

MDT035002	240x320	MCU, RGB Interface	TFT Module
Specification			
Version: 1		Date: 16/12/2023	
Revision			
1	14/12/2023	First issue	

Display Features			
Display Size	3.5"		
Resolution	240x320		
Orientation	Portrait		
Appearance	RGB		
Logic Voltage	2.75V		
Interface	MCU,RGB		
Brightness	750cd/m ²		
Touchscreen	---		
Module Size	60.76 x 81.64 x 2.7 mm		
Operating Temperature	-30°C ~ +85°C	Created By	Checked By
Pinout	40 way FFC	CL	TSB
Pitch	0.50mm	Box Quantity	Weight / Display
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* - For full design functionality, please use this specification in conjunction with the ST7789T3I 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



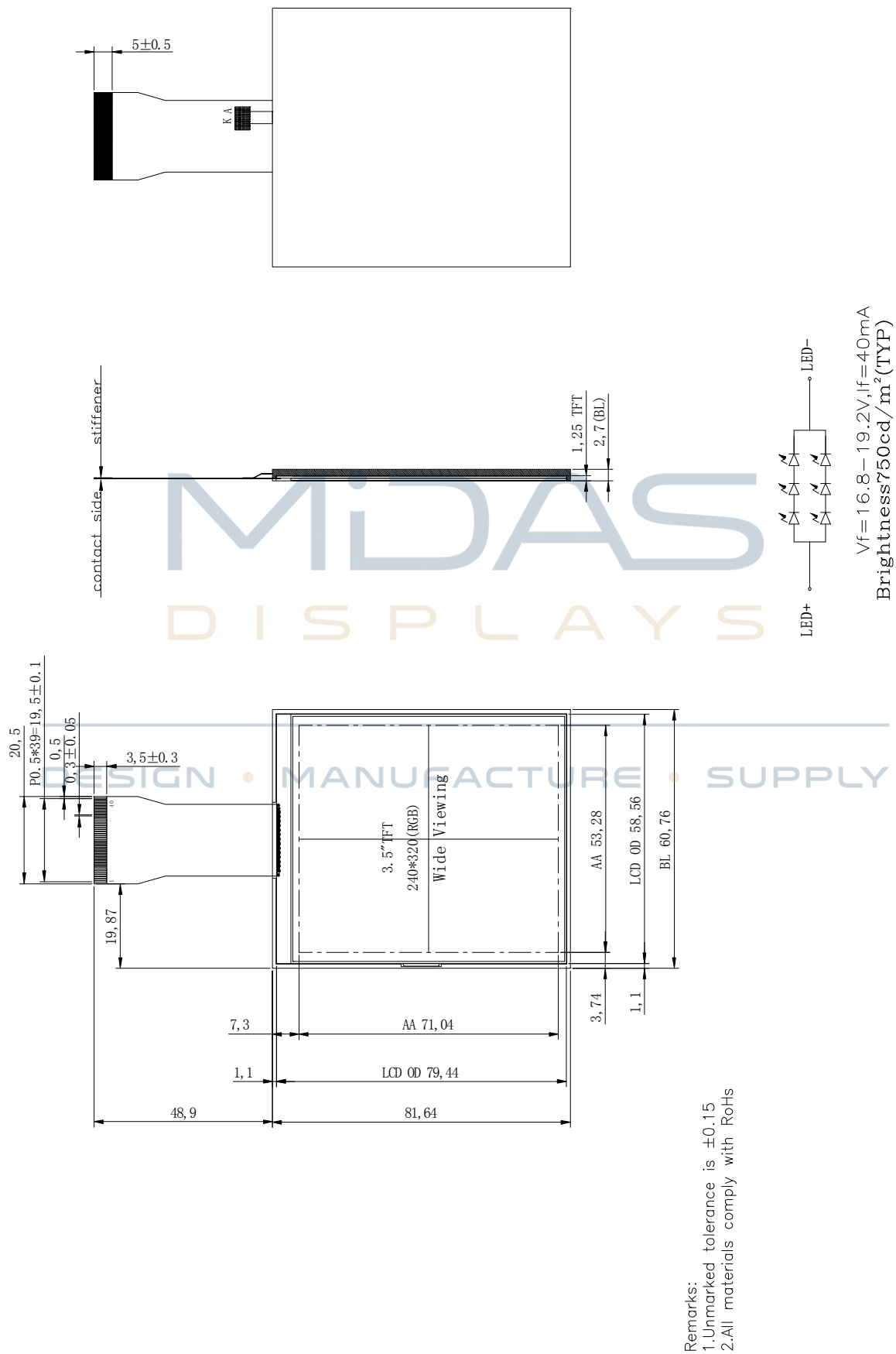
1. GENERAL SPECIFICATIONS

ITEM	STANDARD VALUE	UNIT
LCD SIZE	3.5	inch
LCD TYPE	TFT/IPS/ NORMALLY BLACK/TRANSMISSIVE	
MODULE SIZE	60.76*81.64*2.7	mm
ACTIVE AREA	53.28*71.04	mm
PIXEL PITCH (W*H)	0.222*0.222	mm
NUMBER OF PIXELS	240*320	
DIVER IC	ST7789T3I	
INTERFACE TYPE	MCU,RGB	
RECOMMEND VIEWING DIRECTION	ALL	O'CLOCK
GRAY SCALE INVERSION DIRECTION	-	O'CLOCK
COLORS	262K	
BACKLIGHT TYPE	6-DIES WHITE LED	
TOUCH PANEL TYPE	WITHOUT	

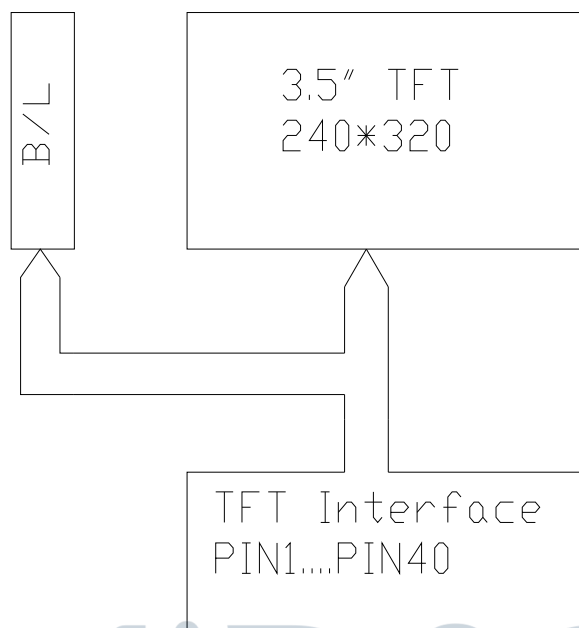
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2. EXTERNAL DIMENSIONS



