LTPS TFT LCD Paper-machine

ALR333RGT

8.8cm(3.5inch) 480 x RGB x 640 dot

*This specification is tentative, and is subject to change without notice.

This 3.5 inch low temperature poly- silicon TFT-LCD module is suitable for PDA.

<Features>

-Display size : 8.8cm diagonal (3.5inch)
-921,600 dot (480 x RGB x 640)(232ppi)
-Transflective type
-RGB stripe color arrangement.
-Preferred viewing angle ; 12 o'clock
-Polarizer : AR coat
-Slim design, light weight and narrow frame.
-Operating temperature is -20 to +60 °C.
-Storage temperature is - 30 to +70 °C.

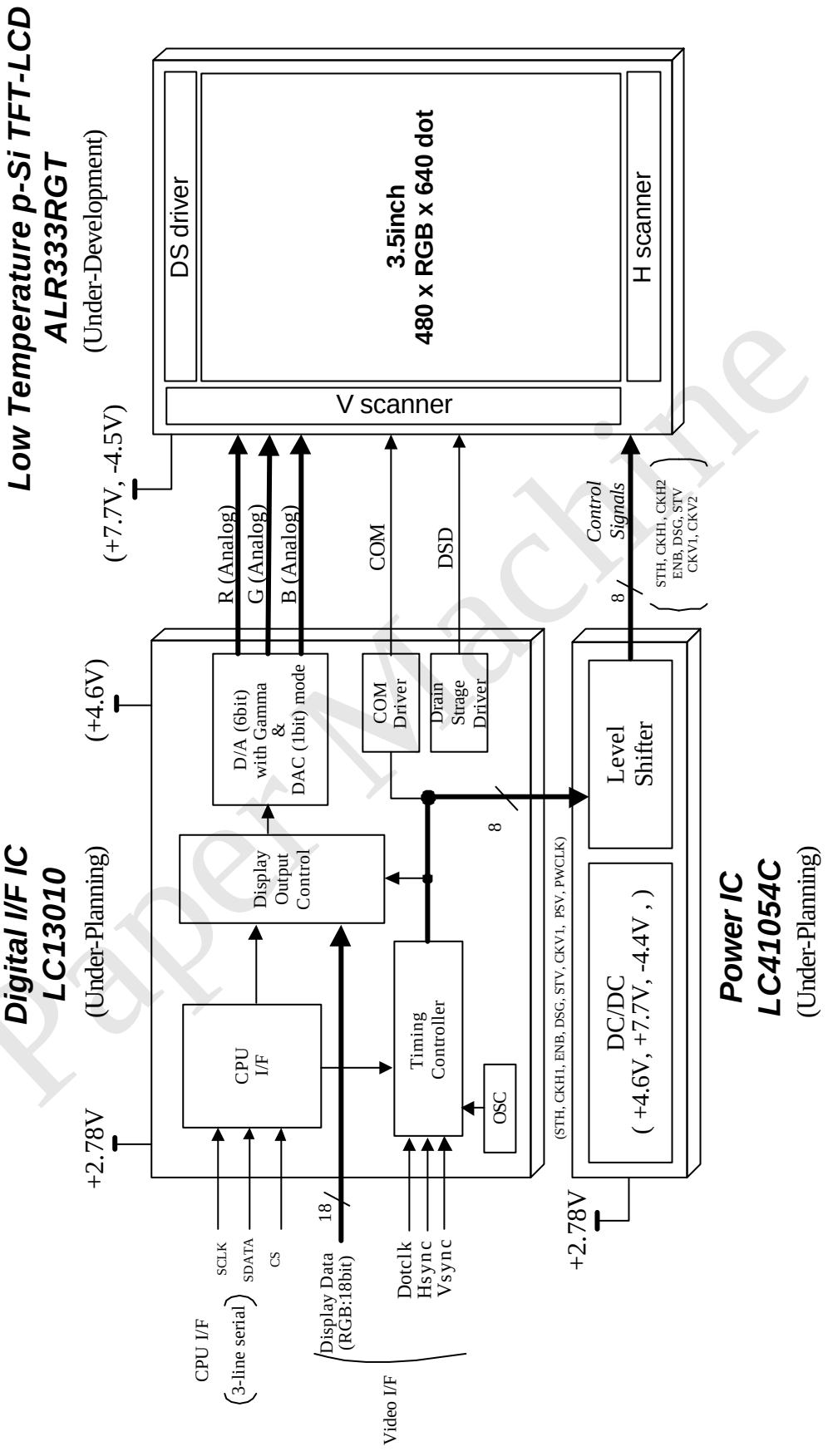
<Specifications>

Item	Specifications	Unit
Dot count (H)×(V)	480 x RGB x 640	dot
Effective display dimensions (H)×(V)	52.56 x 70.08	mm
Display size (diagonal)	8.76 (3.5inch)	cm
Dot pitch (H)×(V)	0.0365 x 0.1095	mm
Color arrangement	RGB Stripe	-
Module external dimensions (W)×(H)×(D) *	TYP. 59.6 x 89.8 x 3.81	mm
FPC length	TYP. 16.0	mm
Weight	T.B.D.	g

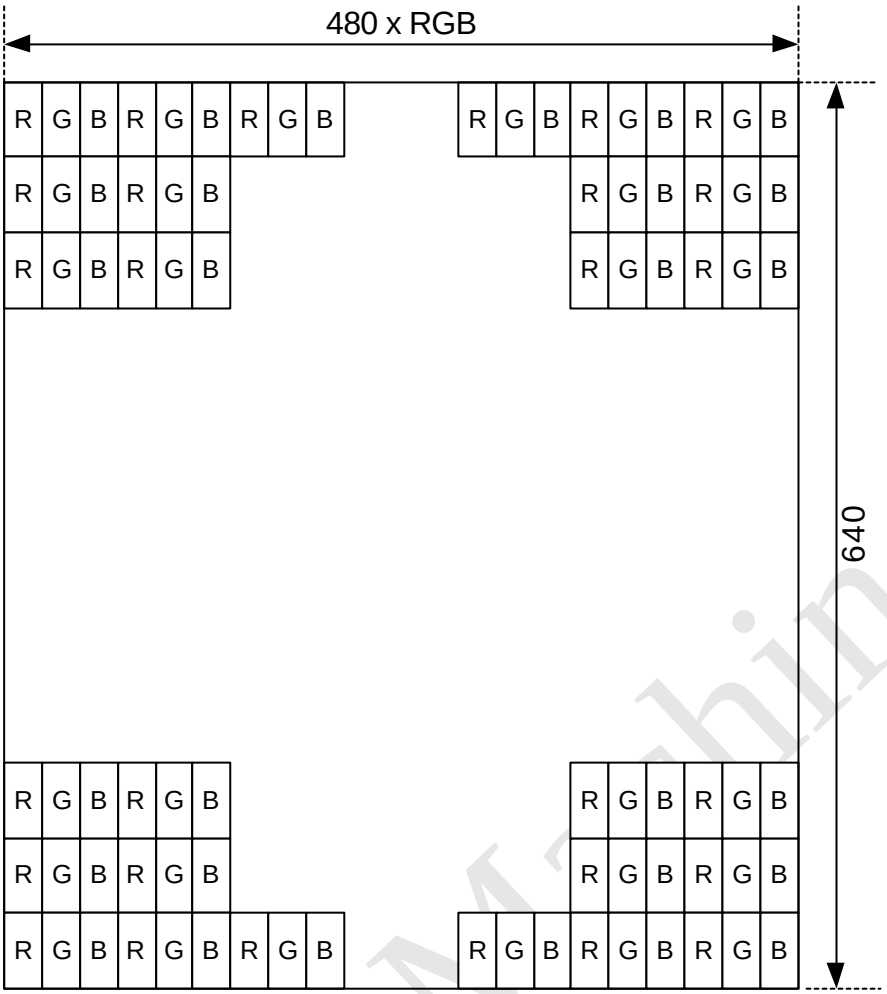
* : Without Projection

[Block diagram]

*This is tentative and this is subject to be changed without notice.



