Thin-Film-Transistor LCD Module
Model: GKTY43SP9C3R0

Acceptance

Solomon Goldentek Display Corp.

NO. 18 Ta-Yeh St., Ta-Fa Industrial Park,Ta-Liao Hsiang, Kaohsiung Hsien 831, TAIWAN , R.O.C.

FAX: 886-7-7886800

Approved and Checked by

Approved by	Checked by		Made by
Eric Lai SEP/21/09		*Eric Lai SEP/21/09*	*Kobe Su SEP/21/09*

Revise Records

Rev.	Date	Contents	Written	Approved
A	2009/06/02	Preliminary Specification	Kobe su	David lee
-	2009/9/21	Modify Backlight thickness 4.3±0.2→5.05±0.1mm	Kobe su	Eric Lai

Special Notes

Note1.	
Note2.	
Note3.	
Note4.	
Note5.	

Contents

1 General Description and Features

GKTY43SP9C3R0 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 and a back-light unit. The resolution of a 4.3" contains 480x272RGB dots and can display up to 16.7M colors. The following table described the features of GKTY43SP9C3R0.

1.1 Features

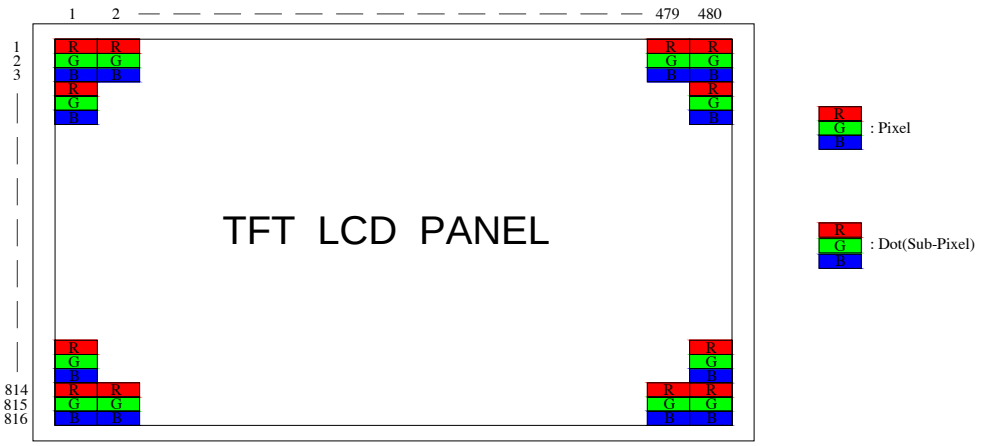
- Transmissive and back-light with seven LEDs are available.
- TN (Twisted Nematic) mode.
- Line inversion mode with stripe type.
- 24bit RGB Interface

1.2 Applications

- Display terminals for PMP (Portable Multimedia Player) application products.

1.3 LCD Module

Item	Specification	Unit
Screen Size	4.3 inches	Diagonal
Display Resolution	480(H) x 272(V) x RGB	Dot
Pixlel Pixels	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 4.3 (D)	mm
Display Mode	Normally white/Transmissive	--
Pixel Arrangement	RGB Side-Stripe	--
Surface Treatment	Anti-glare (AG)	--
Display Color	16.7M	--
Viewing Direction	6 o'clock	--
Input Interface	Digital 24-bits parallel RGB	--
Color Gamut (NTSC%)	NTSC 51.7%	--

