TFT LCD Module

Product Specification

DT035BTFT-PTS1

3.5” (320(RGB) x 240 DOTS) TFT Module
with Capacitive Touch Screen

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Revision Record

REV	CHANGES	DATE
0.0 (Ref. 1.0 20160930)	First release	Oct 28, 2016

Table of Content

1. Scope

This data sheet is to introduce the specification of DT035BTFT-PTS1, active matrix TFT module. It is composed of a color TFT-LCD panel, driver ICs, FPC, capacitive touch panel and a backlight unit. The 3.5” display area contains 320 (RGB) x 240 pixels.

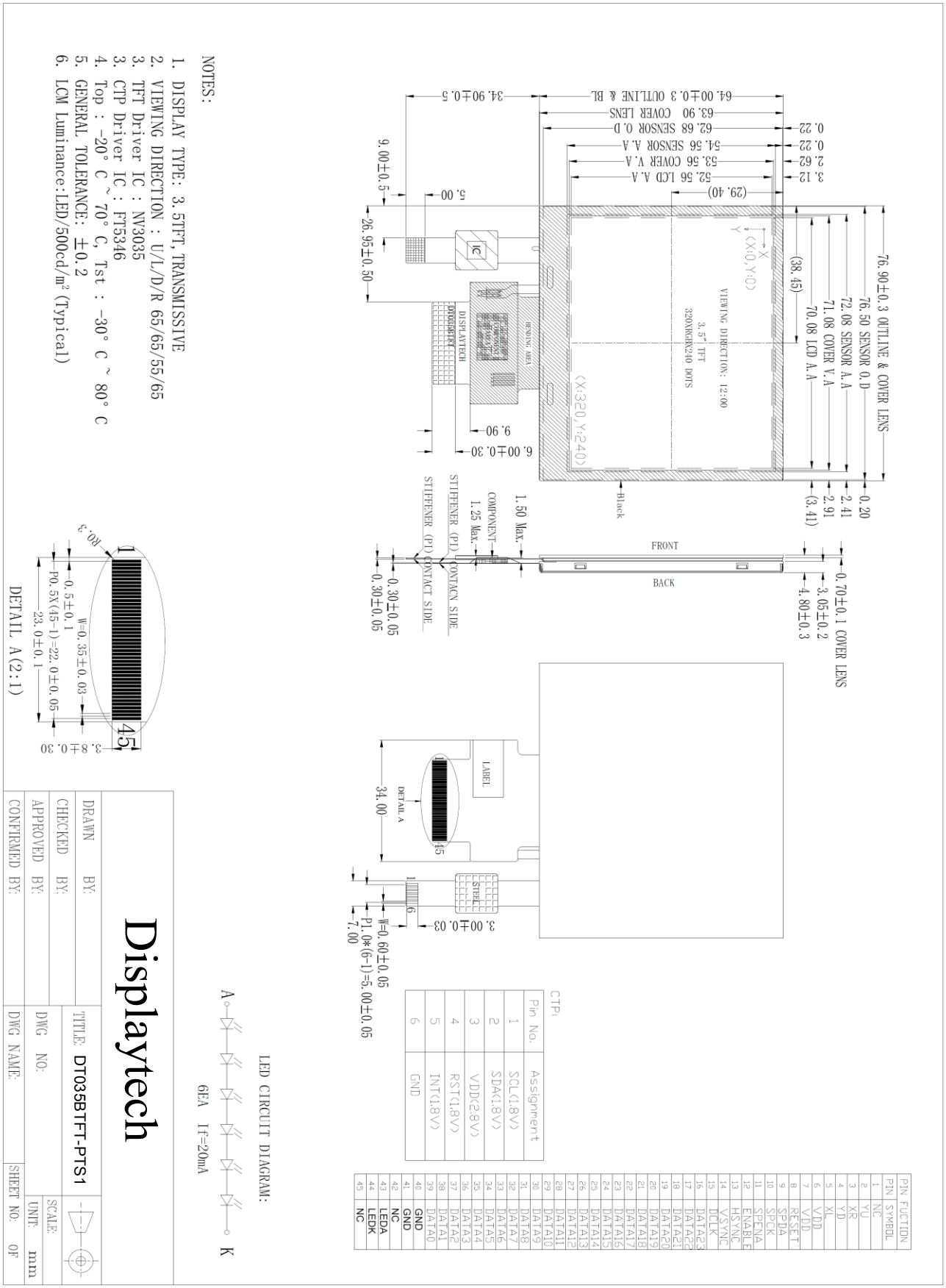
2. Application

Digital equipment which need color display, mobile phone, mobile navigator/video systems.