3. BLOCK DIAGRAM



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4. PIN ASSIGNMENT

PIN NO.	SYMBOL	DESCRIPTION
1	GND	Power ground
2	GND	Power ground
3	VDDIO	Power Supply for I/O system
4	SDO	Serial data output
5	DB17	Data bus
6	DB16	Data bus
7	DB15	Data bus
8	DB14	Data bus
9	DB13	Data bus
10	DB12	Data bus
11	DB6	Data bus
12	DB7	Data bus
13	DB8	Data bus
14	DB9	Data bus
15	DB10	Data bus
16	DB11	Data bus
17	DB5	Data bus
18	DB4	Data bus
19	DB3	Data bus
20	DB2	Data bus
21	DB1	Data bus
22	DB0	Data bus
23	SDA	Serial data input
24	DOTCLK	Dot clock signal for RGB interface operation
25	ENABLE	Data enable signal for RGB interface operation
26	HSYNC	Horizontal sync signal; negative polarity
27	VSYNC	Vertical sync signal; negative polarity
28	RDX	Read enable in 8080 MCU parallel interface
29	WRX	-Write enable in MCU parallel interface -Display data/command selection pin in 4-line serial interface
30	DCX	-Display data/command selection pin in parallel interface. -This pin is used to be serial interface clock.
31	CSX	Chip selection pin
32	RESX	Reset pin
33	IM0	The MCU interface mode select
34	IM1	
35	IM2	
36	IM3	
37	VDD	Power Supply for Analog
38	GND	Power ground
39	LEDK	LED Cathode
40	LEDA	LED Anode



