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Thin-Film-Transistor LCD Module Model: GKCY43SPBH1R0

Acceptance	

Solomon Goldentek Display Corp.

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Approved and Checked by						

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SOLOMON GOLDENTEK DISPLAY CORP. SGD®

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Revise Records

Rev.	Date	Contents	Written	Approved
А	2016/04/19	Preliminary Specification	Alex	Roger

Special Notes

Note1.	



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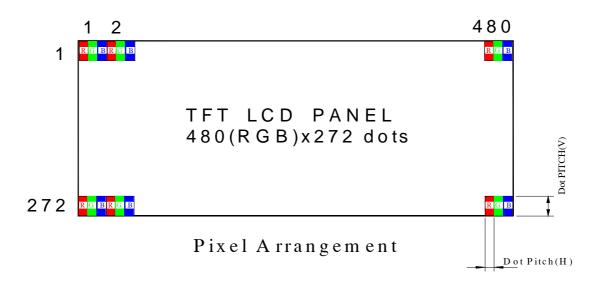
1 General Description and Features

GKCY43SPBH1R0 is a TM (Transmissive) type color active matrix TFT (Thin Film Transistor) liquid crystal display (LCD) that uses amorphous silicon TFT as a switching device. This model is composed of a TFT-LCD module, a driver circuit ,a Touch Panel and a back-light unit. The resolution of a 4.3" contains 480(RGB) x 272 dots and can display up to 16.7M colors. The following table described the features of GKCY43SPBH1R0.

1.1 Features

- Transmissive and back-light with 12 LEDs are available.
- TN (Twisted Nematic) mode.
- 24bit RGB Interface
- ROHS Compliance
- 4-wire Touch panel
- 1.2 LCD Module

Item	Specification	Unit
Screen Size	4.3 inches	Diagonal
Display Resolution	480(H) x RGB x 272(V)	Dot
Pixlel size	0.198 (H) x 0.198 (V)	mm
Active Area	95.040 (H) x 53.856 (V)	mm
Outline Dimension	105.5 (W) x 67.2 (H) x 4.85 (D)	mm
Display Mode	Normally white/Transmissive	
Pixel Arrangement	RGB Vertical-Stripe	
Surface Treatment	Anti-glare (AG)	
Display Color	16.7M	
Viewing Direction (Gray Inversion)	6 o'clock (Gray Inversion)	
Input Interface	Digital 24-bits parallel RGB	





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2 **Mechanical Information**

Item		Min.	Тур.	Max.	Unit	Note
	Horizontal (H)		105.5		mm	
Module Size	Vertical (V)		67.20	-	mm	(1)
	Thickness (T)		4.85		mm	(1)
Weight			60		g	

Note (1) Not include FPC.

Refer to the Dimensional Outlines for further information.



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3 Electrical Specifications

- 3.1 Absolute Max. Ratings
 - 3.1.1 Absolute Ratings of Environment

If the operating condition exceeds the following absolute maximum ratings, the TFT LCD module may be damaged permanently.

 $(Ta=25\pm2^{\circ}C, V_{SS}=GND=0)$

Item	Symbol	Min.	Max.	Unit	Note
Storage temperature	T_{STG}	-30	80	°C	(1)
Operating temperature	T _{OPR}	-20	70	°C	(1,2,3)

- Note (1) 95 % RH Max. ($40 \, ^{\circ}\text{C} \ge \text{Ta}$). Maximum wet-bulb temperature at 39 $^{\circ}\text{C}$ or less. (Ta > $40 \, ^{\circ}\text{C}$) No condensation.
- Note (2) In case of below 0°, the response time of liquid crystal (LC) becomes slower and the color of panel becomes darker than normal one. Level of retardation depends on temperature, because of LC's character
- Note (3) Only operation is guarantied at operating temperature. Contrast, response time, another display quality are evaluated at +25°C.

