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FOR MESSRS. : _____

CONTENTS

NO.	ITEM	PAGE
1.	COVER	1
2.	RECORD OF REVISION	2
3.	GENERAL SPECIFICATION	3
4.	MECHANICAL DATA	3
5.	ABSOLUTE MAXIMUM RATINGS	4
6.	ELECTRICAL CHARACTERISTICS	5
7.	OPTICAL CHARACTERISTICS	5-7
8.	OUTLINE DIMENSION	8
9.	BLOCK DIAGRAM	9
10.	INPUT TEMINAL PIN ASSIGNMENT	10
11.	INTERFACE TIMING CHART	11
12.	DRIVER IC CONTROL ALGONRITHMS	12
13.	RELIABILTY TEST ITEMS	12
14.	GENERAL PRECAUTIONS	13-14

ACCEPTED BY : _____

PROPOSED BY : _____



RECORD OF REVISION

DATE	REV.	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. The resolution of a 1.45”Main LCD contains 128 x 128 pixels, and can display up to 262K colors and is suitable for cell phone application.

3.2 Features

- High image quality a-Si TFT LCD module.
- 262K color number.
- 80-system 8-bit bus CPU I/F selection. / 3-wire SPI / 4-wire SPI
- High-speed RAM write function is available.
- Partial-screen display function is available.
- Sleep and Stand-by modes are available for power saving.
- High contrast, high brightness, Gamma adjustment.
- Low power consumption.

3.3 Applications

- Mobile phone.
- Portable Device

4. Mechanical data

No	Item	Specification	Remark
1	Type	Transmissive	--
2	Display Mode	Normally White	--
3	Pixel Element	a-Si TFT	--
4	Screen Size	1.45inch (diagonal)	--
5	Resolution	128(RGB) x128	--
6	Color Number	262K	--
7	Active Area	26.04(W) x 26.04(H) (mm)	--
8	Dot Pitch	0.2034 x 0.2034 (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	32.36 (W) x 38.0 (H) x 2.7 (D)	(Excluding FPC)
15	Power Supply	2.5~3.3 V	--
16	Interface	CPU I/F	--

5. Absolute maximum ratings

5.1 Electrical absolute maximum ratings

(1) TFT-LCD Panel Absolute Maximum Ratings

Ta=25°C GND=0V

Item	Symbol	Condition	Standard Value		Unit	Remark
			Min.	Max.		
Input power supply voltage	VDD	GND=0V	-0.3	3.3	V	--
	VDDI	GND=0V	-0.3	3.3	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.

(2) Back-Light Unit

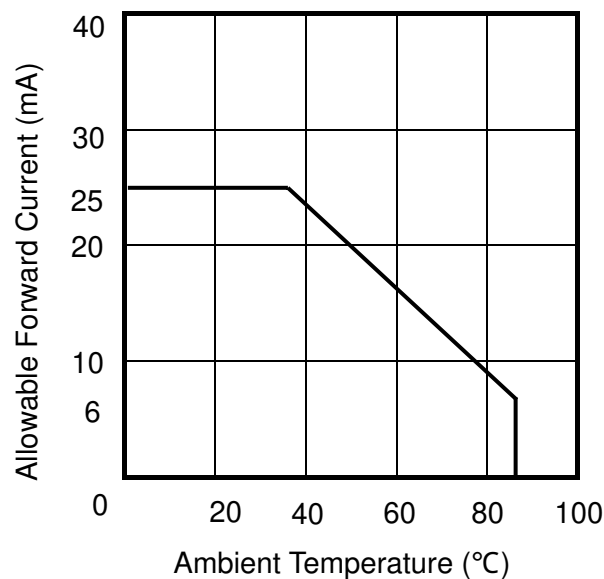
Ta=25°C

Item	Symbol	Min.	Max.	Unit	Remark
Current	I _B	--	(25)	mA	--

5.2 Environmental absolute maximum ratings

Item	Symbol	Min.	Max.	Unit	Remark
Operation temperature range	Top	-20	70	°C	Ambient
Storage temperature range	Tst	-30	80	°C	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°C