3. General Information

Item	Contents	Unit
Size	3.5	inch
Resolution	320(RGB) x 240	/
Interface	CPU	/
Technology Type	a-Si TFT	/
Pixel Configuration	R.G.B. Vertical Stripe	/
Pixel Pitch	0.219 x 0.219	mm
Outline Dimension (W x H x D)	76.90 x 64.00 x 4.8	mm
Active Area	70.08 x 52.56	mm
Display Mode	Transmissive, Normally White	/
Backlight Type	LED	/
Driver IC for PCAP	FT5346	
Weight	TBD	g

4. Outline Drawing



5. Interface Signals

No	Symbol	Description	Remark
1 ~ 5	NC	No connection	
6	VDD	Power supply	
7	VDD	Power supply	
8	RESET	Global reset pin	
9	SPDA	SPI Serial data input/output	
10	SPCK	SPI interface clock	
11	SPENA	Serial port data enable signal	
12	ENABLE	Data enable input	
13	HSYNC	Horizontal sync input	
14	VSYNC	Vertical sync input	
15	DCLK	Data clock	
16 ~ 39	DATA23 ~ DATA0	Data bit	
40	GND	Power ground	
41	GND	Power ground	
42	NC	No connection	
43	LEDA	LED backlight (Anode)	
44	LEDK	LED backlight (Cathode)	
45	NC	No connection	

CTP signal interface

No.	Symbol	Function
1	SCL	Clock for the data input
2	SDA	Data input
3	VDD	Power supply
4	RESET	Reset
5	INT	Interrupt output pin
6	GND	Ground

6. Absolute Maximum Ratings

6.1 Electrical absolute maximum ratings

Parameter	Symbol	MIN	MAX	Unit	Remark
Power supply voltage	VDD	-0.3	5.0	V	

6.2 Environment conditions

Parameter	Symbol	MIN	MAX	Unit	Remark
Operating Temperature	TOPR	-20	+70	°C	
Storage Temperature	TSTG	-30	+80	°C	

7. Electrical Specifications

7.1 Electrical characteristics

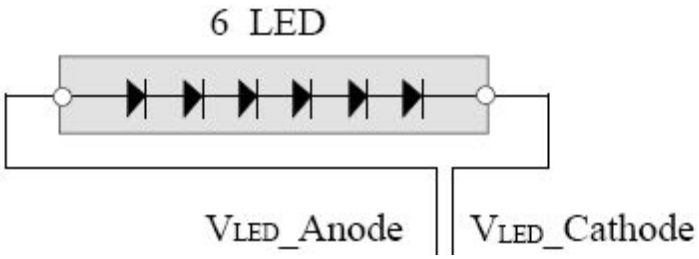
Item		Symbol	MIN	TYP	MAX	Unit	Remark
Supply voltage		VDD	3	3.3	3.6	V	
Input signal voltage	Low level	VIL	GND	-	0.1xVDD	V	
	High level	VIH	0.8xVDD	-	VDD	V	
TFT Common electrode Voltage		VcomH	2.5	-	4.5	V	
		VcomL	-3	-	0	V	
TFT Gata ON voltage		VcomH			15	V	
TFT Gata OFF voltage		VcomL	-10			V	

7.2 LED backlight

Ta=25°C

Item	Symbol	MIN	TYP	MAX	Unit	Remark
Forward current	IF	-	20	25	mA	
Forward voltage	VF	16.8	19.2	21.6	V	
LED life time	-	-	25,000	-	Hr	

The figure below shows the connection of LED



8. Command / AC Timing

8.1 AC Electrical Characteristics

Test Condition: (VDD=VDDP=3.3V, VDDA=5.0V, GND=GNDA=GNDP=0V, TA= 25℃)

