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PART NO. : MF480272A43-BF

FOR MESSRS. : _____

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ACCEPTED BY : _____

PROPOSED BY : _____



RECORD OF REVISION

DATE	PAGE	SUMMARY

3. General specifications

3.1 General specifications

It is a color active matrix TFT (Thin Film Transistor) liquid crystal display (LCD) that uses the amorphous silicon TFT as a switching devices. This model is composed of a Transmissive type TFT-LCD Panel, a driver circuit and a back-light unit.

3.2 Features

- High image quality a-Si TFT LCD module.
- 16.7M color number.
- Support 24-bit parallel (RGB) input mode
- High contrast, high brightness
- Low power consumption.

4. Mechanical data

No	Item	Specification	Remark
1	Type	Transmissive	--
2	Display Mode	Normally White	--
3	Pixel Element	a-Si TFT	--
4	Screen Size	4.3inch	--
5	Resolution	480(RGB) x272	--
6	Color Number	16.7M	--
7	Active Area	95.04 (W) x 53.856(L) (mm)	--
8	PIXEL SIZE	0.198 x 0.198 (μm)	--
9	Color Arrangement	RGB-stripe	--
10	Assembly Type	COG	--
11	Back Light	LED	--
12	Viewing Direction	6 o'clock	--
13	Weight	TBD	--
14	Module Dimension	105.5(W) x 67.2(L) x 3.95(H)	

5. Absolute maximum ratings

5.1 Electrical absolute maximum ratings

(1) TFT-LCD Panel Absolute Maximum Ratings

Ta=25 GND=0V

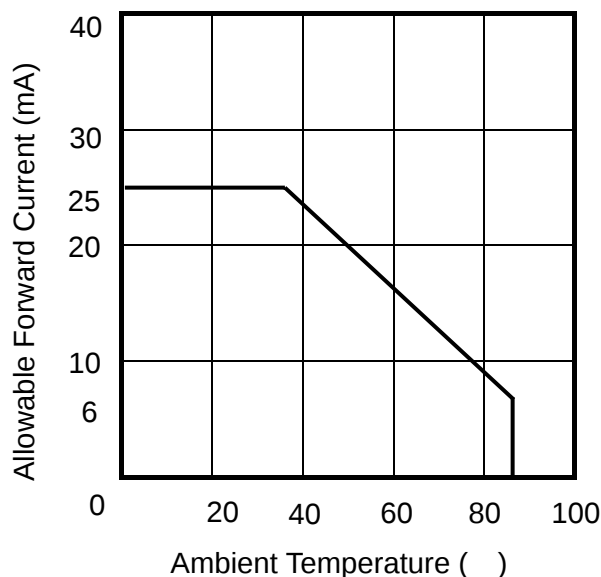
Item	Symbol	Condition	Standard Value		Unit	Remark
			Min.	Max.		
Power supply voltage	AVDD	GND=0V	-0.3	6.0	V	--
	VCC	GND=0V	-0.3	6.0	V	
	V _{GH} -V _{GL}	GND=0V	-0.3	45	V	--
	V _i	--	-0.3	VCC+0.3	V	--

* If the LSI is used above these absolute maximum ratings, it may become permanently damaged. Using the LSI within the following electrical characteristics limit is strongly recommended for normal operation. If these electrical characteristic conditions are also exceeded, the LSI will malfunction and cause poor reliability.

5.2 Environmental absolute maximum ratings

Item	Symbol	Min.	Max.	Unit	Remark
Operation temperature range	Top	-20	70		Ambient
Storage temperature range	Tst	-30	70		Ambient

- (1) Corrosive gas environment is not acceptable.
- (2) TFT-LCD color will change slightly depending on environment temperature. This phenomenon is reversible.
- (3) Current reduction rate of LED backlight is according to the graph indicated below:



6. Electrical characteristics

(1)TFT-LCD Module

Ta=25

Item	Symbol	Min.	Typ.	Max.	Unit	Remark
Digital Supply Voltage	VCC	2.3	2.5	3.6	V	
Digital Operation Current	ICC	--	12.1	20	mA	VCC=2.5V NOTE(1)
Analog Power supply	VDD	4.8	5.0	5.2	V	--
Analog Operating Current	IDD	--	14.5	25	mA	VCC=2.5V NOTE(1)
GAMMA Voltage	Vn	0.2	--	VDD-0.2	V	--
Input H/L Level Voltage	VIH	0.7VCC	--	VCC--	V	--
	VIL	0	--	0.3VCC		--
Frame frequency	fFrame	--	60	90	Hz	--
Clock frequency	FCLK	--	9	15	MHz	--

