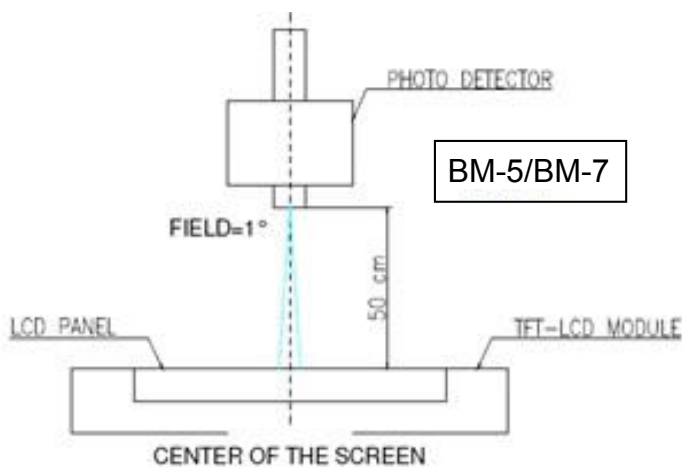
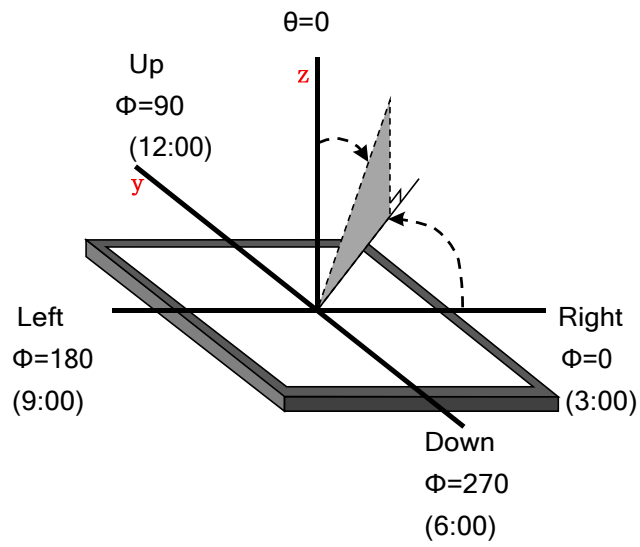


