



SPECIFICATION

Revision: A

Product Model: K D; 028C1A-TP

Designed by	R&D Checked by	Quality Department by	Approved by

Approval by Customer

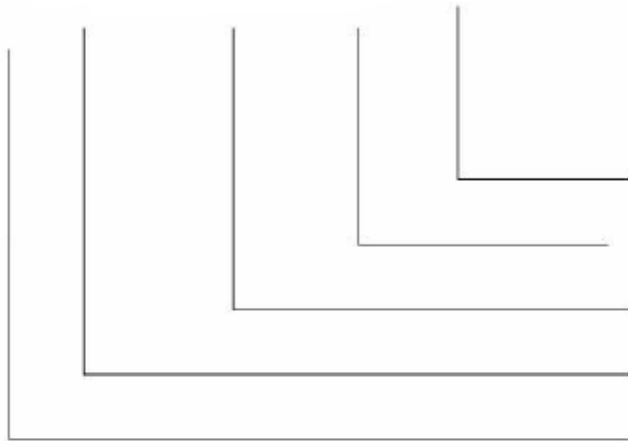
<p>OK</p> <p>NG, Problem survey:</p> <p style="text-align: right;">Approved By _____</p>
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1. Numbering System

KDG XXX C -X-tp



with touch panel or without

Identifier

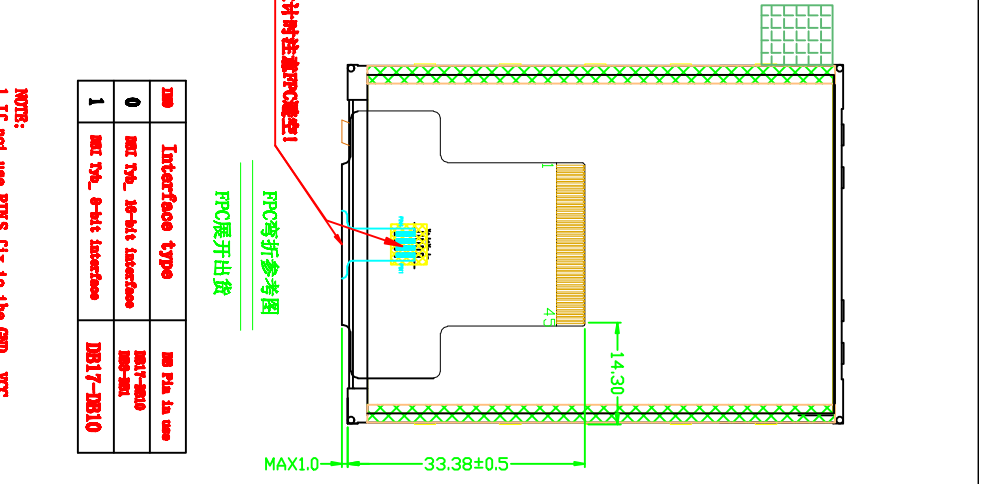
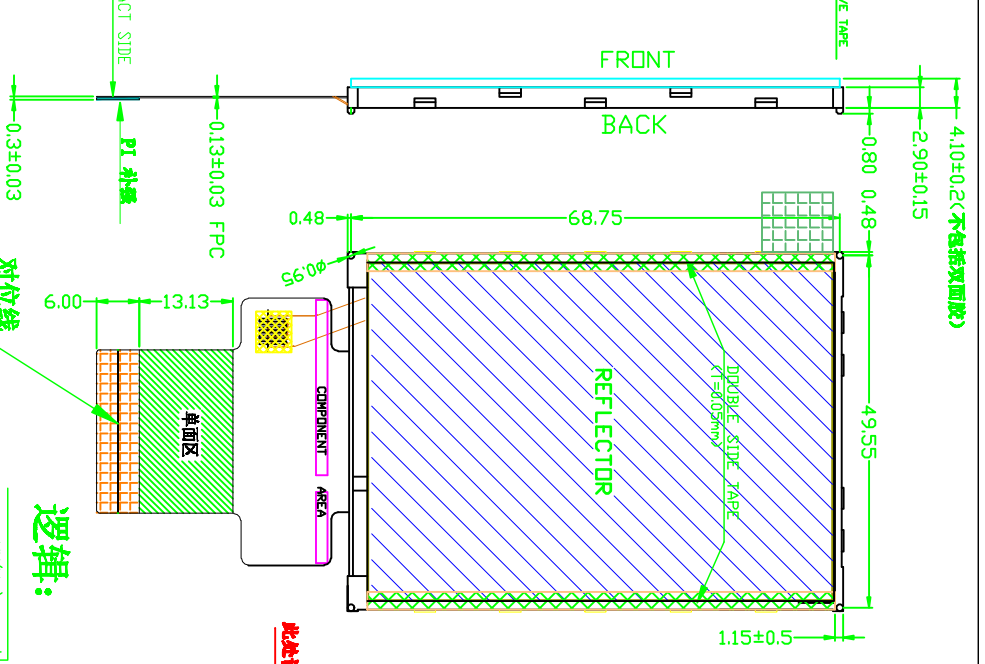
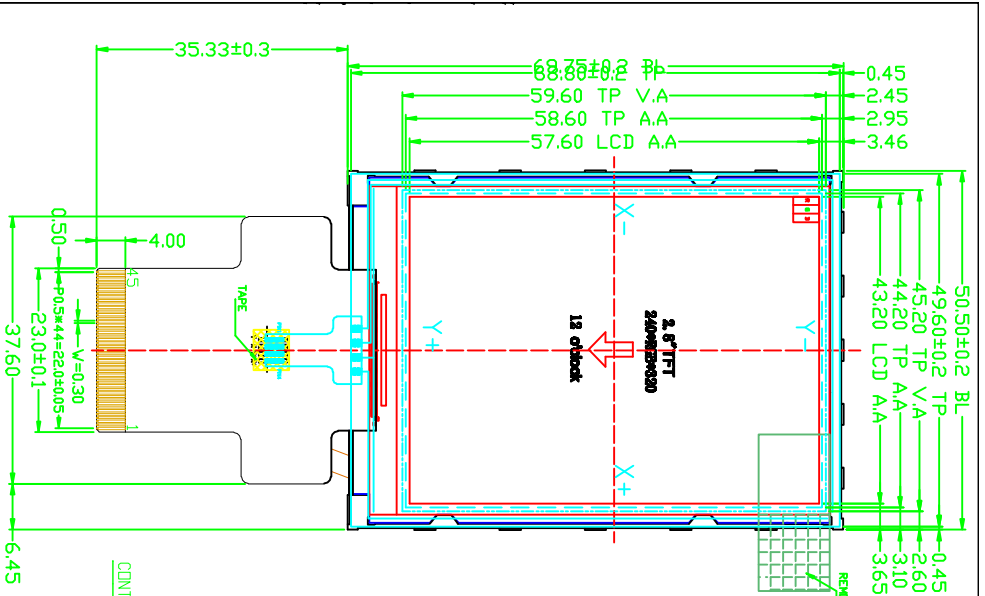
standard product

