



LCD MODULE
(DEPARTMENT)

SPECIFICATION

T2432C13VR01 – REV. B
(3.5” DIGITAL TFT with LED BACKLIGHT)
1-Chip Solution

CUSTOMER APPROVAL
.....STAMP AND SIGNATURE.....
DATE: _____

IMPORTANT NOTE: This document must be approved by customer and send back to CCT by mail, email or fax.

If the approved document is not returned, CCT will assume it has been approved if any Mass Production Order is issued subsequently.

	Designation	Name	Signature/Date
Originator	Electronic Engineer	Christopher Choong	05.03.08
Checked by	Assistant Manager	Azhar Rosdi	05.03.08
Approved by	Project Manager	Jack Ng	05.03.08



LCD Module Specification

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2.0 Record of revision

2



3.0 General specification

Display format : 320 (W) x RGB x 240 (H) dots

Screen size : 3.5 inch

Surface treatment : Anti-glare

Active area : 70.08mm x 52.56mm

General dimensions : 76.90mm x 63.90mm x 3.25mm

Pixel pitch : 0.219mm x 0.219mm

LCD type : ☐ CSTN ☒ TFT

Polarizer mode : ☐ Reflective ☐ Transflective
☒ Transmissive

View angle : ☐ 6 O'clock ☒ 12 O'clock

☐ 9 O'clock ☐ 3 O'clock

Backlight : ☐ EL ☒ LED ☐ CCFL

Backlight color : ☐ Yellow Green ☐ Amber ☒ White

☐ Blue Green ☐ Others

Temperature range : ☐ Normal temperature ☒ Wide temperature
Operating -10 to 60 C Operating -20 to 70 C
Storage -20 to 70 C Storage -30 to 80 C



4.0 Absolute maximum rating – IC only

Parameter	Symbol	Min.	Max.	Unit	Remark
Input voltage	V_{CI}	VSS-0.3	+5.0	V	Note 1
Supply voltage	V_{CC}	-0.3	+5.0	V	Note 1
	V_{CCIO}	-0.3	+5.0	V	Note 1

Note 1 – The modules may be destroyed if they are used beyond the absolute maximum ratings.

5.0 Electrical characteristics

Item		Symbol	Min.	Typ.	Max.	Unit	Remark
Supply voltage		V_{CC}	-	+2.8	-	V	
Input voltage	H Level	V_{IH}	+0.8 V_{CC}	-	V_{CC}	V	
	L Level	V_{IL}	0.0	-	+0.2 V_{CC}	V	
Supply current		I_{CC}	-	20	-	mA	
Vcom		V_{comH}	2.5	-	4.5	V	
		V_{comL}	-3.0	-	0	V	
TFT Gate ON voltage		V_{GH}	-	15	-	V	
TFT Gate OFF voltage		V_{GL}	-	-10	-	V	

Backlight

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark
Backlight voltage	V_{LED}	18.0	19.2	20.8	V	$I_{LED} = 20mA$
Backlight current	I_{LED}	-	20	-	mA	LED = 6
Luminance		3200	3600	-	cd/m ²	

6.0 Environmental requirements

No	Item	Conditions
1.	Operating Temperature	Refer page 3
2.	Storage Temperature	Refer page 3
3.	Operating Humidity	5% to 95%RH
4.	Cycle Test	0 C @ 30 min to 50 C @ 30min for 1 cycle run for 10 cycles

Note: The background on LCD has the possibility to be changed in different temperature range.



