

MDT024000	240x320	MCU,SPI+RGB Interface	TFT Module
Specification			
Version: 1		Date: 30/04/2022	
Revision			
1	28/04/2022	First issue	

Display Features			
Display Size	2.40"		
Resolution	240x320		
Orientation	Portrait		
Appearance	RGB		
Logic Voltage	2.75V		
Interface	MCU,SPI+RGB		
Brightness	500 cd/m ²		
Touchscreen	---		
Module Size	42.72 x 60.26 x 2.65 mm		
Operating Temperature	-20°C ~ +70°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 ST7789 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



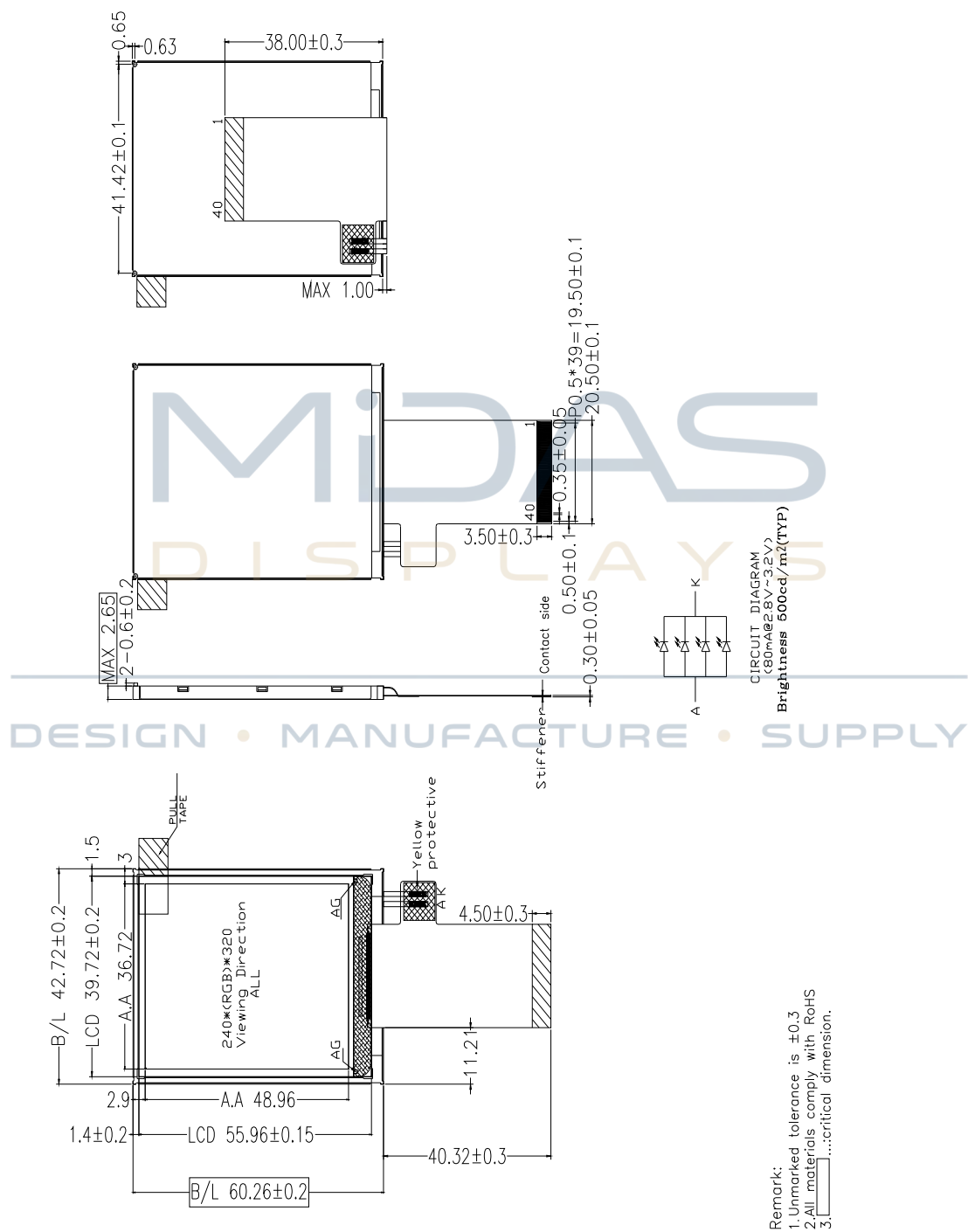
1. GENERAL SPECIFICATIONS

ITEM	STANDARD VALUE	UNIT
LCD TYPE	TFT/IPS/ NORMALLY BLACK/TRANSMISSIVE	
MODULE SIZE	42.72*60.26*2.65	mm
ACTIVE AREA	36.72*48.96	mm
PIXEL PITCH (W*H)	0.153*0.153	
NUMBER OF PIXELS	240*320	
DIVER IC	ST7789	
INTERFACE TYPE	MCU,SPI+RGB	
RECOMMEND VIEWING DIRECTION	ALL	O'clock
GRAY SCALE INVERSION DIRECTION	-	O'clock
COLORS	262K	
BACKLIGHT TYPE	4-DIES WHITE LED	
TOUCH PANEL TYPE	WITHOUT	

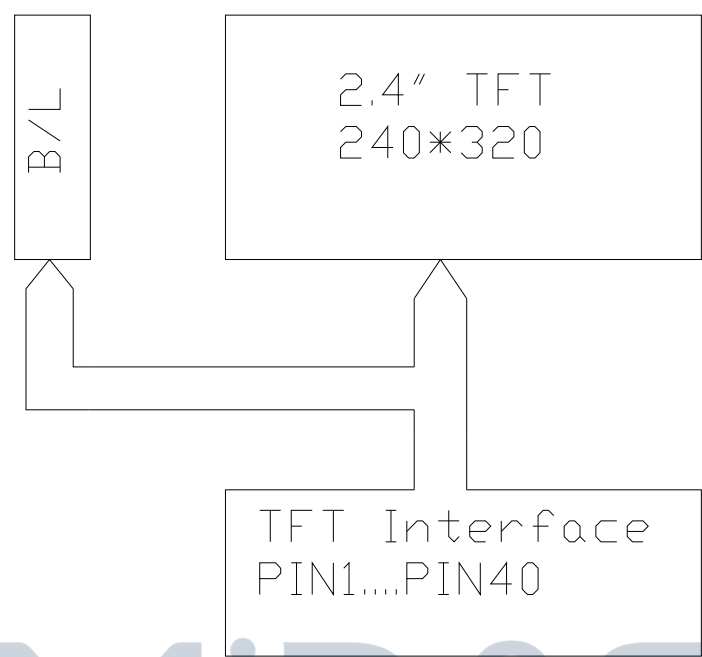
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2. EXTERNAL DIMENSIONS



3. BLOCK DIAGRAM