3.2 Electrical Absolute Rating

3.2.1 TFT-LCD Module

 $(Ta=25\pm2^{\circ}C, V_{SS}=GND=0)$

Item	Symbol Value		alue	Unit	Condition
	Syllibol	Min.	Max.	Offic	Condition
Power supply voltage	V_{DD}	-0.3	4.5	V	

3.2.2 Back-Light Unit

 $(Ta=25\pm2^{\circ}C)$

Item	Symbol	Min.	Max.	Unit	Note
Current of One LED	${ m I}_{\sf LED}$	-	25	mA	(1)

Note (1) Permanent damage to the device may occur if maximum values are exceeded or reverse voltage is loaded. Functional operation should be restricted to the conditions described under normal operating conditions.



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4 Electrical Characteristics

4.1 TFT-LCD Module

 $(Ta=25\pm2^{\circ}C, V_{DD}=3.3V)$

The	em	Symbol		Value		Unit	Condition	
100	5111	Зуппоот	Min.	Тур.	Max.	Offic	Condition	
Power supply vol	tage	V_{DD}	3.0	3.3	3.6	V		
Input Voltage	H Level	VIH	$0.7xV_{DD}$	-	V_{DD}	V		
for logic	L Level	VIL	0	-	0.3xV _{DD}	V		
Digital Current		I_{DD}	-	15	18	mA		

Note (1) The specified power consumption is under the conditions at V_{DD} =3.3V , F_{V} =60Hz, whereas a Power dissipation check pattern below is displayed.

Black Pattern / 0 Gray



Active Area

4.2 Backlight Unit

The back-light system is an edge-lighting type with white LED (Light Emitting Diode)s.

(Ta=25±2°C)

Item	Cymbol		Value		Unit	Condition
Item	Symbol	Min.	Тур.	Max.	Oill	Condition
LED Voltage	V_{L}	ı	19.8	21	>	
LED Current	\mathbf{I}_{f}	-	40	50	mA	
Power Consumption	P_{BL}	-	792	1050	mW	(2)
LED Life Time (25°C)	-	20000	-	-	hr	(3)

Note:(1) 6 LEDs serial 2 parallel type.

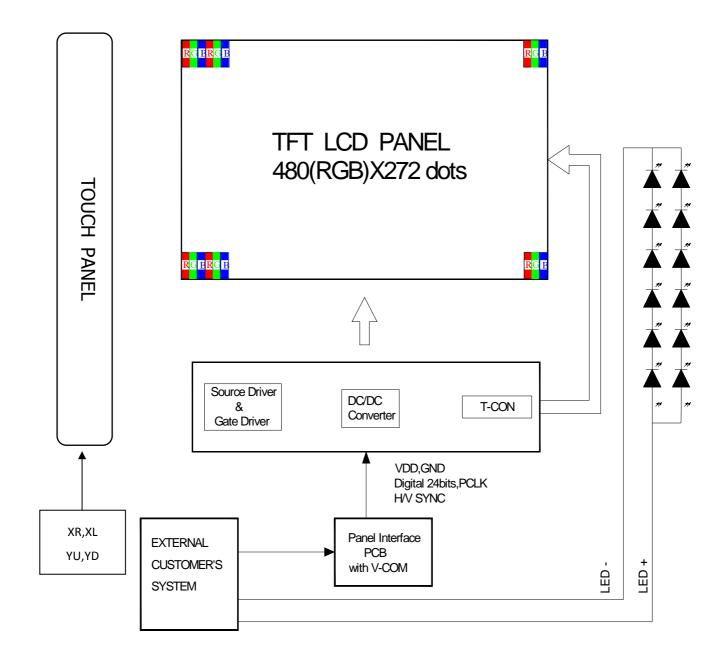
- (2) Where I_f = 40mA, V_L = 19.8V, P_{BL} = $V_L \times I_f$
- (3)The environmental conducted under ambient air flow ,at Ta=25±2°C,60%RH±5%



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6 Input Terminal Pin Assignment

6.1 CN1 Pin Assignment

(Reference Connector: Hirose Electric Co., LTD. Product No. FH12A-40S-0.5SH(55) Top contact type)