7.0 LCD specification

7.1 Electro-optical characteristic

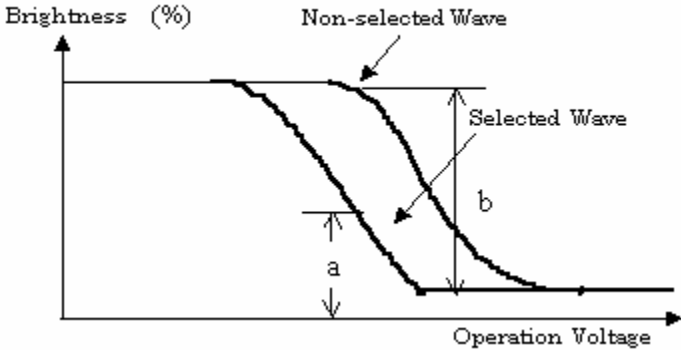
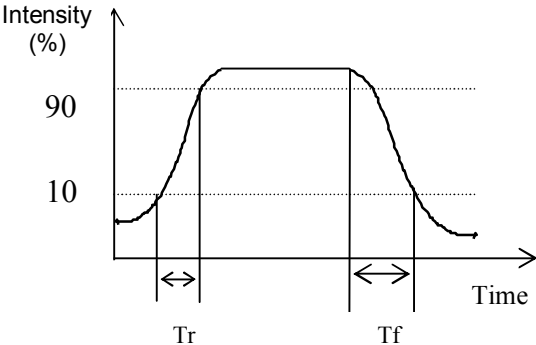
Temp = 25°C

No	Item	Symbol	Conditions	Commercial			Unit	Ref.
				Min.	Typ.	Max.		
1	Brightness			300	350	-	cd/m ²	
2	Viewing Angle	θ_{x1}	$CR \geq 10$	55	70	-	Deg	7.1.1
		θ_{x2}		55	70	-		
		θ_{y1}		45	60	-		
		θ_{y2}		55	70	-		
3	Contrast Ratio	Cr	$\theta = 0^\circ$	300	450	-		7.1.2
4	Response Time	Tr	$\theta = 0^\circ$	-	10	-	ms	7.1.3
		Tf		-	15	-		
5	Chromaticity White	X	$\theta = 0^\circ$	0.29	0.31	0.33		
		Y		0.31	0.33	0.35		
6	Uniformity	U	9 points	75	80		%	

* Measurement readings are subjected to method of measuring and varies between different measuring methods.

No.	Characteristics	Definition
7.1.1	Viewing Angle	The diagram illustrates the viewing angle of the LCD. The top part shows a 3D perspective of the LCD panel with axes labeled Left, Right, Front, and Bottom. A viewing angle is shown from the rear. The bottom part shows a 2D circular diagram with axes labeled REAR (θy2), FRONT (θy1), LEFT(θx2), and RIGHT(θx1).



7.1.2	Contrast Ratio <i>Conditions</i> (a) Temperature: 25°C (b) Viewing Angle, $\theta = 0^\circ$	 Contrast Ratio = $\frac{\text{Brightness of non-selected state (b)}}{\text{Brightness of selected state (a)}}$
7.1.3	Response Time	 T_r : Measured between 10% and 90% of LCD segment maximum response with V_{ON}. T_f : With voltage switches to zero and the instant LCD segment reaches 10% of its maximum response.



8.0 Interface

8.1	Pin-out Assignments		
CONNECTOR			
Pin No	Symbol	Function	Remark
1	VBL-	Cathode of LED backlight	
2	VBL-		
3	VBL+	Anode of LED backlight	
4	VBL+		
5	NC	Not connected	
6	NC		
7	POL	Polarity signal to monitor VCOM signal	
8	/RESET (RESB)	System reset signal pin	
9	/CS (CSB)	Chip select signal pin for serial interface	
10	SCL	Clock signal input pin for serial interface	
11	SDI	Data input pin for serial interface	
12	D0	Data input pins	
13	D1		
14	D2		
15	D3		
16	D4		
17	D5		
18	D6		
19	D7		
20	D8		
21	D9		
22	D10		
23	D11		
24	D12		
25	D13		
26	D14		
27	D15		
28	D16		
29	D17		
30	D18		
31	D19		
32	D20		
33	D21		
34	D22		
35	D23		
36	HSYNC		
37	VSYNC		
38	DOTCLK		
39	NC	Not connected	