Item	Symbol	Min.	Typ.	Max.	Unit	Remark
Power supply	VDD	(2.5)	(2.8)	(3.3)	V	--
	VDDI	(2.5)	(2.8)	(3.3)	V	--

(2) Back-Light Unit

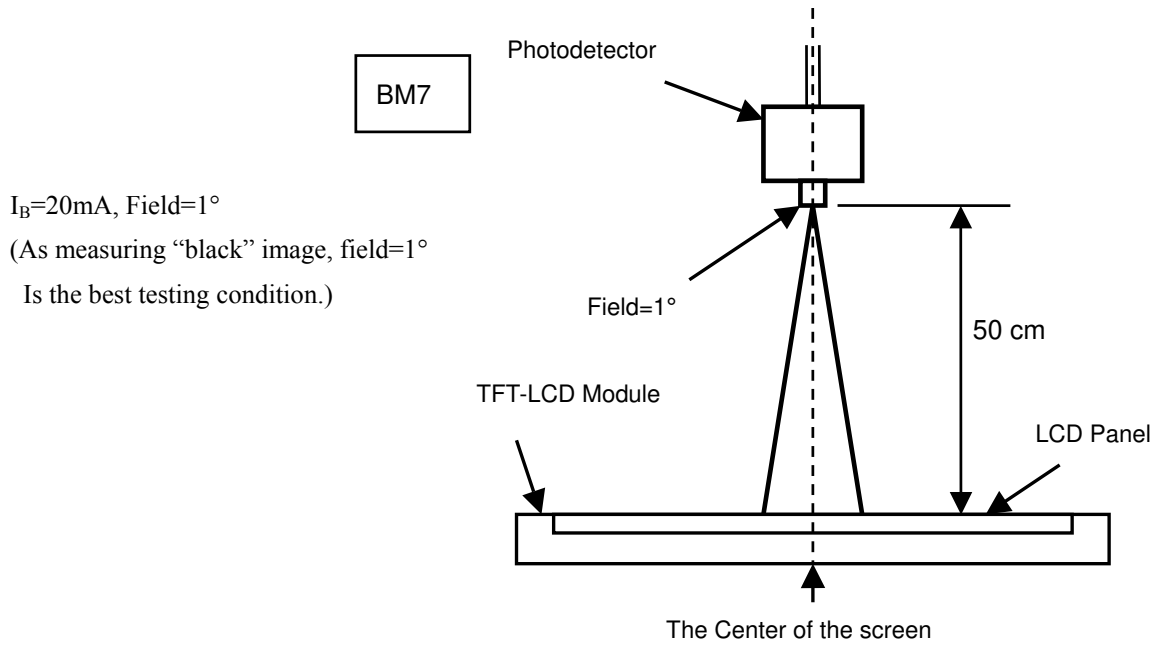
Item	Symbol	Min.	Typ.	Max.	Unit	Remark
Current	I _B	--	(20)	--	mA	LED:1EA

7. Optical characteristics

Ta = 25°C, VDD = 2.8V, IB=20mA

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Note	
Brightness	B	θ=0° Normal viewing angle At the center of panel	--	(110)	--	cd/m ²	(1)	
Contrast Ratio	C/R		--	(350)	--	--	(2)	
Response Time	Rising		Tr	--	(25)	--	ms	(3)
	Falling		Tf	--	(25)	--	ms	(3)
Color chromaticity (CIE 1931)	White		W _X	(0.265)	(0.315)	(0.365)	--	--
			W _Y	(0.277)	(0.327)	(0.377)		
	Red		R _X	(0.534)	(0.584)	(0.634)		
			R _Y	(0.297)	(0.347)	(0.397)		
	Green		G _X	(0.290)	(0.340)	(0.390)		
			G _Y	(0.510)	(0.560)	(0.610)		
Viewing Angle	Top	θ _U	--	(40)	--	Degrees	(4)	
		Bottom	θ _D	--	(20)			--
	Left	θ _L	--	(40)	--			
		Right	θ _R	--	(40)			--
Uniformity	Un	θ=0° Normal viewing angle	--	(80)	--	%	(5)	

