ILLUMINANT 北極光企業有限公司

PRODUCT SPECIFICATION FOR TFT LCM

CUSTOMER:	
MODEL NO:	I3507-6HMN3224B
ACCEPTED BY:	

APPROVED BY:	CHECKED BY:	ORGANIZED BY:
LCM產品部 2009.10.30 隆茂生	LCM產品部 2009.10.30 贺秋芳	LCM產品部 2009.10.30 贺秋芳

□Approval for Specifications Only

■Approval for Specifications and Sample

Note: 1. Version of Specifications : 1

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Version	Date	Contents
1	09/10/30	Initial Release

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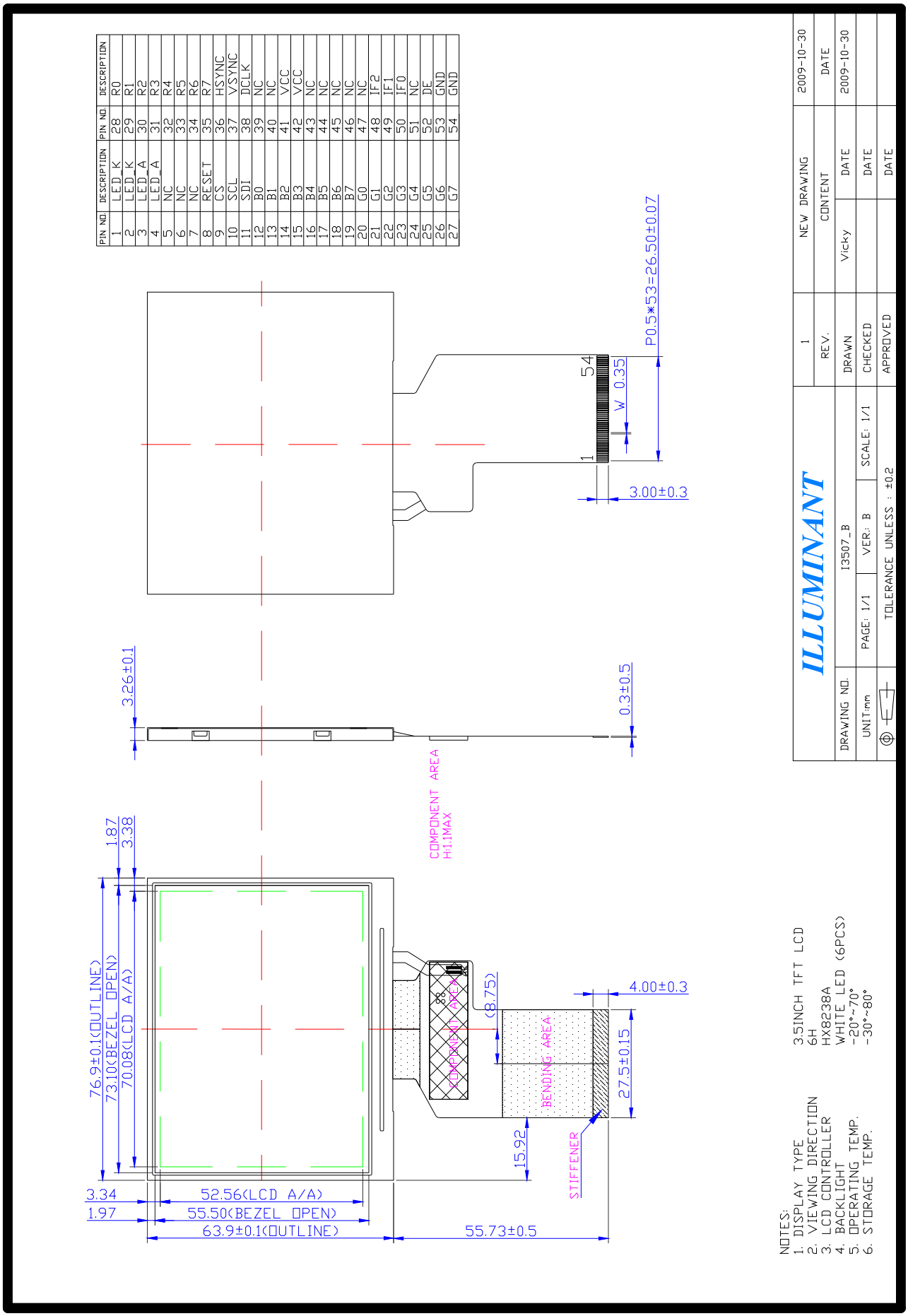
1. Mechanical Specification

Item	Standard Value	Unit
Display Size	3.5	inch
Module Dimension	76.90(W)*63.90(H)*3.26(D)	mm
Active Area	70.08(W)*52.56(H)	mm
Number of Dots	320RGB*240Dots	Dot
Pixel Arrangement	RGB Strip Type	-
Dot Size	0.073*0.219	mm
Dot Pitch	0.219*0.219	mm
LCD Type	Normal White / Transmissive / Positive	-
Interface	RGB Data Bus, 24Bit Parallel Data	
Controller	HX8238A	
Approx. Weight	TBD	g
Viewing Direction	6 H	
Various Color Display	16.7M	
Backlight Color	White (6chip LED serial)	
Operating Temperature	-20℃~70℃	
Storage Temperature	-30℃~80℃	



2. Absolute Maximum Ratings

Item	Symbol	Condition	Min.	Max.	Unit	Remark
Power Voltage	DVDD,AVDD	GND=0	-0.3	+5.0	V	
Input Signal Voltage	V_{IN}	GND=0	-10	VCC+0.3	V	Note1
Logic Output Voltage	V_{OUT}	GND=0	-20	VCC+0.3	V	Note1

*NOTE1 : Device is subject to be damaged permanently if stresses beyond those absolute maximum ratings listed above

Temperature ≤60℃, 90% RH MAX.