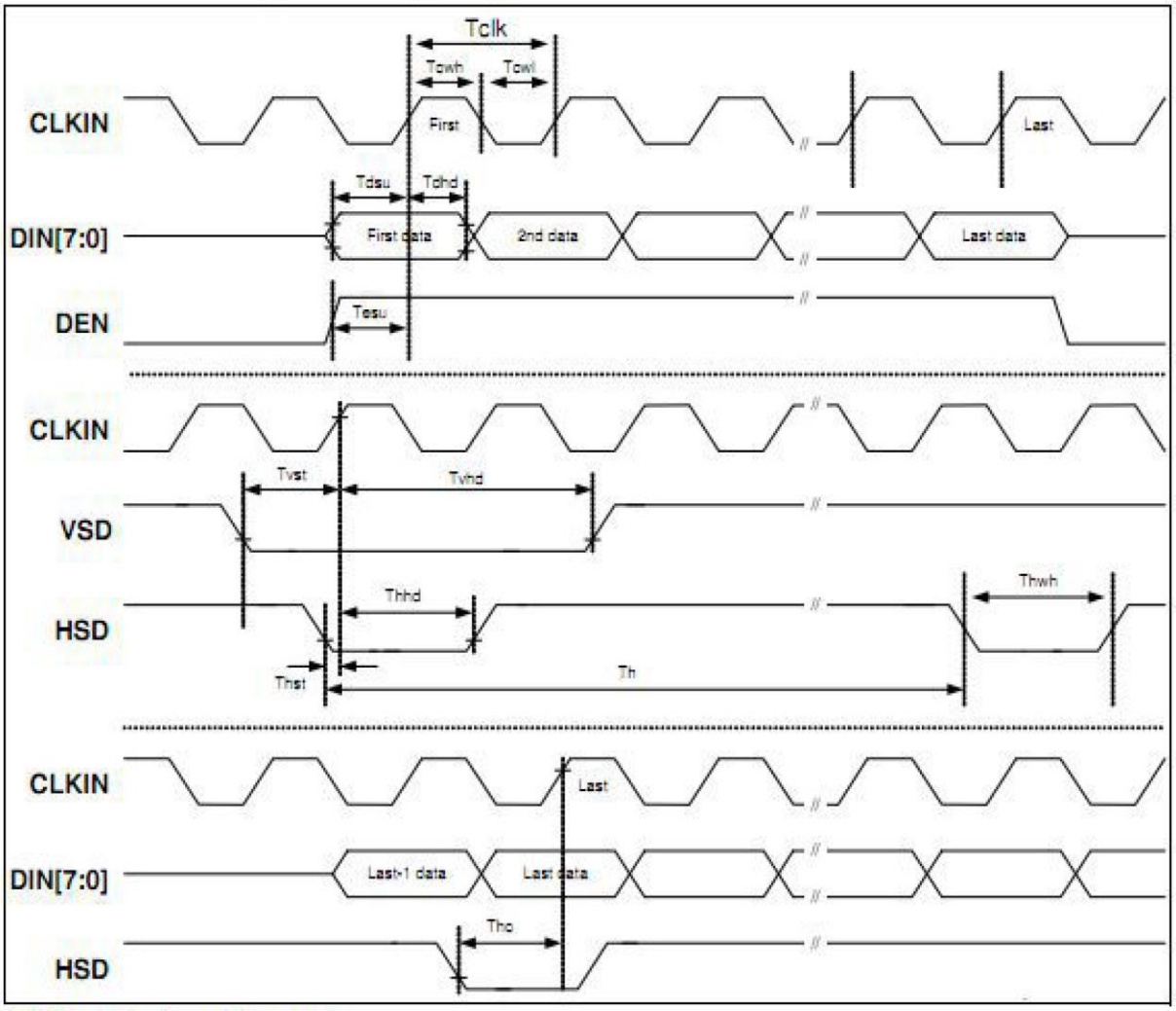
Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
System Operation Timing						
VDD power source slew time	T_{POR}			1000	us	From 0V to 90% VDD
RSTB active pulse width	T_{RSTB}	40			us	VDD = 3.3V
Input Output Timing						
CLKIN clock time	Tclk	33.3/125	-	-	ns	Please refer to timing table(p.32)
HSD to CLKIN	Thc	-	-	1	CLKIN	
HSD width	Thwh	1	-	-	CLKIN	
VSD width	Tvwh	1	-	-	Th	
HSD period time	Th	60	63.56	67	us	
VSD setup time	Tvst	8	-	-	ns	
VSD hold time	Tvhd	10	-	-	ns	
HSD setup time	Thst	8	-	-	ns	
HSD hold time	Thhd	10	-	-	ns	
Data set-up time	Tdsu	8	-	-	ns	DIN[23:0] to CLKIN
Data hold time	Tdhd	10	-	-	ns	DIN[23:0] to CLKIN
DEN setup time	Tesd	12	-		ns	DEN to CLKIN
Time that VSD to 1st line data input	Tvs	2	13	127	Th	@CCIR601 / 8bit RGB HV mode Control by HDLY[6:0] setting Tvs = HDLY[6:0]
Time that CCIR_V to 1st line data input	Tvs	12	20	28	Th	@CCIR656 NTSC mode Control by HDLY[6:0] setting Tvs = HDLY[6:0]
Time that CCIR_V to 1st line data input	Tvs	17	25	33	Th	@CCIR656 PAL mode Control by HDLY[6:0] setting Tvs = HDLY[6:0]
Time that VSD to 1st line data input	Tvs	2	13	127	Th	@24bit RGB HV mode Control by HDLY[6:0] setting Tvs = HDLY[6:0]
Source output stable time 1	Tst	-	25	30	us	96% final, CL=30pF, RL=2K
Gate output stable time	Tgst	-	500	1000	ns	96% final, CL=40pF
VCOMOUT output stable time	Tcst	-	4	8	us	96% final, CL=33nF, RL=100ohm
3-wire serial communication AC timing						
Serial clock	Tspck	320	-	-	ns	
SPCK pulse duty		40	50	60	%	Tckh / Tspck
Serial data setup time	Tisu	120	-	-	ns	
Serial data hold time	Tihd	120	-	-	ns	
Serial clock high/low	Tckh/l	120	-	-	ns	
Chip select distinguish	Tcd	1	-	-	us	
SPENB to VSD	Tcv	1	-	-	us	
SPENB input setup time	Teck	150	-	-	ns	
SPENB input hold time	Tcke	150	-	-	ns	

8.2 24 Bit RGB Mode (@ SEL\[3:0] = 1100 or 1101)