NOTE(1):PATTEN:FULL DISPLAY (MAXIMUM CURRENT DISPLAY)

(2) Back-Light Unit

Ta=25

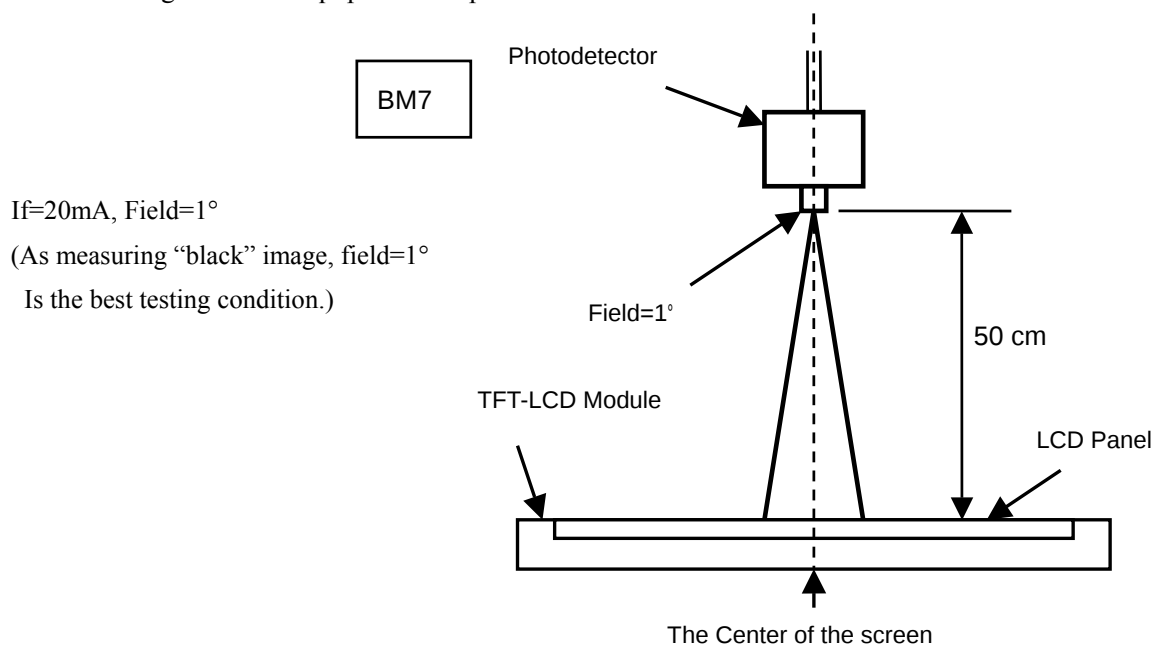
Item	Symbol	Conditions	Min.	Typ.	Max.	Unit	Remark
Forward Voltage	Vf	If=20mA	21.0	22.8	24.5	V	--
Forward current	If	----	--	(20)	---	mA	--
Power Dissipation	PD	----	--	(456)	---	mW	--

7. Optical characteristics

Ta = 25 , If=20mA

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Brightness		B	$\theta=0^\circ$ Normal viewing angle At the center of panel	(240)	(280)	--	cd/m ²	(1)
Contrast Ratio		C/R		(200)	(250)	--	--	(2)
Response Time		Rising: Tr		--	(15)	(20)	ms	(3)
		Falling: Tf		--	(35)	(50)		
Color chromatic ity	White	W _x		(0.21)	(0.31)	(0.41)	--	--
		W _y		(0.23)	(0.33)	(0.45)		
Viewing Angle	Top	θ_U	CR 10 Backlight On	--	(45)	--	Degrees	(4)
	Bottom	θ_D		--	(50)	--		
	Left	θ_L		--	(50)	--		
	Right	θ_R		--	(50)	--		
Uniformity		Un	$\theta=0^\circ$ Normal viewing angle	--	(80)	--	%	(5)