size

GEMINI

2. General Information

ITEM	STANDARD VALUES	UNITS
LCD type	2.8" TFT	--
Dot arrangement	240(RGB) × 320	dots
Driver IC	ILI9341	--
Module size	50.50(W) × 69.70(H) × 4.1(T)	mm
Active area	43.20(W) × 57.60(H)	mm
Dot pitch	0.18 (W) × 0.18 (H)	mm
Back Light	4 White LED In Parallel	--
Weight	TBD	g
Viewing angle	12:00	oclock

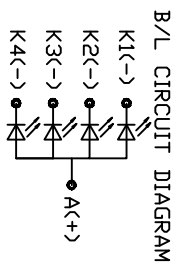


PIN	SYMBOL
1	NC
2	NC
3	NC
4	IMO
5	CS
6	RS
7	WR
8	RD
9	RESET
10	NC
11	NC
12	DB17
13	DB16
14	SB15
15	DB14
16	DB13
17	DB12
18	DB11
19	DB10
20	NC
21	DB8
22	DB7
23	DB6
24	DB5
25	DB4
26	DB3
27	DB2
28	DB1
29	NC
30	NC
31	NC
32	NC
33	NC
34	LEDA
35	LEDK1
36	LEDK2
37	LEDK3
38	LEDK4
39	X+(XR)
40	Y-(YU)
41	X-(XL)
42	Y+(YD)
43	GND
44	GND
45	VCC

NO	Interface type	NO Pin for use
0	MI1 Typ. 16-pin Interface	MI1-MI10 MI6-MI11
1	MI1 Typ. 8-bit Interface	DB17-DB10

NOTES:
1. If not use PINS, fix to the GND , VCC or NC.