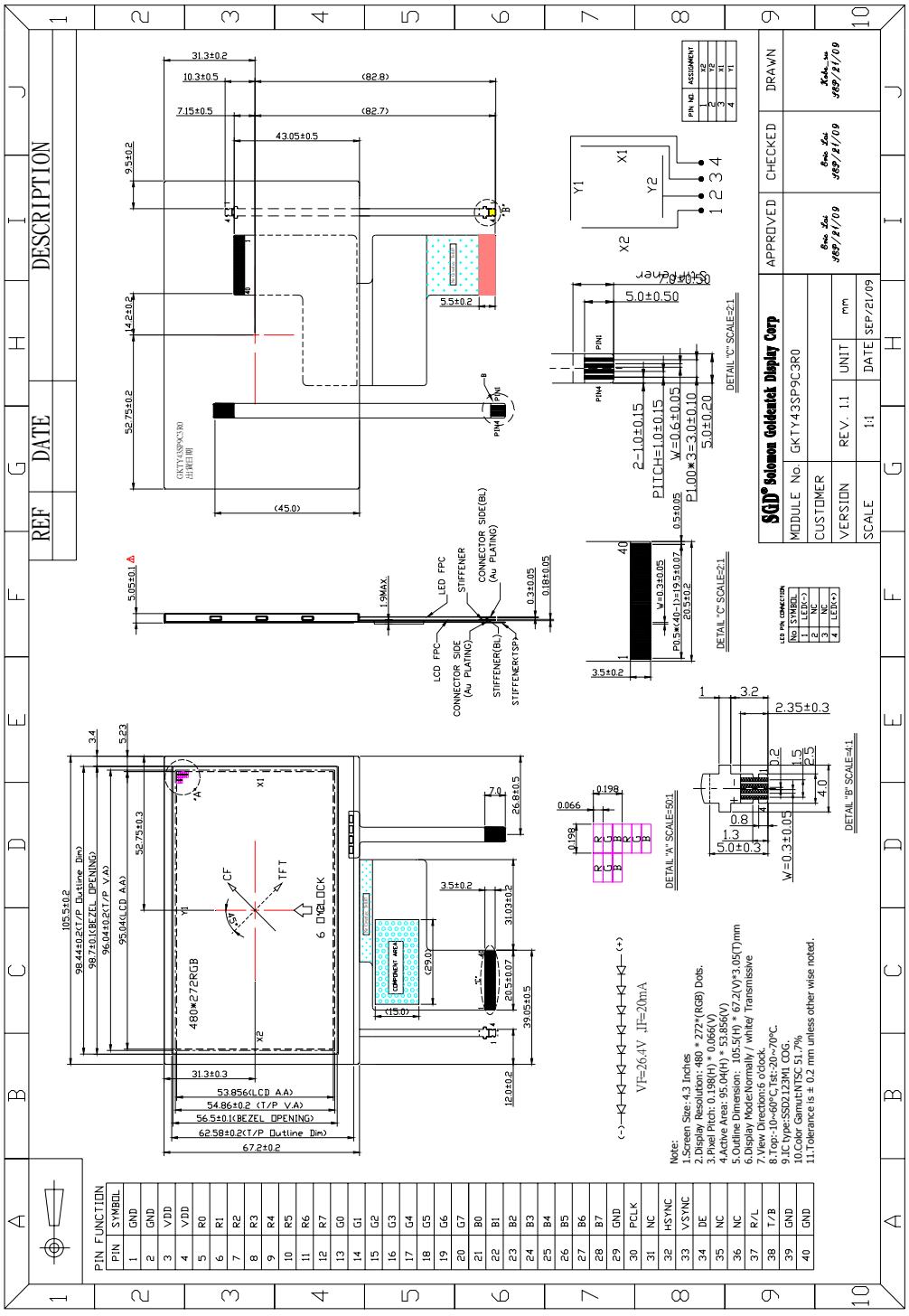


2 Mechanical Information

Item		Min.	Typ.	Max.	Unit	Note
Module Size	Horizontal (H)	--	105.5	--	mm	--
	Vertical (V)	--	67.20	--	mm	(1)
	Thickness (T)	--	5.05	--	mm	(1)
Weight		--	80	--	g	--

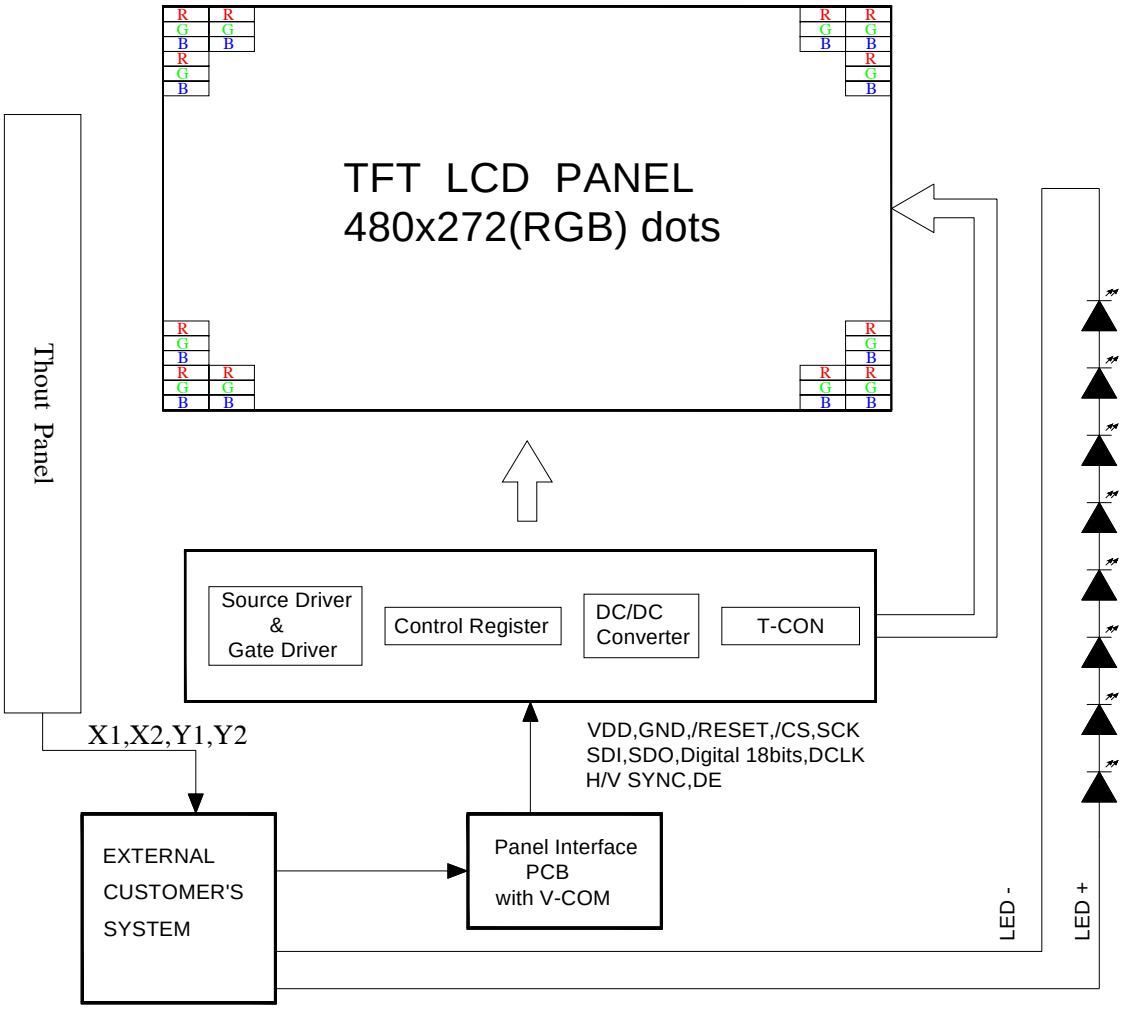
Note (1) Not include FPC.
Refer to the Dimensional Outlines for further information.
(2) Back-light & touch panel unit are included.