Note 1: The brightness test equipment setup

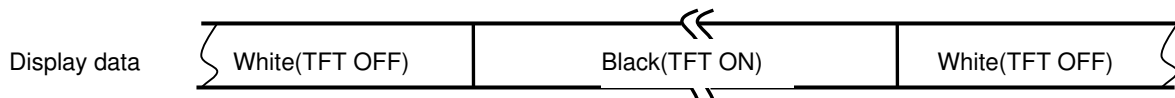
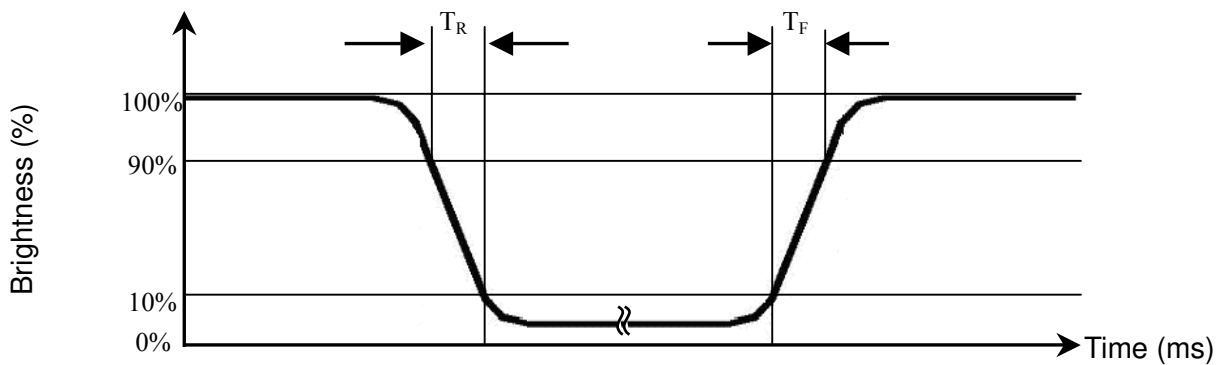


$I_B=20\text{mA}$, Field=1°
 (As measuring “black” image, field=1°
 Is the best testing condition.)

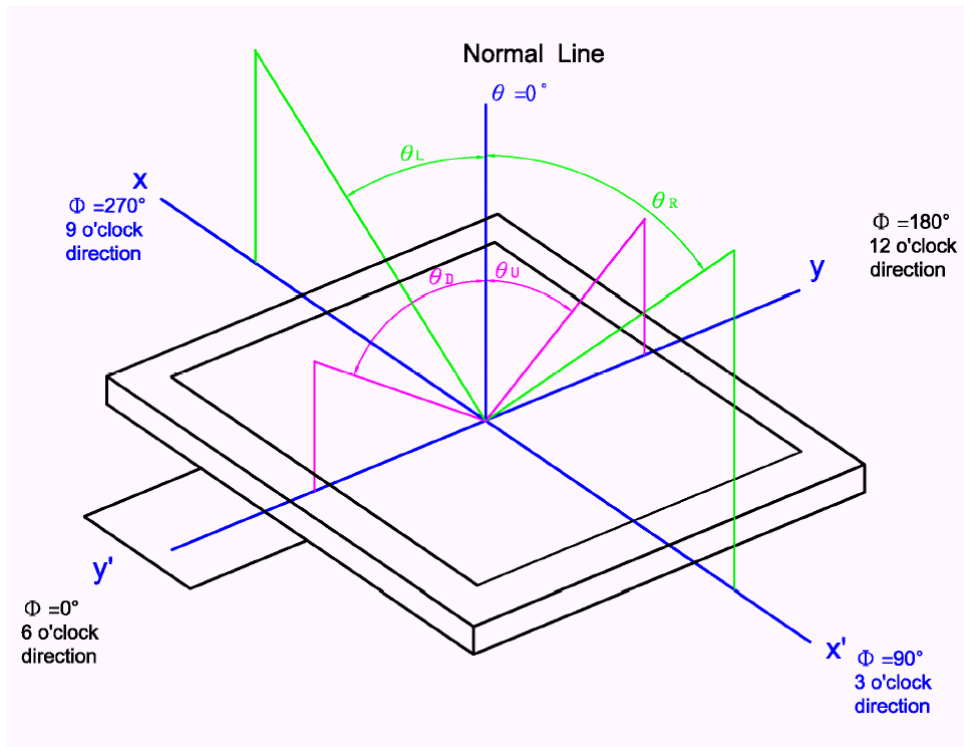
Note 2: Definition of contrast Ratio (C.R)