Note 1: The brightness test equipment setup



If=20mA, Field=1°

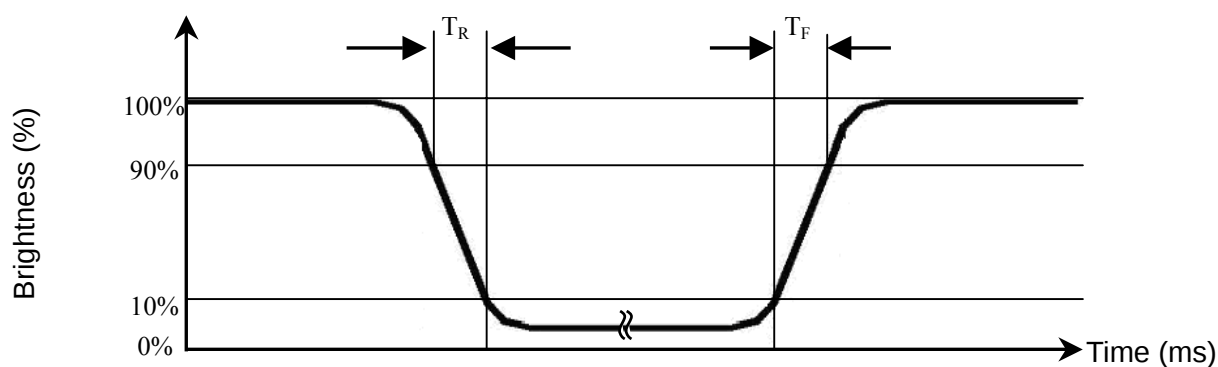
(As measuring “black” image, field=1°

Is the best testing condition.)

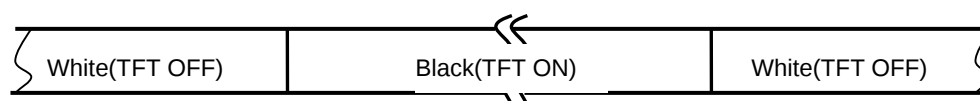
Note 2: Definition of contrast Ratio (C.R)

$$C.R = \frac{\text{Brightness When LCD is at “White” State}}{\text{Brightness When LCD is at “Black” State}}$$