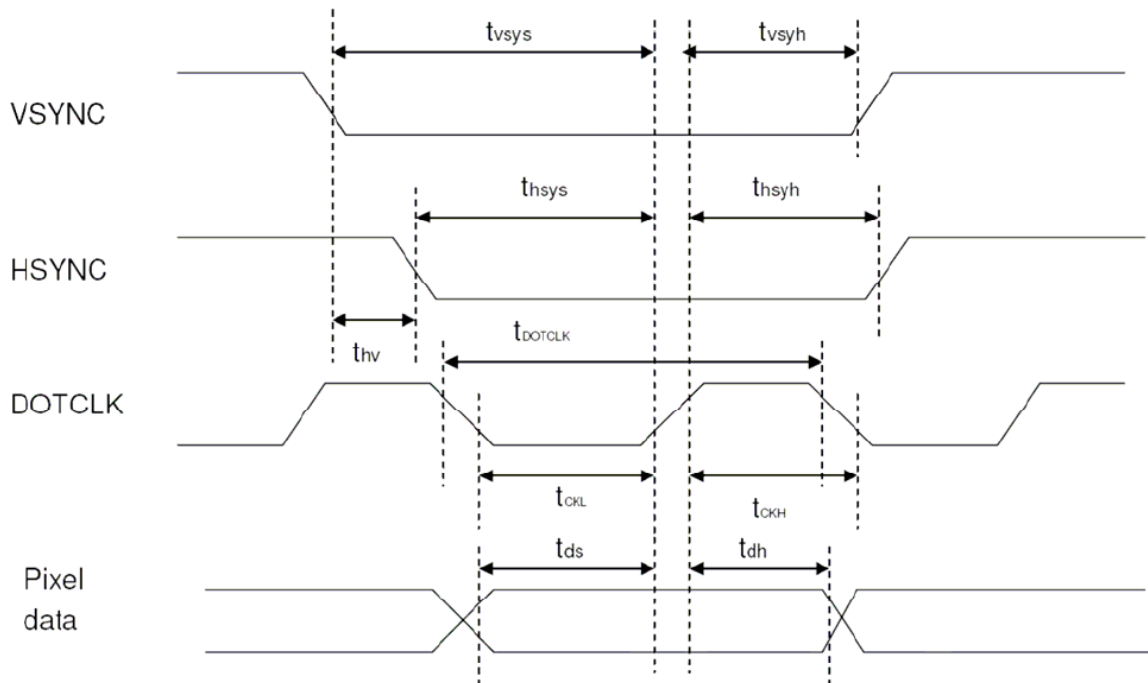


40	NC	Not connected	
41	VCC	Power supply for logic system	
42	VCC		
43	NC	Not connected	
44	NC		
45	NC		
46	UD	Up / Down scan setting High – Normal scan (G0 ~ G239) Low – Reverse scan (G239 ~ G0)	
47	NC	Not connected	
48	LR	Left / Right scan setting High – Normal scan (First data S0~S2) Low – Reverse scan (First data S959~S957)	
49	NC	Not connected	
50	NC		
51	NC		
52	DEN	Display enable signal pin	
53	GND	Ground terminal	
54	GND		

Connector type – Pin no 54pins, pitch = 0.5mm

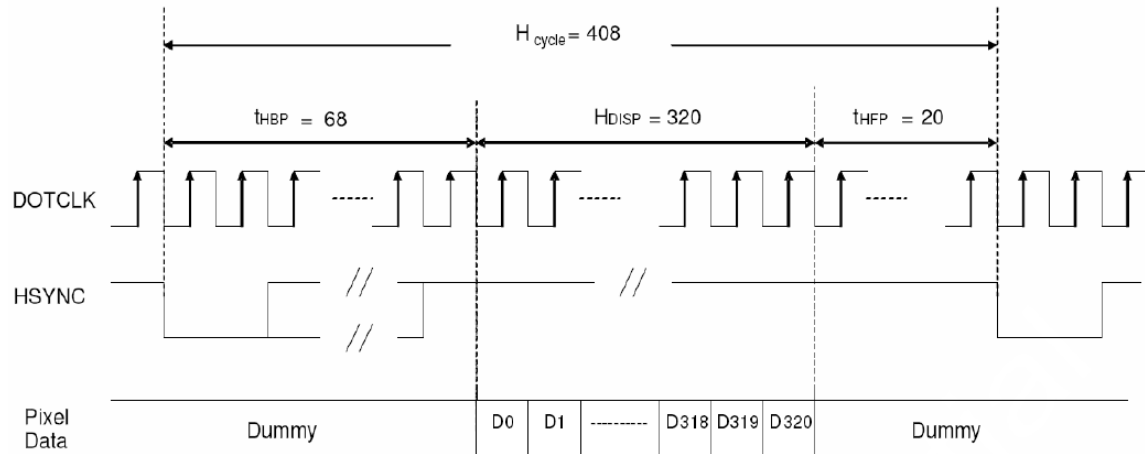
**9.0 Timing Characteristics / Timing Diagram****9.1 Pixel timing**