Temperature 〉60℃, Absolute humidity shall be less than 90% RH at 60℃

3. Electrical Characteristics

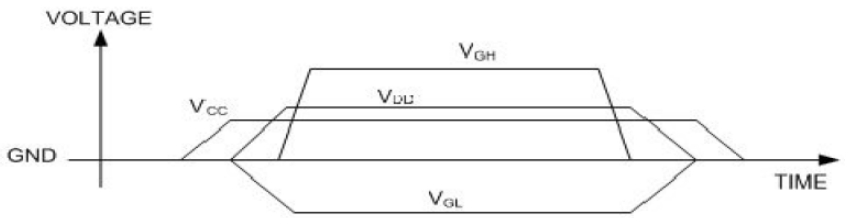
3.1 Typical Operating Conditions

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Power Voltage	V_{CC}	3.0	3.3	3.6	V	
Digital Operation Current	I_{CC}		8.6		mA	
Gate On Power	V_{GH}	14	15	18	V	
Gate Off Power	V_{GL}	-11	-10	-8	V	
Vcom High Voltage	V_{COMH}		3.7		V	Note1
Vcom Low Voltage	V_{COML}		-1.6	-	V	Note1
Vcom Level Max	V_{COMA}			6		

*NOTE1 : V_{COMH} & V_{COML} => Adjust the color with gamma data.

V_{P-P} should be higher than 4V. (Option : 5V)

*NOTE2 : Please power on following the sequence VCC->VDD



3.2 Backlight Driving Conditions

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Supply Current	IF	-	20		mA	
Supply Voltage	VF	18.6	19.8	21	V	1
Life Time	-	-	10,000	-	Hr	2,3

*NOTE1 : 6-chips serial connection,

*NOTE2 : Ta=25℃

*NOTE3 : Brightness to be decreased to 50% of the initial value.

4. Interface

No.	Symbol	I/O	Function
1	LED-	P	Backlight LED Cathode
2	LED-	P	Backlight LED Cathode
3	LED+	I	Backlight LED Anode
4	LED+	I	Backlight LED Anode
5	NC	I	Not Use
6	NC	I	Not Use
7	NC	-	Not Use
8	/RESET	I	This signal low will reset the device and must be applied to properly initialize the chip. Signal is low active.
9	CS	I	Chip Select Input Pin (“Low” Enable)
10	SCL	I	Serial Data Clock in Serial Bus System Interface
11	SDI	I	Serial Data Input Pin
12	B0	I	Blue Data Bit 0
13	B1	I	Blue Data Bit 1
14	B2	I	Blue Data Bit 2
15	B3	I	Blue Data Bit 3
16	B4	I	Blue Data Bit 4
17	B5	I	Blue Data Bit 5
18	B6	I	Blue Data Bit 6
19	B7	I	Blue Data Bit 7
20	G0	I	Green Data Bit 0
21	G1	I	Green Data Bit 1
22	G2	I	Green Data Bit 2
23	G3	I	Green Data Bit 3
24	G4	I	Green Data Bit 4
25	G5	I	Green Data Bit 5
26	G6	I	Green Data Bit 6
27	G7	I	Green Data Bit 7
28	R0	I	Red Data Bit 0
29	R1	I	Red Data Bit 1

No.	Symbol	I/O	Function
30	R2	I	Red Data Bit 2
31	R3	I	Red Data Bit 3
32	R4	I	Red Data Bit 4
33	R5	I	Red Data Bit 5
34	R6	I	Red Data Bit 6
35	R7	I	Red Data Bit 7
36	HSYNC	I	Horizontal Sync Input in DPI Interface Mode
37	VSYNC	I	Vertical Sync Input in DPI Interface Mode
38	DCLK	I	Dot Data Clock
39	NC		Not Use
40	NC		Not Use
41	VCC	P	Power Supply to Interface Pins
42	VCC	P	Power Supply to Interface Pins
43	NC		Not Use
44	NC		Not Use
45	NC		Not Use
46	NC		Not Use
47	NC		Not Use
48	IF2	I	Control the Input Data Format /Floating
49	IF1	I	Control the Input Data Format
50	IF0	I	Control the Input Data Format
51	NC		Not Use
52	DE	I	Data Enable Signal in DPI Interface Mode
53	GND	P	Power Ground Pin
54	GND	P	Power Ground Pin

*NOTE1 : If mode control (IF2) not use, it can't control CCIR 601 interface.
If not use CCIR 601, it can be floating.

*NOTE2 : Control the input data format.
IF2-0 : Define the input data interface.

IF2	IF1	IF0	Format	Operating Frequency
0	0	0	Parallel-RGB data format (Only support stripe type color filter)	6.5 ㎒
0	0	1	Serial-RGB data format	19.5 ㎒
0	1	0	CCIR 656 data format (640RGB)	24.54 ㎒
0	1	1	CCIR 656 data format (720RGB)	27 ㎒
1	0	0	YUV mode A format (Cr-Y-Cb-Y)	24.54 ㎒
1	0	1	YUV mode A format (Cr-Y-Cb-Y)	27 ㎒
1	1	0	YUV mode B format (Cr-Y-Cb-Y)	27 ㎒
1	1	1	YUV mode B format (Cr-Y-Cb-Y)	24.54 ㎒

Input Format	DCLK Freq(㎒)	Display Data	Active Area (DOTCLK)
YUV mode	24.54	640	1280
	27	720	1440

Mode	D[23:16]	D[15:8]	D[7:0]	HIS	IVS	DEN
ITU-R BT 656	D[23:16]	GND	GND	NC	NC	NC
ITU-R BT 601	D[23:16]	GND	GND	HIS	IVS	NC
8BIT RGB	D[23:16]	GND	GND	HIS	IVS	NC for HV Mode
						DEN for DEN Mode
24BIT RGB	R[7:0]	G[7:0]	B[7:0]	HIS	IVS	NC for HV Mode
						DEN for DEN Mode

*NOTE3 : For digital RGB input format, both SYNC mode and DE+SYNC mode are supported. If DE signal is fixed now, SYNC mode is used. Otherwise, DE+SYNC mode is used, Suggest use SYNC mode, suggest DE signal usually pull low.