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

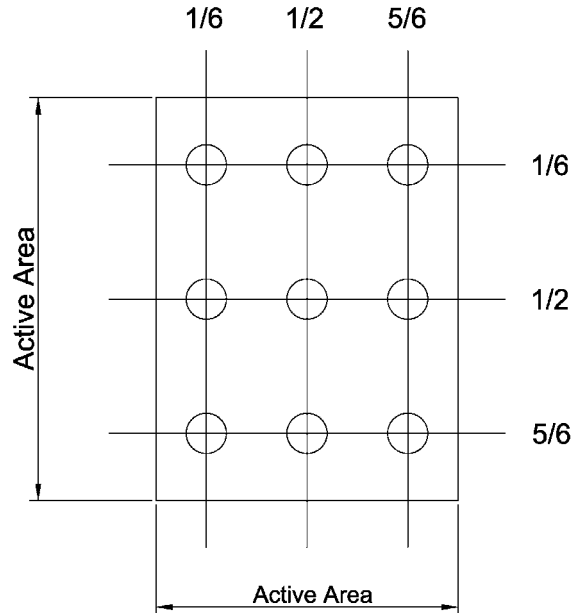
Note 3: Definition of response time



Note 4: Definition of viewing angle

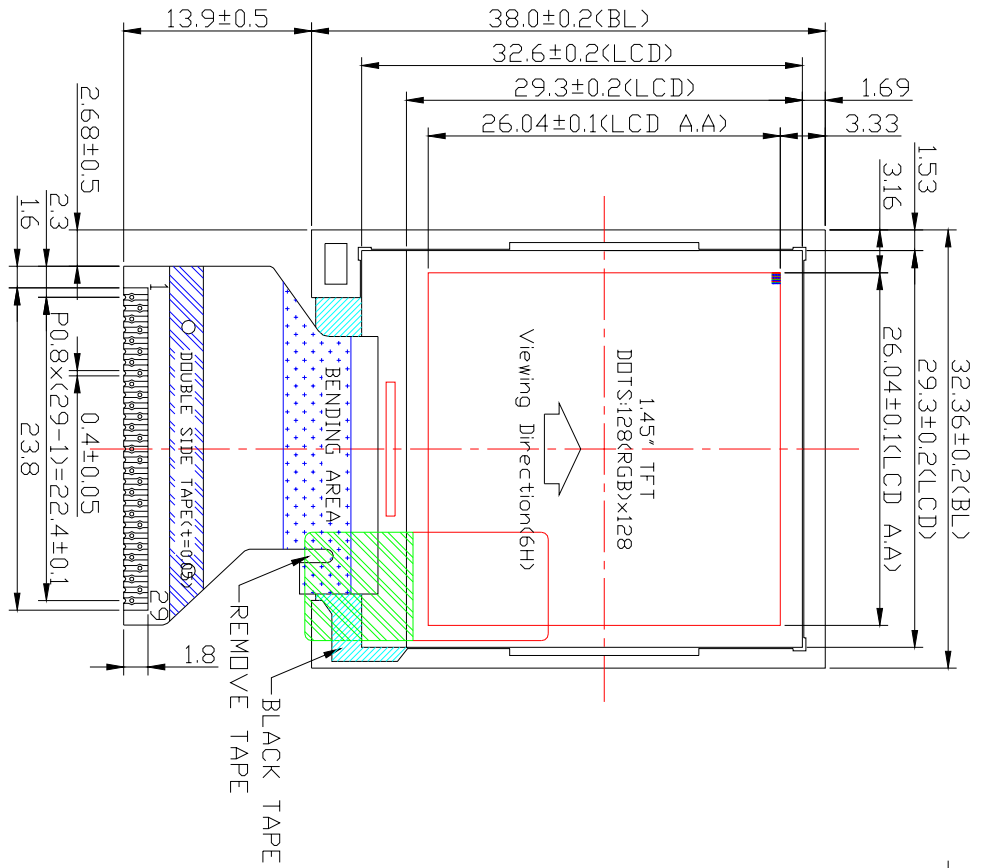


Note 5: Definition of uniformity (U_n)