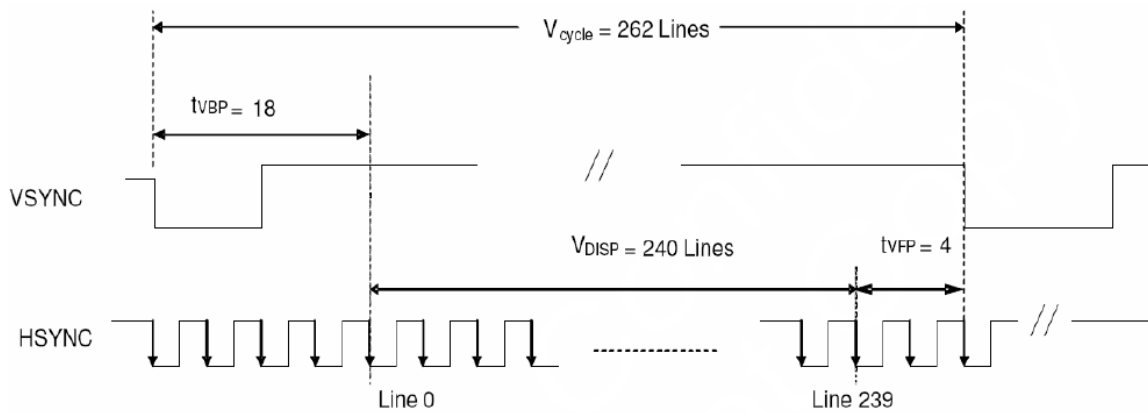
Characteristics	Symbol	Min.	Typ.	Max.	Unit
		18 bit	18 bit	18 bit	
DOTCLK Frequency	fDOTCLK	-	6.5	10	MHz
DOTCLK Period	tDOTCLK	100	154	-	ns
Vertical Sync Setup Time	tvsys	20	-	-	ns
Vertical Sync Hold Time	tvsyh	20	-	-	ns
Horizontal Sync Setup Time	thsys	20	-	-	ns
Horizontal Sync Hold Time	thsyh	20	-	-	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
Data pulse width	tRES	10	-	-	ns