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4. PIN ASSIGNMENT

PIN NO.	SYMBOL	DESCRIPTION
1	SDI	When IM3: Low, SPI interface input/output pin. When IM3: High, SPI interface input pin.
2	SDO	SPI interface output pin
3	IM0	The MCU interface mode select
4	IM1	The MCU interface mode select
5	IM2	The MCU interface mode select
6	IM3	The MCU interface mode select
7	RESET	Reset pin
8	VSYNC	Vertical (Frame) synchronizing input signal for RGB interface operation
9	HSYNC	Horizontal (Line) synchronizing input signal for RGB interface operation
10	DOTCLK	Dot clock signal for RGB interface operation.
11	DE	Data enable signal for RGB interface operation.
12~17	DB17~DB12(R5~R0)	Data bus
18~23	DB11~DB6(G5~G0)	Data bus
24~29	DB5~DB0(B5~B0)	Data bus
30	RDX	Read enable in 8080 MCU parallel interface
31	WRX	Write enable in MCU parallel interface.
32	DCX	Display data/command selection pin in parallel interface.
33	CSX	Chip selection pin
34	GND	Power ground
35	VCC	Power supply for analog
36	IOVCC	Power supply for I/O system
37	NC	No connection
38	NC	No connection
39	K	Cathode of LED backlight
40	A	Anode of LED backlight



The MCU interface mode select:

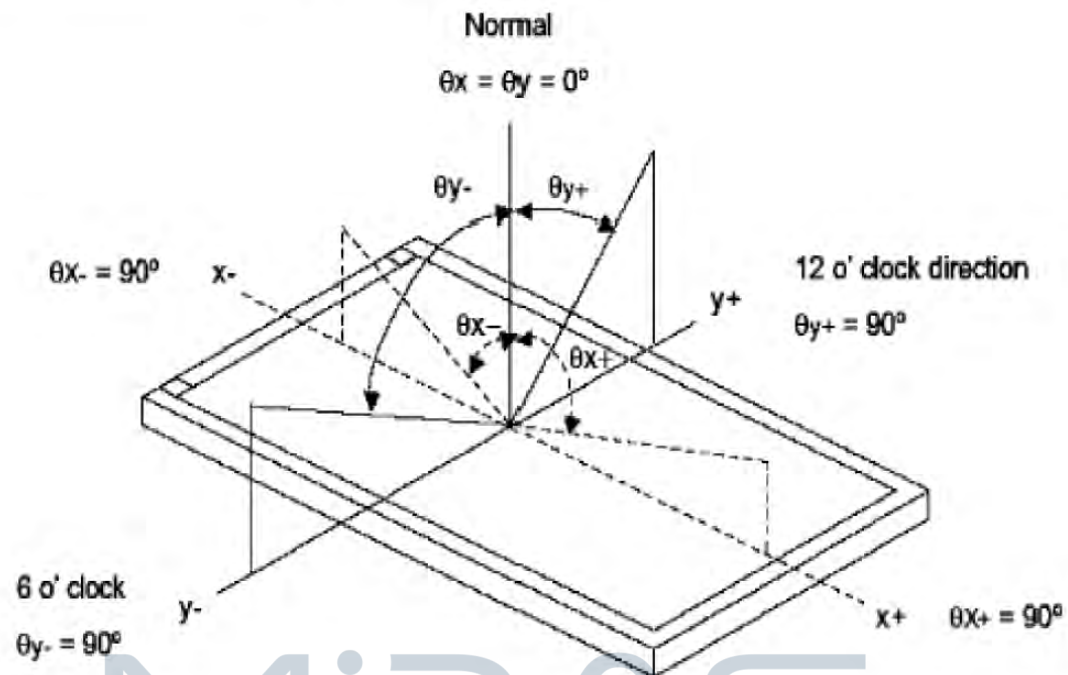
IM3	IM2	IM1	IM0	MPU Interface Mode	Data pin
0	0	0	0	80-8bit parallel I/F	DB[7:0]
0	0	0	1	80-16bit parallel I/F	DB[15:0]
0	0	1	0	80-9bit parallel I/F	DB[8:0]
0	0	1	1	80-18bit parallel I/F	DB[17:0],
0	1	0	1	3-line 9bit serial I/F	SDA: in/out
				2 data lane serial I/F	SDA: in/out WRX: in
0	1	1	0	4-line 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			500	-	Cd/m²	
Contrast ratio		CR	$\theta = 0^\circ$	640	800			
Response time	Rising	T _R	25℃		16	21	ms	
	Falling	T _F			19	24		
CIE COLOUR COORDINATE	RED	XR	VIEWING NORMAL ANGLE	0.627	0.647	0.667		
		YR		0.297	0.317	0.337		
	GREEN	XG		0.255	0.275	0.295		
		YG		0.562	0.582	0.602		
	BLUE	XB		0.120	0.140	0.160		
		YB		0.068	0.088	0.108		
	WHITE	XW		0.290	0.310	0.330		
		YW		0.316	0.336	0.256		
VIEWING ANGLE	Hor.	θ_{x+}	CR≥10		80		Degree	
		θ_{x-}			80			
	Ver.	θ_{y+}			80			
		θ_{y-}			80			