- NOTES:
1. DISPLAY TYPE: 2.8", TFT-LCD, 65K COLORS
 2. DISPLAY MODE: T/M NORMALLY WHITE
 3. VIEWING DIRECTION: 12:00
 4. DRIVER IC: IL9341 (COG)
 5. VCI: 3.3V(TYP)
 6. OPERATING TEMP: -20°C TO 70°C
 7. STORAGE TEMP: -30°C TO 80°C
 8. BACK LIGHT: LED WHITE, 4 LED, 60mA, 3.2±0.3V
 9. RoHS COMPLIANT.



REV	Revision content description	Date
A	FIRST	2012/12/18

FindLed

TOLERANCE(公差)	H/L?	DRAWING NAME
FORMANCE	X.X±0.3	Denna
OTHERWISE SPECIFIED	X.XX±0.2	Checked
Scale	1:1	Approve

4. Interface Description

PIN NO.	PIN NAME	DESCRIPTION									
		IM3	IM2	IM1	IM0	interface mode	DB Pin				
1	NC	Select the MPU system interface mode									
2	NC	0	0	1	0	i80-system 16-bit interface	DB[17:10],DB[8:1]				
3	NC	0	0	1	1	i80-system 8-bit interface	DB[17:10]				
4	IM0										
5	/CS	Chip select signal input terminal, Active at 'L'									
6	RS	Register select signal input terminal: RS='H': control register; RS='L': index or status register.									
7	/WR_SCL	Write signal input terminal, Active at 'L'. Synchronizing clock signal in SPI mode.									
8	/RD	Read signal input terminal, Active at 'L'.									
9	/RESET	Reset signal input terminal, active at 'L'									
10	NC										
11	NC										
12	DB17	An 18-bit parallel bi-directional data bus for MPU system interface Mode: 8-bit I/F: DB[17:10] is used. 9-bit I/F: DB[17:9] is used. 16-bit I/F: DB[17:10] and DB[8:1] is used. 18-bit I/F: DB[17:0] is used.									
13	DB16										
14	DB15										
15	DB14										
16	DB13										
17	DB12										
18	DB11										
19	DB10										
20	NC						Unused pins must be fixed to GND level.				
21	DB8										
22	DB7										
23	DB6										
24	DB5										
25	DB4										
26	DB3										
27	DB2										
28	DB1										
29	NC										
30	NC										
31	NC										
32	NC										
33	NC										
34	LEDA	LED backlight anode									
35	LEDK1	LED backlight kathode									
36	LEDK2	LED backlight kathode									
37	LEDK3	LED backlight kathode									
38	LEDK4	LED backlight kathode									
39	X+	TOUCH PIN(XR)									
40	Y+	TOUCH PIN(YU)									
41	X-	TOUCH PIN(XL)									

42	Y-	TOUCH PIN(YD)
43	GND	Power ground
44	GND	Power ground
45	VCC	System power supply.

5. Absolute Maximum Ratings.

Item	Symbol	Unit	Value
Power Supply Voltage1	IOVCC – GND	V	-0.3 ~+4.6
Power Supply Voltage 2	VCI – AGND	V	-0.3 ~+4.6
Power Supply Voltage 3	DDVDH – AGND	V	-0.3 ~+6.5
Power Supply Voltage4	AGND – VCL	V	-0.3 ~+4.6
Power Supply Voltage 5	DDVDH – VCL	V	-0.3 ~+9.0
Power Supply Voltage7	AGND – VGL	V	-0.3 ~+14.0
Power Supply Voltage 8	VGH– VGL	V	-0.3 ~+30.0
Input Voltage	Vt	V	-0.3 ~IOVCC + 0.3
Operating Temperature	Topr	°C	-40 ~+85
Storage Temperature	Tstg	°C	-55 ~+110

