

MDT039200	320x320	MCU Interface	TFT Module
Specification			
Version: 1		Date: 26/05/2023	
Revision			
1	24/05/2023	First issue	

Display Features		 RoHS compliant	
Display Size	3.92"		
Resolution	320x320		
Orientation	Landscape		
Appearance	RGB		
Logic Voltage	2.75V		
Interface	MCU		
Brightness	800 cd/m ²		
Touchscreen	---		
Module Size	75.66 x 78.23 x 2.25 mm		
Operating Temperature	-30°C ~ +80°C	Created By	Checked By
Pinout	40 way FFC	CL	TSB
Pitch	0.50 mm	Box Quantity	Weight / Display
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* - For full design functionality, please use this specification in conjunction with the ST7796 display driver specification.(Provided Separately)

Display Accessories	
Part Number	Description
MBID-40FP	40 Way FFC to cable and wires. Driven by any driver board that can be wired to a 1mm pitch SHDR-40V-S-B receptacle.
MDIB-CC1	Interconnect board for standard pitch pinouts to fine pitch wires. Providing pinouts for 2.54 pinout. 1.27, 1, 0.845, 0.8, 0.7, 0.65, 0.62, 0.6, 0.5 & 0.3 pads.

Optional Variants	
Appearances	Voltage



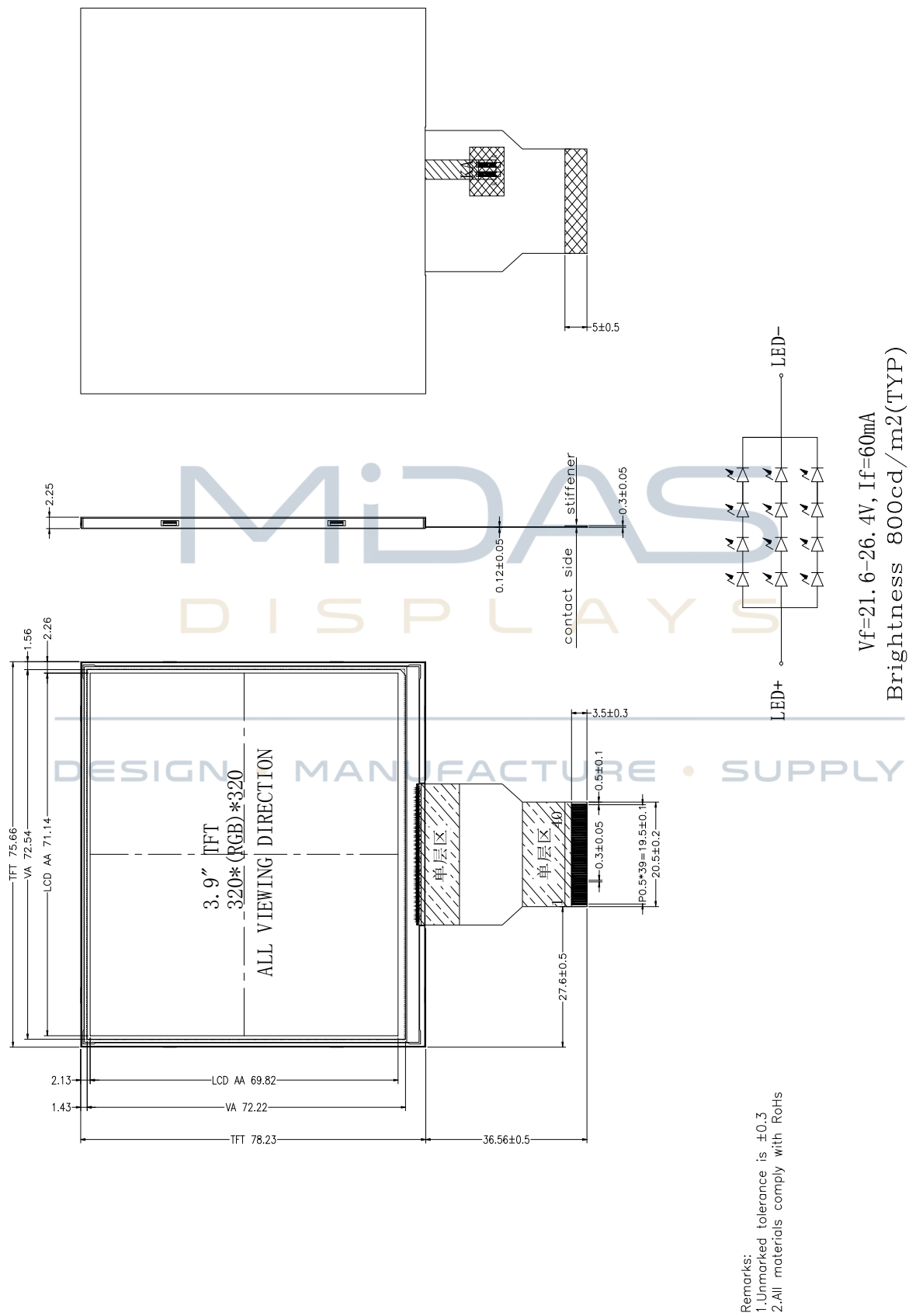
1. GENERAL SPECIFICATIONS

ITEM	STANDARD VALUE	UNIT
LCD SIZE	3.9	inch
LCD TYPE	TFT/IPS/ NORMALLY BLACK/TRANSMISSIVE	
MODULE SIZE	75.66*78.23*2.25	mm
ACTIVE AREA	71.14*69.82	mm
PIXEL PITCH (W*H)	0.2223*0.2182	mm