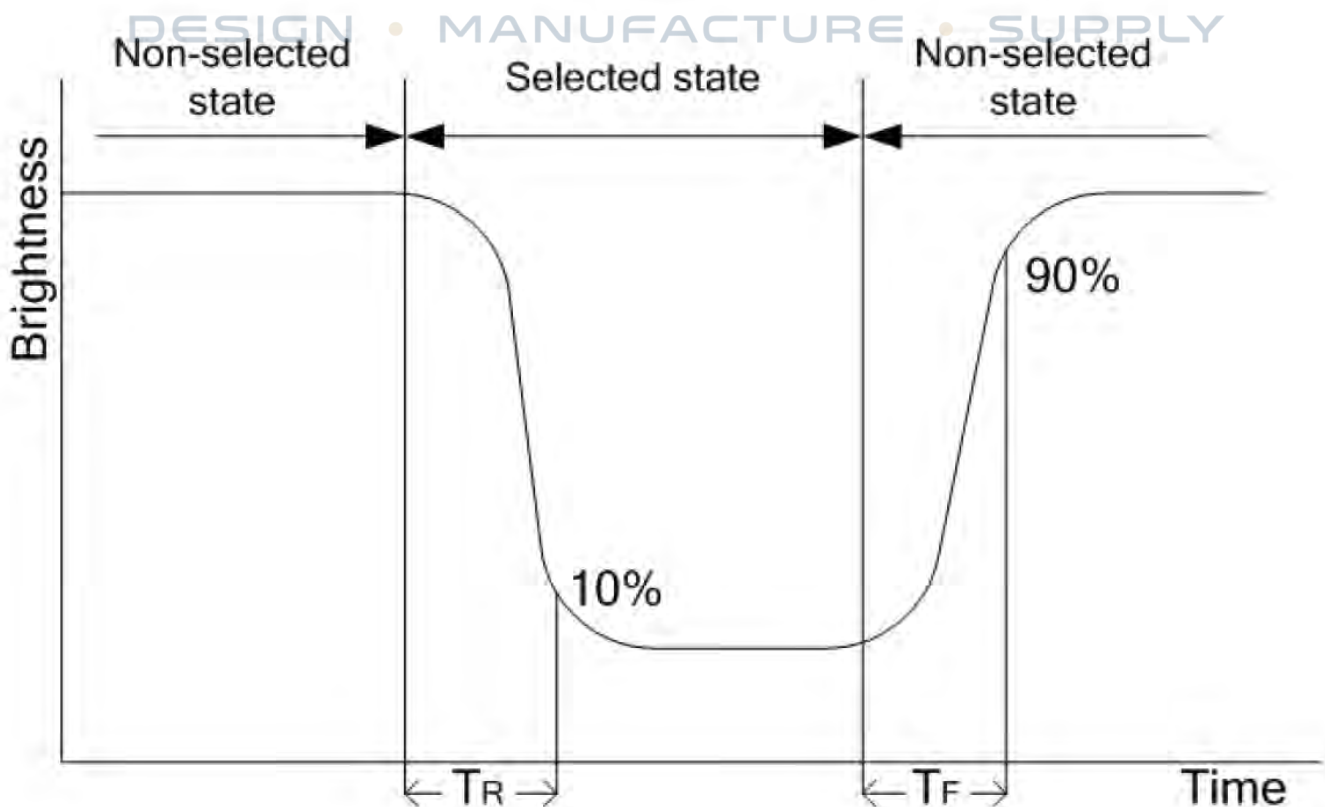
Note 1 : Definition of Viewing Angle θ_x and θ_y :



Note 2: Definition of contrast ratio CR:

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

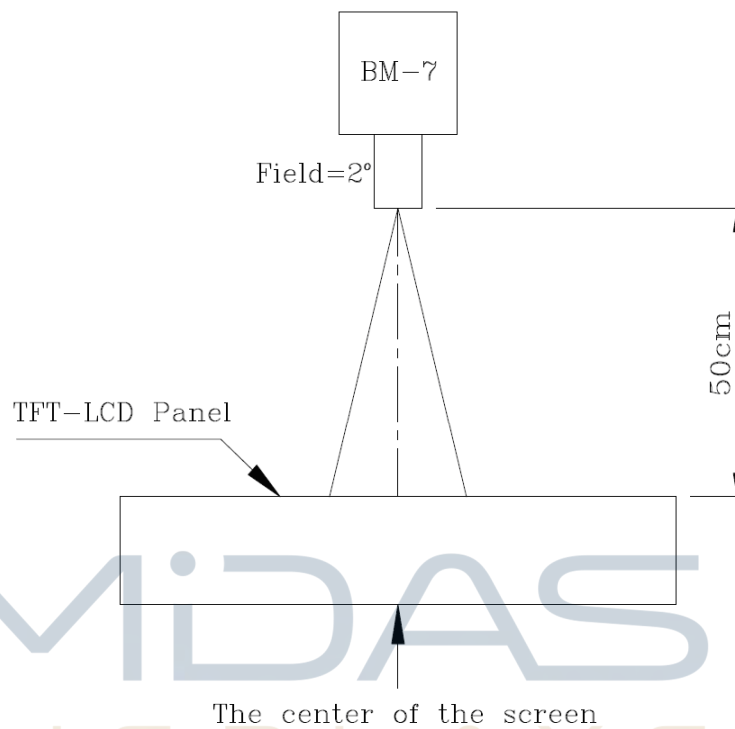
Note 3: Definition of response time (T_R , T_F)