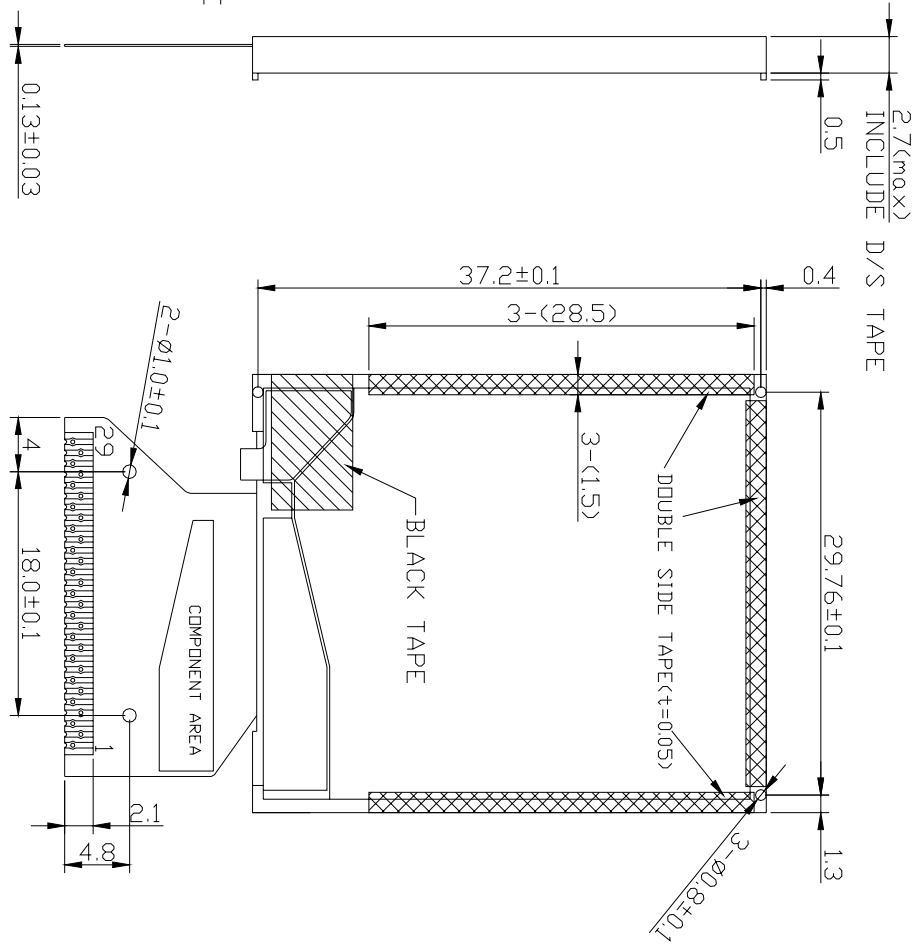


$$U_n = \frac{B_{\min}}{B_{\max}} \times 100\%$$

8. Outline dimension

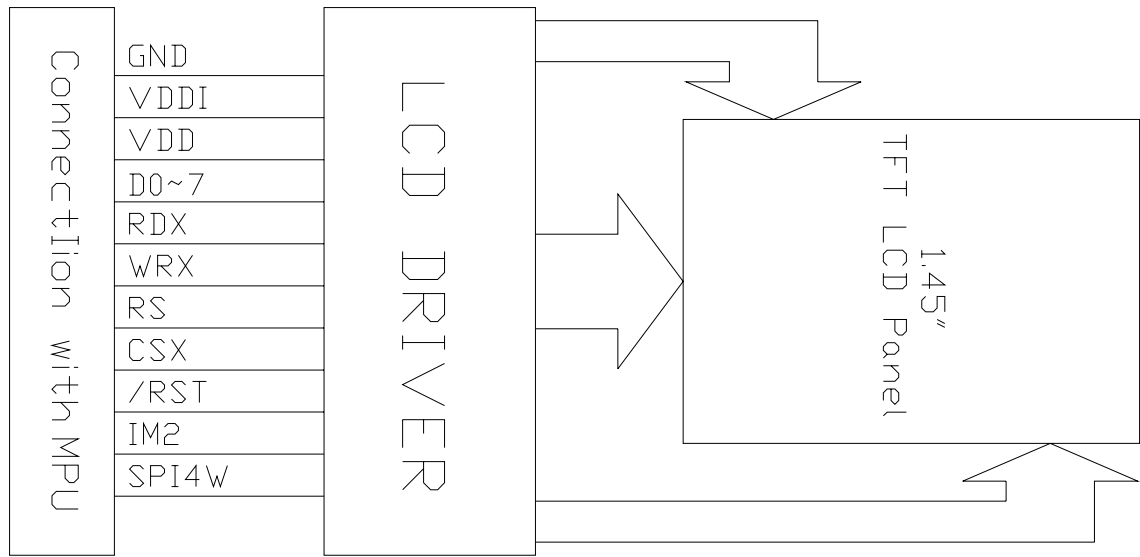


NOTE:
 (1)UNIT : mm
 (2)SCALE : NTS
 (3)NOT SPECIFIED TOLERANCE:±0.3

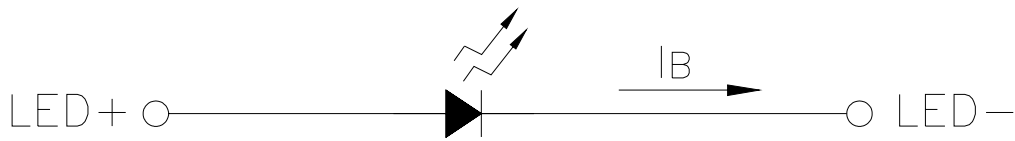


9. Block diagram

9.1 TFT-LCD Module (Interface System Structure)



9.2 Back-light Unit



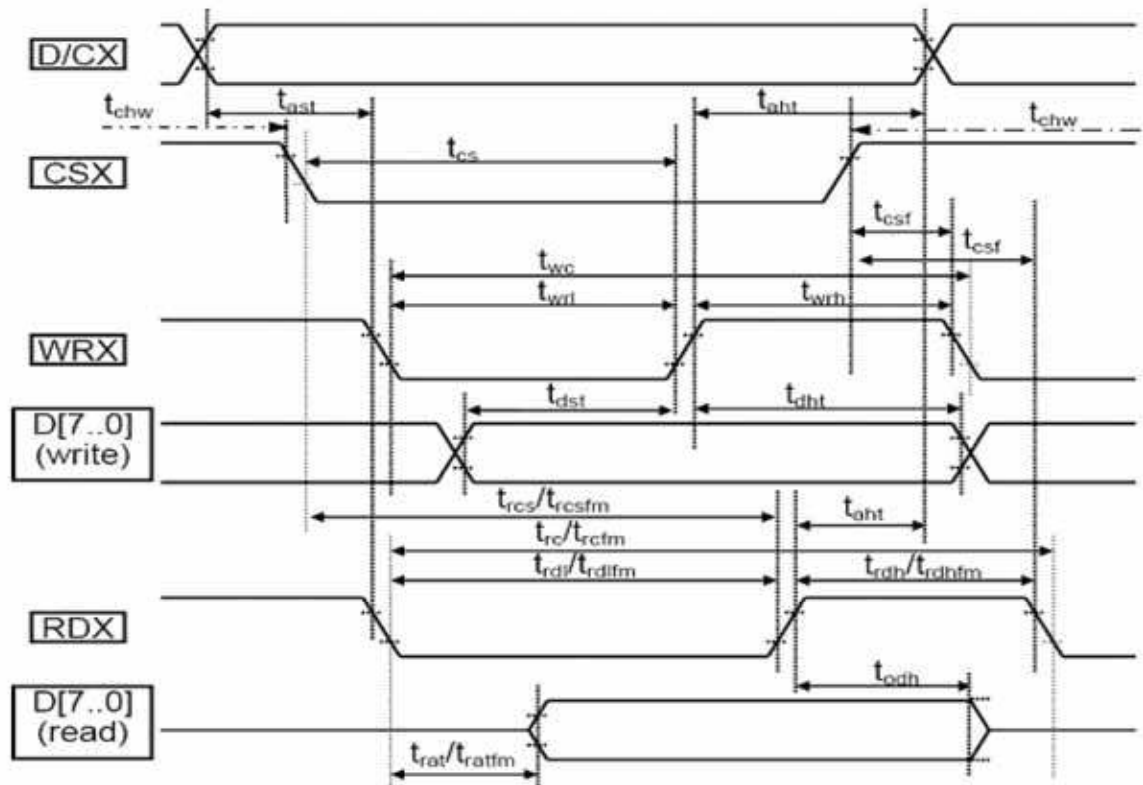
10. Input Terminal Pin Assignment

10.1 Input Signal & Power

Pin no	Symbol	Description	Remark
1	N.C	No Connection	-
2	LED+	LED Anode(+)	Power