Pin No.	Symbol	I/O	Function	Remark
1	VSS	Р	Ground	
2	VSS	Р	Ground	
3	V_{DD}	Р	Logic power supply(+3.0~3.6V)	
4	V_{DD}	Р	Logic power supply(+3.0~3.6V)	
5	R0	I	Red Data Bit 0(LSB)	
6	R1	I	Red Data Bit 1	
7	R2	I	Red Data Bit 2	
8	R3	I	Red Data Bit 3	
9	R4	I	Red Data Bit 4	
10	R5	I	Red Data Bit 5	
11	R6	I	Red Data Bit 6	
12	R7	I	Red Data Bit 7(MSB)	
13	G0	I	Green Data Bit 0(LSB)	
14	G1	I	Green Data Bit 1	
15	G2	I	Green Data Bit 2	
16	G3	I	Green Data Bit 3	
17	G4	I	Green Data Bit 4	
18	G5	I	Green Data Bit 5	
19	G6	I	Green Data Bit 6	
20	G7	I	Green Data Bit 7(MSB)	
21	В0	I	Blue Data Bit 0 (LSB)	
22	B1	I	Blue Data Bit 1	
23	B2	I	Blue Data Bit 2	
24	В3	I	Blue Data Bit 3	
25	B4	I	Blue Data Bit 4	
26	B5	I	Blue Data Bit 5	
27	B6	I	Blue Data Bit 6	
28	В7	I	Blue Data Bit 7(MSB)	
29	VSS	Р	Ground	
30	P _{CLK}	I	Dot Data Clock	
31	DISP	I	Display on/off	
32	H_{SYNC}	I	Horizontal Sync Input	



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33	V_{SYNC}	I	Vertical Sync Input
34	DE	I	Data Enable
35	XR	0	Touch panel Right
36	YD	0	Touch panel Down
37	XL	0	Touch panel Left
38	YU	0	Touch panel Up
39	LEDK	Р	Backlight Cathode
40	LEDA	Р	Backlight Anode



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7 Touch Screen Panel Specifications

7.1 Electrical Characteristics

Item	Min.	Тур.	Max.	Unit	Note
Linearity	-1.5	-	1.5	%	Analog X and Y directions
Terminal resistance	500	-	1300	Ω	X (Glass side)
Terminal resistance	100	-	540	Ω	Y (Film side)
Insulation resistance	20	-	-	MΩ	DC 25V
Voltage	-	5.0	7.0	V	DC
Chattering	-	-	10	ms	100kΩ pull-up

7.2 Mechanical & Reliability Characteristics

Item	Min.	Тур.	Max.	Unit	Note
Activation force	60		100	g	
Durability-surface scratching	Write 100,000	-	-	characters	
Durability-surface pitting	1,000,000	ı	1	touches	
Surface hardness	3	-	-	Н	JIS K5400,ASTM D3363



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8 Optical Characteristics

The following items are measured under stable conditions. The optical characteristics should be measured in a dark room Measuring equipment: BM-7A

 $(Ta=25\pm2^{\circ}C, VDD =3.3V, I_{f=}40mA)$

Item		Symbol	Condition	Min	Type	Max	Unit	Note
Brightne	SS	-		640	800	I	cd/m ²	
Response	timo	T_R	θ=0°		5	10	ms	
Response	ume	T_F	0-0		15	20	ms	
Contrast r	atio	CR	At optimized viewing angle	200	250	1		-
	Red	R_X		0.57	0.62	0.67		
	Red	R_{Y}		0.29	0.34	0.39		
	Green	G_X		0.29	0.34	0.39		
Color	Green	G_Y	θ=0° Normal Viewing	0.52	0.57	0.62		
Chromaticity	Blue	B_X	Angle	0.09	0.14	0.19		
	Dide	B_Y	_	0.05	0.10	0.15		
	White	Wx		0.27	0.32	0.37		
	VVIIICE	Wy		0.29	0.34	0.39		
	Hor.	θ_{R}		50	65			
Viewing	1101.	$ heta_{L}$	CR≥10	50	65		Degree	
Angle (6H)	Ver.	$\theta_{\sf U}$	CK210	40	50		Degree	_ _
	VCI.	θ_{D}		50	60			



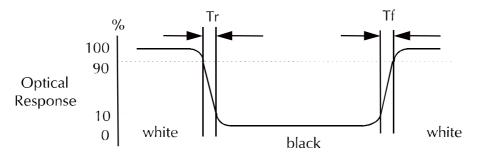
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a. Test equipment setup