5. Basic Display Color and Gray Scale

COLOR		INPUT COLOR DATA																							
		RED								GREEN								BLUE							
		MSB LSB								MSB LSB								MSB LSB							
		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 COLORS	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(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(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(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
	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	Red(0) Dark	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(253)	1	1	1	1	1	1	0	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) Bright	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	Green(0)	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) Dark	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(253)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	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) Bright	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	Blue(0) Dark	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(253)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	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) Bright	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1

6. DC Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
Low Level Input Voltage	V_{IL}	0	-	0.3VCC	V	
High Level Input Voltage	V_{IH}	0.7VCC	-	VCC	V	

7. AC Characteristics

[Parallel-RGB Data Format]

Signal	Item	Symbol	Min.	Typ.	Max.	Unit
Dclk	Frequency	Tosc	-	156	-	ns
	High Time	Tch	-	78	-	ns
	Low Time	Tcl	-	78	-	ns
Data	Setup Time	Tsu	12	-	-	ns
	Hold Time	Thd	12	-	-	ns
Hsync	Period	TH	-	408	-	Tosc
	Pulse Width	THS	5	30	-	Tosc
	Back-Porch	Thb	-	38	-	Tosc
	Display Period	TEP	-	320	-	Tosc
	Hsync-den Time	THE	36	68	88	Tosc
	Front-Porch	Thf	-	20	-	Tosc
Vsync	Period	Tv	-	262	-	TH
	Pulse Width	Tvs	1	3	5	TH
	Back-Porch	Tvb	-	15	-	TH
	Display Period	Tvd	-	240	-	TH
	Front-Porch	Tvf	2	4	-	TH

*****NOTE1 : Thp+Thb=68, the user is made up by yourself.

*NOTE2 : Tv=Tvs+Tvb+Tvd+Tvf, the user is made up by yourself.

*NOTE3 : When SYNC mode is used, 1st data starts from 68th Dclk after Hsync falling.

[Serial-RGB Data Format]

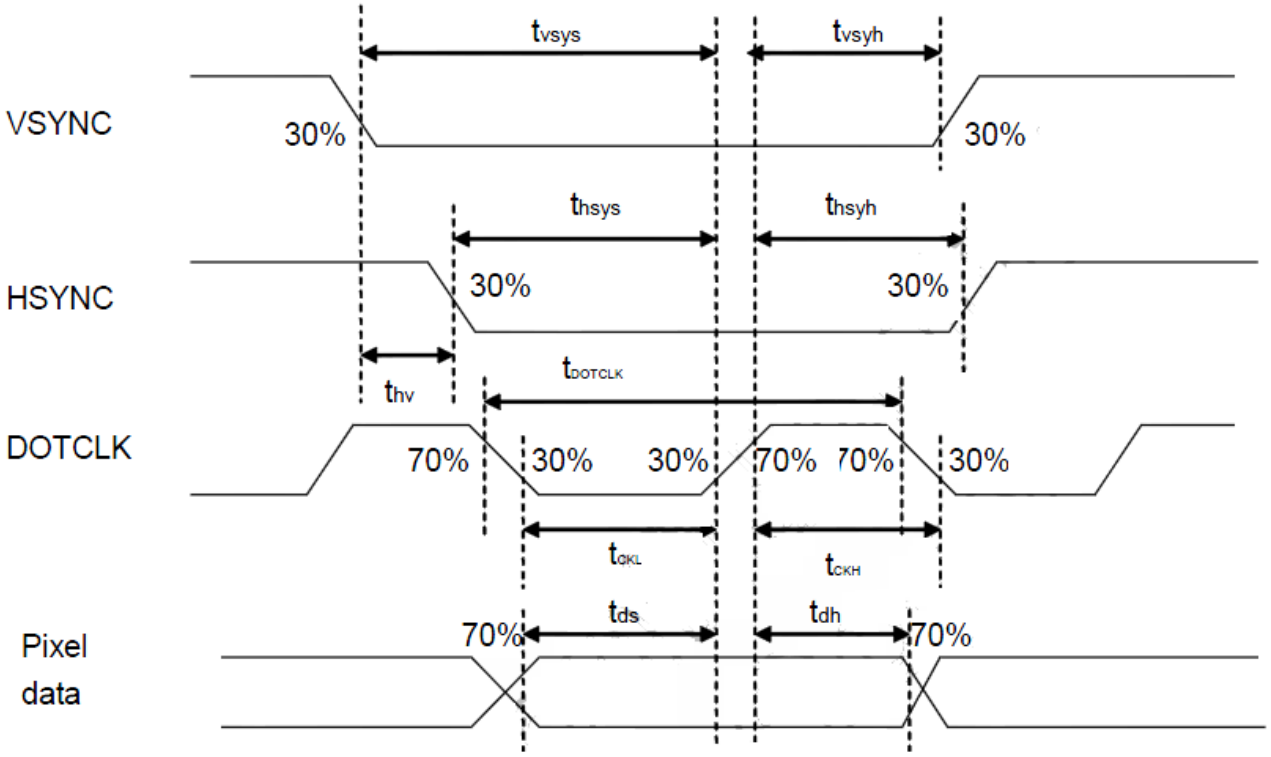
Signal	Item	Symbol	Min.	Typ.	Max.	Unit
Dclk	Frequency	Tosc	-	52	-	ns
	High Time	Tch	-	78	-	ns
	Low Time	Tcl	-	78	-	ns
Data	Setup Time	Tsu	12	-	-	ns
	Hold Time	Thd	12	-	-	ns
Hsync	Period	TH	-	1224	-	Tosc
	Pulse Width	THS	5	90	-	Tosc
	Back-Porch	Thb	-	114	-	Tosc
	Display Period	TEP	-	960	-	Tosc
	Hsync-den Time	THE	108	204	264	Tosc
	Front-Porch	Thf	-	60	-	Tosc
Vsync	Period	Tv	-	262	-	TH
	Pulse Width	Tvs	1	3	5	TH
	Back-Porch	Tvb	-	15	-	TH
	Display Period	Tvd	-	240	-	TH
	Front-Porch	Tvf	2	4	-	TH

*****NOTE1 : Thp+Thb=204, the user is made up by yourself.

*NOTE2 : Tv=Tvs+Tvb+Tvd+Tvf, the user is made up by yourself.

*NOTE3 : When SYNC mode is used, 1st data starts from 204th Dclk after Hsync falling.