NUMBER OF PIXELS	320*320	
DRIVER IC	ST7796	
INTERFACE TYPE	MCU	
RECOMMEND VIEWING DIRECTION	ALL	O'clock
GRAY SCALE INVERSION DIRECTION	-	O'clock
COLORS	16.7 M	
BACKLIGHT TYPE	12-DIES WHITE LED	
TOUCH PANEL TYPE	WITHOUT	

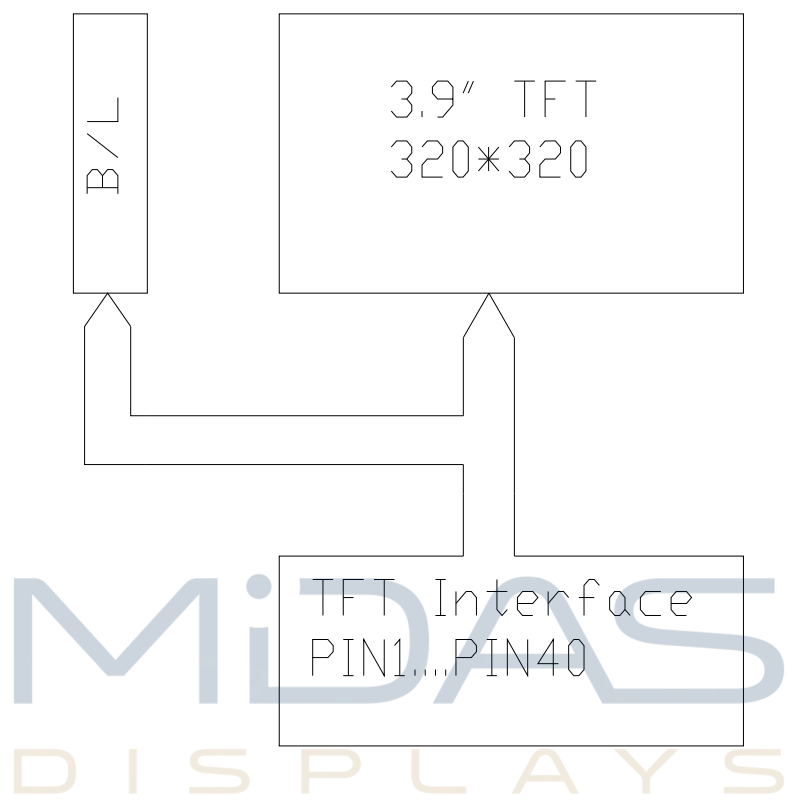
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2. EXTERNAL DIMENSIONS



3. BLOCK DIAGRAM



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4. PIN ASSIGNMENT

Pin No.	Symbol	Description
1	LEDK	Cathode of LED backlight
2	LEDA	Anode of LED backlight
3	GND	Power ground
4	VCI	Power supply for analog
5	IOVCC	Power supply for I/O system
6	GND	Power ground
7	RESET	Reset pin
8	CS	Chip selection pin.
9	RS	Display data/command selection (RS) pin in MCU interface
10	WR	Write enable in MCU parallel interface
11	RD	Read enable in 8080 MCU parallel interface
12	GND	Power ground
13	IM0	The MCU interface mode select
14	IM1	
15	IM2	
16	SDO	SPI interface output pin
17	SDA	SPI interface input/output pin
18	GND	Power ground
19-34	DB0-DB15	Data bus
35	GND	Power ground
36	CTP_VDD	No connection
37	CTP_SDA	No connection
38	CTP_SCL	No connection
39	CTP_INT	No connection
40	CTP_RST	No connection



IM2	IM1	IM0	MPU Interface Mode	Data pin
0	1	0	8080 16-bit Interface	DB[15:0]
0	1	1	8080 8-bit Interface	DB[7:0],
1	0	1	3SPI	SDA, SDO
1	1	1	4Line SPI	SDA, SDO