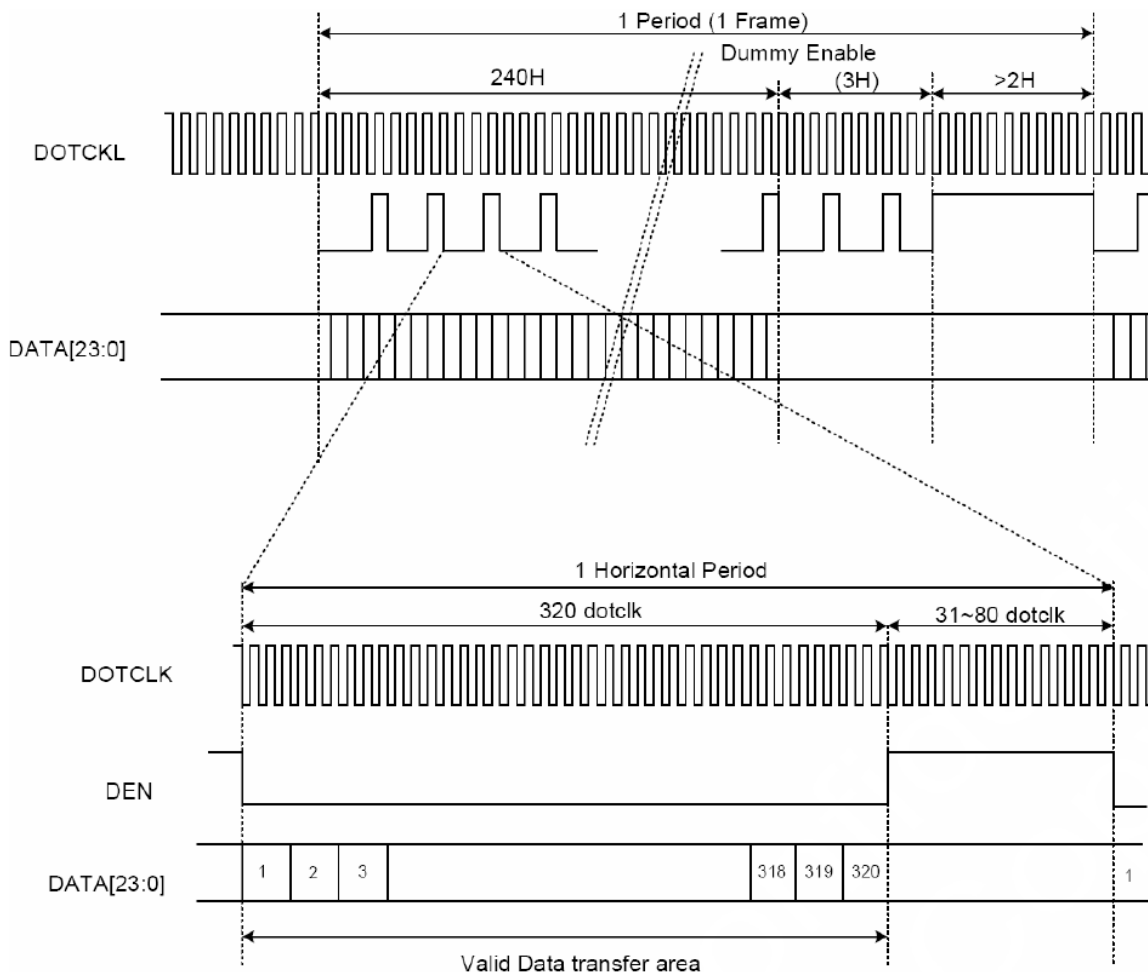
**9.2 Timing characteristics of data transmission**

Characteristics	Symbol	Min.	Typ.	Max.	Unit
		18 bit	18 bit	18 bit	
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	VDISP	-	240	-	Lines
Vertical Cycle	Vcycle	-	262	350	Lines





Vertical timing transmission timing (SYNC mode – Parallel RGB interface)



