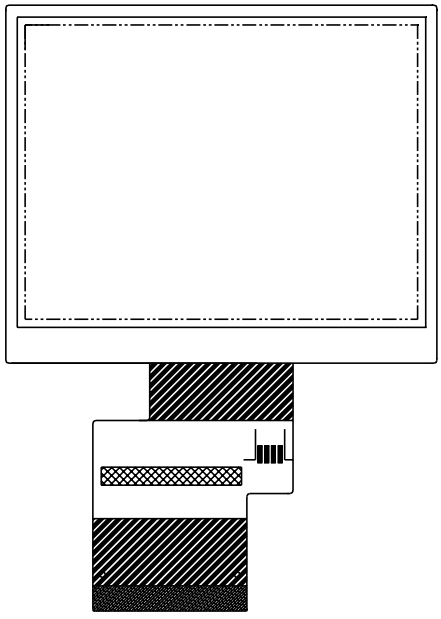
HANTRONIX

PRODUCT SPECIFICATION

HDA350-2G

QVGA, TFT COLOR GRAPHICS
LCD DISPLAY MODULE



HANTRONIX, INC. 10080 BUBB RD. CUPERTINO, CA 95014	Q.A.: Z.W.	REV.: 1.0	HDA350-2G	SHEET 1 OF 19 DATE: 1/18/11

1. General Description and Features

HDA350-2G 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 3.5" contains 320RGBx240 dots and can display up to 16.7M colors.

1.1 Features

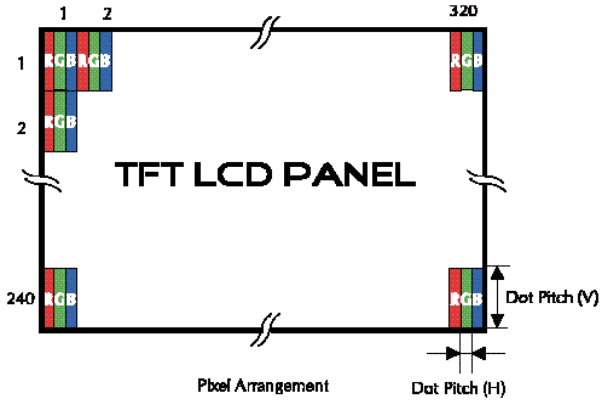
- Transmissive and back-light with six LEDs are available.
- TN (Twisted Nematic) mode.
- Programmable Frame & N-line polarity inversion.
- System & Graphic interface 3-lines SPI + 8bits color RGB.
- DEN (Data Enable Input) mode, SYNC mode
- RoHS Compliance

1.2 Applications

- Display terminals for DSC (Digital Still Camera), PMP (Portable Multimedia Player) application products.

1.3 LCD Module

Item	Specification	Unit
Screen Size	3.5 inches	Diagonal
Display Resolution	320 x RGB x 240	Dot
Dot Pitch	0.219 (H) x 0.219 (V)	mm
Active Area	70.08 (H) x 52.56 (V)	mm
Outline Dimension	76.9 (W) x 63.9 (H) x 3.3 (D)	mm
Display Mode	Normally white/Transmissive	--
Pixel Arrangement	RGB-Stripe	--
Surface Treatment	Anti-glare (AG)	--
Display Color	16.7 M	--
Viewing Direction	6 o'clock	--
Input Interface	Digital 8-bits color RGB	--
Color Gamut	NTSC 60%	--