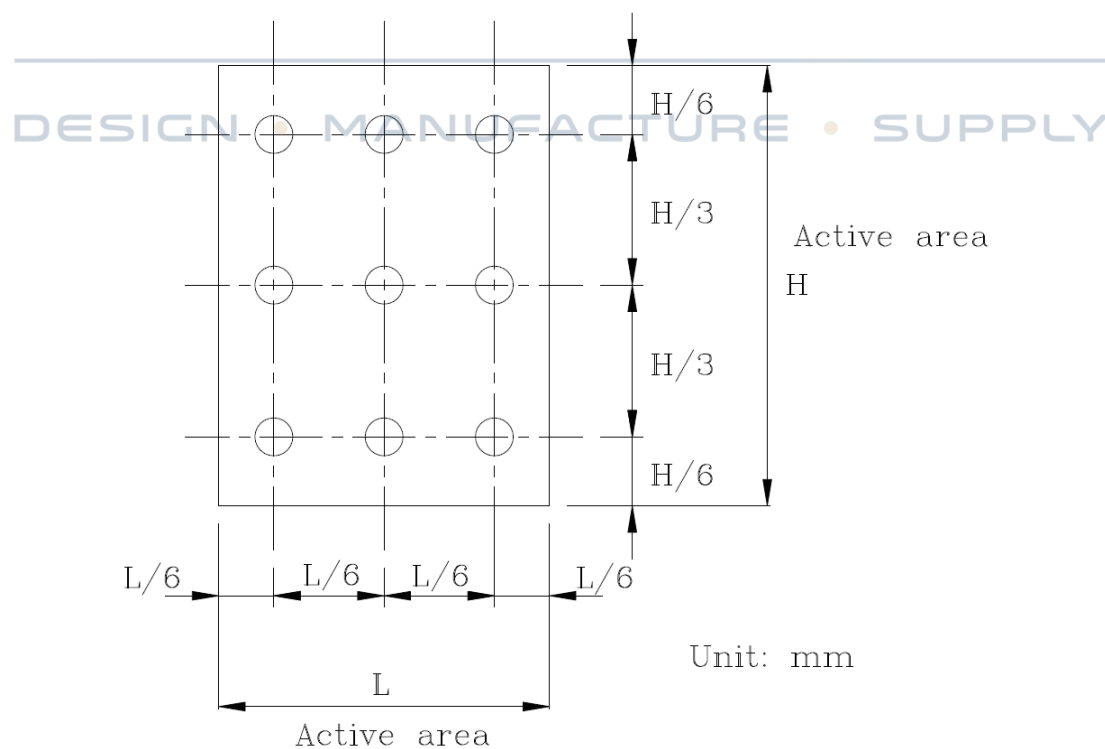
Note 4: Definition of Luminance

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
Supply Voltage	VCC	-0.3	4.6	V
Supply Voltage (Logic)	IOVCC	-0.3	4.6	
Operating temperature	Top	-20	+70	°C
Storage temperature	Tst	-30	+80	°C

7. ELECTRICAL CHARACTERISTICS

7.1 BLACKLIGHT DRIVING CONDITIONS

ITEM	SYMBOL	SPECIFICATIONS			UNIT	REMARK
		MIN	TYP.	MAX		
Supply Voltage	Vf		3		V	
Supply Current	IL		80		mA	
Power consumption	P		0.24		W	
LED lifetime			50,000		Hr	