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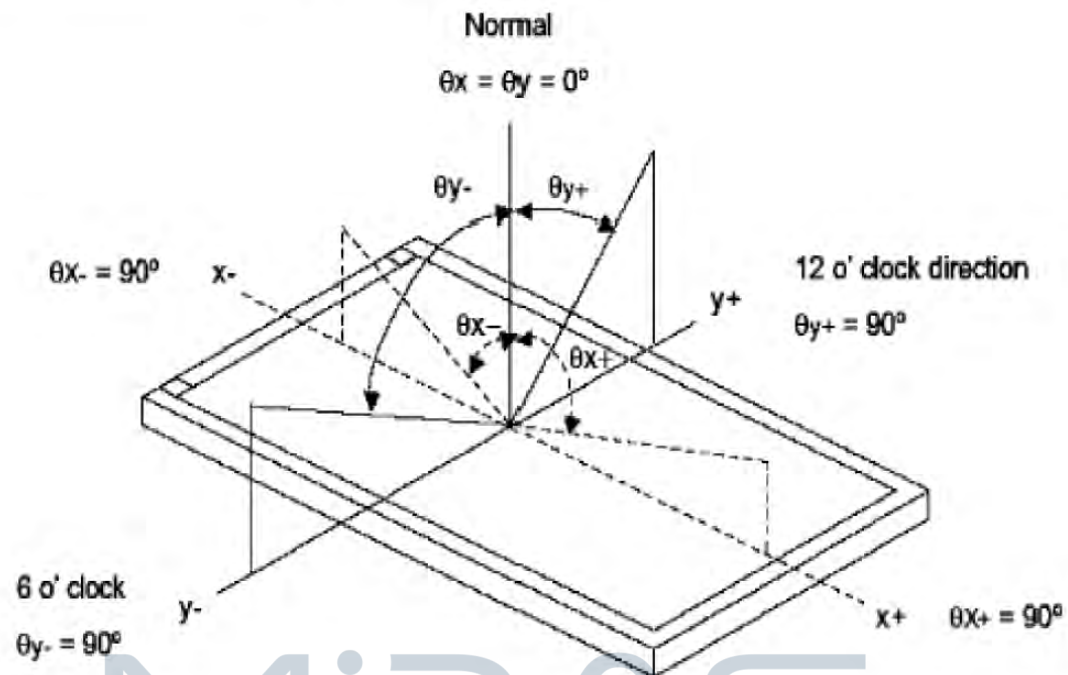


5. OPTICAL CHARACTERISTICS

ITEM		SYMBOL	CONDITIONS	SPECIFICATIONS			UNIT	NOTE
				MIN	TYP.	MAX		
Luminance		L			800	-	Cd/m²	
Contrast ratio		CR	$\theta = 0^\circ$	800	1000			
Response time	Rising	T _R	25°C	4.0	4.8		ms	
	Falling	T _F						
CIE COLOUR COORDINATE	RED	XR	VIEWING NORMAL ANGLE					
		YR						
	GREEN	XG						
		YG						
	BLUE	XB						
		YB						
	WHITE	XW		-0.03	0.294	+0.03		
		YW		-0.03	0.329	+0.03		
VIEWING ANGLE	Hor.	θ_{x+}	CR ≥ 10	75	85		Degree	
		θ_{x-}		75	85			
	Ver.	θ_{y+}		75	85			
		θ_{y-}		75	85			