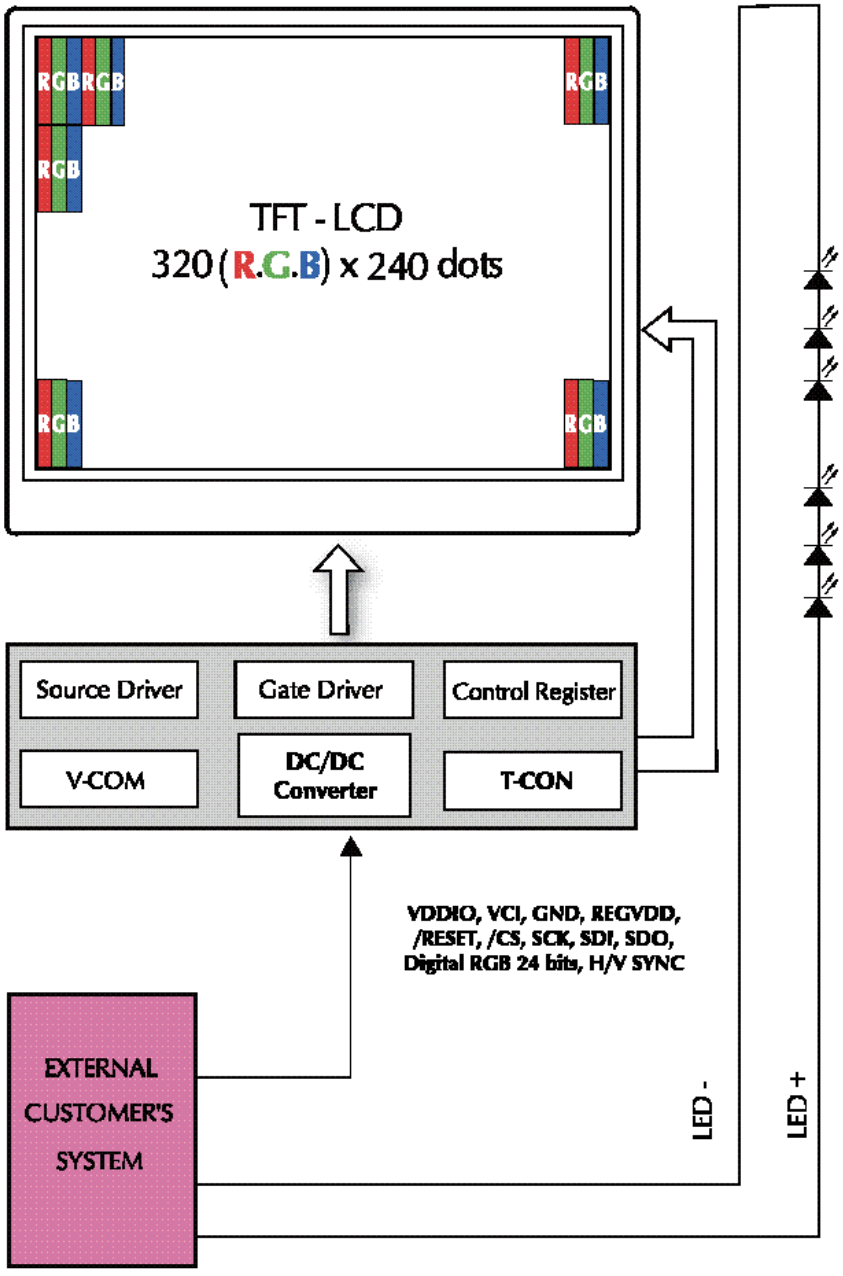
2. Mechanical Information

Item		Min.	Typ.	Max.	Unit	Note
Module Size	Horizontal (H)	--	76.90	--	mm	--
	Vertical (V)	--	63.90	--	mm	(1)
	Thickness (T)	--	3.30	--	mm	(2)
Weight		--	TBD	--	g	--

Note (1) Not include FPC.
Refer to the Outline Dimension for further information.
(2) Back-light unit are included.

4. Block Diagram

4.1 TFT-LCD Module with Back Light



5. Input Terminal Pin Assignment

5.1 Pin Assignment (LCD)

Pin No.	Symbol	I/O	Function	Remark
1	LED-	I	Backlight LED Ground	
2	LED-	I	Backlight LED Ground	
3	LED+	I	Backlight LED Power	
4	LED+	I	Backlight LED Power	
5	N/C	---	No Connection	
6	N/C	--	No Connection	
7	/RESET	I	Reset Signal	
8	/CS	I	SPI Interfaces, Chip Select pin	
9	SCLK	I	SPI Interface Clock pin	
10	SDI	I	SPI Interface Data INPUT pin	
11	SDO	O	SPI Interface Data OUPUT 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 Bit0	
21	G1	I	Green Data Bit1	
22	G2	I	Green Data Bit2	
23	G3	I	Green Data Bit3	
24	G4	I	Green Data Bit4	
25	G5	I	Green Data Bit5	
26	G6	I	Green Data Bit6	
27	G7	I	Green Data Bit7	
28	R0	I	Red Data Bit0	
29	R1	I	Red Data Bit1	
30	R2	I	Red Data Bit2	
31	R3	I	Red Data Bit3	
32	R4	I	Red Data Bit4	
33	R5	I	Red Data Bit5	

34	R6	I	Red Data Bit6	
35	R7	I	Red Data Bit7	
36	H_{SYNC}	I	Horizontal Sync Input	
37	V_{SYNC}	I	Vertical Sync Input	
38	D_{CLK}	I	Dot Clock signal	
39	V_{DDIO}	P	Voltage input pin for I/O logic. (2.5V to 3.6V)	
40	V_{DDIO}	P	Voltage input pin for I/O logic. (2.5V to 3.6V)	
41	V_{CI}	P	Booster input voltage pin. (2.5V to 3.6V)	
42	V_{CI}	P	Booster input voltage pin. (2.5V to 3.6V)	
43	REGVDD	I	Connect to voltage source between 2.5V to 3.6V	
44	N/C	--	No Connection	
45	N/C	--	No Connection	
46	N/C	--	No Connection	
47	N/C	--	No Connection	
48	N/C	--	No Connection	
49	N/C	--	No Connection	
50	N/C	--	No Connection	
51	N/C	--	No Connection	
52	DE	I	Data Enable Input	
53	GND	P	Ground	
54	GND	P	Ground	