Figure c

FIG.3.The definition of viewing angle

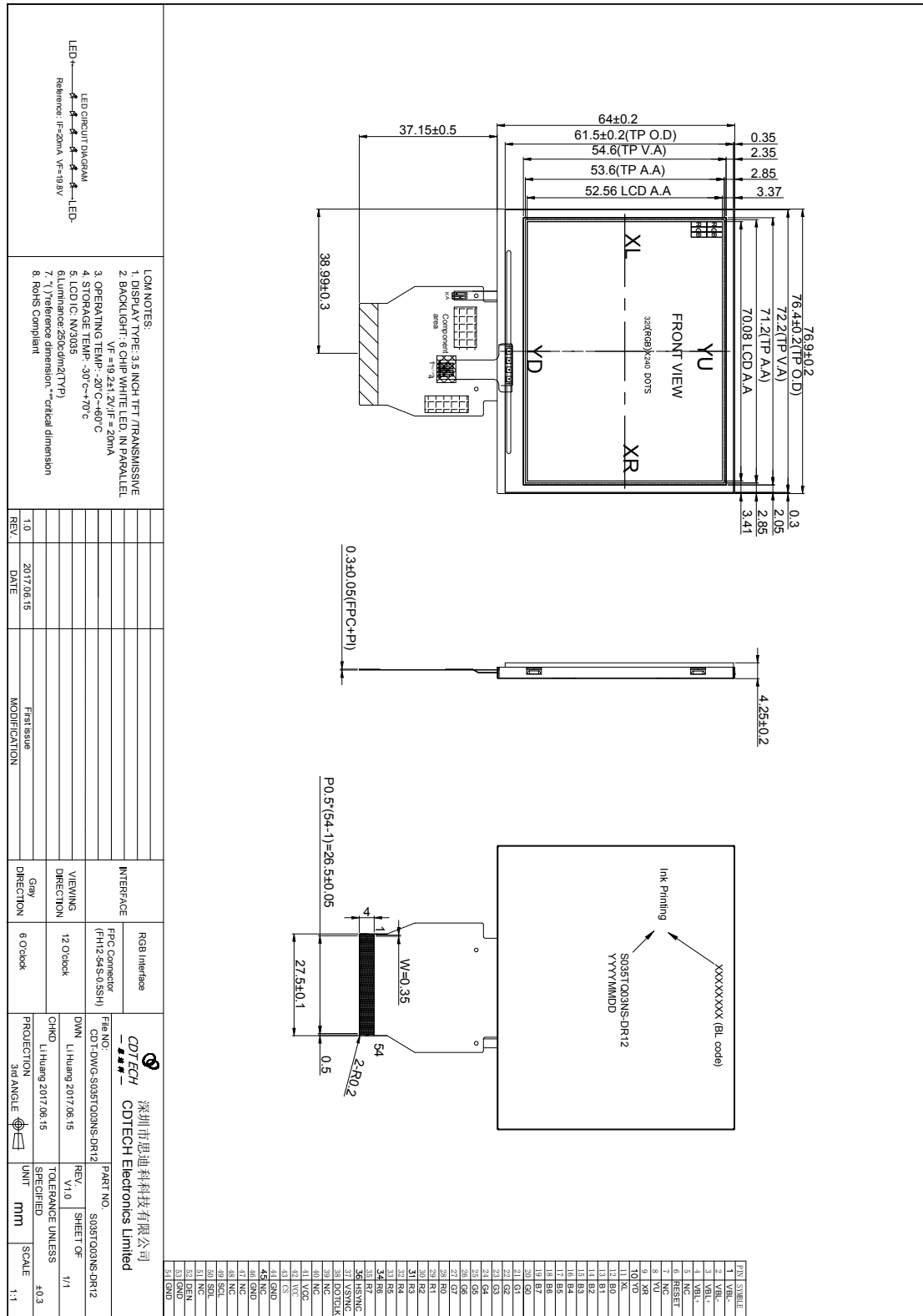


8 Environmental / Reliability Tests

No	Test Item	Condition	Remarks
1	High Temperature Operation	Ts= +60℃, 96hrs	Note 1 IEC60068-2-2, GB2423. 2-89
2	Low Temperature Operation	Ta= -20℃, 96hrs	Note 2 IEC60068-2-1 GB2423.1-89
3	High Temperature Storage	Ta= +70℃, 96hrs	IEC60068-2-2 GB2423. 2-89
4	Low Temperature Storage	Ta= -30℃, 96hrs	IEC60068-2-1 GB/T2423.1-89
5	High Temperature & Humidity Storage	Ta= +60℃, 90% RH max,120 hours	IEC60068-2-3 GB/T2423.3-2006
6	Thermal Shock (Non-operation)	-20℃ 30 min ~ +60℃ 30 min Change time: 5min, 30 Cycle	Start with cold temperature, end with high temperature IEC60068-2-14, GB2423.22-87
7	Electro Discharge (Operation) Static	C=150pF, R=330 Ω, 5 points/panel Air:±8KV, 5 times; Contact: ±4KV, 5 times; (Environment: 15℃ ~ 35℃, 30% ~ 60%, 86Kpa ~ 106Kpa)	IEC61000-4-2 GB/T17626.2-1998
8	Vibration (Non-operation)	Frequency range: 10~55Hz, Stroke: 1.mm Sweep: 10Hz~55Hz~10Hz 2 hours for each direction of X .Y. Z. (package condition)	IEC60068-2-6 GB/T2423.5-1995
9	Shock (Non-operation)	60G 6ms, ± X, ±Y , ± Z 3 times for each direction	IEC60068-2-27 GB/T2423.5-1995
10	Package Drop Test	Height: 80 cm, 1 corner, 3 edges, 6 surfaces	IEC60068-2-32 GB/T2423.8-1995