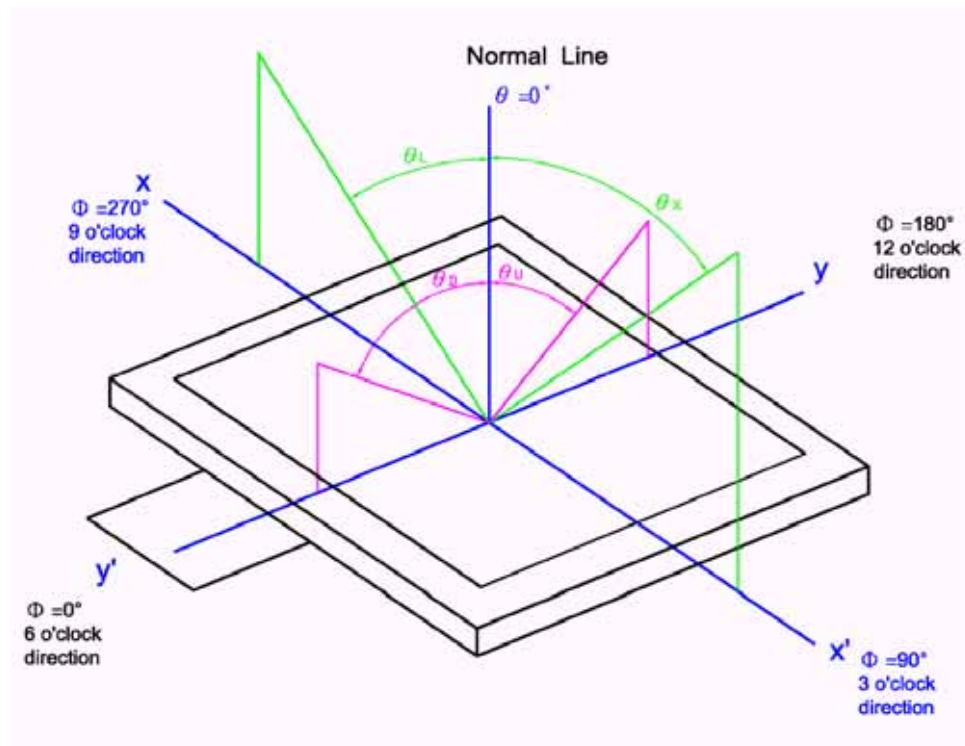
Note 3: Definition of response time



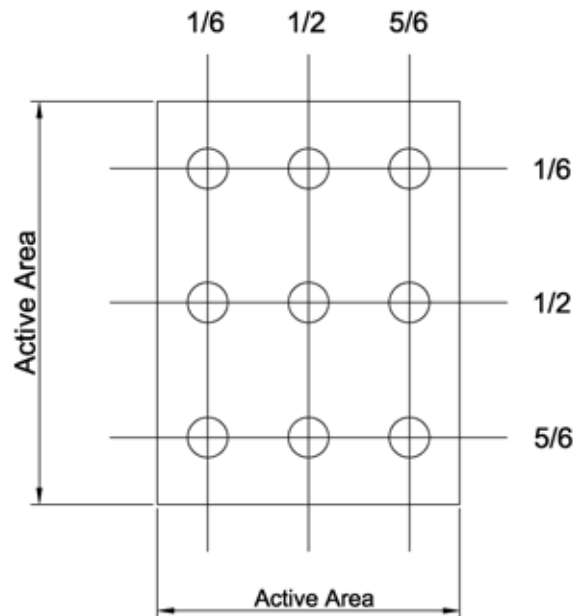
Display data



Note 4: Definition of viewing angle

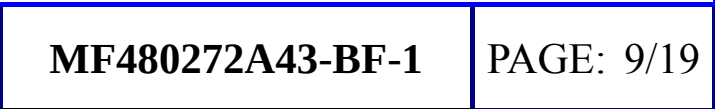


Note 5: Definition of uniformity (U_n)



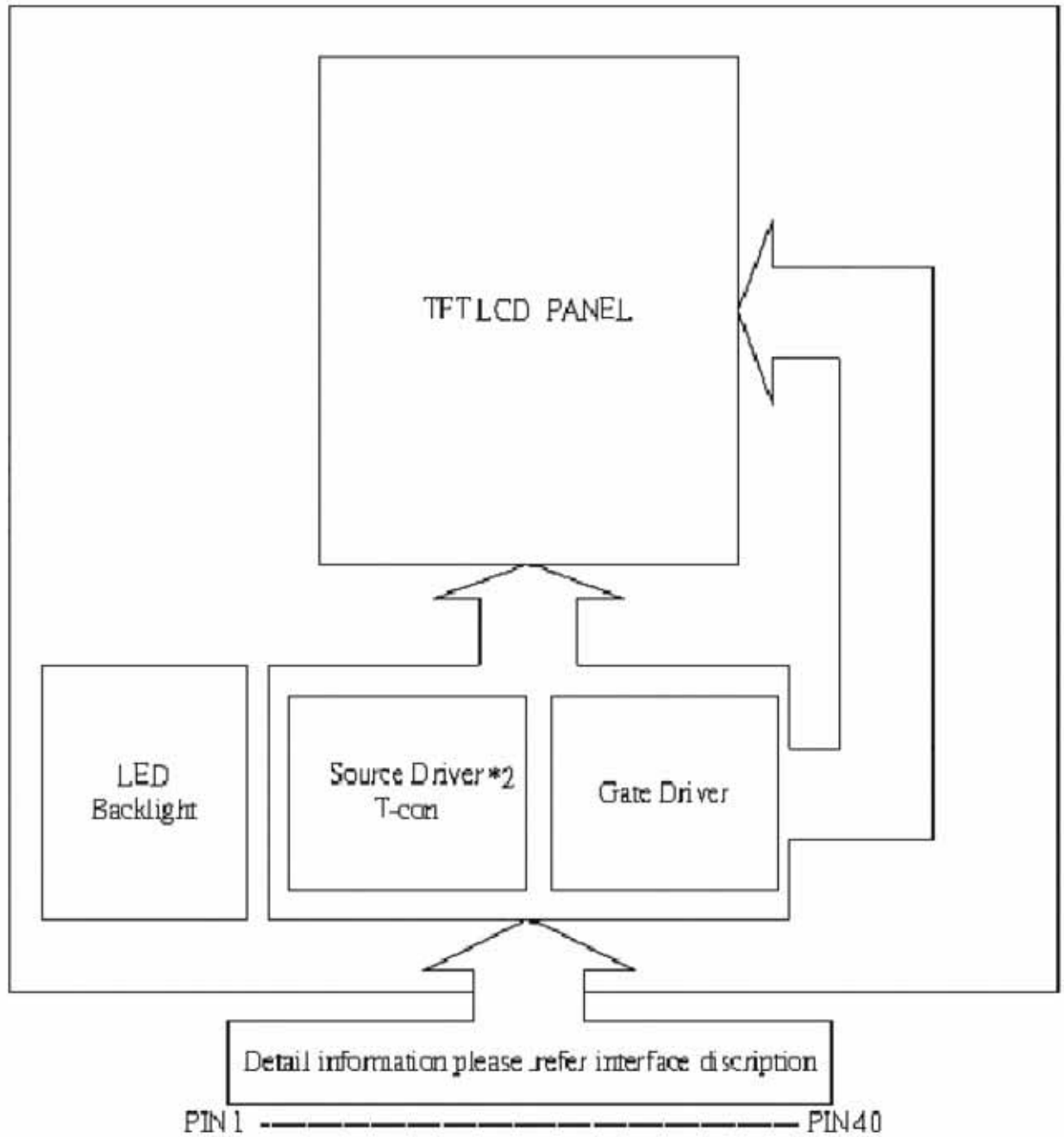
$$U_n = \frac{B_{\min}}{B_{\max}} \times 100\%$$