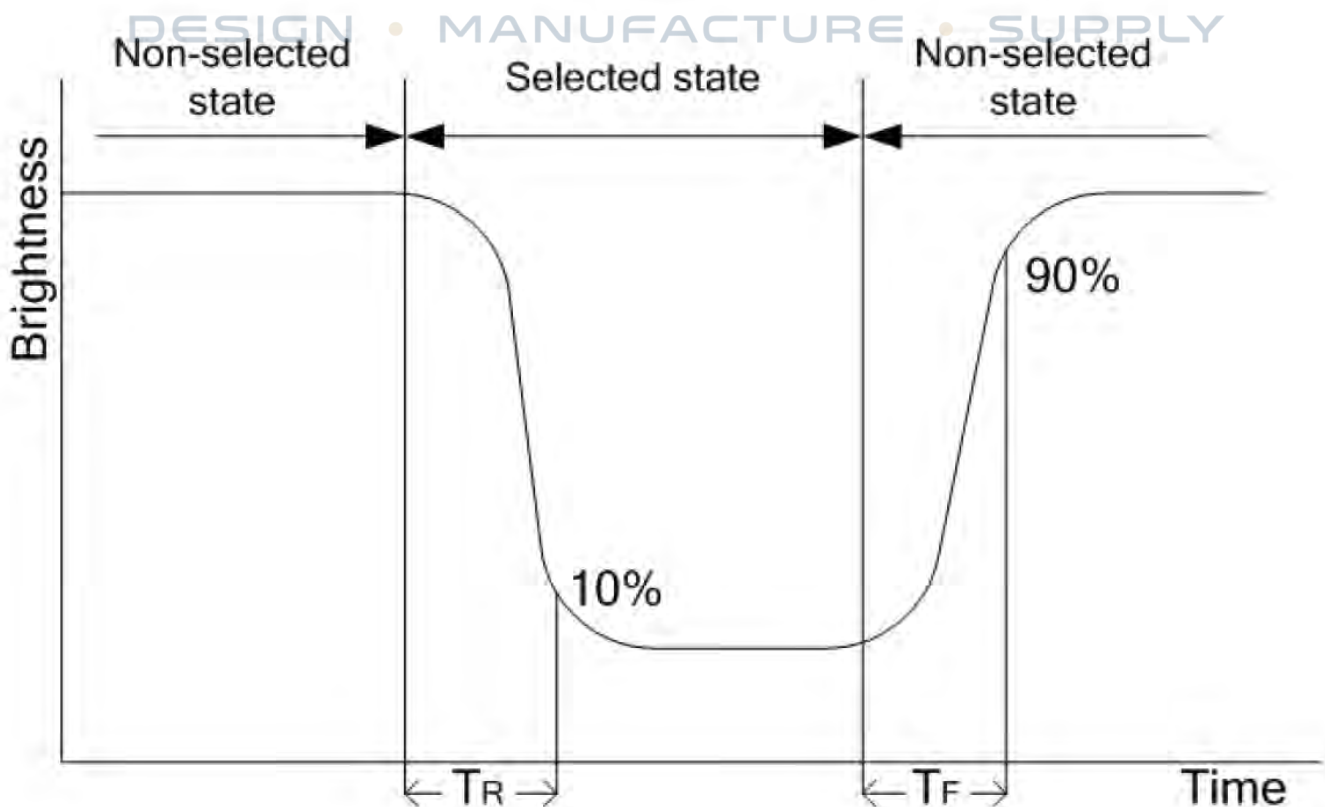
Note 1 : Definition of Viewing Angle θ_x and θ_y :



Note 2: Definition of contrast ratio CR:

$$CR = \frac{\text{Brightness of non-selected dots (white)}}{\text{Brightness of selected dots (black)}}$$

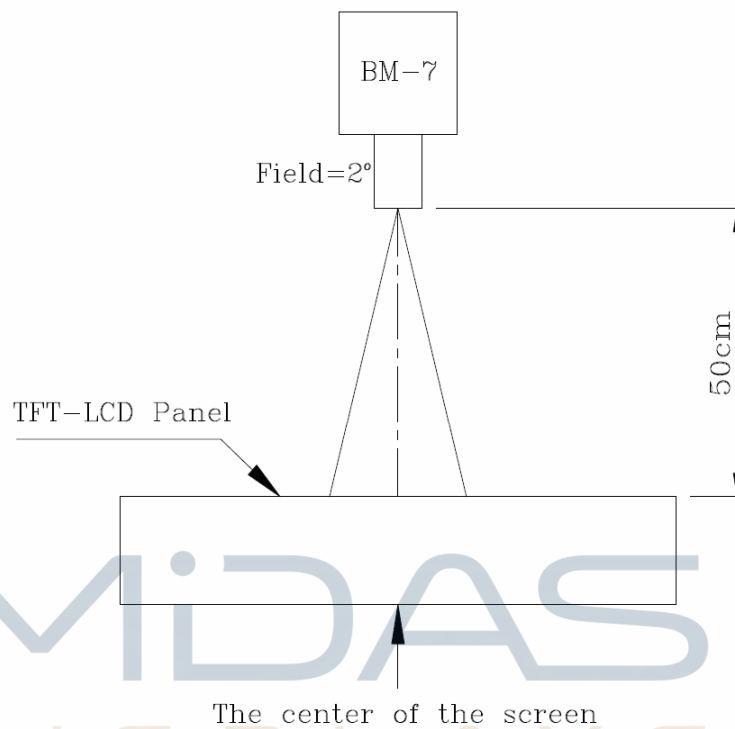
Note 3: Definition of response time (T_R , T_F)