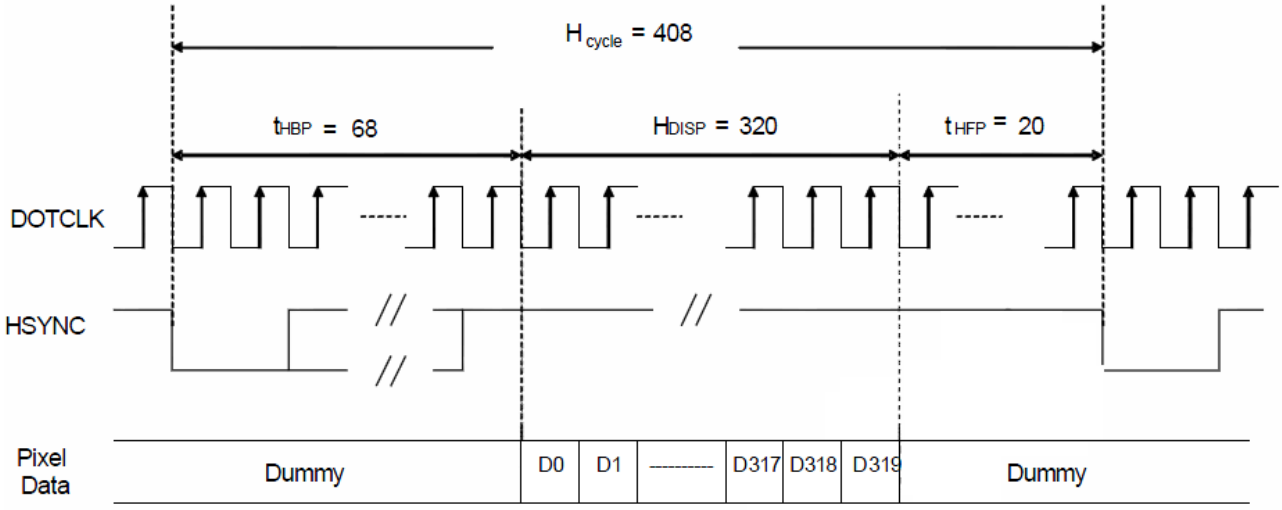
[Pixel Timing Characteristics]



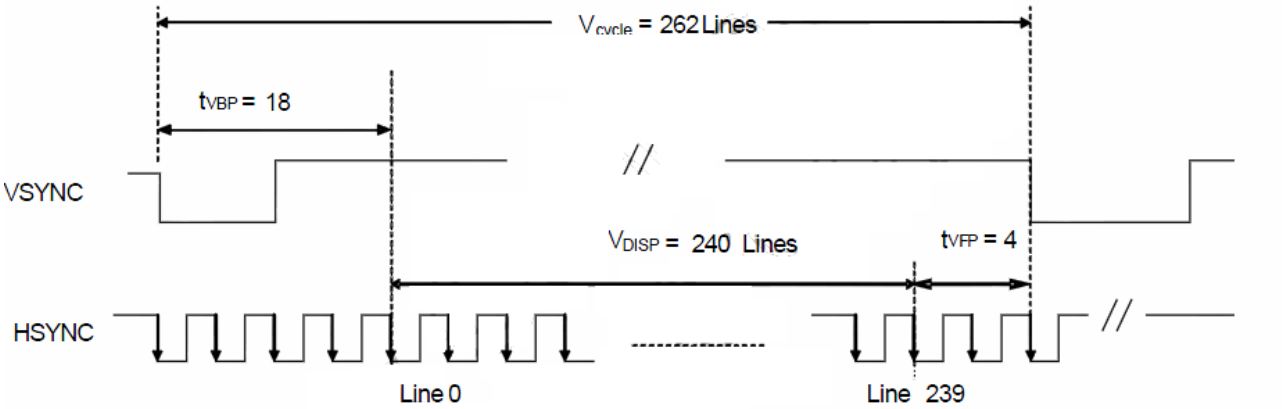
Characteristics	Symbol	Min.		Typ.		Max.		Unit
		24 bit	8 bit	24 bit	8 bit	24 bit	8 bit	
DOTCLK Frequency	fDOTCLK	-		6.5	19.5	10	30	MHz
DOTCLK Period	tDOTCLK	100	33.3	154	51.3	-	-	ns
Vertical Sync Setup Time	tvsys	20	10	-	-	-	-	ns
Vertical Sync Hold Time	tvsyh	20	10	-	-	-	-	ns
Horizontal Sync Setup Time	thsys	20	10	-	-	-	-	ns
Horizontal Sync Hold Time	thsyh	20	10	-	-	-	-	ns
Phase difference of Sync Signal Falling Edge	thv	1		-		240		tDOTCLK
DOTCLK Low Period	tCKL	50	15	-	-	-	-	ns
DOTCLK High Period	tCKH	50	15	-	-	-	-	ns
Data Setup Time	tds	12	8	-	-	-	-	ns
Data hold Time	tdh	12	8	-	-	-	-	ns
Reset pulse width	tRES	10		-		-		us

Note: External clock source must be provided to DOTCLK pin of HX8238-A. The driver will not operate if absent of the clocking signal.

[Data Transaction Interface Timing in Parallel RGB(24bit) Interface(SYNC mode)]