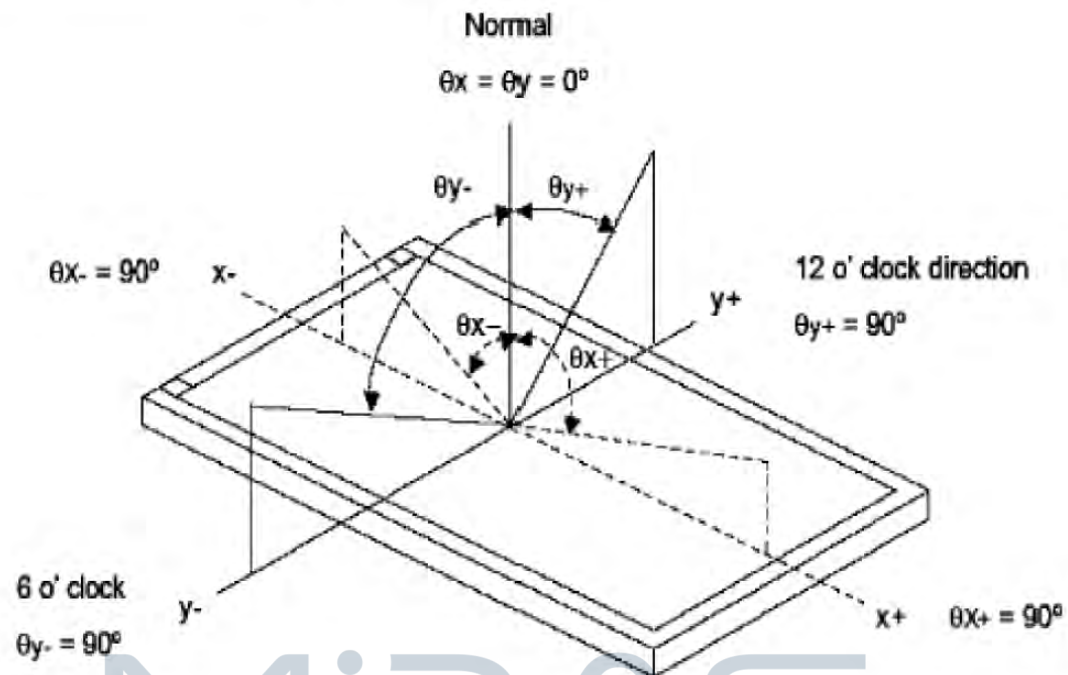
IM3	IM2	IM1	IM0	MPU Interface Mode	Data pin
0	0	0	0	80-8bit parallel I/F	DB[7:0]
0	0	0	1	80-16bit parallel I/F	DB[15:0]
0	0	1	0	80-9bit parallel I/F	DB[8:0]
0	0	1	1	80-18bit parallel I/F	DB[17:0],
0	1	0	1	3-line 9bit serial I/F	SDA: in/out
				2 data lane serial I/F	SDA: in/out WRX: in
0	1	1	0	4-line 8bit serial I/F	SDA: in/out
1	0	0	0	80-16bit parallel I/F II	DB[17:10], DB[8:1]
1	0	0	1	80-8bit parallel I/F II	DB[17:10]
1	0	1	0	80-18bit parallel I/F II	DB[17:0],
1	0	1	1	80-9bit parallel I/F II	DB[17:9]
1	1	0	1	3-line 9bit serial I/F II	SDA: in/ SDO: out
1	1	1	0	4-line 8bit serial I/F II	SDA:in/ SDO: out

5. OPTICAL CHARACTERISTICS

ITEM		SYMBOL	CONDITIONS	SPECIFICATIONS			UNIT	NOTE
				MIN	TYP.	MAX		
Luminance		L			750	-	Cd/m²	
Contrast ratio		CR	$\theta = 0^\circ$	800				
Response time	Rising	T _R	25℃		30	50	ms	
	Falling	T _F						
CIE COLOUR COORDINATE	RED	XR	VIEWING NORMAL ANGLE	0.628	0.648	0.668		
		YR		0.299	0.319	0.339		
	GREEN	XG		0.267	0.287	0.307		
		YG		0.570	0.590	0.610		
	BLUE	XB		0.125	0.145	0.165		
		YB		0.064	0.084	0.104		
	WHITE	XW			0.310			
		YW			0.330			
VIEWING ANGLE	Hor.	θ_{x+}	CR≥10	60	80		Degree	
		θ_{x-}		60	80			
	Ver.	θ_{y+}		60	80			
		θ_{y-}		60	80			