[Color arrangement]



[Input pin arrangement]

No.	Pin Name	No.	Pin Name
1	DGND	19	RD2
2	DGND	20	RD3
3	VDD	21	RD4
4	VDD	22	RD5
5	AGND	23	DGND
6	EN16	24	GB0
7	VDD	25	GB1
8	TERST	26	GB2
9	CS	27	GB3
10	DIN	28	GB4
11	DOUT	29	GB5
12	SCLK	30	DGND
13	VSYNC	31	BD0
14	HSYNC	32	BD1
15	DCLK	33	BD2
16	DGND	34	BD3
17	RD0	35	BD4
18	RD1	36	BD5

[Electrical characteristics]

Absolute Maximum Ratings:(VSS standard, Ta=25deg. ± 2deg.)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Power Supply Voltage	VDD		-0.3	-	+4.0	V
Power Supply Voltage	VSS		-0.3	-	0.3	V
Input Voltage (Logic)	Vin		-0.5	-	VDD+0.5	V
Storage Temperature	Tstg		-30	-	70	deg.
Operating Temperature	Topr		-20	-	60	deg.

Allowable Operating Ranges （VSS standard）

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Power Supply Voltage	VDD		+2.58	+2.78	+2.98	V
Power Supply Voltage	VSS		-	0	-	V
Operating Temperature	Topr		-20	-	+60	deg.
H-Level Input Voltage	Vih		0.7VDD	-	VDD	V
L-Level Input Voltage	Vil		0	-	0.3VDD	V

[AC characteristics]

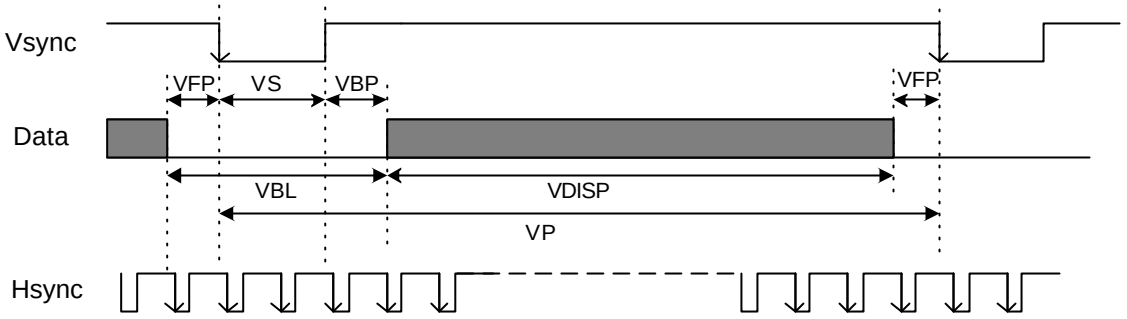
VDD=2.58 to 2.98V

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Vertical Sync. Set-up Time	tvsys		10	-	-	ns
Vertical Sync. Hold Time	tvsyh		10	-	-	ns
Horizontal Sync. Set-up Time	thsys		10	-	-	ns
Horizontal Sync. Hold Time	thsyh		10	-	-	ns
Phase difference of Sync. Signal Falling edge	thv		0	-	-	clk
Clock Cycle	tclk		-	39.7	-	ns
	fclk		-	25.175	-	(MHz)
Clock "L" Period	tckl		15	-	-	ns
Clock "H" Period	tckh		15	-	-	ns
Data Set-up Time	tds		10	-	-	ns
Data Hold Time	tdh		10	-	-	ns

[Input Timing]