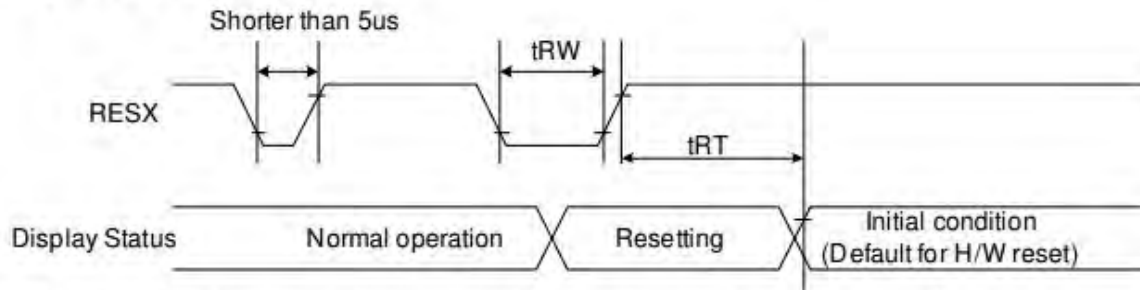
6. DC Characteristics.

Item	Symbol	Unit	Test Condition	Min.	Typ.	Max.
Input High level voltage	VIH	V	IOVCC=1.65V~3.30V	0.8xIOVCC	-	IOVCC
Input Low level voltage	VIL	V	IOVCC=1.65V~3.30V	-0.3	-	0.2xIOVCC
Output "High" level voltage 1 (DB0-17)	VOH	V	IOVCC=1.65V~3.30V, IOH=-0.1mA	0.8xIOVCC	-	-
Output "Low" level voltage 1 (DB0-17)	VOL	V	IOVCC=1.65V~3.30V, IOL=0.1mA	-	-	0.2xIOVCC
I/O leak current	ILI	μA	Vin=0~IOVCC	-1	-	1

7. Timing Characteristics.

7.1 Reset Timing Characteristics.

15.4. Reset Timing



Signal	Symbol	Parameter	Min	Max	Unit
RESX	tRW	Reset pulse duration	10		uS
	tRT	Reset cancel		5 (note 1,5)	mS
				120 (note 1,6,7)	mS

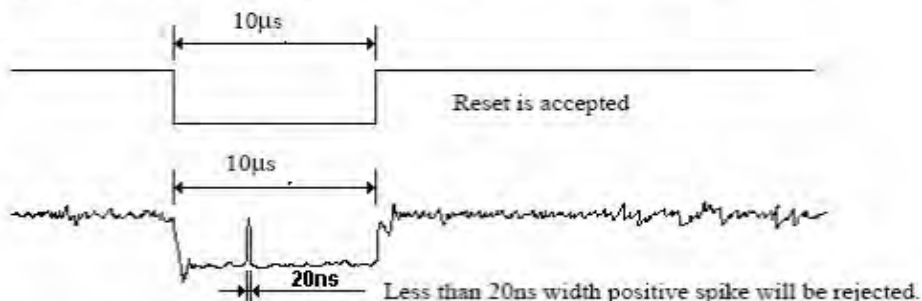
Note 1: The reset cancel includes also required time for loading ID bytes, VCOM setting and other settings from NV memory to registers. This loading is done every time when there is HW reset cancel time (tRT) within 5 ms after a rising edge of RESX.

Note 2: Spike due to an electrostatic discharge on RESX line does not cause irregular system reset according to the table below: -

RESX Pulse	Action
Shorter than 5us	Reset Rejected
Longer than 10us	Reset
Between 5us and 10us	Reset starts

Note 3: During the Resetting period, the display will be blanked (The display is entering blanking sequence, which maximum time is 120 ms, when Reset Starts in Sleep Out -mode. The display remains the blank state in Sleep In -mode.) And then return to Default condition for Hardware Reset.

Note 4: Spike Rejection also applies during a valid reset pulse as shown below:

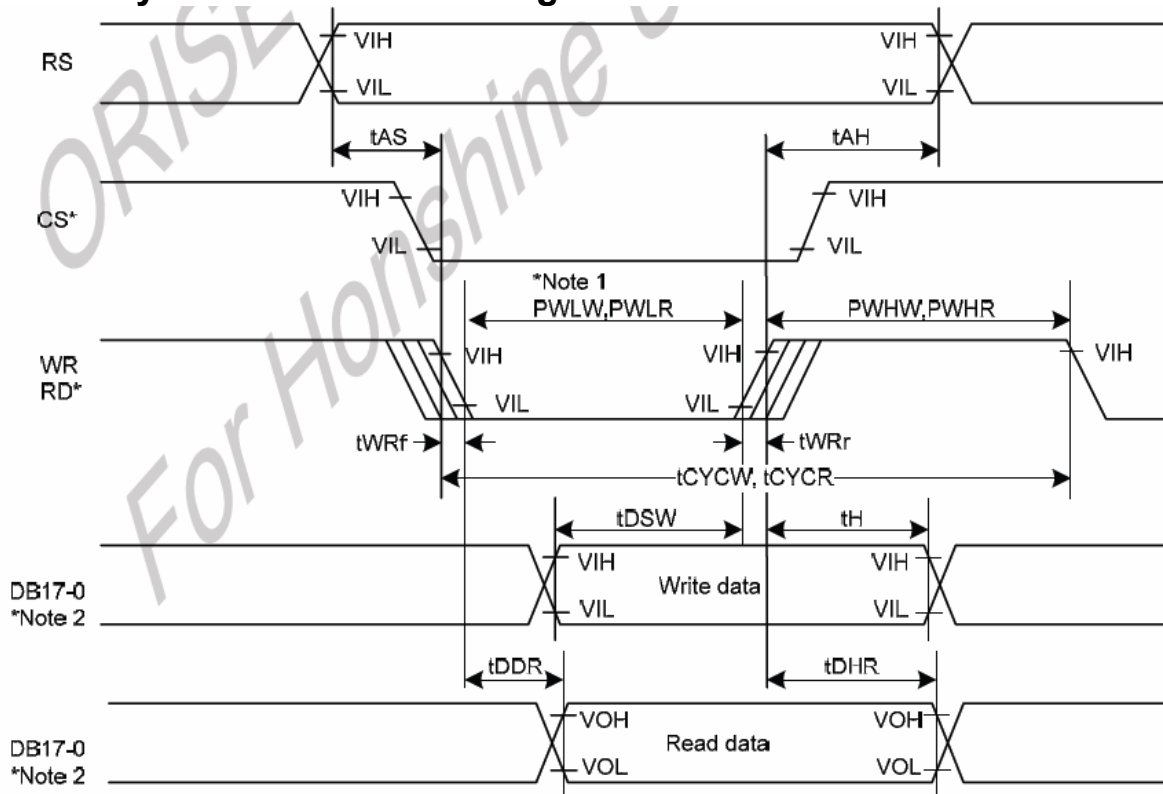


Note 5: When Reset applied during Sleep In Mode.

Note 6: When Reset applied during Sleep Out Mode.

Note 7: It is necessary to wait 5msec after releasing RESX before sending commands. Also Sleep Out command cannot be sent for 120msec.

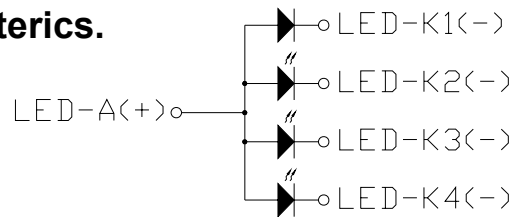
7.2 i80-Sy stem Interface Timing Characteristics.



Note1: PWLW and PWLR are defined by the overlap period when CS is "Low" and WR* or RD* is "Low".
 *Note2: Unused DB pins must be fixed at "IOVcc 1" or "IOGND 1".

Item	Symbol	Unit	Min.	Typ.	Max.	
Bus cycle time	Write	t_{CYCW}	ns	125	-	-
	Read	t_{CYCR}	ns	450	-	-
Write low-level pulse width	PWLW	ns	45	-	-	
Read low-level pulse width	PWLR	ns	170	-	-	
Write high-level pulse width	PWHW	ns	70	-	-	
Read high-level pulse width	PWHR	ns	250	-	-	
Write/Read rise/ fall time	t_{WRr} , t_{WRf}	ns	-	-	25	
Setup time	Write (RS to CS*, WR*)	t_{AS}	ns	0	-	-
	Read (RS to CS*, RD*)	t_{AS}	ns	10	-	-
Address Hold Time	t_{AH}	ns	2	-	-	
Write data setup time	t_{DSW}	ns	25	-	-	
Write data hold time	t_H	ns	10	-	-	
Read data delay time	t_{DDR}	ns	-	-	150	
Read data hold time	t_{DHR}	ns	5	-	-	