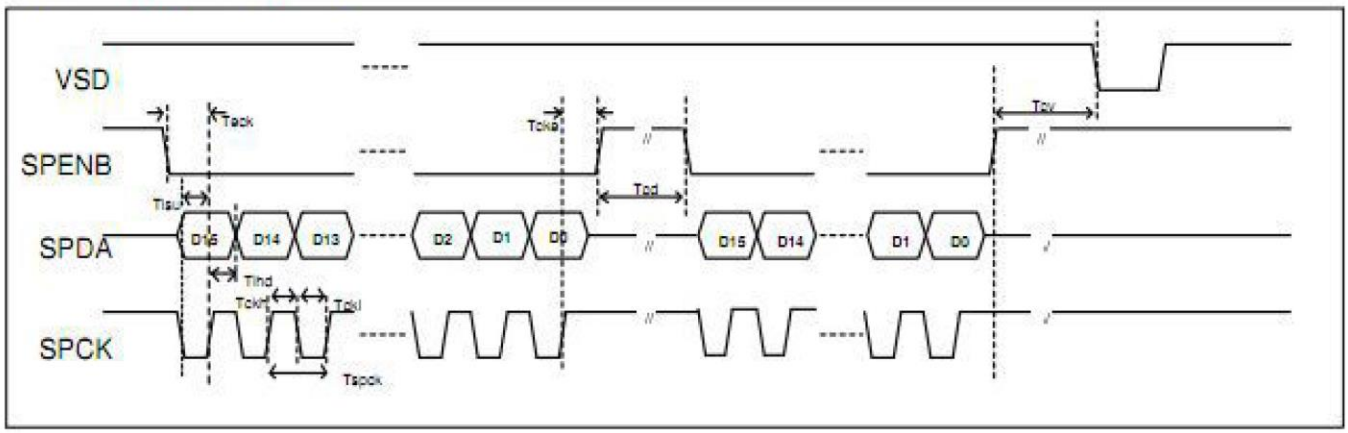
Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
CLKIN frequency	Fclk	6.1	6.4	8.0	MHz	VDD = 3.0 ~3.6V
CLKIN cycle time	Tclk	125	156	164	ns	
CLKIN pulse duty	Tcwh	40	50	60	%	Tclk
Time that HSD to 1'st data input(NTSC)	Ths	40	70	255	CLKIN	DDLY =70, Offset = 0 (fixed)