Video I/F

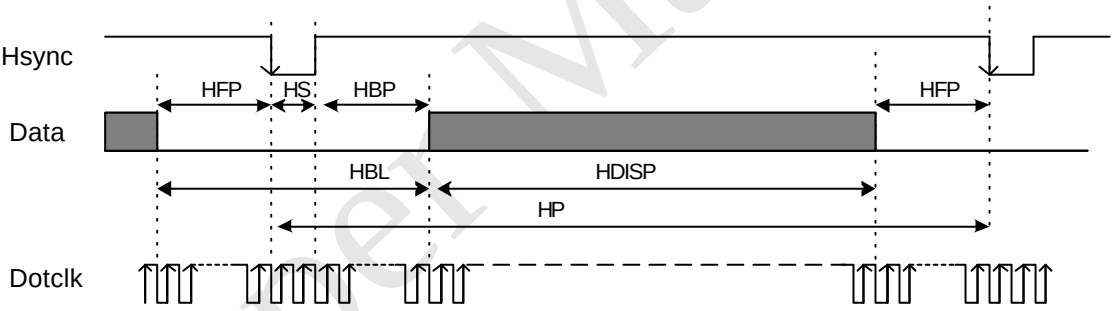
<Vertical Timing Chart>



(VDD=2.58 to 2.98V)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Vertical Cycle	VP		—	644	—	line
Vertical Sync. Pulse Width	VS		—	2	—	line
Vertical Back Porch	VBP		—	1	—	line
Vertical Data Start Point		VS+VBP	—	3	—	line
Vertical Front Porch	VFP		—	1	—	line
Vertical Blanking Period	VBL	VS+VBP+VFL	—	4	—	line
Vertical Active Area	VDISP		—	640	—	line

<Horizontal Timing Chart>



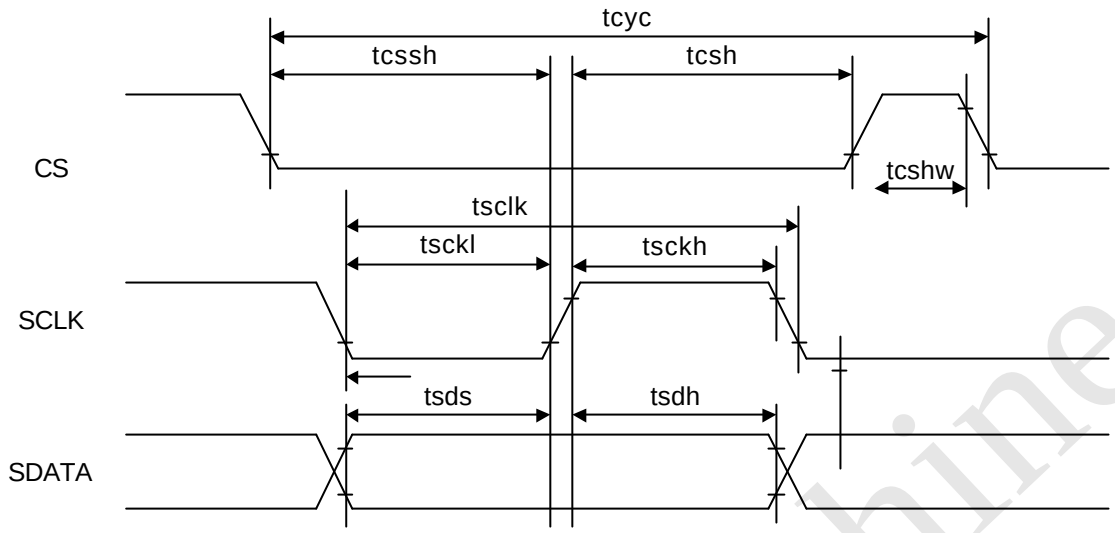
(VDD=2.58 to 2.98V)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Horizontal Cycle	HP		-	660	-	dot
			-	26.2	-	(us)
Horizontal Sync. Pulse Width	HS		-	96	-	dot
			-	3.8	-	(us)
Horizontal Back Porch	HBP		-	43	-	dot
			-	1.7	-	(us)
Horizontal Data Start Point		HS+HBP	-	139	-	dot
			-	5.5	-	(us)
Horizontal Front Porch	HFP		-	41	-	dot
			-	1.6	-	(us)
Horizontal Blanking Period	HBL	HS+HBP+HFP	-	180	-	dot
			-	7.1	-	(us)
Horizontal Active Area	HDISP		-	480	-	dot
			-	19.1	-	(us)
Clock Frequency	tclk		-	39.7	36	ns
	fclk		-	25.175	27.7	(MHz)

[Timing Chart]