8. Backlight Characteristics.



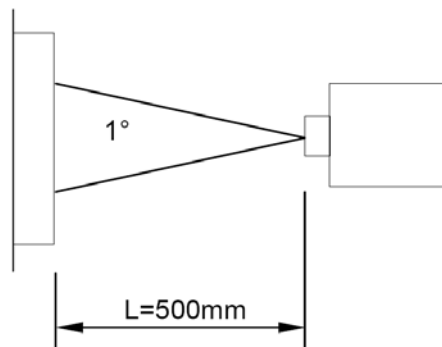
Item	Symbol	MIN	TYP	MAX	UNIT	Test Condition	Note
Supply Voltage	Vf	3.0	3.2	3.5	V	If=60mA	-
Supply Current	If	-	60	80	mA	-	-
Reverse Voltage	Vr	-	-	5	V	15uA	
Power dissipation	Pd	-	250	-	mW	-	
Luminous Intensity for LCM		-	400	-	Cd/m ²	If=60mA	
Uniformity for LCM	-	80	-	-	%	If=60mA	
Life Time	-	50000	-	-	Hr	If=60mA	-
Backlight Color		White					

9. Optical Characteristics

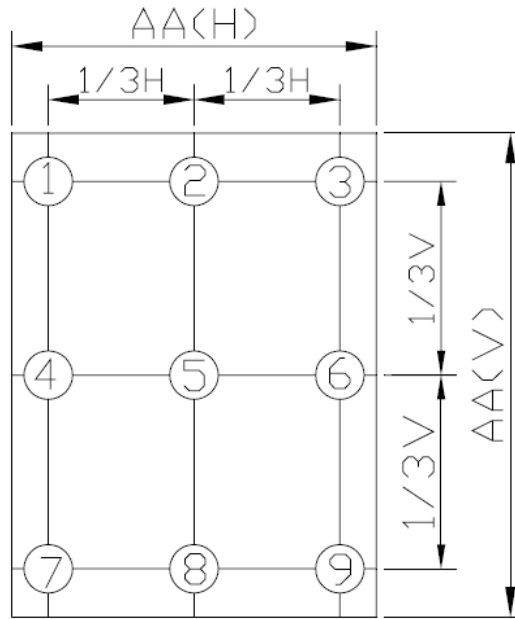
ITEM		SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	REMARK
Transmittance(%)		T			5.8			
Luminance		L		180	200	—	cd/m ²	
Luminance Uniformity		ΔL		80	—	—	%	Note 3
Contrast Ratio		CR		—	300	—		Note 4
NTSC Ratio		---			61%			
Response Time		Tr	$\theta = \psi = 0^\circ$	—	10		ms	Note 5
		Tf		—	15		ms	
View angle	Upper	ϕ	$CR \geq 10$	—	60	—	°	Note 6
	Lower			—	55	—	°	
	Left	θ		—	50	—	°	
	Right			—	50	—	°	
Color Coordinate	W	x	$\theta = \psi = 0^\circ$	—	0.313	—		
		y		—	0.329	—		
	R	x		—	0.6457	—		
		y		—	0.3391	—		
	G	x		—	0.3438	—		
		y		—	0.6012	—		
	B	x		—	0.1476	—		
		Y		—	0.1110	—		

Note 1. Ambient condition : $25 \pm 2^\circ\text{C}$, $60 \pm 10\%RH$, under 10 Lux in the darkroom .

Note 2. Measure device: BM-5A(TOPCON), viewing cone= 1° , $I_L=20\text{mA}$, after 10 minutes operation.



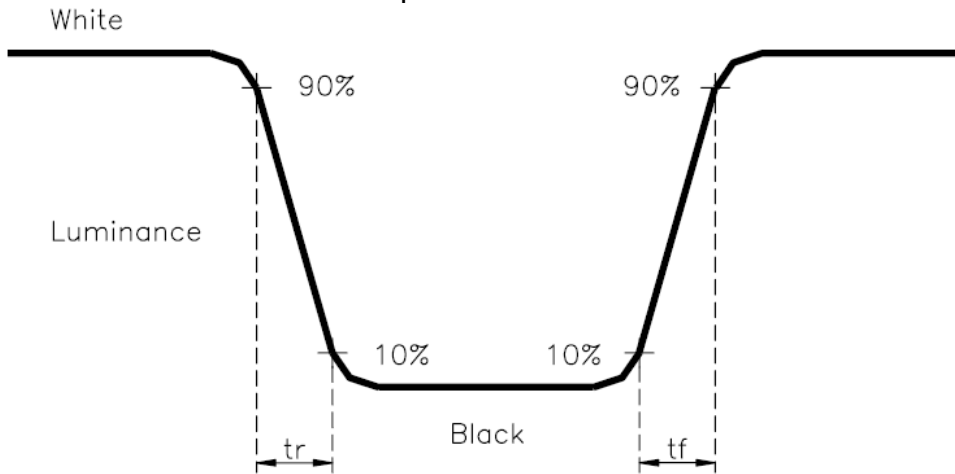
Note 3. Definition of Luminance Uniformity : $L = L(\text{MIN}) / L(\text{MAX}) \times 100\%$