8.3 Timing Diagram

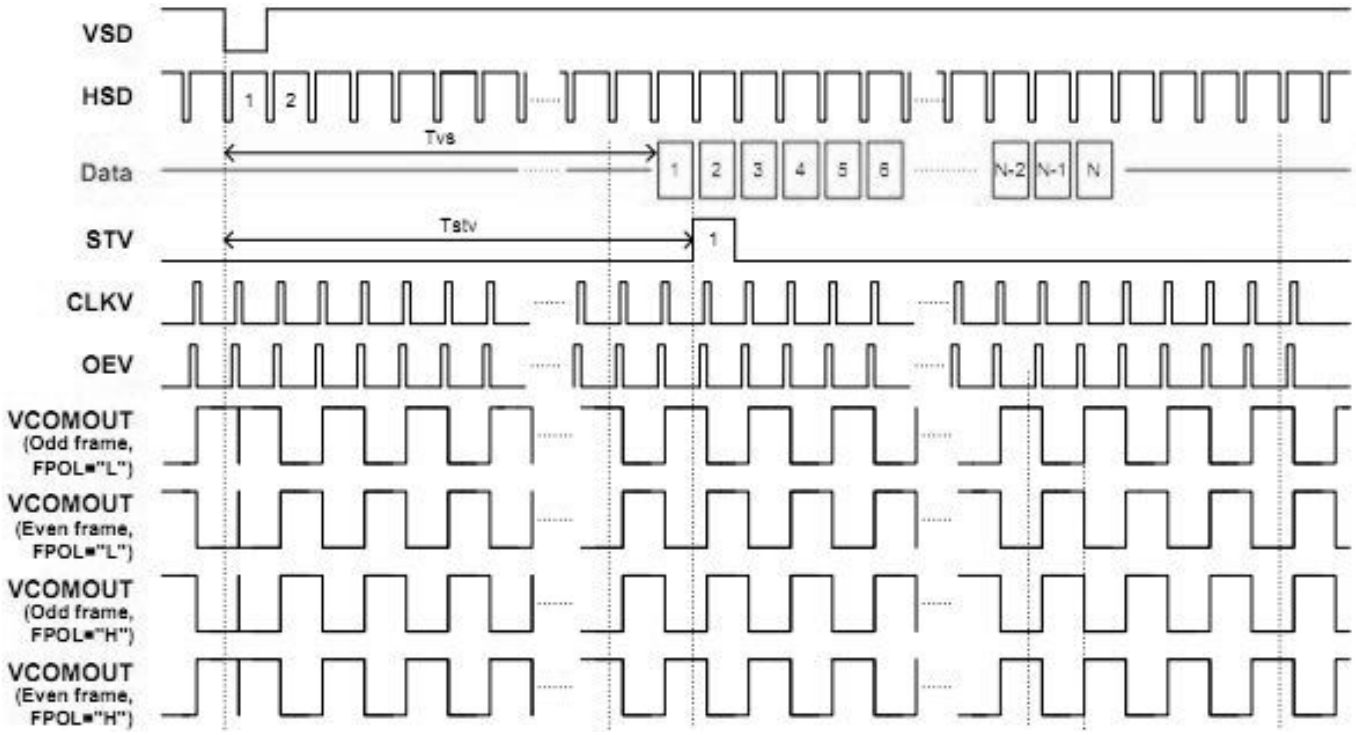
Clock and Data Input Timing Diagram



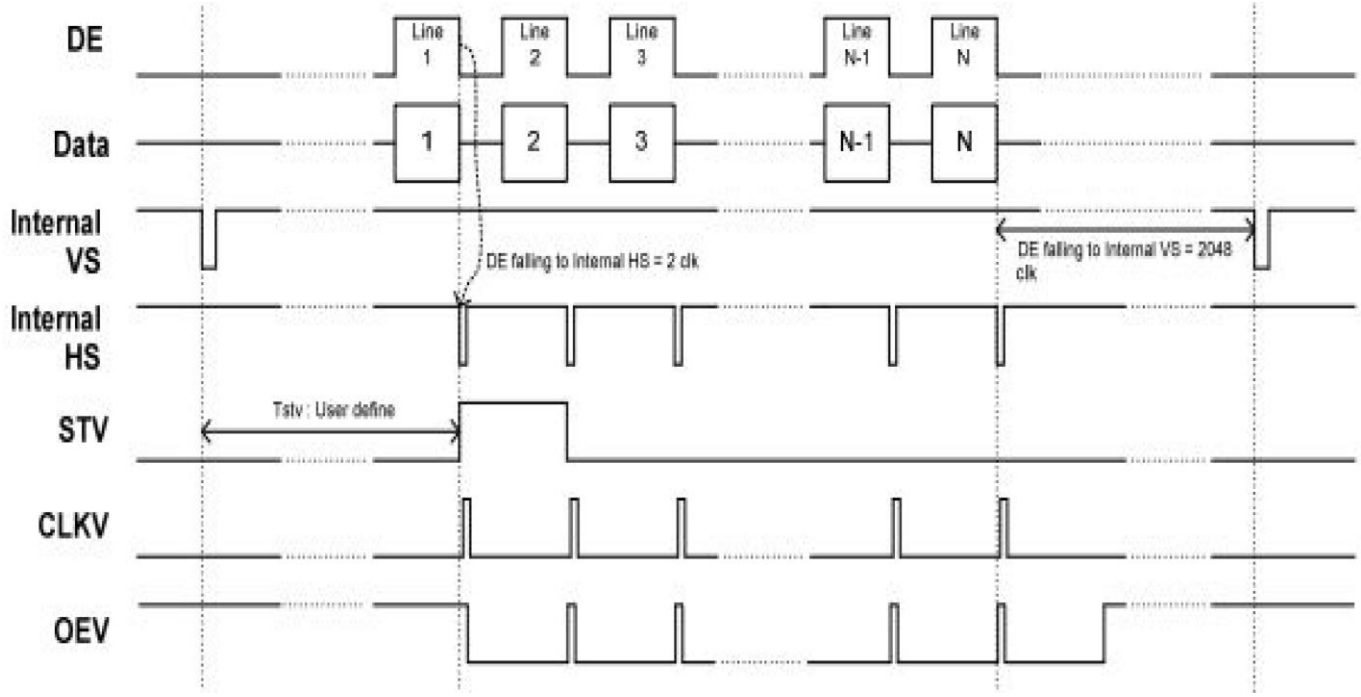
3-Wire Timing Diagram



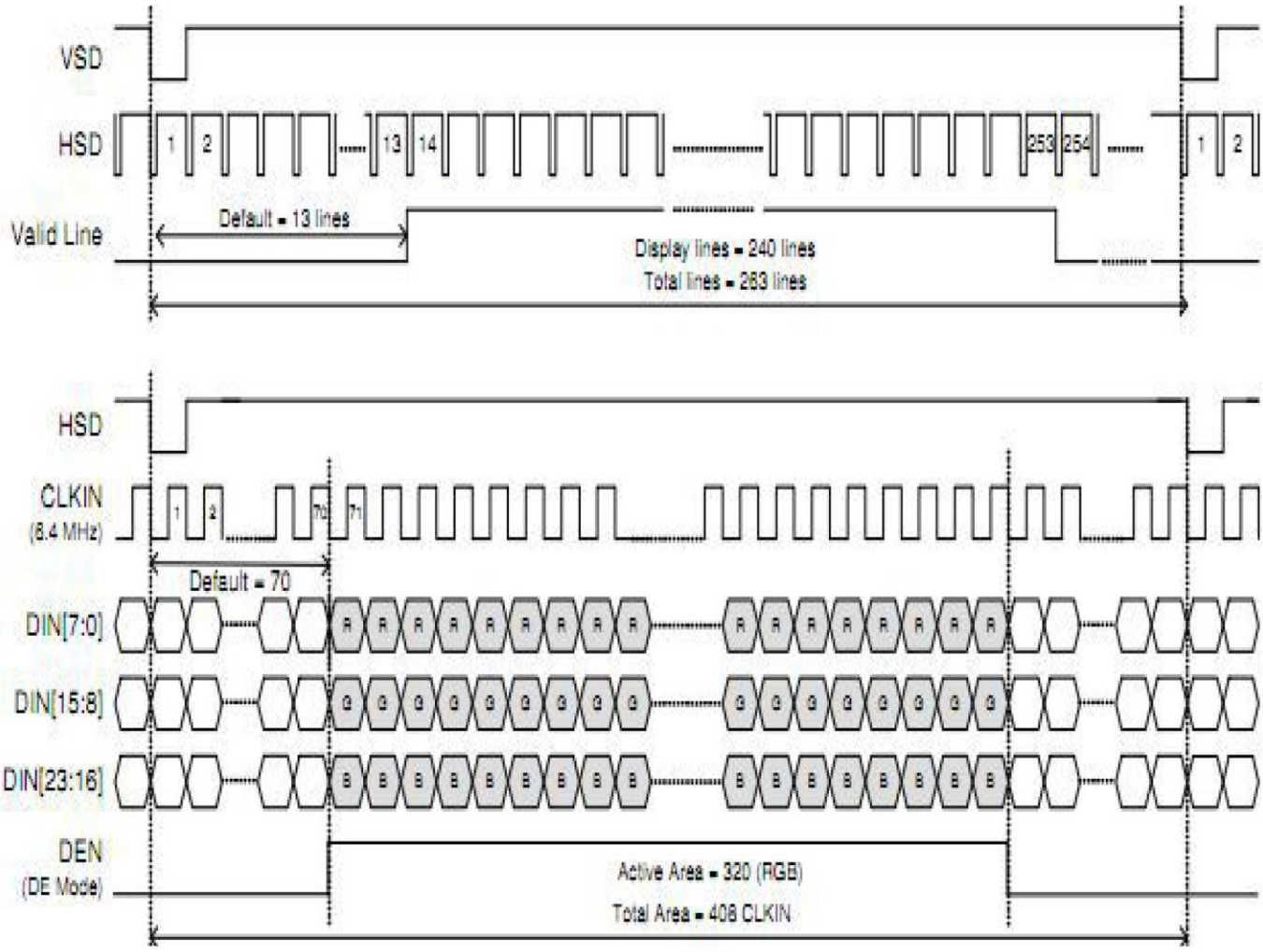
8.4 Vertical Timing Diagram (HV Mode)