6. Optical Characteristics

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

(Ta=25±2°C , Vcc = V_{CI}=3.3V, I_F=40mA)

Item		Symbol	Condition	Min	Type	Max	Unit	Note
Brightness		--		250	300	--	cd/m^2	--
Response time		T_R	θ=0°	--	15	20	ms	Note.
		T_F		--	35	50	ms	
Contrast ratio		CR	At optimized viewing angle	240	300	--	--	Note.
Color Chromaticity (CIE1931)	Red	R_X	θ=0° Normal Viewing Angle	0.590	0.640	0.690	--	Note.
		R_Y		0.294	0.344	0.394		
	Green	G_X		0.248	0.298	0.348	--	
		G_Y		0.532	0.583	0.633		
	Blue	B_X		0.090	0.140	0.190	--	
		B_Y		0.080	0.130	0.180		
	White	Wx		0.262	0.312	0.362	--	
		Wy		0.299	0.349	0.399		
Viewing Angle (6H)	Hor.	θ_R	CR≥10	50	60	--	Degree	Note.
		θ_L		50	60	--		
	Ver.	ϕ_H		40	50	--		
		ϕ_L		50	60	--		

Note : Definition of Transmittance (T%)

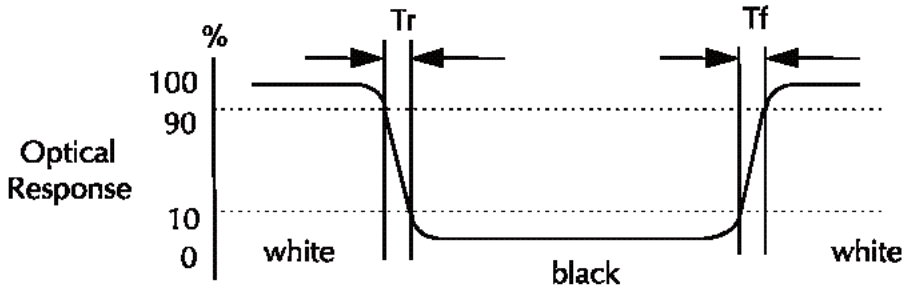
T = Aperture Ratio (TFT) x W_Y (CF)

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".

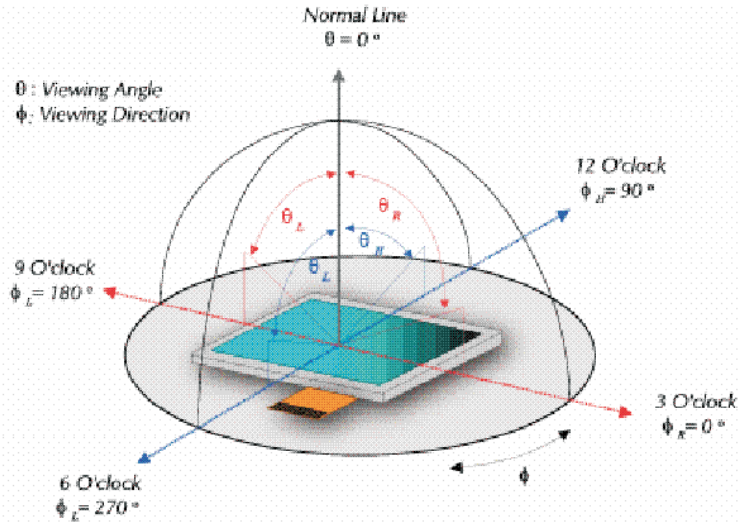


c. Definition of contrast ratio:

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

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

e. View Angle



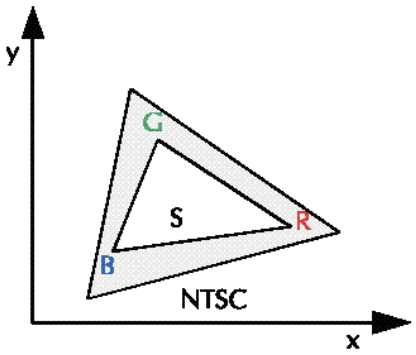
f. Definition of Luminance of White: Luminance of white at the center points

Light Source of Back-Light Unit	LED Type

g. Definition of White Uniformity

$$\text{White Uniformity} = \frac{\text{Min. luminance of white among 9-points}}{\text{Max. luminance of white among 9-points}} \times 100$$

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}	-30	80	°C	(1)
Operating temperature (Ambient temperature)	T_{OPR}	-20	70	°C	(1), (2)