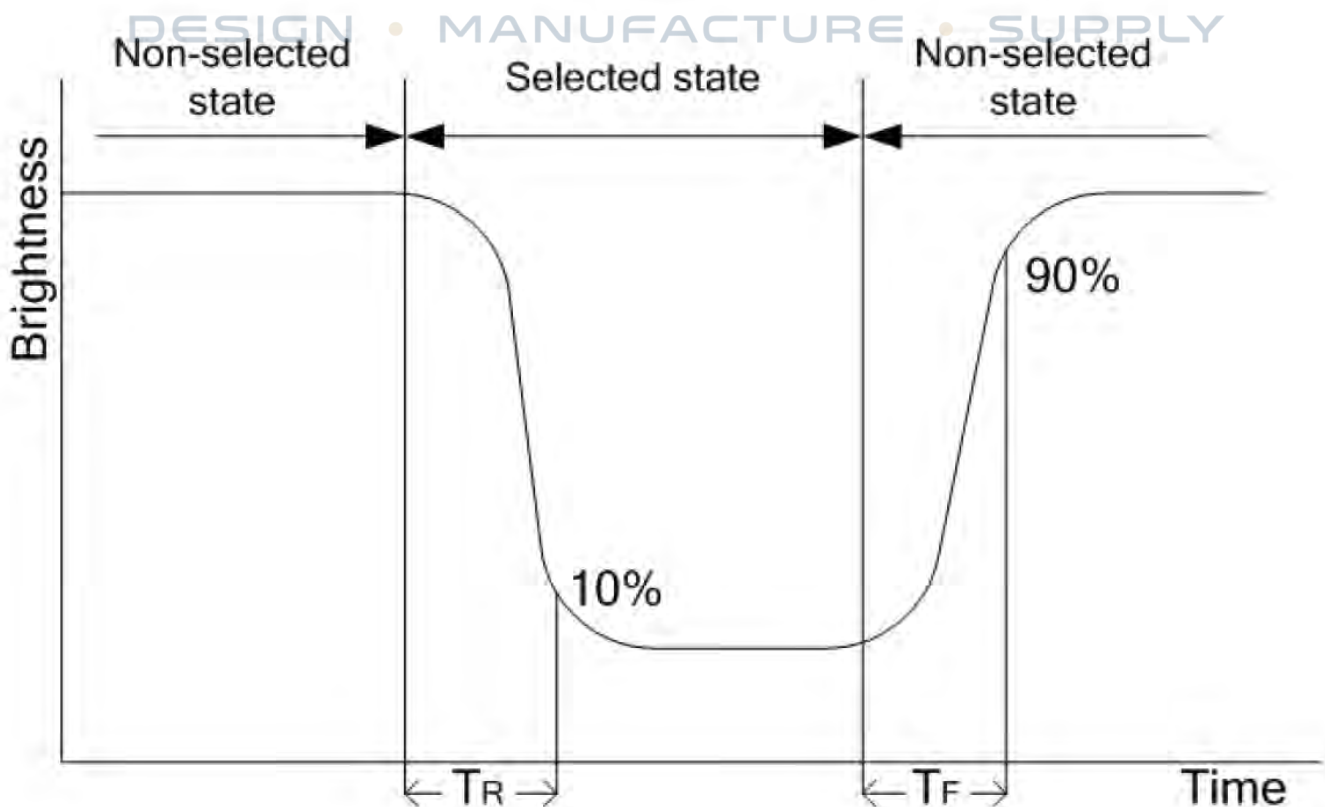
Note 1 : Definition of Viewing Angle θ_x and θ_y :



Note 2: Definition of contrast ratio CR:

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

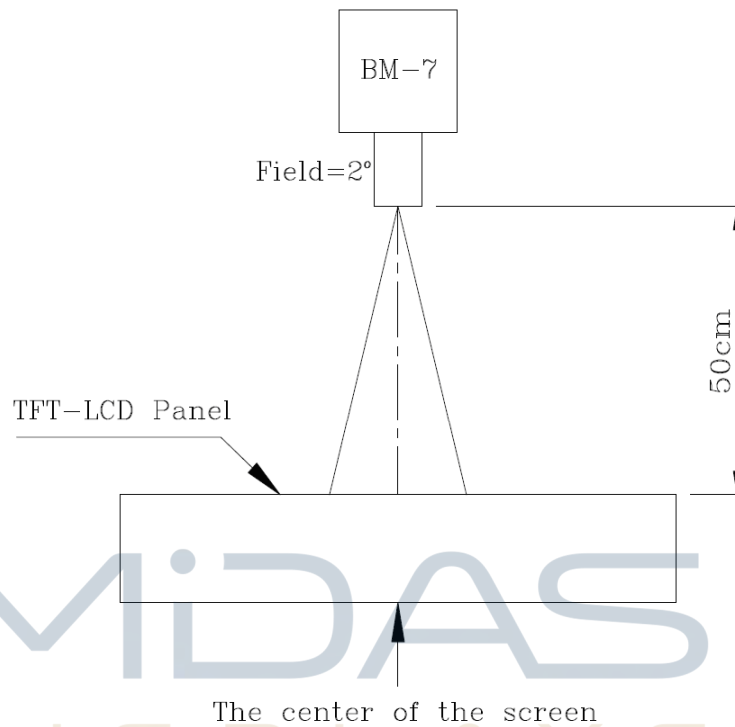
Note 3: Definition of response time (T_R , T_F)