3 Dimensional Outlines



4 Block Diagram

4.1 Interface System Structure with Back Light Unit



4.2 Touch Panel (TSP)

Pin No.	Symbol	Function	Remark
1	X2	Touch Panel Left Side	--
2	Y2	Touch Panel Bottom Side	--
3	X1	Touch Panel Right Side	--
4	Y1	Touch Panel Top Side	--

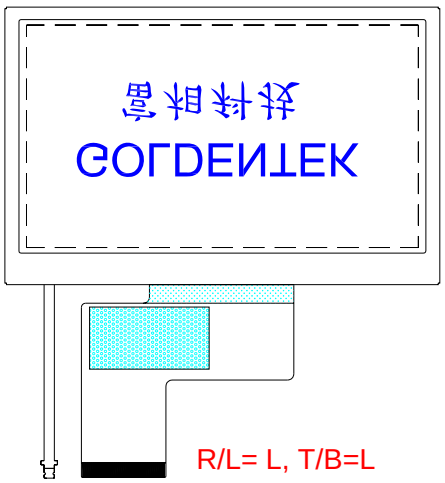
5 Input Terminal Pin Assignment

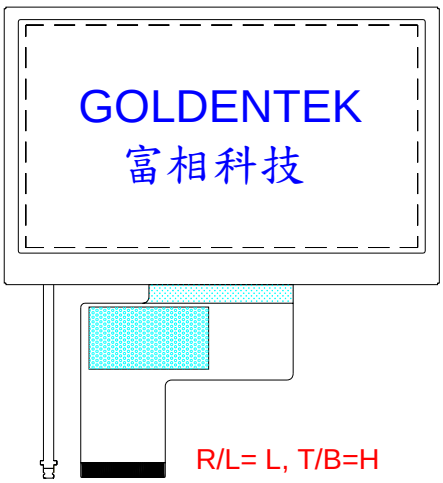
5.1 CN1 Pin Assignment (LCD)

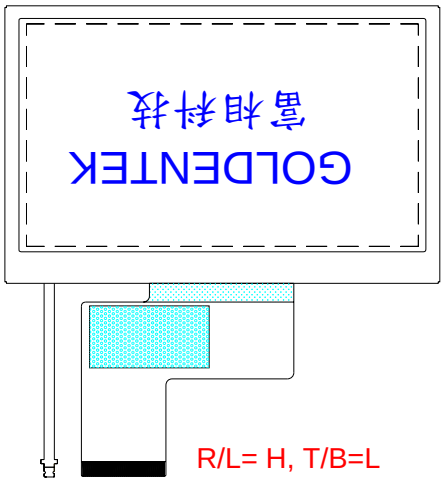
Pin No.	Symbol	I/O	Function	Remark
1	GND	P	Ground	
2	GND	P	Ground	
3	V_{DD}	P	Logic power supply(+3.0~3.6V)	
4	V_{DD}	P	Logic power supply(+3.0~3.6V)	
5	R0	I	Red Data Bit 0(LSB)	
6	R1	I	Red Data Bit 1	
7	R2	I	Red Data Bit 2	
8	R3	I	Red Data Bit 3	
9	R4	I	Red Data Bit 4	
10	R5	I	Red Data Bit 5	
11	R6	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	B0	I	Blue Data Bit 0 (LSB)	
22	B1	I	Blue Data Bit 1	
23	B2	I	Blue Data Bit 2	
24	B3	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	B7	I	Blue Data Bit 7(MSB)	
29	GND	P	Ground	
30	P_{CLK}	I	Dot Data Clock	
31	NC	I	NC	
32	H_{SYNC}	I	Horizontal Sync Input	
33	V_{SYNC}	I	Vertical Sync Input	

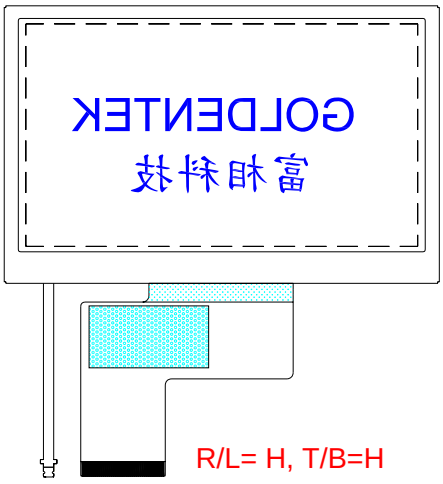
34	DEN	I	Data Enable Input	
35	NC	P	NC	
36	NC	P	NC	
37	R/L	I	Shift direction selection signal.	
38	T/B	I	Shift direction selection signal.	
39	GND	P	Ground	
40	GND	P	Ground	