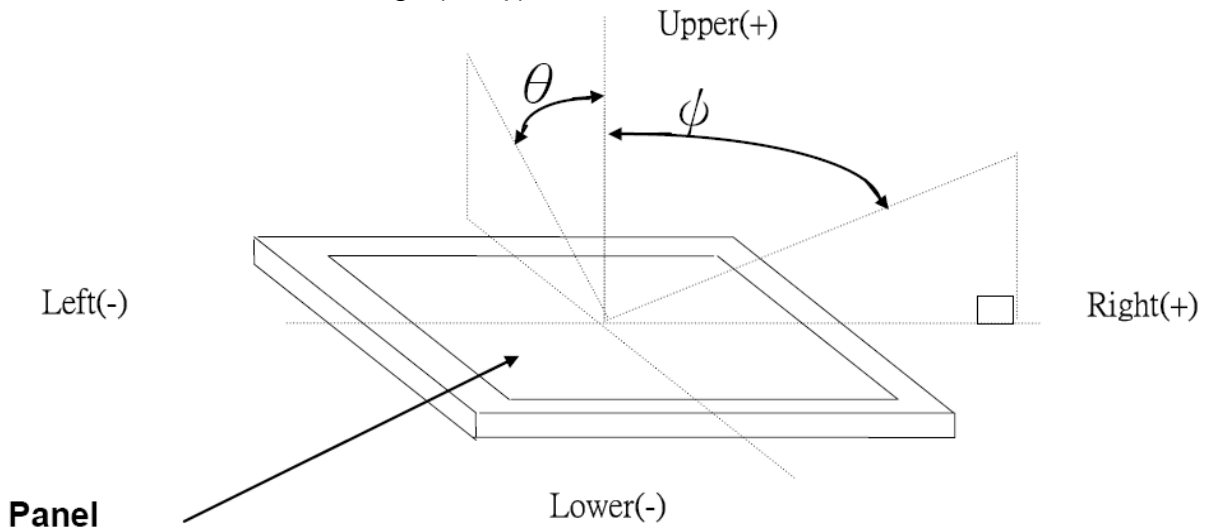
Note 4. Definition of Contrast Ratio :

$$CR = \text{White Luminance (ON)} / \text{Black Luminance (OFF)}$$

Note 5. Definition of response time : The response time is defined as the time interval between the 10% and 90% amplitudes.



Note 6. Definition of view angle($\theta \cdot \psi$) :



10. Reliability Test Conditions And Methods

NO.	TEST ITEMS	TEST CONDITION	INSPECTION AFTER TEST
①	High Temperature Storage	80°C±2°C×200Hours	Inspection after 2~4hours storage at room temperature,the samples should be free from defects: 1,Air bubble in the LCD. 2,Sealleak. 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 charateristic requirements shall be satisfied.
②	Low Temperature Storage	-30°C±2°C×200Hours	
③	High Temperature Operating	70°C±2°C×120Hours	
④	Low Temperature Operating	-20°C±2°C×120Hours	
⑤	Temperature Cycle(Storage)	-20°C ↔ 25°C ↔ 70°C (30min) ← (5min) → (30min) 1 cycle Total 10cycle	
⑥	Damp Proof Test	50°C±5°C×90%RH×120Hours	
⑦	Vibration Test	Frequency:10Hz~55Hz~10Hz Amplitude:1.5M X,Y,Z direction for total 3hours (Packing Condition)	
⑧	Drooping Test	Drop to the ground from 1M height one time every side of carton. (Packing Condition)	
⑨	ESD Test	Voltage:±8KV,R:330Ω,C:150PF,Air Mode,10times	

REMARK:

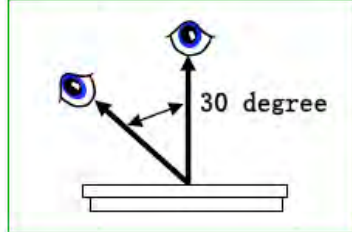
- 1,The Test samples should be applied to only one test item.
- 2,Sample side for each test item is 5~10pcs.
- 3,For Damp Proof Test,Pure water(Resistance > 10MΩ)should be used.
- 4,In case of malfunction defect caused by ESD damage,if it would be recovered to normal state after resetting,it would be judge as a good part.
- 5,EL evaluation should be excepted 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

This standard apply to TFT module specification.