Timing characteristics of DE mode

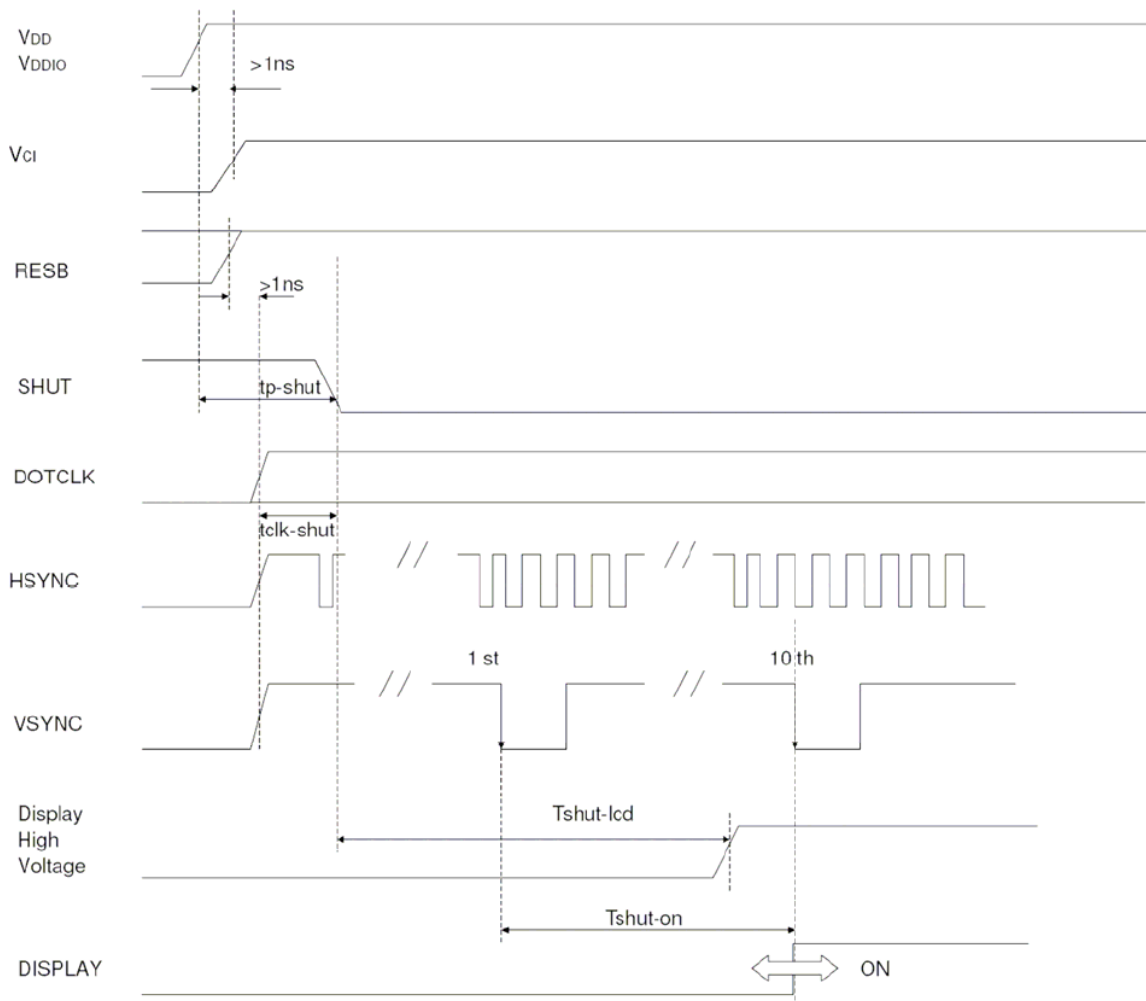


9.3 Power up sequence

Characteristics	Symbol	Min	Typ	Max	Units
VDDD / VDDIO on to falling edge of SHUT	tp-shut	1	-	-	us
DOTCLK	clk-shut	1	-	-	clk
Falling edge of SHUT to LCD power on	tshut-lcd	-	-	128	ms
Falling edge of SHUT to display start	tshut-on	-	-	10	frame
- 1 line: 408 clk - 1 frame: 262 line - DOTCLK = 6.5MHz		-	166	-	ms

Note: It is necessary to input DOTCLK before the falling edge of SHUT.

Display starts at 10th falling edge of VSTNC after the falling edge of SHUT.