Note:









6 Optical Characteristics

The following items are measured under stable conditions. The optical characteristics should be measured in a dark room or equivalent state with the methods shown in Note (1).
Measuring equipment: BM-5A

(Ta=25±2°C , Vcc = V_{CI}=3.3V, $I_{f=}$20mA)

Item		Symbol	Condition	Min	Type	Max	Unit	Note
Brightness		--	--	(200)	(250)	--	cd/m^2	(1),(2)
Response time		T_R	θ=0°	--	(35)	--	ms	(1),(2)
		T_F		--		--	ms	
Contrast ratio		CR	At optimized viewing angle	(200)	(250)	--	--	(1)
Color Chromaticity	Red	R_X	θ=0° Normal Viewing Angle	(0.598)	(0.618)	(0.638)	--	(1)
		R_Y		(0.298)	(0.318)	(0.338)		
	Green	G_X		(0.277)	(0.297)	(0.317)	--	
		G_Y		(0.525)	(0.545)	(0.565)		
	Blue	B_X		(0.114)	(0.134)	(0.154)	--	
		B_Y		(0.120)	(0.140)	(0.160)		
	White	Wx		(0.283)	(0.303)	(0.323)	--	
		Wy		(0.320)	(0.340)	(0.360)		
Viewing Angle (6H)	Hor.	θ	CR≥10	(100)	(110)	--	Degree	(1)
	Ver.	ϕ		(120)	(130)	--		

Note : (1) Measuring surrounding : dark room

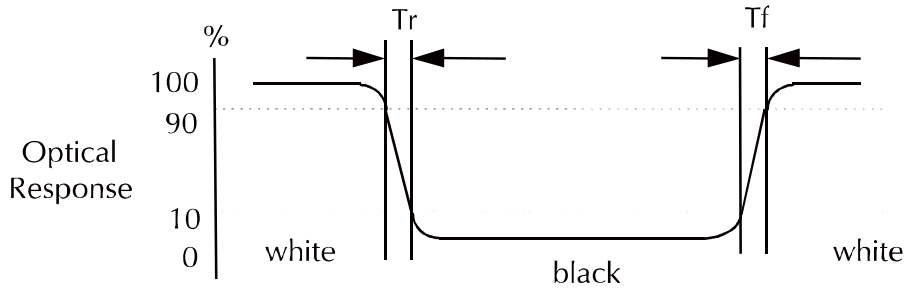
(2) 5min. warm-up time

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-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".

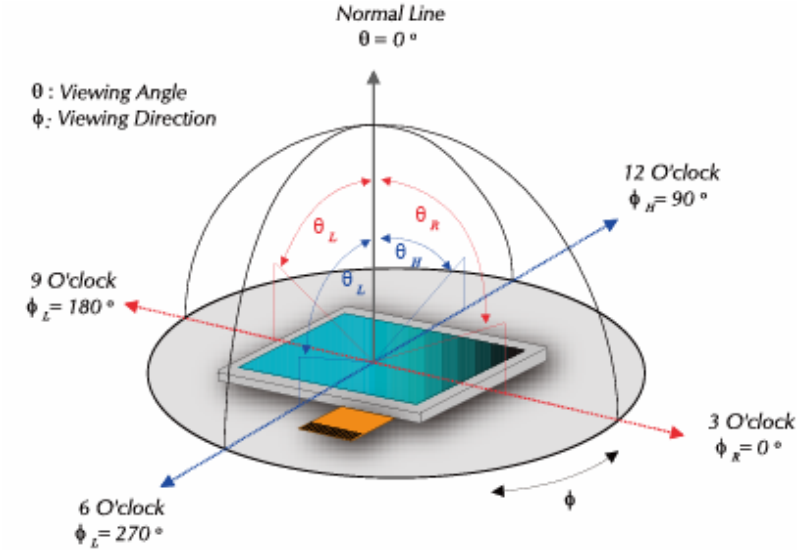


c. Definition of contrast ratio:

$$\text{Contrast Ratio (CR)} = \frac{\text{Brightness measured when LCD is at "white state"}}{\text{Brightness measured when LCD is at "black state"}}$$

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

e. View Angle



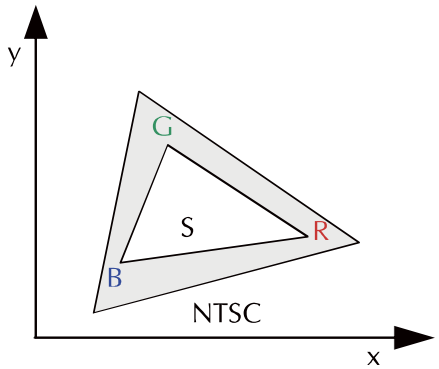
f. Definition of Luminance of White: Luminance of white at the center points

Light Source of Back-Light Unit	LED Type

g. Definition of White Uniformity

$$\text{White Uniformity} = \frac{\text{Min. luminance of white among 5-points}}{\text{Max. luminance of white among 5-points}}$$

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



7 Absolute Maximum Ratings

7.1 Absolute Ratings of Environment

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

(Ta=25±2°C, V_{SS}=GND=0)

Item	Symbol	Min.	Max.	Unit	Note
Storage temperature	T_{STG}	-20	70	°C	(1)
Operating temperature (Ambient temperature)	T_{OPR}	-10	60	°C	(1), (2)

Note (1) 90 % RH Max. (60 °C ≥ Ta)
Absolute humidity shall be less than 90 % RH (Ta > 60 °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.