CPU I/F

< Serial I/F >



(VDD=2.58 to 2.98V)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
CS Cycle Time	tcyc	Fast OSC Operating Normal Command & FD Write Command	1000	-	-	ns
Serial Clock Cycle	tsclk		50	-	-	ns
CS Cycle Time	tcyc	Fast OSC Operating PD Write Command	4000	-	-	ns
Serial Clock Cycle	tsclk		50	-	-	ns
CS-SCLK Time	tcssh	CS	60	-	-	ns
	tcsh	CS	40	-	-	ns
CS "H" Pulse Width	tcshw	CS	50	-	-	ns
SCLK "L" Pulse Width	tsckl	SCLK	20	-	-	ns
SCLK "H" Pulse Width	tsckh	SCLK	20	-	-	ns
Data Set up Time	tsds	SDATA	15	-	-	ns
Data Hold Time	tsdh	SDATA	15	-	-	ns

[Electro-optical specifications]

Electro-optical characteristics (Ta = 25 deg., VDD = 2.78 V)

<Backlight OFF>

Measurement Items		Symbol	Method	MIN	TYP	MAX	Unit
Reflectance		R	(1)	-	3	-	%
Contrast ratio		CR	(2)	-	12	-	-
Viewing angle	CR≧5	θ (ϕ= 90 deg.)	(4)	-	30	-	deg.
		θ (ϕ=270 deg.)		-	30	-	
		θ (ϕ= 0 deg.)		-	50	-	
		θ (ϕ=180 deg.)		-	50	-	
Chromaticity	White	x_W	(5)	-	0.33	-	-
		y_W		-	0.37	-	
	Red	x_R		-	0.48	-	-
		y_R		-	0.35	-	
	Green	x_G		-	0.32	-	-
		y_G		-	0.48	-	
	Bule	x_B		-	0.24	-	-
		y_B		-	0.25	-	

<Backlight ON>

Measurement Items		Symbol	Method	MIN	TYP	MAX	Unit
Contrast ratio		CR	(2)	-	80	-	-
Response Time		ton + toff	(3)	-	40	-	ms
Display surface luminance	θ=0	L	(6)	-	80	-	cd/m^2
Viewing angle	CR≧5	θ (ϕ= 90 deg.)	(4)	-	30	-	deg.
		θ (ϕ=270 deg.)		-	30	-	
		θ (ϕ= 0 deg.)		-	30	-	
		θ (ϕ=180 deg.)		-	30	-	
Chromaticity	White	x_W	(7)	-	0.30	-	-
		y_W		-	0.33	-	
	Red	x_R		-	0.57	-	-
		y_R		-	0.34	-	
	Green	x_G		-	0.30	-	-
		y_G		-	0.49	-	
	Bule	x_B		-	0.14	-	-
		y_B		-	0.18	-	
Luminance uniformity			(8)	-	80	-	%

Electro-optical characteristics measuring method

<Basic measuring condition>

a) Drive voltage

VDD = 2.78 V, V_{COM} = Optimum voltage

b) Measuring temperature

25°C unless otherwise specified

c) Measuring point

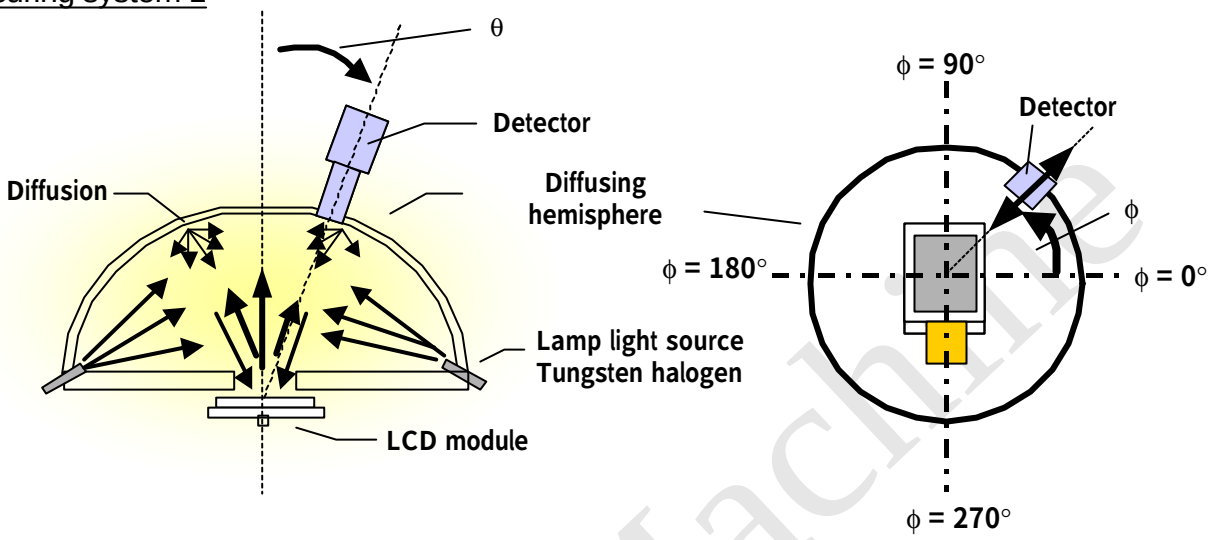
One point in the screen center, unless otherwise specified.