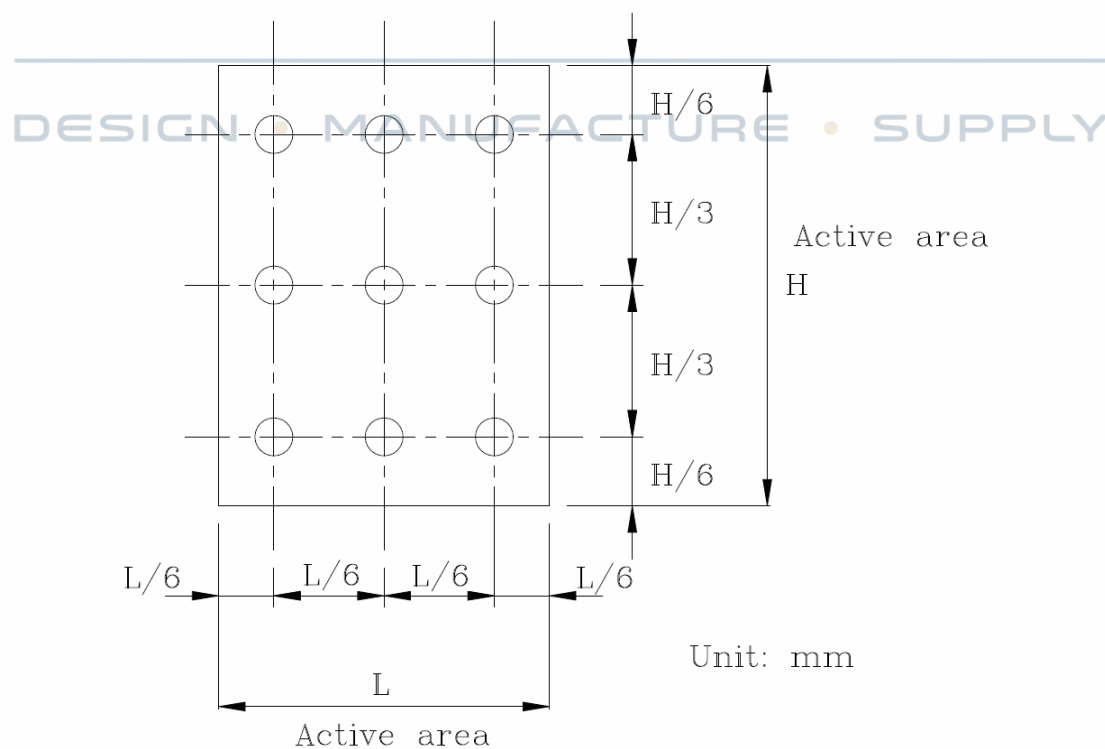
Note 4: Definition of Luminance

①The Brightness Test Equipment Setup

Field=2° (As measuring “black” image, field=2° is the best testing condition)



②The Brightness Test Point Setup



6. ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	MIN	MAX	UNIT
Supply Voltage (Analog)	VCI	-0.3	4.6	V
Supply Voltage (I/O)	IOVCC	-0.3	4.6	V
Operating temperature	Top	-30	+80	°C
Storage temperature	Tst	-30	+85	°C

7. ELECTRICAL CHARACTERISTICS

7.1 Input Power

ITEM	SYMBOL	MIN	TYP.	MAX	UNIT
Power Supply Voltage	VCI	2.5	2.75	3.3	V
IO Supply Voltage	IOVCC	1.65	1.8	3.3	V
Input voltage	Vil	GND	-	0.3IOVCC	V
	Vih	0.7IOVCC	-	IOVCC	V