7.2 Electrical Absolute Rating

7.2.1 TFT-LCD Module

(Ta=25±2°C, V_{SS}=GND=0)

Item	Symbol	Value		Unit	Condition
		Min.	Max.		
Logic power supply	V_{DDIO}	-0.3	4.0	V	
Logic input voltage	A_{VDD}	Vss-0.3	6.1	V	
Gate driver Low Output Voltage	V_{GL}	-15.0	-6.0	V	

Note : Temp. ≤ 60°C, 90% RH MAX.
Temp. > 60°C , absolute humidity shall be less than 90% RH at 60°C

7.2.2 Back-Light Unit

(Ta=25±2°C)

Item	Symbol	Min.	Max.	Unit	Note
Current	I_f	--	20	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.

8 Electrical Characteristics

8.1 TFT-LCD Module

(Ta=25±2°C, V_{DDIO} =3.3V)

Item	Symbol	Value			Unit	Condition
		Min.	Typ.	Max.		
Power supply of IO pins	V_{DDIO}	1.6	--	3.6	V	
Booster Reference suppy Voltage Range	V_{CI}	2.5 or V_{DDIO}	--	3.6	V	
AV_{DD} * primary booster efficiency	AV_{DD}	--	--	6.1	V	
Gate driver Low Output Voltage	V_{GL}	-15.0	--	-6.0	V	
Logic High Output Voltage	V_{OH1}	0.9* V_{DDIO}	--	V_{DDIO}	V	
Logic Low Output Voltage	V_{OL1}	0	--	0.1* V_{DDIO}	V	
Logic High Input voltage	V_{IH1}	0.8* V_{DDIO}	--	V_{DDIO}	V	
Logic Low Input Voltage	V_{IL1}	0	--	0.2* V_{DDIO}	V	

8.2 Backlight Unit

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

(Ta=25±2°C)

Item	Symbol	Value			Unit	Condition
		Min.	Typ.	Max.		
Power Consumption	P_{LED}	-	528	-	mW	
LED Current	If	-	20	-	mA	

Note (1) 8 LEDs serial type.

(2) When If = 20mA, V_B =26.4V= P_{LED} / If

8.3 Basic Display Color and Gray Scale

	Color & Gray Scale	Data Signal																							
		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	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(0)	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	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	Blue(0)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	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
Red	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(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
Green	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(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
Blue	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(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.

9 Touch Screen Panel Specifications

9.1 Touch Screen Panel Specifications

9.1.1 Electrical Characteristics

Item	Min.	Typ.	Max.	Unit	Note
Linearity	-1.5	-	1.5	%	Analog X and Y directions
Terminal resistance	200	-	700	Ω	X (Glass side)
	200	-	900	Ω	Y (Film side)
Insulation resistance	20	-	-	MΩ	DC 25V
Voltage	-	5.0	7.0	V	DC
Chattering	-	-	10	ms	100kΩ pull-up
Transparency	-	82	-	%	Non-glare

Caution (1) : Do not operate it with a thing except a polyacetal pen (tip R0.8mm or less) or a finger, especially those with hard or sharp tips such as a ball point pen or a mechanical pencil.

9.1.2 Mechanical & Reliability Characteristics

Item	Min.	Typ.	Max.	Unit	Note
Activation force	-		80	g	(1)
Durability-surface scratching	Write 100,000	-	-	characters	(2)
Durability-surface pitting	1,000,000	-	-	touches	(3)
Surface hardness	3	-	-	H	JIS K5400,ASTM D3363

Note (1) Stylus pen Input : R0.8mm polyacetal pen or Finger

Note (2) Measurement for Surface area - Scratch 100,000 times straight line on the Film with a stylus change every 20,000times