d) Measuring system

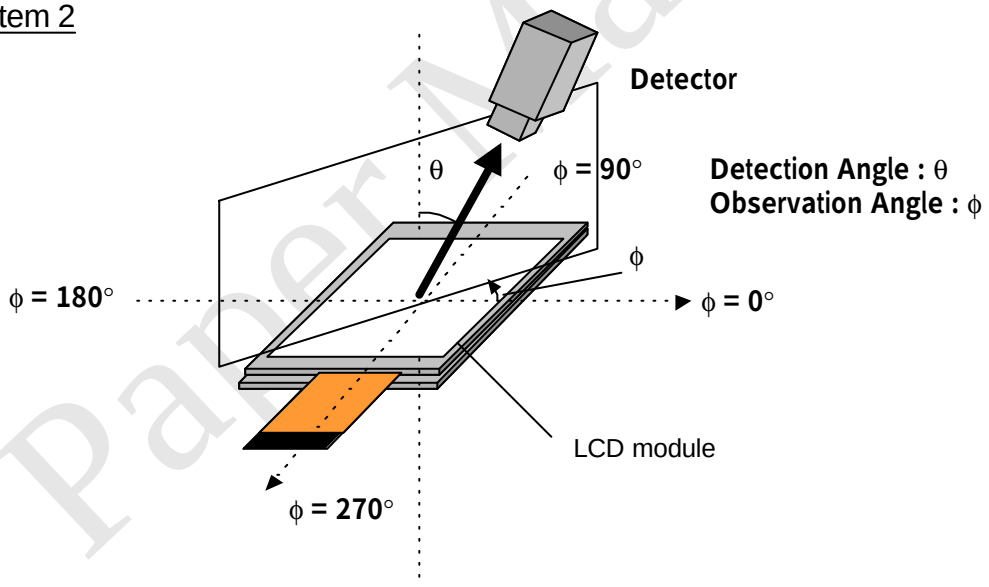
The following three system are to be used.

e) The constant current circuit for Backlight in measuring is OFF, unless otherwise specified.

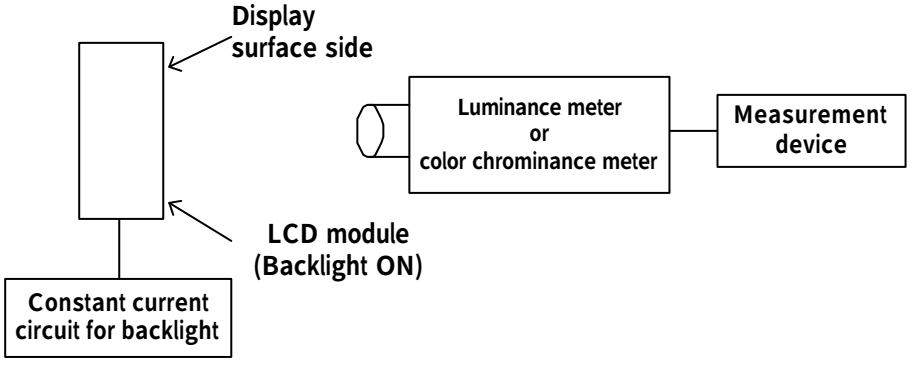
Measuring system 1



Measuring system 2



Measuring system 3



(1) Reflectance

In the measuring system 1 (θ = 0°, φ = 0°), measure the panel surface luminance L (white) when the input data is set to 3Fh, and measure the surface luminance of the standard diffusion white board L (Ref) . Then, calculate the reflectance using the following expression.