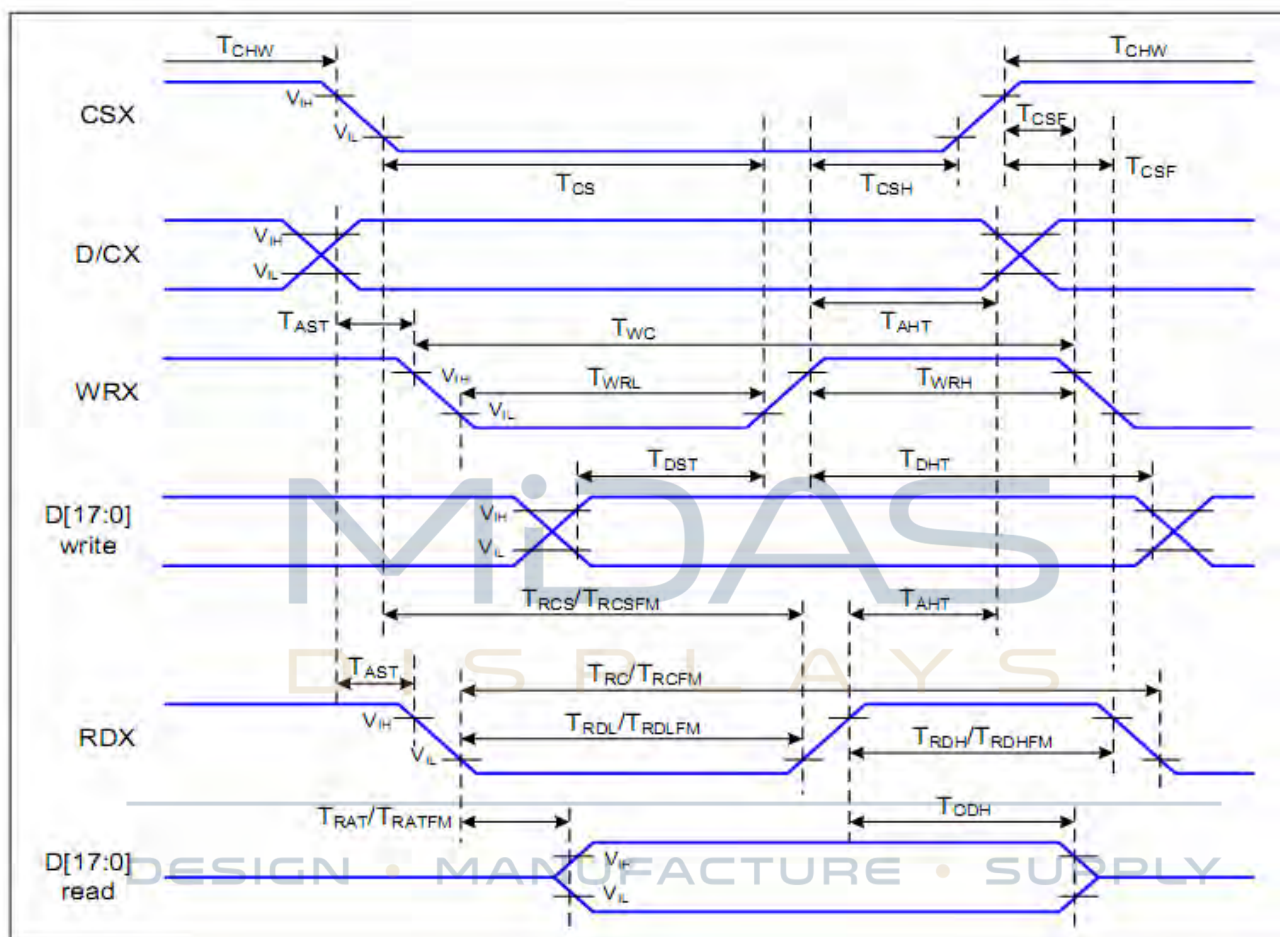
7.2 Backlight Driving Conditions

ITEM	SYMBOL	SPECIFICATIONS			UNIT	REMARK
		MIN	TYP.	MAX		
Voltage for LED backlight	Vf	21.6		26.4	V	Il=40mA
Current for LED backlight	Il		60		mA	
Power consumption	P	1.296		1.584		
Led life time			50,000		Hr	Note



8. TIMING CHARACTERISTICS

8.1 8080 Series MCU Parallel Interface Characteristics



Signal	Symbol	Parameter	Min	Max	Unit	Description
D/CX	T_{AST}	Address setup time	0		ns	
	T_{AHT}	Address hold time (Write/Read)	10		ns	
CSX	T_{CHW}	Chip select "H" pulse width	0		ns	
	T_{CS}	Chip select setup time (Write)	15		ns	
	T_{RCS}	Chip select setup time (Read ID)	45		ns	
	T_{RCSFM}	Chip select setup time (Read FM)	355		ns	
	T_{CSF}	Chip select wait time (Write/Read)	10		ns	
	T_{CSH}	Chip select hold time	10		ns	
WRX	T_{WC}	Write cycle	66		ns	
	T_{WRH}	Control pulse "H" duration	15		ns	