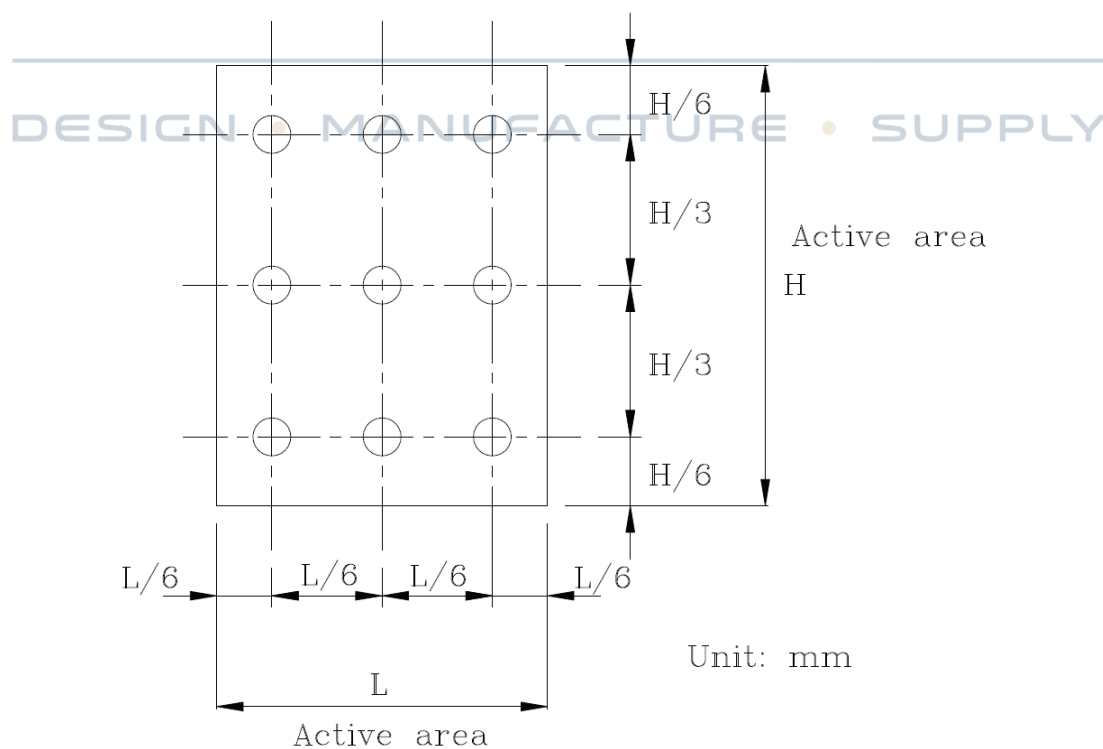
Note 4: Definition of Luminance

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
Power Supply for Analog	VDD	-0.3	4.6	V
Power Supply for I/O system	VDDI	-0.3	4.6	V
Operating temperature	Top	-30	+85	°C
Storage temperature	Tst	-40	+90	°C

7. ELECTRICAL CHARACTERISTICS

7.1 ELECTRICAL CHARACTERISTICS

ITEM	SYMBOL	MIN	TYP.	MAX	UNIT
Power Supply for Analog	VDD	2.4	2.75	3.6	V
Power Supply for I/O system	VDDI	1.65	1.8	3.6	V
Input voltage	Vil	GND	-	0.3VDDI	V
	Vih	0.7VDDI	-	VDDI	V