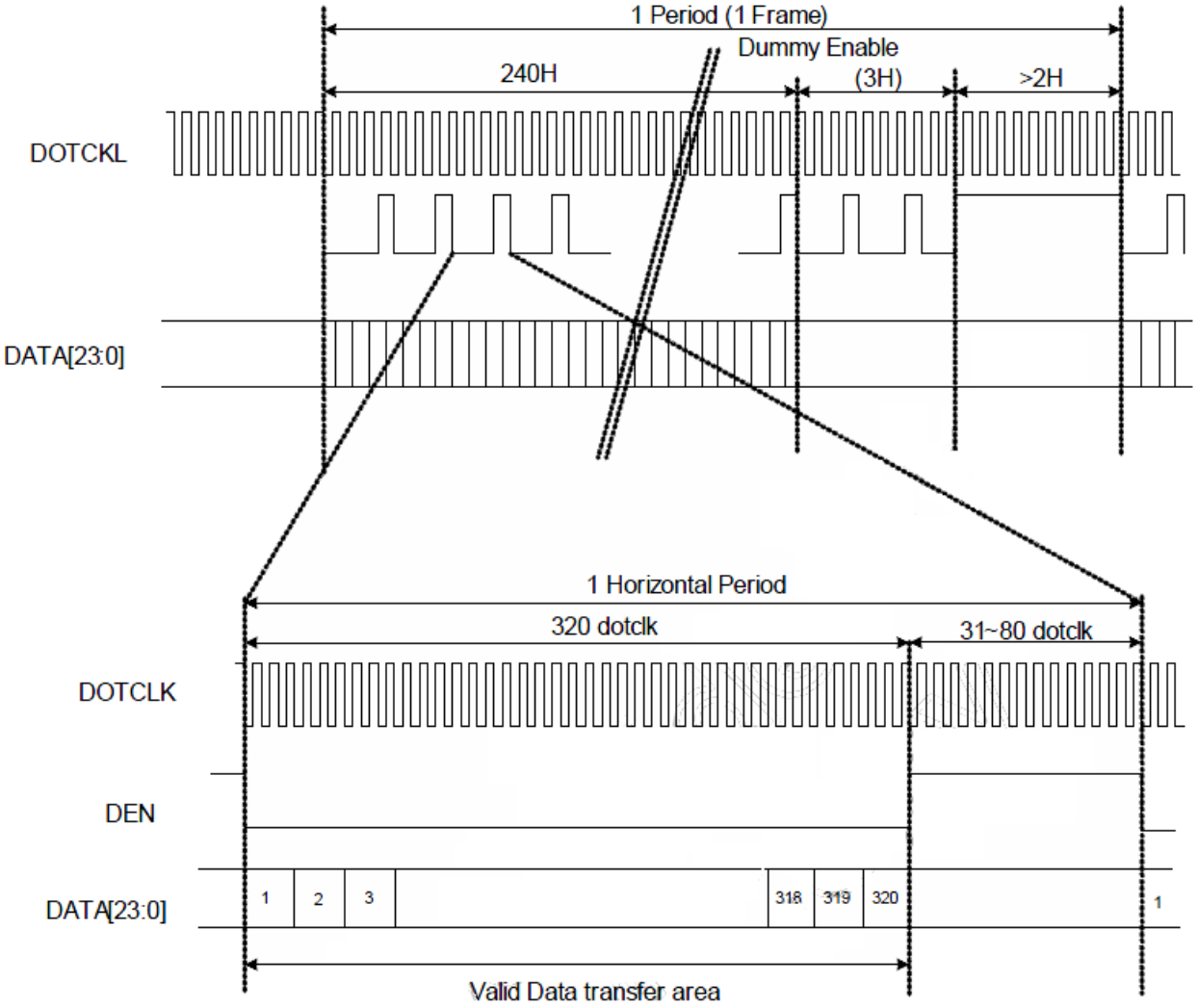


a) Horizontal Data Transaction Timing



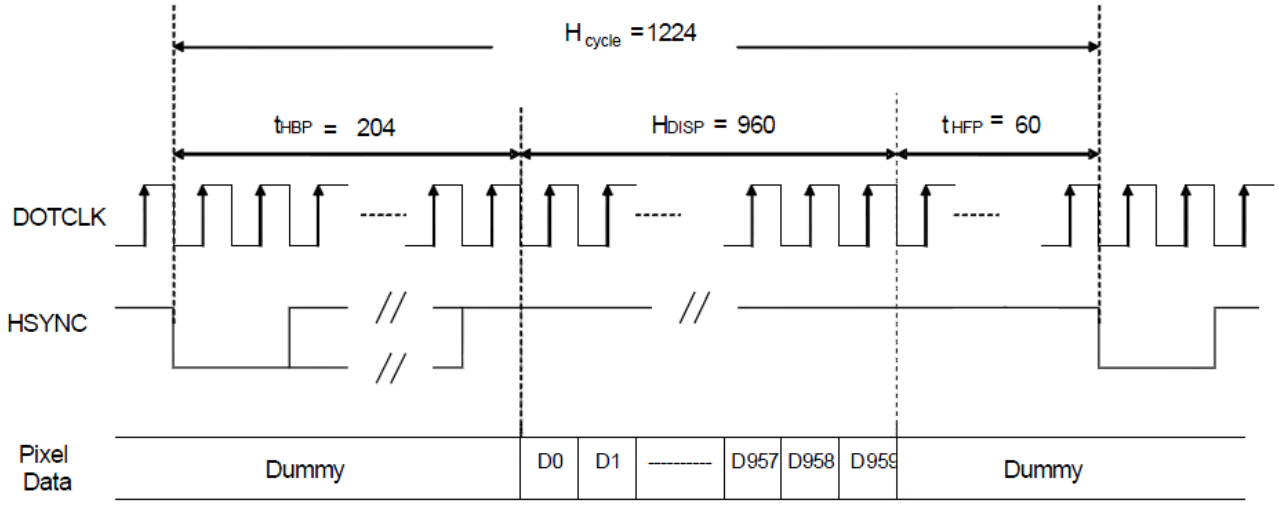
b) Vertical Data Transaction Timing

[Data Transaction Interface Timing in Parallel RGB(24bit) Interface(DE mode)]