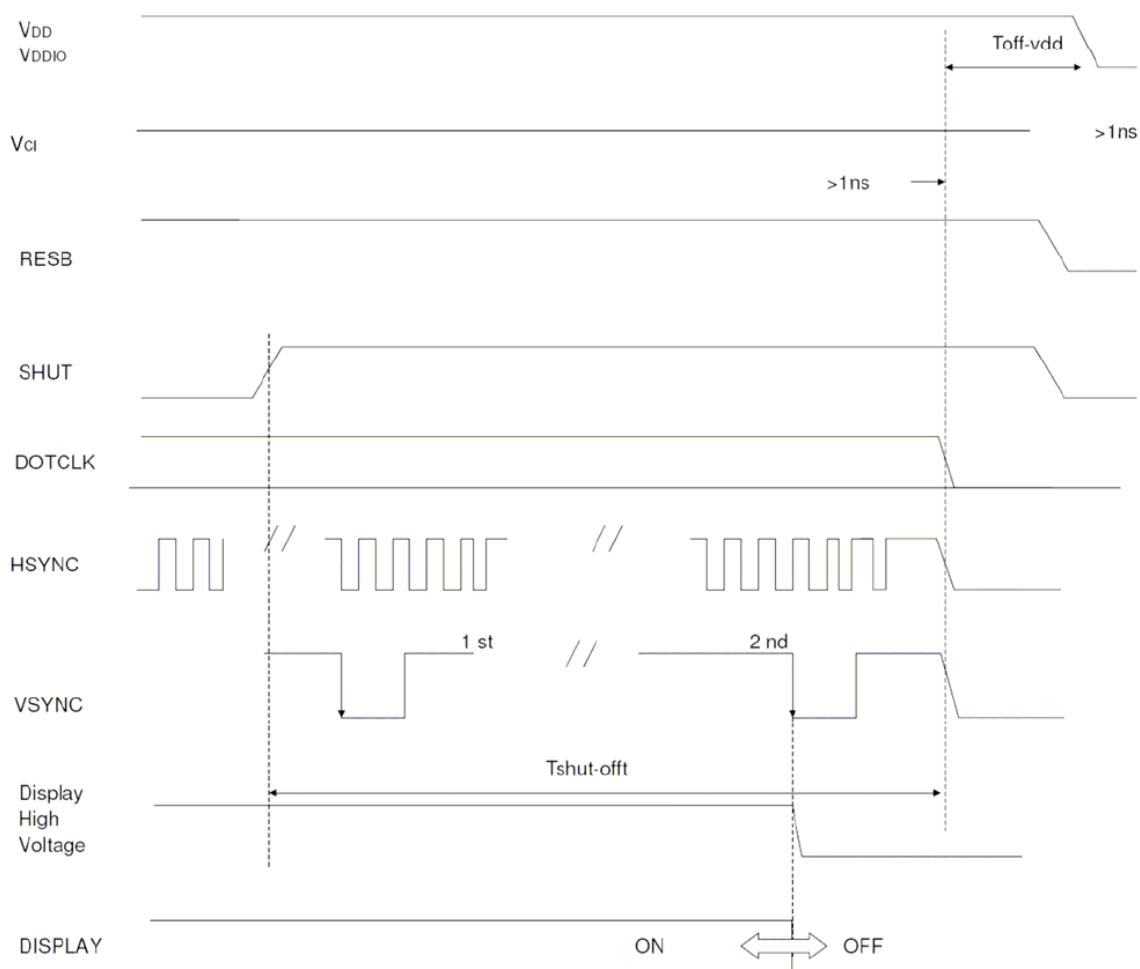
9.4 Power down sequence

Characteristics	Symbol	Min	Typ	Max	Uni
Rising edge of SHUT to display off	tshut-off	2	-	-	frame
- 1 line: 408 clk					
- 1 frame: 262 line		33.4	-	-	ms
- DOTCLK = 6.5MHz					
Input-signal-off to VDDD / VDDIO off	toff-vdd	1	-	-	us

Note: DOTCLK must be maintained at lease 2 frames after the rising edge of SHUT.