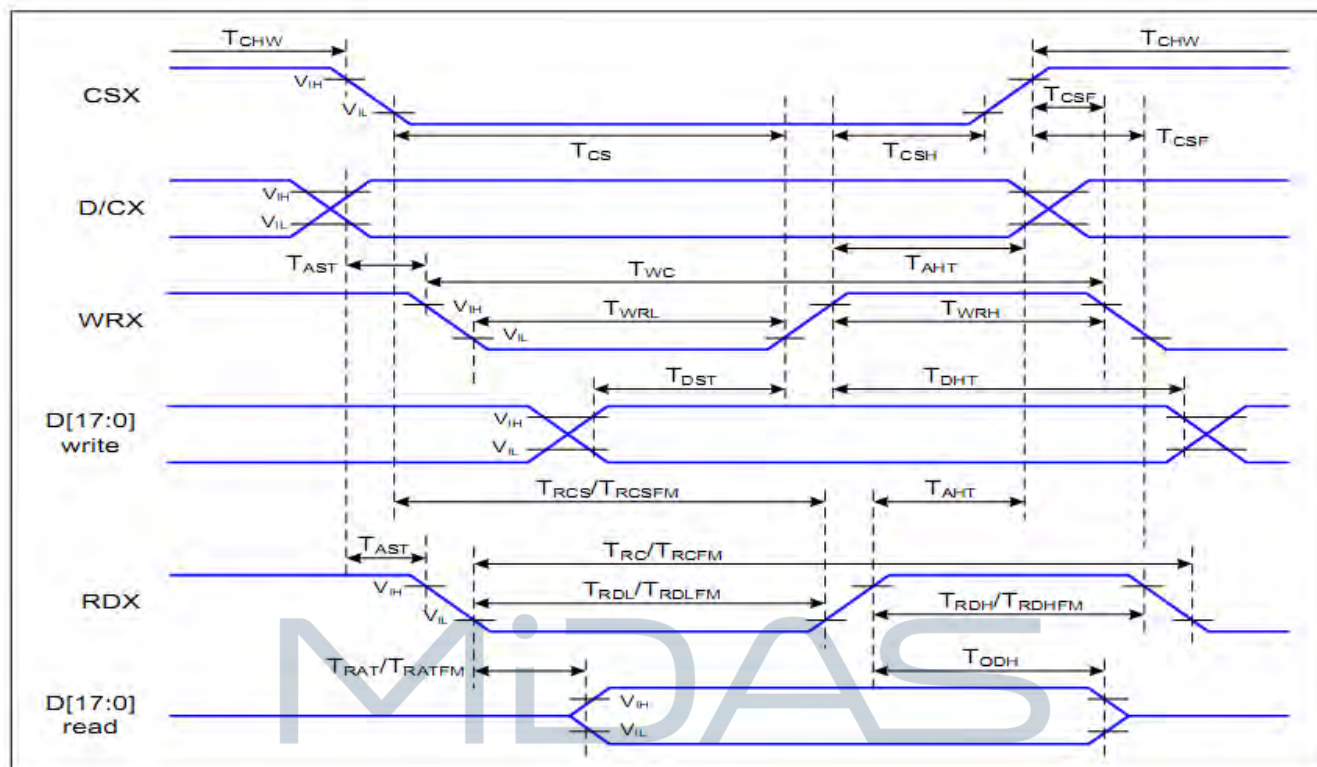
7.2 BACKLIGHT DRIVING CONDITIONS

ITEM	SYMBOL	SPECIFICATIONS			UNIT	REMARK
		MIN	TYP.	MAX		
Supply Voltage	Vf	16.8		19.2	V	
Supply Current	IL		40		mA	
Power consumption	P	0.672		0.768	W	
LED lifetime			50,000		H _r	



8. TIMING CHARACTERISTICS

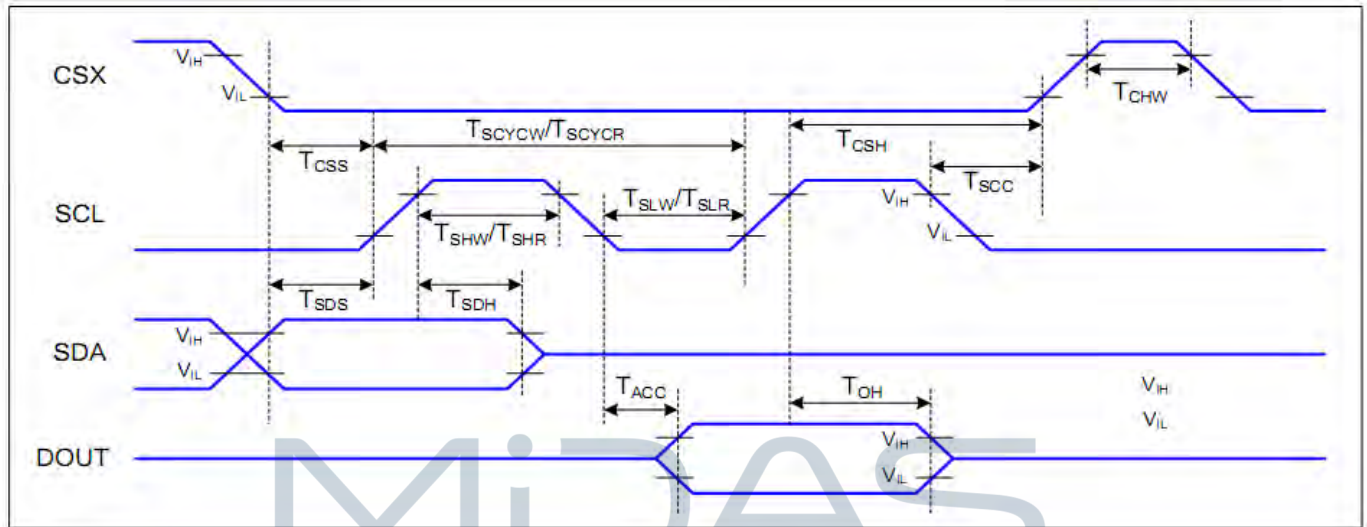
8.1 8080 Series MCU Parallel Interface Characteristics: 18/16/9/8-bit Bus