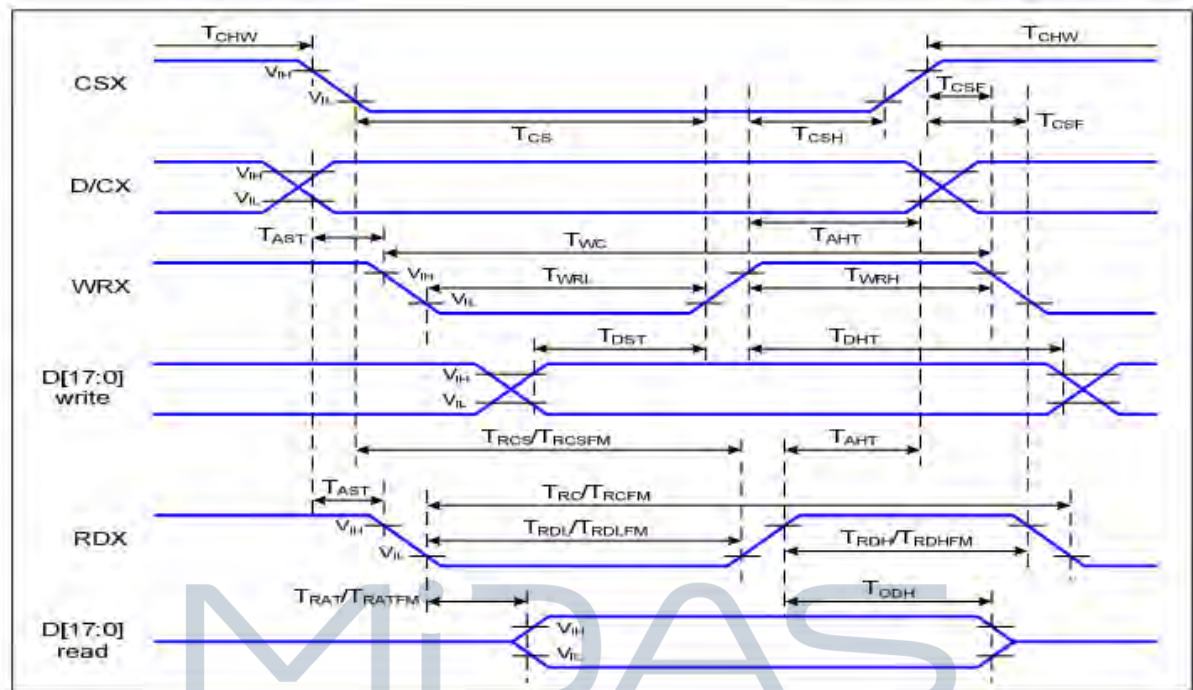
7.2 ELECTRICAL CHARACTERISTICS

ITEM	SYMBOL	MIN	TYP.	MAX	UNIT
System Voltage	VCC	2.4	2.75	3.3	V
Interface Operation Voltage	IOVCC	1.65	1.8	3.3	V
Logic-High Input Voltage	VIH	0.7IOVCC		IOVCC	
Logic-Low Input Voltage	VIL	GND		0.3IOVCC	