Note (1) 95 % RH Max. (40 °C ≥ Ta)

Maximum wet-bulb temperature at 39 °C or less. (Ta > 40 °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

(Voltage Referenced to GND=VSS)

Item	Symbol	Value		Unit	Condition
		Min.	Max.		
Supply Voltage	VDDIO	-0.3	+4.0	V	--
Supply Voltage	VCI	VSS-0.3	5.0	V	--

7.2.2 Back-Light Unit

(Ta=25±2°C)

Item	Symbol	Min.	Max.	Unit	Note
Current	I_f	--	30	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 (DC Characteristics)

(TA=25°C)

Item	Symbol	Condition	Value			Unit
			Min.	Typ.	Max.	
Logic Power Supply	V_{DDIO}		2.5	3.3	3.6	V
Boost Power Supply	V_{CI}		2.5	3.3	3.6	V
Logic High Input voltage	VIH		0.8 V_{DDIO}	-	V_{DDIO}	V
Logic Low Input voltage	VIL		0	-	0.2 V_{DDIO}	
Logic Power current	Iv_{DDIO}	V_{DDIO} =3.3V	-	0.5	-	mA
Boost Power current	Iv_{CI}		-	7	-	mA

8.2 Backlight Unit

The back-light system is an edge-lighting type with **six** white LEDs (Light Emitting Diode).

(Ta=25±2°C)

Item	Symbol	Value			Unit	Condition
		Min.	Typ.	Max.		
Power Consumption	P_{LED}	-	(408)	-	mW	(2)
Forward voltage	V_f	-	(19.8)	-		(1)
LED Current	If	-	20	-	mA	
LED Life Time(25℃)	-	(20000)	-	-	hr	(3)

Note (1) Six LEDs serial type.

(2) Where If = 20mA, $V_f = P_{LED}$ / If

(3) The environmental conducted under ambient air flow ,at Ta=25±2℃,60%RH±5%

9. 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	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
	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
	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
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	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

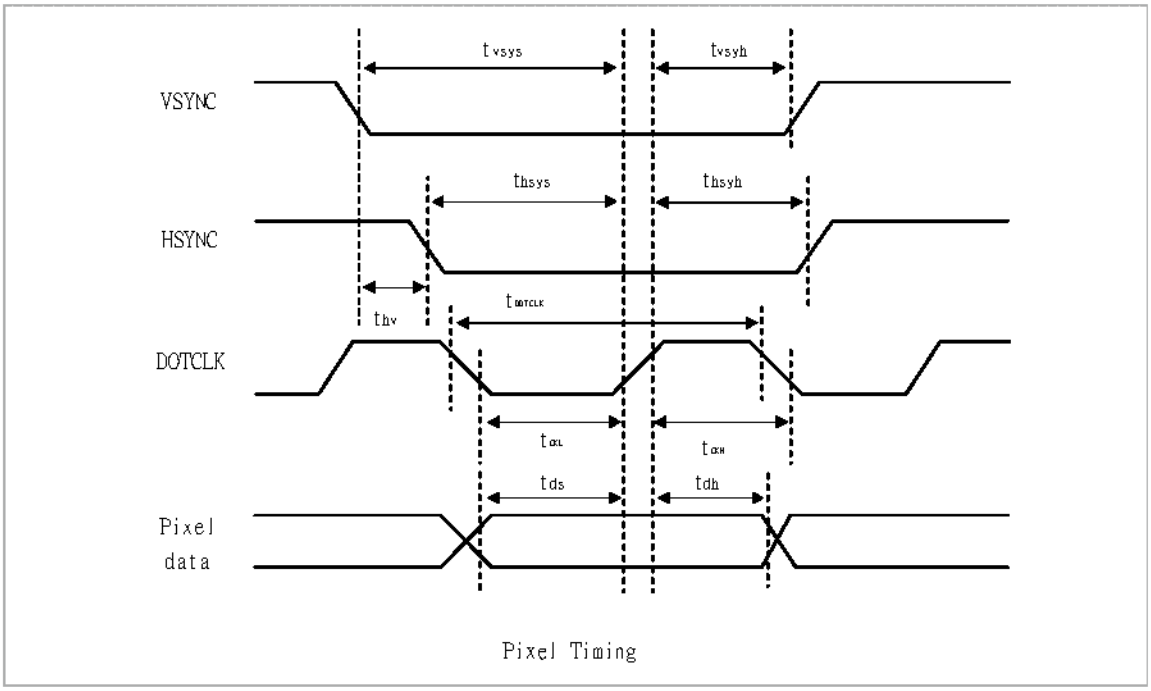
Each basic color can be displayed in 256 gray scales from 8 bit data signals. With the combination of total 24 bit data signals, the 16,777,216-color display can be achieved on the screen.