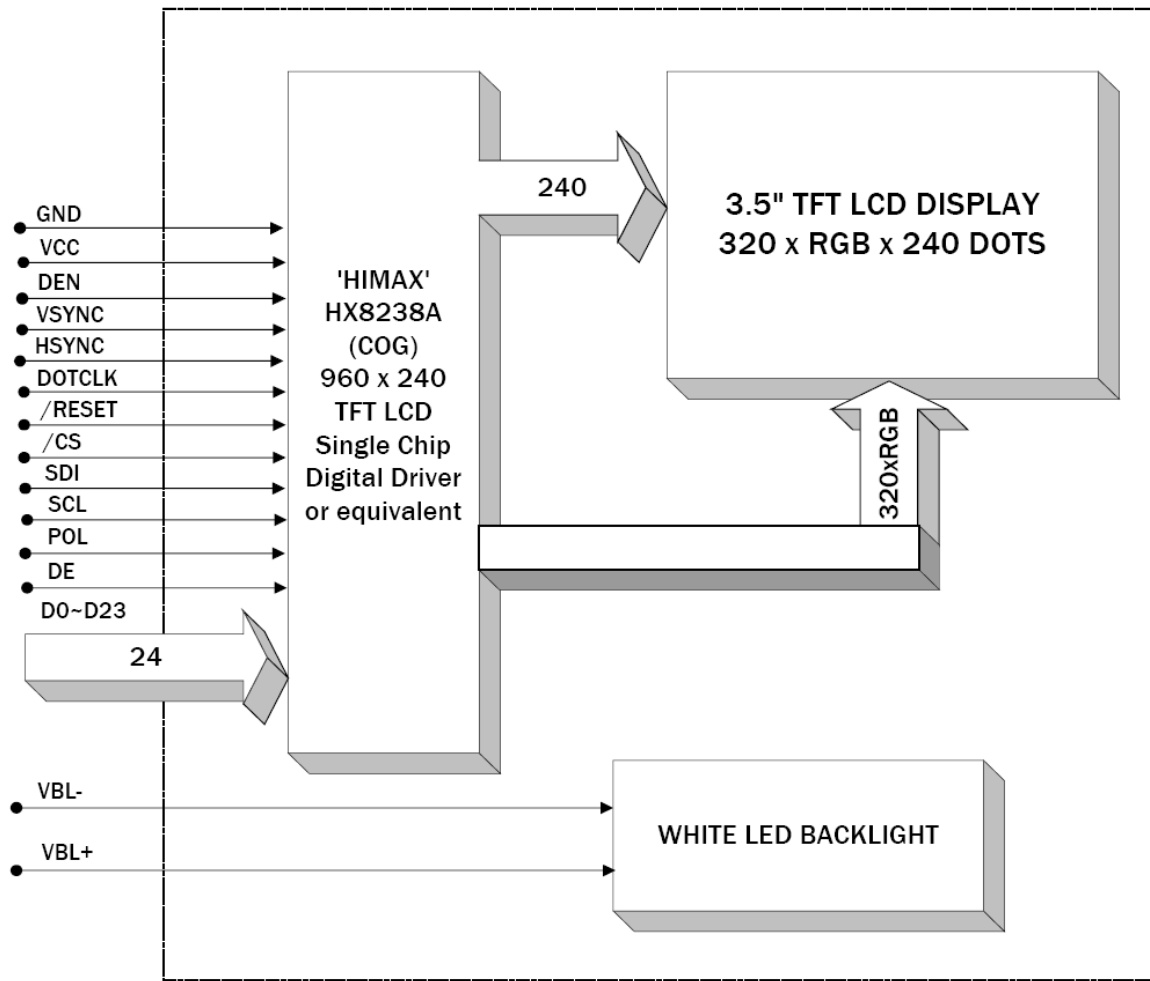
Display become off at the 2nd falling edge of VSTNC after the falling edge of SHUT.

If RESET signal is necessary for power down, provide it after the 2-frames-cycle of the SHUT period.





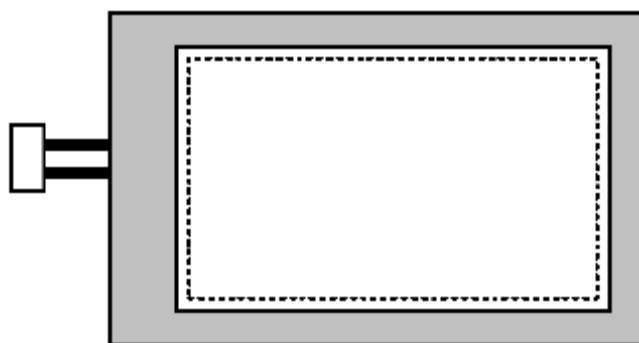
10.0. Block diagram





11.0 Panel inspection

Item		Specification/Description				
Display	Function	No Display				
		Malfunction				
	Contrast ratio	Out of Spec				
	Line defect	No obvious Vertical and Horizontal line defect in bright , dark and colored.				
Operating	Point Defect (red,green,blue,dark)	Item	Acceptable number			
			A	B	Total	
		BRIGHT DOT	$N \leq 0$	$N \leq 2$	$N \leq 6$	
		DARK DOT	$N \leq 2$	$N \leq 4$		
		TOTAL DOT	$N \leq 2$	$N \leq 4$		
			TWO ADJACENT DOT	NOT ALLOWED		
			THREE OR MORE ADJACENT DOT	NOT ALLOWED		
External Inspection (non-operating)	Scratch on the polarizer	L(mm)	W(mm)	Acceptable number		
		$L \leq 2.5$	$W \leq 0.1$	3		
		$L > 2.5$	$W > 0.1$	0		
	Dent or bubble on the polarizer	Dimension(mm)		Acceptable number		
		$D \leq 0.3$		3		
		$D \leq 0.1$		Disregard		
	Foreign material on the polarizer	Dimension(mm)		Acceptable number		
		$D \leq 0.5$		2		
		$D \leq 0.1$		Disregard		



 Zone A (Active Area)

 Zone B (Viewing Area)



12.0 Mechanical specification