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9. Block diagram

9.1 TFT-LCD Module (Interface System Structure)



10. Input Terminal Pin Assignment

10.1 Input Signal & Power

Pin no	Symbol	Description	Remark
1	GND	Ground	-
2	GND	Ground	-
3	VCC	Digital Power	-
4	VCC	Digital Power	-
5	R0	Red data bit 0	-
6	R1	Red data bit 1	-
7	R2	Red data bit 2	-
8	R3	Red data bit 3	-
9	R4	Red data bit 4	-
10	R5	Red data bit 5	-
11	R6	Red data bit 6	-
12	R7	Red data bit 7	-
13	G0	Green data bit 0	-
14	G1	Green data bit 1	-
15	G2	Green data bit 2	-
16	G3	Green data bit 3	-
17	G4	Green data bit 4	-
18	G5	Green data bit 5	-
19	G6	Green data bit 6	-
20	G7	Green data bit 7	-
21	B0	Blue data bit 0	-
22	B1	Blue data bit 1	-
23	B2	Blue data bit 2	-
24	B3	Blue data bit 3	-
25	B4	Blue data bit 4	-
26	B5	Blue data bit 5	-
27	B6	Blue data bit 6	-
28	B7	Blue data bit 7	-
29	GND	Ground	-
30	PCLK	Dot data clock	-
31	DISP	Display on/off mode control	
32	HSYNC	Horizontal sync input	-
33	VSNC	Vertical sync input	-

Pin no	Symbol	Description	Remark
34	ENB	Data enable control	NOTE(1)
35	VDD	Analog Power	-
36	VDD	Analog Power	-
37	NC	NO USE	-
38	NC	NO USE	-
39	A(+)	Power supply for LED Backlight anode input	-
40	K(-)	Power supply for LED Backlight cathode input	-

NOTE:

- (1) For digital RGB input data format, both SYNC mode and DE+SYNC mode are supported.
If ENB signal is fixed low, SYNC mode is used. Otherwise, DE+SYNC mode is used.