8.5 Vertical Timing Diagram (DE Mode)



8.6 Input Data Timing (24 bit RGB mode for 960 x 240 @ SEL\[3:0] = 1100b)



9. Optical Specification

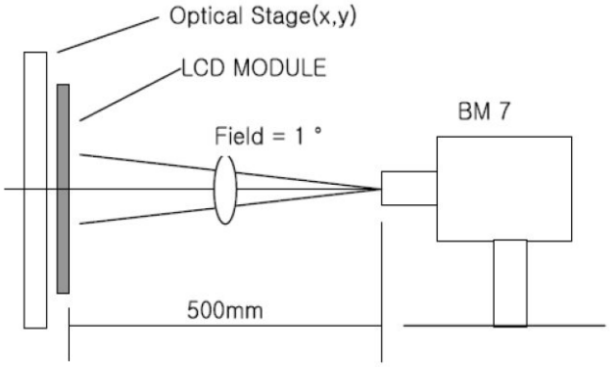
Ta=25°C

Item		Symbol	Condition	MIN	TYP	MAX	Unit	Remark
Contrast ratio		CR	θ=0°	350	500	-		Note 1, 2
Response time		Tr / Tf	25°C	-	10	-	ms	Note 1, 3
View angles		ΘT	CR≧10	-	65	-	Degree	Note 4
		ΘB		-	55	-		
		ΘL		-	65	-		
		ΘR		-	65	-		
Chromaticity	Red	x	Brightness is on	-	0.51	-		Note 1, 5
		y		-	0.34	-		
	Green	x		-	0.31	-		
		y		-	0.56	-		
	Blue	x		-	0.15	-		
		y		-	0.14	-		
	White	x		-	0.28	-		
		y		-	0.33	-		
NTSC				50	60		%	Note 5
Luminance		L		-	480	-	cd/m^2	Note 1, 6
Uniformity		U		75	80	-	%	Note 1, 7

Note 1: Definition of optical measurement system.

Temperature = 25℃(±3℃)

LED back-light: ON, Environment brightness < 150 lx

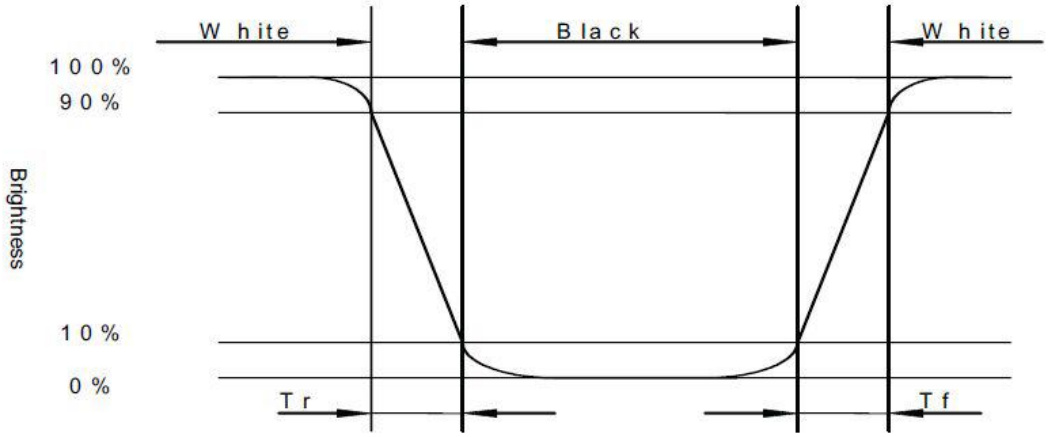


Note 2: Contrast ratio is defined as follow:

$$\text{Contrast Ratio} = \frac{\text{Surface Luminance with all white pixels}}{\text{Surface Luminance with all black pixels}}$$