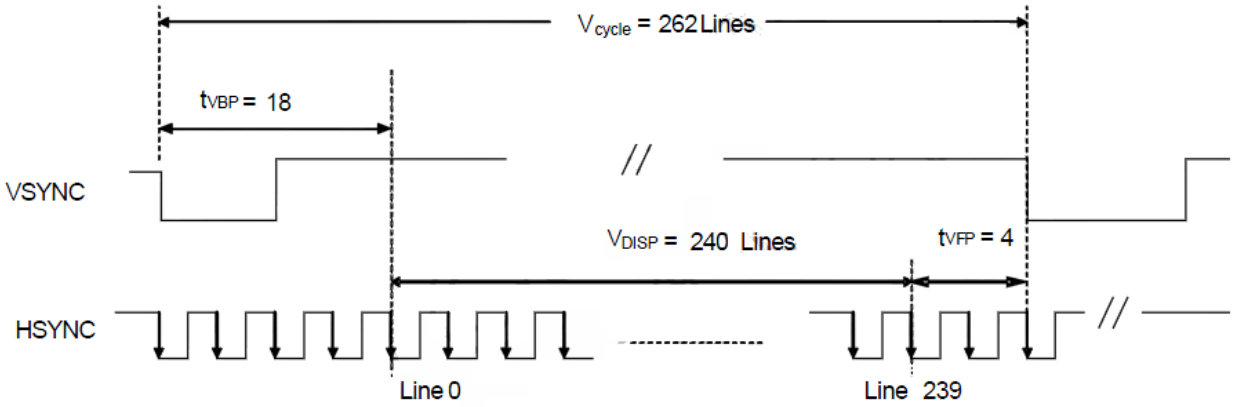


Characteristics		Symbol	Min.		Typ.		Max.		Unit
			24 bit	8 bit	24 bit	8 bit	24 bit	8 bit	
DOTCLK Frequency		fDOTCLK	-	-	6.5	19.5	10	30	MHz
DOTCLK Period		tDOTCLK	100	33.3	154	51.3	-	-	ns
Horizontal Frequency (Line)		fH	-		15.72		22.35		KHz
Vertical Frequency (Refresh)		fV	-		60		90		Hz
Horizontal Back Porch		tHBP	-	-	68	204	-	-	tDOTCLK
Horizontal Front Porch		tHFP	-	-	20	60	-	-	tDOTCLK
Horizontal Data Start Point		tHBP	-	-	68	204	-	-	tDOTCLK
Horizontal Blanking Period		tHBP + tHFP	-	-	88	264	-	-	tDOTCLK
Horizontal Display Area		HDISP	-	-	320	960	-	-	tDOTCLK
Horizontal Cycle		Hcycle	-	-	408	1224	450	1350	tDOTCLK
Vertical Back Porch		tVBP	-		18		-		Lines
Vertical Front Porch		tVFP	-		4		-		Lines
Vertical Data Start Point		tVBP	-		18		-		Lines
Vertical Blanking Period		tVBP + tVFP	-		22		-		Lines
VS pulse width		tWV	-		4		-		Lines
Vertical Display Area	NTSC	VDISP	-		240		-		Lines
	PAL				280(PALM=0)				
					288(PALM=1)				
Vertical Cycle	NTSC	Vcycle	-		262		350		Lines
	PAL				313				

[Data Transaction Interface Timing in Serial RGB(8bit) Interface (SYNC mode)]