10. AC Timing

10.1 AC Characteristics (Pixel Timing)

(Unless otherwise specified, Voltage Referenced to VSS, VDDIO = 2.8V, TA = 25°C)					
Item	Symbol	Min.	Typ.	Max.	Unit
DOTCLK Frequency	fDOTCLK	-	6.5	10	MHz
DOTCLK Period	tDOTCLK	100	154	-	ns
Vertical Sync Setup Time	tvsys	20	-	-	ns
Vertical Sync Hold Time	tvsyh	20	-	-	ns
Horizontal Sync Setup Time	thsys	20	-	-	ns
Horizontal Sync Hold Time	thsyh	20	-	-	ns
Phase difference of Sync Signal Falling Edge	thv	1	-	240	tDOTCLK
DOTCLK Low Period	tCKL	50	-	-	ns
DOTCLK High Period	tCKH	50	-	-	ns
Data Setup Time	tds	12	-	-	ns
Data hold Time	tdh	12	-	-	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.

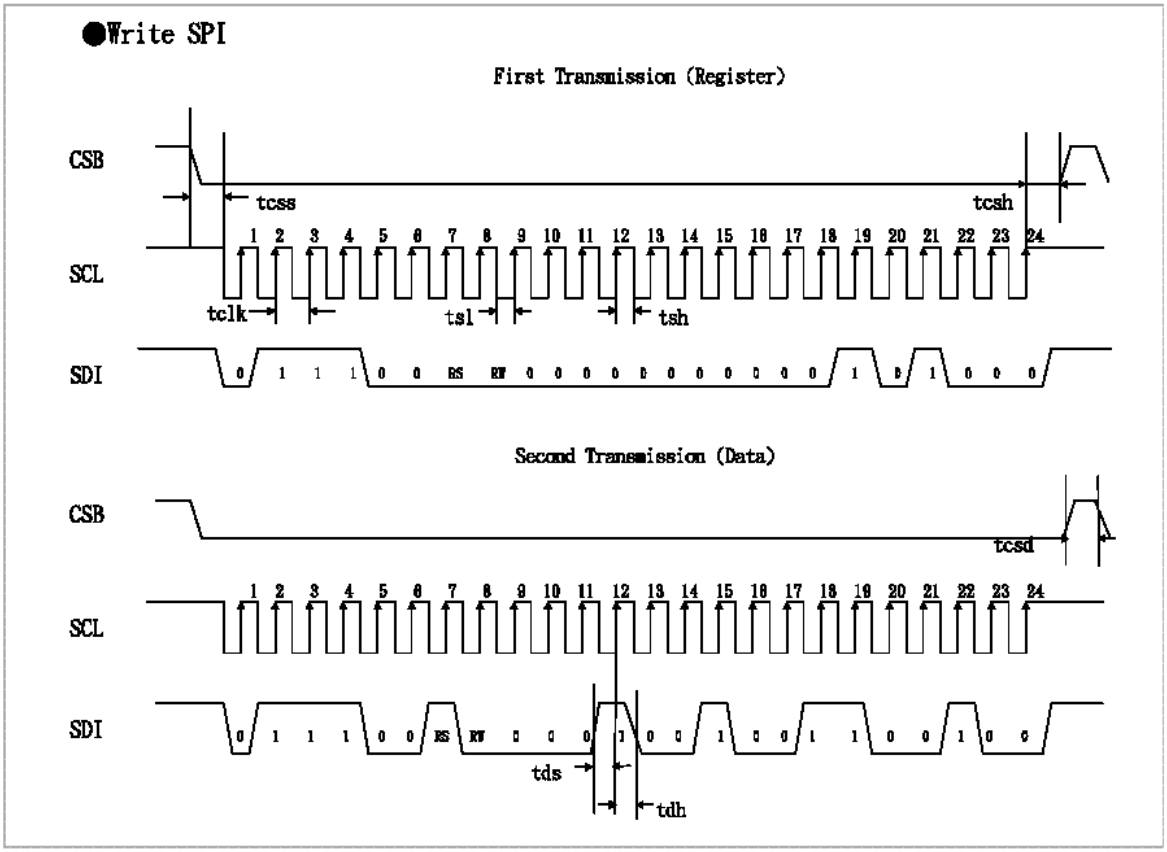


Pixel Timing

10.2 SPI Timing Characteristics

Item	Symbol	Min.	Typ.	Max.	Unit
Serial Clock Frequency	fclk	-	-	20	MHz
Serial Clock Cycle Time	tclk	50	-	-	ns
Clock Low Width	tsl	25	-	-	ns
Clock High Width	tsh	25	-	-	ns
Chip Select Setup Time	tcss	0	-	-	ns
Chip Select Hold Time	tcsh	10	-	-	ns
Chip Select High Delay Time	tcsd	20	-	-	ns
Data Setup Time	tds	5	-	-	ns
Data Hold Time	tdh	10	-	-	ns