3	LED-	LED Cathode(-)	Power
4	N.C	No Connection	-
5	N.C	No Connection	-
6	N.C	No Connection	-
7	N.C	No Connection	-
8	VDD	Power Supply Voltage	Power
9	GND	Ground	Power Ground
10	VDDI	Power Supply Voltage for Logic Circuit	Power
11	N.C	No Connection	-
12	CSX	Chip Select : Low Active	Input
13	IM2	Parallel/Serial Interface Selection Pin “H” : 8080 sys 8-bit / “L” : Serial Interface	Input
14	SPI4W	SPI Interface Selection Pin “H” : 4-wire SPI / “L” : 3-wire SPI(default)	Input
15	/RST	Reset Pin	Input
16	RDX	Read Enable Clock Pin	Input
17	VDDI	Power Supply Voltage for Logic Circuit	Power
18	D7	Parallel Interface : 8 Bit Data Bus SPI Interface : D[7 : 1] are not used and should be connected to ground D0 is Serial Input/Output Signal Pin	Input/Output
19	D6		Input/Output
20	D5		Input/Output
21	D4		Input/Output
22	D3		Input/Output
23	D2		Input/Output
24	D1		Input/Output
25	D0(SDA)		Input/Output
26	WRX(D/CX)	Parallel Interface : Write Enable Pin 4-wire SPI Interface : D/CX Pin	Input
27	RS(SCL)	Parallel Interface : Data / Instruction Selection Pin SPI Interface : SCL Pin	Input
28	N.C	No Connection	-
29	N.C	No Connection	-