$$\text{Reflectance} = \frac{L(\text{White})}{L(\text{Ref})} \times 100(\%)$$

(2) Contrast ratio

In the measuring system 1 (θ = 0°, φ = 0°), measure the panel surface luminance L (white) when the input data is set to 3Fh, and measure L(Black) when the input data is set to 00h. Then, calculate the contrast ratio CR using following expression.
*** With Backlight ON, use the measuring system 2.**

$$CR = \frac{L(\text{White})}{L(\text{Black})}$$

(3) Response time

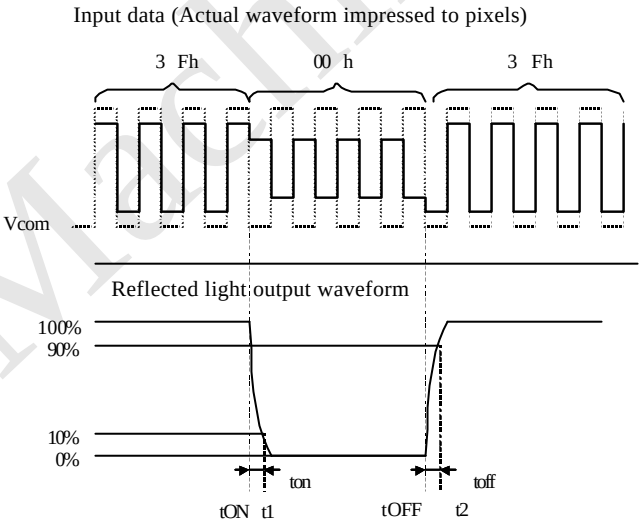
In the measuring system 2 (θ = 0°, φ = 0°), impress the input data shown in the right drawing to each input terminal and then measure times t on and t off:,

t on = t 1 - t ON

where t on is the time period between t ON and t 1, where the reflected light output reduces to 10%.

t off = t 2 - t OFF

where t off is the time period between t OFF and t 2, where the reflected light output reaches 90%.



(4) Viewing angle

In measuring System 1, measure the contrast ratio in the θ direction (0° to 70°), at the angles of φ=0°, 90°, 180° and 270°. The viewing angle is defined as the angle range which shall be the one where CR≥5.

(5) Display screen chromaticity (Backlight OFF)

In measuring System 1 (θ = 0°, φ = 0°), measure the chromaticity (White, Red, Green, Blue) with D65 light source. (conversion by the data of spectrum photometer)

Red : input 3Fh to R. (B, G is 00h.)
Green : input 3Fh to G. (R, B is 00h.)
Blue : input 3Fh to B. (R, G is 00h.)
White : input 3Fh to each R, G, B.

(6) Display surface luminance (Backlight ON)

In measuring system 3, measure the display surface luminance according to the following conditions. Measure without input data.

Parameter	Condition
Ambient lighting	Inside a darkroom 10 lux or below
Ambient temperature	25±3°C
Measuring instrument	Luminance colorimeter (BM-5A:TOPCON)
Measuring diameter	f5mm
Measuring point	Center area of display screen

(7) Display screen chromaticity (Backlight ON)

In measuring system 3, measure the chromaticity according to the same condition as for (6).

Red : input 3Fh to R. (B, G is 00h.)
Green : input 3Fh to G. (R, B is 00h.)
Blue : input 3Fh to B. (R, G is 00h.)
White : input 3Fh to each R, G, B.

(8) Luminance uniformity (Backlight ON)

In measuring system 3, measure the luminance uniformity according to the following condition.

Parameter	Condition
Ambient lighting	Inside a darkroom 10 lux or below
Ambient temperature	25±3°C
Measuring instrument	Luminance colorimeter (BM-5A:TOPCON)
Measuring diameter	f10mm
Measuring point	3 row 3 line on effective area
Calculating method	Minimum/Maximum values among measuring values on 9 points
Measuring signal	Input 3Fh to each R,G, B.