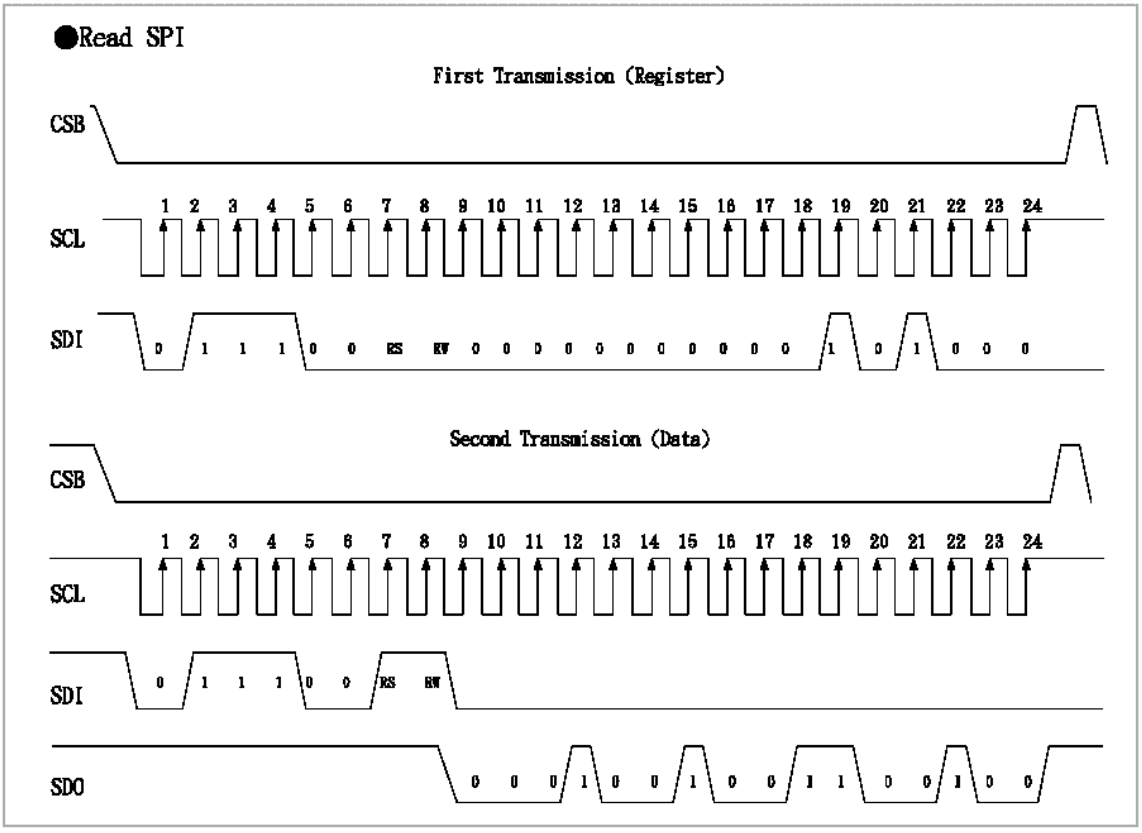
10.3 Write SPI interface Timing Diagram



Note: The example writes "0x1264h" to register R28h.

SPID connected to VSS.

10.4 Read SPI interface Timing Diagram



Note: The example Read "0x1264h" from register R28h.

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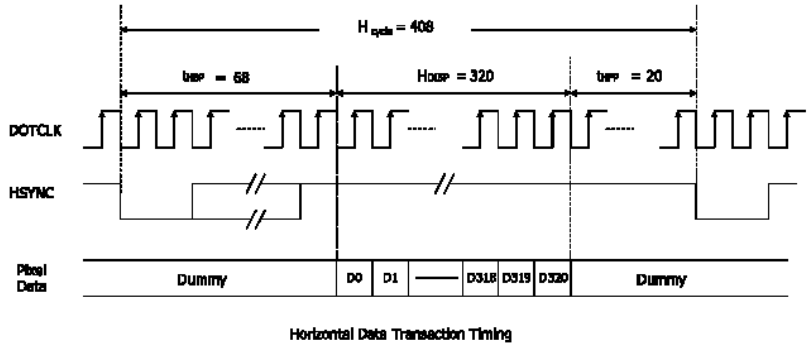
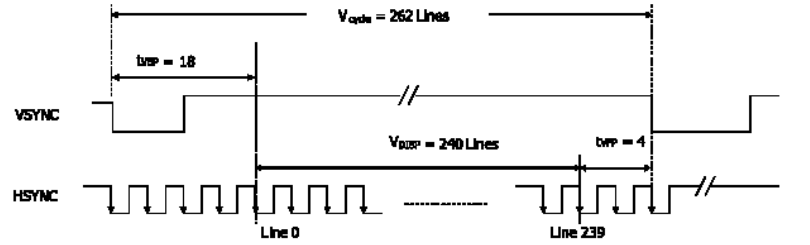
10.5 AC Characteristics