11. Timing Characteristics

11.1 Timing Parameters 1

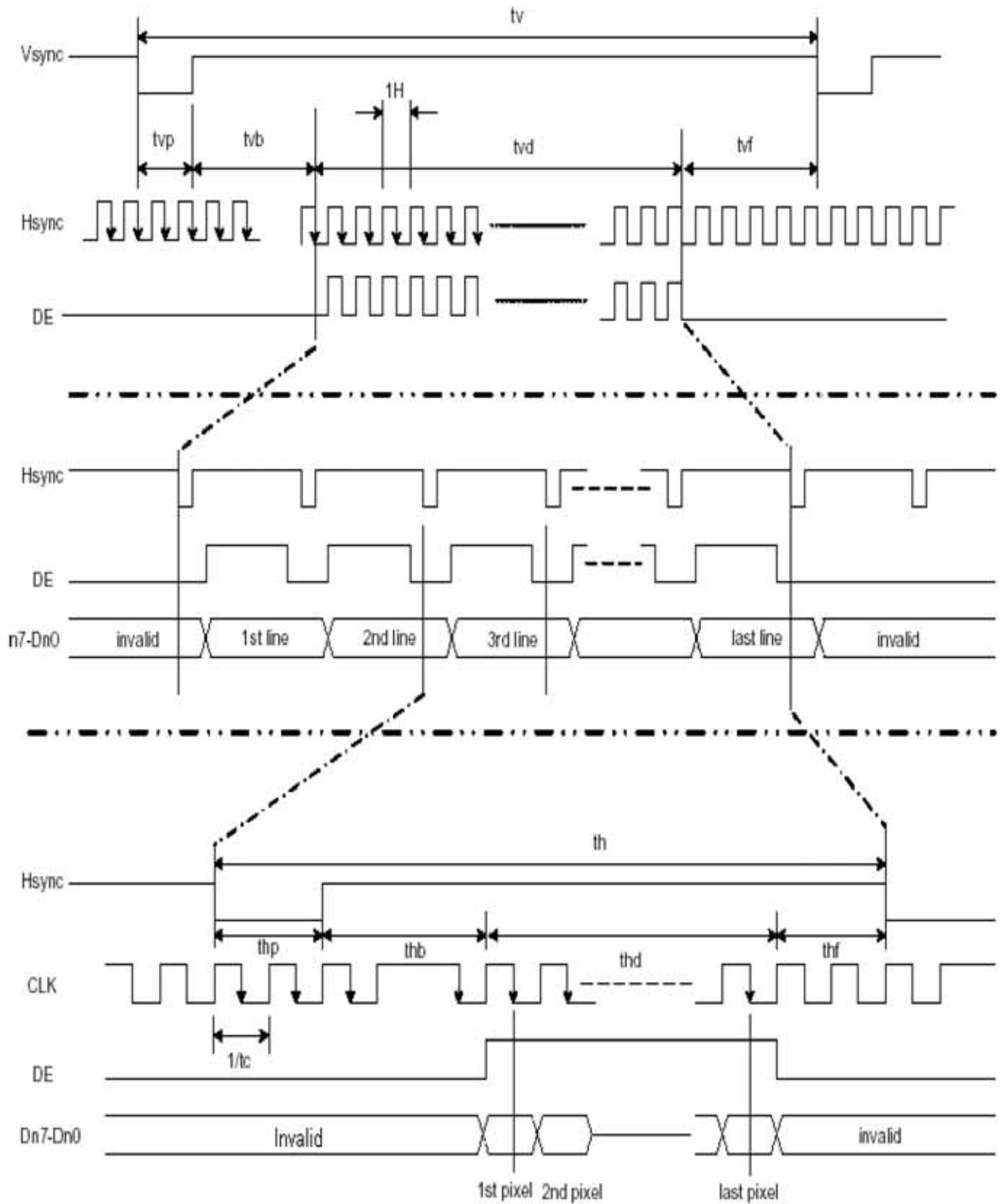
PARAMETER	Symbol	Min.	Typ.	Max.	Unit
Clock cycle	$f_{CLK}^{(1)}$	-	9	15	MHz
Hsync cycle	1/th	-	17.14	-	KHz
Vsync cycle	1/tv	-	59.94	-	Hz
Horizontal Signal					
Horizontal cycle	th ⁽²⁾	-	525	-	CLK
Horizontal display period	thd	-	480	-	CLK
Horizontal front porch	thf	2	-	-	CLK
Horizontal pulse width	thp	2	41	-	CLK
Horizontal back porch	thb	2	2	-	CLK
Vertical Signal					
Vertical cycle	tv	-	286	-	H
Vertical display period	tvd	-	272	-	H
Vertical front porch	tvf	1	2	-	H
Vertical pulse width	tvp	1	10	-	H
Vertical back porch	tvb	1	2	-	H

Note: (1) The table is parallel interface. Clock frequency and horizontal signal parameters are tripled in serial interface.