After stabilizing and leaving the panel alone shall be warmed up for the stable operation of LCM, the measurement should be executed. Measurement should be executed in a stable, windless, and dark room. Optical specifications are measured by Topcon BM-5A/BM-7(fast) with a viewing angle of 2° at a distance of 50cm and normal direction.

b. Definition of response time: Tr and Tf

The response time is defined as the following figure and shall be measured by switching the input signal for "black" and "white".



c. Definition of contrast ratio:

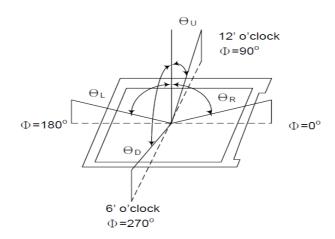
Brightness measured when LCD is at "white state" Contrast Ratio (CR) = Brightness measured when LCD is at "black state"

d. Measured at the center area of the panel when all the input terminals of LCD panel are electrically opened.



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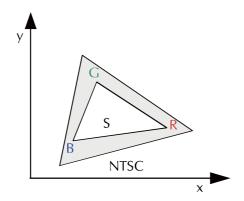
e. View Angle



f. Definition of Luminance of White: Luminance of white at the center points

g. Definition of White Uniformity

h. The definition of Color Gamut -Color Chromaticity CIE 1931
 Color coordinate of white & red, green, blue at center point.
 Color Gamut : NTSC(%) = (RGB Triangle Area / NTSC Triangle Area) x 100



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9 Basic Display Color and Gray Scale

	Color & Gray		Data Signal																						
	Scale	R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	В6	B5	B4	В3	B2	B1	В0
	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
Basic	Blue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
Color	Cyan	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Magenta	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(1)	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(2)	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Red	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
Reu	Red(127)	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Red(254)	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(255)	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
	Green(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Green	••	••	••	:	:	••	••	••	••	•••	••	••	••	••	••	••	••	••	••	••	••	:	:	:	:
Green	Green(127)	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Green(254)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
	Green(255)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Blue(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Blue(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Blue	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
Diac	Blue(127)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Blue(254)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0
	Blue(255)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1

0 : Low level voltage, 1 :High level voltage

Each basic color can be displayed in 256 gray scales from 8 bit data signals. With the combination of total 24 bit data signals, the 16,777,216-color display can be achieved on the screen.



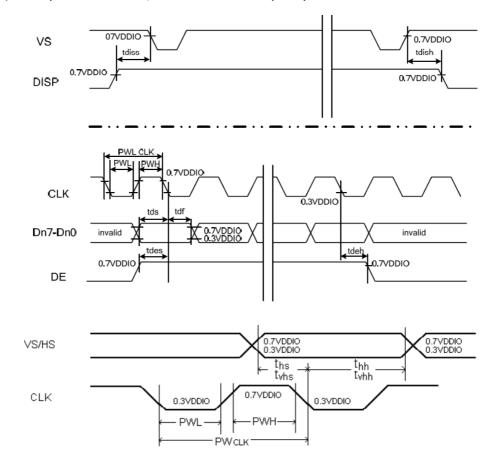
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10 AC Timing

10.1 AC Characteristics

Parameter	Symbol	Min	Тур	Max	Unit
DISP setup time	tdiss	10	-	-	ns
DISP hold time	tdish	10	-	-	ns
Clock period	PWCLK(1)	66.7	-	-	ns
Clock pulse high period	PWH(1)	26.7	-	-	ns
Clock pulse low period	PWL(1)	26.7	-	-	ns
Hsync setup time	ths	10	-	-	ns
Hsync hold time	thh	10	-	-	ns
Data setup time	tds	10	-	-	ns
Data hold time	tdh	10	-	-	ns
DE setup time	tdes	10	-	-	ns
DE hold time	tdeh	10	-	-	ns
Vsync setup time	tvhs	10	-	-	ns
Vsync hold time	tvhh	10	-	-	ns

Note (1): For parallel interface, maximum clock frequency is 15MHz



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10.2 Parallel RGB Input Timing Table