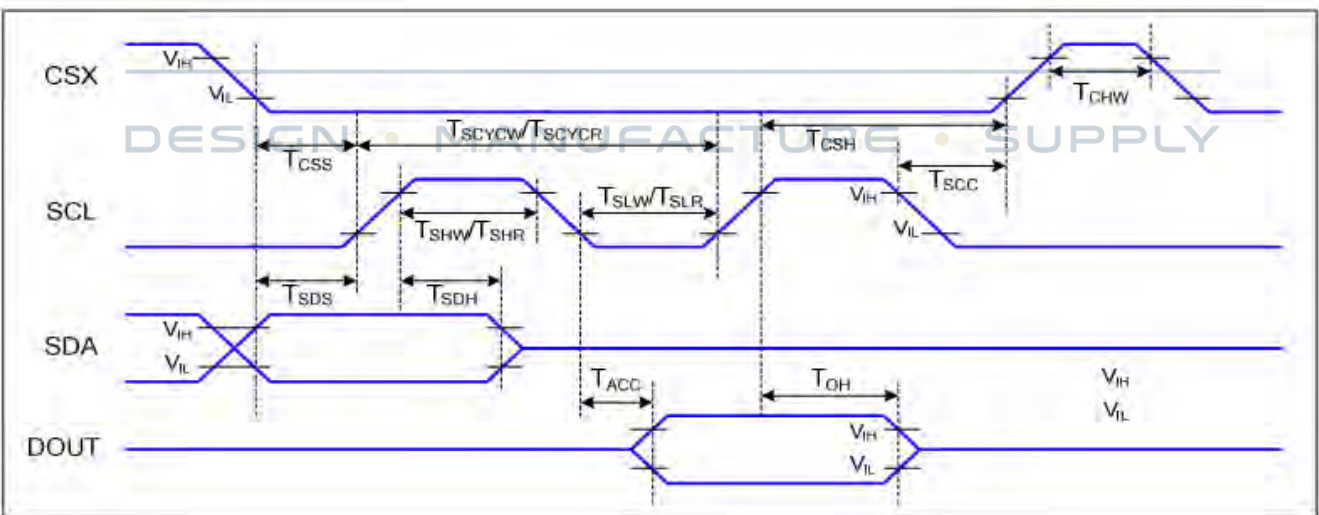


8.TIMING CHARACTERISTICS

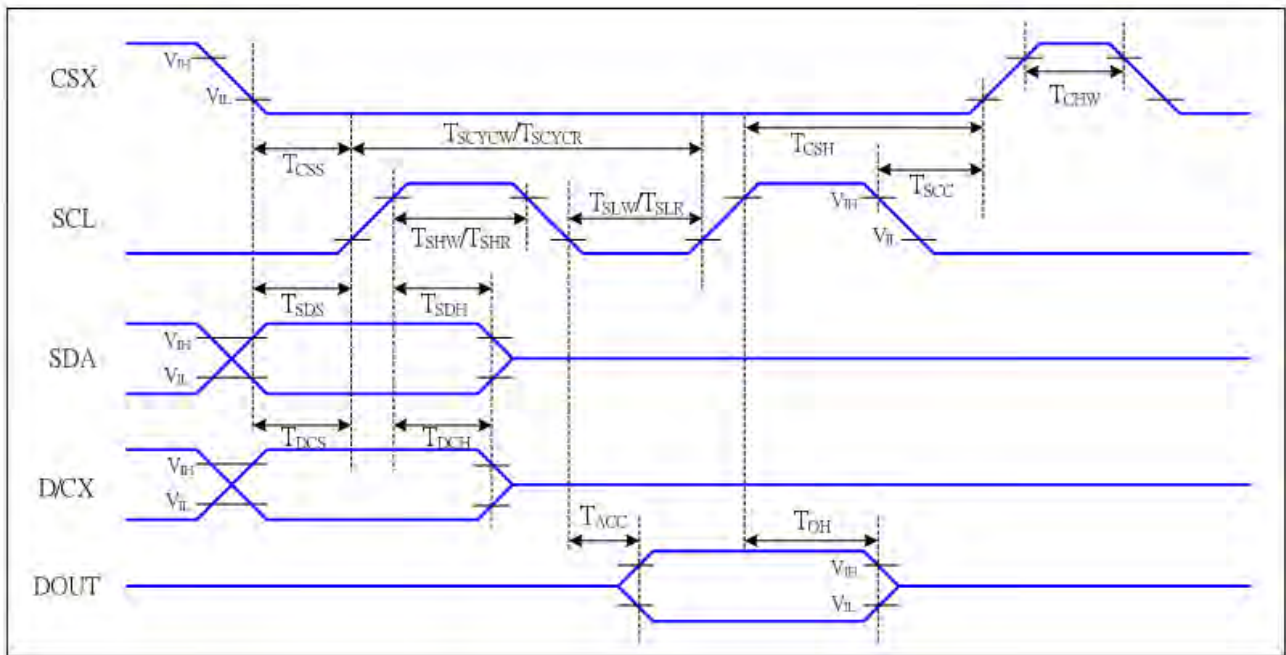
8.1 8080 Series MCU Parallel Interface Characteristics: 18/16/9/8-bit Bus