The maximum clock frequency of serial interface is 33MHz

(2) thd=480CLK, thf=2CLK, thp=41CLK, thb=2CLK, thf + thp + thb > 44CLK. (CLK=1/ fCLK ,H=th)

Timing Chart1



11.2 Timing Parameters 2

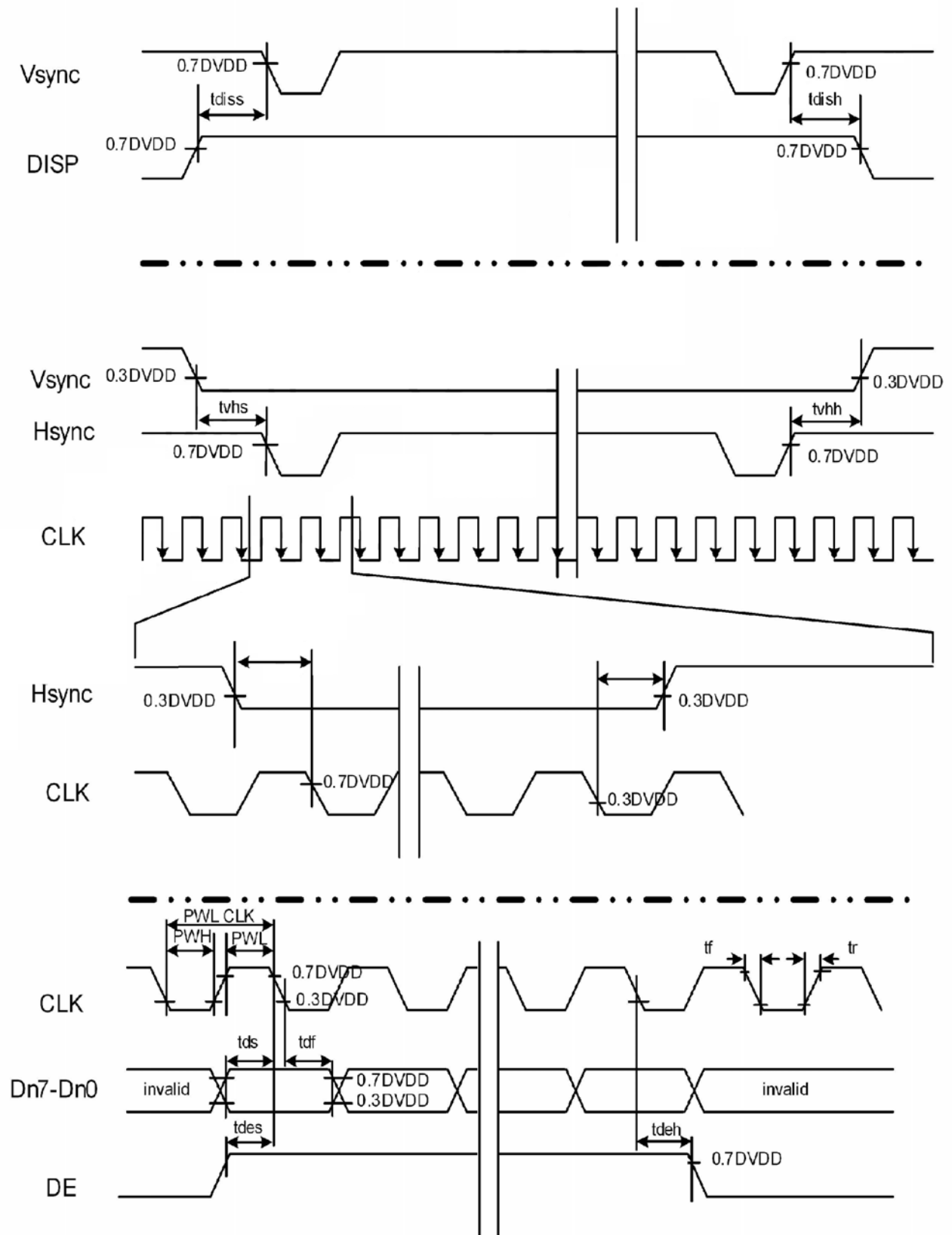
($T_A = 25^\circ\text{C}$, $V_{CC} = 2.3\text{V to } 3.6\text{V}$, $GND = 0\text{V}$, $t_r^{(2)} = t_f^{(2)} = 2\text{ns}$)