- Force : 150gf
- Speed : 100mm/sec
- Stylus : R0.8 polyacetal tip

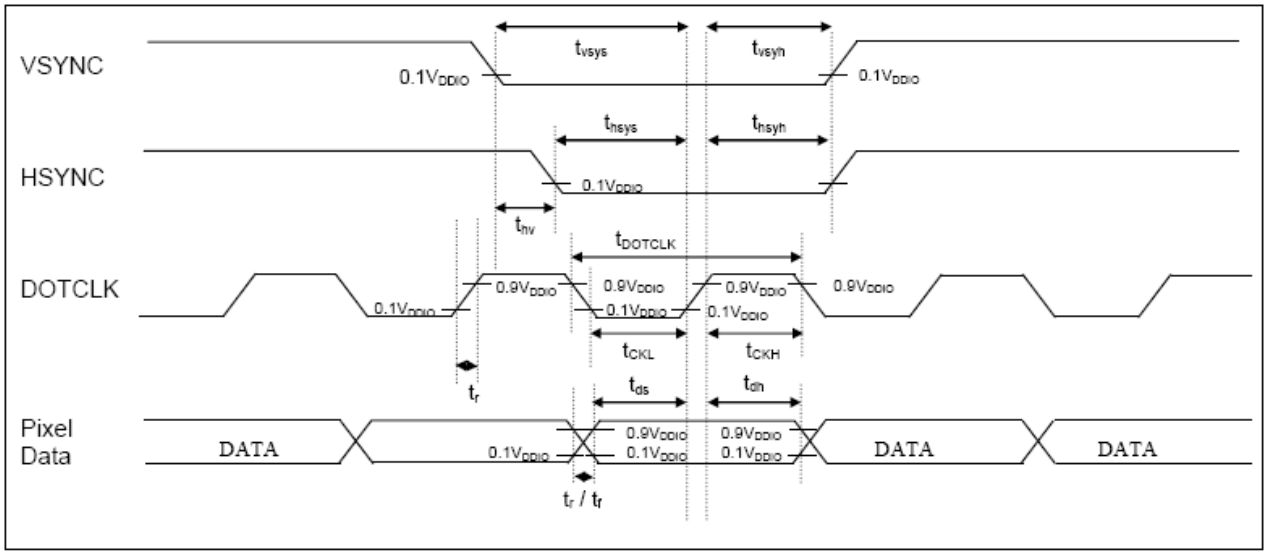
Note (2) Pit 1,000,000 times on the Film with a R8.0 silicon rubber.

- Force : Force : 250gf
- Speed : 3times/sec

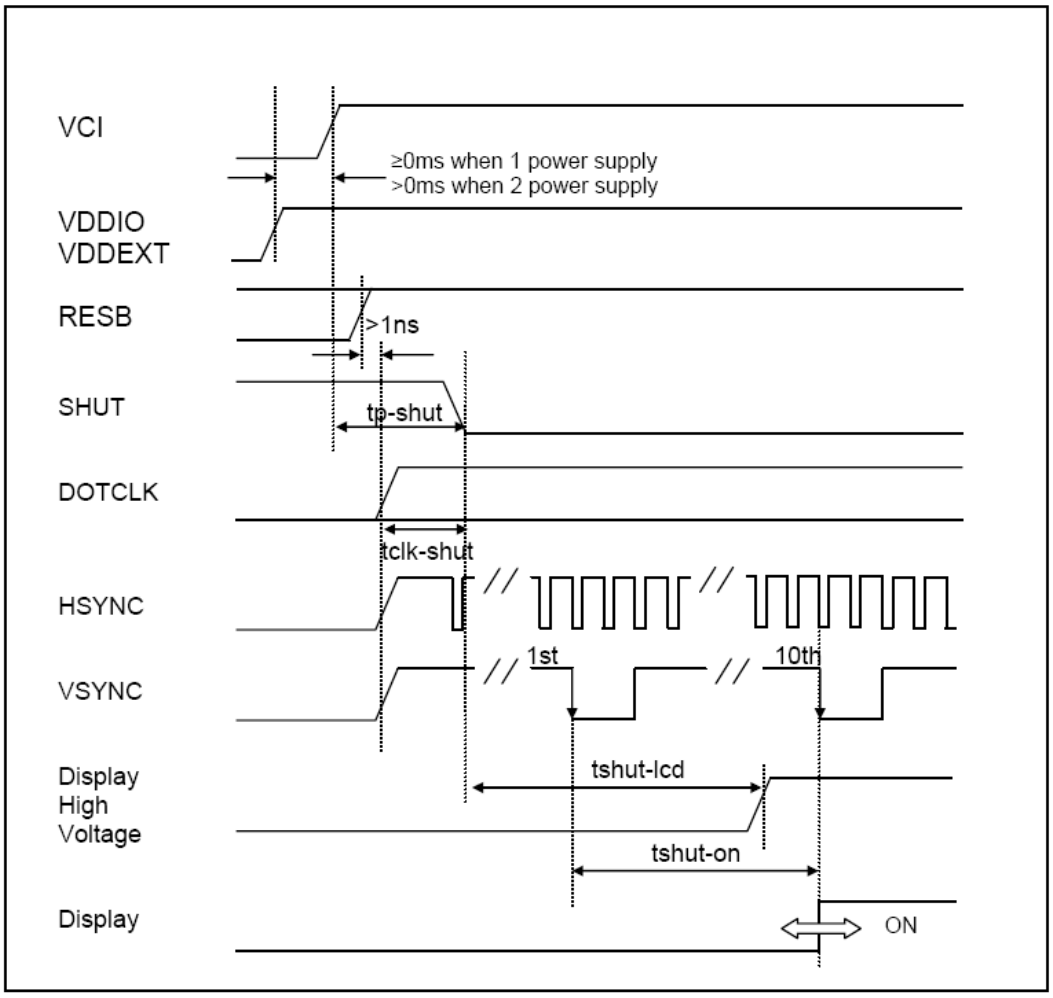
10 AC Timing

10.1 AC Timing Characteristics

(Gamas=1 , V_{DDIO} =3.3V)