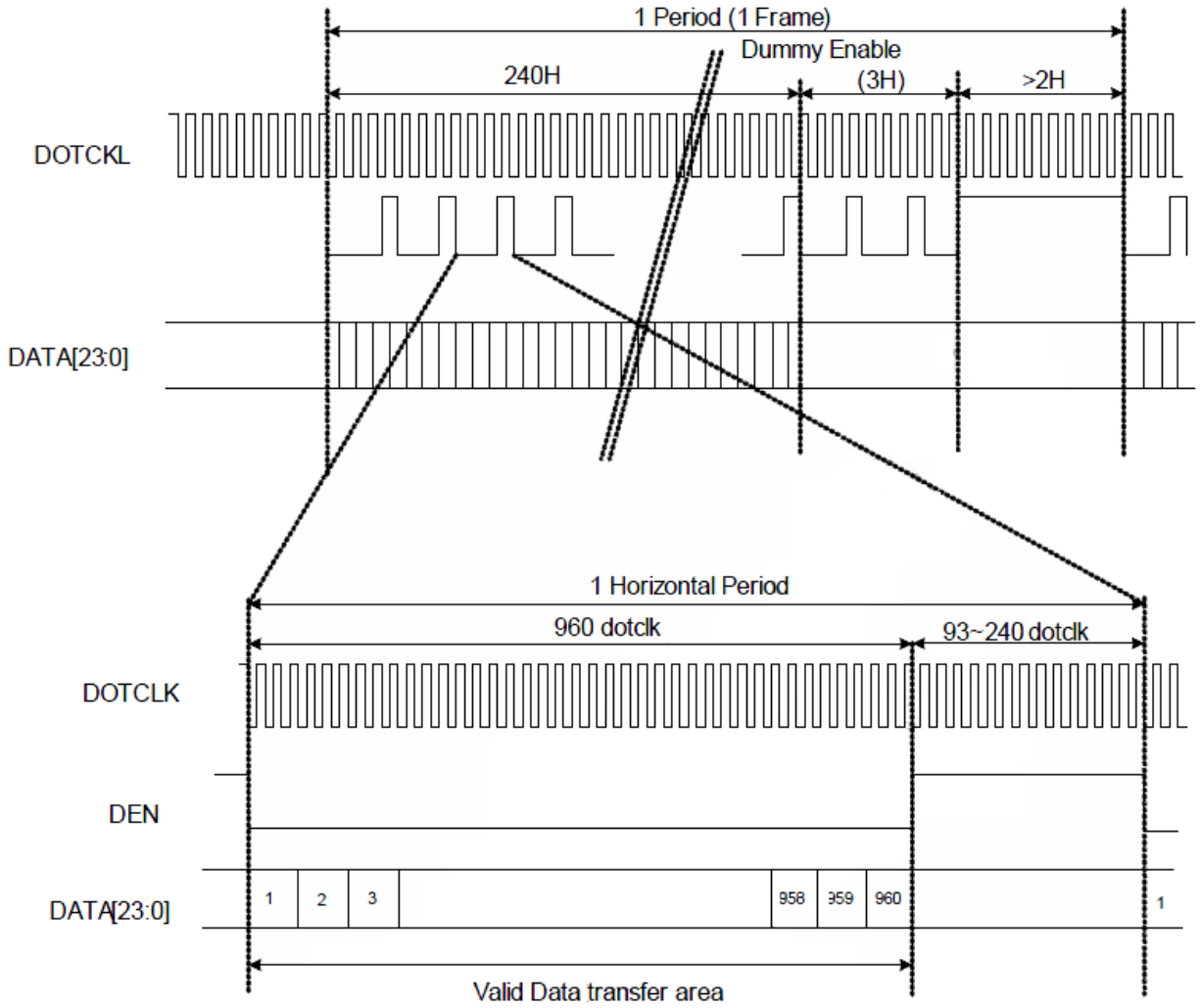


a) Horizontal Data Transaction Timing

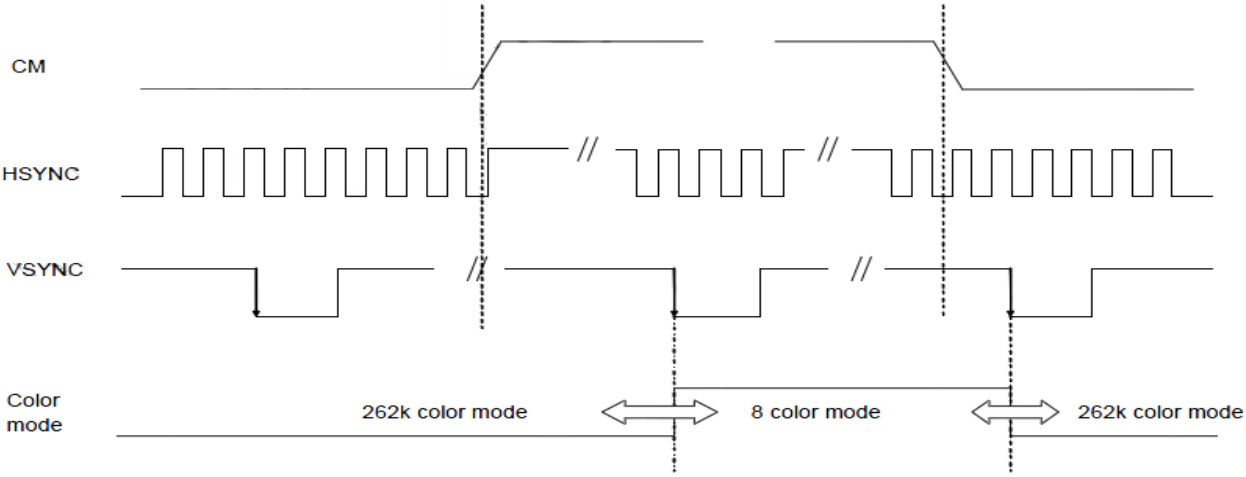


b) Vertical Data Transaction Timing

[Data Transaction Interface Timing in Serial RGB(8bit) Interface (DE mode)]



[Color Mode Conversion Timing]



Note: The color mode conversion starts at the first falling edge of VSYNC after stage change of CM.

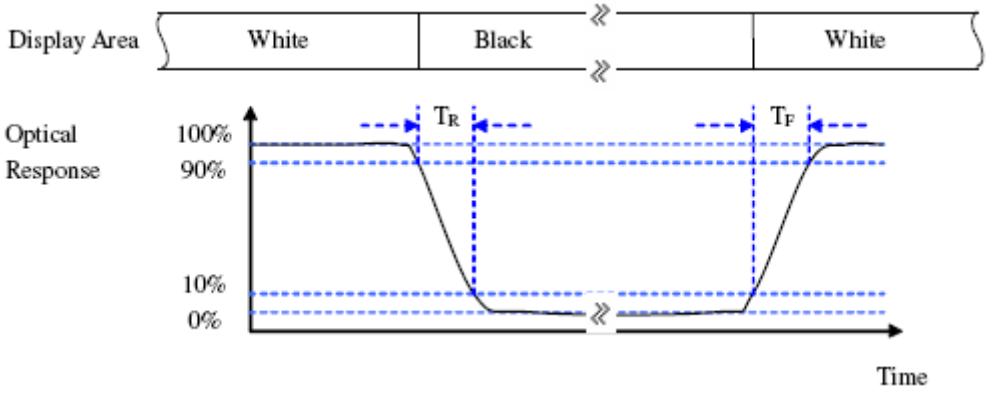
8. Electro-Optical Characteristics

(Ta=25±2℃, ILED=20mA)

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Response Time		Tr	Φ_1=0°	-	10		ms	Note2
		Tf	Φ_2=0°	-	15		ms	
Contrast Ratio		CR	At optimized viewing angle	300	400	-	-	Note3
Color Chromaticity	White	W_X	Φ_1=0°	0.282	0.312	0.342	-	Note1,4
		W_Y	Φ_2=0°	0.319	0.349	0.379		
Viewing Angle		$\Phi_{1(UP\ DOWN)}$	CR≥ 10	-55~+50			Degree	Note5
		$\Phi_{2(LEFT\ RIGHT)}$		-60~+60				
Brightness		Bp	Φ_1=0°	200	250		cd/m^2	
Uniformity		△Bp	Φ_2=0°	80%				
NTSC Ratio		S			60%			

* Note 1 : Test equipment setup
After stabilizing and leaving the panel along at a given temperature for 30mins, 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 50 ㎝ and normal direction.

* Note 2 : Definition of Response Time : T_R and T_F
The figure below is the output signal of the photo detector.



* Note 3 : Definition of Contrast Ratio

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

White Vi=$V_{i50\%}$ -/+1.5V

Black Vi=$V_{i50\%}$ ± 2.0V

“±”means that the analog input signal swings in phase with VCOM signal.