PARAMETER	Symbol	Min.	Typ.	Max.	Unit
DISP setup time	t_{diss}	10	-	-	ns
DISP hold time	t_{dish}	10	-	-	ns
Clock period	$PW_{CLK}^{(1)}$	66.7	-	-	ns
Clock pulse high period	$PWH^{(1)}$	26.7	-	-	ns
Clock pulse low period	$PWL^{(1)}$	26.7	-	-	ns
Hsync setup time	t_{hs}	10	-	-	ns
Hsync hold time	t_{hh}	10	-	-	ns
Data setup time	t_{ds}	10	-	-	ns
Data hold time	t_{dh}	10	-	-	ns
DE setup time	t_{des}	10	-	-	ns
DE hold time	t_{deh}	10	-	-	ns
Vsync setup time	t_{vhs}	10	-	-	ns
Vsync hold time	t_{vhh}	10	-	-	ns

Note: (1) For parallel interface, maximum clock frequency is 15MHz.

(2) t_r , t_f is defined 10% to 90% of signal amplitude.

Timing Chart2



12. Driver IC Control Algorithms

- 1.Refer to the data Sheet of LCD DRIVER HX8227-A01 or equivalent
- 2.Refer to the data Sheet of LCD DRIVER HX8655-A or equivalent

13. Reliability Test Items

No.	Test items	Conditions		Remark
1	High temperature storage	70	240H	--
2	Low temperature storage	-30	240H	--
3	High temperature & high humidity storage	60	. 90% RH, 240H	--
4	Low temperature operation	-20	240H	--
5	Vibration test	Freq.:10 ~ 55~10 Hz, Amp.:1.5 mm 1H for each direction of X, Y, Z		Non-operation
6	Electrostatic discharge	Terminals	150pF, 0Ω, ±300 V, Contact	Non-operation
		Panel	150pF, 330Ω, ±8 KV, Air	
7	Thermal Shock	-30 ,30 min /80 ,30 min , 20 cycles		Static
8	High temperature operation	70	240H	--
9	Low temperature operation	-20	240H	--
10	High temperature & high humidity operation	50	. 90% RH, 240H	Operating
Criterion: There should be no change which might affect the practical display function when the display quality test is conducted under normal operating condition.				

14. General Precautions

Please pay attentions to the followings as using the LCD module.

14.1 Handling

- (a) Do not apply strong mechanical stress like drop, shock or any force to LCD module. It may cause improper operation, even damage.
- (b) Because the polarizer is very fragile and easy to be damaged, do not hit, press or rub the display surface with hard materials.
- (c) Do not put heavy or hard material on the display surface, and do not stack LCD modules.
- (d) If the display surface is dirty, please wipe the surface softly with cotton swab or clean cloth.
- (e) Avoid using Ketone type materials (e.g. Acetone), Toluene, Ethyl acid or Methyl chloride to clean the display surface. It might damage the polarizer permanently. The recommended solvents are water and Isopropyl alcohol.
- (f) Wipe off water droplets or oil immediately.
- (g) Protect the LCD module from ESD. It will damage the LSI and the electronic circuit.
- (h) Do not touch the output pins directly with bare hands.
- (I) Do not disassemble the LCD module.

14.2 Storage

- (a) Do not leave the LCD modules in high temperature, especially in high humidity for a long time.
- (b) Do not expose the LCD modules to sunlight directly.
- (c) The liquid crystal is deteriorated by ultraviolet. Do not leave it in strong ultraviolet ray for a long time.
- (d) Avoid condensation of water. It may cause improper operation.
- (e) Please stack only up to the number stated on carton box for storage and transportation. Excessive weight will cause deformation and damage of carton box.

14.3 Operation

- (a) When mounting or dismounting the LCD modules, turn the power off.
- (b) Protect the LCD modules from electric shock.
- (c) The Driver IC control algorithms should always obeyed to avoid damaging the LSI and electronic circuit.
- (d) Be careful to avoid mixing up the polarity of power supply for backlight.

- (e) Absolute maximum rating specified above has to be always kept in any case. Exceeding it may cause non-recoverable damage of electronic components or, nevertheless, burning.
- (f) When a static image is displayed for a long time, remnant image is likely to occur.
- (g) Be sure to avoid bending the FPC to an acute shape, it might break FPC.

14.4 Others

- (a) If the liquid crystal leaks from the panel, it should be kept away from the eyes or mouth.
- (b) For the fragility of polarizer, it is recommended to attach a transparent protective plate over the display surface.
- (c) It is recommended to peel off the protection film on the polarizer slowly so that the electrostatic charge can be minimized