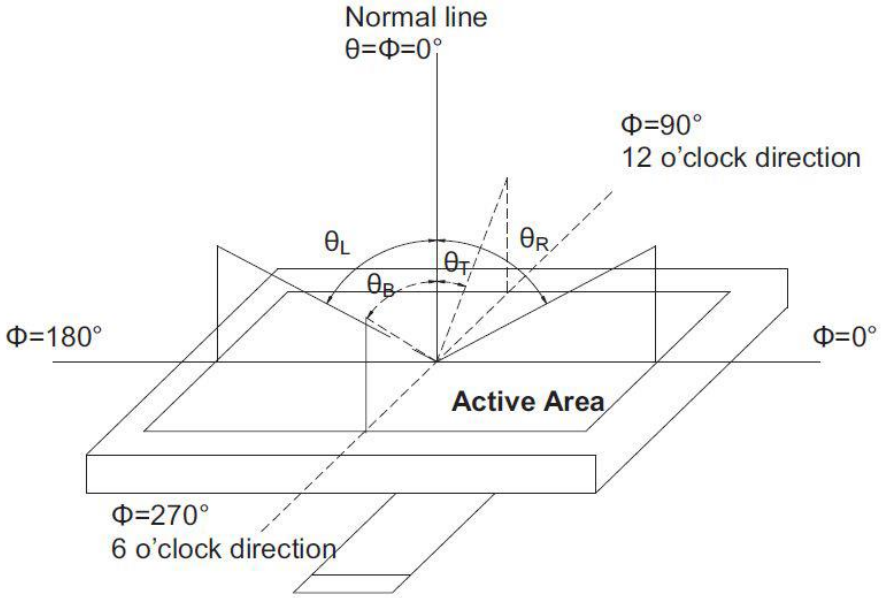
Note 3: Response time is defined as follow:

Response time is the time required for the display to transition from black to white (Rise time, Tr) and from white to black (Decay Time, Tf).



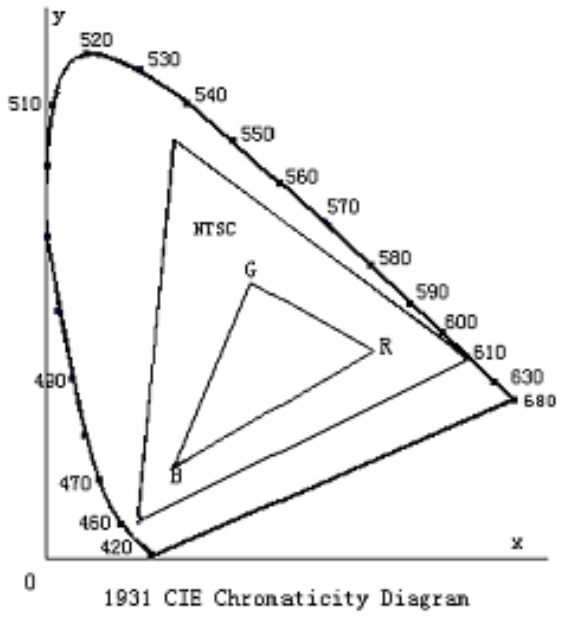
Note 4: Viewing angle range is defined as follow:

Viewing angle is measured at the center point of the LCD.



Note 5: Color chromaticity is defined as follow (CIE1931)

Color coordinates measured at center point of LCD.



$$S = \frac{\text{area of RGB triangle}}{\text{area of NTSC triangle}} \times 100\%$$

Note 6: Luminance is defined as follow:

Luminance is defined as the brightness of all pixels “White” at the center of display area on optimum contrast.

Note 7: Luminance Uniformity is defined as follow:

Active area is divided into 9 measuring areas (Refer Fig.2). Every measuring point is placed at the center of each measuring area.

$$\text{Uniformity (U)} = \frac{\text{Minimum Luminance(brightness) in 9 points}}{\text{Maximum Luminance(brightness) in 9 points}}$$