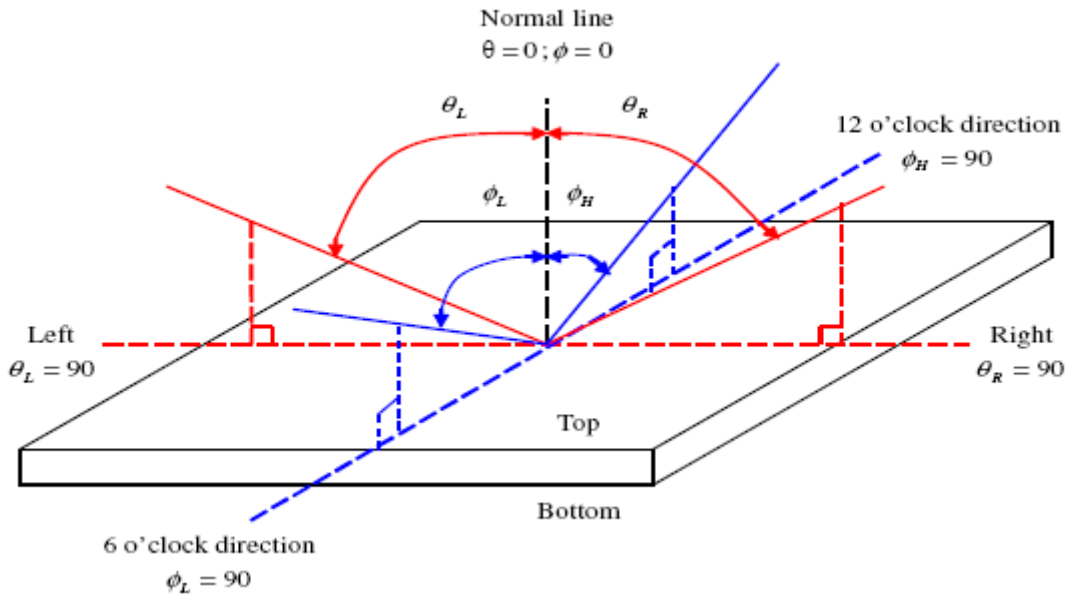
“-/+” means that the analog input signal swings out of phase with VCOM signal.

$V_{i50\%}$: The analog input voltage when transmission is 50%.

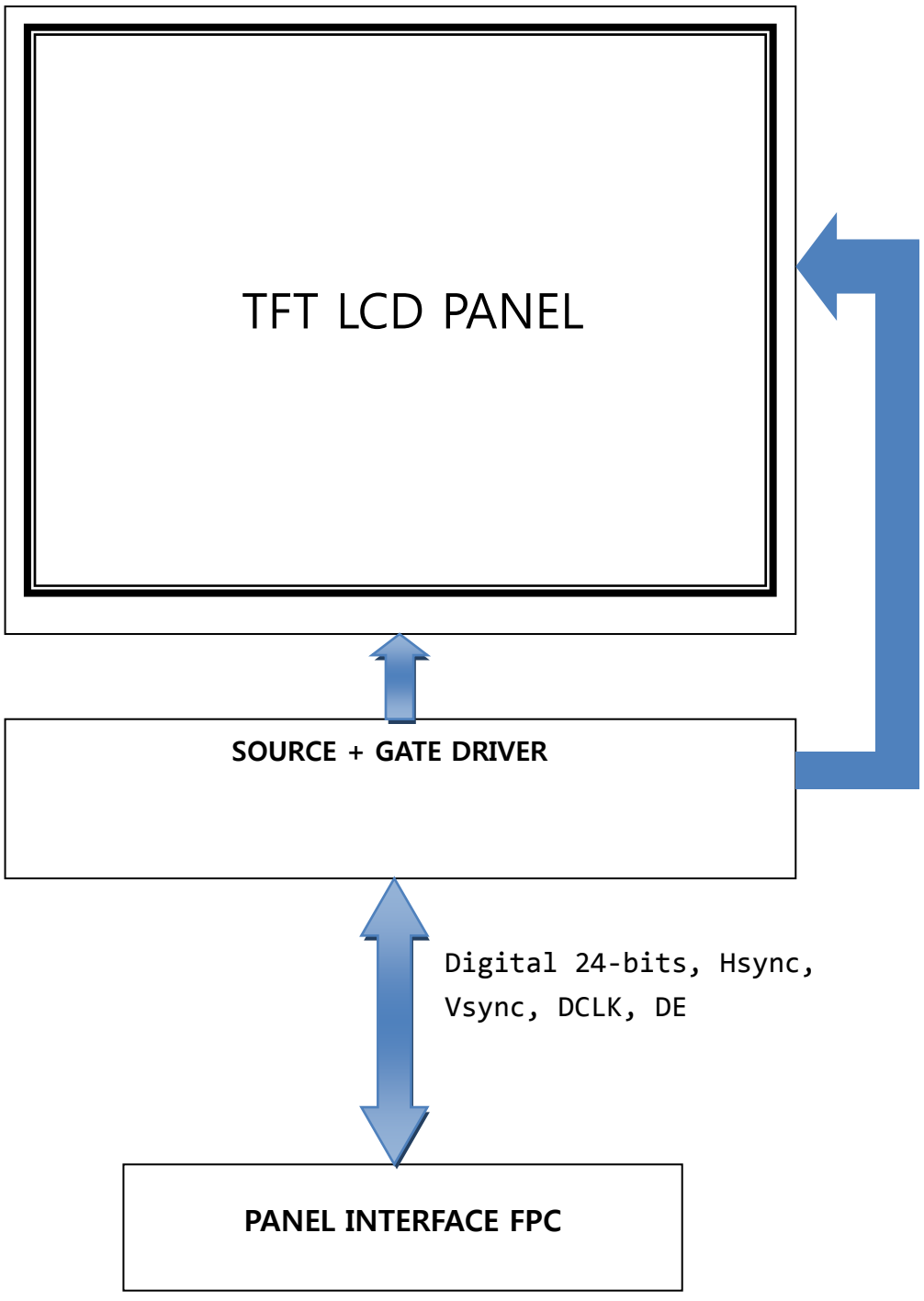
The 100% transmission is defined as the transmission of LCD panel when all the input terminal of module are electrically opened.

* Note 4 : Measured at the center area of the panel when all the input terminals of LCD panel are electrically opened.

* Note 5 : Definition of Viewing Angle



9. Block Diagram



10. Reliability

No.	Item	Condition	Remark
1	High Temperature Storage Test	Ta=80℃, Dry, 240h	
2	Low Temperature Storage Test	Ta=-30℃,Dry, 240h	
3	High Temperature Operation Test	Ta=70℃, Dry, 240h	
4	Low Temperature Operation Test	Ta=-20℃, Dry, 240h	
5	High Temperature and High Humidity Operation Test	Ta=60℃, 90%RH, 240h	
6	Electro Static Discharge Test	Panel Surface /FPC Input Contact/Air:±200V machine mode, 150pF, 330Ω	Non-Operation
7	Thermal Shock Test	-20℃(0.5h)~70℃(0.5h)/100cycles(Dry)	