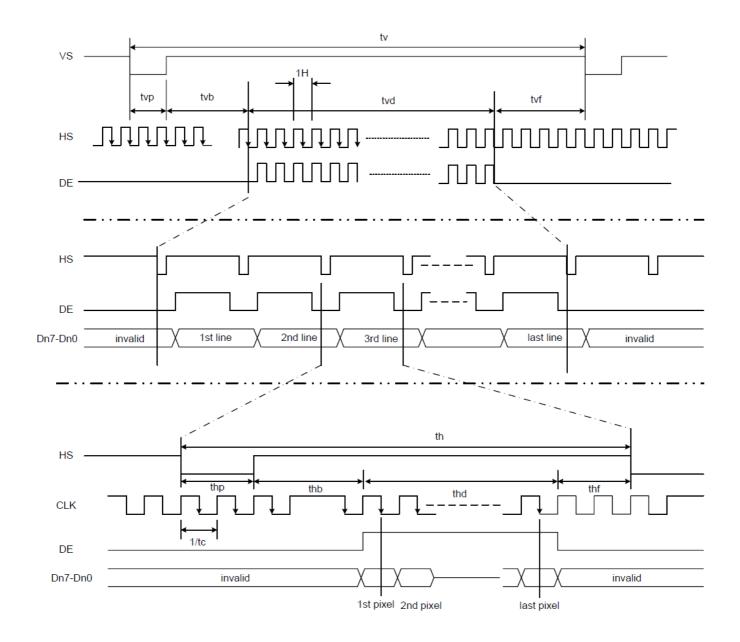
Signal	Parameter	Symbol	Min.	Тур.	Max.	Unit.	Remark
CLK DCLK frequency		fCLK	-	9	15	MHz	
	Hsync cycle	1/th	-	17.14	-	KHz	
	Horizontal cycle	th	525	525	605	CLK	
Heyne	Display Period	thd	480	480	480	CLK	
Hsync	Back Porch	thb	2	2	41	CLK	(2)
	Front Porch	thf	2	2	82	CLK	
	Pulse Width	Thp	2	41	41	DCLK	(2)
	Vsync cycle	1/tv	-	59.94	-	Hz	
	Vertical cycle	tv	285	286	399	Н	(2)
Veyne	Display Period	tvd	272	272	272	Н	(1)
Vsync	Back Porch	tvb	1	2	11	Н	(1)
	Front Porch	tvf	1	2	227	Н	(1)
	Pulse Width	tvp	1	10	11	Н	(1)

Note (1): Unit: CLK=1/fCLK, H= th,

Note (2): It is necessary to keep tvp+tvb=12 and thp+thb=43 in sync mode. DE mode is unnecessary to keep it.



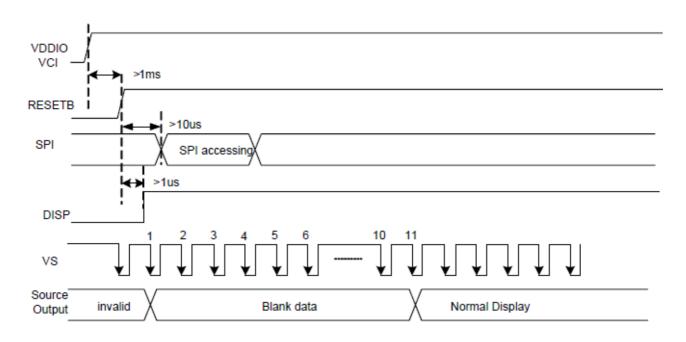
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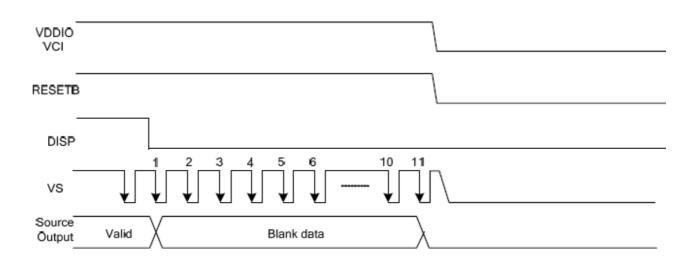
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10.3 POWER ON/OFF SEQUENCE

10.3.1 Power ON Sequence



10.3.2 Power OFF Sequence



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11 Test

No change on display and in operation under the following test condition.

Condition: Unless otherwise specified, tests will be conducted under the following condition.

Temperature: 20±5°C. Humidity: 65±5%RH.