1. Inspection condition:

Under daylight lamp 20~40W, product distance inspector' eye 30cm, incline degree 30° .



2. Inspection standard

NO.	Item	Inspection standard	Rate															
2.1	Dot	<p>Case of Dot defect is below</p> <p>① Bright Dot (whit spot) : "0"</p> <p>② Dark Dot (black spot) : "0" (In case of Dark Dot on Main TFT LCD)</p> <p>- NG if there's full Dot defect.</p> <p>- Damaged less than the size of sub-pixel is not counted as defect</p> <p>- Dots darker than the size of sub-pixel are not defined as bright dot defect</p> <table border="1"> <thead> <tr> <th>area size (mm)</th> <th>Acceptable number</th> </tr> </thead> <tbody> <tr> <td>$\Phi \leq 0.10$</td> <td>ignore</td> </tr> <tr> <td>$0.10 < \Phi \leq 0.15$</td> <td>3</td> </tr> <tr> <td>$0.15 < \Phi \leq 0.20$</td> <td>2</td> </tr> <tr> <td>$0.25 < \Phi \leq 0.25$</td> <td>1</td> </tr> <tr> <td>$0.25 < \Phi$</td> <td>0</td> </tr> </tbody> </table>	area size (mm)	Acceptable number	$\Phi \leq 0.10$	ignore	$0.10 < \Phi \leq 0.15$	3	$0.15 < \Phi \leq 0.20$	2	$0.25 < \Phi \leq 0.25$	1	$0.25 < \Phi$	0	minor			
area size (mm)	Acceptable number																	
$\Phi \leq 0.10$	ignore																	
$0.10 < \Phi \leq 0.15$	3																	
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$0.25 < \Phi \leq 0.25$	1																	
$0.25 < \Phi$	0																	
2.2	line	<table border="1"> <thead> <tr> <th colspan="2">Size (mm)</th> <th>Acceptable number</th> </tr> </thead> <tbody> <tr> <td>ignore</td> <td>$W \leq 0.03$</td> <td>ignore</td> </tr> <tr> <td>$L \leq 4.0$</td> <td>$0.03 < W \leq 0.04$</td> <td>2</td> </tr> <tr> <td>$L \leq 4.0$</td> <td>$0.04 < W \leq 0.05$</td> <td>1</td> </tr> <tr> <td></td> <td>$0.05 < W$</td> <td>Treat with dot non-conformance</td> </tr> </tbody> </table>	Size (mm)		Acceptable number	ignore	$W \leq 0.03$	ignore	$L \leq 4.0$	$0.03 < W \leq 0.04$	2	$L \leq 4.0$	$0.04 < W \leq 0.05$	1		$0.05 < W$	Treat with dot non-conformance	
Size (mm)		Acceptable number																
ignore	$W \leq 0.03$	ignore																
$L \leq 4.0$	$0.03 < W \leq 0.04$	2																
$L \leq 4.0$	$0.04 < W \leq 0.05$	1																
	$0.05 < W$	Treat with dot non-conformance																

12. Handling Precautions

12.1 Mounting method

The LCD panel of SC LCD module consists of two thin glass plates with polarizers which easily be damaged. And since the module is 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 happens by miss-handling or using some materials such as Chlorine (Cl), Sulfur (S) from customer, Responsibility is on customer.

12.3 Caution against static charge

The LCD module uses C-MOS LSI drivers, so we recommend that you:

Connect any unused input terminal to V_{DD} or V_{SS}, do not input any signals before power is turned on, and ground your body, work/assembly areas, 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 directly 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 voltage than the limit causes 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 than the operating temperature range and on the other hand at higher temperature LCD's show 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.
- A 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 storage

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 LCD , 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.

14 Packing Method