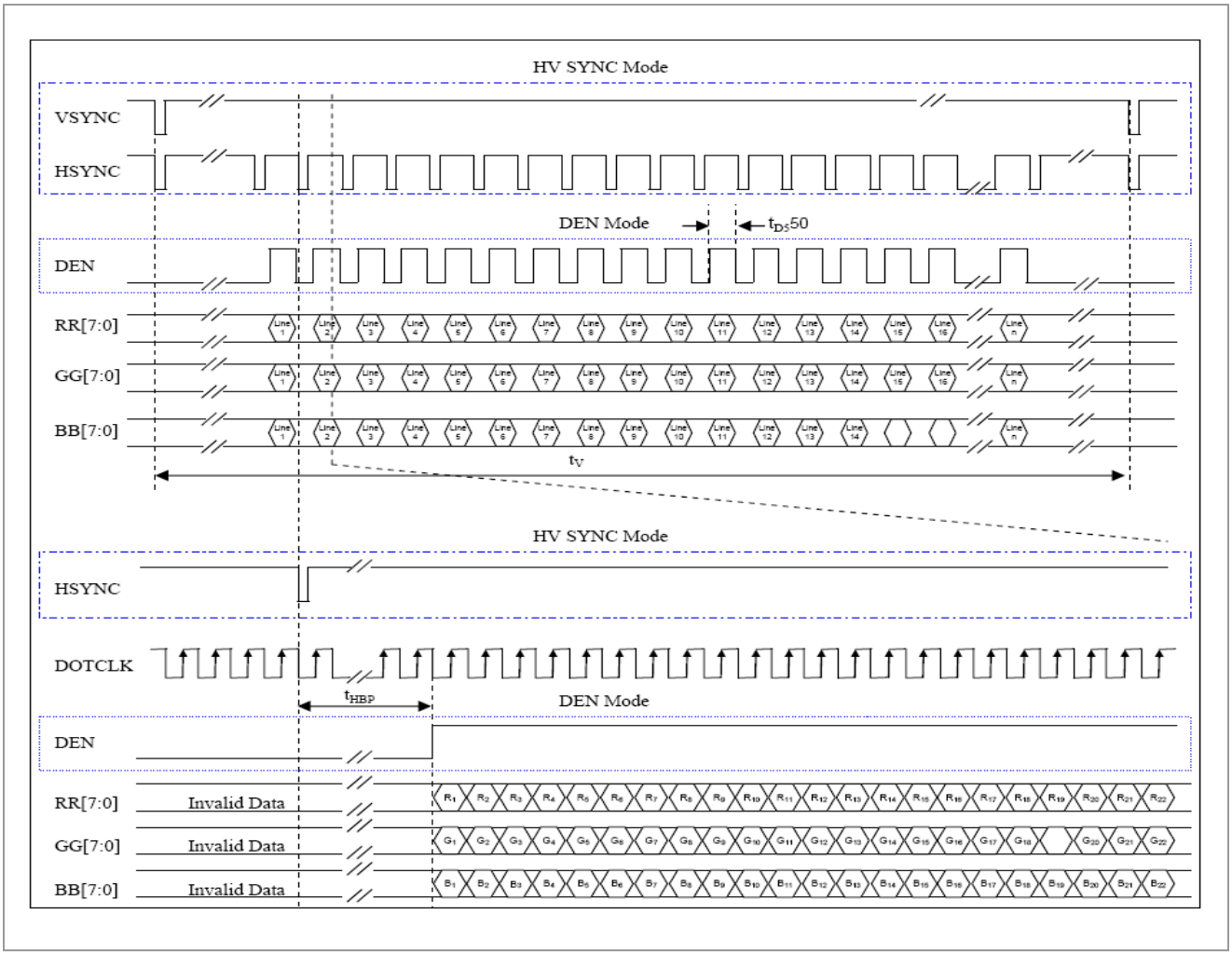
Item		Symbol	Min.	Typ.	Max.	Unit
DOTCLK Frequency	24 bits parallel	f_{DOTCLK}	-	-	14	MHz
	8 bits parallel		-	-	-	
DOTCLK Period	24 bits parallel	t_{DOTCLK}	71.4	-	-	n_{Sec}
	8 bits parallel		-	-	-	
Pixel Clock Period	24 bits parallel	t_{PIXCLK}	-	1	-	t_{DOTCLK}
	8 bits parallel		-	3	-	
Pixel Clock Freq	24 bits parallel	f_{PIXCLK}	-	-	14	MHz
	8 bits parallel					
Vertical Sync Setup Time		t_{VSYS}	5	-	-	n_{Sec}
Vertical Sync Hold Time		t_{VSYh}	5	-	-	n_{Sec}
Horizontal Sync Setup Time		t_{hSYS}	5	-	-	n_{Sec}
Horizontal Sync Hold Time		t_{hSYh}	5	-	-	n_{Sec}
Phase difference of Sync Signal Falling Edge		t_{hv}	0	-	480	t_{DOTCLK}
DOTCLK Low Period		t_{CKL}	18	-	-	n_{Sec}
DOTCLK High Period		t_{CKH}	18	-	-	n_{Sec}
Data Setup Time		t_{ds}	10	-	-	n_{Sec}
Data Hold Time		t_{dh}	15	-	-	n_{Sec}
Reset pulse width		t_{Res}	10	-	-	n_{Sec}
Rise /Fall time		t_r / t_f	5	-	25	n_{Sec}