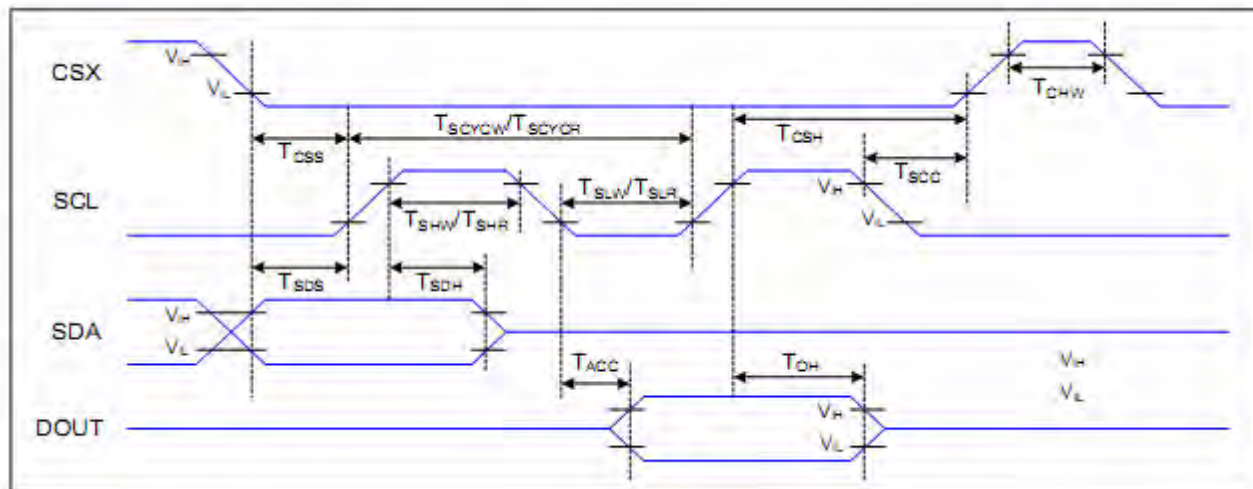
	T _{WRL}	Control pulse "L" duration	15		ns	
RDX (ID)	T _{RC}	Read cycle (ID)	160		ns	When read ID data
	T _{RDH}	Control pulse "H" duration (ID)	90		ns	
	T _{RDL}	Control pulse "L" duration (ID)	45		ns	
RDX (FM)	T _{RCFM}	Read cycle (FM)	450		ns	When read from frame memory
	T _{RDHFM}	Control pulse "H" duration (FM)	90		ns	
	T _{RDLFM}	Control pulse "L" duration (FM)	355		ns	
D[17:0]	T _{DST}	Data setup time	10		ns	For CL=30pF
	T _{DHT}	Data hold time	10		ns	
	T _{RAT}	Read access time (ID)	-	40	ns	
	T _{RATFM}	Read access time (FM)	-	340	ns	
	T _{ODH}	Output disable time	20	80	ns	

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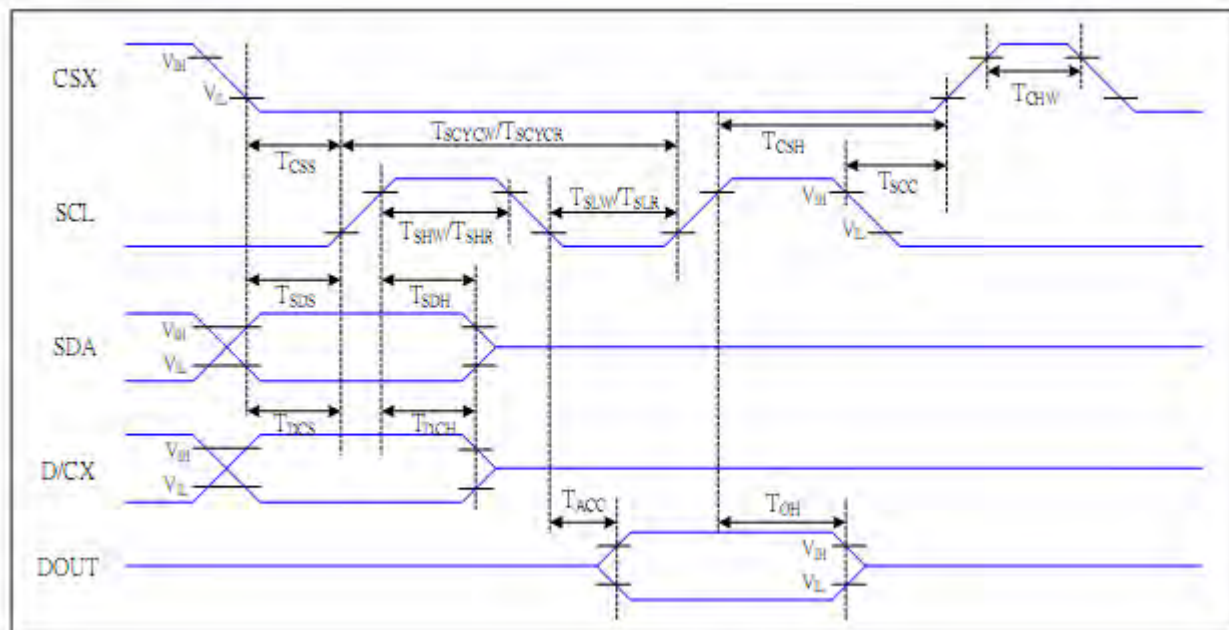


8.2 3-SPI Serial Data Transfer Interface Characteristics:



Signal	Symbol	Parameter	Min	Max	Unit	Description
CSX	T_{CSS}	Chip select setup time (write)	15		ns	
	T_{CSH}	Chip select hold time (write)	15		ns	
	T_{CSS}	Chip select setup time (read)	60		ns	
	T_{SDC}	Chip select hold time (read)	65		ns	
	T_{CHW}	Chip select "H" pulse width	40		ns	
SCL	$T_{SCYC W}$	Serial clock cycle (Write)	16		ns	
	T_{SHW}	SCL "H" pulse width (Write)	7		ns	
	T_{SLW}	SCL "L" pulse width (Write)	7		ns	
	$T_{SCYC R}$	Serial clock cycle (Read)	150		ns	
	T_{SHR}	SCL "H" pulse width (Read)	60		ns	
	T_{SLR}	SCL "L" pulse width (Read)	60		ns	
SDA (DIN)	T_{SDS}	Data setup time	7		ns	
	T_{SDH}	Data hold time	7		ns	
DOUT	T_{ACC}	Access time	10	50	ns	For maximum CL=30pF
	T_{OH}	Output disable time	15	50	ns	For minimum CL=8pF

8.3 4-SPI Serial Data Transfer Interface Characteristics:



Signal	Symbol	Parameter	MIN	MAX	Unit	Description
CSX	T_{CSS}	Chip select setup time (write)	15		ns	-write command & data ram
	T_{CSH}	Chip select hold time (write)	15		ns	
	T_{CSS}	Chip select setup time (read)	60		ns	
	T_{SOC}	Chip select hold time (read)	65		ns	
	T_{CHW}	Chip select "H" pulse width	40		ns	
SCL	T_{SCYCW}	Serial clock cycle (Write)	16		ns	-read command & data ram
	T_{SHW}	SCL "H" pulse width (Write)	7		ns	
	T_{SLW}	SCL "L" pulse width (Write)	7		ns	
	T_{SCYCR}	Serial clock cycle (Read)	150		ns	
	T_{SHR}	SCL "H" pulse width (Read)	60		ns	
D/CX	T_{DCS}	D/CX setup time	10		ns	
	T_{DCH}	D/CX hold time	10		ns	
SDA (DIN)	T_{SDS}	Data setup time	7		ns	
	T_{SDH}	Data hold time	7		ns	
DOUT	T_{ACC}	Access time	10	50	ns	For maximum $CL=30pF$
	T_{OH}	Output disable time	15	50	ns	For minimum $CL=8pF$

9.RELIABILITY TEST

NO.	TEST ITEM	CONDITIONS	
1	HIGH TEMPERATURE STORAGE	TA=85℃	240H
2	LOW TEMPERATURE STORAGE	TA=-30℃	240H
3	HIGH TEMPERATURE OPERATION	TA=80℃	240H
4	LOW TEMPERATURE OPERATION	TA=-30℃	240H
5	HIGH TEMPERATURE AND HIGH HUMIDITY OPERATION	+60℃, 90%RH	240H



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10. LCD MODULES HANDLING PRECAUTIONS

- The display panel is made of glass. Do not subject it to a mechanical shock by dropping it from a high place, etc.
- If the display panel is damaged and the liquid crystal substance inside it leaks out, do not get any in your mouth. If the substance come into contact with your skin or clothes promptly wash it off using soap and water.
- Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary.
- The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarize carefully.
- To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.
 - Be sure to ground the body when handling the LCD module.
 - Tools required for assembly, such as soldering irons, must be properly grounded.
 - To reduce the amount of static electricity generated, do not conduct assembly and other work under dry conditions.
 - The LCD module is coated with a film to protect the display surface. Exercise care when peeling off this protective film since static electricity may be generated.
- Storage precautions
When storing the LCD modules, avoid exposure to direct sunlight or to the light of fluorescent lamps. Keep the modules in bags designed to prevent static electricity charging under low temperature / normal humidity conditions (avoid high temperature / high humidity and low temperatures below 0°C). Whenever possible, the LCD modules should be stored in the same conditions in which they were shipped from our company.

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11. OTHERS

- Liquid crystals solidify at low temperature (below the storage temperature range) leading to defective orientation of liquid crystal or the generation of air bubbles (black or white). Air bubbles may also be generated if the module is subjected to a strong shock at a low temperature.
- If the LCD modules have been operating for a long time showing the same display patterns may remain on the screen as ghost images and a slight contrast irregularity may also appear. Abnormal operating status can be resumed to be normal condition by suspending use for some time. It should be noted that this phenomena does not adversely affect performance reliability.
- To minimize the performance degradation of the LCD modules resulting from caused by static electricity, etc. exercise care to avoid holding the following sections when handling the modules:
 - Exposed area of the printed circuit board
 - Terminal electrode sections.