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

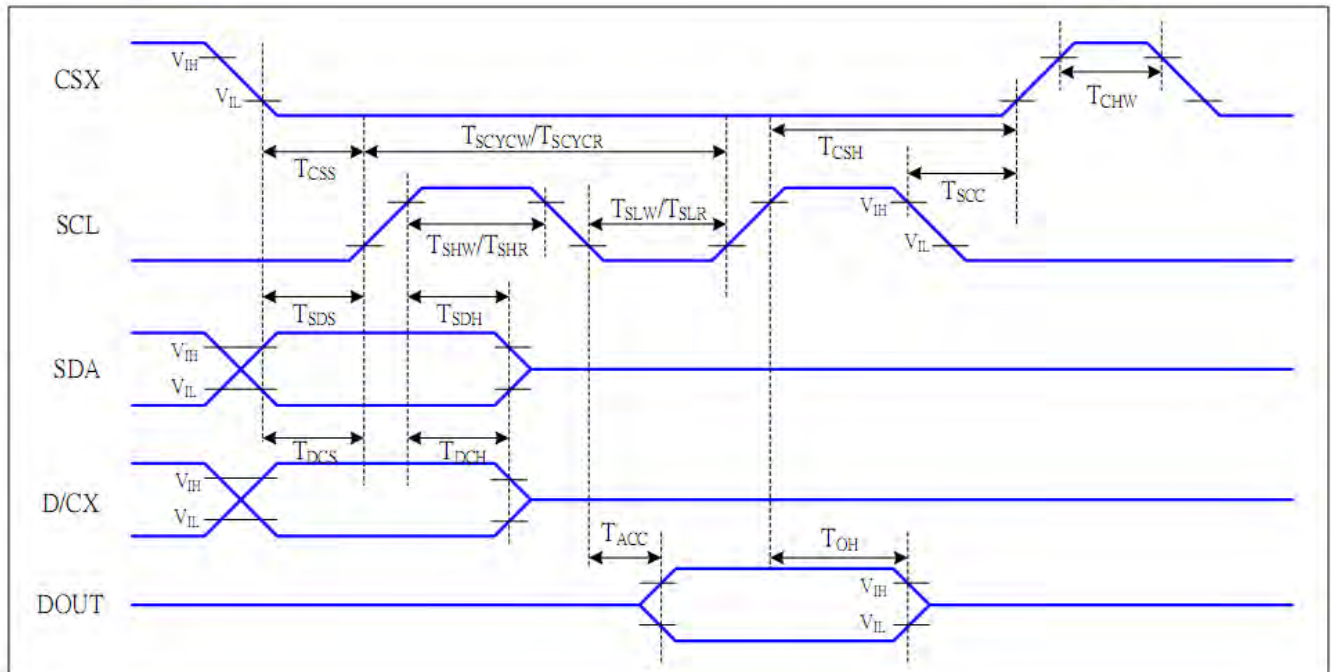
	T_{DHT}	Data hold time	10		ns
	T_{RAT}	Read access time (ID)		40	ns
	T_{RATFM}	Read access time (FM)		340	ns
	T_{ODH}	Output disable time	20	80	ns