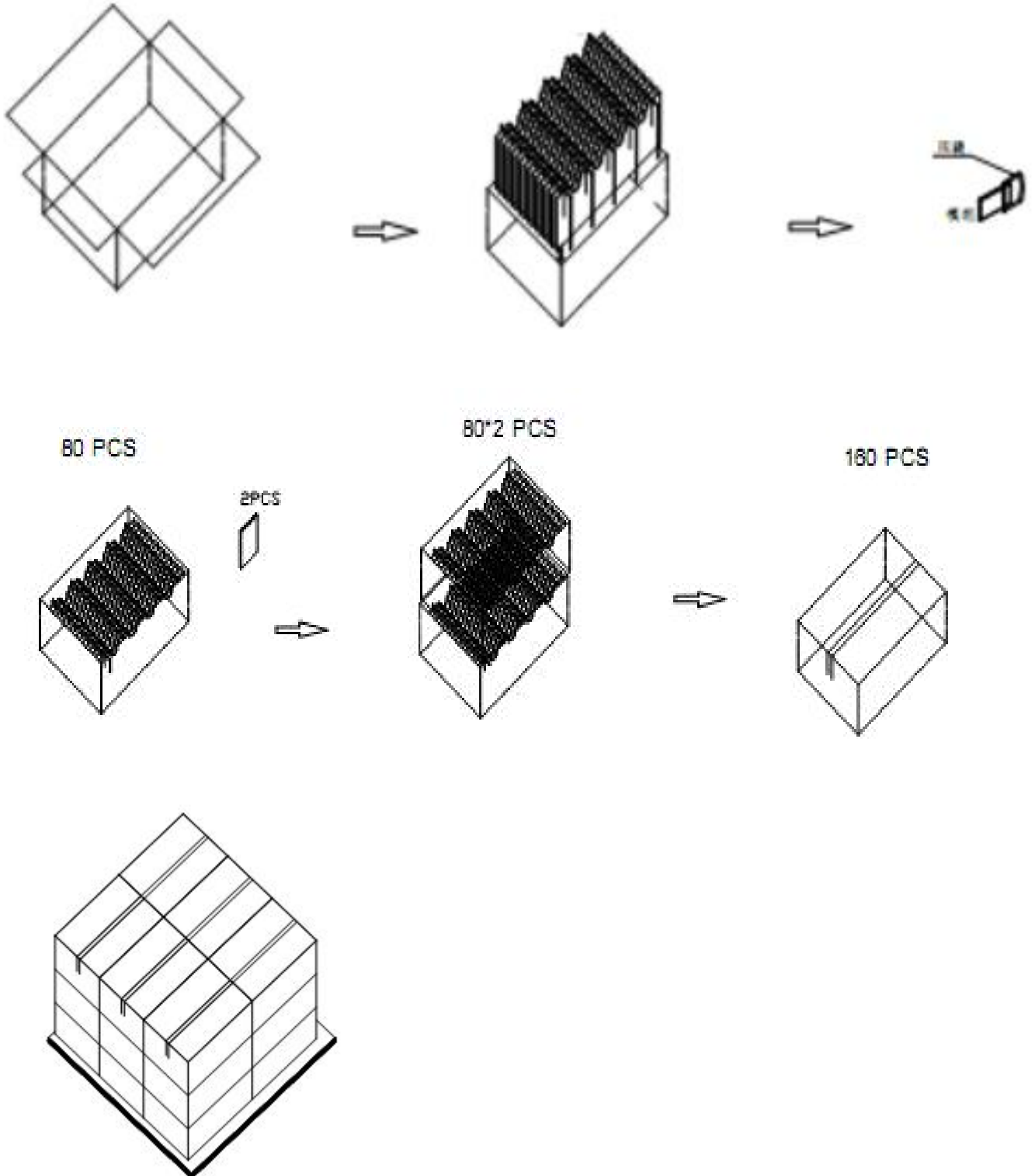
Note:1. Ts is the temperature of panel's surface.
2. Ta is the ambient temperature of sample.
3. The size of sample is 5pcs.

9 Mechanical Drawing



10 Packing

Packing Method



11 Precautions for Use of LCD modules

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 alcohol

Solvents other than those mentioned above may damage the polarizer. Especially, do not use the following:

- Water
- Ketene
- 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.

11.2.2. 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.