[Outline dimensions]

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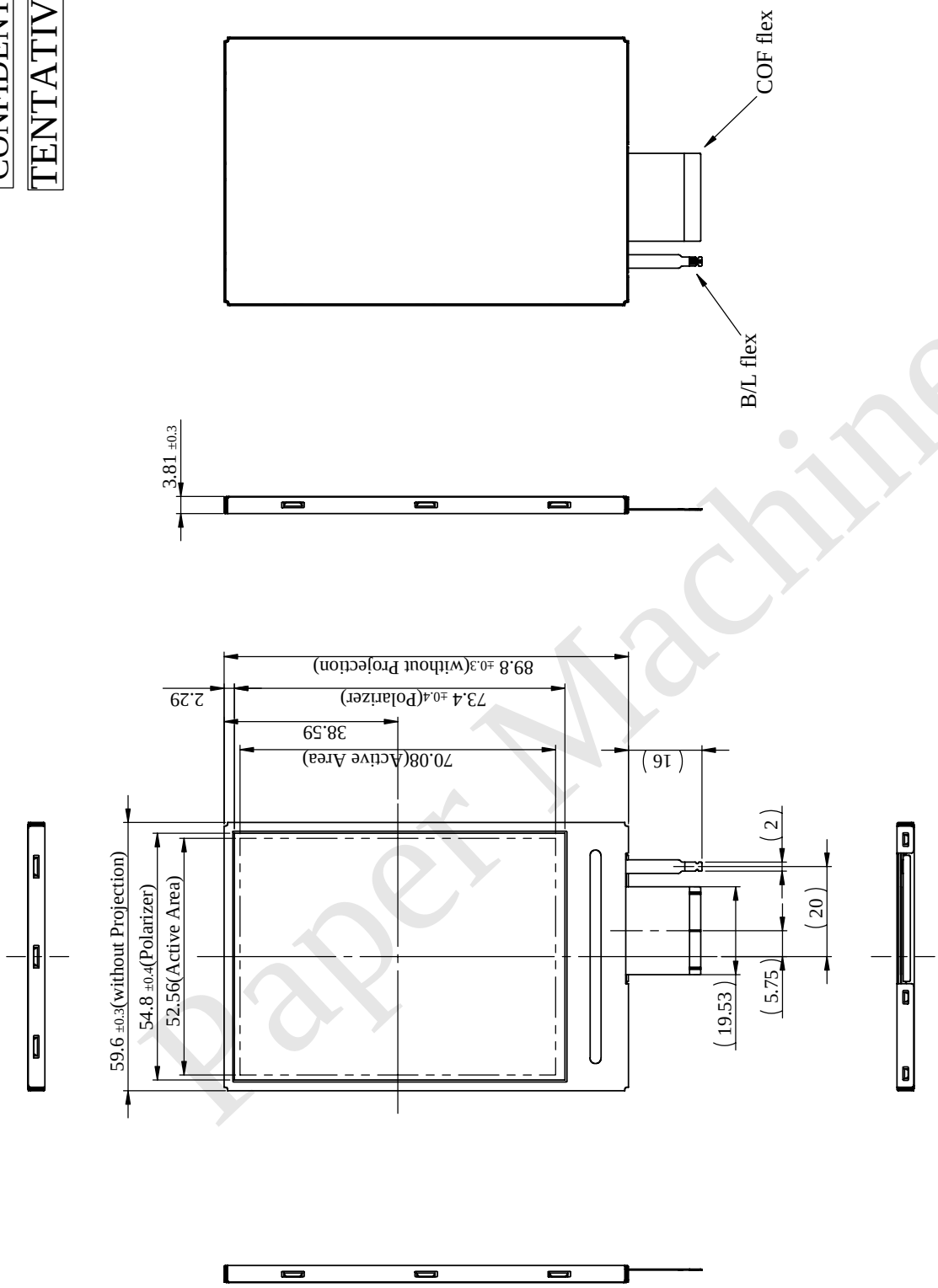
TENTATIVE



Note1.Unspecified dimensional tolerance shall be ±0.4.
2.When assembling into the unit,ground the case(at the ground potential).
3.For the LCD module positioning,avoid areas near the corners and projections.