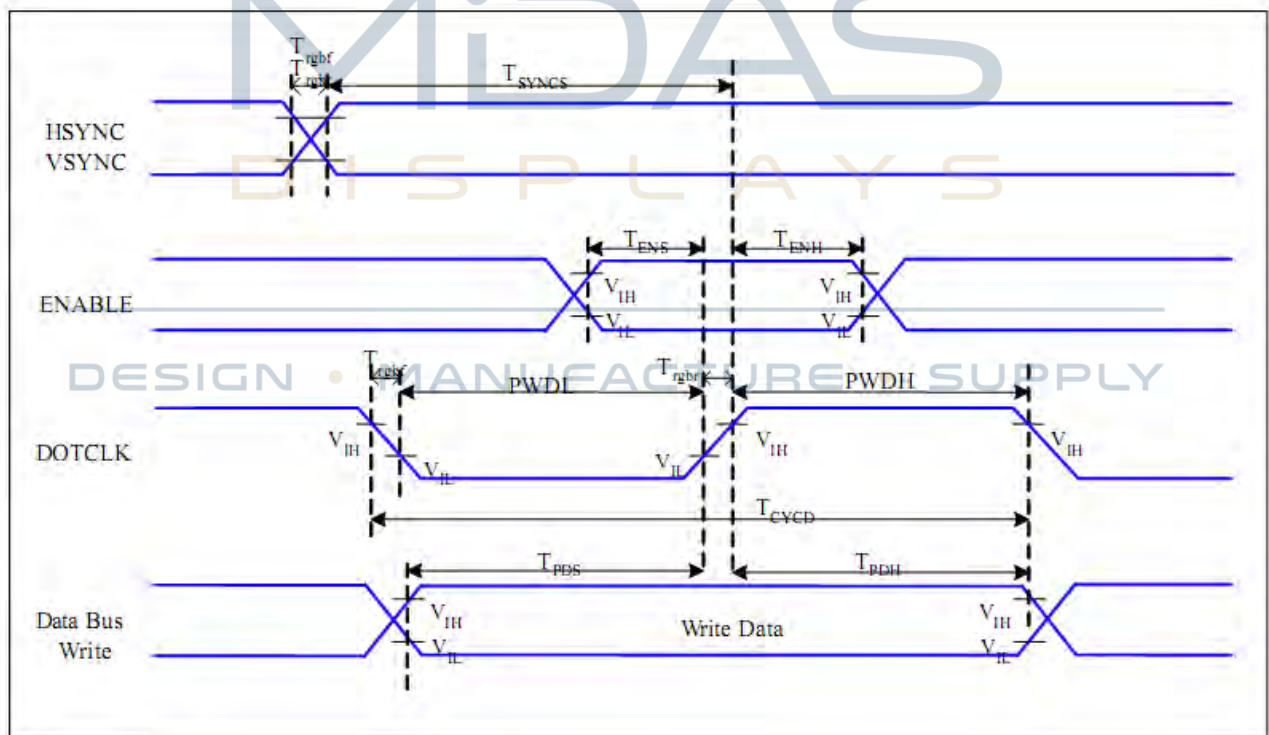
8.2 Serial Interface Characteristics (3-line serial):



8.3 Serial Interface Characteristics (4-line serial):



8.4 RGB Interface Characteristics:



Signal	Symbol	Parameter	MIN	MAX	Unit	Description
HSYNC, VSYNC	T_{SYNCS}	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	

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9. RELIABILITY TEST

NO.	TEST ITEM	CONDITIONS	
1	HIGH TEMPERATURE STORAGE	TA=80℃	96H
2	LOW TEMPERATURE STORAGE	TA=-30℃	96H
3	HIGH TEMPERATURE OPERATION	TA=70℃	96H
4	LOW TEMPERATURE OPERATION	TA=-20℃	96H
5	HIGH TEMPERATURE AND HIGH HUMIDITY OPERATION	+60℃, 90%RH	96H
6	THERMAL SHOCK	-30℃ → +80℃,	0. 5H:5CYCLES



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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.