Tests will be not conducted under functioning state.

	rests will be not conducted under functioning state.					
No.	Parameter	Condition	Notes			
1	High Temperature Operating	70°C±2°C, 240hrs (Operation state).				
2	Low Temperature Operating	-20°C±2°C, 240hrs (Operation state).	1			
3	High Temperature Storage	80°C±2°C, 240hrs.	2			
4	Low Temperature Storage	-30°C±2°C, 240hrs.	1,2			
5	High Temperature and High Humidity Operation Test	60°C±2°C, 90%, 240hrs	1,2			
6	Vibration Test	Total fixed amplitude: 1.5mm. Vibration Frequency: 10~55Hz. One cycle 60 seconds to 3 direction of X, Y, Z each 15 minutes.	3			
7	Electro Static Discharge Test Panel Surface/Top Case: 150pF, 330 ohm					
_ ′	(non-operating)	Air: ±12kV, Contact: ±6kV				
8	Drop Test	To be measured after dropping from 60cm high on the concrete surface in packing state. Dropping method corner dropping: A corner: Once edge dropping.				

Notes:

- 1. No dew condensation to be observed.
- 2. The function test shall be conducted after 4 hours storage at the normal temperature and humidity after removed from the test chamber.
- 3. Vibration test will be conducted to the product itself without putting I in a container.

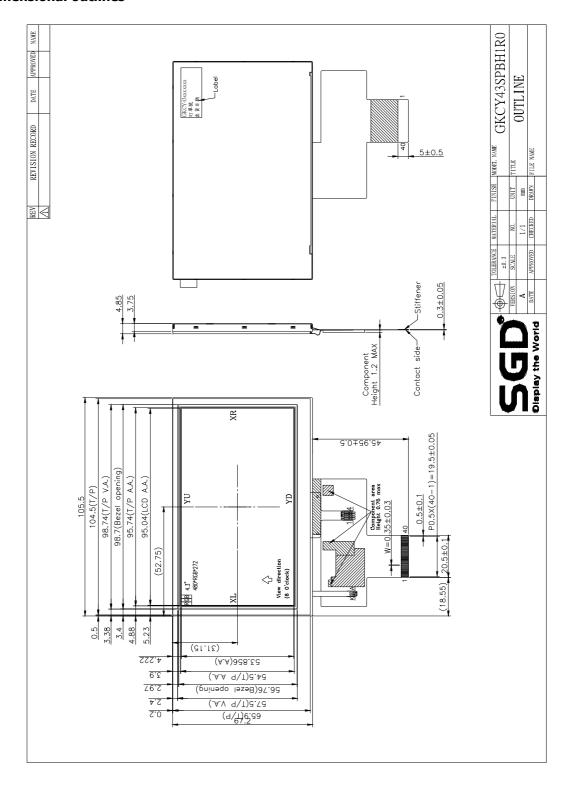




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12 Dimensional outlines





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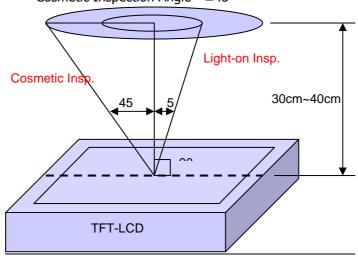
13 Incoming Inspection Standards

- 13.1 Inspection and Environment Conditions
 - 13.1.1 Inspection Conditions:

(1)Inspection Distance: 35 cm±5cm

(2)View Angle : Light-on Inspection Angle : $\pm 5^{\circ}$

Cosmetic Inspection Angle: ±45°



(perpendicular to LCD panel surface)

13.1.2 Environment Conditions:

Ambient Temperature		23°C ±5°C
An	bient Humidity	55±10%RH
Ambient Illumination	Cosmetic Inspection	more than 600 Lux
Illullillation	Functional Inspection	300~500 Lux

12.1.3 Sampling Conditions:

(1) Lot Size: Quantity of shipment lot per model

(2) Sampling Method:

	,			
Sampling Plan		MIL-STD-105E		
		Normal Inspection, Single Sampling		
		Level II		
٨٥١	Major Defect	1.0%		
AQL	Minor Defect	1.5%		

(3) The classification of Major(MA) and Minor(MI) defects is shown as 3. Inspection Criteria.