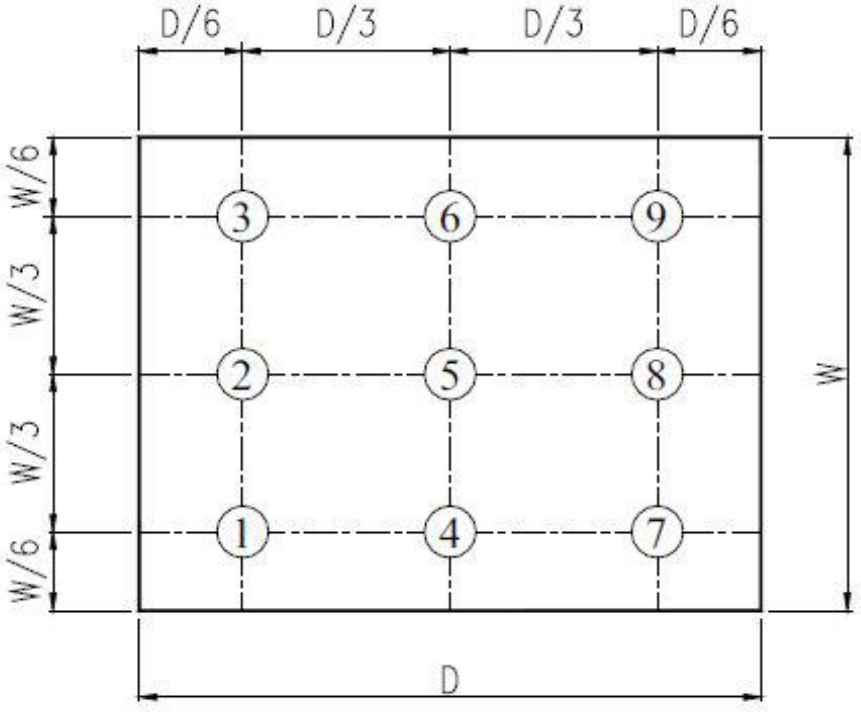


Fig. 2 Definition of uniformity

10. Environmental / Reliability Tests

No	Test Item	Condition	Judgment Criteria
1	High Temp Operation	Ta=+70°C, 120hrs	Per table below
2	Low Temp Operation	Ta=-20°C, 120hrs	Per table below
3	High Temp Storage	Ta=+80°C, 120hrs	Per table below
4	Low Temp Storage	Ta=-30°C, 120hrs	Per table below
5	High Temp & High Humidity Storage	Ta=+60°C, 90% RH, 120hrs	Per table below (polarizer discoloration is excluded)
6	Thermal Shock (Non-operation)	-30°C 30 min ~ +80°C 30 min, Change time: 5 min, 10 cycles	Per table below
7	ESD (Operation)	C=150pF, R=330Ω, 5points/panel Air:±8KV, 5 times; Contact:±4KV, 5 times	Per table below
8	Vibration (Non-operation)	Frequency range:10~55Hz, Stroke:1.5mm Sweep:10Hz~55Hz~10Hz 2 hours for each direction of X.Y.Z.	Per table below
9	Shock (Non-operation)	60G 6ms, ±X, ±Y, ±Z, 3 times, for each direction	Per table below
10	Package Drop Test	Height: 80cm, 1 corner, 3 edges, 6 surfaces	Per table below

Inspection	Criterion (after test)
Appearance	No crack on the FPC, on the LCD panel
Alignment of LCD panel	No bubbles in the LCD panel No other defects of alignment in active area
Electrical current	Within device specifications
Function / Display	No broken circuit, no short circuit or no black line No other defects of display

11. Precautions for Use of LCD Modules

11.1 Safety

The liquid crystal in the LCD is poisonous. Do not put it in your mouth. If the liquid crystal touches your skin or clothes, wash it off immediately using soap and water.

11.2 Handling

a. The LCD and touch panel is made of plate glass. Do not subject the panel to mechanical shock or to excessive force on its surface.
b. Do not handle the product by holding the flexible pattern portion in order to assure the reliability.
c. Transparency is an important factor for the touch panel. Please wear clear finger sacks, gloves and mask to protect the touch panel from finger print or stain and also hold the portion outside the view area when handling the touch panel.
d. Provide a space so that the panel does not come into contact with other components.
e. To protect the product from external force, put a covering lens (acrylic board or similar board) and keep an appropriate gap between them.
f. Transparent electrodes may be disconnected if the panel is used under environmental conditions where dew condensation occurs.

g. Property of semiconductor devices may be affected when they are exposed to light, possibly resulting in IC malfunctions.
h. To prevent such IC malfunctions, your design and mounting layout shall be done in the way that the IC is not exposed to light in actual use.

11.3 Static electricity

a. Ground soldering iron tips, tools and testers when they are in operation.
b. Ground your body when handling the products.
c. Power on the LCD module before applying the voltage to the input terminals.
d. Do not apply voltage which exceeds the absolute maximum rating.
e. Store the products in an anti-electrostatic bag or container.

11.4 Storage

a. Store the products in a dark place at +25°C±10°C with low humidity (40% RH to 60% RH). Don't expose to sunlight or fluorescent light.
b. Storage in a clean environment, free from dust, active gas, and solvent.

11.5 Cleaning

a. Do not wipe the touch panel with dry cloth, as it may cause scratch.
b. Wipe off the stain on the product by using soft cloth moistened with ethanol. Do not allow ethanol to get in between the upper film and the bottom glass. It may cause peeling issue or defective operation. Do not use any organic solvent or detergent other than ethanol.

11.6 Cautions for installing and assembling

Bezel edge must be positioned in the area between the Active area and View area. The bezel may press the touch screen and cause activation if the edge touches the active area. A gap of approximately 0.5mm is needed between the bezel and the top electrode. It may cause unexpected activation if the gap is too narrow. There is a tolerance of 0.2 to 0.3mm for the outside dimensions of the touch panel and tail. A gap must be made to absorb the tolerance in the case and connector.