Item		Symbol	Min.	Typ.	Max.	Unit
DOTCLK Frequency		fDOTCLK	-	6.5	10	MHz
DOTCLK Period		tDOTCLK	100	154	-	ns
Horizontal Frequency (Line)		fH	-	14.9	22.35	KHz
Vertical Frequency (Refresh)		fV	-	60	90	Hz
Horizontal Back Porch		tHBP	-	68	-	tDOTCLK
Horizontal Front Porch		tHFP	-	20	-	tDOTCLK
Horizontal Data Start Point		tHBP	-	68	-	tDOTCLK
Horizontal Blanking Period		tHBP + tHFP	-	88	-	tDOTCLK
Horizontal Display Area		HDISP	-	320	-	tDOTCLK
Horizontal Cycle		Hcycle	-	408	450	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
Vertical Display Area	NTSC	VDISP	-	240	-	Lines
	PAL			280(PALM=0)		
				288(PALM=1)		
Vertical Cycle	NTSC	Vcycle	-	262	350	Lines
	PAL			313		

10.6 Timing in Parallel RGB (24 bit SYNC Mode)



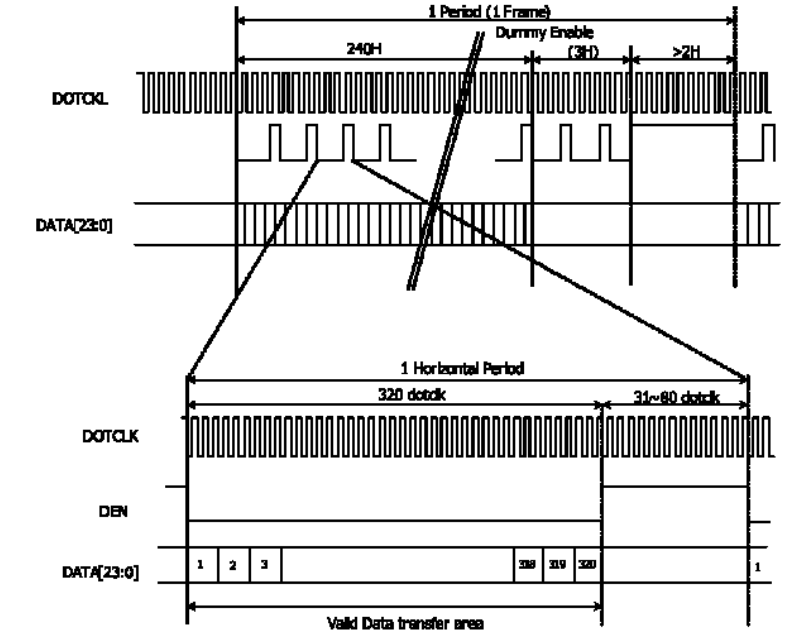
Horizontal Data Transaction Timing



Vertical Data Transaction Timing

Data transaction timing in parallel RGB (24 bit) interface (SYNC mode)