8.2 Serial Interface Characteristics (3-line serial)



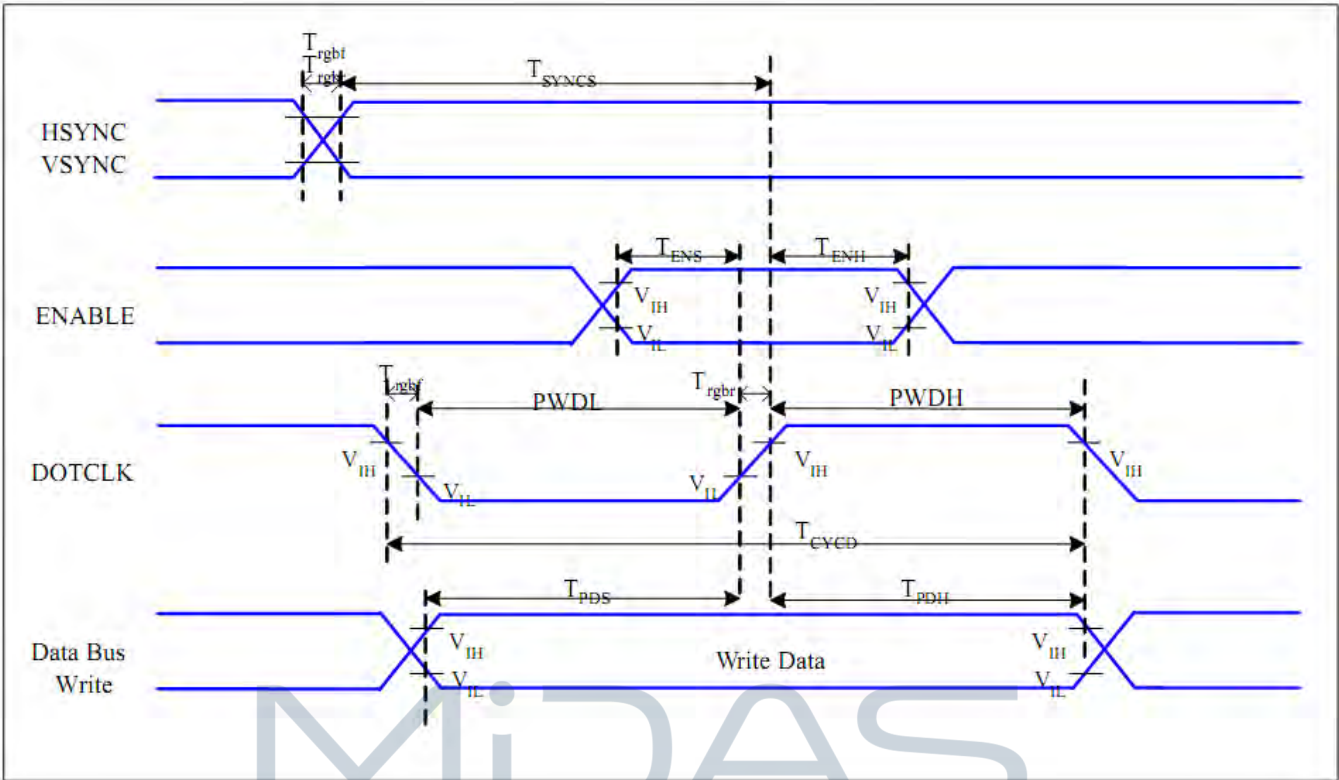
Signal	Symbol	Parameter	Min	Max	Unit	Description
CSX	T _{CSS}	Chip select setup time (write)	15		ns	
	T _{CSH}	Chip select hold time (write)	15		ns	
	T _{CSS}	Chip select setup time (read)	60		ns	
	T _{SCC}	Chip select hold time (read)	65		ns	
	T _{CHW}	Chip select "H" pulse width	40		ns	
SCL	T _{SCYCW}	Serial clock cycle (Write)	16		ns	
	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	
	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 Serial Interface Characteristics (4-line serial)



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_{SCC}	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	-write 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	-read command & data ram
	T_{SHR}	SCL "H" pulse width (Read)	60		ns	
	T_{SLR}	SCL "L" 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

8.4 RGB Interface Characteristics



Signal	Symbol	Parameter	MIN	MAX	Unit	Description
HSYNC, VSYNC	T_{SYNC}	VSYNC, HSYNC Setup Time	30	-	ns	
ENABLE	T_{ENS}	Enable Setup Time	25	-	ns	
	T_{ENH}	Enable Hold Time	25	-	ns	
DOTCLK	PWDH	DOTCLK High-level Pulse Width	60	-	ns	
	PWDL	DOTCLK Low-level Pulse Width	60	-	ns	
	T_{CYCD}	DOTCLK Cycle Time	120	-	ns	
	Trghr, Trghf	DOTCLK Rise/Fall time	-	20	ns	
DB	T_{PDS}	PD Data Setup Time	50	-	ns	
	T_{PDH}	PD Data Hold Time	50	-	ns	

18/16 Bits RGB Interface Timing Characteristics

Signal	Symbol	Parameter	MIN	MAX	Unit	Description
HSYNC, VSYNC	T_{SYNC}	VSYNC, HSYNC Setup Time	35	-	ns	
ENABLE	T_{ENS}	Enable Setup Time	35	-	ns	

	T_{ENH}	Enable Hold Time	35	-	ns	
DOTCLK	PWDH	DOTCLK High-level Pulse Width	35	-	ns	
	PWDL	DOTCLK Low-level Pulse Width	35	-	ns	
	T_{CYCD}	DOTCLK Cycle Time	80	-	ns	
	Trghr, Trghf	DOTCLK Rise/Fall time	-	10	ns	
DB	T_{PDS}	PD Data Setup Time	35	-	ns	
	T_{PDH}	PD Data Hold Time	35	-	ns	

6 Bits RGB Interface Timing Characteristics

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9. RELIABILITY TEST

NO.	TEST ITEM	CONDITIONS	
1	HIGH TEMPERATURE STORAGE	TA=90℃	240H
2	LOW TEMPERATURE STORAGE	TA=-40℃	240H
3	HIGH TEMPERATURE OPERATION	TA=85℃	240H
4	LOW TEMPERATURE OPERATION	TA=-30℃	240H
5	HIGH TEMPERATURE AND HIGH HUMIDITY OPERATION	+60℃, 90%RH	240H
6	THERMAL SHOCK	-30℃→+80℃,	0.5H:100CYCLES



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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.