11. Interface Timing Chart

11.1 80-System CPU Interface

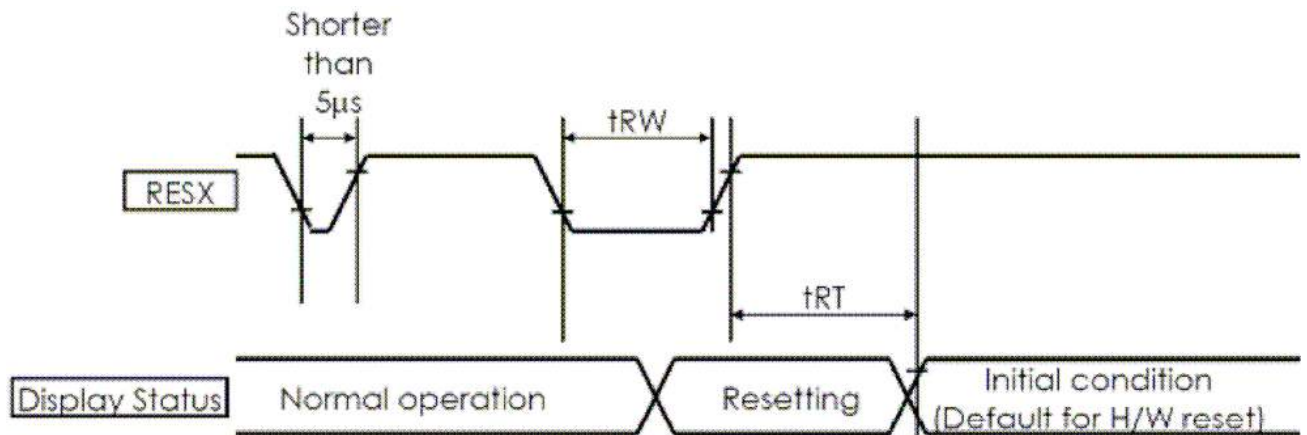


Note: Logic high and low levels are specified as 30% and 70% of VDDI for Input signals.

11.2 80-System AC Characteristics

Signal	Symbol	Parameter	min	max	unit	description
D/CX	tast	Address setup time	0		ns	
	taht	Address hold time(Write/Read)	10		ns	
CSX	tchw	"S""H" Pulse Width	0		ns	
	tcs	Chip Select setup time (Write)	10		ns	
	trcs	Chip Select setup time (Read ID)	45		ns	
	trcsfm	Chip Select setup time (Read FM)	355		ns	
	tcsf	Chip Select Wait time(Write/read)	10		ns	
WRX	twc	Write cycle	60		ns	
	twrh	Control pulse H duration	15		ns	
	twrl	Control pulse L duration	15		ns	
RDX	trc	Read cycle (ID)	160		ns	When read ID
RDX	trdh	Control pulse H duration(ID)	90		ns	data
	trdl	Control pulse L duration(ID)	45		ns	
RDX	trcfm	Read cycle (FM)	450		ns	When read from frame memory
	trdhfm	Control pulse H duration (FM)	90		ns	
	trdlfm	Control pulse L duration (FM)	355		ns	
D[17..0]	tdst	Data setup time	10		ns	For maximum
	tdht	Data hold time	10		ns	
	trat	Read access time (ID)		40	ns	For minimum
	tratfm	Read access time (FM)		340	ns	
	todh	Output disable time	20	80	ns	

11.3 Reset Timing Characteristics(VCC=2.6 to 3.3V)



Symbol	Parameter	Related Pins	MIN	TYP	MAX	Note	Unit
tRESW	*1) Reset low pulse width	RESX	10	-	-	-	µs
tREST	*2) Reset complete width	-	-	-	5	When reset applied during Sleep in mode	ms
		-	-	-	120	When reset applied during Sleep out mode	ms

12. Driver IC Control Algorithms

Refer to the data Sheet of LCD Control IC ILI9163C or equivalent

13. Reliability Test Items

No.	Test items	Conditions		Remark
1	High temperature storage	80°C 96H		--
2	Low temperature storage	-30°C 96H		--
3	Vibration test	Freq.:10~150 Hz, 100m/s ² 1H for each direction of X, Y, Z		Non-operation
4	Electrostatic discharge	Terminals	150pF, 0Ω, ±300 V, Contact	Non-operation
		Panel	150pF, 330Ω, ±8 KV, Air	
5	Temperature cycle	-30°C ,30 min /80°C ,30 min , 10 cycles		Static
6	High temperature operation	70°C, 96H		--
7	Low temperature operation	-20°C, 96H		--
8	High temperature & high humidity operation	60°C, 90% RH, 96H		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 be 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