10.7 Timing in Parallel RGB (24 bit DE Mode)



Signal timing in DE mode

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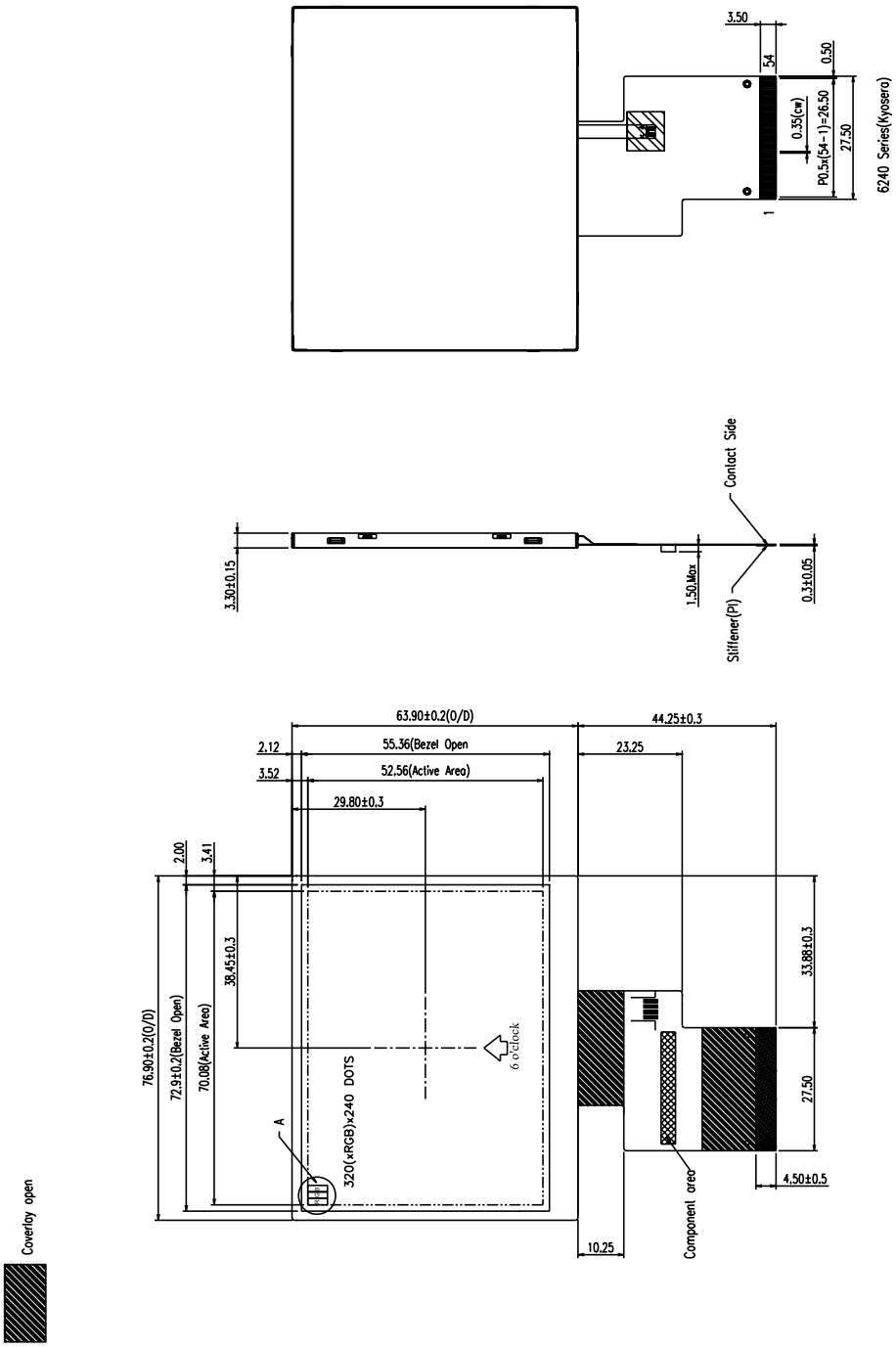
11 Reliability Condition for LCD

11.1 Main LCD Reliability Test

11.1.1 Reliability Test Condition

No.	Panel	Item	Condition	Test time	Note
1	√	High temp. operating	70°C	240 Hrs	--
2	√	Low temp. operating	-20°C	240 Hrs	--
3	√	High temp. storage	80°C	240 Hrs	--
4	√	Low temp. storage	-30°C	240 Hrs	--
5	√	High Temp / High Humidity Storage	T = 60°C /85%. For (But no condensation dew)	240 Hrs	--
6	√	High Temp/ High Humidity Operating	T = 40°C /85% For (But no condensation dew)	240 Hrs	--
7	√	Thermal Shock (Non-Operation)	-10 ← → 60°C, 50 cycle 30min 30min	1 Hrs	--
8	√	Vibration (Non-Operation)	Frequency:10 ~ 55Hz, mp:1.5mm Sweep Time : 11min Test Time : 2hrs for each direction of X,Y,Z	--	--
9	√	Shock (Non-Operation)	Acceleration : 100G, Period : 6ms Directions of X,Y,Z Cycles: Twice	--	--

3. Dimensional Outlines



PIN	ASSIGNMENT
1.	LED−
2.	LED−
3.	LED+
4.	LED+
5.	NC
6.	NC
7.	/RESET
8.	/CS
9.	SCK
10.	SDI
11.	SDO
12.	B0
13.	B1
14.	B2
15.	B3
16.	B4
17.	B5
18.	GND
19.	GND
20.	G0
21.	G1
22.	G2
23.	G3
24.	G4
25.	G5
26.	GND
27.	GND
28.	R0
29.	R1
30.	R2
31.	R3
32.	R4
33.	R5
34.	GND
35.	GND
36.	HSYNC
37.	VSYNC
38.	DCLK
39.	VDDD
40.	VDDD
41.	VDDIO
42.	VDDIO
43.	NC
44.	NC
45.	NC(YU:TOP)
46.	NC(XR:RIGHT)
47.	NC(YD:BOTTOM)
48.	NC(XL:LEFT)
49.	NC
50.	NC
51.	NC
52.	DE
53.	GND
54.	GND