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13.1.4 Inspection Criteria

13.1.4.1 Cosmetic Inspection(Panel):

13.1.4.1 Cosmetic Inspection(Panel):					
Item	Judgment Criteria	Classification			
Chipping on Panel	$a \le 3.0 \text{mm}, \ b \le 3.0 \text{mm}, \ c \le t$ (Bottom glass thickness)	MA			
	W≤0.05mm or L< 5mm: Ignored				
Scratch on Panel *Note-2	0.05 mm< $W \le 0.1$ mm and $L \le 5$ mm: $N \le 5$	MI			
	W>0.1mm or L>5mm: Not allowed				
Bubble or Dent on Panel *Note-3	$D \le 0.2$ mm: Ignored 0.2 mm $< D \le 0.3$ mm: $N \le 5$ $D > 0.3$ mm: Not allowed	MI			
Panel Crack	Not Allowed crack	MA			
Bezel Deformation	Obvious deformation is not allowed.	MI			
Bezel Oxidation	Not allowed if it rusts continuously over 1 cm (It is out of warranty with rusted tin plate)	MI			
Bezel Scratch	L \leq 20mm , W \leq 0.2 , N \leq 3	MI			
Metal Squash Dent /Flange(Front Side)	D(W)≦1,L≦3,N≦3;	MI			
B/L High Voltage Wire Denudation	Not allowed	МА			
Polarizer flaw or leak out resin	Defect is defined as the active area.	MI			



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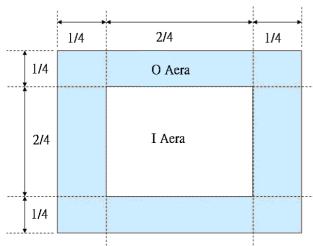
Outline Dimension Must in Spec, refer to related product spec. MI

13.1.4.2 Functional Inspection:

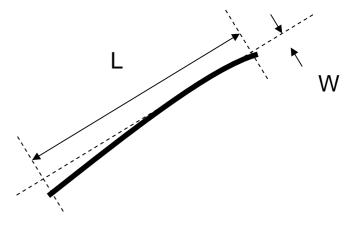
Thomas	Judgment Criteria				Classification
Item		Area(Note1)	I	0	Classification
		Random		2	
	Bright dot	2 dots adjacent	0	0	
		3 dots adjacent or more	0	0	
	Random		3		
	Dark dot	2 dots adjacent	0		
		3 dots adjacent or more	0	0	
	Total Dot De			5	
Point Defect		Distance between Bright and Bright dot	L≧5mm		MI
	Distance	Distance between Bright and Dark dot	L≥5mm		
		Distance between Dark dot	L≧5mm		
	(2) It is igno (3)Weak poi	ned as Point Defect if defect ored if defect area≤0.5dot int defect will be defined as d through ND filter 5%(Full	Bright Dot if it o		
Line Defect	Obvious vertical or horizontal line defect is not allowed.			MA	
Mura	Not allowed if it can be observed through ND Filter 5 %				MI
Foreign Material		D≦0.2mm: Io	gnored		
in spot shape		0.2mm <d≦0.5n< td=""><td>nm: N≦8</td><td></td><td>MI</td></d≦0.5n<>	nm: N≦8		MI
*Note-3		D>0.5mm: Not	allowed		
Foreign Material		W≦0.05mm or L≦5	mm: Ignored		
in line or spiral shape	in line or spiral shape 0.05mm <w≤0.2mm and="" l1.0mm≤5mm:="" n≤8<="" td=""><td>MI</td></w≤0.2mm>			MI	
*Note-4					
Display Function Abnormal	Display No Malfunction can be allowed			MA	

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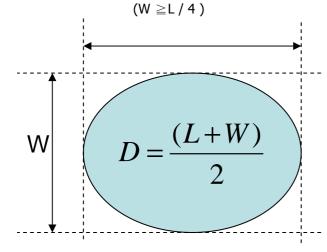
Note-1: I/O Area Definition



Note-2: Polarizer Scratch



Note-3 : Spot Foreign Material



Note-4 : Line or Spiral Foreign Material (W<L / 4)