Power UP Sequence (Games =1)

Item	Symbol	Min.	Typ.	Max.	Unit
V_{DDEXT} / V_{DDIO} on to falling edge of SHUT	$t_{p\ -\ Shut}$	1	-	-	μ sec
Start of DOTCLK to SHUT low	$t_{clk\ -\ Shut}$	1	-	-	DOTCLK
Falling edge of SHUT to LCD power on	$t_{shut\ -\ lcd}$	-	-	167	Msec
Falling edge of SHUT to display start -- 1 line : 512 clk -- 1 frame : 278 line -- PIXCLK = 8.5MHz	$t_{shut\ -\ on}$	-	-	10	Frame
		-	167	-	msec

10.2 24-bit RGB Interface



Characteristics		Symbol	HV SYNC Mode	Units
Dotclk Frequency		$1/t_{DOTCLK}$	8.54	MHz
Horizontal	One Line Period	t_H	525	t_{DOTCLK}
	Active Data Period	t_{data}	480	t_{DOTCLK}
	Horizontal Back Porch	t_{HBP}	43	t_{DOTCLK}
	Horizontal Frame Porch	t_{HFP}	2	t_{DOTCLK}
Vertical	One Field Period	t_V	286	t_H
	Active Line Period	t_{AL}	272	t_H
	Vertical Back Porch	t_{VBP}	12	t_H
	Vertical Frame Porch	t_{VFP}	2	t_H

11 Reliability Condition for LCD

11.1 LCD Reliability Test

11.1.1 Reliability Test Condition

No.	TFT	Item	Condition	Test time	Note
1	V	High temp. operating	60°C	240 Hrs	--
2	V	Low temp. operating	-10°C	240 Hrs	--
3	V	High temp. storage	70°C	240 Hrs	--
4	V	Low temp. storage	-20°C	240 Hrs	--
5	V	High Temp / High Humidity Storage	T = 60°C /90%. For (But no condensation dew)	24 Hrs	--
6	V	High Temp/ High Humidity Operating	T = 40°C /90% For (But no condensation dew)	240 Hrs	--
7	V	Thermal Shock	-20 ~ 70°C, 50 cycle	1 Hrs	--

11.1.2 Operating Test Pattern

No.	Items	Test Pattern
1	Test Pattern in Driving Condition	1. Full Red 2. Full Green 3. Full Blue 4. Gradation (horizontal) 5. Gradation (vertical) 6. Character (111111) 7. Full White 8. Full Black 9. Black Line (horizontal) 10. Black Line (vertical) 11. Mosaic (1X1) The Test Pattern is changed 1sec. The same Pattern are repeated.
2	Black Square	Black Window and White Background

11.1.3 Test Method

The method of visual inspection is equal to the appearance standard. Evaluation and assessment made two hours after return to room temperature (25 ± 5°C). The LCDs subjected to the test must not have dew condensation.
The test pattern is gray scale and the operating voltage sweep from Vth to Vsat variable.
The non-uniformity and other appearance are checked in LCD.

11.1.4 Result Evaluation Criteria

There should be no change which might affect the practical display function when the display quality test is conducted under normal operating condition.

11.1.5 Life time

Life time expectancy of LCD Panel is approximately 50,000 hours under the room environment. Definition on the termination of life time is deterioration of contrast ratio by one fifth against initial value.

11.1.6 Basic rule for Reliability test

* Place all the samples under room temperature & humidity for 24 hours after reliability stressing.
* Room environment means 25+/-10°C, 45+/-20%RH.
* There should be no condensation during the test.
* One LCD module shall be used for one test item only and once.

11.1.7 Judgment Criteria for reliability test No. 1-2

* Contrast (or Brightness) ratio variation is within 50% of the initial value.
* No abnormal function
* No extreme decay on appearance

11.1.8 Life time

Main Display (LCD module) : Life time expectancy of LCD Panel is approximately 50,000 hours under the room environment. Definition on the termination of life time is deterioration of contrast ratio by one fifth against initial value. (25±10°C, 45±20%RH).

Life time shall be defined as one of below cases;
* When the contrast ratio for Main display reaches 30% of initial condition and the brightness (or luminance with polarizer) for sub display reaches 50% of initial condition.
* When the appearance degradation appears.

12 Warranty

This product has been manufactured to your company's specifications as a part for use in your company's general electronic products. It is guaranteed to perform according to delivery specifications. For any other use apart from general electronic equipment, we cannot take responsibility if the product is used in medical devices, nuclear power control equipment, aerospace equipment, fire and security systems, or any other applications in which there is a direct risk to human life and where extremely high levels of reliability are required. If the product is to be used in any of the above applications, we will need to enter into a separate product liability agreement.

1 We cannot accept responsibility for any defect, which may arise from additional manufacturing of the product (including disassembly and reassembly), after product delivery.

2 We cannot accept responsibility for any defect, which may arise after the application of strong external force to the product.

3 We cannot accept responsibility for any defect, which may arise due to the application of static electricity after the product has passed your company's acceptance inspection procedures.

4 We cannot accept responsibility for industrial property, which may arise through the use of your product, with exception to those issues relating directly to the structure or method of manufacturing of our product. SGD-origin longer than one year from SGD production.